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RESTORATION OF *CHELONIA MYDAS* POPULATION IN THE CARIBBEAN: ECOSYSTEM IMPACTS RESULTING FROM REDUCTION OF SEAGRASS HABITAT COMPLEXITY[1]

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Since the extinction of the diverse dugongid fauna in the Caribbean, green turtles have had the strongest ecological and evolutionary impacts on seagrass habitat. Evidence suggests that green turtle grazing of seagrasses can cause changes such as increased productivity and adjustments in nutrient composition of leaves (Moran & Bjorndal, 2007; Moran & Bjorndal, 2005). However, the community-wide impacts that a restored green turtle population would have on seagrass community dynamics are less clear.

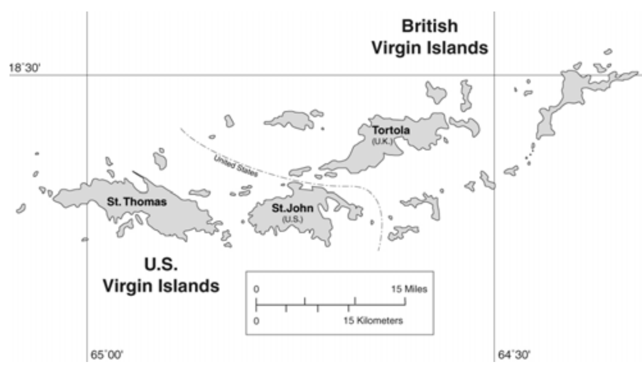

Figure 1. Map of the US Virgin Islands reproduced from Grober-Dunsmore *et al*. (2007).

To investigate this, we developed a Caribbean coral reef ecosystem model, using the modelling software Ecopath with Ecosim; where Ecopath, the foundation of the EwE suite, is a static, mass balanced snapshot of the system; and Ecosim represents a time dynamic simulation module for the exploration of past and future impacts of fishing and environmental disturbances (in this case an increase in green turtle abundance).

The coastal waters around the USVI and Puerto Rico were chosen as representative of a Wider Caribbean region coastal system (Figure 1) and modelled for an average mid-1990s situation based on Opitz (1996). Data were obtained for a total of 36 functional groups including 17 fish and 19 non-fish groups. For each group, four input parameters were estimated: biomass, production per unit of biomass (P/B), consumption per unit of biomass (Q/B), and diet composition. Estimates, in order of preference, were based on: local ecological studies, other regions of the Caribbean, or extrapolated data from comparable

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reef systems. Restoration of green turtle abundance in the region was simulated through a hypothetical bio-accumulation. Non-trophic interactions were of key significance to model dynamics and represented changes to: (i) the shelter capacity from predation of seagrass beds; and (ii) abundance in prey populations; i.e., changes to the nursery function of seagrass beds as a result of increased turtle grazing.

Preliminary results indicate that at greater abundance levels, green turtles display a negative impact on their competitors, such as green turtles and other seagrass herbivores, e.g., parrotfishes and sea urchins (Figure 2). More green turtles also mean a reduction in the biomass of seagrass. Shorter blades have negative implications for the nursery (protective) function seagrass plays for the juveniles of certain species. Fewer juveniles making it to adulthood, in turn, reduces the biomass of these species (e.g., here carnivorous reef fish A). Fewer of these carnivorous fish mean less predation pressure on their prey.

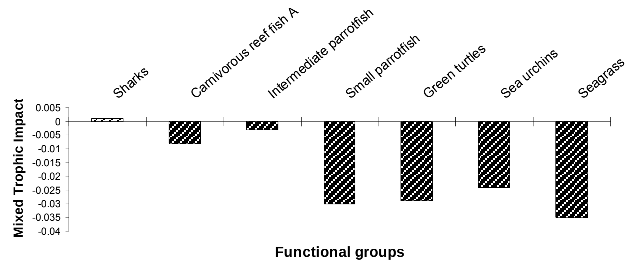

Figure 2. Mixed trophic impact of green turtles at high biomass in a Caribbean coastal ecosystem in the mid 1990s.

The system's response was particularly sensitive to changes in the vulnerability of seagrass to turtle grazing, i.e., increasing the vulnerability value led to larger differences in biomass gains/losses in the functional groups. The most significant changes were registered when the amplitude in vulnerabilities between the start and the end of the simulations was the greatest.

The degree to which and precisely how predator-prey interactions are affected by changing amounts of vegetation, the scale at which simulations were conducted and the potential trophic impacts resulting from the higher quality forage made available to herbivores as a result of turtle grazing is discussed.

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