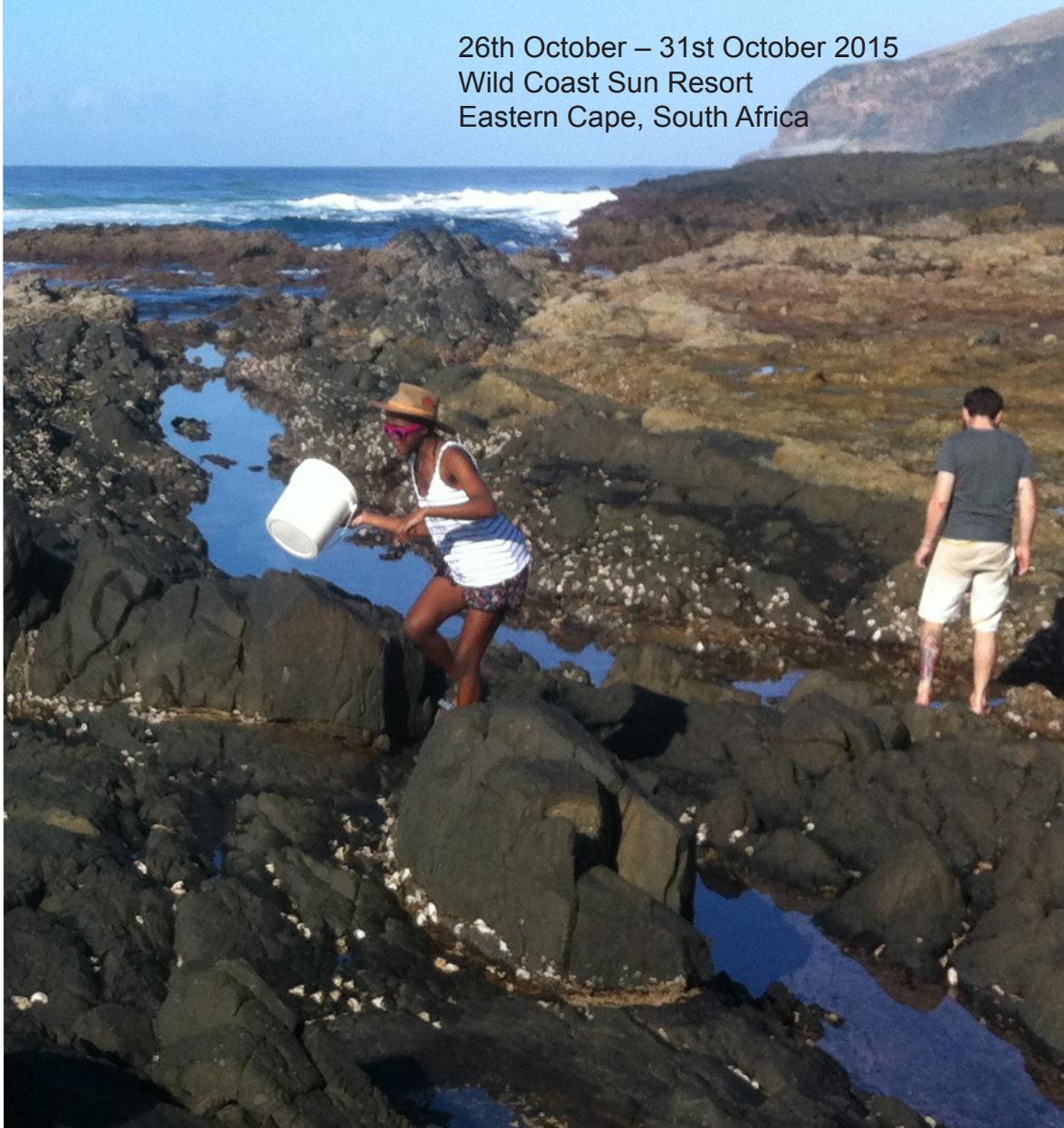


9th WESTERN INDIAN OCEAN MARINE SCIENCE ASSOCIATION SCIENTIFIC SYMPOSIUM

26th October – 31st October 2015
Wild Coast Sun Resort
Eastern Cape, South Africa





WESTERN INDIAN OCEAN MARINE SCIENCE ASSOCIATION SCIENTIFIC SYMPOSIUM

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Wild Coast Sun Resort
Eastern Cape, South Africa



SPONSORS:



Coastal, Marine and Island Specific Biodiversity Management in ESA-I0 Coastal States



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OUTLINE OF NINTH WIOMSA SYMPOSIUM PROGRAMME

Monday, 26 October 2015					
09:00	Opening Ceremony Venue: Amadiba				
10:30	COFFEE/TEA BREAK				
	Amadiba	Msikaba 1	Msikaba 2	Msikaba 3	Msikaba 4
11:00	Status of coral reefs	Primary productivity	Mangroves: Provision of ecosystem services	Livelihood options	Marine biodiversity focus
12:30	LUNCH				
14:00	Coral reefs: Ecological processes	Deep-sea fisheries: Status	Mangroves: Status and their integrity	Social dynamics of coastal communities	Marine biodiversity focus
15:30	COFFEE/TEA BREAK				
16:00	Anthropogenic and natural perturbations to coral reef ecosystems	Trophic dynamics	Mangroves and seagrass meadows: Ecological processes and anthropogenic influences	Impacts of pollution	Advances in turtle research
17:30	END				
19:30	Opening Reception				
Tuesday, 27 October 2015					
09:00	Two Keynote presentations Venue: Amadiba				
10:30	COFFEE/TEA BREAK				
	Amadiba	Msikaba 1	Msikaba 2	Msikaba 3	Msikaba 4
11:00	Estuarine processes	Impacts of fisheries	Influence of physical phenomena on biological processes	Sub-regional multi-disciplinary studies	Elasmobranchs of the WIO – Sharks
12:30	LUNCH				
14:00	Poster Session				
15:30	COFFEE/TEA BREAK				
16:00	Poster Session				
17:30	END				
Wednesday, 28 October 2015					
09:00	Two Keynote presentations Venue: Amadiba				
10:30	COFFEE/TEA BREAK				
	Amadiba	Msikaba 1	Msikaba 2	Msikaba 3	Msikaba 4
11:00	Development in coral reef monitoring and research	Vulnerability and resilience of social-ecological systems	Fish reproduction patterns	Impacts of anthropogenic WIO - Sharks & Rays activities	Elasmobranchs of the WIO – Sharks & Rays
12:30	LUNCH				
14:00	Restoration of Coastal ecosystems	Adaptation strategies	Small-scale fisheries – species composition	Seaweed: Chemical composition and farming activities	Effectiveness of MPAs
15:30	COFFEE/TEA BREAK				
16:00	Coral reef science: Implications for management	Assessing carbon stocks	Impacts and effectiveness of fishing gears	Mariculture	Planning for establishment of MPAs
17:30	END				
Thursday, 29 October 2015					
09:00	Two Keynote presentations Venue: Amadiba				
10:30	COFFEE/TEA BREAK				
	Amadiba	Msikaba 1	Msikaba 2	Msikaba 3	Msikaba 4
11:00	Coral reef fish communities	Small scale fisheries: Trends and impacts	Ecological connectivity	Coastal physical processes	Communicating science
12:30	LUNCH				
14:00	Uptake of research results	Small scale fisheries: Trends and impacts	Fish assemblages in shallow habitats	Modeling of physical processes	Governance challenges
15:30	COFFEE/TEA BREAK				
16:00	Climate Impacts and barriers to mitigation of effects	Fishery resources trade	Locally managed areas	Shoreline changes	Tools for improved management of coastal and marine environment
17:30	END				
Friday, 30 October 2015					
	Amadiba	Msikaba 1	Msikaba 2	Msikaba 3	Msikaba 4
09:00	Special Session	Special Session	Special Session	Special Session	Special Session
10:30	COFFEE/TEA BREAK				
11:00	Special Session	Special Session	Special Session	Special Session	Special Session
12:30	LUNCH				
14:00	Special Session	Special Session	Special Session	Special Session	Special Session
15:30	COFFEE/TEA BREAK				
16:00	Special Session	Special Session	Special Session	Special Session	Special Session
17:30	END				
18:00	Closing Reception				

MEMBERS OF THE SYMPOSIUM SCIENTIFIC COMMITTEE

Atanásio Brito
IIP
Mozambique

Blandina Lugendo
Department of Aquatic Sciences and Fisheries,
University of Dar es Salaam, Tanzania

Brent Newman
Council for Scientific and Industrial Research
South Africa

David Glassom
University of KwaZulu-Natal
South Africa

Jared Bosire
WWF-Kenya
Kenya

Johan Groeveveld
Oceanographic Research Institute (ORI)
South Africa

Jose Paula
University of Lisbon
Portugal

Judy Mann
Oceanographic Research Institute (ORI)
South Africa

Louis Celliers
Council for Scientific and Industrial Research
South Africa

Sean Fennessy
Oceanographic Research Institute (ORI)
South Africa

William Froneman
Nelson Mandela Metropolitan University
South Africa

Washington Ochola
Africa Lead
Kenya

Aviti Mmochi
Institute of Marine Sciences,
University of Dar es Salaam, Tanzania

Boaz Kaunda-Arara
University of Eldoret
Kenya

Chantal Conand
University of Reunion
Reunion

Gavin Gouws
South Africa Institute of Aquatic Biodiversity (SAIAB)
South Africa

Jerome Bourjea
IFREMER
Reunion

John Machiwa
Department of Aquatic Sciences and Fisheries,
University of Dar es Salaam, Tanzania

Josh Cinner
James Cook University
Australia

Juliet Hermes
South African Environmental Observation Network
(SAEON)
South Africa

Maria Manez
CSC
Germany

Sergio Rosendo
University of East Anglia
UK

Ursula Scharler
University of KwaZulu-Natal
South Africa

MEMBERS OF THE LOCAL ORGANIZING COMMITTEE

Angus Macdonald (Chairperson)
University of KwaZulu-Natal

Sean Fennessy
Oceanographic Research Institute

Jennifer Olbers
Ezemvelo KwaZulu-Natal Wildlife

Kristina Naidoo
KwaZulu-Natal Sharks Board

Gloria Andrews
Council for Scientific and Industrial Research

Louis Celliers (Co-Chair)
Council for Scientific and Industrial Research

Bernadine Everett
Oceanographic Research Institute

Matt Dicken
KwaZulu-Natal Sharks Board

Tarryn Newman
Council for Scientific and Industrial Research

MEMBERS OF THE LOCAL ORGANIZING COMMITTEE IN ZANZIBAR

Julius Francis

Tim Andrew

Lilian Omolo

Innocent Wanyonyi

Hamad Hassan

Thabit Ame

Mondi Muhando

INTRODUCTION

The Western Indian Ocean Marine Science Association (WIOMSA), University of KwaZulu-Natal, Council for Scientific and Industrial Research (CSIR) and KwaZulu-Natal Sharks Board wish a warm welcome to all delegates to the 9th WIOMSA Scientific Symposium. We hope that your stay at the Eastern Cape during the symposium will be fruitful and enjoyable.

This book of abstract contains general information as well as guidance for your stay in the Eastern Cape and to enhance your better participation during the symposium. The booklet contains a detailed symposium programme, abstracts of all the presentations and posters, and an index of authors and their addresses.

Plenary sessions are scheduled for Monday to Thursday, preceded by key note presentations. Five parallel sessions will be held during these days. On the afternoon of Tuesday 27th a poster session will be held from 14:00 to 17:30h.

Delegates should note that the symposium will start at 09:00h each morning of the five days of the symposium, health breaks will be held at 10:30 and at 15:30, while lunch will be served from 12:30 to 13:25, all served at the symposium venue.

GENERAL INFORMATION

EASTERN CAPE - AN ORIENTATION

The Wild Coast is the northernmost stretch of the Eastern Cape and the beginning of the recently proclaimed Pondoland Marine Protected area. It is a warm temperate coast with numerous estuaries, river mouths, rocky shores and sandy beaches. It is the site of the beginning of the yearly Sardine Run on South Africa's East Coast and harbours a wealth of marine biodiversity. It has protected areas and large portions which serve local communities' subsistence needs. It has been spared the relentless development that most of South Africa's coastline has been subjected to and as such serves as a reminder of the beauty that natural environments offer. As the venue for WIOMSA's 9th Scientific Symposium we hope that you are able to take a moment during your visit to enjoy the natural beauty it has to offer.

SYMPOSIUM VENUE

WIOMSA's 9th scientific symposium will be held at Wild Coast Sun Resort. The hotel is located within the borders of the Eastern Cape and only a two hour scenic drive along the South Coast from Durban's King Shaka International Airport. Plenary and oral presentation sessions will take place at the Convention Centre which has the following rooms: Amadiba, and Msikaba 1, 2, 3 & 4. These rooms are air-conditioned and all Audio/Visual equipment will be supplied and ready in time for the conference.

The main room, Amadiba: This conference room has a maximum capacity of 500 people in school room style seating, and will be used for the opening ceremony and the key note presentations as well as one of the parallel oral presentation sessions. The remaining 4 parallel oral presentation sessions will take place in the following venues where the seating will be in cinema style (no desks/tables):

Room	Approximate capacity
1.	Msikaba 1 150
2.	Msikaba 2,3,4 70

TRANSPORT

Airport – Shuttles will be organized to pick up delegates on Saturday 24th and Sunday 25th from the airport to the listed symposium hotels and on Sunday 1st of November from hotels to the airport. Time tables for departure days will be placed at respective hotel receptions.

Symposium - Shuttles will be organized every morning at 8:30 am from the surrounding hotels listed below to Wild Coast Sun Resort and back to these hotels at 18:00.

Surrounding hotels

- *Premier Hotel The Edwardian*
- *San Lameer Villas*
- *Carribbean Estates*
- *Port Edward Holiday Resort*
- *Margate Hotel*
- *To Strand Hotel*

Alternative transport arrangements – For participants arriving in Durban (on other dates than 24th and 25th October) and departing from the Eastern Cape for Durban (on other dates than 1 November), please contact Reece Le Grange (reece@eventsolutionskzn.co.za) to make travel arrangements.

Taxi – For taxi services, contact Margate Taxi Service PACE, Berea Road, Margate – 4275, Phone: 071 231 3294

Car hire – For car rentals, please visit <http://kingshakainternational.co.za/car-rental/>.

WEATHER

October on the Wild Coast is a pleasant time of year with temperatures ranging between 16C and 25C and there is always the chance of rain. Days are warm and evenings are cool and the level of humidity is usually low. Forecasts for the area are relatively accurate for the week ahead.

DRESS

Smart casual attire is suitable for the symposium sessions and social functions.

MESSAGES

Messages will be announced on each morning before the start of plenary sessions, and will be posted on the symposium notice board.

ORAL PRESENTATIONS

Oral presentations have been allocated 20 minutes each. Chair persons will be very strict in time management, so limit your presentations to 15 minutes and allow five minutes for questions, discussions and changeover to the next presenter. Oral presenters are urged to give more time to the objectives of their studies and scientific results obtained rather than to literature review, materials and methods and /or description of the study sites.

All presentations should be handed in at the conference office a day prior to presenting in order to preload presentations thus enabling the smooth running of sessions (contacts: Sware Semesi (sware@wiomsa.org) or Ms Tarryn Newman (TNewman@csir.co.za)). Monday's, 26 October 2015, oral presenters will have to hand over their presentations to the Secretariat at the venue on Sunday, 25 October 2015, from 10am to 5pm.

POSTER PRESENTATIONS

A session dedicated to poster presentations will be on Tuesday, 27th October 2015 afternoon. Posters will be displayed throughout the symposium. Presenters should hand over their posters to the poster venue technician as early as possible on Sunday, 25th October 2015 through to early Monday, 26th October 2015. Standard poster size is A0 (1189x841mm) and the poster board size is 2400x950 Each poster should contain the title, author(s) name and address of the presenter (institution, city, country). If possible, attach a passport-sized photograph of the presenter to the upper right hand corner of the poster.

HEALTH BREAKS

Two health breaks are scheduled per day, where delegates will have time to unwind, and get refreshments. These will be held at 10:30 and at 15:30 for half an hour each.

LUNCH BREAKS

Lunch will be served at the symposium venue from 12:30 to 13:50 on symposium days, except on Friday when it will be served from 12:30 to 13:30.

SOCIAL FUNCTIONS

Opening reception: Delegates are invited to an opening reception at Driftwood Terrace. The reception will start at 19:30 on Monday 26th. Shuttles will collect delegates from their hotels from 18:30h.

Closing reception: Delegates are invited to the closing ceremony on Friday 30th at 18:00 at the Amadiba Ballroom. Students and best photo award ceremony and formal closing will take place on this date.

TIDES

Mon 26	Tue 27	Wed 28	Thur 29	Fri 30
High 02:33	High 03:13	High 03:51	High 04:29	High 05:06
Low 08:39	Low 09:19	Low 09:57	Low 10:34	Low 11:12
High 14:53	High 15:31	High 16:08	High 16:45	High 17:21
Low 21:07	Low 21:44	Low 22:21	Low 22:58	Low 23:35

BUSINESS SERVICE

Telephones

To call South Africa from another country, dial the South Africa area code (+27) followed by the number. Mobile telephone providers in South Africa are Vodacom, MTN and Cell C.

Banking, cash and credit cards

There is a Bureau de Change at the Wild Coast Sun Hotel. Several major South African banks have branches in Port Edward, including Standard Bank, ABSA, and FNB.

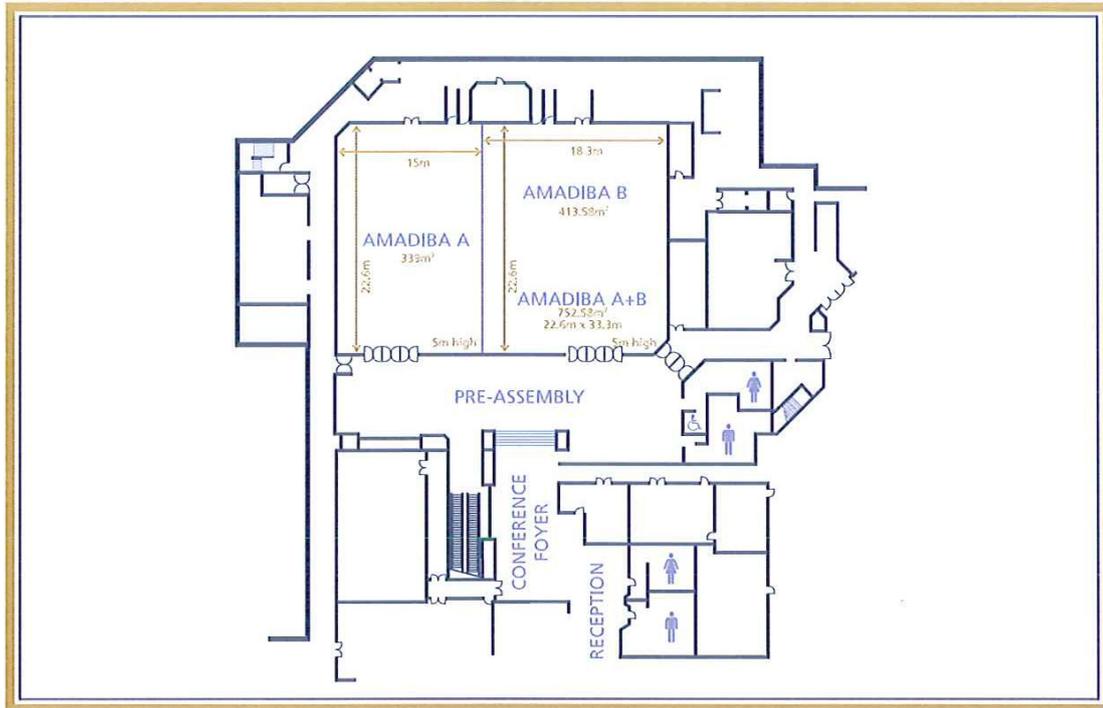
Hotels and recognised restaurants accept major credit cards.

RESTAURANTS AND PUBS

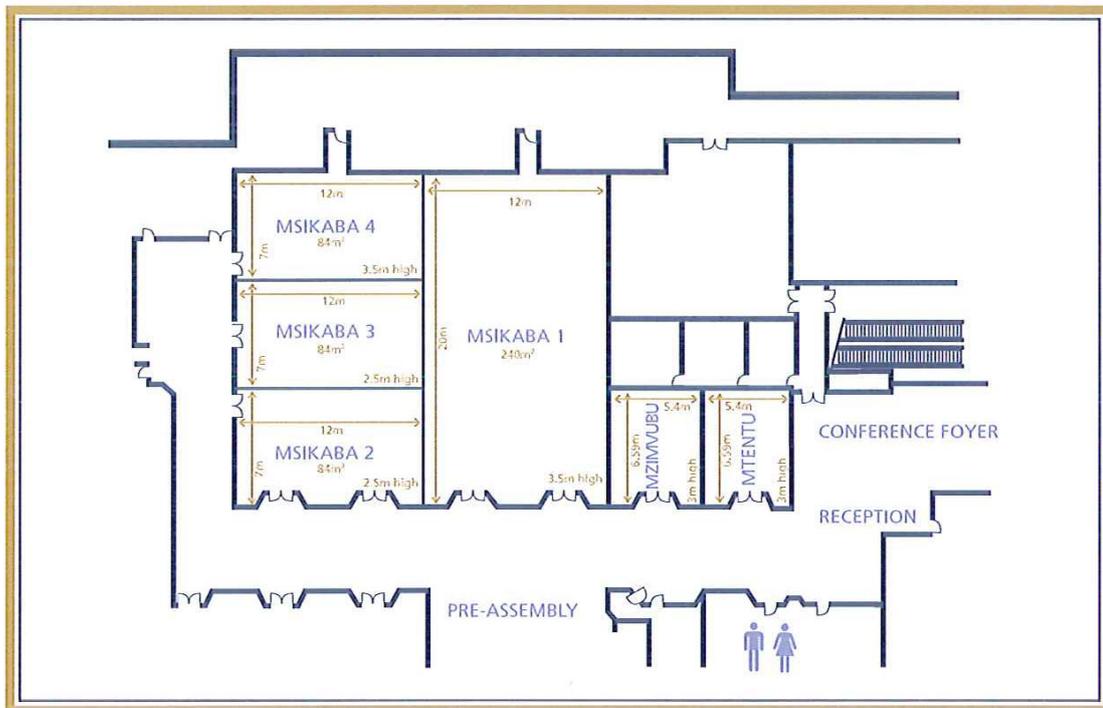
<i>Restaurant</i>	<i>Type/ location</i>	<i>Tel</i>
Beach Bobbies Restaurant & Cocktail Bar	Fun family eatery. Port Edward Holiday Resort	039-311-2301 (ext. 112/113)
Fish Eagle Restaurant "The Place to be Seen"	Established at The Port Edward Country Hotel in 1996, the Fish Eagle restaurant is one of the South Coast's top five dining establishments. Be it a light snack, original Viennese coffee break or a candlelit dinner for two - we promise to tantalize your taste buds with unsurpassed cuisine and a well-stocked cellar of complementing wines. Visit the http://www.southcoasthappenings.co.za/portedwardaccommodation.htm	039-311-2675 It is best to book
Mother's Sport Pub & Grill	Family restaurant. Windwood Lodge, Port Edward	039-311-2169
Sleepers Restaurant	Family restaurant. Windwood Lodge, Port Edward	039-311-2169
The Edwardian	Bar lunches, weekend carvery, breakfast, kids menu and one of best a-la-carte menus along the coast. Follow signs inland from Port Edward traffic light.	039-311-1047
The Webb Family Restaurant	Family restaurant. 6 O Ellis Drive, Port Edward	039-311-1313
Waterfront Restaurant	Family restaurant. Port Edward	039-311-2301

SYMPOSIUM ROOM PLAN

AMADIBA BALLROOM



MSIKABA, MZIMVUBU AND MTENTU CONFERENCE ROOMS



SESSION CHAIRS AND RAPPOURTEURS

Date	Session	Chair	Rapporteur
26 October 2015	Status of coral reefs	Lionel Bigot	N.E. Mbiye
	Coral reefs: Ecological processes	Ranjeet Bhagooli	E. Sola
	Anthropogenic and natural perturbations to coral reef ecosystems	Pascale Chabanet	Lola Masse
	Primary productivity	Ray Barlow	Joeline Ezekiel
	Deep-sea fisheries: Status	Sebastien Jaquemet	Osvaldo Chacate
	Trophic dynamics	Sean Fennessy	Clement Trystram
	Mangroves: Provision of ecosystem services	Christina Hicks	David Maina
	Mangroves: Status and their integrity	Salomao Bandeira	Faura Amade
	Mangroves and seagrass meadows: Ecological processes and anthropogenic influences	Jose Paula	L.D. Lyimo
	Livelihood options	Josh Cinner	Mwanahija Shalli
	Impacts of pollution	Adriano Macia	Aloyce Andrew
	Social dynamics of coastal communities	Gilbert David	Robert Katikiro
	Marine biodiversity focus	Peter R. Teske	Thomas Mkare
	Marine biodiversity focus	Chantal Conand	Ntuli Noxolo
	Advances in turtle research	Jerome Bourjea	Mike Olendo
27 October 2015	Keynote Presentations	Jacqueline Uku	M.R. Semba
	Estuarine processes	Anthony Forbes	Siajali P. Zegge
	Impacts of fisheries	Johan Groeveneld	Catherine Mwakosya
	Influence of physical phenomena on biological processes	Angus Macdonald	N. Bodin
	Sub-regional multi-disciplinary studies	Tundi Agardy	George Maina
	Elasmobranchs of the WIO – Sharks	Andrea Marshall	K.L. Mmonwa
28 October 2015	Keynote Presentations	Hildegard Westphal	Juliet Karisa
	Development in coral reef monitoring and research	Tim McClanahan	Saleh Yahya
	Restoration of Coastal ecosystems	Paul Siegel	P. H. Montoya-Maya
	Coral reef science: Implications for management	Ian Bryceson	Jervas Mwaura
	Vulnerability and resilience of social-ecological systems	Louis Celliers	S. P. Mbense
	Adaptation strategies	Jared Bosire	Lilian Mugi
	Assessing carbon stocks	Janine Adams	Mwita Mangora
	Fish reproduction patterns	Jan Robinson	Joan Kawaka
	Small-scale fisheries – species composition	Melita Samoily	M.K. Mbaru
	Impacts and effectiveness of fishing gears	Yunus Mgaya	Paul Tuda
	Impacts of anthropogenic activities	Harifidy Ralison	G.R. Narayan
	Seaweed: Chemical composition and farming activities	Margareth Kyewalyanga	Grace Mutia
	Mariculture	Max Troell	M.C. Ndaro
	Elasmobranchs of the WIO - Sharks & Rays	Matt Dicken	Clare Pebble
	29 October 2015	Keynote Presentation	Nyawira Muthiga
Coral reef fish communities		David Glassom	E. Crochelet
Uptake of research results		Jesper Vassell	Lydia Gaspare
Climate Impacts and barriers to mitigation of effects		Yohanna Shaghude	Anne Kairu
Small scale fisheries: Trends and impacts		Matthias Wolff	Aneeque Javaid
Small scale fisheries: Trends and impacts		Jude Bijoux	H. Koike
Fishery resources trade		Kassim Kulindwa	Patrick Kimani
Ecological connectivity		Ivan Nagelkerken	D. Carvalho de Abreu
Fish assemblages in shallow habitats		Johan Eklof	Elisa Alonso Aller
Locally managed areas		Hugh Govan	George Maina
Coastal physical processes		Johnson Kitheka	V.M.S. Zikhali
Modeling of physical processes		Issufo Halo	Juliano Dani
Shoreline changes		M.K. Watkeys	A. Rawat
Communicating science		Joy Owango	Rukia Kitula
Governance challenges		Lena Gipperth	P. N. Mbatha
Tools for improved management of coastal and marine environment	Tim Daw	Carol Abunge	

SCIENTIFIC PROGRAMME

MONDAY, 26 October 2015	
07:30	Registration
	Opening Ceremony
0900	Welcoming Remarks by Dr Angus Macdonald, Chair of Local Organizing Committee
0905	Address by the WIOMSA President, Dr Jacqueline Uku
0915	Address by Dr Claes Kjellstrom, Senior Policy Specialist, Research, Sida
0925	Address by Mr Laurens Cloete, CSIR Group Executive: Operations
0935	Address by Dr Albert Van Jaarsveld, Vice Chancellor, University of KwaZulu-Natal
0945	Opening Address by Hon. Michael Mabuyakhulu, MEC for KZN Department of Economic Development, Tourism and Environmental Affairs
1000	Photo session
1030	Coffee break
	Amadiba
	Session I: Status of coral reefs
1100	A. Macdonald, A. Green, G. Wehr, J. Kara - Back to the future: the relevance of evolutionary and geological history to predictive models
1120	E. Sola, D. Glassom, I. da Silva - Spatio-temporal patterns of hard-coral recruitment at Vamizi Island, Quirimbas Archipelagos, Mozambique
1140	G.K. Wehr, A. Macdonald - The phylogeography of the scleractinian coral, <i>Anomastrea irregularis</i> , along the KwaZulu-Natal coastline using mitochondrial sequence data
1200	N.E. Mbije, J. Douek, E. Spanier, B. Rinkevich - Population genetics parameters of the emerging corallivorous snail <i>Drupella cornus</i> in the northern Gulf of Eilat and Tanzanian coastlines based on mitochondrial COI gene sequences
	Session II: Coral reefs: Ecological processes
1400	D. Glassom, C. Schoeman - Use of maximum entropy models to predict event distributions: coral synchronous spawning as a case study
1420	S.B. Helber, G. Steinert, M. Wolff, C.A. Muhando, C. Richter, P. Schupp - Chemical defence in Western Indian Ocean reef sponges
1440	T. Hempson, N. Graham, S. Wilson, A. MacNeil, G. Almany - Effects of prey availability on mesopredator condition, growth rate, and fecundity on coral reefs of the Seychelles Inner Island Group
1500	A.M. Ussi, C.A. Muhando, R. van Woesik - Density and survival rates of juvenile scleractinian corals and their seasonality in Unguja Island, Zanzibar, Tanzania
	Session III: Anthropogenic and natural perturbation to coral reef ecosystems
1600	F.A. Januchowski-Hartley, C. Perry, N. Graham, T. McClanahan, S. Wilson, T. Chaigneau - The effects of coral declines on reef structural processes and coral reef habitat in the Western Indian Ocean
1620	P. Z. Thoya - Decadal spatial-temporal trends of total suspended sediments loads in Malindi-Watamu reefs area of Kenyan Coast
1640	R. Bhagooli, A. Gopechund - Tropical cyclonic conditions reduce occurrence of coral diseases in the coral <i>Acropora muricata</i>
1700	S. Mattan-Moorgawa, R. Bhagooli, S. Rughooputh - Coral disease occurrence and associated effect on The photo-physiology of in hospite <i>Symbiodinium</i> among six scleractinian corals
1720	M. S. Mohammed, N. Jiddawi - Coral Diseases in Tanzania: Occurrence Prevalence and Distribution
	Msikaba 1
	Session IV: Primary productivity
1100	V.L. Machava - Seasonal Variation of Plankton Communities at Sofala Bay, Mozambique
1120	J. Ezekiel, M.S. Kyewalyanga, Y.W. Shaghude, M. Racault - Spatial and Temporal Variations of Phytoplankton in Rufiji Delta/Mafia Channel, Southern Tanzania
1140	M.R. Semba, M. Kyewalyanga, N. Peter - Detecting Seasonal dynamics of Chlorophyll-a Concentration Using Ocean Color Satellite Data: A case study of Mafia Channel, Tanzania
1200	R.A. van Rooyen Connectivity of <i>Perna perna</i> populations between Madagascar and South Africa
	Session V: Deep-sea fisheries: Status
1400	J.C. Groeneveld, B. Everett, S. Fennessy, N. Dias, O. Filipe, L. Zacarias, M. Igulu, B. Kuguru, E. Kimani, C. Munga, H. Razafindrakoto, G. Rabarison, and D. Yemane - Abundance of deep-water crustaceans in the SW Indian Ocean: Enough to support trawl fisheries?
1420	B.I. Everett, J.C. Groeneveld, S.T. Fennessy, N. Dias, O. Filipe, L. Zacarias, M. Igulu, B. Kuguru, E. Kimani, C. Munga, G.A. Rabarison, H. Razafindrakoto - Along the coast and across the channel – trends in diversity of crustaceans and fishes caught by deep-water trawl surveys in the SW Indian Ocean
1440	O.E. Chacate - Catch rates of the main fishery resources along the southern and central Mozambique coast during the 2007 and 2014 Nansen survey
1500	R.A. Govinden - An assessment of the Seychelles rock lobster resource using fisheries independent survey data

Session VI: Trophic dynamics	
1600	S. Lawrence, D. Lesperance, S. Hollanda, M. Cedras, M. Degroote, N. Bodin - Trophic dynamics of a tropical marine food web in Seychelles using stable isotope and fatty acid tracers
1620	S. Jaquemet, Y. Aumond, A. Sadeyen, C. Trystram, J. Huet, D. Roos - A first investigation of the trophic ecology of deep-sea fishes exploited by the artisanal fishery of Reunion Island
1640	N. Bodin, S. Hollanda, M. Degroote, D. Lesperance, M. Cedras, V. Lagarde, P. Bustamante - Bioaccumulation of trace elements in a tropical marine food web (Seychelles, Indian Ocean)
1700	C. Trystram, D. Guyomard, C. Tardy, S. Brown-Villemin, Y. Thubin, C. Esposito, F. Leclercq, S. Jaquemet - Trophic Relationships in a Large Predatory Pelagic Species Community Exploited by Local Fisheries of an Oceanic Island
1720	F. Sardenne, N. Bodin, A. Amiel, E. Fouché, M. Degroote, L. Debrauwer, S. Hollanda, F. Ménard - Are the trophic niches of tropical tuna the same in mixed schools?
Msikaba 2	
Session VII: Mangroves: Provision of ecosystem services	
1100	P.H. Bhanderi - Economic valuation of mangroves in Tana Delta, Kenya
1120	J. Hugé, F. Benítez-Capistrós, K.V. Puyvelde, J.G. Kairo, L. Agosto, K. Leemans, F. Dahdouh-Guebas, N. Koedam - Assessment of 'single ecosystem services-based' mangrove management in Gazi Bay, Kenya & Zanzibar, Tanzania: methodological perspectives
1140	D.N. Maina, J.G. Kairo, M.W. Skov, R.M. Chira, V. Wang'ondou - The role of mangroves in shoreline protection in Gazi Bay, Kenya
1200	N.A.A. Ratovoson, H.R. Ratsimba, Y.P. Rakoto, M.F. Rabenilalana, S. Razanaka, J. Bogaert - Coastline change on landward and seaward mangrove dynamic: impacts analysis and institutional involvement
Session VIII: Mangroves: Status and their integrity	
1400	J. Bosire, J. Kiplagat, J. Mironga, G. Ogendi, L. Mugi, A. Mbelase - A Landscape assessment of mangrove ecosystem integrity
1420	B. Uviwe, A. Rajkaran - Re-evaluation of the distribution of mangroves in South Africa
1440	G.L. Ndegwa, J.G. Kairo, N. Koedam - Modelling stand and individual growth in mangroves, <i>Rhizophora mucronata</i> L.
1500	V. Wang'ondou, A. Muthumbi, N. Koedam, A. Vanrusel - Temporal variation in vegetative and reproductive phenological traits of mangrove species
Session IX: Mangroves and seagrass meadows: Ecological processes and anthropogenic influences	
1600	A. Nehemia, D. Frank, M. Kochzius - Influence of mangrove deforestation on eco-morphometrics and genetic diversity of <i>Littorariasubvittata</i> along the Tanzania mainland and Zanzibar coast
1620	M.O.S. Mohamed, J.G. Kairo, F. Dahdouh-Guebas, N. Koedam - Cover changes and regeneration status of a peri-urban mangrove
1640	M.J. Mabula, M.M. Mangora, C.A. Muhando - Peri-urban mangroves of Dar es Salaam-Tanzania are highly vulnerable to anthropogenic pressures
1700	J. Raw, R. Perissinotto, N. Miranda, N. Peer - Decline of the giant mangrove whelk, <i>Terebralia palustris</i> , in South African mangroves: Diet and feeding dynamics of a tropical species at its global distribution range limit
1720	L.D. Lyimo, M. Gullstrom, T. Lyimo, D. Deyanova, M. Dahl, M. Hamisi, M. Bjork -Methane emission from tropical seagrass meadows increases by disturbance
Msikaba 3	
Session X: Livelihood options	
1100	R. A. Kitula - Influence of marine tenure types on livelihoods of fishing communities in Mafia Island, Tanzania
1120	B. Schulte-Herbrüggen, D. Gonçalves, V. Machava, E. Ribeiro, A. Wamukota, T. Daw - To what extent do coastal ecosystem services reduce income poverty?
1140	T.M. Daw, S. Bandeira, K. Brown, T. Chaigneau, W. Cheung, B. Crona, C. Hicks, F. Januchowski-Hartley, T. Mcclanahan, N. Muthiga, J. Omukoto, C. Perry, S. Rosendo, C. Sandbrook, B. Schulte-Herbrüggen, M. Thyresson - Elasticity in ecosystem services: analysing variable relationships between ecosystems and human wellbeing
1200	E. Chauque, S. Rosendo, E. Chauque, N. Hill, M. Riddell, M. Samoilys, S. Tembe - Socioeconomic analysis for improved livelihood security of coastal communities in northern Mozambique
Session XI: Social dynamics of coastal communities	
1400	R. E. Katikiro - Understanding change and resilience in social-ecological systems on the Tanzania's coast
1420	G. Stoica, L. Mase, Z.T. Tantely, J. Manahirana, M. Masseret, J. Mahafina, Pascale Chabanet, J. Ferraris - Social representations of the coral reef ecosystem: local knowledge, perceptions and challenges. The example of Madagascar and Reunion Island
1440	N. Summers, C. Miteron, E. Montocchio - Community perception of the state and use of marine resources in a coastal village in Mauritius
1500	P. M. Tuda, I.N. Wanyonyi, A. W. Wamukota - Strategies for survival; migration among artisanal fishers
Session XII: Impacts of pollution	
1600	B. Newman, N. Mbatha, S. Weerts, R. Pillay, A. Omarjee - Chemical concentrations of sediment in South African ports
1620	H. Bouwman, M. Krátká, H. Kylin, R.C. Yive, K. Minnaar, J. Klanova - Mercury and persistent organic pollutants in plastic debris and coral from St. Brandon's Rock, Indian Ocean
1640	K. Minnaar - Characterization of microplastic particles from three isolated islands in the Western Indian Ocean
1700	A. M. Andrew, J. Routh, J. F. Machiwa, V. J. Klump - Environmental Assessment of Temporal and Spatial Distribution of Trace Metals in Rufiji Delta Mangrove Sediments, Tanzania
1720	T. Naidoo, D. Glassom and A.J. Smit - Plastic pollution in five urban estuaries of KwaZulu-Natal, South Africa

Msikaba 4	
Session XIII: Marine biodiversity focus	
1100	C.A.F. Bourmaud, H. Magalon, N. Gravier-Bonnet - Hydroids (Cnidaria, Hydrozoa) along the Latitudinal Gradient of the Coral Reefs of Eparse Islands
1120	R.P. Payne, T. Samaai, M.J. Gibbons, W.K. Florence - Taxonomy and diversity of the sponge fauna from Walters Shoal; a shallow seamount in the Western Indian Ocean region
1140	V. Bhoyroo, D. Jahajeeah, M.R. Sanmukhiya - Bio-prospecting bivalves for commercial purposes: Inventory and molecular characterization
1200	T.K. Mkere - Conservation genetics of the endangered Knysna seahorse, <i>Hippocampus capensis</i> Boulenger 1900 (Syngnathidae)
Session XIV: Marine biodiversity focus	
1400	N. Noxolo - An investigation of core-edge genetic diversity in South African marine mussels
1420	F. Huyghe - Connectivity of the Skunk Clown Fish in the Indian Ocean using a combination of microsatellite and mitochondrial genetic markers
1440	I.E. Kiper, P. Borsa, D. Ponton, T.B. Hoareau - Microsatellite markers for the development of genetic studies in siganid species of the Western Indian Ocean
1500	P.R. Teske, J. Sandoval-Castillo, M. Tine, E. Drost, S. von der Heyden, L.B. Beheregaray - Marine biodiversity discovery, stage 3: how next-generation sequencing will complete what barcoding started
Session XV: Advances in turtle research	
1600	D. le Gouvello - Eggnog for beach bugs: turtle-introduced nutrients promote meiofaunal communities in the short term
1620	J. Bourjea, D. Mayeul, G. Philippe, B. Rumeau, C. Jean, S. Ciccione - Population structure and connectivity at the oceanic region scale: keys issues for sustainable management of green turtles in the western Indian ocean
1640	M.I. Olendo, L.K. Mulupi, L.D. Mwasi, H.B. Mohamed, C.N. Munga, G.M. Okemwa - Spatial and temporal trends of nesting sea turtles in the Lamu archipelago, Kenya
1700	R. Rambaran, R. Nel, S. Kirkman, T. Samaai - Defining the potential ecological roles of three sea turtle species (<i>Caretta caretta</i> , <i>Cheloniemydas</i> and <i>Eretmochelysimbricata</i>) along the eastern seaboard of South Africa
1720	L. Rozanne Harris, S. Benhamou, R. Nel, H. Oosthuizen, S. Bachoo - Where to, ambassadors of the big blue? Delineating turtle migration corridors in the Western Indian Ocean to support multi-national conservation
TUESDAY, 27 October 2015	
Amadiba	
0900	Keynote Presentation I: M.K. WATKEYS - The ever-changing canvas on which the portrait of life evolves
0945	Keynote Presentation II: H. GOVAN - Promoting Community Resource Management in developing countries – What governments need to do
Amadiba	
Session XVI: Estuarine processes	
1100	A. Forbes, N. Forbes - “River mouth” Estuaries in South-East Africa - How do we Assess their Status?
1120	Q. Schutte, L. Vivier, D.P. Cyrus - Recruitment of marine fish species into the closed St Lucia Estuary (South Africa): Is the Mfolozi Beach Channel really the answer?
1140	K. Tirok, U. Scharler, D. Stretch - System production and respiration in a shallow estuarine lake estimated from oxygen diel time series and mathematical models
1200	C.G. McNally, A.J. Gold, R.B. Pollnac - Stakeholder Perceptions of Ecosystem Goods and Services of the Wami River Estuary
1400	POSTER SESSION
1600	POSTER SESSION
Msikaba 1	
Session XVII: Impacts of fisheries	
1100	S.T. Fennessy, B.I. Everett, M. Tomalin - Dragging up the past – can we move forward now?
1120	L. Le Foulgoc, E. Richard, E. Romanov, M. Condet, J. Philippe - Listening to understand. -preliminary study of cetacean depredation on pelagic longline fisheries using passive acoustic monitoring offshore Reunion Island
1140	E. P. Morais - Initiatives of landing discarded by-catch from commercial shrimp trawlers at a social, economic and environmental feasible manner. The case of Sofala Bank, Mozambique
1200	A. Norbert - Hunting and Bycatch Assessment of Marine Mammals on the South West Coast of Madagascar, 2000-2015
1400	POSTER SESSION
1600	POSTER SESSION

Msikaba 2	
Session XVIII: Influence of physical phenomena on biological processes	
1100	N. Nikolic, N. Bodin, A. Puech, M. Potier, W. West, S. Hollanda, S. Kerwath, J. Bourjea - Across two oceans: demographic connectivity and population structure of albacore tuna from the southwest Indian Ocean and the southeast Atlantic
1120	S.A. Ockhuis - Are mesoscale eddies agents of gene flow between Madagascar and KwaZulu-Natal?
1140	R. Barlow, T. Lamont, M. Gibberd - Phytoplankton community adaptation in a cyclonic eddy in the Mozambique Basin
1200	S.B. Sadally, N. Taleb-Hossenkhan, B.E. Casareto, Y. Suzuki, R. Bhagooli - Dynamics of micro-phytoplankton in response to micro-tidal changes at two tropical coral reef ecosystems
1400	POSTER SESSION
1600	POSTER SESSION
Msikaba 3	
Session XIX: Sub-regional multi-disciplinary studies	
1100	D. Obura, V. Burgener, H. Ralison, P. Scheren - The natural assets underpinning a Northern Mozambique Channel sub-regional initiative
1120	E. Crochelet, J. Roberts, P. Chabanet - A model-based evaluation of reef fish connectivity - Implications for future marine spatial planning policies in the Mozambique Channel
1140	U. Scharler, R. van Ballegooyen, K. Lechman - The importance of working towards a systems-level perspective of ecosystem functioning: an example of the KwaZulu-Natal Bight
1200	C.F. Mackay, C.B. Untiedt, L. Hein - Important habitats and environmental drivers of macrobenthos on the KwaZulu-Natal Bight, South Africa
1400	POSTER SESSION
1600	POSTER SESSION
Msikaba 4	
Session XX: Elasmobranchs of the WIO– Sharks	
1100	A. V. Blaison, E. Crochelet, G. Bertrand, S. Jaquemet, P. Cotel, F. Marsac, M. Soria - Ecological behaviour of bull shark (<i>Carcharhinus leucas</i>) on the west coast of Reunion Island, WIO. Implication for shark risk management
1120	M.L. Dicken, N. Nkabi - Trends in annual catch rates of the tiger shark (<i>Galeocerdo cuvier</i>) within the KZN Sharks Board bather safety program
1140	K.L. Mmonwa, S. Wintner, G. Cliff - Review of the global genetic connectivity and diversity of sharks caught off the east coast of South Africa: implications for species' conservation management
1200	A. Pirog, A. Blaison, S. Jaquemet, M. Soria, H. Magalon - Genetic diversity in the bull shark <i>Carcharhinus leucas</i> and the tiger shark <i>Galeocerdo cuvier</i> in Reunion Island
1400	POSTER SESSION
1600	POSTER SESSION
WEDNESDAY, 28 October 2015	
Amadiba	
0900	Keynote Presentation III: I. HALO - Drivers of Mesoscale Ocean Variability in the Southwest Indian Ocean: Impact on the Marine Ecosystems
0945	Keynote Presentation IV: T. AGARDY - Marine Spatial Planning for nature and humanity: Lessons for Africa
Amadiba	
Session XXI: Development in coral reef monitoring and research	
1100	K. Pothin, M. Facon, M. Pinault, S. Pioch, J.P. Quod, L. Bigot, B. Cauvin, R. Garnier, D. Obura - A comparative study of the accuracy and effectiveness of Line-Intercept and Point-Intercept methods for monitoring subtropical coral communities
1120	L.D. Bigot, B. Cauvin, P. Chabanet, K. Pothin - Lessons from an exceptional long term coral reef monitoring conducted at Reunion Island (Southwest Indian Ocean) since the last 18 years
1140	D.A. Zacarias - Visualizing research landscapes associated to coral reefs at the Indian Ocean: a bibliometric approach
1200	V. Munbodhe - Retrospective study- Evaluating phase shift in coral reef research priorities in a changing climate
Session XXII: Restoration of Coastal ecosystems	
1400	P. H. Montoya-Maya, A. J. Burt, C. Reveret, K. Rowe, S. Frias-Torres - Coral transplantation effects on fish and benthic community structure at a naturally damaged coral reef
1420	R. M. Pillay, B.G. Suraj, M. P. Ruby, N. Arnaud, B. Pamela, S. Vedant, N. Nazurally, N. Arnaud - Small Scale Reef Rehabilitation in Mauritius
1440	N. Shah, P.H. Montoya-Maya, S. Frias-Torres - Reef Restoration in the WIO: a success story in the Republic of Seychelles
1500	M. Randrianirina, H. Rakotondrazafy, D. Randriamanantena, J. Rakotondrazafy - Climate-smart Mangrove Restoration in the Delta of Tsiribihina (Western Madagascar)

Session XXIII: Coral reef science: Implications for management	
1600	J. Cinner - Bright spots among the world's coral reefs
1620	T. McClanahan - Modeling regional fish biomass, recovery potential, and marine protected area and fisheries management priorities in the western Indian
1640	H. Reuter - Management of coral reef based marine resource uses - application of agent-based models
1700	J. Robinson, N. Graham, J. Cinner, A. Gruss, C. Gerry, J. Bijoux - Highly variable catchability in a siganid spawning aggregation fishery: implications for management
1720	N.A. Muthiga, T.R. McClanahan - Population changes of sea urchins in coral reef closures and implications for reef ecology and management
Msikaba 1	
Session XXIV: Vulnerability and resilience of social-ecological systems	
1100	S. P. Mbense, J. Adams, A. Rajkaran - Resilience of mangrove ecosystems
1120	D. K. Nicolau, C. Macamo, H. Mabilana, S. Bandeira - Mangrove structural studies, long term climate impact and options for adaptation – a case of the Quirimbas National Park, Northern Mozambique
1140	N. L. Phair, S. Heyden, D. Pillay - Vulnerability, resilience and adaptation: the future for the seagrass, <i>Zostera capensis</i>
1200	M. Pfaff - South Africa's National Rocky Shore Monitoring Programme
Session XXV: Adaptation strategies	
1400	M.T. Paubert - Assessment of potential halieutic resources and propositions of climate variability adaptation in the deep southern Madagascar
1420	E. Darling, J. Maina, D. Mouillot, T. McClanahan - Data-driven portfolios of coral diversity and climate adaptation in the Western Indian Ocean
1440	H.H. Rakotondrazafy, A. Belokurov, V. Ramahery, L. Andriamaharo, J.H. Bakarizafy, Y. Razafimandimby - Climate Adaptation Methodology for Protected Areas (CAMPAs) – Innovative tool applied in two marine protected areas (MPAs) in Madagascar
1500	L.A. Ojwang, D. Obura, S. Oluoch, M. Murunga, A. Muiji, J. Kamula, E.M. Mwangi, E. Ng'ang'a, L. Celliers, S. Rosendo - Potential barriers to effective climate change adaptation by local coastal government in Kenya
Session XXVI: Assessing carbon stocks	
1600	V.O. Otieno - Evaluation of carbon sequestration in seagrass meadows of Malindi-Watamu Marine Parks, Kenya
1620	C.E. Stringer, C. Trettin, S. Bandeira, C. Macamo, D. Nicolau - Carbon Stock of Intact Mangroves in the Zambezi River Delta, Mozambique
1640	A. H. Mohamed, F.L. Tamooh, J. G. Kairo - Carbon accounting for REDD in transboundary mangrove forest in WIO
1700	M.N. Githaiga, L. Gilpin, J.G. Kairo, M. Huxham - Carbon Stocks in Seagrass Meadows, Gazi Bay, Kenya
1720	M. Dahl, D. Deyanova, L.D. Lyimo, J. Näslund, G. Samuelsson, M. Björk, M. Gullström - Effects of shading and simulated grazing on carbon sequestration in a tropical seagrass meadow
Msikaba 2	
Session XXVII: Fish reproduction patterns	
1100	B.S. Malauene, C.L. Moloney, B. Atanasio, F. Marsac, M. Roberts - Spawning pattern of banana shrimps on the Sofala Bank: Identification and characterization
1120	S.J. Collocott, S. Fennessy, S. Weerts - Patterns and influencing factors in the larval fish assemblage on the east coast of South Africa
1140	J.P. Bijoux - Post-translocation spawning site fidelity of the spinefoot shoemaker (<i>Siganus sutor</i>)
1200	B. O. Ogongo - The distribution and reproductive patterns of the <i>Epinephelus</i> genus groupers off Kenyan south coast marine waters
Session XXVIII: Small-scale/Commercial fisheries – species composition	
1400	C. Mwakosya, N. Jiddawi - Shallow Water Prawn Fishery: Species Composition, Abundance and Distribution along the Tanzanian Coastal Waters
1420	G. Berke, J. Bijoux, C. Gerry, F. Lesperance, J. G. Hiddink - Using Baited Remote Underwater Video Stations (BRUVS) to study the distribution and abundance of the demersal fish assemblages on the Seychelles continental shelf
1440	K.R.J. Luc, C. Jadot, A. Brenier - Small-scale reef fishery in the north west of Madagascar: a relatively healthy fishery
1500	J. Rehren, M. Wolff, N. Jiddawi - A Preliminary Evaluation of the Fishery of Chwaka Bay, Zanzibar Based on Stock- and Ecosystem Based Assessments
Session XXIX: Impacts and effectiveness of fishing gears	
1600	M. Wolff, M. H. Taylor, G. Tesfaye - Exploring the impact of small gillnets on yield per recruit (Y/R) and escapement spawning stock (ESS) for different fish species - a theoretical exploration
1620	M.K. Mbaru - Evaluating the role of gear technology innovations in coral reef fisheries in the Indian Ocean: A proof of concept
1640	J. A. Kawaka, K. Osuka, M. Samoilys - Assessing catches of gillnets to help eradicate illegal beach seines in Kenya's artisanal fisheries
1700	C.M. Kihia - Perspectives on Sustainable Management of Bait Fishery along the Western Indian Ocean Region
1720	R.E. Short, E.J. Milner-Gulland, M. Rowcliffe, N. Hill, S. Rosendo - Disentangling the net: the socio-ecological dynamics of mosquito net fishing

Msikaba 3	
Session XXX: Impacts of anthropogenic activities	
1100	G.R. Narayan - Are Zanzibar's coastal ecosystems undergoing change? Foraminifera bio-indicators for assessing Zanzibar's coastal ecosystem health
1120	N.N. Herrán, C. Reymond and H. Westphal - Local impacts are reducing calcium carbonate production in Zanzibar coral reefs: indication or implication for improved management?
1140	E. Longépée - The effects of recent changes on the resilience of WIO atolls, some hints from Kiribati (Pacific islands)
1200	J. Kitheka Analysis of the achievements of the UNEP-GEF WIO-LaB Project focused on addressing land-based sources and activities in the Western Indian Ocean
Session XXXI: Seaweed: Chemical composition and farming activities	
1400	Y.S. Yussuf - Characterization of agar extracted from Gracilaria species collected along Tanzanian Coast
1420	G. M. Mutia, Mtolera S.P.M., E. Akunda - Variations in Nutritional Composition of Seaweeds <i>Ulva rigida</i> , <i>C. Agardh</i> and <i>Ulva reticulata</i> , Forsskal and their Potential for use in Aquaculture, South Coast of Kenya
1440	J.G. Wakibia, H. M. Mwalugha, G.M. Kenji - Chemical composition of some common seaweed species from the Kenya coast – Joseph G. Wakibia
1500	C. Halling, S.A Tano, M. Eggertsen, A. Buriyo, F.E. Msuya, S.A. Wikström - The introduction of South East Asian seaweed and its ecological implications for East African coastal waters; Can indigenous African seaweed be a potential alternative for farming?
Session XXXII: Mariculture	
1600	A. J. Mmochi Growth rates of selected <i>Oreochromis</i> species cultured at different salinities
1620	M.C. Ndaró, A.J. Mmochi, M.S. Mtolera, M.K. Maalim - Ammonium Nitrogen Removal and Total Suspended Solids Control Efficiency Using <i>Hyphaene compressa</i> (H. Windl., 1878) Fronds and Effective Microorganisms (EM) Consortium in a Semi-intensive Mariculture System
1640	K. Narrain, P.V. Ramjeawon, M. Madhou, A. Suddhoo - Community-based <i>Gracilaria salicornia</i> farming in the coastal village of Grand Sable in Mauritius
1700	F. G. Maherizo - Role of the metabolites of <i>Byssochlamys Laguncularia</i> isolated from shrimp against the White Spot virus
1720	V.S. Assanaly - Analysis of environmental factors that could influence growth and apparition of diseases on seaweed <i>Kappaphycus alvarezii</i> farming
Msikaba 4	
Session XXXIII: Elasmobranchs of the WIO - Sharks & Rays	
1100	K. Naidoo, A. Chuturgoon, G. Cliff, M. Gregory, M. Ellis, N. Otway, S. Singh - Possible heavy metal transference to raggedtooth (<i>Carcharias taurus</i>) embryos
1120	C. Prebble, C. Rohner, F. Cagua, A. Armstrong, S. Pierce, J. Cochran, M. Berumen, T. Sinclair-Taylor - Residency and feeding ecology of whale shark (<i>Rhincodon typus</i>) aggregation at Mafia Island, Tanzania
1140	C. Elston The ecology of stingrays at the St. Joseph Atoll, Seychelles
1200	A.D. Marshall, D. van Duinkerken, C. Murie, S.J. Pierce - Manta ray cleaning stations in the Inhambane Province, Mozambique and the effects of marine tourism
Session XXXIV: Effectiveness of MPAs	
1400	J. Eklöf, S. Bandeira, S. Bystedt, A. Hennyey, N. S. Jiddawi, H. Linderholm, S. Skoglund, V. Thunell, J. Nduku-Uku, M. Gullström - Predictable effects of marine protected areas on ecosystem multifunctionality
1420	B. Randriamanantsoa, A. Brenier, C. Jadot, J. Maharavo, L. Bigot, P. Chabanet - A Successful Example of Marine Protected Area Adaptive Management in the Western Indian Ocean
1440	A. Brenier, B. Randriamanantsoa, C. Andrianaivojaona - Collaborative Enforcement of Marine Parks in Madagascar
1500	M. Dlamini - An investigation into the asymmetries in fish assemblages in sanctuaries, partially protected and open areas of KwaZulu Natal, South Africa using Baited Remote Underwater Video (BRUV) surveys
Session XXXV: Planning for establishment of MPAs	
1600	H.A. Ratsimbazafy - Testing the fitness of the future network of Marine Protected Areas (MPA) around Madagascar based on the connectivity of marine population & Identifying the ideal governance system and setting approach for the actual and/or the future MPAs
1620	S.P. Jorge, T. Pereira, C. Corne, Z. Wijten, D. Ponce-Taylor, A. Woods-Ballard, M. Omar, J. Katello, M.Kinyua, D. Oro, M. Louzao - Combining occurrence and abundance models to evaluate the suitability of an existing Marine Protected Area for dolphins
1640	R. Henriques, S. Heyden - Marine Protected Areas in the 21st century: using Phylogenetic Diversity as a tool for spatial planning
1700	J.M. Harris - Phakisa Initiative: fast-tracking establishment of an effective and representative network of Marine Protected Areas for South Africa
1720	C. Floros, M. Schleyer, B. Mann - Differential movement patterns in two predatory coral reef fish species: Implications for Marine Protected Area design

THURSDAY, 29 October 2015	
Amadiba	
0900	Keynote Presentation V: I. NAGELKERKEN - Ecological connectivity among tropical coastal ecosystems – current insights and threats
0945	Keynote Presentation VI: C. HICKS - Incorporating diverse values into small-scale fisheries management
Amadiba	
Session XXXVI: Coral reef fish communities	
1100	K. Osuka, M. Kochzius, A. Vanreusel, D. Obura, M. Samoily - Linkage between fish functional group distribution and coral reef benthic habitat composition in the Western Indian Ocean
1120	R. H. Bennett, C. Delacy, M. Markovina - East Africa's marine protected areas: fish refuges or fishery resources
1140	M.A. Samoily, R. Roche, H. Koldewey and J. Turner - Disentangle ecological and anthropogenic drivers of coral reef fish populations: using Chagos as an ecological benchmark
1200	N.N. Wambiji, Santie de Villiers, S. Maina, M. Wamalwa, M. Agaba - Genetic variability of <i>Siganus sutor</i> (Family: Siganidae) populations through analysis of the mitochondrial D-loop along the Kenyan coast
Session XXXVII: Uptake of research results	
1400	C. Abunge, N. Muthiga, T. R. McClanahan, E. Mueni - Community fishers' forum as a means to facilitate the uptake of science into small-scale fisheries co-management
1420	A.O. Tuda - Understanding the use of Science in Marine Protected Area decision making in the Western Indian Ocean
1440	Lydia Gaspare, Ian Bryceson, Kassim Kulindwa - Complementarity of fishers' traditional ecological knowledge and conventional science: Contributions to the management of groupers (Epinephelinae) fisheries around Mafia Island, Tanzania
1500	J. Ferraris, C. Sabiot, C. Chaboud, M. Durand, J. Mahafina, G. Stoica - Vulnerability of coral reef heritage: returns of a summer school experience
Session XXXVIII: Climate Impacts and barriers mitigation effects	
1600	S. N. Musyoka - Future Consequences of Sea Level Rise in Kenyan Coast
1620	A.A. Lipangue - Marine GIS for Assessment of the impacts of Sea Level Rise in Mozambique
1640	L. M. Mugi, A. J. Hamza, G. Luvuno, A. Wanjiru, J. G. Kairo - Application of IPCC Guidelines in Monitoring, Reporting and Verification (MRV) and Blue Carbon in WIO Countries
1700	A. W. Kairu, K. Kotut, R. Mbeche, J. Kairo, H. Mark, C. Upton - Institutional barriers to mangrove REDD: Effects of local and meso institutions and governance on implementing PES schemes in mangroves
1720	C. Wanjiru, F. Nunan, L. King - Preparing for Climate Change: A Climate Development Future for Coastal Kenya
Msikaba 1	
Session XXXIX: Small scale fisheries: Trends and impacts	
1100	G.M. Okemwa, E.N. Kimani, B. Kaunda-Arara, C.O. Obota, M. Ontomwa - Resource overlap between artisanal and ornamental reef fisheries in coastal Kenya
1120	A. Temple, O. Amir, A. Brito, N. Jiddawi, E. Kimani, N. Wambiji, H. Ong'anda, N. Ngisiang'e, S. Perez, S. Fennessy, B. Everett, P. Berggren, J. Kiszka, C. Poonian, Y. Razafindrakoto - Artisanal vulnerable megafauna catch - BYCAM, an overview
1140	A. Javaid, A. Schlüter, N. S. Jiddawi - Time preferences and natural resource extraction.
1200	V.C.M. Julien, A. Guissamulo, S. Bandeira, F. Januchowski-Hartley - Artisanal fisheries at Pemba Town, Cabo Delgado: Structure, dynamics and contribution of catch for livelihood in an urban environment
Session XL: Small scale fisheries: Trends and impacts	
1400	B. Fulanda, E. Mueni, A. A. Van Dam, C. Munga - Ecosystem modelling of Ungwana Bay Fishery, Kenya: A holistic approach to Fisheries Management
1420	B.E. Rasoanirina, C. Gough, K. England, N. Teichert, S. Zafinirina, R. Rasolofonirina - Identifying a biologically appropriate minimum catch size for mud crabs <i>Scylla serrata</i> in southwest Madagascar using L50
1440	H. Koike, C. Gerry, A - Friedlander Seychelles' Sea Cucumber Stock Assessment: management options for sustainable fishery
1500	C. Conand, H. Eriksson, N. Muthiga, M. Leopold, J. Prescott, S. Purcell, V. Toral-Grand - Management of sea cucumber fisheries: the problem of illegal captures
Session XLI: Fishery resources trade	
1600	L. F. Rajonhson, T. Lavitra, L. Soambola, Z. Rasoloarijao - Fishery, trade and essay of larval production in hatchery of <i>Hippocampus</i> southwest of Madagascar
1620	C. O. Odoli, P. Oduor-Odote, T. Tomasson, G. Thorkellson, S. Arason - Influence of drying methods and blanching treatment on the drying rate, quality and lipid stability of sardine (<i>Sardinella gibbosa</i>)
1640	P. Kimani, C.M. Mlewa, J.O. Manyala, A. Wamukota - Influence of local fish grading systems in value chain structure differentiation
1700	E.D. O'Neill, M. Thyresson, B. Crona, N. Jiddawi, R. Pomeroy, A. Ferrer - Markets and Middlemen: Taking a Value Chain Approach to Study Important Social-Ecological Linkages in Small-Scale Fisheries
1720	B.M. Fulanda, G.M. Waweru, B. A. Wagude, E. M. Mueni, E. Andalya, M. K. Bashir Fishery Value Chains and Implications for Sustainable Fishery Markets in Small-Scale Fisheries of the Lamu Archipelago

Msikaba 2	
Session XLII: Ecological connectivity	
1100	A. Rajkaran, E. Bornman, T. Leslie, N. James - Now you see me now you don't! The influence of habitat complexity and connectivity on fish abundance in mangrove, salt marsh and seagrass beds
1120	J.Q. Maggs, P.D. Cowley - Tracking movement of important marine and estuarine fish species in South Africa: a synthesis of research and findings
1140	L. Bigot, P. Chabanet, C. Bourmaud, C. Conand, P. Durville, N. G. Bonnet, H. Magalon, L. Mattio, L. Masse, T. Mulochau, J. B. Nicet, D. Obura, J. Poupin, M. Zubia - A multidisciplinary approach for coral reef management: a case study of the Iles Eparses (SW Indian Ocean)
1200	D.C. de Abreu, A. Vetina, J. Matsombe, A. Macia, P. Moksnes - Carbon and nitrogen stable isotope signal from estuarine penaeid shrimp nursery areas in Maputo Bay, Mozambique - A tool for the assessment of nursery areas contribution to adult shrimp fishing grounds
Session XLIII: Fish assemblages in shallow habitats	
1400	M. Eggertsen, S.A. Tano, S.A. Wikström, C. Berkström, A. Buriyo, C. Halling - The function of tropical East African macroalgal beds, part I: Invertebrate communities
1420	S.A. Tano, M. Eggertsen, S.A. Wikström, C. Berkström, A. Buriyo, C. Halling -The function of tropical East African macroalgal beds, part II: Fish assemblages
1440	L. Eggertsen, L. Hammar, M. Gullström - Shallow-water fish communities around Inhaca Island (Mozambique): assessing the influence of habitat characteristics on seascape connectivity
1500	M. Gullström, L. Hammar, G. Palmqvist, K. Wikström, L. Eggertsen, A. Knudby, L.M. Nordlund, A. Koliiji, N. Jiddawi, R. Lindborg - Exploring effects of seascape configuration on tropical seagrass fish communities
Session XLIV: Locally managed areas	
1600	M. Barnes, K.L.L. Oleson, L.M. Brander, B. Zafindrasilivonona, T. A. Oliver, P. Van Beukering - Social capital as an ecosystem service: Evidence from a locally managed marine area
1620	S. Blyth - Small scale, community-established no take zones in southwest Madagascar increase biomass of coral reef fish assemblages
1640	M. Murunga, J. Kawaka, M. Samoilys, J. Church - Establishing Locally Managed Marine Areas in Kenya
1700	G.W. Maina, M.A. Brown, M.K. Bashir, C.L. Oluchina - Strengthening fisheries co-management through Community-driven approaches in Northern Coast of Kenya
1720	L. Andriamaro - Strengthen marine biodiversity conservation through community-based approach in Ambodivahibe protected area
Msikaba 3	
Session XLV: Coastal physical processes	
1100	S. Mahongo - Variability and trends of surface air temperature along the coast of Tanzania over the last half century
1120	Y.W. Shaghude - Seasonal and Inter-Annual Variability of Sea Surface Temperature along the Coast of Tanzania: Implications for Coastal Resources Management
1140	D.S. Mukaka - Tides and tidal currents in Zanzibar channel
1200	V.M.S. Zikhali - Wind-driven waves & sediment resuspension in shallow lakes with muddy substrates: St Lucia, South Africa
Session XLVI: Modeling of physical processes	
1400	S.P. Zegge, Y.W. Shaghude, A.N. Muzuka - Hydrodynamic Modelling on Transport, Dispersion and Deposition of Suspended Particulate Matter in Pangani Estuary, Tanzania
1420	K.H. Kai - Seasonal Prediction of Tropical Cyclones and Storms over the Southwestern Indian Ocean Region using the Generalized Linear Models
1440	J. Dani - Satellite-Based Coastal Upwelling Variability South Madagascar
1500	M.C. Manyilizu - Impacts of the upper-ocean dynamics on ocean properties in the tropical western Indian Ocean: A Model Approach on Annual Cycle
Session XLVII: Shoreline changes	
1600	A. Rawat, J.I. Mosaheb - Impacts of oceanic waves on beach erosion at Flic-en-Flac
1620	L.A. Guastella, A. Smith - Use of Beach Webcams and Wave Data in Understanding and Forecasting Coastal Erosion
1640	A. Smith, L. Guastella, M. Ferentinou - Coastal Erosion: Single Swell Events Vs Seasonal Swell Groups, Kwazulu-Natal, Southeast Africa
1700	B.J. Goble, C.F. Mackay and J.A.G. Cooper - Effects of an extreme event on long-term shoreline change: an example from the KwaZulu-Natal coast, South Africa
1720	S.C. Bundy, N. Forbes - Drivers of Change in Dune Form - A Case Study for Set back line determination

Msikaba 4	
Session XLVIII: Communicating science	
1100	J. Mann - Communicating Marine Science for Conservation in the WIO
1120	L. Masse, G. Stoica, R.M. Moussa, S. Carrere, C. Sabinot, A. Riou, P. Chabanet, J. Ferraris - The impact of the MARECO educational toolkit on the coral reef social representation of children in the south Western Indian Ocean
1140	L. Gipperth, E. Sundblad, A. Grimvall - Developing actor-oriented societal indicators for the influence on marine environments
1200	H. Mwaka, D. Mirera, J. Mwaluma, B. Nyonje - Effectiveness of fish farmer's trainings: Case of Kenya Coastal Development Project (KCDP)
Session XLIX: Governance challenges	
1400	P. N. Mbatha - How multiple governance systems influence coastal livelihood strategies: The case of Kosi Bay, South Africa
1420	J. Rubens, M.I Kroese, J. Kotze, B. Mngulwi, J.S. Mhada, G. Katulumla, M. Markovina, H. Machano - Enforcing legislation against blast-fishing in Tanzania: challenges & lessons
1440	D.V. Garcia-Caceres - International legal regime towards coral reefs conservation: a Western Indian Ocean perspective
1500	G. David - MPAs at risk, when vulnerability to economy and politics beats the Climate change's vulnerability.
Session L: Tools for improved management of coastal and marine environment	
1600	J. Smith, D. Dogley, M. Brown - Towards a Blue Economy in Seychelles: Marine Spatial Planning and a Debt Swap
1620	C. A. Muhando, Y. Barthélemy, M. D Richmond - GIS-based coastal sensitivity map for Tanzania
1640	M. Thyresson, B. Schulte-Herbrüggen, D. Galafassi, T. Daw, S. Bandeira, S. Rosendo, L. M. Baynham - Systems maps and future scenarios- Participatory tools for enhanced systems understanding in coastal Kenya and Mozambique
1700	E. Torell, C. McNally - Measuring the economic and behavioral impacts of sustainable livelihoods in coastal management: Experiences from mainland Tanzania and Zanzibar
1720	T. Chaigneau, D. Gonçalves, S. Offman, C. Abunge, S. Coulthard - A basic needs approach to understanding ecosystem service contribution to wellbeing

FRIDAY, 30 October 2015

Special Sessions Programme

	Mtamvuna	Msikaba 1	Msikaba 2	Msikaba 3	Msikaba 4	Mzamba 1
09:00	1. Coral Reefs: a Common Heritage	3. MSC: Fisheries Improvement Projects (FIPs)	4. Effective Conservation Communication in the Western Indian Ocean	6. Regional State of the Coast Report: What next (By invitation)	8. Creating positive stories of the Future: Seeds of Good Anthropocenes	10. Regional Network for Locally Managed Fisheries (LMF)
10:30	COFFEE/TEA BREAK					
11:00	1. Coral Reefs: a Common Heritage	3. MSC: Fisheries Improvement Projects (FIPs)	4. Effective Conservation Communication in the Western Indian Ocean	6. Regional State of the Coast Report: What next (By invitation)	8. Creating positive stories of the Future: Seeds of Good Anthropocenes	10. Regional Network for Locally Managed Fisheries (LMF)
12:30	LUNCH					
14:00	2. Strategic Adaptive Management of MPAs	3. MSC: Fisheries Improvement Projects (FIPs)	5. Wetlands-Africa: Lively learning: Participatory tools for awareness, advocacy and capacity building	7. WIO Mangrove Network: progress and achievements	9. Capacity building in ocean forecasting for the western Indian Ocean (By invitation)	10. Regional Network for Locally Managed Fisheries (LMF)
15:30	COFFEE/TEA BREAK					
16:00	2. Strategic Adaptive Management of MPAs	3. MSC: Fisheries Improvement Projects (FIPs)	5. Wetlands-Africa: Lively learning: Participatory tools for awareness, advocacy and capacity building	7. WIO Mangrove Network: progress and achievements	9. Capacity building in ocean forecasting for the western Indian Ocean (By invitation)	10. Regional Network for Locally Managed Fisheries (LMF)
1730	END					

POSTERS

1. A.A. Abubakar, B.M. Fulanda, E.N. Kimani- Characterisation of small-scale tuna fishery in Kenya
2. A.M. Ada, A. Halare- Species composition of the avifauna of Bons Sinais Estuary at Zambezia provincial, Mozambique
3. A.M. Ada, E. Mariano, J. Nhaca, A. Guissamulo, S. Bandeira- Socio-economic sustainability of cruiseliner tourism in a coastal rural setting
4. A.M. Ada, J. Nhaca, I. Timba, G. Albano- A two decade of sea turtles monitoring program: What is the nesting trends of sea turtles at Inhaca Island?
5. V.M. Alati- Fish relationships with seagrass habitat structure in Kenya
6. E. Alavaisha, M.M. Mangora, M.S. Shalli- Socio-ecological Potential of Mangrove Forests for Carbon Market in Mtimbwani and Geza Villages, Tanga, Tanzania.
7. A.Z. Alfredo, I.M. da Silva- Influence of tidal cycles in catches of small pelagic Decapterus russelli (Rupell, 1980), Decapterus macrosoma (Bleeker, 1851), Scomber japonicus (Houttuyn, 1782) accessible to the hand line fishing- Pemba District
8. E.A. Aller, N. Jiddawi, J.S. Eklöf- The effects of short-term climate variation and placed-based management on seagrass and associated fish communities
9. F.M.C. Amade, C. Oosthuizen, P.Chirwa- Development of Microsatellite Markers for Avicennia marina from Mozambique using MySeq technology
10. R. Ameen, G. Moodley, D. Robertson-Andersson- The use of sub-tropical east coast copepod species as live feed for fish larviculture
11. O. Amir, A. Brito, P. Berggren, B. Everett, S. Fennessey, N. Jiddawi, E. Kimani, J. Kiszka, N. Ngisiang'e, H. Ong'anda, S. Perez, C. Poonian, Y. Razafindrakoto, S. Stead, A. Temple, N. Wambi- Incidental and targeted marine megafauna captures in Western Indian Ocean fisheries
12. C.A. Amoda- Seasonal exploitation and distribution of the beaked clam Eumarcia paupercula (Holten, 1802) in Costa do Sol , Maputo Bay
13. C.A. Amoda- Seasonal Study of Exploration and distribution of clams dark Eumarcia paupercula (Holten, 1802) on Costa do Sol , Maputo Bay
14. A.M. Andrew, J.F. Machiwa, J. Routh - Temporal and Spatial Variation of Nutrients in Rufiji Delta mangrove, Tanzania
15. M. Andriamahefazafy, F. Le Manach, A. Harris - The good, the bad, and the unspoken: an analysis of Madagascar's foreign fishing access agreements
16. R.R. Andriamampandry- MIHARI: Networking coastal communities in Madagascar
17. N. Andrianarivelo - Hunting and Bycatch Assessment of Marine Mammals on the South West Coast of Madagascar, 2000-2015
18. G. Arvind, R. Bhagooli, V.S.N. Bhujun, T. Bahorun- Antioxidant activities of edible marine molluscs from a tropical Indian Ocean island
19. M.M.M. Bamdou- Coral reefs face the plastics wastes in the Moheli marine park (MMP)
20. S. Bandeira, D.J. Msangameno, J.Paula- Exercises in Marine Biodiversity and Ecology. An Approach for the WIO Region Coastal Zone
21. R. Beesoo, V.N. Bhujun, R. Bhagooli, T. Bahorun- Panning for chemical gold from Mauritian waters: Didemnummolluscs as a new source of Antimicrobial and Antioxidative agents.
22. S.S. Beepat, C. Appadoo, D.P.E. Marie, S.B. Sadally, J.P.M. Paula, K. Sivakumar, R.R. Rao, M. Salah- A first description of sponge-associated Actinomycete from two coastal sponges from Mauritius
23. J.S. Benansio- Have fishing communities of Zanzibar Island benefited from increasing tourism development?
24. J.S. Benansio- Investigating changes in fish biodiversity in coastal villages of Zanzibar Island
25. G.D. Bernabe- The Influence of Environmental Parameters on Growth and Survival of Argyrosomus japonicus Larvae Grown in Marine Aquaculture Station in Pemba
26. R. Bhagooli, A. Gopeechund, D. Kaullysing, S. Mattan-Moorgawa- Variation in density of corallivorous gastropod Drupellacornus and macroalga Padinaboryana on Acropora muricata at Flic-en-Flac, Mauritius
27. P.H. Bhanderi- Managing mangroves with mzingas
28. S. Blyth- Human well-being and mangrove forests: case study on the role of coastal ecosystem services in two communities in Madagascar
29. C. Bourmaud, S. Slobodov, G. Berrocq-irigoien, N. Gravier-Bonnet, J. Goy- The coral reef medusae (cnidaria) of Reunion island (south-west Indian Ocean)
30. H. Bouwman, H. Kylin, R.C.K. Yive, V. Tatayah, N. Cole, S.W. Evans- Birds from Agalega and St. Brandon's Rock, Republic of Mauritius
31. H. Bouwman, H. Kylin, R.C.K. Yive, A. Polder- Halogenated organic contaminants in tern eggs from St. Brandon's Rock and Rodrigues, Republic of Mauritius
32. A.Q. Bovungana, M. Pfaff, J. Nhleko, L. Madikiza, A. Boyd - Novel technologies for developing indicators for marine and coastal water quality in South Africa
33. A. Brenier, B. Randriamanantsoa, C. Andrianaivojaona- Toward collaborative management of fisheries in Madagascar: case study of Antongil Bay
34. A. Carrassi, N.S. Jiddawi- Assessment of octopus (Octopus cyanea) populations in Misali Island, Pemba
35. L. Caussy, C. Appadoo, W. Potts, W. Sauer- A study of the frenchman seabream Polysteganus baissaci (Smith, 1978) (Perciformes: Sparidae) from the Nazareth Fishing Bank, Mauritius
36. R. Cedras- Biogeography of the Western Indian Ocean calanoid copepods
37. L.V. Cele- The Connectivity of Diplodus capensis (Blacktail), Rhabdosargus thorpei (Bigeye Stumpnose) and Neoscorpis lithophilus (Stonebreem) fish populations in the Southwest Indian Ocean
38. P. Chabanet, L. Bigot, C. Bourmaud, C. Conand, P. Durville, N.G. Bonnet, H. Magalon, L. Mattio, L. Masse, T. Mulochau, J.B. Nicet, D. Obura, J. Poupin, M. Zubia - A multidisciplinary approach for coral reef management: a case study of the Iles Eparses (SW Indian Ocean)
39. O. Chakoory, V. Bhoyroo, M.R. Sanmukhiya- Sea-worms a new research avenue: A preliminary assessment using morphological and molecular markers
40. C.M. Chevane, S.V. Canhanga- Water masses characteristics in Maputo bay
41. B. Chiazzari, A. Macdonald- On the margins of their existence: Identifying the evolutionary history and patterns of species level genetic diversity of high latitude scleractinia (hard corals) of the South Western Indian Ocean region
42. S. Choge, H. Ong'anda, J. Kairo - Mangrove mapping and cover change analysis in Vanga, Kenya; using Landsat data and GIS
43. P.K. Chumun, N. Taleb-Hosenkhan, R. Bhagooli, L.J. Chauka, M.S.P. Mtolera- Comparative Study of Genetic Diversity and Distribution of Symbiodinium Harboured by Reef Building Corals Common to Zanzibar and Mauritius Islands

44. G.J. Cilliers and J.B. Adams- Monitoring and evaluation of the thresholds of probably concern for the berg river estuary, South Africa
45. T. Claverie - Large scale study in reef fishes: Body elongation is the principal axis of shape evolution
46. A. Collet, D. Ponton, A. Philippe, R. Dardare, P. Valade, J. Durand, H. Jaonalison, J. Mahafina- DNA barcoding of reef fish postlarvae as a tool for investigating fish biodiversity off La Réunion Island, SW Indian Ocean
47. J.Comte, R. Cassidy, J. Obando, O. Banton, A. Bourhane, K. Ibrahim, J.Join, M. Makokha, S. Melchioly, I. Mjemah, I. Mohamed, C. Noe, N. Robins, H. Shauri - Physical and societal challenges in groundwater security in coastal East Africa: case studies in the Comoros Islands, Kenya and Tanzania
48. C. Conand, T. Mulochau, S. Stöhr, M. Eléaume, P. Chabanet- Diversity of the Echinoderms of the Iles Eparses (Europa, Glorieuses, Juan de Nova), Mozambique Channel, France
49. M.W. Coote - The Use of Aquaculture Techniques in the Determination of the Eco physiological Effects of Micro plastic Consumption/Retention
50. D. Dabee- Ghost crab as an ecological indicator to understand the impacts of natural and human intervention in the coastal setting of Poudre D’Or village, Republic of Mauritius.
51. A. Damian, C.A. Muhandu- Mapping the Utilization Patterns of the Coastal Zones of Unguja Island, Zanzibar
52. A. Damon, M. Gibbons, A. Götz, A. Bernard, S. Kerwath, T. Samaai - Distribution of the benthic invertebrate community and ichthyofauna associated with the Walters Shoal seamount
53. G. David, M.H. Durand, Z.M. Maanfou, K. Sinane- Coral reef heritage, an inheritance in vagrancy
54. D. de Abreu, M. Mafambissa, A. Vetina, R. Cossa, V. Machava, D. Cossa- Benthic macrofauna assessment on Govuro mangrove, southern Mozambique – A climate change impacted mangrove area
55. D. Deyanova, M. Gullström, M. Dahl, L.D. Lyimo, M.I. Hamisi, M.S.P. Mtolera, M. Björk- Productivity of a tropical seagrass meadow under stress: effects of prolonged shading and simulated grazing
56. Z. Dhurmea, I. Zudaire, N. Bodin, M. Cedras, N. Nikolic, J. Bourjea, H. Pethybridge, C. Appadoo- Preliminary results on the reproductive biology of albacore tuna (*Thunnusalalunga*) in the Western Indian Ocean region
57. S.M. Dippenaar- The status of the biodiversity of Siphonostomatoida (Copepoda) off South Africa
58. T.S. Dlaza, S. Madyibi, Z. Mnyaka, C. Yekani and F. Porri- Limpet and seaweed diversity on rocky shores along the Wild Coast of the Eastern Cape Province, South Africa
59. M. Du Preez, K. Minnaar, V.Van Der Schyff, R.C.K. Yive, H. Kylin, H. Bouwman, J. Raffin- Impacts of a wrecked fishing vessel on the coral reefs of St. Brandon’s Rocks, Mauritius
60. C.N. Donasio- The Mozambique Channel in Relation to Livelihood of the Local Communities in Mnazi Bay-Ruvuma Estuary Marine Park
61. V.F. Dove, F.A. Shillington And M.J. Roberts- Seasonal and interannual variability of surface chlorophyll-a and temperature in the Delagoa Bight, Southern Mozambique
62. S.D. Dyall, D.M. Hareeah C. Appadoo - Amphipod (Crustacea) responses to thermal stress and acidification: an analysis using protein profiling
63. M.J. Dyer, C. Floros, D. Pearton, A. MacDonald- Assessment of the genetic connectivity of two reef fish populations, *Epinephelus tukula* (Serranidae) and *Aprionvirescens* (Lutjanidae) in the iSimangaliso Wetland Park
64. T.M. Dzaha- Research on the Kenyan marine cyanobacterium *Lynghya majuscula* opens new frontiers in marine biodiversity efforts in Africa
65. A.D.S. Escardó, M. Wolff, N.S Jiddawi, J. Rehren- Diet composition and overlap of five commercial species of Chwaka Bay, Zanzibar, Tanzania
66. J. Escobar-Porras, A. MacDonald- Population genetics in South African elasmobranchs: Are they defined by the reproductive strategy of the species? – The Blacktip Chapter
67. M.A. Falinirina, T. Lavitra, B. Randriamanantsoa- Outlook of Toliara Great Barrier Reef (TGBR)
68. M.A. Farenako, F.G. Maherizo, E. Razafitradraibe- Biological valorisation of red farmed seaweed *Kappaphycus alvarezii* applied on rice cultivation
69. R.S. Fernandes, R. Campos, J.Melo-Ferreira, M.A.M. Pereira- First insights into the genetic diversity and population structure of loggerhead turtles (*Caretta caretta*) nesting at Ponta do Ouro Parcial Marine Reserve, southern Mozambique
70. S.M.C. Fernando, J.A. Marcelino- Current state of exploitation of bivalves with economic importance on intertidal zone in northern part of Mozambique
71. P.J. Fielding, C. Fielding, M. Spearpoint - Impacts of the Exploitation of Bait Organisms by Subsistence Fishers in the Swartkops Estuary, in the Eastern Cape South Africa
72. N. Forbes, B. James, A. Zaloumis - The restoration of the Lake St Lucia System in the iSimangaliso World Heritage Site, KwaZulu-Natal, South Africa
73. A.M. Frouws - The impact of seagrass canopy removal on infaunal macrobenthic communities and belowground carbon storage
74. B.M. Fulanda, E.MuenI, P. Nyongesa, S. Ndegwa, G. Waweru- Lost Gears – Lost Catches: the Tragedy of Small-Scale Coastal and Marine Fisheries in Western Indian Ocean Region
75. G. Gerber, T. Mkhize, D. Robertson-Anderson, G. Moodley- Microplastic uptake and retention in *Perna perna* (L.); *Tripneustes gratilla* (L.) and *Echinometra mathaei* (Blainville, 1825)
76. L.G. Gillis, S. Holm, G. Narayan, M. Zimmer, F. Belshe- Carbon Exchange: Do mangrove forests facilitate carbon outwelling to seagrass beds and coral reefs?
77. T.R. Golla, J. Sandoval-Castillo, C. van der Lingen, L.B. Beheregaray, B. Chiazzari, B.J. van Vuuren, P. R. Teske - A genomic appraisal of the stock structure of South African sardines
78. R.A. Govinden - Movement and residency patterns of grey reef sharks, *Carcharhinus amblyrhynchos*, along the west coast of Mahé, Seychelles
79. A. Grant, R. Hodgkiss, J. McClelland, C. Mason-Parker – Use of the Curieuse Island , Seychelles, Mangroves as a Nursery Ground by Sicklefin Lemon Sharks, *Negaprion acutidens*.
80. M. Griffith, C. Bryson, C. Mason-Parker – Coral reef recovery along the northwest coast of Mahe Island , Seychelles, following the 1998 mass bleaching event.
81. N. Gravier-Bonnet, E. Boissin, C. Bourmaud- Hydroid biodiversity (Cnidaria, Hydrozoa) at Inhaca Island (Mozambique)
82. T.H. Haingonirina- Quantification of stock total carbon in soil of mangroves in the north of Madagascar: case ambaro bay and Mahajamba bay
83. A.I. Halare- Contribution and impact of artisanal fishing on the Coastal Districts Shark Species of Zambezia Province (2008-2013)
84. A.I. Hamad , N.S. Jiddawi, S. Mohamed- Survival Rates of Cockle (*Anadara antiquata*, Linnaeus, 1758) Larvae under various Treatments which minimize the Level of Bacteria

85. S.S. Hamed, N.S. Jiddawi- Effect of feeding frequency and feeding rate on growth performance and carcasses composition of juvenile silver pompano (*Trichinotus blochii*)
86. A.J. Hamza, J.G. Kairo, N.Koedam, F. Dahdouh-Guebas- Mangroves and livelihood – An assessment of livelihood projects in the mangrove ecosystems along the Kenyan Coast
87. K.A. Harris, R. Nel, L. Harris, K. Bezuidenhout – Scavengers in ecosystems with erratic food supply: Are sandy beach scavengers calorie conscious?
88. T.M. Haupt-Schuter, C. Griffiths, T. Robinson- Alien species associated with oyster farming along the West and East coast of South Africa, with notes on the translocation of species associated with cultured oysters
89. T.M. Haupt-Schuter, I. Malick, S. Kerwath, A. Gotz, C. Wilke - Exploring the benthic invertebrate and ichthyofauna communities of Alphard Bank: changes in community patterns and structure with depth
90. J. Henitsoa, J. Mahafina, P. Valade, J. Durand, A. Collet, D. Ponton, O. Rakotoarson- Biodiversity of fish post-larvae in SW Madagascar
91. N. Hill, E. Chauque, M. Riddell, R. Cachimo, M. Samoily, J. Mussa, D. Obura, S. Rosendo, I.Silva, H. Koldewey- The importance of improved management of marine resources in the northern Quirimbas Archipelago
92. T.B. Hoareau, B. Strybos, K. Reid, P. Borsa- Identification of cryptic species in the Indo-Pacific honeycomb grouper *Epinephelus merra* using a combination of genetic tools
93. D.J.J. Hoeijmakers, F.E. Belshe, U. Nehls, T. Rixen, M. Teichberg- Do nutrients affect seagrass community composition of the heavily populated western coast of Zanzibar?
94. S.J. Hollanda, J. Bijoux, M. Cedras, N. Bodin- Change in condition through a spawning season of spinefoot shoemaker (*Siganussutor*) participating in spawning aggregations
95. H.M. Housseni- Development of negotiation skills for resolving natural resources conflicts: Case of Mohéli Marine Park in Ramadan
96. J. Huggett, M. Noyon, T. Henry, J. D’hotman - Image analysis of microzooplankton in a cyclonic eddy off southern Madagascar
97. R. Jankee, N. Nazurully, V. Bhooyroo- Morphological and molecular characterisation of Barnacles in Mauritius
98. N.S. Jiddawi- Requirements for Pearl farming including growth rate of the pearl oyster *Pinctada margaritifera* in Zanzibar
99. N.S. Jiddawi- Successful coastal entrepreneurship: The case of coastal women in Menai bay, Zanzibar
100. N.S. Jiddawi- Evidence of the occurrence, growth and distribution of milk fish (*Chanos chanos*) which can assist in ensuring better culture in Unguja, Zanzibar Tanzania
101. V.C.M. Julien, A. Guissamulo, A. da Silva, G.I Albano, A. Macia- Temporal distribution of sea turtles nests at Inhaca Island, Mozambique
102. V.C.M. Julien, A. Guissamulo, A. da Silva, G.I Albano, A. Macia- Nest site selection of loggerhead and leatherback sea turtles at Inhaca Island, Southern Mozambique
103. K.H. Kai- The relationship between tropical cyclones and the plant productivity indices along the coast of Tanzania
104. K.H. Kai- Analysis of the contribution of the Southwestern indian ocean tropical cyclones to the December to March rainfall season over Tanzania
105. J G Kairo, M W Skov, M Huxham - REDD+ in Blue Forests: Delivering the world’s first demonstrable community-led mangrove blue carbon project
106. A.W. Kamau, L.M. Mugi, A.J. Hamza, J.G. Kairo, C. Wanjiru- Community perceptions towards management of mangrove resources in Kenya
107. R.E. Katikiro- Promoting support for community owned solutions to emerging challenges in coastal fisheries
108. R.E. Katikiro, J.J. Mahenge- Nature-based coastal eco-tourism activities on marine protected areas of mainland Tanzania
109. D. Kaullysing, A.M.B. Goolamally, S. Mattan-Moorgawa, R. Bhagooli- A comparison of marine molluscan diversity at a highly frequented and a less frequented intertidal area around Mauritius Island
110. C.M. Kihia- Impact of invertebrate bait harvesting by artisanal fishers on migratory shorebird food resources at the Mida creek and implications on avifaunal conservation efforts
111. I.E. Kiper, S. Abeare, R.J. Mutombene, N. Wambiji, T.B. Hoareau- Utility of DNA barcodes across different phases of life: A tale of Rabbitfishes in the Western Indian Ocean
112. A. Koliji, L.M. Nordlund, R. Lindborg, N.S. Jiddawi, M. Gullström- Seagrass fisheries from fishers’ perspective
113. M. Koonja, K. Deeljore, S. Parboteeah, F. Arcienne, J.S.W. Hector, V. Soondur, S. Mattan-Moorgawa, R. Bhagooli- Island-based terrestrial Nature Reserve in Mauritius helps maintain desired quality of its surrounding coastal waters
114. B.L. Kuguru, M. Igulu, M.A.K Ngoile, B.I Everett, F. Sobo- The dynamics of a season of prawn fishing in Bagamoyo, Tanzania
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262. K. Singh, S. Singh, G. Moodley, D. Robertson-Andersson – Using social media as a tool to track the social impact of plastic pollution in the marine environment
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270. B.A. Tarimo, M.M. Mangora- Local Governance Opportunities and barriers for conservation of Mangrove Forests in Geza and Mtimbani Villages, Tanga-Tanzania
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273. I.L. Timba- Marine Biology Station: New Challenges to Marine and Coastal Research on Inhaca?
274. P.Z. Thoya, T. Daw- Spatial dynamics of fishing effort allocation by small-scale fishers near marine reserves
275. P.Z. Thoya- Assessment of effects of sediment load on seagrass cover using satellite imagery
276. S.A. Toavinalisoa, R. Lauric, Rakotoharimalala S.N, Mayer F – Preliminary results of photographic matching of humpback whales (*Megaptera novaeangliae*) breeding in the Sainte Marie channel
277. G.G.B. Todinanahary, L. Terrana, G. Tsiresy, I. Eeckhaut, T. Lavitra- Threat to black corals (*Antipatharia*) community of Madagascar: illegal harvesting and trade
278. C.C. Trettin, M.Mangora, S. Bandeira, C.E. Stringer- A Regional Framework for Mangrove Research and Training Forests
279. J. Trindade- Defining the space-use of Grey Reef Sharks (*Carcharhinus amblyrhynchos*), on Neptunes and Vamizi Island
280. G. Tsiresy, G.G.B. Todinanahary, T. Lavitra, P. Dubois, G. Lepoint, I. Eeckhaut- Seasonal occurrence and morphological description of the stages observed in the life cycle of the epiphytic filamentous algae *Polysiphonia* sp., parasite of the farmed seaweed *Kappaphycus alvarezii* in Madagascar
281. P.M. Tuda, M. Wolff- Species and size selectivity in Kenyan multispecies and multi-gear artisanal coral reef fishery
282. A. Tunin-Ley, F. Maillot, J. Turquet - PHYTOBANK: a promising source of active compounds to develop new biotechnologies using tropical marine microalgae from South West of Indian Ocean
283. J. Turquet, N. Arnich, M. Chinain, J.Diogène, J. Frémy, P. Hess, M. Soria, S. Trotereau, J. Vernoux - Ciguatoxins in sharks – overview of a recent state of knowledge carried out by ANSES (the French food safety agency)
284. V. Van Der Schyff, M. Du Preez, H. Bouwman- Heavy metal contamination in corals from Isimangaliso and Aliwal Shoal Marine Protected Areas, South Africa
285. K. Van Puyvelde, A. Rajkaran, C.N. Munga, J. Groeneveld, M.A. Sheikh, M.S. Shalli, A. Vanreusel, N. Koedam – InteGRADE – a novel approach to linking research, training and networking in marine science
286. L. Vivier, G. Tweddle, D.P. Cyrus- The effect of extended mouth closure on the St Lucia prawn community: Is there a way back?
287. A.W. Wamukota, M. Thyresson, T. Daw, B. Crona, E.D. O’neill, D. Goncales, S. Offman – Market structure and participation in trade in octopus, mixed reef fish and small pelagics in Kenya and Mozambique: A value chains approach
288. V. W. Wang’ondou, A.Muthumbi, K. Nico, A. Vanrusel – Mangrove forest accessibility and its impact on stand structure
289. W.M. Wanyoike, C. Kihia, A.W. Muthumbi – Identification and bioactivity of endophytic fungi isolated from disturbed and non-disturbed mangrove forests in Kenya
290. K.L. Wiggill - Phylogeography of the Bull Ray (*Pteromylaeus bovinus*) along the KwaZulu Natal coast line
291. J.L. Williams – Understanding green and loggerhead sea turtle population demography through photo identification
292. A. Wosu - Drivers and distribution of effort in an octopus fishery: A case study from Ibo Island, Quirimbas Archipelago, northern Mozambique
293. S. Yahya – Coral Reef Conservation in Zanzibar: Current status and outlook for the near future
294. L.D. Zacarias, A. MacDonald, J. Groeneveld – Genetic structure of the knife prawn *Haliporoidestriarthrus* with implications for transboundary stocks in the SW Indian
295. L.D. Zacarias, A. MacDonald, J. Groeneveld – Reproductive strategy gives rise to genetic structure in the langoustine *Metanephrops mozambicus*

PRE-SYMPOSIUM EVENTS

23 – 24 October 2015

1. The Thirteenth Meeting of the MASMA Grantees: Monitoring the Performance of the Approved Projects

Convener: WIOMSA

Venue:

Background

Monitoring and evaluation of the approved project performance is a key component of the Marine Science for Management (MASMA) Programme. This process is achieved through:

- i) Reviewing of the annual monthly progress reports. The MASMA grantees are required to submit to WIOMSA annual progress reports
- ii) Field visits by the Programme Committee (PC) members or experts on the topic. Some of the members of the PC or experts nominated by the PC will make field visits to monitor the implementation of the approved projects
- iii) Annual meetings where project participants are required to attend and present scientific results of their work.

Monitoring and evaluation of the approved projects is essential to both the grantees and the Programme Committee to determine the progress made towards achieving planned objectives and results. It provides an opportunity for timely intervention to assist any project in problem.

The effectiveness of the monitoring and evaluation is dependent on the full collaboration of all individuals involved in the implementation of different components of the approved projects.

The meeting provides an opportunity for the grantees to actively interact with their peers, i.e. the invited experts, members of the Programme Committee as well as the fellow grantees. The experts with varying academic and professional background that is relevant to the subjects covered by all the approved projects will be invited to the meeting as panelists.

Objectives

The main objectives of the Meeting are to:

- Provide an opportunity for grantees to present the results of their work to a wider audience;
- Review and evaluate the performance of the approved projects based on the scientific results generated so far against the research objectives of the projects;
- Provide comments/feedback to the grantees on how the design or implementation of the approved projects could be improved to achieve the desired outcomes;
- Provide an opportunity for the grantees to build networking amongst themselves and with the experts present as well as with the members of the Programme Committee

25 October 2015

1. MASMA Programme Committee Meeting

Convener: WIOMSA

Venue

2. Workshop on ‘Getting Published’

Convener: Joshua Cinner

Centre of Excellence for Coral Reef Studies, James Cook University

Email: joshua.cinner@jcu.edu.au

Venue:

In conjunction with the 9th Western Indian Ocean Marine Science Association (WIOMSA) Symposium, the Australian Research Council (ARC) Centre of Excellence for Coral Reef Studies and WIOMSA will jointly host a one-day workshop on getting published on October 25, 2015. This workshop will be directed at scientists interested in learning how to navigate the publication process.

The workshop will be run by Dr Joshua Cinner, who holds a prestigious ARC Australian Research Fellowship. Dr Cinner has published over 100 peer reviewed papers and a book with Oxford University Press. He serves on the Editorial Boards of Conservation Biology, Global Environmental Change, Ecology & Society, and Coastal Management and has reviewed for over 35 journals. Cinner will use his considerable editorial, publishing, and reviewing experience to provide insights into how to structure manuscripts effectively and to navigate the peer-review process.

The workshop will be suitable for people in different career stages, from graduate students working on their first publication to more senior scientists that want some tips on getting through the review process. Cinner will use five manuscripts from the participants as living examples of what to do and what not to do. Thus, participants that are interested in having their work openly critiqued should indicate so in their application. Dr. Cinner will select five participants to submit manuscripts that will serve as examples for the section of the workshop focusing on structuring a manuscript effectively. However, you need not have a manuscript prepared to attend the workshop.

Workshop outline

Morning

- Introduction: why write a paper? Publish or Perish
- Parts of a paper
- Common Writing Flaws
- Selecting a Journal

Afternoon

- How a Journal Works
- How to Avoid Rejection
- Guidelines for Authorship

3. Coral reef monitoring and Marine Taxonomic Database

Convener: Said Ahamada (Biodiversity program-IOC) and David Oboura (Cordio)

Email: said.ahamada@coi-ioc.org

Venue: Msikaba 2

Background

The Indian Ocean Commission (IOC), the Nairobi Convention and the Western Indian Ocean marine science association (WIOMSA) have developed a strong collaboration on sustainable marine and coastal environment management, including the protection, management and monitoring of coral reefs. This has been established in alignment with the International Coral Reef Initiative (ICRI), and its Global Coral Reef Monitoring Network (GCRMN). Under the IOC, first the ISLANDS project (2011-14) and now the Biodiversity Project (2013-17), have supported actions to revitalize the national and regional coral reef networks, assess the current state of coral reef monitoring, and provide tools (an online database and updated manual) to support national coral reef monitoring teams.

A regional workshop on coral reef networks and monitoring was held in February 2015 in Mauritius, attended by 40 coral reef researchers and managers from Comoros, Kenya, Madagascar, Mauritius, Seychelles and Tanzania. At the workshop, a roadmap for compiling a Western Indian Ocean GCRMN report for 2015-16 was drafted. The online Coral Reef Information System will form a basis for the reporting process.

The 9th Scientific WIOMSA Symposium provides a unique opportunity to gain further support for the reporting process in the broader WIOMSA community, and in the countries not supported in the Biodiversity Project.

A special session on Coral reef monitoring will facilitate communication between researchers and allow for the development of a regional approach to draft the regional status report.

Objectives

- To share with regional scientific community the preliminary results of ongoing coral reef monitoring at national level.
- Assess data available, identify information gaps and ways to fill them
- recommend some actions for a harmonised approach in drafting a regional status report

Target audience

Researchers, students, Marine Protected Area researchers/planners, conservation planners, GIS/spatial analysts, government and multilateral institutions' representatives, coral reef practitioners.

Expected outputs

- Updates on ongoing national monitoring's
- Summary of available data
- Harmonized approach for the regional status report
- Fine-tuned timeline for the regional status report delivery

Provisional Meeting Programme

Timing	Activities	Responsible
08 :30	Registration of participants	
	Session I : Coral reef session	
09 :00	Opening	Said Ahamada & Tim Andrew
09 :15	Overview of the WIO GCRMN coral reef status report drafting process	Dr David Obura (CORDIO)
10 :00	National Progress report (10mn per expert)	National Experts
10 :30	COFFEE BREAK	
10 :45	National Progress report	National Experts
11 :15	Other interventions ?	
11 :45	General discussions on constraints, gaps and recommendations	David Obura
12h30	Lunch	
	Session 2 : Marine Taxonomic Database session	
13 : 30	Welcome, introduction and objectives, and participant introductions as necessary	Lucy Scott and Tim Andrew
14 :00	Presentation of the Concept Paper and feedback from the regional questionnaire	Lucy Scott
14 :30	Discussion of options; strengths and weaknesses of each option discussed	Lucy Scott
15 :00	Way forward: circulation of results and the updated concept document. Process going forward. Suggestions of additional stakeholders with whom to consult.	Lucy Scott
15 :30	COFFEE BREAK	
16 :00-17 :00	Parallel Session: Small working group on the WIO GCRMN coral reef status report drafting way forward	6 Key National experts and 2 regional coordinators (IOC+CORDIO)
16 :00-17h00	Parallel Session: Any further discussion on the marine biodiversity database options	Lucy Scott and Tim Andrew
1530	Meeting closure	
1530	COFFEE BREAK	
1600	Small working group on the WIO GCRMN coral reef status report drafting way forward	6 Key National experts and 2 regional coordinators (IOC+CORDIO)
1700	Closing	

SPECIAL SESSIONS

1. Coral Reefs: a Common Heritage

Co-convenors: T. Boudi, E. Longépée, Z. Maanfou, A. Rasolomaharavo, G. Stoica, G. Todinanahary, T. Veriza and Danilo Garcia

Email: georgeta.stoica@ird.fr

Short Description

The proposed workshop will focus on the coral reef vulnerability and on the notion of heritage and is intended to be an interdisciplinary and dynamic activity that brings together scholars coming from different scientific disciplines such as marine biology, ecology, geography, law, anthropology and economics in order to establish a dialogue and debate on the coral reef heritage.

Workshop objective

The objective of the workshop is to launch a debate on the issues of the 1st Summer School on the Vulnerability of Coral Reef Heritage (EEA-VulPaRe) held in 2014 in Toliara (Madagascar) open to all the participants coming from different disciplinary fields that will be present at the 9th WIOMSA Symposium. Mainly, we intend to define and discuss the notions of heritage and coral reef vulnerability through the lens of law and economic frameworks, ecological and biological indicators, local perceptions, beliefs, uses and practices.

Workshop outcomes

The expected outcomes of this workshop are:

- create a scientific discussion network on the topic of coral reef heritage and its vulnerability
- develop a definition of “coral reef heritage” that is relevant to the people and coral reefs of the Western Indian Ocean but also to the scientific community
- elaborate a workshop document summarizing points of view about: a) the definition of coral reef heritage; b) aspects of its vulnerability; c) cooperation and citizen participation processes. The coordinating committee with the contribution of all the workshop participants will write the document.
- promote collaborations between researchers of different nationalities that are interested to engage in a scientific network on coral reef heritage.

Targeted audience

The workshop is intended to be an open interdisciplinary event. Ideally, participants should include specialists from varied disciplines such as biology, ecology, economics, sociology, anthropology, geography and others. We especially expect to have among the participants graduate and post-graduate students, researchers, and environmental actors such as NGOs or public institutions.

Provisional Session Programme

Timing	Activity	Participant
0900	Introduction to workshop and participants Workshop schedule and logistics	Chairman
0915	Presentation of the first 1st Summer School EEA VulPaRe and general outcomes	Chairman
0930	Opening Keynote Provisional title: Marine Heritage	TBA
1000	Parallel interdisciplinary working groups on coral reef heritage (the following are examples of WG topics, to be finalized in consultation with potential participants) WG1 Coral reefs: an ecosystem under assessment WG2 Coral reefs: a heritage for local populations? WG3 Corals reefs: cultural heritage or natural heritage? WG4 Coral reef heritage, governance, cooperation and institutional frameworks	
1030	COFFEE BREAK	
1100	Parallel interdisciplinary working groups (contd)	
1130	Presentation of each group work and group discussion	Representative of each group
1230	Summary of outcomes Input to Final Report of Workshop	Group representative
1300	Workshop close	

2. Strategic Adaptive Management of MPAs: Linking science with management for effective conservation

Conveners: Jennifer O’Leary, Arthur Tuda, Amin Abdallah, Clay Jones, and Allen Cedras
Email: jkoleary@calpoly.edu

Description:

If you are a researcher working in marine protected areas of WIO or a manager focused on marine systems, this workshop will help you boost your conservation achievements by contributing to a growing adaptive management network in Western Indian Ocean that links science to management. Our objective is to discuss how adaptive management frameworks can help improve management of marine systems, demonstrate progress and lessons learned through case studies in two nations, and have 3 targeted discussions on how scientists and MPA managers can network regionally for effective management and conservation. We will focus on our case studies in implementing adaptive management in nationally-governed marine protected areas (MPAs), but the approach applies to any marine management including fisheries or locally managed MPAs.

The rationale for this session lies in the fact that there remains an ongoing disconnect between scientific knowledge and conservation action. Despite large amounts of research on MPAs and MPA networks, existing MPAs sometimes fall short in effectiveness and thus fail to deliver promised ecological and societal benefits. MPAs must be actively assessed and managed to maintain benefits despite increasing external threats (including climate change). In the Western Indian Ocean, there are more than 100 MPAs and increasing numbers of community-based locally managed marine areas (LMMAs) that were established to create intact ecological systems in a region with intense small-scale fishing and limited fisheries management capacity. However, management of these MPAs is not always focused on social and ecological outcomes. Thus, increasing science-based management capacity is a regional priority. Globally, studies also point to significant shortfalls in MPA management effectiveness.

Effective management occurs when managers have flexibility to respond rapidly to threats and are able to use data strategically to guide management decision-making. Published conservation strategies, and even local monitoring data, when they exist, often fail to lead to management action. Managers often lack access to scientific information or do not have the capacity to interpret it. Even when research outputs are translated for management, little management progress has been made because there is often no framework that helps managers incorporate data into decision-making. Numerous researchers have suggested adaptive management frameworks as a solution. Through adaptive management, measurable objectives are established based on agency or societal objectives, targets are set using scientific data, and actions are based on the status of objectives. Managers evaluate previous management actions in a system of continual learning. Management actions are thus experiments that can improve knowledge of social-ecological dynamics. In collaborative implementation of adaptive management frameworks, managers and stakeholders think through what information is needed to assess management progress, and researchers learn about management needs. Adaptive management thus helps develop problem solving approaches, resulting in innovative conservation solutions and new levels of management action without increasing costs.

In this session, we bring together scientists and managers to determine best practices in building capacity to effectively use the adaptive management framework and scientific information to guide management decision-making and to evaluate management effectiveness in coral reef, seagrass, and mangrove ecosystems.

Provisional Session Programme

Timing	Activity
0900 - 0930	Introduction to Adaptive Management: Linking management with data strategically
0930 – 1000	Case studies in Adaptive Management: Kenya and Tanzania National MPAs
1000 - 1030	Presentation of SAM database and graphing system
1030 – 1100	COFFEE BREAK
1100 - 1130	Objectives with management targets: Can we develop WIO-wide MPA objectives?
1130-1215	Discussion: How scientists and managers can best engage in information sharing
1215 - 1245	Discussion: Developing resource/methods/results sharing in a regional MPA Network

3. Fisheries Improvement Projects (FIPs)

Demand for sustainable seafood is growing worldwide. In South Africa, and elsewhere in the region, an increasing number of retailers and seafood traders have made commitments to sourcing fish from certified fisheries or fisheries in recognised Fisheries Improvement Projects (FIPs).

The Marine Stewardship Council (MSC) Special Session on FIPs will investigate certification and ecolabelling as a driver for change and consider the role of FIPs in supporting structured progress towards certification. This one day symposium is open to all interested delegates. Scientists, fishery managers and NGO stakeholders are encouraged to attend and can expect to benefit from the direct experience of speakers involved in the development and implementation of FIPs in the Western Indian Ocean region. Attention will be also be given to the MSC's accessibility tools – developed for FIP stakeholders to facilitate improved alignment of outcomes and monitoring and encourage uptake by developing world and smallscale fisheries.

Provisional Session Programme

08:30 – 09:00	Registration
	SESSION 1: Improving Fisheries, Improving Livelihoods
09:00 – 09:15	Welcome
09:15 – 09:30	International standards for sustainable fisheries : An overview of the Marine Stewardship Council's ecolabelling programme
09:30 – 09:45	Global impacts: Fishery certification as a driver for change
09:45 – 10:00	Ensuring accessibility: Developing world fisheries and certification
10:00 – 10:15	Fisheries Improvement Projects as a route to sustainability and certification
10:15 – 10:30	Q&A
10:30-11:00	COFFEE BREAK
	SESSION 2: Fisheries Improvement Projects
11:00 – 12:30	Case Studies: Madagascar shrimp Kenya rock lobster Kogelberg mixed species pilot Western Indian Ocean tuna
12:30 – 13:00	Discussion
13:00-14:00	LUNCH
	SESSION 3: Supporting FIPs; MSC Accessibility Tools
14:00 – 14:30	Developing Action Plans for FIPs Identifying gaps, prioritizing and setting goals
14:30 – 15:30	Benchmarking and Tracking improvement towards certification Measuring performance of a FIP against planned activities
15:30 – 16:00	Discussion & close
	MEETING CLOSED

4. Effective Conservation Communication in the Western Indian Ocean

Convenor: Judy Mann-Lang

South African Association for Marine Biological Research

Email: jmann@saambr.org.za

How can we improve our Communication about the Marine Environment in the Western Indian Ocean?

Conservation, therefore, needs clear and effective communication because conservation is more about people than it is about ecosystems. Many of us are trying to communicate more effectively with communities – we may call it education or engagement, knowledge exchange or workshops - whatever we call it - our ability to communicate effectively is critical for our work and for conservation. This workshop will harness our collective experience in this field. The workshop will be participatory and include a range of presenters who will each share some of their experiences in science communication. Thereafter, we will look at how science communication can be improved, building on the foundations of communication, conservation and behaviour change theories. At the end of the session participants will have some of the practical skills required to help them to improve their communication skills. The session will include practical activities – to help participants to practice their new skills.

Ultimately, marine conservation will not be understood by the general public unless they have an appreciation of the importance of the ocean in their daily lives. The first step in creating an appreciation of marine science is the creation of an ocean literate population – only once the people of Africa understand ‘why the ocean is important to me’ and are able to answer the question ‘why should I care about the ocean’ will we be able to make ocean science relevant and start to tackle issues such as pollution, over exploitation, habitat destruction and climate change in a meaningful way

Provisional Session Programme

Time	Activity
0900 – 0940	Welcome and Introduction to Marine Science Communication – this session will introduce the field of marine science communication to the participants and will cover some practical applications of communication and behaviour change theory
0940 – 1010	Lessons from the Frontline – marine science communicators share their stories
1010 – 1030	Practical session – strategic communication planning – during this session participants will develop a strategic communication plan for their environment
1030 – 1100	COFFEE BREAK
1100 – 1130	Practical session (contd)
1130 - 1200	Presentation of plans developed by participants
1200 - 1230	Wrap-up and evaluation
1230	Closing

5. Lively learning: Participatory tools for awareness, advocacy and capacity building about ecosystem values

Convener: Preetika Harish Bhanderi

Wetland Africa

Email: pbhanderi@wetlands-africa.org

Introduction

Complex concepts have always been challenging to grasp. Additionally, the traditional methods and approaches of imparting this knowledge and creating awareness and building capacity have become monotonous and tedious. Therefore addressing these 2 challenges together we propose creative learning that fuses innovation and fun for all.

Objectives of the session

1. To make learning easier, interesting and fun
2. To present tools to help stakeholders from all backgrounds and levels to easily grasp complex concepts
3. To promote understanding of importance of ecosystems through ecosystem values
4. To promote improved participation of all stakeholders

Achievements expected from the session

1. Improved understanding of the values of ecosystems
2. Promote participatory tools for learning and dialogue

Targeted audience

All participants of the WIOMSA symposium: resource managers, policy-makers, scientists, practitioners, private sector, civil society representatives

Provisional programme of the session (assuming the session will be 3hrs)

1. Activity 1: Understanding the value of different marine and coastal ecosystems
2. Activity 2: Competing claims for different marine and coastal ecosystems
3. Activity 3: Harnessing synergies of the different ecosystem values

6. Regional State of the Coast Report: What next (By invitation)

Convener: The Nairobi Convention and WIOMSA

The Regional State of Coast Report for the Western Indian Ocean (WIO) was launched on 22 June 2015 in the Seychelles. Based on the media coverage and the continued download of the report from the Nairobi Convention website, there is no doubt the report has and is continuing to attract attention from a range of stakeholders from within and outside the region.

This report is very timely as it gives its main target audience of policy-makers at national and regional levels, scientific community, civil society and general public, a comprehensive document that is based on a sound, scientific and knowledge based assessment on the status and value of resources of the Indian Ocean as well as the opportunities that exist therein, to assist them in decision making, awareness raising and producing materials for educational and research purposes.

The Eighth Meeting of the Contracting Parties to the Nairobi Convention acknowledged that the Report will inspire countries of the region in their pursuit to take more concrete actions towards turning their dreams of developing blue economy into reality. The meeting also urged the Contracting Parties to consider the findings of the Regional State of Coast Report for the Western Indian Ocean Region in their decision-making processes.

With intention of assisting countries achieve these two complimentary objectives and also ensure the main findings and recommendations of the report are more accessible to a wider audiences, the Nairobi Convention Secretariat and WIOMSA are organizing a Special Session, “Regional State of the Coast Report: What next?”, to discuss on how to generate different products from the Report.

The Session will:

- i) Identify key messages from the Report and how to package them
- ii) Identify products to be produced, targeted audience, their contents and timeframe to produce them
- iii) Define roles and responsibilities of participating authors.

7. WIO Mangrove Network: progress and achievements

Convener: Mwitanga Mangora

Institute of Marine Science (IMS)

Email: mmangora@yahoo.com

1. Background

Mangrove ecosystems in the Western Indian Ocean (WIO) region face similar management challenges albeit at varying intensities and extents. Major threats include over-exploitation for wood products and conversion of mangrove areas to other land uses, particularly aquaculture and rice paddies. Other common threats include coastal pollution, coastal development, mining and more recently climate change related impacts among others. In terms of governance, some of the mangroves are trans-boundary that falls in the jurisdiction of different countries. As such the WIO Mangrove Network, established in 2011, is keen to create a platform for a concerted approach to share experiences and chart a common course of management and conservation where possible.

2. Objectives

- a) Highlight and appreciate outputs of the Network, especially since the last meeting during the 8th WIOMSA Symposium in Maputo in 2013. Of particular interest here will be a presentation on the WIO Region Mangrove Book on the status and management.
- b) Highlight and discuss on new lines of joint programs involving international collaborations.
 - Publication on East African Mangrove Carbon Inventory Field Methods based on the recent experiences and lessons from the comprehensive inventories that have been done in Mozambique (Zambezi Delta) and Madagascar and a planned one in Tanzania (Rufiji Delta) during Nov/Dec 2015.
 - Regional mangrove mapping project to be led by WWF
- c) Deliberate in the draft constitution of the Network

3. Target Audience

It is anticipated that over 50 symposium delegates comprising of scientists, managers, practitioners and students with interest and working in mangrove ecosystems across disciplines will attend the session.

4. Provisional programme

Time	Activity/Agenda
14:00	Welcome note and introductions
14:10	Highlight on recent outputs and a presentation of the WIO Region Mangrove Books
14:30	Highlight of emerging lines of international collaborations - Publication on East African Mangrove Carbon Inventory Field Methods - Regional mangrove mapping project
15:30	Break
16:00	Presentation and discussion on the Draft Constitution of the Network
17:00	Concluding Remarks and Way forward

8. Creating positive stories of the Future: Seeds of Good Anthropocenes Game

Convener: Laura Pereira,

University of Cape Town

Email: pereira.laura18@gmail.com

There is growing consensus that global development is on an unsustainable trajectory and the abundance of scientific and popular visions of future collapse and hardship underscore this point. However, the global change community has produced very few positive visions of more desirable, just, and sustainable future global outcomes for society and nature, or how to achieve them. Together, this abundance of negative visions of the future and a lack of clearly articulated positive visions may inhibit our ability to move towards a positive future for the Earth and humanity. This special session introduces an initiative where we are soliciting, exploring, and developing a suite of plausible visions of “Good Anthropocenes” - positive visions of futures that are socially and ecologically desirable, just, and sustainable. Such a future will likely be radically different from the world in which we are currently living. This sort of imagining can be extremely difficult because it goes far beyond small improvements to the way we currently do things. We aim to scope out some of these radical changes by identifying potential seeds of this future that already exist in the present. Identifying where elements of a Good Anthropocene currently exist, what makes them bright spots of a better Anthropocene, and understanding how and why they occur, can help us envision how we might grow them to create new, positive futures for the Earth and humanity.

This session will be very interactive. Having introduced the audience to the concept of the Anthropocene and how we are using new methods to try to engage with future challenges in a more positive way, the session will then involve all members of the audience. They will each think of an existing initiative, network, project or technology that they believe could contribute to building a better future. Using these ‘seeds,’ the audience will then get into groups to play a game, the aim of which is to create a radical vision of the future. Participants are encouraged to take a look at our website and to contribute a “seed” online: <http://goodanthropocenes.net/>.

Objectives

- Describe the “Seeds of Good Anthropocenes” project’s aims and objectives
- Collect and discuss examples of ‘seeds’ from the audience for our database and website
- Involve audience in playing a prototype game using their “seeds”

Expected outputs

- A selection of new, interesting “seeds” from WIOMSA participants, especially focusing on those relevant to the marine and coastal environment
- Sharing new methods for engaging with decision-making in the future, given the challenges of the Anthropocene
- An academic output that uses the results of the session in conjunction with other workshop outputs held in conjunction with the SPACES project

Targeted audience

All WIOMSA participants are welcome, and encouraged, to attend!

Provisional Session Programme

Time	Activity
0900 – 0920	Introductory talk
0920 – 0940	Engage the audience to propose “seeds”
0940 – 1030	Break into groups of approximately 5 people to share, discuss and write down their own ideas of “seeds”
1030 – 1100	COFFEE BREAK
1100 – 1145	Play “Seeds of Good Anthropocenes” game with participants
1145 - 1215	Reconvene in plenary for feedback
1215 - 1230	Wrap up and Evaluation
1230	Closing

9. Capacity building in ocean forecasting for the western Indian Ocean as an integral component of climate forecasting for the Greater Horn of Africa region

Convener: Shigalla Mahongo

Tanzania Fisheries Research Institute (TAFIRI)

Email: shigalla@yahoo.co.uk

Outline

The Ocean Forecasting Group for the western Indian Ocean was established in February 2013 by the IOC Sub-Commission for Africa and the Adjacent Islands States (IOCAFRICA) in collaboration with the Western Indian Ocean Marine Science Association (WIOMSA). The group comprises oceanographers and marine meteorologists from the WIO region (currently Kenya, Tanzania, Mozambique, Madagascar and Mauritius). The primary goal of the group is to prepare ocean inputs for the Climate Forecasting Group ahead of the Greater Horn of Africa Climate Outlook Forums (COFs). The COFs have in turn been in existence since 1987, with their primary objective being development of consensus regional climate outlooks for the rainfall seasons and formulation of mitigation strategies to the implications of the outlook on the critical climate sensitive sectors of the region. The COFs also provide a regional interaction platform for scientists, policy makers and users of climate information.

Agenda

This workshop will come up with a road map for the period between the 41st COF (August 2015) and the next COF for Sept-Dec season in August 2016, with milestones to be achieved at different levels as follows:

A: Contribution of the ocean forecasting group in climate forecasting

The workshop will discuss on the previous contributions of the Ocean Forecasting Group since the 33rd COF in 2013. We will present some of the products and then examine in detail the challenges and solutions in achieving the objectives of the group including:

- i) Lack of tools and input data for ocean forecasting
- ii) Responding to the needs of the Climate Forecasting Group such as: use of ocean observations to validate satellite data in climate forecasting; provision of high resolution SST data for climate forecasting; modelling of sub-surface temperature and thermocline over the WIO; prediction of cyclones, and a synthesis of the connection between the Indian and Pacific Oceans (e.g. ENSO and IOD teleconnections).

B: Production of ocean products for stakeholders other than climate

The workshop participants will discuss on the possibility of developing products that will benefit not only the climate sector, but also other stakeholders (e.g. environment, fisheries, health etc).

C: Publication of a book or special issue of a journal

The Ocean Forecasting Group has so far produced more than 10 reports, and part of this work has already been published as workshop proceedings. The workshop will therefore discuss on the possibility of publishing future work as special issue of a journal, or as a book, and the logistics on how to achieve that.

Workshop participants are therefore invited to provide feedback to address general or specific issues and to comment on the milestones to be achieved.

10. Regional Network for Locally Managed Fisheries (LMF)

Convener: Tim Andrew, WIOMSA

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KEYNOTE ABSTRACTS

KEYNOTE – Wednesday, Amadiba, 0945

Marine Spatial Planning for nature and humanity: Lessons for Africa

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Marine spatial planning (MSP) and the subsequent zoning and regulations on use that flow from it are emerging in various forms around the world. However, many countries are missing opportunities to use MSP to its full potential to promote sustainable use of ocean space and resources, while at the same time meeting social and conservation objectives. In the rush to promote ‘blue growth’, the focus in some places is on accommodating as many uses within the ocean space as possible, and in such scenarios MSP is used primarily to reduce conflict between big, industrial users. Effective MSP can do much more: it can synch to coastal planning to create truly effective ecosystem-based management, in which degradation of important ecosystems is prevented by focusing management on drivers of degradation (even if those drivers do not trace back to ocean use but rather have their base in land and freshwater use). This sort of holistic planning also creates opportunities for transboundary collaboration to effectively manage shared resources. MSP and related ocean zoning can ensure that ecologically important areas are fully represented in a mosaic of use and protection. Finally, the planning process can ensure that the needs of local communities, and the safeguarding of values that extend beyond those captured by large maritime industries, are considered in decisions on how to allocate space and resources in an equitable way, while promoting economic growth.

KEYNOTE – Tuesday, Amadiba, 0945

Promoting Community Resource Management in developing countries – What governments need to do

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Marine resource management by local communities has proliferated worldwide in the last few decades and in many cases seems to be able to achieve enduring benefits that elude top-down approaches. Since the inception of the Locally Managed Marine Area (LMMA) Network in the year 2000, LMMAs are being implemented by over 600 communities spanning independent countries and territories in SE Asia and the Pacific, representing a unique global achievement.

Scaling up of community efforts to national levels has also been achieved and for example in the case of Fiji, 79% of Fiji’s customary marine areas involving 420 communities are under improved local management. By 2020 Fiji is committed to effectively managing 35,000km² of marine area.

The spread and endurance of LMMAs is mainly attributable to the motivation and empowerment communities’ who perceive that livelihood benefits are very likely to outweigh the costs of implementation. The recognition of community motivations and a shift from imposing external objectives (such as biodiversity conservation) has helped practitioners and NGOs improve support and facilitate wider uptake. The role of science and scientists has had to shift in order to identify and provide key scientific knowledge, ensure that communities tap into local or traditional knowledge and facilitate the exchange of all knowledge and experience between communities and between these and practitioners.

But in a region with more than 10,000 coastal communities there is an urgent need for coherent national government approaches to expanding and sustaining such community driven small-scale fisheries management. While lack of policy, capacity and finance are often proposed as obstacles to progress it appears that governments do not yet have strategies suitable to facilitating and supporting LMMAs and other forms of community management. This presentation explores experiences in strategic implementation and support that hold promise for providing core national fisheries management services within the existing constraints.

Further detail:

Inshore fisheries upon which the majority of coastal populations depend are generally fully exploited, or in some cases, over exploited. Increases in population and demand will drive many of them to collapse unless ways can be found to manage them sustainably. The majority of the population of Melanesia is dependent on inshore fisheries for their subsistence and local economic needs. This high reliance on inshore fisheries is exacerbated by the limited alternative opportunities and increasing external pressures which have already driven the most valuable fisheries such as *bêche-de-mer* into a spiral decline of boom and bust. Climate change will increase vulnerability and management strategies are urgently needed to increase resilience and adaptive capacity. Elements of the way forward have been identified but strategic and effective implementation is still lacking:

Communities: The more than 10,000 Pacific Island communities have traditionally been stewards of their land and coastal marine resources and as predicted by Johannes (2002) have been able to demonstrate potentially viable hybrid approaches to managing SSF that build on this - usually with the help of NGOs. However, this fundamental building block for SSF management has not been adequately harnessed in national approaches (Govan et al 2009).

Policies: Regional and national policies have increasingly incorporated SSF and especially, community based management of SSF. Countries with policy or legislation that reflects community co-management of SSF include

Samoa, Solomon Islands, Vanuatu, Fiji and PNG. Regional policy includes the Apia Policy (2008) and the sub-regional initiative covering Melanesia where the bulk of the Pacific Islands' population reside - the MSG Roadmap for the Protection of Inshore Fisheries for Food Security. However, the policies have not resulted in significant, if any, advances in co-management of SSF (Govan 2013a, 2014; Pratt and Govan 2010).

Institutions and capacity: While it is true that the formal fisheries management institutions are under-funded and short-staffed it appears that the major challenges reside in identifying the appropriate roles of communities and government to co-manage Pacific Island fisheries and strategically deploying the available resources to maximum effect.

Strategic implementation - just doing it: The most promising advances seem to be emerging from concerted discussions between fisheries officials and community leaders and their supporters relating to the fundamental roles and responsibilities of each party in co-managed fisheries. From this some practical initiatives have emerged that bear promise and above all seek to avoid adding to the un-implementable weight of increasing policy, strategies and legislation. The shift needed and being trialled is towards strategic and actionable workplans with specific tasks assigned and devolved to staff at the lowest appropriate level (Govan 2013bc).

KEYNOTE – Wednesday, Amadiba, 0900

Drivers of Mesoscale Ocean Variability in the Southwest Indian Ocean: Impact on the Marine Ecosystems

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The flow-field in the Mozambique Channel and around Madagascar is mainly derived from the South Equatorial Current (SEC). Over the past two-decades several studies have investigated the nature of the circulation in these regions. In-situ observations, remote-sensed-data, drifter measurements, as well as numerical models, all have provided consistent results showing a flow-field strongly dominated by large anticyclonic and cyclonic eddies, and larger anticyclonic rings. The rings forcing mechanisms appears associated to barotropic instability due to the shear between the SEC and the northern tip of Madagascar. Anticyclonic eddies are mostly generated in the narrowest sector of the Mozambique Channel. On the other hand, a large number of cyclonic eddies seems to be linked to the dynamics of the well formed anticyclonic eddies, especially in the eastern boundary of the channel, along the Madagascar coast. Both eddies and rings within the channel are the main agents responsible for the off-shore advection of coastal rich nutrients waters, and enhanced growth and structuring of zooplankton community. In the South of Madagascar an intense mesoscale variability

also is dominant. Numerical models suggest that these eddies are formed by both barotropic and baroclinic instabilities, occurring preferentially in the upper- and intermediate- ocean, respectively. The eddies exhibit a strong seasonal variability, with maximum in winter and minimum in summer. Their intensity appears linked to the seasonal intensification of the general currents system in the South Indian Ocean. These eddies are highly nonlinear, being capable of trapping biological materials in their core and transporting them from Madagascar to the east coast of South Africa, hence establishing the biological connectivity between Madagascar and African main land. To the southeast of Madagascar mesoscale eddies are also known to modulate a large phytoplankton surface boom which exhibits a strong inter-annual variability.

KEYNOTE – Thursday, Amadiba, 0945

Incorporating diverse values into small-scale fisheries management

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Fisheries management often results in trade-offs that influence who benefits, or what they benefit from. Effective and equitable fisheries management can be informed by an understanding of when and why these trade-offs occur. Ecosystem services are the benefits people receive from nature and as a concept are gaining attention in natural resource and fisheries management. Using examples from coral reef fisheries in the western Indian Ocean, I ask: 1) what are the common trade-offs that emerge among people and among ecosystem services? And, 2) what enables or constrains different people from benefitting from these ecosystem services? I found that trade-offs often occur across scale (local vs national benefits), across category (cultural vs provisioning), and that resource users perceive more trade-offs than scientists; but managers can potentially mediate these differences. Further, I found that key access mechanisms influence who is able to benefit from ecosystem services and what benefits they perceive. In particular, social, institutional, and knowledge mechanisms (rather than rights or economic mechanisms) have the greatest influence on the number and diversity of benefits that people perceive. However, local context strongly determines whether specific access mechanisms enable or constrain perceived benefits. For example, local ecological knowledge enables people to perceive a habitat benefit in Kenya, but constrains people from perceiving the same benefit in Madagascar. Ecosystem service assessments, and their resultant policies, need to take into consideration the broad suite of access mechanisms that enable different people to benefit from a supply of ecosystem services.

KEYNOTE – Thursday, Amadiba, 0900

Ecological connectivity among tropical coastal ecosystems
– current insights and threats

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Mangroves and seagrasses are globally valued for the important ecosystem services they provide to mankind. One of these services is their fisheries production, which is based on a wide variety of finfish and shellfish species. Mangrove/seagrass estuaries can be highly productive fisheries areas, but they also support offshore fisheries through their nursery function. In many parts of the world, they act as juvenile habitats for fishes and crustaceans which move offshore to deeper waters, where they replenish adult populations and contribute to fisheries production. Mangroves and seagrasses can also enhance populations of other important species, such as endangered and iconic species, and species that perform important roles in maintaining ecosystem health, such as parrotfishes and top predators like sharks. An emerging insight is that many coastal ecosystems consist of habitat mosaics that are strongly connected through flow of materials and organisms. It is this connectivity that underpins their productivity, functioning, and biodiversity, and the ongoing global loss and fragmentation of coastal ecosystems will therefore have serious implications for mankind. In this presentation, key trends and mechanisms of ecological connectivity among tropical coastal ecosystems will be evaluated as well as their value in supporting related fisheries. The strong cross-ecosystem linkages that exist among coastal habitats have important implications for ecosystem functioning, management of fish stocks, and marine reserve design. Current challenges in valuing, understanding, and studying mangrove–fisheries linkages will be discussed, and potential impacts of climate change examined.

KEYNOTE – Tuesday, Amadiba, 0900

The ever-changing canvas on which the portrait of life evolves

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The Indian Ocean is the most asymmetrical of all the ocean basins. In the east there is a deep sea trench and an active volcanic margin while in the west there is a passive continental margin. In the south it is open to the Southern Ocean whereas in the north it is closed. The macrotopography within this basin formed and continues to be formed through plate tectonic processes while continual modifications to the microtopography are a result of ocean bottom currents interacting with ocean floor sediments.

This basin developed as a consequence of the Tethys Ocean closing and the supercontinent of Gondwana breaking apart. The first vestiges of the present Indian Ocean appeared as small basins about 155 million years ago as Gondwana fractured into two crustal blocks that slid past each other. This eventually led to an ocean gateway leading from Tethys to the Proto-Pacific Ocean by about 140 million years ago when the South Atlantic Ocean began to open, splitting West Gondwana into Africa and South America.

About 120 million years ago, East Gondwana began to break apart when Antarctica and Australia separated from India. India then split from Madagascar about 90 million years ago and began to drift northwards across Tethys, separating from the Seychelles Bank about 66 million years ago and colliding with Asia about 40 million years ago. This collision finally closed Tethys and the resulting plate reconfiguration separated Antarctica from Australia, forming the Tasman gateway.

Each palaeogeographic modification not only offered new areas for colonisation but also changed ocean circulation which, in turn, affected not just environments within the Indian Ocean but also world climate. Superimposed on these changes are rapid to catastrophic geological events, such as volcanic eruptions and meteorite impacts. The present ecosystem is a result of evolution within this dynamic crucible.

ORAL AND POSTER ABSTRACTS

POSTER

Characterisation of small-scale tuna fishery in Kenya

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Kenya's marine fishery is primarily small-scale, exploiting inshore reefs using combined traditional crafts and gears. Increase of the inshore fishing pressure has pushed small-scale fishers to explore outer reefs targeting tuna. The present study characterizes the small-scale tuna fishery in Kenya in terms of production and population structure in an effort to guide fisheries management. The study was conducted in Lamu, Kilifi and Kwale counties over a period of five months from October, 2014 to February, 2015. Systematic sampling was conducted on tuna fishers and vessels and data on gear type used, total catch, fishing effort in terms of hours per day and number of days fished per week, fishing grounds, crew sizes, tuna species landed and fish length and body weight were recorded. Biological data including sex, gonadal and ovarian maturity, and fecundity including the by-catch were also recorded. A total of 16490.61Kgs were sampled with 591 true tuna, 136 tuna-like and 89 by-catch species. Vessel gear combination of motor boat and trolling line in Kilifi had the highest catch-per-unit effort (CPUE) of 90.67 kg/fisher/boat while Ngalawa-handline had the lowest CPUE of 1.75 kg/fisher/boat in Kilifi. *Katsuwonus pelamis* had the highest GSI (0.625) while *Thunnus alalunga* had the lowest GSI (0.0085). *T. obesus* had all the maturity status (I-V) in Kwale in October and November while *Euthynnus affinis* had the maturity status (I-VI) in January and February in Kilifi County.

ORAL- Thursday- Amadiba- 1400

Community fishers' forum as a means to facilitate the uptake of science into small-scale fisheries co-management

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Co-management is increasingly being used to manage small-scale fisheries (SSF) across the western Indian Ocean (WIO) resulting in increased responsibility on fishers who previously were not involved in management. Different types of learning programs have been used successfully in improving fisheries management due to their role in diffusion of information and adoption of management measures. Yet there are few programs in the WIO that provide scientific

information that meets fisher management capacity needs. Uninformed fishers will not be able to play their part in a co-management structure, reducing the benefits of this rapidly growing governance system. We describe here a model for promoting the use of scientific information in SSF management in Kenya where an annual forum has been in existence since 2000. Over a 14-year period, the forum grew from an informal meeting to an annual event of more than 150 actors and practitioners in the SSF sector with support from the Wildlife Conservation Society and the State department of fisheries. We describe the adoption, outcomes and challenges of fisheries management measures discussed at the forum over this time period including, gear management focusing on beach seine removal and basket trap modifications, and community closures (tengefu). The impact of the forum in terms of informing and empowering fishers was greatly enhanced because it developed during a dynamic period of governance conversion in Kenya starting with restructuring of the fisheries sector towards co-management through to the promulgation of a new constitution that devolved state power to the counties. Using the forum to discuss the feasibility of fisher's management preferences and solutions helped to increase community participation and the use of science in the management SSF

POSTER

Species composition of the avifauna of Bons Sinais Estuary at Zambezia provincial, Mozambique

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Estuaries are among the most complex and productive ecosystem. They are home for many species of birds which use it as a home, foraging and stop-over during their migrations. Antropogenic process such as over exploitation of resources, urbanization and natural processes like climate change are threatening these ecosystem. This study provides a baseline information about species composition and the relative numbers. To determine the species composition of the avifauna at the estuário dos Bons Sinais, Mozambique, monthly census was carried out from October 2012 to September 2013, during Low Water Neap Tide, where the sand banks are exposed and birds activity occur. A total of 23 species was found, *Thalasseus* spp., *Egretta garzetta*, *Calidris minutae* *Charadrius marginatus* were numerous species. There were significant differences in abundance index between the seasons, being the dry season the foremost. The estuary is composed majority by occasional birds. The biological Shannon and Margalef index were very low (0.5 and 0.5) respectively, equitability index (0.7) revealed that species aren't distributed equally within the study area. The Estuario dos Bons Sinais is of great importance, specially acting as connecting point for migratory and vagrant birds

POSTER

Socio-economic sustainability of cruiseliner tourism in a coastal rural setting

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This study analyses the tourism activity in rather pristine coastal and marine environment at Inhaca Island, Mozambique, emphasizing socio-ecological dynamics related to an increased cruiseshipping in a once basically fisheries community. Interviews and existing reports were used to access several stakeholders in tourism, conservation and business sector as well as to local communities. Inhaca has long been subject to tourism from mainland and South Africa. This island is home to a well-kept habitats such as the southern most extensive coral reefs, mangroves, seagrasses and extended fisheries and protected dune forests. Since 1992 about 747 cruise liners demanded the Island from South Africa. Yearly, around 66 500 tourists have visited Inhaca. Attractions of tourists have been the marine and coastal environment including forests, the beach, coral reefs, seafood and souvenir markets. Inhaca has experienced an ordinated increase of tourism facilities for observation of coral reefs and amenities. In average every tourist has spent on the islands around US\$ 50, prompting a boost of local economy and people's wellbeing. Cruiseline tourism brought more employment opportunities, easing the pressure on fisheries and subsistence agriculture, stimulating the development of the community. Furthermore, tourism entry taxes at Inhaca supported additional community needs. Demand to critical habitats especially to coral reefs of Barrreira Vermelha and Ponta Torres have increased, somehow prompting debates on carrying capacity for those sensitive habitats. This is exacerbated given possible excesses of fisherman and poor enforcement of conservation of reserves. Portuguese Island concept of integral reserve is kept however a built reception and meal center, on this island, initially questioned long lived status. To conclude, tourism increase at Inhaca is providing benefits to locals, as well as easing pressure to allocoastal habitats except coral reefs where impacts appear occurring.

POSTER

A two decade of sea turtles monitoring program: What is the nesting trends of sea turtles at Inhaca Island?

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Four endangered species of sea turtles occur at Inhaca Island, Mozambique (*Chelonia midas*, *Eretmochelys imbricata*, *Caretta caretta* e *Dermochelys coriacea*), but only two species (*Caretta caretta* e *Dermochelys coriacea*) nest on

the island beaches at the Eastern shoreline facing the Indian Ocean. Inhaca Island is marine and forestry partial reserve which lay under the auspices of Marine Biological Research Station-Eduardo Mondlane University, who have been monitoring the nesting activities since 1989. The nesting season goes from October to March and during this period at nights the number of nests and hatchlings is accessed for each nesting species. This study analyses this data in order to understanding the nesting trends especially in number of nest and nesting site choice over the two decades of this monitoring program for *Caretta caretta* species. Results show that *Caretta caretta* nesting site have shifted onto northern direction, and nest agglomerates along the shore was also observed. The numbers of nests along the time have shown an intercalary distribution within years, with years having more than 20 nests and others less than 10. To conclude, the number of sea turtle nests at Inhaca Island has remained steady but the nesting site has varied along the beach, suggesting more studies to focusing on the drivers of the change of nesting site.

POSTER

Fish relationships with seagrass habitat structure in Kenya

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Seagrasses are important because of the valuable ecosystem services they provide including as nursery beds, feeding grounds and habitat of fish of commercial importance. Despite their importance, they are given secondary consideration in biodiversity and conservation measures. Hence, they have undergone unprecedented level of damage, loss and overexploitation. The objective of this study was to establish the relationship between seagrass habitat complexity and abundance and diversity of fish species. The study was carried out at four sites each at Shimoni and Lamu on the Southern and Northern part of the Kenyan coast respectively. At each site, a minimum of three transects measuring 100 m and 200 m apart were made perpendicular to the beach and seagrass habitat complexity data including substrate cover, canopy height and shoot densities collected. Underwater visual census method was used to collect information on fish species abundance and diversity along six 100 m² transects. Eleven seagrass species were encountered at Shimoni dominated by *Thalassodendron ciliatum* while at Lamu, nine species dominated by *Thalassia hemprichii* were encountered. Fourty two species of fish belonging to twenty one families and fourty three species belonging to sixteen families were recorded in Shimoni and Lamu respectively. In Lamu, fish species assemblage was dominated by *Leptoscarus vaigiensis* while in Shimoni, it was dominated by *Siganus sutor*. The most abundant fish feeding categories were invertebrate and fish feeders. Differences between fish assemblage structure were observed with increasing habitat complexity. One-way ANOVA showed that both seagrass canopy height and seagrass shoot density were not significant predictors of the fish species density and diversity. The study shows that seagrass beds are important habitats for diverse species of fish. Increased awareness of seagrass role in fisheries will enhance their conservation management for biodiversity and food security necessitating their incorporation in conservation legislative frameworks.

POSTER

Socio-ecological Potential of Mangrove Forests for Carbon Market in Mtimbwani and Geza Villages, Tanga, Tanzania.

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Mangroves offer important social and ecological goods and services including the potential for mitigation of climate change due to their high capacity for carbon sequestration and stocking. Nonetheless, little emphasis has been given to these ecosystems, resulting to high rate of degradation. We conducted surveys to assess the socio-economic and ecological aspects of mangrove forests in Geza and Mtimbwani villages in Tanga. Mangrove forest inventory for vegetative and soil carbon assessment was done along Ngole and Bongoa River in Mtimbwani and Geza respectively. Community surveys were carried out through focus group discussions and household questionnaires. Socio-economic qualitative data were analysed through content analysis and quantitative data by multiple regression to establish the influence of different socio-economic drivers on dependence pattern on mangrove resources. Six mangrove species were encountered where *Avicennia marina* and *Rhizophora mucronata* were dominant in all sites. Forest stand density and basal area were 2334 stems ha⁻¹ and 23.59 m² for Mtimbwani; 1740 stems ha⁻¹ and 17.22 m² for Geza, representing viable mangroves. Using mangrove biomass allometric equations available in literature, above ground biomass were 294.64 ton ha⁻¹ for Mtimbwani and 163.36 ton ha⁻¹ for Geza. Above ground carbon was 147.3 Mg C ha⁻¹ for Mtimbwani and 81.68 Mg C ha⁻¹ Geza. Estimated soil carbon by loss on ignition was 621.17±79.64 Mg C ha⁻¹ at Mtimbwani and 400.25±58.9 Mg C ha⁻¹ at Geza. Nonetheless, socio-economic analyses indicated that these mangroves are under threats from cutting mainly for timber, firewood and building poles. Key drivers that define exploitation patterns on mangrove resources were proximity from the resources, household size, level of education and income. In both sites (income, level of education) and distance for Mtimbwani appear to be strong drivers. Based on these findings, both forests prove to be good carbon sinks and therefore potential sites for carbon markets.

POSTER

The influence of the tides in the catches of hand line in Pemba bay, Mozambique

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The lunar cycle is a predictable and continuous frame that provides a variety of marine species with an environmental signal. The relationship between lunar periodicity and catch rates has been demonstrated for a wide variety of commercially exploited species. In artisanal fisheries the local knowledge of fishermen determines most of the times which is the tide or the time of the day more appropriated to fish. Is this folklore or there is a biologic support for these decisions? In this study we access the size and weight of the fish caught and the CPUE according to the tides for the line fishery in Pemba bay. The preliminary data doesn't show any relations between the size of the fishes and tides but catches rates seem to be influenced by lunar tides.

POSTER

The effects of short-term climate variation and placed-based management on seagrass and associated fish communities

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Climate change is expected to alter monsoon patterns. Thus, knowing how monsoon seasonality affects seagrass beds under different levels of protection is essential to understand the possible effects of future climate scenarios. This study investigates the effects of marine protection and short-term climate variability on seagrass beds and their associated fish communities. A field survey is being carried out in seagrass beds at two protected no-take areas and two fished control sites around Zanzibar (Tanzania), during three different monsoon seasons. Within each site, benthic surveys of the seagrass beds and fish community censuses are performed by means of snorkelling. Fish communities are also surveyed using standardised basket traps (*dema*); a method previously used in similar types of studies. Analyses of data collected in November-December 2014 show higher abundance and species richness of fish at one of the protected sites compared to its control, but not at the other protected site. Moreover, fish assemblage structure differs between both sites and levels of protection. These results demonstrate how effects of protection may depend on other factors, such as habitat complexity, wave exposure, time of protection, and the level at which regulations are reinforced. The second and third field seasons, which will take place during March-April and July-August 2015, respectively, will complement these results by adding a temporal dimension. Data will also be paired with detailed climate data (e.g. water temperature, precipitation) to assess the relative importance of short-term climate variation and MPAs for seagrass beds and their associated fish community. Consequently, this study will provide important information to advance management of shallow-water tropical coastal ecosystems.

POSTER

Development of Microsatellite Markers for *Avicennia marina* from Mozambique using MySeq technology F.M.C.

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Mangroves are widely recognized for their high productivity, rich biodiversity and various ecosystem services. *Avicennia marina* is an ecologically important mangrove tree species that is widely distributed in Mozambique. The aim of this study was to develop a set of

polymorphic microsatellite markers for *Avicennia marina* from Mozambique. Leaf samples of this species were collected from the Costa do Sol mangroves, at Maputo City, and DNA extracted using the Zymo Research Plant/Seed DNA extraction kit that yielded a concentration of 61.3 ng/μl of genomic DNA. A total concentration of 61.3 ng of DNA was used for performing the Fast Isolation of Sequences Containing Repeats (FIASCO) protocol in order to create a repeat enriched genomic library for sequencing. Following the FIASCO protocol, the DNA was digested with restriction enzymes, adapters ligated to the fragments and hybridized with three sets of biotinylated probes (TGC₈, CT₁₀), (ATA₇, AAAT₆, AC₁₀) and (GATA₆, GTG₉, AGGG₆). Fragments containing repeats were then recovered, pulled together and sequenced using MiSeq, a sequencing by synthesis technology. Sequences containing 5 or more repeats were identified, and primers designed using CLC Main Workbench 7.6 software. In total, 2625 sequences were found containing repeat motifs and 26 primers sets were designed, four primer sets for fragments containing tetra-nucleotide repeats, twelve primers for fragments containing tri-nucleotiderepeats and nine primer sets for fragments containing di-nucleotide repeats. These primers will be optimised and tested for polymorphism.

POSTER

The use of sub-tropical east coast copepod species as live feed for fish larviculture

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Since South African fin fish larviculture facilities rely on an imported source of live feed for marine larvae, it is important that we identify potential local live feed for marine fish larviculture. Pelagic copepods are an important food source for many fish larvae in their natural habitats, making them a desired feed due to their high nutritional value, their predator-elicitation response, their size variability, and their small size which is ideal for small mouth-gape larvae. Many production systems use alternate zooplankton sources such as *Artemia naupilii* and rotifers as they are much easier to grow on large scales. The disadvantage of these other live food sources is the lack of highly unsaturated fatty acids and polyunsaturated fatty acids, hence enrichment is required thereby increasing the cost of feed. The Mlalazi estuary, located along the sub-tropical east coast of South Africa, is in close proximity to the Mtunzini fish farm, thus facilitating the pumping of water from the estuary to maintain *Argyrosomus japonicus* (Temminck & Schlegel, 1843) larvae. This study identified the most robust sub-tropical copepod species in the Mlalazi estuary by determining the temperature and salinity ranges of pelagic copepods. Copepods were subjected to temperatures from 10–40°C and salinities of 10–40 PSU and their survival recorded over a two week period. This investigation is the first step in identifying suitable sub-tropical copepod species for finfish larviculture to increase the production rate and nutritional value of marine finfish larvae, whilst decreasing production costs.

POSTER

Incidental and targeted marine megafauna captures in Western Indian Ocean fisheries

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Life-history strategies of long-lived marine megafauna (elasmobranchs, marine mammals and turtles) mean they are highly vulnerable to anthropogenic mortalities. Some species are known to be important for maintaining the stability and function of marine ecosystems as apex predators and mesoconsumers. They also provide further ecosystem services in the form of income and sustenance for fishing communities and tourism-based livelihoods. Fisheries catch remains one of the main threats to the status of these species at the global scale, including in the Western Indian Ocean (WIO). Information on the magnitude of incidental (bycatch) and targeted catch is lacking, particularly in the largely undocumented and unregulated artisanal fisheries, which dominate this region. Thus stocks are largely unknown and at severe risk, with many suspected to be fished beyond sustainable levels, yet mitigation measures are largely non-existent. The MASMA-funded BY-Catch Assessment and Mitigation in Western Indian Ocean Fisheries (BYCAM) project (2015–2017) aims to assess targeted and non-target vulnerable megafauna species catches in the WIO. The goal is to develop realistic mitigation measures and recommendations for improving governance arrangements and management strategies across the region with case studies in Kenya, Madagascar, Mozambique and Zanzibar. The initial component of this project is an assessment of current regional fisheries statistics and catch data. The methodologies and data currently collated by governmental fisheries bodies have also been assessed to identify data gaps in current fisheries management and provide recommendations for improvement. This paper will present initial findings from an analysis of existing official statistics complimented by external scientific evidence regarding regional fishing effort, catch of vulnerable megafauna species in artisanal gillnet and line fisheries and small-scale commercial and semi-industrial prawn trawl fisheries.

POSTER

Seasonal exploitation and distribution of the beaked clam *Eumarcia paupercula* (Holten, 1802) in Costa do Sol, Maputo Bay

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Costa do Sol is located in Maputo Bay and is one of the main grounds used for collecting the beaked clam *Eumarcia paupercula*. This species is one of the main sources of food and income for local artisanal fishing communities. The activity of clam collection in Maputo Bay is only regulated by the seasonal cycles of abundance of the species, thus creating a direct pressure on the resource. The aim of this study was to assess the population structure of *Eumarcia paupercula* (Holten, 1802) in Costa do Sol, Maputo Bay. The study was conducted between the months of November 2012 to October 2013. Interviews to clam collectors were conducted consisting of closed questions and all respondents were randomly selected representing approximately 10% of harvesters. 4621 individuals of *E. paupercula* were analyzed to evaluate the density and distribution using standard transects approach. This study indicated that the collection of clams is mostly performed by women. Most frequent clam length class was 10 - 15 mm long and the month of highest population density was the month of October. The collection of clams in the Maputo Bay seems to be the main factor that regulate the density and distribution of the same across the coast.

POSTER

Seasonal Study of Exploration and distribution of clams dark *Eumarcia paupercula* (Holten, 1802) on Costa do Sol, Maputo Bay

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Costa do Sol, located in Maputo Bay and is one of the main regions of collecting clams dark *Eumarcia paupercula*. This species is one of the main sources of food and income for local fishing communities, this activity of clam collection is governed only by the seasonal cycles of abundance of the species, thus creating a direct pressure on the resource, thus making necessary the creation of the this study aimed to study the population distribution of clam dark *Eumarcia paupercula* (Holten, 1802) on Costa do Sol, Maputo Bay. The study was conducted between the months of November 2012 to October 2013, interviews were conducted consisting of closed questions and all respondents were randomly selected representing approximately 10%, were analyzed 4621 subjects to evaluate the density and distribution using the transect methodology. The results of this study indicate that a collection of clams is mostly performed by women, most frequent length group was 10 - 15 mm long and the month of highest population density was the month of October. The standard collection of invertebrates in the Bay of Maputo is dictates of the density and distribution of the same along the coast

ORAL – Monday- Msikaba 3- 1500

Environmental Assessment of Temporal and Spatial Distribution of Trace Metals in Rufiji Delta Mangrove Sediments, Tanzania

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Sediment cores collected from six different selected sampling locations in the Rufiji delta mangroves, south-east coast of Tanzania were studied in order to establish the spatial and temporal distribution of trace metals due to urbanization and agricultural developments in the catchment. ²¹⁰Pb geochronology was established in order to calculate the mass accumulation rates and historic inputs of trace metals. The trace metals (Cd, Cr, Pb, Ni, Cu and Zn) in sediment were sequentially extracted as per the BCR method and analyzed on ICP-MS. The results showed that the mass accumulation rates ranged from 0.4 g cm⁻² year⁻¹ (core NR₃ and NR₄) to 1.75 g cm⁻² year⁻¹ (core SR). The ages in the cores ranged from 3.5 yrs (core SR1) at 0-1 cm to 5353.0 yrs at depth of 200 cm (NR₄). The concentrations of trace metals in the cores were mainly associated with the residual phase. This implies that trace metals in the Rufiji delta mangroves are of crustal origin and are less sensitive to chemical weathering. Further, these metals are least available for plant uptake and poses limited threat.

POSTER

Temporal and Spatial Variation of Nutrients in Rufiji Delta mangrove, Tanzania

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The objective of this study was to elucidate the temporal and spatial nutrients dynamics in water and organic matter dynamics in sediments from the Rufiji delta mangroves. Rainy and dry seasonal variations in nutrient concentration were investigated during 2012–2013. Subsurface water samples were collected from six locations and analyzed for dissolved nutrients, total organic carbon (TOC), total chlorophyll and total carotenoids. Sediments were also collected and characterized for particle size and TOC content. Mean nutrient levels ranged: silica (12.9 – 20.6) µg SiO₂L⁻¹y⁻¹; phosphate (110.4 – 268.0) µg P L⁻¹y⁻¹; ammonia (41.3 – 72.4) µg NL⁻¹y⁻¹ and nitrate (525.9 – 2142.8) µg NL⁻¹y⁻¹. Nutrients turnover number was generally low.

Likewise, pigments indicated an up-stream increase in total concentration. TOC flux in water ranged (8.7 – 14.8) $\text{mgL}^{-1}\text{y}^{-1}$. The study revealed that nutrient concentrations were influenced by seasonal changes with high nutrients concentration at northern part of the Rufiji Estuary, an indicative of less fresh water input from upstream. The majority of soil organic carbon is located in the upper sediments, which decreased with depth in both stations. This suggests that the increase of soil organic carbon due to anthropogenic activities may decrease the potentiality of the Rufiji delta mangrove sediments as carbon sink and may lead to high saline soil. The increase in soil salinity increases mangroves allocation of carbon to growth of roots relative to shoots, thereby enhancing productivity during favorable periods but increasing vulnerability to water stress during drought. The TOC fluxes in sediments showed correlation with sediment particle sizes in which finer particle size sediments showed high TOC content. This study provides considerable advances in understanding the seasonality of nutrient distribution and will guide continuing efforts to support management for coastal mangrove ecosystems.

POSTER

The good, the bad, and the unspoken: an analysis of Madagascar's foreign fishing access agreements

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Like many developing coastal states, Madagascar leases its pelagic fisheries to distant water fleets (DWF) from Europe and Asia through fishing access agreements. Such agreements constitute one of the tools used by developing coastal countries to manage the access and determine fishing revenues of foreign fleet fisheries in accordance with the requirements of The United Nations Convention on the Law of the Sea.

These agreements have long been criticised for contributing to overfishing; threatening the food security of developing coastal countries; providing disproportionate benefits to the foreign fleets and their countries; and for flagrant non-adherence by these foreign fleets to the terms of the agreements.

We review the content of fourteen fishing access agreements signed from 2007-2014 between Madagascar and foreign fishing entities, by scoring them based on 13 variables recognised as contributing to the sustainable use of resources within the 1995 FAO Code of Conduct for Responsible Fisheries.

Our analysis shows that none of the agreements can be deemed to be satisfactory across all the variables analysed, raising grave concerns over the compliance and sustainability of existing DWF activities. The public

EU agreements scored the highest, above the private EU agreements. Asian agreements carried the weakest standards and obligations.

While elements of both public and private EU agreements can be considered to represent good practice, standardisation of agreement terms is urgently required to improve key provisions and transparency, to ensure such contracts represent the interests of the coastal state.

Given the inter-jurisdictional nature of most fleets, the process of contractual formalisation should be conducted in cooperation with regional coastal states in order to help forge regional collaboration in reducing illegal fishing, and ensuring equitable agreements for future negotiations.

POSTER

MIHARI: Networking coastal communities in Madagascar
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Locally Managed Marine Areas (LMMA) are areas of nearshore waters that are fully or largely managed by coastal communities, creating and implementing management rules. Since the first LMMA was set up in Madagascar in 2003, there are now around 64 LMMAs, which use a range of legal mechanisms to secure local management rights. These areas now cover 7,268 km^2 , over 11% of Madagascar's coastal shelf.

Many of Madagascar's LMMAs are facing similar challenges, including: the enforcement of local customary rules or *Dina*, sustainable financing and a lack of alternative livelihoods. Most LMMA communities are located in remote areas, resulting in minimal exchange and coordination between them to address these challenges.

Madagascar's first national LMMA forum was held in June 2012 bringing together community representatives from 18 LMMAs with the aim of addressing these problems through peer-to-peer learning and sharing of experiences. This event resulted in the creation of Madagascar's national LMMA Network, MIHARI. This network aims to reinforce community exchanges, and advocate for the interests of member communities in national policy. Network members include all LMMA communities and the organisations that support them. Government authorities are regularly consulted.

While the network is in the early stages of development, much progress has already been made. Learning exchanges between LMMA communities are underway, the third national MIHARI forum is planned for late 2015, and three regional forums have been organised. The current status of LMMAs in Madagascar has been inventoried and a database made accessible to all partners. Information about the progress of the MIHARI network is presented on the network's website, along with learning materials and resources. Priorities going forward are to reinforce the structure and independence of the network, ensuring the active participation of communities, and securing sustainable sources of funding for the network over the long term.

ORAL- Thursday- Msikaba 2- 1720

Strengthen marine biodiversity conservation through community-based approach in Ambodivahibe protected area

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Ambodivahibe marine protected area (MPA), is exceptional for its coverage of healthy coral reefs and abundance of large individuals of endangered species. It occupies the marine and coastal area and is characterized by the presence of islands, narrow rocky coastline interspersed with beaches, coral reefs, mangroves, and dense dry forests. The area also includes the Ampio forest, a site rich in endemic plants and one of the only remaining fragments of coastal forest in northern Madagascar.

Before the temporary protection in 2010, Ambodivahibe followed the standard formal steps of protected area creation by referring IUCN principles. From the beginning of the process in 2007, local communities are taking important roles to define protection and sustainable use zones. During the establishment of the management plan of the Ambodivahibe site, improvement has added to include the results of vulnerability analysis on climate change. Conservation targets of the protected area are aligned to these new outcomes. For well-being of people mostly fishermen surrounding the MPA, implementation of responsible fishing activities can be done with the proper management of marine reserves established within the Ambodivahibe MPA.

Started with 13,400 ha marine area, the Ambodivahibe MPA is currently about 39,794 ha in order to take in account the large fishing zones for the sustainable use for local communities. The eight years of implementation of the protected area have seen the participation of stakeholders at local and regional levels. The IUCN category V to manage Ambodivahibe MPA shows this essential of interaction between people and nature that create the sustainability of the area and its associated resources with its values. The co-management with local communities is the main approach adopted to have the entire ownership of the communities.

POSTER

Hunting and Bycatch Assessment of Marine Mammals on the South West Coast of Madagascar, 2000-2015

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From January to March 2015, interview surveys of fishers were conducted to assess by-catch and hunting of marine mammals on the south west coast of Madagascar. We conducted 114 interview sessions in 3 villages respectively Ankiembe, Mahavatse and Belitsake, situated to the South West of Madagascar. Socio-economic surveys were collected from individual fishers, focus groups of several fishers, and key informants in each village, always including one locally known individual as a guide to gain confidence of communities. Surveys revealed either hunting

or by-catch of marine mammals in almost all villages. Six species of marine mammals were reported hunted and by-caught: bottlenose, spinner, spotted, Risso and Indo-Pacific humpback dolphins and humpback whale. The interview revealed that 245 cetaceans have been caught in the three villages during fifteen years (2000-2015). Two types of fishing gear, harpoon and gill net, are used in the region to hunt dolphins, and shark gill net (jarifa and palangre) resulted in incidental by-catch. In the southwest, dolphins caught were used for local consumption and sold in the region and other villages, with sale prices of 3000Ar/Kg (approximately USD\$1.00) compared to 2500Ar/Kg for fish. These three villages, all situated in southwest region, reported occasionally drive hunts in which several fishers cooperatively drive pods into a lagoon and set large nets on them. From 1 to 30 dolphins were reported caught in a single drive, and drives may occur 1 to 5 times each year. Despite the existence of the national laws, the fishers continue to eat cetacean hunted and by-caught. The best strategy of the protection of marine mammals is the elaboration of the local laws. The technique of fishing is common in almost of the west coast region but some villages respect national laws and apply the local laws through communities-based efforts association.

ORAL- Wednesday- Msikaba 3- 1720

Analysis of environmental factors that could influence growth and apparition of diseases on seaweed *Kappaphycusalvarezii* farming

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In recent years, a marine protected area has been established on the east coast of the Northern region of Madagascar. The seaweed farming was developed in this zone as an alternative livelihood for the local community. However, algae are subject to two major diseases: ice-ice and epiphytic filamentous algae (EFA). This 4 months study aims at seeing environmental factors that contribute to the occurrence of diseases on seaweed farming. Two sites were chosen for this study: (i) Site A, Ankirikiriky: 12° 24' 50.8" South and 49° 32' 20.0" East and (ii) Site B, Northern Nosy Antandro at 12° 23' 52.5" South and 49° 32' 14.1" East. Environmental parameters such as temperature, salinity and current speed were daily recorded. Also, growth rate of algae and disease progression were weekly measured.

The result showed that at site A, current speed, water salinity and temperature were 0,12ms⁻¹, 38 ‰ and 22 to 31°C respectively. They were 0,20ms⁻¹, 35‰ and 25 to 30°C at site B. Also, at site A, algal growth rates were 1.92 to 4.77% day⁻¹ and diseases progressions were 4% and 15% week⁻¹ respectively for ice-ice and EFA. In the other hand, algal growth rates were higher 2.49 to 4.89% day⁻¹ while diseases progressions were lower (2% and 6% week⁻¹ respectively for ice-ice and EFA infestation) at site B. Factorial corposant analysis of the results showed that seawater temperature was the factor that correlated more with apparition of ice-ice disease while speed current and salinity influence EFA infestation. Moreover, correlation analysis showed that both ice-ice and EFA diseases present negative impact on the growth of algae ($r=-0.501$, $p=0,024$ for ice-ice

and $r=-0.45$, $p=0.043$ for EFAD).

Thus, environmental parameters such as temperature, salinity and current speed play an important role on growth and apparition of disease on seaweed farming.

POSTER

Coral reefs face the plastics wastes in the Moheli marine park (MMP)

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In front of problems of management wastes which haunt the localities of Moheli Marine Park, the beaches of the MMP more particularly those which finds in the coastal villages are the cemeteries of household wastes.

The coastal erosion combined with the water streaming take away, scatter and deposit the plastic waste on the coral reefs.

We led studies on three sites of one of the localities of MMP to determine the stakes of the plastic wastes on the coral reefs by realizing transects in three sites. In every site, we realized 3 transects at least.

Site A: 17 diapers are counted. All are cornered on the branchy corals of the family of the ACROPORIDAE such as *Acropora hyacinthus*, *Acropora formosa*, *Acropora valida*, *Acropora austera* and *Acropora humilis*.

Site B: 32 diapers and 18 plastcs bags are counted. On 32 diapers 28 are cornered on the branchy coral reefs. 21 on the family of the ACROPORIDAE, 4 on *Montipora digitata*, 3 on *Stylophora pistillata* and 4 roam on the coral reefs.

On 18 plastic bags, all are cornered on the branchy coral reefs. 15 on the family of ACROPORIDAE, 3 on *Montipora digitata*.

Site C: 22 diapers are counted. They are cornered on the branchy corals reefs. 12 on the family of the ACROPORIDAE, 3 on *Montipora digitata*, 7 on *Stylophora pistillata*.

On 113 corals counted and taken in trap by plastics, 21, 23% died, 54, 86% sick and 22, 89% have a good healthy. The most affected corals are the family of the ACROPORIDAE. It is the diapers which have a strong proliferation on the coral reefs.

POSTER

Exercises in Marine Biodiversity and Ecology. An Approach for the WIO Region Coastal Zone

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During the past few years a number of methodological textbooks for marine ecology have become available, addressing sampling and associated statistical procedures. These books offer methodologies that are designed for the experienced researcher that engages in advanced research, but provide little help for the design of training protocols that have to deliver appropriate methodologies

and training demonstrations under the regular constraints of academic courses, both in terms of time-frame and involved resources. This current book does not intend to be a theoretical biostatistics book or to be similar to the many other textbooks on numerical ecology. Instead, it will fill a needed gap in support of training in marine biodiversity and ecology, which is the development of specific exercises to train sampling strategy, methods and associated statistics, specially adapted to the coastal environments and dominant species of the WIO region. The book does not intend to cover all possible types of exercises, but provides practical examples, adequately contextualized with theoretical background, demonstrative of the main sampling and statistical approaches to use in different habitats of the coastal zone. Trainers will find many of these exercises appropriate, or otherwise the book will provide alternatives and clues for the adaptation of the protocols to the particular needs of specific courses and available environments for developing fieldwork.

ORAL- Tuesday- Msikaba 2- 1140

Phytoplankton community adaptation in a cyclonic eddy in the Mozambique Basin

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A research cruise was undertaken in a cyclonic eddy in the Mozambique Basin to investigate the role of eddies in connectivity between Madagascar and South Africa as part of the African Coelacanth Ecosystem Programme. A series of stations were occupied from northeast to southwest across the eddy at intervals of 18 km to investigate the hydrographic conditions and plankton community adaptation at the sub-mesoscale level. Absorption, chromatography and CHEMTAX analyses were used to characterise the phytoplankton communities. There was upliftment of isotherms between 800 m and 200 m in the core of the eddy, but the upper 100 m where the phytoplankton was located appeared to be relatively well mixed. Phytoplankton communities at the eddy centre and the on the northeast boundary were dominated by diatoms and haptophytes at both the surface and deep chlorophyll maximum (DCM), with pelagophytes and prasinophytes being of secondary importance. The waters on the eastern approach to the north-eastern boundary were dominated by haptophytes, although *Prochlorococcus* (photosynthetic prokaryote), pelagophytes and prasinophytes were present. The south-western boundary was also dominated by haptophytes, although prasinophytes, cryptophytes and pelagophytes were also present. Beyond the south-western boundary, *Prochlorococcus* was most prominent together with haptophytes. Absorption characteristics indicated that chlorophyll a and photosynthetic carotenoids absorbed 65-70% of the irradiance at both the surface and DCM across the central and north-western boundary sectors of the eddy. Outside the south-western boundary, the photosynthetic carotenoid absorption decreased due to increased

absorption by the photoprotective carotenoids at the surface and by chlorophyll *b* (mostly divinyl chlorophyll *b*) at the DCM. Unusually, the similar surface and DCM population structures and absorption characteristics were indicative of well-mixed communities in the upper 100 m of this cyclonic eddy.

ORAL- Thursday- Msikaba 2- 1600

Social capital as an ecosystem service: Evidence from a locally managed marine area

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Social capital is an important ecosystem service, yet we lack common understanding of how it fits, and can be operationalized, within the ecosystem services framework. We review the literature to clarify the role of social capital in this context, establishing it as a multidimensional concept and a fundamental constituent of human well-being that is both supported by, and affects, all categories of ecosystem services. We then draw on qualitative and quantitative data to assess and value social capital as an ecosystem service and explore its role in facilitating management goals in a Malagasy locally managed marine area. We find high levels of social capital, gauged by trust, community involvement, and social cohesion. Results of a choice experiment show positive utilities associated with high levels of social cohesion. Respondents also ranked social cohesion higher than some provisioning, regulating, and cultural ecosystem services. Qualitative data suggest social capital increased as a result of the community based management institution, and has facilitated the success of marine management measures. Our results offer insight into the ways in which social capital can both affect, and be affected by, the management of natural resources, and how it can be assessed and valued as an ecosystem service.

POSTER

Panning for chemical gold from Mauritian waters: *Didemnum molle* as a new source of Antimicrobial and Antioxidative agents.

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With the problems associated with an increasing incidence of cancer in an ageing society, the steady spread of microbial infections along with a growing failure of current chemotherapeutics, there is a continuous need for novel and more effective drugs. The marine environment, with its rich biodiversity, constitutes an untapped resource

for the discovery of bioactive compounds endowed with pluri-pharmacological properties. This study explores the total phenolic content (TPC), antibacterial and antioxidant potentials of the tunicate *Didemnum molle* collected from Mauritian waters. The TPC and antioxidant potentials of the tunicate's total crude (CE) and fractionated extracts (Hexane (HEF), ethyl acetate (EAF) and aqueous (AF) were assayed using five different antioxidant *in vitro* models. The antimicrobial efficacy were also characterised against 9 human pathogenic bacterial strains using a microplate serial dilution method for the determination of the minimal inhibitory concentration (MIC) and minimal bactericidal concentration (MBC) values of each active extract. Among the tested extracts, EAF registered maximum TPC of 12.97 ± 0.63 mg GAE/g powder. Significantly higher antioxidant activities was realised in EAF as determined by the ABTS⁺ (66.09 ± 1.34 µMol Trolox/g powder) and superoxide (IC₅₀ 0.75 ± 0.08 mg/mL) radical scavenging, ferric reducing potential (39.78 ± 0.58 µMol Fe(II)/g powder) and deoxyribose degradation inhibitory assay (IC₅₀ 1.42 ± 0.023 mg/mL) while HEF displayed the most potent Fe²⁺-chelating activity (IC₅₀ 0.141 ± 0.014 mg/mL) (P < 0.05). All the extracts also inhibited the growth of at least four bacterial strains whilst the best antibacterial profile comparable to that of the antibiotic Ampicillin was exhibited by CE against *Staphylococcus aureus* (MIC: 0.078 mg/mL; MBC: 0.156 mg/mL). The antioxidant activity was positively correlated with TPC (r > 0.5) whereas contrary relationships were found between antibacterial activity and TPC. The present study validates the bioactive properties of *D. molle* extracts and depicts the tunicate as a potential source of pharmaceutical leads against infectious and degenerative diseases.

POSTER

A first description of sponge-associated Actinomycete from two coastal sponges from Mauritius

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Sponges are host to numerous macro and micro-organisms including bacteria. Bacteria from the phylum *Actinobacteria* are often constituents of the sponge-associated bacterial communities. They are well known producers of bioactive compounds and are gaining much interest in the search for novel bioactive molecules. Hitherto, no such reports exist on the actinobacterial diversity from Mauritius. The present study aimed to assess the actinobacterial community associated with two

coastal sponge species from Mauritian lagoons. Sponge associated actinobacteria were cultivated from sponge extracts on three standard media (Actinomycete Isolation Agar, Kuster's Agar and Yeast-extract malt-extract Agar) for the isolation of actinomycetes. Putative actinobacterial strains were sub cultured on their respective media until pure colonies were obtained. Pure actinomycetes colonies were then cultured in broth and were identified through 16S rRNA gene sequence analyses. Phylogenetic analysis was performed on the software MEGA prior to multiple sequence alignment. Seven actinobacterial species representing three genera were successfully isolated from the sponge *Sphaciospongia* sp. and *Neopetrosia* sp. The sponge *Neopetrosia* sp. hosted a higher diversity (71% of the total number of isolates) of actinomycetes. *Streptomyces* sp. and *Micrococcus* sp. were the most represented actinomycete genera (43% each) isolated from both host sponges. Actinomycete Isolation Agar (AIA) was the most effective medium for the selection of actinobacteria, yielding in 57% of the total actinobacterial strains isolated. This study is the first to actinobacterial report on sponge-associated actinobacteria from the island of Mauritius and paves the way for future sponge-associated actinobacterial research in the Mascarenes region

POSTER

Have fishing communities of Zanzibar Island benefited from increasing tourism development?

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The research presented here was conducted at the coastal villages of Kamikazi, Matemwe and Nungi of Zanzibar Island to understand the influence of tourism on the income generating activities of the local fishermen along the coast of Zanzibar Island. The increasing tourism has impacted fishermen twofold: (1) Parts of their fishing grounds were lost through development of tourist infrastructure such as resorts and hotels along the beaches area. (2) Fishing gears were destroyed by tourists during activities such as diving, snorkeling, swimming with dolphins, and boat riding over inshore waters where fishing is actively taking place.

Over the past twenty years of tourism development along the coastal villages of Zanzibar Island the living conditions of the local fishers have remained poor. The fact that fishermen are partly losing the access to their fishing grounds is more likely to increase poverty among the fishing communities and to create conflicts among the stakeholders. Employment in the tourism sector (resorts/hotels) has shown not to be an option for the fisher because of their low educational background. The rapid development of tourism along the coastal villages of Zanzibar Island, while concomitant with a general increase in GNP of the island, has thus not lead to an improvement of income generation activities of the local fishers.

POSTER

Investigating changes in fish biodiversity in coastal villages of Zanzibar Island.

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The marine water body of Zanzibar Island (Tanzania) comprises of multi-fish species. Findings of this research paper revealed that there are twenty seven (27) families of fish species of economically importance in the study area of which Scombridae is the most dominate species. Although the coastal villages shared the same water environment, the distribution of fish biological diversity varies considerable from one coastal village to another. The coastal village of *Nungwi* and *Kizimkazi* were the richest fishing villages in term fish abundance and biological diversity in Zanzibar Island.

The highly experienced local fishers' in the coastal villages perceived that there is a dramatically change in the abundance of fish biological diversity as the senior fishers' described that certain type of fish biological diversity such as Green hump head parrot fish, Javelin grunter, Rosy dwarf monocle bream, Twinspot red snapper, Green job fish and bicour were among the fish species which disappeared a long time ago before the introduction of tourism. However, the continued declines on the abundance of other biological fish diversity were attributed to increased development of tourism which has created a new market for fish and seafood because there is a demand in the coastal tourist resorts/hotels.

ORAL- Wednesday- Msikaba 2- 1420

Using Baited Remote Underwater Video Stations (BRUVS) to study the distribution and abundance of the demersal fish assemblages on the Seychelles continental shelf

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Fishermen have always targeted fish on fishing banks and shoals on the Seychelles bank. The general assumptions are that these areas have a higher diversity of species and overall higher abundances than the other sites. As of yet no studies have been undertaken in the Seychelles to investigate the distribution of fish assemblages on the banks. Baited remote underwater video samples (BRUVS) (n=60) were deployed on fishing banks (n=30) and off of fishing banks (n=30) to investigate if there were any differences between them. Additionally, the effects of depth and habitat type on the fish assemblages were also investigated. Samples were collected from a depth range between 30m and 70m and classed into four habitat categories. Analysis showed that

there was no significant effect of being situated on or off banks sites or in depth on the abundance and diversity of fish assemblages. Habitat type however had an effect on the community structure, diversity, abundance and trophic structure of demersal fish assemblages. Habitats with more complex structures such as coral patches and algal beds had higher abundance and diversity than less complex habitats like sand and rubble. The habitat type seems to be more influential in the structuring of the fish assemblages. The distribution of these habitats appears to be fairly even both on and off of the fishing banks. This suggests that the assumptions of banks and shoals having more fish may not be accurate.

ORAL- Thursday- Amadiba- 1120

East Africa's marine protected areas: fish refuges or fishery resources

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Marine Protected Areas (MPAs) have been implemented in many parts of the world for the protection of reef fishes, and are expected to result in increased fish abundance and mean size. However, the effectiveness of an MPA is dependent on the suitability of its design and the degree to which regulations are enforced. Along the East African coastline, the effectiveness of few MPAs has been assessed. Diver-operated stereo video was used to survey the fish communities of East Africa's shallow-water (<25 m) coral reefs, from Ponta do Ouro in southern Mozambique to Malindi in central Kenya. In total, 208 sites were surveyed across thirteen coastal regions, including open access, restricted use and no-take protected areas. No-take zones exhibited significantly higher average mass per fish (116.7 ± 119.4 g), than restricted use (98.4 ± 73.7 g) or open access areas (78.0 ± 59.6 g) (Kruskal-Wallis ANOVA, $H(2, N = 208) = 8.053, p = 0.018$). However, mean fish density was significantly lower within no-take zones (53.1 ± 35.1 fish.100m⁻²) than restricted use (77.8 ± 50.6 fish.100m⁻²) or open access areas (79.8 ± 88.9 fish.100m⁻²) (Kruskal-Wallis ANOVA, $H(2, N = 208) = 9.178, p = 0.010$). Therefore, while the average mass per fish is greater within no-take zones, many of East Africa's MPAs are not resulting in increased fish abundance. These results reflect the intense fishing pressure that is evident within open access, restricted use and no-take zones. It appears as though distance from urban areas has a greater influence on reef fish abundance than the level of protection, with more remote areas exhibiting healthier ichthyofaunal communities. The generally poor status of coral reef fish communities in East Africa highlights the need for improved management and regulation enforcement throughout East Africa's marine reserves and protected areas.

ORAL- Thursday- Msikaba 1- 1120

The influence of artisanal fisheries on coral reef fish community structure - an interdisciplinary approach

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Coral reefs are under accelerating anthropogenic pressure, fishing being one of the major disturbances. It is recognised that fishing can have a negative impact on the density of coral reef fishes, thus endangering a vital source of food in coastal tropical areas worldwide. However, the specific effects of fishing and fishers preferences on fish community structure are less understood. This study used a social-ecological approach investigating the effects of fisher's preferences of species and size classes of reef fish on the functional composition of fish communities in three coral reef areas subjected to different amounts of fishing activity in Menai Bay, Zanzibar (Tanzania). Semi-structured interviews were conducted with fishers and fishing grounds were mapped by the guidance of local fishers, Aerial photos and GPS markers. Underwater visual censuses were also performed in order to investigate the fish community structure within fishing grounds. Three key-findings were found. First, a clear preference pattern in targeting of functional groups and sizes was found where the preference of fish gradually decreased moving down the trophic chain. Secondly, a linkage between fisher's preferences and fish community composition was detected and thirdly, the degree of fishing activity influenced the density, species diversity, size distribution and species composition of the fish communities in varying ways. These findings suggest that differences in fishing activity and preferences have multiple effects on reef fish community structure, information needed to be considered for successful management of tropical fisheries.

POSTER

The Influence of Environmental Parameters on Growth and Survival of *Argyrosomus japonicus* Larvae Grown in Marine Aquaculture Station in Pemba

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The kob (*Argyrosomus japonicus*) is considered promising aquaculture species however, there is limited information regarding its growth in captivity. This study aimed to evaluate the effects of environmental parameters (Temperature, DO, pH, Salinity, and ammonia

concentration) on growth and survival of *Argyrosomus japonicus* larvae. The experiment started with eggs of fish *A. japonicus*. After acclimatization period in tank water, the eggs were introduced in the culturing system with temperature of 24-26°C. The larvae were kept in tanks which had 8.000 litres of seawater and constant aeration. The tanks were treated with virikon, while data on abiotic factors were collected, such as salinity, temperature, pH, Dissolved Oxygen and Ammonia test was taken daily. Green water, Rotifer and *Artémia* were used to feed larvae during cultivation process. The results showed surprisingly that a fish growing in cold water (20-22°C) can adapt itself to tropical temperatures (28-30°C) when cultivated in captivity. Survival rate was estimated of 95.6%. This is the first experience of mariculture in Mozambique and the results can be used as guide line for mariculture operation farming

ORAL- Monday- Amadiba- 1640

Tropical cyclonic conditions reduce occurrence of coral diseases in the coral *Acropora muricata*.

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Coral reef ecosystems are threatened due to climate change-driven seawater thermal anomalies that have led to widespread coral mortality. Coral diseases have also been implicated in such events. This study examined coral disease, namely white plague (WP), coral tumor (CT) and brown band (BB), occurrence over three months (November to January) during three years (2010-2013) in the dominant coral species, *Acropora muricata*, within the coral reefs of Belle Mare, Mauritius at a finer scale including three zones, namely near the coast (Z1), in the middle of the lagoon (Z2) and on the reef flat (Z3). Data loggers were deployed near the monitored coral colonies to record *in situ* temperature and light levels. For the periods November 2010 – January 2011 and November 2011 – January 2012, higher occurrence of temperatures above 30°C and 31°C were recorded at Z1 compared to Z2 and Z3. Coral disease occurrence varied among the three study periods for WP and BB. During November 2012 and January 2013, temperature ($\leq 30^\circ\text{C}$) and light recordings were lower and almost no WP and BB were observed compared to the previous two years. Tropical cyclonic conditions in the vicinity of Mauritius indicated that only two tropical disturbances occurred in January 2011, three cyclones occurred between December 2011 and January 2012, and five cyclones, passing closer to Mauritius, occurred between October 2012 and January 2013. These findings indicate that tropical cyclonic conditions may reduce global warming related thermal and irradiance stresses and lead to a lower WP and BB disease and not CT occurrence on coral reefs of Mauritius.

POSTER

Variation in density of corallivorous gastropod *Drupella cornus* and macroalga *Padina boryana* on *Acropora muricata* at Flic-en-Flac, Mauritius

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The marine snail *Drupella cornus* feeds exclusively on scleractinian corals and its outbreaks have been reported to reduce about 85% of coral cover in Australian waters. However, limited studies have focused on the abundance of *D. cornus* on Mauritian coral reefs. The present study assesses the densities of *D. cornus* and the macroalga *Padinaboryana* on the coral *Acropora muricata* over the summer (March) and winter (August) months of the years 1998 and 2010-2014 in the coastal waters of Flic-en-Flac, Mauritius. The density of *D. cornus* ranged from 0.00-35.00 m⁻². In 1998, the mean density of *D. cornus* was <1.00 m⁻² for both March and August months, and the percentage coral colonies out of 15 covered by *P. boryana* were 11.11% and 8.89% for March and August, respectively. During the period 2010-2014, the mean density of *D. cornus* ranged between 17.00-30.60 m⁻² for March and 0.40-5.20 m⁻² for August with the percentage of coral colonies covered by *Padina* ranging between 62.22-93.33% and 15.56-26.67%, respectively. The density of *D. cornus* and percentage coral colonies covered by *P. boryana* were significantly high in both March and August of 1998, however, were found to be significantly higher in March 2010 – 2014 compared to August 2010 – 2014. This high density of *D. cornus* and high percentage of coral colonies covered by *P. boryana* in summer may be attributed to prevailing higher nutrient levels, temperatures and rainfall. Both density of *D. cornus* and percentage of coral colonies covered by *P. boryana* varied throughout the study period, with higher density of *D. cornus* occurring on *A. muricata* colonies covered by *P. boryana*, particularly in summer. This might have implications for damage caused by *D. cornus* on the most abundant coral *A. muricata* in Mauritian waters, especially under a globally changing ocean climate

ORAL- Monday- Msikaba 2-1100

Economic valuation of mangroves in Tana Delta, Kenya

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This study focused on the Tana Delta in Kenya. The study aimed at establishing the contribution of the mangroves to the economic wellbeing of the communities in Kipini division of the Tana Delta Sub County. The research employs two valuation techniques namely, market price method and choice modelling (specifically choice experiment). Data is collected through survey covering Kipini division in which the specific locations to be surveyed include; Kipini, Kilelengawni, Ozi and Kau locations.

A total of 530 questionnaires have been collected from three sub locations namely, Kipini, Matangeni and Kau. The collected data sets represent both choice experiment whose total target was 400 questionnaires and the market analysis data whose total target was 370 questionnaires.

The information from the questionnaires reveals that the community relies heavily on the mangrove ecosystem for their needs, in terms of fuelwood and construction wood. This is seen to be of great economic benefit as there is a monetary value attached to these goods. However, the community was not fully aware of the various services provided by mangroves that enhance their economic well-being. Additionally, exploring the various age groups, the results indicate that the older age group had better knowledge of the mangrove ecosystem services and their economic values and benefits, than the younger age group.

This natural capital contributes greatly to the local and national economy. Therefore this knowledge is turned into guidelines for the local and national government. This will inform decisions and trade-offs regarding developments in the Tana River Basin and highlight the importance of conservation and management of this important mangrove ecosystem.

POSTER

Managing mangroves with mzingas

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The uniquely adapted mangroves on the aerial-marine-terrestrial interface are the only halo-tolerant, non-seasonal ever-green tropical forests. Mangrove forests provide a wide range of highly valuable goods and services for coastal environments, communities and the host. Some of these goods and services from mangrove systems are: complex root systems which support natural breeding grounds for molluscs, fish and shrimp; roots, leaves and seeds which are used by the local community for medicinal purposes; erosion regulation by breaking waves and consolidation of sediments; water purification by filtering pollutants and nutrients from the water; supporting bird life; and, providing habitat to other wildlife. Despite the myriad beneficial functions of mangroves, they are being destroyed at rates 3-5 times greater than average rates of forest loss.

The focus of this research is the mangrove forest in Tana Delta, Kenya. The project enhances interactions between mangrove conservation and poverty reduction. The design of this project investigates how apiculture in the mangrove ecosystem can provide alternative income to the local communities living in the area, while also providing an avenue for mangrove conservation. Mangrove reforestation activities are implemented simultaneously to sustain the mangrove ecosystem that provides income through sale of honey. As a result, the mangroves are conserved, as the communities realize other non-destructive benefits from the mangroves.

At each stage of the project, the local community is trained to build their knowledge in mangrove values and importance, mangrove reforestation and beekeeping. Consequently, this knowledge translates to improving lives of the local communities and conservation and sustainable management of the mangrove ecosystem.

POSTER

Mangrove-based climate change adaptation

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Climate change is the current buzz word and it is a constant threat. We thus have to act quickly to adapt to this change. Nature helps people to adapt to climate change through conserving biodiversity through ecosystem-based adaptation in mangrove ecosystems, and improving livelihoods.

This project focuses on climate change vulnerability and capacity assessments in Tana Delta, Kenya. The information from the assessment assists to establish key climate change adaptation strategies for the carbon-rich mangrove ecosystem. Additionally, this assessment identifies the likely impacts of climate change on human populations, ecosystems and ecosystem services. Using the results of these assessments, appropriate interventions are identified that are implemented in the mangroves to reduce vulnerability of the local community to climate change. This in turn will enhance the mangrove ecosystem. The assessments also provide details that help to shape county and national policies on climate change adaptation.

The results of the study indicate that the local community are not aware of the role that the mangrove ecosystem plays in reducing their vulnerability to climate change. Alternative income generating activities such as income from carbon credits for mangroves can demonstrate this important climate change adaptation and mitigation role that mangroves play. Additionally, the buffering role of mangroves during floods and storm surges needs to be emphasized. Such knowledge of the mangroves will assist to conserve the mangroves, as communities realize this added benefit of mangroves.

ORAL- Monday- Msikaba 4- 1140

Bio-prospecting bivalves for commercial purposes: Inventory and molecular characterisation

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Bivalves are known to be the second largest class in the Mollusca phylum comprising of about 15,000 species of great economical and ecological importance. The government's vision to develop an ocean economy, emphasised on the development of an aquaculture industry for both edible and pearl oysters. Till date no or even very few local studies have focused on deciphering the identification of these magnificent Lamellibranchiata. In this study, biological and taxonomical studies of Mauritian bivalvia fauna were carried out around the coastal region of the island: Albion, Trou aux Biches, Mellville, Riambel, Mahebourg, Pointe aux Feuilles, Ile Aux Bénitiers and Black river. Eighteen different species were collected and characterised morphologically. The phenotypic plasticity of bivalves has always impeded the morphological approach for species identification and for this study, 21 morphological characters were pinpointed to be able to identify and classify the collected bivalves. Only, 12 bivalves were successfully identified morphologically. Molecular studies included DNA

extraction from the abductor muscles and amplification of a 710 bp segment of the cytochrome c oxidase subunit I gene. Amplification was successful for 6 bivalves out of 18 samples collected. The 6 amplified fragments were sent for sequencing and ultimately phylogenetic tree of bivalves was constructed using maximum parsimony and neighbour-joining approach. Both the dendrogram from morphological characters and the phylogenetic tree successfully confirm monophyletic nature of subclass Pteriomorpha. These preliminary results suggest the need to develop more specific primers for the Bivalves.

ORAL- Wednesday- Amadiba- 1120

Lessons from an exceptional long term coral reef monitoring conducted at Reunion Island (Southwest Indian Ocean) since the last 18 years

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The Line Intercept Transect methodology has been used to assess benthic and fish communities in coral reefs through a monitoring survey realized each year since 1998 according to the GCRMN protocols. Benthic and fish community structure were regularly studied before and after the implementation of the Reunion Marine Reserve. The first results of this exceptional long-term monitoring show trends on benthic cover occurred during the last 18 years with different population “shifts” linked to environmental disturbances. For all stations, algal assemblages became dominant after 2000 and progressively increase on the reef slope of St Gilles and St Leu. Benthic communities become relatively homogenous after 2010 through the different St Gilles sites. On outer reef slopes, temporal trends are associated with a strong decrease of coral cover (from 56 % in 1998 to 24 % in 2014) and a progressive shift of coral communities characterized by an homogenization of species and a decrease of *Acropora* replaced by *Astreopora* / *Pocillopora* and *Porites*. St Leu outer reef slope sites are characterized by the high live coral coverage for Reunion Island (57 % in 2014). St Pierre outer reef slopes are characterized by a spectacular increase of coral cover since the ten last years (from 40% in 2000 to 65 % in 2014) dominated by *Acropora abrotanoides* communities. For fish communities, in all sites they are dominated after 2002 by herbivores with more than 60% of individuals censused on the reef flat and 40% on the outer slope. Very few piscivores were recorded, less than 3% on all sites. All these results displayed contrasting spatial and temporal situations of Reunion Island coral reef ecosystems that may be correlated with several natural disturbances associated with an increase of chronic anthropogenic pressures that affect coral reef communities according to their resilience processes and functionalities.

ORAL- Thursday- Msikaba 2- 1140

A multidisciplinary approach for coral reef management: a case study of the Iles Eparses (SW Indian Ocean)

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To date little is known about the French remote coral reefs of the Iles Eparses (SW Indian Ocean) because of their limited accessibility. Facing this gap in information, a multidisciplinary program related to biodiversity, resources and conservation (BioReCIE, 2011-2013) aimed to complete the dataset of coral reef ecosystem through inventories (Algae, Cnidarians, Crustaceans, Echinoderms, Fish) and habitat mapping, and establish a baseline study to estimate the coral reef health and state of its fishery resources. This baseline study was ascertained using a standardised methodology consistent with GCRMN methods to assess benthic and fish communities at the highest taxonomic level. Our results show that these islands are characterised by elevated diversity values showing that isolated coralline formations, even of small size, can be endowed with a high biodiversity. These results may be explained by the low anthropic pressure and oceanic currents in the central part of the northern Mozambique Channel that favours connectivity between local populations. A comparison of fish biomass recorded on other Indian Ocean reefs enables us to point out exceptional biomass in the Iles Eparses, which is up to approximately three times higher than the highest value currently recorded in the Indian Ocean. Our data allows us to propose a biomass of approximately 3,500 kg/ha, which represents a reference value for coral reefs with no fishing pressure for over 60 years. The presence of large herbivores and predators at all islands as well as the absence of benthic fleshy algae were indicators of the good health of the reef systems. These results are discussed according to management perspectives with identification of priority zones for conservation. Long-term monitoring is essential to describe trends and evolution in coral communities in the context of increasing human impact and climate change where population dynamics are accelerated.

ORAL- Wednesday – Msikaba 3 – 1620

Post-translocation spawning site fidelity of the spinefoot shoemaker (*Siganus sutor*)

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Many coral reef fishes that form spawning aggregations display high fidelity to specific spawning aggregation site. However, the mechanism by which site fidelity in coral reef fishes is maintained has seldom been discussed. The spinefoot shoemaker is a commercially important species which is endemic to the Western Indian Ocean which forms

large transient spawning aggregations. At Praslin, Seychelles a large number of spawning aggregation sites are known with different proximity to each other. Acoustic tagging of *S. sutor* and monitoring of spawning aggregation sites indicates high but not absolute site fidelity. There is however no information on how individual chose which spawning aggregation site to attend. To determine whether the spawning aggregation sites are chosen based on social interaction or whether it is innate we tagged 56 *S. sutor* in two batches of equal size at two spawning aggregation sites over two spawning seasons with Vemco V9 acoustic tags. Half of the fish tagged at each site were trans-located to the other site while the other half was released at the site of capture. The movement of these fish were monitored over 4 months at 6 different spawning aggregation sites, including the sites of capture and release using an array of 22 passive acoustic receivers. Initial results suggest that trans-located fish do not return to their original site of spawning but rather attend spawning aggregation at the site to which they were translocated. This tend to suggest that the selection of spawning aggregation site is socially determined and that once translocated acoustically tagged fish do not have the ability to home in on their original spawning aggregation sites.

ORAL- Tuesday- Msikaba 4- 1100

Ecological behaviour of bull shark (*Carcharhinus leucas*) on the west coast of Reunion Island, WIO. Implication for shark risk management

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Bull sharks (*Carcharhinus leucas*) were identified as one of the major species involved in shark attacks that occurred in Reunion Island during the last decade. The research program CHARC begun in December 2011 to improve the knowledge on biology and ecology of this species using acoustic telemetry. A total of 38 bull sharks were tagged and 42 acoustic receivers distributed along the west coast of the island were used to monitor shark presence/absence during 18 months. All tagged bull sharks but one (183 cm TL), were adult (205–329 cm TL), with a sex ratio of 0.7:1 (M:F). Spatial distribution along the west coast was not homogenous as sharks were more present in six specific areas. A sexual segregation was observed in these areas with 2 used by both sexes, 2 used mostly by female and 2 used mostly by male. Although females were detected all year round, a strong seasonality in the presence of sharks existed with tagged sharks of both sexes more abundant in winter than in summer. Inter-annual variations in the distribution of sharks were recorded along the west coast of the island. Based on their spatio-temporal movements, individuals could be gathered in two groups: individuals with movements confined within a small area and individuals using the entire network area. All those patterns are analyzed to better understand the role these areas play in the bull sharks life cycle (as hunting, reproductive or resting areas). Results are discussed with the aim of mitigating the shark risk.

ORAL- Thursday – Msikaba 2- 1620

Small scale, community-established no take zones in southwest Madagascar increase biomass of coral reef fish assemblages

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Velondriake meaning “to live with the sea” is a Locally Managed Marine Area (LMMA) in southwest Madagascar. The LMMA is managed by a community association and governed through local laws devised by communities called “dina”. The goal of the LMMA is to improve the sustainability of small-scale fisheries in the area. To achieve this communities implemented the first small scale (<1.0 km²) permanent no take zone (NTZ) within its operational boundaries in 2009 followed by two more in 2011. As part of ongoing monitoring of the LMMA’s ecological impacts, underwater visual census (UVC) were conducted at 20 locations within the NTZs and on comparable reef sites open to artisanal fishing between 2008 and 2014. Surveys assessed the biomass, size, and diversity of 152 reef fish species from 35 families. Reef fish biomass within the NTZ established in 2009 has increased significantly by 1674.23kg/ha (one way ANOVA; p<0.001) between 2010 and 2014, while comparable non-reserve sites also increased significantly during this time by 648.92kg/ha (one way ANOVA; p<0.001). The rate of change was significantly higher in the NTZ than within comparable non-reserve sites (ANCOVA; P < 0.001). Reef fish biomass within NTZs established in 2011 have also increased significantly by 1612.21kg/ha (one way ANOVA; p=0.001) and comparable non-reserve sites have also experienced a significant increase in biomass 409.64kg/ha (one-way ANOVA p=0.005). These results demonstrate that small scale NTZs are able to benefit coral reef fish assemblages within their boundaries and compliment the range of management tools used within the LMMA to increase biomass outside of the reserves. The trends identified in this study illustrate the effectiveness of small community-led NTZs and provide further support for establishing more NTZs as part of community-focused LMMAs around Madagascar, the Western Indian Ocean and the world.

POSTER

Human well-being and mangrove forests: case study on the role of coastal ecosystem services in two communities in Madagascar

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The investigation of socio-ecological interactions involving mangrove ecosystem services (ES) illustrates the complexity of the relationships between functional ecosystems, market integration and the maintenance of human well-being. The Belo-sur-Mer system of mangrove forests, located on the west coast of Madagascar, provides a range of ES to the coastal fishing community of Antanamanimbo and the inland farming community of Marofihitsy. Greater market integration in Antanamanimbo corresponds with larger material, energy and monetary throughputs. Marofihitsy demonstrates the value of mangrove ES to the inland communities that often remain outside assessments of marine and coastal resource use. Mangrove fisheries provide the majority of monetary incomes in both communities, representing 53.53 % of total annual

incomes for Antanamanimbo and 59.76 % for Marofihitsy. The role of mangrove ES in generating incomes is complemented by their importance as key components in local diets, the communities' reliance on the mangrove as a safety-net for incomes and food production, for harvesting fuelwood and lumber, and in supporting cultural identities. Despite significant differences in the size of household incomes ($p < 0.001$) and the scale of mangrove resource extraction ($p = 0.001$) between these communities, levels of human well-being are only marginally different. This indicates that the relationship between human well-being and natural systems is multi-dimensional and relies heavily on components that are not accounted for by the market system. Considering the role of mangrove ES in this local socio-economic context provides an invaluable tool to be used in guiding local resource management decisions and establishing an effective balance between conservation and development.

ORAL- Monday- Msikaba 1- 1640

Bioaccumulation of trace elements in a tropical marine food web (Seychelles, Indian Ocean)

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The Seychelles is recognized as one of the major marine biodiversity hot spot including coral reefs, mangroves, seagrass beds and vast pelagic system. This biodiversity support the ecosystem resilience and provision of ecosystem services as well as contributing to the performance of economic systems and human well-being in general. However, multiple pressures including habitat loss and degradation, climate change, and overexploitation affect Seychelles ecosystems. In addition, the occurrence of heavy metals in Seychelles environment is of concern despite limited anthropogenic activity in this region. Mercury and cadmium have been detected in pelagic fish, and there has been concern about sources and concentrations in food items highly exploited and consumed. Evaluating the bioaccumulation and trophic transfer of trace elements in Seychelles food webs is also very important to assess their ecotoxicological risk on marine organisms, a process still poorly investigated in this region. The present study aims to provide baseline information on trace element contamination status of the Seychelles marine environment. For this purpose, a wide range of exploited crustacean and fish species were collected from Oct 2013 to March 2014 in collaboration with local fishermen associations. Total length was recorded and samples of muscle were analyzed for their trace element and total lipid contents, and carbon and nitrogen stable isotopic composition ($d_{13}C$, $d_{15}N$). Our data allows to identify variations in the levels of heavy metals according to species or catch location. The relationships between metal concentrations, total lipids and stable isotope ratios elucidated bioaccumulation and trophic transfer processes of chemicals across the Seychelles food web. Finally, potential ecotoxicological concerns were investigated because of the sanitary importance of knowing the health status of exploited species for human consumption and to contribute with valuable information that allows improving the harvesting activity in Seychelles.

ORAL- Monday- Msikaba 1- 1600

Trophic dynamics of a tropical marine food web in Seychelles using stable isotope and fatty acid tracers

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At present our knowledge of the Seychelles marine food web is relatively limited. In order to evaluate the biological effects of potential global changes, it is important to have a basic understanding of the marine ecosystems in the Seychelles waters. Furthermore a sustainable exploitation of the fisheries resources has to be based on a basic scientific understanding. In order to gain baseline information on the food web structure and trophic relation of the Seychelles marine ecosystem, we aimed to study stable isotope and fatty acid tracers in the dominant exploited marine species (ie, bivalves, crabs, reef, demersal and pelagic fish). A total of 26 species (5 to 10 individuals per species) were collected throughout the plateau of Mahé during the north monsoon (November 2014 to March 2015). Total length and weight were recorded for each specimen, and a 2g muscle sample was collected and immediately stored at $-80^{\circ}C$. Fatty acid composition was assessed on fresh samples using gas chromatography while carbon ($^{13}C/^{12}C$) and nitrogen ($^{15}N/^{14}N$) isotopes were analyzed on lipid-extracted dried samples using isotopic ratio mass spectrometry. Specific fatty acids were used to identify the preferred food sources (i.e., mangroves, seagrass, phytoplankton, macroalgae, bacteria, and zooplankton) of studied fauna. $d_{15}N$ increased with trophic level with the highest values recorded for large pelagic fish, and $d_{13}C$ values provided a generally good description of carbon flow through the food web. This study is the first to use a comprehensive stable isotope and fatty acid tracer approach to investigate the food web dynamics within Seychelles ecosystem. It is part of a larger research program that aims to understand routes of energy flow and contaminant transfer in food webs and how these pathways may be affected by ecosystem change, and may contribute to the currently developing fishery management strategies in Seychelles.

ORAL- Monday- Msikaba 2- 1400

A Landscape assessment of mangrove ecosystem integrity

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From a conservation perspective, ignored *ex situ* processes may counteract management interventions in an ecosystem of interest if the former aren't taken into account. This study sought to assess land-use cover change and its potential relationship or impact on the integrity of contiguous mangroves downstream. Mangrove cover and land use changes within Mtwapa system in Kenya was assessed using multi-temporal medium resolution Landsat TM (1992) and

SPOT images taken in 2000 and 2009. Carbon stocks of these mangroves were also assessed as an indicator of ecosystem integrity. Land-cover changes around the creek from 1990 to 2009 revealed a high rate of upland deforestation (3.85% yr⁻¹) and an increase in agricultural land (13.9% yr⁻¹). Between 1992 and 2009 the mangrove forest lost 21% of the cover, translating to 1.2% cover loss per annum which fell within the global mean of 1 – 2%. The stocking rates of mangroves in Mtwapa were estimated at 2870±295 stems/ha. The mean biomass carbon for the study area was 49.46±8.49 Mg C ha⁻¹, with no significant variation between sites (p>0.5). Mean SOC of the study area was 196.09±19.31Mg C ha⁻¹ giving a total ecosystem carbon of 245.54±20.95Mg C ha⁻¹. This was quite low compared to in-country and off-shore carbon stocks and is likely due to poor forest structure in Mtwapa creek associated with anthropogenic disturbance as noted by high stump count 2,425±423 stumps/ha. There was a highly positive correlation between land use cover change (agricultural expansion – R² = 0.70) and mangrove cover. Although these mangroves recorded high stocking densities, high degradation rates and observed sedimentation due to poor land-use practices upstream have led to poor stand structure hence low carbon stocks. A landscape approach which combines sound land husbandry upstream and mangrove conservation is recommended.

ORAL-Monday- Msikaba 4- 1620

Population structure and connectivity at the oceanic region scale: key issues for sustainable management of green turtles in the western Indian ocean

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This analysis is a comprehensive summary work aiming to improve scientific knowledge on the Green turtle to provide key scientific evidences needed for the implementation of coherent and effective management measures to protect this threatened species at the scale of the Western Indian Ocean. First of all, we compiled data on the abundance of Green turtle nesting females and long term trends of 8 key nesting populations of the region by applying different modelling methods. Secondly, we determined the regional genetic structure of this species using mtDNA control region and the relationships that exist between the different populations (15 rookeries, 453 samples of nesting females). Thirdly, we compiled all complete post-nesting and nesting Green turtle satellite tracks available for this region (N>100) in order to better estimate the regional connectivity pattern between nesting sites and foraging ground of this species. Finally, hatchlings dispersal patterns from 5 key nesting sites were simulated by releasing particles drifting almost passively into a state-of-the-art World Ocean circulation model. Based on the above results and the fishing activity reported in the area, this work also tried

to characterize the anthropogenic pressure faced by green turtles in the Western Indian Ocean. These results allow unraveling some key gaps on the biology and ecology of the Green turtle in the region and lead to a global vision of the conservation status of this species in the Western Indian Ocean. The compilation of the results enables the identification of regional priority areas for protection, but also some more specific threatened sites such as Europa. Finally, this synthesis sheds light on research priorities and scientific approaches to be promoted in the future to unlock other key scientific issues and refine conservation priorities, not only for marine turtles, but also for marine megafauna as a whole.

ORAL- Monday- Msikaba 4- 1100

Hydroids (Cnidaria, Hydrozoa) along the Latitudinal Gradient of the Coral Reefs of Eparses Islands

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Hydroids are a great component of the benthic fauna of coral reefs. The present work is based on field surveys carried out in 3 Eparses Islands: Glorieuses, Juan de Nova and Europa Islands. These three coralline islands are localised in the Mozambique Channel, stretching on more than 10° of latitude. Sampling was done by snorkelling and scuba diving (max 30 m depth, 1 hour for each station). Species richness was high when grouping the results from the three islands (155 spp) distributed in 24 families and 50 genera. Juan de Nova Island, situated in the middle of the Channel, gathered most of the species (120), while 88 species were identified in Glorieuses Islands (in the North) and 66 spp in Europa (in the South). The number of species per station varied from 2 (reef flat of Glorieuses Island) to 45 (outer slope of Juan de Nova). Some trends could be highlighted within the three islands: Leptothecate hydroids were the major component of the hydroid fauna (~74%); Aglaopheniidae and Sertulariidae were the 2 main families, with 18 and 25 spp, respectively; *Eudendrium* is the most speciose genus for Antoathecate hydroids; hydroid community of the reef flats and reef platforms were different from the one of the outer slopes (the later always richer); brooder species predominated with at least 80% having fixed gonophores (20% budding medusae). Meanwhile taxonomic and genetic analyses are still in progress, the hydroid fauna of the Glorieuses Islands seemed to be very different of that one of Europa, since only 15 spp were shared, when grouping Aglaopheniidae, Sertulariidae and calcareous families, whereas 48% of these species were common between Glorieuses and Juan de Nova Islands. Some species are characteristic of the different morphological units (reef flats/platforms and outer slope) whereas other ones inhabiting the 2 units.

POSTER

The coral reef medusae (cnidaria) of Reunion island (south-west Indian Ocean)

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This study is based of a one-year survey on the West coast of Reunion Island in order to sample medusae around the fringing coral reef. Four locations were investigated with 2 sites per location, one near the reef at 10m depth, and one at 50m depth offshore. Among the 486 samples collected with a plankton net, 3546 salted formalin fixed medusae were examined in the laboratory and 48 species were identified. The most diverse medusa class belong to Hydrozoa (44 species), while Scyphozoa were represented by only 2 species. One species of Cubozoa (*Carybdea* sp.) and one species of Stauromeduzoa (Gen. sp. nov.) were recorded for the first time in Reunion Island. Among Hydrozoa, 75% of the species belong to meroplanktonic Hydroidomedusae with 50% of Anthomedusae (12 families, 20 genera) and 25% of Leptomedusae (5 families, 7 genera), and 25% consisted in holoplanktonic Automedusae, distributed in Trachymedusae (3 families, 7 genera) and Narcomedusae (3 families, 4 genera). Among Anthomedusae, the first records of *Zanclella diabolica* Boero, Bouillon & Gravili, 2000 and *Cnidocodon leopoldi* Bouillon, 1978 were checked.

Concerning the medusae abundance, Automedusae were the most profuse (81% of medusae collected) and present all year round. Three common holoplanktonic species dominated in all samples: *Aglaura hemistoma* Péron & Lesueur, 1810, *Liriope tetraphylla* (Chamisso & Eysenhardt, 1821), and *Solmundella bitentaculata* (Quoy & Gaimard, 1833), with respectively 1546, 682 and 452 specimens collected. Conversely, Hydroidomedusae were rare (19%) and episodic. Reverse development of *Turritopsis nutricula* and *Laodicea* sp. medusae were observed.

ORAL- Monday- Msikaba 3- 1420

Mercury and persistent organic pollutants in plastic debris and coral from St. Brandon's Rock, Indian Ocean

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Marine debris, consisting mostly of plastics, present the potential to transport both the traditional persistent organic pollutants (POPs), heavy metals, and the less persistent industrial chemicals inherent with the plastics themselves. Plastics are found in abundance on SBR – we believe mainly from the East Indies, the northern Indian Ocean. We collected plastic and coralline matrix samples from St. Brandon's Rock (SBR), an isolated atoll north of Mauritius, and analysed for a variety of POPs and mercury. Of the 68 organic compounds that we analysed, we obtained quantifiable residues of 59, many of which are first records for the Indian Ocean. We also found quantifiable mercury,

especially in plastics. There are indications that plastics associated pollutants may have transferred to the coralline matrixes. We discuss the distribution of the compounds between the different matrixes, as well as the implications our findings hold for pollution of distant, isolated oceanic islands in the Indian Ocean.

POSTER

Birds from Agalega and St. Brandon's Rock, Republic of Mauritius

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Here, we report on a marine bird survey of St, Brandon's Rock (SBR) in 2010 and bird observations from Agalega in 2014.

For seven breeding species on SBR we estimate 1.2 million birds, mainly Sooty Tern (*Sterna fuscata*), Lesser Noddy (*Anous tenuirostris*), Brown Noddy (*A. stolidus*), and Fairy Tern (*Gygis alba*). From previous surveys we surmise that species numbers and numbers of birds have decreased. When considering the different islets that make up SBR, we found that different seabird species partition their use of islets based upon islet size. Four species preferred larger islets, while two preferred smaller islets. Rats and other alien species are still present on some islets. We propose a Marine Protected Area based on the reef as a complete system.

On Agalega, we did not see any Glossy Ibis (*Platelea alba*), but did note Yellow-eyed Canary (*Serinus canicollis*) not previously recorded. Interestingly, no Indian Mynahs were found, but House Sparrows (*Passer domesticus*) were common. Curlew Sandpipers (*Calidris ferruginea*) and Ruddy Turnstones (*Arenaria interpres*) foraged on lawns between the houses, and Ruddy Turnstones and Whimbrels (*Numenius arquata*) were flushed from bushes – atypical behaviour. Madagascar Turtle Dove (*Streptopelia picturata*) and Madagascar Fody (*Foudia mascariensis*) were seen, as well as glimpses of a kingfisher that we could not identify.

Much more is now known about the birds from SBR, while much work remains to be done to assess the bird population on Agalega to allow an informed conservation plan.

POSTER

Halogenated organic contaminants in tern eggs from St. Brandon's Rock and Rodrigues, Republic of Mauritius

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The Indian Ocean is the third largest in the world and seems to be increasingly subjected to pollution from development and maritime traffic. To obtain a baseline of pollutants, we collected tern eggs from Rodrigues and St Brandon's Rock (SBR), Republic of Mauritius. The eggs were analysed for chlorinated, brominated and fluorinated pollutants such as DDT and PCBs.

Eggs each of the Common Noddy, also known as the Brown Noddy (*Anous stolidus*), and Sooty Tern (*Sterna fuscata*) were collected from Rodrigues and SBR. ΣPCBs had higher levels in Rodrigues eggs (2.2 and 2.6 ng/g wm, wet mass) for common Noddy and Sooty Tern, respectively, while eggs of the same species from SBR had 1.1 and 1.0 ng/g wm, respectively. For ΣDDT, the concentrations were 3.1 and 1.9 ng/g wm for eggs from Rodrigues, and 0.95 and 1.0 ng/g wm for Brown Noddy and Sooty tern eggs from SBR, respectively. Similar patterns were found for chlordanes, toxaphenes, brominated flame retardants, and perfluorinated compounds.

The contaminant levels were low throughout representing some of the lowest concentrations in the world. However, economic, political instability, and social conditions around the Indian Ocean are changing, probably with a concomitant increase in pollution. Regular monitoring of marine bird eggs from SBR and Rodrigues as background sites for pollutants would be very informative over the long term

POSTER

Novel technologies for developing indicators for marine and coastal water quality in South Africa

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Pollution of coastal marine waters by toxic effluents and nutrients from land poses a major threat for human and ecosystem health. Currently, South Africa's water quality guidelines are based on international best practice, and are based on physical, chemical and biological processes of the receiving environment. These properties vary depending on the properties of a given site, yet no comprehensive spatially-explicit set of water quality standards has been established at this stage. Furthermore, the suitability of the commonly used water quality indicators, such as *E. coli* and intestinal enterococci, has not been assessed in the South African context. While such indicators focus on detection of human pathogens, the health of the marine ecosystem also needs to be considered when choosing indicators to monitor water quality standards. The Department of Environmental Affairs (DEA) has recently established a Coastal Environmental Research group to tackle these shortcomings. This presentation provides the future direction for developing microbial indicators for monitoring of water quality in South Africa. Specifically, the use of novel technologies (such as flow cytometry) will be introduced in this context.

ORAL- Wednesday – Msikaba 4- 1440

A Successful Example of Marine Protected Area Adaptive Management in the Western Indian Ocean

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Marine protected areas (MPAs) are one of the leading tools used today for coral-reef conservation. Effective management requires continuous feedback to reach the

established goal(s) and achieve tangible conservation benefits. However the great majority of marine protected areas fail to meet this requirement hence hindering MPAs effectiveness. Madagascar is one of the poorest developing countries in the world and the population on island depends heavily on fisheries for subsistence. Several MPAs have been established in the country since 1989 to protect coral reefs and the reef fisheries. In March 2014, a reef resilience monitoring was conducted in four of Madagascar's oldest MPAs (Nosy Antafana, Tanjona, Masaola and Tampolo). Two stations in each MPA were sampled to assess six parameters of reef resilience: benthos cover, coral recruitment, coral Shannon-Wiener diversity index, coral bleaching, invertebrate abundance and herbivorous fish biomass. The coral cover in Masaola (36.06 %± 10.9) and Tanjona (46.06% ±12.64) were slightly higher than in Tampolo (34.24% ±24) and Nosy Antafana (28.03%±1.49). The bleaching index was relatively low in all four sites (1.01±0.75). Coral diversity index in all four MPAs was almost identical (0.94±0.01). The results indicated a similar population of herbivorous fish in all sites (380.84±80.78 kg/ha). Coral recruitment (colonies of juveniles/m²) was found to be significantly higher in Tanjona (16.69 ±4.3) compare to the 3 other sites Masaola (8.2 ± 3.4) Tampolo (5.25 ±2.3) and Nosy Antafana (5.2±5.25). Macro-invertebrate abundance (individuals/500m²) was found to be significantly higher in Nosy Antafana (825.8±918.7) compare to Tanjona (105.7 ±4.3), Masaola (72.0 ± 58) and Tampolo (18.5 ±7.8). In order to maintain the resilience capacity of these marine parks, the park authorities have agreed to update the conservation measures taking into account the principles of coral reef resilience

POSTER

Toward collaborative management of fisheries in Madagascar: case study of Antongil Bay

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In countries, such as Madagascar, where traditional top-down fisheries management is difficult due to the weak capacity of state institutions to effectively manage fisheries along vast and remote coastlines, fisheries collaborative management is widely recognized as a priority strategy to restore fisheries. In Madagascar, over the past decade, tremendous progresses were made in implementing community based marine resource management in many sites around the country, with encouraging support from local communities. Unfortunately the sustainability of these initiatives is challenged by the lack of a strong policy environment supportive of decentralized fisheries management. This prevents local communities from securing management and access rights for local fishing grounds. Additional challenge is the need to create links among site-based actions that contribute to more holistic, coordinated efforts to manage fisheries across a broader scale. In 2014 the Government of Madagascar has instituted a new law for Madagascar's Antongil Bay, in Northeastern Madagascar, that legally empower local

communities to manage their nearshore fishing grounds through locally managed marine areas. This new law also establishes collaborative arrangements at the sub-national level between artisanal and industrial fishers, civil society and government to work together on the sustainable management of fisheries in 3,746 square kilometers consisting of the entire Bay and surrounding areas. This provides the governance mechanism to better integrate LMMAs into a broader framework for the sustainable management of fisheries at the seascape scale. In addition this new law restrict access to industrial trawling boats and ban shark fishing in the Bay. Finally this new law provides local fishers the opportunity to be granted exclusive access rights to nearshore fishing areas. This is the first time such a law is established in Madagascar and it will serve as a best practice model for expanding fisheries collaborative management around Madagascar and the region.

ORAL- Thursday- Msikaba3-1720

Drivers of Change in Dune Form - A Case Study for Set back line determination

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The impact of sea level rise on the coastline of KwaZulu-Natal has given rise to an expectation that adaptation to this phenomenon entails the establishment of a set back or buffer from the high water mark or broader beach environment. We argue that a coastal set back in KwaZulu-Natal specifically and along other soft coastlines requires a more complex approach. A case study from the southern eThekweni region is presented to demonstrate the need for such an approach in the establishment of coastal set backs.

The dune cordon to the Illovo River which lies just south of Durban, has been subjected to a number of natural and anthropogenic influences over the past 75 years. As a consequence of these influences the nature of the dune form has changed significantly, vacillating from stable dune to partially mobile dune.

In this paper we present historical evidence of such change and investigate the direct influence of changes in meteorological or climatic conditions, estuary configuration and responses, as well as land use change immediately adjacent to and upon the dune cordon. Such factors are considered to be direct in their influence, however evidence of indirect influences are also present.

It is demonstrated that natural fluctuations in maritime coastal dynamics, meteorological and fluvial factors have played a part in the changes evident on this dune form, while anthropogenic influences also have a direct and indirect contribution to such dynamism. The timing of certain activities may also have had an influence on the nature and structure of the dune. Given the significance of the above factors on the coastline, it is suggested that the methods presented, should form the basis of any set back line determination.

POSTER

Assessment of octopus (*Octopus cyanea*) populations in Misali Island, Pemba

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The distribution and population dynamics of *Octopus cyanea* were studied in Misali Island's non-extraction zone through octopus fishermen catch measurements and transect surveys. The Misali Island octopus fishery is characterized by traditional fishing methods and subsistence fishing practices. The distribution of the octopus, gender ratios, weight, egg bearing, and CPUE measurements were determined based on field observations and catch measurements. Preferred substrates and Misali Island's present habitat distribution and availability were also determined through transect surveys. It was found that the protected non-extraction zone was composed of mostly rock holes with a CPUE of 2.61 kg/hr (244% of the island average of 1.07 kg/hr), and the second largest CPUE was in Kijiwebendera fishing ground (1.18 kg/hr). Recommendations were made to continue to manage PECCA's Misali Island more effectively, and to ensure the continuing re-stocking of octopus populations. Female and male average weights ranged from 140 g to 2250 g. The most frequently caught weight range for both genders was between 400 g – 499 g. Based on previous studies about Misali's octopus landings and catch the catch per unit effort of the area has significantly decreased, and the octopus fishery stock is being depleted. In conclusion, the octopus stock in Misali Island has been consistently overfished and should be better regulated. Boundaries in the area should be made more clear and follow fishermen maps and fishing grounds such as the ones gathered in this study. It is imperative to not only to continue the communal management of the island, but also to understand the internal culture and knowledge of the fishermen working there. Without local knowledge, there cannot be transparency or comparison between different stakeholders. Moreover, fishermen cannot be effectively educated about current regulations, or ways in which they can create a better fishery yield without being understood first.

POSTER

A study of the frenchman seabream *Polysteganus baissaci* (Smith, 1978) (Perciformes: Sparidae) from the Nazareth Fishing Bank, Mauritius

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Polysteganus baissaci (Smith, 1978) is an important commercial fish species found on the slopes of the fishing banks of the Exclusive Economic Zone (EEZ) of Mauritius.

Exploitation of this species started in 2007 and targeted using hydraulic reels with baited hooks. The introduction of suitable management measures is important for this fishery and a sound understanding of the biology is required. Therefore, biological data was collected to investigate several aspects of the biology of *P. baissaci*. Initial analyses of 363 females and 533 males collected from commercial fishing vessels operating in the EEZ of Mauritius resulted in a length-weight relationship $W = 0.032L^{2.847}$ (Female), $W = 0.036L^{2.813}$ (Male), and $W = 0.032L^{2.843}$ (Combined). The mean K-value of the species for each category was calculated as 1.820±0.1236 (Female), 1.805±0.1225 (Male) and 1.811±0.1231 (Combined). Females appear to recruit into the fishery at a smaller size. The fishery targets mature fish ranging from 300 to 450 mm, catch being dominated by classes between 380 and 390 mm. Otoliths are currently being obtained from specimens across the size range and the age and growth parameters will be calculated. Genetic samples are being collected from the different fishing zones to ascertain population characteristics. To inform future management suitable stock assessment models will be investigated, including the feasibility of using an age structured surplus production model.

POSTER

Biogeography of the Western Indian Ocean calanoid copepods

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Published information on the distribution of calanoid copepods from the Western Indian Ocean (WIO) are consolidated and combined with new data collected from the South West Indian Ocean Ridge, in order to generate an updated biogeography for this order of copepods in the region. Eighty six five-degree grid squares were mapped for the WIO. Epi-pelagic biogeographic provinces were identified using Bray-Curtis similarity indices, and were subdivided into sub-Antarctic, warm temperate, subtropical/tropical groups. Good latitudinal and longitudinal agreements were noted in the north, and assemblages failed to separate in the southern latitudes as well as in the coastal waters. These differences might reflect large-scale mixing and a wide distribution of cosmopolitan species amongst neighbouring provinces; however, more data are needed. Calanoid copepod assemblages were consistent with the flow of waters from adjacent provinces, and species richness decreased latitudinally on the basis of the distribution of sampling efforts in the region. This pattern is compared with those generated from other taxa.

POSTER

The Connectivity of *Diplodus capensis* (Blacktail), *Rhabdosargus thorpei* (Bigeye Stumpnose) and *Neoscorpis lithophilus* (Stonebream) fish populations in the Southwest Indian Ocean

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The oceanography in the Southwest Indian Ocean is complex: the island of Madagascar interrupts the movement of water masses from the equator and results in the formation of eddy currents in the Southwest Indian Ocean. This oceanography could affect the distribution

and connectivity of marine species in Mozambique, Madagascar and South Africa. Co-occurrence of many conspecifics has been described for Madagascar and South Africa, and includes the fishes *Diplodus capensis*, *Rhabdosargus thorpei* and *Neoscorpis lithophilus*. These three species are important in the recreational fishing sector in South Africa and the subsistence fishing sector in South Africa, Mozambique and Madagascar. The present study is aimed at examining the connectivity of populations of these three species in the Southwest Indian Ocean. This connectivity is being investigated using microsatellite markers identified and sequenced using Next-Generation sequencing. Fin clip samples were collected from three sites in KwaZulu-Natal, South Africa (Cape Vidal, Durban and Scottburgh) and one site in Fort Dauphin, Madagascar. An ethanol salting-out protocol was used in DNA extraction and only pure, high quality DNA extracts were used for DNA library construction using low coverage *de novo* sequencing. From these reads, microsatellite loci were located and 30 primers for each species were designed with Nextera XT Illumina sequencing adapters included for these regions. Microsatellite regions were amplified using PCR (Polymerase Chain Reaction). Sequencing was conducted using the Illumina Miseq platform. The information gained from this study is expected to reveal the process of evolution in these species, and to elucidate processes driving connectivity between their populations in the Southwest Indian Ocean.

Impacts of a wrecked fishing vessel on the coral reefs of St. Brandon's Rocks, Mauritius

POSTER

A multidisciplinary approach for coral reef management: a case study of the Iles Eparses (SW Indian Ocean)

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To date little is known about the French remote coral reefs of the Iles Eparses (SW Indian Ocean) because of their limited accessibility. Facing this gap in information, a multidisciplinary program related to biodiversity, resources and conservation (BioReCIE, 2011-2013) aimed to complete the dataset of coral reef ecosystem through inventories (Algae, Cnidarians, Crustaceans, Echinoderms, Fish) and habitat mapping, and establish a baseline study to estimate the coral reef health and state of its fishery resources. This baseline study was ascertained using a standardised methodology consistent with GCRMN methods to assess benthic and fish communities at the highest taxonomic level. Our results show that these islands are characterised by elevated diversity values showing that isolated coralline formations, even of small size, can be endowed with a high biodiversity. These results may be explained by the low anthropic pressure and oceanic currents in the central part of the northern Mozambique Channel that favours connectivity between local populations. A comparison of fish biomass recorded on other Indian Ocean reefs enables us to point

out exceptional biomass in the Iles Eparses, which is up to approximately three times higher than the highest value currently recorded in the Indian Ocean. Our data allows us to propose a biomass of approximately 3,500 kg/ha, which represents a reference value for coral reefs with no fishing pressure for over 60 years. The presence of large herbivores and predators at all islands as well as the absence of benthic fleshy algae were indicators of the good health of the reef systems. These results are discussed according to management perspectives with identification of priority zones for conservation. Long-term monitoring is essential to describe trends and evolution in coral communities in the context of increasing human impact and climate change where population dynamics are accelerated.

ORAL- Monday- Msikaba 1- 1440

Catch rates of the main fishery resources along the southern and central Mozambique coast during the 2007 and 2014 Nansen survey

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Fisheries stock assessment is crucial to informed management of the resource around the world. They are an important tool on the process of decision make. The purpose of this study was to assess changes in the main fisheries resource groups over time. The study area was divided in three stratum: inner shelf (20-50m), outer shelf (50-200m) and slope (200-800m). Bottom-trawling data from two Fridtjof Nansen cruise surveys in the southern and central Mozambique one in 2007 and other on 2014 were used. In 2007 a total of 102 valid fishing stations of catch rates estimation were completed while in 2014 there were 98 stations. Seven most important fisheries resource groups were analyzed namely cephalopods, demersal, lobsters, pelagic, rays, sharks and Shrimps. In the southern region, a pronounced change in the catch rate was noted for cephalopods and pelagic while in the central region pronounced changes were observed for demersal, lobsters, shrimps and squids. The main species belonging to the groups mentioned above that are more important in terms of abundance in the area are namely cephalodod (main species *Loligo forbesi*); pelagic (*Otolithes ruber*, *Carangoides malabaricus*, *Decapterus macrosoma*, *Decapterus russelli*, *Nemipterus bipunctatus*, *Trichiurus lepturus*); Shrimps (*Penaeus latisulcatus*, *Penaeus indicus* and *Metapenaeus monoceros*); Demersal (*Pagellus natalenses* and *Merelucius paradoxus*). The actual assessment clearly show that the status of most of the resources looks less variable during the two cruises in both areas perhaps meaning resilience of the stocks to the actual level of exploitation. In the inner and outer shelf area, for cephalopods and pelagic shaped decrease in the Southern region was observed and for shrimps the decrease was pronounced in the Central region. However, considering that many factors have role in the ecosystem, a precautionary approach will be always advisable to ensure long term sustainability of the Mozambican fishery stocks.

ORAL- Thursday –Msikaba 4- 1720

A basic needs approach to understanding ecosystem service contribution to wellbeing

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Ecosystem service research typically starts from ecosystems and then identifies what benefits they deliver to people. This paper explores the merits of the opposite: studying individuals' wellbeing first, and investigating how coastal ecosystems contribute to its different components. A multitude of frameworks now exist which depict the array of wellbeing domains that should be included in any assessment. There also exists considerable debate as to the extent to which the selection of domains should be expert led, or derived from the perspectives of those individuals whose wellbeing is of interest, empowering people to align the way their lives are assessed with their own priorities and values. As part of the ESPA funded SPACES project, which is working to establish how marine ecosystem services can contribute to greater human wellbeing in coastal East Africa, a method was developed to create consensus over domains to be used in wellbeing assessment, that combines expert and community perspectives. Drawing from Doyal and Gough's (1992) Theory of Human Need which provides a theorized list of universal criteria for assessing basic needs, a series of focus groups were conducted in coastal villages in Kenya and Mozambique. These discussions validated the Doyal and Gough (expert-led) list, gave opportunity for new additions, and set locally relevant indicators to assess at what point a basic need can be agreed to be met. A second series of focus groups then deliberated the extent to which different ecosystem services that people have access to can contribute, or detract, from the meeting of basic human needs. The paper discusses the merits and pitfalls of the approach, and posits that understanding the role of ecosystem services in the meeting of basic human needs could help inform decision-making by prioritizing those Ecosystem -Wellbeing linkages that people cannot live without.

POSTER

Sea-worms a new research avenue: A preliminary assessment using morphological and molecular markers

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During the past few years, efforts have been made to understand the deeper relationships within the Annelida phylum. Despite, marine polychaetes are responsible for the diversification of this phylum, the establishment of a stable phylogenetic representation still remains a controversial issue. Polychaetes worms classified as one

of the best indicators of marine pollution are subjected to extensive research for medical applications. Morphological and molecular tools were used to determine the diversity of marine worms in Mauritius. A total of fifteen marine worms were collected, belonging to three different phyla, Annelida (Polychaetes), Nemertea and Echiura. A phenetic analysis based on morphological markers separated the species into two major clusters. Group 1 contained all the segmented worms while the unsegmented worms were clustered into Group 2. Genetic variation was investigated among the marine species using a total of 23 arbitrary primers. Of these, IRAP-4, IRAP-5, URP 2F, OPAS 13, OPAS 14 and GEN 2 showed 100% polymorphism. Moreover, the efficiency of the mitochondrial gene, Cytochrome Oxidase Subunit 1 (CO1) was assessed and successfully amplified for 12 marine sea-worms. DNA sequencing further revealed the presence of nine new marine worms in Mauritius. A phylogenetic analysis was conducted based on 18 sequences of mitochondrial genomes including the unpublished sequences of the nine marine worms. The data was processed using maximum parsimony and pair-wise distance methods and clade robustness was strengthened by bootstrapping at 1000 replicates. This resulted in paraphyletic clades between marine worms with strong support to a close relationship between Echiura and Syllidae. In conclusion, molecular tools have, once more, evolved as a more reliable and fast technique to deal with taxonomic classification of marine worms in Mauritius. However, the phylogeny of polychaetes needs to be revised with a greater taxon sampling and more studies are yet to be carried out

ORAL- Monday- Msikaba 3- 1200

Socioeconomic analysis for improved livelihood security of coastal communities in northern Mozambique

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Understanding the socioeconomic characteristics of coastal communities is widely recognised as a crucial requirement for designing locally-appropriate marine resource management measures. This paper presents results of research exploring livelihoods and dependency on fishing resources and discusses their implications for interventions aimed at improving livelihood security in the context of participatory marine management initiatives. The methods used include PRA techniques, a rapid census and a household survey. The results show that, in some communities, fish is a source of income for over 80% of households and the main provider of income for approximately 60%. On average, fishing often represents over 50% of household income. Fishing is vital for household food security, not only directly through fish for consumption, but also indirectly as a source of income to buy staples such as rice and maize. Food insecurity is high at specific times of the year, and households rely heavily on purchased staples. Fishing is amongst the few sources

of income readily available to buy these staples. Household food security is therefore highly vulnerable to changes in food availability in markets, price increases and drops in household income from fishing. Results suggest that there may be a crucial link between mosquito net fishing by women (undertaken by up to 60% of households in some communities) and food security, which requires further investigation. Subjective measures of wellbeing reveal that many people experience low quality of life due to insufficient food, low income and inadequate housing. Our findings indicate that focusing on improving and diversifying income is an appropriate strategy to address multiple dimensions of livelihood security in local communities increasingly integrated into markets, within a region experiencing rapid transformations due to oil & gas. Addressing low agricultural production is an important complementary measure to improve livelihood security, through food self-sufficiency and tradable surpluses.

POSTER

Water masses characteristics in Maputo bay

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The main purpose of this study was to identify the pattern of the water masses in Maputo Bay. The bay is shallow and is located in the southern part of Mozambique Channel. The data used were obtained from CTD (Conductivity, Temperature and Depth) casts during two research cruises in March and May 2009. Ocean Data View software was used to process the data and to create contours of temperature and salinity. In March, results show that the salinity decreases westward in an oblique gradient whereas in May it is distributed in circles with the core in central zone of the bay. By May the bay is highly stratified in the surface, decreasing with depth. The water masses distributions showed presence of saline and warmer SubTropical Surface Water in March. And in May, the bay is under Tropical Surface Water characteristics (TSW). The TSW may be brought by the South Equatorial Current during the south-west monsoon (May- September).

POSTER

On the margins of their existence: Identifying the evolutionary history and patterns of species level genetic diversity of high latitude scleractinia (hard corals) of the South Western Indian Ocean region

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The reef-building coral fauna of the Western Indian Ocean (WIO) is one of the least studied globally. Dedicated taxonomic and diversity studies are spread over a broad period of time and have tended to be geographically constrained (Obura, 2010). In South Africa, the Sodwana Bay reef complexes represent the southern range extent of coral reefs in the WIO region, and are some of the highest latitude reefs globally. A number of scleractinian species

checklists have been developed for the reef complexes (Riegl 1996, Celliers and Schleyer 2002) In South Africa however, a full taxonomic investigation using genetics has yet to be completed. Globally, recent study by Huang et al. (2004, 2008, 2009, 2014) and Fukami et al. (2004a, 2004b, 2008) have used genetic techniques to understand coral phylogeny and evolution, especially in polyphyletic taxa within the robust coral clade. New species designations, such as in the Faviidae, Merulinidae, Pectiniidae and Trachyphylliidae (Huang et al. 2009, 2011) are under consideration, and will be important for future species and community study. This has implications for scleractinian taxonomy locally, where species designations may have to be revised and compared to global congeners based on genetic data. Thus, this project aims to identify South African scleractinian diversity using genetic and morphological data. These data will be used for a comparisons based taxonomic study of regional and global congeners, and will allow for accurate estimation of species diversity, evolutionary history, reticulation, and hybridisation (with special interest in robust corals and two prominent species families, the Acroporidae and Pocilloporidae). This presentation will present the most recent phylogenetic information of this on-going project and results of a brief scleractinian species checklist of the Sodwana bay reef complex.

POSTER

Mangrove mapping and cover change analysis in Vanga, Kenya; using Landsat data and GIS

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Information on deforestation and forest degradation rates is required in setting reference emission levels (REL) for Carbon offset projects. While establishment of REL has been attempted in terrestrial forests, very little has been done on mangroves. This is despite mangroves and associated coastal wetlands harboring huge stocks of organic carbon than their terrestrial counterparts. To counter this deficiency, we used publicly available Landsat data to map the total extend and spatial distribution of mangroves pilot area. Both un-supervised and supervised classifications were applied to four Landsat imageries spanning from 1984 to 2014. The total area of mangroves in Vanga is estimated at 4000Ha with overall classification accuracy of 95%. Statistical analysis indicates the cover change of mangroves in Vanga is approximately 1% decrease per year mostly due to over-harvesting and shoreline change. The results of this study may assist management decisions on rehabilitation, conservation and sustainable utilization of mangrove resources in the area.

POSTER

Comparative Study of Genetic Diversity and Distribution of Symbiodinium Harboured by Reef Building Corals Common to Zanzibar and Mauritius Islands

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The symbiosis of dinoflagellate micro-algae, zooxanthellae (genus *Symbiodinium*) with cnidarians hosts is vital for the survival and ecology of scleractinian corals. Nevertheless, climate change-induced factors e.g. elevated temperature and/or high irradiance may crumble the association if intolerant zooxanthellae clades are involved in the association. This research aims at assessing the cladal genetic diversity of *Symbiodinium* in coral species found at selected sites in Mauritius and Zanzibar that experience differing factors such as biogeography, temperature and irradiance levels throughout the year in the view to understand the possible environments corals are exposed to. Molecular work was performed on five coral species; *Galaxea fascicularis* (n=51), *Acropora muricata* (n=49), *Pocillopra damicornis* (n=30), *Porites cylindrica* (n=44) and *Pocillopora verrucosa* (n=31) in order to assess their *Symbiodinium* clade diversity. The 18S-rDNA of the endosymbiont, which is a highly conserved region, was amplified using zooxanthellae specific primers and the clades were classified by RFLP method. Taq I and Hha I restriction enzymes were used for the digestion of the PCR product. It was found that zooxanthellae clades A, C and D were present among the studied coral species in both countries but in different proportions. In Zanzibar, clade D was dominant among *A. muricata* (81%) and *G. fascicularis* (88%) but a higher proportion (76% and 68%) of clade C was found in respective Mauritian species. *P. verrucosa* associated more with clade A in Zanzibar (80%) compared to Mauritius (29%). This difference in proportion may be due to varying environmental factors like temperature and light prevailing at the two studied regions or due to stress from climatic changes resulting in coral bleaching. Results obtained can pave the way for a better understanding of zooxanthellae clade dominance among coral species in the Western Indian Ocean region and thus contribute to the long-term management of coral reefs.

POSTER

Monitoring and evaluation of the thresholds of probably concern for the berg river estuary, South Africa

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The National Estuarine Monitoring Programme was initiated by the Department of Water and Sanitation in 2008 and is currently being pilot tested on 28 estuaries across South Africa. The programme consists of three tiers that use abiotic

and biotic indicators as a measure of the health of estuarine systems. Selected physico-chemical data collected from eight sites on the Berg River Estuary, between August 2012 and July 2014 are discussed in this paper. The data collected with the use of permanently deployed water quality loggers currently comprise in excess of 60 000 data points and monthly salinity runs consist of more than 3000 data points. The water quality loggers are stationed at approximately 6 and 40 km from the mouth. The study indicates variation in salinities between 0 and 35 ppt at Site 1 at the mouth, and 0 and 29 ppt at Site 6, 40km from the mouth. This variation is as a result of variation in the flows, which peak in winter. The marine influence extends beyond a point situated 40 kilometers from the mouth during summer. Temperatures varied between 12.2°C and 27.7°C, pH between 6.8 and 8.3, while turbidity varied between 0 and 882 NTU. The parameters investigated were mostly (> 83% of the time) within the Threshold of Potential Concern (TPC) for salinity and system variables set in the Berg Estuary Environmental Water Requirements study of 2012. The data indicate that freshwater inflow and nutrient loading are critical aspects to be monitored in the Berg River Estuary. Recommendations for the national implementation of the monitoring programme and the setting of TPC's for other estuaries in South Africa are made.

ORAL- Wednesday- Amadiba- 1600

Bright spots among the world's coral reefs

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Pathways towards more sustainable use of coral reefs have the potential to positively influence the livelihoods of millions of people across the tropics. Here, we adopt a two-pronged approach to informing improved governance of coral reefs. Firstly, we analyse data from >2500 reef sites worldwide to quantify how key socioeconomic and environmental drivers are related to reef fish biomass. We found that market pressure was the strongest driver of reef fish biomass worldwide, with an important but smaller role of local human demographics, national socioeconomic development, local management, and environmental conditions. These results highlight several underutilized policy levers that have the potential to considerably improve the quality of coral reefs. Second, drawing on theory and practice in socioeconomic development, we use a positive deviance analysis to systematically identify reefs that are over performing compared to their expected conditions. These anomalous 'bright spots' provide an opportunity to learn how societies have successfully confronted the coral reef crisis, and should form a basis to prioritize additional policy options.

POSTER

Large scale study in reef fishes: Body elongation is the principal axis of shape evolution

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Tropical reef fishes are widely regarded as being perhaps the most morphologically diverse vertebrate assemblage on earth, yet much remains to be discovered about the scope and

patterns of this diversity, eliciting questions such as: What is the main trend in their morphological diversification? Can we identify underlying processes and formulate new hypotheses on the driving forces for this incredible diversity? In this study, we identified major patterns and repeating themes in body shape evolution of acanthomorphs using Jack Randall's publicly available lateral-view photographs of Indo-Pacific fishes. We used geometric morphometric methods to quantify the entire body morphology of nearly 3,000 species representing 56 acanthomorph families. We summarized shape variation using principal components analyses and principal coordinate analyses on landmark coordinate data. We showed that a major axis of shape variation is related to elongation, such that deep bodied species contrast with slender, elongate forms. This pattern was found independently for two thirds of the families, but we showed that elongation is reached through different variation in three body regions: the head, the abdominal, and the caudal regions. Some groups such as Pomacentridae and Lethrinidae undergo decreases in body depth with proportional increases in the length of all body regions, while other families show disproportionate changes in the length of the head (e.g., Labridae), the trunk, or caudal region in all combinations (e.g., Pempheridae and Pinguipedidae). In conclusion, we found that evolutionary changes in body shape along an axis of elongation dominates diversification in reef fishes. Changes in shape on this axis are thought to have immediate implications for swimming performance, feeding performance, defense from gape-limited predators, suction, and access to highly specialized habitats. The morphological modifications that underlie changes in elongation are highly diverse, suggesting a role for a range of developmental processes and functional consequences.

POSTER

DNA barcoding of reef fish postlarvae as a tool for investigating fish biodiversity off La Réunion Island, SW Indian Ocean

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Preliminary studies on reef fish postlarvae in Reunion Island during the POLARUN Project (2011-2013) were based on pictures of post-larvae taken at capture and at different periods of their development when raised in aquaria. This approach provided unique information as little had been done before in the Indian Ocean. One of the results of this project was an illustrated guide of identification for 141 fish species from 28 families. For this past project, only 58% of fish post-larvae collected were identified at the species level using this approach. From October 2014 to March 2015, the COLOR project (European Regional Development Fund) allowed to sample fish post-larvae on a monthly basis off the west coast of Reunion Island. Specimens were processed following the "barcoding of life" procedure which couples for each specimen high definition photography and DNA-based identification based on the mitochondrial gene cytochrome oxidase I. This procedure developed in the COLOR project will allow verifying the previous identifications based on photography during the previous project and will contribute to the catalogue of DNA barcodes of fish species in the WIO Region.

ORAL-Wednesday- Msikaba 2- 1120

Patterns and influencing factors in the larval fish assemblage on the east coast of South Africa

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Little is known of the marine larval fishes of the east coast of South Africa, with the only previous study dating back to 1990/1991. This study reports on two synoptic surveys conducted off central KwaZulu-Natal in January (wet season) and July (dry season) of 2010. Oblique bongo nets (2x500mm) were towed at stations on the shelf, mid-slope and deep-slope (<100m, 100-600m and ~1 000m depths respectively) along 15 coast-perpendicular transects. Transects were grouped into three areas: Durban, Thukela and Richards Bay. In the 109 samples collected, 2 537 fish larvae, representing 116 taxa from 68 families, were identified. The Durban shelf had the highest larval density (392.74 ind. 100m⁻³) during the dry season, as well as the lowest (2.08 ind. 100m⁻³) during the wet season. Multivariate analyses, which included environmental factors, were undertaken to elucidate patterns in larval distribution which displayed strong seasonality, likely due to varying spawning times of fish species. Distribution was also influenced by large-scale water masses, with samples collected in the Agulhas current waters differing significantly from those from shelf waters. Samples collected over the deep-slope were influenced by the encroaching Agulhas current which is characterised by increased SST and surface salinity, and the presence of deep water taxa, while Durban and Thukela shelf samples, collected where the shelf is wider, were characterised by higher chlorophyll-*a* levels and inshore species. This influence was more apparent in the wet season, during which Durban and Thukela shelf samples differed significantly from all others. During the dry season, larval fish patterns were more homogenous, with the only significant differences being between samples from the shelf and the deep slope off Durban and Thukela. Overall, season, depth and the dynamic oceanographic environment accounted for most of the observed patterns.

POSTER

Physical and societal challenges in groundwater security in coastal East Africa: case studies in the Comoros Islands, Kenya and Tanzania

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African coastal regions are expected to experience the highest rates of population growth in coming decades. Fresh groundwater resources in the coastal zone of East Africa (EA) are highly vulnerable to seawater intrusion. Increasing water demand is leading to unsustainable and ill-planned well drilling and abstraction. Wells supplying domestic, industrial and agricultural needs are or have become, in many areas, too saline for use. Climate change, including weather changes and sea level rise, is expected to exacerbate this problem. The multiplicity of physical, demographic and socio-economic driving factors makes this a very challenging issue for management. At present the state and probable evolution of coastal aquifers in EA are not well documented. The UPGro project 'Towards groundwater security in coastal East Africa' brings together teams from Kenya, Tanzania, Comoros Islands and Europe to address this knowledge gap. An integrative multidisciplinary approach, combining the expertise of hydrogeologists, hydrologists and social scientists, is investigating selected sites along the coastal zone in each country. Hydrogeologic observatories have been established in different geologic and climatic settings representative of the coastal EA region, where focussed research will identify the current status of groundwater and identify future threats based on projected demographic and climate change scenarios. Researchers are also engaging with end users as well as local community and stakeholder groups in each area in order to understanding the issues most affecting the communities and searching sustainable strategies for addressing these.

ORAL- Thursday – Msikaba 1– 1500

Management of sea cucumber fisheries: the problem of illegal captures

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Sea cucumbers are mostly fished and processed into trepang for Asian consumers, since the ancient times. Fishing has recently expanded beyond its traditional geographic boundaries to cover much of the world. Despite increasing concern by national, regional and international bodies, sea cucumber fisheries are showing many signs of overexploitation in the different tropical, and now temperate, regions where they occur. Market demand and the prices are presently very high, spurring exploitation in open fisheries and illegal fishing in closed fisheries and marine reserves. Many reports about these fisheries have

been published recently and international initiatives have helped fishery managers to understand how best to manage and conserve stocks. Governance structures for the WIO region are diverse and management reforms need to take into account multiple factors. Illegal, Unreported and Unregulated (IUU) fishing has developed as a critical issue that must be addressed by national management institutions and through regional or international collaboration. Here, we define the main characteristics of IUU fishing of sea cucumbers, in the different geographical and socio-economic contexts, and propose some solutions to reduce it. In some areas, illegal fisheries for sea cucumbers have been known for centuries, but more recently IUU fishing of sea cucumbers has become prevalent as a consequence of strong market demand, moratoria on fishing, and declines in other marine resources. Different types of IUU fishing occur in countries across the tropical West- and East Pacific, the Indian Ocean and the tropical Atlantic. Because IUU fishing impacts on the export revenues, the stock recovery and the risk of extirpations of valuable species, we recommend fisheries management institutions double their compliance efforts (inspections and reporting) and engage committedly in regional initiatives to reduce IUU fishing of sea cucumbers.

POSTER

Diversity of the Echinoderms of the Iles Eparses (Europa, Glorieuses, Juan de Nova), Mozambique Channel, France

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The multidisciplinary program BioReCIE (Biodiversity, Resources and Conservation of coral reefs at Eparses Is.) set out to complete the inventories of several marine groups and provide information on the coral reef health of the Iles Eparses in the Mozambique Channel. The five classes of echinoderms were observed by visual census, photographed and some individuals sampled and later identified. About 100 species have so far been reported, including a few unidentified ones that require further studies. The Holothuroidea and Ophiuroidea, with 31 species each, are the most diverse classes; the Asteroidea with 11 species and the Echinoidea with 16 species have an intermediate diversity and the Crinoidea are the least diverse, with only 9 species from the results of this program. One new species, the asteroid *Aquilonastra chantalae* O'Loughlin and McKenzie, 2013, has been discovered and several new records have been reported. The holothurians are presently highly valuable resources which are overexploited in most countries worldwide. The illegal fisheries targeting holothurians in these rather pristine islands are discussed. The recent analysis of the governance network has shown that its structure is important, but that multiple other interacting factors must also be taken into account in the efforts to accomplish a sustainable management

POSTER

The Use of Aquaculture Techniques in the Determination of the Eco physiological Effects of Micro plastic Consumption/ Retention

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A large component of marine plastic pollution is microplastic particles. Microplastics are highly prone to ingestion due to their small size and their presence in both pelagic and benthic environments. Ingested microplastics may affect an organism's physical processes such as digestion, assimilation and gut evacuation. There is currently very little research focusing on the gut retention time and evacuation time of microplastics, or their effects on gut histology and physiology. In addition observational studies of fish in natural systems are unable to accurately correlate the extent of microplastic consumption with physiological effects, due to high natural variability. These eco-physiological effects could be better examined in aquacultural systems. This study investigates the effects of known concentrations of microplastics on the gut evacuation rates, gut histology, and growth of both long gut (mullet) and short gut (spotted grunter) species. Fish samples collected from Durban bay were maintained on a depuration diet for 1 month whereafter they were fed known amounts of UV fluorescent microplastic particles. The fish were then exposed to one of three treatments containing known concentrations of microplastics for a period of 3 months. Samples were taken at monthly intervals and examined for any physiological and histological effects. Preliminary gut evacuation rate experiments with mullet indicated retention times of 39.6 ± 5.8 h and 23.8 ± 10.4 h for microbeads (5 mm) and microfibrils (> 1 mm) respectively, compared to a natural gut retention time of 13.3 ± 1.6 h. Further results will be presented on long term exposures

ORAL- Tuesday- Msikaba 3- 1120

A model-based evaluation of reef fish connectivity - Implications for future marine spatial planning policies in the Mozambique Channel

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Marine resources are under increasing pressure from a wide variety of threats such as overfishing, offshore energy development, and climate change. As marine ecosystems degrade, so do the well-being and livelihoods of humans that depend directly on the ecosystem goods and services they provide. Marine protected areas have been proposed to protect biodiversity, restore damaged ecosystems, sustain fisheries, and rebuild overexploited stocks. The effectiveness of marine protected areas depends in part on their effectiveness as connected networks, linked over large areas by ecological processes such as larval dispersal. Here, we applied a biophysical model driven by ocean currents derived from satellite altimetry to evaluate connectivity

between Mozambique Channel reefs. We applied graph-theoretic analysis, including clustering and a betweenness centrality metric. Our results show high interconnectivity within several regions and lower connectivity across the Western Indian Ocean region. We compared the results with the current MPA network, and proposed sites/reefs that should be considered priority sites for MPA implementation. Our results are timely, considering the oil and gas exploration that is ongoing in the region. We discuss implications for transboundary marine policies and regional cooperation in the Mozambique Channel, and advocate the creation of a regional-scale organization to structure interactions among the different actors.

This work has been conducted within the framework of the MOZALINK project.

POSTER

Ghost crab as an ecological indicator to understand the impacts of natural and human intervention in the coastal setting of Poudre D'Or village, Republic of Mauritius.

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Ocypode quadrata (Ghost Crab) locally known as 'Trouloulou' has been used for a long time as an ecological indicator to measure natural and human impacts on coastal settings throughout the world.

These species are reputed for being negatively affected by human activity such as trampling of foot, vehicle traffic, building of new infrastructure on coastal areas; and especially by the presence of inorganic pollutants, on which they prey due to their general scavenger habits.

Ghost crabs were observed in the estuarine wetlands of Poudre D'Or village for an initial period of three years. The main objective was to understand the impact of the local household garbage within this coastal landfill; as well as the effects of the textile industry activities in the vicinity.

Measures were also used to understand human use of beaches for recreational purposes; well-intentioned conservation efforts; consequences of short term beach nourishment and bulldozing for economic development; and hardening of seashore lining (Gabion).

A low cost effective programme was set up for data collection so as to enable the development of a baseline assessment of ghost crab population size in the studied location. Data collected by international interns volunteering with the organization-EPCO, were used to follow population trends; distribution patterns; home range; and behavior in relation to food habits and habitat.

The physical description and development of the Ghost Crab, its reproductive and other behaviors, as well as lifespan and predation patterns were measured to understand impacts of the new ecosystem and its new roles.

Findings were used to advise the authorities and other stakeholders on the impact of these interventions so as to fine tune future actions with regards to coastal zone management and policy development.

The action is ongoing and is being monitored by interns, who voluntarily offered their scientific know-how for this action.

ORAL- Wednesday- Msikaba 1- 1720

Effects of shading and simulated grazing on carbon sequestration in a tropical seagrass meadow

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Seagrass ecosystems are highly efficient in capturing and storing carbon but the accelerating loss of seagrass areas worldwide are leading to a decline in carbon sinks. How anthropogenic disturbances affect the carbon sequestration process is however not well-known. In this study, we experimentally manipulated seagrass plots within a tropical seagrass (*Thalassia hemprichii*) meadow on Zanzibar (Tanzania) to examine the impact of shading and simulated grazing at two levels of intensity using shading cloths and clipping of shoot tissue. We tested the effects on carbon sequestration by measuring net community production (NCP), carbon and nitrogen content in the plant biomass as well as organic matter concentrations and THAA (total hydrolysable amino acids) in the sediment down to 40 cm depth. NCP was significantly lower in the high shading and high grazing treatments, which were also the treatments with highest reduction in carbon (g C m⁻²) of belowground plant biomass, compared to the seagrass control. Furthermore, there were no effects of disturbance on any of the sediment-related variables (organic carbon, total nitrogen, C:N ratio and THAA). However, both clipping treatments had different carbon- and THAA depth profiles to the seagrass control, with lower organic carbon content in the uppermost sediment layer (0-2.5 cm) and a peak concentration in the second depth layer (2.5-5 cm). This may be attributed to increased erosion as a lower sediment surface was seen in the clipping treatments and also due to higher degradation of the belowground plant biomass, which increases the amount of organic matter in the sediment, in turn potentially explaining why there were no effects of disturbance on sedimentary carbon storage. The findings show that high intensity disturbances are depleting the carbon stored in the seagrass biomass pool, which given longer time may lead to a reduction in carbon storage capacity in seagrass sediment.

POSTER

Mapping the Utilization Patterns of the Coastal Zones of Unguja Island, Zanzibar

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West Indian Ocean coastal zones, associated habitats and resources plays a crucial role in sustaining people's livelihood, therefore deserves management attention. Showing the spatial extent of habitats and locations of the various human activities is the first basic step towards

sustainable management. Currently, there are no maps showing hotspot (over-utilized, threatened) or areas with conflicting activities. This study therefore, is the first attempt to map the key habitats and activities around Unguja Island, Zanzibar, with the purpose of elucidating areas that deserve management attention. Data and information were gathered through community mapping protocols, field observation, Google Earth, and from the Institute of Marine Sciences GIS database. The important habitats mapped includes beaches, mangroves, rocky shores, soft-muddy flats, coral reefs and shallow water with depth of 0-20m dominated by seagrass and open deeper waters. Important human activities mapped were fishing, mariculture, and rope making. Tourism activities mapped were diving, swimming snorkeling, water motorcycle riding, and kitesurfing. It was revealed that many activities conducted with coastal people are done in the near shore zones up to 40 m depth concentrating around fish resource rich coral reefs and seagrass meadows. Interviewed fishers agreed that most of the shallow water habitats are facing high use pressures. In Paje conflicting activities are the use of beach by tourists, seaweed farming and passage of fishing boats. Water sports, motorcycle riding and fishing are conflicting in Nungwi. The beach hotels and fishers are competing for beach area in Mangapwani. The produced maps can be used to develop spatial plans, hence reduce conflicts among users. Furthermore, the management of the habitats and resources will be simplified because their spatial locations are known. This study has demonstrated that the use of GIS for management is possible in Tanzania, thus managers and others are encouraged to use it.

POSTER

Distribution of the benthic invertebrate community and ichthyofauna associated with the Walters Shoal seamount.

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Seamounts are unique, prominent topographical features found within ocean basins. Although they have been described as 'islands', 'oases' and 'biodiversity hotspots' only 300 of an estimated 200,000 seamounts have been sampled to date. This has led to gaps in our knowledge of seamounts and their associated ecosystems. Walters Shoal is a shallow seamount located in the Western Indian Ocean, along the Madagascar Ridge. It is the only feature in this area which penetrates the photic zone. This study aims to describe the benthic invertebrate and ichthyofauna communities associated with Walters Shoal. During a 2014 RV Algoa cruise, the benthic invertebrate community found within the mesophotic zone of Walters Shoal was investigated by photo-quadrats taken with a remote jump camera system and physical samples collected by SCUBA diving and a benthic rough sled. Preliminary results indicate that Walters Shoal does not have a high biomass of filter feeders/suspension feeders, as described in seamount literature for other sites. Instead, Walters Shoal is dominated by red coralline algae within a depth range of 20-100m and is characterized by a low growth profile. The

ichthyofauna community associated with the seamount was investigated with stereo and mono baited remote underwater video systems (BRUVs) and physical samples collected (angling and spearfishing collections) which will support the identification of species. Using the fish species inventory from this study, and comparing the results of previous studies, some general conclusions can be drawn: There appears to be a greater representation of widespread tropical species than previously reported, including members of the subfamily Ephinephalae (Groupers). Together with the paucity of temperate species endemic to the West Wind Drift island province, this suggests that the fish fauna of Walters Shoal may play a less important role in linking the Tristan-Gough and Amsterdam-St.Paul Provinces than previously thought

POSTER

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ORAL- Thursday – Msikaba 3 – 1440

Satellite-Based Coastal Upwelling Variability South Madagascar

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The coastal upwelling regions south of Madagascar is renowned for his rich productive marine ecosystems nature which sustains large biological food web particularly primary productivity flux. However, the upwelling is a highly variables phenomena which can have a vital effects on the fluctuation of the trophic dynamics.

In fact, very high resolution satellite data is used to investigate seasonal and annual variability coastal upwelling south Madagascar. The research is aimed to understand the variabilities in order to understand the change in the past, to the present and for the future.

Using Multi-scale Ultra-high Resolution (MUR), new generation of Sea Surface Temperature (SST) product, spatial dynamic upwelling cell is made in evidence. He has possessed two seasonal cores which has different properties.

The upwelling index is calculated to qualify and quantify the intensity the upwelling event for each core. The upwelling intensity is mostly represented during austral winter season. And It has revealed that it has been a permanent upwelling.

Upwelling index spectral analysis has shown an important energy in annual cycle. And more than 80 percent of the total of the variance is indicated the explanation of the seasonality timescale. These statistical approach have explained the seasonal and annual cycle of the upwelling cell.

The spatial correlation has been significantly favorable between upwelling index and chlorophyll A concentration. A correlation lag approach between both is made and shown that the biological response is observed after less one month since an upwelling event.

Physical process responsible of the upwelling event are examined. No significant relation is observed in long term between wind stress and upwelling index, and chlorophyll A concentration. But the combination between EMC and wind favorable have influenced mostly the process generating the upwelling event.

ORAL- Wednesday – Msikaba 1 – 1420

Data-driven portfolios of coral diversity and climate adaptation in the Western Indian Ocean

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Climate change is an unprecedented threat to global coral reefs. In the Western Indian Ocean, there is mounting evidence that conventional marine management cannot prevent wholesale losses in the face of climate change.

Urgently, innovative regional approaches to are needed to tackle climate change through portfolios of local conservation and management actions, such as strategically establishing marine reserves within natural climate refuges or promoting climate-tolerant fisheries. I will present a multi-stakeholder project that involves 90+ international researchers from universities, NGOs and government agencies to identify climate adaptation options for 2200+ coral reefs throughout the Indian and Pacific Oceans, with a focus on the Western Indian Ocean. We identify the first regional hotspots of trait-based functional diversity for reef corals in the northern Mozambique Channel, Reunion, the Maldives and Chagos. We also highlight biodiversity patterns across gradients of climate exposure, from areas of climate refuges to strong warming and bleaching. Our data-driven interdisciplinary approach of ecology, oceanography and climate science identifies portfolios of adaptation actions that can be coordinated for a regional response to climate change in the Western Indian Ocean. I will also address the practical realities of coordinating collaborative databases to support evidence-based conservation actions for coral reefs and the local communities and governments that depend on these valuable ecosystems.

ORAL- Thursday- Msikaba 4- 1500

MPAs at risk, when vulnerability to economy and politics beats the Climate change's vulnerability

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This communication deals with the vulnerability of MPAs to economical and political hazards. This topic drives a major and first question: what is really an MPA ? Most people involved in or around MPAs will answer you: "it is a powerful tool for protecting or restoring marine biodiversity and maximizing the services provided by the marine ecosystem to human beings living in the surroundings or more far". Second question to the same target people: "how do MPAs work ?" The answer will probably show a great variety of points of view. But most of people will probably tell you finally: "it works well" and they can prove this assumption : "look at the willingness of politicians to create MPAs and the lobby of international environmental NGOs for promoting 10 or 20 % of the marine areas into MPAs". This question drives to a third one: "why do people create MPAs ?" The answer is obvious: see answer n°1:" for protecting or restoring marine biodiversity and maximizing the ecosystem services... And promoting the adaptation of marine ecosystems to climate change will add probably some of these people".

This efficiency of MPAs drive a strong feeling of sustainability : once implemented MPAs will work during years and years, except if the growing climate change will drive disturbancy.

Reallity may be quite different as shown by the example of Reunion Island where the marine Park now goes through a series of problems driven by local political games and financial shortage due to the economical crisis in Europe. Obviously, the governance arrangements for MPAs are not strong enough for resisting to the economical and political disturbancy. The dark side of governance is coming...

POSTER

Coral reef heritage, an inheritance in vagrancy

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How to manage and to preserve common property exploited resources or not yet exploited resources is always crucial problem. The establishment of protected areas is seen as the main tool of biodiversity conservation although location, zoning, governance, financing and relations with local populations are always debated questions. Some natural areas are now classified as a “world heritage” that must be protected accordingly and for which international organizations or nongovernmental organizations provide the funding and management.

Cases in Madagascar, Comoros and in many other places show that coral reef fishing communities used to manage their reefs as patrimonial territories. These communities are governed by traditional laws and institutions preserving their means of existence and cultural identities. Nowadays the traditional resource management systems based on using rights are jeopardized, unable to cope with an increasing population of inland people attracted by the sea and its richness.

The label of natural heritage adds a new legitimacy on coral reefs which overlay with traditional marine tenure. Any people in the world are now entitled of a “humanity right” on these natural sites. This label is a strong attractor for international tourism, a new and far more lucrative industry which rarely benefit to local people. Coral reefs eligible to the label of natural heritage should have a good value in terms of visitor attraction, remarkable landscape and biodiversity or emblematic species.

We then question this notion of natural heritage and property of humankind: is it a tendency to establish new owners with well defined and operational rights and to expropriate former but too weak owners with badly known and badly recognized rights?

ORAL- Monday- Msikaba 3- 1140

Elasticity in ecosystem services: analysing variable relationships between ecosystems and human wellbeing

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The Millennium Ecosystem Assessment highlighted the role of ecosystem services for human wellbeing, suggesting a positive relationship between ecosystem health and human wellbeing. Yet improvements in human wellbeing have coincided with ecosystem degradation, suggesting a more complex relationship. To investigate this relationship, the ESPA funded Sustainable Poverty Alleviation from Coastal Ecosystem Services (SPACES) project has applied an extensive ecological and social dataset from rapidly transforming coastal areas of Kenya and Mozambique to a heuristic framework to conceptualise and assess the processes linking ecosystems to human wellbeing. The SPACES framework uses multiple interlinked chains of ecosystem services that encompass multiple provisioning, regulating and cultural services. For each service we assess the elements of the ecosystem underpinning the services and goods obtained, how these are given value through access and markets, and the distribution of wellbeing benefits among groups of resource dependent people. Here, we show how fishery catch data, Ecopath modelling, reef carbonate budget censuses, household and community surveys can be used to populate this framework. The framework describes the “elasticity” of each service, (how human wellbeing responds to incremental changes in ecosystem quality), and the linkages, conflicts and inequalities within and between ecosystem services. Further, this framework will allow us to investigate which links in the chains are most sensitive to changes in the levels, access or value of goods and services provided by the ecosystem and how human needs and wellbeing can drive feedbacks within chains. By exploring “elasticities” under different future scenarios the framework can be used to identify where policy and management tools for promoting both human wellbeing and ecosystem health are likely to have the greatest impact.

ORAL- Thursday- Msikaba 2- 1200

Carbon and nitrogen stable isotope signal from estuarine penaeid shrimp nursery areas in Maputo Bay, Mozambique - A tool for the assessment of nursery areas contribution to adult shrimp fishing grounds

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Successful movement of juveniles from a nursery area to adult grounds is a critical aspect characterizing a productive nursery area. The movement of juvenile penaeid shrimps from their nursery areas, in shallow coastal habitats, to adult deep-water areas has never been assessed in East Africa. Here we assess the contribution of potential nursery areas for three, economically important, penaeid shrimps (*Penaeus indicus*, *Metapenaeus monoceros*

and *Metapenaeus stebbingi*) in Maputo Bay, south of Mozambique, to the production of adult population. We assessed the juvenile shrimp movement from 4 nursery areas to adult fishing grounds, making use of carbon and nitrogen stable isotope analysis ($\delta^{15}\text{N}$, $\delta^{13}\text{C}$). Seston, sediment detritus and polychaetes were analyzed to characterize the general isotopic difference between areas. Two of the nursery areas in the north-west part of the Bay, Incomati and Espírito Santo estuaries, showed a consistent and significant difference of $\delta^{15}\text{N}$ or $\delta^{13}\text{C}$ in all, previous, three elements in comparison with the other nurseries and the studied fishing ground, which did not differ from each other. The same pattern in stable isotope ratios were found in the three shrimp species collected in the different areas, indicating that the nursery areas in the southern part of the bay, Maputo River estuary and Bembe, contributed more to the shrimp fishery. The present study may help to identify the most important nursery areas for the penaeid shrimp in Maputo Bay, and provide valuable scientific information for an ecosystem-based fishery management of the second most important shallow water shrimp fishery in Mozambique.

POSTER

Benthic macrofauna assessment on Govuro mangrove, southern Mozambique – A climate change impacted mangrove area

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Mangroves are found in the inter-tidal areas at the boundary between the terrestrial and marine habitat. Important habitat for diverse communities of benthic organisms, mangroves have as well a role in trapping sediment and providing coastal protection against extreme natural events such as severe storms, cyclones and floods. In the year 2000, the Govuro mangroves, the greatest mangrove area in southern Mozambique, were affected by cyclone Eline and floods, which led to a high level of sedimentation. The evaluation of the effect of these events on the macrofauna composition in the Govuro mangroves was carried out in summer, 2011 and the sampling was taken in three areas with different levels of sedimentation (called impacted, medium impacted and not impacted areas). Each area was divided into three strata matching the mangrove species zonation. The most represented benthic macrofauna were Polychaeta, Gastropoda, Bivalvia and Crustacea. The greater abundance of crustaceans was found in non-impacted areas, while polychaetes presented higher densities in impacted areas. A decrease in the density of crustaceans and gastropods was observed from the non-impacted to the impacted areas. The influx of sedimentation in the mangroves of Govuro caused by the 2000 events has had an impact on the macrofauna community.

POSTER

Productivity of a tropical seagrass meadow under stress: effects of prolonged shading and simulated grazing

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Seagrass communities are well recognized for their important role in providing valuable ecosystem services. Nevertheless, they are facing serious threats worldwide, which are mainly caused by direct or indirect human impact. To study prolonged effects of shading and simulated grazing (clipping of seagrass shoot tissue), two of the most prominent stressors that directly influence the health and survival of seagrasses, a four-month manipulative field experiment was performed in Chwaka Bay, Zanzibar (Tanzania), from November 2013 to March 2014. Two intensity levels (low and high) were used as treatments for both shading and simulated grazing, and the four disturbance treatments were assessed in comparison with seagrass control plots. The stress effect on meadow productivity was evaluated by measuring dial electron transport rates (ETR) over a period of 24h to 48h as well as seagrass shoot growth rate, biomass and morphometric characteristics. All measurements were performed in the end of the experimental period and treated experimental plots were compared to untreated control plots (n=4). Our results showed a significant twofold reduction in dial ETR in all disturbance treatment plots (i.e. low shading, high shading, low clipping and high clipping) compared to seagrass control plots. Leaf width was significantly reduced in the both clipping treatments as well as in the high shading treatment, while leaf length of the third fully developed leaf was constantly affected by both clipping treatments. Leaf growth rate, root- and rhizome biomass and age of the youngest seagrass shoots were also significantly reduced in the high clipping and high shading treatments. Although the applied intensity of the treatments did not cause a complete die off of the seagrasses, such permanent conditions would compromise their long-term survival and the potential to recover even if the negative effect disappears.

POSTER

Preliminary results on the reproductive biology of albacore tuna (*Thunnus alalunga*) in the Western Indian Ocean region

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Albacore tuna, *Thunnus alalunga*, is an economically valuable species worldwide. However, information on the reproductive biology of this species in the Western Indian Ocean is scarce. This study aims to examine important aspects of the reproductive potential of this albacore population to eventually improve the quality of biological

inputs required for its stock assessment. A total of 323 female albacore sampled from 2013 to 2015 from four different areas, i.e. Mauritius, La Réunion, Seychelles and South Africa surrounding waters, were analysed. The total fish weight, fork length and gonad weight were recorded for each individual, and a sample of gonad was collected and preserved for further histological analysis. The spatio-temporal aspects of spawning season of albacore in the Western Indian Ocean were also analysed using the gonadosomatic index (*GSI*). Moreover, fecundity was estimated by batch fecundity (BF) using the gravimetric method to evaluate the reproductive potential. Preliminary analyses estimated the mean BF at 1.07 ± 0.50 million oocytes and the relative batch fecundity (relBF) at 53.0 ± 24.0 oocytes g⁻¹ of body weight. BF and relBF were found to increase with *GSI*. Albacore fished in the area between latitude 11°S to 23°S and longitude 49°E to 67°E were found to be most spawning active during summer from September to March. Within this area, a higher percentage of fish with ovaries at an advanced development phase (*GSI* value > 1.3) occurred from November to February. The preliminary results in this study provide new information on important reproductive traits of albacore tuna in the Indian Ocean based on new and accurate techniques. Further analyses of albacore ovaries to be undertaken in 2015 will contribute to a better understanding of the reproductive biology, its seasonal and temporal variation in the Western Indian Ocean as well as estimating reproductive parameters.

ORAL- Tuesday- Msikaba 4- 1140

Trends in annual catch rates of the tiger shark (*Galeocerdo cuvier*) within the KZN Sharks Board bather safety program

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We present an analysis of tiger shark (*Galeocerdo cuvier*) catches in the nets and drumlines of the KwaZulu-Natal Sharks Board. Between 1980 and 2014, a total of 1, 676 tiger sharks (*Galeocerdo cuvier*), were caught in the protective nets off KwaZulu-Natal, South Africa. The mean annual catch was 47.8 sharks (SD = 13.1, range 26–76). There was a significant increase in catch rate with time ($p < 0.0001$). Of the total *G. cuvier* catch, 598 (35.7%) were released alive of which 456 were tagged. Only nineteen (4.1%) tagged animals were recaptured. The sex ratio of sharks was significantly different from unity with more than twice the number of females than males caught (2.12:1). The size of sharks caught ranged from 85 to 400 cm (PCL) with the majority of both female (98.1%) and male (95.1%) being juvenile. No pregnant sharks were caught. There was a significant temporal increase ($p < 0.05$) in the average size of both male and female sharks caught over the study period. Sharks were caught throughout the year, with the highest catches of both males and females between October and December. Geographically, the highest catch rates were between Amanzimtoti and Umzumbe. Between 2007 and 2014, a total of 109 tiger sharks were caught on 76 drumlines. The number of drumlines needed to catch the same number of tiger sharks as a net was 2.56. There was no significant difference in the CPUE of tiger sharks caught in the nets, in the seven years pre and post-drumline deployment in 2007, suggesting that drumlines are not acting as a major attractant drawing sharks into the near shore zone. The results from this study indicate that the KZN Sharks Board nets and drums are having little effect on an increasing local tiger shark population.

POSTER

The status of the biodiversity of Siphonostomatoida (Copepoda) off South Africa

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Siphonostomatoida (Copepoda) currently consists of 39 families and about 2200 species. They are symbiotic members of aquatic organisms ranging from Cetacea to Porifera. Current knowledge about the biodiversity of the symbiotic marine Siphonostomatoida from South Africa's waters (136 species) is sparse compared to the world wide knowledge (2200 species). This is especially obvious when taking into account South Africa's long coastline of about 3650 km that constitutes three ecoregions and the rich marine fauna of reported fish (more than 2000 species) and invertebrates (approximately 12914 species), most of which can host symbiotic siphonostomatoids. Considering the current trends in commercial fishing and the effect of this on fish populations as well as the reported environmental changes and their effects on the marine biota, we may lose siphonostomatoid species before realizing they were there. Additionally the lack of professional taxonomists to study poorly known groups will only improve when less emphasis is placed on commercially important groups and taxonomic studies are recognized for their value in research programmes. In this respect it is imperative to increase awareness of the multifaceted contribution to knowledge that is provided by taxonomic studies i.e. information on morphology, biology, habitat preference, host association and distribution of species and their associated taxa so that taxonomic studies on unknown groups such as siphonostomatoids are encouraged which will increase knowledge about their biodiversity

ORAL- Wednesday- Msikaba 4- 1500

An investigation into the asymmetries in fish assemblages in sanctuaries, partially protected and open areas of KwaZulu Natal, South Africa using Baited Remote Underwater Video (BRUV) surveys

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In South Africa, Marine Protected Areas (MPAs) are the pillars of marine conservation planning. The establishment of MPAs has in many cases achieved conservation and biodiversity goals. For MPAs to continue achieving their conservation objectives within them and adjacent areas, the correct tools and active management is required. In 2014, Ezemvelo KZN Wildlife implemented Baited Remote Underwater Video (BRUV) surveys to study the relationships and patterns of fish assemblages in KwaZulu Natal (KZN), including inside and outside MPAs. The BRUV surveys were undertaken at five study sites, namely Saxon Reef, Two Mile Reef, Leadsman Shoal, Blood Reef and Aliwal Shoal. Four deployments were done at each

site. BRUV rigs were deployed 200 meters apart, to avoid overlapping bait plumes and within 15 minutes of each other. All deployments were undertaken in water less than 20 meters depth. A total of 131 species were recorded from 18 videos, representing 33 families. *Chaetodontidae*, *Labridae*, *Serrenidae* and *Sparidae* were dominant families. The highest number of species recorded was at Leadsman Shoal (59 species), followed by Blood Reef and Aliwal Shoal (51 species), Saxon Reef (42 species) and Two Mile Reef (30 species). The data shows disparity in the diversity and abundance of fish at two no-take sanctuary areas, namely Leadsman Shoal and Saxon Reef in Northern KZN in iSimangaliso Wetland Park. The implementation of BRUV monitoring in KZN provides more insight about relative abundance, diversity and fish assemblages of the province. Additional BRUV surveys will enable scientists to make better scientific recommendations to marine conservation managers for the protection of KZN's reef fish communities both in and outside KZN Marine Protected Areas.

POSTER

Limpet and seaweed diversity on rocky shores along the Wild Coast of the Eastern Cape Province, South Africa.

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Rocky shores are dynamic in their environmental conditions since they are an interface between the terrestrial and marine environments. As a result, rocky shores are rich in biodiversity with seaweeds and invertebrates being distributed in distinct zonation patterns. The rocky shores of the Wild Coast are characterised by various microhabitats and form a transition between South Africa's major biogeographic regions. The rock pools of the four nature reserves (Dwesa, Hluleka, Silaka and Mkhambathi) were measured for diameter, depth and shape. This study also identified the various seaweed and limpet species along these reserves. Within each reserve, quadrats (50 cm x 50 cm) were used to determine the density and association of species inside tidal rock pools and on emergent rocks. The distribution of both seaweeds and limpets were compared across the rocky shores of these four reserves. Multi Dimension Scaling showed that the tidal rock pools of Dwesa were similar to those of Silaka, while Hluleka was similar to Mkhambathi. Diversity indices revealed that Dwesa had more Rhodophyta seaweeds than the Phaeophyta and Chlorophyta. In Hluleka and Silaka there were no differences between the phyla while Mkhambathi had low diversity in Chlorophyta. A total of 11 limpet species were recorded, with Dwesa having the highest diversity. When using multivariate analysis, assemblage of species inside rock pools was different from the emergent outcrops. Overall, Dwesa was similar to Silaka while Mkhambathi was similar to Hluleka.

POSTER

The Mozambique Channel in Relation to Livelihood of the Local Communities in Mnazi Bay-Ruvuma Estuary Marine Park

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Mozambique Channel lies between Madagascar and the Eastern coast of Africa. It is the home for significant current including Agulhas and Mozambique, and is widely considered as a breeding ground of some of the southern hemisphere most severe biodiversity. Fishing in this area and nearby areas is conducted by local artisanal fishermen, who threaten marine biodiversity in the coastal area. The demarcation of Mozambique Channel is within the Mnazi Bay-Ruvuma Estuary Marine Park and the people living within this protected marine environment are affected and affect the Mozambique Channel. This study examine relationship of Mozambique Channel to the livelihood of the local communities in Mnazi Bay-Ruvuma Estuary Marine Park. Our study will base on understanding the relationship of the Mozambique channel in providing food to communities living within the Mnazi Bay-Ruvuma Estuary Marine Park, how do these people perceive Mozambique Channel; in term of territoriality, what are do's and do not, what do they fear in the Mozambique channel. It also aims to understand how local communities in Mnazi Bay-Ruvuma Estuary Marine Park design management strategy in relation to Mozambique Channel, and how their designed management strategy on come into controversies with the designed management strategy of Mnazi Bay-Ruvuma Estuary as a Marine Park. To accomplish this, the study employed a qualitative research methodology. The data will be generated by using in-depth interviews, Focus Group Discussions, drawings, documentary reviews and field observation. The study presuppose that, by understanding livelihood relation which the local communities have with Mozambique channel will help in developing a roadmap toward the regional governance of the Mozambique Channel and the people living within it and in Mnazi Bay-Ruvuma Estuary Marine Park.

POSTER

Seasonal and interannual variability of surface chlorophyll-*a* and temperature in the Delagoa Bight, Southern Mozambique

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The Delagoa Bight in the Southern Mozambique has sparse and non-systematic in-situ data on chlorophyll-*a* (Chl *a*) and water temperature. Multi satellite level-3 data for surface Chl-*a*, sea surface temperature (SST), sea surface wind (SSW) and sea level anomalies (SLA) have been obtained and analyzed over the Delagoa Bight (24-

28°S, 32-36°E), for the period 2003-2012 at monthly time scales. Both descriptive and quantitative analysis using wavelets have been used to obtain a better understanding of the nature of the seasonal and interannual variability of the data. The lowest maximum in Chla was in December (0.127 mg.m⁻³) and the highest in August (0.541 mg.m⁻³). The lowest maximum in SST was in September (21.8°C) and the maximum in February (27.9°C). Strong seasonal structure and interannual modulation were observed in the Chla and SST contrasting with the SSW and SLA. The daily observations of temperature at 18 meters depth, from the northern Delagoa Bight at Ponta Zavora (24.48°S-35.24°E) for the period 2006-2011 have confirmed a seasonal signal with amplitude of about 6.5°C. Cool coastal water events were found mostly in summer and spring, with maximum amplitude of 6°C. Further analysis of this daily data did not reveal the timing of such events to be regular.

POSTER

Impacts of a wrecked fishing vessel on the coral reefs of St. Brandon's Rocks, Mauritius

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Very little has been documented on the impacts and recovery after shipwrecks on coral reef islands. St. Brandon's Rocks (SBR) is an atoll 400 km north of Mauritius. There is at least one shipwreck a year on SBR. In 2012, a Taiwanese fishing vessel ran aground on a shallow coral reef near one of SBR's islets, Ile Cocos. Fishermen noticed an unusual green filamentous alga growing on the coral covering 20 ha down-current of the wreck. We investigated this phenomenon during our 2014 Mascarene Coral Island Expedition (MCIE). We swam four, 50 m transects, 50 m apart, and recoded all fish seen within a 5 m wide transect. In the control area, we saw 376 individuals of 21 fish species, while in the algae-affected area we counted 123 individuals of five fish species. Three sea cucumber species were seen, 19 individuals in the unaffected area, and 218 in the alga-affected area. Around the wreck, we counted 979 individuals of 17 fish species. At the wreck, we counted 979 individuals of 17 fish species, most of them quite large individuals, as would be expected at wrecks. Clearly, the wrecking had a negative impact on the fish community, but a positive effect on sea cucumbers. We discuss the implications of our findings.

POSTER

Amphipod (Crustacea) responses to thermal stress and acidification: an analysis using protein profiling.

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Amphipods are small crustaceans that occupy various habitats where they act as mesograzers and form fundamental food chain components. They are widely

used as biomonitors and indicators of environmental quality. Amphipods are key in studies to understand biodiversity and biogeographic patterns. This study aims at investigating phenotypic effects of environmental parameters linked to climate change, such as rising temperature and ocean acidification, on marine amphipods. Specimen of *Platorchestia platensis* and *Cymadusa filosa* were collected from coastal shores and lagoons of Mauritius. Amphipods were laboratory-reared at 31°C in seawater buffered at pH 8 before being subjected to variable temperatures (31, 33.5 and 36°C) and pH (5, 6.5 and 8.0) in separate set-ups. The effects of these stresses were investigated over a 3-day period (1, 3, 5, 24, 48 and 72 hr) by monitoring survival rate and examining protein profiles and immuno-detection of heat shock protein 40 (Hsp 40), a stress-induced repair protein in other biological systems. Amphipods of both species survived both treatments at a rate of 100%. However, we noted significant changes in the protein profiles with small bands of around 15 kDa becoming more apparent in the heat-shocked *P. platensis* as well as increased levels of Hsp40 at 36°C. No changes could be observed in pH-shocked *P. platensis*. *C. filosa* specimen appeared to have more Hsp40 at 33.5°C and 36°C and at pH 5. Our studies collectively demonstrate that *P. platensis* and *C. filosa* are able to withstand thermal stress and acidification over short periods and display increased amounts of Hsp40. These changes in protein are indicative of early responses to repair damage. Given the fundamental role of amphipods in marine food chains, it is imperative to further such studies: we propose to use protein profiling of amphipods as a bio-monitoring tool to investigate potential climate change effects.

POSTER

Assessment of the genetic connectivity of two reef fish populations, *Epinephelus tukula* (Serranidae) and *Aprion virescens* (Lutjanidae) in the iSimangaliso Wetland Park.

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Understanding the genetic connectivity in reef fish populations between different MPA usage zones is of particular importance when designing and managing MPA networks. No study has investigated fish connectivity on South African coral reefs and this knowledge gap is of concern. The overall effect of the different levels of protections in MPA zones is a further unknown. This study aims to address this lack of knowledge by assessing the genetic connectivity within the iSimangaliso Wetland Park MPA network with specific focus on two key reef fish with differing mobility patterns, the Green jobfish (*Aprion virescens*) and the Potato bass (*Epinephelus tukula*). Fin-clip samples were collected from both the shore and offshore, in multiple-usage and sanctuary areas of the MPA. The genetic analysis will be conducted using two mitochondrial and one nuclear locus. Population structure is being assessed based on haplotype analysis to determine the level of interconnectedness within and between different regions of the MPA and to assess whether the differing life

history of the two species contributes to varying levels of connectivity. We have successfully designed primers for and amplified three loci from both species including two mitochondrial (COI and the MTCR) and a nuclear EPIC (intron) markers. These are currently being sequenced and will be used to assign haplotypes and, subsequently, determine the population structure of the two species with particular emphasis on ecologically relevant population connectivity (i.e. population sources and sinks). The results of this study will be used to assess whether the current structure of the iSimangaliso Wetland Park is adequate to protect these two species or whether further action is required based on the particular population connectivity of each species. The conclusions arising from this study will be used for future management decisions and will be applicable to other MPA networks.

POSTER

Research on the Kenyan marine cyanobacterium *Lyngbya majuscula* opens new frontiers in marine biodiscovery efforts in Africa

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Cancer still remains the undisputed number one challenge in societal health care worldwide. A decade of research on the Kenyan marine cyanobacterium *Lyngbya majuscula* has revealed the geno and phenotypes for producing the anticancer modular cyclodepsipeptides homodolastatin 16 and dolastatin 16; and antanapeptin A in the *L. majuscula* genome. I report here important milestones and contributions of the research on the Kenyan *L. majuscula* for realizing a sustainable supply of these essentially important anticancer compounds for drug discovery. These findings highlight the urgent need for new frontiers in Marine Bio-discovery efforts in Africa

ORAL- Thursday- Msikaba 2- 1440

Shallow-water fish communities around Inhaca Island (Mozambique): assessing the influence of habitat characteristics on seascape connectivity

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Coastal ecosystems in the tropics are commonly composed of a mosaic of habitats, such as mangroves, seagrass beds, mudflats and coral reefs. Many species of fish, including those of commercial importance, use several habitats during their different life stages. Since the different habitats in the shallow seascape are highly interconnected, it is important to use a holistic approach to understand what processes that influence distribution of fish. Little is still known about how coastal habitats are interconnected on different temporal and spatial scales, how this influences

local distribution of fish and what spatial scales that are relevant. To contribute to identify appropriate assessment scales for seascape management, we investigated fish community composition in the shallow subtropical seascape at Inhaca Island, Mozambique. We hypothesized that abundance, species diversity and life-stage distribution of fish are determined by habitat characteristics such as type of habitat, habitat coverage, local water conditions (depth and currents) and distance to other habitats. We sampled fish using stereo video systems in seagrass beds (including beds of different seagrass species composition and coverage), in unvegetated areas and on coral reefs at different sites randomly spread around the island. Results showed a generally diverse fish community around the island, with a large proportion of juveniles of coral reef associated species represented in seagrass habitats, verifying connectivity between coral reefs and seagrass beds. Habitat was a strong predictor for the fish community, as well as depth for fish species composition in unvegetated habitats, suggesting different management approaches for distinguished habitats. The findings show that conservation efforts around the island require a broad seascape connectivity perspective to be successful.

ORAL- Thursday- Msikaba 2- 1400

The function of tropical East African macroalgal beds, part I: Invertebrate communities

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Tropical algal beds as habitats are largely unknown, and it is only recently that it has been receiving attention as an important part of the tropical seascape. With current predictions of environmental impacts due to climate change it is essential to improve knowledge of the shallow tropical habitats and their potential linkages. This study is the first step towards a better understanding of the function of macroalgal beds as habitats within the tropical seascape.

In this study we investigate the tropical East African macroalgal habitat by comparing it to the ecologically important seagrass habitat in regards to habitat structure and complexity, invertebrate and macrophyte density, species richness and functional groups in a tropical shallow bay in Zanzibar, Tanzania. All above ground organisms were collected in standardised squares, identified to the lowest possible taxonomical level, quantified and weighed. Macrophyte height and cover for each investigated site were estimated using squares along transects, as well as the number of growth forms and the rugosity of the underlying substrate. In addition to this the larval supply of crustacean larvae was investigated by towing a plankton-net close to the macrophyte substrate.

Our results suggest that algal areas harbour a higher biomass, density and species richness of invertebrates than seagrass beds, despite the higher macrophyte biomass

found in the latter. Algal beds also have a higher number of macrophyte species and growth forms than do seagrass meadows, while the larval supply of crustacean larvae was similar between substrates. This study highlights the importance of macroalgal beds as a high diversity habitat, with potential for being utilized for subsistence invertebrate collection as well as feeding ground by invertivore fish species.

ORAL- Wednesday – Msikaba 4– 1400

Predictable effects of marine protected areas on ecosystem multifunctionality

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No-take marine protected areas (MPAs) are well-known to affect various ecosystem properties like fish biomass, cover of foundation species, and predation pressure. However, generalizations about MPA effects on the overall state of ecosystems – the focus of much current management – are made difficult by the fact that both the direction and strength of effect varies considerably between different organisms, ecosystem types and areas. Based on theory and applications in other fields of ecology, we suggest that ‘ecosystem multifunctionality’ (the aggregated response of multiple ecosystem processes or state variables) better represents the ecosystem than single variables, and can also be used to assess effects of MPAs. Against this background, we tested how time of protection affects five common ecosystem variables vs. several ‘ecosystem multifunctionality’ indexes, using data from a unique seagrass and coral reef ecosystem survey within and outside 12 MPAs along the East African coastline. Responses of single ecosystem variables (fish biomass and species richness, urchin density, cover of foundation species, algal cover) were highly variable (from exponentially positive effects on fish biomass, to no effect on algal cover, to exponentially negative effects on urchin density), and differed between the two ecosystems. Depending on the choice of variable, this suggests that MPA effects are either present or absent, and either grow stronger or weaker with time. Meanwhile, the ‘ecosystem multifunctionality’ index showed a clear positively linear effect of time of protection in both ecosystems. Moreover, the individual contribution of single variables can easily be calculated and weighted depending on interest. In summary, we show that while single ecosystem variables show highly variable responses to protection, the ecosystem multifunctionality index suggest that the overall effects of MPAs on marine ecosystems are positive, strong and continuous even after >40 years of protection.

ORAL- Wednesday – Msikaba 4 – 1140

The ecology of stingrays at the St. Joseph Atoll, Seychelles

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Very little information is available on the ecology of tropical stingrays at a global scale despite concerns over their declining populations. Several species, particularly, *Himantura granulata*, *Urogymnus asperrimus* and *Pastinachus sephen* are abundant in the St. Joseph Atoll (S 5°24.9'; E 53°17.9') on the Amirantes Bank, Republic of Seychelles. This remote atoll is hypothesized to be an important nursery area for these stingrays and in turn these stingrays are hypothesized to play a vital role within the atoll through linking trophic levels and affecting community structure through predation and bioturbation. This study aims to investigate aspects of the spatial and trophic ecology of these three stingray species at this remote atoll. Thirty stingrays were surgically implanted with acoustic transmitters in March 2014 and have subsequently been passively monitored by an array 85 receivers deployed throughout the atoll, its fringing reefs and across various sites on the Amirantes Bank. Diet sampling was conducted using gastric lavage on 55 *U. asperrimus* individuals and sediment samples were collected to assess feeding selectivity. The data from the acoustic receivers were downloaded in November and will again be downloaded in April and preliminary results will be presented. Stomach contents revealed that *U. asperrimus* is a generalist feeder and its predominant prey group is annelids followed by crustaceans. Although the St. Joseph Atoll is relatively isolated from anthropogenic activities it is still impacted by global change and pollution. Anecdotal evidence suggests that stingray numbers have been subject to fluctuations and there has been an overall decline in abundance over the past two decades. It is thus important to better understand interactions between the dominant species and the role they play in atoll ecosystems.

POSTER

Diversity of sessile non-scleractinian cnidarians of the Great Reef of Toliara.

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Among many studies carried out up to now concerning coral reefs, especially on cnidarians in the Southwestern region of Madagascar, rare are those on the sessile non-scleractinian. This study, carried out within the Polyaquaculture Research Unit Project, led by IH.SM and UMons, is the first to perform research whose objectives are to determine the diversity of sessile non-scleractinian cnidarians on the Great Reef of Toliara (GRT), and to work out a guide to their identification.

Three sites were chosen for this study: Nosy Tafara (NT), in the South (latitude 23°30'S), Outer Slope (OS), in the center (latitude 23°29'S) and Grande Vasque (latitude

23°23'S), in the North part of the GRT. Samplings were performed on 2 stations per site taking in account the variability of each site. Adapted linear point intercept method was used on each station, and 15 transects of 10 m performed, totaling 90 transects for whole study. Fragments of approximately 7cm diameter per observed colony were collected and fixed with ethanol 100% for DNA sequencing identification.

Preliminary results show that despite of the degraded state of the GRT, healthy and diverse species of sessile non-scleractinian cnidarians were observed. The most dominant species are those of Alcyonacea (37%), Gorgonians (20%) and Actinaria (17%) Orders. The research is still in progress and intended to end in few months to find out all required results for further conclusion.

POSTER

Diet composition and overlap of five commercial species of Chwaka Bay, Zanzibar, Tanzania

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Chwaka Bay is a non-estuarine tropical embayment located at the east coast of Unguja Island, in the Zanzibar Archipelago, where artisanal fishery is the most important source of income. Knowledge on diet composition and overlap of important species aids in the understanding of ecological processes, providing tools to help address issues arising from overfishing and/or habitat loss. Between September 2014 and January 2015, stomach contents and stable isotopes analyses were performed on *Lethrinus borbonicus*, *Lethrinus harak*, *Lethrinus lentjan*, *Parupeneus barberinus* and *Octopus cyanea*, collected at seagrass and reef areas. The Index of Relative Importance (IRI), multivariate analyses (PERMANOVA and ANOSIM) and Bayesian Mixing Models were applied to determine the diet composition and to assess the overlap among species. Preliminary results of diet composition showed that all species fed mainly on benthic invertebrates, being the taxonomic group crabs highly dominant in all of them. Emperors (Lethrinidae) exhibited a broader, more generalized diet, while the Goatfish (*P. barberinus*) a slightly more specialized one. The octopus consumed crabs almost exclusively. The analysis of similarity (ANOSIM) revealed varied degrees of overlap between the emperors, while no significant result was shown with the goatfish. The octopus presented no significant overlap with the fishes. Signatures from stable isotopes analysis of the studied species and their respective prey items, will complement the diet composition and overlap, as well as provide their isotopic niche and trophic level. Furthermore, these signatures will shed light

on the study at a larger temporal scale, helping address the issues involved with food selectivity and varying digestion rates. These kinds of studies not only give insights into basic ecological questions, but can also contribute as a major input in complex ecosystem models, which play an important role in the decision-making process of ecosystem-based management

POSTER

Population genetics in South African elasmobranchs: Are they defined by the reproductive strategy of the species? - The Blacktip Chapter

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Elasmobranchs are apex predators that are currently being captured at high rates, and their low reproductive and slow growth rates make them vulnerable to overexploitation. The fished quantities are more likely exceeding their reproductive capacity. Although reproduction strategies and processes are an important factor for designing conservation and management initiatives, elasmobranch reproduction is still poorly understood.

This study addresses differences in genetic population structure within shark species from South African waters and assess whether these are related to the shark's reproductive strategy. The specific objectives are to establish the degree of genetic spatial relatedness and phylogeography within three selected shark species, and to assess these parameters in relation to their reproductive strategy.

Tissue samples for genetic analysis were obtained from commercial prawn trawlers, research cruises and targeted field trips. The selected species representing each reproductive strategy are *Carcharhinus limbatus*, *Carcharias taurus* and *Holohalaelurus* spp.complex. A minimum of forty individuals were sampled per species. Extraction of DNA from tissue has been carried out using commercial kits or standard protocols. Different scales of genetic diversity are being assessed by screening two types of genetic markers, mitochondrial DNA (mtDNA) and nuclear markers (microsatellites - STRs). Differences in maternal and paternal derived genetic diversity will be assessed by the combined analysis of mtDNA and STRs.

Results for *Carcharhinus limbatus* confirmed the distinct maternal lineage for an Indian Ocean clade observed in previous studies. Furthermore, it appears that blacktip subpopulations are present in the region.

Important information about life history and population structure will be obtained through this study, which will contribute to the application of conservation and management strategies.

ORAL- Monday– Msikaba 1– 1420

Along the coast and across the channel – trends in diversity of crustaceans and fishes caught by deep-water trawl surveys in the SW Indian Ocean.

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As part of the South West Indian Ocean Fisheries Project (SWIOFP), four bottom trawl surveys were undertaken at depths of 170-655 m in Madagascar, Mozambique, Tanzania and Kenya in 2011-2012, to investigate the fishery potential of offshore grounds. The surveys relied on wet-leased commercial fishing vessels accompanied by scientists from the region. The composition and diversity of crustaceans and fishes in trawl catches were assessed in terms of three factors: depth, country (a proxy for latitude), and mainland vs. Madagascar. Species richness was highest in Mozambique and, for all countries, at a depth of 400m. Multi-variate analyses revealed three depth-based clusters: shallow (200 - 300m); medium (400 - 500m) and very deep (600 - 700m). Genera driving the difference in catch composition between shallow trawls and medium-depth trawls were *Metanephrops*, *Rossia* and *Saurida* while *Neoscopelus*, *Aristaeomorpha* and *Polychaetes* contributed the most to the difference between medium-depth trawls and very deep trawls. Removal of shallowest and deepest trawls from the data to reduce the depth influence revealed clear across-channel community differences with Madagascar grouping separately from the mainland countries of Mozambique, Tanzania and Kenya. The genera driving the across-channel dissimilarity were *Champsodon*, *Argentina*, and *Sepia*. On more detailed examination of the genera found in Mozambican and Madagascan trawls, it was found that despite the surveys being undertaken at similar latitudes, there was a substantial difference between the communities of the two countries. These differences were in most part attributed to *Neoscombrops*, *Neoepinnula* and *Champsodon*. From the analyses undertaken it was apparent that the main driving force behind the differences in the communities was the depth at which the trawls were set rather than any differences in latitude and that deep-shelf ecology in western Madagascar differed from that of mainland Africa.

ORAL- Monday – Msikaba 1– 1120

Spatial and Temporal Variations of Phytoplankton Spatial and Temporal Variations of Phytoplankton in Rufiji Delta/Mafia Channel, Southern Tanzanian Rufiji Delta/Mafia Channel, Southern Tanzania

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Using in situ and remote-sensing data, we have characterized the spatial, seasonal and inter-annual variations of Chl-*a* (a proxy indicator of phytoplankton biomass) in Rufiji Delta/Mafia Channel in Southern Tanzania and we have investigated the influence of environmental factors on the phytoplankton variations. *In-situ* measurements of Chl-*a*, Sea Surface Temperature (SST), salinity, pH and nutrients have been collected in December 2012 along 49 stations near the mouth of the delta. Remote-sensing observations of Chl-*a* and SST were obtained from MODerate resolution Imaging Spectroradiometer (MODIS)-Aqua and Advanced Very High Radiometer Resolution (AVHRR) sensors respectively for the period from January 2003 to December 2012. The standard global empirical algorithm MODIS OC3 was applied to retrieve Chl-*a* concentration. The correlation between MODIS OC3 and in-situ Chl-*a* concentrations was significant ($R^2=0.75$, $p<0.05$), indicating good agreement between the two analytical methods. Analysis of the spatial distribution of satellite Chl-*a* revealed high concentrations of Chl-*a* off the Rufiji coast ($>10 \text{ mgm}^{-3}$) and low concentration towards the central parts of the Mafia Channel ($<1 \text{ mgm}^{-3}$). Seasonal cycles of Chl-*a* were characterized by minimum concentrations during dry season (lowest value of 0.6 mgm^{-3} was observed in December 2006) and maximum concentration in wet season (highest value of 1.5 mgm^{-3} was observed in May 2003). Annual mean Chl-*a* concentrations from satellite data for Rufiji Delta/Mafia Channel showed a decrease during the decade 2003-012 and a significant correlation was found between the seasonal variations of Chl-*a* and Rufiji river discharge.

POSTER

Outlook of Toliara Great Barrier Reef (TGBR)

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The most known reef structure in Madagascar is the TGBR which is covering 18km of length. It is part of Toliara's identity and a Western Indian Ocean Region icon. TGBR were well documented in 70s (more than hundred published

documents) with bilateral collaboration between Aix-Marseille University and Toliara University. However, after this moment until now poor are publications on the TGBR. This Outlook of TGBR aims at assessing and documenting the current state of TGBR. Its scope is to update the environmental and socio-economical baseline of the TGBR.

The study was conducted into 3 sectors on the TGBR: (i) the sector I is the northern part of TGBR, in front of Besakoa village, (ii) the Sector II is located at the medium section of TGBR, in front of the Toliara City and (iii) the sector III is at the southern part of the TGBR. The study was focused on 3 assessments: biology and habitats, ecosystem health, risks and coral reef resilience. All assessments were carried out by (i) traversing the reef flat from the inner slope talus to the reef front during the low tide, in the flat reef within all 3 sectors, and (ii) by diving in the outer slope of each sector to evaluate coral cover, coral diversity and fish biomass/abundance.

Results showed that the benthos of outer slope was characterized by 35% of coral cover in which more than 50 genera of coral were recorded with 35% young corals. Also 90% of seagrass were recorded. For the reef fish, more than 150 species were recorded with mean biomass 550kg/ha. The risk was very important in the flat reef due to the fishing activity during low tide.

Despite the threats on the ecosystem, the health of the corals still gives hope for the future of TGBR.

POSTER

Biological valorisation of red farmed seaweed *Kappaphycus alvarezii* applied on rice cultivation

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Rice is a basic food in Madagascar, but its production is increasingly declined over the last 10 years which leads to massive importation to respond to alimentary needs of the people. Many rice farmers are facing major problems during the growing seasons on the use of chemical urea to the arable soils.

This study concerns the biological valorisation of red farmed seaweed *Kappaphycus alvarezii* on rice cultivation in the area of Bas Mangoky in the district of Morombe Southwestern Madagascar.

The aim of this work is to study the nutritional potential of the compost of red farmed seaweed to replace the chemical urea compost that usually used by the people in order to increase rice production in quantity and quality for an exportation vision.

To accomplish this work, a simple fermentation process of the seaweed was adopted. Study of the effect of the seaweed treated on the growth of rice planted was achieved by the application of three different quantities (5m³ / ha 10m³ / ha 15m³ / ha) in the rice fields of 4m² area compared with the rice field only treated with water. Whole rice fields were seeded with rice grains X265 type.

Results showed that the production is proportional to the increase of the quantity of seaweed used. Production varies from 304.22% to 785.21%. Rice production is 5,74t / ha 8,39t / ha 12,57t / ha respectively for 5m³ / ha, 10m³ / ha and 15m³ / ha while the reference site is 1,42t / ha.

In summary, replacement of the chemical urea compost to that of seaweed has been proven effective and suggested to be adopted in Madagascar rice granaries to increase the rice production and to avoid dependency on outside countries

POSTER

Diversity, distribution and endemism within the South African Echinoidea.

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South Africa is ranked among the countries displaying the highest species richness per unit area, despite the fact that many invertebrate taxa in the region are still poorly characterized. The South African Echinoidea (Echinodermata) were last reviewed by Clark & Courtman-Stock in 1976, and numerous unidentified specimens and records have accumulated in the 39 years since that publication. This study aims to update the state of knowledge on echinoid diversity in the region. Dry and wet specimens, particularly those within the extensive collections of the Iziko South African Museum, were morphologically examined and identified, and associated data added to a database. Other data considered included historic data from the South African Museum and University of Cape Town catalogues, imagery data from the EchinoMap VM open-online database, trawl by-catch invertebrate data from the Department of Forestry and Fisheries research surveys, and data from published literature. These resulted in 19 new records for the region, of which 84 % were Indo-Pacific, 5 % introduced, and the remaining 11 % non-endemic, raising the total number of known species to 71; across 14 orders and 29 families. As expected, species richness increased from west to east coast. Despite the high reported species richness, the East coast had the lowest number of records; as compared to the South coast, which had the highest. Endemism peaked on the South coast and the West and East coast both supported the same proportion of endemics. Species richness was highest in < 500 m and lowest in > 500 m. This may be a result of the deep-seas (> 500 m) being severely under-sampled. The lack of full-time taxonomists and lack of expertise to review this group in past decades may have contributed to the high number of new records reported here.

ORAL- Tuesday- Msikaba 1- 1100

Dragging up the past – can we move forward now?

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Demersal trawling has a reputation for impacting on sea floor ecology, although hard data to support this contention are often lacking. Frequently, there is no information available for the period before regular trawling commences, or from the initial years of the fishery; this is particular the case for sub/tropical fisheries. On the east coast of South Africa, research trawl surveys commenced at the turn of the 20th century, in order to investigate fisheries potential of the region. Subsequent surveys occurred in the 1920s, 1940s and 1970s, whereafter regular commercial trawling for crustaceans commenced, with onboard observer data being collected in the early 1990s and the mid-2000s. The fish catch composition data from these periods were validated, standardized and compared using diversity indices and multivariate methods. Difficulties were experienced with comparing data between periods, owing to disparities in the gear types being used, and because of species' identification issues in the early surveys. Many of the species commonly recorded before fishing started have persisted, although there have been changes in relative abundance. Ascribing these changes to the effects of trawling on the east coast of South Africa is not straightforward; but maybe we know enough about the effects of fishing anyway. The implications are discussed in the light of declining effort in the South African east coast trawl fishery, and recent Marine Protected Area initiatives in the region.

POSTER

First insights into the genetic diversity and population structure of loggerhead turtles (*Caretta caretta*) nesting at Ponta do Ouro Parcial Marine Reserve, southern Mozambique.

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Loggerhead turtles (*Caretta caretta*) are widely distributed and threatened marine turtles. Aiming at describing the genetic variability and population structure of the loggerheads nesting at Ponta do Ouro Marine Reserve, we analyzed one mitochondrial (mtDNA) and 21 nuclear (microsatellite) *loci* from 63 tissue samples. The mtDNA analysis showed two haplotypes, CC-A2.1 and CC-I1, and very low levels of genetic diversity (nucleotide diversity (π) was 0.00005 and haplotype diversity (h) was 0.033). This is the first study describing the CC-I1 haplotype, which seems to be a private haplotype of the RMPPO nesting population. The CC-A2.1 haplotype is present in several populations that nest in the Mediterranean beaches and, less commonly, in the Northwest Atlantic and Northeast Atlantic beaches. This result thus reinforced the hypothesis of recent (during the Pleistocene) colonization of the Indian Ocean beaches from the Atlantic Ocean. Microsatellite analysis

did not show geographic structuring, whether the artificial geographic partitions were considered *a priori* or not. The absence of structuring did not allow the setting of geographic population limits, indicating the possible gene flow between loggerhead turtles from southern Mozambique, South Africa, and probably, although to a lesser degree, Madagascar and Oman. The effective population size (N_e) estimate for loggerhead turtles provided by the LDNE software was 276 to 428 (depending on the lowest allelic frequency used), whereas the ONeSAMP software estimated 193 and 703. The Bottleneck software evidenced a low likelihood of a recent demographic bottleneck. However, these results should be evaluated with caution, since the mutations models of microsatellite *loci* are difficult to determine and the long generation time of loggerhead turtles may hamper the identification of recent demographic events. Finally, the low genetic variability and the reduced effective population size suggest that this nesting population may be susceptible to environmental changes or anthropogenic threats.

POSTER

Current state of exploitation of bivalves with economic importance on intertidal zone in northern part of Mozambique

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To access the current state of exploitation, diversity and abundance for the main bivalve species with socio-economic importance, seagrass beds in Olumbi, Quissanga and Pemba were studied for 2 months (December 2013 – January 2014) by daily observation of catches, number of collectors and fishing frequency. 25 quadrats (0.25 m²) was placed randomly for each area in beginning and the end of sampling. *Pinctada imbricata*, *Modiolus philippinarum* and *Choromytilus meridionalis* were the most harvested species for daily consumption and home trade. Olumbi attained the highest diversity (0.325 Simpson index) followed by Quissanga (0.248) and Pemba (0.105). Mean biomass and density were significantly different ($p < 0.01$) for all sampled areas. *M. philippinarum* was the most abundant species in Olumbi (10 ind/m²) and Pemba (22 ind/m²) and *P. imbricata* was the most abundant species at Quissanga (22 ind/m²). The CPUE was 39 kg/collector/day for Olumbi, 28 kg/collector/day for Quissanga and 7 kg/collector/day for Pemba. Based on the harvesting area of 58 ha-Olumbi, 389 ha-Quissanga, 9 ha-Pemba and mean effort of 22 collectors/day-Olumbi, 10 collectors/day-Quissanga, 5 collectors/day-Pemba, annual catch was estimated at 270 ton, 88 ton and 6 ton respectively. The catches show the prevalence of *P. imbricata* in 99% for Olumbi and Quissanga, what reflects the preference of collectors for invertebrates with high commercial value. Pemba area is the only one with signs of over exploitation and less lengths due to the proximity to province capital city and high demand. Thus, is recommended to maintain the fishing effort in Olumbi and Quissanga and the fishery must be monitored to avoid over-exploitation.

POSTER

Impacts of the Exploitation of Bait Organisms by Subsistence Fishers in the Swartkops Estuary, in the Eastern Cape South Africa.

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The Swartkops estuary in the Eastern Cape is ranked 11th in terms of conservation importance in South African estuaries. It also plays a prominent recreational and economic role in the environment of the Nelson Mandela Bay Metropole. The mud and sand flats in the estuary are colonised by invertebrates which are collected by subsistence bait collectors and sold to recreational fishers. Subsistence fisher bait collecting activities have been legitimised by the issue of bait collecting permits under the Department of Agriculture, Forestry and Fisheries Small Scale Fisheries Programme, but bait collecting activities appear to be damaging the estuary.

An assessment of benthic bait organism stocks - mud prawns (*Upogebia africana*), sand prawns (*Callinassa kraussi*), pencil bait (*Solen capensis*) and blood worm (*Arenicola loveni*) - in the estuary was conducted in 1980 using standard macro-benthic sampling techniques. Similar assessments using the same methods and sites were conducted in 2008 and again in 2013.

Densities and total numbers of mud prawns in 2008 were about 50% of those recorded in 1980 and by 2013 had declined to between 30% and 50% of 1980 levels. Sand prawn densities had declined to to about 30% of 2008 levels by 2013. Pencil bait and blood worm densities were approximately the same. The use of gardening forks to collect bait in muddy substrates results in sediment turnover and long term negative impacts on the system.

Compliance with permit conditions is extremely poor, poaching by unlicensed fishers is rife, and catch monitoring is non-existent.

ORAL- Wednesday- Msikaba 4- 1720

Differential movement patterns in two predatory coral reef fish species: Implications for Marine Protected Area design

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South African coral reefs are situated within two long-standing, contiguous marine protected areas (MPAs) which form a network of multiple-use and no-take sanctuary zones. Despite their location within MPAs, fish communities in the different zones differ. Top predators, in particular, are significantly reduced in abundance and biomass in zones open to different human activities. Acoustic telemetry was thus introduced to investigate the movement of two predatory fish (*Aprion virescens* and *Epinephelus tukula*) between the MPA zones to determine which are acting as sources or sinks of adult and juvenile fish. It was anticipated that movement patterns of the selected fish species would differ due to their different life history traits. In addition, it was expected that their

movement patterns would differ in zones of varying human activity. To date, 14 VR2W acoustic receivers have been deployed at representative reef sites spanning 120 km within the iSimangaliso Wetland Park, and 41 fish (20 *A. virescens* and 21 *E. tukula*) have been tagged with acoustic transmitters in close proximity to the acoustic receiver stations. Preliminary data revealed that movement patterns are dominated by inshore-offshore detections for both species, which suggests strong site-fidelity to core reef areas. Within the core areas, the tagged fish exhibited diel habitat shifts with greater detections being recorded by the offshore receivers during daylight hours. Inter-MPA detections were insignificant, but it is anticipated that future data will elucidate adult fish emigration patterns as well as seasonal migration patterns. Such data may provide valuable evidence of the existence of spawning aggregation sites. Movement patterns will be discussed in the context of current MPA network design and management.

ORAL- Tuesday- Amadiba- 1100

“River mouth” Estuaries in South-East Africa - How do we Assess their Status?

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“River mouth” is one of the five categories of South African estuary types. They constitute a minority amongst the approximately 300 estuaries in the region and are relatively poorly known, particularly from a benthos point of view, or available information is significantly dated. Benthic and general observational data now exist for five south-east African estuaries, viz. the uMzimvubu, Mzimkulu, uMkhomazi, uThukela and Limpopo which constitute the river mouth type of estuaries along roughly 850 km of coastline. They are characterised by relatively large catchments, marked seasonal flow contrasts, periodic major floods and occasional mouth closure. These characteristics are shared by the uMfolozi, which historically had a link to the St Lucia Narrows but from 1952 until 2012, when it was re-connected, was artificially separated. From a floral point of view all fall within the distribution range of mangroves, but only the Limpopo supports a significant area. The uMfolozi/St Lucia mouth area now supports a greater mangrove area than in the past, a reflection of 1952-2012 management which maintained longer open mouth conditions and consequent tidal regimes. From a faunal point of view, macrobenthic data indicate a “sparse” estuarine fauna, allowing for the questionable reality of comparing the very different habitats provided by “river mouths” with other estuarine types. Contributory factors include, in addition to the above, and not necessarily in all cases, combinations of deeply incised valleys, inhospitable or highly mobile sediments, restricted intertidal habitats, periodic strong river flows and associated low salinities. Behaviour and responses of the macrobenthic community can be arguably exemplified on the basis of a 15 year data set from the Mkhomazi estuary where low river flows and occasional mouth closure is followed by a rapid proliferation of opportunistic r-adapted smaller macrobenthic species, particularly polychaetes as well as amphipod and tanaid crustaceans.

POSTER

The restoration of the Lake St Lucia System in the iSimangaliso World Heritage Site, KwaZulu-Natal, South Africa

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The St Lucia System is the largest estuarine lake complex in South Africa contributing 80% of the estuarine area of the subtropical region and 60% nationally. Its unique size and biotic diversity in combination with surrounding habitats have earned it recognition under the RAMSAR convention and more recently World Heritage Status as a key and core component of the iSimangaliso World Heritage Site.

The effects of a separate mouth policy, which removed the uMfolozi from the system in 1952, were exacerbated during the first decade of this century when the isolation of the uMfolozi coincided with a period of below average rainfall and the lake dried up for the first time in recorded history. This highlighted the need for a change in the management approach for this system and in 2012 with the support of focused studies and scientific input a decision was taken by the iSimangaliso Authority to reverse the separate mouth policy and re-link the two systems.

Multidisciplinary Studies recently completed have expanded our knowledge of the physical character and ecological responses of the estuary, and have allowed the iSimangaliso Authority to identify the critical restoration actions to be implemented to improve the health status and estuarine functioning of this important system. Specifically, the removal of a large island of dredge spoil in the mouth area of the estuary was identified as the most important restoration action to improve the hydrodynamic functioning of the estuary. This large and ambitious ground engineering project is currently underway and the response of the system will be discussed.

ORAL- Thursday –Msikaba 1- 1400

Ecosystem modelling of Ungwana Bay Fishery, Kenya: A holistic approach to Fisheries Management

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The Ungwana Bay shallow water fishery covers an estimated area of 1200.5 km². The bay is fed by two major rivers that discharge enormous amounts of nutrient-rich sediments, and especially during the rainy seasons

associated with the South-East Moonsons (SEM). The bay fisheries are a source of livelihood to thousands of small-scale fishers and also support a rich semi-industrial shrimp trawl fishery. Over the last few decades, there has been an intensified exploitation of the fisheries resources from this bay negatively impacting the composition and size of fish landed over the years. The result has been an increased landing of low commercial value fish and increasing cases of resource-use conflict. To assess the impact of the fisheries on the system and its ecological sustainability, the fishery was modelled using Ecopath-with Ecosim (EwE) trophic model using the available data on fish catches, estimated biomass, exploitation rates, and the dynamics and relationships of the main species in the system analysed. System through-put, net-production and energy-transfer efficiency were estimated with initial assumption of eco-trophic efficiency (EE) in the system. Results showed that large flows of biomass originated from the detritus which formed the benthic domain. The total system throughput was estimated at 6660 t/km²/yr while the system energy transfer efficiency was 11.8% with a Finns recycling index of 0.07% and a mean path-length of 4.86. This indicated that the Ungwana Bay is low biomass - high productivity system and prone to some degree of instability with the continued increase in resource exploitation. Furthermore, most of the energy throughput was mainly within the II and III trophic level due to the fishery concentration on exploitation of demersal fish species and benthic invertebrates. It is evident that the Ungwana Bay shallow water fishery is highly over-exploited with regards to some target species explaining the year-to-year shift in the major landed species. A shift in exploitation strategies with targeting of more of the pelagic species and venturing further offshore would reduce the pressure on these important inshore resources

ORAL- Thursday – Msikaba 1 – 1720

Fishery Value Chains and Implications for Sustainable Fishery Markets in Small-Scale Fisheries of the Lamu Archipelago

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Value Chain Analysis (VCA) of Lamu archipelago and analysis of opportunities and constraints for fishery development were conducted to answer key questions for development of sustainable fishery markets. Results show that the fisheries are multi-gear and multi-species in nature contributing a dismal 10% of the national fish production. The fisheries accounts for ~28% of the national marine catches. Majority of this catch comes from Kiunga and Pate Island, where annual landings range 14.0-28.0 Mt and 43.0-

116 Mt, respectively. Over 60% of the population derives their livelihood from fisheries with top groups comprising Palinuridae, Siganiidae, Lethrinidae and Lutjanidae. Majority of catch is exported out of the archipelago to Malindi and Mombasa. Smoked and dried-salted fish products are mainly from remote islands of Kiwayu and Ndau. About ~74% (351.9 Mt.) of the catch is sold as chilled, 17.0% as fresh and 8.0% as live crabs and lobsters. Over 80% of the catch is “exported” out of the archipelago as unprocessed products and over 99% of the crab and lobster catch. Average prices at end markets are almost tenfold compared to prices at landing sites. Fish traders were categorized into: Level-I; elderly fishers who buy and sell locally; Level-II who transport small quantities to markets outside the archipelago; Level-III bulk (>300 kg) dealers destined for factories in urban areas; and Level-IV who handle larger (up to 5mt) of select species (shrimps, crabs, lobsters and octopus). Average income varies with season, due to the demand-supply dynamics with ~US\$ 4-35/day for finfish and up to US\$150 /day for lobsters. Despite the high productivity, fisher’ earnings remain low due to poor fishing technologies and inefficient market systems. Enhancing fishery governance and management through support to fisheries value chain development and improvement would enhance conservation benefits and improve the community livelihoods within the Lamu Archipelago.

POSTER

Lost Gears – Lost Catches: the Tragedy of Small-Scale Coastal and Marine Fisheries in Western Indian Ocean Region.

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Kenya’s coastal and marine fisheries are, like many other coastal fisheries around the world, multi-gear and multi-species. The small-scale marine fisheries contribute a dismal 10% of the national fish production and the fishers are poorly equipped, limiting them to the inshore waters around reefs which are often suffer localized over-fishing and ecosystem degradation. Consequently, the fishers are faced with a low and diminishing profitability state forcing them to go for cheaper and cheaper gears, often, monofilament gillnets and their derivatives. Tragically, these cheap gears are often exhibit shorter life-spans and majority end are discarded at sea or along the beaches. Furthermore, the nets cannot withstand the rough abrasions of the reef habitats and hence majority are lost at sea after a few fishing trips. These discarded and lost gears place the poor fishers into cyclic dilemmas of “bought-cheap”-“short-lived” fishing gears making the fishing ventures often unprofitable. Furthermore, the lost gears, christened “ghost fishing gears” continue to fish and trap animals, entangle and kill marine life, and are hazards to

fisheries and fishing activities. All these factors, augmented by overfishing and climate change have resulted in lower and lower catches making the lost and discarded gears a double tragedy for the fishers in terms of loss of fishery inputs and catches due to ghost fishing and habitat degradation. Earlier studies in Kenya show higher rate of gear loss in fisheries of the Lamu archipelago (~60 % gillnets over 2 years; ~24% long line hooks). Further studies, must quantify fishing effort and the loss in catches in terms of entrapped fish catch and reduced recruitment, the potential impacts to both local and migratory fish stocks, and the economies of the small-scale fishers within the Western Indian Ocean region in order to raise awareness on the double tragedy of lost fishing gears

ORAL- Thursday- Amadiba- 1440

Complementarity of fishers’ traditional ecological knowledge and conventional science: Contributions to the management of groupers (Epinephelinae) fisheries around Mafia Island, Tanzania

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Traditional ecological knowledge (TEK) is increasingly advocated as a complementary source of information that can potentially be integrated into mainstream science, particularly to help improve fisheries management. However, less attention has been paid to identifying specific areas where the TEK of fishers may confirm or contradict conventional scientific knowledge (CSK); or where TEK may provide new insights for fisheries systems characterized by multi-species and multi-gear usage. We conducted a qualitative exploration of TEK of grouper fishing patterns and compared the findings with an analysis of catch data in order to elucidate the extent of fishing pressure on groupers. We further compared TEK of the ecology and biology of groupers with published CSK to understand the complementarity between the two domains. Data collection methods included structured open-ended questionnaire, semi-structured interviews with key informants, focus group discussions, personal observations and a literature review. Results indicate that TEK complements CSK in terms of catch assessment and the ecology of groupers. TEK provides additional information on fishing gear, specific grouper species caught, habitat use and feeding habits; however, TEK contradicts CSK regarding spawning aggregation behavior. TEK offers new knowledge on environmental threats facing groupers, but fishers lack knowledge on reproductive modes and life history traits (i.e. hermaphroditism and spawning season) of groupers. We conclude that, in a conducive democratic setting based upon mutual respect and trust, TEK can complement conventional science and help to make more informed management decisions for sustainable fishing.

ORAL- Thursday- Msikaba 4- 1440

International legal regime towards coral reefs conservation: a Western Indian Ocean perspective”

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I. Short description:

The presentation focus on the importance of Reefs in international law, and It focus the legal Framework towards Protecting Coral Reefs in the Western Indian Ocean.

In the same way, this contribution explains about the improved fishing practices into the “HOT spot” areas, and recommends how to change to the “HOPE spot” areas with a holistic contribution.

Finally, this presentation could be the complementary part of the Workshop about “Vulnerability of Coral reef heritage” in the last day. Specifically, about one of their parts: “Cooperation and citizen participatory governance of coral reefs”.

II. Objective

The objective is to contribute to improving the scientific basis permitting to address most of the previous challenges through the analysis of international law.

III. Contents

From “the preservation” to “the conservation”: a multidisciplinary perspective (legal; sociological and biological).

The importance of Reefs to international law

International legal Framework towards Coral Reefs conservation in the Western Indian Ocean.

- United Nations Convention on the Law of the Sea (UNCLOS), 1982
- Agenda 21, 1992
- Convention on Biological Diversity, 1992
- Convention on International Trade in Endangered Species (CITES), 1973
- United Nations Framework Convention on Climate Change (UNFCCC), 1992
- United Nations Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972

Improved fishing practices into the “HOT spot” areas, and how to change to the “HOPE spot” areas.

Marine Protected Areas (Mpas) : a holistic work.

IV. Outcomes

Promote the legal collaboration with specific scientist discussions in this Symposium.

Create an interdisciplinary discussion network on “Coral reefs conservation”.

POSTER

Microplastic uptake and retention in *Perna perna* (L.); *Tripneustes gratilla* (L.) and *Echinometra mathaei* (Blainville, 1825).

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Microplastics particles (< 5 mm) are found throughout the marine environment. As a result of the size and ubiquity of microplastics organisms in lower trophic levels, such as filter-feeders, are likely to ingest these particles. Once ingested, they may pose several physiological threats. Additionally, the surfaces of microplastic particles may readily adsorb persistent organic pollutants, heavy metals and other toxins, which may then be absorbed by the organism, bioaccumulated and then transferred through the food web. There are currently limited studies on the physiological effects of microplastic ingestion by filter-feeding organisms. This study aimed to determine (1) determination of madreporite pore size via SEM in *T. gratilla* and *E. mathaei* (2) selective uptake of various microplastics in the mussel (*Perna perna* L.) and echinoids (*Tripneustes gratilla* L. and *Echinometra mathaei* Blainville) and (3) the retention time of microplastics in the gut and the water vascular system of the echinoids. Madreporite pores sizes were determined to investigate the minimum microplastic particle size that could be taken up by the echinoid water vascular system. The effects of chemosensory selection on the ingestion of fluorescent microplastics by mussels and echinoids were assessed by exposing specimens to treatments of both biofilmed and un-biofilmed microbeads and microfibrils. Microplastic gut retention times were recorded after feeding by removing and washing the invertebrates to remove surface microplastic particles and thereafter placing them in clean seawater and checking the faeces under ultra violet light for the presence of microplastics. The results from these experiments may have implications for the physiology of the animals, environmental- and human health in addition to possible reassessment in the regulations governing subsistence harvesting.

POSTER

Carbon Exchange: Do mangrove forests facilitate carbon outwelling to seagrass beds and coral reefs?

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Recent research highlighted the importance of connective nutrient fluxes between systems within the tropical coastal seascape i.e. mangrove forests, seagrass beds and coral reefs. Connective nutrient fluxes were shown to facilitate the

establishment and health of these ecosystems. However, the complex interactions of carbon exchange between connected mangrove forests, seagrass meadows and coral reef ecosystems are poorly understood. The amount of dissolved carbon exported by mangrove forest leaf litter and made available for passive tidal exchange between downstream seagrass meadows and coral reefs may be important in understanding changes in coastal productivity. Currently, scientists and managers lack information of the actual hydrodynamic movement of dissolved and particulate nutrients between these systems. Hence, we developed a model, validated with data from our site (Chwka Bay, Zanzibar), which captured the most relevant processes of carbon exchange whilst at the same time answering key questions regarding how nutrient fluxes change with physical aspects of the ecosystems (areal extent, degradation) or with external nutrient input (fish farms).

ORAL- Thursday – Msikaba 4- 1140

Developing actor-oriented societal indicators for the influence on marine environments

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The pressure from society on many marine water areas is today unsustainable. This calls for changed behaviour by a long range of actors. Initiatives taken to initiate such changes, needs to be based on a good understanding of current ecological state, trends and causal relationships of complex social, economic and natural systems. Especially, it is urgent to identify and characterize societal phenomena contributing to an unsustainable pressure. In this paper we present a structured method to develop societal indicators that can help identify and follow up measures to reduce the pressure from human behavior on marine environments. This method, which integrates analyses of physical flows with a thorough identification of actors, has the following main components: 1. The BPSIR (Behaviour-Pressure-State-Impact-Response) framework emphasizes the importance of acknowledging both direct operating on the interphase between biosphere and technosphere, and indirect actors influencing the direct actors, 2. A generic model of the flow of substances and goods, which presents physical flows in a standardized way on any scale from flows of specific products to flows aggregated over whole sectors or societies. 3. Analyses of influence that describe how actors influence other actors. Case studies have demonstrated that important groups of actors and their behaviour could be identified by analyzing aggregated substance flows, whereas specific actors were more efficiently identified by analyzing product chains. When strong links between actors and physical flows of substances have been established, the magnitude of the physical can serve as a societal indicator. Other societal indicators can be based on surveys of the behaviour of key actors. Regardless of the type of societal indicators emanating from our method, further work is needed to ensure feasibility of data collection and acceptance of proposed indicators.

ORAL-Wednesday- Msikaba 1- 1700

Carbon Stocks in Seagrass Meadows, Gazi Bay, Kenya

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Understanding the role of vegetated coastal ecosystems in the global carbon dynamics is currently a field of great interest. Knowledge on the carbon flows and the ecological connectivity is important to the sustainable utilization of these ecosystems. Despite its relatively wide global cover, there is paucity of information and a geographical bias in the knowledge of seagrasses as carbon sinks. This study aimed at determining the relationship between carbon stocks and the above ground parameters of four dominant seagrass species: *Thalassodendron ciliatum*, *Thalassia hemprichii*, *Enhalus acoroides* and *Syringodium isoetifolium* of Gazi Bay, Kenya. Higher vegetative carbon stocks were recorded in *S. isoetifolium* at 666.6±47.8g C m⁻², followed by *T. hemprichii* at 529.3 ±59.7g C m⁻², then 508.1±3.1 g C m⁻² for *E. acoroides* and least for *T. ciliatum* at 452.9±52.1 g C m⁻² for. Carbon stocks were positively correlated to shoot density for the four species, but only significant in *T. ciliatum*, ($r = 0.520$, $p = 0.003$ and $R\text{-sq (adj)} = 24.4\%$). A positive and significant relationship of BGB to the AGB, was observed only in *T. ciliatum* ($r = 0.431$, $p = 0.017$, $R\text{-sq (adj)} = 15.7\%$). The below ground carbon pool accounted for the highest at 87.6 % in *E. acoroides*. Variation in biomass partitioning was attributed to species specific differences in growth patterns and heterogeneity in the physical- chemical parameters. Species next to the mangrove ecosystem develop higher biomass as they benefiting more from the land derived organic matter and minerals exports. Results of this study will help develop climate adaptation and mitigation project and advice on the sustainable management of the seagrass meadows.

ORAL- Monday – Amadiba – 1400

Use of maximum entropy models to predict event distributions: coral synchronous spawning as a case study

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Maximum entropy models use an iterative process to predict species distributions based on knowledge of their habitat use, the distribution of appropriate habitats and presence / absence data of species over at least part of the range. They are frequently used in studies of biogeography.

Despite the popularity of maximum entropy models for predicting species distributions, they seem to be used little if at all to predict the geographical distributions of events that might equally depend on environmental characteristics. We used MAXENT software to test whether such models can predict event distributions, using coral mass spawning as a case study. Mass spawning, during which many coral species spawn synchronously over a short period, was first described from the Great Barrier Reef but has since been observed in a number of other locations. Its occurrence in some reef locations but not others has been variously ascribed to the variation between

summer and winter water temperature, the rate of change of the SST as summer arrives, the level of solar insolation and the length of windless periods during the year. It has also been posited that mass spawning should occur wherever there is a sufficiently diverse, Acropora dominated coral community.

We obtained environmental data for reef areas globally from the bio-oracle website and manually calculated rates of change where these were not available. A search of the literature revealed 25 locations where multi-species coral spawning has been documented. Anecdotal reports of multi-species spawning were excluded. Locations where multi-species spawning has been confirmed were regarded as 'presence data'. Locations where multispecies spawning is known not to occur were regarded as 'absence' points. MAXENT models were run to predict the distribution of multispecies spawning beyond the known locations and to define the environmental variables most likely to be associated with these events.

POSTER

A genomic appraisal of the stock structure of South African sardines

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The southern hemisphere sardine *Sardinops sagax* is common throughout South Africa's temperate marine bioregions, and undertakes annual spawning migrations up the east coast. The species is exploited under the assumption that there is a single stock. Although there is evidence for at least two, genetic data have so far failed to confirm this. Given the species' very high dispersal potential, it is unlikely that coastal dispersal barriers such as currents and upwelling cells are sufficient to isolate regional populations to such an extent that this would be detectable on the basis of traditional DNA markers, and high-throughput sequencing technology is required to settle the issue. In particular, it is possible that environmental factors such as primary productivity or temperature exert selection pressure on regional populations, and that genetic divergence is only evident at loci that are involved in physiological adaptation to these factors. Here, we outline a research project that will use next-generation sequencing to generate tens of thousands of short reads throughout the sardines' genome to determine whether recent but significant regional divergence is already evident. The present study has great potential to facilitate the sustainable management of this important resource, and can contribute significantly to improving our understanding of the importance of adaptation in driving population divergence in South African marine communities.

POSTER

Antioxidant activities of edible marine molluscs from a tropical Indian Ocean island

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Supplementary antioxidants are considered as crucial in modern day medicine in eliminating oxidative stresses involved in various diseases. The present study assessed the levels of antioxidant activities, as well as total phenolic and flavonoid contents (TPC & TFC) in 11 marine molluscs species from Bivalvia and Gastropoda classes. Samples were collected from four sites around Mauritius, namely Poudre D'Or, Poste De Flacq, Trou D'eaux Douce and Amber Island, at comparable depths in summer 2014. Antioxidant activities were determined using five antioxidant assays: di(phenyl)-(2,4,6-trinitrophenyl) iminoazanium (DPPH) scavenging assay, superoxide scavenging assay (SOS), nitric oxide scavenging (NOS), ferric reducing antioxidant potential (FRAP) assay and iron chelating assay. Species exhibiting the highest antioxidant activities in at least two assays were considered to possess good antioxidant potential. *Donax faba* exhibited the highest antioxidant activities in iron chelating assay with EC₅₀ (half maximal effective concentration) of 0.76mg/ml and in FRAP assay with 0.5 mmol Fe²⁺g⁻¹. *Lithophaga teres* exhibited the highest antioxidant activities is DPPH and iron chelating assays with EC₅₀ of 1.25 and 5.23 mg/ml, respectively. *Saccostrea cucullata* exhibited the highest antioxidant activities in DPPH and SOS assays with EC₅₀ of 1.15 and 0.756 mg/ml, respectively. *Pleuroploca trapezium* exhibited the highest antioxidant activity in DPPH and SOS assays with EC₅₀ of 0.93 and 0.95 mg/ml. One species from the sea slug family (Opisthobranch) exhibited the highest antioxidant activities in NOS and SOS assays. The highest TPC was obtained in *Pleuroploca trapezium* (19.03 mg Gallic acid equivalent), while the highest TFC was obtained in *Donax faba* and *Lithophaga teres* (0.75 and 0.76 mg/ml, respectively). However, no correlations between antioxidant activities and phytochemical contents were obtained. Further investigations on fractionation and characterization of the crude extracts are needed to fully explore the suitable edible mollusc species as potential antioxidant sources.

ORAL- Monday- Msikaba 1- 1500

An assessment of the Seychelles rock lobster resource using fisheries independent survey data

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The Seychelles spiny lobster fishery has been described as a "boom-bust" fishery. The fishery is currently managed through controls on access, fishing effort and minimum size limits that are based on fisheries-dependent data (i.e. logbooks). The status of the resource is assessed through

fisheries indicators such as total catch, effort and catch per unit effort. However, the information available is often inaccurate and lacking which might impair the fishery management. To improve the monitoring and assessment of the lobster resource, a collaborative research programme called the Participatory Lobster Monitoring Programme (PLMP) was recently developed in collaboration with fishers. Between 2005 and 2014, 10 fixed fishing sites were surveyed during five surveys by experienced fishers. Information on the biology of the lobsters caught (sex, weight, etc.) as well as fishing effort and total catch by species (in numbers and weight) was collected. Changes in the biomass, abundance and size structure of the lobster resource were investigated over time. In addition, sizes at 50% maturity were derived for males and females of the two main species caught, *Panulirus penicillatus* and *P. longipes*, to examine whether the minimum size limit set in place was appropriate. The relative abundance of lobsters was quite stable over time, however, changes in biomass were observed between years. Moreover, significant changes were observed in the relative abundance of legal size lobsters and a decline in mean size of lobsters caught was noticed over the study period. The increasing proportion of smaller lobsters might indicate encouraging signs of recruitment. Estimates of size at maturity for *P. penicillatus* were found to be higher than minimum size limits whilst those of *P. longipes* were smaller. The results of this assessment revealed key information on the status of lobster stocks and are now used to inform the management of this fishery.

POSTER

Movement and residency patterns of grey reef sharks, *Carcharhinus amblyrhynchos*, along the west coast of Mahé, Seychelles

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Growing conservation concerns about the status of shark populations in Seychelles, led to the development of the Seychelles National Plan of Action for the Conservation and Management of Sharks (NPOA Sharks) in 2007. The plan highlighted a lack of species-specific knowledge on the distribution and biology of sharks. The grey reef shark, *Carcharhinus amblyrhynchos*, classified as near threatened on the IUCN Red List, is a shark species that is important for both the tourism and fishing industry in Seychelles. Grey reef sharks are one of the most sighted reef sharks by divers and are commonly caught by artisanal fishermen. Despite their ecological importance, very little information exists on their behavioural ecology to inform management decisions. In this study, we used acoustic telemetry to describe the movement and residency patterns of grey reef sharks between offshore rocky reefs and inshore coastal habitats along the west coast of Mahe. A total of 18 acoustic listening stations (Vemco VR2W) were deployed at Stork Patch, Pilot Patch and along the coastal area near Grand Anse. We tagged 23 sharks of which 16 sharks were detected within the acoustic array. Preliminary data analysis shows that sharks were more resident at Stork Patch followed by Pilot Patch. The majority of sharks made extensive movements between the two rocky reefs. In addition, 2 sharks made extensive movements between the two reefs and the coastal areas of Grand Anse. Moreover, 3 sharks were detected for short

periods in the Baie Ternay Marine National Park where acoustic listening stations has been deployed as part of another project. Information collected from this project will help us to understand the movement patterns of this species which will help us to better decide on the proper spatial and temporal scales for implementing management measures for this species.

ORAL- Thursday – Msikaba 3 – 1700

Effects of an extreme event on long-term shoreline change: an example from the KwaZulu-Natal coast, South Africa

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Shorelines are in a constant state of flux, experiencing cycles of erosion and accretion. These changes are the result of seasonal fluctuations in wave energy, storm events, changes in sea level and anthropogenic impacts (Moore et al., 2006). However, recent estimates show that over 70% of the world's beaches are experiencing net erosion (Appeaning Addo et al., 2008), making it important to understand shoreline change dynamics as a measure for management of coastal areas (Dolan, 1991). This research focusses on the KwaZulu-Natal (KZN) coast, on the east coast of South Africa and considers long-term shoreline change and the effects of a single event on shoreline dynamics and trends. This was done through the assessment of aerial photography for the period 1937 to 2013 using standard GIS processes and the USGS Digital Shoreline Analysis System. A limitation of aerial photography use is that capture in terms of frequency, resolution and coverage is not consistent resulting in errors and uncertainties. The use of multiple images over the period and the weighted linear regression approach aims to address these shortcomings (Romine et al., 2009). This research shows that the KZN coast is experiencing net erosion for the 76 year period, with 72% of the coast showing overall erosion. Shoreline dynamics have become more varied post-2007 storm event, with the pre-2007 storm event erosion reaching a maximum of 6m.yr^{-1} and post-2007 reaching up to 21m.yr^{-1} . Furthermore, it is evident that areas of erosion and accretion have changed spatially post-2007 storm event, with historically accreting areas along the north coast now showing signs of erosion and areas along central coast historically eroding showing evidence of accretion. It is important to note that these spatial variations are likely the result of coastal and catchment management, such as sand pumping and damming of river systems.

POSTER

Hydroid biodiversity (Cnidaria, Hydrozoa) at Inhaca Island (Mozambique)

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A small survey of the hydroid biodiversity was done during three days in shallow waters at Inhaca Island after the 8th WIOMSA Scientific Symposium held in Maputo in 2013. Three stations were visited once, Inhaca Marine Station (1), Ponta Torres (2) and Light House (3). Sampling was done

on the littoral at low tides and by snorkelling. Considering the low collect effort, the total species richness is high, with 40 species distributed in 29 thecates and 11 athecates. The stations are compared for species richness and faunistic composition. Due to contrasted ecological conditions, each of them exhibited a very different hydroid fauna, with only one species in common (*Dynamena crisioides*) while two were present in two stations (*Hebella scandens* and *Sertularia linearis*). 13 species were found in station (1) characterized by the dominance of epiphytic species, the family Sertulariidae being the most diversified (8 species); most of the 10 species of station (2) are typical species of Indian Ocean coral reefs (like *Nemalium lighti* and *Macrorhynchia philippina*); station (3) is the most original and diversified, with 21 species and the predominance of sertularids epiphytic on algae and on the two *Thalassodendron* species growing in the tide pools. The present results are compared with literature data available on Inhaca and with recent studies in the Indian Ocean. In contrast with the hydroid fauna of the French remote islands of the Mozambique Channel, that of Inhaca differs in having a high percentage (>25%) of species with a free medusa stage in their life cycle, a difference that could be linked to its continental location on the African coast.

POSTER

Coral reef recovery along the northwest coast of Mahé Island, Seychelles, following the 1998 mass bleaching event

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In 1998 a record breaking El Niño event led to unprecedented levels of bleaching worldwide and subsequent coral death. In Seychelles, mortality rates for scleratinian corals were as high as 90%. Such a large scale event allows a unique opportunity to monitor the recovery dynamics and rates of coral reefs post mass bleaching. In 2005 Global Vision International (GVI) alongside the Seychelles National Parks Authority started monitoring the recovery of coral reefs at 24 sites across the northwest coast of Mahé Island in Seychelles, leading to 10 years of surveys by 2015. Monitoring focused on fish populations, coral reef complexity, coral recruitment rates and invertebrate populations. Fish populations were surveyed through point count and belt transect methodologies, benthic coverage by line intercept transects, coral recruitment using 1m² quadrats, and invertebrates by belt transect methodologies. Results show an increase in coral coverage, lifeform diversity and distribution. A rise in the number of branching corals has led to an increase in the abundance of obligate corallivorous fishes, while coral recruitment rates have steadily increased throughout the study period. The effectiveness of Marine National Parks was assessed and results show that fish numbers within protected areas remained higher than unprotected areas. Recovery was not even across all sites and results indicate coral reef resilience may be linked to other factors, including structural complexity. In the 10 years since GVI began monitoring, there has been a steady increase in species abundance and biodiversity on the coral reefs of northwest Mahé. This indicates that if environmental conditions are stabilised and outside influences minimised, natural reef recovery is possible, however, recovery rates are on the scale of decades rather than years and may not occur uniformly.

ORAL- Monday – Msikaba 1 – 1400

Abundance of deep-water crustaceans in the SW Indian Ocean: Enough to support trawl fisheries?

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Expanding coastal fisheries into deeper waters is frequently mentioned as an option to increase harvests from the sea in the SW Indian Ocean. In this region, only Mozambique and South Africa have established deep-water trawl fisheries for mixed crustaceans. To investigate the fishery potential of deep shelf waters over a broader geographical extent, four bottom trawl surveys were undertaken at depths of 170-655 m in Madagascar, Mozambique, Tanzania and Kenya in 2011-2012. Teleosts dominated catches in all countries (59-74% of total catches) and depths. Crustaceans made up a much larger proportion of the catch in Mozambique and Madagascar than in Kenya and Tanzania, where elasmobranchs and other invertebrates were more abundant. The abundance of four commercially important crustacean species was compared across depth and by country (a proxy for latitude). Knife prawn *Haliporoides triarthrus* and langoustine *Metanephrops mozambicus* abundance decreased from south (Madagascar, Mozambique) to north (Kenya, Tanzania), but the shrimp *Heterocarpus woodmasoni* was more abundant in Madagascar, Tanzania and Kenya. Deep-sea crab *Chaceon macphersoni* and *H. triarthrus* abundance increased up to 600 m depth, whereas *M. mozambicus* and *H. woodmasoni* abundance peaked shallower, at 350-500 m. Crustacean catch composition in Mozambique was strikingly similar to commercial landings in eastern South Africa, supporting a distinct sub-region for fisheries management, but differed markedly from catches made in Madagascar, across the Mozambique Channel. Deep-water crustaceans were less abundant in Kenya and Tanzania, with limited commercial appeal.

POSTER

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opportunity to monitor the recovery dynamics and rates of coral reefs post mass bleaching. In 2005 Global Vision International (GVI) alongside the Seychelles National Parks Authority started monitoring the recovery of coral reefs at 24 sites across the northwest coast of Mahé Island in Seychelles, leading to 10 years of surveys by 2015. Monitoring focused on fish populations, coral reef complexity, coral recruitment rates and invertebrate populations. Fish populations were surveyed through point count and belt transect methodologies, benthic coverage by line intercept transects, coral recruitment using 1m² quadrats, and invertebrates by belt transect methodologies. Results show an increase in coral coverage, lifeform diversity and distribution. A rise in the number of branching corals has led to an increase in the abundance of obligate corallivorous fishes, while coral recruitment rates have steadily increased throughout the study period. The effectiveness of Marine National Parks was assessed and results show that fish numbers within protected areas remained higher than unprotected areas. Recovery was not even across all sites and results indicate coral reef resilience may be linked to other factors, including structural complexity. In the 10 years since GVI began monitoring, there has been a steady increase in species abundance and biodiversity on the coral reefs of northwest Mahé. This indicates that if environmental conditions are stabilised and outside influences minimised, natural reef recovery is possible, however, recovery rates are on the scale of decades rather than years and may not occur uniformly.

ORAL- Thursday- Msikaba 3- 1620

Use of Beach Webcams and Wave Data in Understanding and Forecasting Coastal Erosion

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Beach webcams can be used to gather regular short- to long-term imagery of the coastline, which can be a useful tool in assessing changes in coastal morphology over hourly, semi-diurnal, diurnal, synoptic, seasonal and inter-annual time periods that sporadic aerial and satellite imagery is not capable of showing. Imagery collected from web-based webcams at a selection of beaches in KwaZulu-Natal, South Africa, is used together with available wave data to analyse seasonal changes in beach morphology and the impact of swell groups on beach state. Results show that seasonal variability of the ocean swell regime influences seasonal beach rotation. This is manifested as erosion in the south of bays during winter under the influence of SSEs, with deposition of sediments in the northern sector of bays; whilst during summer the reverse is evident with deposition in the south of bays and erosion to the north under the influence of easterly component swells. Groups of swells can also have a dramatic cumulative effect on beach erosion, as the beaches do not necessarily have time to recover between events. Wave models and predictions, based on synoptic events, have improved immensely over the past decade. These, together with a knowledge-base built up from the analysis of webcam imagery, can be a vital tool in predicting coastal erosion over the short- and medium- term. In the short-term one can predict where a particular swell pattern is going to impact. From this the resultant erosion impact points can be determined and mitigation/adaptation measures employed. In the medium term, seasonal erosion patterns can be forecast.

ORAL- Thursday- Msikaba 2- 1500

Exploring effects of seascape configuration on tropical seagrass fish communities

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Understanding how the coastal seascape structure is related to ecological patterns and processes operating at different spatiotemporal scales is of emerging importance in applied ecology and facilitates improved resource management and conservation planning. Especially challenging for management and marine spatial planning is to identify habitat linkages across the seascape mosaic and to assess the strength of connectivity over relevant scales, for example when selecting marine protected areas. Although widely applied in the terrestrial environment, a multi-scale landscape ecology approach to study the relationship between measures of spatial heterogeneity and ecological processes in seascapes is still underdeveloped. With focus on tropical (Zanzibar, Tanzania) and subtropical (Inhaca Island, Mozambique) shallow-water environments, we used a hierarchical landscape ecology approach to examine the relative importance of seascape configuration and a range of scale-dependent environmental predictors on seagrass fish community composition. Field data was collected in 15 seascape units at each island, where we assessed density, species diversity, assemblage structure, functional group composition and life stage distribution of fish associated to seagrass habitats. Predictors were divided into three scales: landscape (km) e.g. seascape configuration, patch richness and total area of habitat patches; habitat (100s m) e.g. patch size, patch structure and edge effect; and local with-patch (10s m) e.g. plant structure, habitat coverage, depth and local current speed. We found that seascape configuration play a major role in structuring seagrass fish communities, while environmental predictors (e.g. seagrass structural complexity) at finer scales also influence distribution patterns and connectivity. Our research clearly demonstrates the importance of understanding strength of seascape connectivity and highlights the need of a multi-scale seascape approach to properly conserve seagrass fish communities.

POSTER

Quantification of stock total carbon in soil of mangroves in the north of Madagascar: case ambaro bay and mahajamba bay

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The recent and rapid increase in the concentration of CO₂ in the atmosphere results from the use of fossil fuels and land use change by humans. It's very likely effect on climate change at the global scale attracted the attention of many researchers on the quantification of CO₂ emissions in the atmosphere, and the identification of ecosystems can fix and store carbon. With that, the mangrove forest plays a very important role in the fight against climate change through its carbon storage in aboveground biomass and sediment party. This reason has pushed us to quantify the total carbon stock in northern mangrove soil of Madagascar: Case Ambaro bay and Mahajamba bay. Direct field observations are followed by samples of soil samples for analysis at the Laboratory. For sampling, five depth levels were selected (0 to 15 cm, 15-30 cm, 30-50 cm, 50 to 100 cm and 100 to 150 cm) in the two study sites. The sampling is stratified random and the sample is taken center of the plot.

The study shows that the difference between the depths of levels in the two study sites is significant. The carbon stock varies depending the depth and the study sites. More depth is deep, the higher carbon content increases. The carbon content of the soil of mangroves in Ambaro bay can reach up to 454.20± 20.89 Mg / ha while the Mahajamba bay is 193 60 ± 13.98 Mg / ha. And for total area of mangrove Mahajamba bay (75 303.00 ha) is extended by report that of mangrove Ambaro bay (65 418. 00 ha). By extrapolation between the carbon content and the total area in the two sites, mangrove Ambaro bay has the most total carbon stock (29 712 855.60Mg) than the mangrove of Mahajamba bay (14,578 660.80 Mg).

POSTER

Contribution and impact of artisanal fishing on the Coastal Districts Shark Species of Zambezia Province (2008-2013)

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Zambezia province is the major contributor in global fish production of artisanal fisheries, compared to other provinces with approximately 23% production weight (MP, 2013). Although sharks constitute organisms that make relatively significant catches in artisanal fisheries in Zambezia, few studies that parallel and seek additional way to monitor the phenomenon. Little research on sharks were conducted in Mozambique and information about their contribution to fisheries is scarce. The lack of knowledge about the contribution and impact of fishing on shark fish volume in particular Zambezia coast, as well as the vulnerability of species caught in different arts, were the main reasons for carrying out the present study. The study was conducted based on historical data of landings in

the coastal districts of Zambezia Province with emphasis on driftnet, in the period 2008-2013, and aimed to study the contribution and the impact of fishing on species of shark fish. We identified eight shark species (*Sphyrna lewinié*, *Carcharhinus leucas*, *Carcharhinus limbatus*, *Carcharhinus sealei*, *Carcharhinus sorrah*, *Carcharhinus wheeleri*, *acutus Rhizoprionodon*, and *Sphyrna zygaena*) who contributed total of 2312 (5%) tons in the period under review, being more productive art background driftnet with 576 tons and less productive was the line art as 65 tons. Catches show growth in the period with 1% in 2008 and 12% of the catch in 2013. In terms of small-scale fishing impact on the species of shark fish from 8 identified 62.5% were considered near threatened and 12.5 % for vulnerable, threatened and least concern each.

ORAL- Wednesday – Msikaba 3 – 1500

The introduction of South East Asian seaweed and its ecological implications for East African coastal waters; Can indigenous African seaweed be a potential alternative for farming?

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Seaweed farming is expanding globally and its expansion potential in coastal East Africa is immense, both in economic and socio-economic terms. However, in the light of recent research on Zanzibar, showing that two haplotypes of farmed *Euचेuma denticulatum* introduced from South East Asia have spread and are now highly abundant in the wild outside farms, with uncertain ecological consequences, continuous introduction of foreign stock for desirable farming vitalization is disputed. Consequently the indigenous East African *E. denticulatum* should be of consideration, not only for its farming potential but also for its capability for enhancing stock adaptation capacity due to e.g. climate changes and diseases.

This study is a first step for identifying potential native varieties for farming purposes. Molecularly identified indigenous haplotypes of *E. denticulatum* were tested at different sites and depths, in otherwise in-situ farming conditions in Zanzibar, and compared with introduced farmed ones in respect to variables of significance for seaweed farming, such as growth, grazing, epiphytes and carrageenan yield. The results indicate that the native haplotypes have a production potential with a comparable growth rate, varying mainly due to site, up to 7.4% day⁻¹. This growth rate, generally lower than the rate of the introduced haplotypes, might explain their slightly higher epiphyte coverage. No significant differences were found in grazing rate, between native and introduced ones.

The study indicate a farming potential among native *E. denticulatum*, but also a further need for continued search for native seaweed resources and identification of their desirable traits. This in order to enable East African seaweed industry to further expansion and secure its' ecological as well as economic sustainability.

POSTER

Survival Rates of Cockle (*Anadara antiquata*, Linnaeus, 1758) Larvae under various Treatments which minimize the Level of Bacteria

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Attempts to improve shellfish (*Anadara antiquata*, Linnaeus 1758) hatcheries in Tanzania coastal areas have been among the important activities in our country recently aiming at increasing the numbers of these species in the wild which play a great role to local livelihoods. More effort has been done to account for the best water treatment method favouring their growth and survival capacity that can be adopted by the local stakeholders in culturing this species. This study focused to determine the most effective water treatment methods on survival rate of *A. antiquata* larvae. Mature *A. antiquata* were conditioned in three tanks for 40 days, spawned and larvae were reared in three different treatments in triplicates (Ultra violet treated water, bleached water and one micron filtered water). Bacterial test (Vibriosis) was carried out daily in each treatment whereas temperature variation was measured in the morning and afternoon daily. Growth performance was done once a day by measuring the size of larvae in terms of microns. Larval counting was done twice a day in each treatment to determine the best treatment favouring their larval survival capacity. Water were exchanged three times a week while food, algae (*Isochrysis galbana*) were added to larvae daily in proportion to their feeding rate. It was clear that, maximum number of larval surviving was found in Ultra violet treated water. Also behaviour of larvae such as larval mobility and food clearance was higher UV treatment while bacterial level was lower compared to other treatments. These results from UV treatment suggest the possibility of culturing this vital species from juvenile to the stage that can be discharged to the ocean. This will assist in conservation and restoration of *A. antiquata* in the country

POSTER

Effect of feeding frequency and feeding rate on growth performance and carcasses composition of juvenile silver pompano (*Trichinotus blochii*).

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The silver pompano *Trichinotus blochii* is ideal species for aquaculture development, but the success depend on the identification of proper feeds and feeding regimens. The

objective of this work was to evaluate the ideal feeding rate and frequency for juvenile silver pompano. The feeding regimens experiments were carried out concurrently in a completely randomized design, with three replicates each. A total of 180 fish ($7.6 \pm 0.5g$ and 10.52 ± 0.01 cm) were stocked in 18 tanks (1000 L) during 40 days and fed at 3%, 5%, 10% body weight (BW) per day either in single feeding (1 \times) or three times and six times equal feeding. The tested feeding rates and frequencies did not influence survival. Weight gain and the specific growth rate increased significantly with feeding rate, and growth was generally greater and more efficient in the 6 \times groups than in the 1 \times groups. The apparent feed conversion ratio showed significant difference, with the worst value observed for fish fed 10% body weight per day in single feeding (1 \times). Fish fed at higher feeding rates accumulated significantly more lipid within the body and had associated decreases in moisture, protein, and ash content, but carcass composition was unaffected by feeding frequency. Juvenile pompano show better growth performance when fed 5% body weights per day in 3 and 6 times a day. We suggest that the growth of juvenile pompano can be optimized when they are fed at 5% BW/d in three daily feedings

POSTER

Mangroves and livelihood – An assessment of livelihood projects in the mangrove ecosystems along the Kenyan Coast

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Several livelihood activities have been initiated along the Kenyan Coast to counter declining fisheries and destruction of habitats. The present study aimed at assessing the feasibility and sustainability of ecotourism, mariculture and beekeeping projects practiced in various mangrove areas along the Kenyan Coast. Focus group discussions with project proponents, local interviews and online Delphi survey with project stakeholders were conducted on livelihood projects along the Kenyan Coast. A total of 209 local people were interviewed and 65% of invited stakeholders responded for the Delphi survey. A SWOT analysis identified the presence of a healthy mangrove forest and support from local stakeholders as projects strengths; while lack of technical skills was noted as a weakness of the projects. Diversification of the livelihood projects was seen to be an opportunity; while illegal cutting of mangrove was found to be a major threat to the project sustainability. This study provides recommendations on how to improve on efficiency and effectiveness of the initiatives so as to help in sustainable management of the mangrove ecosystem.

ORAL- Wednesday – Msikaba 4 – 1700

Phakisa Initiative: fast-tracking establishment of an effective and representative network of Marine Protected Areas for South Africa

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An effective and representative Marine Protected Area (MPA) network is an essential tool to ensure the integrity of South Africa's ocean ecosystems. It is also essential to support increased development to unlock new economic opportunities, which is the goal of the South Africa's President's new Phakisa initiative. Currently, South Africa's existing MPAs fall short of representing the diversity of three major ocean systems, the Atlantic, Indian and Southern Oceans. Only 0.4% of ocean space is protected. This falls far short of the 5.8% average level of protection currently attained by developing countries. Eighteen new MPAs and expansion of three MPAs are proposed. This would almost double the number of MPAs, increase MPA coverage to more than 5% and advance habitat representation from 60% to 94%. Key stakeholders for each area in the network were identified and potential activities that may be compatible in each MPA were recognised. Consultation on this proposed network was advanced through the Operation Phakisa Oceans Lab process and subsequent key stakeholder consultations. It is anticipated that the proposed network will be declared in 2017. This paper explains the rationale, challenges and proposed process to achieving a representative MPA network for South Africa, and Phakisa's role in enabling the achievement of the country's signed commitment to the Convention for Biological Diversity's target of at least 10% protection by 2020.

ORAL-Monday- Msikaba 4- 1720

Where to, ambassadors of the big blue? Delineating turtle migration corridors in the Western Indian Ocean to support multi-national conservation

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Turtles are ambassadors of the sea, crossing multiple national borders and traversing the high seas. Their highly migratory nature is thus a critical aspect of their conservation, often necessitating international co-operation among countries. A recent evaluation of the endangered loggerhead and critically endangered leatherback turtles in the Western Indian Ocean (WIO) has shown the nesting-beach environment in South Africa to favour population growth for both species. Although loggerhead abundance is increasing exponentially, leatherback abundance is failing to increase, suggesting that key threats offshore may differentially impact the two species. This study aims to quantify differences in loggerhead and leatherback migration corridors to determine if offshore pressures could be the reason for their contrasting population growth rates. Satellite transmitters were fitted to post-nesting loggerhead and leatherback females, and tracked for approximately one year each, with tracking taking place on

different animals across multiple years (2006-2013). Both migration tracks and current-corrected migration tracks were analysed to construct weighted migration corridors using movement-based kernel density estimation. Three primary migration corridors are clear for both species: north along the Mozambique coast; north-east across the Mozambique Channel; and south in the Agulhas Current. Leatherbacks travel much further than loggerheads in the latter corridor, swimming around southern Africa up into the Benguela as far north as Angola, or east in the Agulhas retroflection and up onto the Mascarene Plateau. Given their greater pelagic movements, leatherbacks are more likely to encounter offshore industrial fisheries compared to loggerheads. Further, contrary to the prevailing paradigm, it appears that leatherbacks are not always pelagic drifters, and can swim against the currents to maintain geographic position, presumably for foraging. Conservation of turtles is thus critically dependent on multi-national commitment and co-operation, and fisheries regulations in areas beyond national jurisdiction are especially important for the persistence of leatherbacks in the WIO.

POSTER

Scavengers in ecosystems with erratic food supply: Are sandy beach scavengers calorie conscious?

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Using sandy beaches as a model system, where food sources i.e. allochthonous inputs are erratic in their supply, the notion of food selectivity and related predictions (highlighted by the optimal foraging theory) were explored. The aim of this study was to determine if intertidal sandy beach scavengers (*Ocypode ryderi* and *Bullia rhodostoma*) are selective in the foods they consume when presented with a choice of food items differing in their calorific content. Research questions included: 1) If presented with a choice of food items, do sandy beach scavengers a) show selection for a specific food item? b) select for the food item with the highest calorific content? and 2) in the case of *B. rhodostoma*, is selectivity for a specific food item similar across all size classes? The study was conducted at two sandy beaches: Manzengwenya in KwaZulu-Natal and Kings Beach in the Eastern Cape of southern Africa. *O. ryderi* and *B. rhodostoma* were sampled in these areas respectively using different experimental designs. For *O. ryderi*, four gelatine-encased food items in the form of cubes i.e. fish (high calorific content), blue bottle (low calorific content), blue dyed and clear gelatine were presented. For *B. rhodostoma*, two food items were used i.e. fish (high calorific content) and jellyfish (low calorific content). Results revealed that among all food items presented, both *O. ryderi* and *B. rhodostoma* showed selection for the food item with the highest calorific content (i.e. fish), however this trend was only significant in the case of *B. rhodostoma*. Furthermore, selection for fish was similar across all *Bullia* size classes (i.e. small, medium and large). Despite the erratic nature of their food supply, sandy beach scavengers may display selection for foods with a higher calorific content due to the greater energetic reward as opposed to foods lower in nutritional quality.

POSTER

Alien species associated with oyster farming along the West and East coast of South Africa, with notes on the translocation of species associated with cultured oysters

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Translocated oysters are well known to act as vectors of marine alien species, but to date, this topic has received scant attention in South Africa, despite the fact that oysters have been imported into this region since 1894. Surveys of oyster farms in South Africa revealed four newly-recorded alien species: the black sea urchin, *Tetrapyrgus niger*, from Chile; the European flat oyster, *Ostrea edulis* from Montagu's crab, *Xantho incisus*, from the North Eastern Atlantic seas of Europe, and the brachiopod *Discinisca tenuis* from Namibia. Oyster imports are the most likely vector of all these species. Moreover, farmed oysters host a diverse community of epifaunal and infaunal fouling taxa, including alien species, and these are easily translocated during commercial oyster trade. We document the diversity and densities of fouling taxa associated with farmed oysters, *Crassostrea gigas*, in South Africa, how effectively these are removed by conventional cleansing techniques, and whether those that remain after cleansing survive intra-regional translocation. Over 40 invertebrate species, belonging to 11 major taxa, were found living on farmed oysters. Both mean abundance and biomass of invertebrate taxa associated with unclesed oysters were greatly reduced following cleansing, but small numbers survived even after translocation. We examined the effectiveness of exposing oysters to either fresh water or heated seawater as a more thorough cleansing regimen to prevent the intra-regional translocation of such taxa. Oysters survived soaking in fresh water better than immersion in heated seawater, but associated organisms were more effectively eliminated by the latter treatment. However, as some taxa survived both types of treatment, the translocation of oysters would still pose some bio-security risks, even following such treatments. The needs for additional control measures to limit or prevent further introduction and spread of alien species are discussed

POSTER

Exploring the benthic invertebrate and ichthyofauna communities of Alaphard Bank: changes in community patterns and structure with depth

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Eighty kilometres offshore the Southern tip of Africa, lie the legendary Alaphard banks. Despite the ecological and economical significance of this offshore reef, information

remains scarce and anecdotal. The unique reef structure which consists of a relatively shallow (20-70m) rocky bank and slender clusters of pinnacles, is unlike any other reef formation within the Agulhas bank. Moreover, the remoteness of this reef qualifies it to serve as a potential spawning ground and natural refuge for many fish and invertebrate species that are elsewhere on the verge of extinction. The current study represents the first extensive survey using new insitu video techniques of this unexplored bank. Sampling of the area was conducted during two cruises aboard the RV Ellen Khuzwayo in May and November of 2009. During both trips, a remotely operated vehicle (ROV) was deployed at varying depths (from 20 to 75 m) to assess reef structure, invertebrate benthos and demersal ichthyofauna. All mega-invertebrate fauna and ichthyofauna were identified from the ROV footage. The substrate is comprised mainly of rocky reef with a few sandy grooves. Diverse assemblages with clear depth zonation patterns were documented. The shallow depth zone (20 to 35 m) is dominated by algal communities of *Ecklonia radiata* and *Caulerpa filiformis*. Deeper zones are comprised of diverse poriferan, bryozoan and cnidarian taxa of which the slow growing hydrocoral, *Styaster nobilis*, is by far the most abundant. Common among the ichthyofauna was a population of juvenile Roman, *Chrysoblephus laticeps*. Based on these initial observations, the Alaphard Bank region appears to be an Ecological and Biological Significant Area (EBSA) home to a host of endemic and vulnerable biota.

ORAL- Monday- Amadiba- 1420

The importance of sponge-bacteria associations on coral reefs in Zanzibar

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Sponges are among the dominating benthic organisms in coral reefs. They play a key role in the retention and recycling of organic matter by converting dissolved organic matter (DOM) excreted by photosynthetic reef biota to particulate organic matter (POM) shed into the water column. This sponge loop, favoring the retention of nutrients in the reef and providing POM food source to detritivores, is believed to be facilitated by sponge-associated bacteria, but the role of sponge-associated microbes and the pathways of DOM-derived energy remain enigmatic. This study, carried out in reefs around Zanzibar, aims to (1) assess the importance of sponge-associated microbes in the uptake of reef-derived DOM, (2) identify the microbial taxa involved in the processing and conversion of DOM and (3) assess the fraction of the energy gained from the consumption of DOM allocated to the production of secondary metabolites. The different microbial taxa in the 12 most abundant sponge species

in coral reefs around Stonetown were identified by 454 Pyrosequencing. DOM uptake rates, measured in situ by simultaneously sampling the inhalant and excurrent water of the sponges' oscula were quantified. Secondary metabolites will be identified by High-performance liquid chromatography. The microbial and cytotoxic activity of secondary metabolites will be tested with Agardiffusion and the brine shrimp assay, respectively. The results highlight the importance of sponge-bacteria associations for coral reef nutrient cycling and conservation.

POSTER

Biodiversity of fish post-larvae in SW Madagascar

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Marine resource conservation highlights the needs of surveying fish communities to detect changes in marine biodiversity. In this context, surveys of fish post-larvae assemblages provide one of the basic information to be taken into account. However, identifying the post-larvae to the species level remains difficult in the Indian Ocean due to the paucity of published information. Thus, Madagascar and Reunion Island have launched a study of fish post-larvae diversity through the COLOR project (European Regional Development Fund). This work intends to provide information on the fish biodiversity in the SW Indian Ocean and to elaborate an identification guide of fish post-larvae for the area. Off Toliara, SW Madagascar, fish post-larvae were collected using light-traps for three consecutive nights at new moon, from October 2014 to March 2015. After sorting the samples by morphospecies, representative specimens were selected, photographed and fish tissues were sampled for DNA-based identification based on the mitochondrial gene cytochrome oxidase I. Over a total of 10 289 post-larvae captured, more than 380 pictures of specimens belonging to 42 families were obtained and their fish tissues analyzed. The first results of DNA analyses are presented.

ORAL-Monday- Amadiba- 1440

Effects of prey availability on mesopredator condition, growth rate, and fecundity on coral reefs of the Seychelles Inner Island Group

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Mesopredators on coral reefs play a key ecological role, transferring energy from lower trophic levels to apex predators. Mesopredators also have great economic value in subsistence, commercial, and recreational fisheries. Despite their ecological and economic importance, there is a paucity of knowledge about how mesopredators are affected by habitat degradation in coral reef ecosystems.

While the impacts of altered reef conditions may manifest as a change in the population size of predatory fish in the long term, these impacts may become evident sooner as a modification of the life histories of these species. Here we investigate whether changes in prey availability due to habitat degradation have sublethal effects on coral reef mesopredators. *Cephalopholis argus*, an important piscivorous fisheries species in Seychelles, was sampled from six sites in the Seychelles Inner Island Group. Long term monitoring has identified that some reefs in this group have recovered following the severe 1998 bleaching event, while others have continued to decline into a heavily degraded algal-dominated state. Changes in the reef fish community have also been monitored, providing a valuable record of the historic availability of prey species for reef predators. As the abundance of preferred prey species declines with habitat loss following disturbance, we expect that predators will have diminished energy reserves to allocate to growth and reproduction, resulting in reduced population growth rates and survivorship. This study uses morphometrics, lipid analysis, histology and stable isotopes to investigate how energy reserves, growth rates, and the reproductive potential of mesopredators differ between these two reef conditions. This will provide insight into whether mesopredators experience sublethal effects on degraded reefs, which may have long term implications for reef fisheries, management and conservation.

ORAL- Wednesday- Msikaba 4- 1640

Marine Protected Areas in the 21st century: using Phylogenetic Diversity as a tool for spatial planning

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The need to protect the marine environment from anthropogenic pressures such as over-fishing, habitat degradation and, more recently, climate change has led to the establishment of Marine Protected Areas (MPAs) throughout the globe. To date, implementation of MPAs has mainly relied on taxonomic-based diversity measures (e.g. species richness and abundance) to predict the spatial distribution of biodiversity and the most efficient design. Nevertheless, increasing evidence suggests that other sources of information should be taken into account when establishing MPAs. Molecular data has the potential to unlock important information regarding the evolutionary history and connectivity patterns of species. In particular, Phylogenetic diversity (PD) is a measure of evolutionary diversity, which in conjunction with species richness (SR) has been shown to be an effective tool for spatial planning by identifying important areas for maintaining biodiversity and evolutionary potential.

South Africa has a diverse marine environment, harbouring a high number of endemic species. However, no studies so far have included genetic biodiversity for marine planning in the region. Therefore, we targeted 30 commercially exploited species of the Sparidae family, which occur across all biogeographic regions that define South Africa's marine habitats. Genetic data for the mitochondrial DNA CO1 gene and the 1st intron of the nuclear S7 ribosomal gene were generated, and phylogenetic analyses were performed using Bayesian Inference. Obtained genetic and Phylogenetic diversity for both markers were combined and plotted against SR in order to both understand how these two measures capture biodiversity information, and

identify hotspots of evolutionary diversity across the South African coastline. The data gathered in this study will help inform marine spatial planning in South Africa and contribute to the conservation of its unique marine fauna.

ORAL- Wednesday- Msikaba 3- 1120

Local impacts are reducing calcium carbonate production in Zanzibar coral reefs: indication or implication for improved management?

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Human activities are responsible for a number of local and global stresses leading to the decline in coral reef health worldwide. Example of local stressors include, growing population, eutrophication, increased sedimentation, and increase marine resource exploitation. Tourism in Zanzibar has quadruplicate in the last 40 years. Unmanaged tourism can have many adverse effects on reef health e.g. over fishing, unsustainable fishing methods (explosives, poison), and mechanical damage (anchorage).

In this study we use CaCO₃ production as an indicator to assess ecosystem services and health. Comparing it to other reefs we can affirm Tanzanian coral reefs off the coast of Zanzibar have a high benthic cover and the natural oceanographic conditions promote optimum conditions for growth. However, some of these areas are at risk of exploitation due to the low occurrence and the proximity to coastal towns and resource extraction associated to a growing population. The study site within the conservation area 'Chumbe Coral Park' shows the highest gross carbonate production 20.95 kg m⁻² yr⁻¹. In contrast, Changuu Island supports the larger load of tourist and reports the lowest calcium carbonate production 10.58 kg m⁻² yr⁻¹. There is a clear trend between proximity to Stonetown and the level of reef use.

This highlights the importance of effective management and education as a tool to mitigate local pressures and thus improving reef health and sustainable tourism in the Western Indian Ocean.

POSTER

The importance of improved management of marine resources in the northern Quirimbas Archipelago

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The northern Quirimbas Archipelago is at the epicentre of what is now being recognised as the biodiversity hotspot for the western and northern Indian Ocean. It is also an area of increasing economic importance to Mozambique due to the presence of huge oil and gas deposits. Here, we present results of some recent work by the "Our Sea Our Life" programme that highlight the urgency and opportunities for improving the management of marine resources in this area.

Reef fish biomass and biodiversity in the northern Quirimbas Archipelago have declined in recent years, primarily as a result of increased levels of fishing. However, the area continues to attract fishers from other parts of Mozambique and beyond because fish catches are still much higher than those in their areas of origin. Additionally, measures of coral species richness, resilience and health in this area remain amongst the highest in the Western Indian Ocean, suggesting there is high potential for recovery of fish populations if adequate management measures were introduced. The position of the northern Quirimbas Archipelago in relation to the South Equatorial Current and biodiversity patterns suggests that further declines in this area could impact marine biodiversity and coastal communities beyond the northern Quirimbas Archipelago.

The Our Sea Our Life programme is an EU- and UK-funded initiative to develop and pilot mechanisms for incentivising and sustaining pro-poor co-management of marine biodiversity. We discuss recent developments and opportunities for engaging migrant fishers in sustainable management; something that is often considered too difficult to tackle. We will also discuss the importance of engaging women in management and the approach we are taking to address this. We show that there are opportunities to reverse the declines in marine biodiversity in this important area, and highlight the opportunities for engaging industry in this process.

POSTER

Identification of cryptic species in the Indo-Pacific honeycomb grouper *Epinephelus merra* using a combination of genetic tools

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Coral reefs are the most diverse of all marine ecosystems, however, they are highly threatened through overharvesting, tourism and global change. Before accurate conservation strategies can be implemented to protect coral reefs, connectivity of reef-associated species should be assessed to understand the level of interdependence of coral reefs. To evaluate its connectivity at the scale of the Indo-Pacific, we analysed the genetic diversity of the widely distributed honeycomb grouper *Epinephelus merra* (Serranidae) using mitochondrial sequences and microsatellites. A COI barcoding approach revealed misidentification among the samples of *E. merra* and also showed two reciprocally monophyletic lineages, each specific to the Pacific or the Indian Ocean. Analyses combining the barcoding survey, coalescent and phylogenetic algorithm and morphological features suggested that these lineages can be considered as distinct species. Furthermore, the analyses of microsatellite data using F-statistics and clustering methods identified substructuring within both the Indian and Pacific Oceans. Additional analyses based on Approximate Bayesian Computation methods revealed the best scenario describing the colonization history of the honeycomb grouper across the Indo-Pacific.

POSTER

Do nutrients affect seagrass community composition of the heavily populated western coast of Zanzibar?

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Shifts in community composition of seagrass meadows are considered to be a herald of cascading seagrass decline. Once set in motion, it is difficult to halt degradation and, even more so, to restore a destroyed seagrass habitat to its original state. A better understanding of the factors driving seagrass community composition could provide us with early-stage indicators to foresee the onset of seagrass decline. Furthermore, it would strengthen our insight to improve management and protect this critical habitat for future generations. In this study, we assess the current state of the seagrass meadows of Zanzibar, Tanzania on the less studied western side of the archipelago's main island (Unguja). Due to high population density of this area, the coastal waters are documented to be impacted by cultural eutrophication. Seagrass meadows were selected with increasing distances from the coast in order to obtain a gradient in anthropogenic nutrient input receding from the Unguja's capital, i.e. Zanzibar city. Along this gradient several monospecific and heterospecific seagrass meadows were sampled along 50m transects. Water column and sediment pore water nutrients (NH_4^+ , NO_x , PO_4^{3-}), Chl *a*, POM and photometric measurements were determined together with measurements of photosynthetic yield, cover, abundance, biomass and C:N contents of the seagrass plants. In contrast to our expectations, results showed low ambient nutrient concentrations throughout the sampled area, with NO_x and PO_4^{3-} levels $<2\mu\text{M}$, and NH_4^+ concentrations not exceeding $5\mu\text{M}$ and $30\mu\text{M}$ in water column and sediment pore water respectively. However, preliminary results on seagrass community composition, biomass and plant morphological variations along the gradient provide strong evidence that the seagrass meadows on Unguja's western coast are impacted and possibly declining in this region.

POSTER

Change in condition through a spawning season of spinefoot shoemaker (*Siganus sutor*) participating in spawning aggregations

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Spinefoot shoemaker (*Siganus sutor*) is an endemic and commercially important species in western Indian Ocean. They reproduce every full moon on spawning aggregation sites for 8 consecutive months (September-April). These aggregations have become important for local artisanal fisherman whereby a fishery has developed that specifically *S.sutor* at aggregation sites using traditional bamboo traps. There are no legislation controlling the fishery and it may potentially be submitted to overfishing. Maintaining good body condition is important for growth, maturation, quality and quantity of offspring. Body condition is affected by several factors which includes food

availability and environmental conditions. Low condition affects reproduction greatly, especially in females where large amount of energy is allocated towards egg production; in terms of lower quantity and quality of eggs produce at each spawning event. Fish condition can be estimated through morphometric indices like the Fulton's condition factor (body weight: cubic length ratio), energetic indices like the gonado-somatic index (gonad weight: somatic weight ratio) and the tissue lipid composition (total lipids and reserve: structure lipids ratio). The study aims to observe the change in the condition of *S.sutor* during its spawning season and to investigate the relationship between morphometric and energetic condition indices and fecundity. 10 fishes in 3 size categories (21-25cm, 26-30cm, 31-35cm) were sampled every month from fishermen's catch on Praslin Island from October 2013 to August 2014. Length, bodyweight, liver and gonad weight were recorded for each fish and samples of muscle, gonads and liver were collected and analyzed for total fat, main reserve lipids (triacylglycerol) and structural lipids (phospholipids and sterols). The fecundity of each female was also estimated using gravimetric method. This study will give an understanding how *S.sutor* condition vary throughout the reproduction cycle, and will constitute valuable information towards the creation of a responsible management plan for the fisheries.

POSTER

Development of negotiation skills for resolving natural resources conflicts: Case of Mohéli Marine Park in Ramadan

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Marine protected areas and biodiversity (terrestrial and marine) are coming under increasing pressure from the various users and stakeholders who benefit from AMP. In Comoros, predominantly rural communities dependence on natural resources, indicates a strong human pressure on resources and ecosystems. There is an intensification of global environmental degradation, which affects all natural resources and weakens the ability of natural resources to regenerate, in the case of fisheries resources must say that this is not the collection of resources that is at issue, but rather the rate of sampling. Other factors such as climatic stress or not enough plays a major role in the loss of biodiversity, rising sea levels and the contribution of sediments upstream watershed causes erosion and sedimentation zones coastal. In the month of Ramadan demand for fishery products increases by the simple fact that the population of the island of Mohéli is almost 100% Muslim and Ramadan is the holy month for Muslims (fasting month). To sustainably manage the resources of the Marine Park conservatives apply regulations on fishing, as demand is high and the highest bidder for the fishermen of the island, sometimes to catch much fish, fishermen are tempted to use practices fishing that are prohibited in the Marine Park of Mohéli. The resolution of this conflict through negotiations between the different stakeholders of the Marine Park of Mohéli by which time the parties involved arrives do not find an expectation, the Mutual Gains Approach to negotiation is necessary for good management of marine resources. This approach allows parties to improve their chances of creating an agreement superior to existing alternatives and meeting the priority needs of all stakeholders in the MPA

ORAL- Monday – Msikaba 2 – 1120

Assessment of ‘single ecosystem services-based’ mangrove management in Gazi Bay, Kenya & Zanzibar, Tanzania: methodological perspectives

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Biodiversity conservation is subject to conflicting understandings by various stakeholders, which often leads to divergent priorities. If the plurality of biodiversity conservation interpretations is not considered, conservation initiatives might fail. Mangrove patches are often managed with the aim of maximizing a single ecosystem service (e.g. mangroves as carbon sink, or as timber supply area, or as ecotourism destination etc.) during a specific period of time, but this unidimensional perspective can lead to a significant decrease in the overall functionality of the mangrove in the long run. Based on our field experience in mangrove ecosystems in Gazi Bay and Zanzibar, we reflect on the applicability of a combination of ecological functionality assessment methods and participatory methods. We discuss the use of the Delphi technique, the Q methodology and Participatory Rural Appraisal (PRA) in understanding how single ecosystem-based management is framed and appreciated by different stakeholders, and how it impacts mangrove functionality. The application of these methods in support of mangrove management actions can lead to the identification of shared conservation perspectives. This in turn ideally leads to an improvement of conservation practices by focusing on consensus points. For example, prioritizing holistic ecosystems conservation over single ecosystem-service based-management. We here report on ongoing fieldwork in Kenya and Zanzibar, but given the variation of ecological and social contexts, additional research in other socio-ecological and institutional contexts will allow us to move towards a better understanding of the general applicability of the framework.

POSTER

Image analysis of microzooplankton in a cyclonic eddy off southern Madagascar

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Microzooplankton are small (20-200 μm) planktonic animals that pass through conventional mesozooplankton sampling nets, which traditionally have a mesh size of 200 or 300 μm . Microzooplankton play a key role in shaping the structure of marine ecosystems, as primary grazers of

marine phytoplankton, as major secondary producers, and as intermediaries between primary producers and copepods. However, this important component of the ecosystem has received little attention in the South West Indian Ocean. The recent acquisition of a FlowCAM, that enables semi-automated sampling and imaging of microplankton, has provided an opportunity to investigate this poorly studied community while the organisms are still living and undamaged by chemical preservation methods. The FlowCAM was used on a cruise on the RV Algoa during July 2013, to study microzooplankton within a cyclonic eddy off southern Madagascar. Water samples (5 litres) were collected from the surface and depth of maximum fluorescence (f-max) on the southern Madagascar shelf and within the cyclonic eddy using a CTD-rosette sampler (“bottle samples”), and from the upper ~25 m within the eddy using a 55- μm mesh inlay net inside an obliquely towed MultiNet, which filtered 200 litres on average (“net samples”). Samples were pre-filtered through 200- μm mesh and collected on 20- μm mesh. Image analysis reveals a rich community comprising foraminiferans, radiolarians, ciliates, eggs and nauplii of copepods and euphausiids, small copepods, rotifers, ostracods and appendicularians, as well as detritus such as copepod moults. Abundance of microzooplankton in the bottle samples was consistently higher in surface than in deeper samples. Preliminary analyses of selected net samples in areas of high microzooplankton abundance in the eddy show nauplii were most abundant (~53 L⁻¹), followed by small copepods (13 L⁻¹), dinoflagellates (12 L⁻¹) and radiolarians (5 L⁻¹). Further analysis will reveal whether the microzooplankton community varies between the different eddy zones.

ORAL- Monday- Msikaba 4- 1420

Connectivity of the Skunk Clown Fish in the Indian Ocean using a combination of microsatellite and mitochondrial genetic markers

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Knowledge of connectivity, the exchange of individuals between populations on coral reefs, is vital for a correct spacing of Marine Protected Areas, needed for the management and conservation of these reefs. For most coral reef associated organisms, migration during the adult life stage is impossible or extremely difficult. Dispersal between reefs in the patchy coral reef environment is therefore limited to a weeks to months long pelagic larval stage. This study uses the Skunk Clown Fish (*Amphiprion akallopisos*) as a model species to assess connectivity. It has a disjunct distribution, occurring in the Western Indian Ocean (WIO) and the Eastern Indian Ocean (EIO), separated by more than 4.500 km of open sea. Levels of gene flow are estimated between the WIO and EIO populations and among populations within the WIO. A combination of mitochondrial (MtDNA) and nuclear genetic markers (microsatellites) is used. In total, 337 individuals from 21 different sites in the WIO (Kenya, Tanzania, Madagascar, and Mozambique) and the EIO (Indonesia) were analysed. Strong population structure ($\phi_{st} = 0.28$; $P < 0.001$) was encountered between the EIO and the WIO populations using MtDNA (Control Region, 337 bp alignment), indicating the WIO and EIO populations are not connected by gene flow. Within the WIO, low but significant population structure ($\phi_{st} = 0.021$;

$P < 0.01$) was observed, but no clear geographic genetic break. Selective neutrality tests (Tajima's D and Fu's F_s) indicate a derogation from selective neutrality in the WIO, and suggest this population underwent a rapid expansion in the past (raggedness index $r = 0.068$; $P = 0.82$). Within the EIO, results suggest panmixia ($\phi_{st} = -0.006$). The analysis will be completed using a set of 16 microsatellite primers, of which the results will be available before the conference and included in the presentation.

POSTER

Morphological and molecular characterisation of Barnacles in Mauritius

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Barnacles are intertidal colonisers of rocky shores which might be proved as potential organisms for the Mauritian aquaculture industry, also used as bio-monitors. Traditionally, barnacle taxonomic studies were based on morphological markers but, with the advent of modern molecular tools, more reliable and accurate results. Surveys carried out around the island revealed four species of barnacles consisting predominantly of acorns. Because of morphological similarities one mollusc species had been sampled as barnacle but Cytochrome C Oxidase Subunit 1 (CO1) sequences revealed its true identity. The protocol used for their DNA extraction yielded adequate amount and acceptable DNA purity which varied between 0.067-2.4. Pair-wise distance between sequences varied between 0.013 up to 0.611. Most parsimonious tree regenerated using CO1 sequences showed its robustness with bootstrap values above 50% for the the major clades except for one clade showing 37%. Moreover, operon RAPD primers such as OPAS 12, OPAS 13, OPAS 14, and RAPD H showed more than 80% polymorphism indicating their potential use for inter-specific and intra-specific studies. ISSR (Inter Simple Sequence Repeat) markers ISSR 1, ISSR 2, ISSR 4, ISSR 5 and ISSR 8 were screened were more reproducible than RAPD (Randomly Amplified Polymorphic DNA). This preliminary study also revealed the wide distribution of some barnacle species (*Chthamalus southwardi*) while some were restricted to few specific lagoons. Future works should focus on the bio-fouling aspects and phylogenetic and phytogeographic assessments to understand the migration route of these species

ORAL- Monday- Amadiba- 1600

The effects of coral declines on reef structural processes and coral reef habitat in the Western Indian Ocean

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Anthropogenic pressures on coral reefs have led to global declines in the abundance and changes in community composition of both corals and fishes. In particular, climate associated bleaching of corals has led to mass mortality of corals throughout the Western Indian Ocean. While the

impact of these events on fish and coral communities have been well studied, their implications for structural processes underpinning the long term persistence of coral reefs – the maintenance of the carbonate framework – are little considered. Coral reefs often attenuate up to 80% of the wave energy reaching the shore, and with the importance of protected shorelines and lagoons for fishing, transport, social events and property, knowing whether reefs are eroding or accreting is essential. Here we used a census based approach that combines estimates of the abundance of carbonate producing (e.g., corals, coralline algae) and bioeroding (e.g., parrotfish, urchins) species with rates of carbonate deposition and bioerosion to estimate the carbonate budget of reefs using historically collated data in the Seychelles. By utilising generalized additive models, we were able to predict which characteristics of reefs pre-bleaching indicated whether a reef would become net erosional or net accretional 15 years post-bleaching event. We then compared the current characteristics of reefs at various sites in Mozambique and Kenya with the predications from the model to identify reefs that are likely to become net erosional post-bleaching, and those reefs that if already erosional, are likely to recover to an accreting state. Our results indicate that maintenance of structural complexity, cover of massive corals and nutrient availability are all essential to maintain accretional reefs post bleaching. Finally, we consider what the differing trajectories of reefs mean within the context of each coastal community, and how this matches with the ecosystem services upon which people rely.

ORAL- Monday- Msikaba 1- 1620

A first investigation of the trophic ecology of deep-sea fishes exploited by the artisanal fishery of Reunion Island

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In 2000 to diversify artisanal fishing activities and reduce the pressure on coastal and coral reef resources, the exploitation of deep-sea fishes was considered at Reunion Island. In the first years of exploitation, catches were promising and diversified. In 2010, a survey was conducted on the fishery and results showed a severe decrease of the catches, of the number of species caught, and of the size of the individuals, suggesting that targeted species could be overexploited. Some methodological biases were however suspected, and a new survey was decided with broader objectives that included not only fishing statistic analyses, but also investigations of the biology and ecology of the species. Here we presented the first results on the trophic ecology of fish species exploited by the fishery using a combination of stomach content and stable isotopes of carbon and nitrogen analyses. A total of 528 stomach contents were analysed and stable isotopes were measured in white muscle of 600 individuals belonging to 25 species. In addition stable isotopes were measured in fresh prey collected in stomach contents, in the particulate organic matter from the water column up to 500m in depth and from deep sediments. Fish fed on a variety of prey such as crustaceans, fish larvae and juveniles, cephalopods and benthic organisms. Interestingly, fish prey are an assemblage of both deep species such as myctophids or endemic deep-sea species associated to the volcano slopes, and coastal shallow water species. Stable isotopes values in fish suggest however that most of the energy was derived from deep waters in all species. They

also show a trophic segregation among species that could be explained by the depth of their foraging habitats. The results suggest that vertical movement of predators probably exist and this highlights the connectivity that exists between surface and deep ecosystems.

ORAL- Thursday – Msikaba 1- 1140

Time preferences and natural resource extraction

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Natural resource users face trade-off between future consumption and present consumption. Using harmful methods or extracting unsustainably lowers future consumption. This leads to the possibility that people with higher individual discount rates extract more as compared to people with lower individual discount rates.

The present study combines experimental methods and questionnaire data to understand the relationship between individual time-preferences and natural-resource (fisheries) extraction. We elicit individual time preferences with incentivized choice experiments and link the resulting time preference measures to extraction data from questionnaires and CPR experiment. We collect information about the gears used, number of hours spent using that gear in fishing activities, and income earned from fisheries using questionnaires. This self-reported fisheries extraction data is complemented with CPR experiments. Standard CPR experiments do not include any time related aspects since participants receive both the earnings from private extraction and earnings from unused CPR immediately after the experiment session. In order to account for the time-effect we include a treatment where earnings from private extraction are delivered immediately whereas earnings from conserved resource are delivered 14 days later. These experiments and questionnaires were conducted with 252 fishermen in Zanzibar.

POSTER

Requirements for Pearl farming including growth rate of the pearl oyster *Pinctada margaritifera* in Zanzibar

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Several species of pearl oysters which are marine bivalves such as *Pinctada fucata*, *P.margaritifera* and *Pteria penguin* are used for pearl culture world wide. In Tanzania the species tried so far are *P. fucata*, *P. margaritifera* and *Pteria* sp. Procedures used in pearl farming consist of collection and preparation of the host shell, nucleus insertion and cultivation of mother oyster. Pearl farming started in the early 2000 in Mafia island using *Pinctadas* sp. In Zanzibar this activity started in 2006. Major problems facing future pearl culture is security of good culture ground, and preservation of their environmental conditions. Elaboration on the culture technique that has been used in Bweleo and Nyamanzi village in Zanzibar using both floating lines and underwater lines and the

bivalve *Pteria* and *Pinctada* will be elaborated. It will also present information on the process conducted in finding the bivalves, determining some of the environmental parameters taken in the vicinity where the rafts have been put together with the survival, growth, spat production methodology around the area (which is very important in ensuring sustainability of the activity) and nacre deposition on these pearls. Growth in shell hinge length of the species *P.margaritifera* was measured once every month and the average growth rate was found to be around 0.3 to 0.4 mm which is a good sign. As a result of these studies there is a continuity of pearl farming in this area as the community has already shown collaboration and keen interest in this activity as it has assisted them in increasing their economic

Several species of pearl oysters which are marine bivalves such as *Pinctada fucata*, *P. margaritifera* and *Pteria penguin* are used for pearl culture world wide. In Tanzania the species tried so far are *P. fucata*, *P. margaritifera* and *Pteria* sp. Procedures used in pearl farming consist of collection and preparation of the host shell, nucleus insertion and cultivation of mother oyster. Pearl farming started in the early 2000 in Mafia island using *Pinctadas* sp. In Zanzibar this activity started in 2006. Major problems facing future pearl culture is security of good culture ground, and preservation of their environmental conditions. Elaboration on the culture technique that has been used in Bweleo and Nyamanzi village in Zanzibar using both floating lines and underwater lines and the bivalve *Pteria* and *Pinctada* will be elaborated. It will also present information on the process conducted in finding the bivalves, determining some of the environmental parameters taken in the vicinity where the rafts have been put together with the survival, growth, spat production methodology around the area (which is very important in ensuring sustainability of the activity) and nacre deposition on these pearls. Growth in shell hinge length of the species *P.margaritifera* was measured once every month and the average growth rate was found to be around 0.3 to 0.4 mm which is a good sign. As a result of these studies there is a continuity of pearl farming in this area as the community has already shown collaboration and keen interest in this activity as it has assisted them in increasing their economic status. A book on pearl farming techniques and requirements in Kiswahili has also been produced. A book on pearl farming techniques and requirements in Kiswahili has also been produced

POSTER

Evidence of the occurrence, growth and distribution of milk fish (*Chanos chanos*) which can assist in ensuring better culture in Unguja, Zanzibar Tanzania

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The culture of milk fish *Chanos chanos* locally known as “Mwatiko” is gaining importance along the whole coast of Tanzania. In order to sustain the industry it is important to understand the occurrence and distribution of adults and juveniles as well as growth rates. Growth rate studies of the species were conducted for one year at Bubwini, Unguja. Some fish were tagged to monitor the growth rates of specific fish. The results indicated a growth of about 2 – 3 cm per month. Comparison of growth in ponds where the fish were fed with food pellets and those where they were feeding on natural feed was done. Mortality was observed to be very low as these fish

are very hardy. Distribution of the species was also studied at six landing sites in Zanzibar (Nungwi, Uroa, Mkokotoni, U/Ukuu, Paje and Chwaka) once a month to check for the occurrence of adult milkfish (*Chanos chanos*) in fish catches and to learn about their breeding sites and seasonality. Similarly, the presence of fingerling in these waters was studied by beach seining in shallow water lagoons near mangrove stands of Chwaka, Mizingani, Maruhubi, Nyamanzi and Mbweni. Fingerlings were observed at Bubwini and Makoba but fry were found only at Chwaka bay. The weight of the fingerling varied between 5-10g. and these were used for stocking the ponds. Interviews were also conducted in these villages to get local knowledge of milkfish. This information has assisted and will continue to encourage farmers to culture milk fish in a reliable, profitable and sustainable manner

POSTER

Successful coastal entrepreneurship: The case of coastal women in Menai bay, Zanzibar.

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Coastal women play various roles along the coast of Zanzibar which contributes to their socioeconomic wellbeing. Recent attempts in Zanzibar has been to be actively involved in processing and selling fish, something which was not possible twenty years ago when there were hardly two women selling fish due to culture and tradition. Now they are actively involved in pearl farming and jewellery making using shells as well as processing bivalves and gastropods for sell. The paper discusses on selected women groups of Menai bay who started small and have been able to pave way to success independently. They have been empowered economically through building their entrepreneurship skills in various activities in a sustainable manner one of which is the establishment of no take zones which they monitor themselves bi annually. The paper elaborates on how they have become stronger through collaborative efforts in group formation and learning of leadership skills as well as participating actively in various workshops and trade fairs. Some have achieved great developments through building simple houses for their families and learning foreign languages which they use during their businesses in less than 5 years. The achievements obtained and challenges up to 2015 as well as future directions are presented. also the success of the no take zones are elaborated. These case studies could be useful examples for other women along the coast in other countries facing similar problems to follow.

POSTER

Marine reserves approach assessment within the Ambodivahibe Bay MPA (Ambodivahibe MPA, north-eastern of Madagascar)

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The establishment of marine reserves is a new approach to blue economy and initiated by Conservation International in the Ambodivahibe Bay MPA since 2010. In the north-eastern of the island, the village of Iovovona has been considered as a pilot site for the marine reserve approach in the DIANA Region. This system aims, firstly, to develop and local communities responsibilities through

participatory management of marine resources, and secondly, to encourage the active support of fishermen in setting of the Marine Protected Area.

At its fifth year of practice (2010 to 2015), the system has grown significantly in terms of fishery production, local communities involvement, number of targeted species and number of fishing site enclosed. Three of the four villages are now touched by the practice. Targets are usually octopus, fish, shrimp and crabs, some areas prohibit all forms of fishing, that is to say, total enclosure of favorite sites. The results are exceptional. Starting with 609kg of octopus from a single fishing site in 2011, we are about 4750kg within 4 marine reserves this year of 2015. The marine reserve success is measured not only in terms of catches that always increase each year, but also in terms of community involvement in patrolling and surveillance. The increase number of MR remains as a strength and an efficiency success indicator.

Management and monitoring methodologies are usually developed and coordinated with the local communities who are direct beneficiaries and managers. Daily patrol through the presence of a patrol team who are well trained in participatory monitoring. The management of the locally marine reserves is regulating by the local law called DINA.

Thus, CI, for its part, always ensures the organizational and permanent technical support to those local communities in collaboration with the authorities (local, regional) and other organizations.

ORAL- Wednesday- Msikaba 4- 1620

Combining occurrence and abundance models to evaluate the suitability of an existing Marine Protected Area for dolphins

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Along the East African coast, marine top predators are facing an increasing number of anthropogenic threats which requires the implementation of effective and urgent conservation measures to protect key marine areas. Identifying the habitat features that determine marine top predator' distribution and abundance is a crucial step to evaluate the suitability of an existing Marine Protected Area (MPA), originally designated for the protection of coral reefs. We developed species distribution models (SDM) on the IUCN data deficient Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) in southern Kenya. We followed a comprehensive ecological modelling approach to study the environmental drivers influencing the occurrence (presence/absence) and abundance (combining number of sightings and group size) of dolphins developing SDMs. Through

the combination of ensemble prediction maps, we defined recurrent, occasional and unfavourable habitats for the species. Our results showed the influence of dynamic and static predictors on the dolphins' spatial ecology. We also predicted a higher occurrence and abundance of dolphins within the MPA, and covering a large percentage of recurrent and occasional areas (47% and 57% using presence-absence and abundance models respectively). However, the MPA does not adequately encompass all of them and within this context, we propose to extend the MPA to incorporate all occasional and recurrent areas which are likely key habitats for the highly mobile species. The results from this study provide two key conservation and management tools: (i) an integrative habitat modelling approach to predict key marine habitats, and (ii) the first study evaluating the effectiveness of an existing MPA for marine mammals in the Western Indian Ocean

ORAL- Thursday- Msikaba 1- 1200

Artisanal fisheries at Pemba Town, Cabo Delgado: Structure, dynamics and contribution of catch for livelihood in an urban environment

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Artisanal fisheries are a key subsistence activity of coastal populations of East Africa. The coral coast region of northern Mozambique is a rapidly changing region boosted by the oil and gas industry and tourism. Therefore setting the baseline for evaluation of the subsistence fishery, its sustainability and relation with transformations in Pemba town is important to understanding how these may impact people currently dependent on the coastal ecosystem. As part of the Sustainable Poverty Alleviation from Coastal Ecosystem Services (SPACES project), we investigated the relationship between gear, catch and income generated by the fishers in different seasons. Data was collected through fish catch surveys at landing sites in Pemba town. A standard questionnaire was used to collect the effort and location of the fishery. Each sampling season consisted of two weeks including both spring and neap tides. There are a variety of both pelagic and demersal species caught, varying by gear used. However, hand line fishers tended to target small and large pelagic species, the income from which varies highly day by day. Lone fishers with wooden canoes that target large pelagic species, profit more than those using other gears such as harpoons, basket traps and nets. Large motorized vessels that use either purse seine lantern fishing or seine nets employ large numbers of fishers, but fish only for a few days each semi-lunar cycle. Therefore, individual income is reduced despite potential high catches due to fuel expenses and catch-sharing systems, which benefit the fishmasters and boat/net owners. The fishery shows a wide range in both gears and profitability, and our surveys in conjunction with ecological surveys conducted by other SPACES team members, suggests that the nearshore coral reef environment in Pemba is overexploited with fishers preferring to target pelagic species.

POSTER

Nest site selection of loggerhead and leatherback sea turtles at Inhaca Island, Southern Mozambique

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Nest site selection is the non-random placement of eggs within a particular area of a nesting beach. That selection represents an important reproductive strategy for sea turtles, as it can strongly affect the development and survival of the offsprings and consequently the reproductive fitness of the adult. In this study we analyze the nest site selection of loggerhead and leatherback turtles at Inhaca Island using the spatial data of five non-consecutive nesting seasons.

Overall results revealed that loggerhead and leatherback's nest placement was restricted to the coast of the Island.

The nest site selection analysis revealed that loggerhead turtles tend to spread their nests along the entire beach, with 30 % of the loggerhead nests restricted to the northern most section of the eastern coast. Leatherback turtles tend to be more nest specific, with approximately 40% nests at the central sections of the coast.

Beach height was the physical variable significantly correlated to loggerhead's nest density ($r = 0,309$, $p < 0,01$) while grain size particles (0,125mm grain size particles) ($r = 0,399$, $p < 0,01$) and organic content ($r = 0,218$, $p < 0,05$) were the variables significantly correlated to leatherback's nest density. No other factors investigated affected nest site selection of either species.

POSTER

Temporal distribution of sea turtles nests at Inhaca Island, Mozambique

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Inhaca Island has the longest monitoring data base on sea turtles nesting in Mozambique (~27 years). However, despite the monitoring efforts, such information has been underexplored and has not been used either to increase the understanding of sea turtles nesting activity, to improve the monitoring and conservation programs or to promote sea turtle based tourism in the Island. Therefore, the present study aimed to describe the temporal nesting activity of two sea turtles species in Inhaca Island based on the long-term database on sea turtle nidification.

A total of 530 nests were reported, of which, approximately 64% (340 nests) were loggerhead's and 36% (190 nests) were leatherback's. Mean annual nest numbers between loggerhead and leatherback turtles were significantly different ($t = 2.467$, $df = 42$ and $p < 0.05$), because loggerhead turtles laid more nests than leatherback turtles. It appears that loggerhead and leatherback turtles have different re-migration intervals. Loggerhead turtles tend to have lower re-migration intervals than leatherback turtles. Those differences had to do with the different trophic statuses occupied by each species and food availability depending on the conditions of the environment.

In terms of seasonality, loggerhead and leatherback nesting activities were restricted to the summer months (October-March). The nesting peaks of loggerhead turtles were one month later and shorter (November and December) than those of leatherback turtles which spanned through October, November and December. This suggests that the subtropical Inhaca Island beaches may have different optimal temperatures for hatching the nests of each species.

ORAL- Thursday- Msikaba 3- 1420

Seasonal Prediction of Tropical Cyclones and Storms over the Southwestern Indian Ocean Region using the Generalized Linear Models

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The tropical cyclones (TC) and tropical storms (TS) data covering December to March (DJFM) and November to May (NM) over Southwestern Indian Ocean (SWIO) for a period of 34 years (1978 – 2011) were analyzed using generalized linear models, where various environmental parameters such as vertical wind shear (evws), etc. were used as TCs/TSs predictors. The main objective of the study was to establish the relationship between the occurrence of TCs and TSs over the SWIO and meteorological or oceanographic parameters. The data used were obtained from NOAA (NCEP-NCAR and Climate Prediction Centre (CPC)). The inter annual variability of DJFM and NM TCs and TS showed peak values during El Nino years. Validation of the data using the poison model revealed that observed and cross-validated (forecasted) TCs during DJFM, strongly correlated ($p \leq 0.02$) with each other for thermodynamic, dynamic and combined models, with $r = 0.73, 0.86$ and 0.84 , respectively. Similar correlation ($p \leq 0.02$) were also established for the TSs, with $r = 0.62, 0.78$ and 0.80 , respectively. Further analysis of similar relationships ($p \leq 0.02$) during the NM season gave similar results, with $r = 0.62, 0.8$ and 0.8 , respectively (for TCs) and $r = 0.52, 0.68$ and 0.87 respectively (for TSs). Assessment of the model skill for all statistical model types had high scores of about 52%, 73% and 70% and 37%, 60% and 72% for DJFM TCs and TSs, respectively. Whereas for the NM TCs and TSs the skill scores were 38%, 67% and 64% and 26%, 61% and 76%, respectively. The results suggest that dynamic and combined models had higher skill scores compared to thermodynamic models. However, based on contingency 2x2 and 3x3 square matrices, it was revealed that all models types had adequate verification skills, with high bias value ranging from 0.85-0.94.

POSTER

The relationship between tropical cyclones and the plant productivity indices along the coast of Tanzania

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The relationship between tropical cyclone (TCs) and the plant productivity indices along the coast of Tanzania was investigated using both field observations and change detection methods. The MODIS data (250 x 250 m) comprising of 16 days composites and Landsat 7 ETM

(8 days composites), all spanning from 2000-2014 and 5 Landsat 8 (LC8) images (from 2013 - 2014), were used to determine the pattern of the inter-annual variability of the Normalized Difference Vegetation Index (NDVI) and Enhanced Vegetation Index (EVI) and the TCs impacts on vegetation productivity. Tropical Rainfall Measuring Mission (TRMM), from TRMM website and daily to monthly rainfall data, from Tanzanian Meteorological Agency (TMA) were analyzed using GrADS software. Inter annual variability of NDVI/EVI over Chwaka and Rufiji, and monthly rainfall were analyzed using R statistical software. The results revealed that, 2002 had highest NDVI/EVI values, with peaks in March/April and minimum values in November. MODIS data for most stations during specific TC events (Gafilo, Kalunde and Fobane) gave significantly lower EVI changes (-0.15 to 0.45) compared to L7 ETM data (-0.4 to 0.5) for all TCs. Analyses of spatial changes in NDVI showed that TCs Besija and Fobane were associated with both reduction and enhancement of the NDVI over Chwaka and Rufiji depending on location. Over Chwaka, the associated NDVI enhancement was > 0.51 (Besija) and > 0.47 (Fobane) and a reduction of < 0.03 and < 0.02 , respectively. Over Rufiji the net NDVI enhancement was > 0.31 and the net reduction was < 0.19 . Analyses of spatial land cover features showed a high deposition of sediments along the shorelines suggesting that originally water covered areas had been vegetated after the TC events. The NDVI and EVI results were consistent with the patterns showed by analysis of rainfall data.

POSTER

Analysis of the contribution of the southwestern Indian Ocean tropical cyclones to the December to March rainfall season over Tanzania

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The contribution of Southwestern Indian Ocean (SWIO) Tropical cyclones (TCs) to the December to March (DJFM) rainfall season over Tanzania was analyzed. Seasonal, monthly and daily rainfall observations were obtained from Tanzania Meteorological Agency (TMA), while daily and monthly sea surface temperatures (SSTs), relative and specific humidity, zonal and meridional winds were acquired from NOAA (NCEP – NCAR). The TRMM daily average gridded rainfall estimates were used. The observed and gridded rainfall data for each TC day were extracted and computed to monthly and seasonal totals for all TCs and non TCs days. Point to field correlation maps between September to November (SON) gridded SSTs and December to February (DJF) rainfall, and correlation between DJFM TCs and DJF/DJFM rainfall were determined. Inter annual variability between TCs and DJF rainfall was analyzed. Wind patterns at 850-200 mb, relative humidity (850-700mb), vertically integrated horizontal wind and moisture divergence (1000-500 mb) for two TC events (Izilda and Fobane) were analyzed. The results revealed that, TCs contribution to the DJFM rainfall was very significant. The influence of TCs to monthly total rainfall showed a general increasing trend from north to south along the coast of Tanzania, with a southwest to northeast alignment. Furthermore, correlation between

DJFM TCs with DJF rainfall was relatively weak although few stations such as Dodoma and Tabora showed relatively higher correlations of about 0.39 ($p \leq 0.05$) suggesting that these stations are highly vulnerable to the TCs impacts. Moreover the results revealed the TCs rainfall prone areas over Tanzania, which runs from southern parts (Mtwara) through central parts (Dodoma) to northeastern highlands (Kilimanjaro). The results indicated that 700 mb wind vectors, integrated moisture fluxes and their convergence from Congo air mass, northwesterly and northeastern Indian Ocean air masses were the main contributors of rainfall over Tanzania during TCs events.

ORAL- Thursday – Amadiba- 1700

Institutional barriers to mangrove REDD: Effects of local and meso institutions and governance on implementing PES schemes in mangroves

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Institutional arrangements governing forests are critical in realizing opportunities for reducing emissions from deforestation and forest degradation (or REDD+). While Kenya is making progress in implementing carbon-offset projects in terrestrial forests, this is hardly being replicated in mangrove forests. This is despite mangrove being one of the most carbon rich ecosystems on earth. Institutional barriers to the implementation of payments for ecosystem services (PES) schemes in mangroves have not been documented. The present study entailed ethnographic research, semi-structured interviews, and tracking daily activities of key personnel regulator in-charge of mangrove forests in the study area. Narratives and texts collected were coded and categorized using NVIVO software, and data analyzed using thematic analysis procedures. Preliminary results indicate that the main barriers to implementing mangrove REDD projects are conflicting legislations and policies. Funding from the national government was observed to be too low making forest managers rely on donations and external funding to run forest management activities. There seems to be lack of clear defining of carbon rights, community involvement in decision making, and benefit-sharing systems among stakeholders. The study recommends appraisal and review of forest legislation to align it to emerging climate compatible development.

POSTER

Community perceptions towards management of mangrove resources in Kenya

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There is increased advocacy for community participation in natural resource governance. Involving communities creates a sense of ownership leading to improved resource management. In the process of developing a

national mangrove management plan for Kenya a series of consultative meeting involving communities and other stakeholders were held all along the coast. During the workshops, community perception and attitudes towards mangrove goods and services were assessed in terms of values, threats, trends, and management interventions. An analysis of the data generated shows an immense understanding of mangrove ecosystem functions. On uses of mangroves products and services, harvesting mangroves for fuel wood and building poles were ranked highest. This was followed by value of mangrove to fisheries and shoreline protection. A number of community groups are engaged in conservation activities reflecting the positive perceptions towards mangrove ecosystem. The proposed Community Program of the national mangrove management plan is designed to address community interests in the rehabilitation, conservation, and sustainable utilization of mangrove resources.

ORAL-Monday- Msikaba 3- 1600

Understanding change and resilience in social-ecological systems on the Tanzania's coast

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In recent decades, significant changes had occurred in many coastal ecosystems on the western Indian Ocean (WIO) region. Research also indicates ongoing and emerging risks and vulnerabilities on these systems, which could further derail alternative pathways for change and sustainable livelihoods. Yet, there are very few (if any) research studies which looking holistically at resilience of social-ecological systems at local levels on the WIO region, and particularly in Tanzania. This study aimed to examine change in a social-ecological system and the elements of that system that influence resilience in order to contribute to efforts for resilience toward sustainable development in Mtwara district specifically and in similar systems on the Tanzania's coast. The study looked on how communities dealt with change in their social-ecological systems and how can resilience be built to adapt to unprecedented change and prepare for sustainability. A participatory case study approach, involving the use of interviews and participant observation was deployed to collect primary data. Secondary research provided further information required for this study. The findings show that in the past three decades, coastal social-ecological systems in the study area has transformed into a less resilient system. The resilience is increasingly threatened by weak local institutions negatively affecting local management, rapid technological change leading to destructive exploitation of fisheries resources, and rapid changes in the local social-economic system. This analysis demonstrates that there are critical components of social-ecological systems that must be addressed prior to implementation of specific adaptation measures to unprecedented changes including anticipated effects of the impact of climate change.

POSTER

Promoting support for community owned solutions to emerging challenges in coastal fisheries

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For many decades, scientists have often perceived fishing communities in developing world unable to manage their environment without harming them. More recent and nuanced research show that there is increased evidence that fishing communities have extensive knowledge of their environment that could offer robust and effective solutions to upcoming social-ecological challenges in their areas. This research aims to identify and promote community owned solutions for the management of fishing resources in three coastal district of Tanzania. It used participatory action research to facilitate effective participation by local communities and other stakeholders in identification of actions needed on the site (village) level to address the problem of rampant destructive fishing practices. The findings reveal that fishing communities have multiple options such as community togetherness, knowledge sharing and promotion of local knowledge for adapting to new social-ecological situations. However, these solutions are hardly receiving adequate and legitimate representation at various levels of decision making in Tanzania. The research argues policy makers to support community owned solutions because they may constitute a better opportunity in searching for alternative ways to deal with environmental change and complex social-ecological challenges facing fishing communities

POSTER

Nature-based coastal eco-tourism activities on marine protected areas of mainland Tanzania

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Through its emphasis on nature-related activities, tourism is currently heralded by coastal managers and researchers in WIO region for its propensity to enhance environmental conservation and as a source of income. Nonetheless, tourism industry is at varying levels for different states of the WIO. This research was carried out to examine stakeholders' perceptions of the nature and demand of eco-tourism activities in marine protected areas of mainland Tanzania to provide information for sustainable development of this sector. Eighty stakeholders in tourism industry, chosen on a random basis at Dar Marine Reserves and Mnazi Bay Ruvuma Estuary Marine Park were interviewed based on standardised questionnaires. Data were analysed statistically and triangulated with information from 12 key informant interviews with marine park managers, NGOs, tour guides and operators; participant observation, and secondary sources mostly

being official publications and statistics on tourists from Marine Parks and Reserves Unit and the National Bureau of Statistics. The results indicate that the major components of coastal eco-tourism were snorkelling, coral diving, bird-watching, visits to archaeological sites and boat tours around mangrove areas. Proportionately, a vast majority of visits (80%) were done by foreigners who came for leisure, spending on average 2-4 days. Two-thirds of questionnaire respondents indicated that the level of tourism activities was low. The results suggest a need to invest in tourism facilities and collaboration of public and private sector in tourism planning and development. The findings can be used to assess the strengths of MPAs in mainland Tanzania as tourist destinations and for searching further options to promote and enhance coastal eco-tourism as an effective means for sustainable development.

POSTER

A comparison of marine molluscan diversity at a highly frequented and a less frequented intertidal area around Mauritius Island

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Marine molluscs are highly successful organisms in terms of ecological adaptation and are found in nearly all habitats ranging from intertidal zones to deep ocean trenches. At present, coastal biodiversity is reeling under the effects of anthropogenic pressure and coastal activities. This study assesses the spatio-temporal variation in the diversity of intertidal molluscs at a highly frequented site (Flic en Flac, HF-FF) and a less frequented site (Gris-Gris, LF-GG) around the coast of Mauritius in 2008-2009 and 2014-2015. Five random transects, each of 30 m in length stretching from the supralittoral fringe to the sublittoral fringe, were drawn at each site across the intertidal area. Three random samples were collected from each transect using 1m x 1m quadrats. The Shannon-Wiener index (H) was used to assess diversity while mean and standard deviation indicated the population density. The results indicated that LF-GG had highest molluscan diversity (H₂₀₀₈₋₂₀₀₉= 3.030; H₂₀₁₄₋₂₀₁₅ = 2.510) as compared to HF-FF (H₂₀₀₈₋₂₀₀₉= 1.832; H₂₀₁₄₋₂₀₁₅= 1.429) both in 2008-2009 and in 2014-2015. In 2008-2009, *Turris* sp. was the dominant mollusc species at LF-GG (0.066±4.443) with an average size of 1.4 cm whereas the bivalve *Donaxin carnatus* was most abundant (0.121±1.68) at HF-FF with an average size of 1.8 cm. However, in 2014-2015, temporal comparisons indicated that there has been a considerable decrease in molluscan diversity at both sites, with the most dominant species being *Conus tessulatus* (2.143±0.350) with an average size of 2.7 cm at HF-FF and *Bulla vernicosa* (5.669±1.372) with an average size of 1.5 cm at LF-GG. The low molluscan diversity at HF-FF could possibly be attributed to prevailing high rate of beach erosion as compared to LF-GG, and the temporal drop in diversity may be attributed to the large extent of coastal anthropogenic activities that have increased over the years.

ORAL- Wednesday – Msikaba 2 – 1640

Evaluation of Kenya's coastal gillnet fishery for management recommendations

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The catch assessment of gillnets was carried out in two counties at 8 landing sites spanning 140 km of Kenya's coast from June 2014 to May 2015. The catch was identified to species level. Relative abundance, size structure, trophic level and CPUE were determined based on six gillnet mesh size categories determined from available mesh sizes and differences in catch composition of the gillnets. Species dominated the mesh categories as follows: *Hyporhamphus affinis* (Tropical halfbeak): 0.5-1.5 inches; *Siganus sutor* (whitespot rabbitfish): 2.0-2.5, 3.0-3.5 inches, *Euthynnus affinis* (Mackerel tuna/kawakawa): 4.0-5.0, 6.0-7.0 inches; and *Himantura uarnak* (honey comb stingray): 8.0-12.0 inches. The catch from meshes > 4 inches included several sharks and rays, which were either vulnerable or endangered. Selectivity of longer fork length and higher trophic level fish was higher in gillnets of > 4 inches, which also had lower juvenile retention. Management of the coastal gillnet fishery will require a trade-off between the level of juvenile retention and the capture of vulnerable or endangered species. We recommend that gillnets of mesh sizes 5.0-6.0 inches be used in offshore fishing grounds because of their low juvenile retention and capture of higher trophic level species, notably Kanadi Kingfish, and very few sharks and rays. Gillnets of mesh sizes 0.5-1.5 should be allowed from September to December for small seasonal pelagic species such as *Herklotsichthys punctatus* (Spotback herring). The trade-offs between avoiding capture of juveniles and endangered or vulnerable species versus fisher needs, for example to fish in lagoons for rabbitfish, will be discussed.

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POSTER

Benefits of experiential learning: Example from Chumbe Island Coral Park

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Experiential learning is a process through which learners develop knowledge, skills, and values from direct experiences outside a traditional academic setting. Chumbe Island Coral Park, Ltd (CHICOP), a privately managed no take marine protected area, off Zanzibar, with an extensive education programme applies experiential learning in environmental education. The education programme has been in place since 1996 to raise awareness on environmental conservation, marine ecology, sustainability, forest conservation, waste management and eco-tourism among other things to school children, community members and governing bodies. Chumbe has e.g. taken part in developing the school curricula for marine ecology, and in recent years the education programs are implemented according to Education for Sustainable Development (ESD).

During field excursions to Chumbe Island, learners get the chance experience the natural environment at the same time as they are learning about it. For example the educators lead the learners on a guided snorkel swim along the coral reef, pointing out interesting things. After the snorkelling the learners participate in a food web game pretending to be different animals and thereafter discuss what they have experienced.

Another opportunity for experiential learning is during the Chumbe Challenge Environmental Award competition that CHICOP introduced in 2006. Schools that have participated in the field excursions are encouraged to establish an environmental club that engages students to take positive actions on environmental issues in their school and surrounding communities. The members of the club can participate in the competition and to enter they have to implement two environment projects within 6 months, which are assessed and awarded by CHICOP. Over the years projects have been e.g. installing rainwater harvesting system and creating gardens. The benefits of direct experience during the learning process cannot be emphasized enough. We hope that we can inspire to include experiential learning in your teaching!

ORAL- Wednesday- Msikaba 2- 1700

PERSPECTIVES ON SUSTAINABLE MANAGEMENT OF BAIT FISHERY ALONG THE WESTERN INDIAN OCEAN REGION

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Bait fishing (hook-line, baited-traps), an important tropical artisanal livelihood strategy, has attracted limited attention among researchers and policy makers. It is regarded as environmental friendly, and hence the open nature, along most of the Western Indian Ocean region. This study employed fisher interviews and field sampling to elucidate patterns of bait exploitation at Mida creek, a Kenyan marine biosphere reserve. A selection of some of the results is presented here. Bait fishers constitute nearly 60% of fishers that know over 10 bait, but target 2 to 4 types, dominated by intertidal invertebrates, such as polychaete, hermit crabs and gastropods. Baits are currently undervalued ecosystem service, harvested by collection (hermit crabs and gastropods) or excavation into sandy-muddy (polychaete) at accessible exposed intertidal substrates. Bait harvesting rates are dependent on bait type, but ranges from 3 to 110 kg.yr⁻¹, largely governed by optimal foraging principles. The baits are used to land 180 to 950 kg.yr⁻¹, of over 20 types of fish dominated by lethriniid and lutjanidae. Most of the fish landed are immature, and belong to mid-trophic levels. Bait overharvesting impact targeted and non-targeted populations, but also community structure and functioning. Similarly, bait overfishing precipitates disappearance of high value species, trophic cascades and eventual collapse of the fishery. Bait harvesting effort controls attempted elsewhere, that include quotas and closed season, may be unsuitable for multi-species harvesting, but when combined with input controls, such as fishing gear and area, are recommended. Inadequate policing may require significant investment in community participation. Otherwise, alternative bait types and sources (e.g. artificial culture and lures), may also offer respite to beleaguered resources and habitats. Additionally, concretizing alternative livelihood strategies (e.g. tourism, farming and trade), especially among parttime fishers, may be crucial to reducing fishing pressure.

POSTER

Impact of invertebrate bait harvesting by artisanal fishers on migratory shorebird food resources at the Mida creek and implications on avifaunal conservation efforts

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Tropical tidal wetlands, such as the Mida creek World Biosphere Reserve, are stopover habitats for foraging and roosting, resident and migrant shorebirds. 72 Palearctic migrants, especially, sand and crab plovers, are commonly encountered at Mida creek. Migrant shorebirds are especially vulnerable to disturbance due to habitat modification and disturbance of their feeding and roosting habitats. Availability of preferred food resources, such as crustacean, crabs, mollusks, and polychaetes is critical to their conservation. While foraging patterns of most shorebirds is well documented,

the effects of intertidal harvesting of invertebrates bait by artisanal fishers are poorly known. This study compares abundance and composition of known intertidal shorebird food resources, among sites under different levels of intertidal bait harvesting at the Mida creek. Benthic invertebrate occurrence of shorebird food taxa, were compared among sites with low (Kirepwe), Moderate (Dabaso) and high (Mayonda) bait harvesting. Results indicate sites with high harvesting recorded significantly higher benthic food density (92.2 ind.m⁻²), but diversity were similar among the sites. At all sites, food species densities were dominated by *Uca* sp and *Terebralia* sp, among epibenthos, and *Marphysa* sp, among endobenthos. At high harvesting sites, crab taxa declined, while *Marphysa* density increased. This suggests that artisanal fisher harvesting of intertidal invertebrates, may enhance density of endobiota while decreasing predominance of epibiota. Intertidal shorebird food resources may be more dependent on substrate characteristics, and thus conservation of avifauna should concentrate on these habitats with adequate food resources. While human activity may not directly influence shorebird food resource availability, it may affect avifaunal foraging behavior and requires evaluation

ORAL-Thursday- Msikaba1- 1640

Influence of local fish grading systems in value chain structure differentiation

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Fish grading systems have been described in commercial fisheries based on qualitative and quantifiable attributes. They also influence the resultant value chain structure. The grading systems are aligned to three main differentiation attributes; fish species, fish size and the end-user purposes. In small-scale fisheries, fish grading is largely informal and the extent to which fish grades influence the value chain structure has been inadequately described. This study describes the applicable fish grades based on identified attributes and explores how the grades influence the resultant value chain structure. The study was undertaken at four sites in Kenya's coast; Malindi, Mayungu, Shimoni and Vanga. Methods applied in data collection targeting fishers, fish traders and women fish mongers (mama karanga) included structured interviews, focus group discussions and field observations. Data were analyzed to delineate specific fish species aggregated to genus level by market type, estimated fish grades and the price ranges they attract. The results indicated that fish grading in small-scale marine fisheries is defined by fish size, fish species and market conditions where different fish grades attracted different prices. Fish grading patterns were clear in some sites and species and hence influencing the value chain structure but not in others. Some fish species were more correlated to specific nodes, while others were sold across the different nodes. Fish traders target higher value fish grades for the tourism and urban markets, while mama karanga's target low valued fish grades as part of their business strategy. These findings are useful in identification of the most appropriate nodes and fish types for value chain development.

ORAL- Wednesday– Msikaba 3 – 1200

Analysis of the achievements of the UNEP-GEF WIO-LaB Project focused on addressing land-based sources and activities in the Western Indian Ocean

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The WIO-LaB Project ‘Addressing land-based sources and activities in the Western Indian Ocean’ was a flagship project of the Nairobi Convention. The goal of the project was to contribute to sustainable management and development of the WIO region. This study aimed at establishing the achievements of the project. The study involved the stakeholder’s consultations and extensive review of project documents. The study established that the WIO-LaB project delivered key programmed outputs such as TDA, SAP, LBSA Protocol, a regional Clearing House Mechanism and a strengthened Nairobi Convention. The project also delivered several specific outputs to address the objectives of the project. Most of these outputs contributed towards sensitizing and raising awareness of the participating countries on the magnitude of the pollution problem in the region and its effects on marine habitats. The study also examined the key challenges faced in the implementation of the project. The study concluded that the implementation of the UNEP-GEF WIO-LaB Project aroused interest on the part of the governments and key stakeholders to focus their attention to land-based issues are threatening the sustainability of the marine environment. While, the project attained most of the short-term goals, the long-term goals of the project can only be realized in future when governments and key institutions in the WIO Region build their capacity for implementing the Strategic Action Programme (SAP). The outputs generated by the WIO-LaB Project identified gaps to be filled, plans and strategies to be developed at national and regional level including investments that need to be made in order to forestall the degradation of the coastal and marine environment. The study provide key lessons learnt in the implementation of the project and makes recommendations that can inform future processes for the implementation of multi-national projects in the WIO Region.

ORAL- Monday – Msikaba 4 – 1440

Microsatellite markers for the development of genetic studies in siganid species of the Western Indian Ocean

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The siganids are commercially important species as they represent one of the main food resources for coastal communities in the Western Indian Ocean (WIO) region. Because there is a rising concern about their over-exploitation, studying genetic connectivity of the species

across the region can help to improve the management strategies. To develop efficient population genetic studies on these species in the WIO, we first developed suitable, highly informative microsatellite markers for a selected species (*Siganus sutor*), then we tested the utility of these markers on other species of the family. Using the DNA of a specimen of *Siganus sutor* from Mozambique, a microsatellite library was enriched and sequenced using 454 pyrosequencing technology. We developed 19 *Siganus*-specific microsatellites, and tested 14 additional universal microsatellites developed for acanthopterygian. Their degree of amplification and their polymorphism were investigated in *S. sutor* samples from different locations in the WIO region. In total, 25 markers successfully amplified and 17 were polymorphic. The selected loci were applied in cross-species amplification using 13 *Siganus* species from the Indo-Pacific. Moreover, these loci were used to identify two independent populations in *S. sutor*, one in the Mozambique Channel and one in Mascarene. These results illustrate the restriction of gene flow between the Mascarene and the Mozambique Channel and suggest that these populations should be managed independently. However, additional microsatellite markers need to be specifically developed for the other species of the family.

POSTER

Utility of DNA barcodes across different phases of life: A tale of Rabbitfishes in the Western Indian Ocean

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Accurate species identification is of key importance in addressing questions concerning biodiversity and fisheries management. Traditional identification based on morphological characteristics is time consuming and often inaccurate, as many species exhibit similar morphologies during early life stages. Therefore, for many species a more accurate approach is needed. The aim of the present study is to evaluate the usefulness of DNA barcoding technology as a tool in the accurate identification of the cryptic, yet commercially important, siganid species collected from fisheries surveys throughout the Western Indian Ocean. A mitochondrial DNA gene, cytochrome b, is used to identify the specimens of siganid species varying in age/length from different locations throughout the region, including Kenya, Mozambique and Madagascar. Neighbour Joining

analysis and the Kimura-2-parameter (K2P) model are used as support to identify the species and to analyse the species diversity in the fisheries survey. The present study demonstrates the usefulness and accuracy of the barcoding approach as a tool in the species-level identification of siganid species. Furthermore, identification accuracies are examined and discussed with respect to the age/length of landed fish. Results of this study provide useful information in determining identification accuracies based on age/length, thereby allowing surveyors to establish a minimum survey-size dependent on the acceptable levels of accuracy/error.

ORAL- Monday- Msikaba 3- 1100

Influence of marine tenure types on livelihoods of fishing communities in Mafia Island, Tanzania

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Globally, various marine tenure regimes are being implemented at different governance levels in an attempt to manage marine resources sustainably. In Tanzania, using Mafia Island as a case study is dominated by different marine tenure regimes including state, open access and communal. However, it is not known which marine tenure regime has more positive influence on livelihoods of fishing communities. This paper analyses influence of marine tenure types on livelihoods of fishing communities in Mafia Island. Data for the study were collected from 120 randomly selected households from four villages in Mafia Island using Participatory Rural Appraisal (PRA), Focus Group Discussions (FGDs), discussions with key informants and questionnaire survey. Content analysis was used to analyse qualitative information collected through PRA, FGDs, and discussions with key informants. Data from questionnaire were analysed using the Statistical Package for Social Sciences (SPSS) computer software. The main analyses were descriptive statistical analysis. Significant differences between categories and tenure regimes were judged based on χ^2 values at 5% level of significance. Ranking and scoring results revealed that state was the most dominant tenure regime with regards to contribution to livelihood capitals because it was ranked first. The results showed that state tenure type was important in contributing to the livelihoods of communities in the study area in many ways, including creating marine protected area (MPA) and organizations for collective action, enhancing the physical capital, supporting income generation activities and enhancing natural capital. In conclusion, the creation of MPA has resulted in the increase of fish abundance and recovery of coral reefs, mangrove forests and seagrass in areas that were almost damaged before the Mafia Island Marine Park (MIMP) took over the management. There is a need for continuing effort in promoting co-management to ensure sustainable management of fishery resources in the area.

ORAL- Thursday – Msikaba 1 – 1440

Seychelles' Sea Cucumber Stock Assessment: management options for sustainable fishery

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Processed sea cucumbers (Beche-de-Mer) are highly sought after as Chinese delicacy, and are known to sell for up to \$200/kg. Because of high price, some popular species are now overfished and has been listed as endangered by IUCN. Furthermore, most species of sea cucumber are understudied and their life history traits such as growth rate, preferred habitat, density, and mortality rate has been unclear, complicating the conservation effort.

Seychelles has been fishing sea cucumbers since the late 1990s. Their main targeted species are *Holothuria nobilis*, *H. fuscogilva*, *Thelenota ananas*, *Actinopyga miliaris*, and undescribed species called Pentard. With fishery being very lucrative, Government of Seychelles has been interested in sustainably management this fishery. Our objective of this study was to: 1) assess current stock status, 2) estimate the population growth rate by region, and 3) estimate sustainable catch limit through spatial stock assessment for these five targeted species.

To estimate current stock size, we used both fishery dependent (fishery log) and independent data (underwater dive survey). Since fishery log was reported by assigned grid area, we ran spatial surplus production model in order to estimate current stock status and various growth rates over the Seychelles water. We used these outputs to run management strategy evaluation (MSE) to estimate sustainable catch limits and possible closure areas.

Total estimated population size showed that the current landing were between 1-9% of the entire stock, but not sustainable due to specie's very low population growth rate. MSE showed that catch needs to be reduced to 80% of current catch for some of the targeted species to be sustainable. Productive area (area with high population growth rate) was limited to certain areas of the ocean, thus we recommend closing some of these productive sites in the east to prevent Allee effect and ensure future stocks.

POSTER

Seagrass fisheries from fishers' perspective

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Small scale fisheries (SSF) are vital for the economy, food security and development of millions of people all over the world. SSF constitute most of all fishing activities in the Western Indian Ocean (WIO) region, and seagrass is a key fishing

habitat. Seagrass is disappearing and overfishing is common in the region, therefore adaptive management approaches are needed. The study's overall objective was to demonstrate a method, and the utilization of the results, to gather crucial information to advance management and local livelihood in relation to SSF in seagrass. Zanzibar in Tanzania was used as a case study and we interviewed 126 local fishers, not including invertebrate harvesting/gleaning. The study showed that fishing strategies in seagrass differed widely. Fish was the preferred catch but gear preference varies among fishers and sites. There was a perceived decline in seagrass distribution and fish catch during the last decade among the interviewees. The overall management efforts of SSF by authorities were perceived as low, especially with distance to authorities' offices. The awareness of existing fishing regulations seemed high among the fishers. However, many believed that these regulations are just on paper and were not applied nor enforced and many were therefore willing to use illegal methods. This study adds to the existing research by providing fishers' perspective of seagrass fisheries from heterogenic fisher groups fishing in great diversity of seascapes, in all points of the compass. It demonstrates how interview information can be used to understand the present situation, i.e. what is being fished, how it is done and when, if there are any changes in fish stocks and how present management actions affects the fishers engaged in seagrass fishery. Furthermore, it shows the importance of investigating different types of fishers and areas as results may vary widely across sites

POSTER

Island-based terrestrial Nature Reserve in Mauritius helps maintain desired quality of its surrounding coastal waters.

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Terrestrial Nature Reserves are designed for the conservation and protection of land biodiversity usually with restricted terrestrial anthropogenic activities. Fishing reserves however are designed for the preservation and conservation of mainly aquatic biodiversity and their water quality has to conform to set Coastal Water Quality guidelines. Though rapid coastal urbanization has deteriorated the water quality of several areas in Mauritius, the influence of protected terrestrial ecosystems on adjacent coastal water quality has still not yet been extensively studied. Thus the coastal water quality of Ile aux Aigrettes Nature Reserve, an island-based terrestrial reserve, and Poudre d'Or Fishing Reserve were assessed for a period of two months in 2014. Physico-chemical parameters including temperature, pH and salinity were measured *in situ* and nitrate, phosphate and silicate concentrations, chlorophyll *a*, micro-phytoplankton abundance, microbial quality indicators (Total coliform (TC), *E.coli*, Faecal coliform (FC) and Faecal *Streptococci* (FS)) were analysed *ex situ*. Microbial pollution was noted at Mahebourg station for Ile aux Aigrettes and at the estuarine station for Poudre d'Or. Only FC exceeded the EPA2002 guidelines by 5 folds at one station at Poudre d'Or. Forty-two and twenty-eight genera of micro-phytoplankton were observed in Poudre d'Or and Ile aux Aigrettes coastal

waters, respectively, with diatoms being most abundant. High density of micro-phytoplankton was recorded in stations close to areas subject to anthropogenic activities but no algal blooms were recorded. Phosphate was the highest occurring nutrient in Ile aux Aigrettes and silicate was the most abundant in Poudre d'Or. Microbial indicators showed strong positive correlations with nutrients. These results indicate that the island-based terrestrial reserve extended its protection to the adjacent coastal water quality. Long term studies on physico-chemical and biological indicators will provide more robust data on the extent to which desired surrounding coastal water quality can be provided by an island-based terrestrial reserve.

POSTER

The dynamics of a season of prawn fishing in Bagamoyo, Tanzania

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The dynamics of a season of prawn fishing was studied using industrial prawn catch data collected from 15 vessels for 6 months (April to October) in 2005 to understand factors that contributed for the declined of prawn fishery in Tanzania. A general linear model (GLM) was used to assess distribution and abundance of two commercially important species of prawns, namely *Penaeus indicus* and *P. Monodon*, in the fishing zone off Bagamoyo. Catch rates were standardised using month, depth, sea surface temperature and vessel effects as variables. All the variables were significant for each of the two prawn species except sea surface temperature which was not significant for *P. Monodon*. Higher catch rates occurred at depths between 7m and 12m in April and May for both species. The mean monthly catch rates increased for both prawn species even during lower peak season for prawn recruitment. The result suggests that the vessels were possibly harvesting the prawns at higher rate than was sustainable. This study demonstrates that the observed declined abundance of prawn stock in the Bagamoyo fishing zone may have been due to overfishing as well as environmental conditions, particularly the variability of sea surface temperature.

POSTER

Can computers count bacteria?: Using macro programming as a tool to improve speed and accuracy for bacterial counts

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Image and data analysis of large datasets manually conducted is tedious and time-consuming. To this end, the use of macro programming within already-running image and data analysis programs would save time and effort. Macro programming is a built-in function of many available programs and does not require an extensive coding knowledge to utilize. Macros function by performing a pre-programmed set of instructions any number of times,

gathering or producing data that it is specially coded for. The manual counting, sizing and analysis of thousands of individual bacterial cells takes a long time. This can be coded for using image and data analysis software macros. Image analysis macros were coded to count and measure the length and width of each bacterial cell using a predefined manual set of parameters. This data for each sample was exported to Excel®. Additional macros in Excel® (now using Excel® coding) were used to sort, delete unwanted data points, arrange and calculate the final required data. This technique took only two weeks to complete compared to the 8 months of manual counting normally required. The macros will be described and its applications discussed.

POSTER

Comparison of seasonal bacterial numbers, biomass and productivity within the KwaZulu-Natal Bight: (ACEP 1, Cruise 1 and 2)

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The KwaZulu-Natal Bight is an oligotrophic system which is dependent both on allochthonous and autochthonous nutrient sources. Heterotrophic bacteria are heavily dependent upon organic nutrient sources supplied by both sources, and as such, the presence or absence of such nutrient sources can be correlated with bacterial numbers and biomass (bacterial dynamics). Here, we present the final set of results showing spatial distribution of bacterial numbers and biomass across the KwaZulu-Natal Bight, derived from ACEP 1 research cruises undertaken during 2010. Samples were taken in surface water, close to Chl-Fmax and in water well below Chl-Fmax. Samples were fixed with formaldehyde, stained with DAPI and cells were visualised by epifluorescent microscopy. Automatic counting techniques were used to reduce investigator bias of cell dimensions (halo effect), as well as to increase data accuracy, reproducibility and reliability. Bacterioplankton dynamics for both cruises (synoptic section), were higher within the photic zone and near riverine-influenced waters, with summer showing for the most part significantly higher dynamics than winter. Irrespective of season, bacterioplankton dynamics decreased with increasing distance from the coast as well as with increasing depth, potentially via bottom-up control mechanisms. Results obtained from the focus section of both cruises showed a significant difference between seasons for the Thukela Mouth and Richards Bay North, with no difference at the Durban Eddy. These results from the focus section suggest that bacterioplankton temporal dynamics were more top-down controlled, rather than environmentally influenced, resulting in fluctuating dynamics over time. Overall, it is proposed that the degree of inorganic nutrient supply to the phytoplankton, resulted in the formation of DOM for use by the heterotrophic bacteria, resulting in a bottom-up control mechanism, where Chl-a concentrations within the euphotic zone induces either top-down or bottom-up control mechanisms on the heterotrophic bacteria directly affecting their numbers, biomass and productivity.

POSTER

Harvesting incema in the iSimangaliso Wetland Park: understanding and managing resource use

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In the province of KwaZulu-Natal (South Africa) harvesting the salt marsh rush, *Juncus kraussii* (incema in isiZulu) is part of everyday life. The knowledge of harvesting and crafting incema has been passed on from generation to generation and is widely used in Zulu culture. iSimangaliso Wetland Park, South Africa's first world heritage site, remains the only place where *J. kraussii* exists in abundance. The stocks however, are being placed under increasing pressure as demand increases.

Currently, in iSimangaliso harvesting is regulated to manage the use of *J. kraussii*. To ensure the conservation of both cultural and ecological resources, harvesting strategies and the resource are being assessed and implementation of monitoring protocols and regulatory methods explored. Recently, community leadership has been more involved in the regulation of the harvesting process adding an interesting dimension to the management of this resource. The effectiveness of current management measures will be discussed in the context of current trends in the use of the resource within the Lake St Lucia and Ozabeni sections of the iSimangaliso Wetland Park.

POSTER

Remotely-sensed phytoplankton size structure in the South-Western Indian Ocean

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The three-component model of Brewin et al. (2010) computes the fractional contributions of three phytoplankton size classes (micro-, nano-, and picophytoplankton) to the overall chlorophyll a concentration. Using in situ HPLC data, the model coefficients were fine-tuned for application to the southern African marine region. The refined model was then applied to seasonal climatologies of MODIS Aqua chlorophyll a over the south-western Indian Ocean (SWIO) region during summer and winter. During summer, high chlorophyll a concentrations ($> 1 \text{ mg m}^{-3}$) were limited to the shelf regions along the coasts of Southern Africa and Madagascar, while values less than 0.1 mg m^{-3} occurred

over most the open ocean regions of the SWIO, between the equator and 40°S. Between 40°S and 45°S, elevated concentrations (up to 0.5 mg m⁻³) were associated with the Subtropical Convergence zone. During winter, chlorophyll a values up to 0.5 mg m⁻³ extended over a much larger area of the SWIO, with low values (< 0.1 mg m⁻³) restricted to the Mozambique Channel and the subtropical gyre east of Madagascar. During both seasons, micro-phytoplankton comprised more than 50 % of the total chlorophyll a in the shelf regions, and less than 10 % in the open ocean, while the converse was true for pico-phytoplankton. During summer, nano-phytoplankton tended to dominate in small patches along the edges of the continental shelves and in the Subtropical Convergence zone, while in winter, they were distributed over a larger area and contributed more to the total chlorophyll a. Characterizing the spatial and temporal variations in phytoplankton size structure in this way will allow the evaluation of the influence of climate change and variability on ecosystems in the SWIO

POSTER

Observation on growth performance of Mud crab (*Scylla serrata*) fattened in three different salinity levels in Pangani estuary

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A study on mud crab (*Scylla serrata*) fattened in three locations with different salinity levels was conducted along the Pangani estuary to determine the growth performance and survival. An experiment was conducted for 70 days at Ferry (39 ppt), Matakani (24 ppt) and Mashine (14 ppt). At each site pens with a dimension of 124 x 124 cm split into 16 cells and fitted with plastic bucket was constructed and each stocked with one crablet to avoid cannibalism. The crablets were collected from the wild and before stocking their body weights and carapace widths were recorded using weighing balance and caliper respectively. Feeding was done once per day using fish offal at a rate of 10% of body weight. The measurements were taken at an interval of two weeks. Environmental and meteorological parameters were recorded from the study sites and meteorological stations respectively. Data on rainfall, atmospheric temperature, and river discharge for the past ten years (2003 - 2012) were recorded from Tanga meteorological station and Pangani Water Basin Authority respectively. There were no significant variations in temperature, dissolve oxygen and pH among studied sites. Rainfall and river discharge showed high fluctuations with years, the highest recorded in 2007 and lowest 2012. The growth performance of mud crab showed significant difference in final weight among the studied sites. (ANCOVA, $P < 0.05$), Matakani showed the highest final weight (345.19 g) and Mashine had the lowest (283.5 g). These difference might be due to differences in initial weight. It can be concluded that although there were variations in final weight among the three sites, salinity levels observed support the surviving and growth of mud crab. It is therefore, recommended that local community in Pangani may explore the possibility of fattening mud crab as one of the mitigation measure of climate change impact.

POSTER

Feasibility of sea cucumber farming in the Bazaruto Archipelago-Mozambique

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Bazaruto Archipelago National Park (BANP), the only marine park in Mozambique was created in 1971 in order to protect dugong, marine turtles and their habitats. In 2011, a partnership with Endangered Wildlife Trust was developed to provide BANP technical, operational and financial assistance, through the Dugong Emergency Protection Project. One activity of the project was to provide alternative livelihood for local communities. In this context, we studied the environmental and economic potentials for the development of sea cucumber farming in BANP.

The study was realized in November 2014 and the area chosen was around Banguera, Bazaruto and Santa Carolina Islands. A flight over the Archipelago by aircraft was conducted before the field observation by boat. Each field observation was realized during low tide and the following parameters were recorded: (i) salinity, temperature, turbidity of the seawater, (ii) water depth and (iii) observed fauna and flora species. Also, for each site, a sediment sample was taken for granulometric and organic matter content analyses. Finally, meetings with villagers and discussions with BANP manager were conducted at the end of the mission.

The results showed that BANP is not a good site for sea cucumber farming. Almost all sites were too sandy and too windy. The sediment was composed especially by sand of medium size (78% +/-5), with a very low amount (<20%) of fine sand (<250µm) and no argil and silt (<63 µm). Also, a very low organic matter content was recorded (0,8% +/-0,4). On the other hand, fishermen clearly expressed their needs to the Government to help them finding alternative livelihoods as no intensive farming was allowed since the Island became a National Park.

According to this study, sea cucumber farming is not feasible at BANP. Instead, we recommend to testing the potential of seaweed farming for the Islands.

POSTER

Understanding the biology of Carangidae in the Seychelles

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Carangid makes a significant contribution to food security in the Seychelles. In effect, it is an essential component to the Seychellois food culture, particularly consumed as part of the famous fish broth known as "Bouyon Bred". Based on fish catch time series generated by Seychelles Fishing Authority (SFA), carangids represents the most common fish species caught as part of the artisanal fishery, with a total catch of 1355 T recorded in 2013, although it does

not hold the same commercial and economic significance as the common Bourgeois, *Lutjanus sebae* (348 T). In Seychelles, carangids are caught mainly by hook and line in the coastal waters around the islands. Regardless of its significance and prevalence, there is a lack of disaggregated data and species specific studies about the main species. Hence, this study aims to establish a baseline relating to the understanding of key population dynamics parameters such as growth, reproductive and feeding patterns for two commonly caught carangid species, *Carangoides fulvoguttatus* and *Carangoides gymnostethus*. The specific objectives are to i) determine length-weight relationship; ii) derive size and age frequency distribution of the catch; iii) determine size and age at sexual maturity; iv) define reproductive biology and periodicity; v) and study its feeding ecology. A maximum of 300 samples per species will be collected over a period of one year. Since February 2015, fish are purchased at various landing sites around the main island, Mahe based on seasonal variability. Each sampled fish was identified, measured (total and fork length), weighed (wet and eviscerated mass), and the sex and macroscopic maturity stage was determined. Finally, samples of otoliths, gonads, muscle and liver was collected and preserved for further aging, histological, isotopic and lipid analyses respectively. This will aid towards better understanding of the Carangid biology for stock assessment and future management plan.

ORAL- Tuesday- Msikaba 1- 1120

Listening to understand. -preliminary study of cetacean depredation on pelagic longline fisheries using passive acoustic monitoring offshore Reunion Island

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Depredation can be defined as the predation of caught fish or bait by free-ranging animals. Since the 1900s, depredation of Reunion's longline fishery by toothed whales is known to contribute significantly to reduced commercial catch (sometimes destroying 100% of the catch). Describing depredation by cetaceans is a key driver in helping implement non-destructive adaptive fishing solutions. With fishing mainly occurring at night and over long distances, passive acoustic monitoring is a promising method. A preliminary study was launched to determine the technical feasibility accompanied by acoustic analysis of associated with depredation.

Over two months (November- December 2014), 3 autonomous hydrophones (HTI-96-MIN) were attached at the extremities and central section of a 30 km longline for 9 fishing operations, 30 miles off Reunion Island. A total of 387 hrs of sound were recorded and analyzed. Biological sounds (clicks and whistles) and physical sounds were quantified over time with two automatic-

methods in relation to recorder locations. Whistle samples allowed species identification using a semi-automatic method (ROCCA classifier). Catch data were correlated with cetaceans' presence.

Engagement and support from local fishers resulted in a final protocol demonstrating good quality acoustic measurements with reduced physical noise. Whistles and clicks represented 34% of all detections (~12% for clicks). Cetacean sounds were detected during all trials with variable detection rates (between 2.5 to 66% of the recorded duration). Distances between hydrophones enabled the drawing of possible trajectories of groups along longlines. On four fishing trials, cetaceans were detected immediately after the line deployment.

Six different species of toothed whales were identified with a predominance of false killer whales (*Pseudorca crassidens*).

Since few signs of depredation were visible on catches, no obvious correlation was determined between the presence of cetaceans and depredation rates. Further investigations are thus required to build on these preliminary results.

POSTER

CAP RUN: Technical Support for Reunion island fisheries-Presentation and Operational programmes

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CAP RUN was established within ARDA (Réunion Association for the Development of Aquaculture) in Septembre 2010 by the will of fishermen and government support. Among the members of the CAP RUN are represented the Regional Committee of Fisheries and Marine Aquaculture, the School of Maritime learning, pelagic longline fishing companies and scientists (IRD-Research Institute for Development, Ifremer-French Research Institute for Exploitation of the Sea).

ARDA & CAP RUN are certified Technical resource center obtained in 2011 and renewed in 2013.

Our goals are:

- Improve the competitiveness of the Reunion fishing fleet in worldwide globalization by applying the best principles of sustainable resource management.
- Being a technical interface between professionals and research
- Being a research and developpement transfer tool

Our works are:

- Evaluate R&D needs for fishing industry
- Workout and implement R&D programs
- Informative and technical resources center
- Knowledge transfer in real-time for fishermen.

CAP RUN had already results on 6 operational programs detailed in a poster (in preparation):

- Programme ENERGIE on the reduction of fuel consumption 5 to 10%. Through the use of an intelligent Monitoring system to following fuel consumption and create a database to providing recommendation. 6 longline pelagic fishing boats equipped, data during 2 years
- Programme RAF : fishing trials of ecological based artificial baits (EBAB) .Comparison efficiency, strenght, selectivity with naural baits (squids). 8563 deployment ont 46 fishing sets.
- Programme OOPPAL : Operational Oceanography for pelagic longline. Training and inittation use oceanographic mapping tools. Analysis catch & environment.
- Programme ECOCEPARE: Understanding and listening marine mammals noises (clicks and whistles) involved in longline depredation. Faisability studies on board. 9 fishing sets. Current results
- Programme PROSPER: tagging tuna (Albacore and Bigeye) to understanding ecological habitats and migration. 9nth mision.
- Programme PELICAN: New technical fishing deployment for an alternative and sustainable fishery. In development.

ORAL- Monday – Msikaba 4 – 1600

Eggnog for beach bugs: turtle-introduced nutrients promote meiofaunal communities in the short term

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Flows of nutrients across ecosystem boundaries can strongly influence consumer populations and food web dynamics. Sandy beaches are nutrient-poor ecosystems that are almost entirely subsidized by allochthonous inputs. Sea turtles introduce large quantities of nutrients to sandy beaches in the form of eggs during the nesting season, and therefore play a critical role as vector of nutrients to sandy beach ecosystems. However, the effect of such allochthonous resources on consumer populations remains largely unexplored. This study quantifies the response of meiofauna to the decomposition of turtle eggs over time in Kwa-Zulu-Natal sandy beaches of South Africa. We first determined meiofaunal densities in depredated nests. Second, we experimentally quantified meiofaunal response to nutrient inputs over time, in situ, by comparing the meiofauna from 5 artificially predated pseudo-nests with those from 5 control pseudo-nests, sampled daily for three weeks. After five days, the meiofaunal communities in the experiment treatment were strongly different to those in the control treatment: abundance of all taxa increased dramatically, particularly of the consistently dominant nematodes. The peak of the response (maximum nematode abundance: $\sim 500\,000$ indi. 40 ml^{-1}) was observed after nine days. Thereafter, their density declined until only the control treatment density (<1000 indi. 40 ml^{-1}) was reached again after 21 days. Given the enormous quantity of turtle eggs deposited on sandy beaches at the dune base, our study suggests that this seasonal input represents a pulsed resource that makes a significant contribution to the energy budget of beach systems. Further, the turtle nesting phenomenon may play a key ecological role in structuring faunal communities of sandy beach ecosystems.

POSTER

Assessment of the Status of Commercial Finfish Species in Mangrove Systems of Kisakasaka and Uzi, Zanzibar.

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Knowledge on the status of commercially important mangrove dependent finfish species in Zanzibar is limited to Chwaka and Makoba mangrove systems. In the present study spatial variation in fish size structure, proportion, relationship between water environmental factors and fish abundance were established at Kisakasaka and Uzi Island mangrove ecosystems. The study aimed at generating information on the position of mangrove dependent commercial finfish in these relatively unstudied ecosystems. Fish samples were obtained with seine net at low spring tides. Sizes were measured and length-weight regressions were established. Fish assemblage structure was determined and size structure of the most common species established. Correlations between fish abundance and environmental parameters such as water temperature, pH, salinity and Dissolved Oxygen were investigated. Analysis indicated that environmental factors had little influence on fish abundance at both Kisakasaka and Uzi sites. Size structure varied significantly between sites for all target species unlike proportion which varied significantly only for *M. cepahlus* species. Absence of key species, such as the milkfish *Chanos chanos*, which is currently being promoted as a key species for small scale aquaculture in Tanzania, could indicate that fingerling supply from the wild may be a constraint to the fast-growing aquaculture industry in future. We conclude that commercially important finfish in mangrove systems of Zanzibar are unsustainably harvested. Therefore, urgent conservation and sustainable management initiatives of these resources and their environment are required to protect them from further decline

POSTER

Environmental factor influencing the distribution of *Scylla serrata*'s holes in mangrove

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The mud crab, *Scylla serrata*, is a common species of the Indian Ocean mangroves. Since few years the fishing pressure has greatly increased throughout Madagascar. The acquisition of knowledge about biology and ecology of populations is essential to improve management plan and conservation approaches.

The objective of the study was to characterize the habitat preferences of the mud crab for the building of holes in the Belo-sur-Mer mangrove, southwest of Madagascar. Holes have an essential functional role to limit the exposure of adult crabs to predators during the critical stages of their life cycle. Three areas were surveyed by performing a series of

transects in order to describe the available habitat conditions and those used for the hole construction. A total of 15 environmental parameters was systematically recorded. These parameters reflected the position of the sampling point into the mangrove, the physico-chemical conditions, the substrate features, and the surrounding floristic composition. A total of 140 crab holes were observed and 168 available sampling points have been described during low tide. A Boosted Regression Tree model was used to determine the preferred habitat conditions. The mud consistency was the most important parameter and showed a marked avoidance for hard substrates. The distance to the bank reflected a preference for areas located on the outer edge of the mangrove. The physico-chemical parameters also showed preferential conditions for a salinity of 38 ‰ and a pH above 6.5. In addition, the occurrence probability gradually decreases with the foliar covering rate.

Highlighting habitat selection for the building of holes in *Scylla serrata* reveals promising methods for the identification of essential mangrove areas that have a functional role in the conservation of mud crab populations.

POSTER

Macrobenthic zonation and influencing factors in the iSimangaliso Wetlands Park for inclusion in Marine Protected Area planning

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Soft bottom habitats dominate the ocean benthos, undertaking numerous vital functions for ocean maintenance including nutrient cycling and food provision. Data deficiencies exist for most benthic environments, however it is particularly evident in the tropics and subtropics, such as the subtidal areas inshore of Two-Mile reef within the iSimangaliso Wetlands Park. As this park has been a protected area for approximately 65 years, it does allow for the identification of baseline conditions where relatively little human impact has occurred.

We measured physico-chemical parameters inshore of Two-Mile reef and associated benthic fauna. Physico-chemical parameters did not vary significantly between the coral reef and the shoreline, or throughout the water column. This is likely due to the turbulent environment not allowing notable structuring of the water column to occur. However microphytobenthos (MPB) chl-a increased in concentrations from the reef towards the shore, as well as towards the Mgobozeleni estuary mouth. This is likely due to increased nutrients from the estuary and water seeps originating from Lake Mgobozeleni or Sibiyi. Overall MPB chl-a appeared to increase over the winter months but decline in summer (1.58-36.80 mg chl-a/m²). As expected for oligotrophic areas surrounding coral reefs the chl-a concentrations in the water column remained low throughout the year and over the entire sampling area (0.17-0.86 mg chl-a/l). Sediment grain size, changing considerably throughout the sampling area, impacted the structuring of the macrobenthic community assemblages and caused zonation patterns, where abundance increased with decreasing grain size. Macrobenthic diversity for the entire study area remained high. As MPAs have historically been primarily structured according to habitats with more fashionable foci such as coral reefs, such information is important for future planning and regulations to ensure the protection of these diverse habitats and needs to be taken into account when planning MPAs and when granting exploitation rights.

ORAL- Thursday – Amadiba- 1620

Marine GIS for Assessment of the impacts of Sea Level Rise in Mozambique

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Mozambique is potentially prone to the impacts of sea level rise (SLR) as largest cities extend north-south over low coastal lands. Moreover, the specific estimation of inundation impacts from projected rates of SLR has not yet produced due to the lack of comprehensive digital elevation maps for most of coastal cities. However, at the present there are available three global digital elevation models (GDEMs) with a near-global coverage, SRTM-30m ASTER-30m and, lastly the GMTED2010, a new enhanced product to replace the GTOPO30. Although the GDEMs play an important role on assessment of impacts of coastal inundation, vertical accuracy varies significantly depending on the land cover. This study aims to assess the impacts of SLR for all over coastal cities. However, due to limited availability of comprehensive digital elevation maps at high degree of resolution, it was therefore investigated whether the GDEMs might be suitable for modelling SLR. Thus, the three near-global coverage products, respectively ASTER, SRTM and GMTED2010 elevation data, were simultaneously validated with respect to LIDAR Datasets and digital topographic maps, objectively to understand the potentials and limitation on SLR modelling. Results based-on Marine GIS technology pointed out accuracy to ASTER-30m, with a RMSE of 2.49 and 2.07, in comparison to LidarDTM and TopoDTM, respectively. In addition, the ASTER and GMTED2010 DEM revealed a coarse height offset of RMSE about 6.91 and 4.85, respectively with reference to LidarDTM and, similarly, a RMSE of 6.54 and 1.72, comparatively to topoDTM. Thus, by integrating SRTM-30m Low-elevation data and hydrographic bathymetry into one feature layer, were built the Digital Elevation Models used subsequently on predicting coastal cities vulnerable to SLR by 2100 and beyond. The cities were ranked into low, medium and high vulnerability based-on assumptions, taking into account past, present and future shoreline retreat.

POSTER

Spatial and temporal patterns of fisheries effort around the De Hoop Marine Protected Area

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Fisheries have led to the collapse of many fish populations. This is particularly true for reef fish species that are resident, slow growing, late maturing and long lived. Marine Protected Areas (MPAs) are considered to be key reef fish management tools. The management functions fulfilled by MPAs centre around three criteria: (1) habitat conservation, (2) protection of broodstock within an MPA and (3) fish population replenishment in the areas adjacent to an MPA. The replenishment of fish stocks in the fishing grounds

surrounding an MPA occurs through spillover of adults and larval export. In turn, stock replenishment is advocated as a benefit for fishing communities that can access these areas. To test this, long-term commercial catch per unit effort (CPUE) data were analysed for the areas surrounding the De Hoop MPA, South Africa. The De Hoop MPA is an old (30 years) and large (253 km²) MPA, situated near prominent fishing grounds where commercial CPUE data are available from the year the MPA was established. Trends in the spatial and temporal patterns in catch were analysed through predictive generalised additive models and effort mapping in two areas, one close to the MPA boundary (≤ 5 nmi) and the other isolated from the MPA boundary (>5 nmi). Results from the dominant reef fish captured in the area indicate no clear pattern in the spatial movement of the fisheries for both areas and the main fisheries focus remained at the area isolated from the MPA boundary. However, CPUE showed a steady decrease over the years for all reef fish species analysed with a subsequent recovery in recent years. This trend was similar for both areas analysed.

POSTER

Seasonal zooxanthellar clade C photo-physiology in *Acropora muricata* colonies with different light and thermal histories.

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Bleaching of *Acropora muricata* was observed in reef flat (RF) but not in near coast (NC) colonies in Belle Mare, Mauritius. Seasonal fluctuations in environmental data, photo-physiology and zooxanthellae clade composition of *A. muricata* colonies were simultaneously examined to understand the variable bleaching pattern within this coast-reef scale. Sea temperature (ST) and light intensity were recorded using data loggers deployed at NC and RF stations. *In situ* photo-physiological parameters of zooxanthellae were measured with a Diving-Pulse-Amplitude-Modulated Fluorometer (D-PAM). Zooxanthellae clades were identified by polymerase chain reaction and restriction fragment length polymorphism analysis (PCR-RFLP) of 18S-rDNA. *A. muricata* harboured a *Symbiodinium* clade C variant at both stations. Both stations experienced maximum summer ST of 30.5°C but daily ST fluctuations in summer and winter 2014 were higher in NC station (3-5°C) compared to RF station (1-1.5°C). RF station experienced higher light intensity both in summer (11600 lux/ft²) and winter (5000 lux/ft²). Zooxanthellae had higher effective quantum yield (0.60) at photosystem II (PSII) in winter for both stations. Maximum non-photochemical quenching (NPQ_m) at PSII was higher in summer for NC colonies but slightly higher for RF colonies compared to winter despite experiencing a 2.5 fold higher light intensity. Maximum relative electron transport rate (rETR_m) was higher in summer for NC colonies (120 $\mu\text{mol electrons m}^{-2}\text{s}^{-1}$) but lower for RF colonies (62 $\mu\text{mol electrons m}^{-2}\text{s}^{-1}$) compared to winter (80 $\mu\text{mol electrons m}^{-2}\text{s}^{-1}$). A relatively lower summer NPQ_m of RF colonies at higher light intensities, may imply lower photo-protection effectiveness compared to NC colonies. Lower rETR_m of RF colonies in summer may suggest a dysfunction of the PSII apparatus and an early sign of bleaching. These differences in photo-physiological responses may make RF colonies more

susceptible to bleaching compared to NC colonies and thus possibly explain such bleaching variability at a coast-reef scale.

ORAL-Wednesday –Msikaba3 -1140

The effects of recent changes on the resilience of WIO atolls, some hints from Kiribati (Pacific islands)

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Atoll states are confronted with media coverage of their extinction because of climate change and especially sea-level rise. Atolls are considered particularly at risk because of the low elevation of islands, just 2-3 meters above mean sea level, and because of their limited land area. Moreover, over the last decades, some atolls are concerned by fast mutations linked to their integration to World-system: urbanization, pollution, exhaustion of resources, malnutrition, social disintegration, foreign dependence, etc. In the capital atoll of Kiribati, Tarawa, the population has been multiplied by 16 between the end of the Second World War and today. The density reaches 1 800 inhabitants per km². New pressures on ecosystems have appeared with this fast increase of population and buildings on Tarawa. In Indian Ocean, the atoll of Malé (Maldives) is also highly concerned by this kind of issues. This communication will discuss of the recent evolutions in the resilience of the atoll of Tarawa doing some parallel with the situation of Malé.

The results on Tarawa that will be presented are based on: (1) a population survey led in Tarawa on personal capital, access to natural local resources, on state of ecosystems, on climate-related hazards and on climate change; (2) semi-structured interviews conducted with stakeholders on governance and management plan for Tarawa; (3) analysis of statistical data from census of population; (4) analysis of aerial photographs showing the evolution of settlement and land use in the past fi

POSTER

Marine Turtle Strandings at Ponta do Ouro Partial Marine Reserve, Southern Mozambique

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A total of 35 marine turtle strandings were recorded over a period of 6 years (2008 – 2014) in the Ponta do Ouro Partial Marine Reserve in Southern Mozambique. Records from marine turtles found dead were from green (*Chelonia mydas*, n=12), hawksbill (*Eretmochelys imbricata*, n=8), loggerhead (*Caretta caretta*, n=7) and leatherback turtles (*Dermochelys coriacea*, n=1). Shark injuries were clearly identified in 3 of the strandings: *Caretta caretta* (n=2) and *Chelonia mydas* (n=1); entanglement in fishing nets was reported in *Chelonia mydas* (n=1) and a dune stranding of a nesting *Dermochelys coriacea* (n=1) was also reported. For the remaining marine turtles found stranded no immediate cause of death was identified. Records of

marine turtles found alive and in unusual circumstances were only for green turtles (*Chelonia mydas*, n=7). These were mostly juveniles washed up in the surf. *Chelonia mydas* and *Eretmochelys imbricata* do not nest in the area and their deaths have been presumably caused by thermal shock caused by sudden drops in temperature. A more systematic and detailed data collection from stranded marine turtles is necessary in order to provide valuable biological and ecological insight on seasonal and spatial patterns of occurrence, age structure, sex ratio, diet, life history, as well as a better understanding into the different mortality causes of marine turtle populations in this region.

ORAL- Wednesday-Msikaba 2- 1440

Small-scale reef fishery in the north west of Madagascar: a relatively healthy fishery

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Madagascar small-scale fisheries support the livelihoods and well being of millions of inhabitants, providing a crucial source of dietary protein and generating revenue. In 2012, Madagascar's Government endorsed a new marine fishery policy in order to help in better governance. To assist this process, fishermen participatory surveys were realized in November and December 2014 in 12 villages of the lesser-studied Nosy Be area, in the northwest of the country (n=192). The traditional fishery in the bay is characterized by non-motorized pirogue and is a non-selective multi-gear multi-species fishery. A total of 73 species (in 52 family group) was landed from the bay. Species composition showed that catches were dominated by carnivorous fishes, with 4 families representing over 60% of the total catch – the Lethrinidae (emperors), Serranidae (groupers), Carangidae (jacks) and Lutjanidae (snappers). In terms of abundance and biomass, the most dominant family group was the Lethrinidae (57.58% and 27.98% respectively). Herbivorous fish (Siganidae, Caesionidae, Labridae, Sparidae, Scaridae) represented only 6.37% of the total species landed. During the study period, seven fishing gears were used in the studied villages (handline, gillnet, longline, speargun, spear, beach seine and a combination of several). Catch per unit effort varied largely between gear used, with the highest being the longline and the beach seine (22.9 and 23.57 kg/boat/day) but the lines and gillnet were the most commonly used (n=359 and 117). In reef fisheries, species composition is a powerful indicator of reef health, and has proven to be the most readily measurable effects of fishing pressure. The relative health of Nosy Be fishery can be explained by the fact that fishing is only a secondary activity after tourism in the region and the lower fishing effort means lower trophic level are not targeted yet.

ORAL- Monday- Msikaba 2- 1720

Methane emission from tropical seagrass meadows increases by disturbance

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The contribution of the greenhouse gas methane from natural sources to global warming highlights the need to identify and accurately estimate its emissions from both pristine and disturbed ecosystems. In an experimental field study, the *in situ* emission of methane was measured in a tropical seagrass meadow with experimental treatments exposed to five months of constant stress from two levels of shading and mechanical stress (leaf clipping), as well as an undisturbed control treatment. Both types of disturbances (light reduction and tissue removal) caused pronounced increases in methane emissions, with up to six times the levels of the control plots. By reviewing the empirical literature, we found that research on methane emission from coastal marine ecosystems is overlooked, and to our knowledge, no previous study has experimentally explored the effect. These findings suggest that disturbance to these marine plant systems might impair their oxygen transport into the sediment, promoting anoxic sediment conditions, which in turn favor methanogenesis and ultimately production and emission of methane that will contribute further to global warming

POSTER

The marine reserve of Bimbini, embryo of Comoros marine park

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In the west of Anjouan island, the Bimbini village includes at the coastal level a remarkable unit, consisted various types of mangroves bordering a large lagoon limited in the ocean by a large coral reef. The mangroves diversity and the marine species make it a major element of Comoros coastal biodiversity conservation. This coastal zone constitutes a significant traditional resource for the twelve villages of the peninsula. Proposed to be classified inheritance world of humanity, this zone has been projected for the creation of a protected marine area awaited impatiently by the local population.

In 2011, the installation of the Marine reserve of Bimbini managed by the local fishermans and UMAMA association allowed a management more or less conscious of the resources. Only, the non-application of the law has a good chance of discouraging the managers.

By the direct observation, islets, beaches, whales, dolphins, makis, bats, baobab trees, clove trees, ylang-ylang... provide the ingredients of the ecotourism. The presence of endemic, rare or threatened species, of landscape inheritance of a great aesthetic and floristic value are true assets. The coastal unit also includes the seagrass, small lagoons and marine pools propitious to aquaculture development, site of food or big-shot for many species of which birds, marine tortoises and dugongs.

For the resources conservation, UMAMA conducts activities of: Community awareness, garbage management, cleaning beaches, mangroves restoration, coral monitoring, setting biological rest of fishing areas, enlistment the municipal police in the environment protection, reception tourists in host families, annual organization of the "Festival de Mangrove"...

Poaching of the tortoises, taking away of sand, discharge of rubbish, use of the destroying methods threaten this biological diversity. This is why urgency of a legislative protection and an ecological rehabilitation.

ORAL-Monday- Msikaba 2- 1640

Peri-urban mangroves of Dar es Salaam-Tanzania are highly vulnerable to anthropogenic pressures

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Dar es Salaam city is the major economic hub of Tanzania. It has a population of 4.36 million (10% of the total population in the country) with increasing projections to 5.12 million by 2020. This high population attracts ever-increasing demand for socio-economic services including infrastructure and property development, and exerted multiple pressures on its coastal and marine resources, and mangroves are not spared. The aim of this study was to assess, and map the anthropogenic threats and determine the vulnerability status of mangrove stands at Kunduchi and Mbweni in the outskirts of Dar es Salaam. The threats were identified and validated through field observations and vulnerability scores were assigned to the mangroves (on a 1-3 scale) based on the factors of threats' proximity, persistence and respective area of mangrove modified. Salt pans and settlements representing major threats were digitized from Google Earth image. Normalized Vegetation Index (NDVI) from Landsat 8 images of 2014 was analysed in QGIS. Analysis revealed that, the pressing threats in Kunduchi were salt works and settlement encroachment. In Mbweni, degradation was mainly due to trampling, but compounded by inland floods caused by heavy rainfall which occurred in 2013. Using the 2014 images, the mangrove cover in Kunduchi and Mbweni were estimated as 157.3 and 42.1 ha respectively. In 2003-2014, the mangrove area gained by 12.0 and 0.7 ha in Kunduchi and Mbweni, respectively but NDVI values indicated poor health. About 40% and 31% of the mangroves in Kunduchi and Mbweni, respectively, were found to be highly vulnerable to anthropogenic pressures. This requires strengthened control measures to regulate human pressures and protect these critical mangroves. Promotion of incentive based conservation schemes like community-based payment for ecosystem services is one of the plausible options to explore.

ORAL- Monday- Amadiba- 1100

Back to the future: the relevance of evolutionary and geological history to predictive models

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Marine spatial planning initiatives generally rely on information garnered from populations and systems sampled in contemporary times. Using data-sets from the present we are able to model and predict potential shifts in the distribution of species amongst suitable habitats. South African reef coral communities are found at the margins of reef coral distribution and have formed a veneer on submerged aeolianite and beachrock, remnants of ancient shorelines stranded on the shelf by rising sea levels. The presence of these submerged shorelines are fortuitous, having promulgated reef coral communities rich in biological diversity. However, it is significant that these reefs were recruited to by coral fauna and not the result of biogenic accretion. One predicted outcome of climate change is that the range of hard corals will shift from the equator poleward. This could result in current marginal reef coral populations becoming reservoirs of genetic diversity, the assumption being that habitat that can be recruited to will be available for this shift in range. Using ancient submerged coastline characteristics and their relationship to shifts in climate and sea-level, together with contemporary distributions of coastal marine organisms and their evolutionary histories, we demonstrate the importance of habitat availability and character. These patterns and the timescales at which they have emerged are important for current MPA plans to incorporate.

POSTER

Empowering local communities to enable socio-economic development while ensuring environmental sustainability in Coastal Kenya: Case of Tana River County, Kenya

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Development Fund for the Coast translated in Kiswahili as Hazina ya Maendeleo ya Pwani (HMP) is a fund under the Kenya Coastal Development Project (KCDP) which aims at enhancing natural resource conservation and social wellbeing in the six coastal counties of Kenya. Through the HMP grant scheme, Common Interest Groups (CIGs) in Tana River County identified and prioritized the challenges and opportunities that need to be addressed to ensure that the communities live a healthy and productive life. All project ideas were scrutinized for their environmental and social impacts to safeguard against adverse impacts. The capacity of CIGs to implement projects was then enhanced through training and provision of technical expertise. Close supervision and monitoring was provided to ensure that implementation of projects is on track. Sixteen projects on enhancing access to portable water, sanitation services, education and animal health & agro-forestry have been

funded in the county. A total of 80 members of the sixteen CIGs have been trained on procurement, financial and audit procedures and guidelines in a bid to enhancing their capacity to execute community projects approved. The expected benefits include enhanced access to portable water to 3050 HH, enhanced access to sanitation services to 11100 people, improved learning conditions for 1000 students, improved animal health for over 40000 livestock and increased tree coverage. Further, to ensure inclusivity of Vulnerable and Marginalized communities in local development a group drawn from the same was supported in their small scale irrigation project aimed at improving their food security status. It is envisaged that communities will be empowered to participate effectively in sustainable local development on the prioritized sectors.

ORAL-Monday – Msikaba 1- 1100

Seasonal Variation of Plankton Communities at Sofala Bay, Mozambique

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An investigation of seasonal variation in plankton at Sofala Bay, Central Mozambique has been carried out in a bimensal basis from August 2012 to March 2014. The study was performed in twelve fixed stations from the mouth of the Pungue/Buzi Estuary facing Beira City coast to a distance offshore of about 45km. In this study, we investigate the major taxonomic groups of plankton occurring in the Bay and the relationship between spatial and temporal variation of plankton in water mass and the effects of water physical and chemical parameters at the Sofala Bay. Sampling included water mass, physic-chemical parameters by means of STD/CTD model 204, nutrients, chlorophyll and phytoplankton with net of 40 µm pore aperture and zooplankton with net of 100µm pore aperture. Nutrients showed maxima in December when rain provide the higher outflow of rivers discharging into the Bay and around August when the winds blowing effects starts mixing water. Two annual variations in chlorophyll-a concentration and phytoplankton abundance were recorded in December and August with higher values in December months. Phytoplankton was very diverse presenting marine, estuarine to intermediate groups. The Bacillariophyceae was the most dominant Class of phytoplankton. During the study period two Phytoplankton blooms were identified during the hot and rainy period in February 2013 (*Phaeocystis* sp.) and December 2013 (*Trichodesmium erythraeum*). Zooplankton community dominated by copepods was diverse and presented several unidentified larval stages. The MDS analysis showed that seasonality is the key factor explaining both phytoplankton and zooplankton variation than spatial grouping. The peaks in abundance of zooplankton followed closely phytoplankton peaks special the herbivorous. The results indicate a need for more studies in this Bay in order to understand the origin and probable effects the frequent blooms may cause to the environment

POSTER

Perception of transformation and sustainability from coastal and marine resources in a fast changing town of northern Mozambique

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The oil and gas development in the Cabo Delgado province of northern Mozambique is resulting in rapid socioeconomic changes for local communities and the environment. High levels of investment in infrastructure, the tourism sector and formal employment present an opportunity for a long neglected part of the country. However, little is known about the actual effects of current developments on livelihood security and wellbeing for disadvantaged people. To assess the effect of current changes on livelihood security and wellbeing, a detailed household survey, focused on recent changes, was conducted among 148 households (including 39 fishermen) living in a poor quarter of Pemba Town, Cabo Delgado province. The study aimed to assess sources of vulnerability, levels of subjective wellbeing and how these are affected by both socioeconomic and environmental changes. The results indicate that survey respondents showed some level of satisfaction with recent changes as it provided more employment opportunities, due to economic transformation and development. These positive effects were impaired by the recent negative climate related impacts that resulted in loss of infrastructure, indicating the remaining vulnerability. However, the development opportunities help the communities to recover faster from these negative impacts. Despite more employment opportunities in sectors such as construction, merchandise and tourism, report indicate reduction of fisheries which has prompted fewer revenues. Increment of migrant fisherman specially those coming from other areas as well as Tanzania could explain fisheries reduction. Transformation of Pemba town area and the associated surroundings demands however additional marine resources management.

ORAL- Tuesday – Msikaba 3 – 1200

Important habitats and environmental drivers of macrobenthos on the KwaZulu-Natal Bight, South Africa

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Coastal habitats are shaped by water column and seabed attributes and distinct combinations of these characteristics influence continental shelf organisms. The wide KwaZulu-Natal (KZN) Bight shelf on the east coast of South Africa is recognised for its biological importance, mostly attributed to the range of environmental conditions from local oceanographic features that are Agulhas Current, wind driven and influenced mid-Bight by Thukela River outwelling. The KZN Bight was the focus of a multidisciplinary

investigation on the sources and influences of nutrients to the shelf. One element was a study on the poorly-known macrofauna (<1 mm), distributed on soft sediments along a mid-shelf transect north to south, and three coast to shelf edge transects on the northern, central and southern Bight. Community attributes such as taxonomic composition (No. Taxa [S]) and frequency of occurrence (Abund.No.m⁻² [N]) were used as response variables to environmental predictors related to bottom type and physico-chemical attributes. Macrofauna comprised >1000 species from various *Phyla*. Species numbers were low in the northern Bight (average of 41±11m⁻²) and highest off the Thukela River (55±29m⁻²) as was relative abundance, with a poorly abundant northern shelf (165±62 indiv.m⁻²) compared with Thukela (784±469 indiv.m⁻²) and the southern Bight (764±525 indiv.m⁻²). Assemblages were region specific, but overall distributed according to substrate characteristics such as medium sand, fine sand, mud and sediment sorting. Depth and Chl-*a* were distribution variables for macrobenthos particularly in the northern and central Bight. Two regions on the central shelf are noteworthy. Thukela has a coast to shelf edge mud field with unique macrofauna assemblages. Between Thukela and Durban is influenced by a poorly sorted, coarse sand bed with probable influences from the semi-persistent Durban eddy. This study revealed unique habitats and critical biodiversity areas needing further exploration, that are likely vital to the ecology of the region.

POSTER

Assessing conservation status and developing awareness of sharks and rays in North Mozambique

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In developing countries, where fish is the main resource for coastal populations, sharks are sought after for both food and fins which can be sold to traders. Fisheries surveys are undertaken among fishing villages in Northern Mozambique, but catches of sharks and rays are rarely reported. The aim of this project is to assess the conservation status of sharks and rays through questionnaires in fishing communities and by establishing a monitoring program among fishermen to develop awareness for shark protection. Questionnaires were designed to determine the species composition and historical abundance trends of sharks caught in artisanal fisheries, in terms of fishery characteristics (location, gear, and seasonality) – this will form the baseline data. The monitoring program included photo of shark catches by key fishermen that will allow a more robust identification of species and current catch rates. The preliminary results show low quantities of sharks landed but diversified species caught. A Facebook page was created where they obtained photos were posted and a dialogue on the conservation and management issues of sharks is being promoted. A Shark month (documentary and talks) was promoted in the local university and a workshop for discussion of the shark problems highlighted some of the biggest problems faced by sharks in the North of Mozambique.

POSTER

Offshore macrobenthos used to validate multicriteria-derived biodiversity spatial zones for marine conservation planning

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There is much pressure on marine diversity due broadly to direct extraction of living and non-living resources and effects of urbanisation of adjacent coasts. To retain specific goods and services provided by this ecosystem, marine conservation plans aim to protect spatial areas that are critical in the support of these benefits. Methods for derivation of conservation plans are proven, but here we work in a generally data-poor environment. To bridge this gap, data substitutes for biodiversity are often used. The benthic ecology of the northeast South African coast is poorly studied despite the large area of seafloor on the KwaZulu-Natal Bight (KZN Bight). Here is the first attempt at using one aspect of local marine ecology to validate biodiversity zones (biozones) derived through multi-criteria spatial modelling. Between the rivers Thukela on the KZN north coast and Mkomaas on the south coast, three predefined biozones with subunits based on seafloor characteristics, were used to locate nineteen offshore macrobenthic stations. To limit confounding issues of depth, all stations were at 55-80m in unconsolidated sediments and evenly spread and replicated across all biozone subunits. Macrobenthic characteristics such as richness patterns within (α -diversity) and between (β -diversity) biozones, are being assessed relative to the abiotic attributes representing each biozone. Thus far, distribution patterns and functional attributes of species agree well with biozone separations, using but not limited to permutational anova and canonical analysis of principal coordinates. This study contributes significantly to existing local knowledge, including augmenting and refining taxonomic information of the KZN Bight. Also, it subsidises poor information for large spatial areas in local and national marine conservation plans.

ORAL-Thursday-Msikaba 2- 1120

Tracking movement of important marine and estuarine fish species in South Africa: a synthesis of research and findings

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South Africa has a rich diversity of interconnected marine and estuarine ecosystems. The life-history of important fish species often depends on a complex array of movement behaviours within and between these ecosystems. Direct tracking of species has been popular among researchers to

increase knowledge of movement patterns for management purposes. We reviewed 102 marine and estuarine studies published over a period of 82 years from 1934 to 2015 with the aim of summarising prominent themes and knowledge gaps. From 2000 onwards movement research featured more often as the primary topic of publications in contrast to the previous periods where movement research was more often included as an auxiliary topic within biological or ecological publications. Studies have focused on the area from Cape Point to Kosi Bay with the bulk (57%) of studies covering the Western Cape. Some 79% of studies covered the marine environment with only 32% covering estuaries. Mark-recapture techniques featured in 70% of studies, while acoustic telemetry, a more recent technological development, featured in only 30%. Most studies were focused on osteichthyes (63%), 31% on elasmobranchs and only one (1%) study covered both groups. Overall, 26 families were identified in the literature, with endemic sparids featuring in 30% of publications, followed by carcharhinids (15%). Ten movement themes were identified in the surveyed literature, including general movement patterns, which featured in 58% of studies, followed by fine-scale habitat usage (28%) and protected areas (23%). Major knowledge gaps include a classification of movement types and drivers of movement behaviour.

ORAL- Wednesday – Msikaba 3 – 1700

Role of the metabolites of *Byssochlamys Laguncularia* isolated from shrimp against the White Spot virus

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Throughout the year of 90 and in the beginning 2000, the prawn's sector was on its maximum production in Madagascar with a net production around 15,000 tons per year. Prawns constitute the first exported marine resource with a value of 120 000 000€ / year. Since 2000, prawns farming in Madagascar faced to viral disease called White Spot Syndrome Virus (WSSV) that made some prawn's farming society in Madagascar in a difficult position.

This study was done in order to see the biological role of toxin (mycotoxin) of *Byssochlamys Laguncularia* isolated from wild prawns affected by the virus against itself. Two places (Morondava and Mahajanga) were selected by their potential production in aquaculture and the appearance of the virus on the livestock. These places are located respectively in the southwest coast of Madagascar at the delta of Tsiribihina and in the West Coast along the Mahajamba river.

Pure extracts obtained from extraction with dichloromethane/ethyl acetate 50/50 (v / v) have undergone more fractionation processes (VLC, flash chromatography, HPLC, LC-MS) and purification (dereplication and analysis in spectrometry mass, CCM, UPLC-MS, NMR) were tested on the human pathogenic bacteria, cancer cells of the human pharynx (KB), breast (MCF7) and the virus "White Spot".

Results obtained from this study showed that the pure extracts have remarkable biological activities. The study of biological activities of pure extracts showed antibacterial activity, cytotoxic or anti proliferative activity with an $IC_{50} = 3\mu\text{g/ml}$ and antiviral activity of $IC_{50} \pm 5\mu\text{g/ml}$. They also have significant neurotoxic activities.

In short, the study shows that it is possible to fight against the white spot syndrome virus biologically without using chemicals products. Which may soon to be a strategy of resistance against virus attack which is benefic to establish the importance of Malagasy aquaculture.

POSTER

Role of the metabolites of *Byssochlamys Laguncularia* isolated from shrimp against the White Spot virus.

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POSTER

Historical and perspectives of reef fish Post-larvae survey in SW Madagascar

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The coral reefs of SW Madagascar and the associated marine resources are impacted by anthropogenic pressure. As a consequence, marine resources in the area are under the deleterious influence of overfishing which is probably the most important factor altering reef function. Consequently, SW areas recognize the urgent and increased needs for various alternatives activities to enhance people's quality of life. Thus, the capture and culture of reef fish post-larvae methods (PCC) have been envisaged as an alternative activity through ornamental fish market and floating cage rearing development. The pilot experiment on reef fish post-larvae capture in Toliara Bay has been launched as a PhD work in 2007. Methods are based on capturing the post-larvae during new moon periods using light traps. Based on the results of this first survey, research project has been implemented from 2010 to 2012 for combining the objectives of conservation and sustainable valorisation of coral reef ecosystem in the area. As little is still known about the structure of reef fish larvae assemblages in the SW area, a comparative survey was carried out in 2013 for comparing spatial and temporal structure of reef fish larvae assemblages nearby the reef of Anakao and Great Barrier Reef of Toliara. In 2014, the FEDER biodiversity project that aims to elaborate an identification guide by photographing representative specimen and sampling fish tissues for DNA Barcoding has been undertaken in the both sites for conserving the adopted sampling methods for 2013 survey. The results for eight (8) years of survey showed that the peak of fish post-larvae arrival in terms of abundance and diversity were observed during hot season. Food fish were the most dominant that mostly occurred during hot season. The future activity to be carried out will be focused on development mariculture through food fish valorization.

ORAL- Thursday-Msikaba 3- 1100

Variability and trends of surface air temperature along the coast of Tanzania over the last half century

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The patterns of atmospheric surface temperature at four coastal stations in Tanzanian were investigated for variability and trends over the last 50 years (1960-2009). Various statistical tools were employed in the research, including non-parametric models as well as trend, spectral and wavelet analyses. A key finding of this study is the revelation of significant warming trends of surface temperature along the coast. The increases per decade are consistent with global trends, being generally greater in minimum temperature than in maximum temperature, most likely due to increased cloud cover over the coast of

Tanzania during this period. Within the last half century, the warmest year in minimum temperature differed slightly between stations but all fell within the last decade (2000-2009). Nevertheless during the second half of the records, the minimum temperatures coincided with the warm phase of the PDO signal, also making the last decade the warmest. Results also show that the maximum temperatures were mainly influenced by ENSO and PDO around equinoxes, while the minimum temperatures were largely associated with ENSO during both equinoxes, solstices, as well as during OND. Generally, the ENSO and PDO were the most significant climate phenomena affecting the inter-annual and decadal variability of surface temperatures along the coast of Tanzania, respectively. This indicates that during the last half century, the combination of large scale systems and solar intensity were the main driver of surface temperature variations along the coast of Tanzania.

ORAL- Monday – Msikaba 2 – 1140

The role of mangroves in shoreline protection in Gazi Bay, Kenya

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Mangrove forests provide natural coastal protection by attenuating wave energy and stabilizing sediments against erosion. Efficiency of coastal protection is likely to decline with increase in forest degradation as tree density reduces but there are few empirical tests to these hypotheses. The aim of this study was to investigate how wave attenuation and sediment stabilization varied along a gradient as tree cover diminished through wood extraction. Seven, 80 m long transects were positioned along a stretch of shoreline with homogenous emergent wave energy. Transects consisted of three intertidal stations perpendicular to the shoreline: station A, on the seaward side; station B, and C 30 m apart into the mangrove forest. Each station had 5 sampling spots which were sampled for hydrological energy using clod cards prepared using plaster of Paris powder. Ten points per station were used to estimate sinking depths of metal disks as a proxy to sediment stability (pooled for analysis). A significant correlation was expressed between wave energy and tree density ($r = -0.594$, $p = 0.000$) and with pneumatophores density ($r = 0.740$, $p = 0.000$), sediment stability showed significant difference between wave energy and tree density ($R^2 = 46.0$, $p = 0.002$) and pneumatophores density ($R^2 = 40.5$, $p = 0.005$)

The study has shown merits of mangroves in protecting coastal erosion in the current era of global changing climate.

ORAL- Thursday- Msikaba 2- 1700

Strengthening fisheries co-management through Community-driven approaches in Northern Coast of Kenya.

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Fisheries co-management approaches have been widely adopted internationally in response to the widespread degradation of fisheries resources. In Kenya, the government with support from partners have in the recent past increasingly provided frameworks within which natural resources including fisheries, forests and wildlife can be co-managed more sustainably and effectively. These co-management tools, among them fisheries Beach Management Units, Community Forest Associations and Community Wildlife Conservancies have been seen to improve democracy, transparency and accountability and are required to yield benefits to nature and people, particularly local communities. This paper identifies these co-management structures and discusses how local communities and partners in the northern coast of Kenya are taking advantage of the new innovative co-management structures, to promote ecosystem management for improved human livelihoods, biodiversity conservation and enhanced fisheries management.

ORAL- Wednesday –Msikaba 2 – 1100

Spawning pattern of banana shrimps on the Sofala Bank: Identification and characterization

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Understanding spawning patterns of marine organisms and their space and time variability is important for both management and ecology, especially for short-life species like banana shrimps (*Penaeus indicus* and *Metapenaeus monoceros*). This study analyzes commercial data from 2000–2003 and annual research cruise survey data from 2003–2010 to identify the main areas and timing of spawning of banana shrimps on the Sofala Bank. These spawning areas and times are characterized in relation to environmental factors. Both species spawned year-round. For *P. indicus*, there were two periods of increased

spawning activity, one in spring and the other in autumn. For *M. monoceros*, there was only one increase, from spring to summer. The proportion of mature females of *M. monoceros* decreased with cool winter temperatures ($r = 0.48$, $p = 0.08$, $\alpha = 0.1$), whereas that for *P. indicus* was independent of temperature, although rising temperatures from winter to spring and/or from year to year stimulated and promoted maturation and spawning of this species. There was a spawning migration from shallow to relative deep water for *M. monoceros*, but not for *P. indicus*. Spawning of both species overlapped in waters < 25 m depth, whereas *M. monoceros* spawning extended deep to ~40 m depth. Three main spawning areas were identified on the bank: (1) northern, (2) central and (3) southern, and all were adjacent to a river. The northern and central areas were more consistent than the southern area. The maps and descriptions of the main spawning areas provided by this study can be used to assist in management of this important fishery.

POSTER

Designing a Mangrove Research and Training Forest in the Rufiji Delta, Tanzania

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Mangroves are integral to the socio-economic and ecological well-being of coastal communities in Tanzania. However, uncontrolled and illegal exploitation, conversion to other forms of land use, and development pressures have led to degradation and deforestation that threatens the integrity of the resource. There is insufficient technical information to support wise management or effective restoration. Accordingly, an active research, education and technology transfer program is warranted to provide needed information and enhance local capacity in the science and management of mangroves. We have organized an interagency consortium to establish a mangrove research and training forest, with funding from the USAID Bureau for Africa. The purpose is to establish a facility that can sanction research, demonstration, and education activities in such a way as to realize long-term studies, interdisciplinary and participatory monitoring, and a field laboratory for demonstrating good management practices and effective restoration techniques. Local communities will be involved to ensure their socio-economic considerations are appropriately incorporated

in both the operation of the forest and in the studies and demonstration trials. This mangrove research forest is being established in the Rufiji River Delta, which hosts the largest continuous mangrove forest in the east Africa region. This designated area will encompass approximately 9,200 ha in the northern block of the Delta, covering a gradient from the ocean-front to the tidal-freshwater interface where clearance for rice farming is practiced. Similarly, the site includes stands subjected to both legal and illegal selective cutting. Here we present a framework of procedures and consultations undertaken, findings from preliminary surveys, and proposed activities to support the design of the research forest.

POSTER

Biomass and carbon stocks in the mangrove forests in Wami and Ruvu Estuaries, Tanzania

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Mangrove forests of Wami and Ruvu Estuaries experience contrasting management. Wami Estuary is within Saadani National Park that receives total protection since 2005 while Ruvu Estuary experience tacit open access exploitation for mangroves poles, timber and charcoal. A rapid assessment was conducted in the two mangrove forests to compare forest structure, and biomass and carbon stocks. In each forest, 12 inventory plots were systematically laid along the estuary gradient from the ocean upstream. Allometric models available in literature were used to estimate biomass and carbon from vegetative measurements. For soil carbon, one soil core was retrieved from each plot near the center using a multistage sediment corer at intervals of 30 cm to 210 cm deep. Soil carbon was estimated by loss on ignition procedure. Forest stand structural attributes revealed low values in Ruvu Estuary where density was 2270 stems ha⁻¹, basal area was 14.76 m² ha⁻¹ and above ground biomass (AGB) from live trees was 148.21 Mg ha⁻¹ translating to carbon stock of 74.1 Mg C ha⁻¹. In Wami Estuary, density was 1998 stems ha⁻¹, basal area was 24.16 m² ha⁻¹ and AGB was 257.83 Mg ha⁻¹ depicting carbon stock of 128.92 Mg C ha⁻¹. Soil carbon stock was comparable for the two forests with estimated 832.33 Mg C ha⁻¹ in Ruvu Estuary and 849.81 Mg C ha⁻¹ in Wami Estuary. These results demonstrate higher mangrove degradation in Ruvu Estuary. While a good amount of carbon is still stored in the soils, this carbon stock is at exposure of turning into carbon source due to the continuing forest degradation in this estuary. Comprehensive and long-term monitoring is needed to ascertain the functional role of protective management in securing the carbon stocks and enhancing their potential for mitigation of climate change.

ORAL- Thursday – Msikaba 4 – 1100

Communicating Marine Science for Conservation in the WIO

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This paper will highlight the work of the South African Association for Marine Biological Research (SAAMBR), in Durban on the east coast of South Africa and undertakes work throughout the Western Indian Ocean. The aim of SAAMBR is to help people to care for our ocean. This is achieved through the operation of three divisions – the Oceanographic Research Institute, the uShaka Sea World complex and our Education Centre. Effective communication is a critical component of our work. Our communication programmes are varied and range from simply raising an awareness of the importance of caring for the ocean amongst scholars and teachers, holiday makers and local residents, to building the capacity of resource users to understand and manage their own resources, to promoting wise decision making amongst government officials involved in policy and management decisions. With over 60 years of experience in science and conservation communication we have learnt a great deal about what works, as well as what does not work. Building on the fundamentals of communication and conservation psychology, and based on research into the effectiveness of our current efforts, SAAMBR's communication efforts are continually evolving. This paper will provide delegates with a deeper understanding of science communication and will share experiences to help the WIOMSA community build capacity in science communication.

ORAL- Thursday- Msikaba 3- 1440

Impacts of the upper-ocean dynamics on ocean properties in the tropical western Indian Ocean: A Model Approach on Annual Cycle.

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A regional ocean model is used to simulate the annual cycle of the upper-ocean dynamics and its influence on ocean properties in the tropical western Indian Ocean. Surface winds and heat fluxes from the National Centers for Environmental Prediction reanalysis force the model with initial and lateral boundary conditions derived from the Simple Ocean Data Assimilation. The model findings are in good agreement with previous research, satellite and observational data as well as another model configuration forced by Comprehensive Ocean and Atmosphere Data Sets (COADS). The initial and lateral boundary conditions for COADS were extracted from World Ocean Atlas

2001. Anti-cyclonic wind stress curl occurs to the north of Madagascar, and extends towards the Tanzanian coast throughout the year leading to Ekman convergence and downwelling there. The lowest SSH values during the year occur between 5 and 12°S with an elongated and contracted shape. The East African coastal current (EACC) is in phase with the westward Northeast Madagascar current (NEMC) throughout the year with volume transports that peak in June through July. The variability of the volume transport, the ocean currents, temperature and salinity in the north of Madagascar on the path of the NEMC mirrors those in the middle Tanzanian shelf on the path of the EACC throughout the year. The NEMC seems to influence the water masses with cooler and low salinity water in the South West monsoon, and warmer and salty water during the North East monsoon.

ORAL- Wednesday – Msikaba 4- 1200

Manta ray cleaning stations in the Inhambane Province, Mozambique and the effects of marine tourism

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The Inhambane Province of southern Mozambique hosts one of the largest documented populations of reef manta rays, *Manta alfredi* (Marshall *et al* 2011) in the world. In this region SCUBA divers most commonly encounter these rays as they visit shallow water reefs to be cleaned by fish. Cleaning behaviour in manta rays is generally poorly understood with few published studies detailing the dynamics and importance of interactions. Here we describe inshore habitat use, with respect to cleaning behaviour, of a semi-resident population of *Manta alfredi* in southern Mozambique. In addition we detail the diversity of cleaner fish species and behavioural interactions between the rays and cleaner fishes. Of particular importance were estimates of the frequency with which *M. alfredi* visit particular inshore cleaning stations and the amount of time individuals spend at the cleaning stations per day. These estimates offer new insights into the importance of these sites to the daily and seasonal activity of these rays. With inshore cleaning stations providing the best opportunities for manta ray sightings and SCUBA diver interactions, we report on the influence of divers on the cleaning behavior of manta rays in the region. We also make a case for the need for a standardized and enforced code of conduct, and the benefits that manta ray tourism can bring to the region if regulated appropriately.

POSTER

Coastal Vulnerability Index for Indian Ocean Commission Member States under the MESA programme

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The Monitoring for Environment and Security in Africa (MESA) programme is an EU-funded project under the 10th EDF with an overall budget of 40M EURO. It is managed by the African Union Commission (AUC) and aims at contributing to poverty eradication and sustainable

development by fully exploiting Earth Observation (EO) data (marine, land and climate data) and technologies. The Service 2B (Coastal Area Management) of the Indian Ocean Commission (IOC) thematic action of the MESA project is about the monitoring of the coastal environment of the island states of the IOC. The idea is to make a vulnerability assessment of the coastlines of the IOC countries (Mauritius, Comoros, Madagascar and Seychelles) using historical / archived and present data. The parameters to be used to determine the Coastal Vulnerability Index (CVI) are Shoreline Type, Shoreline Change Rate, Coastal Slope, Mean Significant Wave Height and Mean Tidal Range. Shoreline will be extracted using a GIS platform and Arc-GIS extension DSAS will be used to calculate the shoreline change rate. The CVI maps produced will indicate the level and type of vulnerability. Through the CVI, sites more susceptible to erosion will be identified within each country for monitoring purposes and inclusion in their respective conservation plan.

ORAL- Thursday- Msikaba 4- 1120

The impact of the MARECO educational toolkit on the coral reef social representation of children in the south Western Indian Ocean

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MARECO is an educational toolkit developed by a team of scientists which aims to inform young people on coral reefs in order to increase their awareness on the biodiversity, perturbations and management of the marine ecosystem. Its impact on the social representations of coral reefs by schoolchildren was assessed in several classrooms in Reunion Island and Mayotte during the school year. MARECO is composed of a card game (“coral reef happy families”), a picture book (“the colours of the reef”), a board game (“see you at the reef”) and a teacher handbook. Each tool points out a different aspect of the coral reef ecosystem including reef biodiversity, threats, and sea user management. The experimental protocol was based on the comparison of children’s drawings of the sea and the reefs before and after using the educational toolkit in the classroom. The drawing were analysed with a reading grid. To ensure a similar use of the educational toolkit in each classroom, the children participated in nine activities involving the three tools which were demonstrated by the scientists. The kit was then left to the teacher to use during the following two months. The preliminary results showed that in the two localities, the first drawings were quite homogenous and pictured few marine organisms or reef users. Moreover, the children showed difficulties in representing the coral reef. The second drawings will be done and analysed at the end of June 2015. The use of MARECO in different localities showed that this toolkit is adaptable to various environment and may help the children to better understand what are coral reef ecosystems and the need to maintain their health. Such educational toolkit may also be used to point out the importance of collaborative management initiatives between research, education, political institutions and the general community.

POSTER

Sustainability and Suitability of the Marine Small Pelagic Fish Processing Techniques in Unguja Island

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The fast growing marine small pelagic fish (*dagaa* – mainly sardines and anchovies) are the most important cheap source of protein compared to other species; consequently it has high demand among people with low level of income. However, they are highly perishable, thus require an immediate preservation. A relatively new preserving method involving boiling prior to sun drying is currently practiced in Zanzibar. This method consume substantial amount of firewood and the discarded soup was suspected to degrade the environment. This study examined the trend, sustainability and suitability of the processing techniques in Zanzibar Islands. Field assessments were conducted to evaluate its impacts and eventual sustainability to the environment. Data was gathered through individual and focus group interviews and questionnaires. This study confirmed that there is potential danger of deforestation that could be caused by continued use of firewood. The preferred coconut wood is in short supply and more mango trees are used. Instead of discarding the soup in mangroves, it is now dumped in the beach after cooling. Processor's perceptions suggest that it has little environmental impacts, but it possess a potential danger in the future. There are more than four prominent processing sites, each with between 50,000 m² and 135,000 m², producing about 15-20 tons of dried fish per month and employing about 150 – 350 people. About 30 % of the final products are consumed locally the rest is exported to mainland Tanzania and beyond. High demand trends are attracting more investment in small pelagic fishing and processing, but it also poses a potential environment risk; however better management strategies to make this activity sustainable are suggested. The major constraints are the poor financial capability and inadequate institution and legal framework for fisheries resource management.

ORAL- Monday- Amadiba- 1700

Coral disease occurrence and associated effect on The photo-physiology of in hospite *Symbiodinium* among six scleractinian corals

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The recent increased incidence of coral diseases is threatening the health of coral reefs. Diseases in reef-building corals are known to alter the coral tissue structure, skeletal morphology and density of *in-hospite* zooxanthellae, thus likely to modify the holobiont micro-environment which has a direct impact on the photosynthetic potential of the symbiont. The present study investigates the occurrence of coral diseases, namely

tissue sloughing (white band disease, WBD) and complete whitening (white plague, WP), among six scleractinian corals in the tropical lagoon of Belle Mare, Mauritius. It also characterises the photosynthetic responses of *in hospite* *Symbiodinium* in diseased, adjacent-to-disease and non-diseased (healthy) parts of the corals using an underwater Pulse-Amplitude Modulated Fluorometer (divingPAM). The coral disease occurrence survey (n=20 colonies) and sampling for diseased/ healthy corals were carried out at nine stations along three transects across the lagoon from coast to reef over the summer months of November 2013 to February 2014. A maximum sea surface temperature of 30.2±0.66°C was recorded. A high percentage (90%) of disease occurrence was observed in the branching *Acropora muricata*, both WBD (45%) and WP (55%), as compared to *Pocillopora damicornis* (10%) with WBD, *Pocillopora eydouxi* (0%), *Galaxea fascicularis* (0%), *Acropora cytherea* (0%) and *Fungia* sp. (0%). Maximum quantum yield (Fv/Fm) was normal (0.6±0.008) in all healthy corals, but was very low (<0.2) in diseased (WBD) parts of *A. muricata* and *P. damicornis* indicating damage to the photosynthetic apparatus. However, tissue adjacent-to-disease in WP-affected *A. muricata* indicated a decreased Fv/Fm (0.38±0.028), a lowered electron transport rate (ETR_m=57.02±3.647) but an increased non-photosynthetic quenching (NPQ_m=2.23±0.305) compared to the healthy parts indicating a photosynthetic stress response. *A. muricata* was the most common host and most susceptible among the six corals, thus having implications for coral reef management and conservation in the face of a climate-driven ocean warming.

POSTER

Differential effects of two brown macroalgae on the photo-physiological performance of *Symbiodinium* in *Acropora muricata*.

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Interactions among macroalgae and corals is an important process on tropical coral reefs. Under conditions of climate change-driven ocean warming, high nutrient loading, absence of grazing and reef degradation, macro-algae out compete the abundant corals and grow on them. Limited studies have focused on the effect of macroalgal growth on symbiont photosynthetic functioning. The present study has investigated the effects of two species of brown proliferative macroalgae, namely *Distromium skottsbergii* and *Padina boryana*, on the branching reef-building coral, *Acropora muricata*, at two tropical lagoons Flic-en-Flac and Belle Mare, Mauritius, over the study period 2013-2014. The photosystem II functioning (effective quantum yield - ΔF/F_m, relative electron transport rate - rETR, and non-photochemical quenching - NPQ) measurements were taken *in situ* on three different parts of the affected corals, namely algae-covered-pale (ACP), adjacent-healthy-looking (AHL) and healthy-looking (HL), using an underwater Pulse Amplitude Modulated Fluorometer (Diving-PAM) on colonies of corals found near the

coast at each lagoonal site. Differential effects of the two macroalgae were observed on *A. muricata* symbiont's photo-physiology, with *P. boryana* having greater effects than *D. skottsbergii*. $\Delta F/F_m$ was at an average of 0.619 ± 0.010 in all three (ACP, AHL and HL) parts of *D. skottsbergii*-affected *A. muricata*, and maximum rETR (rETR_m, 103.694 ± 3.901) and the maximum NPQ (NPQ_m, 0.870 ± 0.065) being high indicating a photosynthetic stress with no damage to the photosynthetic apparatus. In *P. boryana*-affected *A. muricata*, $\Delta F/F_m$ was lowest in algae-covered-pale parts (0.274 ± 0.021) compared to the adjacent-healthy-looking (0.410 ± 0.038) and healthy-looking (0.619 ± 0.021) parts, whilst both rETR_m (8.573 ± 0.982) and NPQ_m (0.262 ± 0.091) were significantly low in algae-covered parts, indicating damage to the photosynthetic apparatus. These findings might suggest a strong differential competitive interaction among *A. muricata* and the two benthic macroalgae which have implications for *A. muricata* survival in the wake of a changing ocean climate.

POSTER

An assessment of knowledge and perception of natural and marine cultural heritage among age groups in the community, the case of Mnazi Bay Ruvuma Estuary Marine Park in Mtwara District Council

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One among challenges of managing resources associated with the coastal area and marine cultural heritage is the diversity of knowledge and perception among age groups and gender in the community. That may or may not share the same essential resource management values of the governing bodies, as reflected in leading policies and some initiatives. Understanding the community knowledge and perception toward the sea environment, coastal resource management and marine cultural heritage among age groups and gender is crucial for successful implementation of meaningful management programs. This study will assess the knowledge and perception of natural and marine cultural heritage among age groups and gender in the community in Mnazi Bay Ruvuma Estuary Marine Park in Mtwara. The main objective of the study is to assess the Knowledge and Perception of the Mozambique Channel area of the high seas and Coastal area, reflecting on the issues relative to the uses and management and four specific objectives as to-; identify age differences in the Knowledge on meaning of natural and marine cultural heritage in the Mozambique Channel area, examine age differences in the uses, and management of the sea and resources specific to the Mozambique Channel area, identify the communities' perceptions to the Mozambique Channel as an entity in terms of socio-cultural representation and describe the awareness of people about local and regional management based on gender and age. Purposive sampling will be applied and the sample size will be 200 respondents including men and women. Qualitative research methods will be applied, including in-depth interviews, focus group discussions, pictures, videos, social mapping, observation and documentary reviews. All data will be summarized in descriptive way, and analysed qualitatively by using contents analysis and the findings will be useful for successful management and implementation of various programmes and policies

POSTER

Scales of variability of phytoplankton composition and biomass in Algoa Bay, South Africa

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This study investigated the variability of environmental drivers of phytoplankton communities and biomass at different time scales in Algoa Bay. This research was motivated by Pacific oyster culturing at an Algoa Bay oyster farm. The time series showed strong seasonal and interannual variability in the winds and SSTs. The dominance of south-easterly and south-westerly winds in summer of 2010/11 resulted in cooler temperatures and higher chlorophyll-a concentrations than were found in 2011/12. The summer of 2011/12 had non-persistent south-westerly winds that lead to warm temperatures and low chlorophyll-a concentrations. Two short field trips in early summer 2011 and early autumn 2012 indicated a minor variability in the winds during sampling periods and little spatial variability in SSTs, with spatial differences in nutrient concentrations and chlorophyll-a distributions. Temperature and nutrient values were significantly correlated (at $p < 0.001$) for NO₃, PO₄, and SiO₄ in both field trips. Phytoplankton community structure in early summer had a dominance of dinoflagellates of *Gonyaulax polygramma* and other species, which are known for creating hypoxic conditions in the water column. In early autumn there was a dominance of pennate diatoms of *Pseudo-nitzschia* sp. and this genus has been reported to produce the neurotoxin, domoic acid. Variable environmental conditions with low chlorophyll-a concentrations at Algoa Bay's marine culture site indicate unsuitable conditions for Pacific oyster production.

ORAL-Wednesday-Msikaba 2-1620

Evaluating the role of gear technology innovations in coral reef fisheries in the Indian Ocean: A proof of concept

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Fishing gear technology innovations in near-shore coastal fisheries have faced varied adoption capabilities. However, it is not clear whether vulnerability indices such as exposure, sensitivity and adaptive capacity of communities exploiting coral reef fisheries act as barriers of change. Our objective was to assess critical contributions and criticisms of gated

traps in the Kenyan coral reef fishery following a functional approach that reveals community responses to change. Fishery data comprised of geo-referenced catches from traps with five escape slot (2, 3, 4, 6 and 8x30cm) and large mesh traps with a 2.5" aperture. We examined differences in catch rates, composition and value between traditional traps with no modifications (controls) and the modified traps (experimental gated traps). Additionally, continuous catch data was used to calibrate simulation models to predict how ecological and economic outcomes will change as the standing stock responds to new size selectivity of the fishing traps. Results suggest significant differences in catch composition between trap types with numbers of butterfly fishes significantly reduced in the experimental traps. Captures in experimental traps were 31% longer and 55% heavier with no significant differences in economic value. Although the model predicts a decline in per trap profits in the first year, sequential implementation of 2cm slots followed by 4cm slots in the fourth year reduces the total economic cost of implementing the 4cm slot by 34%. Nonetheless, fisher's vulnerability to decline in coral reef fisheries still inhibits diffusion of the modified trap innovation. Consequently, adoption of these modifications in the trap fishery would conserve key ecosystem functions and reduce poverty. Key words: Fish traps; coral reef; artisanal fishery; technology innovation

POSTER

An assessment of the small scale marine fisheries in Kenya: trends in catch, effort and participation between 2001 and 2009.

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An access point survey at four coastal regions was conducted between 2001 and 2009 to gather baseline information on the status of marine fisheries in Kenya. Data on catch composition and catch per unit effort (CPUE) of the most common fishing gears and vessels from 22,213 angler outings at four prominent fishing regions is presented. The fishery was characterized as being artisanal with low capital investment. A large majority (88%) of fishers use outdated equipment such as basket traps, beach seines, hook and lines, fence traps, gillnets, spearguns and cast nets. Despite high diversity in the fishery, five species (*Lethrinus lentjan*, *Siganus sutor*, *Leptoscarus vaigiensis*, *Lethrinus harak* and *Parupeneus macronemus*) represented over 75% of the catch. The mean annual CPUE per region ranged from (1.5 kg.fisher-1.hr-1) in Diani-Chale to (1.0 kg.fisher-1.hr-1) in Malindi-Ungwana bay. These findings were sufficient to lead to assertive conclusions that gear-based management, although under studied, has the potential to be adaptive, address multiple objectives, and be crafted to the socio-economic setting. Consequently, this paper seeks to identify ways in which the artisanal fishery can be sustained and managed from within coastal communities, giving them the resources and education to effectively improve their lives

POSTER

A dropline survey of species composition and catch rates of demersal fishes in coastal East Africa

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Trawl gear surveys have mostly been used to capture commercially valuable species for stock assessment; however, they are not suitable for surveying rocky grounds. This paper provides preliminary results on a dropline survey of deep slope fishery resources on the East African coast. 52 dropline sets covering a wide range of habitats on the Kenya and Tanzanian waters were randomly fished at three depth zones (75 - 199, 200 - 299, and 300 - 425 m) during a 10-days period in 2012. Nine species of fish were caught by the droplines with *Etelis coruscans* being of high relative abundance (32.4%) in the catches. Mean catch rates (kg/100hook.hour) ranged from 27.8 for *Hexachus griseus* and 148.5 for *Epinephelus chlorostigma*. Fish total lengths were higher than those recorded in FishBase for *Polysteganus coeruleopunctatus*, *Squalus megalops* and *Pristipomoides argyrogrammicus*. About 95% of the 2340 hooks were empty with most of the fish being caught by the middle section hooks of the rigs. A fishing model predicts peak catches to occur at 150-200 m depth range after about an hour of soaking. Lack of oceanographic data and depth profiles of the East African deep slope habitats resulted into poor sitting of the rigs with resultant gear losses and low catches. Nonetheless, the results provide preliminary indications of the potential for a dropline fishery on the shelves.

POSTER

Community Driven Development Approach in Community Based Mangrove Initiatives, Is it the Sustainability Solution?

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Public participation in mangrove conservation has been influenced by some key global events such as the Rio Earth Summit and the World Summit for Sustainable Development, both events emphasised on local community integration in conservation of their natural resources. In Kenya today, the Forest Act 2005 provides for community participation in forestry conservation through defined management objectives and prepared management plans for approval. Principally, the Act creates an impression that the powers to conserve the forests are transferred to the communities. However in reality, the powers of the communities are more limited as they are not allowed to exploit forest resources for both domestic and commercial use. Besides this, the communities are not equipped with the requisite financial and human resources including technical skills to permit development and establishment of mangrove based livelihood sources. Through such policies and the fact that mangrove resource underpins the livelihood of most coastal dwellers, the challenge of its conservation are more profound. As a result the coastal region has witnessed increasing degradation of mangroves

even within community managed mangrove areas hence hindering sustainability of such livelihood sources. Hazina ya Maendeleo ya Pwani (HMP), a community based initiative under the Kenya Coastal Development Project attempts to support conservation of mangroves through promotion of non- extractive uses. This is done by capacity building communities in planning, and establishment of community projects whose primary goal is enhancing revenue generation from conservation of mangrove resource. Through its Community Driven Development Approach, HMP engages coastal communities in taking the leadership role in all the crucial stages of project development: planning, implementation and monitoring. This poster seeks to exhibit an assessment of the CDD approach with regard to its potential in sustaining mangroves. The poster will also highlight some of the preliminary challenges and recommendations on the way forward

ORAL- Thursday- Msikaba 4-1400

How multiple governance systems influence coastal livelihood strategies: The case of Kosi Bay, South Africa

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Coastal resources are significant in supporting the livelihoods of marginalized communities adjacent to the coastal zone. In South Africa, a significant number of rural households living along the coast rely on harvesting marine resources, timber, non-timber forest products, and agricultural resources for subsistence or small-scale sale in order to support their livelihoods. Simultaneously, biodiversity protection in the form of internationally and nationally recognized protected areas are increasingly being enacted in South Africa in areas adjacent to rural communities which have been historically marginalized in the apartheid era pre-1994; and who also continue to be experience other forms of marginalizations in the democratic dispensation. Moreover, coastal governance in rural areas of South Africa remains highly contested by plural co-existing governance actors and institutions whose roles and mandates are usually confusing not only to the local communities, but sometimes also among themselves. This is exacerbated by the fact that institutions with mandates over coastal governance in rural areas also usually operate in silos, creating a case of red tape that slows down development opportunities in these areas. Plurality in coastal governance in coasts adjacent to rural areas predominantly exists between and within statutory and customary governance systems operating under different sources of law. Through the lens of Kosi Bay, a rural area existing within South Africa's first World Heritage Site, iSimangaliso; this study is therefore interested in documenting livelihood strategies in rural coastal communities and interrogating how people's livelihoods are influenced by the existence of multiple and plural coastal governance systems and processes. This is done in view to contribute towards knowledge that links sustainable livelihoods thinking to governance debates in order to further the understanding of interactions between the two.

ORAL- Wednesday- Msikaba 1-1100

Resilience of mangrove ecosystems

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Mangroves are resilient ecosystems that can recover following large natural and anthropogenic perturbations. Mangroves in South Africa exist at one of the most southerly limits in the world providing a unique opportunity to study responses and resilience to change. Here we aim to measure the resilience of mangroves using rate of mangrove growth to understand how quickly these ecosystems recover from perturbations at forests along a latitudinal gradient. We used long term monitoring plots to determine the resilience of mangroves to browsing and flooding at Wavecrest and Kobonqaba (temperate), and drought at St Lucia (subtropics). Growth rates were measured in terms of plant height and seedling recruitment/survival was measured to investigate the relationship with growth rates and recovery in terms of reproduction. We found that mangrove tree growth rates were higher in the subtropics (*Avicennia marina*-100cm/yr, *Bruguiera gymnorhiza*-70 cm/yr) compared to the temperate regions (*A.marina* -5 cm/yr, *B. gymnorhiza*- 1 cm/yr). When pressures such as browsing is alleviated the growth rate of *A.marina* can be as high as 14 cm in the temperate regions. Previously, drought at St Lucia had a negative impact on seedling recruitment, however, a new cohort of seedlings has been found in dry areas. At Kobonqaba the presence of propagules on living trees indicated recovery. We concluded that mangroves in the subtropics are more resilient in terms of growth rates, however, temperate mangroves are able to recover well by recruiting and seedling survival.

ORAL- Monday- Amadiba – 1200

Population genetics parameters of the emerging corallivorous snail *Drupella cornus* in the northern Gulf of Eilat and Tanzanian coastlines based on mitochondrial COI gene sequences

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The genetic diversity and population genetic structure of *Drupella cornus* populations from six localities in the northern Gulf of Eilat (GOE) and five localities in Tanzania (269 individuals) were investigated using mitochondrial cytochrome c oxidase subunit I (COI) gene sequences. Overall, 108 haplotypes, 47 in GOE and 61 in Tanzania were revealed, with similar calculated haplotype diversity for all *D. cornus* populations within each location (0.9 +/- 0.00025 and 0.903 +/- 0.00078, respectively). Only one haplotype was shared between the GOE and Tanzanian populations. Network analysis for the 108 COI haplotypes displayed two major clades, separated by nine mutations. Bayesian analyses of population structures revealed two clusters

highly correlated with the collecting region. Analysis of molecular variance showed 73% of the molecular variance for all *Drupella* populations is a result of the differences among regions. Within regions, most of the molecular variance is based on within population differences, 89% north vs. south in Tanzania and 98% Israel vs. Jordan in GOE. Fu's and Tajima's D values for all populations were negative, suggesting that the *Drupella* populations in GOE and Tanzania underwent population expansion or purifying selection. Based on the differences in genetic structuring within populations, the study strongly recommends application of conservation approaches that suit the description of the population in each region.

ORAL- Wednesday- Amadiba- 1620

Modeling regional fish biomass, recovery potential, and marine protected area and fisheries management priorities in the western Indian

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Fish biomass is a primary driver of coral reef ecosystems health and has high sensitivity to human disturbances and reef decline. Spatial estimates of fish biomass and recovery potential are therefore important for evaluating reef status and crucial for setting management targets. Here we compile an empirical dataset of fish biomass across 337 sites in the WIO with differing fisheries management status and age of protection and use these data to evaluate and map factors influencing WIO reef fish biomass. First, we constructed Generalized Additive Models in a multi-model selection and averaging framework, with market population, distance to markets, fisheries management type, and fishing status as predictors of fish biomass. This approach created an ensemble model that predicted up to 64% of the empirical fish biomass data. Second, we mapped all coral reefs within 11,678 - 2.5x2.5 km square grid planning units and used the above models to predict fish biomass in each planning unit. These activities produced a fish biomass map that shows high variability ranging from ~50 to 4000 kg/ha primarily driven by distance to markets. Finally, we assembled data on fisheries closures where biomass shows that it takes around 20 years to recover to equilibrium values of ~1200 kg/ha. Using this time to recovery and the above map, we predicted recovery times to minimum biomass levels for sustainable fishing and conservation if fishing were suspended. Finally, the Marxan spatial planning tool was used to develop a by-region and by-country conservation plan to minimize the time to 20% conservation and 50% sustainability target. Results indicate high regional heterogeneity but the potential to achieve sustainable fisheries within a decade of focused management.

POSTER

A study of the interactions between marine turtles and the artisanal gill net fishery in Temeke District, Tanzania

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Abstract Marine turtle conservation efforts in Tanzania focus almost exclusively on the protection of nesting females. However, little is known about the extent of in-water threats to marine turtles at other life history stages. To investigate the relationship between fisheries interactions and marine turtle mortalities, a pilot study of marine turtle bycatch in the artisanal gill net fishery was conducted in Temeke

District. The study site was selected by analysing marine turtle stranding data collected over a ten year period between 2004 and 2014. Observers joined two gill net boats for net setting and hauling over a period of six months (total of 152 gill net sets). Observers collected data on gear characteristics (net length, mesh size, setting position and soak time) and turtle bycatch (species, sex, carapace length and width and presence/absence of flipper-tags). 57 turtles were recaptured in 43 of the 152 gill net sets (28%). 48 green turtles were captured and nine hawksbills. 10 sets captured multiple turtles, including one set which captured five individuals. All of the captured turtles were juveniles except for one adult green turtle (female). A third of the turtles (n=20) were dead when the nets were hauled. All gill nets were top set and had mesh sizes ranging from 5 - 9 inches. The mean soak time was 22 hours. The study demonstrates that the inshore waters of Temeke District provide foraging grounds for juvenile green and hawksbill turtles which are exposed to a high risk of bycatch. The area is subject to high fishing pressure due to its close proximity to Dar es Salaam. Sea Sense recommends that the pilot study be expanded to increase the sample size of boats and include coverage of other locations to build a true picture of the extent of marine turtle bycatch in Tanzania

ORAL- Tuesday – Amadiba – 1200

Stakeholder Perceptions of Ecosystem Goods and Services of the Wami River Estuary

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Management of riverine and coastal ecosystems warrants enhanced understanding of how different stakeholders perceive and depend upon different kinds of ecosystem services. Employing a mixed methods approach, this study compares and contrasts the use and perceptions of upstream residents, downstream residents, tourism officials, and conservation organizations regarding the value of 30 ecosystem services provided by the Wami River and its estuary in Tanzania, and investigates their perceptions of the main threats to this system. Our findings reveal that all of the stakeholder groups place a high value on the provision of domestic water, habitat for wild plants and animals, tourism, and erosion control, and a relatively low value on the prevention of saltwater intrusion, refuge from predators, spiritual fulfillment, non-recreational hunting, and the provision of traditional medications and inorganic materials for construction. Differences emerge, however, between the groups in the value assigned to the conservation of riverine and estuarine fauna and the provision of raw materials for building and handicrafts. Declining fish populations and an increasing human population are identified by the residents and conservation employees, respectively, as their prime concerns regarding the future conditions of the Wami River and its estuary. These groups also acknowledge increasing salinity levels and the loss of mangroves as other key concerns. The identification of these mutual interests and shared concerns can help build common ground among stakeholders while the recognition of potential tensions can assist managers in balancing and reconciling the multiple needs and values of these different groups

POSTER

Factors affecting grazing patterns in tropical seagrass meadows: a case study at Inhaca and Zanzibar islands in Western Indian Ocean

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Seagrass grazing is a natural process contributing to ecosystem dynamics and ecological stability. Understanding which are the major factors (natural and anthropogenic) determining grazing patterns in seagrass meadows is however a challenge. In this study, we examined how spatial patterns of grazing pressure on seagrass leaves are related to seagrass structural complexity (based on shoot density and canopy height), nutrient content and landscape configuration, with focus on seagrass meadows dominated by either *Thalassodendron ciliatum*, *Cymodocea serrulata* or *Thalassia hemprichii* at Inhaca Island (southern Mozambique) and Zanzibar Island (Tanzania). We hypothesized that grazing pressure would (i) be higher in more complex seagrass meadows, (ii) be higher in meadows of higher carbon and nitrogen content in seagrass tissues, (iii) be affected by landscape configuration, and (iv) differ among meadows dominated by different seagrass species. The sampling of seagrass was done in 30 sites around Inhaca (10 sites of each seagrass meadow type) and 20 sites around Zanzibar (10 sites each of *T. ciliatum*- and *T. hemprichii*-dominated meadows). Twenty-five shoots at each site were assessed for structural complexity and nutrient content, and mapping of both islands were done to examine the influence of landscape configuration. Preliminary results from Inhaca Island show that grazing pressure was lower in meadow dominated by *T. hemprichii* compared to *C. serrulata* and *T. ciliatum*, which had a similar grazing pressure. The *C. serrulata*- and *T. ciliatum* meadows were usually located closer to other coastal habitats than *T. hemprichii* meadows, and this habitat connectivity might explain the higher grazing pressure seen in these meadows. Ongoing analysis of the entire data set, including both islands, indicates that multiple variables are driving variability in seagrass grazing patterns. Our findings highlight the necessity to consider a multitude of factors at different scales when conserving coastal seagrass systems.

POSTER

The artisanal tuna and billfish fishery on Zanzibar - description, quantification & valuation

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Starting in the 1960s the artisanal tuna and billfish fishery on Zanzibar has been continuously expanding. This fishery is economically and socially important by providing an

attractive food source for tourists and providing employment to many fishermen and traders. The stocks of Tanzania's large pelagic fish populations have been categorized as underexploited in 2005, although few stock assessment surveys have been conducted to verify or update this claim. In the period from October 2014 to March 2015 we collected fishery dependent data and conducted semi-structured and in-depth interviews with artisanal fishermen, traders and hotel managers to investigate the artisanal fishery on a socio-economic and ecological basis. The artisanal tuna and billfish fishery on Zanzibar uses wooden sailing boats using gillnets with an average mesh size of 5 inches. GPS-tracking of the fishing trips revealed that the fishing grounds surround Zanzibar with an average distance of 35km. The catch composition varies depending on the seasons, however 90% of the catch is comprised by Yellowfin tuna, Sailfish, Kawakawa, and Skipjack tuna. Length converted catch curves and virtual population analysis will be used to assess the status of the fishery and estimate population sizes. Results of value chain and cost-benefit analyses will clarify how the market of large pelagic fish is structured and identify the financial scope of this fishing sector. During the North-east monsoon fishermen migrate and fishing effort concentrates from the north to the south of the island. Analyses will show if the spatially alternating mitigation and intensification of fishing pressure provides time for population recovery or poses an additional stress factor for the populations. This interdisciplinary study will contribute to the understanding of the artisanal tuna and billfish fishery on Zanzibar. It will provide ideas for management strategies for a socially and ecologically sustainable use of marine resources

ORAL- Monday-Msikaba3-1440

Characterization of microplastic particles from three isolated islands in the Western Indian Ocean

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Plastic debris has become a major problem in our oceans. In recent years, the international research focus has shifted to the presence, and potential impacts of microplastics (arbitrarily plastic particles <5mm in its largest dimensions) in the environment. This interest is motivated by the large amounts likely to be involved in, and the ubiquity of microplastics in the environment. This study aimed to better understand the spatial variations in concentrations of microplastics along three islands, situated next to a presumed major gyre in the western Indian Ocean. We hypothesized that these islands will retain marine debris transported within such major gyres, resulting in the accumulations of persistent organic pollutants and possible hazards to species and ecological functioning. Samples of sand, sediment, coral, coral rubble, and fish guts were collected. A Fourier Transform – Infra Red (FT-IR) microscope was used to identify and characterize the microplastic particles. The results show the distribution and abundance of microplastics in pristine environments, far away from pollution sources. The transport of pollution over great distances is highlighted by these results.

POSTER

Small-scale milkfish (*Chanos chanos*) mariculture: A profitability model under Kenya Coastal Development Project (KCDP)

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Milkfish (*Chanos chanos*) farming in Kenya is dependent on wild seed supply and remained relatively underdeveloped over long time. Community/village based small scale milkfish farming was initiated about one and half decades ago where organised community groups (OCGs) formed the entry point for the interventions. The number of OCGs involved in milkfish farming increased by 211% between 2007 and 2013 while the area under milkfish pond culture increased from 3.1ha to 13.3ha (429%). However, with the intervention of KCDP the culture area has doubled over the last three years while the number of OCGs has remained the same. The milkfish production capacity which varied between 0.06-0.2 kg fish/m² in 2007 and 0.08-0.44 kg fish/m² in 2013 has significantly improved to a remarkable 0.4 – 0.8kg/m² with stocking densities of 0.5 – 3fish/m² respectively under KCDP support. Hence maintaining the model has the potential of turning mariculture in East Africa into a gold mine reserve.

ORAL-Monday- Msikaba 4-1200

Conservation genetics of the endangered Knysna seahorse, *Hippocampus capensis* Boulenger 1900 (Syngnathidae)

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The South African Knysna seahorse, *Hippocampus capensis*, is the most threatened species in the genus *Hippocampus* according to the IUCN Red List, because it has the smallest distribution range of any of the world's seahorses. It occurs only in the Knysna, Swartvlei and Keurbooms estuaries on the South African south coast. Following reports of invasive species and continued degradation of the species' habitats due to human encroachment, there is great uncertainty about the long-term survival of *H. capensis*. Moreover, the populations in the Swartvlei and Keurbooms estuaries are frequently subject to mass mortalities. Genetic research conducted a decade ago using mitochondrial DNA sequence data could not provide answers to several questions of conservation relevance. First, if one of the populations becomes extinct, would it be acceptable to restore it by translocating individuals from another population? Second, should occasional translocations be used as a management tool to increase genetic diversity in all three populations, and in that way reduce the risk of inbreeding depression? This study will use highly polymorphic microsatellite loci to address the above questions.

ORAL- Wednesday – Msikaba 3- 1600

Growth rates of selected *Oreochromis* species cultured at different salinities

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Five studies were carried out on growth rates of 2 species of *Oreochromis* namely *O. urolepis urolepis* and *O. pangani* at different salinities. In the 1st study *O. urolepis urolepis* fingerlings (5.3 - 42 g) were cultured in freshwater and seawater at salinity of 35. The percentage daily specific growth rates for *O. urolepis urolepis* in fresh and seawater were 2.92 and 0.9 respectively while the percentage survival rates were 100 in both. In the second study *O. pangani* fingerlings (1.3 -31.4 g) cultured at salinities of 0, 15, 25, 35 exhibited daily percent specific growth rates of 2.08, 11.86, 5.48 and 5.00 respectively. In the 3rd study *O. urolepis urolepis* just hatched fry grown at salinities of 5, 15, 25 and 35 exhibited percentage daily growth rates of 2.5, 3.1, 4.9 and 3.1 and survival rates of 96, 97, 93 and 98 respectively. In the 4th study *O. urolepis urolepis* fry (0.7-1.4 g) grown at a salinity of 30 fed with protein substitute of fish meal using blood meal, azolla and sunflower seed cake exhibited percent specific growth rates ranging from 3.7 to 5.1 and percent survival rates between 83 and 97. The last study was on *O. urolepis urolepis* cultured at salinities between 27 and 34 which exhibited percentage daily growth rates between 2.5 and 3.4. In these studies the best growth rates were in the salinities of 15 and 25 while the growth rates at between 0 and 5 salinities were similar to or less than those in full strength seawater. The studies have proved that the species in question can be farmed in brackish and seawater conditions with growth rates that are equal or better than those exhibited in freshwater.

ORAL-Tuesday-Msikaba4-1200

Review of the global genetic connectivity and diversity of sharks caught off the east coast of South Africa: implications for species' conservation management

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The knowledge of the genetic structure of sharks is important in implementing plans for species' conservation and management. Global phylogeographic structure of sharks was mainly shaped by historical oceanographic oscillations over many evolutionary time scales. The interactions of contemporary oceanographic features and species' life history may maintain such genetic structures or elicit new genetic breaks. We reviewed global genetic structure and diversity in the mitochondrial DNA region of six shark species (*Carcharhinus amboinensis*, *C. brachyurus*, *C. brevipinna*, *C. leucas*, *C. obscurus* and *Carcharodon carcharias*) caught in the shark safety gear along the east coast of South Africa. The aim was to investigate the effects of shark catches on the level and maintenance of genetic diversity between the east coast of South Africa and neighbouring continental coastlines. On a small regional scale (along continental coastlines), some species revealed genetic panmixia along the southern African coastline but significant genetic variation

compared with elsewhere in the world. On a global scale (amongst continental coastlines), the large expanses across the Atlantic and Indian Oceans impedes gene flow between South Africa and neighbouring continental coastlines. Therefore, the South African populations of these shark species should be managed as genetically distinct units. Overall, the impacts of shark safety gear on species' genetic diversity is species-specific and dependent on the life-history and genetic connectivity along the southern African coastline. We recommend future studies to investigate the effects of sex-biased dispersal on genetic structure of these species along the southern African coastline.

ORAL- Monday-Msikaba 2- 1620

Cover changes and regeneration status of a peri-urban mangrove

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Stability of anecosystem is determined by its resilience, regenerative capacity and numerousweak trophic links, amongst other natural and human induced factors. The Tudorcreek mangroves, a typical peri-urban mangrove, are exposed to both episodicnatural and recurrent human disturbances, including decades' long exposure to raw domestic sewage, sporadic unregulated-harvesting and episodic siltation.This study evaluates the regeneration patterns within extended gaps and the under storey. An evaluation on species mix and regeneration patterns is alsodone. Preliminary analysis of aerial photographs (1969 and 1992) and asatellite image (2005) indicate a 12.5% decline in closed canopy mangrovebetween 1969 and 1992, and a 55% decline between 1992 and 2005. Distribution ofadult trees was variable, with mixed stands and large canopy openings in themid intertidal range. Species composition of seedlings and saplings did notalways reflect the overstorey species composition and varied with gap sizes. Gap sizes range between 10 - 50m² have higher or mostly adequate regeneration,while gaps smaller than 10m² and bigger than 60m² have lower regenerationlevels. *R. mucronata* seedlings and saplings occurred in the understorey underall cover types and inundation regime, conferring advantages to this speciesunder the current disturbance regime. This may favour its establishment inrelation to other species. *A. marina* and *C. tagal* saplings and seedlings arerestricted to the forest edges and gaps. The current status of the forest isreminiscent of a recovery phase, a multiphase succession stage, after a majordisturbance event, accompanied by recurrent anthropogenic pressure. This studyshows that species composition depends in part on the balance between naturallarge-scale and recurrent small-scale human disturbances.

ORAL- Wednesday – Msikaba 1- 1640

Carbon accounting for REDD in a transboundary mangrove forest in Kenya, WIO region.

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Carbon accounting is one of the precursors of carbon-offset projects in forestry. It entails measurement of carbon captured and stored by the system, in this case mangrove forests. We measured total carbon stocks of a transboundary mangrove forest of Vanga pilot area, using the IPCC protocol for coastal wetlands. This was followed by development of localized allometric relations for determination of stand biomass and volume of principal mangrove species. A total of 22 sampling plots measuring between 100 and 400m² were used. Soil organic carbon (SOC) was determined using loss of ignition (LOI) method. Total carbon stock of mangroves in Vanga were estimated at ~422 Mg C/ha, with SOC and above ground biomass accounting for 77% and 23% of the total ecosystem carbon. The significance of this data in the development of carbon offset project for mangroves of Vanga is discussed

ORAL- Monday-Amaiba-1720

Coral Diseases in Tanzania: Occurrence Prevalence and Distribution

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Twenty coral reefs covering the whole coast of Tanzania and nearby islands were surveyed to assess the status and temporal variability in prevalence of coral diseases. 20x2 meter long permanent band transects were marked with tagged rebars at one or two depths and surveyed using scuba twice a year, for two years covering two warm seasons and two cool seasons in ten localities. Ten other localities were surveyed using rapid assessment once during the study. All coral colonies along one meter on each side of the line transect were checked for disease, predation and/or overgrowth from other organisms. Results show that overall, there were seven coral diseases and disease prevalence ranged from 2.24±1.55 in Misali Pemba to 0.09±0.29 in Bilad, Stone town reef. The difference between sites was statistically significant ($p < 0.0000$) but between season was not ($p > 0.317$). Similarly, competitive overgrowth was found to be statistically significant between sites ($p < 0.0000$), the highest prevalences were on sites close to large cities; in Chapwani 22.72±16.82, Mbudya 21.76±15.68 and Bilad 19.13±10.33 and lowest on South of Unguja Is. Kizimkazi where the prevalence was 2.82± 2.92. The relatively undisturbed sites away

from large cities with high coral diversity and high cover had higher disease prevalence while overgrowth by coral competitors; algae, sponges and corallimorpharians were higher close to Zanzibar town reef of Chapwani and Bilad and Dar es Salaam city reefs of Bongoyo and Mbudya. Overgrowth competition was found to be more prevalent on areas related to poor water quality from urban areas. These finding, though promising due to low prevalence of infectious coral diseases, coral competitors increase on reefs close to developed cities should be taken as an early warning and prepare for proper management measures.

ORAL-Wednesday-Amadiba- 1400

Coral transplantation effects on fish and benthic community structure at a naturally damaged coral reef

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The restoration of damaged reefs via transplantation of nursery-reared coral colonies can increase coral abundance, species diversity and local recruitment. However, the effects of coral transplantation on reef fish and benthic communities still remain poorly studied. In the present study, we surveyed reef benthic cover, coral community composition and fish community structure before, during and after a large scale coral transplantation project within the marine protected area of Cousin Island Special Reserve, Seychelles, Indian Ocean (November 2011-November 2014). This island hosts the largest coral reef restoration project in the western Indian Ocean with 24,431 nursery-reared corals transplanted of 9 species: *Acropora hyacinthus*, *A. cytherea*, *A. irregularis*, *A. vermiculata*, *A. formosa*, *A. lamarcki*, *A. appressa*, *Pocillopora verrucosa* and *P. eydouxi*. The project aimed to restore the structural complexity of an 1998-El Nino damaged coral reef with bleaching-resistant species resembling the natural coral community of the Seychelles' inner granitic islands. The experimental design included a control healthy (H) site, a control degraded (D) and the transplanted site (T). The H site was included to quantify differences in reef fish and benthic community structures between D and T sites and how they compare to a reference healthy coral reef. Preliminary data analysis revealed that coral cover, coral and fish diversity and abundance were highest at H site and lowest at D site. The T site values were located between the H site and the D site. Further analyses will evaluate the effects of reef restoration on the resilience and recovery of a coral reef ecosystem after large-scale disturbance and the time-frame needed for detection.

POSTER

Coral transplantation onto damaged reefs enhances coral settlement and recruitment in the Seychelles, Indian Ocean

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A large-scale coral transplantation project was initiated in 2011 in the inner Seychelles to assist the recovery of local damaged reefs. Whether this coral transplantation would enhance natural coral recruitment at the rehabilitated site is unknown. To investigate this effect, we quantified the density of scleractinian settlement (spats <1 cm) and recruitment (colonies 1-5 cm) at a transplanted degraded (T), a degraded control (DC) and a healthy control (HC) sites at Cousin Island, Seychelles. We used 16x16x0.8 cm ceramic tiles (n=20 per site) for settlement and visual surveys with 1 m² quadrats (n=18 per site) for recruitment. Over the six month sampling period, settlement of all taxa at T site was 1.9 times higher than at DC site and 1.6 times higher than at HC site. Over a two year period mean recruitment of all taxa was 1.8 times higher at HC site than at T site and 2.9 times higher than at DC site. Recruitment was 1.8 times higher at T site than DC site. Mean recruitment at T site increased gradually from the beginning to the end of sampling, November 2012 to October 2014. We concluded that: 1) coral transplantation in Seychelles, enhances natural settlement and recruitment of corals onto degraded reefs and 2) attraction of coral larvae might be the most immediate benefit of coral transplantation. We suggest this is due to cementing corals directly to denuded reef areas, high species diversity, high density of transplants, and mimicking the structural properties of a natural healthy coral reef

ORAL- Tuesday – Msikaba 1 – 1140

Initiatives of landing discarded by-catch from commercial shrimp trawlers at a social, economic and environmental feasible manner. The case of Sofala Bank, Mozambique

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Shrimp trawling generates enormous amount of by-catch of low economic value which ends up discarded at sea in most commercial shrimp fisheries worldwide. While this by-catch is needed to support food security efforts and generate income in coastal areas it has always been a challenge for governments and fishing industry to efficiently land those by-catch fish products. This study presents a case study of a by-catch collection informal program carried out by small scale entrepreneurs in Mozambique's Sofala Bank coastline and proposes ways to maximize its socio-economic and environmental benefits. Both biological samples and interview-based information were obtained in five major landing sites located across the 450 nm coastline of the fishery during the 2012 shrimp fishing season. The results indicate that a total of 505 informal collectors operating on average 68 boats (28 motor boats and 40 sail) participate in the

collection activity. Each trip to sea lasts up to 9 hours and traveling up to 102 km offshore to purchase from the industrial trawlers by-catch fish through exchange with money or agricultural products. The business generates over 4,000 t of fish per season and revenues in the order of 153,000 USD. A non-metric Multidimensional Scaling (MDS) analysis carried out for exploring similarities or dissimilarities in the composition of fish taxa landed with the actually caught shows a clear separation between the composition caught and landed, indicating some fish selection. The landings represent only 10% of estimated by-catch from the Sofala Bank shrimp fishery therefore there is still room for expansion of the activity. There are difficulties faced by this informal system, whose solutions for maximization and optimization of the socio-economic and environmental benefits are proposed in this work.

POSTER

The current status and classification of the aMatikulu Estuary: biomonitoring results and recommendations

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The aMatikulu Estuary, situated on the sub-tropical KwaZulu-Natal coast, has erroneously been described as a permanently open, turbid system with a poorly developed benthic fauna. The current biomonitoring programme has sampled the estuary quarterly over the past four years and has aimed to establish the physico-chemical conditions and status of the benthic macrofauna and avifauna communities. Frequent and protracted mouth closures and biological responses suggest that the aMatikulu Estuary is more appropriately classified as 'intermittently open'. Observations include the abundance of the burrowing sand prawn *Callinassa kraussi*, the response of *Ruppia cirrhosa* seagrass to stability and salinities that develop during certain phases, and the notable absence of mangroves despite proximity to the extensive mangrove communities in the adjacent uMlalazi and uMhlathuze estuaries. The avifauna is dominated by piscivores, a likely response to good water clarity during certain phases. The study results have implications for provincial and systematic conservation planning initiatives. As a partially protected estuary there is a need to improve the resilience of the system and recommendations are made in this regard, including the removal of the invasive alien tree, *Casuarina equisetifolia*, from the sand barrier and lower estuary.

POSTER

Marine Dynamics of Tamarin Bay estuary, West Mauritius

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The Tamarin River estuary, a micro tidal estuary located at 57°E, 19°S on the west coast of Mauritius. This system is one of most estuarine environments around Mauritius, is distinctive in its kind and where the topology of the sandy beach changes during heavy rain or waves. The mouth of the river is often blocked by sand deposits due to current pattern causing the water to be trapped inside the estuary. The main objective of this paper is to summarize

recent knowledge of this estuary, integrating physical, chemical and biological measurements to explore the mechanisms responsible for the transport of water, salt and chlorophyll at the mouth of the river in this lagoon and to understand the current pattern. A multi-parameter CTD and an Electromagnetic Current Meter (ECM) were used to record the parameters continuously over a period of one month. The temporal distribution of salinity, turbidity, pH, chlorophyll, wave, conductivity, pressure and current of the seabed at a depth of about fourteen metre were analysed from March to April 2014.

POSTER

Distribution and Abundance of Phytoplankton along Zanzibar Coastal Waters

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Phytoplankton species composition, diversity, distribution and abundance were investigated in the surface layer off Zanzibar coastal waters. Generally, the findings from this study revealed that, three main algal groups namely:- Diatoms, Dinoflagellates and Cyanobacteria dominated the phytoplankton composition of Zanzibar waters. A total of 260 species of phytoplankton were encountered, in which a relatively higher phytoplankton abundance and diversity was recorded during the Southeast monsoon (SEM) season (Jun-Oct) than in the Northeast monsoon (NEM) season (Dec-Apr) ($p=0.044$), this could be due to favourable conditions during the SEM. Furthermore, the results demonstrated that Diatoms have higher contribution to the total phytoplankton abundance (70.26%), followed by the dinoflagellates (24.52%) and Cyanobacteria (5.20%), while less than 1% was attributed to Chlorophytes, mostly the *Pediastrum* spp, Dictyochophyceae (*Dictyocha* spp) and Crysophyceae (*Distephanus* spp). For the dominant groups, the frequently encountered genera were *Chaetoceros*, *Rhizosolenia*, *Nitzschia*, *Thalassiothrix*, *Guinardia*, *Bacteriastrum*, *Pleurosigma* and *Coscinodiscus* for the Diatoms, while *Ceratium*, *Dinophysis*, *Gonyaulax* and *Amphisolenia* were dominant Dinoflagellates, and *Oscillatoria*, *Schizothrix* and *Trichodesmium* were the most dominant Cyanobacteria genera. Low abundance and diversity in the NEM was probably due to rain waters and low water clarity which reduced the amount of light available to the planktonic algal.

POSTER

Trophic considerations of bonefish (*Albula oligolepis*) in the St. Joseph Atoll, Seychelles

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Recreational fishing is an economically important industry at many remote tropical island destinations, including the Seychelles. Bonefish (*Albula* spp.) are one of the top attractants for recreational anglers due to their reputation of being 'one of the most elusive fish to catch on the fly.' Despite their importance limited information is available

on this species and almost none in regards to the Indian Ocean. As spatial and trophic information is essential effective conservation strategies, this study will examine stomach contents of bonefish to further understand their role in a tropical atoll ecosystem. Gastric lavage, a non-lethal technique for identifying dietary information will be adopted and the stomach contents of 50 bonefish will be flushed and examined. The objective of this study is to describe the diet of *Albula oligolepis* at the St. Joseph Atoll, Seychelles. The findings will contribute towards a better understanding of the trophic ecology of this species as well as the global resource of academic literature.

POSTER

The responses of macrobenthic communities to human-induced habitat perturbations within intertidal sea grass meadows on Unguja Island

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Differences in macrobenthic abundances were tested within *Thalassia*-dominated sea grass meadows between areas subjected to varying degrees of trampling intensities. Two intertidal foot-tracks, traversing the sea grass beds were randomly selected and used as transects for macrobenthic sampling within the meadows, along the shore height axis. For each transect, sampling for epi and endo-fauna as well as sea grass biomass was done by coring. At each shore height (upper, mid and lower shore) four cores were randomly sampled on the track (0m); and two 5m and 10m perpendicularly off the track on either side, respectively. Macrofauna abundances were found to vary significantly among the different trampling intensities ($F_{0.05} = 4.3$, $p < 0.05$), with communities adjacent to the foot track (0m) having lower density than those 5m and 10m off the track. Variations were also observed among the different shore heights ($F_{0.05} = 5.3$, $p < 0.01$), with highest abundances observed on the lower shore. However, species diversity did not vary significantly across the stress levels, although slightly lower diversity were observed within the highly stressed communities (0m). Likewise below, above and total sea grass biomass showed no differences among the stress levels. The lower fauna abundances on the most tramped parts of the sea grass beds demonstrate the negative impact of physical disturbances on the benthic communities resulting from human visitation onto the intertidal zone, besides resource harvesting. However, the lack of impact on fauna diversity may be proof that such communities have evolved some mechanisms to respond to increased levels of physical stress. This study, although small scale, has further demonstrated the importance of the traditional practice by most shore visitors on Unguja Island, of using specific foot tracks when traversing the shore, in preserving the otherwise highly stressed intertidal benthic communities

POSTER

Mitochondrial DNA analysis reveals a single stocks of Frigate tuna *Auxis thazard* (Lacepède, 1800) in the northern coastal waters of Tanzania

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Frigate tuna *Auxis thazard* is an epipelagic and migratory species of family Scombridae found in the Indo Pacific Ocean. It is commercially important fish and it accounts

for 35% of the tuna catches in the Tanzania coastal waters. However, the genetic structure of this species is not documented in the Western Indian Ocean. In present study, genetic structure of Frigate tuna was examined using sequence analysis of mitochondrial DNA D-loop gene from two geographically separate locations along the northern Tanzania coastal waters. A 500bp segment of D-loop region was sequenced and analyzed for 38 samples. Hierarchical analysis of molecular variance ($F_{ST} = 0.451$, $P > 0.05$) and pair wise differences ($\Phi_{ST} = 0.384$, $P > 0.05$) did not reveal a significant genetic differentiation between locations 03844, ($P \leq 0.001$). Furthermore, there was no temporal genetic differentiation between samples collected during southeast and northeast monsoon. Results were further corroborated by a non significant value of nearest neighbour statistic ($S_{nn} = 0.361$, $P > 0.05$). Thus finding of this study accepts the null hypothesis of single panmictic population of Frigate tuna in Indian Ocean. Such spatial and temporal homogeneity on genetic structure of the Frigate tuna confirms that the current management of the species as a single stock in the Indian Ocean is in agreement with our findings.

POSTER

Tubular nets, an innovative technique of cultivating the higher valued *Kappaphycus alvarezii* in Zanzibar, Tanzania

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Seaweed farming in Tanzania has faced recent challenges that cause mortalities of the higher valued species *Kappaphycus* including the rise in surface seawater temperatures, epiphytism, ice-ice disease signs, and fouling. More recently, even the lower valued *Eucheuma* is dying-off especially during the hot seasons. Furthermore, incidents of algal blooms in the past 2-3 years have been observed on the shallow water areas where the seaweed is farmed causing dermatological problems to the farmers and die-off the *Eucheuma*. Several research works have pointed out that these challenges and incidents are directly linked climate change. Innovative scientific research has been carried out to develop farming technologies that will allow farming *Kappaphycus* in deeper waters by using the floating lines technique and bamboo rafts. These technologies have, however, faced a problem of roughness of the sea that causes breakage and loss of the seaweed. With funding from WIOMSA, this research was carried out to test the feasibility of the tubular nets as an alternative technique to farm the higher valued seaweed in rough sea conditions. Preliminary results show that with the tubular nets there was no seaweed breakage during the study period of August – December 2014 and the seaweed grew at high growth rate (sgr) ranging from a minimum average of 6.2 ± 0.7 to a maximum average of 15.6 ± 1.1 . These preliminary results indicate that tubular nets could be a way of producing the higher valued seaweed *Kappaphycus* in Tanzania

POSTER

Growth Performance and Survival Rates of Hybrids of (Nile Tilapia (*Oreochromis Niloticus*) Female X Rufiji Tilapia (*Oreochromis Urolepis Urolepis*) Male) Reared at Different Salinities

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The study assess the growth performance and survival rates of hybrids (Nile tilapia (female), *Oreochromis niloticus*, Linnaeus, 1758x Rufiji tilapia(male), *Oreochromis urolepisurolepis*, Norman, 1922 reared at different salinities evaluating the possibilities of producing all male tilapia. With increasing effect of climate change and consequently induced drought coupled with competing demands for freshwater, developing brackish and seawater tilapia farming is of prime importance. The experiment cultured twenty seven days old fry of 1.573 g \pm 0.04714 SE weight stocked at a rate of five individuals/m² in triplicate nursery tanks at three levels of salinity including a control at 2 and treatments at 15 and 35. Salinity was raised at a rate of 2ppt per day by proportionally adding seawater to fresh water. Spawners and fry were fed with formulated feed (40% crude protein) twice and thrice a day at the rates of 5% and 10% of their body weight respectively. Feed ration for fry was reduced to 5% of their body weight after the first X months. Growth performance indicators including specific growth rate, weight gain, average daily weight gain, food conversion ratio and survival rate were evaluated. Preliminary results observed after 18 days indicated survival rates of 100% in all salinity levels. Mean growth (g) was 3.53 \pm 0.854 SE, 2.660 \pm 0.94 SE and 2.10 \pm 0.56 SE for control, 15 ppt and 35 ppt respectively. No significant differences in growth performance among treatments ($p > 0.05$). The experiment will go on for a total of 6 months and % males will be identified and the results be presented in the symposium. Since the hybrids have already shown high adaptability to different salinity levels, they can be considered a potential alternative species for mariculture.

POSTER

Kenya Lobster Fishery improvement projects – Process to Resource Sustainability and Certification

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Kenya has a well-developed shallow water lobster fishery extending along the Kenyan coast. The fishery is targeted for both export and local market with the extent of local

sales probably under-estimated hence a management challenge. The lobster fishery is therefore one of the few fisheries that has been proposed for certification and has the potential for raising the living standards of the local fishermen, providing employment and better income if it is certified. Since 2008 Kenya Fisheries Department embarked on a collaborative process with the World Wildlife Fund for Nature working towards obtaining Marine Stewardship Council (MSC) lobster certification with an ultimate goal of sustainability. The pre-assessment was followed up by the development of a lobster fishery management plan and a comprehensive Fishery Improvement Project (FIP). Several stakeholder consultative workshops were as part of the MSC certification process evaluating success at every step. A retrospective analysis on progress of Lobster Fishery Improvement Project (FIP) priority activities using MSC Bench Marking and Tracking tool (BMT) gave a score of 0.60-0.79 (preliminary) indicating improvement on the fishery performance towards meeting the MSC standards. Since stock assessment has shown that the stocks are not over-exploited and there is a draft management plan, this fishery provide great potential for demonstrating the concept of sustainable fisheries in Kenya, low ecosystem impact and healthy stocks for the present and future. It is also clear that many lobster fishing sites are close to a number of Marine Protected Areas (MPAs) but no adverse effects have been observed in these habitats. Based on the facts and expert opinion, the lobster fishery along the Kenya coast can be managed sustainably for increased socio-economic benefits to the country and the local fishing communities.

POSTER

The reproductive biology of the beaked clam *Eumarcia paupercula* from Maputo Bay

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The beaked clam *Eumarcia paupercula* is one of the bivalves' species with commercial importance in Maputo Bay. For a better regulation of its fishery, managers will demand data on the reproduction pattern. The present study marks the first attempt to describe the reproductive activity of clams in Maputo Bay. This study aimed to assess the seasonality of the reproductive cycle of *E. paupercula* and the environmental factors affecting it. Seasonal fluctuations in the condition of a standard individual (29.99 mm) were followed in peer with analysis of fresh gonad smears.

The sex ratio revealed by Chi-square test did not significantly differ from parity ($p > 0.05$). A minor spawning period occurs during the winter (April to June), and a major during summer (December to February). In addition, an intermediate event takes place in late winter/early summer (September) when a drop in DFW is recorded, and 46.7 % of individuals were partially and totally spawned. Macroscopic

gonad observations and changes in the body condition revealed that *E. paupercula* in Maputo Bay is a year-round breeder. Rainfall is the main factor regulating spawning of *E. paupercula* ($r = -0.726$, $p < 0.01$). Nevertheless, it appears that interaction of environmental factors during summer, namely food availability, temperature and rainfall are regulating the intensity spawning. Factors preceding the spawning season, such as nutrient reserves accumulation, during winter have to be considered.

ORAL- Thursday- Amdiba- 1640

Application of IPCC Guidelines in Monitoring, Reporting and Verification (MRV) and Blue Carbon in WIO Countries

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The Intergovernmental Panel on Climate Change (IPCC) recently published the 2013 Supplement of the IPCC (2006) guidelines for national greenhouse gas inventories. The supplementary addresses gaps identified in the 2006 IPCC Guidelines as far as possible. It focuses on those human activities and management that give rise to anthropogenic emissions or removals by wetlands. Chapter 4 of the Supplement concerns Coastal Wetlands that are tidally influenced and, include mangroves, saltmarsh, seagrass and tidal freshwater systems. Importance and unique characteristics of these wetland types is also provided (e.g. Soil- organic versus mineral; Hydrology and water quality; and Vegetation types). Furthermore, methodologies for undertaking carbon accounting in coastal wetlands under different pools, plus the emission factors, is given. This paper underlines the appropriateness of 2013 Supplement for carbon accounting in coastal wetlands in WIO countries. The challenges of using these Guidelines and how to overcome them is discussed in a means to assist countries in WIO use their coastal wetlands in their pursuit for nationally appropriate mitigation actions (NAMA's).

ORAL- Thursday – Msikaba 4 – 1620

GIS-based coastal sensitivity map for Tanzania

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The Tanzania coastal zone provides important habitats and natural resources which must be sustainably exploited. Important zones includes fishing grounds, aquaculture sites, tourist destinations and many others. The recent discovery of gas deposits implies that Tanzania coastal zones will experience even more activities in the near future. While the question of sustainability and compatibility is being worked out, this study attempted to demonstrate the relative locations of the key biophysical environment (habitats), resources and infrastructure within the coast area and produced a sensitivity index showing which sites are especially sensitive to the effects of an oil spill accident or any other similar disaster that could introduce oil to the marine environment. The overall environmental sensitivity index (high, medium high, medium low and low) was evaluated by combining shoreline

characteristics, socio-economic and biological features. About 36 % of the coastline was evaluated to have high, 60 % medium and 4 % was regarded to have low sensitivity. A total of 37 reference maps, covering the entire Tanzania coastline were produced. This first attempt to produce a sensitivity atlas used existing data and information from previous studies, interviews and field verifications in selected areas. It was carried out by the University of Dar es Salaam – Institute of Marine Sciences, Samaki Consultants and OBSCOM with support from oil and gas prospecting and exploration companies (Statoil Tanzania AS, BG International Limited and Petrobras Tanzania Ltd).

ORAL- Thursday – Msikaba 3 – 1140

Tides and tidal currents in Zanzibar channel

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Zanzibar Channel, which separates the Tanzania Mainland coast and Unguja Island, is an important area because it houses a wide variety of ecosystems and species, valuable resources and economic activities. It is an important shipping route for ferries daily between Dar es Salaam and Zanzibar. Despite its importance, knowledge on hydrographs and circulation patterns particularly in relation to tides, tidal currents and influence of the East African Coastal Current in the Channel, is limited. Tide and underwater pressure gauges and *in situ* recording current meters were deployed and recorded tides and currents selected sites in the Zanzibar Channel. Meteorological data such as wind, air temperatures, relative humidity, solar radiation, rainfall and evaporation were obtained from the Zanzibar meteorological station. Tides and tidal currents data were used for harmonic analyses and computation of tidal ellipse and tidal characteristics. The study used the ROMS model to simulate the tides and currents to examine possible effect of the East African Coastal Current and tidal waves entrance into the Zanzibar Channel. Key findings of this study include: harmonic analysis of data which shows that tides in the Channel is semidiurnal with form factors 0.163 in Zanzibar and 0.177 in Dar es Salaam; the tides seemed to be affected by annual variations of climatic factors, mean sea level showed a decreasing trend from year 1984 to 2001, thereafter an increasing trend up to year 2012. The flood tidal waves from the Indian Ocean enter Zanzibar Channel through both openings converging at the Zanzibar archipelago resulting in higher tidal range and lower mean tidal currents speed. No significant influence of EACC on the currents in the Zanzibar Channel was found, however there was evidences of monsoon influence, where the currents flew southward during NE monsoon. ROMS model was 99% effective in predicting tidal elevations.

POSTER

Examining the population structure of yellowfin tuna (*Thunnus albacares*) in southern Africa using a next-generation DNA sequencing technique

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Yellowfin tuna (*Thunnus albacares*) is a commercially important tropical and subtropical pelagic fish species; it supports the second most important global tuna fishery, and important fisheries in both the eastern Atlantic and

western Indian Oceans. The population structure of this species in these regions is, however, unclear. Globally, *T. albacares* is considered to consist of four genetically distinct populations, with a relatively shallow genetic divergence. Southern Africa's *T. albacares* stocks are currently considered to be comprised of two populations: an Atlantic Ocean population, whose fisheries are regulated by the International Commission for the Conservation of Atlantic Tunas (ICCAT) and an Indian Ocean population regulated by the Indian Ocean Tuna Commission (IOTC). These stocks may however be composed of a single panmictic population as an initial genetic study by the authors, using mitochondrial DNA (mtDNA) markers, found no significant genetic variation among South African *T. albacares* samples, and indicated that individuals from the eastern Atlantic Ocean (southern Africa's west coast) have a higher genetic variation to Atlantic Ocean samples than to Indian Ocean samples. The *T. albacares* stocks in the Atlantic waters of southern Africa may therefore not form a part of the Atlantic Ocean population, but may be an extension of the Indian Ocean population. If this is the case, South Africa's *T. albacares* stocks may be managed as a whole by the IOTC. The power to detect small but potentially significant differences between Atlantic and Indian Ocean components of the South African *T. albacares* stocks was limited by the shallow depth of the mtDNA marker networks and the small number of nuclear gene loci used in previous studies. To rectify this we will collect further samples and utilise a next-generation DNA sequencing technique to identify more variable genome-wide genetic markers, single nucleotide polymorphisms (SNPs).

POSTER

Spirulina (Arthrospira spp) Culture and Its Use as a Protein Source in *Oreochromis urolepis urolepis* Mariculture.

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The use of blue green algae *A. platensis* in aquaculture as a protein source has several potential advantages over fish production. In the present investigation, spirulina (*Arthrospira platensis*) was used as feed additives on growth performance in Rufiji Tilapia (*Oreochromis urolepis urolepis*) mariculture. *A. platensis* was isolated from Momella Lakes in Arusha National Park, Tanzania. The results showed that the optimum physical-chemical parameters: light intensity, pH, temperature and culture media for the growth as optical density (OD) and biomass (g/l) of *A. platensis* were 3.5 klux, 10, 32°C and Zarrouk medium respectively. *A. platensis* was used as feed additives on growth performance in Rufiji Tilapia for 60 days. Six (6) isonitrogenous diets containing about 35% crude protein for Tilapia fry were formulated: one, a control diet without supplements and the rest being supplemented with 5%, 15%, 25%, 35% and 100% *A. platensis*. Results indicated that fish fed on 5% spirulina exhibited superior final weight (FW), average weight gain (AWG), specific growth rate (SGR), feed conversion ratio (FCR) and protein efficiency ratio (PER) suggesting that spirulina is an appropriate growth-stimulating additive in Rufiji Tilapia mariculture.

POSTER

Assessing climate change vulnerability of communities dependent on the mangrove ecosystems in the Tana River Delta, Kenya

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The coastal mangrove ecosystems of the Tana Delta provide various goods and services. Communities living at the coastal mangrove wetlands such as those around the Tana Delta are highly dependent on these ecosystems. However, the ecosystems and their surrounding communities face an increasing number of threats including various environmental impacts from climate change. Mangrove ecosystems and their dependent communities are most likely to be impacted as a result of sea-level rise, changing hydrological regimes and more frequent and destructive tropical storms (Gilman *et al.*, 2007; Field, 1995). The predominantly natural resource based livelihoods and low level of adaptive capacity due to high poverty levels make these communities vulnerable to climate change (Oxfam, 2009). The main objective of this study is to assess the vulnerability of the Tana River Delta mangrove ecosystem dependent communities to climate change and identify ecosystem based adaptation options.

Project Objectives

1. To evaluate the vulnerability of mangrove ecosystem dependent communities in Kipini Division;
2. To assess the coping capacities of mangrove ecosystem dependent communities in Kipini Division to climate change and vulnerability;
3. To develop ecosystem based adaptation options for the coastal mangrove communities on the Kenyan coast.

Major outputs of the project will include:

- An assessment report on of the current status of mangroves in the Kipini Division
- Documentation of the critical ecosystems services in the Kipini Division
- Data and information on the sensitivity, exposure and adaptive capacity of mangrove dependent communities to effects of climate change.
- An ecosystem based management plan for the conservation and restoration of coastal mangrove ecosystems

POSTER

Fisheries co-management: A case study of Lamu - Tana seascape, Kenya

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Co-management is commonly defined as a partnership in sharing management authority and responsibility (and the benefits) between a group of resource users and the government. Co-management was adopted in Kenya in the late 1990s

We assessed the status of fisheries co-management in marine waters in Kenya, focusing on Lamu – Tana seascape. This entailed a desk review of the existing policy and legislation

to assess their robustness, assessment of initiatives by government agencies and non-governmental organizations to strengthen fisheries co-management and a rapid field assessment of BMUs through focus group discussions and administration of questionnaires. Respondents were drawn from 19 registered BMUs in Lamu – Tana seascape; within Kiunga marine protected area, Pate Island, Lamu Island and Tana delta. 29 women and 82 men were interviewed. Information was collected on governance, institutional management, monitoring, control and surveillance and understanding of emerging issues.

There is a favourable policy and legal environment for fisheries co-management in Kenya. However, BMU members do not readily access copies of legislation 16% of the assessed BMUs had copies of the Fisheries (Beach Management Unit) Regulations, 2007. Government agencies and Non-governmental organizations support fisheries co-management in Kenya through training on governance, financial management; sustainable fisheries management and fish catch data collection. BMUs do not have co-management and financial plans; 50% of the respondents attributed this to lack of the knowledge of how to develop the plans. The training has been effective; time allocated is too short and there is minimal follow-up. 74% of the BMUs assessed do not have the capacity to carry out MCS. BMUs lack adequate facilities at landing sites. Some fishermen do not see the need to join BMUs; they have not made significant contribution to increase fishery yields and access to savings and credit facilities for fishers.

ORAL- Wednesday- Amadiba- 1200

Retrospective study- Evaluating phase shift in coral reef research priorities in a changing climate

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With prolonged climatic variability and persistent human-induced disturbances, coral reefs are facing serious threat to rapid community changes at an unprecedented rate. This retrospective study on the coral reef related publications from 1965 to 2012 focuses on the phase shift of the various anthropogenic impacts threatening the ecosystem. The meta-analysis of the 48 years reef related publication data showed that global warming (coral bleaching) claimed major part of the research attentions from the late 1990's onwards. Of all the measured impacts, three other major phase shifts in the researches were recognized, namely crown of thorns infestation (1970's and 1990's), overfishing along with runoff (eutrophication) and sedimentation (1980's onwards), and emergence of severe coral diseases (2000's). Based on the retrospective study, it is obvious that the coral reefs are under escalating threat of climate change, as such there is an urgent need of strict action and commitment to the reef management strategies at the global level. However, the management of the coral reefs strictly depends on the models that would incorporate these climatic changes at a multi-dimensional level including the scientific, socio-economic, political and environmental considerations from local, regional to a global scale.

ORAL- Thursday- Msikaba 2- 1640

Establishing Locally Managed Marine Areas in Kenya

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Coastal communities in Kenya have adopted the use of Locally Managed Marine Areas (LMMA) since the mid-1990s, to protect fisheries and marine resources but also to securing alternative livelihood activities. However, these LMMAs have been established in a somewhat *ad hoc* manner due to a lack of guidelines for their development and implementation. In this review we sought to define generic guidelines for the establishment of LMMAs that are accessible to coastal communities. Information on ten coral reef-based LMMAs was reviewed and Key informants interviews conducted. LMMAs in Kenya go through five phases: i) Conceptualization, ii) Inception, iii) Implementation, iv) Monitoring and management, and v) Ongoing adaptive management. This contrasts with LMMAs in Pacific Island countries where four stages are reported, with the first Conceptualization phase not mentioned. Our results illustrated the need for full acceptance of the LMMA concept by local communities and other stakeholders before progressing beyond the first phase, a mistake that was made during the establishment of most LMMAs, causing them to stagnate between the 1st, 2nd and part of 3rd phase. Four LMMAs in Kenya are in the fifth phase, though their financial sustainability is weak. Across all LMMAs there no strategies for education and awareness, marketing, long term financing and monitoring. We recommend that establishment of LMMAs in Kenya focus on these four areas. Most importantly the lack of sustainable financing means that most LMMAs are heavily dependent on outside aid and communities are unaware of the costs involved in implementing their LMMA. In conclusion, two phases require attention if LMMAs are to be effective in Kenya: the first Conceptualization phase that ensures all stakeholders are committed, and the final Ongoing adaptive management phase which will ensure monitoring, enforcement and implementation of a detailed management plan are funded and ongoing.

POSTER

Lessons learned from fisher peer exchange visits towards establishment of marine community conservation areas in Kenya

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Peer exchange visit are effective, practical tools of learning between organizations, projects and initiatives. The intentions of such visits are to benefit participants through open exchange of ideas, concepts and knowledge. Fisheries management strategies along the Kenyan

coast has lots of similarities that can be borrowed for advancement of fisheries activities. Thus creates a good opportunity for fishers to learn about the successes and failures of each other. The use of peer exchange visits in successful establishment of community conservation areas (CCA) cannot be underestimated. In the last one year, we have organized fisher exchange visits that enabled 30 fisher folks experience how marine community conservation areas have been established, with the understanding that this would provide an opportunity to not only acquire information, but also go through a practical experience of establishing marine community conservation areas; how they work and how they can sustainably be used to improve their livelihoods. This aim of this work is to highlight the factors that would result in a more enlightening fisher exchange visit. We assessed 2 field exchange visits through focus group discussions and key informants interview with participants of the two exchange visits, hosts and organizers. Firstly, we sought to find out if the CCA model is best for resource management. Secondly, we inquired what communities needed for an effective peer exchange visit. Thirdly, what challenges or constraints were encountered in planning and carrying out the exchange visit? And what advice would you give to those planning an exchange visit. This exchange achieved its objectives of responding to areas of concerns among participants. Some factors that would contribute to planning more responsive and rewarding peer exchange visits were i) Selecting diverse group of participants; old, young, fishers with different fishing skills. And ii) Selecting participants from different geographical representation.

ORAL- Wednesday- Amadiba-1720

Population changes of sea urchins in coral reef closures and implications for reef ecology and management

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Species respond to fisheries closures depending on their phylogeny and their life history characteristics interacting with environmental conditions such as climate change. Understanding these interactions is important for managing invertebrate populations – especially those playing key ecological roles such as sea urchins. We studied the short and long-term changes in sea urchin populations in and outside of coral reef fisheries closures across several latitudes (~2°S to 25°S) in the western Indian Ocean (WIO). We counted urchins in nine 10m² quadrats per site at 304 sites in seven countries across the WIO. A predation index was also calculated by measuring predation on tethered individuals of the urchin *Echinometra mathaei*. Sea urchin communities reflected the status of reef ecology in terms of density, diversity and the characteristic of the assemblages. Urchins did not reach ecological thresholds where there were sufficient predators, which was mainly in the southern part of the WIO. Permanent fisheries closures played an important role in controlling

urchin in areas where urchin numbers were dominated by a mix of the large bodied species such as *Echinothrix diadema* and *Diadema setosum*, and also the smaller bodied *E. mathaei*. Measurements of predation showed a slow but continuous increase in closures as expected due to the increasing numbers of fish predators. Biogeographic and human drivers but particularly fishing pressure explain the different responses for urchin communities and complicate management solely by the use of fisheries closures. Given that latitude was also a strong predictor of urchin numbers, there are likely some oceanographic factors that influence the assemblages in the region.

POSTER

Spatial and temporal variability of endobenthos in mangroves sediment in Mida Creek, Kenya: implications to mangrove management and ecosystem monitoring

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Mangrove forests are important ecosystems ecologically and socio-economically being some of the most diverse marine ecosystems. Due to their close proximity to human settlements they are threatened by human activities including removal of extractable resources and trampling during cleaning of these resources. These activities can lead to compromises on ecosystem function. In order to establish if there are changes due to human activities we studied the endobenthic fauna distribution in five sites (Dabaso, Kirekwe Macho, Kirekwe Mark, Uyombo 1 and Uyombo 2) in Mida Creek. We hypothesise that proximity to human habitation can induce ecosystem changes that can be detected by changes in benthic community. The benthic sampling was carried out quarterly (January, July, April and October) for two years (2010-2012) and sample analysis was done using standard benthic procedure. Total macrofauna densities were not correlated with %Om or %sand and neither were the two most dominant taxa, nematodes and oligochaete. Total macrofauna density was less than 20000 individuals per m² in most sites except Kirekwe Macho which recorded >20000 ind/m². Nematode densities were significantly higher in Kirekwe Macho compared to the other sites (site: pseudo-F_{4,7} = 5.18, p = 0.011) and oligochaetes were significantly different between sampling periods (month: pseudo-F_{4,7} = 2.66, p = 0.02). Average meiofauna densities ranged between 500 and 1500 ind/10cm² for most of the sites and sampling periods except Kirekwe Macho which recorded > 1500 ind /10cm² during most of the sampling periods. Species diversity for macrofauna was also highest in Kirekwe Macho with recorded 9 meiofauna taxa. It can be noted that Kirekwe Macho that was furthest from any human habitation and most difficult to access had higher benthic fauna densities and diversities. This indicates a possible link between site proximity to humans and preservation of benthic communities implying that site selection for mangrove ecosystem protection should consider proximity and accessibility to humans as criteria

ORAL- Wednesday- Msikaba 3- 1420

Variations in Nutritional Composition of Seaweeds *Ulva rigida*, *C. Agardh* and *Ulva reticulata*, Forsskal and their Potential for use in Aquaculture, South Coast of Kenya.

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With agriculture and fisheries output being threatened by dwindling freshwater supply and stocks respectively, a long-term vision for aquaculture must be to derive new sources, primarily taken from outside the human food chain, and to derive them mainly from primary producers for example marine algae. Green macroalgae *U. rigida*, and *U. reticulata* were therefore collected from Gazi bay and Diani, Kenya and analysed for total proteins, lipids, carbohydrates, crude fibre, and crude ash following AOAC certified methods over a 12 months period from October 2011 to September 2012. This was done along with subsequent analysis of physico-chemical parameters within the two sites. The protein content ranged from 6.1 to 29.1 % DW with a mean of 16.12 ± 5.54 %DW, total carbohydrates ranged (20.2 to 53.3 %DW) and mean (40.74 ± 6.69 %DW). Crude ash ranged from 16.1 to 38.9 %DW an indication of a high mineral content. Lipids (0.68 ± 0.34 %DW) were lowest. The nutritional components were significantly different between the species, sites and seasons ($p < 0.05$). The differences seem to be influenced by the prevailing physico-chemical factors (salinity, sea water temperature, pH, phosphates and nitrate concentrations) at the sites. The results support the inclusion of *U. rigida* and *U. reticulata* as ingredients in fish feed formulation.

POSTER

Bioaccumulation of Heavy Metals in Seaweeds *Halimeda opuntia*, *Laurencia papillosa* and *Chaetomorpha crassa* in relation to their Safety for Use in Aquaculture Feeds in Kenya

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Seaweed use as human food and animal feed supplement is, among others, determined by their heavy metals status and or the ambient environment. Currently, the use of seaweeds among coastal communities is focused on their use as ingredients in aquaculture feeds. A study was therefore carried out in Gazi Bay and Diani at the South coast of Kenya from October 2011 to September 2012 to determine the concentration levels of toxic heavy metals including total arsenic, lead, mercury and cadmium in seaweeds *H. opuntia*, *C. crassa*, and *L. papillosa*. The species are some of those primarily used in artisanal fishery at the south coast of Kenya as fishing baits and could be of importance as supplement ingredients in the formulation of fish feeds. The heavy metal concentration levels were determined using Atomic Absorption Spectrometry (AAS) procedures. With the exception of *H. opuntia* all the other

seaweed baits had heavy metals (in mg kg⁻¹ DW \pm SE) within internationally permissible limits by Joint FAO WHO Expert Committee on food additives of <3.0 for total arsenic, < 1.0 for mercury, and <5.0 lead and cadmium. The four heavy metals concentration, varied among the seaweed species, study stations and seasons under the influence of the ambient environmental factors.

POSTER

The effects of nutrients on macroalgae species distribution and diversity-a case study of Kisite Mpunguti MPA in Kenya

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Coral reefs worldwide have suffered substantial changes in cover and species diversity in the recent past. Cycles of damage followed by recovery have become natural aspects of reef persistence. This pattern breaks down when reef communities are lost and fail to recover or when critical components are lost on a regional scale causing fundamental change in the larger coral reef ecosystem. Local environmental controls are key factors determining species diversity and cover among the benthic communities within the coral reef ecosystem.

This study focused on determining the influence of nutrients on macroalgae species diversity in Kisite-Mpunguti MPA. Four sites with varying environmental conditions and protection status were assessed. Macroalgae was sampled using 0.5 by 0.5 m quadrat frame made of Polyvinyl Chloride (PVC) pipes on a 10 m line transect once in every site per month for four months. Water quality parameters including nitrates, phosphates, ammonia, salinity, temperature and pH were determined from each site per month for four months during the macroalgae sampling period.

A total of 26 genera were recorded with *Sargassum* being the most abundant in three out of four sites. A total of 52 species were recorded in all the four sites. There was significant difference in nutrients load between sites.

POSTER

Adjustment of the closed season for artisanal beach seine fishery in Inhassoro district, south coast of Mozambique

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The beach seine fishery of Inhassoro district observes a closed season established since mid-1970s. The fishery is managed by the local Co-management forum, which decides when the fishery is closed and reopened. Originally of three months, from May to August, the closure become variable and frequently implemented in shorter periods. Presently, this variability is the major issue of concern within the Inhassoro Co-management committee which asked for a scientific advice for adjustment of the closed season. Based on data collected by a random-stratified sampling during 2009-2013, we investigated inter- and intra-annual variations on fishery catch, effort and CPUE, and intra-annual variations on size structure of

two dominant fish species (*Siganus sutor* and *Lethrinus lentjan*). We also investigated the reproductive period of *S. sutor* and *L. lentjan* based on gonadal development of adult fish sampled monthly between 2013 and 2014. Results suggest the period of three months, between June and September as the most appropriate for the beach seine seasonal closure. During that period, great percentage of the catches is composed by small juvenile fishes (60% for *S. sutor* and 80% for *L. lentjan*), indiscriminately removed by poor selectivity of the gear. However, the closed season will not be sufficient to ensure long-term sustainability of the resources exploited, while the fishery continue to be pressured by high levels of fishing effort, during the fishing campaign. Thus, in addition to aforementioned closure period, we propose other measures to be introduced on management of the fishery; i) a second closed season period of two months between February and April which is coincident with the peak of reproduction of important fish species; ii) close the fishery for new entries (license limitation) to contain the actual trend of effort increase; and iii) ban the beach seine and substitute it by a trap fishery.

POSTER

Evaluation of coastal fisheries of Cabo Delgado, Mozambique, as part of the Our Sea Our Life project
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The coastal communities of Cabo Delgado, Northern Mozambique are highly dependent on marine resources for food security and income, making them highly vulnerable to changes in the marine environment. The Our Sea Our Life Project (OSOL) aims to develop sustainably financed and community-run solutions to meet Mozambique's coastal and marine protection commitments. Monitoring of artisanal fisheries forms part of the evaluation of the project's outcomes. A sampling protocol was developed to record catch data from various artisanal gears deployed in coral reef, intertidal and pelagic habitats. Since December 2013, creel surveys have been conducted in five villages at a frequency of six days per month with catch per unit effort (CPUE) assessed across gear types. Results of the first year of monitoring show handlines, harpoons and beach seines as the three most frequently used gears. Spearguns and handlines recorded the highest CPUE while beach seines and mosquito nets showed the lowest CPUE. Women were strongly associated with the use of mosquito nets. The CPUE of the gears were generally higher during the Southeast monsoon than Northeast monsoon. Emperors (*Lethrinus* spp.), squid, rabbitfish (*Siganus sutor*) and octopus were the dominant taxa caught by all gears. The multispecies nature of these Cabo Delgado coastal fisheries requires accurate species identification to better track trends in CPUE to properly assess impacts of the OSOL Project interventions. Useful background information has now been collected, particularly with reference to gear use and from this a list of indicator species of conservation interest and high fishery value has been compiled and their CPUE monitored. The challenges and efficacy of species level fisheries monitoring for assessing conservation impacts will be discussed.

ORAL-Thursday-Amadiba-1600

Future Consequences of Sea Level Rise in Kenyan Coast

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The reality of climate change and sea level rise is currently widely accepted. The debate in both scientific and political remains on the actual impacts and projected consequences. Kenyan coast like most African coasts are at a greater risk due to their higher vulnerability caused by environmental degradation, low development and its low adaptive capacity. The exposure rate is due to fact that, first the Kenyan coastal zone has 17% of the land lying below the 10m contour could be submerged by a sea level rise of 30 cm. Secondly, the rate of urbanization and population growth is relatively high and is predicted to raise in future which will see 75% of the coastal area exposed to sea level rise. The few database available mostly model the impact and vulnerability of sea level rise on global scale. This paper first reviews the trends of rising sea level and vulnerability. Secondly it highlights the future consequences of the sea level rise on the Kenya coast. This is analysed based on the current and future predicted level of vulnerability and exposure in the coastal zone of Kenya. The current exposure of Kenyan coast is in the ratio of 1:100 storm surge level based on GIS studies. It is reported that, the country is projected to incur economic loss of \$7 - 58 million per year by 2030 and \$31 - 113 million per year by 2050 from above exposure while by the year 2030 the cost of adaptation to vulnerability and exposure is estimated to cost the country \$28-56 million / year and \$80 million / year by the year 2050. Seal level rise is in Kenya is projected to have more indirect impacts than the direct impacts which are already being experienced

POSTER

Spatial and seasonal variation in phenolic content of seagrass *Thalassia hemprichii* along Dar es Salaam coast

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Seasonal and spatial variation in total phenolics in *Thalassia hemprichii* from four different sites along Dar es Salaam coast was studied. Phenolic compounds have been studied in few seagrasses species to assess the health condition of the seagrass meadows, but very little have been done to investigate the use of phenolic compounds as biomarkers of seagrass health status along the coast of Indian Ocean in Dar es Salaam. In this study, *T. hemprichii* were collected from four different sites having different levels of anthropogenic perturbation namely, Ocean Road, Mjimwema, Kunduchi and Oysterbay during dry and rainy seasons. The total phenol contents of above and belowground parts of the seagrass were determined using Folin-Ciocalteu method. The significant differences in total phenol were observed among sites in both above and below ground parts, with the range from 2.7 to 35.7 µg GAE / mg and 1.9 to 142.9 µg GAE / mg for the above and belowground parts, respectively during the

dry season. The highest concentration of total phenol was recorded in samples collected from Kunduchi and the lowest being at Oysterbay. Similarly, in the rainy season there was significant difference in concentration of total phenols among sites ranging from 2.3 to 26.4 and 12.7 to 77.0 $\mu\text{g GAE} / \text{mg}$ for aboveground and belowground parts, respectively. In all sites during both seasons there was significant higher concentration of total phenol in the belowground parts than in the above ground parts. Furthermore, there was significant higher concentration of total phenol in *T. hemprichii* in dry season than rainy season. Our findings shows that phenol content is a potential early warning biological marker for assessing the status of seagrass meadows subjected to multiple environmental pressures

POSTER

Community based aquaculture initiatives in coastal Kenya
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Kenya enjoys a competitive advantage for mariculture and coastal aquaculture development in terms of access to diverse marine water resources. Kenya's marine fisheries potential is hardly realized and the current landings are only about 4.5 % of the capture fisheries potential. Therefore, mariculture presents an alternative supplement to the capture fisheries and can positively contribute towards food security, income generation and job creation. However, despite the huge mariculture potential in Kenya only a few community-based pilot projects and isolated trials for prawn, oyster, artemia, mud crab, seaweed, and finfish culture have been done which have largely remained at experimental/demonstration stages. Despite this, a few initiatives in the culture of milkfish, prawns, crabs and seaweeds have started realizing some profits albeit at subsistence levels. This paper presents some of these initiatives and discusses the successes, challenges and constraints in community based aquaculture at the coast.

ORAL-Thursday – Msikaba 4 – 1200

Effectiveness of fish farmer's trainings: Case of Kenya Coastal Development Project (KCDP)

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Aquaculture interventions in Kenya have always been introduced with limited training but even where trainings are done, no effectiveness studies exist. For sustainable aquaculture development under KCDP, farmer's trainings are prioritised. The trainings use either the older theoretical class work trainings or field based hands-on trainings. The study assessed how effective one-week trainings are through evaluations at the end of the training session by interviewing all farmers involved. A significant number (50-60%) preferred hands-on field based trainings. About 10-15% of the farmers preferred trainings in Kiswahili or any local direct. All farmers gained one or two ideas that could be applicable in the farms i.e. methods of controlling predators, making own feeds and employing different culture facilities. Emerging areas for training included; fish diseases, fish predators, fish culture methods, feed formulation and production and business skills. More than 35% of the farmers underscored the importance of allocating more time for trainings and development of proper training plans.

POSTER

Malindi-Ungwana Bay Small-scale Prawn Fishery Stock Assessment

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This presentation discusses findings of 8 surveys conducted between 2013 and 2014. Sampling was done from a total of five fish landing sites within the Malindi Ungwana bay stretch. The objective of the study was to determine the stock structure and the recruitment patterns. Catch, effort and biological data was collected. Fresh wet weights of prawns were taken using a digital balances to the nearest 1g and Carapace Length (CL mm) measurements taken using Vanier callipers to the nearest millimetre. Average CPUE ranged from 0.45 – 8.89 Kg/ fisher over the entire sampling period. The CPUE for SEM was higher than that for NEM suggesting that the SEM season is more productive than the NEM. Comparison of carapace length frequencies among sites and between seasons revealed varied patterns for prawns landed. Prawn species caught at all the sites consisted of a wide range of sizes, from as small as 3 mm for *Fenneropenaeus indicus* at Kipini to as large as 114 mm for *Penaeus monodon* at Mijikenda. Same pattern was observed for between season analyses with larger prawns for most species in the NEM season than the SEM season. *Fenneropenaeus indicus* had significantly larger individuals during NEM than SEM for all sites except Gongoni. *Metapenaeus Monoceros* had significantly larger individuals during NEM than SEM at Gongoni and Kipini but the opposite for Kurawa while *Penaeus monodon* had larger individuals during NEM than SEM in all the sites. Gonadal maturity stages examined macroscopically indicated all species except for the freshwater *Macrobrachium rude* were characterized by stages I and II thus signifying that most fishing grounds for artisanal fishery are nursery grounds for those species. There is need for management interventions that contribute to conservation and protection of the delicate early life stages of the prawns.

ORAL- Wednesday – Msikaba 2 – 1400

Shallow Water Prawn Fishery: Species Composition, Abundance and Distribution along the Tanzanian Coastal Waters

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Prawn fishery is of major economic importance to individual fishers and the nation. The study was conducted to assess shallow water prawn fishery species composition, abundance and distribution by site, zones, depth and season in three prawn fishing grounds along Tanzania coastal waters and two land based sites Bagamoyo and Nyamisati. Data was collected during two ship surveys conducted on February and June 2011 along three prawn fishing

grounds and monthly sampling activities in the two sites. Sampling activities considered the two major Monsoon seasons (Northeast and Southeast) prevailing within the region. Six prawn species were dominant in the catch these included in order of abundance: *Fenneropenaeus indicus*, *Metapenaeus monoceros*, *Penaeus monodon*, *P. semisulcatus*, *Macrobranchium rude* and *Nematopalaemon tenuipes* of which *F. indicus* and *M. monoceros* dominating the catch. A similarity analysis indicated that there was dissimilarity in species composition that ranged from 44-68, 76-82 and 47-61% (ANOSIM) among site, zones and seasons respectively. Catch rates was estimated to be 39.5-49.6 kg/hr (zone 1), 17.5-34.9 kg/hr (zone 2) and 1.2-8.3 kg/hr (zone 3) and there was a significance difference between sites/zones and seasons (One Way-ANOVA, $p < 0.05$). Most of the species were caught in shallow waters of depth between 5m and 15m. Comparing these results to previous studies there is improvement on the catch rates which is an indicator of slow recovery of the stock. Introduction of a management strategy to monitor fishing pressure contributed by artisanal fishers in order to improve the recovery of the stock is suggested.

POSTER

Cetacean Species Distribution and Encounter Rates in the Malindi Watamu National Marine Reserve

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The abundance and distribution of cetaceans in Kenyan waters is not well understood; thus resulting in a lack of information to help develop effective conservation strategies. This study was conducted within the Malindi Watamu National Marine Reserve on the North Kenyan coast investigating the distribution and encounter rate of three cetacean species. 101 dedicated boat-based surveys were conducted seasonally between November and April, during the northeast monsoon season from 2011 to 2014, covering an area of 71 km². The research team consisted of Watamu Marine Association and Kenya Wildlife Service. Search effort covering 951 km resulted in 92 sighting records. The most frequently encountered species was the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*), observed in inshore waters within the Marine Reserve; with a total of 88 encounters over the study period, corresponding to an encounter rate (ER) of 0.156 sightings/km (SD= 0.12). The Indo-Pacific humpback dolphin (*Sousa chinensis*) was encountered 4 times throughout the same period (ER=0.054) (SD= 0.06). Humpback whales (*Megaptera novaengliae*) were observed seasonally between July and August 2014 from a fixed land position on a headland elevation of 29 m, with a 180 degree view of the Reserve. Surveys were conducted 4 days a week for five hour periods, with a total effort of 143 hours of, data collection, resulting in 54 sightings and 73 individual animal counts. These results indicate

that the Malindi Watamu National Marine Reserve is an important area for cetaceans and consistent and continuous research is required to gain a greater knowledge of these species distribution and population dynamics. This will provide data and information needed to develop a National Cetacean Research and Conservation Management Plan.

POSTER

The first community led mangrove carbon offset project in the world

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Gazi bay communities are enjoying the benefits of carbon funds from the carbon offset project Mikoko pamoja a small scale carbon feasibility project in the Kenyan Coast that aims at enhancing mangrove productivity and intergrity by carrying out activities that benefits local community tenure through a special user agreement with Kenya Forest Services allowing them to conserve and protect 117 ha of mangrove forest. This is in addition to replant 0.4 ha every year of mangrove in the degraded intertidal areas of the project area over 20 years. This carbon project is certified by Plan vivo standards and system to sell 3000 tonnes of CO₂ every year, derived from avoided deforestation, avoided forest degradation and reforestation of degraded areas. These activities improve other ecosystem services such as coastal protection and nursery habitats for fish having multiple additional benefits to the ecosystem. The carbon is sold to the voluntary Carbon Market generating approximately US\$15,000/yr for the community.

32% of the funds raised from the sale of carbon are channeled to local community development project determined by community consultation while the rest 36% is for Labour (work teams, planting, nursery establishment, forest surveillance and monitoring activities, 21% annual salary for the employed coordinator, 6% goes to fixed fees paid for each carbon credit sold through plan vivo and 3% is used for office expenses.

The project consist of representatives of Gazi bay, specifically Gazi and Makongeni villages and expenditure benefits the people in these areas. Association for Coastal Ecosystem Services (ACES) is a charity registered in Scotland that facilitate the transfer of international funds and report to Plan Vivo Foundation.

POSTER

Priority fisheries in Lamu – Tana Seascape, Kenya

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To valorize the management of marine fisheries in Lamu seascape and by extension the Kenyan coast, WWF commissioned a consultancy to assess the status of fisheries of high economic and social importance in Lamu-Tana Seascape.

Stakeholders included were: fishermen, traders, BMU Officials, Conservation Groups, Special Interest groups, Key informants and miscellaneous groups.

The assessment combined desktop analysis, field surveys, Focus Group Discussions (FGDs) and Key Informant Interviews (KII) to select priority species for the Lamu-Tana Seascape.

During the FDGs, fishers were guided through scoring systems examining specific issues for each fishery based on community participation, income levels, production and catch, co-management, ecosystem impacts of fishing, vessels and gears.

The scoring criteria were later used to select three fisheries that satisfied a specified level of compliance for composite scoring criteria.

Two members of each focus group with in-depth knowledge of the fishery were selected as key informants for scoring using the same procedure for validation of the FGD results.

Pair-wise ranking procedures identified main challenges based on management issues that had highest scores and hence ranked highly. Structured desktop literature review of the priority species identified by the fishers during the field work and Participatory Rural Appraisal (PRA) process were conducted through rapid fishery profiling from the secondary data by use of indicators such as spatial distribution of fishermen and effort, spatial distribution of fishing grounds/area, catch trends, trends in economic contribution, stock status, existing and proposed management measures and identification of gaps for research.

The findings identified three priority fisheries.

1. Lobster
2. Prawn
3. Mixed Demersal

Recommendations from the findings include harmonization of the conflicting inter agency legal framework governing fisheries and adjacent ecosystems in the area and the development of a management plan for the mixed demersal fishery.

POSTER

Reducing pressure on Marine fisheries through the diversification of livelihoods

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Fishing is the largest source of income in Lamu seascape with over 90% of the population dependant on it.

Climate change, population pressure and emergent issues like planned developments (Lamu Port Southern Sudan-Ethiopia Transport (LAPSSET) Corridor, coal project) and oil and gas exploration threaten the productivity of fishery.

The planned development projects threaten to upend the area's centuries old customs and social capital. They will cause a population influx because of opportunities they represent. The erosion of social capital and increased natural resource dependence is linked to destruction and overexploitation of marine resources due to lack of a sense of ownership. This is projected to worsen the vulnerability of these resources and the people who depend on them.

Village savings and loans associations (VSLAs) are being implemented as adaptation interventions to help communities in Lamu – Tana seascape build resilience. They are groups of 15-25 people saving and together and taking small loans from those savings. VSLAs run in 'cycles' of one year after which savings and loan profits are shared among the members. The savings and loans help members take part in income generating ventures that make them less dependent on fishing.

Five VSLAs have been formed. Part of the goal was to improve women's participation in natural resource management by ensuring at least 50% composition. The groups have a total of 89 members, 58 of them women.

There is need for group specific entrepreneurship trainings as each group has different business interests, to stress the importance of a saving culture that is nonexistent in coastal communities and to eliminate the poverty mentality in the minds of the people. The major challenge working with Muslim communities has been to convince them the groups are not interest based or profit making.

POSTER

Mapping of land-based nutrient enrichment in coastal lagoon reef, adjacent to urban and tourism center, Kenya

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Use of stable isotopes as bioindicators of human impacts on coastal ecosystems has become famous worldwide, as it trace the source and provide a time-integrated measurement of assimilated nutrients, hence providing useful information on potential impacts on coastal lagoon ecosystems. Water column nutrients, $\delta^{15}\text{N}$ values of macroalgae and sediments, and biocover were analysed in order to map and identify transport pathways of anthropogenic N loadings and influence on coastal fringing reefs neighbouring urbanised and tourism center, in comparison to a pristine reef. Nutrient concentrations closer to urbanized inshore reef were on average 65% higher than at non-urbanized reef (approx.25 km apart) and over 30% higher than fore-reef areas. The correlations between the distance from the shoreline and $\delta^{15}\text{N}$ values in majority of macroalgae were not clear, although their average values among the reefs seemed to indicate differences in nitrogen loadings from land. These preliminary observations indicate that major point sources have more nutrient loading implication on reefs than shoreline anthropogenic nutrients. Identifying the major source of nutrient loading to coastal ecosystems is important for guiding future policy and management change in wastewater disposal

POSTER

Aspects of the ecology of small temporally open estuary on the south east coast of South Africa

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The study was conducted at Nkanya estuary which is a small temporally open/closed system situated between Xhora and Mbashe river estuaries on the south-east coast of South Africa in the former Transkei region. The estuary is characterized by rocky upper reaches, rocky/

muddy middle reaches and a sandy mouth. The estuary normally closes in late summer to winter and probably opens in spring following early rainfall. The study was aimed at determining aspects of the ecology of Nkanya estuary. The objectives were to determine physico-chemical properties of the estuary, to determine spatial and temporal distribution and abundance of fish and to determine biodiversity of fish found in the estuary. The results indicated that the estuary served as a marine pocket with salinity levels reaching 38‰ during the dry season. Temperature increased from winter to summer with a small difference of about 1°C between the surface and bottom waters of the system. The estuarine water was slightly basic with average pH values of 7.8. There were 24 fish species representing fourteen families recorded in the estuary; marine species numerically dominated both seine net and gill net catches. *Glossogobius callidus* dominated seine net catches in terms of abundance with 41.40% while *Argyrosomus japonicus* dominated gill net catches with 23.33% in abundance. *Glossogobius callidus*, *Therapon jarbua*, *Arothron hispidus* and *A. immaculatus* appeared in summer while *Psammogobius knysnaensis*, *Rhabdosargus holubi* and *Myxus capensis* were frequently recorded. About 85% of species recorded in the estuary were captured in the middle reaches

ORAL- Wednesday- Msikaba 4- 1100

Possible heavy metal transference to raggedtooth (*Cacharias taurus*) embryos

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The transference of contaminants that the female possess onto her progeny during the high-energy derived process of reproduction has been documented in some elasmobranchs (Lyons et al, 2013; Lyons and Lowe, 2013; Frias-Espericueta et al, 2015). This pilot study investigated the presence of heavy metals in the main fluid components involved in the reproductive strategy of the raggedtooth female (i.e. plasma, uterine fluid and capsule fluid). Three deceased early staged pregnant raggedtooth females (i.e. embryos <100mm in total length) caught in the bather protection nets of the KwaZulu-Natal Sharks Board (KZNSB) were dissected. Plasma was removed from the lateral veins while uterine fluid (UF) and capsule fluid (CF) was removed from the uterus and capsules respectively of each female. Mass spectrophotometry verified the presence of six metals (As, Pb, Se, Cd and Al) in all samples taken. The metals ranked in a decreasing trend for each compartment were as follows: Plasma and CF: As>Al>Se>Pb>Cd and UF: As>Se>Al>Cd>Pb.

Arsenic was ranked at the highest mean concentration for each compartment i.e. plasma (35.39 mg/ml), CF (6.75 mg/ml) and UF (4.62 mg/ml). Besides being a reflection of the mother's accumulated contamination, the concentration of heavy metals in these fluid components represents another pathway of contamination for these embryos growing in utero; apart from other internal and exogenous exposure. The presence of these heavy metals during early developmental stages suggests a possible concerning negative effect on embryonic growth and development for these embryos.

POSTER

Plastic ingestion by estuarine mullet in an urban harbour, KwaZulu-Natal, South Africa

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Coastal urban environments have high plastic pollution levels, making interactions between plastic debris and marine life frequent. This study set out to investigate if mullet in the Durban harbour is ingesting plastics and if this is influenced by the digestive tract content or total length of the fish. Seventy-three percent of mullet ingested suspected plastic particles with an average of 3.8 ± 4.7 (std. dev.) particles per mullet. Plastic fibres were among the common plastics ingested. White and clear particles were more commonly consumed overall than particles of other colours. Plastic ingestion by mullet within a 13.0 to 19.9 cm range showed no relation to digestive tract content or total length. Further experimental investigations are needed to confirm if these results.

ORAL-Monday-Msikaba 3- 1720

Plastic pollution in five urban estuaries of KwaZulu-Natal, South Africa.

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Widespread disposal of plastics negatively affects biotic and abiotic components of marine systems. Monitoring plastic concentrations in estuaries is vital in assessing the magnitude of terrestrial inputs to oceanic environments. Data on plastics ≤ 5 mm in estuaries are scant. This study determined microplastic levels within five estuaries along the Durban coastline and on intervening beaches. Plastics were isolated from estuarine sediment, beach sediment and the surface water of each estuary and characterised. Sediment at the Bayhead area of Durban harbour had the highest average plastic concentrations (745.40 ± 129.72 particles per 500 ml). Overall, an attenuating concentration trend away from the city centre was found. Fragments composed the largest percent of plastics (59 %) found in Bayhead, whereas fibres dominated other estuaries with proportions ranging from 38 % of total plastics in the uMgeni estuary to 66 % in the Mdloti.

ORAL- Wednesday – Msikaba 3 – 1100

Are Zanzibar's coastal ecosystems undergoing change? Foraminifera bio-indicators for assessing Zanzibar's coastal ecosystem health

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Zanzibar's reefs provide important ecosystem services and resource base for generating fisheries and tourist revenue for local coastal communities. Coastal ecosystems on the western side of Zanzibar are threatened by local anthropogenic disturbances including: untreated, wastewater pollution from Stone Town; increased boating activities stimulated by rapid development of tourism; and overharvesting. Without regular monitoring and management of water quality, long-term protection of Zanzibar's ecological integrity and natural resources is undermined. As a management practice, the maintenance of good water quality is a fundamental 'first step' in supporting carbonate reef producers, which act as important sediment stabilizers necessary for reef accretion. To investigate the potential effects of eutrophication, we collected water samples for nutrient analysis along transects from Stone Town sewage point-sources to nearby reefs. Despite large volumes of sewage outflow, preliminary findings indicate overall low nutrient input, with phosphate and ammonia concentration values near detection level in Bwawani/Malindi and Harbour/Port. Very low values suggest hydrodynamic mixing as a factor in controlling distribution. Foraminifera are widely accepted bio-indicators used for detecting altered ecological conditions. The FORAM Index (FI) has been globally applied as a measure of reef health. Detailed examination of sediments from Zanzibar's marine reef environments reveal foraminifers as key carbonate producers found in high abundance and taxonomic diversity. Symbiont-bearing large benthic foraminifers (LBFs) dominate the assemblage with *Amphistegina* spp. being the common taxonomic component. Reefs close to Stone Town consisted of high diversity 'disturbance' assemblage consisting of mixed opportunistic, heterotrophic and symbiont-bearing assemblages and variable FI values (5.5 to 8.5). Chumbe Reef, a marine protected area, which supports a more established/stable assemblage, is dominated solely by LBFs reflecting high FI values (7.1 to 7.6). Remarkably, seagrass meadows in Stone Town harboured *Amphistegina* spp. as the dominant epiphyte, revealing possible adaptation to stressed conditions in Zanzibar's coastal environments.

ORAL- Wednesday- Msikaba 3- 1640

Community-based *Gracilaria salicornia* farming in the coastal village of Grand Sable in Mauritius

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Gracilaria salicornia; a red macro-algae, has been identified by previous studies as one amongst 435 reported seaweed species in the Republic of Mauritius having a commercial potential.

A community-based *Gracilaria salicornia* farm was established in 2014 in the coastal village of Grand Sable in the South East Region of Mauritius. The objectives of this farm were to confirm, with the collaboration of the women entrepreneur of Grand Sable, the results obtained in a previous study conducted in the neighbouring region of Vieux Grand Port from April 2013 to October 2013 and to build local capacity in seaweed farming to empower them on alternate income-generating activities.

Prior to the setting up of the community-based farm, community mapping and bio-assessment exercises were conducted to align with communal lagoon usage and environmental pre-requisites. A hands-on training was conducted to impart knowledge and skills to a total of 20 coastal women entrepreneur on seaweed farming, physiology and safety.

Four PVC rafts of 36m², each containing 100 net bags, were established in the intertidal zone of the Grand Sable/Vieux Grand Port lagoon. The seeding rate was 0.278Kg FW m⁻² with 100gm in each net bag. Physical parameters including temperature, salinity, pH and conductivity were monitored on a weekly basis. A total harvest of 145.2 kg FW was obtained after 19 weeks representing a 3.63 fold increase. An average harvest of 36.3 ± 3.06 kg FW raft⁻¹ was recorded with yield rate of 1.008 Kg FW m⁻² and net yield rate of 0.730 Kg FW m⁻². Nutritional profiling of the harvested seaweed denoted amongst others a protein content of 0.74 ± 0.9 gm 100gm⁻¹ FW and calcium content of 51 ± 19 mg 100gm⁻¹ FW indicating a good potential for value-addition activities such as food products and cosmetics.

POSTER

An in-situ comparison of PVC Raft as an adaptive innovation technique for *Gracilaria salicornia* farming against conventional seaweed farming technologies in the island of Mauritius using the Analytic Hierarchy Process

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Mauritius is a Small Island Developing State with limited land resources but with an extensive Exclusive Economic Zone (EEZ) of about 2.3 million km². There are about 435 species of seaweeds in Republic of Mauritius and this represent an untapped potential for development of seaweeds and their derivatives. Previous studies conducted by the Mauritius Research Council identified, *Gracilaria salicornia*, which occurs naturally in the lagoons of Mauritius as one of the seaweed species with commercial potential due to its possible uses include human consumption and animal feed formulation

This study aimed at conducting a comparative evaluation of conventional seaweed farming techniques against the innovative technique developed in Mauritius. The conventional farming methods included Off-Bottom, Line Raft, and Bamboo Raft Techniques and the innovative technique consisted of PVC Raft which was initially conceived as a means to overcome the problem of availability of materials and short-lived farming structures.

A 100 m² experimental farm was implemented in the lagoon of Albion in the west of Mauritius. The four

techniques were implemented and evaluated in the sub tidal region over one year. To determine which seaweed farming method is best suited for Mauritius; the Analytic Hierarchy Process (AHP) was used.

The AHP is an analytical tool which combines mathematical logical reasoning for decision making and is used to solve multi-criteria decision problems. Different selection criteria including availability, resilience, cost and management were used to assess the different seaweed farming methods at Albion. After the analysis of the different methods, PVC raft method was found to be best adapted to local conditions in Mauritius. This technique was further refined to enhance its resilient to Mauritian waters.

POSTER

Perceptions about marine community Sanctuaries, in North Mozambique

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The creation of Protected Marine Areas has recently received a lot of attention from all of those who, one way or the other, have an interest in the oceans. As a matter of fact these areas gather a set of characteristics important for the conservation of sea life and its habitats. The acceptance of these areas, by the populations leaving nearby them, depends on the understanding of the terms that define them. Otherwise it may rise suspicious related to its effects.

This study will describe the different perceptions that different individuals have of the sanctuary. Interviews were realized with the head of families from the 3 main villages in the Vamizi Island: Aldeia, Lance e Kivuri. In total 100 interviews were made: 20 in Aldeia, 21 in Lance and 59 in Kivuri. Data analysis showed that high level of individuals declared that the CCP was good to the government. On the contrary lower income individuals said that the CCP improve their standards of living. The communities closer to the sanctuary showed more negative answers compared to the ones more distant to the sanctuary. Most of them recognizing that the amount of fish available increased.

POSTER

Master Curriculum Development in Sustainable Fisheries in SIO Region

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The Master Curriculum in Sustainable Fisheries is jointly organized in SWIO region by the Eduardo Mondlane University in Mozambique, University of Toliara in Madagascar, and University of Dar-Es-Salaam in Tanzania, with partnership with University of Alicante and University of Algarve in Europe. The objective of the master is to provide high level specialization in issues related to the

biology, economics and management of the fishing activity through: an analysis of the fishing system, exploitation mechanisms, marketing and management in the South-West Indian Ocean region; a multidisciplinary vision of fisheries management from the perspective of different sciences such as biology, economics, law and sociology; an approach of fisheries management and co-management, fish trading, fish marketing, and social perspective at international and regional levels; etc. The course is developed over two academic years on a full-time basis and comprises two parts, namely course work and research. In Mozambique and Tanzania a minimum of 60 credits must be completed in the first part in order to proceed to the second part, which corresponds to 60 credits, while in Madagascar the taught part comprise 90 credits and the thesis will be 30 credits. This master program intends to promote the mobility of lecturers and students from SWIO region, and will be taught in national language in each country, however, some classes will be delivered in English; therefore good knowledge of English is recommended for the students. International lecturers are invited for collaborate on delivering courses and students supervising. The master program is composed by subjects of fishery biology, statistics, economy, social science, fish stock assessments and management, fishery oceanography, fish population dynamics, among others subjects related to marine science

POSTER

Physico-chemicals and Marine Biodiversity Monitoring in the Mauritius Harbor: Implications for Sustainable Ports Development

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The next economic frontier as identified by the Government of Mauritius is the Ocean Economy. As a SIDS, Mauritius is very limited in natural resources and land is scarce for innovative major economic development. As a nation with a vast Exclusive Economic Zones, there is an imperative need to develop its immense potential as an Ocean State. Seven main clusters in the short, medium and long-term were identified, out of which the Port-Louis Harbor, the sole maritime gateway of Mauritius is of outmost importance for major development and sustaining the ocean economy main clusters. In line with the main recommendations of the Port Master Plan of 2009, the Mauritius Ports Authority embarked on a series of development projects initiated in three distinct phases, all of which have direct environmental impacts. As such, the commitment of the Mauritius Ports Authority in environmental protections and preservations initiated a baseline marine study in 2010 to be incorporated in the Environmental Impact Assessment. Twenty sites were identified and ecologically assessed using the line intercept transect: % coral cover, % algae cover, % bare substratum, no of coral and fish species observed over the 20 sites. Physico-chemical analysis such as pH, DO, temperature, salinity, nitrate, phosphate, chemical oxygen demand (COD) and total suspended solids (TSS) were also

performed. Following the baseline surveys and given that the Mauritius Harbor is located near the Rivulet Terre Rouge Bird Sanctuary (Ramsar Site), proper protective measures were undertaken during constructions and quarterly monitorings in the year 2013-2014 for phase I were done to ensure compliance and performance objectives were met, thus minimal damages to the surrounding sensitive areas. Seventeen sites were monitored for comparison in March 2015 prior to construction activities in phase II as three sites have been enclosed in the first phase of the developments.

POSTER

Investigation of Trou-aux-Biches as a Potential Site for Aquaculture

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The Government of Mauritius has recently embarked on a new sector for the economy, namely the ocean. The Government's 2007 Master Plan for Sustainable Aquaculture has identified a few potential sites for different types of aquaculture in view to kickstart this aspect of the ocean economy. Therefore, there is an imperative need to perform an in-depth investigation of the abundance and distribution patterns of the various species present and physico-chemical parameters over the selected sites to ensure long-term sustainable aquaculture development. Trou-aux-Biches located in the north of Mauritius is among the sites identified in the Master Plan. Given its importance as a highly touristic area, it is necessary to be cautious about any aquaculture investment in this region. In this study, the lagoon and the open sea outside the reefs, including shipwrecks, were ecologically assessed using established methodologies, such as the line intercept transect. Five stations with 3 transects, as well as the shipwrecks around Trou-aux-Biches, were assessed for their species composition, distribution and structure. The benthic surveys within the lagoon revealed a high percentage of live benthic cover of 51%, but very few fishes and corals, while the outside reefs were rich in coral cover and fish populations. The shipwrecks surveyed included the "Water Lilly & Emily" and "Stella Maru"; both being heavily colonized by various species of coral and fish. Physico-chemical analysis such as salinity, DO, pH, temperature, nitrate, phosphate, TSS and conductivity performed and were within the "Guidelines for Coastal Water Quality Requirements" for Mauritius. Trou-aux-Biches being rich in its marine ecosystem and furthermore, a touristic village, is not recommended for intensive/extensive cage culture and needs further in depth study before it can be exploited for integrated aquaculture

POSTER

Socio-economic aspects and local governance mechanisms in supporting sustainable conservation of mangrove and seagrass resources in Charawe and Kibele communities, Zanzibar

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Sustainable exploitation of resources from natural ecosystems to enhance poverty alleviation initiatives in low-income countries is the main agenda on the policy and institutional change. While policy and legal instruments exist that promote sustainable utilization of resources, they are in practice not fully understood nor appreciated. Socio-economic drivers and governance arrangements shape natural resources exploitation and management. Understanding how these drivers affect community based coastal resources management is crucial in shaping the emerging conservation incentive strategies like payment for ecosystem services. We assessed how socio-economic and local governance traits are associated with good and poor status of mangroves and seagrasses in Charawe and Kibele coastal communities in Zanzibar. Primary data were collected through focus group discussions, key informant interviews, individual household interviews and field observations. It was found that major sources of livelihood in Charawe were dominated by mangrove related activities; including charcoal making, firewood collection and cutting of building poles. In Kibele, main sources of livelihoods were dominated by non-mangrove activities; including small businesses, agricultural and bivalve collection. Seagrass resources in Kibele are impoverished due to concentrated and uncontrolled bivalve collection unlike in Charawe where it is not a substantive livelihood activity. A difference in local governance arrangements for mangrove resources between the two villages was observed. Kibele has a well-organized and effective mangroves committee which is largely attributed to strong cooperation within community members and leaders in protecting mangrove forest unlike in Charawe. To enhance sustainable conservation, there is a need for exploring and promoting credible alternative livelihood activities to reduce pressure on mangroves in Charawe and seagrass resources in Kibele. Promoting knowledge on Conservation and availing by-law governing access and use of mangrove and seagrass resources to all members is important for communities to sustainably conserve the resources.

POSTER

Meso-Level Institutional Capacity and Barriers for Community-Based Payment for Ecosystem Services from Mangrove Conservation in Zanzibar

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The emerging concepts of market-based conservation through payment for ecosystem services (PES) in mangroves is gaining pace as mangroves are revealed to be one of the most carbon rich ecosystems on earth. Development and operationalization of PES schemes that involve communities as conservation stewards is shaped by capacity of the prevailing institutional and governance mechanisms at different levels that oversee management of mangroves. This study was set to assess the capacity of national institutional and governance mechanisms to potentially support of community-based arrangements for PES, while ensuring enhanced biodiversity conservation and benefit sharing within local communities in Zanzibar. Three state departments namely Department of Forestry and Non Renewable Natural Resources, Department of Environment and Department of Fisheries Development that are mandated directly or indirectly with management strategies and plans, provision of policy directives and related technical support for mangrove resources management were studied. Review of relevant policies, legislations and strategies was done as a basis for detailed ethnographic study. Primary data were collected through focus group discussions, key informant interviews and daily observations of duties. The results show that there are substantial barriers against community-based PES. Mangroves are not directly addressed in the key coastal and marine resources conservation policies and legislations rather are generalised under biodiversity conservation, except in some specified forest resources management plans. Existing operational policies and legislations are in cases not well understood by some responsible staff. Inadequate resource capacity including professional staff, facilities (e.g. office space, transport, and finance) is prevalent. There are variations in the structural set-up of departments that hinder effective institutional coordination. Attention should be paid to governance systems; particularly power relations, accountability and knowledge flow across operational levels in the departments where an opportunity for revision of the policy and institutional frameworks is available.

ORAL- Wednesday- Msikaba 3- 1620

Ammonium Nitrogen Removal and Total Suspended Solids Control Efficiency Using *Hyphaene compressa* (H. Windl., 1878) Fronds and Effective Microorganisms (EM) Consortium in a Semi-intensive Mariculture System

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Determination of ammonium nitrogen removal and total suspended solids control efficiency using *Hyphaene compressa* (H. Windl., 1878) fronds and effective Microorganisms (EM) consortium in a semi-intensive mariculture system was conducted for 65 days at IMS Pangani mariculture centre, in

Tanga. Doum palm fronds with (EADPF-F) or without prior seawater treatment (EADPF-U) and Effective Microorganisms (EM) consortium on Polyvinyl Chloride sheets (PVC-EM) or mere EM consortium without media (EM) and Polyvinyl Chloride without EM (PVC) were set in 1 m³ triplicate polyculture tanks of *Oreochromis urolepis urolepis* (Norman, 1922). The control (CONTROL) tanks had none of the above biofilters. It was found that PVC-EM, PVC, EADPF-F and EM systems had better ammonia reduction efficiency mean \pm SE of $83.7 \pm 3.13\%$, $80.9 \pm 3.13\%$, $73.2 \pm 5.36\%$ and $66.7 \pm 3.23\%$ respectively while EADPF-U had least ($38.4 \pm 7.09\%$). The ammonium nitrate removal was evidenced by the accumulation of nitrates nitrogen in PVC-M, PVC and EM. Less accumulation of nitrates nitrogen was observed in EADPF-F, EADPF-U and CONTROL, a possible indication of fixation by the massive heterotrophic bacteria in EADPFs. Total suspended solids levels were less in PVC-EM, PVC and EM but relatively high in EADPF-F and EADPF-U biofilter systems. The results show that EM with or without media, PVC and EADPF-F (conditioned EADPF) were much effective in enhancing effluents ammonia removal. Also, EADPF-F indicated potential attributes as a biofilter media and enhancer of periphyton or bioflocs in mariculture system.

POSTER

Growth and Survival Rates Performance of *Oreochromis urolepis urolepis* (Norman, 1922) and *Mugil cephalus* (Linnaeus, 1758) in a biofilter Semi-intensive Mariculture System

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Development of coastal mariculture is advocated to reduce fresh water conflicts on land systems but relying on wild collection for seeds. The use of salt tolerant *Tilapia* species like *O. urolepis urolepis* shade light on the available potentials but its growth and survival rates relative to marine species need to be accessed. Growth and survival performance of *Oreochromis urolepis urolepis* and *Mugil cephalus* (Linnaeus, 1758) were compared in a biofilter system consisting of Doum palm fronds with (EADPF-F) or without prior seawater treatment (EADPF-U) and Effective Microorganisms (EM) consortium on Polyvinyl Chloride sheets (PVC-EM) or mere EM consortium without media (EM) and Polyvinyl Chloride without EM (PVC) set in 1 m³ triplicate tanks. The control (CONTROL) tanks had none of the above biofilters.

Of the two finfish, *O. urolepis urolepis* had relatively higher specific growth rate (SGR) and survival rate (SR) than *M. cephalus* with EM and EADPF-F systems providing the best SGR (3.41%) and SR ($55.6 \pm 9.0\%$) while the CONTROL and EADPF-U providing least SGR ($2.45 \pm 0.03\%$) and SR ($27.9 \pm 14.7\%$) respectively. *M. cephalus* indicated poor performance in both SR and SGR. EADPF-F provided the best SR and run-up SGR of 3.17 ± 0.06 similar to PVC-EM (3.17 ± 0.04) indicating the importance of fronds treatment to enhance fish survival. Based on results from the present study, *O. urolepis urolepis* is three fold better mariculture species than *M. cephalus* in terms of both SR and SGR performance.

POSTER

Trend in octopus fishery in tanga coelacanth Marine Park

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Octopus fishery is among the major income earners for coastal communities and also sustains Octopus processing factories in Tanzania. A study on Octopus fishing trend was carried out in Tanga Coelacanth Marine Park during October, November and December 2014 to establish the relationship between catch size (in terms of number of octopus) and its corresponding weight. Catch size and weight were examined at two selected landing stations by visual count and weight measurement. Results indicated that the catch was mainly composed of Octopus weighing between 500-1000g. On average 9.5 Octopus contributed to 7.5kg giving an indication of trend in octopus stock biomass. This catch-weight trend is ecologically unsustainable and compromises the future economic viability of the fishery. Detailed survey, regulation, education and awareness campaigns on Octopus fishing were recommended in order to enhance sustainability of octopus fishery.

ORAL- Monday – Msikaba 2 – 1440

Modelling stand and individual growth in mangroves, *Rhizophora mucronata* L.

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Growth models in forestry permit estimates of biomass accumulation, either at individual or stand levels. While growth models exist for terrestrial tree species, existence of long term growth data in mangrove is almost absent. We have been following stand development of mangroves, *Rhizophora mucronata* L., for almost 20yrs; and individual trees of the same species for more than 5 yrs. Data on tree height, Dbh, stand density, and biomass were collected in 10 x 10 m² plots systematically located inside the plantation. Preliminary results indicate biomass increment at stand or individual level to be influenced greatly by site quality, stand age, and density. Biomass increment in thinned plantations ranged from 1.0-2.2 t/ha/yr, whereas in high dense stands significantly lower biomass accumulation rates were derived. These results will be discussed in the context of maximizing yields from mangroves managed for their multiple products and services.

POSTER

Structural variability of mangrove forests along the Kenya coast

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Mangrove forest structure is influenced by several forcing functions. While climate is the main environmental factor influencing global pattern of mangrove distribution, other factors determining forest structure are soils, salinity, species composition, and management regime. We used standard plots to study mangrove structure all along the Kenya coast. All trees in plots of 100 m² plots were identified, their position marked, and counted. The following parameters were collected; Tree height (m), stem diameter at 130 cm above ground (D130),

forest cover (%), and natural regeneration; from which stand density and biomass were derived. The structural data was then correlated with environmental data of the area. Results of this work indicate that the mangroves north of Tana river delta are structurally more complex than mangroves in the south. For instance, the standing biomass of mangrove in Lamu is estimated to range from 400-700t/ha; compared to 150 – 450t/ha in mangrove south of Tana delta. This difference is attributed to amount of freshwater flow, tidal currents, and rainfall among other factors. The significance of this information in the management of mangroves in Kenya will be discussed

ORAL – Monday, Msikaba 2, 1600

Influence of mangrove deforestation on eco-morphometrics and genetic diversity of *Littoraria subvittata* along the Tanzania mainland and Zanzibar coast

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Littorinids are common macro faunal epiphytes that form important component of mangrove ecosystem. They play vital role by consuming living and decaying plant materials and consequently contributes to nutrients dynamics. They have been also used as bioindicator to assess the environmental health and community stress. *Littoraria subvittata* is the most abundant species littorinids species along the east African coast. In this study morphometrics relationship and stable isotopes composition in tissue of *Littoraria subvittata* and sediments were used to assess the effects of salt ponds constructions in mangroves on epiphytic macroinvertebrates living around these ponds and their habitats. Scaled body mass index indicates significant positive effect on the well being of *L. subvittata* while $\delta^{13}C$ and $\delta^{15}N$ isotopic composition in tissue indicates higher and significant enrichments around salt ponds compared to areas with no salt ponds. Conservative protein-coding genes (COI sequences) will be used to determine whether there is shift in genetic diversity. It is expected that the results from this study will be useful for decision makers in planning the management strategies and conservation of both marine flora and fauna in the area and along the Western Indian Ocean

POSTER

The utility of DMSP/OLS Night Light satellite imagery to track the evolution of urban dynamics in the Western Indian Ocean

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Coastal areas are characterised by an abundance of natural resources that attract human interest and result in exploitation such resources. Coastal areas are also under intense anthropogenic pressure. Population densities on the

coast are three times higher than the global average. Coasts are also popular destinations for tourism and recreational activities and priority location for commerce, strategic transport routes and industrialisation associated with port developments. In addition, climate change scenarios are predicting more frequent and intense extreme weather events; and an increase in sea-level rise rates which will exacerbate the impacts of these events on the coasts. In order to track the aforementioned anthropic pressures in Western Indian Ocean (WIO), this study is proposing the use of U.S Air Force Defence Meteorological Satellites Program/Operational Line scan System (DMSP/OLS) data to identify and track changes in coastal urban dynamics of the WIO over the last two decades. DMSP/OLS data are captured annually since 1992, a major advantage over less frequent land cover data. The results from the temporal and spatial analysis of the DMSP/OLS data have shown substantial increase in light emission in the coastal strip during the last two decades. Light emission in the case study area grew more than 4% in the last two decades, having in 2012 more than 16% of the area covered by night lights emission. The province of KwaZulu-Natal (South Africa) presents significant results, with more than 65% of the area covered in 2012. At the city level, Dar es Salaam, in Tanzania, more than doubled its light emission area in the two decades in analysis, presenting a growth rate of more than 156%. This study will present the methodology and ultimate utility of the DMSP/OLS data for coastal applications such as the spatial and temporal tracking of urbanisation.

ORAL- Monday – Msikaba 3 – 1400

Chemical concentrations of sediment in South African ports

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Ports provide a sheltered environment for the safe off-loading and loading of cargo from vessels. However, this sheltered environment promotes the accumulation of fine-grained material, onto which particle reactive contaminants may adsorb and be retained. There are numerous and significant sources of contaminants to ports, including port-associated activities and surface runoff. With continued input and little sediment remobilisation the contaminants may accumulate to such high concentrations that they pose a risk to bottom-dwelling organisms. This study examined the degree of sediment contamination by a range of chemicals, including metals, polycyclic aromatic hydrocarbons, pesticides, polychlorinated biphenyls and butyltins. With few exceptions sediment in the Ports of Durban, Cape Town and Port Elizabeth was the most contaminated. Of concern in these ports were high polychlorinated and butyltin concentrations. There were contamination trends in other ports that were linked to specific activities in these ports. The potential significance of the contaminants in sediment to bottom-dwelling organisms was estimated using various approaches. This showed that numerous chemicals in sediment in some ports were present at concentrations that may be adversely impacting bottom-dwelling organisms through direct toxic effects. The implications of the findings in terms of dredging are discussed.

POSTER

Water quality in Durban Bay, South Africa

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Estuaries are recognised as being amongst the most productive ecosystems on earth. Durban Bay, a large estuarine embayment situated in the province of KwaZulu-Natal on the sub-tropical northeast coast of South Africa, is home to South Africa's busiest port in terms of ocean-going vessel calls and cargo volumes handled. Currently Durban Bay is considered to be in a degraded state. Three rivers flow into and numerous stormwater outfalls discharge surface runoff into the Bay. The increased anthropogenic loading of nutrients is widely considered to be the primary cause of eutrophication in estuaries. Eutrophication is widely regarded as one of the most significant threats to coastal ecosystems throughout the world with severe ecological impacts. The aim of this study was to identify trends in water quality in Durban Bay, with a specific focus on nutrients. Fifteen stations were monitored over a period of eighteen months. Water samples were collected for nutrient analysis and profiles of various physico-chemical parameters were measured in situ using a water quality sonde. The results indicate that rivers flowing into the Bay exert a strong influence on water quality, especially in the upper reach. This is compounded by the long water retention time in the upper part of the Bay. The influence of the typically small volume rivers inflows attests to poor water quality in the rivers. Any attempt to manage water quality in Durban Bay must, therefore, of necessity focus on managing water quality in the rivers

POSTER

Ichthyofauna of Bons Sinais Estuary

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November 2012 to September 2013, were studied the ichthyofauna of Bons Sinais Estuary and impact of fishing on it. Samples were collected monthly during the daytime, with a bid in each estuarine zone using bottom trawl gear. 595 individuals who comprised 34 genera, 25 families and 39 species during the rainy season and the dry season yielded 543 individuals belonging to 29 genera, 29 families and 31 species were sampled. The most numerically dominant species in the rainy season were *Johnius dissumieri*, *Pomadasy kakaan* and *Leiognathus splendens*, while the drought were *Johnius dissumieri*, *Sardinella albella*, *Thryssa vitrirostris* and *Secutor insidiator*. The families with the highest number of species were Carangidae, Clupeidae and Scieanidae in the rainy season, while Scieanidae and Carangidae were the most prominent being the most dominant lower estuarine zone (ZEI) number of individuals, families and species and the upper estuarine zone (ZES), which is less stressed. High similarity was observed between the different combinations of estuarine areas especially for the dry season. The diversity index showed high values except the Shannon diversity, which was low. The correlation between the abundance of key species and environmental factors (precipitation and salinity) was low except between species *Pomadasy kakaan* and precipitation (0.6). The lengths of the individuals captured by fleets of artisanal and industrial fisheries indicted catches of juveniles

POSTER

The status of estuarine monitoring in South Africa

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South Africa's environmental legislation outlines principles and pathways to achieving conservation and sustainable development of the country's expansive coastal zone. Estuaries form part of the coast and constitute some of the most productive, but also most heavily utilised zones on the planet. As a result, many organizations are mandated to conduct estuarine monitoring, but there are currently no systems in place to coordinate monitoring efforts, to compile data, or to share information among stakeholders. The Estuary Monitoring Register was identified as a tool address these shortcomings and coordinate monitoring and research efforts on a national scale, with the aim to eliminate the duplication of work in certain estuaries, and instead initiate monitoring in estuaries that are currently data-poor. This presentation reviews the current status of estuarine monitoring in South Africa, and introduces the National Department of Environmental Affairs' vision for implementing a concerted monitoring programme to inform management of ecosystem health in estuaries.

ORAL- Wednesday– Msikaba 1 – 1120

Mangrove structural studies, long term climate impact and options for adaptation – a case of the Quirimbas National Park, Northern Mozambique

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This study is part of the WWF climate change adaption programme implemented in the Quirimbas National Park (QNP), which preserves one of the largest mangrove areas in the region. This study aimed to evaluate the forest condition and its resilience to climate change. Random 10x10m quadrates were set throughout the mangrove area of the Park, and adult individuals (>2.5 cm of diameter at breast height – DBH) were identified to species, height, diameter measured and classified according to cut level and straightness of main trunk. Data on regeneration (>2.5 cm) was collected in smaller 5x5m quadrates. Satellite imagery (1991-2011/4) was used to map changes in area. NASA's Global circulation model (NASA GISS-E-R) was used to predict changes on temperature and precipitation within QNP between 2050-2070. All data were analyzed statistically for density, diameter, height, regeneration and other meaningful parameters. *Rhizophora mucronata* and *Ceriops tagal* were the dominant species and the total density of stems was 572 ind/ha, mean DBH was 9.1 cm and mean height was 6.08 m. Differences on northern, central and southern parts of the QNP mangroves were significant and reflected the conservation condition: the southern and northern more populous parts were more impacted by human action. *C. tagal* and *A. marina* were preferred logged species. All sites had lower density of straight poles compared to semi-straight and crooked. These impacts were not reflected on the total mangrove area, which expanded 2% from 10.980 ha to 11.337 ha. The climate

model predicted rising temperatures and lowering precipitation, which could prompt transformation of the mangroves. An adaptation strategy for climate change is shall include mainly managing human stresses on mangroves, restore degraded areas, develop alternative livelihood and protect critical areas.

ORAL- Tuesday- Msikaba 2- 1100

Across two oceans: demographic connectivity and population structure of albacore tuna from the southwest Indian Ocean and the southeast Atlantic

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Albacore tuna (*Thunnus alalunga*) is targeted by commercial tuna fisheries worldwide and management units are seldom defined along stock structure and dynamics. Albacore from the Indian Ocean remains the least well known population and the level of connectivity with Atlantic Ocean population still needs to be unraveled. Based on the results of the GERMON project (GEnetic stRucture and Migration Of albacore tuNa), we investigated the link between southwest Indian and southeast Atlantic Oceans with genetic (mtDNA and microsatellite markers), biological (size, sex), and trophic (stomach contents and isotopes) classical approaches as well as Bayesian and coalescent analysis. A total of 1874 individuals were collected from November 2013 to August 2014 from four different areas in the southwest Indian Ocean (around Seychelles and La Réunion), in South Africa (off the Cape of Good Hope) and in southeast Atlantic (off Namibia) during and outside of the expected spawning season (November-February and May-August). A total of 35 microsatellite markers of high quality were selected and mtDNA marker was sequenced to investigate the population structure and migration rate between sampled sites. Even though gene flow from Atlantic to Indian Ocean was found, two genetically distinct groups were identified (1) southeast Atlantic and South African albacore and (2) southwest Indian Ocean albacore. Intra-population differentiation was observed between geographic areas and a potential regional migratory pattern has been hypothesized. The implications of these findings for albacore stocks for regional fisheries management will be discussed.

This work was developed under the project Germon "N°759/DMSOI/2013" funded by European Fisheries Funds EU FEP 2013-2015 and IFREMER. Partnership: IRD, DAFF, IPMA, CapFish, CapRun, SFA.

POSTER

Coastal water quality status at Pointe Aux Sables in Mauritius following the set up of a sewage treatment plant.

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A scientific study in 2001 described Pointe aux Sables as a highly contaminated coastal area due to an old sewage outfall in the middle of the lagoon and was qualified for permanent closure especially for bathing. In 2006-2007, the Montagne Jacquot sewage treatment plant was set up as part of the Mauritius Wastewater Management Master Plan. The present study investigated the status of coastal water quality at Pointe aux Sables (PAS) in comparison to a regulated and protected site, the Blue Bay Marine Park (BBMP), for 2 consecutive months in 2014. Physico-chemical parameters including temperature, pH and salinity were measured in situ whilst chlorophyll a, nutrients, micro-phytoplankton density and diversity, and microbiological quality (total coliform (TC), faecal coliform (FC), faecal Streptococcus (FS)) were analysed ex situ. Chl a concentration at PAS ranged from 2.18±0.42 to 5.9±0.03 mg/ whilst that in BBMP ranged from 6.92 ± 0.04 to 7.72 ± 0.85 mg/. Chl a concentration correlated with temperature ($r = +0.553$) and nitrate ($r = +0.301$) in BBMP as compared to PAS where a very weak correlation was found for both parameters, $r = +0.001$ and $+0.038$, respectively. The estuarine systems of PAS and BBMP exhibited a total micro-phytoplankton density (TMPD) of 5.56x10⁵cells.L⁻¹ and 2.39x10⁵cells.L⁻¹, respectively, thus were non bloom-forming. Micro-phytoplankton communities were further categorized into three main groups: diatoms, dinoflagellates and cyanobacteria. Nitrate levels in PAS were below the range prescribed in the Environment Protection Act (EPA) 2002 coastal water quality guidelines (<0.30 mg/L). Both TC and FC were lower at PAS than at BBMP during both study months while FS was higher in BBMP than in PAS in November 2014, with all microbiological parameters within the prescribed guidelines. These findings indicate a recovery of the coastal water quality at Pointe aux Sables following the implementation wastewater management plan.

POSTER

Procedures for quantification of belowground biomass of three mangrove tree species

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A review of studies on tree belowground biomass (BGB) of mangroves revealed that procedures for excavation and determination of dry weight are insufficiently documented. The main objective of this study was therefore to describe procedures for quantification of tree BGB for *Avicennia marina* (Forssk.), *Sonneratia alba* J. Smith and *Rhizophora*

mucronata Lam. Specifically the study aims were to (i) describe procedures for excavation of tree BGB, (ii) document procedures for determination of tree BGB, (iii) provide basic information on tree BGB quantities and (iv) test relevant previously developed models for predicting tree BGB. The study covered four sites in Tanzania where 30 trees were sampled (10 for each species). A new root sampling procedure applied for *A. marina* and *S. alba* seemed to work adequately. Dry to fresh weight ratios (DF-ratios) varied between tree species, between tree sizes and between root components. Therefore, for each tree species, tree- and root component-specific DF-ratios were applied for dry weight determination. For *A. marina* and *S. alba* trees, a significant proportion of total tree BGB is stored in the root crown (34 and 10 % respectively). Future studies should therefore ensure inclusion of root crown when accounting for total tree BGB. Tests of previously developed models on our data revealed large prediction errors, partly due to differences in site conditions and partly due to incomprehensive excavation procedures applied when these models were developed. Local tree BGB models for mangroves should therefore be developed

ORAL- Tuesday- Msikaba 1- 1200

Hunting and Bycatch Assessment of Marine Mammals on the South West Coast of Madagascar, 2000-2015

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From January to March 2015, interview surveys of fishers were conducted to assess by-catch and hunting of marine mammals on the south west coast of Madagascar. We conducted 114 interview sessions in 3 villages respectively Ankiembe, Mahavatsa and Belitsake, situated to the South West of Madagascar. Socio-economic surveys were collected from individual fishers, focus groups of several fishers, and key informants in each village, always including one locally known individual as a guide to gain confidence of communities. Surveys revealed either hunting or by-catch of marine mammals in almost all villages. Six species of marine mammals were reported hunted and by-caught: bottlenose, spinner, spotted, Risso and Indo-Pacific humpback dolphins and humpback whale. The interview revealed that 245 cetaceans have been caught in the three villages during fifteen years (2000-2015). Two types of fishing gear, harpoon and gill net, are used in the region to hunt dolphins, and shark gill net (jarifa and palangre) resulted in incidental by-catch. In the southwest, dolphins caught were used for local consumption and sold in the region and other villages, with sale prices of 3000Ar/Kg (approximately USD\$1.00) compared to 2500Ar/Kg for fish. These three villages, all situated in southwest region, reported occasionally drive hunts in which several fishers cooperatively drive pods into a lagoon and set large nets on them. From 1 to 30 dolphins were reported caught in a single drive, and drives may occur 1 to 5 times each year. Despite the existence of the national laws, the fishers continue to eat cetacean hunted and by-caught. The best strategy of the protection of marine mammals is the elaboration of the local laws. The technique of fishing is common in almost of the west coast region but some villages respect national laws and apply the local laws through communities-based efforts association.

POSTER

Scleractinian coral recruitment in the south western region of Madagascar

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Due to environmental perturbations and potential damage to coral reefs, studying coral recruitment is very important to understand its population dynamics and for a better management of marine ecosystems. In fact, coral recruitment was studied in 3 coral reefs sites of the South-western region of Madagascar: Nosy Tafara of Sarodrano (NT), Grande Vasque of Grande Récif of Toliara (GV) and Jardin des Roses of Ifaty (JR), using ceramic recruitment tiles (for recruits of <1 year age) and quadrat recruitment monitoring (for recruits of >1 year age). The rate of new settling is significantly higher ($p=0$) in NT with 1585,62 recruits.m⁻².year⁻¹ compared to those of JR and GV, with respectively 79,25 and 68,25 recruits.m⁻².year⁻¹. New settled corals are dominated by Pocilloporidae in NT (60,56%) and in GV (36,94%), followed by Acroporidae (respectively 22,78% and 26,13%) and Poritidae (respectively 7,46% and 12,61%), but dominated by Acroporidae in JR (44%). In the South western of Madagascar, the massive sexual reproduction of Scleractinians is estimated to occur in October and February because high rate of monthly recruitment was observed during that period. Besides, NT dominates significantly ($p=0$) GV concerning >1 year aged recruits. NT shows 31,2±14,92 recruits.m⁻² for settlement of <2cm diameter and 16,24±9,94 recruits.m⁻² for 2cm< settlement <5cm, and respectively, 15,85±8 recruit.m⁻², 9,63±4,18 recruits.m⁻² for GV. In the Grand Récif, the low rate of recruitment is due to the high anthropic impacts, when in Jardin des Roses, this is probably due to the low diversity of Scleractinians in this monospecific reef reserve. Unlike these two sites, Nosy Tafara shows an important recruitment rate thanks to its important diversity of coral associated with the low levels of disturbance. Thus, Nosy Tafara is the best site for a natural repopulation and coral aquaculture.

ORAL- Monday- Msikaba 4- 1400

An investigation of core-edge genetic diversity in South African marine mussels

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The 'abundant-centre' hypothesis is a well-established ecological hypothesis which states that the abundance of a species is highest at the centre of its range and decreases towards the edges, where conditions are less favourable. Although the hypothesis is often taken for granted, a recent meta-analysis has indicated that many studies do not support it, and that it may often be too simplistic. In this study, I will test the genetic implications of the abundant-centre hypothesis on South African marine mussels, including the assumption that genetic diversity is highest at the center of the range, and that the edge populations are either genetically distinct or genetically swamped, depending on levels of gene flow. The study organisms for this research

are the native mussel *Perna perna* (of which a temperate western lineage and a subtropical eastern lineage occur in South Africa), and *Mytilus galloprovincialis*, which has recently invaded South Africa's temperate coasts. Microsatellite data will be generated for both species, and in addition, mitochondrial DNA COI sequences will be generated for the two lineages of *P. perna*. The main aim of this study is to determine whether genetic diversity is higher in the core habitat of these species/lineages and lower in the edges. The cool-temperate/warm-temperate biogeographic transition zone on the south-west coast (Cape Point to Cape Agulhus) will represent the range edge for the western lineage of *P. perna*. The warm-temperate/subtropical transition zone on the south-east coast (Algoa Bay to Wild Coast) will represent the range edge for both *M. galloprovincialis* and the eastern lineage of *P. perna*. In addition, gene flow between core and edge will be determined to compare the relative importance of ocean currents and favourable habitat on connecting populations.

POSTER

A comparative study of growth rates and yield of the seaweed, *Kappaphycus alvarezii* (Doty), using different seedling densities and farming methods in south coast, Kenya

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The study aimed to generate information that will contribute to development of alternative livelihoods as a policy to uplift the socio-economic status of small-scale fishers and to reduce fishing pressure on overexploited fisheries. The study identified and assessed ecological indicators based on the objectives of sustainability of harvests, farming methods, seedling densities, site characteristics and seasonal variations in growth rates. Sampling was done fortnightly at three sampling stations (Kibuyuni, Gazi Bay and Mkwiro). Data analyzed were sourced from on-project fieldwork. Trends in growth rates and yield of *Kappaphycus alvarezii* (2014-2015) from the three sites were analyzed using PCA and a canonical analysis model. Effects of seven variables— water depth, salinity, Dissolved Oxygen turbidity, temperature, conductivity and pH on *K. alvarezii* growth rate were evaluated in this study. The Gazi Bay was influenced by variable river discharges in March–June and August–November, respectively which impacted the salinity gradient resulting into two different salinity regimes, i.e. mesohaline and polyhaline. Parameters such as conductivity, turbidity and pH fluctuated temporally, but no significant differences were recorded among other sampling sites.

In both sites the raft type of farming accounted for the highest yields with the medium seedling densities (100g) as compared to the off bottom method temporally and spatially. The correlation between sites, methods, densities and variables, suggests the importance of environmental parameters in determining the growth rate and yield of *K. alvarezii*. Some sites such as Gazi Bay showed a strong correlation with salinity and pH, whereas others such as Kibuyuni and Mkwiro were strongly correlated with turbidity. The study recommended adoption of the raft type of farming in addition to the indicators described in this study, socio-economic and biological data will be needed to develop a holistic model for the management of the bay resources

POSTER

Allometric relations for determination of biomass carbon in mangroves, *Rhizophora mucronata* L. and *Ceriops tagal* P. in Kenya

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As forest carbon offset projects pick up in many parts of the world, the need for localized equations for the determination of standing biomass is becoming more apparent. We developed species specific biomass equations for *Rhizophora mucronata* and *Ceriops tagal* in managed and natural mangrove forests along the Kenya coast. Fifty trees of each of the species with diameter ranging from 2.5 cm to 50 cm were harvested; and separated into their component parts: trunks, leaves, branches, and stilt roots (buttress roots in the case of *C. tagal*). The weight of individual component parts was measured in situ and sub-samples of each component carried to the laboratory for wet-dry weight conversion. Correlations between the total biomass against stem diameter (D130), either alone or in combination with height, were used to develop allometric equations of the form $y = ax^2 + bx + c$ (where; y = biomass, x = D130 and a , b and c are constants). The strength of the equations was assessed by the correlation coefficient of determination (r^2) and standard error. Stem diameter (D130) was found to be the best predictor for aboveground biomass with correlation coefficient (r^2) of 0.91 and 0.93 for *R. mucronata* and *C. tagal* respectively. The aboveground biomass for *R. mucronata* was estimated to range between 4.8 and 162.3 t/ha while that for *C. tagal* ranged between 9.2 and 136.4 t/ha. The developed equations could be used to accurately estimate biomass carbon of the mangrove forests in Kenya.

POSTER

Mangrove Conservation Initiatives at Community Level: The Case of Mida Creek, Kilifi County

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Mida creek is a world biosphere reserve and one of the communities where communities organized themselves to more than a decade ago to conserve mangroves through formation of an umbrella group; mida creek conservation community (MCCC) in 2002. Despite the historical community organization and enormous efforts by different stakeholders to support the mangrove conservation, limited information exists on the challenges of the mangrove conservation efforts. The study assessed how various socioeconomic factors impacted mangrove conservation efforts in the creek and possible intervention measures. The study covered two villages (Mida Msikitini and Mida Majaoni) with a long history in mangrove conservation. A set of questionnaires and semi-structured interviews were used to collect data during the study and a combination of cluster sampling and systematic sampling were used to obtain the respondents. The level of illiteracy was high in the two villages with between 30 -45% having no formal

education at all while an average of 48% had attained only primary level education an aspect that impacted on their mangrove conservation efforts. Consequently, more than 40% of the respondents had an household size of more than 10 members. There was a high dependency on mangroves (43-47% in mida majaoni and mida miskini respectively). Participation in conservation of mangrove was relatively low in Mida Msikitini 53% compared to Mida Majaoni 87%. More than 50% of community members participate in mangrove conservation efforts through organized community groups. The study showed a high dependency on mangrove products and services in mid creek and numerous efforts towards conservation of the ecosystem

POSTER

Biophysical studies and occurrence of *Kyphosus cinerascens* at Matemwe reef on the east coast of Zanzibar

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The hydrodynamic conditions for the occurrence of the fish *Kyphosus cinerascens* on the east coast of Unguja Island are not well known except for the fact that the fishing area is generally swept by the East African Coastal Current (EACC). Time series of current meter measurements of currents and tides were subjected to harmonic analysis of least squares fit to understand the effects of the tidal dynamics and the EACC on the fishery while hydrodynamic modelling using ROMS was used for water circulation simulation. The results showed that eddy activity and non tidal streams activity are greater than tidal currents activity. The principal tides (mm) M2 (1057.08), N2 (238.74), K1 (157.6), and O1 (111.5) with the exception of S2 (684.04), induce very minimal tidal currents in the study area. Most tidal currents (mm/s) are MM (59.34), S2 (48.76), MSF (40.54), SN4 (24.2), MU2 (23.6), M4 (21.13), and K1 (19.57). Tidal ellipses are inclined are N-S aligning aligned with eddy flow.

The observed hydrodynamic regime suggests an incoming (and outgoing) tidal wave forming eddy that spirals counter clockwise from north of Mnemba Island as far south as Chwaka bay recycling nutrients into the Matemwe reef. Offshore incoming and outgoing tidal wave off Mnemba Island flows northward signifying the influence of the EACC. The *Kyphosus cinerascens* occurrence on the Matemwe reef on the east coast of Zanzibar is thus largely influenced by the eddy flow. The fish utilises a wide range of food resources including macroscopic algae, turfing algae, pelagic and planktonic animal matter, organic detritus and sediments that are readily available on the reef.

POSTER

Reproductive biology and body condition of Emperor angelfish, *Pomacanthus imperator* along the Kenya Coast

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Emperor angelfish, *Pomacanthus imperator* is a coral reef fish with an Indo-Pacific distribution. This species has a great potential in the Kenyan export trade among the marine ornamental fishes. However, fundamental knowledge of the reproductive biology of this species is deficient. Selective

harvesting of specific sizes of *Pomacanthus imperator* may affect its reproductive capacity and population structure and thus reduce its resilience to growth overfishing. A total of 93 specimens of the *P. imperator* were sampled from artisanal fish landings along the Kenyan coast during March through July 2014 and January and February 2015. Analysis showed a sex ratio of 1:1. The smallest mature individual recorded was 15cm TL for males and 20 cm TL for females. The mean size of females was 30.3±1.1 (Mean±SE) ranging from 15-44.7cm while males had a mean size of 26.5±1.4 (Mean±SE) ranging between 14.9-44.7cm TL. Body weight in females ranged from 0.10-2.63kg with a mean of 0.84±0.12 (Mean±SE) while in males the mean weight was 1.14±0.12 (Mean±SE) with a range of 0.09-3.07kg. Higher GSI values were recorded in June, with 0.43±0.06 for females and 0.43±0.10 for males while May recorded the lowest GSI values for both sexes with a mean of 0.02±0.05 for females and 0.01±0.04 for males. Length-frequency analysis showed that most of the individuals were in the 30-40cm length classes for females and 15-20 and 35-40 for males. For both sexes, individuals in the 40cm length-classes and larger were not frequently encountered in the samples. The sex ratios shows that just as many pairs as harems were formed but with spatial and temporal variations. The Length weight relationship for females exhibited slightly negative allometric growth with b values of 2.99 while males showed slight positive allometric growth with b value of 3.037.

ORAL- Tuesday – Msikaba 3 – 1100

The natural assets underpinning a Northern Mozambique Channel sub-regional initiative

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The natural assets of the Northern Mozambique Channel (NMC) are unparalleled in the Indian Ocean, making it an emerging priority for research, exploitation and management. The Mozambique Channel dates back 180 my to the breakup of Gondwanaland, resulting in a stable configuration of the channel for over 150 my. The configuration of the channel also results in a unique oceanographic regime, of highly energetic eddies several hundred km in size, and high connectivity of locations throughout the channel. The combination of old and recent tectonics and oceanography has resulted in the second hotspot for shallow tropical marine diversity globally, and globally unique, highly productivity pelagic and benthic systems. Geological stability may also be the factor enabling natural gas accumulation resulting in the largest recent natural gas finds globally.

In coming decades, these natural assets will support the full range of economic actors from subsistence fishers to global energy corporations, with concomitant competition and conflict over access to and impact on resources and the environment. No precise estimates for human population and economic growth are available for this subregion, but based on the current low levels in both, and the richness of the assets that will drive immigration and expansion, both are likely to be higher than other subregions continentally and globally, over the coming decades.

This presentation will focus on the natural assets and ecosystem service values of the northern Mozambique Channel (NMC), and the growth in multiple stressors likely as a result of demographic and economic growth

in the subregion. It will conclude with an indication of the science and knowledge needs that may be required to minimize or even avoid adverse impacts, as well as an information platform for Marine Spatial Planning, to make this knowledge available for decision-making in the countries of the NMC.

POSTER

Updating and online publishing of biodiversity data: an example of the hard corals of Sodwana Bay, Western Indian Ocean

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In the Western Indian Ocean, where in-country taxonomic capacity on invertebrate groups has been minimal and information has largely derived from short field visits, the availability of consistent information on systematics has been poor. As a result, species lists reflect poor and incomplete surveys, and demotion of the biodiversity importance of the region in large scale assessments. This paper illustrates the use of Scratchpads, a free online biogeographic database, as the foundation for a regional dataset on Scleractinian corals. The online and open access nature of the resource facilitate participation and review by the scientific community and other experts, and a publication flow to the Biodiversity Data Journal facilitates dissemination of results.

Out of a regional database of over 369 species, surveys in Sodwana Bay (KwaZulu Natal, South Africa) in May 2014 recorded over 140 species. This raises prior species counts for the area from <100. It also highlights some of the problems in hard coral taxonomy of synonymy based on localized species descriptions and identifications that can be redressed through regional (or linked) datasets. The overall character of the South African coral fauna, of a subset of the regional species pool as a result of isolation and marginal conditions, is upheld.

The role of resources such as this in supporting national obligations for biodiversity reporting, e.g. on the Aichi Biodiversity Targets, will be illustrated. Links to other online resources, such as the citizen-science platform iSpot can further enhance the value and reach of the system. An initiative through WIOMSA and the Indian Ocean Commission Biodiversity Project in 2015-2017 to support regional biodiversity bases will help significantly in facilitating this process, and coordinated development across taxonomic groups at the regional level will bring significant advantages.

ORAL- Tuesday- Msikaba 2- 1120

Are mesoscale eddies agents of gene flow between Madagascar and KwaZulu-Natal?

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Similarities in fauna found off the coasts of southern Madagascar and KwaZulu-Natal led to the development of the "Suitcase Project", with the aim of establishing whether eddies that form off southern Madagascar may package

and transport biological material, as if in a suitcase, across the Mozambique Channel. In pursuit of this question, we sampled through a cyclonic eddy which originated off the southern tip of Madagascar, as well as reference stations on the southern Madagascan shelf using two types of plankton nets: (a) Bongo nets and (b) a Neuston net to collect zooplankton within the upper 200 m and surface respectively. Samples were sorted for meroplankton (e.g. rock lobster, fish larvae) under a stereo microscope, particularly seeking species known to be common to both the east coasts of Madagascar and South Africa and thus potential indicators of connectivity between these regions. Selected organisms were used for DNA barcoding. We compared zooplankton biovolume and abundance between the eddy core, eddy perimeter and outer regions, as well as at reference stations on the Madagascan shelf. Initial results indicate higher neuston biovolume in both the eastern and western outer zones as well as in the eastern eddy perimeter zone (0.06-0.09 ml m⁻³) and lower biovolume in the eddy core (0.02 ml m⁻³). Highest zooplankton biovolume collected with the 500-µm Bongo net was in the eastern eddy perimeter zone and western outer zone (0.25-0.29 ml m⁻³) and lower biovolume in the eastern eddy zone and eddy core (0.11-0.16 ml m⁻³). Reef-associated fish genera, for example *Halichoeres*, *Chromis* and *Epinephelus* were identified using DNA-Barcoding were more abundant in the western outer zone of the eddy. Meroplankton were more abundant on the Madagascan shelf and outer regions of the eddy, which could indicate that they being entrained off the shelf by the eddy.

ORAL- Thursdy- Msikaba 1- 1620

Influence of drying methods and blanching treatment on the drying rate, quality and lipid stability of sardine (*Sardinella gibbosa*)

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Along the Kenyan coast, it's common that sardines are partially cooked before drying on the mats in open air. This results to variable and more often low quality products with limited shelf life, thereby restricting products marketing within the local community areas other than high end national markets. In this study, the effects of drying methods and blanching treatment on the drying rate and quality of sardine (*Sardinella gibbosa*) were examined under controlled and uncontrolled drying conditions. The drying process was evaluated using drying rate and moisture content. After drying and during the storage, lipid oxidation, fatty acids composition, sensory attributes and protein solubility were analysed. Dried sardine had moisture at equilibrium of 24.5% and 23% during controlled and 28.5% and 25.5% during uncontrolled drying for unblanched and blanched sardine respectively. Uncontrolled drying and blanching treatment increased lipid oxidation rate significantly ($p < 0.05$). Proportion of polyunsaturated fatty acids, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) declined rapidly during storage. Unblanched sardine retained desired attributes longer according to sensory evaluation. Blanched dried sardine had significantly ($p < 0.05$) lower muscle

protein solubility than unblanched groups. Protein solubility remained apparently stable during storage. In conclusion, uncontrolled drying and blanching adversely affected the final product quality and stability. A stable dried product of improved quality needed for access to high end market can be produced from unblanched sardine dried under controlled temperature, relative humidity and air speed.

POSTER

Socioeconomic Impact of Capture and sale of *Sylla serrata* in Metuge Community

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The mangrove crabs *Sylla serrata* are very important for livelihood of coastal communities particularly in Metuge District, South of Cabo Delgado Province, where the study was conducted from June to August 2014. The aim of this study is to determine the socioeconomic impact of mangrove crabs captures in communities of Metuge district. Data were collected in the landing sites in the village and in local crab markets. In total 26 crabs fishermen and 6 traders was surveyed it was found that activity of capture mangrove Crabs is practiced 100% by man. Their ages ranged from 15 to 68 years old and the range 35-60 year old was dominant. To capture the mangrove crabs the fishermen use a long hook iron with 1.5 to 2 meters, they goes 5-7 times per week and spend about 5-8 hours a day in mangrove forests, the quantities captured by fishermen can vary from 2 to 20 kg per day, the price of crabs depend where fishermen sell, in village one kilogram cost 1 to 1.5 USD and 3 USD for local traders. On the other hand the traders can sell until 50 kg of crabs along the road and specific places in Pemba city. The incomes vary from 11 to 174 USD per month. The money is intended to purchase food and agricultural instruments. 90% of interviewed dropout the school, high number of family members, poor housing made by local materials, and relies on community wells to access water and most do not have electric power.

POSTER

First community-led management plans for Beach Management Units launched in Kenya: Factors leading to success

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Rising depletion of marine resources due to overexploitation led the Kenyan government to adopt a bottom-up approach to co-management of fisheries resources with the Fisheries Act Cap 378, 1991 (Revised 2012). This approach aims to employ fishers' knowledge, skills and experience to spearhead sustainable resource management in cooperation with the State Department of Fisheries (SDF) under the structure of local Beach Management Units (BMUs). Since 2011, BMUs on the South Coast of Kenya (Shimoni, Majoreni, Kibuyuni, Mkwiro, Wasini, Vanga, Jimbo) have

partnered with NGOs and the SDF to form Community-Conserved Areas whose governance is linked by the Kwale County BMU Network. The first of their kind in Kenya, in 2014-15, two management plans were approved and launched on the South Coast (Kibuyuni, Vanga). This study gathers the experiences of key practitioners working with those BMUs to establish the factors leading to the successful launch of their management plans.

Throughout the process of their development, NGOs worked with the SDF to conduct awareness raising campaigns, scoping and documentation of baseline information, participatory mapping, zonation exercises, workshops with stakeholders, public consultations on the management plans and community meetings to revise local BMU by-laws and facilitate empowerment and ownership of their content by BMUs.

Important factors which enabled the approval and launch of the Vanga and Kibuyuni management plans were strong leadership within BMUs and the ability of assemblies to empower effective leaders, ongoing BMU-led community awareness campaigns, and motivation on the part of the BMU to mobilise their own resources, based on guidance provided by implementation plans within management plans. Technical and financial autonomy and good governance by BMUs appear to be the overriding factors empowering and incentivizing certain BMUs on the south coast CCAs to successfully launch, and begin implementation of their management plans under Kenya's Fisheries Act.

ORAL- Wednesday- Msikaba 2 – 1200

The distribution and reproductive patterns of the *Epinephelus* genus groupers off Kenyan south coast marine waters

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Given the paucity of management protection intervention knowledge data available on the *Epinephelus* genus groupers in Kenya, their distribution and reproductive patterns investigation in the Kenyan south coast inshore marine water fisheries was undertaken for a period of 8 months starting from December, 2013 to July, 2014. Data was obtained from both the experimental underwater visual surveys and artisanal fishery landings at Msambweni, Shimoni, and Vanga. Underwater visual surveys were conducted to assess the *Epinephelus* genus groupers abundance and spatial distributions. Further, landed artisanal fishermen catches were also purchased and analysed for species composition, spatial distributions, abundance, and maturity stages. The results showed that thirty (30) *Epinephelus* genus grouper species existed within the Kenyan south coast inshore marine water fisheries. Eleven (11) of the species; *Epinephelus fasciatus*, *E. malabaricus*, *E. longispinis*, *E. chlorostigma*, *E. coeruleopunctatus*, *E. multinotatus*, *E. merra*, *E. melanostigma*, *E. tukula*, *E. fuscoguttatus*, and *E. tauvina* were found common in all sites. Five (5) species comprising *E. flavocaeruleus*, *E. chabaudi*, *E. socialis*, *E. undulosus*, and *E. morrhua* were dominant in Msambweni while *E. Polyphekadion* was dominant in Shimoni. The one specimen of *E. acanthistus* recorded was only found

in Vanga. In abundance, the smaller bodied *E. fasciatus* accounted for 13.5% whereas the larger bodied *Epinephelus fuscoguttatus* performed dismally by accounting for only 1.7% of the total small scale artisanal fishery landings off Kenyan south coast. Reproductive patterns analyses on the other hand, showed that inactive females (stage I) occurred throughout the study period. Active (stage III) and ripe (stages IV & V) females occurred from April and May respectively. The reproductive peak period of 18 out of the 30 species recorded, occurred in May to July, coinciding with the Southeast monsoon (SEM) season.

ORAL- Wednesday- Msikaba 1- 1500

Potential barriers to effective climate change adaptation by local coastal government in Kenya

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The coastline of Kenya already experiences the effects of climate change. Failure to adapt to projected climatic variability and associated effects will have economic, social and environmental consequences. Emerging Knowledge for Local Adaptation, a MASMA funded project is a regional study that intends to evaluate the current capacity of local governance institutions to use "emerging climate change knowledge" to inform adaptation and build resilience. This paper presents the findings of a local governance assessment that used the Capitals approach which measured a governance baseline consisting of 20 factors and 90 indicators in three Counties on the coast of Kenya. Data were generated through content analysis of local government (counties) documents and Key informant interviews (38). Interviewees included officials from various county government departments and other coastal stakeholders. Seven focus group interviews were conducted with community groups in order to triangulate the findings. Results suggest that adaptation measures at local government level are still in transition from being a marginal concern to a mainstream consideration. County governments are ill-prepared for climate related disasters (short-term) and are not yet taking action that could be considered climate change adaptation (long-term). Some reasons for the lack of planned adaptation, include a lack of institutionalisation of climate change and leadership, inadequate human capacity and expertise, limited access to reliable information on climate change and coastal vulnerability, lack of involvement in and understanding of integrated coastal zone management, and limited awareness of the importance of ecosystems in climate risk reduction. This paper will present data from the assessment and some of the initial findings.

POSTER

The mangroves of Pate Island and Kiunga, Lamu Kenya

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Located in a transition ecotone between the warmer East African coral reef bioregion to the south, and colder waters of the Somali Current to the north, Lamu archipelago is endowed with rich biodiversity. The presence of Kenya's largest continuous acreage of mangroves approximately (33, 000 ha), coral reefs and sea grass beds makes it a hotspot for management and conservation efforts. The current study was initiated by The Nature Conservancy in collaboration with CORDIO East Africa to document the structural status of the mangroves around Pate Island and Kiunga. Although several structural surveys have been conducted along the Kenyan coast, demand still exists for location specific assessment to aid in monitoring of forest status. This is especially important under the current dispensation where participatory forest management is given an upper hand in Kenya. The current study was conducted in March 2015 and it involved both stratified and random spot sampling to collect vegetation data. Preliminary results indicate occurrence of seven out of the nine mangrove tree species found in Kenya. There is a high density of overgrown mature trees hindering natural regeneration particularly within the national reserve in Kiunga. Outside the reserve, there is rampant poaching of trees by use of both power saw and traditional axes. The results of this study will provide an ample basis to be used in deciding on best possible management options for these mangroves.

ORAL- Thursday – Msikaba 1 – 1100

Resource overlap between artisanal and ornamental reef fisheries in coastal Kenya

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Coral reef fishery resources are under increasing threat from overfishing resulting in resource competition and conflict between fisheries, especially where competing gear types are used in the same fishing grounds. We quantified the resource overlap between artisanal and ornamental reef fisheries by monitoring artisanal landings from January to December 2014 in Shimoni, Kenya. The fishing grounds, gear types and catch composition by species, sizes were documented. Multivariate Detrended Correspondence Analysis (DCA) was used to test for gear associations in the composition of ornamental species captured. Eight

gear types interacted with the ornamental fishery with handlines accounting for 46% of the ornamental catches, followed by spearguns (26%), basket traps (17%) and reef seines (6%). The DCA separated spearguns and handlines from reef seines, gillnets and basket traps, indicating differing selectivity patterns in the capture of ornamental species. Overall, species of ornamental value constituted approximately 12% by weight and 10% by number, comprising of 18 families and 57 species. The bulk of ornamental captures were fished within the Mpunguti Reserve, an area restricted from ornamental fishing. Ornamental wrasses were the most dominant in the catches making up 39% (19 species), followed by surgeonfishes (9 species), damselfishes (6 species), triggerfish (3 species), angelfishes (3 species), serranidae (3 species) and butterflyfish (4 species). The surgeonfish *Acanthurus triostegus*, the angelfish *Pomacanthus imperator* and the wrasses *Thalassoma hebraicum* and *Halichoeres hortulanus* were the most abundant ornamental species respectively. The study provides insights into other sources of fishing pressure on adult phases of ornamental reef fish populations, and important aspect to consider in the sustainable management of ornamental reef fisheries in the WIO.

POSTER

The Ringnet Fishery in Kenya: Lessons to be learned in managing a developing fishery

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Small and medium pelagic fish provide an important shared resource in the Western Indian Ocean (WIO) region that contributes to food security and income for coastal communities. Ringnets are currently the most efficient fishing method accessible to local fishers in Kenya for targeting small and medium pelagic fish. The gear was introduced in early 1990's and its use has evolved and spread throughout the Kenya coast. Management of the ringnet fishery has since faced significant environmental and socio-economic challenges due to the lack of a fishery-specific regulatory framework. Stakeholder perceptions on the benefits and threats of the ringnet fishery have been polarized, with supporters arguing that the gear provides for high economic benefits and food security for the local communities; while those against argue that many of the perceived economic benefits are short-term and will result in more long-term effects on the resource base. Due to rampant resource use conflicts in 2009, a temporary ban on the fishery was instituted, subject to development of a ringnet fishery management plan. A collaborative consultative process was initiated culminating in the development of a management plan for the fishery in 2014. Proposed management measures were oriented towards a precautionary and adaptive management approach. A detailed synopsis of the consultative process, the challenges and key outcomes is presented, providing key lessons to be learned in managing emerging fisheries in the WIO.

POSTER

Bait preference by artisanal bait fishers in an East African coastal creek - Mida

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Bait fishers know a large repertoire of bait types, however drivers for choice of bait among the fishers has rarely been explored. Optimal foraging theory predicts hunter-gatherer societies maximize returns by choosing prey items that are either numerous (patch dynamics) or more profitable (diet breadth). Fishers were interviewed on the bait they know and those preferred with reasons for choice, using a structured questionnaire. The number and types of bait preferred were compared among gears, sites and fisher demographics. Results indicate the fishers at Mida knew over 13 bait types, but were highly selective, for choo, dophe, and ngisi but also kamba. Ability to land large quantities of fish was the major reason driving bait preference irrespective of site, gear or source of bait. Exclusive hook and line fishers preferred using choo and dophe, harvested from the adjacent mangrove. Trap fishers on the other hand, preferred tondo and moani. While patch dynamics may explain spatial patterns of bait preference, diet breadth models may be useful in explaining localized patterns of bait use

POSTER

Into a new era of brittle star (Echinodermata: Ophiuroidea) taxonomy in South Africa

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In South Africa, brittle star (Echinodermata: Ophiuroidea) research has not kept pace with global taxonomic research with the last major taxonomic review of the group being published in 1976. Since then, a number of new records have been documented and a small echinoderm collection housed in the Durban Natural Sciences Museum has been documented. New records originate from specimens housed in five zoological collections, photographic records and from reports published in the non-taxonomic literature. As a result, an additional 28 species have been recorded within the mainland Exclusive Economic Zone of South Africa, elevating the total known number of ophiuroid species reported in the region to 139. The rediscovered collection in Durban includes holotypes of the South African endemic ophiuroid *Asteroschema capensis* Mortensen, 1925 [= *Asteromorpha capensis* (Mortensen, 1925)] and the South African endemic asteroid *Anthenoides marleyi* Mortensen, 1925. In addition, two neotypes have been designated for *Amphilimna cribriformis* A.M. Clark, 1974

and for *Ophionephthys lowelli* A.M. Clark, 1974 which are both held in the Iziko South African Museum collection in Cape Town. During the presentation, a review of the history of ophiuroid taxonomy in South Africa will be given as well as detail on the new records and the significance of the small rediscovered collection in Durban.

ORAL- Monday- Msikaba 4- 1640

Spatial and temporal trends of nesting sea turtles in the Lamu archipelago, Kenya

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Five species of sea turtles (green, hawksbill, olive ridley, leatherback and loggerhead) forage in Kenyan waters. Three of these (green, hawksbill and olive ridley) also nest. The study examined nesting, egg production, incubation and hatchling emergence success in five locations (~31,042 km length) in Lamu archipelago. The data was collected between 1997 - 2013. Results indicate that green turtles are most common; 98% of the total number of nests. Over the study period there has been an increasing trend in nest numbers with Rubu and Kiwayu Islands contributing most. Forty (40) percent of nests in Rubu were by green turtles whilst 45% in Kiwayu were by Hawksbills. Clutch size for the three species ranged from 20 to 186 (mean sizes 118 eggs for green: 103 for hawksbill and olive ridleys). Nesting occur all-year-round, peaking during the southeast monsoon months from April to July. The mean incubation period varied spatially and seasonally ranging from 40 to 67 days. Hatchling emergence was 81.3 % with a total output of 173,333 successful hatchlings between 1997 and 2013. A remigration interval of 3.6 years is estimated for green turtles giving an estimated female sea turtle population of 170 - 200 for the study area. These results highlight the significance of the Lamu archipelago for the West Indian Ocean sea turtle population and the role of local communities collaboration in sea turtle conservation.

POSTER

Trends in Sea Turtle Predation and Mortality in Lamu Seascape, Kenya

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Lamu archipelago is one of the few remaining enclaves for sea turtles along the Kenya coast. Data emanates from continuous sea turtle monitoring (1997 - 2013) at key locations of Kiunga, Kiwayu, Mkokoni, Mvundeni and Rubu Island comprising 34 beaches. Information and data was collected daily during the nesting season (February - July). Data recorded include: tagging, turtle hatchlings,

laid nests status, incidences of nesting and predation, translocation, hatchlings, and turtle strandings. The green turtle (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and olive ridley (*Lepidochelys olivacea*) nest and forage. The leatherback (*Dermochelys coriacea*) and loggerhead (*Carretta carretta*) forage only. 2,017 turtle nests were recorded during the study period. Temporal trends show an increasing number of turtle nests. The percentage number of translocated nests was found to be comparatively higher than in-situ nests. Predation levels show a reducing trend ($R^2 = 0.292$). Significantly higher number of nests were recorded on island beaches ($p < 0.05$), indicating turtle nesting preference. Turtle nest predation incidences showed seasonal fluctuation, the Southeast Monsoon (SEM) recorded lower incidences ($9.2 \pm 2.2\%$) in comparison to the Northeast Monsoon (NEM) season ($14.8 \pm 3.0\%$) although not significant. 227 sea turtle strandings were recorded during the study period. Fishing and related activities were the main cause of mortality for the strandings ($n = 121$). Turtle strandings were dominated by the green sea turtles (mean size 68.9 ± 1.9 cm CCL; $n = 180$). Higher turtle strandings were recorded during the NEM season. The study underscores the importance of reducing mortality on the evolutionary fit older individuals and cohorts especially at the critical life cycle stages of nesting and mating.

POSTER

Eye on the community: Analysis of local governance systems, attitudes and perceptions supporting mangrove management in Vanga, south coast Kenya

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Poor local governance structures coupled with negative attitudes and perceptions of the local community towards mangrove ecosystems could be major hindrances to the establishment of sustainable incentive based management in mangrove areas. Household surveys and key informant interviews were carried out in 3 villages adjacent to the Vanga pilot area with the aim of determining the local governance system roles and acceptance as well as community attitudes and perceptions towards the state of the mangrove ecosystem. According to the preliminary results 51% of the respondents view the mangrove ecosystem to be degraded, 24.5% view it as unchanged and 18.5% view it as not degraded in the past 5 years. There is a significant relationship between community perceptions on the condition and use of mangrove products. 80.1% of respondents would be willing to participate in conservation indicating positive attitude towards mangrove conservation. In general, improved understanding on conservation, rehabilitation and sustainable utilization of mangrove resources would result in the up-scaling of a successful mangrove carbon offset project.

POSTER

Spatio-temporal patterns in coastal artisanal fishery resources exploitation across fishing craft-gear combinations and the implication for fisheries management in Kenya

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Lack of consistent catch assessment survey (CAS) data to inform coastal fisheries management in Kenya has been prevalent. The Kenya Coastal Development Programme (KCDP) supported a structured and harmonized landed catch data collection using trained local data collectors at 22 designated landing sites beginning June – 2013 and currently ongoing. We present an analysis of 12-month data collected over June 2013 – May 2014 period where we explored spatial and temporal variations in artisanal landings across fishing craft-gear combinations for overall catches, landing sites and two distinct seasons of northeast monsoon (NEM) and southeast monsoon (SEM). Results indicate operations by 102 craft-gear combinations from 8 crafts and 19 gear types along the Kenyan coast with varying catch composition based on sample weights of landed fish families. A total of 95 craft-gear combinations were recorded over the SEM season and 77 during the NEM season. All the sites recorded between 9 and 40 craft-gear combinations with more of these combinations during SEM than NEM for 17 of the 22 sites. Overall mtumbwi-handlines craft-gear combination had the highest composition of 59 families while mashua-longlines craft-gear combination had the highest catch by weights (114.9 kg/craft-gear/day). By sites Shimoni had the highest number of families landed while Bamburi had the lowest. Seasonal variations were evident with more families landed during SEM but over 12 of the commonly landed fish families were caught year round irrespective of season and site. Multivariate detrended correspondence analysis (DCA) indicated an overlap of 34 dominant craft-gear combinations with the commonly caught fish families. The implication of these findings is that management measures for this tropical multi-craft, multi-gear and multi-species fishery need to incorporate holistic information on crafts, gears, seasonality and site specificity towards achieving ecosystem based management of the Kenyan coastal fishery amid the existent complex socio-ecological settings.

POSTER

North Kenya Banks participatory drop-line fishing gear trials: successes, challenges, lessons learnt and opportunities for development

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Drop-line fishing gear trials were done at the North Kenya Banks (NKB) Indian Ocean approximately 40 - 47 nautical miles off Ngomeni and Malindi in February and April 2015. Handline fishers catch on average from 1-4

fish/haul and spend up to 2 days at sea to catch 400 - 1000 kg of fish. The drop-line gear development initiative was aimed at sensitizing and demonstrating to target handline fishers about drop-line gear fabrication and fishing and the advantage it offers of increasing catches and reducing the time spent fishing. In this paper, we highlight the successes, challenges, lessons learnt and opportunities offered following two participatory drop-line fishing gear fabrication and deployment trials within the NKB. Results showed that the fabricated drop-line gears caught between 3- 11 fish/haul with fishers landing an average of between 57 - 222.5 kg of fish after 4-5 hours of fishing giving an average of between 11.4 - 43.0 kg/boat/hour. On the other hand, handline fishing caught an average 150-500 kg of fish after 16 hours of fishing, giving an average of 9.4 - 31.25 kg/boat/hour. Participating fishers and other stakeholders unanimously agreed that fabricated drop-line gear performed better than handlines. Challenges include the ability for fishers to adopt the drop-line fishing technology due to high costs of components and the lack of ownership of boats. Lessons learnt included the need to have different types of baits and equipping the boats with fish finders and depth echo-sounders. Opportunities for further development of this gear are proposed through collaborative working between fishers, boat owners and development partners including the county governments. It is recommended that as this fishery develops, there is need for supporting scientific information to advice on management measures that would ensure sustainability in the harvesting of these long-lived deep sea demersal fishes.

ORAL- Thursday – Msikaba 1 – 1700

Markets and Middlemen: Taking a Value Chain Approach to Study Important Social-Ecological Linkages in Small-Scale Fisheries

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Seafood trade is currently intensifying around the small-scale fisheries (SSF) of the Western Indian Ocean region with an increasing pressure on local marine social-ecological systems. Marine resource management tends to shine the spotlight on the resource extractors, the fishers. This project instead shifts focus to the traders, the critical link between fishers and the market. The question is does this link trap fishers in relationships that cause unsustainable fishing behavior (i.e. social-ecological traps) or do they provide relief in hard times?

Using a Value Chain (VC) approach, this study follows three of the most important seafood products (i.e. octopus, mixed reef fish and small pelagics) being landed in Tanzania (Zanzibar), the Philippines, Mozambique and Kenya as well as the actor relations involved in this trade to answer these questions.

Preliminary results from Zanzibar show that revenue and seafood products flow from landing sites to markets throughout the island, Tanzania mainland and are demanded as far away as the Democratic Republic of the Congo and Rwanda. Finance and commodities appear to extend up and down the VC between fishers and traders of all sizes or types e.g. male hotel suppliers, small-scale female traders, spear fishers, boat crew, as well as secondary actors such as young fish processors and retired fishers. So far unsuitable patron-client relationships are not detectable at the base of the VC; yet predetermined buyers are frequent. Tourist hotels appear to potentially create difficult VC conditions with payment systems disengaged from the dynamics of the local economy. Initial findings emphasize the necessity of extending the focus of SSF management up the VC towards traders and ultimately the more powerful players like hotels and demanding foreign export markets to ensure future sustainable fisheries.

ORAL- Monday – Msikaba 3 – 1700

Socio-Economic Assessment of Artisanal Shrimp Fishery of the Malindi Ungwana Bay

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The importance of Malindi Ungwana Bay prawn fishery is indisputable, given that it hosts Kenya's only prawn trawling industry and supports livelihoods of thousands of artisanal fishers and their dependants. While the contribution of the prawn trawl fishery has generated data for management, the artisanal shrimp fishery which is conducted along the near-shore areas that are also the feeding and nursery grounds of critical larval and juvenile stages of these shallow water penaeid shrimps has not been fully understood thus resulting in difficulties in coming up with effective management regimes. This study focused on the socio-economic conditions of the artisanal prawn fishermen and their perception towards bottom trawl in order to understand the effectiveness of the Prawn Fishery Management Plan 2010 in minimizing resource-use conflicts and to guide in revision of the existing management plan. A combination of questionnaire survey, participant observation, and key informant interviews were used to collect data. Results reveal that the prawn fishers are involved in professional, seasonal or subsistence fishing. Prawn catches from the bay have declined significantly because of climate change (54%), use of destructive fishing gears (25%), and overfishing (21%), thereby threatening the health of the bay's ecosystem as well as the future of small-scale fishery. We evaluate various social, economic and ecological challenges faced by the prawn fishers and propose a conceptual framework that recognizes linkages among social, economic and ecological aspects in devising a sustainable prawn fishery management system. We recommend effective enforcement of policies and regulations, strong institutional collaboration and active fisher community participation in management to ensure sustainable use of the resource base.

POSTER

Assessment of biodiversity, socio-economic status and conservation options at the kisite- mpunguti marine park in south coast, Kenya

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In order to address the challenges faced by the existing conventional MPAs and the less conventional community managed conservation areas that are increasingly coming up, it is important generate scientific data from both the biophysical and socioeconomic spheres to guide decision-making while at the same time taking cognizance of emerging socioeconomic issues such as oil and gas exploration that were not there when the first conventional MPAs were established. An assessment was conducted on the socio-ecological and economic issues that relate to the interaction and effectiveness of conservation and sustainable use of biodiversity resources at Kisite- Mpunguti Marine Park in the Kenya South Coast. A combination of questionnaire, key informant interview and observation techniques were used to establish resource users' perceptions towards the status of local biodiversity. Results indicate that: overdependence on biodiversity resources for consumption; inequity in ownership and access to natural resources including benefits from use and conservation of biodiversity; inadequate knowledge and inefficient use of information; and legal and institutional systems that promote unsustainable exploitation, are the major conservation challenges faced by the respondents. 81% of interviewees said that there were heavily degraded local sites, and among these 93% were optimistic that these sites could still be rehabilitated while also suggesting possible methods of doing so. It is recommended that the social, cultural and economic context for conservation and sustainable use measures should involve community participation and use of local knowledge; and the curbing of destructive or unsustainable uses by those who are uninterested or uncaring. There is need to provide support for on-going community conservation initiatives (tengefu) and development of joint-management programs which "do not seek to replace traditional forest practices and fishing activities but augment them. Successful joint management requires a significant transfer of responsibility from state agencies to villagers

POSTER

Coral reef fish species of Agalega Islands, Western Indian Ocean

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Agalega Islands (10°25'S 56°35'E) are found 990 km north of Mauritius and 700 km east-north-east of Madagascar in the western Indian Ocean. The twin islands have a very narrow lagoon and is surrounded by a fringing reef. The coral reef ecosystem has not been previously studied. It is known that a very diverse fish community resides the coral reef. Therefore coral degradation or loss might lead to a change in the fish population structure. The goal of the study was to create a preliminary baseline of the coral reef fish community. Data collection was carried out along transects by visual, photographic and video techniques. Fourteen stations up to a depth of 15 meters spreading over the entire reef system of Agalega were surveyed. Fifty fish species from 17 families were identified. The most abundant fish species were Labridae, Acanthuridae, Scaridae, Pomacentridae and

Serranidae respectively. The trophic structure of the fishes species were classified based on their food preferences. The benthivorous represented 28 % of the fish species, followed by 22 % herbivorous fish species and omnivorous represented 16 % of fish species. The carnivorous trophic community was significantly represented in the coral reef environment. This result indicated that the fish population structure was relatively similar to other coral reef environment of the Western Indian Ocean.

POSTER

Functional and qualitative aspects of mangrove wood in a context of climate change - Importance and priority-setting for conservation and restoration

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The mangrove ecosystem occurs at the border between land and sea along tropical and subtropical coasts. It is of high ecological importance, provides valuable ecosystem services to human coastal communities and plays an important role in carbon sequestration. Mangrove trees have developed several adaptations to cope with high variability in soil salinity and water availability, inundation, tidal current and wave action, and unstable sediments, characterizing the intertidal zone. Species-specific differences in hydraulic architecture explain the local differences in mangrove distribution range. On a global scale, the mangrove latitudinal limits are defined by a complex interaction of temperature and humidity, which is not yet fully understood. We hypothesize that adaptability and sensitivity of the mangrove hydraulic architecture in relation to climate and environmental conditions are major factors in the response of mangroves to global climate change. Therefore we aim to establish the quantitative relation between hydraulic properties and the ecological success of the globally important mangrove genera *Avicennia* and *Rhizophora*. Wood samples were collected from trees growing at their latitudinal limits and in tropical regions from which variation in wood anatomy, density and carbon content was measured to determine and compare the range of adaptability of both genera and their species. These results were linked to local climate conditions providing the necessary insights for explaining the differences in current distribution and allowing projections of the future mangrove dynamics in light of climate change. Based on our results, we will work out guidelines for mangrove conservation and establishment by identifying critical areas of future (un)suitability

ORAL- Thursday- Amadiba- 1100

Linkage between fish functional group distribution and coral reef benthic habitat composition in the Western Indian Ocean

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Benthic habitat composition is a key factor that structures assemblages of coral reef fishes. However, natural and anthropogenic induced disturbances impact this relationship. This study investigates the link between benthic habitat

composition and fish functional groups in countries in the Western Indian Ocean (WIO). Benthic composition (percent cover of live corals, algae, and rubble) of 32 sites was quantified visually. The densities and size class of 12 coral associated trophic functional groups of fish were estimated at the same sites using 50 x 5 m belt transects. Cluster analysis was applied to identify and characterise reefs based on benthic cover and revealed five habitat types characterised by varying percentage cover of live hard corals, soft corals, fleshy and turf algae. These benthic habitats of the WIO showed geographic variations where sites from central Tanzania and northern Mozambique were associated with habitats dominated by live hard corals, fleshy and turf algae. Northern Madagascar reefs showed habitats, dominated by live hard corals and fleshy algae, while benthic habitats in Comoros were characterised by a dominance of live hard corals and turf algae. Reef sites in Madagascar and Comoros were also characterised by habitats with high benthic diversity. Variation in benthic variables influenced the relative abundance and biomass of fish functional groups. Corallivores, invertivores, detritivores, and grazers showed an association with diverse habitats, while planktivores and small excavators showed an antagonistic association with these habitats. Algal dominated habitats showed a higher biomass of browsers and omnivores than coral dominated habitats. These links between benthic habitat type and fish functional groups should inform conservation and management planning.

ORAL-Wednesday- msikaba 1- 1600

Evaluation of carbon sequestration in seagrass meadows of Malindi-Watamu Marine Parks, Kenya

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Seagrass ecosystems provide ecological and economic service. They provide nursery grounds and foraging areas for fish, stabilize bottom sediments to regulated wave erosion and provide livelihoods to coastal communities. Seagrass act as net CO₂ sinks in the biosphere, therefore regulating climate change. The Western Indian Ocean (WIO) region is endowed with 13 seagrass species, with 12 seagrass species found on the Kenyan coastal waters. Despite the seagrass potential, there is limited direct attention given to seagrass in management plans and often ignored in global carbon budgets and human direct economic impacts. The purpose of the study was to determine the amount of blue carbon in seagrass meadows in MPAs of Malindi Watamu Marine Parks. Four sampling transects were identified across the marine parks' shoreline. Three sampling sites were identified along each transect where seagrass densities were determined, Seagrass tissues and sediments were sampled on a 1m² quadrant. Sediment samples were collected using PVC cores. The amount of organic carbon in seagrass tissues was determined indirectly by calculating the %LOI. Organic carbon in sediments was determined by digesting dry samples with 1 ml of 5% H₃PO₄. The study, which is on-going, provides baseline data on the total organic carbon sequestered in seagrass meadows in Marine Protected Areas. The data provide insight on the potential nature of seagrass in global climate change mitigation initiatives and for strategic policy formulation for MPAs as well as provide opportunities for communities to harness seagrass potential for economic prosperity and climate change mitigation.

POSTER

Characterisation of Fish Landed by Artisanal Bait Fishers at the Mida Creek

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Artisanal bait fishing, using hook and line and basket traps, predominates among tropical shoreline communities. Although the quantity of fish landed by these fishers is known, few studies have attempted to ascertain landings among the different bait used by the fishers. This is in spite of the importance of such data to infer fished stock characteristics in order to reduce fishing down the food web cascades. This study compares landing composition, morphometrics and diet, between hook and line gear, baited with polychaete (*Marphysa* sp) and hermit crab (*Clibenarius* spp), and traps, baited with gastropod (*Terebralia palustris*) at the Mida creek, Kenya. Fish landed by fishers at Mida creek, were identified, measured and stomach content examined. Data obtained was used to compute morphometric indices, diet and trophic levels, and compared among the gears, bait and fish taxa. Results indicate fishers land over 20 fish taxa, with similar morphometric indicators. Fish landed were juveniles, below 20% of adult size, of low condition and gonadal development. Hooks baited with hermit crab, landed significantly higher trophic levels fish, such as Carangidae, compared to other gears and bait, which predominantly landed Gerridae. Apparently, bait fisher landings is dominated by a multispecies assemblage of juveniles from mid to low trophic levels and a paucity of high value top predators. This is further evidence of overfishing impacts, and requires management intervention to stem eminent collapse of the fishery and livelihoods. Participatory effort controls, through closure, alternative fishery and livelihoods, and voluntary release of immature, coupled with limiting the use of small mesh traps and hooks, may reduce harvesting pressure and lead to improvement of future landings and sustainability of the fishery.

POSTER

Role of General Management Plan in the Dar es Salaam Marine Reserves systems for conservation of reef fishes in Tanzania

J. PAGU

Dar es Salaam Marine Reserves systems (DMRs) comprising the North Dar es Salaam Marine Reserves systems (NDMRs) and the South Dar es Salaam Marine Reserves systems were gazetted in 1975 and 2007 respectively. NDMRs has a General Management Plan (GMP) that was established in 2005 with an aim of conserving, managing and developing of four islands with SDMRs lacking GMP. The present study aimed at determining the effectiveness of GMP in conservation of coral reefs within the DMRs. Sampling was conducted in two phases ranging from August/September 2014 to January/February, 2015. Line-Intercept Transect (LIT) was used to characterize benthic cover and Underwater Visual Census (UVC) was used to assess reef fish abundance, biomass and species richness. Result showed that abundance of reef fish was 0.94 and 0.58 m⁻² in NDMRs and SDMRs respectively and did not differ significantly. However, reef fish biomass differed significantly between NDMRs (0.04kg m⁻²) and SDMRs (0.0138kgm⁻²). Similarly, live hard coral cover was significantly higher in NDMRs (66%) than in SDMRs (20%). Reef fish species richness were 44 and 37 in NDMRs and SDMRs respectively. Higher reef fish abundance, biomass and species richness were attributed to higher live hard coral

cover demonstrating that the presence and implementation of GMP in NDMRs is an effective management tool for the conservation of marine resources in Tanzania, a strategy that could be adopted in the WIO region

ORAL- Wednesday- Msikaba 1- 1400

Assessment of potential halieutic resources and propositions of climate variability adaptation in the deep southern Madagascar

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The southern Madagascar is very reputed by the succession of famines – kere that lead the death of people and livestock in that region. Those famines are due to repetitive droughts that occur periodically caused by climate variability in that area which belongs to the arid zone of the country. Yet, the main activity of the population is agriculture and fishing activity is only practiced by a very few percentage of the community.

We have conducted socio-economic assessment within three fishermen villages to better understand the life style of the southern coastal community. Then, we have also undertaken traditional fishing survey in those villages to more understand and identify the characteristics of fishing activities and identify the main potential resources. Finally, an assessment of the climate variability was directed to well apprehend the climate risks in the south and to have an overview on the community vulnerability.

Socio-economic assessment results shown that fishing activity plays an important role in the southern coastal community livelihood. The fishing survey results let us to conclude that the southern Madagascar still has lots of resources that are less exploited by the community – except lobsters and shells. Lobsters and big pelagic fishes constitute the potential halieutic resources. The main climate risk is the drought – since 1896 till 2014, 14 droughts episodes have occurred.

For a better climate variability adaptation, the development of the fishing activity will enhance the fishermen adaptation capacity and improve the food security in whole. A deep assessment of the southern Madagascar upwelling system is recommended to well apprehend its characteristics as it is linked to the upcoming of drought.

ORAL- Monday- Msikaba 4-1120

Taxonomy and diversity of the sponge fauna from Walters Shoal; a shallow seamount in the Western Indian Ocean region

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Globally, the marine biodiversity of the Western Indian Ocean is one of the least known, with many taxa inadequately recorded and studied from this region. This lack of knowledge is further exacerbated in the softer-bodied invertebrate taxa, including the Phylum Porifera. Work on this group is hampered by difficulties with identification (associated with morphological

plasticity), as well as a dearth in the relevant taxonomic capacity. Consequently, taxonomic work on this group in the Western Indian Ocean is in need of extensive revision, with the aid of current technology. Even less is known of this group in the deeper parts of the Indian Ocean, with less than 300 species being recorded from seamounts in this region, and little to no work carried out on the sponge fauna.

Here, research will be presented that focuses on the diversity and bathymetric distribution patterns of sponges from Walters Shoal, a shallow seamount located on the South Madagascar Ridge. This feature, which lies approximately 400 nautical miles south of Madagascar and 600 nautical miles east of South Africa, was the focal point of a multidisciplinary cruise initiated in May 2014. Carried out on the FRS Algoa as a component of the African Coelacanth Ecosystem Programme, sponges were sampled using SCUBA and an epibenthic sled, from the peak and down two opposing slopes of the seamount to a depth of 500 m. Using various photographic and video sources (SCUBA footage and photographs, jump camera and baited remote underwater videos) to aid taxonomic identification (and description), the bathymetric and biogeographic affiliations of this sponge fauna will be discussed.

Comments will also be made on the possibility of future research to be carried out on the coastal sponge fauna of this region.

POSTER

The cushion-star *Parvulastra exigua* in South Africa: one species or more?

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The cushion-star *Parvulastra exigua* is a widely distributed member of the temperate intertidal fauna, found along the west and east coasts of Africa, and in Australia. Along the south coast of South Africa, it occurs in sympatry with the endemic *Parvulastra dyscrita*, the two species being differentiated predominantly by gonopore placement. Several recent studies have suggested that there may be additional cryptic species within the *P. exigua* complex in South Africa, based variously on colour morphology, genetic evidence and the differential placement of the gonopores.

Here, we resolve this taxonomic confusion by confirming whether one, or more than one, species are represented within the South African *P. exigua* complex. A total of 346 *P. exigua* and 8 *P. dyscrita* were collected from sites on the west and south-west coasts of South Africa; morphological, anatomical and genetic analyses were performed to determine whether cryptic species and/or *P. exigua* specimens with aboral gonopores were present. Results show that neither cryptic species nor *P. exigua* specimens with aboral gonopores occur at these sites. This study thus refutes previous claims of the existence of aboral gonopores in South African *P. exigua*, and suggests that a single species is represented, although this can occur in a wide range of colour morphs. The distinction between *P. exigua* and *P. dyscrita* is also confirmed, and features separating these two species are clarified and documented

POSTER

Sport and recreational fishing at the ponta do ouro partial marine reserve, mozambique (2010-2014)

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Results of recreational and sport fishing monitoring undertaken at the Ponta do Ouro Partial Marine Reserve in southern Mozambique, from January 2010 to December 2014, are presented. A total of 8367 boat launches were logged, of which 3835 provided useful data. Anglers (95.3%) were the dominant group, with spearfishers representing a small proportion. Other watercraft (jetskis, kayaks) were also monitored (total of 1238 launches), and were similarly dominated by anglers (99.3%). Sampled shore fishers totalled 888 anglers and 10 spearfishers. A total of 9955 fish were caught, of which 84.9% (8454 fish) were captured by deep-sea craft (ski-boats, jets skis and kayaks) and 14.1% by shore anglers (1408 fish). Overall, the yellowfin tuna (*Thunnus albacares*) was the dominant deep-sea species with 2919 individuals representing 34.5% of the total number of fish caught, followed by the narrow-barred Spanish mackerel (*Scomberomorus commerson*; 29.4%), green jobfish (*Aprion viriscens*; 8.1%) and striped bonito (*Sarda orientalis*; 6.8%). The shore catches were dominated by the large-spotted dart (*Trachinotus botla*) with 443 individuals (31.5%) followed by the javelin grunter (*Pomadasyds kaakan*; 18.0%). The CPUE for deep-sea boats was estimated at 9.4 ± 12.6 kg/boat (\pm SD) and 1.7 ± 2.0 fish/boat, while other watercraft caught 7.9 ± 7.6 kg/craft and 1.1 ± 1.2 fish/craft. The CPUE for shore angling was estimated at 4.9 ± 5.3 kg/angler and 1.4 ± 2.0 fish/angler. A steady increase of boat fishing effort was observed from 2010 to 2013 (1364 launches to 1983 launches) and a slight decrease in 2014 (1834 launches), with an accompanying decrease of CPUE from 2.1 ± 3.0 fish/boat in 2010 to 1.9 ± 2.1 fish/boat in 2014 (ANOVA, $p < 0.01$). Implications and management recommendations are discussed.

POSTER

Spatio-temporal variation in macroalgae abundance and diversity at Palmar, Mauritius

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This study investigates the spatio-temporal distribution of macroalgae at Palmar, located along the eastern coast of Mauritius. Macroalgae abundance and cover were surveyed during summer and winter of years, 2011 and 2012; using line transect supported by photography method. The survey site was divided into three zones; near shore, mid lagoon and near reef. Nitrate and phosphate levels were quantified

using Cadmium Reduction and Ascorbic Acid methods, respectively. Seawater analyses showed generally higher phosphate levels during summer (28.3-57.7 μ g/L) compared to winter (14.3-29.7 μ g/L). Results of two-way ANOVA analyses of season and zone revealed that phosphate levels were affected by season, and season and zone affected nitrate levels. Phosphate concentration and macroalgal cover exhibited a temporal variation as opposed to nitrate levels. Macroalgal distribution exhibited a spatial variation. A total of ten different species of macroalgae were identified in the study site with six green, three brown and one red algae species. Macroalgal distribution and percentage coverage at near shore zone were found to be significantly different from the mid lagoon zone as opposed to near reef zone, with a higher abundance of green algae. The mid lagoon macroalgal distribution and coverage did not differ significantly from the near reef one. The main colonizer, *Chaetomorpha crassa* (12.05% as general percentage cover) invaded the lagoon during summer periods. Considerable stands of *Sargassum* (5.40 %) and *Padina* (2.35%) species were present during winter mainly at near reef zones, which decreased considerably in summer (0.25 and 0.40% respectively). Temporal distribution showed a complete resurgence of a few species of green algae, with relatively high percentage cover. These results indicate that macroalgal coverage is possibly directly impacted by the influx of phosphate and thermal changes due to seasons at Palmar.

POSTER

Spatio-temporal variation of Coral Recruitment and competition with fouling organisms at Trou aux Biches, Mauritius

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Coral reefs are in peril under anthropogenic and climate-change driven impacts worldwide, with their potential, to naturally recover, uncertain. Studies on population dynamics of corals are fundamental to the management and conservation of Mauritian reefs which also suffered from mass coral mortality. However, little is known about coral recruitment in Mauritian waters. Thus coral recruitment was investigated using terracotta tiles at Trou aux Biches (TAB) lagoon in Mauritius between November 2005 to February 2007. The TAB lagoon support heavy touristic activities and the impact on juvenile coral recruitment need to be understood. Terracotta tiles were deployed at lagoon and off lagoon stations and sampled back after 4, 8, 12 and 24 months after tile deployment, so as to assess juvenile coral recruitment and post recruitment mortality. Physico-chemical parameters and fouling organisms colonising the plates were monthly monitored and correlated respectively with the coral recruitment patterns. However, no correlation was found. The coral recruitment on the different surfaces

of the plates (face up, sides and face down) showed that corals recruited mostly on the lower surface of the tiles in the lagoon and shift to the sides in the off lagoon stations. The *Acropora* and *Pocillopora* were quantified separately and were compared. *Acropora* coral recruitment was more significant outside lagoon (highest mean of 0.12 ± 0.07 SE recruits per 100cm² in off lagoon compared to maximum mean value of 0.05 ± 0.07 SE per 100cm²) as opposed to *Pocillopora* which recruited mostly in the lagoon (highest mean of 0.35 ± 0.52 SE per 100cm² in lagoon compared to maximum mean value of 0.12 ± 0.32 SE per 100cm²). The study shows that post recruitment mortality is indeed significant and that the physicochemical parameters do not relate to the changes observed which are significant for coral reef rehabilitation.

ORAL- Wednesday- Msikaba 1- 1200

South Africa's National Rocky Shore Monitoring Programme

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Coastal ecosystems are heavily impacted by the effects of climate change, pollution, harvesting and alien invasive species. Intertidal rocky shores, in particular, are very accessible and therefore vulnerable to human-induced threats. Their accessibility and vulnerability also make them ideal ecosystems for conducting cost-effective long-term and spatially-extensive monitoring programmes that provide information to manage environmental changes. In South Africa, a National Rocky Shore Monitoring Programme has recently been initiated by the Department of Environmental Affairs. The main goals of this programme are to: (1) coordinate and standardize existing monitoring efforts among institutions; (2) generate spatio-temporal baseline data for data-poor areas; (3) provide data layers for Marine Spatial Planning; (4) separate natural from human-induced change; (5) identify effects of sea level rise on coastal systems; (6) identify range expansions and alien invasions; (7) monitor long-term changes in oceanographic regimes; and (8) provide a context for more focused experimental studies. At this stage, the programme has been implemented in Marine Protected Areas of various provinces, and at sentinel sites around the country, where sampling is done seasonally along fixed transects, using photo quadrats and visual surveys for key species. Temperature loggers at each site will provide additional information on changes in coastal oceanography and their effects on biodiversity. Analyses are done to functional group and species level. In addition, training workshops are held around the country to capacitate local and regional conservation agencies with monitoring methodologies and tools to process and analyse data and directly extract information for their own managing purposes. This programme aims to initiate the formation of a Consortium for Rocky Shore Monitoring for South Africa and neighbouring African countries, with the vision to involve multiple institutions including government, conservation agencies, NGOs and academic institutions

ORAL-Wednesday- Msikba 1- 1140

Vulnerability, resilience and adaptation: the future for the seagrass, *Zosteracapensis*

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Seagrasses play an integral role in estuarine health, biodiversity and ecosystem services. The seagrass, *Zostera capensis*, is rated as 'vulnerable' by the IUCN, largely due to its fragmented distribution in southern and eastern Africa. Yet estuaries are a naturally fragmented habitat type and *Z. capensis* is found along a wide range of physicochemical and climatic conditions, suggesting a high level of plasticity. Therefore, is *Z. capensis* actually vulnerable to extinction? Our study aims to assess the vulnerability, resilience and potential for adaptation in *Z. capensis*. Our first goal was to assess the factors driving its distribution and thereby assess their physiological vulnerability to change, using a generalised additive model (GAM). Preliminary results suggest that estuary classification (eg. temporarily open/closed), winter precipitation and turbidity appear to be important factors driving the distribution of the species. Global change is likely to impact the distribution and vulnerability of *Z. capensis* through human activities such as damming and urbanisation, as well as climate induced change such as flooding and sea-level rise. Our second goal is to assess the genomic vulnerability using a next-generation sequencing approach. Examining local adaptation, genetic plasticity and variation in *Z. capensis* populations throughout its range will allow us to make management recommendations so that this important biological resource may be preserved. Results are to be discussed. This is the first look at reassessing vulnerability and assessment criteria of *Z. capensis* and combining physiological and genomic plasticity will result in more meaningful conclusions.

ORAL-Wednesday- Amdiba- 1420

Small Scale Reef Rehabilitation in Mauritius

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In Mauritius, healthy coral reefs play a critical role in the socio-economic development of the island. Despite their importance, the Mauritian reefs are facing numerous environmental challenges. For the past few years, a significant decrease in live coral cover has been registered around the island. In response to continuous reef degradation, the Mauritius Oceanography Institute (MOI) started a small scale reef rehabilitation project in 2012. Locally adapted multi-layered rope nurseries were set up for the mass propagation of nine coral species at Albion (ALB) and Flic en Flac (FEF) in 2012 and in 2013 at Trou aux Biches (TAB) in collaboration with ELI Africa and financial support from the GEFSGP, implemented by UNDP. The 8 to 14 months nursery grown corals were

subsequently transplanted to locally-adapted artificial reef rehabilitation modules (ARRMs). We present here results obtained from the 3-year study on the survivorship and growth rates of nursery grown and transplanted corals. At ALB and FEF, highest survivorship (>70%) and lowest survivorship (<35%) were recorded for the Pocilloporidae family (*Pocillopora damicornis*, *P. eydouxi* and *P. verrucosa*) and for *Galaxea fascicularis* respectively. Similarly at TAB, *P. eydouxi* had 84% survivorship whereas none of *G. fascicularis* and *A. formosa* fragments had survived. Of the cultured Acroporidae corals (*Acropora austera*, *A. formosa*, *A. humilis*, *A. latistella* and *A. selago*), *A. formosa* had the lowest survivorship (45% to 0%), irrespective of sites. Furthermore, growth rates did not differ significantly between nursery grown corals and transplanted corals ($p < 0.5$). Predation by fish and drupella snails and algal overgrowth were the main causes of coral mortality at the nurseries and ARMs. Besides choosing sites with the right environmental conditions, it is important to regularly maintain the nurseries and the rehabilitated sites for at least one year for the successful implementation of small scale reef rehabilitation projects.

POSTER

Linking nitrogen pollution in estuaries to rocky shores: A stable isotope approach

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Many coastal regions in KwaZulu-Natal (KZN) are impacted by sewage effluent, but the knowledge and extent of this impact remains poor. Additionally, previous impact studies were restricted to community dynamics and nutrient trends in estuaries and coastal habitats. However, this information can be supplemented by tracing the fate of nitrogen and its sources to coastal systems. An accepted methodology is the use of stable isotopes of Nitrogen (N) to determine anthropogenic origin to both terrestrial and marine systems. This study aimed to determine anthropogenic sources and impacts of N-pollution to three estuaries in southern KZN. To achieve this, stable isotope analysis together with nutrient and community composition data, were used in the selected temporarily open/closed estuaries. Source differentiation between the open (summer) and closed (winter) phase of the estuaries and the importance of anthropogenic nitrogen (via estuarine input), was made possible using two species of rocky shore macroalgae, *Hypnea spicifera* and *Jania intermedia*. The $\delta^{15}\text{N}$ in these organisms (algae and mussels) provided evidence that estuarine inputs were more important during the open phase than closed phase and were from anthropogenic sources in two sites (Mhlugwa and Kongweni). Additionally, stable isotope analysis, physicochemical water properties and determination of community composition, when integrated, were found to be useful tools in nutrient pollution studies. The condition of sites chosen for this study indicated a need for mitigation of nutrient pollution in estuaries and a greater need for development of Wastewater Treatment Works along the coast of KZN

ORAL- Tuesday - Msikaba 4 – 1120

Genetic diversity in the bull shark *Carcharhinus leucas* and the tiger shark *Galeocerdo cuvier* in Reunion Island

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The bull shark *Carcharhinus leucas* and the tiger shark *Galeocerdo cuvier* (*Carcharhinidae*) are large elasmobranchs suspected to have, as other apex predators, a keystone function in marine ecosystems and are currently considered Near Threatened (Red list IUCN). Knowledge on their ecology, that is crucial to design proper conservation and management plans, is very scarce.

Samples (piece of fin) were taken on individuals fished or tagged in Reunion Island mostly (52 adults bull shark comprising two gravid females and 49 adults tiger shark comprising one gravid female), and in Mozambique (18 adults bull shark). In order to assess the genetic diversity of the populations, molecular markers were needed. Twenty polymorphic microsatellite loci were isolated for the bull shark and eight for the tiger shark. Specific primers were used to amplify the sequence of a mitochondrial marker, the control region.

The population of tiger shark from Reunion Island presented a low genetic diversity, below what was observed in the population of bull shark. Microsatellite loci presented a weak number of alleles and a weak overall allelic richness, and a low number of polymorphic sites was found in the sequence of the control region. A partial structuring was detected when studying the control region between bull sharks sampled in Reunion Island and those sampled in Mozambique. This structure was not found with the microsatellite loci, and may thus indicate philopatry. These results need to be confirmed by a larger sampling in the South Western Indian Ocean. Finally, a genetic investigation of the litters of the gravid bull shark females revealed polyandry.

These results bring new insights on the ecology of these species, and a study at a regional scale would allow to better understand the connectivity of the populations of bull and tiger sharks in the South Western Indian Ocean.

ORAL-Wednesday –Amadiba- 1100

A comparative study of the accuracy and effectiveness of Line-Intercept and Point-Intercept methods for monitoring subtropical coral communities

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Coral reefs around the world are facing increasing disturbance. The ability to monitor them is constrained by cost and experience factors. The Line Intercept Transect

(LIT) method is used with an expert level of identification, but these are time-consuming, require a high level of expertise and are therefore expensive. Over the last 20 years, surveys performed by non-specialist volunteers have provided data for increasing numbers of reefs, using simplified sampling methods and more basic levels of identification. In between these extremes, new stakeholders (e.g. marine nature reserves, etc.) requiring an intermediate level of expertise and resolution are now carrying out coral reef surveys and are desirable to identify monitoring methods that optimize the data provided and the ease of implementation according to the users' needs. In this study, we used multivariate analyses to compare four increasing levels of identification using the LIT method (between 2003 and 2013). For each level, we studied the structure of the benthic community and its spatial (reef flat vs. outer slope) and temporal (before vs. after a cyclone) variation. The most basic level of identification showed differences between the reef flat and outer slope, but did not show a significant effect of the cyclone. The two highest levels of identification, both of which we rated 'expert', showed the highest differences in variation. The intermediate level of identification supplied the same information as the expert levels. Next, we compared the LIT with the Point Intercept Transect (PIT) method which supplied an almost equivalent level of information as LIT, while reducing the time spent underwater. Thus, when managing coastal areas or carrying out impact studies to monitor disturbance, it may be useful to a) perform surveys with an intermediate level of identification, and b) using PIT rather

POSTER

Integrating recreational fishermen management into the MPA of Reunion Island: towards a win-win contract project

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The success of coral reef conservation initiatives is highly depending on shared point of views between stakeholders interests balance of marine biodiversity and conservation goals.

The MPA of Reunion Island, launched in 2007, is located on the western coast. This MPA integrates three fisheries practices with different levels of regulation on its area. A process of discussion between fishermen and the managerial team responsible for the MPA have started recently about possible modifications or adaptations of the regulation status inside the MPA.

When fishermen asked for a redefinition of the MPA fisheries activities regulation, the MPA team took the opportunity to propose a "win-win" contract. This contract will be signed between the two parts, which could result in reinforcing the MPA acceptance and users 'appropriation. The mutual exchange between the MPA managers and fishermen implies reciprocity dynamic, so that further responsibilities, respects of MPA rules and collaboration for collecting fisheries data would be the key management

success. The MPA team agrees to go on a possible evolution of the MPA status, if the fishermen accept to be more responsible, to respect the rules and to participate for collecting fisheries data. The future win-win contract may be an important point to improve a necessary balance between sustainable fisheries and coral reefs management/conservation.

Volunteering fishermen will complete daily fishing logbooks, to record their fish catches by specie, unit effort (time), location and fishing tools/engines used.

Furthermore, fisheries mediators would be recruited to perform a better link between the MPA team and the fishermen, to improve their appropriation of the MPA and to collect fisheries data.

This presentation will discuss on the limits and success of this new challenging story between recreational fishermen and MPA managers.

POSTER

Juncus kraussii: harvesting this cultural asset given its limited distribution

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What constitutes a 'precious extractable resource'? From an anthropocentric perspective, a plant or animal which has an important history of exploitation for human benefit. In order for this resource to remain available for human use and consumption, the resource has to be harvested such that it can be replenished, can actively recruit and maintain its population size despite the pressure of exploitation. *Juncus kraussii* is a rush which has a long history of being harvested for Zulu products (locally referred to as 'incema') and is an important cultural asset for many people in KwaZulu-Natal. The rush has a very limited distribution and is only found in very specific regions, typically estuaries in the province, which provide intertidal exchange and a range of salinities in which this rush grows. There has been an increasing demand on this valuable asset but without much tangible evidence as to whether the current practice of harvesting and scale of extraction has changed the size, distribution and health of the current populations of *J. kraussii*. In addition, there appears to be very little literature available on the impacts on associated biota. In the Lake St Lucia estuarine system, the harvest is concentrated over a short period whereas in other areas harvesting takes place throughout the year. It is important to establish whether current resource harvesting practices are sustainable, particularly given the dependence of communities on the resource. Preliminary results have been used to compare the resource size and harvesting demands across the province with a focus on the iSimangaliso World Heritage Site.

ORAL- Wednesday – Msikaba 4 – 1120

Residency and feeding ecology of whale shark (*Rhincodontypus*) aggregation at Mafia Island, Tanzania

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Although whale sharks (*Rhincodon typus*) have been documented to move thousands of kilometers, they are most frequently observed at a few predictable seasonal aggregation sites. Their repeated presence at these sites often driven by local food availability, and their apparent absence at the surface during visual surveys has led to the assumption that sharks disperse to places unknown during ‘off-seasons’. Here we compare two years of *R. typus* visual sighting records from Mafia Island in Tanzania to concurrent acoustic telemetry of tagged individuals, and characterise the taxonomic composition of zooplankton during feeding and non-feeding events. Sightings revealed a clear seasonal pattern with a peak between October and February and no sharks observed at other times. In contrast, acoustic telemetry demonstrated year-round residency of *R. typus*. The sharks utilise a deeper offshore habitat in the off-season reducing the sharks’ visibility, giving the false impression that they have left the area. We demonstrate, for the first time, year-round residency of unprovisioned *R. typus* at an aggregation site, and confirm their presence during the ‘peak season’ is indeed driven by dense patches of zooplankton prey. We will highlight the importance of using multiple techniques to study the movement ecology of marine megafauna.

POSTER

Quantifying environmental threats from the oil and gas industry on marine focal species in the western Indian Ocean

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Problem statement

East Africa’s proven oil and gas reserves have increased significantly in the last few decades. Consequently, the governments of East African countries are keen to develop an attractive investment climate to accelerate economic growth and social development. However, environmental impacts related to oil and gas resource exploitation are well documented in developed countries, providing an appropriate prequel of what can be expected in East Africa in the near future. This study therefore aims to predict threats to marine focal species (cetaceans, sea turtles, whale sharks and dugongs) in the Western Indian Ocean (WIO) from the growing oil and gas industry.

Methodology

A system to rank threats to focal species was created based on an extensive literature review and information solicited

from experts in conservation, and the oil and gas sector. This system was then used to quantify a vulnerability measure for each focal species, per threat, and as an integrated measure across all threats. Further, maps of focal species’ distribution and associated habitats were generated to determine spatially-explicit areas of overlap between areas critical for focal species, and areas of highly likely exploration and production activity, with deliberate focus on the Rovuma Basin region between Tanzania and Mozambique.

Results

Both the vulnerability-measures ranking and spatially-explicit mapping highlighted a strong conflict between focal species and oil and gas activities in the WIO. Preliminary analyses suggest that coast-associated species are likely to suffer significant impacts owing to the strong overlap with the industry in this region.

Conclusion

Given these preliminary results, it’s clear that marine spatial planning will be an essential tool for mitigating the spatial conflicts. These conflict areas, as identified in this study, can aid in directing and focussing the planning of future oil and gas development to minimize the impact to the numerous focal species.

POSTER

Education: a variable to estimate fisher’s productivity in small scale fisheries in Madagascar

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This paper aims to deliver empirical evidence on the links between production efficiency, pluriactivity, and education by analyzing a case study on small-scale fisheries in the North-East of Madagascar. Fishers’ production in Madagascar suggests that power-driven boats and environment don’t explain small-scale fisheries production. This study investigates the relationship between education and performance in fishing activity. Convergence of interests and entrenchment hypotheses were tested via cross-sectional and panel two-stage least square (2SLS) and Limited Information Maximum Likelihood estimation (LIML) estimate on methods for linear and non-linear models. The study found that 1) educational level is low in Malagasy fishing communities and 2) there is an overall positive and significant relationship between education level and fisher’s performance. Consequently, this study revealed a convergence of interests but also entrenchment effects of Non-Governmental Organizations projects on pluriactivity and fishers’ happiness. Marine conservation projects should thus focus on informing and educating fishers to improve their income and reduce threats to marine resources. While an excessive granting on education could weaken fisheries performance due to entrenchment effects.

ORAL- Thursday – Msikaba 2- 1100

Re-evaluation of the distribution of mangroves in South Africa

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Along the eastern coast of Africa, mangroves are distributed from Somalia (2.03° N) to South Africa (33.00° S). Mangrove distribution is restricted by temperature, but on a regional and local scale; rainfall, tidal inundation and river flow influence patterns of distribution and biomass of mangrove forests. Climate change has already influence biodiversity patterns with some species recording ranges shifts (altitude and latitude) due to changing climates. The coastline of South Africa extends from the mouth of the Orange River (west coast), to Kosi Bay at the Mozambique border (east coast). In South Africa, mangrove trees are larger in the north (26.00° S) becoming smaller in southern estuaries. In 1982 mangroves extended from Kosi Bay to Nahoon Estuary in South Africa. The aims and objectives of the study were to revise the distribution limits of mangroves in South Africa taking into account both planted and natural forests. It is expected that since 1982, new forests have been established. Estuaries considered for this study were from Kwelera to Kariega Estuary to determine if previously planted forests and new forests existed. A 3m×3m quadrat was used to determine population structure. Physical and sedimentary characteristics were measured and data loggers were placed in each mangrove forest to record temperature hourly. Overall results show that mangroves are expanding in some areas and environmental conditions make it possible for them to survive. Trees at the most southern forests (33°13'32" S; 27°35'01") were reproductively active and producing propagules. In order for mangrove forests to survive a number of factors need to be in place such as propagule production and dispersal as well as stability in physico- chemical factors. This presentation will define the new southern limits of mangroves on the east coast of Africa and will discuss the implications of this on other estuarine habitats

POSTER

Diversity of sessile non-scleractinian cnidarians of the Great Reef of Toliara

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Among many studies carried out up to now concerning coral reefs, especially on cnidarians in the Southwestern region of Madagascar, rare are those on the sessile non-scleractinian. This study, carried out within the Polyaquaculture Research Unit Project, led by IH.SM and UMons, is the first to perform research whose objectives are to determine the diversity of sessile non-scleractinian cnidarians on the Great Reef of Toliara (GRT), and to work out a guide to their identification.

Three sites were chosen for this study: Nosy Tafara (NT), in the South (latitude 23°30'S), Outer Slope (OS), in the center (latitude 23°29'S) and Grande Vasque (latitude 23°23'S), in the North part of the GRT. Samplings were performed on 2 stations per site taking in account the variability of each site. Adapted linear point intercept method was used on

each station, and 15 transects of 10 m performed, totaling 90 transects for whole study. Fragments of approximately 7cm diameter per observed colony were collected and fixed with ethanol 100% for DNA sequencing identification.

Preliminary results show that despite of the degraded state of the GRT, healthy and diverse species of sessile non-scleractinian cnidarians were observed. The most dominant species are those of Alcyonacea (37%), Gorgonians (20%) and Actinaria (17%) Orders. The research is still in progress and intended to end in few months to find out all required results for further conclusion

POSTER

A preliminary review of skin conditions and other body anomalies observed on humpback whale (*Megaptera novaeangliae*) photographed in Sainte-Marie channel (North east of Madagascar)

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Skin lesions occur frequently among many cetacean populations across the globe, and methods to examine lesions have relied on photo-identification (photo-id), stranding, and by-catch data. The current used photo-id data from 2 years : 2012 and 2013 estimate skin lesion prevalence and type occurring on humpback whale (*Megaptera novaeangliae*) from Sainte-Marie Island. Digital photo-id images were screened for lesion presence on an animal's body ; detected lesions were subsequently classified into 7 different categories according to Castro descriptions. The results showed that all group type of humpback whale can be affected by differents skin diseases. Interactions with other individuals may be the main cause of some diseases. Pigmentation anomalies (35%), skin lesions (47%), parasitic infections (6%), deformities (9%), miscellaneous traumata (2%) are the most observed diseases in this population

ORAL- Thursday- Msikaba 1- 1600

Fishery, trade and essay of larval production in hatchery of Hippocampus southwest of Madagascar

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Hippocampus, commonly known "seahorse", is overexploited due to their importance in traditional Chinese medicine. Nowadays, hippocampus fishing is becoming one of the main activities of fishermen at Ankilibe, a village located at 15 Km in the south of Toliara City, Southeastern coast of Madagascar. This 3 months study (February to April 2014) aims at (i) analyzing fishery and trade of this animal in Ankilibe village and (ii) essaying the juveniles production and rearing in the hatchery.

For the fishery and trade study, surveys of fishermen, resellers, collectors and exporters were conducted. Also, field observation and mensuration of hippocampus were realized. For juveniles' production, brood stocks (pregnant male) collected by fishermen were transported and transferred directly into the hatchery for breeding and rearing.

The results showed that 5 species of hippocampus exist and exploited in Ankilibe village: *H. fuscus* (31,13%), *H. borboniensis* (23, 49%), *H. spinosissimus* (20,05%), *H. trimaculatus* (19,98%) and *H. histrix* (0,35%). Catch rates vary with tides: 781 individuals day⁻¹ during neap tide and 1306 individuals day⁻¹ during spring tide. Prices of one fresh hippocampus at resellers and collectors vary from Ar 100 to Ar 4.500 (0,05-2,5 US\$) depending on their size. Dry products are sold to exporters at Ar 200000 to Ar 800000 Kg⁻¹ (100 to 400 US\$). For juvenile production and rearing, results showed that one hippocampus parent gave birth on average 300 juveniles (varying from 50 to 450 according to their size). A strong correlation ($r=0,96$) was observed between the length of the parent and the number of juveniles produced. During the experimentation, hippocampus juveniles died few days after birth. The cause of the mortality seemed linked with the food availability.

Aquaculture is one of best solutions to the overexploitation of hippocampus in the region. However, further research is required especially for better food for juveniles.

POSTER

A preliminary review of skin conditions and other body anomalies observed on humpback whale (*Megaptera novaeangliae*) photographed in Sainte-Marie channel (North east of Madagascar)

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Skin lesions occur frequently among many cetacean populations across the globe, and methods to examine lesions have relied on photo-identification (photo-id), stranding, and by-catch data. The current used photo-id data from 2 years : 2012 and 2013 estimate skin lesion prevalence and type occurring on humpback whale (*Megaptera novaeangliae*) from Sainte-Marie Island. Digital photo-id images were screened for lesion presence on an animal's body ; detected lesions were subsequently classified into 7 different categories according to Castro descriptions. The results showed that all group type of humpback whale can be affected by different skin diseases. Interactions with other individuals may be the main cause of some diseases. Pigmentation anomalies (35%), skin lesions (47%), parasitic infections (6%), deformities (9%), miscellaneous traumata (2%) are the most observed diseases in this population.

ORAL- Wednesday- Msikaba 1- 1440

Climate Adaptation Methodology for Protected Areas (CAMPA) – Innovative tool applied in two marine protected areas (MPAs) in Madagascar

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Protected areas (PAs) play a vital role to safeguard high value biodiversity and to provide long term goods and services to for communities. At the same time, many challenges are emerging such as climate change (CC)

which could jeopardize the ability of PAs to continue to meet these objectives. Innovative approach should be therefore developed to help managers and stakeholders to better manage their PAs in a changing climate. In order to improve PA resilience, WWF and its partner has piloted the development of methodology for coastal and marine protected area called CAMPA. This methodology is focused on the assessment of vulnerability to climate change, identification of adaptation options and mainstreaming CC into new or existing planning documents. It has been designed for a wide range of stakeholders (MPA managers, Community based organisation, etc.) without necessarily detailed technical background in climate change science.

Innovative features of the methodology include mainly a multi-disciplinary and participatory approach and a holistic approach to Ecosystem Based Adaptation that looks at both climate and non-climate influences on ecological and human systems. This methodology has been tested and refined through its practical application in six coastal and marine protected areas (Colombia, Madagascar and the Philippines). For Madagascar, it was applied in two MPAs: Nosy Hara National Park and Ambodivahibe (respectively managed by Madagascar National Parks and Conservation International). Best practices and lessons learned from these two MPAs are part of this methodology which gives substantial information on its application and relevance. It will also serve as a manual to guide others MPA managers in mainstreaming CC issues in their management tools and will be shared to various audiences for wider application

POSTER

Mangrove vulnerability assessment to climate change: Ambaro Bay, North West Madagascar

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Ambaro Bay, located in northwest Madagascar, is one of the country's largest and ecologically most valuable mangrove habitats (20,950 ha). The mangroves are the most important spawning and nursery for shrimp in this area (1,200 tons a year) and are the most important traditional income sources for the local population. However, due to illegal logging for charcoal production, the rate of mangrove loss is very high in this area. It is exacerbated by several climate factors: rising sea temperatures, shorter and more intense rain seasons, increased erosion and sedimentation in the mangroves, longer periods of strong winds along the coast, and an increase in cyclones. Mangroves are intrinsically resilient and adaptive against climate change; but due to the increasing destruction of mangroves, the natural capacity of this ecosystem is decreasing.

In order to better understand the vulnerability to climate change (CC) of these ecosystems and coastal communities who rely on it, vulnerability assessment was done in mangrove areas of four villages (which inhabitants manage 29% of Ambaro's Bay mangroves). The applied methodology was a combination of: an

overall understanding of mangrove vulnerability to CC from literature review, establishing the baseline of mangrove and communities status without CC impacts, developing climate information for the area and analyzing the climate implications on these targets. As an example of results, 46% of mangroves in the two northern villages are extremely highly vulnerable. Village extension, due to increased migration, is among the main driver of mangrove degradation in these areas. In terms of social vulnerability, farming activities in these two villages are affected by reduced precipitation while fisheries activities in southern villages are affected by strong wind intensity. These results will serve as a basis for the management plan of mangrove resources managed by four local community-based-organizations in the Ambaro Bay.

POSTER

Building resilient marine protected area (MPA) in Nosy Hara National Park

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Nosy Hara National Park, located in the northwest of Madagascar and covering an area of 125,471 hectares, is the first protected area in the country to incorporate climate change into its management. The marine park management plan was developed with less focus on climate change issues. However, this area has already experienced changes in precipitation patterns, higher frequency of strong winds, sea level rise, etc, which could have several impacts on its conservation targets and coastal communities living around the MPA. Since 2008, WWF and Madagascar National Parks have combined their efforts to address this emerging challenge in Nosy Hara and to build a resilient MPA as a tool for increasing social and ecological resilience to climate change.

The building blocks comprise: climate change capacity building for MPA managers and key stakeholders, reviewing the status of Nosy Hara conservation and social targets by undertaking a multi-expert and multi-method vulnerability assessment, screening adaptation options which help to address both human pressures and climate related threats. Results have shown the degree of vulnerability of each target which is the foundation of the climate-smart MPA zoning (in order to maintain existing resilient area, to strengthen the most vulnerable area and to protect climate refugia) and priority adaptation options which support the effectiveness of strategies developed for Nosy Hara. Based on these results, Nosy Hara management and monitoring plans are under revision. Having these plans will also support the role of resilient MPA as a global strategy to help marine biodiversity and coastal communities to adapt against current and future climate impacts. This work done in Nosy Hara will help MPA managers to better understand the link between business as usual work and adaptation. It will mainly serve as a pilot approach for replication in all protected areas in Madagascar.

POSTER

Mainstreaming climate change adaptation into Community Based Mangroves Management Model

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19% of mangroves in southern part of Manambolo and Tsiribihina Deltas were rated highly vulnerable to climate change in 2011. Encouraging local communities to take part into the management of this ecosystem was identified as one of the most appropriate adaptation measures - mainly within areas less affected by sea level rise - to strengthen these ecosystems resilience as well as to sustain goods and services they provided. Since 2005, WWF and its local partners had promoted and supported the creation of a model of Community Based Mangroves Management (CBMM). Around 25,000 Ha of mangroves in this area was effectively managed by this model. Initially, approaches and methodology adopted for the management process had literally based on the recommendation of GELOSE Act. This traditional process usually based on timber resources management is not really adapted to the context of mangroves which should also consider the fisheries resources, and its high vulnerability to the effects of climate change.

Faced with this situation, WWF and its local partners have improved approaches adopted by integrating aspects of climate change in the mangrove management process. Mainstreaming of climate change required various training and planning sessions. Only in 2014 can we say that the consideration of adaptation in CBMM was initiated. The understanding of adaptation has been farther deepened/enhanced by the implementation of concrete adaptation measures in the field. Currently, we can say that we have a little experience in this consideration of climate change aspects into CBMM that needs to be shared with others practitioners. However, we are also interested to receive feedbacks and to learn from a similar case in WIO Region in order to improve our approaches.

POSTER

Land tenure and juridical patterns assessment in the mangrove area of Tsiribihina and Manambolo Deltas, West Coast Madagascar

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Madagascar's legal CBNRM framework grants communities the right to manage, use, and benefit from their resources by forming community-based organizations that establish resource rules based on traditional social norms called "Dina" or local law. However, CBNRM faces serious challenges, including insufficient capacity, lack of benefits for communities, and inadequate authority to address issues such as migration and land tenure conflicts. Faced with these challenges, WWF was conducted a land tenure and juridical patterns assessment within the mangroves area of Tsiribihina and Manambolo Deltas whose reached 881 interviewed households in 29 villages. This study highlights the importance of land issues in the framework of the CBNRM.

This study highlights the importance of land issues in the framework of the NRM. Indeed, developments of land even if it is an illegal holding are socially and locally considered as legitimate. There is often a “legal pluralism” because generally, local communities still refer to customary rights, but they turned hastily towards modern rights in cases of land disputes. Subsequently, these communities have more land authorities of different types such as: community leaders, heads of lineages and the President of Fokontany (local administrative unit). For some remote villages, a segment of the population refers to the Autonomous Security Detachment to solve their land disputes. The recognition of these several rights and legitimacy in terms of land ownership remains a challenge for all those who want to invest in some part of the area of study. Legal provisions such as the long lease and / or multi-partite agreement are among the operational measures to be in place relative to local land tenure. CBNRM action must necessarily accompany by anthropological approaches. The establishment of a long lease will allow the community to prove: property rights, use rights and the right to manage the contractors.

POSTER

Test of liquid injection and elastomer implant for tagging edible sea cucumber *Holothuria scabra*

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Sea cucumber farming is well developed in the Southwestern region of Madagascar. However, poaching problem occurred during the growing phase when sea cucumber reached >100g. The aim of this work is to study the feasibility of *Holothuria scabra* integument tagging in order to protect them against the poaching.

For this experiment, two types of markers have been used: (i) fluorescent and non-fluorescent liquid and (ii) wire elastomer implant. As biological material, 256 adult sea cucumbers of different class sizes: [50-100g],[100-150g],[150-200g], and [200-250g] were used.

The result showed that all individual *Holothuria scabra* were healthy after the experimentation. However, they rejected all types of markers 100% within 50 and 11 days respectively for liquid injection and wire elastomer implant and thus whatever (i) the location of the implantation (dorsal, ventral or lateral side of the animal) and (ii) the size of the animal. The result showed also that fluorescent liquid markers are more visible and then better to use than those non-fluorescents.

For further researches, we suggest the use of fluorescent liquid markers but these researches should focused on processes where *Holothuria scabra* could retain them on a long time.

POSTER

Towards legalization of local and traditional system of marine resource management: Participatory approach of social convention drafting and implementation in the South-West of Madagascar.

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Trough the article 3 of the law n° 94-005 of 26 January 1994, the State of Madagascar promote the politic of decentralisation until the local level, in the objective to search the mobilization and integration of the population on the development actions. The population is the responsible of it development on defining and realizing all actions to undertake.

The maritime fisheries play important role on the Vezo fishermen economy, because it contribute on the growth o their economy and the actions against poverty and food insufficiency in the South-West part o Madagascar (Toliara)

Traditional fisheries predominates the maritime coastal activities of the South-West region of Madagascar. In fact, fishery constitutes the major destination of boat (90% for fishery; 2% for transport and 7% for mix use).

Diverse legislative dispositions and law distinctively regulates marine resource in Madagascar on traditional fisheries level.

Only on the South-West coast, the coastal communities have twenty eight (28) social conventions called locally Dina with one (01) convention especially for marine turtles and with regional character.

The social convention « Dina » establishes through process typically Malagasy, elaborated from traditional rules and management, lead by the Dean or Chief of the community, normalized by Malagasy States law via homologation of the convention provisions within the Tribunal that set it as legal instrument on the same range of local legislations. The Dina convention includes the principles and the concept of good ocean governance on local level. It met the goals of the sustainable development.

This legal instrument become locally use and judge efficient on term of coastal resource management indeed for the most vulnerable, although some of them suffer of legitimate authority abuse and rare case of social exclusion.

POSTER

Marine Resource Management Systems: convergence and divergence of Common Right Regime, Exclusive Right Regime, and Open Access Regime

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The aim of this paper is to present an overview of current issues and lesson learned from marine resource and environmental management in number case of developing countries. It will demonstrate from legal analysis the weakness of some marine management systems adopted by coastal organization and community in ambition to save the environment and bring sustainable development.

The legal regime of marine management is one of the substantive components of good governance and its effectiveness.

Through reasoned and analytic bibliographies, the work particular attention is paid to the local, traditional and communitarian management model and regime, and the open access regime. Analyse will be focused on their convergence and divergence as impacts on the resource preservation or conservation and socio-economic.

The exploration in this paper will contribute to the perspective of improvement of the governance of marine space.

POSTER

How design and mechanism of judicial system should appropriate the marine environmental offence and spoil for national and regional governance perspective?

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There is no single method to manage the Ocean. Many legal measures have been established for response to growing environmental awareness in society. The environmental laws, wildlife conservation laws and other legal instrument for marine resource management become more and more powerful and constraining. Another branch of environmental law refer to conflict resolution mechanisms for environmental disputes; Most of them targeting and seeking compensations from specific offenders. In fact of the dimension of environmental offence and resource spoiling on developing States, the branch of resolution mechanism have to be strength trough the judicial system and legal doctrine of environmental rights for national trial use; and should redefined and enriched for identifying the infraction elements for court instructions.

This work tries to indicate the mechanism of identification of legal element on marine environmental infraction and resource destruction for judiciary interpretation and judgement under courts.

The results will nourish the debate and for the process of design of judicial system on marine resource use abuse and environmental offence. This will be in perspective to aware political recognition for need of effort to protect the valuable natural resources on creating a specific environmental court as well on national level as regional level.

POSTER

Towards legalization of local and traditional system of marine resource management: Participatory approach of social convention drafting and implementation in the South-West of Madagascar.

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Trough the article 3 of the law n° 94-005 of 26 January 1994, the State of Madagascar promote the politic of decentralisation until the local level, in the objective to search the mobilization and integration of the population on the development actions. The population is the responsible of it development on defining and realizing all actions to undertake.

The maritime fisheries play important role on the Vezo fishermen economy, because it contribute on the growth o their economy and the actions against poverty and food insufficiency in the South-West part o Madagascar (Toliara)

Traditional fisheries predominates the maritime coastal activities of the South-West region of Madagascar. In fact, fishery constitutes the major destination of boat (90% for fishery; 2% for transport and 7% for mix use).

Diverse legislative dispositions and law distinctively regulates marine resource in Madagascar on traditional fisheries level.

Only on the South-West coast, the coastal communities have twenty eight (28) social conventions called locally Dina with one (01) convention especially for marine turtles and with regional character.

The social convention « Dina » establishes through process typically Malagasy, elaborated from traditional rules and management, lead by the Dean or Chief of the community, normalized by Malagasy States law via homologation of the convention provisions within the Tribunal that set it as legal instrument on the same range of local legislations. The Dina convention includes the principles and the concept of good ocean governance on local level. It met the goals of the sustainable development.

This legal instrument become locally use and judge efficient on term of coastal resource management indeed for the most vulnerable, although some of them suffer of legitimate authority abuse and rare case of social exclusion.

POSTER

Marine Resource Management Systems: convergence and divergence of Common Right Regime, Exclusive Right Regime, and Open Access Regime

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The aim of this paper is to present an overview of current issues and lesson learned from marine resource and environmental management in number case of developing countries. It will demonstrate from legal analysis the weakness of some marine management systems adopted by coastal organization and community in ambition to save the environment and bring sustainable development. The legal regime of marine management is one of the substantive components of good governance and its effectiveness.

Through reasoned and analytic bibliographies, the work particular attention is paid to the local, traditional and communitarian management model and regime, and the open access regime. Analyse will be focused on their convergence and divergence as impacts on the resource preservation or conservation and socio-economic.

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POSTER

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POSTER

Assessment of the coral reefs resilience to climate change in Nosy Hara National Park, North West Madagascar

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Nosy Hara MPA lies in the extreme northwest of Madagascar, south of the country's northern tip, Cap d'Ambre, and west of the large Antsiranana bay. It covers an area of approximately 125,471 ha, including a core protection zone of 32,310 ha and is managed by Madagascar National Parks. The MPA comprises part of the mainland as well as a number of islets located up to 20 km offshore. Coral reefs are located around the islands or fringing along the coast. These habitats provide shelter or constitute breeding sites for several marine organisms. They also bear an important artisanal fishery on which more than 90% of the local populations rely for their subsistence. In Northern Madagascar, natural habitats, particularly coral reefs, are subjected to the effects of climate change in terms of increased climate variability such as higher temperatures, stronger seasonal winds, fluctuating rainfall, and frequent extreme climate events. Moreover, non-climatic threats could exacerbate the effects of climatic stressors.

In order to increase the MPA resilience to climate change, coral reefs resilience status was assessed according to the methodology developed by Obura and Grimsdith in 2009. Results from 2012 survey showed that Nosy Hara reefs have medium resilience. Sites with greater hard coral cover and a relatively low fishing pressure were most resilient. All sites showed a continued growth and low mortality. Anthropogenic influences seemed to be rather minimal even though signs of negative pressures were observed on the coral reefs, as suggested by the absence of large predatory fish and low fish biomass. The number of fishers observed during the study period was relatively low.

ORAL-Monday- Msikaba 4- 1700

Defining the potential ecological roles of three sea turtle species (*Caretta caretta*, *Cheloniemydas* and *Eretmochelysimbricata*) along the eastern seaboard of South Africa

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Sea turtles were once considered as key species, driving ecosystem processes and energy flows. However, the past decline in sea turtle abundance and subsequent loss of their ecological roles has resulted in reduced ecosystem functionality through food web shifts and trophic cascades. Therefore defining the past and present ecological roles of sea turtles is identified as one of the global research priorities for sea turtle management and conservation. While South African sea turtles are relatively well-protected through the combination of a successful, long-term sea turtle conservation program and a series of coastal marine protected areas, the ecological roles of these turtles have never been investigated. This study aimed to evaluate the ecological roles of two non-breeding foraging species (*Chelonia mydas* and *Eretmochelys imbricata*) and one breeding species (*Caretta caretta*) along the eastern seaboard of South Africa. A multi-technique approach that incorporated the use of satellite telemetry, stable isotope analysis and dietary analyses were implemented to examine key ecological features such as habitat use, trophic position and diet. Satellite tracks revealed that all species formed aggregations in the near-shore environment. While this is typical of the breeding species, the continual uses by the non-breeding foraging species are indicative of residency. Algae was the predominate food item for *C.mydas*, sponges for *E.imbricata*, while *C.caretta* stomachs were usually empty, consistent with capital feeding during breeding. There were no significant differences in $\delta^{15}\text{N}$ among species, which suggest that all species are feeding within similar trophic levels. The significant difference in $\delta^{13}\text{C}$ between *E.imbricata* and *C.caretta* can be attributed to the benthic carbon-rich diet of *E.imbricata* and the prolonged fasting periods of *C.caretta*. This study elucidates the importance of small-scale differential ecological roles fulfilled by sea turtles, strengthens the on-going conservation efforts and provides an ecological framework for future studies in the region.

POSTER

Assessment of coastal water quality at a barachois-based pilot oyster culture site in Mauritius

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Foodborne outbreaks from contaminated oysters are serious threats to human health. Micro-phytoplankton and faecal indicator organisms (FIOs) are both potential bio-indicators for aquaculture site monitoring. However, limited studies have been undertaken on the water quality of barachois aquaculture in Mauritius. This study evaluated the water quality at seven stations of a tropical pilot oyster (*Saccostrea cucullata*) culture site using micro-phytoplankton density and diversity, and colony forming unit (CFU) values of FIOs from October to December 2014. Micro-phytoplankton was categorised into three major groups: diatoms, dinoflagellates and cyanobacteria while four commonly used FIOs: Total coliform (TC), Faecal coliform (FC), Faecal Streptococcus (FS) and *Escherichia coli* were investigated. Physico-chemical parameters namely temperature, salinity, pH and turbidity were monitored in situ. The total micro-phytoplankton density and dinoflagellates density had a significant spatio-temporal variation unlike FC, *E.coli* and FS. Diatoms and cyanobacteria densities varied significantly temporally and TC varied spatially. No micro-phytoplankton bloom (cells x 10⁸ L⁻¹) was observed and the total micro-phytoplankton density ranged from 1.46±2.47 x 10⁵L⁻¹ to 9.29±17.20 x 10⁵L⁻¹. TC exceeded the set limits of 70 CFU/100 ml for aquaculture of shellfish in November 2014 at only two stations outside the oyster culture area. A total of 20 micro-phytoplankton genera were observed with *Nitzschia* being the dominant genus and *Lioloma* the least dominant one. Seawater temperature and salinity were significantly correlated with the total micro-phytoplankton density. Turbidity correlated with FC and *E.coli*. The non bloom-forming micro-phytoplankton density and the CFU/100ml values of the FIOs infer that the test barachois is an oyster cultivable site. However, the two stations outside the culture area near the coast with TC higher than the set norm warrant further attention to ensure the healthy growth of the cultured edible oyster.

ORAL- Wednesday –Msikaba 4 – 1420

A Successful Example of Marine Protected Area Adaptive Management in the Western Indian Ocean

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Marine protected areas (MPAs) are one of the leading tools used today for coral-reef conservation. Effective management requires continuous feedback to reach the established goal(s) and achieve tangible conservation benefits. However

the great majority of marine protected areas fail to meet this requirement hence hindering MPAs effectiveness. Madagascar is one of the poorest developing countries in the world and the population on island depends heavily on fisheries for subsistence. Several MPAs have been established in the country since 1989 to protect coral reefs and the reef fisheries. In March 2014, a reef resilience monitoring was conducted in four of Madagascar's oldest MPAs (Nosy Antafana, Tanjona, Masaola and Tampolo). Two stations in each MPA were sampled to assess six parameters of reef resilience: benthos cover, coral recruitment, coral Shannon-Wiener diversity index, coral bleaching, invertebrate abundance and herbivorous fish biomass. The coral cover in Masaola (36.06 %± 10.9) and Tanjona (46.06% ±12.64) were slightly higher than in Tampolo (34.24% ±24) and Nosy Antafana (28.03%±1.49). The bleaching index was relatively low in all four sites (1.01±0.75). Coral diversity index in all four MPAs was almost identical (0.94±0.01). The results indicated a similar population of herbivorous fish in all sites (380.84±80.78 kg/ha). Coral recruitment (colonies of juveniles/m²) was found to be significantly higher in Tanjona (16.69 ±4.3) compare to the 3 other sites Masaola (8.2 ± 3.4) Tampolo (5.25 ±2.3) and Nosy Antafana (5.2±5.25). Macro-invertebrate abundance (individuals/500m²) was found to be significantly higher in Nosy Antafana (825.8±918.7) compare to Tanjona (105.7 ±4.3), Masaola (72.0 ± 58) and Tampolo (18.5 ±7.8). In order to maintain the resilience capacity of these marine parks, the park authorities have agreed to update the conservation measures taking into account the principles of coral reef resilience

POSTER

Monitoring climate change impacts on coral reefs in northeast Madagascar

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Worldwide, the future of coral reefs is under threat from rapid climate change. Interestingly however, there is a great spatial heterogeneity in coral reefs' response to climate change impacts, especially bleaching. Some reefs are largely impacted whereas others, are only slightly affected. Mapping coral bleaching and better understanding the parameters that allow reefs to be more resilient and persistent represent a key step towards ecosystem management and conservation planning. Annually, since 2010, coral reefs in Antongil Bay, on the eastern coast of Madagascar, were monitored for bleaching two to three weeks after the highest temperatures in the warm season. A simple, cost-effective protocol for monitoring was used to estimate coral cover, coral diversity and bleaching index at each site. Results indicated for the 10 sites surveyed, no statistical difference in coral cover and diversity inside and outside protected areas (respectively 40.57%±9.7, 42.01%±8.55; 0.94±0.02 ; 0.94±0.01). The bleaching index differed among sites inside and outside of the protected areas but was not significantly different (0.96±0.89, 1.74±1.7 respectively). However, the same index was significantly different between sites from the western, central, eastern, south part of the bay and just outside of the bay. We hypothesized that due to the influence the South Equatorial Current that hits Madagascar's east coast and the nine rivers flowing into the bay, it is possible to identify coral reefs of Antongil Bay that have a greater potential for resilience to current climate warming. Those sites should benefit an even greater protection status within the bay.

POSTER

Conserving mangroves for a sustainable harvesting of mud crabs in the Manambolo and Tsiribihina Seascape (west coast of Madagascar) – Improving socioeconomic gain through promoting new sustainable crab fishing and processing techniques

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In Tsiribihina-Manambolo mangroves seascape, the popularization of new sustainable crabs fishing techniques gained a great success especially on the improvement of daily catches. Local beneficiaries confirm that the use of these new techniques allow them to increase three-fold the average of production compared to the use of traditional fishing techniques, and also allows them to have an increase in revenues of 50 to 75% per day. A total of 108 households have benefited from the support of this initiative and the acquisition of 540 “balances à crabes” and 48 “cage viviers” were facilitated. Analysis of local perceptions and rapid monitoring results revealed the following: (1) the use of “Balance à crabe or Belaroa” was very appreciated by fishermen, and allowed them to increase their production, to improve the selectivity of their catches, and especially to decrease their fishing efforts. In one take, they may have two to five large crabs. However, 32 of the 40 monitored fishermen admitted that they found some difficulties to board more than 2 “Balance à crabe” in their small traditional pirogues as this type of fishing gear is quite heavy. Therefore, they decided to combine the use of this gear with traditional practices using fishing line or “Firango Behihy”. (2) The use of “Cages-viviers” was also popular with fishermen because of its effectiveness. The analysis carried out showed that by using this technique the post-harvest losses recorded for a delay of two or three days before selling does not exceed an average value of 0.5% of the total weight caught by fishermen. However, some individuals stole the stored crabs taking advantage of the remoteness of the area and which really demotivated fishermen. At the level of crab collectors (Middlemen), the value of post-harvest loss does not exceed 1.8% of the collected products.

POSTER

Contribution to the study of specific diversity of reef-building scleractinian of the Great Reef of Toliara and Sarodrano, South-western Region of Madagascar

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Specific studies to date on scleractinian in Madagascar are rare. Hence the present work offers a new contribution to the knowledge of hard corals populations of the South-western region of Madagascar. Three sites located on the Great Reef of Toliara (GRT) were chosen: Grande Vasque (GV) (latitude 23°23'S), to the north and is large basin located in the innermost part of reef flat, Nosy Tafara (NT), in the South (latitude 23°30'S) and in the outer slope (OS) of the GRT

(latitude 23°29'S) . Samplings were performed on 2 stations per site taking in account the variability of each site. Adapted linear point intercept method was used on each station, and 15 transects of 10 m performed, totaling 90 transects for whole study. Approximately 7 cm diameter coral fragments were collected from each observed colony for skeletal characteristics and for DNA sequencing identification.

Of all the identified families, Acroporidae remains the most dominant. The branching Acropora colony are abundant compared to tabular colonies and then comes the fingered colonies. Massive colonies are belong to the families of Favia and Faviidae. Foliose are rare compared to encrusting colonies. Many areas remain unexplored on the GRT, which suggests that biodiversity may be much higher than what was observed. The data collected provide new elements to the data base on the GRT and may be used for sustainable management and conservation of marine biodiversity in Madagascar.

The research is still in progress and intended to end in few months to find out all the required results for further conclusion.

ORAL- Wednesday- Amadiba- 1500

Climate-smart Mangrove Restoration in the Delta of Tsiribihina (Western Madagascar)

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WWF has undertaken vulnerability assessment of the mangroves in the Delta of Tsiribihina in 2010 and the results showed that 19% of them are highly vulnerable to climate change. This high vulnerability is associated with a high human pressure and threat which are exacerbated by a high exposure and sensitivity to climate factors (especially sea level rise) as observed and measured from 1951 to 2010 as well as a low adaptive capacity due to a limited areas for mangroves migration and their low rate of regeneration. Furthermore, climate change exacerbates those existing threats.

WWF and its local partners have identified mangroves restoration as one of the most important adaptation measures that should be prioritized in the Delta of Tsiribihina. But, since local communities and partners became aware of the importance of mangroves (especially since the increasing of the local price of crabs); they began planting and restoring degraded areas according to their needs without considering that climate change could collapse their effort in the future.

Hence, from the results of vulnerability assessment, in order to ensure the resilience of the mangroves to benefit biodiversity and people depending on it, WWF has changed its approach from a business as usual mangrove restoration to a climate-smart mangrove restoration. Compared to a usual mangrove restoration, climate-smart restoration considers climate change as a potential threat in the future. Therefore, this new methodology suggests the use of remote sensing and GIS mapping combined to the results of vulnerability assessment to produce maps allowing decision makers and managers to identify the areas to be restored. These areas are now selected based on multiple criteria that take into account ecological conditions and especially future climate change factors.

POSTER

Contribution to the study of specific diversity of reef-building scleractinian of the Great Reef of Toliara and Sarodrano, South-western Region of Madagascar

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POSTER

Artisanal fisheries of nosy hara Marine Park and current management systems

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The Nosy Hara archipelago is a major artisanal fishing ground in Northwest Madagascar, hosting numerous migrant fishers and supplying the main markets of Antsiranana. Nosy Hara Marine Park, a Marine Protected Area, covers most of the archipelago and is managed by Madagascar National Parks in collaboration with local communities. We surveyed fish landing sites throughout Nosy Hara Marine Park, recording the species landed, the gears and vessels used and frequency/length of fishing

trips. Expert fishers were also interviewed to gather detailed information on their perceptions of existing management regimes. Our results showed that a wide diversity of taxa were regularly caught by fishers in Nosy Hara, including threatened species such as sharks and sea turtles. Overfishing was noted as a threat, especially for sea cucumbers. Existing fishing regulations, particularly for sea cucumber collection, were often ignored by migrant fishers and local fishers generally felt that they were not sufficiently involved in the fisheries governance process. Opportunities exist to develop regulations through existing dina (traditional justice system), particularly for octopus and destructive fishing gears.

ORAL- Thursday – Msikaba 1 – 1420

Identifying a biologically appropriate minimum catch size for mud crabs *Scylla serrata* in southwest Madagascar using L50

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Rapid growth in Madagascar's mud crab (*Scylla serrata*) export market between 2012 and 2014 has raised concern over the long-term sustainability of the fishery. To assess the biological adequacy of national size limits to protect spawning populations of mud crabs, the size of crabs at sexual maturity was examined in Belo-sur-Mer, southwest Madagascar. The minimum size at maturity and L50 (carapace length at which 50% of the population has reached sexual maturity) was estimated for crabs collected from seven different villages by dissection and visual appraisal of testes in male crabs (n = 300) and ovaries in females (n = 300). Ovaries showed a pronounced macroscopic differentiation in size and coloration with maturation and were classified according to six ovarian developmental stages: immature, rudimentary, developing, developed, advanced and spent. Male gonad maturity was clearly distinguishable into immature classes with thin vas deferens with few or no spermatophores and mature classes with thick white vas deferens.

Analysis showed that carapace length was significantly related to maturity ($p < 0.001$) and minimum size at sexual maturity was different between sexes ($p < 0.001$) $p < 2.2e-16$. First mature individuals measured 11.8 cm for females and 9.4 cm for males. Results of L50 analysis showed that estimated size at 50% maturity is 13.84 cm for female crabs and 11.29 cm for male crabs.

While the minimum catch size for mud crabs in Madagascar has recently been increased to 11 cm, this size is not consistent with the L50 estimate from this study nor sex-related differences in size at maturity. Regional-level management should focus on the protection of female crabs below 14 cm and further investigations should determine if regional differences exist for *S serrata* L50 within Madagascar.

POSTER

Analysis of the relationship between shrimp fisheries production and mangrove abundance along the western coast of Madagascar, for a sustainable fishery management.

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Management concept for a sustainable exploitation ought to consider environment effect on the resource. Do mangrove ecosystem environments hold an important role on shrimp resources as nursery grounds to shrimp growth? Relationship between shrimp catch from 1997 to 2002 and mangrove characteristics was carried out along the western coast of Madagascar. Catch per unit effort for diverse types of present mangroves were assessed. Lagoon mangroves seemed to be the most productive, followed by deltaic mangrove and in bay mangroves; estuarine mangroves got lower yield. Linear regression analysis showed a positive relationship between “mangrove area” and “shrimp catch”. Principal components–regression approach reduced predictor variables: mangrove area, relative mangrove abundance, latitude, catchment area, tidal range, coastline length, rainfall, and air temperature to three orthogonal principal components, such are: climatic factor, biotic ecological factor and estuarine ecological factor accounting for 82% of the overall data variation. Pearson correlation analysis showed that biotic factor got the highest correlation with shrimp catch. Multiple regression analysis using the three principal components with shrimp catch demonstrated that “biotic ecological factor” through “climatic factor” show stronger influence on shrimp catch. Significant effect of the component “biotic ecological factor”, on the shrimp catch, resulted mainly from its effect on the vegetation and thereafter on the mangroves productivity. Subsequent analyses indicated that “biotic ecological factor” is strongly influenced by variables “catchment area” and “mangrove area” which represent ecological indicators of mangrove extension. Discussion focused on the influence of “catchment area” on mangrove environments, highlighting the effect of upstream slash and burn agricultural practices. Based on the findings of this study, integrated coastal management and applied perspectives researches were proposed

POSTER

Trial in seahorse breeding (*H. borboniensis* and *H. spinosissimus*): what are the driven factors of their survival?

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The Great coral reef ecosystem of the Southwest region of Madagascar offers a great potential for marine resources exploitation. Unfortunately, reef is threatened by overexploitation and degradation. Among these exploitable species in the region is the seahorses. This fish is exclusively marine and has about thirty- three species, but listed as IUCN red list. Illegal fishing is the main cause of its decline.

The proposed study aims at identifying key parameters for an alternative to this illegal fishing, as the resource is highly demanded for trade. *Hippocampus spinosissimus* and *H. borboniensis* were chosen as trial species for tank rearing. From June 2014 to June 2015, experiences that consist in rearing breeders from the wild and evaluate survival of new born seahorses related to the environmental parameters was performed. Effect of temperature on growth and feeding success for new born seahorses are evaluated to determine the best proxy for their rearing. Seahorse breeding is so far well-developed but not yet spread in Madagascar. This study is the first trial by using greenwater in seahorse aquaculture in Madagascar. The copepod *Oncaea* spp is the most adapted food for new born seahorse as these microorganisms are active and reduce hunting effort for the seahorses during feeding. This research is still ongoing and further results are to be enlight

POSTER

Assessment of the state of vitality of a marine Ecosystem facing the investment project: the case of mining and port infrastructure in Toamasina (Eastern region of Madagascar).

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This study, realized in July 2014 in the eastern region of Madagascar, particularly in Toamasina give an example of a suitable methodology for the diagnosis of marine and coastal ecosystems in relation to investment projects. Two cases were studied: the mining project (case Ambatovy) and port infrastructure (port of Toamasina). The eastern region was chosen as the site of study because it brings the typical cases of what is happening in the Big Island in terms of potential impacts of investments project on coastal and marine ecosystems. For Ambatovy project, three sites were chosen which are reef “Nosy Faho”, “Ile aux Prunes”, and the outfall of Ambatovy project. For port’s infrastructure, two sites were selected whose reef “Bain des Dames” and the Great Reef of Toamasina. Several indicators were assessed, among other: the percentage of coral coverage of the substrate and the existence of bio-indicator species to get a sense of the vitality of reefs, concentrations of heavy metals in water, sediments and biota to assess the change in environmental quality, finally the availability of fishery resources through species composition, abundance and biomass of commercial fish. The results obtained during this intervention showed that there is not yet a significant variation in percentage coral reef cover inside all followed site, since 2008, date when Ambatovy project’s assessment started. For the Great reef and the reef of “Bain des dames”, a phenomenon of advanced silting is found, caused by human activities that are made at these sites, fragmenting and destroying coral colonies. Given these environmental issues facing the region of Toamasina, the rigorous monitoring of marine area with high ecological values should be established. The continuous monitoring would be better for the management of available fish resources.

ORAL- Monday- Msikaba 2- 1200

Coastline change on landward and seaward mangrove dynamic: impacts analysis and institutional involvement

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Coastline change is a long-term natural process and has been observed before human settlements. It is shaping littoral landscape over years and may probably speed up with environmental global change. Increased sea level rise, coastal erosion, natural extreme events such as cyclone which may related have increased coastline vulnerability. This study investigated how the coastline change alters natural resources dynamic especially mangrove forest which seems to be the most affected littoral area in Madagascar. Landward and seaward mangrove dynamic is almost observed in tropical mangrove area on which there is still a lack on scientific knowledge especially on landscape dynamic observation using remotely-sensed data. Based on Landsat satellite image processing, band index allows the differentiation of coastline, inland area and mangrove forest. Besides, an institutional approaches have been used to analyze the integration of this change using scale level analysis towards institution's prioritization on the field. Thus, their impacts on mangrove resources management has been assessed in order to find a way to improve coastline management strategy.

ORAL- Wednesday – Msikaba 4 – 1600

Testing the fitness of the future network of Marine Protected Areas (MPA) around Madagascar based on the connectivity of marine population & Identifying the ideal governance system and setting approach for the actual and/or the future MPAs

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Madagascar is the 9th poorest country in the world and 80% of the population entirely depend on natural resources. Madagascar is well known as a biodiversity hotspot. This high importance of natural resources has led to the engagement during the IUCN World Parks Congress of 2003 in Durban to triple the total area of protected areas in Madagascar (10 % of the total area of the country) by 2012. Only 79 % of that goal was achieved and only 0.1 % was assigned for Marine Protected Area (MPA). During the latest World Parks Congress in Sydney, Madagascar took again the engagement to triple the extent of its MPAs by 2020. Thus, information are urgently needed in order to identify the most efficient spatial arrangement for a

network of MPA around the Island. It is proposed that the spatial distribution of MPAs should match the dispersal capabilities of each targeted organisms. The present study use 4 key species (*Linckia laevigata*, *Penaeus Indicus*, *Pocillopora damicornis* and *Octopus cyanea*) to investigate the level of genetic diversity, the genetic population structure and connectivity for 18 potential conservation sites along the Malagasy coast using the mitochondrial CO1 and microsatellites genetic markers. The results can be used as proxy for other species that have similar biological feature. In addition to this, consensus is expected to be reached between specialists among the stakeholders, governmental experts and researchers in identifying the ideal management system and governance of the existing MPAs as well as the ideal approach for the setting of a new MPA using the “Delphi” method. Such information is crucial and will help and influence efficiently the stakeholders on their process of decision-making.

POSTER

Genetic population structure of the mangrove whelk *Terebralia palustris* (Linnaeus, 1767) suggest panmixia in the Western Indian Ocean

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Connectivity among marine populations is only possible by the planktonic larval stage, enabling exchange of genetic material and colonisation of new or disturbed habitats. A long planktonic larval duration (PLD) provides high dispersal potential and possibly increases gene flow among populations. *Terebralia palustris* (Potamididae) is the largest gastropod in Indo-Pacific mangrove forests, important for decomposing mangrove detritus, litter removal, and entrapping primary production in the mangrove ecosystem. In some regions of Africa and Asia *T. palustris* is utilised as a fisheries resource for human consumption. The pelagic larval duration (PLD) of *T. palustris* is not known, but estimates for other gastropods suggests a possible PLD of two months, indicating a high potential for dispersal. Samples were collected along the coasts of Eastern Africa and Madagascar in the Western Indian Ocean (WIO). In order to infer gene flow among locations in the WIO, a fragment of the mitochondrial cytochrome c oxidase subunit I (COI) gene was sequenced in 177 individuals from 10 sites. Genetic differentiation among populations was analysed with F-statistics and testing for significance by conducting an Analysis of Molecular Variance (AMOVA). Based on a DNA fragment of 624 base pairs 26 haplotypes were identified and the two most abundant haplotypes were shared among all sample sites. Moderate haplotype diversity and low nucleotide diversity, as well as analysis of historical demography indicated population expansion. Isolation-by-distance analysis was not significant. Analysis of Molecular Variance (AMOVA) revealed no significant genetic differentiation among populations ($\phi_{st} = 0.015$). These results indicate high gene flow and high level of connectivity among the samples sites in the WIO. Potential oceanographic barriers do not influence dispersal and prevailing currents, as well as a presumably long PLD facilitate panmixia in *T. palustris*

POSTER

Participatory approach in fishing sites mapping provide high accuracy in results

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The accuracy of fishing sites map is crucial in fisheries monitoring. For instance, to investigate the impact of conservation efforts such as those of seasonal closure of fishing sites on catch per unit effort, an accurate estimation of fishing sites size and location is needed. In the southwest of Madagascar, it was observed that each shared fishing sites, different names could be assigned by different villages. Additionally, illiteracy is very common in fishers community. Very few of them could spell the exact name of fishing sites despite their extremely strong knowledge of their fishing ground. Thus, each data collectors have to improvise when writing up the name of fishing site during the process of catch recording. The present study, a case study for the Velondriake locally managed marine area (LMMA), opted for a participatory approach after not succeeding in having an accurate map using other techniques. Other techniques gave overlapping map for neighboring fishing sites and barely, if not at all, draw the real shape of the fishing sites. Nevertheless, the experience brought the knowledge that fishermen knows precisely the exact shape of the reef (their fishing ground) and are able to draw it. Utilizing a printed habitat map from satellite imagery of fishing ground and having the fishers drawing on them indicating and delimiting each fishing sites, satisfactory and very accurate map was finally gathered. Knowledge of local fishers as well as their participation are very crucial in the approach to map fishing sites. From this technique, for Velondriake, three hundred and twenty five sites were identified from thirteen villages, freed from duplicates and mapped bringing valuable help in fisheries management efforts. The approach strengthen the relationship between scientists, manager and local community and is now widely spread all over the Malagasy community of fishers.

POSTER

Evaluation of Three Naturally Occurring Seaweed Species Under two Seaweed Cultivation Methods in Rodrigues Island, Republic of Mauritius

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Rodrigues Island supports several types of subsistence fishing (unsustainable) practices that continuously imposed pressure on its lagoon ecosystems and fisheries. Consequently, the bottleneck is the lack of alternative livelihoods to support the growing fisher community. In 2011, a seaweed cultivation project was initiated by the Mauritius Research Council in collaboration with the Rodrigues Regional Government in view of researching alternative livelihoods for subsistence fisherwomen in Rodrigues.

The study aimed at evaluating two seaweed cultivation methods: off-bottom and bamboo raft cultivation techniques. This involved an experimental phase and a pilot phase. Three locally occurring seaweed species: *Gracilaria salicornia*, *Padina* sp., and *Chnoospora implexa* were evaluated from the period 2011 to 2013 at Petite-Butte (S19o751 E63o3993), Jean-Tac (S19o6653 E63o4475S) and Baie-du-Nord (S19o69808 E63o3655S) respectively based on seaweed cultivation site criteria. The study was conducted through a fisher community-participatory based approach. Quality seaweed species were collected from identified naturally-occurring stands of which 100-150g bunches were tied on monolines of the respective cultivation structures at interval of 30cm. Monitoring involved recording of weight change using an electronic balance, cleaning and maintenance of structures, removal of fouling agents on a weekly basis. Physicochemical changes were recorded every 3 months. Shelf life of cultivation structures were assessed through photographic observation.

A shelf life of 1 year was observed for off-bottom structures compared to 6 months for bamboo rafts. The red algae *Gracilaria salicornia* positively adapted to cultivation conditions with new buds formation and stipe elongation. *Chnoospora implexa* (Max. %day-1(0.32%)), and *Padina* sp (Max. %day-1(1.6%)) showed rapid die-off one week after tying. Field experiment on (growth rate % day(-1)) of the *Gracilaria salicornia* at the three selected cultivation sites were 0.23083%, 3.22%, and 17.3% at Petite-Butte, Jean-Tac and Baie-du-Nord Respectively. 652 ± 5.03 kgFW were harvested over a 250m² pilot *Gracilaria salicornia* farm at Baie-du-Nord.

ORAL- Monday- Msikaba 2- 1700

Decline of the giant mangrove whelk, *Terebraliopalustris*, in South African mangroves: Diet and feeding dynamics of a tropical species at its global distribution range limit

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Globally, species have been predicted to undergo poleward range expansions in response to climatic warming. However, sensitivity to disturbances at the range limits can result in local contraction. *Terebralia palustris* is considered a prominent component of the malacofauna across mangrove habitats of the Indo-Pacific region. The southernmost point of this tropical species' global distribution is along the eastern subtropical coastline of South Africa. However, recent surveys of this coastline have reported local declines and even extirpation. At present *T. palustris* only occurs above detection thresholds at two localities, the southernmost of which is Durban Bay, approximately 200 km north of the previously recorded southern limit. Habitat degradation and loss of food resources have been suggested as factors contributing to this decline, however the lack of previous ecological assessments for this species at its range limit prevent any solid conclusions from

being drawn. The aim of this study therefore was to provide baseline information on the diet and feeding dynamics of *T. palustris* from the healthy population at Kosi Bay, South Africa. A stable isotope approach investigating the diet of *T. palustris* showed that adults exhibit a shift in diet which may indicate seasonal dietary overlap with juveniles which feed predominantly on microphytobenthos. An experimental approach, using their *situ* gut fluorescence technique, was used to determine the ingestion rate and feeding impact of juvenile snails on microphytobenthos within the mangrove habitat. Grazing was found to be mainly influenced by tidal cycles with large potential impacts on microphytobenthos depending on snail population density. The range contraction of *T. palustris* along the South African coastline is likely due to a combination of natural and anthropogenic disturbances. The decline of conspicuous species in threatened habitats needs to be monitored in the face of global change, particularly when considering biodiversity and ecosystem health baselines.

ORAL- Thursday – Msikaba 3- 1600

Impacts of oceanic waves on beach erosion at Flic-en-Flac

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Swell and wind waves are the primary forcing for the hydrodynamics within reefed lagoons, particularly those with low tidal ranges. Hence they can be the primary driver for near-shore processes including the morphodynamics inside such lagoons. During the past two decades, erosion has been heavily impacting the beaches of Flic-en-Flac on the western coast of Mauritius. It has been suggested that the degradation of the fringing reefs is one of the main causes although this has not been properly studied. Here we propose to explore the effects of wave action on the morphodynamics inside the Flic-en-Flac lagoon using a nearshore numerical model.

We use a surfbeat modelling approach with sediment transport to assess the natural coastal response during normal and hurricane conditions. Surfbeat models are basically shallow-water models forced on wave group scale whereby a wave driver model provides the forcing on a primary wave group scale through the radiation stress. This type of numerical model is computationally efficient since individual short waves don't need to be resolved. It is therefore adapted to the scale of the whole Flic-en-Flac lagoon. The hydrodynamics is examined using linear shallow water equations, taking into account the presence of bottom friction principally due to coral reef, the infragravity wave response, tidal modulations, setup of the mean water level and the induced longshore currents. The bathymetry being used inside the lagoon was established in 2009 by the Mauritius Oceanography Institute and was complemented by additional datasets outside the lagoon up to the forcing boundary. Several wave forcing scenarios were examined and the effect of reef degradation was investigated. Validation was carried out using field data for coastal hydrodynamics and erosion assessment, and also through shoreline evolution investigated from remote sensing.

POSTER

How to implement a resilient mpa in a very local level

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The establishment of the Ambodivahibe bay MPA in North-eastern of Madagascar has began in 2007. Since 2013, the Ambodivahibe MPA has been selected among the pilot sites where the climate change aspect is incorporated in the management. The main objective of the approach is to implement a resilient MPA co-managed with the resilient communities.

Three major stapes have been followed: (1) vulnerability assessment of the conservation targets and assets by focusing on the climate aspects, (2) Adaptation strategies identification and (3) implementation (ecological and social economic actions).

Vulnerability assessment regarding coral reefs, mangroves, sea birds, traditional fishery and social economic of the local communities are the main subjects of the assessments. Different experts have participated to the assessment such as bio-ecological, weather and social-economic experts, development leaders in national, regional and local level and local fisher's communities...

The stakeholders should choose between the listed adaptation actions. The first selection has been undertaken in the regional level. Then, the short list from the regional level has been brought to the based communities to be selected by considering the climate aspect.

Four adaptation actions have been retained. In terms of ecological adaptation, the mangrove restoration and the capacity buildings related to the participatory marine reserves management have been chosen. The promotion of goat and sheep farming and water supply rae the selected as social-economic adaptation actions.

As result, 5ha of mangrove restored and 10ha of mangrove enriched with the participation of local people. Materials are provided to reinforce the participatory ecological monitoring. One infrastructure is installed in the Iovovona village to reinforce the water supply within the surrounding villages. The 1800 people of the MPA benefit from and are engaged to sustain the infrastructure so that the action will correctly respond to the philosophy such as the climatically scale of the adaptation

ORAL-Wednesday- Msikaba 2-1500

A PRELIMINARY EVALUATION OF THE FISHERY OF CHWAKA BAY, ZANZIBAR BASED ON STOCK- AND ECOSYSTEM BASED ASSESSMENTS

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The artisanal, multispecies, multi-gear fishery of Chwaka Bay at the eastern coast of Zanzibar (Tanzania), is experiencing a steady increase in fishing effort and decreasing individual catch rates. Although the bay is among the best studied areas of the Island, a comprehensive fisheries analyses let alone ecosystem based approaches are still missing. Efforts to manage the fishery have mainly been based on ineffective tries to close the net fishery

leading to discontentedness of stakeholders and distrust between fishermen and fishing authorities. The presented study aimed at assessing the status of the Chwaka Bay fishery and to simulate potential management measures for sustainable resources extraction using 1) length frequency analysis and yield per recruit models, 2) catch size spectra analysis and 3) a mass balanced food web model (Ecopath with Ecosim and Ecospace), Fisheries and ecological data were collected from January – June 2014 and September – December 2014 and were complemented with existing data from the literature. The steep slope and intercept of the catch size spectrum (-6.18 and 23.44, respectively) suggest a highly productive system under intense fishing pressure. The catches of the two most abundant species (*Siganus sutor* and *Lethrinus lentjan*) show high juvenile retention rates (60.6% and 73.4%) with most specimens fished below or around the size at first maturity, reflecting the use of small mesh sizes, but also the great abundance of immature fish in the bay. Exploitation rates are 0.56, 0.6, respectively and above sustainable levels. A preliminary food web model of Chwaka Bay reveals a concentration of energy flows between the first and second trophic level. The low mean trophic level of the catch (2.88) indicates that the more productive small sizes and low trophic level species are mainly targeted. Management measures and best fishing practices will be explored and presented.

ORAL- Wednesday- Amadiba- 1640

Management of coral reef based marine resource uses - application of agent-based models

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Corals reefs are heavily used resources throughout the world. At the same time are they massively threatened by anthropogenic impacts on global (sea temperature rise, acidification) and regional (nutrient inputs, overfishing and destructive fisheries and tourism) scales. Fisheries may severely impact the trophic structure of reef systems, thus reducing herbivorie. These may act synergistically with disturbances and lead to phase shifts replacing corals with other dominant organisms (e.g. macro-algae).

The underlying interactions are complex and interrelated by a number of feedback cycles which make it extremely difficult to analyse the implications of specific management measures. Additionally, socio-economic processes determine under which conditions and in which way reef components are used.

In this situation agent-based (individual-based) models provide an integrative approach which allows a detailed representation of ecological as well as social components and processes. They facilitate the inclusion of realistic spatially explicit interrelations between components and allow integrating knowledge from different scientific fields. Thus they have a great potential to analyse the implications of different management strategies under realistic conditions in a virtual laboratory.

The presentation will illustrate the applicability of these models with a number of examples from different regions and contexts including intensive fisheries in coral reefs and dive tourism. Implications of management measures under different environmental conditions are analysed and the limitations of the approach are discussed.

POSTER

Perceptions of degradation of ecosystem service in a large estuarine zone in central Mozambique

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Coastal habitats such as mangroves and estuaries provide important ecosystem services for the human communities, however a tendency of being heavily exploited therefore threatening natural systems. This study, aimed to understand the implication of extreme events on peoples' livelihoods depending on natural resources, was carried out at Nova Mambone, a small village by the Save River in central Mozambique, which has been impacted by recurrent floods and some cyclones. Semi-structured open interviews were conducted to 25 key informants and structured interviews conducted to 400 households selected randomly within the village. Fisherman is engaged in exploiting fish, prawns and crabs in large scale for commercial purposes. Female adult are either unemployed or are engaged in informal business, while children are enrolled in collection of shells, fish and crabs, honey and firewood for their daily subsistence. Fishing was the main source of income, followed by wages from employment, handcraft, sale of livestock and of agricultural products and small business. 83% of fishers respondents perceived that the current fish abundance reduced in the last 10 years period and 72% recognize that their fish consumption reduced in the same period. Despite the perception of fish reduction, most fishers are reluctant in reduce fishing effort. We conclude that the provision of alternative livelihoods would thus reduce pressure on the resources and increase community satisfaction.

POSTER

Understanding octopus fishing as a livelihood in coastal Cabo Delgado and implications for community octopus management

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This paper describes the socioeconomic context of the octopus fishery in Cabo Delgado Province in northern Mozambique, analyses the potential for locally managed temporal closures following the approach developed in Madagascar, and describes management steps taken by coastal communities to date. In both mainland coastal and island communities of the Quirimbas archipelago of Cabo Delgado women harvest octopus on reef flats, and men fish octopus off the reef slopes. In this paper we describe the institutional, socioeconomic and biological components of the octopus fishery based on mixed research methods including participatory rural appraisal (PRA) techniques, a household survey, direct measures of octopus catch and effort and informal discussions with octopus fishers.

The results highlight the importance of cash income from octopus sales for men and women, and the complex nature of the market for octopus. From an institutional perspective, although there are no formal institutions governing the fishery, customary rules exist to manage use. Fishers report reductions in catch over the last decade due to both increasing effort within their communities, and effort from in-migrants and immigrant fishers. The introduction of periodic fishery closures as developed in Madagascar poses numerous challenges due to a lack of octopus-specific policy in Mozambique, a lack of knowledge on the local level about octopus ecology, a lack of formal institutions, multiple traders, and few alternative income sources. Working closely with a consortium of NGOs and IDPPE (small scale fisheries institute) communities to date have conducted a series of activities in order to address these challenges, and the paper describes steps taken, activities implemented, and the manner in which the Madagascan approach is being adapted to the context of Cabo Delgado

ORAL- Wednesday- Amadiba-1700

Highly variable catchability in a siganid spawning aggregation fishery: implications for management

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Many fish species of socioeconomic and ecological importance form spawning aggregations, comprising a significant proportion of predator and herbivore biomass on coral reefs. Spawning aggregation behaviour typically results in strong spatial structuring of population density and fish size distributions on seasonal or lunar scales, leading to concomitant shifts in catchability (vulnerability to the gear), catch-per-unit-effort (CPUE) and size selectivity. This critical life history behaviour therefore offers opportunities for spatial measures to effectively control population and size-specific mortality rates, yet is not widely integrated in reef fishery management. For the *Siganus sutor* (Siganidae) trap fishery in Seychelles, we use a boosted regression tree (BRT) to examine whether CPUE is density dependent, and a per-recruit marine reserve model to explore the management implications of changes in catchability and size selectivity between spawning and non-spawning fishery components. While spawning site CPUE was, on average, 4-fold greater than CPUE in non-spawning habitat, it was also highly variable, with two thirds of trips to the spawning site yielding zero or low catch rates. Though vulnerability to fishing increased, a greater proportion of the catch from spawning aggregations was closer to size at maturity and optimal size. Controlling for a range of other parameters (current strength, depth, fisher, trap type, visibility and soak time), the BRT model indicated weak density-dependence in CPUE. However, in spite of higher catchability, *S. sutor* are only present at the spawning site for less than 8% of the year and most fishing mortality occurs on smaller individuals in non-spawning habitat. Consequently, protecting a fraction of non-spawning habitat using reserves has greater benefits for both spawning stock biomass and yield-per-recruit than protecting spawning sites. An understanding of spawning behaviour and its effects on the fishery could significantly improve our ability to manage reef fishes for multiple societal objectives.

POSTER

In the dark: should conservation biologists use blind assessment in comparative surveys?

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Double blinding plays a vital role in modern medicine to reduce the risk of human expectation affecting findings, but is yet to be applied to all areas of scientific research. Blinding usually refers to keeping study participants, and those involved in assessment, management, or data collection, unaware of the allocated treatment or true hypotheses, in order to avoid influence caused by that knowledge. On average, trials that have not blinded assessors show larger treatment effects than properly blinded studies. However, the idea of natural human bias also has important, yet currently unaddressed, implications for conservation biology, for example in assessments of marine reserve performance, where researchers may expect greater fish abundance in protected compared to unprotected sites, leading to a subconscious upward bias in their estimations. Here, we present the results of a two-group double-blind randomised controlled trial based on underwater video fish surveys on Indonesian coral reefs. An unblinded group of observers were told which transects were filmed in an unfished marine reserve and which were from fished controls, whereas a blinded group were not. We compared estimates of fish abundance from both groups and found that the unblinded group significantly and erroneously overestimated the effectiveness of the reserve, inflating their fish counts by approximately 28% (95% CI 18.5% to 40.5%, $p > 0.0001$). We conclude that blinding is a valuable tool for both applied ecologists and conservation managers and can be used to maximise accuracy in experimental design and discern the true performance of management strategies. We also call for the development of guidelines to encourage best practice.

POSTER

Scaling success in octopus fisheries management in the Western Indian Ocean: workshop summary and priority actions

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The past decade has seen a proliferation of management efforts targeting small-scale fisheries in the Western Indian Ocean (WIO). Many measures have focused on building local capacity for management of reef octopus (*Octopus cyanea*) and several fisheries have undergone pre-assessment against the Marine Stewardship Council's (MSC) environmental standard. Recent years have seen a growing interest in fisheries improvement projects (FIPs) for invertebrate fisheries across the region, including some octopus fisheries moving towards MSC certification. As part of this effort, Blue Ventures Conservation and the MSC held a workshop in Stone Town, Zanzibar in December 2014 to explore experiences and lessons learned from efforts undertaken across the WIO to improve octopus fisheries management. The meeting brought together representatives from governments, NGOs, fishing communities, regional organisations, academic institutions and the seafood industry. Discussion was framed around five topics: i) The status and trends of WIO octopus fisheries and

markets; ii) Local and national management approaches; iii) Overcoming data and capacity gaps for monitoring octopus fisheries; iv) Management challenges for attaining the MSC standard; and v) Developing and implementing octopus fisheries improvement action plans. Here, we summarise workshop outcomes and identify priority actions to improve sustainability, including the development of regional and national expertise in fisheries stock assessment to reduce the costs of the MSC certification process, greater support for local dialogue and community exchanges, and enhanced networking among small-scale fisheries management efforts around the region.

POSTER

Potential of fattening crabs from fisheries residues in South west of Madagascar

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In 2014, the mud crab *Scylla serrata* turned out to be a high value product of Madagascar; especially in live form for the international market. Today, crab aquaculture is considered a priority for a sustainable future production.

Since March of 2013, ARDA and COPEFRITO set up experimental aquaculture ponds and conducted tests to gain more knowledge about the potential and feasibility of developing crab fattening and aquaculture using available fishery residues in the southwest of Madagascar.

After reviewing Asian mud crab grow-out and fattening aquaculture practices, several trials were done using individual floating cages on liner ponds.

First tests batch objective was to evaluate feed requirements and weight gain when fed with fresh or dry octopus/squid/crab residues from COPEFRITO within 10 days.

When fed ad libitum crabs need: dry octopus 5 to 10% PV/j /fresh octopus 13%/ dry crab meat 5-7%. Weight gain reaches between 3.6 and 6.4% from initial weight.

Then the aim was to get full meat crab when fed with fresh or dry octopus and squid residues.

After 20 days, 72.5% of crabs were fattened with a bigger percentage of males (90%) than females (55%). However, no significant difference was observed in fattening period and weight gain between sexes.. Weight gain ranges from 4-5% of initial body weight.

Determining the daily feed ration of crabs allowed to sustain a good water quality in the ponds, hence a good survival rate (from 83% to 95%).

This study confirms the possibility and potential of working with fishery residues to initiate a fattening and grow-out activity in South West Madagascar.

POSTER

Fertilization and early embryonic development assessment of the hooded oyster *Saccostrea cucullata* (born, 1778) in laboratory

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Oysters constitute one of the sources of protein for the native inhabitants of the Inhaca Island in Mozambique. The massive exploitation of this resource due to increased demand constitutes a threat and may lead to a rapid decrease of the population stocks in the area. Therefore, alternative solutions to minimise this gloomy situation need to be established to ensure the correct use of the resource and ensure sustainability. This study intends to produce oyster larvae in captivity for development until settlement of juveniles for potential use in aquaculture promotion and replantation for stock rehabilitation in the wild. Laboratory experiments were undertaken to assess factors affecting fertilization and early development of *Saccostrea cucullata* and evaluate growth and survival of the different early stages of the *Saccostrea cucullata* was performed in laboratory conditions in November 2014 at Marine Biological Station at Inhaca. Mature specimens of *Saccostrea cucullata* oyster were captured in wild to induce artificial spawning. Two methods were used for the purpose the thermal spawning induction and the mechanical extraction of the gametes in order to get the egg fertilised and subsequent embryonic stages. The thermal induction method carried out under controlled temperature of 27°C (±2) has shown the release of only male but no female gametes while mechanical extraction of gametes provided fertilization and embryonic development but, the growth and survival rates recorded for the larvae during the experiment were low compared to other existing studies. Although the method of mechanical extraction of gametes has provided acceptable results, factors which may have influenced negatively on growth and survival of oysters larvae are still being investigated in a more detail in order to guarantee a sound development: Thermal induction ranges and factors affecting fertilization are being investigated in order to improve larval growth and reduce survival rates of oyster larvae.

POSTER

Mapping the octopus trade in northern Mozambique and its implications for octopus management through periodic closures

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There is increasing recognition among conservationists and fisheries managers that understanding markets is critical for successful management of marine resources. For octopus, a fast-growing species that yields increases in productivity when managed with periodic closures, the need to understand the market context is particularly important. Fishers require

assurances that they can sell their harvest, and certainty that prices will not be dramatically reduced due to high supply. Similarly, traders must have capacity to handle large quantities of octopus when closures are reopened. These requirements can be met where there are large private companies that form agreements with communities, and can cope with large fluctuations in octopus supply, as in Madagascar (Copefrito). However, in northern Mozambique, there are no large private companies purchasing octopus, and there is little information about the octopus market. This study maps the structure of the octopus trade in this region, including factors affecting prices and trading capacity. The methodology consisted of an open-ended questionnaire with traders supplemented by key-informant interviews. Phase 1 interviewed 36 traders operating in producing areas. Phase 2 is ongoing and further explores the market chain as octopus moves from production to consumption areas. Preliminary results suggest that the ability of traders to buy octopus is constrained by availability of funds to finance trading, which often involves credit agreements with fishers. Inland areas of Cabo Delgado and Nampula Provinces and Tanzania are key market destinations. Demand in inland markets is higher during the lean season when households have little or no cereal stocks, and no food in the fields and thus there may be an important link with food security. Our results indicate that octopus management through periodic closures must involve traders at different nodes of the market. Measures aimed at supporting the ability of traders to purchase octopus may be necessary.

ORAL- Thursday- Msikaba 4- 1420

Enforcing legislation against blast-fishing in Tanzania: challenges & lessons

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Although illegal since 1970, blast-fishing has been a longstanding problem along Tanzania's marine coast. It has caused extensive damage to reef habitats, undermined fisheries productivity, injured fishermen and hindered coastal tourism development. A five-year respite between 1997-2002 following a coast-wide Navy operation and deployment of Navy personnel to Tanga, was not sustained thereafter. The period since 2002 has seen a major resurgence, beyond the control of relevant authorities and more prevalent than ever. A 6-week acoustic study in 2013 recorded an average of 19 blasts per day in the vicinity of Dar es Salaam alone. Although freely practiced close to both marine borders, blast-fishing has never become entrenched in either Kenyan or Mozambican waters.

Historically, enforcement approaches have been largely directed towards sea patrol operations, albeit limited, by fisheries and marine parks authorities with support of the Marine Police and the Navy. Notwithstanding their relatively high cost, sea operations have sometimes been successful in arresting blast-fishers and confiscating materials. But they have been wholly ineffective in deterring blast-fishing. Two recent reviews of judicial process since 2002 highlighted shortcomings in prosecution and sentencing procedures for blast-fishing cases. They help explain why minimum penalties under fisheries legislation, currently a 5 year jail sentence, were not applied in a single one of more than 120 cases reviewed.

The approach to enforcement of legislation against blast-fishing in Tanzania has not proven strategic. It has seldom involved intelligence-gathering or investigation; it overlooks the hinterland of criminal organization, activity and influence that sustain blast-fishing; and has lacked the inter-agency collaboration required to tackle it effectively. This paper outlines the challenges in greater detail, reports on preliminary results of a revised approach pioneered under a new multi-agency task force, and presents the key requirements of an integrated, intelligence-oriented strategy for the future.

POSTER

Photosynthetic responses of four tropical seagrasses to temperature stress

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This study used chlorophyll a fluorescence to investigate the photosynthetic responses of seagrasses to temperature stress. Four different seagrass species (*Thalassodendron ciliatum*, *Thalassia hemprichii*, *Enhalus acoroides* and *Cymodocea serrulata*) were exposed (1-3 hours) to thermal stress (25-45°C) for seven days. The ETR and Fv/Fm ratio were used as stress indicators and assessed for each species. There was a decrease in both ETR and Fv/Fm ratio values for all species at 40°C and 45°C, with the most dramatic effects on *Thalassodendron ciliatum*. The key finding was that *T. ciliatum* suffered detrimentally after 4 days of exposure (in 45°C) due to chronic inhibition of photosynthesis that indicate its low tolerance and susceptibility to temperatures exceeding 40°C. In comparison to *T. ciliatum*, the three other seagrass species showed higher tolerance to temperature extremes and maintained higher daily maximum ETR and Fv/Fm values. The findings of this temperature stress experiment suggests that repeated short-time water temperature peaks occurring at low tide in shallow waters negatively affect photosynthetic processes of tropical seagrasses

ORAL- Thursday – Amadiba – 1500

Vulnerability of coral reef heritage: returns of a summer school experience

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The vulnerability of coral reefs heritage was the topic of the first EEA-VulPaRe Summer School organized by IRD and IH-SM in November 2014 in Toliara (Madagascar). The objective was to gather a group of young and senior scientists of different disciplines (biologists, ecologists, geographers, economists, anthropologists, fishery

scientists and biostatisticians) to share experiences and span all aspects of coral reefs vulnerability and to confront interdisciplinary points of view. The given lectures were completed by field trips in the South West of Madagascar: mainly the estuary of Onilahy river in the South of the Great Reef of Toliara and three coastal villages: Sarodrano, Anakao and Saint-Augustin. This communication will present the main results of this summer school whose most important outcome is the emergence of a young scientists network on the theme of the vulnerability of the coral reef heritage and of many questions about the concept of heritage and its relevance in the context of increasing pressure on reef habitats and resources. We will also present some results of exercises intended to reveal the coral reef heritage representations by the participants : 1) free word association from the stimulus word “Heritage” collected at the beginning of the school 2) textual analysis of how each participant see “the coral reef heritage” after the experience of this interdisciplinary school. This communication is also an invitation to participate to the workshop “Coral Reefs: a Common Threatened Heritage” that the new steering committee of the future EEA-VulPaRe Summer School is already planning for 2016.

POSTER

How do people perceive the high seas in two contrasted villages in the West coast of Madagascar?

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The idea of “transforming into heritage” a place as big as the Mozambique Channel under the Unesco label emerged in the 2000s. The challenge in terms of governance is important. It can only be met over a long period which would co-construct common governance or “articulated subregional governances”. It is in this context that researchers from various disciplines belonging to institutions from five countries of Mozambique Channel came together to develop the MOZALINK research program funded by the WIOMSA: Linking marine science, traditional knowledge and cultural perceptions of the sea in the Mozambique Channel to build tomorrow’s marine spatial management using simulation tools and educational games. By confronting and articulating scientific knowledge and local knowledge, Mozalink which began in early 2014, aims: (1) to contribute to a better knowledge and understanding of the ecological and human dynamics in the Mozambique Channel; (2) to give some “keys” to local communities and to countries border of the Channel to build modalities of governance respectful of and in coherence with their values. In this paper, adopting an ethnographical and geographical approach relying on fieldworks conducted in two very different villages in the West Coast of Madagascar (Ankatafa and Andavadoaka) on the knowledge and representations/perceptions that local actors have of the high seas and the ocean, of the migrations that take place at a regional scale, we will present a cross-comparative approach of knowledge and

know-how linked with the marine environment, and of the representations that people have of the marine heritage

ORAL- Tuesday- Msikaba 2- 1200

Dynamics of micro-phytoplankton in response to micro-tidal changes at two tropical coral reef ecosystems

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Short-term variations of micro-phytoplankton biomass in response to tide in coastal areas are as significant as long-term seasonal and inter-annual variations but are yet to be thoroughly studied. To investigate this short-term variation, as well as its seasonal variations, micro-phytoplankton carbon biomass (C-biomass), concentrations of chlorophyll a, nitrate, phosphate and silicate, and physico-chemical parameters (temperature, salinity and pH) were analysed at three zones (coast, lagoon and reef) at Flic-en-Flac (FEF) and Belle Mare (BM) on two consecutive days covering two high and low tides once in August (winter) and once in November (summer) 2011. Micro-phytoplankton was categorised into three classes, namely Bacillariophyceae, Dinophyceae and Cyanophyceae. A total of 36 (29 Bacillariophytes, 5 Dinophytes and 2 cyanobacteria genera) and 34 (31 Bacillariophytes, 3 Dinophytes and 2 Cyanophytes genera) was recorded at FEF and BM, respectively. Micro-tide levels had a significant effect on the total micro-phytoplankton carbon-biomass (C-biomass) and nutrient levels (nitrate, phosphate and silicate) with higher C-biomass and nutrient levels occurring at low tides. Spatial (at the different zones within the sites) of micro-phytoplankton biomass was also observed such that significantly higher biomass was recorded near the coast at both sites while no significant seasonal variation was observed. Moreover, the Class Bacillariophyceae was the dominant micro-phytoplankton class, followed by Cyanophyceae and Dinophyceae, irrespective of micro-tidal changes throughout the study thus indicating their ability to thrive in a wide range of environmental conditions and their potential differential adjustment to various environmental factors within hours. These results might indicate the alternate episodes of the micro-tidally-induced sinking and vertical mixing of micro-phytoplankton cells. This study provides insights on the effect of micro-tidal cycle on micro-phytoplankton dynamics in terms of its C-biomass, diversity and nutrient levels within tropical coral reef ecosystems.

POSTER

Salinity tolerance and Growth Rates of Tilapia (*Oreochromis pangani*) in Marine environment

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Coastal communities depend on fisheries activities as their main source of income. With the fast rising coastal population and technological advancement, pressure on the wild marine resources is increasing thus leading to

overexploitation. Many people are looking at aquaculture as a possible livelihood alternative that will provide them with an alternative source of income. The aim of this study was to determine the survival and growth of *Oreochromis pangani* in four different salinities.

O. pangani specie were collected from Pangani River and acclimatized for several days by raising salinity by 20‰/day. The fingerlings were raised at 0, 15, 25 and 35‰ in 13m concrete ponds. The pH, temperature, Dissolved Oxygen and salinity) in the ponds were monitored twice a day. Water exchange was done at 15% per day throughout the experiment while fecal matter, feed remains and other particulate matter were removed daily using scoop net. Survival and growth rates of fingerlings at different salinities were assessed weekly for 30 days.

Mean growth rates per week were 2.25±2.0g, 2.77±1.55g, 2.34±1.38g, and 1.86±0.16g at salinity level of 0, 15, 25, 35ppt, respectively. One way ANOVA showed that growth rates were not statistically different among the salinity levels ($F=1.129$, $df=55$, $p>0.05$). One way ANOVA also showed no significance difference in growth rates between treatments ponds and control ponds for 0, 15 and 25ppt. However, at 35ppt stress had impact on growth rate ($t=8.85$, $p=0.006$). Therefore, *O. pangani* grows better on salinity level of 15ppt. Overall survival was 96.46% and that of the different salinities were 100, 95, 95 and 90 for 0, 15, 25 and 35ppt, respectively

POSTER

Seasonal Distribution and Abundance of the Major Carangid Fishes Found in Zanzibar Coastal Waters, Tanzania

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The study was carried out to investigate carangid fish species seasonal distribution and abundance variations in different sites, growth type and size structure in Zanzibar coastal waters, Tanzania from April 2013 to March 2014. A total of 20 carangid species were identified, of which only 7 composed of sub-adult and adult fish and 4 of juveniles dominated. Sampling was done using visual catch assessment from local fishers at their landing sites and beach seining for juveniles. The most abundant species was *C. bajad* with a composition of 31.2 % with the highest peak in November, which coincides with North-East monsoon season and the least common species was *G. speciosus* with 3.2 % with highest peak in October. Juvenile *T. blochii* occurred year round and were found in sandy and sandy beach with some rocky outcrops whilst other carangid species were found seasonally in the sandy and sandy-muddy habitats near the mangroves with peaks during the rainy seasons. The coefficient b of the length-weight relationships indicated negative allometric growth ($b<3$) for juveniles, sub adults and adults of major species, except juvenile *C. sexfasciatus* which showed isometric growth ($b=3$). The overall sex ratios for seven major carangids were not significantly different from the expected value of 1:1 ($p>0.05$). The length frequency distribution showed that six species were numerically dominated with fish sized <49 cm TL except *C. sexfasciatus* which is dominated with size >60 cm TL. These results will be convenient for fishery biologists and ecologists to recommend suitable guidelines for sustainable fishery management, conservation of its numerous stocks and aquaculture in the Zanzibar coastal waters, Tanzania and neighbouring countries.

ORAL- Thursday- Amadiba- 1140

Disentangle ecological and anthropogenic drivers of coral reef fish populations: using Chagos as an ecological benchmark

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Understanding the primary drivers that determine fish species assemblages on coral reefs is vital for effective conservation planning. However, separating factors that are natural, such as habitat requirements, from anthropogenic, such as fishing and climate induced coral bleaching, is challenging. Chagos Archipelago is an isolated and largely uninhabited and unfished archipelago of reefs on the north eastern edge of the Western Indian Ocean, and can therefore provide a useful reference point for natural processes affecting reef fish assemblages. The abundance and size structure of 110 species of coral reef fishes were measured together with a range of benthic and reef structure variables at 13 sites in 2014. These fish species can be assigned to 12 trophic group categories to examine assemblage structure differences in terms of ecological functionality. Fish assemblages differed significantly between outer reef slopes and inner protected lagoons, and species assemblage structure was significantly correlated with both live hard coral and dead coral. There were broad geographic scale differences in the relative proportions of different trophic functional groups across the archipelago with four groups primarily driving these differences: Grazer – detritivores, Piscivores, Corallivores and Invertivores. Species level ordinations revealed seven species (from parrotfish, snapper and surgeonfish families) were consistently highly correlated with the species assemblage differences across the archipelago. Discussion will revolve around the natural processes that may be driving the structure of these fish assemblages, the potential for using ~10 key species as indicators of fish assemblage type and hence for simplified monitoring, and the relevance of these results to assessing anthropogenic influences on reef fish populations in the Western Indian Ocean.

POSTER

Preliminary checklist of coral species of Agalega Islands, Republic of Mauritius

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Agalega Islands of Republic of Mauritius, situated in the western Indian Ocean, are made up of two outer islands. The low-lying islands have a narrow lagoon surrounded by fringing reef without natural passes. The taxonomic knowledge of corals of Agalega islands has been overlooked by the scientific community till date despite harbouring high biodiversity and providing ecosystem

services to the island population. The present study was conducted to identify the hard coral species present in the waters of Agalega islands. Line transect method was used to survey at depth up to 15 meters at fourteen different stations, spreading over the whole Agalega Islands. Coral species were identified using digital photography and coral underwater photographs. Results showed 36 species of corals belonging to 8 families and 11 genera were observed. The most abundant genus was *Acropora* representing 38.9% followed by the genus *Porites* representing 19.4% of coral species recorded. The result of this study constitutes the first database of corals and might have far reaching implications in the initiation of a coral monitoring program.

POSTER

Use of the Curieuse Island, Seychelles, Mangroves as a Nursery Ground by Sicklefin Lemon Sharks, *Negaprion acutidens*

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The importance of shark species as apex predators is well-known, yet they are threatened by overfishing and habitat loss with an annual global decline of nearly 7.9%. Species that prefer coastal areas, such as the sickle-fin lemon shark, *Negaprion acutidens*, are particularly at risk. *N. acutidens* is significantly under-studied, and the population of *N. acutidens* found in the mangroves and surrounding waters of Curieuse Island, Seychelles has never been studied. The mangrove system is unique due to the construction and later partial destruction of a seawall; an ongoing study by the Seychelles National Parks Authority and Global Vision International is monitoring the now receding mangrove forest and determining how various fauna depend on and utilize it. This study aims to obtain baseline information on the Curieuse *N. acutidens* population and assess their use of the mangroves and surrounding habitat as a nursery site. A total of 25 sessions, carried out in the mangroves and pond formed by the seawall, from October 2014 through January 2015, resulted in 112 captures, of which 25 were recaptures. Data collected includes gender, length (pre-caudal, fork and total), weight, state of umbilical scar, and a DNA sample. Capture rates were initially high but dropped significantly mid-January with further sessions resulting in fewer captures. Results suggest a greater population size than would be expected for a nursery area of such size, and mark-recapture calculations together with negative mean annual growth rates suggest the decline in capture rates is due to a high natural mortality combined with migration of juveniles outside the area. Continued data collection and the addition of active tracking will provide further information on growth and mortality rates, as well as valuable information on habitat use and spatial movements for future management decisions and conservation efforts.

ORAL- Monday- Msikaba 1-1720

Are the trophic niches of tropical tuna the same in mixed schools?

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In Indian Ocean, three co-occurring tropical tuna species share the pelagic ecosystem in mixed schools: bigeye (*Thunnus obesus*), skipjack (*Katsuwonus pelamis*) and yellowfin (*T. albacares*) tuna. Tuna schools encountered in upper layers display specific compositions, with skipjack tuna generally recovered with juvenile stages of bigeye and yellowfin tuna, while adults of these two species are found together. These fishes are opportunist predators feeding on small fishes, crustaceans and cephalopods depending on local prey availability. Understanding of the competitive and predatory processes in tuna schools would improve our knowledge about the energy acquisition strategies adopted by these species, and should help then to predict how they can adapt their ecological behavior to face external pressures such fishing, climate change, and pollution. In this study, several trophic markers were investigated in different tissues of the three tuna species from the Western Indian Ocean to determine their diet composition, trophic niche and spatio-temporal variations. More than 60 individuals per species covering a large range size (BET: 30-167 cm; SKJ: 30-78.5cm; YFT: 29-158 cm in fork length) were collected in 2013 from five different areas in the Western Indian Ocean. Total lipids, fatty acids of neutral lipids, as well as carbon and nitrogen isotopic compositions were analyzed in both white muscle and liver. These tissues were chosen for their different integration time to detect possible rapid changes in tuna's diet. Trophic niches used as proxies of energy acquisition, were then compared between species, life stage (i.e. juvenile vs adult) and fishing area

POSTER

Macrobenthic assemblage composition as bioindicator of environmental status in a subtropical estuary

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Estuaries are heavily influenced by humans through habitat loss and pollution, and there is a need to effectively assess and monitor environmental status. The aim of the present study was to use macrobenthic assemblage composition to assess the environmental status of Espírito Santo Estuary, located in the subtropical southwest coast of the Indian Ocean (in southern Moçambique). The estuary was divided

into three zones (i.e. the upper, middle and lower reaches) and for collection of macrobenthos sediment samples were taken from seven sites at each zone in January 2014 using a van Veen grab. Physico-chemical variables were also measured in the water and sediment at every site, and a nearby estuary (Incomati) was additionally used as a comparison site. The results showed clear differences in invertebrate density and assemblage structure between ESE and the comparison site, while the three zones in ESE showed negligible differences from each other. The difference between the two estuaries was mainly due to distinguished dominance of certain macrobenthic groups; polychaetes were common in ESE, while bivalves and amphipods were highly abundant in Incomati. Based on the outcome of a parallel study on pollution and the physico-chemical variables measured here, it could be assumed variation in assemblage structure of benthic organisms among the four locations (the three zones of ESE and Incomati) is driven by multiple natural and anthropogenic environmental factors. This study hence suggests that assemblage composition of benthos may to some degree be useful as bioindicators.

ORAL- Monday- Msikaba 1-1140

Detecting Seasonal dynamics of Chlorophyll-a Concentration Using Ocean Color Satellite Data: A case study of Mafia Channel, Tanzania.

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Recently, an assortment of bio-optical and ecological methods have been established that employ ocean color satellite data to map and characterize phytoplankton concentration in the surface ocean. We selected ocean color data from Moderate-Resolution Imaging Spectroradiometer (MODIS) to investigate the spatial and temporal dynamics of chlorophyll-a concentration along the Mafia Channel. A ten years' time window period (2002-2011) was selected for analysis. The results showed chl-a mean concentration of 0.5mgm⁻³ per month, but with a significant inter-annual contrast. Southeast monsoon (SE) season was statistically more productive than northeast monsoon (NE) ($U=10024$, $p<0.05$). Both seasons showed a general trend of increased monthly chlorophyll concentration; for NE monsoon, the concentration increased gradually from November attaining its peak in April whereas during the SE monsoon season, chl-a increased slightly from June through August. A sample of 180 sampling points were selected to assess the influence of freshwater inputs from Rufiji River to chl-a concentration. Good statistical relation was found, in which productivity increased toward the coastal areas of Rufiji River ($R^2=0.88$), and the relation was statistically significant ($t=3.15$, $p<0.05$). These results from MODIS sensor demonstrates a close match of measurements from in-situ data, with the exception of the narrow stretch of the coastal waters, suggesting that ocean color data can be used to estimate, identify, and delineate areas of possible primary production

POSTER

Environmental Hydrodynamic Modeling and Sediment Transport in Maputo Bay

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In Maputo Bay, located in south of Mozambique, it is important to know the hydrodynamics circulation due to tides and local winds, as well as the sediment dynamics processes, to auxiliary the maritimenavigation. For this work, a finite element modelling system has been adopted, this being employed SisBaHiA®, which is the acronym for BaseSystem for Environmental Hydrodynamics in Portuguese. Simulations have been done using a 2DH hydrodynamic model coupled with a sediment transport model, forced with local winds, river discharges and tides. This work presents results for an environmental hydrodynamic and sediment transport study, focused on the Maputo harbor area and close to the border open (near the Inhaca Island) in order to assess the trend of the drift of sediment. The results showed that the tides are the physical process that dominates the circulation on the bay. The tidal current is highest in the central part of the bay than in eastern and western. As expected, current velocities are more intense during spring tides than during neap tides. It has not been identified any seasonal variations in tidal current intensities. In most parts of the bay, variations in bathymetry due to sediment transport showed small differences from summer to winter.

ORAL-Tuesday- Msikaba 3- 1140

The importance of working towards a systems-level perspective of ecosystem functioning: an example of the KwaZulu-Natal Bight

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“From the parts to the whole” is a prominent phrase describing a shift in thinking from a reductionist, mechanistic view towards a systems-level thinking that encompasses the whole and enables us to analyse properties emerging on the systems level. Engaging at the systems level implies a shift towards multidisciplinary, and towards examining relations and processes rather than individual objects and structures. We applied such a systemic view to the KwaZulu-Natal Bight, with the objective to work towards an understanding of its relation with adjacent systems, and for gaining an overview of its functioning. The KZN-Bight has been studied since the 1960s, starting typically with single projects that shed information on uncharted territory in terms of its physical oceanography, biogeochemistry and biology. Typical, and very important, outcomes of these studies were data on its physico-chemical properties, primary productivity, geographical species ranges, and abundance and biomass data for selected groups at certain time

periods, and some fisheries catch data. From these data, comparisons can be made with measurements taken over the various decades, which are informative. However, they do not provide a view of how the system functions overall. Following several connectivity studies (physical oceanography, sardine run, riverine influence), a large step was taken towards the understanding of the KZN-Bight's functioning. Thereafter followed analyses of ecosystem models that provided quantitative insight into the ecology, connectivity and some implications towards the fisheries related economy of the bight. For instance, the influence of estuarine nursery areas on the marine ecosystem and exploitable biomass was illustrated. Secondly, the impact of different freshwater flow scenarios from one of the largest detritus importers (Thukela River) were quantified. A next important step towards understanding the system as a whole, the socio-economic implications need to be incorporated to understand the cycle of impacts between ecosystem changes and humans.

POSTER

Community structure of planktonic ciliates in a South African hypersaline estuarine lake system

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Ciliates play a very important role in determining the overall grazing rates, nutrient generation and secondary production in estuarine systems and their community structure varies temporarily and spatially. Very little is known about the ciliate community structure and dynamics in South African estuaries. This research thus investigates the diversity abundance, biovolume and biomass of planktonic ciliates under different environmental conditions and their role in planktonic food webs in the St. Lucia estuarine lake system. The lake system was characterised by a reverse salinity gradient with hypersalinity furthest from the estuarine inlet. 18 ciliate taxa were recorded in the St. Lucia estuarine lake system from Oct 2010 - Sept 2011. The ciliates could survive distinct salinity ranges, 8.5 - 63.65 and 43.5 - 157.3 with a few taxa capable of surviving in a wider salinity range. Ciliate abundance and biomass increased from the estuarine mouth (MT) towards the northern embayments ranging respectively from 1.10×10^3 to 1.08×10^5 Cells/L and 2.30×10^6 to 3.5×10^8 pg/L with highest values in northern embayments (LP) and lowest in south lake (CC). In LP, Scuticociliates accounted for 70% of the abundance while Heterotrichs (e.g. *Fabrea*) accounted for >70% of the biomass. In CC and MT, Choreotrichs accounted for >65% and >80% of the abundance and biomass respectively. Overall, Choreotrichs and tintinnids dominated in salinities close to coastal marine environments (8.5 to 63.65) while heterotrichs (especially *Fabrea*) dominated in hypersaline environments (43.2 to 157.3). Salinity and food (phytoplankton) availability influenced the ciliate community structure (abundance, biovolume and biomass) with taxon richness increasing with increase in salinity. The correlation of phytoplankton biomass and ciliate biological variables enlightens the importance of ciliates in their role of transferring energy from the primary producers (phytoplankton) to other organisms in the microbial food web

POSTER

The effect of bait on the abundance patterns of reef fish recorded with baited remote underwater stereo-video systems

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The application of bait when investigating site specific differences in reef fish communities with baited remote underwater stereo-video systems (stereo-BRUVs) may alter patterns in abundance and biomass as bait may influence fish behaviour. Although the use of stereo-BRUVs is advocated as a highly suitable method for surveying reef fish throughout their depth distribution, the effect of such bait bias still requires further clarification. A field study was conducted in the Algoa Bay and Tsitsikamma regions of South Africa to quantify the extent to which bait can bias data obtained with this method. The experiments consisted of baited and unbaited (stereo-RUVs) treatments which targeted two sites within both regions: a marine protected area (MPA) and an exploited site. Data from stereo-BRUVs and stereo-RUVs treatments were compared within each region to determine whether the fish density gradients between the MPA and the exploited sites showed consistent patterns for both regions. The results show that for the examined commercially important reef fish species roman (*Chrysoblephus laticeps*), and the non-targeted fingerfin family (*Chirodactylus* spp), the patterns of abundance change between the protected and the exploited sites was consistent when measured with the stereo-BRUVs and stereo-RUVs methods. For roman, bait had a positive effect on abundance, thereby inflating abundance estimates in both regions. For the fingerfins bait had no effect on abundance, suggesting that this family's contribution within a recorded community might be underestimated when applying bait, at least in comparison to species that respond positively to bait. However, the consistency in the change in abundance across MPA borders for both species suggests that stereo-BRUVs are a reliable and powerful tool for sampling reef fish communities and can provide accurate information on both, the state of reef fish populations and the effectiveness of MPAs.

ORAL- Monday – Msikaba 3 – 1120

To what extent do coastal ecosystem services reduce income poverty?

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Ecosystem services are considered an important source of income for coastal communities and hence contribute to poverty alleviation. However, this is typically complicated by diverse household livelihood strategies. Surprisingly

few studies provide quantitative evidence for the importance of coastal ecosystems for household income and income poverty.

Here we present the results of a socio-economic survey of 830 randomly selected rural and urban households from four study sites (Mombasa, Tsunza, Vanga and Mkwiro) along Kenya's southern coast. We elicited total monetary and non-monetary household income using a one-year recall period for fisheries, farming, non-timber forest products (NTFPs) and any non-ecosystem based income source. This allows a quantitative measure of the proportional contribution of ecosystem services to household income, how the importance of ecosystem services varies based on location (e.g. rural or urban), household type (e.g. male- or female-headed households) and socioeconomic characteristics (e.g. wealth, ethnicity, migration status).

Preliminary analysis for example shows that fisheries comprises 26% (SD=41%) of rural household income (excluding farming and NTFPs). Average contribution of fishing will be lower once farming and NTFPs have been included in the analysis but the high standard deviation points towards substantial variation in benefits from fisheries across households. This suggests that the importance of fisheries for poverty alleviation may not apply to all rural households.

Further analyses will include farming and NTFP incomes to obtain total household income and explore in detail the importance of different ecosystem derived incomes for different groups of people across rural and urban sites.

ORAL- Tuesday- Amadiba - 1120

Recruitment of marine fish species into the closed St Lucia Estuary (South Africa): Is the Mfolozi Beach Channel really the answer?

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St Lucia is the largest estuary along the southern African east coast and acts as a nursery for many estuary-dependant marine species. Since the mouth closed in 2002, there has been a gradual decline in fish species numbers and abundance due to low water levels and hypersalinity. Historically St Lucia was connected to the Mfolozi system and the resulting freshwater input prevented extended periods of mouth closure. However these systems were separated in 1952. In July 2012, Ezemvelo KZN Wildlife opened a beach channel connecting the Mfolozi and St Lucia estuary mouths to simulate the historical connection between the two systems in an attempt to increase water input into St Lucia and promote natural breaching. This study assessed the effect of the beach channel on the fish community of St Lucia and the recruitment of marine species. Sampling was conducted at six sites using seine nets during the two years before and two years after the beach channel was opened. The beach channel contributed to a rise in water level across the lake and a decline in salinities, resulting in a salinity reversal occurring in the system. A total of 45 and 50 species were recorded pre- and post-channel, respectively, largely due to an increase in the number of marine species. Seven marine species were lost during the closed phase and 11 previously absent species were recorded in the system after the channel opened.

Marine species abundance in the Lower Narrows tripled after the channel opened. However, total fish abundance in the system decreased after channel opening. The study highlights the changes resulting from the beach channel, but healthy estuarine and off-shore fish populations will depend on a more extensive, regular connection between the St Lucia Estuary and marine environment.

POSTER

Building Effective Long Term Fisheries Co-Management in Five Coastal Districts in Tanzania, and Promoting Coast-Wide Learning on the Same

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WWF's Fisheries Co-management Programme is a direct and specific response funded by the European Union and WWF UK (through DFID) to address the impending devastation of coastal and marine fisheries resources in Tanzania, and the livelihoods of communities that depend on them. By adopting an integrated, multi-disciplinary approach, the programme seeks to actively engage all stakeholders in the management and conservation of fisheries resources; and through the incorporation of enterprise training and support, the programme aims to improve the socio-economic well-being of the communities. Initiated in 2013 under the WWF Rufiji-Mafia-Kilwa (RUMAKI) Seascape Programme umbrella, the programme has grown in strength and number, extending its efforts to develop collaborative fisheries management strategies to the Temeke Municipality and Mtwara Rural Districts. Through active support and facilitation, 57 Beach Management Units (BMUs) and 9 Collaborative Fisheries Management Areas (CFMAs) have been established concurrently with a total of 146 Village Community Banks (VICOBA); engaging 4,008 members of the coastal communities in enterprise skills development and access to small & medium-scale savings and loan initiatives. The impact of VICOBA to the communities is evident and clearly shows growth and commitment of members as the past year alone saw an increase of 28% and 23% in savings and loans, respectively. Moving forward, the programme will seek to utilise the engagement, willingness and commitment of the communities and other stakeholders to address challenges faced; prioritising collaborative efforts to reduce blast fishing, improve monitoring and follow-up activities, and resolve any conflicts that may exist among stakeholders.

ORAL Thursday-Msikaba 3- 1120

Seasonal and Inter-Annual Variability of Sea Surface Temperature along the Coast of Tanzania: Implications for Coastal Resources Management

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MODIS monthly sea surface temperature (SST) satellite data along the coast of Tanzania covering the period between 2002 and 2014 was analyzed to determine the pattern of seasonal and inter-annual variability and its implications on the management of the Tanzania coastal resources. The data for this study, consisting of day and night fields SST and acquired from NOAA ERDAP

website were first downloaded from the site and saved into two file formats, namely the network common data format (NetCDF), corresponding to the monthly composite imageries and the Microsoft excel spread sheet files, corresponding to the raw data for the monthly imageries. The monthly imageries were analyzed using Bilko software, while the excel files were analyzed using sigma statistical data analysis software. Analyses of the monthly images and the raw data for the monthly imageries showed temperature variation from one month to another with highest temperatures (30-32oC) in March/April and lowest temperatures (23-25oC) in August/September. Both the days and nights temperature fields showed bimodal seasonal temperature distribution with peaks in November/December and March/April but with significant day's and night's temperature variation, particularly in November/December and March/April and minimum temperature variations during May - September. Furthermore, both data showed relatively higher temperatures on the Zanzibar and Mafia Channels compared to the Pemba Channel. Analysis of the inter-annual variability of the SST for the Monthly Maximum night field's temperatures showed considerable inter-annual variations with no clear trends, although the day fields temperatures showed bimodal distribution with two peaks, the first in December and the second in March/April. The results show that nearshore resources such as coral reefs and seagrass beds within the Zanzibar and Mafia Channels are more vulnerable to the impacts of the rising sea water temperatures than the resources located in the Pemba Channel.

ORAL- Wednesday- Amadiba- 1440

Reef Restoration in the WIO: a success story in the Republic of Seychelles

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We implemented a large-scale coral reef restoration project in the Cousin Island Special Reserve, Republic of Seychelles, to recover coral loss due to massive bleaching from the 1998 El Nino-Indian Ocean Dipole event and coral breakage from the 2004 Indian Ocean tsunami. We used the "coral gardening" concept: First we harvested coral fragments from donor colonies or corals of opportunity in nearby areas and reared them in mid-water rope nurseries for about 1 year. Second, we transplanted the nursery-reared corals to a degraded reef site. Nine rope nurseries contained about 40,000 coral fragments of 9 species: *Acropora hyacinthus*, *A. cytherea*, *A. irregularis*, *A. vermiculata*, *A. formosa*, *A. lamarcki*, *A. appressa*, *Pocillopora verrucosa* and *P. eydouxi*. After losses to a hurricane and an invasive sponge, a total of 24,431 corals were transplanted to the degraded reef site in two phases: December 2012-April 2013 and November 2013-April 2014. Coral survival from insertion in the nursery to

transplantation was 75.2 % and the restored area was 5,225 m². We used local available materials, recycling and upcycling. We field-tested and scaled up coral restoration techniques previously used at a small experimental scale. We developed a time-saving "cleaning station" underwater, so fish at the restoration site cleaned the coral ropes prior to transplantation. The restoration enhanced coral settlement and recruitment, increased fish biomass, and maintained coral bleaching rates similar to those found in natural reefs. The use of natural substrate as a support to cement corals, 1-year old nursery-reared colonies (10-20 cm wide), and a species composition similar to a healthy nearby coral reef were critical in achieving success. We also trained 45 people from around the world in coral reef restoration techniques. We conclude science-based large-scale coral reef restoration is feasible, affordable, and restores ecosystem function.

POSTER

Local Knowledge on Weather Prediction from Marine Fisherfolks in Tanzania

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Traditional communities have used traditional knowledge to understand weather patterns to make decisions about production cycles in their local environment. Coastal communities in Tanzania are largely dependent of fishing which is influenced by weather conditions. This study aimed at investigating and documenting fishermen local knowledge on weather forecasting from coastal communities of Tanzania and so decides on patterns of their fishing efforts. Focus Group Discussions, Seasonal Calendars, Time-line analysis, Individual questionnaire survey, Key informant interviews, Direct observations and a Review of literature were used to gather data. Quantitative information was processed to generate descriptive and inferential statistics, and content analysis was used to breakdown qualitative information into meaningful units. Almost, all fishermen interviewed were aware of the changing weather conditions. Wind and rainfall were reported as the most important weather parameters in fishing operations. Fishermen local knowledge on weather prediction relies on physical observation and behaviours of living and non-living things such as marine mammals, birds, insects, stars and sea water. Many of the local knowledge weather forecasts concurs with scientific forecasts, albeit both are challenged by a number of issues such as changing of the occurrences of local indicators and unreliability of modern predictions. The study concluded that local knowledge and scientific knowledge on weather forecasts may be integrated to produce a more reliable and acceptable forecasting information to fishing communities. This is important in lessening the impacts of extreme weather changes to the livelihoods of fishing communities. It was suggested that a platform for discussion between local fishermen forecasters and meteorological staff be created to find ways of coming up with a hybrid solution on weather forecasting

POSTER

Temperature and salinity effects as a climate change impact on flowering of the seagrass *H. stipulacea* along the coast of Tanzania

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Long term data sets on the phenology of Tanzania seagrasses either do not exist or have not been correlated with changing climate. The present investigation attempts to assess the influence of ocean physical parameters (temperature and salinity) on flowering of seagrass (*H. stipulacea*) as the means of determining and predicting the effect of climate change on sexual reproduction of marine plants. Flowers have not been reported for tropical seagrass *Halophila stipulacea* along the coast of Tanzania, Indo-Pacific, but after transplanting from Kunduchi intertidal mudflats to experimental cultures, flowers were observed. Staminate and pistillate flowers were produced at the temperature-salinity interactions of 24-28 °C/38-42 ‰ and 28-32°C/38-42 ‰ under 12 hr photoperiod (582 Lux) after twelve months in culture, but not at low temperature against low and mid salinity interactions at 20-24 °C/30-34 and 20-24 °C/34-38 ‰. A total of 79 flowers were recorded from January to December, 2013; where 54 staminate and 25 pistillate flowers were recorded throughout the experimental culture. Plants cultured at 24-28 °C/38-42 ‰ produced 25 staminate and 11 pistillate flowers, while plants at 28-32 °C/38-42 ‰ produced 29 staminate and 14 pistillate flowers, while none of the flowers observed in lower ranges of temperature against low and mid salinity interactions. It is concluded that temperature and salinity are the primary controlling factors involved in the flowering of *Halophila stipulacea*; and hence climate change is expected to cause a significant effect on seagrasses by affecting their reproductive ecology and physiology

ORAL-Wednesday – Msikaba 2- 1720

Disentangling the net: the socio-ecological dynamics of mosquito net fishing

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Anti-malarial programmes, supported by the World Health Organisation, have distributed millions of mosquito nets (MNs) across sub-Saharan Africa in recent years with great success; in 2013 almost half of the population at risk had access to an insecticide-treated net, compared to 3% in 2004. Misuse of MNs within artisanal fisheries is now anecdotally widespread in these regions but formal investigation is lacking. Artisanal and subsistence fisheries globally have been referred to as “the occupation of last resort”, attracting developing nations’ dispossessed. As growing populations become unable to survive on depleted terrestrial resources, new entrants to what are generally already overexploited fisheries are an increasing problem. Small mesh sizes undermine traditional fisheries management which have been founded on increasing selectivity for mature adults, meaning use of MNs as fishing gear is generally illegal. However, ready availability, lack

of necessary skill for deployment and low cost means they appeal to these new entrants and Mozambique’s most vulnerable people, whose dependence on them is unquantified. Recent paradigm shifts promote the theory of balanced fishing; where exploitation of juveniles (using fine mesh gears) may play a valuable role in ecosystem-based management of artisanal fisheries. This questions the validity of bans on gears like MNs. This study investigates the dependence of local people on MNs for food security, wellbeing and livelihoods in five coastal communities in Cabo Delgado, Northern Mozambique, building on a previous case study from Kenya. These case studies are contextualised by a global review of the extent and prevalence of the issue. Additionally, we aim to explore how increasing fishing pressure interacts with the use of MNs in ecological communities, framing the issue within co-management of the wider fishery and integrating the results into participatory scenario analyses.

POSTER

The culture of Sea horse (Syngnathidae: Hippocampus) at the Kenya coast.

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Sea Horse is highly sought after by traditional medicine in Asia, live aquaria and souvenir markets. The demand has put pressure on wild populations prompting regulations for the International trade. Coastal developments near the estuary channels, sea grass beds or mangrove channels have effects on local Sea Horse numbers because of turbulence and loss of vegetation that provides shelter and supports crustacean breeding, the main food source for species. Sea Horse population densities are generally low but reach 10 m⁻² in some patches. Their inferred lifespan range from one year to five years and consume live prey but are ontogenic as they grow. Some species are monogamous within a cycle but some are polygamous across cycles in the wild. After brooding, males release from five to 200 young, depending on species and adult size. This brood size at release is lower than expected among marine teleosts. Eight aquaria tanks (250 litres each) were set up in a culture room lit using Fluorescent bulbs and supplied with sea water from the ocean. Temperature ranges were 23 - 26°C, Salinity ranges were 24 – 28 ‰ and aerated with pipes. Five breeding experiments were carried out between September 2014 and March 2015 and survival of brood to 12 weeks were three, one, three, zero and seven for *H. capensis*, *H. kuda*, *H. capensis*, *H. histrix*, *H. kuda* and *H. capensis* respectively.

POSTER

Environmental Hydrodynamic Modeling and Sediment Transport in Maputo Bay

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In Maputo Bay, located in south of Mozambique, it is important to know the hydrodynamics circulation due to tides and local winds, as well as the sediment dynamics

processes, to auxiliary the maritimenavigation. For this work, a finite element modelling system has been adopted, this being employed SisBaHiA®, which is the acronym for BaseSystem for Environmental Hydrodynamics in Portuguese. Simulations have been done using a 2DH hydrodynamic model coupled with a sediment transport model, forced with local winds, river discharges and tides. This work presents results for an environmental hydrodynamic and sediment transport study, focused on the Maputo harbor area and close to the border open (near the Inhaca Island) in order to assess the trend of the drift of sediment. The results showed that the tides are the physical process that dominates the circulation on the bay. The tidal current is highest in the central part of the bay than in eastern and western. As expected, current velocities are more intense during spring tides than during neap tides. It has not been identified any seasonal variations in tidal current intensities. In most parts of the bay, variations in bathymetry due to sediment transport showed small differences from summer to winter.

POSTER

Spatial and seasonal variability of fish catch in relation to climate-related variables, landscape configuration and population growth

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In the Western Indian Ocean region where people are resource dependent and where climate patterns play a fundamental role in shaping natural ecosystems, biodiversity, economies and cultures, there are uncertainties in how a changing climate would affect fish populations and thus future fisheries productivity. The global temperature has been estimated to increase as a result of greenhouse gas emissions, which leads to concerns about the level of future emissions and associated impacts. The small-scale fisheries sector in the WIO region, which is predicted to be affected by climate change, provides multiple benefits for poverty reduction, especially in terms of food security and nutrition. In this study, we collected fish catch data from landing sites all over Tanzania between June 2013 and May 2014. This comprehensive resource mapping focused on factors such as gears, target species, catch sizes, fishing grounds, and spatial and seasonal catch patterns. Fish landing data were then related to climate variability by focusing on climate-related factors such as temperature, rainfall and river runoff as well as to landscape configuration and population growth. Preliminary results show that mean fish catch rates in the coastal Tanzania was higher during the northeast monsoon, which might be linked to the higher air temperature, lower wind speed and less terrestrial runoff (and hence less sedimentation) compared to the opposite conditions during the southeast monsoon. The greatest mean fish catches were observed in an area (Kilindoni) near Mafia Island Marine Park, which might be a spillover effect of fishes to the nearby fishing areas. Comprehensive analyses of species-environment relationships and correlations between climate variability and spatiotemporal patterns of fish catch data are ongoing. Our findings suggest that climate change should be carefully considered in fisheries management of coastal areas across the Western Indian Ocean region

POSTER

Using social media as a tool to track the social impact of plastic pollution in the marine environment.

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Despite the global concern and awareness of plastic pollution there is continuing use of plastic products, due to its cost-effective and convenient nature. Improper waste disposal of terrestrial plastics account for approximately 80% of the plastics found in marine environments. Marine conservation education programs addressing waste disposal/pollution are largely ineffective. Scientists have realised that human behaviour plays an important role in marine conservation (MC). The main issue appears to be how conservation messages are conveyed. Social media are found to be an effective way to communicate with the general public. This study aims to 1) examine strategies and evaluate bias around plastic pollution awareness using social media as tools to educate people on the importance of MC and 2) track the spread and impact of marine plastic pollution conservation messages. Twenty biodiversity-related YouTube LLC videos were selected, ranked on criteria related to message impact and a cluster analysis was run to determine the 10 highest-ranked criteria. These were used to create two YouTube LLC videos (one which included the highest and the other which included lowest ranked criteria) which were compared using Likert Scale questionnaires, to test the efficacy of conventional conservation message transmission. Memes of marine mammals, reptiles, birds and scenes affected by plastic pollution were uploaded on social media sites. The number of 'likes', 'shares' and 'comments' were used to interpret reactions, to determine meme bias. Surveys were conducted to test awareness of macro and micro-plastics in the marine environment in different age groups and factorially analysed. The results indicate that MC education needs to be viewed as a lifestyle preference to encourage sustainability.

POSTER

The octopus fishery in Kisiwa Panza, Zanzibar and opportunities for collaborative management

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Kisiwa Panza is a 13.5 km chain of mangrove-linked islets off the SW coast of Pemba, Tanzania and within the Pemba Channel Conservation Area (PECCA), declared 2005. Only one island is permanently inhabited. The islands are fringed to the south by inter-tidal flats bound by reef crests 0.25-2 km offshore, representing extensive fishing grounds for villagers and migrants.

A quantitative and qualitative baseline survey (2014) showed >90% of villagers engage in fishing. Octopus (*Octopus cyanea*) is the most important resource for the family (67% respondents) followed by fish (ranked by 47% respondents as first and second-most important). Other resources include sea cucumbers, cowries, shellfish and seaweed.

Octopus are caught on foot (predominantly women), using fins and mask (exclusively men) and some scuba. Metal rods and spear guns are the most common gears. The majority of catch is exported to Europe via Tanga.

70 % of octopus fishers ranked the resource status as poor, attributing this to introduction of snorkel equipment (1990s), use of scuba, population increase, disrespect of traditional resting periods, and coral reef destruction. Catch data (1.5 months, 2015) indicates overfishing with 62% of catch $\leq 600\text{g}$ and 39% $\leq 400\text{g}$.

PECCA legislation provides opportunities for collaborative management via the Shehia Fisheries Committee (SFC). Existing laws and regulations show inconsistencies and the SFC is not functional.

Villagers have established a pilot 3-month no-take-zone. The opening will coincide with the start of Ramadhan, 2015. By-laws are being progressed via customary village laws and simultaneously through the Department of Fisheries Development. Catch monitoring and enforcement measures have been established at the village level.

Preliminary results indicate that certain aspects of fisheries collaborative management are possible under the current legislation but recommendations for improvements include the clarification of SFC procedures for standard operation and by-law formulation.

ORAL- Thursday – Msikaba 3- 1640

Coastal Erosion: Single Swell Events Vs Seasonal Swell Groups, Kwazulu-Natal, Southeast Africa

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Single high-swell occurrences, such as the 18-20th March 2007 Equinoctial Event (M07EE), can cause extreme erosion on the southeast African coast. However it is more normal for erosion to be related to swell groups. The M07EE was the largest ($H_s=8.5\text{m}$) of a high-swell group comprising 13 members, each with a $H_s \geq 3\text{m}$, that occurred in 2007. Although coastal erosion did accompany the M07EE, it is frequently forgotten that much of the “2007” erosion happened in the austral winter thereafter, between May and September. Similarly the 2014 austral spring was characterized by a group of four high-swells ($H_s \geq 3\text{m}$). In this case each of the first three swells had a progressively more easterly propagation direction, which in turn progressively moved the hotspot erosion loci in a clockwise direction within headland-bound embayments, common to this coast, and driving seasonal beach rotation. The fourth swell was more south-easterly and drove the hotspot loci back in an anticlockwise direction. Although single large swells can cause extreme coastal erosion and damage to unwisely placed structures, swell groups are responsible for the seasonal erosion/ deposition cycles of beach rotation. Against this new knowledge, the 2007 austral winter erosion can be seen as seasonal, but the effects were significantly enhanced by the preceding M07EE swell. In order to understand coastal dynamics, high-swell group events must be understood and viewed within their seasonal context.

ORAL-Thursday- Msikaba 4- 1600

Towards a Blue Economy in Seychelles: Marine Spatial Planning and a Debt Swap

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The Seychelles is a rich, tropical marine ecosystem situated in the Western Indian Ocean. Encompassing 1.37 million km² and 115 islands, Seychelles has two UNESCO World Heritage Sites and is home to approximately 85,000 inhabitants. A recognised global biodiversity hotspot, there are high rates of endemism and 735 species on the IUCN Red List. Biodiversity is one of Seychelles’ most important assets and drives the country’s Blue Economy: tourism and fisheries. The sustainability of existing and future uses of marine resources is very important to Seychelles’ economic growth and their biodiversity protection goals. Development and environmental pressures along the coast and at sea, including climate change and extreme ocean events, are impacting Seychelles’ natural heritage, affecting livelihoods and economic prosperity. The Seychelles Marine Spatial Planning (MSP) Initiative is focused on planning for, and management of, the sustainable and long-term use and health of the Seychelles’ Blue Economy. The MSP is a government-led consultative process facilitated by The Nature Conservancy and takes an integrated, multi-sector approach to address marine challenges in Seychelles. The process began in early 2014 and has significant stakeholder input from all major sectors including fishing, tourism, terrestrial and marine biodiversity conservation, economic development, national parks, recreation, maritime safety, ports, and petroleum. Ecological and socio-economic spatial data sets, a UNDP Marxan biodiversity representation analysis, participatory mapping, and spatial analyses are being used to develop a zoning design for the entire Exclusive Economic Zone. Management considerations will link the zoning to national policies and strategies, including the Blue Economy, Protected Areas, EU Fisheries Agreements, and a new demersal fisheries management plan for the Mahe Plateau. Implementation of the plan will be partially supported by a National debt swap and creation of a National Trust Fund that will provide a sustainable revenue stream for ocean management and climate change

ORAL- Monday – Amadiba- 1120

Spatiotemporal patterns of hard-coral recruitment at Vamizi Island, Quirimbas Archipelagos, Mozambique

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Spatial and temporal patterns of recruitment of reef corals were assessed for the first time in Mozambique by deploying settlement plates at various spatial and temporal scales between October 2012 and October 2013

and abundance of juvenile corals (5–50 mm in diameter) was assessed along transects. Settlement of acroporids was highly seasonal, with 97% of spat settling between July and October 2013. Pocilloporids settled throughout the year with a slight peak observed between October 2012 and January 2013. The annual mean larval settlement of up to 1135 spat m⁻² was comparable to other East African reefs, but was dominated by acroporids, which constituted over 80% of all spat, as opposed to Kenya and South Africa where pocilloporids settle in higher density. The peak settlement season also differed from other African locations. A greater proportion of variance in settlement rates occurred at the spatial scale of kilometres, between sites, and at the scale of centimetres, between settlement plates than at the scale of metres, between sub-sites, implying most patchiness occurs at those scales. The peak in acroporid settlement coincided with the period of multispecific spawning with settlement observed as early as nine days after a spawning event. Since no similar spawning events have been reported for other reefs in the area, our results suggest that these spawning events strongly influence overall annual settlement rates and promote high levels of self-seeding at Vamizi. There was no relationship between settlement of larvae to settlement plates and juvenile density on adjacent reefs, suggesting either variable level of early post-settlement mortality, or high inter-annual variability in settlement. Our study adds to a growing global dataset on coral settlement dynamics and provides useful information to support the management and conservation effort in the region. Keywords: Coral reproduction, Juveniles, Mozambique, Larval settlement, Recruitment, Scleractinia, Western Indian Ocean.

POSTER

Reproductive synchrony in a diverse *Acropora* assemblage at Vamizi Island, Mozambique

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Multispecific synchronous spawning has never been recorded in East Africa, but coral spawn-slicks are observed annually at Vamizi Island, northern Mozambique. We monitored gamete development in *Acropora* species from July 2012 to October 2013 and from August to September 2014 to describe patterns of reproductive seasonality and synchrony within and among species of *Acropora*. Gamete maturation was highly synchronized within and among *Acropora* species and culminated in multispecific spawning events lasting one to three nights in each year of the study in late August or September. In late September 2013, mature gametes were visible in 49% of colonies from 10 of 20 species sampled two weeks before spawning. Two weeks after spawning, 93% of colonies sampled were empty. At least three additional species had most colonies with mature gamete one month earlier resulting in split-spawning with a smaller event occurring end of August.

In 2014, 59% of colonies from 77% of 22 sampled species had mature gametes in the 8 days prior to spawn-slicks being observed and 99% had no visible gametes the day after. The proportion of colonies with mature gametes was up to 100% for some species. In other, the absence of mature gametes over the whole study period indicated that they might not spawn in certain years. The analysis of a ten year record of observations of spawn slicks showed that spawning generally occurred once a year for few consecutive days between September and December, during periods of rising sea surface temperature and low wind speed and rainfall. This study is the first to document coral multispecific synchronous spawning off the coast of Africa. These findings contrast with the asynchronous breeding reported for Kenyan reefs and support the absence of breakdown in coral reproductive synchrony towards low latitudes. This high reproductive synchrony has important implications for management of those reefs, especially in this region soon to be subject to major environmental pressure from the developing offshore natural gas industry. Keywords: *Acropora*, multi-specific spawning, Mozambique, reproductive synchrony, Vamizi Island, Western Indian Ocean.

POSTER

The concept of gender in the context of mangrove conservation in Sakalava Region of Menabe: what potential risks taking into account? (Oral presentation)

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Currently, the concept of gender is unavoidable in the processes in which men and women both constitute important actors. In the matter of protection and preservation of mangroves, the balance of the participation of both sexes has been claimed by some donors as being a necessary and effective condition in the implementation of activities. Thus, through its mangrove conservation actions in the Sakalava[1] Region of Menabe WWF tried to initiate a process that can help him to mainstream gender in all its activities. However, with the experience the team was able to notice setbacks in form of potential risks that could seriously disrupt the conservation process already in place. In fact, two different conceptions are in confrontation, and the conservation activities substitute themselves for a material basis for this confrontation. The first conception, initiated by promoters as WWF, tries to strengthen the participation of women in all conservation process (decision making to execution), while the second, manifested by local people and inspired by the organization and social division of labor, only recognizes the participation of women in decision-making having no significant and strategic importance for the life in society. This is why women are systematically excluded where it is a decision-making on important issues.

The main objective of this communication is to share, reflect on the risks that may cause the integration of gender in the mobilization of populations, especially

[1] An appellation to designate a tribe of South-western part of Madagascar.

POSTER

The market dimension of the use of marine turtles in the South of Toliara: a tragic evolution of the perception of Vezo.

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Since today, many researchers and professionals in the conservation of marine turtles systematically recognize the importance of traditional and cultural value of marine turtles for populations of fishermen. In fact, in some places people attribute primarily a traditional and cultural importance to the use of turtles. Around Kanak[1] people, for example, traditional and cultural aspects of marine turtles still holds a central place in their perception and their turtles' use (Brikké, 2010). The use of turtles is still incorporated within the social and cultural logic. While, for Vezo people a new conception has emerged recently (around year 2010) and marine turtles now represent a significant financial benefit with as a corollary the extraordinary development of Mahavatse market (a market located in Toliara specializing in the commercialization of the meat of marine turtles). Thus, in the south of Toliara, even in Madagascar, the attribution of the market dimension of their use goes beyond the social, cultural and food dimension.

The current situation reveals a new problem, complex, and deserves deep reflection. Social and cultural questions regarding the use of turtles would be only a simple facet which hides another, more decisive. For this, is it not necessary to better understand the mechanism behind the emergence of the financial dimension of the use of marine turtles in order to find an adequate solution? The main objective of this communication will be to incite the conservation actors of marine turtles to think about this financial aspect and to propose some possible solutions.

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POSTER

Metagenomic investigation of *Vibrio* species in a mangrove ecosystem

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Aims: This study was carried out to investigate the occurrence of *Vibrio* species in Kunduchi mangrove ecosystem along the coast of Dar es Salaam, Tanzania. **Methods and Results:** The study started with extraction of environmental DNA from sediment samples, cloning the DNA into a suitable vector, transforming the clones into a host bacterium, and screening the resulting transformants by the phylogenetic analysis. The results revealed the occurrence of more than ten *Vibrio* spp. in Kunduchi mangrove ecosystem. **Conclusions:** These findings indicate the need for further investigations on potential sanitary danger on human health associated with the presence of some pathogenic *Vibrio* spp. in the ecosystem.

POSTER

Study on turtle excluder device used by a shallow water shrimp fishing company on Sofala bank – Mozambique

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Shallow water shrimp in Sofala Bank – Mozambique is caught by three different sectors: an artisanal fishery and semi-industrial and industrial fleets that operate to 60 m. *Penaeus indicus* and *M. monoceros* are the main shrimp species. By catch fish species in the industrial fishery are *Otolithes ruber* (croaker), *Johnius amblicephalus* (croaker), *Johnius dussumierii* (croaker), *Pomadasy maculatum* (grunt), *Trichiurus lepturus* (largehead hairtail), *Pellona ditchela* (Indian sardine), *Thryssa vitirostris* (orangemouth thryssa) and *Arius dussumierii* (blacktip sea catfish), small shrimps, *Brachyura* crab and cephalopods including *Loligo* sp (squids) and *Sepia* sp (cuttlefish).

A study based on data collected on a shallow water shrimp trawler with nets with and without turtle excluder devices was undertaken during one trip on Sofala Bank in order to compare species and size composition of the shrimp and fish caught in the two kind of nets and to know if the use of the devices gives clean catches avoiding some species such as rays and trash.

Some results are presented regarding species and size composition in the two nets and recommendations.

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POSTER

Spatial Ecology Patterns of Rocky Reef Benthic Invertebrates in Tsitsikamma National Park

R.A. STEYN, A. GÖTZ, A. BERNARD

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Marine invertebrates in South Africa have not been as widely studied as vertebrates. In the 1970's to 1990's, spatially comprehensive distribution records were collated, but since then research has been limited, with little new spatial ecology data emerging. This is especially true of subtidal rocky reef communities in the warm-temperate Agulhas ecoregion. Little is known about the fine (<100m) and medium scale (<10km) spatial ecology of benthic invertebrates, and how factors such as water depth control invertebrate community structure. In order to understand dynamic ecological relationships and assess ecosystems as a whole, methods such as trawls and SCUBA assisted surveys have been heavily relied upon in the past for data collection, but both are limited in terms of scope and depth. The growing use of photographic equipment in

marine surveying has provided large amounts of data in relatively short periods of time. Through the analysis of photographic quadrats collected with jump camera and SCUBA surveys in the oldest marine protected area in South Africa, Tsitsikamma National Park, this research provides a far more comprehensive understanding of the biodiversity and processes that structure benthic rocky reef invertebrate communities.

This extensive survey aims to establish if fine-scale spatial patterns of the rocky reef benthic invertebrates in Tsitsikamma indicates that spatial variability of community structure across depth zones is greater than variability within depth zones. Preliminary data shows that sponges, ascidians, and algae form the dominant groups of benthic organisms, and that an increase in the presence of bryozoans and upright growth, especially in sponges, occurs with depth. We predict that future analyses will reveal a strong spatial correlation between depth and changes in the invertebrate community, and we are seeking to determine if depth related patterns observed at one site are repeated throughout all sites of the study reef area.

ORAL- Monday – Msikaba 3 – 1620

Social representations of the coral reef ecosystem: local knowledge, perceptions and challenges. The example of Madagascar and Reunion Island

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Coral reef ecosystems are facing major threats due to a variety of anthropogenic and natural factors such as climate change, pollution, overfishing, destructive fishing practices and coastal development. In this context, an interdisciplinary research team (biologists, anthropologists, ecologists, biostatisticians) started a research on the social representation of the coral reef focusing on children's drawings of sea and coral reef realized in two research areas: Madagascar and Reunion Island. Drawing on interviews, participant observation, fieldwork diaries, this presentation reports on the study of social representations of coral reef in order to better understand the coral reef perceptions and knowledge of local coastal communities. The research methodology used is mostly based on the drawings realized by primary school children coming from different coastal communities and is enforced by the use of an educational tool kit aiming at informing and making children aware about the coral reef importance. As part of an effort to understand the social representations of the coral reef, the present study assesses the impact of an educational kit and the evolution in time of the social representations of the coral reef. The study findings show that despite difference in context, community uses and dependence on coral reefs, the social representations of the coral reef are anchored and filtered through the local knowledge, experiences, and beliefs.

ORAL- Wednesday – Msikaba 1 – 1620

Carbon Stock of Intact Mangroves in the Zambezi River Delta, Mozambique

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As preparations are made to be involved with incentive programs for climate change mitigation, there is increasing interest in the inclusion of mangroves in national plans, as the ecosystem is known to sequester a globally-significant carbon pool. The quality and precision of data required by incentive programs necessitates the use of an inventory approach that allows for a robust quantification of carbon stocks. In this study, we quantified the ecosystem carbon stock of the Zambezi River Delta mangrove by applying a stratified random sampling inventory design, based on five canopy height classes determined through the analysis of remote-sensing data. The ecosystem carbon density among the five height classes ranged from 373.8 Mg C ha⁻¹ to 620.8 Mg C ha⁻¹. Soil carbon was the largest measured pool, containing 274.6 Mg C ha⁻¹ to 314.1 Mg C ha⁻¹ and accounting for 45–73% of the height class total carbon pool. The estimates of carbon density within height classes were integrated with their spatial distribution and used to scale to the landscape level and arrive at a carbon stock estimate for the Zambezi River Delta mangrove of 1.4 x 10⁷ Mg C. This value has a 95% confidence interval equal to 6% of our ecosystem carbon stock estimate, well within acceptable levels of uncertainty. A land-cover change analysis was also conducted, evaluating changes in Delta mangrove coverage from 1994 to 2013. Analyses revealed areas of mangrove loss are primarily concentrated at the seaward front, where there are stronger tidal influences and a more dynamic system prone to erosion. Mangroves were also found to be expanding in some of the upstream areas, as well as colonizing in areas of sediment accretion. Calculations revealed a net gain of approximately 4,000 ha of mangrove coverage within the study area over the nineteen-year time frame.

ORAL- Mondy –Msikaba 3- 1640

Community perception of the state and use of marine resources in a coastal village in Mauritius

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Many coastal villages in Mauritius rely on the marine environment through fishing as well as touristic activities. Unfortunately, the lagoons have become degraded by a combination of human and natural impacts. The aim of this study was to determine the level of community awareness in Anse la Raie-St Francois-Cap Malheureux of the problems affecting the local marine environment and their receptivity to potential solutions. An attitude and perception survey was carried out by interviewing twelve key informants followed by a quantitative household

survey of 221 interviews. Local inhabitants were asked about their perception of the state of the marine habitat, potential impacts of activities conducted in the lagoon, other threats to the coastal environment, awareness of existing rules and regulations, and their opinion on lagoon protection through Voluntary Marine Conservation Area (VMCA). The results showed a mixed perception of the state of the marine habitat with 26% of respondents saying that the environment was in a good state, 32% thought it was fair and 36% believed it was bad or very bad. The biggest threat was thought to be pollution followed by over fishing and beach erosion. Most people were aware that marine resources and activities were governed by rules and regulations but their degree of awareness of specific rules varied from one resource to another. When asked about solutions, most respondents (91.88%) would agree to the creation of a VMCA but were more divided when specific locations were proposed. The response from this survey has allowed Reef Conservation to push forward the VMCA project in Anse La Raie but has highlighted the need for more sensitisation to fill in the gaps in knowledge and motivate the community to take a more active role in marine conservation.

POSTER

Crabs as mangrove bioindicators

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Mangrove ecosystems display critical ecological roles for both coastal protection and global biodiversity (estuarine and marine communities, avifauna). The management of the human impact on mangrove and lagoon ecosystems is a key issue in the island of Mayotte (Comorian archipelago). The bioremediation project located in the Malamani mangrove is designed to evaluate the effects of wastewater discharge on all the ecosystem players. Among them, mangrove crabs are considered to be ecological engineers and crab populations from the wastewater's impacted area are negatively affected. To assess this impact, the spatial scale at which the mangrove is affected was monitored by counting crab burrows on quadrats, along transects deployed across both impacted and control areas. Results show that number of crab burrows per unit area decrease together with soil water salinity as a result of wastewater input. Additionally, our study focuses on the impact of wastewater discharge on the ecophysiology of *Neosarmatium meinerti*. The effect of diluted seawater and wastewater discharge were tested on different physiological parameter indicators: osmoregulatory capacity (OC), the Na⁺/K⁺-ATPase gill activity, histological damages and oxidative stress. Results indicate that both low salinities and wastewater contaminants may be the cause of physiological threats.

The present work contributes to establish reliable biological indicators that will assess the health status of mangrove areas in the context of the current demographic explosion and the lack of adequate wastewater treatment on the island of Mayotte.

ORAL- Thursday- Msikaba 2- 1420

The function of tropical East African macroalgal beds, part II: Fish assemblages

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It is commonly recognized that tropical shallow habitats such as seagrass meadows and mangroves constitute important nursery grounds for many coral reef fish species. Some studies have indicated that structure per se rather than the specific habitat itself may play a larger role in recruitment of many species than fully recognised. This points to a need for exploring also other, less studied, tropical shallow habitats with high structural complexity, such as macroalgal beds, as potential juvenile grounds. Seagrass beds and mangroves in East Africa have been shown to be juvenile habitat for as much as eighteen percent of coral reef fish species, however, there are no studies on the fish assemblages of closely situated algal beds.

In this study we investigate the shallow East African macroalgal habitat by comparing it to the ecologically important seagrass habitat regarding species richness, density, age structure and functional groups of fish assemblages. Fish assemblages were assessed with visual census transects, where fish were counted and identified to species. The length of the fish was also estimated. Habitat assessment of macrophyte height and cover was made for each transect using quadrats.

Our results show that juveniles are more numerous in algal beds than subadult and adult fish, whereas seagrass beds contained more juveniles and subadult than adult fish, and shallow coral reef contained a higher proportion of subadult fish. Further, still preliminary results indicates that macroalgal areas harbouring higher densities of juvenile fish than both seagrass beds and shallow coral reef, but with species composition of fish assemblages being dependant on the habitat. This study shows that macroalgal areas appear to have been underestimated as juvenile habitats in comparison with other shallow areas, and highlights the importance of broadening the view of the tropical seascape.

POSTER

Spatial distribution of fish larvae in an East African tropical seascape

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Seagrass beds are highlighted in the literature as important nursery habitats for fish and invertebrates. Even if sedentary and living as adults in the coastal zone, many organisms (fish, crustaceans, echinoderms, corals) spend their larval stage in the open ocean. Recruitment to an area is initiated through supply of larvae from the larval "pool", which is patchily distributed over vast distances. Very little is known how larvae are distributed in time and space within the shallow tropical seascape. Pelagic late stage larvae of some coral

reef fish species actively select a suitable habitat for settling. Settling preferences, as well as supply and survival of larvae are thought to influence species composition and densities at a certain site. This raises questions on the importance of habitat and landscape matrix for the settlement of larvae. Do seagrass- or algal beds have a role in the retention of pelagic larvae and hence are larvae in higher concentrations within these habitats? In the present study, we compare fish and crustacean larvae composition and abundance between two different macrophyte habitats; macroalgal beds and seagrass meadows (*Thalassodendron ciliatum*), and a shallow coral reef site in a coastal East African seascape. Plankton samples were dominated by families of Tripterygiidae and Gobiidae and no difference in fish and crustacean abundance was found between macrophyte habitats. However, larvae were less abundant at the coral reef site. Whether early-stage larvae actively chose their distribution or were intercepted by macrophytes decreasing water movement is not determined, but results indicate that these habitats might be important for pre-settlement stages of fish- and invertebrate larvae.

POSTER

Local Governance Opportunities and barriers for conservation of Mangrove Forests in Geza and Mtimbwani Villages, Tanga-Tanzania

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We conducted a survey and analysis of local governance institutions and mechanisms that would be supportive to potential development and promotion of sustainable conservation of mangrove forests, particularly carbon markets in Geza and Mtimbwani villages along the northeastern coast of Tanzania. The study focused on assessing local governance for opportunities and barriers for support mangrove conservation and promotion of carbon market. Primary data were collected through focus group discussions, key informant interviews and household questionnaires. Secondary data were collected through analysis of policy and legislative documents, institutional plans and reports. This study revealed the presence of some barriers. The barriers revealed in both sites include shortage of forest staff, poor coordination between district level regulators and community and lack of sharing of forest revenue. In Mtimbwani, barriers include lack of environmental committees and conflicts between Beach Management Units (BMU) and Tanzania Forest service agency (TFS) while in Geza barriers include conflicting interest between marine park, district council and TFS and Presence of regulations in Tanga coelacanth marine park which supersede other regulations in mangrove management. Although people were aware about the presence of rules and regulations governing mangrove forests but clarity of laws to the community is affected by enforcement, increase in education (especially traditional rules and customs). The level of clarity of different laws and regulations include, traditional rules and customs in Mtimwani (6.7%) compared to Geza (13.3%); forest act and regulations in Mtimbwani (56.7%) while in Geza (53.3%); by-laws in Mtimbwani (13.3%) while in Geza (36.7%). Awareness of community about access and user rights to PES (10%) while Geza (20%). There is much to be done to improve local governance especially law enforcement, provision of education to community and establishing and equipping district /village environment teams.

ORAL- Thursday – Msikaba 1 – 1720

Artisanal vulnerable megafauna catch - BYCAM, an overview

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The life-history strategies of large long-lived marine megafauna (elasmobranchs, marine mammals and turtles) mean they are highly vulnerable to non-natural mortalities. These species are important to the balance and stability of some marine ecosystems as apex predators, mesopredators and grazers. They provide further ecosystem services in the form of tourism and sustenance. Fisheries catch remains one of the main threats to these species at the global scale, including in the Western Indian Ocean (WIO). Information on the magnitude of target catch and incidental catch (bycatch) is severely lacking, particularly in the largely undocumented and unregulated small-scale artisanal fisheries, which dominate the region. This means population levels are largely unknown and at severe risk, with many suspected to be fished beyond sustainable levels, yet mitigation measures are largely non-existent. The MASMA-funded BY-Catch Assessment and Mitigation in Western Indian Ocean Fisheries (BYCAM) project 2015-2017 aims to begin assessment of target and non-target vulnerable megafauna in the WIO. The project also aims to develop realistic mitigation measures and recommendations for governance and management across the region with case studies in Kenya, Madagascar, Mozambique and Zanzibar. This report presents progress on activities carried out in the first nine months of implementation of this project and clarifies issues raised by the Programme Committee. Steps taken so far, include those for completion of initial components of this project, specifically the collection of baseline fisheries statistics, information and bycatch data and engaging stakeholder in SWIO countries artisanal gillnet, longline fisheries, and semi and industrial prawn trawl fisheries. The data gathered through this process provide the necessary information for effective trials of different potential megafauna mitigation devices for gillnets, longlines and trawls during 2016. The long-term aim of this project is to provide realistic mitigation measures and recommendations for governance and management.

POSTER

Spatial and temporal variations in the occurrence and behavior of Indo-Pacific bottlenose (*Tursiops aduncus*) and Indian Ocean humpback (*Sousa plumbea*) dolphins off the south coast of Zanzibar, East Africa

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Understanding spatial and temporal patterns in occurrence and behaviour is vital for effective conservation of cetaceans. This study used cetacean click detectors (C-PODs) to investigate temporal variation in occurrence and foraging activity of the Indo-Pacific bottlenose (*Tursiops aduncus*) and Indian Ocean humpback (*Sousa plumbea*) dolphins in the Menai Bay Conservation Area (MBCA), Zanzibar, East Africa. Occurrence was measured using detection positive minutes and inter-click intervals were used to identify terminal buzz positive minutes allowing for analysis of foraging activity. Data were analysed in relation to spatial, temporal, environmental and anthropogenic factors. Results showed significantly increased occurrence and foraging activity in more southern areas of the MBCA and during hours of darkness. Higher occurrence at night was not explained by changing echolocation rates with diel phase and so were considered representative of true occurrence patterns. Monsoonal change did not affect patterns of occurrence within deployment sites, however tidal phase significantly influenced occurrence at the southernmost site. Further, prey density and tourism pressures were implicated as significant influences over dolphin distribution patterns. In a wider context the study demonstrates the potential for use of passive acoustics in monitoring coastal delphinids in the East African region. However it highlights the largest pitfall of passive acoustic techniques. The limited understanding of broadband echolocation signals for many delphinids severely limits the application of these technologies. Basic steps need to be taken to allow for categorisation of species but such studies are rare. In the initial study we identified a potential difference between the broadband signals of *T. aduncus* and *S. plumbea*. Follow up work has confirmed these differences and steps can now be taken towards separation of species through acoustic signatures.

POSTER

Using local knowledge to guide the assessment of dugong habitat distribution and diversity.

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A community based dugong monitoring network, established in 2004, has confirmed the presence of dugongs in Tanzanian waters. However, little is known about the size of the dugong population or the distribution and quality of available seagrass habitat.

Local knowledge of seagrass distribution and historical and recent dugong sightings was gathered through a series of Focus Group Discussions with fishers, informal conversations with village elders and community theatre projects. The information was compiled and two sites were subsequently prioritized for a fine scale seagrass survey.

Six local fishers participated in snorkel surveys at one site in the Rufiji Delta and at one site in Mafia Island. Each survey site was divided into 100m² grids and further subdivided into 50m² quadrats. Surveyors swam along 50m transects and recorded the percentage cover of seagrass and the presence/absence of dugong feeding trails. Seagrass samples were collected from within each quadrat to determine species composition.

Four seagrass species were identified at the survey site in the Rufiji Delta. The same four species were recorded in Mafia Island plus two additional species. Four dugong feeding trails were observed in sub-tidal seagrass beds in the Rufiji Delta and eight were observed in inter-tidal seagrass beds in Mafia Island. No dugongs were observed during the survey at either location.

Prior to the survey, dugong sightings and mortalities had been reported within the Rufiji– Mafia Seascape but the exact location of their feeding habitat was unknown. The indigenous knowledge proved to be invaluable in guiding the survey team to specific sites where dugongs forage. Acoustic loggers will now be deployed at these sites to determine the prevalence of dugongs. The research is part of a trans-disciplinary assessment of the status of dugongs across their range within the western Indian Ocean region.

ORAL- Monday- Msikaba 4-1500

Marine biodiversity discovery, stage 3: how next-generation sequencing will complete what barcoding started

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Genetic research based mostly on the mitochondrial COI gene (the “barcoding gene”) has revealed that southern Africa’s biodiversity is much greater than previously thought. Particularly important is the discovery of cryptic species, i.e. species that are morphologically so similar to each other that they can often only be distinguished by means of genetic methods. What has emerged at this stage is that many cryptic species have ranges that are defined by the disjunctions between the region’s temperature-defined marine biogeographic provinces, while others do not. This discrepancy has precluded any predictions about cryptic biodiversity, and suggests that species need to be investigated on a case-by-case basis. Using next-generation sequencing (an approach that generates data from hundreds to thousands of genes rather than just one), we show that DNA barcoding fails to identify very young species. Our preliminary results suggest that few of southern Africa’s marine species are really present in more than one marine biogeographic province

POSTER

Propagation of the Tidal Wave Along the Bons Sinais Estuary in Zambezia province

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The knowledge of the actual contribution of each constituent, is a long period, as many of the short terms, are extremely important to improve the models of analysis and prediction of tides.

This study consisted in describing the propagation of the tidal wave along the Bons Sinais Estuary in Zambezia province. Tides were predicted at the Mouth and confluence of the estuary, from the sea level heights recorded between July 8th to August 31st, 2011, as well as data from 1995 collected at Port of Quelimane using ordinary tide gauges. 35 and 59 tidal constituents were analyzed and identified for the Mouth plus Confluence region, and the Port of Queli-mane region, respectively, using the `t_tide` package. Transferring constituents from the longer record to the shorter record (15 days and 25 hours) did not render any improvement in the quality of tidal prediction, except when the shorter record was 30 days long. The difference of amplitude between the Mouth and Confluence was about 0.365 meters, with a time delay of 52 minutes. It was concluded that tides in the estuary are distorted, with the distortion increasing towards the Confluence region, and that ebbing tides predominate.

POSTER

Marine Biology Station: New Challenges to Marine and Coastal Research on Inhaca?

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Marine and coastal environments support more than half of the population in Mozambique which increases concerns about the effects of human-induced disturbances on biodiversity. Human-induced disturbances represent the major cause of habitat loss and fragmentation, the drivers for spatial patterns, with implications to ecological processes and species persistence. Spatial patterns will remain a challenge to conservation and management of biodiversity as the question “how species and community respond to spatial patterns as well as what their socio-economic implications?” is still to be answered. This is a challenge for research bodies such as the Inhaca Marine Biology Station at the Eduardo Mondlane University, one of the first marine stations on the southeastern coast of Africa established on Inhaca (ca. 42 km² and more than 5000 inhabitants) having the most representative marine and coastal habitats/ecosystems of the entire country coastline (more than 3000 km). Consultative strategic planning meetings with stakeholders were held in 2014/2015 to define the research framework for the period 2016-2020. The strategic planning identified biodiversity issues, the effects of global change on marine and coastal environments as well as human-

natural resource interaction as priority research themes for the next five years. To support the research framework, new facilities (laboratory and accommodation) were built as well as new equipment and material were acquired. The marine and coastal environment on Inhaca is appropriate for experimental research and modelling whose results can be tested and applied in other Western Indian Ocean (WIO) countries opening up opportunities for further partnership and collaboration.

ORAL- Monday- Amadiba- 1620

Decadal spatial-temporal trends of total suspended sediments loads in Malindi-Watamu reefs area of Kenyan Coast

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Several studies have demonstrated the negative effects of Sediment discharges from rivers to coral reef ecosystem. In the Malindi-Watamu coral reef areas, sediments influence from river Sabaki has been cited to affect the health and distribution of coral reefs in the area. Variation in meteorological conditions and lack of long spatial-temporal datasets on sediments has often limited studies on how coral reefs are affected by sediments. The use of remote sensing Data to study Sediment discharges from rivers to adjacent coral reef ecosystems have been applied in many countries, but such methods have rarely been used in the WIO region. This study presents a long term study on the variations of total suspended matter (TSS) using Medium Resolution Imaging Spectrometer (MERIS) remote sensing data, for the Malindi-Watamu coral reef area. We obtained already calibrated (MERIS) datasets for the region and conducted an analysis over a period of 10 years. Our decadal analysis of TSS levels (2003-2012) showed a steady trend of sediment levels over the study period. Similarly, there was coherent trend of precipitation (expressed as mean monthly 5km grid area rainfall from CHIRPS (Climate Hazards Group Infrared Precipitation with Stations) and sedimentation levels along the river basin. Ocean TSS re-suspension was explored to explain higher sedimentation occurrences to specific hot spots. In the absence of long term in-situ data, this study clearly demonstrates that Earth observation data such as ocean color products could be used to delineate TSS patterns. This will provide the much needed long term data trends lacking in the region.

POSTER

Assessment of effects of sediment load on seagrass cover using satellite imagery

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There is growing evidence that seagrasses are experiencing declines globally due to increasing anthropogenic threats. In Malindi-Watamu reef area, Sabaki River have been cited to contribute to sediments that have negatively affect coral reef communities. Changes in Meteorological condition

due to climate changes may change the pattern the rates and patterns at which sediments affect this area. This study presents a long term analysis of total suspended matter (TSS) using Medium Resolution Imaging Spectrometer (MERIS) remote sensing data, for the Malindi-Watamu coral reef area and relating sediments level to seagrass communities. Our decadal analysis of TSS levels (2003-2012) showed a steady trend of sediment levels over this period. Similarly, there was coherent trend of precipitation (expressed as mean monthly 5km grid area rainfall from CHIRPS (Climate Hazards Group Infrared Precipitation with Stations) and sedimentation levels along the river basin. Seagrass cover estimated using Landsat satellite imagery showed a good correlation with areas exhibiting higher sediment levels. This study showed that shallow seagrass communities are related to TSS supplied from Sabaki river in the study area.

POSTER

Spatial dynamics of fishing effort allocation by small-scale fishers near marine reserves

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No-take marine protected areas (MPAs) are increasingly recommended as a tool for fisheries management and habitat and biodiversity protection. MPAs have negative impacts on fishers including loss of fishing grounds, increased travel time and fuel costs. How fishers respond to and are affected by MPAs depends on their individual fishing strategies and behavior. It is therefore important to understand the spatial behavior of fishermen as individual harvesters and incorporating individual characteristics running costs, this gives a better confidence in understanding fisher behavior and for designing management actions.

Previous research by the WIOMSA 'Fishers in Space' project identified key factors determining spatial effort allocation as well as contrasting perceptions of MPAs by fishers depending on their resource space, skills, technology, institutions, and socioeconomic conditions. However, high resolution data of individual fishing trips have until now not been statistically analyzed to explore individual fishing behavior.

We examine the spatial behavior of 12 Kenyan fishers over a period of two years based on participatory effort mapping and monitoring using hand-held gps, logbooks and interviews to understand individual fishing trips characteristics. This required statistical tools of 'behavioral partitioning' to identify fishing behavior before testing of models of foraging behaviour such as Levy flight. Our results show that the behavior and allocation of effort near reserves is related to the use of different fishing gears and fishers operations are only limited to nearshore areas. As high resolution spatial data increasingly becomes available from artisanal fisheries, this study provides an example of analytical techniques that can be applied to such data.

ORAL- Thursday- Msikab 4- 1640

Systems maps and future scenarios- Participatory tools for enhanced systems understanding in coastal Kenya and Mozambique

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Coastal communities in the WIO region live in an increasingly complex and interconnected world where the future is difficult to predict. In this context, dealing with interdependent challenges such as resource degradation and poverty requires understanding linkages between issues as well as uncertain future trajectories.

Within the Sustainable Poverty Alleviation from Coastal Ecosystem Services (SPACES) project, we developed a set of participatory tools to enhance understanding of the coastal social-ecological systems in terms of feedback dynamics, tradeoffs and opportunities for future sustainable poverty alleviation. Two participatory workshops in Kenya and Mozambique engaged stakeholders to collaboratively build system diagrams and future scenarios to explore important aspects of the social-ecological systems and how they might develop in the future. The approach identified threats and opportunities associated with different future pathways, and the implications of different development or policy choices.

Here we describe the steps followed during the participatory process and preliminary results arising from the combined use of i) a 'structured' tool (fuzzy cognitive mapping) to map the current social-ecological systems; ii) a 'creative' tool (exploratory narrative scenarios) to explore future scenarios to foster systems thinking and iii) a 'playful tool' ('toy models') to allow interactive learning about system behaviour.

Preliminary analysis of the system diagrams resulted in a list of 14 overarching themes considered most important for describing the components of the current Kenyan and Mozambican social-ecological system (e.g. Climate change; Ecosystem benefits; Human population). Key insights that emerged from exploratory scenarios in Kenya included the importance of driving forces such as governance, insecurity and the role of education, while for Mozambique these drivers included governance, climate change and oil and gas development.

Our results demonstrate how the combination of the different modes of thinking supports the identification of challenges and opportunities for poverty alleviation while fostering complexity thinking.

ORAL-Tuesday- Amadiba- 1140

System production and respiration in a shallow estuarine lake estimated from oxygen diel time series and mathematical models

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We estimated ecosystem metabolism (net ecosystem production, respiration and gross primary production) from diel oxygen changes in a shallow estuarine lake system, Lake St. Lucia, South Africa. Lake St. Lucia is part of the iSimangaliso Wetland Park, a World Heritage site of profound ecological and touristic importance. Diel changes in oxygen measured in the southern basin of Lake St. Lucia during winter 2013, summer 2014 and autumn 2015 differed from day to day and were most pronounced in shallow areas and on days with low turbidities. Ecosystem metabolism was estimated using two methods, 1) by calculating the difference in oxygen over time during day and night and 2) by fitting a simple autoregressive model to the oxygen time series. Both methods revealed metabolic rates within a similar range. Net ecosystem production (NEP) varied between -360 and +540 mg C m⁻² day⁻¹. That is GPP and R were similar, with maximum values of 1040 and 840 mg C m⁻² day⁻¹, respectively. The system appears to be balanced between autotrophy and heterotrophy with a GPP/R ratio of about one. Gross production added up to approximately 125 g C m⁻² year⁻¹ which is comparable to previously reported values from Lake St. Lucia using the 14C method, but in the lower range for production observed in estuaries worldwide. No seasonal differences in NEP, GPP and R were observed, differences existed between sites and days. Highest GPP was reached on calm days in shallow areas indicating a contribution of micro-phytobenthos to water column oxygen and an effect of turbidity. To investigate the question how high turbidity may limit primary production in Lake St. Lucia we use mathematical models to describe photosynthesis dependent on light, temperature and initial chlorophyll a. The models also allow to distinguish between production by phytoplankton and by micro-phytobenthos.

POSTER

Preliminary results of photographic matching of humpback whales (*Megaptera novaeangliae*) breeding in the Sainte Marie channel

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Sainte Marie Island is one of the Indian Ocean hot spot for whale watching activities. Humpback whales caudal fluke photographic collected by whale watching boat from 2012 to 2014 were used to study their site fidelity and used to determine temporal distribution as well as the percentage of re-sight individuals during the breeding period through a

return index and by examining the re-sight group structures. Data collected from 6 touristic boats in 2012, 8 in 2013 and 5 in 2014 allowed to cumulate 2097 hours sampling effort and 1000 single individuals were identified: 182 individuals in 2012, 415 in 2013 and 398 in 2014. By using the online matching system (IdentiWhale), 20 individuals (2% of the photographic number) were matched within year in a short time interval period (average of 8.3 days). Mother and calf groups were the most observed (66% of matched individuals). Temporal effective distribution analysis shows an important individual dispersion. The return index ($R = 0,022$) confirms this result and the matching between year shows that humpback whales population in this area is not identical each year (5 re-sight individuals for 3 years). These observations do not lead to identify fidelity behavior, however, re-sighting per year is very rare and the individual's residence time is relatively short

POSTER

Threat to black corals (*Antipatharia*) community of Madagascar: illegal harvesting and trade

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Since around 2011, illegal traffic of *Antipatharia*, commonly known as black corals occurs in the main cities of the coastal Southern regions of Madagascar: Ambovombe and Tolagnaro. A private operator applied, unsuccessfully, for full collect and exportation authorisation. However, despite the lack of authorization, several scuba divers still have collected these animals, even so listed in Appendix II of CITES, using hacksaw. Discretely, not less than 10 tons of dry black corals have been collected from the deep south regions of the country and illegally exported mainly in Asia. Marine biologists community, environmental civil society and local responsables started to investigate and take part to a large scale petitions to involve the governmental authorities to rapidly, sign and apply a Bylaw that prevent from collect and trade of black corals in Madagascar. On December 2013, with the meritable volontology and responsible actions of the Anosy authorities, a regional Bylaw has been published, preventing collect of black corals in that region, followed by the region of Androy, on March 2014. Anonumous operators tried, unsuccessfully, to explore other regions. However, with the increasing petitions and lobbying from the scientific communities and local administrative authorities, ministerial Bylaw was published, by the government, on June 2014, preventing collect in all the country. Since then, several equipments, including 49 scuba tanks and more than 160 kg of black corals branches of 35.7 ± 6.63 mm diameter have been caught. The illegal activities did not stopped, but all the brave actions and decisions should be accompanied by alternative and sustainable solutions for the management of these vulnerable resources. Since 2014, researchers from the Fishery and Marine Science Institute of the University of Toliara, Madagascar and the University of Mons, Belgium began to study the conservation biology of these marine animals and the feasibility of their aquaculture.

ORAL-Thursday- Msikaba4- 1700

Measuring the economic and behavioral impacts of sustainable livelihoods in coastal management: Experiences from mainland Tanzania and Zanzibar

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The successful implementation of sustainable livelihoods can help lift people out of poverty while also protecting the rapidly depleting natural resources that communities rely on for sustenance and income. However, successful livelihood initiatives have proven difficult to execute. The USAID-funded Pwani Project (2009-2013) implemented successful enterprises in coastal Tanzania through the integration of natural resources conservation, livelihood diversification, and efforts to improve health, gender equity, and food security. Livelihood interventions in 17 coastal villages supported the goals of implementing sustainable development and protecting marine and coastal ecosystems. Survey data from 2013 show that Project participants increased household income and improved their quality of life through a combination of alternative livelihoods, access to micro-credit from local cooperative savings and credit organizations, and positive feedback loops. Pre-requisites for success include conducting a comprehensive analysis of the local context at the intervention outset; choosing livelihoods that can provide daily income relatively quickly; targeting individuals or households rather than large groups; empowering women, who are particularly disenfranchised; and choosing easily adaptable enterprises. By introducing multiple streams of income, households build resiliency to both manmade and natural shocks, reduce their participation in extractive livelihoods, and become more aware of the importance of biodiversity conservation

POSTER

A Regional Framework for Mangrove Research and Training Forests

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Mangroves are widely recognized for their ecosystem services; however, there is insufficient information available for developing sustainable use strategies or for considering adaptation strategies to the threats from climate change, sea level rise, and land use conversion. There is also insufficient technical information to support effective mangrove restoration in the region. Accordingly, an active research, education and technology transfer program is warranted to provide needed information and enhance local capacity in the science and management of mangroves. Recognizing that a research and demonstration site is needed to provide the basis for long-term monitoring, experimentation, training and education, the USAID Africa Bureau is supporting the establishment of two research and teachings forests in Mozambique and Tanzania. The purpose is to establish a facility that can sanction research, demonstration, and education activities in such a way as to realize long-term studies, interdisciplinary and participatory monitoring, and a field laboratory for demonstrating good management practices and effective restoration techniques. Local communities will be involved to ensure their socio-economic considerations in both the operation of the forest

and in the studies and demonstration trials. The mangrove research forest being established in Tanzania will be located in the Rufiji River Delta, and the one in Mozambique located in Maputo Bay. Each of these forests is being developed by an inter-agency team within the respective countries, and they will have the responsibility for the operation and coordination of the facility. Establishing monitoring capabilities and baseline studies are part of the start-up activities, which are intended to provide a foundation for collaborators working on the site. The activities among the mangrove research forest will be coordinated through the West Indian Ocean Mangrove Network.

POSTER

Defining the space-use of Grey Reef Sharks (*Carcharhinus amblyrhynchos*), on Neptunes and Vamizi Island

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Understanding the residency and movement dynamics of reef sharks at aggregation sites is central for regional management in the Western Indian Ocean given concerns over their population status. At Neptune's Arm (11° 5.941'S 40° 43.071'E), south of Vamizi Island, Quirimbas Archipelago, Mozambique, a previously undocumented aggregation of grey reef sharks (*Carcharhinus amblyrhynchos*) occurs, potentially representing a unique site for this species in the region. Currently, the area is subjected to artisanal fishing pressure but the extent of this threat has yet to be established. To investigate the population structure (numbers, sex and size) and presence of sharks at Neptunes and surrounding reefs, a combination of direct observations of SCUBA divers, ultrasonic telemetry and satellite archival tags are being used.

Scuba diver observations confirm that the aggregation is composed primarily of female sharks including both juveniles and pregnant females. Relatively large aggregations of up to 30 individuals occur with the peak aggregation time between August and October. A preliminary ultrasonic telemetry and satellite tagging (PSAT) study was initiated, and three receivers were deployed at Neptune's Arm and on an adjacent reef from October 2014. Two of three acoustically tagged sharks have been present at the site from October to March 2015, suggesting the sharks may be more resident at the site but reside at depth during the summer. A single PSAT attached to a pregnant female shark for one month in October popped off at the same location as tagging on Neptunes. The shark occupied an average depth of 20m but undertook multiple dives >100m with the deepest to 222m. A monitor located on a reef in a community no take fishing zone will be downloaded in the near future to examine connectivity between these localized reef systems.

POSTER

Seasonal occurrence and morphological description of the stages observed in the life cycle of the epiphytic filamentous algae *Polysiphonia* sp., parasite of the farmed seaweed *Kappaphycus alvarezii* in Madagascar

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With the increase of seaweed farming activities these last years, EFA (Epiphytic Filamentous Algae) disease appeared in many regions of Madagascar. The present

study characterizes the structure and ultrastructure (SEM and TEM) of the stages observed in the life cycle of *Polysiphonia* sp. and gives the results of a monitoring of 18 months made in three *Kappaphycus alvarezii* farming sites of the South West of Madagascar. TEM was also used to analyze the ultrastructure of the cortex in infested *K. alvarezii*. Five stages have been observed in the life cycle of *Polysiphonia* sp.: (i) the infesting stage, a small dark spot observed at the surface of *K. alvarezii*, (ii) the male gametophyte stage where individuals bear spermatangia, (iii) the female gametophyte stage where individuals have cystocarps, (iv) the tetrasporocysts where some thalli present spore tetrads and (v) the undifferentiated stage where individuals show normal thalli without sexual differentiation. The symptoms due to rhizoid implantation are the breakdown of the cell wall of cortical cells and the disappearance of extracellular matrix in *K. alvarezii*.

EFA infestation was never recorded in Sarodrano but well in the two other villages (Lambohara, Tampolove). Prevalence of infestation varied from 40 to 100% and the rates of infestation from 42 to 78 epiphytes cm⁻². Prevalence of infestation showed significant seasonal variation and a between-sites variation; the rates of infestation were not significantly different between sites and did not vary with the period. The various stages were present in cold and warm seasons. The supposed ways of infestation between *K. alvarezii* individuals in an infested field and from infested to healthy fields are discussed at the light of the present results.

ORAL- Thursday – Amadiba- 1420

Understanding the use of Science in Marine Protected Area decision making in the Western Indian Ocean

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In marine and coastal systems, marine protected area (MPA) managers, like other decision makers, are frequently confronted with the need to make major decisions in the face of high system complexity and uncertainty. MPA managers require critical information to enable them make decisions, yet very little is known of how MPA managers access, adopt and apply scientific information for decision making. The Western Indian Ocean (WIO) has more than 100 MPA sites over which some form of management exists. However, there is evidence that management decision in most of these MPAs is not science-based. We hypothesized that one contributing factor to this issue is that critical information for decision making is often not readily available or accessible to managers, or not presented in a usable form. To determine the type of information valued and used by MPA managers, we distributed an electronic survey to 70 MPA managers in the WIO from which 46 responded. Information types considered most important in current management decision-making were: ecological monitoring data (87%), agency policy (85%), information from stakeholders (78%) and past experience (78%). Least used were websites, but this was still considered very important by 37% of managers. Majority of managers prefer to receive scientific information as written data summaries (73%), databases (63%), and as scientific publications (54%). Scientific data was found to be only partly available to managers (70%). Information accessibility and use was hindered by budgetary constraints, poor communication from scientists to managers, and low staff capacity. Linking science and decision making in the WIO will require enhancing managers' capacity to interpret and use scientific information and improving packing of scientific information by researchers.

ORAL- Monday- Msikaba 3- 1720

Strategies for survival; migration among artisanal fishers

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Sedentary behaviour is commonly regarded, as the natural state while migration is the anomaly or a problem to be solved. Nonetheless, most of the fishers of coastal East Africa particularly among the Bajuni, Kojani, Macua and Vezo ethnic communities have historically practiced migration. Migration is a more complex phenomenon than “fishers moving to where fish are” as explained by the migrant networks theory and the livelihood spaces concept. This study explores the strategies used by coastal migrant fishers’ in the Western Indian Ocean region as a livelihood strategy. By adopting a modified sustainable livelihoods framework the study uses in-depth interviews and questionnaires to explore the life histories of the fishers in migrant communities,, their motivations to migrate, how these have changed over time and their associated ecological and socio-economic impacts. Results point out that general factors contributing to migration are varied ranging from following fish to more complex natural, economic and social factors. While natural factors are resource related economic factors relate to prospect of better markets and prices for fish and the possibility to save money while away from home and invest back in fishing or family projects. Interactions of such factors as well as the vulnerability context of fishers and the resulting livelihood implications have been instrumental in shaping fisher migration into an important livelihood strategy. Consequently, fishers’ migration should be seen in light of how people succeed or fail in sustaining their livelihoods in the face of natural and socioeconomic perturbations. This understanding is critical in the design of policies and interventions necessary to ensure resource sustainability and secure fishers livelihoods.

POSTER

Species and size selectivity in Kenyan multispecies and multi-gear artisanal coral reef fishery

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The species composition and length frequency analysis of the artisanal reef fishery catch from the Kenyan South coast was investigated. The artisanal catch comprised of over 70 reef and sea grass associated species representing 34 families. Despite the large number of species caught, the catches were dominated by 15 species making up 91% of the overall abundance and 70% by weight of the total catch from all gears. Species selectivity by gear

was determined by a classification analyses (hierarchical agglomerative clustering) based on a similarity matrix from a transformed abundance data of the fish species by gear. At a similarity of 82%, the cluster dendrogram identified six groups determined by the selectivity of the various gears towards the key species studied. The basket trap and spear gun overlapped in their species and size selectivity but differed from the hook and line. Overall the beach seine landed the smallest individuals in the catch but cumulatively the basket traps targeted similar size range with at a higher abundance than the beach seine while the ring net targeted the largest individuals in the catch. Length-frequency analyses identified between 3-5 age-class modes an indication of high exploitation for the younger cohorts in the population. Nevertheless, the exploitation rate for most of the species has remained below the 0.5 thresholds except for the *Leptoscarus vaigiensis*, an indication that the system is not overfished. Our study reveals that the species and size overlap in the fishery could be attributed to the fact that fishers are able to adapt their fishing techniques and strategies to target if not all but significant components of the fishery. This puts a major challenge to managers as the current regulations focusing on gear restriction is not adequate to manage this complex fishery.

POSTER

PHYTOBANK: a promising source of active compounds to develop new biotechnologies using tropical marine microalgae from South West of Indian Ocean

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Created in 1990 the PHYTOBANK aims to explore and promote the biodiversity of microalgae from Reunion Island (French department) and South West of Indian Ocean. Our original bank gathers 160 strands of tropical marine microalgae isolated from diverse habitats, among them are many cyanobacteria and benthic species representing a great source of active compounds. Through collaborative research projects, we investigate their phytochemical profile to develop innovative applications in the field of biotechnologies.

As an example, the European-funded and multi-disciplinary project BIOPAIN TROP was launched in 2012, in order to develop ecological antifouling paints based on natural compounds with anti-adhesive properties isolated from the microalgae of the PHYTOBANK. To that purpose, the anti-adhesive activity of 50 strands was tested with microplates and flow-cell techniques. At that point, 5 strands belonging to different algal classes have been selected for their ability to reduce bacterial biofilms. Next, they will be produced at pilot volumes and integrated into ecological paint matrices. For the final step of the project, the new paint formulations will be evaluated with one year-long in situ immersion tests, both in temperate and in tropical marine environments, and ecotoxicological tests will be performed on marine temperate and tropical organisms to assess their neutral effect on the environment.

Through such projects we hope to bring new insights on the biotechnological potential of microalgae from coral reefs and other tropical marine ecosystems.

POSTER

Ciguatoxins in sharks – overview of a recent state of knowledge carried out by ANSES (the French food safety agency)

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In December 2013, ANSES (the French Agency for Food, Environmental and Occupational Health & Safety) set up a Working Group to provide the current state of knowledge about the contamination of sharks, especially tiger sharks (*Galeocerdo cuvier*) and bull sharks (*Carcharhinus leucas*), by ciguatoxins regarding occurrence, analytical methods, human outbreaks and ethology of the sharks.

The WG carried out a literature search on human outbreaks associated with the consumption of shark from 1873 to the most recent cases reported in November 2013 and February 2014 in Madagascar (Indian Ocean). After a review of the analytical methods available (in vivo mouse bioassay (MBA), in vitro cell based assay (CBA), competitive receptor binding assay (RBA), immunological tests, physicochemical analysis), the WG highlighted their strengths and weaknesses for reliable ciguatoxin detection in sharks with regards to the complexity and variability of this toxin family. To better characterize the level of contamination of shark meat by ciguatoxins, the WG suggests a combination of biological and physicochemical methods (e.g. MBA, neuro-2a CBA or RBA and, in case of positive results, LC-MS/MS to confirm the presence of known toxins). A research program has also been launched in spring 2014 to analyse samples of sharks i) from La Réunion (a French island in Indian Ocean) by neuro-2a CBA (MBA results already available) and ii) from Madagascar (samples of the shark associated with a human outbreak in November 2013) by MBA and neuro-2a CBA. Conclusions of the WG and results of this research program will be presented

ORAL – Monday - Amadiba-1500

Density and survival rates of juvenile scleractinian corals and their seasonality in Unguja Island, Zanzibar, Tanzania

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Knowledge of recruitment pattern is vital in determining the effects of past and ongoing stresses as well as in

predicting reef recovery. However, there is limited information regarding coral recruitment in Tanzania. This study investigated the seasonal density and survival rate of juvenile corals among reef sites, and among habitats in three reef sites; Chumbe, Changuu and Mnemba in Unguja Island from October 2010 to June 2012. The density assessment and survival monitoring were done in situ in permanent quadrats, and using supplemental random quadrats for juvenile corals density assessments. Juvenile coral density (juveniles/m²) was highest at Changuu (16.4) and lowest at Mnemba (10.3), with more juvenile coral abundance on reef crests and on reef flats at Chumbe and Changuu, and on the reef slope at Mnemba. Among the 38 observed juvenile coral genera, *Acropora* at Chumbe (5.27 m⁻²), *Porites* at Changuu (4.7 m⁻²), and *Pocillopora* at Mnemba (2.8 m⁻²) made significant relative contributions to their respective reefs sites. The survival of juvenile corals was significantly higher at Chumbe (78%) compared to Changuu (70%) and Mnemba (60%) reefs. Highest juvenile survival rate was on reef slopes at Chumbe and Mnemba and on reef crest at Changuu. *Acropora* at Chumbe reef (81%) and Changuu reef (79%) had the highest survival rates. By contrast, *Favites* (67%) showed the highest survival rate at Mnemba. More juvenile corals were observed during northeastern monsoon (NEM) for Chumbe and during the southeastern monsoon (SEM) for Changuu and Mnemba. Juvenile corals survival was higher in NEM at Chumbe (84%) and Changuu (71%) relative to SEM, 72% and 68%, respectively, and was higher during SEM (64%) than NEM (57%) at Mnemba. The results showed that more juvenile coral corresponded with areas with little competition for space, with high survival rates in calmer areas within reefs and seasons

ORAL- Monday – Msikaba 2 – 1420

Re-evaluation of the distribution of mangroves in South Africa

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Along the eastern coast of Africa, mangroves are distributed from Somalia (2.03° N) to South Africa (33.00° S). Mangrove distribution is restricted by temperature, but on a regional and local scale; rainfall, tidal inundation and river flow influence patterns of distribution and biomass of mangrove forests. Climate change has already influence biodiversity patterns with some species recording ranges shifts (altitude and latitude) due to changing climates. The coastline of South Africa extends from the mouth of the Orange River (west coast), to Kosi Bay at the Mozambique border (east coast). In South Africa, mangrove trees are larger in the north (26.00° S) becoming smaller in southern estuaries. In 1982 mangroves extended from Kosi Bay to Nahoon Estuary in South Africa. The aims and objectives of the study were to revise the distribution limits of mangroves in South Africa taking into account both planted and natural forests. It is expected that since 1982, new forests have been established. Estuaries considered for this study were from Kwelera to Kariega Estuary to determine if previously planted forests and new forests existed. A 3m×3m quadrat was used to determine population structure. Physical and sedimentary characteristics were measured and data loggers were placed in each mangrove forest to record temperature hourly. Overall results show that mangroves are expanding in some areas and environmental conditions make it possible for them to survive. Trees at the most southern forests (33°13'32" S; 27°35'01") were reproductively active and producing propagules. In order for

mangrove forests to survive a number of factors need to be in place such as propagule production and dispersal as well as stability in physico-chemical factors. This presentation will define the new southern limits of mangroves on the east coast of Africa and will discuss the implications of this on other estuarine habitats

POSTER

Heavy metal contamination in corals from Isimangaliso and Aliwal Shoal Marine Protected Areas, South Africa

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Little is known concerning the accumulation of heavy metals in corals from the Indian Ocean. Previous studies from Africa were from the Red Sea. Heavy metals have been found in corals all over the world, but this study, as far as we are aware of, is the first from South Africa. Corals are prey to various reef fish and invertebrates, indicating the potential of bio-accumulation of heavy metals in coral reef food webs.

During June 2014, we collected samples of four genera of soft coral (Sarcophyton, Dendronephthya, Eutherobia and Sinularia) and five genera of hard coral (Fungia, Montipora, Stylophora, Pocillopora and Dendronephyllia) from two localities: (1) Sodwana Reef is located in the North of KwaZulu-Natal and is a popular tourist diving site, and (2) Aliwal Shoal, 100 km South of Durban. The largest SAPPI factory is located on the shores of the Umkumaas River and effluent is pumped out to sea through a 6 km pipeline that ends up north of the shoal. Because of this point source of potential contamination, we predicted that Aliwal Shoal will have a higher concentration of contaminant metals in the coral tissue due to its proximity to industry relative to the corals collected at Sodwana — a World Heritage Site.

We analysed the coral samples for heavy metals, including Hg, Pb, Zn, Cd, Mn and Ni, with ICP-AES, and will discuss the implications of the results.

ORAL- Monday- Msikaba1- 1200

Connectivity of *Perna perna* populations between Madagascar and South Africa

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The terrestrial biota of Madagascar are characterised by a large number of endemics. This divergence has not been mirrored in the marine environment, with many organisms apparently shared with the east coast of Africa. This would suggest that, unlike the terrestrial system, a level of genetic connectivity persists. A proposed mechanism for this connectivity is transport by large open-ocean eddies. Conservation of potential vorticity of the southern East Madagascar Current and a change in seafloor topography result in the generation of cyclonic and anticyclonic eddies. *Perna perna* has a relatively long larval period

(15-20 days) and it is suggested that, like other members of the Mytilidae, it is able to delay settlement for up to three months during unfavourable conditions. This, and its ability for substrate attachment, makes it an ideal candidate to investigate connectivity between Madagascar and south east Africa.

Perna perna samples were collected from south east Madagascar and six sites along the South African coastline (Sodwana to Cape Town harbour). Next Generation Sequencing (NGS), through the implementation of short read sequencing, was used to identify over 250 single sequence repeats (SSRs). 53 primer sets have been developed for the SSRs with the highest confidence. Such high-throughput sequencing and associated data output will allow for high resolution of *P. perna* populations dynamics, beyond the scope of classical molecular methodologies

POSTER

InteGRADE – a novel approach to linking research, training and networking in marine science

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The Western Indian Ocean region (WIO), particularly its coastal nations, face dual challenges of striving for sustainable environmental management under human pressure, and being subject to a range of policies and priorities on shared resources. Regional approaches and the flow of information through scientific networks are therefore crucial. With a solid foundation, the WIO states could even play a pioneering role in international cooperation on ocean and coastal management through effective networks of scientists, and their link to policy making. InteGRADE (INternational inTEnsive Southern training proGRAMme and network DEvelopment for marine and lacustrine scientists) is a new research, training and networking project supported by the VLIR-UOS (Flemish Interuniversity Council – University Development Cooperation). Similar training programmes at MSc level have been active in various forms since 1984, and these have trained many marine scientists worldwide. The organizing consortium of InteGRADE (Vrije Universiteit Brussel and Universiteit Gent), in collaboration with the State University of Zanzibar (SUZA) and WIO regional partners are organizing an InteGRADE training workshop

in Zanzibar, using a novel approach of directly linking an active research project with an advanced training regime and networking opportunities. The approach is expected to deliver scientific outputs, while at the same time enhancing the experience level of alumni, and establishing networks of scientists for future collaboration. The main theme of the workshop will be 'Marine Connectivity', which will require multidisciplinary studies linking aspects such as: climate change and coastal integrity; fish stocks and shared fisheries; oceanic migration and larval recruitment; ecosystem connectivity, oceanic pollution and ocean currents. Emphasis will be on novel approaches of data gathering, data treatment and data analysis and on integration of disciplines into final reporting.

POSTER

The effect of extended mouth closure on the St Lucia prawn community: Is there a way back?

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The mouth of Lake St. Lucia, the largest estuarine coastallake in southern Africa, has been closed since 2002, except for a seven month period in 2007, when the mouth was breached by Cyclone Gamede. Mouth closure resulted from a regional drought and water deprivation through catchment related anthropogenic influences. Extended mouth closure resulted in low lake levels and development of hypersaline conditions. Prawns were sampled at two sites each in North Lake, South Lake and the Narrows, using a small and large seine, in summer 2004 and biannually (summer/winter) from May 2006 to May 2012. Seven Penaeidea and seven Caridea species were recorded, of which *Palaemon p. cificus*, *P. peringueyi*, *Penaeus indicus* and *Metapenaeus monoceros* were most dominant (93%, 3%, 2% and 0.35% of abundance, respectively). During the initial closed period (2002–2007), there was a rapid decline in the number and abundance of freshwater, estuarine and marine species, due to increases in salinity and decreasing water levels, as well as the curtailment of recruitment from the marine environment due to the closed mouth. Temporary mouth opening in March 2007 resulted in a large influx of marine species, predominantly *P. indicus*, with a subsequent decline in abundances after mouth closure in August 2007. Flooding connections from the adjacent Mfolozi-Msunduzi River system during 2008, 2009 and 2010 slightly increased the numbers of marine Penaeids and freshwater Caridina. This highlights the dependence of marine prawn recruitment on a regular link to the marine environment, the absence of which will lead to a total collapse in prawn stocks. Recruitment breakdown has led to the closure of the offshore Thukela Banks Prawn Fishery due to the loss of the extensive nursery function provided by the system.

ORAL- Wednesday – Msikb 3- 1440

Chemical composition of some common seaweed species from the Kenya coast

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The proximate composition of 34 seaweed species from the Kenya coast was investigated to evaluate their nutritional value as food ingredients in fish feed. The proximate constituents (crude protein, nitrogen free extract (NFE), crude fat, crude fibre and ash levels) of the seaweeds were determined according to the standard AOAC methods of analysis. The NFE was the most abundant chemical component ($42.09 \pm 0.83\%$ dry wt) for all the seaweed species whereas the crude fat ($1.81 \pm 0.04\%$ dry wt) was the least obtained ($p < 0.05$). The mean percentage (dry wt basis) of crude protein, crude fibre, and ash were 10.09 ± 0.26 , 14.08 ± 0.26 , and 31.94 ± 0.78 , respectively. The chemical constituents of the seaweeds varied significantly among algal divisions, months and sites ($p < 0.05$). The relationships between the nutritive components are also presented. The findings obtained from this study demonstrated that some seaweed species could be potential good sources of protein, fat and fibre for human and animal nutrition.

ORAL- Thursday- Amadiba- 1200

Genetic variability of *Siganus sutor* (Family: Siganidae) populations through analysis of the mitochondrial D-loop along the Kenyan coast

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Rabbitfishes (*Siganus sutor*) of family Siganidae, an economically core group of herbivorous fish constituting 31% of total reef fish landings; a source of proteins and valuable commercially. The average catch per fisher is 4.03 kg. Genetic diversity is an important marker of ecological status in aquatic ecosystems, a powerful tool that evaluates biological communities. Currently, most studies in the WIO are ecological or biological but rarely genetic. The objective was to assess the genetic diversity of *Siganus sutor* along the Kenyan coast based on mitochondrial DNA control region sequences. 141 fish were sampled from thirteen landing sites along the 650 km² coastline (4 - south and 9 - north) an average of 35 km between sites. Overall data was pooled into five groups (Lamu, Malindi, Kilifi, Msambweni and Shimoni). 811 base pairs long D-loop fragments were amplified and sequenced using Sanger method. The overall number of polymorphic sites in sampling sites was 149. High genetic diversity at population level inferred from 153 mutations from which 86 haplotypes with haplotype diversity of 0.98 were

identified. The nucleotide diversity (per site) was 0.02. Overall differentiation among populations was low ($F_{ST}=0.04855$) suggesting that this species freely bred with other individuals in the population along the Kenyan coastline. AMOVA revealed most genetic variance present within populations (81.34%), rather than among populations within groups (2.60) and among groups (2.38), consistent with high levels of genetic similarity between populations. Tajima's D values suggested presence of significant excess of low frequency polymorphisms especially in Shimoni, Msambweni and Kilifi (-2.09, 2.09 and -0.69, $P < 0.05$) respectively. This indicated a recent Kenyan population size expansion whereas the north coast showed the signature of a more stable population. Using genetic tools in will provide an important baseline of fish species resulting in understanding the stock status and management through regulating harvesting profiles.

POSTER

Market structure and participation in trade in octopus, mixed reef fish and small pelagics in Kenya and Mozambique: A value chains approach

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Reef fisheries are known to be important for food and livelihoods of coastal communities in the Western Indian Ocean (WIO) region. Even for small scale fisheries, fish is highly traded and it is the structure of the marketing system that determines who benefits from this ecosystem service either by eating fish or earning money from selling it. The degree to which different people can benefit from them depends on the structure of the value chains. In spite of their critical role in supporting livelihoods, most fisheries research in WIO has focused on the ecological basis of fish production or on the activities and catches of fishers; little empirical information exists regarding access to trade and implication on wellbeing.

We mapped the structure of value chains of octopus, and mixed reef fish and small pelagics and contrasted their market characteristics including, structure, identity and role of different actors in the chain, volumes, prices, and commodity differentiation at each node. We also made a preliminary assessment of how market power and value-addition is shared amongst the market chain actors. Our methods were based on observation, key informant interviews (n~100), and a survey of representatives of each node (n~700) at representative coastal sites in Kenya and Mozambique.

Preliminary results, which seek to answer questions related to market structure points to a complexity in the marketing system of octopus, mixed reef fish and small pelagics. The complexity is evident in terms diversity and contrast in the value chain structures of respective fishery types, the extent of marketing channels, diversity in actor composition and categories, as well as specific functions at each node including product differentiation. All these dynamics play an important role in determining market power. The results are particularly important in providing an understanding between access to and benefits from ecosystem services.

ORAL- Monday- Msikaba 2 -1500

Temporal variation in vegetative and reproductive phenological traits of mangrove species

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Mangroves are highly reproductive ecosystems globally. However, they are threatened by anthropogenic factors and climate change especially sea level rise. Phenological trends of mangroves over a period of time are good indicators of the likely effects of climate change on different species. Vegetative and reproductive phenology of *Rhizophora mucronata*, *Ceriops tagal* and *Bruguiera gymnorrhiza* belonging to the family Rhizophoraceae was studied in Dabaso, Kirepwe Island and Uyombo mangrove forests in Mida Creek, located within the Watamu National Reserve in Kenya. Litter fall data was collected monthly on randomly established 10 × 10m plots from July 2010 to July 2012 in mono and mixed species stands. Litter collected was analyzed for leaf, stipules, flower, propagule fall and length of aborted propagules. Results indicate that leaf growth occurred throughout the study period for all species. Peak months of leaf fall in *R. mucronata* varied within sites, but were within the wet season. Peak leaf fall in *C. tagal* occurred during the dry season and peak months varied within sites. Leaf fall in *B. gymnorrhiza* had no distinct peaks. Reproductive phenological trends of the three species varied within sites in terms of timing and peak production months. Fall of propagules was in the dry season for *C. tagal* and *G. gymnorrhiza*, whereas for *R. mucronata* it occurred during the wet and dry season. Propagule production depended on productivity of the stand in the previous year. Abortion of small sized propagules was high in all species indicating that fewer propagules reached maturity stage. Longest abscised propagule measured 40.5cm, 30cm and 28cm for *R. mucronata*, *C. tagal* and *B. gymnorrhiza* respectively. Observed differences could be site and/ or tree specific illustrating that phenological traits of mangroves are highly elastic and slight changes in environmental factors could trigger different phenological responses among species

POSTER

Mangrove forest accessibility and its impact on stand structure

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Mangroves are active carbon sinks and play a major role in climate change mitigation. However, with increase in population, mangroves have been and continue to be threatened by anthropogenic factors which have led to their degradation. Provision of goods and services derived from this ecosystem is threatened. In Kenya

mangrove destruction is happening at an alarming rate despite increased sensitization on benefits of mangrove conservation. The aim of this study was to investigate the impact of human proximity and ease of access to mangrove forests on stand structure in a protected area in Mida creek, Kenya. The study was carried out in ten monospecific and mixed mangrove stands in three study sites in July 2010- July 2012. Study plots measuring 10 × 10m were established in each stand. Tree height, DBH, cut tree stumps and species type was recorded to determine the stand structure. Stands closer to human habitation had only one size class as opposed to those located further which had various size classes. Monospecific for *R. mucronata* stands close to human habitation had trees with a DBH greater than 25cm, whereas those in an Kirepwe Island, monospecific for *S. alba* and *R. mucronata* had trees with a size class distribution ranging from 10-25 cm and 0.5- 25cm respectively. Mixed stands closer to human habitation had fewer tree class sizes than those further away in the same study sites. Highly preferred *R. mucronata* had few or no trees with lower size classes' even for stands far from human habitation. Many cut tree stumps were observed in near than far away mangrove stands. Stand density was high in stands far than nearer human habitation. These findings have management implications for both protected and open access mangrove in regard to conservation of forests close and far from human settlements.

ORAL- Thursday – Amadiba – 1720

PREPARING FOR CLIMATE CHANGE: A Climate Development Future for Coastal Kenya

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The functions and the structure of coastal areas and ecosystems in the Western Indian Ocean states have been affected by climate change. In the recent times, policy makers are having to make choices as to which activities to prioritise in order to minimize the impacts and the losses brought about by climate change. Climate change often complicates the choice national policy makers must make between supporting development activities or those that support adaptation or mitigation. The Climate Compatible Development (CCD) concept suggests that it is possible to make a choice that considers all these aspects in order to achieve triple wins. CCD is an integrated strategy that focuses on “development that minimises the harm caused by climate impacts, while maximising the many human development opportunities presented by a low emissions and a more resilient future”. Climate compatible development further asks policy makers to consider ‘triple wins’ strategies that encourage low emissions development that in turn will lead to a low carbon climate resilient development. In Kenya, for CCD to be realized, both institutional and legislative support are needed. A desktop literature review has revealed that many current policy approaches already have the potential to contribute to mitigation, adaption and development.

Existing mechanisms such as Payment for Ecosystem Services (PES), Environmental Impact Assessment (EIA) and Integrated Coastal Zone Management (ICZM) framework, among others, offer a good launching pad for climate compatible development. However, the challenge of coordinating their implementation remains. This paper explores in detail some of the existing mechanisms that can be used by the country to help achieve CCD.

POSTER

Identification and bioactivity of endophytic fungi isolated from disturbed and non-disturbed mangrove forests in Kenya

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Endophytes are receiving attention as potential sources of useful natural products, such as biopesticides. Mangroves are intertidal forests, with medicinal value and a number of natural products of importance have been isolated. Elsewhere, mangrove endophyte extracts have been shown to suppress bacteria, fungi and invertebrates, however, endophytes from Kenyan mangroves are undocumented. Physical chemical data from the upper, mid and lower intertidal zone at disturbed (Mikindani) and relatively undisturbed (Mida) mangrove forests were analysed. Plant specimens were collected, surface sterilized pure endophyte isolated and bioactivity analysed. Canopy cover at the undisturbed mangrove forest ranged from 80 to 97 % (average 87 %) while at the disturbed site it ranged from 10 – 90 % (average 55 %). Human disturbance at mikindani affected the forest structure which was dominated by *Avicennia* and stunted trees while undisturbed sites was dominated by *Rhizophora* and *Ceriops*. Endophytic fungi and bacteria from the mangroves were isolated. The fungal endophytes were classified in the genus *Fusarium*, *Alternaria*, *Aspergillus*, *Penicillium* and *Mycelia* sterile using phenotypic and microscopic characteristics. The bioactivity of the fungal endophytes was examined and a number of isolates exhibited antibacterial properties. Preliminary screening for the bioactivity indicates that there exists no correlation between human disturbance and endophyte diversity and potency of bioactive extracts. This study showed that fungal endophytes are readily isolated from the mangrove species and that these exhibit promising bioactive properties. Thus, endophytes from mangrove forests may be a useful source of novel bioactive compounds.

ORAL- Monday- Amadiba- 1140

The phylogeography of the scleractinian coral, *Anomastrea irregularis*, along the KwaZulu-Natal coastline using mitochondrial sequence data

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Anomastrea irregularis is currently listed as ‘vulnerable’ on the IUCN Red List of Threatened Species. However, no species specific population data exists to confirm this classification. The mitochondrial cytochrome c oxidase I marker was sequenced in order for species level confirmation

and to ascertain the levels of genetic structure, variability and gene flow within and between populations of the stony coral, *A. irregularis*, along the KwaZulu-Natal coastline. Populations were sampled from (north to south) Mabibi Beach, Adlams Reef, Sheffield Beach, Park Rynie Beach and Southbroom Beach. A phylogeny of scleractinian corals was constructed to assess the relation of *A. irregularis* with respect to other Scleractinia. Mitochondrial COI data confirmed the presence of a single, panmictic species. No genetic structuring exists for the *A. irregularis* populations studied and gene flow between populations was significant. However, the population at Sheffield Beach was found to be partially isolated from northern KwaZulu-Natal *A. irregularis* populations with a larger genetic distance and lower indices of gene flow and polymorphism percentage. Further research is necessary to elucidate and quantify the possible mechanisms, thought to be deflection by the Natal Bight, to provide a greater understanding of the restricted gene flow in populations affected thereby. This study suggests, taking into consideration that additional research is needed, that the IUCN classification of *A. irregularis* should be re-evaluated.

POSTER

Phylogeography of the Bull Ray (*Pteromylaeus bovinus*) along the KwaZulu Natal coast line.

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Pteromylaeus bovinus, more commonly known as the bull ray, is a chondrichthyan that belongs to the family Myliobatidae. The life history traits of chondrichthyans make them particularly vulnerable to fishing which cause low population growth rate. These traits include long gestation periods, long-lived species, low productivity, late sexual maturity and high amounts of maternal investment. Their populations have been overfished and habitats destroyed. The Information on the health status of *P. bovinus* worldwide is especially limited. The International Union for the Conservation of Nature (IUCN) has globally assessed the bull ray as 'data deficient' as it has clearly been poorly monitored. The lack of data on bull rays in South Africa and all over the world is distressing as the above total catch of chondrichthyans by the FAO in 2003 was +- 850 000 tons which suggests that population declines are not unlikely. The proposed study aims at determining the phylogeography of *P. bovinus* along the KwaZulu Natal coast line, Richards Bay to Port Edward (+- 350 km), by using molecular techniques. The molecular markers proposed for this study are cytochrome c oxidase subunit I (COI) and exon-primed intron-crossing (EPIC) markers. This information will provide an indication of the health of the species along the coast and will determine if there is more than one population occurring along the coast

POSTER

Understanding green and loggerhead sea turtle population demography through photo identification

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Understanding sea turtle population demography is crucial for making effective conservation and management decisions. However, in areas where financial or human

resources for intensive field sampling programs are not available, collecting these data are challenging. Citizen science monitoring programs can be useful in this situation. Between 2010 and 2014, 840 encounters of four sea turtle species were reported from Inhambane province in Mozambique by recreational divers and researchers. We assessed photos of facial scutes and carapaces from Green (*Chelonia mydas*; 104 submissions) and Loggerhead (*Caretta caretta*; 110 submissions) turtles, resulting in the identification of 22 individual Green and 39 Loggerhead turtles. A modified maximum likelihood modelling approach was used to assess lagged identification rate (RLI), the probability of re-identifying these animals over increasing time periods, to compare the residency characteristics of each species. Green turtles resided in the study area for long periods of time (mean residency time $n=260$ days), whereas loggerhead turtles were transient (mean residency time 0.8 days). These results have significant conservation implications at the study site given the presence of active in-water poaching in Mozambique. A practical evaluation of the quality and quantity of images submitted by citizen scientists will be discussed.

ORAL- Wednesday- Msikaba 2- 1600

Exploring the impact of small gillnets on yield per recruit (Y/R) and escapement spawning stock (ESS) for different fish species - a theoretical exploration

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Using three case study examples of two slow and one fast growing fish species, this study explores the yield per recruit (Y/R), escapement spawning stock (ESS) and megaspawners (MS) remaining in the stock, estimated for gillnets with mesh sizes of optimal capture (LCAP) below and above size at maturity (L50) under different levels of fishing. For all case studies, results suggest that, while Y/R increases with mesh size at the level of full exploitation and beyond, ESS is significantly larger if a small mesh size was used (even if $LCAP < L50$). The fraction of megaspawners remaining in the stock would - under conditions of moderate to extreme exploitation rates - be significantly larger if gillnets of small mesh sizes ($< L50$) were used. These findings are explained by the fact that the vulnerable time to the fishing gear increases exponentially with mesh size, since larger fish need far more time to grow through the vulnerable size window. These findings contradict the general belief that small mesh sizes of gillnets are destructive to the stock, and may explain why in many tropical fisheries a shift towards the use of small gillnets directed to the smaller, highly productive fish species of the system has been observed.

POSTER

Drivers and distribution of effort in an octopus fishery: A case study from Ibo Island, Quirimbas Archipelago, northern Mozambique

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Income from octopus sales is one of women's principal income sources in coastal communities in the Quirimbas Archipelago where women have limited cash-earning options. Yet, throughout the Quirimbas Archipelago there

is increasing pressure on octopus due to increasing market demand, a decline in the fin fishery, and an influx of in-migrant and immigrant fishers. Despite the livelihood value and increasing fishing effort, the octopus fishery is not explicitly addressed in Mozambican fisheries policy. Effort restrictions are the dominant form of management intervention in Mozambique and the WIO. However, they can only be successfully applied with an understanding of fisher behavior.

This paper uses a mix of qualitative social science methods to explore fisher behavior. These include resource user follows and informal discussions, and quantitative octopus catch data collected at three different fishing zones on Ibo Island between 2010-2011 to explore harvesting effort.

The results illustrate the principal drivers that affect fishers' decision to go octopus harvesting on a given day are a mixture of environmental and socio-economic factors. These factors are wind, tide, season, and whether a woman is the head of her household or not. A spatial-temporal analysis of harvesting effort reveals that on a monthly basis, women tend to space themselves in proportion to resource abundance, however on a daily basis this pattern is not as strong.

This information on spatial temporal use of the octopus fishery will help inform fisheries managers of i) the periods of year when women use octopus most; ii) the zones that are used most, and which are most productive; iii) periods of time and zones that could be most appropriate for temporally closed zones with minimal effects on women's livelihoods.

POSTER

Coral Reef Conservation in Zanzibar: Current status and outlook for the near future

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Coral reef conservation initiatives in Zanzibar, Tanzania have traditionally been driven by the Government, with occasional short-term support from regional and international organisations. However, a recent trend has been for non-government actors to initiate their own coral reef and other coastal resource conservation and management programmes. It so happens that there is no central database or monitoring base or body for these activities, a mechanism which could inform management and other stakeholders on opportunities for collaboration as well as connecting the projects to possible funding opportunities or interested donor agencies. It would also help reduce duplication of effort and identify needs and priority areas (perhaps in line with national development goals and objectives). Another recent development is the push by the Indian Ocean Commission, through its ISLANDS and (the new) Biodiversity projects, to reanimate national coral reef monitoring bodies and expand networking with other nations in the region, thus forming a Western Indian Ocean reef network. This paper tries to list the various coral reef monitoring and conservation programmes currently in place in Zanzibar, explores who the actors are, and discusses the Zanzibar Coral Reef Monitoring Network, its history, activities undertaken and potential role in coordination of the various conservation projects undertaken in the area. It also looks at the legal and political implications of this, particularly with reference to the Zanzibar Marine Conservation Unit regulations of 2015.

ORAL- Wednesday- Msikaba 3-1400

Characterization of agar extracted from *Gracilaria* species collected along Tanzanian Coast

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In Tanzania the demand of agar is growing rapidly due to increased number of biotechnology and microbiology laboratories. Despite of being a home of several species of seaweeds which are the major raw material for agar production, the supply system depends wholly on importation. The characteristics of agar produced from three *Gracilaria* species (*G. Salicornia*, *G. Edulis* and *G. Corticata*) from Dar es Salaam, Tanga and Zanzibar coasts were studied. Moreover the effect of spatial variation, alkali treatment and the volume of extraction on total yield and gel strength were also studied. 25g of treated and 25g of untreated samples were used for agar extraction, 350ml of 20% of aqueous NaOH was used for alkali treated experiment and the gel strength was measured using gel strength tester. The mass yield varied significantly between species and sites, where p-value was < 0.05 . Both treated and untreated *Corticata* showed highest yield of $27 \pm 0.7\%$ and $26.2 \pm 1.3\%$ respectively, followed by *Salicornia* then *Edulis*. *Salicornia* from Zanzibar showed highest mass yield ($22.9 \pm 4.3\%$ for treated) followed by those from Tanga. Varying the volume of distilled water used for extraction showed no significant different in mass yield where p-value was > 0.05 , the highest mass yield recorded at 1500ml ($23.7 \pm 5.3\%$ for treated), and the smallest mass yield was at 500ml. Gel strength also varied significantly between species and sites where p-value was < 0.05 . The highest gel strength was recorded from treated *Salicornia* collected from Tanga ($495 \pm 29.5 \text{g/cm}^2 \text{s}^2$). Sample from Tanga show highest gel strength followed by Zanzibar then Dar es salaam. The volume of distilled water used for extraction showed no significant different in gel strength where p-value was > 0.05 . The study showed some promising results toward replacing highly expensive imported agar with local available resources.

ORAL- Wednesday- Amadiba- 1140

Visualizing research landscapes associated to coral reefs at the Indian Ocean: a bibliometric approach

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Coral reefs are important hotspots for marine and oceanic biodiversity. Against climate changes and anthropogenic pressures, this ecosystem is facing risk of disappearing, raising concerns about which management strategies should be implemented. Considering that management strategies need to be based on scientific evidences, extensive research has been undertaken with the list of publications increased year after year. This reality happens in every seas and the Indian Ocean is not an exception. Unfortunately, no extensive study has been conducted to provide a broader picture of the trends in publication and

major research patterns at the region. This paper presents the first bibliometric analysis of research associated to coral reefs at the Indian Ocean, providing a map of relationships of terms used, authors' networks and major research lines and trends. To do this, the Web of Science database was used to retrieve publications associating the terms "coral reefs" and "Indian Ocean" and with support of the VOSviewer program key terms were identified and co-occurrence frequencies were calculated. 955 peer-reviewed publications related to coral reefs at the Indian Ocean were retrieved from 1971 to 2014, of which 752 were used in this study. Most publications were articles (n= 635; 84.8%) published in journals such as Coral Reefs (n = 51; 6.8%), Marine Ecology Progress Series (n = 41; 5.5%) and PLoS ONE (n= 27; 3.6%). Most papers were produced by researchers based or associated to Australia (n = 133; 17.8%), the United States of America (n = 101; 13.5%), France (n = 90, 12%) and the United Kingdom (n = 77, 9.3%) and were concentrated around 4 main research clusters (i) the population structure, phylogenetic relations and diversity, (ii) structural dimensions, growth rates and oceanographic parameters, (iii) climate change, environmental attributes and species responses and (iv) ecosystems, protected areas and ecosystem services. These results can support decision-makers to target better approaches for the management of coral reef ecosystems, establishment of new protected areas and coping with the effects of climate change and anthropogenic pressures.

POSTER

Genetic structure of the knife prawn *Haliporoides triarthrus* with implications for transboundary stocks in the SW Indian

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The knife prawn *Haliporoides triarthrus* is captured by commercial trawl fisheries in the SW Indian Ocean, where it occurs in deep shelf waters across the geopolitical boundaries of Mozambique, Madagascar and South Africa. To investigate genetic stock structure for fisheries management purposes, we sequenced the mitochondrial 16S rRNA (569 bp) and COI (1300 bp) genes and the nuclear ANT gene (237 bp) of 220 prawns collected at six sampling sites. The mtDNA displayed high haplotype diversity, and no haplotypes were shared between samples from the African shelf and those from Madagascar. AMOVA revealed significant genetic differentiation among samples from individual sites, by country grouping, and across the Mozambique Channel. The ANT gene showed fewer mutations and less structure than the mtDNA. Mismatch distributions and Fu's F_s suggest recent demographic expansions, with coalescence estimates of ~65 000–171 000 years ago, coinciding with late Pleistocene glaciations and sea-level changes. Phylogenetic analysis of the COI gene showed that African shelf and Madagascar samples grouped into distinct clades, separated by ~2% sequence divergence, and that they may be considered sister species. The strong signal of genetic differentiation across the Mozambique Channel and between country groupings, in combination with published information on morphological and life history variability, support a finding of separate stocks, which could be managed individually.

POSTER

Reproductive strategy gives rise to genetic structure in the langoustine *Metanephrops mozambicus*

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The langoustine *Metanephrops mozambicus* is widely distributed along the upper shelf-edge of the SW Indian Ocean, where it has a transboundary distribution. Biological studies have shown a short (few hours), or no drifting larval phase, suggesting that larvae do not disperse far from their point of release, and that they settle close to parent populations. Consequently, genetically structured populations would be expected. We sequenced mitochondrial (16S rRNA and COI) and nuclear (ITS) DNA fragments of 220 langoustines collected at six sites in Mozambique, Madagascar and eastern South Africa. All three genes displayed high haplotype diversity, and few haplotypes were shared between African shelf and Madagascar samples. AMOVA revealed significant genetic differentiation between samples from individual sites, by country grouping, and across the Mozambique Channel. Mismatch distributions and Fu's F_s suggest selective neutrality and recent demographic expansions, dated at 36 000–154 000 years ago. The finding of genetically structured populations over short geographical distances supports the hypothesis that larvae settle close to parent populations. The absence of a prolonged drifting larval phase is presumably an adaptation to retain adult populations in an area with strong ocean currents. The apparent isolation of sub-populations suggests that they are vulnerable to local extinction, and a strategy of individual management units is supported. The results from this study are in stark contrast with the standard model of genetic homogeneity expected in marine organisms with dispersive larvae.

ORAL- Thursday- Msikaba 3- 1400

Hydrodynamic Modelling on Transport, Dispersion and Deposition of Suspended Particulate Matter in Pangani Estuary, Tanzania

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The present study was formulated with the aim of using MIKE 21 software in studying the hydrodynamic regime of the Pangani estuary. Water level, river discharge and wind drag force were used as hydrodynamic forcing factors during the model set up. The data set for the model were collected in Pangani estuary during the field campaigns conducted from December 2010 and August 2011. The results indicated that the tidal currents were relatively sluggish (0-0.05 m/s) in the beginning of model simulation. The ebb currents were established from 2 to 7

hours; originating from the inner part of the estuary tended to flow radially (Eastwards, Northwards and Southwards) soon after reaching the river mouth. The radial flow pattern of the ebb tidal currents seemed to be influenced by the funnel shape of the estuary. The flood tidal currents were established after 7 hours. The flood tidal phase started earlier on the southern part of the river mouth compared to the northern and tended to become more intensive on the northern part than on the southern part of the estuary. The currents pattern observed were influencing the transport and deposition of suspended Particulate Matter. The maximum deposition of SPM preferentially occurred about 3 km north and south of the estuary mouth and the minimum deposition occurred in the middle of the estuary mouth. The deposition of SPM was highest during the southeast monsoon relative to the northeast monsoon. Approximately 872.6 kg/m²/year of SPM were brought into the estuary. This implies that, in the long term, the SPM deposition along the River mouth will significantly change the Pangani hydrodynamic regime, from its present condition. Also infilling of navigational channel and alteration of the ecosystems is imminent.

ORAL- Thursday- Msikaba 3- 1200

Wind-driven waves & sediment resuspension in shallow lakes with muddy substrates: St Lucia, South Africa

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Wind-waves in shallow lakes or estuaries with muddy substrates can drive sediment resuspension and cause high turbidities that negatively impact the productivity of photosynthetic organisms. This investigation evaluated the efficacy of simulating suspended sediment concentration (SSC) dynamics using a simple semi-empirical wave model to predict the wave characteristics to be used in a depth averaged SSC model. Lake St Lucia was used as a case study and is the largest estuarine system in South Africa with average depths of about 1 m and fetches up to 10 km. Lake bed composition varies from sandy to muddy with deeper locations predominantly the latter. An array of pressure sensing wave poles was deployed over 20 days to measure significant wave heights and turbidity to compare with model predictions. The influence of wind speed, fetch, fetch-averaged depth, and bed composition on the model's performance were evaluated. The calibrated model performs best during steady high wind events and in muddy regions of the lake. Variability in the overall model's performance can arise due to difficulties in estimating appropriate fetch and depth parameters, complex lake geometry, and variable bed composition especially during changing wind conditions. This model provides a means for spatially explicit prediction of SSC. Models such as this can be used to understand and model the effects of SSC on primary production and other biological interactions, and to improve sediment transport calculations.



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