Causal Complexities In Small-scale Fisheries: Combining Stories And Simulations For Understanding The Social-ecological Dynamics Of Periodic Octopus Closures

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Background
Communities around the Western Indian Ocean are adopting periodic octopus closures as an innovative way to improve livelihoods, economic and environmental sustainability in small-scale fishing communities. Important factors such as information, bylaws, and other design rules are well known however less is known about how these factors interact or how they play out over the short and long term, affecting men, women and other social groups in the communities differently. This research aims to unravel the causal mechanisms for successful closure implementations, i.e., what explains when we see equitable and sustainable outcomes of closures in an archetypal coastal fishing community?

Method
To investigate this, we used multi-methods approach combining participatory fieldwork, expert workshops, and agent-based modeling (ABM). The fieldwork helped us identify key concerns within and across different social groups about the closure intervention, with three case-studies in Zanzibar. The engagement with experts led us to understand the practicalities around introducing and implementing the closure model, in Zanzibar but also through cases throughout the Western Indian Ocean. The key processes that emerged from out fieldwork and analysis, e.g., poaching, patrolling, and who benefits from the closure were designed and included in our ABM. We ran four different scenarios: “baseline”, “lack of patrolling”, “women first”, and “incoming fishers”, analyzing female foot fishers (F) and male divers (D) analyzing their catches and acceptance of the closure over 6 closure cycles (cc; closed 3 months, opened 3 days). Acceptance is the positive or negative feelings held about the closure intervention model (0 … 1 where < .5 neg, >.5 pos). N fishers= 200 (fish in random location in open area or poaching in the closed area when closure closed); N octopuses = 3000 (move based on disturbance from fishing, and to switch dens); Initial acceptance = 0.5.

Results
Our simulations disclose several causal mechanisms, or pathways, in which successful outcomes of closures may emerge. Our “baseline” scenario resulted in fisher’s acceptance of the closure increasing for the 6cc. However, during closed periods acceptance decreased slightly due to fishers not being held responsible for poaching, but then increased during opening as the positive feelings on opening day festivities and
big octopus being caught. Octopus biomass increased in the system compared to the period before closures were implemented, especially in the free shallow area. In contrast our “lack of patrolling” scenario resulted in fisher’s acceptance of the closure decreasing for the 6cc. During closed periods acceptance decreased due to poaching and fishers not being held responsible due to lack of patrolling, and even though acceptance increased during opening as the positive feelings on opening day festivities and big octopus being caught – this was not enough to bring the acceptance to positive levels over all. In all scenarios women caught less because of crowding effects in the shallow areas, compared to the deep areas where divers could fish. Even though women could enter before others in the “women first” scenario, the overall catches in the free reefs were still very low. The “incoming fishers” scenario show that if too many fishers enter at the opening, the women and other local fishers do not benefit at all from the closure, even so they are positive towards the opening and if patrolling is high, they still can be positive towards the closure model.

Conclusion
Our unique approach of combining case-study work, stories, workshops and modeling resulted in a collaborative learning process between involved project participants and through continuous engagement with expert researchers and practitioners. The model will support in-field collaborative learning during June-July 2022, to discuss what successful closure interventions mean to those participating. Results from this field trip will be added to the presentation at WIOMSA. The interactions between poaching, patrolling, gender differences and other factors and processes investigated show the complex nature of how closures may have different levels of success when it comes to who benefits, based on funds for patrolling, who can fish when and where and the intrusion of income fishers attracted to the openings. The main aim of the closure model, to empower coastal fishing communities, is something future versions of this model aims to investigate.