

MM285 Changes in reef fish and coral communities from 2009-2012 in Southern Mozambique

Dr. Caine R Delacy, University of Western Australia

Background

Southern Mozambique and its marine ecosystems between Maputo and the Mozambique/South African border is a unique. The region, especially towards the border has low human population densities and little coastal development, and although situated at high latitudes and towards the edge of the range of tropical coral reef ecosystems, the reefs are highly diverse and support a wide range of taxa. In 2009, the Ponta do Ouro Partial Marine Reserve (PPMR) was proclaimed in order to ensure the conservation and sound management of the marine resources in the area.

Climate change, tourism and over fishing, will all have, or have had an impact on the area effecting the distribution of reef fish, coral species and other taxa. The management of the area under the PPMR will ensure the long-term sustainable use of the regions' resources, and its longevity in the face of ever increasing threats. One of the reasons for the creation of the marine protected area has been the historical exploitation of reef fish by of recreational fishers. These fishers typically target species such as groupers and rockcods (Serranidae), sweetlips (Haemulidae), sea breams (Sparidae), emperors Lethrinidae) and snappers (Lutjanidae) that have life history characteristics that make them exceptionally vulnerable to exploitation even at low levels of fishing effort. These life histories are slow growing, long-lived and late to maturity. Concern had existed over the exploitation of these fish species targeted by recreational fishers that in 2003 bottom fishing was banned. And now, with the creation of the PPMR the decline in abundance of target species should cease. In order to monitor the effectiveness of management by achieving an increase in the abundance of target species and also to monitor the shifts due to climate change, Operation Wallacea, is collecting annual data on the diversity, abundance and length distribution of reef fish and changes in the benthic community.

These annual data will allow us to detect changes in the structure of the reef communities over time. Firstly it is expected that changes in species composition will occur as warmer tropical species migrate poleward with increasing sea temperatures, and sub-tropical/ temperate species are pushed out of their range by increased inter-specific competition or as a result warmer water pushing their thermal tolerances. Secondly, an increase in abundance of reef fish species that have been typically targeted by fishers is expected if management and enforcement succeed in reducing the impact of fishing. Thirdly, indicator species such as butterfly fish, which respond to change in hard coral cover, may show that with warmer water, hard coral cover is increasing thus leading to an increase in the abundance and diversity of butterfly fishes.

Goals

The goal of the research program in Southern Mozambique is to detect change over time in reef fish communities, and the combined effects of management and enforcement of the PPMR and the more long-term effects of climate change.

The historical impact of recreational and illegal and unreported fishing is also under investigation, and given the marine protected area status and the banning of bottom fishing, the recovery of these fish stocks and the detection of this through the annual monitoring will highlight the extent of past overexploitation, and the success of management.

Method

Stereo-video techniques that have been developed by the University of Western Australia are being used to monitor the change over time of reef fish communities in the PPMR. Monitoring of reef fish communities, particularly those in marine protected areas is often hampered by the high errors associated with diver based underwater visual census (UVC). The effectiveness of monitoring programs to detect change relies entirely on the skill of the individual observer in identifying species, counting individuals, estimating length of fish and the boundaries of the survey area. While a single observer can be trained over time to have better identification skills, length and survey boundary estimates, it is difficult for monitoring programs to have the same single observer conducting the work each year for protracted periods (up to 10 years to detect change). Therefore, by frequently changing observers, monitoring programs are further plagued by the change in errors across multiple observers. Stereo-video eliminates the errors associated with UVC and solves the concern of managing differences between observers. Firstly, using cameras in stereo individual fish can be measured with less than 5% error, of their true length meanwhile. Secondly, complimentary to obtaining the length measurement the position of the individual relative to the centre of the cameras (hence the transect) is obtained, thus the transect boundaries (e.g. 5 m width) can be adhered to. Thirdly, misidentified species especially from novice observers is eliminated as identification sources such as books and websites can be consulted, therefore allowing novice observers to identify all species that are recorded on the video. These benefits allow managers to use volunteers and novice observers to collect the required data without compromising data quality.

Data Sets Available

There are three years of data available for analyses. For 2010 and 2011 these data sets consist of abundance, diversity and length data, and for 2009 just abundance and diversity of reef fish exists. Coupled with these data, habitat data has been collected also. These data are basic percentage cover of hard coral, soft coral, algae and bare/ sand covered substrate.

Length data, given its precision can be converted to mass using the allometric length-weight conversion: $W = aL^b$, where parameters a and b are constants. Therefore, in addition to the abundance, diversity and length data, biomass can also be obtained.

The structure of all the data sets is based around 25 x 5 m transects between depths of 10-24. On each site which for 2009 there were eight, 2010 nine, and 2011 ten, between 9-12 transects are surveyed using the stereo-video cameras, and each transect three photo quadrats are collected.

Possible Questions

Comparison of four years (2009, 2010, 2011 and 2012- to be collected) of stereo-video data to examine changes in abundance, diversity or size structure of the entire community, indicator species or target reef fish groups.

This is a multifaceted question and students should consult the reading list to pick, a specific species, group or metric that they wish to examine. Also, more ecology-based questions can be asked using the same data sets, by looking at changes with depth and habitat of these groups and metrics.

Reading List

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