HONDURAS DISSERTATION/THESIS PROJECT

HO28 Long-term changes in reef fish and benthic communities in a newly established marine protected area (MPA)

Dr Dan Exton | Head of Research | dan.exton@opwall.ac.uk

Coral reefs are highly dynamic and biologically diverse ecosystems of great conservation and economic value. Although coral reef fisheries make up less than 1% of global commercial fisheries, they contribute approximately 6 million tons of fish, valued in the region of $6 billion, per year. Coral reef fisheries also supply food for over a billion people each year through subsistence, 85% of which are dependent upon the reefs for the majority of their protein. Thus, managing coral reef fisheries sustainably is critical to the economies of the countries where coral reefs are found, but also to the coastal communities that are heavily reliant on these fisheries for their daily sustenance.

Sustainable management of healthy reef fish populations is also essential for the continued functioning of the reef system as a whole. For example, overfishing important herbivores can decrease grazing pressures and ultimately result in phase shifts from coral dominated to algal dominated systems. Maintaining the dynamic equilibrium within coral reef systems is vital for ensuring both biological diversity and local fisheries are safeguarded. Thus, annual monitoring of economically and/or ecologically important species is essential for assessing the health of the reef system and to provide early warning signs of any negative trends in fish populations.

Tela Bay, on the Caribbean coast of the Honduran mainland, is home to one of the most unusual reef systems anywhere in the region. Named Banco Capiro, this reef exists under atypical environmental conditions, but boasts a percentage cover of live healthy coral that is one of the highest anywhere in the Caribbean. Despite this coral dominance amongst the benthic community, the associated fishery exhibits low abundance and diversity compared to more typical Caribbean reef systems nearby. In 2018, Tela Bay was designated as a new Marine Protected Area (MPA) by the Honduran government, in part thanks to data collected by the Operation Wallacea teams since 2013. Our data from 2019 onwards will then be used to assess the effectiveness of the new MPA, allowing managers to modify their conservation approach accordingly.

Traditionally, surveys of reef fish populations, as well as benthic and invertebrate community structure, have been conducted by underwater visual census (UVC) by a team of scuba divers. However, the recent development of stereo video equipment for surveying reef fish communities is allowing large volumes of data to be collected within a single dive and analysed in detail back in the laboratory. An added advantage of stereo video surveys (SVS) over UVC, or even surveys that use a single video camera, is that SVS allows the researcher to accurately measure the size of the fish observed on the transect with computer analysis. The ability to accurately assess fish size makes it possible to estimate and compare biomass of fish populations. Although fish size has often been approximated during UVC, it has been shown that these approximations introduce a large degree of error and, thus, it is very difficult to make reliable comparisons of fish biomass between areas. Therefore, SVS provides a sophisticated and novel approach to reef fish surveys that is allowing the first accurate assessment of the biomass of fish populations in Honduran reef systems.

Stereo Video Surveys (SVS) are carried out by a small team of scuba divers with the principal investigator operating the stereo video equipment. Up to six consecutive transects can be filmed per dive using this method, although the actual number will depend on the dive site and the experience of the surveyors. On Banco Capiro these surveys are conducted at 10m and 15m depth, as the site is a deeper offshore rather than fringing reef system. Stereo-video footage is converted from MTS to AVI format using MTS converter and then analyzed using the program *EventMeasure*. Footage from the left and right cameras is then synchronized in *EventMeasure* so that the frames are perfectly aligned. Once the setup is complete, individual fish are identified by family, genus, and species, and lengths calculated from snout to base of tail.

In addition to collecting fish community data, students will use GoPro video cameras to conduct benthic surveys using line-point-intercept transect techniques. This will provide them with data pertaining to the health of the reef and enable them to make inferences about the relationships that exist between fish population structures and benthic community health and composition. From 2019, students may also be able to use cutting-edge 3D modelling technology in order to investigate how fish abundances and diversity are affected by the underlying architecture of the reef. This has potentially major implications for conservation as reef flattening processes in the Caribbean continue to gain momentum.

Students may design projects that look at differences in fish community assemblages, abundance and biomass within and between sites within Tela Bay, and also look at depth distributions and the impact of environment on shaping reef benthic and fish community structure. This project has been running for a number of years, and past data can be used to assess the health of the reef and associated fishery pre-MPA. New data collected in 2019 will be able to be used to make the first assessment of immediate impacts of the MPA.

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