Using Novel Methods to Determine Marine Megafauna Distribution in Areas of Anthropogenic Disturbance

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Background

Anthropogenic disturbances, such as habitat degradation, are affecting coastlines globally. In this context, monitoring coastal marine species populations is critical for conservation and management (Bremner 2008). Marine megafauna species, for example sharks, rays, and turtles, in particular should be monitored as they are highly susceptible to human impacts, yet current methods can be invasive, timely, and costly (Pollock et al. 2004). Traditional methods involve fishing gear that have associated mortality rates, and visual surveys have typically used boats, planes, helicopters, or military drones, which are timely and expensive. However, a personal use drone such as the DJI Phantom Vision 2+® may provide an alternative method to monitor marine megafauna species. This study consisted of two components. First, we calculated detection probabilities in different habitat types. Second, we compared marine megafauna species in disturbed and undisturbed habitats.

Hypothesis

A higher abundance of marine megafauna will be found in low development areas compared to developed areas because of various human impacts on these systems.

Study Sites

To investigate the differences in human development at the survey sites, classification and site identification was used from Stoner et al. (2011). Human development sites were characterized by the presence of nutrient loading, artificial structures (docks and seawalls), and erosion of sediments due to land-use practices (Stoner et al. 2011). Our study used three paired sites, i.e., north, central, and south, to have similar environmental conditions to limit extraneous variables. White lines below represent transect paths.

Methods

For our survey, we oriented the DJI Phantom Vision 2+® drone approximately 25 feet above the water at a speed of 3mph and continuously recorded video footage. Three transect surveys were repeated at each site throughout June–July 2015. Video footage of the transects were taken back to the lab to count the total number of individuals and identity to lowest taxonomic level possible. Preplanned transects were important for the video viewer to reduce double counting and to properly replicate sites.

Due to the variability of the substrate, animal depth, and water clarity, we wanted to ensure detection of marine megafauna in our videos. Therefore, we performed a detection probability test in January 2016. Model shark decoys were haphazardly placed along a 50 m transect at two different depths (i.e., just below the surface and at mid-depth). Once placed, we performed at least three aerial surveys and the number of shark decoys seen on video footage were recorded.

Results

96% sandy substrate
94% grass environment
95% reduced water clarity

The detection probability found for mock shark decoys placed above sandy substrate, seagrass, and reduced water clarity.

Conclusions

- Marine megafauna abundances were higher in undeveloped areas.
- In areas where this pattern was not significant, we suggest low number of replications may be the case.
- Drones are advantageous for their affordability and low time investment.
- Additional surveys will be performed in June 2016 to validate our findings.

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References