



MAURITIUS RESEARCH COUNCIL

TRACKING OCTOPUS AND FISHES TO AID THE DEVELOPMENT OF MARINE RESOURCE MANAGEMENT STRATEGIES

Final Report

June 2008

MAURITIUS RESEARCH COUNCIL

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MAURITIUS RESEARCH COUNCIL FINAL REPORT

PART 1- PROJECT IDENTIFICATION INFORMATION

1. Type the name of the MRC Scheme under which the grant is made
Unsolicited Research Grant Scheme
2. Award Dates (MM/YYYY) From: 07/2007 To: 06/2008
3. Organisation and Address
Shoals Rodrigues, Marine Research Training & Education Centre, Pointe Monier,
Rodrigues
4. Award Number:
MRC/RUN-0606
5. Project Title
Tracking Octopus and Fishes to Aid the Development of Marine Resource Management
Strategies

Mauritius Research Council

MRC Grant Conditions require submission of a Final Report to the MRC no later than 30 days after the expiration date of the award. Final Reports for expired awards must be received before new awards can be made.



PART II – SUMMARY OF COMPLETED PROJECT

The project aimed to improve our understanding of the daily and seasonal movements of commercial finfish and octopus in Rodrigues and to assist policy makers in the development of strategies that will protect vulnerable species and improve fishery sustainability. Over 300 commercially important fish, caught within the Anse aux Anglais and Grand Bassin marine reserves were tagged using T-bar tags and their release position was marked; fishers were then encouraged to return any captured tagged fish. Field trials were undertaken to assess the possibility of acoustically tagging octopus to track their movement patterns around the lagoon. Seven bluespine unicornfish were also tagged with acoustic tags and their movement patterns tracked over a 2 month period using a directional hydrophone. Unfortunately, none of the fish tagged with T-bars were recovered, therefore future studies will need to tag a larger number of fish. Tagging of octopus was successful but more field trials are needed to determine to what extent tags influence the behaviour of animals released back into the natural environment. The study of unicornfish indicated that the fish do not move large distances and all 7 individuals remained within the Grand Bassin marine reserve throughout the study, occupying <2% of its area. This is important for management of this species, suggesting that the population will benefit from the development of the network of marine reserves in Rodrigues.

PART III – TECHNICAL INFORMATION

Introduction

The lagoon fisheries of Rodrigues are of great socio-economic importance to the island as there is a lack of industrial development and tourism is in its infancy. In 2006, there were 2,024 registered full-time fishers, making up 13% of the total workforce (Central Statistical Office, 2007). The fisheries are however, in serious decline. Total lagoon catches have declined by 50% between 1998 and 2006 and octopus catches fell from 775 tonnes in 1994 to 266 tonnes in 2006 (FRTU, unpublished data). The seine net fishery is now dominated by small herbivorous fish and large carnivores are rare (Hardman *et al.*, in prep.); many species are also being caught before they reach maturity. The techniques used by the fishers create further problems: octopus and large net fishers work on foot and through trampling, cause substantial damage to the coral and algal habitats in which they fish.

The Government of Mauritius has however recognised the threat to the marine environment in Mauritius and Rodrigues. The second National Environmental Action Plan, for the period 2000 to 2010, identified the deterioration of marine systems and the degradation of the coastal zone as major national environmental problems, and advocated as mitigation measures the reduction of fishing activities, the establishment of protected areas, and the expansion of coastal zone monitoring activities. In Rodrigues, the Rodrigues Regional Assembly responded to the degradation of the reef environment and the need to improve fisheries sustainability by developing a network of marine reserves in the north of the island. These reserves, which were proclaimed in April 2007 cover a

total area of 24.3km². They were identified working in collaboration with the local fishing communities and include lagoon, reef and offshore habitats.

Marine Protected Areas (MPAs) are being increasingly suggested as a method for promoting sustainability in fisheries (Ward *et al.*, 2001). MPAs are defined as regions that provide sanctuary for local populations to increase in abundance or body size; increased abundance of larger fishes should provide greater spawning biomass to support the population and spillover of large fishes should help support fisheries (DeMartini, 1993). Many of the benefits of marine reserves are dependent upon movement patterns and dispersal rates of target species, which are largely unqualified. It has, for example, been suggested that MPAs are not effective for mobile or migratory species, although this is assuming that these species do not return to specific sites or use a predictable or known migratory route. In the case of highly migratory species, it may be more effective to protect animals at a particular stage in their life cycle, for example by protecting nursery or spawning areas (Roberts, 2000). In order for marine reserves to be effective it is therefore, very important to understand the movement and behaviour patterns of the species to be protected.

Traditionally, fish movement information has been obtained through mark and recapture studies, which have limited spatial resolution, a low return rate and assume that fish movement behaviour is uniform. Recent advances in technology however have led to the development of acoustic telemetry to track the movements of fish. Acoustic tagging studies have been used to identify nursery grounds for the protection of blacktip sharks (Heupel and Simpfendorfer, 2005); to suggest management plans for the protection of Caribbean reef sharks (Chapman *et al.*, 2005); to study behaviour of dolphinfish around Fish Aggregating Devices (Girard *et al.*, 2006); to predict the effects of marine reserves on fishery yields for Lingcod in Alaska (Starr *et al.*, 2005); and to study the movement of Atlantic cod in a potential marine protected area in Canada (Green *et al.* 2004).

At present, in Rodrigues, only limited biological research has been carried out and much fundamental information is still lacking. The aim of this project was therefore to improve understanding of the daily and seasonal (reproductive) movements of selected commercial finfish in Rodrigues and to assist policy makers in the development of strategies that will protect vulnerable species and improve fishery sustainability.

Aims and Objectives

The aim of the project was to improve understanding of the daily and seasonal (reproductive) movements of selected commercial finfish and octopus in Rodrigues and to assist policy makers in the development of strategies that will protect vulnerable species and improve fishery sustainability. The specific objectives were as follows:

- To carry out a pilot study to assess the potential for tagging octopus with acoustic tags.
- To study the movements of selected fish in reef and lagoon areas using acoustic telemetry and conventional tagging to assess their movement within and outside of a potential marine reserve;

- To give training in fish tagging techniques to local NGO and Government personnel.
- To report findings to the island Government (the Rodrigues Regional Assembly) together with recommendations pertinent to the development of resource management strategies and future research.

Work undertaken

a) Pilot study to assess potential for tagging octopus

Octopus were caught by hand at low tide within the lagoon, working in collaboration with octopus fishers at Graviers and Baie du Nord for use in laboratory trials to assess several techniques and locations for attaching sonic transmitters to their body. Dummy transmitters of the same size and weight as the transmitters that were planned for use in field trials were used. Once caught, octopus were returned to the laboratory where they were held in a large static, aerated aquarium where their behaviour and health could be monitored. Only after an octopus was determined to be in good condition, was it tagged.

Prior to the surgical procedure a subject was anaesthetised in a mixture of 3% ethanol and seawater. This anaesthetic proved to be effective and an octopus was usually unresponsive to touch, and could be handled, after 5-8 minutes in the anaesthetic. A tag was attached such that the dummy transmitter was tightly held against the inner wall of the mantle cavity. To accomplish this, two hypodermic needles mounted side by side on a stainless steel rod were pushed through the exterior wall of the mantle into a silicone probe held firmly against the inner mantle wall. The silicone probe was then removed from the mantle cavity to expose the ends of the hypodermic needles. Fine stainless steel wires attached to the tag were inserted into the needles following which the needles were withdrawn through the mantle wall with the tag wires. The wires were then threaded through a plastic plate and tightened such that the exterior plate and interior tag were snug against the mantle. This procedure took several minutes after which the subject was rinsed in fresh sea water to remove the anaesthetic, and then allowed to recover in the large aquarium where it had been housed since capture.

Over several weeks eight octopus were tagged with dummy transmitters; 7 were tagged in the laboratory and one was tagged in the field at Graviers. Five octopus were observed for up to six days in the aquarium, with notes made on their pre and post-tagging behaviour. Three octopus were released in the field and observed *in situ* by snorkelling for several hours.

b) Study of the movements of fish in reef and lagoon areas using conventional tagging methods

Between August and December 2007, 300 fish were tagged with the Floy T-bar tags. Working in collaboration with local fishers and the Fisheries Protection Service, fish were caught with a 9cm (mesh size) seine net within the marine reserves of Anse aux Anglais and Grand Bassin (Figure 1). All fish were measured to the nearest 0.5cm using a measuring board, tagged with individually numbered T-bar tags and released. Release positions were determined with a GPS unit and recorded. Tagged fish represented 11 commercially important fish species:

Siganus sutor
Caranx melampygus
Gerres longirostris
Chanos chanos
Mulloidichthys flavolineatus
Acanthurus triostegus
Lethrinus harak
Parupeneus barberinus
Chlorurus sordidus
Scarus ghobban
Naso unicornis

An awareness raising campaign was also organised to inform the fishing community and members of public in Rodrigues about the project, and to encourage them to return recaptured tagged fish. Fishers who return recaptured fish were offered a reward. Posters were placed in the fish landing stations in the north of Rodrigues and articles were published in all of the local newspapers in December 2007 and March 2008. *Shoals Rodrigues* research staff also participated in interviews on local radio programmes during November 2007 and March 2008 in which the aims and methods of the fish tagging program were explained.

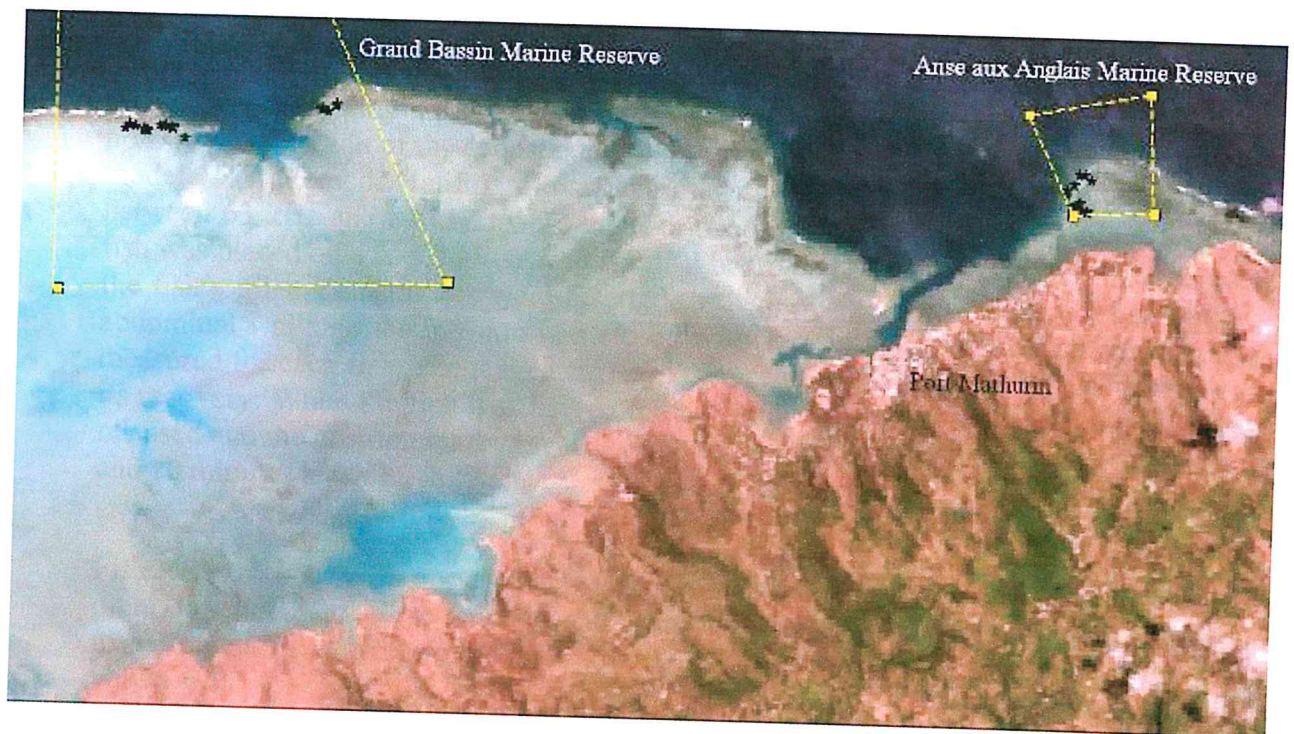


Figure 1. The release position of the 300 tagged fish within the marine reserves of Grand Bassin and Anse aux Anglais.

c) Study of the movements of fish in reef and lagoon areas using acoustic tagging methods

Following initial trials, the bluespine unicornfish, *Naso unicornis* was chosen to undertake acoustic tagging studies as this is a tough fish and has previously been successfully tagged in other studies (Meyer and Holland, 2001; 2005). It is also an important component of the lagoon catch, making up 5% of seine net catches over the period 2002-2006 (Hardman *et al.*, in prep.), however is currently close to full exploitation (Edwards *et al.*, in prep.). In order to assess the effectiveness of the new marine reserves in protecting this species from further exploitation its movement patterns were assessed in relation to the marine reserve at Grand Bassin. This reserve covers an area of 14.1km² in the north of Rodrigues, including 8.2km² of shallow lagoon area (<2m depth) and 5.9km² of shallow fore reef, extending to a depth of 25m. Although the reserve was proclaimed in April 2007 no management measures have yet been enforced and artisanal fishing using seine nets, hook and line and basket traps is still undertaken within the reserve area. Unicornfish are targeted by both seine net and basket trap fishers on the edge of the lagoon, on the reef crest and shallow reef slope. Seine net fishers tend to catch Unicornfish 2-3 hours either side of high tide as they believe that the fish swim into the shallow lagoon at high tide to feed on algae.