Detecting patterns of marine wildlife around islands with and without invasive rats, using long-range UAV images

Detecting patterns of marine wildlife around islands with and without invasive rats, using Long-range UAV images

Melissa Schiele

Bird colonies on islands have shown to sustain elevated fish productivity level and reef fish biomass on adjacent reefs, through nutrient subsidies. However, the implications of this localised enhancement on higher and often more mobile trophic levels (marine megafauna, such as elasmobranchs) is unclear. We used a novel long-range water-landing fixed-wing UAV (unoccupied aerial vehicle) to survey the distribution of marine megafauna associated with tropical coral islands with and without bird colonies, in 2018 and 2020, in the British Indian Ocean Territory Marine Protected Area. The UAV has water-landing capabilities allowing for easy retrieval from the ocean once landed and 2018 was the first time this type of technology had been trialled in BIOT. Systematic and opportunistic flights over the island canopies enabled counts of seabird densities and dominant foliage assemblages. From the two expeditions, we identified sooty terns, red footed boobies, and turtles (green and hawksbill) to species level. We were able to identify sting rays, noddys, frigate birds, reef and nurse sharks, eagle rays and other terns to genus level. Total detections across all samples shows the relative abundance of conspicuous species across the archipelago (13 islands across six atolls), were in line with expectation, seabirds dominate. From the UAV imagery we manually identified five bird species to species or genus level, three elasmobranchs to genus level, teleosts to group level and turtles to species level. We calculated densities of all detected wildlife per km^2 which showed sooty tern counts being the highest (314 km^{-2}) over near-pristine islands with bird colonies, as opposed to the former coconut plantation islands where

no sooty terns were observed. We detected elevated numbers of sharks and large fishes (0.91 – 13.3 km^{-2}) around islands with bird colonies compared with rat infested islands. Mixed effect modelling is being used to quantify effects of the variables of atoll, year, side of the island(reef or lagoonal zones) on the presence or absence of marine megafauna on islands which are near pristine or former plantations with rats. No pronounced difference was detected between the occurrence of prominent canopy plant species between the island types. Our results provide some evidence that naturally occurring nutrient subsidies likely introduce distribution gradients in high-trophic levels and that this may be further affected by the atoll location and whether the habitat is ocean or lagoon side. Water-landing fixed-wing long-range unoccupied aerial vehicle technology, designed for surveillance and mapping, may provide cost effective monitoring opportunities in remote ocean locations, and engineering developments are ongoing, with further UK and BIOT trials planned for the future.