Modelling the Viability of the last viable dugong population off East Africa: Dugongs (Dugong dugon) in the Bazaruto Archipelago, Mozambique

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Decades of qualitative and quantitative surveys in the Western Indian Ocean suggest that dugongs are now restricted to small, isolated, scattered and relict sub-populations. The largest of these is some 300 animals within the Bazaruto Archipelago (BA). This population is under increasing pressure, 18 known by-catches between 2000 and 2016. Consequently, the survival of this, the largest known population in the WIO, south of the Red Sea, is uncertain. PVA modeling statistically predicts whether a population will survive, under a defined scenario of demographic, environmental and stochastic events and natural history variables, all of which may influence survival. We modeled the viability of the dugong population in the BA, where variable impacts; environmental (cyclones) and anthropogenic (by-catch, hydrocarbon exploration/extraction); and their impact on dugongs were statistically assessed. 1. Complete habitat loss, causing extirpation. 2. Fragmentation of the habitat, causing a decrease in numbers, or extirpation. 3. A decline in reproductive success, through stress (habitat loss, hydrocarbon exploration and exploitation, increased competition for food), or death of reproductive females. 4. A decline in number, beyond that sustainable (especially fecund females). PVA modeling, however, depends on the accuracy of input, though much of this is unknown for BA dugongs, for example anthropogenic mortality is known only from what's reported and may be substantially higher. Consequently, several hundred models were run, each for greater than 1000 iterations, to obtain as wide interpretation as possible. Overall, model results were surprising. Natural disasters, hydrocarbon exploration and exploitation, occasional disturbance, all had little impact on long term survival, unless producing a catastrophic event, where 90% of dugongs were killed. In contrast, by-catch models were incredibly sensitive, suggesting that the removal of even two or three fecund females annually dooms the population to extirpation. These insights are vital in management strategies, by providing critical timelines and scenarios.