

1. Introduction

1.1 Background

The Island of Mitiaro (Nukuroa) has a population of 320 and is located approximately 260km North-East of Rarotonga, the capital of the Cook Islands. Mitiaro is a small raised makatea type island of 22.26 square kilometres (km²) which comprises four distinct geographical areas of flat terrain. These include; (1) makatea or upraised coral of 15.78 km² which surrounds the island, (2) fertile soil of 1.21 km² where crops are grown primarily for subsistence purposes, (3) swamp area of 4.65 km² where taro crops are abundant and (4) a large brackish lake of 0.62 km². Important food resources which occupy the lake include fresh water eels (*itiki*), tilapia (*tirapia*) and until recently (late 1980s) milkfish (*ava*) have been introduced to supplement food reef fish resources. The island has one reef passage suitable for boats between 4-8 meters in length with several small passages which are navigable by canoes .

Due to the recent government restructuring many inhabitants lost their regular source of income thus having a major impact on the economy. Subsistence farming and fishing produce much of the islands locally derived protein, economically supported by handcrafts and a limited tourist industry. Like all islands in the Cooks the possibilities for revenue generating ventures remain high on the agenda.

1.2 Existing Fisheries

Fishing is carried out primarily on a subsistence basis, to supply the immediate household food requirements. The fishing areas are: 1) the narrow reef flat where gill nets, spear and pole fishing occur to harvest various shallow coral reef species, 2) the mid-water reef slope, where hand-line fishing is used to capture tuna, snake mackerel and other bottom fish species and 3) surface reef slope trolling, targeting surface swimming species such as tuna, mahi mahi, and wahoo.

The majority of reef slope fishing activities is carried out in canoes (2 - 2.5 meters in length) which are either hand paddled or powered by small outboard motors (1.5 - 3 horse power (hp)). There are a total of 48 fishing vessels on Mitiaro, comprising 43 canoes, three aluminium and two ply wood constructed type boats. These larger boats range between 4 to 5.5 meters in length. Approximately ninety per cent of the households on Mitiaro possess a canoe to assist with subsistence fisheries activities. It is interesting to note that children between the age of ten to sixteen regularly fish from these canoes for *Decapterus macarellus* (koperu). This is usually the first step towards learning the skills of the older fishermen.

2. Fisheries Training: Objectives

In order to enhance the knowledge of fishing and to encourage fishermen to fish along the reef slope, the Ministry of Marine Resources developed a Small Scale Fisheries Training Program. Similar workshops have so far been conducted on Aitutaki, Mauke and Rarotonga with varying degrees of success. It is hoped that as a result of this extension program, fishermen will be better able to improve and diversify fishing practices targeting a larger variety of species. The overall goal of these workshops is to focus on the development of modern fisheries skills to provide sufficient fish for the island of concern, secondary goals are to develop semi-commercial fishing to supply the high demand for fresh fish locally or on Rarotonga. It is anticipated that the long term result is that some outer islands will have sufficient efficient small scale commercial fishers, which could supply the seafood demand for the growing tourist industry hence increase self employment.

The primary objective of the Mitiaro small scale fisheries workshop was to transfer knowledge of various small scale fishing techniques which are employed successfully elsewhere in the Pacific. These include: -

- Ø theoretical and practical training in the methods of vertical and horizontal longlining and paru-ahi for the capture of deep swimming tuna species,
- Ø training in the methods of deep reef slope bottom fishing, to target snapper,
- Ø introduce a cost effective hand reel and various types of relatively simple and inexpensive fishing gear, and
- Ø promote safety at sea issues.

3. Gear Configuration

Samoan hand reel

The Samoan hand reel is a simple, inexpensive, multi-use piece of fishing equipment. It can be used for vertical long lining, paru-ahi, bottom-fishing, mackerel fishing and trolling. A complete reel is within the order of NZD120.00, and all materials for construction are available in Rarotonga. Figure 1 illustrates the hand reel used during the workshop.

Grapnel & Parachute sea anchor

The grapnel anchor (Figure 2) is standard among most fishermen. It comprises of two lengths (2m) of D12 reinforcing rod bent in half then further bent to take the form of a double fishing hook. Both sets are welded together with a length of 10 –15 mm chain (3-5 m) attached, from which the anchor line (approx 6-8 mm) is attached. For deep water fishing a

length of No. 8 fencing wire is attached to the anchor line about 5 meters from the chain. This allows simple retrieval of the anchor (Figure 3).

During retrieving a float (15 Kg buoyancy) is attached to the anchor line via a shackle the boat then steams sea-ward where the float lifts the anchor (Figure 3). The parachute sea anchor is used for slow drift fishing (Figure 4) and is within the order of NZD300.00.

Vertical long line

Vertical long line gear comprises of several hooks (10-25) attached to a mainline with some form of a sinker and flotation device. Snood lines (150-200 lb test), approximately 4-5 meters in length contain a relatively large Mustard tuna circle hook (No. 14/0) and a shark clip. On the main line (300-500 lb test) several large lead swivels (60-80 g) are fixed for the attachment of snoods via the shark clip. The distance between each lead swivel range from 10 to 20 meters (depending on fishers preference) (Figure V). A 15 kg float and two kg weight is attached to either end of the long line. Optimum depths for tuna are within the order of 100 – 300 meters.

Horizontal long line

The horizontal long line (Figure 5) is primarily used to target tuna by large scale commercial fishing. Although not suitable for the types and sizes of boats on Mitiaro the fisher's were briefed on various aspects of the gear.

Paru ahi

Paru-ahi fishing is similar to the traditional method of fishing tuna (ii). Apart from the standard hook and line, the traditional method comprises a rock (for sinker) and leaves (to encase the chum and bait). The recent modification utilises a lead weight (500g) and a cloth (20x20cm) in replacement of rocks and leaves respectively. This paru-ahi techniques requires less preparation time and positions the baited hook at a predetermined depth.

Bottom fish rig

The bottom fishing rig consists of a chum bag, three to five branch-lines with hooks attached and a one to two kilogram weight (Figure 7). The rig can be made out of monofilament or wire. The latter being particularly useful for areas with high occurrence of sharks and other sharp toothed fishes. Optimum fishing depths for snapper range from 200 to

300 meters. This rig can also be used to fish groupers, jacks and various shallow reef slope species.

4. Training Operations

The training program was conducted over four days covering both theoretical and practical issues. Theoretical issues were discussed on the first two days, with practical training following. There were a total of 65 participants with traditional fishing experience ranging from ten to fifty years (appendix 1).

Reef slope fishing for deep swimming Tunas

Two fishing boats were equipped with three hand reels each, one boat was used for vertical longline fishing and the other rigged with the bottom fishing gear. With limited boat space the fishing trials only manage to take four participants per boat trip for demonstration. A grapnel anchor (figure 4) was used for anchoring while the long line (figure 8) gear was being set, soaked and retrieved. The second boat utilised a four meter (diameter) parachute sea anchor while drift paru ahi fishing.

Bottom fishing for snapper

Mitiaro reef slope is relatively steep with depths reaching 300 meters some 200 meters from the reef edge. The bottom fishing sites at Vai o Tara point and Ana o Matua (figure 9) had suitable depths for snapper ranging from 180 to 250 fathoms. Strong currents and Northeastly winds made fishing for snapper using a parachute anchor rather difficult. In which case bottom fishing was made possible using the grapnel anchor.

5. Results & Discussion

A total of six fishermen (9% of those which participated in theoretical sessions) participated during the two day practical component of the workshop. Only two yellow-fin tuna with a combine weight of 14.5 kilograms were caught during vertical longlining fishing trails. The paru-ahi technique did not yield any fish. The low catch rates are not likely due to the techniques but more so to a combination of the following factors; 1) bad weather, 2) limited fishing time, 3) poor fishing season and 4) limited known tuna aggregation sites. The catch rates can further be improved by increasing fishing time.

Bottom fishing for snapper resulted in 18.5 kg; at the current Rarotonga restaurant price of NZD11.00/kg the catch is worth NZD200.00.. From the short time in Mitiaro it is difficult to determine the potential yield for bottom fish resources, however this may be obtainable if fishers recorded their catches and submitted it to MMR Rarotonga. Data recorded should include numbers and weight of fish and length (hours) of fishing trip (Appendix 1).

Fishers on the island were encouraged to be aware and take precautions of safety while fishing on the reef slope. During the training sessions the Nukuroa Fishing Club through, the Mayor, raised the importance of forming a safety committee for the fishing club in order to affiliate with the main bodies (i.e. Telecom, Hurricane safety committee, Te Kukupa and Cook Islands Police) in the Cook Islands so that proper management and prompt actions can be met when the need arises.

In general the participants were impressed with the gear that was demonstrated during the trials and were interested in adopting this type of gear to suit local canoes. As an outcome of this workshop the gear transfer technology remains as one of MMR's future developments.

The development of a semi - commercial fishing sector on a small scale for Mitiaro appears to be challenging. With respect to the lightly fished reef slope species, there seems to be a potential for increased fisheries yield to supply valuable food fish resources for the small tourist industry on Mitiaro. Exports of this resource to supply the Rarotonga market should be diversified to include Tuna's, Mahi-mahi, Wahoo and snake mackerel, all of which are in high demand.

6. Summary and Recommendation:

In order to enhance a more effective way to catch pelagic species and to assist the development of an artisanal fishery in Mitiaro, the Nukuroa fishing Club recommended that :-

- (a): Some methods covered during the workshop were more applicable to FAD fishing the Nukuroa Fishing Club thus requested that the Ministry of Marine Resources assist with a FAD project for the future.
- (b): There is a need to have safety equipment such as :-
- 1 base VHF radio communication
 - 4 hand held VHF radio
 - 1 EPRIB
 - 4 life jackets
- (c): A follow up workshop is required in future regarding:
- fish handling
 - outboard maintenance
- (d) the program should run for a period of ten to fourteen days in order to ensure satisfactory completion.

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