JAMES RENNIE BEQUEST

REPORT ON EXPEDITION/PROJECT/CONFERENCE

Expedition/Project/ Conference Title: Frontier Marine Conservation & Education

Travel Dates: 29 Jun – 20 Aug 2012

Location: Madagascar

Group member(s): Jamie Donaldson

Aims: See below

OUTCOME (not less than 300 words):-

James Rennie Bequest Report - November 2012

Madagascar Marine Conservation and Education Project – July/August 2012

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Introduction and project aims

Coral reefs are one of the most diverse ecosystems in existence and large-scale correlations between species richness of corals (the primary habitat-forming organisms) and the species richness of fishes have been well documented along latitudinal and longitudinal gradients (Briggs 1999, Hughes et al. 2002). The global degradation of coral reefs and detrimental effects on the diversity and abundance of fish communities as a consequence of this loss in coral cover and structural complexity (Jones et al. 2004, Graham et al. 2006) highlight the importance of live corals for associated animal communities. A better understanding is necessary if we are to design effective conservation strategies. This research and conservation project aims to provide the local communities, stakeholders and government bodies with the information they need to design and implement management plans for the future protection of this pristine marine ecosystem.

The main aim of the project was to assess the health of coral reefs and the biodiversity of invertebrate species located on the coast of Nosy Be, Madagascar, documenting signs of regeneration and/or degradation due to the effects of local pollution and destructive fishing techniques. Secondary aims of the project were to assist in local workshops and education classes to raise the awareness of marine conservation and sustainable management practices.

In addition to the mains aims of the project carried out in conjunction with Frontier; the hosting organisation, I also carried out my own independent research whilst in the field. The main aim of my personal research was to determine whether reef fish species occur in higher densities on coral reefs adjacent to nursery habitats than on reefs located at some distance from the nursery habitat?

Coral reef fish species have a pelagic life stage where they change from poorly developed plankton into nekton with swimming capabilities. During their juvenile stages reef fish spend up to 2 months in back reef habitats such as mangroves and sea grasses. Mangrove forests

provide a high abundance of food and protection from predators, and as such provide suitable nursery habits for juvenile fishes. Upon maturation, sub-adult or adult reef fishes participate in a final migratory movement to their adult habitat, the coral reef[1]. Mangrove forests provide an invaluable nursery for many juvenile reef fishes native to Madagascan reefs such as; *Scarus iserti, Scarus guacamaia, Haemulon sciurus, Haemulon flavolineatum, Lutjanus apodus and Sphyraena barracuda. The availability of mangrove nursery habitat has a significant positive impact on the community structure and biomass of reef fish in their adult, coral reef habitat[2]. The presence of prolific mangrove forests* in the vicinity of coral reefs was found to exert a profound impact on the community structure of reef fish in the Caribbean and greatly elevated the total adult biomass of several species[2]. Similar patterns are to be expected in Madagascan reefs, whereby, the presence of mangrove forests located nearby to reefs significantly increases the densities of adults of these nursery species. It has been shown on various reefs throughout the Caribbean and the Indian Ocean that a reduced density of several nursery species on the coral reef is related to the absence of and mangroves[3].

Methods

All coral reef ecological data was collected using a standardized baseline protocol (BSP). For each site, a 20m long transect is laid at each station at a constant depth following the contour of the reef. Three transects are to be carried out at each station with 10m between each transect. Three BSPs were conducted at each survey site.

The abundance of fish species are observed within a $5m*5m^2$ area, along the 20m transect at constant depth. Mobile fish were counted first, followed by slower or territorial fish. Fish species were identified to species level in the field, and unidentifiable fish were recorded and identified on return to camp. Benthic composition was also identified as it varies along the 20m transect. Benthic composition is classified using categories such as; algae, rock, rubble, sand, sea grass, hard/soft corals or sponges.

In total 3 reefs were surveyed, reef 1 was adjacent to a mangrove forest 100m in-shore, reef 2 had no adjacent mangrove forest and was further from the shore (250m), reef 3 was 150m from shore and had a small mangrove forest adjacent.

Results

Do reef fish species occur in higher densities on coral reefs adjacent to nursery habitats than on reefs located at some distance from the final stage habitat?

H_0 - There will be no differences observed in the densities of adult reef fishes that use mangroves as juvenile nurseries between reefs that are located at a greater distance form mangroves and coral reefs found adjacent to mangrove nurseries.

H_1 - Coral reefs adjacent to mangrove nursery areas will be expected to harbour higher densities of adults of these nursery species than reefs located at greater distance to these nursery areas, assuming that adult migration along the coast between reefs is limited.

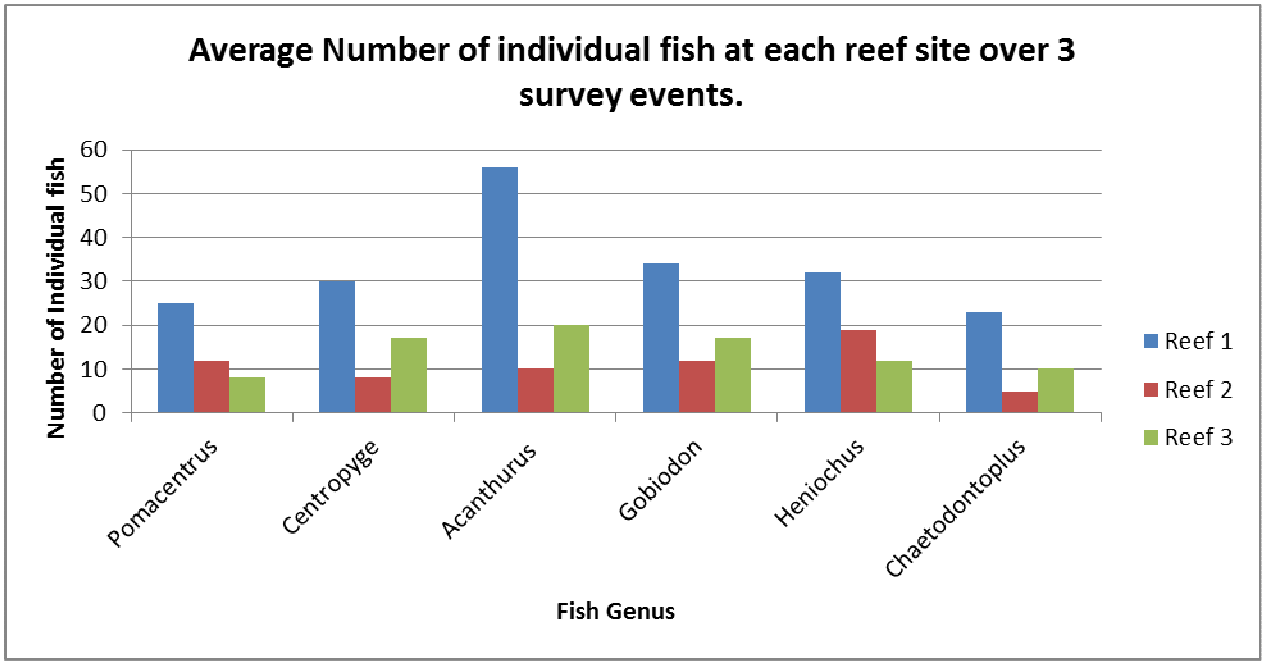

Figure 1 - Graph showing the number of individuals of each fish genus at each of the three reef sites. The numbers of individuals were averaged at each of the reef sites over the three survey events.

Reef site one was observed to have the highest counts over all 6 fish genus. Reef 3 was observed to have the second highest counts of individuals over 4 genus in comparison to reef 2, only in two genus; Pomacentrus and Heniochus was reef site 2 observed to have a larger count of individuals compared to reef site 3. The differences in fish populations between reef sites one and three could potentially be explained for through the extra distance that fish had to travel to site 3 compared to site one. Increased distance from the reef will increase the time the fishes are exposed to predation. For example; there were 45 Gobiodon recorded at mangrove site 3 and only 17 individuals recorded at the corresponding reef (reef 3), there were however, 40 recorded Gobiodon at mangrove site 1 and 34 at reef site one. The populations of each genus are similar between the two mangrove sites, however the populations at the reef sites differ significantly. Distance between the nursery mangroves and the home reef may be an influential factor in determining the differences in population sizes between the two sites.

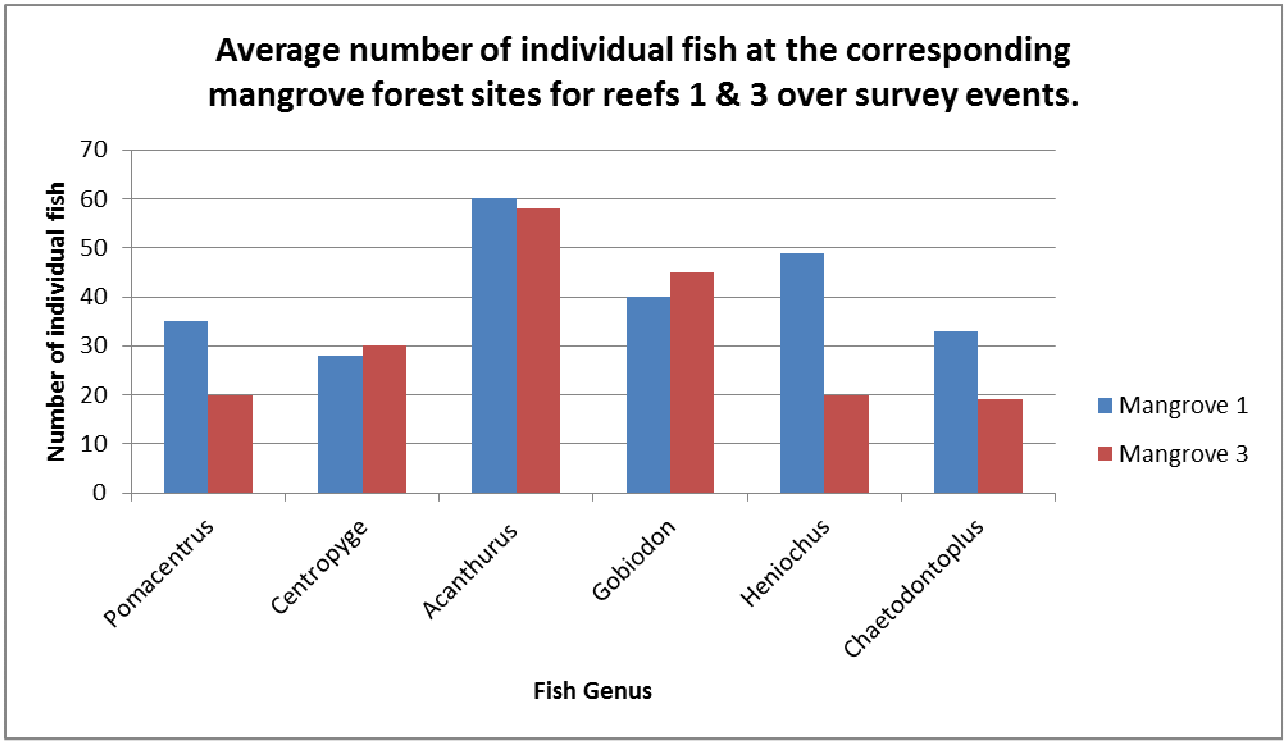

Figure 2 - Graph showing the number of individuals of each fish genus at each of the two mangrove forest sites. The numbers of individuals were averaged at each of the mangrove sites over the three survey events.

Discussion/Conclusion

Mangrove forests provide a high abundance of food and protection from predators, and as such provide suitable nursery habits for juvenile fishes. Upon maturation, sub-adult or adult reef fishes participate in a final migratory movement to their adult habitat, the coral reef[1]. Mangrove forests provide an invaluable nursery for many juvenile reef fishes native to Madagascan reefs. *The availability of mangrove nursery habitat has a significant positive impact on the community structure and biomass of reef fish in their adult, coral reef habitat*[2] *(see Fig. 1 & 2). The presence of prolific mangrove forests* in the vicinity of coral reefs (reef sites 1 and 3) were found to exert a profound impact on the community structure of reef fish in the reefs observed. The presence of mangrove forests located nearby to reefs significantly increases the densities of adults of these nursery species. It can be seen from the graphs that the absence of mangroves near site 2 has had a negative impact on the fish populations of that reef. Reduced densities of several nursery species on the coral reef (Centropyge and Pomacentrus) can be related to the absence of mangroves[3] as a fish nursery site.

1- Blaber, S.J.M., (2000) Tropical estuarine fishes. Ecology, exploitation and conservation. Fisheries and Aquatic Resources Series **7**, 372 pp.

2 – Mumby, P.J., (2006) Connectivity of reef fish between mangroves and coral reefs: Algorithms for the design of marine reserves at seascape scales. Biological Conservation. **128**, 215-222 pp.

3 - Nagelkerken, I., Roberts, C.M., van der Velde, G., Dorenbosch, M., van Riel, M.C., Cocheret de la Morinie` re, E., Nienhuis, P.H., (2002). How important are mangroves and sea grass beds for coral-reef fish? The nursery hypothesis tested on an island scale. Marine Ecology Progress Series **244**, 299-305 pp.

Summary

It was an incredible experience and one which has helped me fully appreciate the work that goes in to conservation projects and scientific projects. Also on a personal level it has confirmed my passion for conservation and environmental education and has really inspired me to do more work like this in the future. The opportunity to carry out my own independent research was also extremely valuable; it gave me the experience of conducting research in tropical environment. This will prove useful in my future career, as I wish to pursue a career in tropical ecology and conservation.

Aknowledgements

I would like to thank the secretaries and committee members of the James Rennie Bequest, Barnson Bequest and European Travel Fund for the funding provided. Without funding from these bodies the trip would not have been possible, for that I am truly grateful. For the time and effort that was committed by the secretaries and committee members of the bequests to make my applications successful is greatly appreciated

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