AN INNOVATIVE CANOE BUILDING AND INSHORE-FAD PROJECT IN NAURU

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In May, the Secretariat of the Pacific Community (SPC), in collaboration with the Nauru Fisheries and Marine Resources Authority (NFMRA), hosted a workshop in Nauru on canoe building. This workshop resulted from consultations with NFMRA, SPC's Coastal Fisheries Programme (Nearshore Fisheries Development and Training Section and Coastal Fisheries Management Section) and community leaders regarding sustainable food security, reducing pressure on overfished inshore resources, and providing alternative fishing opportunities to the district communities on Nauru. An agreement was reached between SPC and NFMRA to work towards implementing a project focussed on canoe building and inshore FAD fishing. SPC's Nearshore Fisheries Development and Training Section (NFDTS) Adviser, Michel Blanc, was instrumental in formalising a project proposal that was approved and funded by the Republic of Taiwan's regional development assistance programme.

The project's objective was to alleviate fishing pressure on the inshore resources and enhance food security for locals through a canoe building training programme and the deployment of fish aggregating devices (FADs) close to communities' foreshore for their canoe fishermen to capitalise on.

The project was carried out in two phases.

Phase I consisted of two components that were run concurrently: a FAD deployment component and the canoe building training component. SPC's Fisheries Development Officer (FDO), William Sokimi, implemented the FAD component from 29 April–12 May. Wiliam assisted with setting up the canoe building training component by organising tools and building materials in preparation for the workshop, which was conducted by Kiribati-based boatbuilder, Mike Savins (5–30 May). During phase I, the FDO also conducted a classroom presentation on FAD fishing methods, with a focus on mid-water jigging and chumbait fishing.

Phase II of the project was implemented by the FDO from 24 June–7 July and consisted of:

- three workshops on canoe safety awareness and practical mid-water fishing methods for the communities selected by NFMRA;
- a performance assessment of the canoes under practical fishing conditions;
- the construction and deployment of one additional inshore FAD off Baitsi District;
- the monitoring of the FADs deployed earlier in May;
- the development and introduction of a logbook for monitoring the fishing activities undertaken by the canoe fishermen.

Canoe building workshop and related activities

Nine local boatbuilders from the communities of Anetan, Anibare, Bauda, Boe, Denig and Meneng have been trained in modern canoe building techniques by Mike Savins. SPC ordered building materials and tools for the workshop while NFMRA provided the venue and managed the logistics.

At the end of the training, four canoes had been built: three, one-man FAO KIR 7 (4.7 m) design (Fig. 1) and one, two-man FAO KIR 6 (6.5m) design (Fig. 2).

Design and construction

The FAO KIR 6 and KIR 7 canoe designs were recommended for the workshop as they suit local conditions and Nauruans are familiar with them because many I-Kiribati and Tuvaluan fishermen on the island have used similar canoes for many years. Those canoes are light and so are easy to launch and retrieve. The one-man canoe weighs approximately 40 kg and can be carried by a single person, while the two-man canoe weighs approximately 65 kg and requires two people to carry it. This is especially advantageous for communities that do not have launching ramps. The fishermen can carry the canoes over the reef flats to launch at the reef edge and lift the canoes back for storage onshore instead of having to keep the canoe anchored.

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The canoes were constructed from 4 mm marine plywood using a compounded plywood construction technique in which the canoe's inner keel is shaped exactly to the design by using a hog placed on a construction jig (Figs. 3, 4 and 5). The hull was then sheathed on the outside with a layer of fibreglass to further strengthen it. This technique was perfected during an FAO project in Kiribati.

The construction technique used for the outrigger of the one-man canoe follows an innovative concept developed by consultant boatbuilder, Mike Savins. This technique provides the canoe with an outrigger with higher floatation properties than traditional outriggers made of timber or plywood. These outriggers were constructed from five 2.2 m pieces of 25 mm thick polyurethane foam. The five pieces of foam were glued together to produce the outrigger (2.2 m x 0.125 m x 0.125 m) with the two ends bent during gluing to develop a raised profile. The outriggers were then machined to the required shape and a timber insert glued at both ends into the foam, similar to normal outrigger beam attachments. Finally, the whole outrigger was glassed with two layers of 450 g glass mat on the bottom and one layer on the top.

The outrigger for the two-man canoe was constructed from plywood as specified for the KIR 6 design and was glassed on the outside. The plywood outrigger has greater buoyancy than the original outrigger used on the same type of canoe, eliminating any undue drag result-

Figure 1: KIR 7 one-man canoe

Figure 2: KIR 6 two-man canoe

Figure 3: Construction jig for shaping the canoe hull

Figure 4: Canoe hull takes shape

Figure 5: Canoe hull clamped to the construction jig

ing from the paddling action of two people. It is also an additional safety factor for maintaining stability.

Future canoe building activities

It is envisaged that communities wishing to build additional canoes will require some logistical support from NFMRA. To facilitate this, the full set of canoe building tools will remain the property of NFMRA. The tools will be lent out to interested communities under a controlled and monitored system that will guarantee the retention and maintenance of the tools for continuous use.

It is also likely that communities will require assistance in importing materials. Orders will need to be coordinated either through NFMRA or a private enterprise. NFMRA should consider liaising with the government customs and duty department to explore the possibility of a tax exemption (or reduction) on canoe materials so as to make them more affordable to local boat builders, thus promoting small business development in Nauru.

Canoe safety awareness briefings

These briefings, done by the FDO during the second phase of the project, addressed safety issues relevant to canoe fishing activities. The FDO informed community fishermen about the importance of maintaining a pre-departure checklist as part of a Safe Operations Plan (SOP). Such a checklist ensures that measures are put into place to counter any challenging situations or emergencies that may arise while on a fishing trip. SPC has developed and promoted a standard safety checklist card for small craft, but this is directed at power-driven vessels rather than paddle-driven craft. However, most of the recommended items on the card, especially those not related to the use of small engines, can be adapted to suit canoe safety (Fig. 6). Although most of these concepts are common knowledge for regular fishermen, it is a handy reminder for them and is important information for new fishermen. One important consideration in relation to canoe fishing safety is that the fisherman should carry the

Figure 6: Canoe safety checklist card

essential fishing gear and safety items in one or several sealed containers that can also serve as floatation devices in case of emergency.

Part of the safety briefings included some discussions on canoe handling, and participants were briefed on safe procedures for boarding canoes and how to recover from accidents such as capsizing and foundering. Participants were given a general idea of how these accidents happen, how to prevent them and how to react if they do occur.

Overall, the canoes constructed for the project proved ideal for the Nauruans. The one-man canoe can safely take the load of two people without any problems and still have ample freeboard to maintain some buoyancy. The two-man canoe is able to seat three people and still maintain ample safe freeboard.

Inshore fish aggregating devices

FAD construction and deployment

Seven inshore FADs were constructed and deployed to support the coastal communities' canoe fishing activities. The materials and tools for the FADs were supplied by SPC, and the FDO carried out the construction and deployment work with staff from NFMRA's Coastal Fisheries section. NFMRA provided information on the FAD deployment locations FADs and the remaining logistics, including workshop space for construction and vessel deployment. The first six FADs were deployed during phase I of the project while a seventh FAD was deployed during the FDO's second visit to Nauru in July.

Five types of FAD design are being trialled as part of this project. The designs include two all-wire mooring, two combination wire/rope mooring (Fig. 7), one sub-surface FAD (Fig. 8), one cheap, all-rope mooring (Fig. 9), and one combination subsurface/surface FAD (Fig. 10).

The surface component for the combination wire/rope and all-wire FADs consisted of five 200 m rating pressure floats of 20 kg buoyancy, and four Polytech M-700 purse-seine floats of 7 kg buoyancy. A purse-seine float

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Figure 7: Inshore FADs with grapnel anchors being prepared at the NFMRA workshop

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Figure 8: Flotation section for the sub-surface FAD

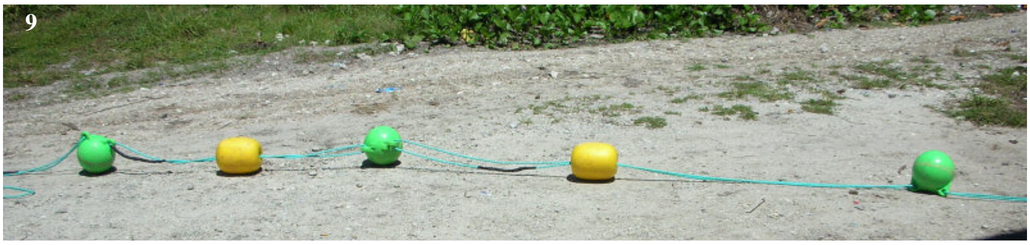

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Figure 9: Mooring section for the cheap all-rope FAD before aggregators were connected

was positioned between two consecutive pressure floats to avoid damage from the hard plastic pressure floats knocking against each other. The nine floats were strung on 10 m of 3-strand 22 mm nylon rope. Similarly, the upper section of the sub-surface FAD consisted of three pressure floats and two purse-seine floats between them. The surface component for the all-rope cheap FAD consisted of three ear-lugged 1000 m pressure-rated trawl floats buffered by two purse-seine floats in between them. The trawl floats were used due to their availability at NFMRA, but other pressure floats could have been used instead.

The middle section of the mooring for the combination rope/wire and all-wire FADs used a 5 mm stainless steel wire in the wire sections, and 3-strand 12 mm polypropylene rope in the rope sections. The combination mooring was constructed with an additional length (equal to 25% of the depth at the site) to account for current and weather fluctuations. The all-wire mooring, however, had only 13% additional scope, which is sufficient to absorb the forces in the middle section, yet not so long as to become tangled on the sea bottom. The sub-surface FAD had an all-wire middle section that is supposed to be stretched taut by the five floats making the upper section of the FAD.

Figure 10: The sub-surface section alongside the surface flotation of the combination sub-surface/surface flotation inshore FAD deployed at Baitsi

Figure 11: Grapnel anchors and inshore FADS lined up on the Anibare wharf apron ready for loading

Large grapnel anchors were used in the anchoring system of all FADs (Fig. 11). This made their transport to the deployment site easy and was effective in ensuring that the anchors settled quickly into position on the steep bottom slope. Two grapnel anchors were used for each FAD. The anchors were linked to each other by a 10 m length of 12 mm galvanised chain and 1 mm galvanised shackles. The upper grapnel was linked to the middle mooring by another 10 m length of 12 mm galvanised chain, a 12 mm galvanised forged swivel, and 12 mm galvanised shackles. Each anchor was constructed using two 6 m lengths of size #8 (25 mm) building rebar rods thrust through a metal pipe 1.5 m long and 160 mm in diameter.

The inshore FADs were deployed using NFMRA's surveillance vessel *Doguo* (Fig. 12). This is different from previous FAD deployments in Nauru when barges or tugboats of the Republic of Nauru Phosphate (RONPHOS) company had to be used because of the weight of the anchors and mooring depths of over 1000 m requiring almost twice as much rope than for the inshore FAD deployments on this project.

All the inshore FADs were successfully deployed (Fig. 13). The combination rope/wire FADs were deployed off Meneng and Denig in 300 m. The all-wire FADs were deployed off Ijuw in 290 m and Ewa in 270 m. The sub-surface FAD was deployed off Anibare in 230 m with the upper section settling 50 m below the surface. The cheap, all-rope FAD was deployed off Meneng in 320 m, and the combination sub-surface/surface FAD was deployed off Baitsi in 306 m.

The inshore FADs deployed in May were visited by the FDO early in July, during the second phase of the project. At that time, all FADs were still in place and were aggregating fish. The most productive FADs were the two FADs off Meneng (combination rope/wire and all-rope) and the FAD at Ijuw (all-wire). Large, mixed fish schools, including yellowfin tunas and wahoos, were spotted in the vicinity of those three FADs. The FADs at Ewa, Anibare and Denig were also aggregating schools in their vicinity, predominantly rainbow runners, skipjack tunas and frigate mackerels.

The FADs at Meneng and Denig were riding well in the water with all floats visible throughout the tidal phases. However, the FAD at Ijuw (Fig. 14) tended to submerge during strong currents until only three floats were above water at high tide. The FAD at Ewa submerged to a point where only one float was above water at high tide and sometimes momentarily disappeared (Fig. 15). This


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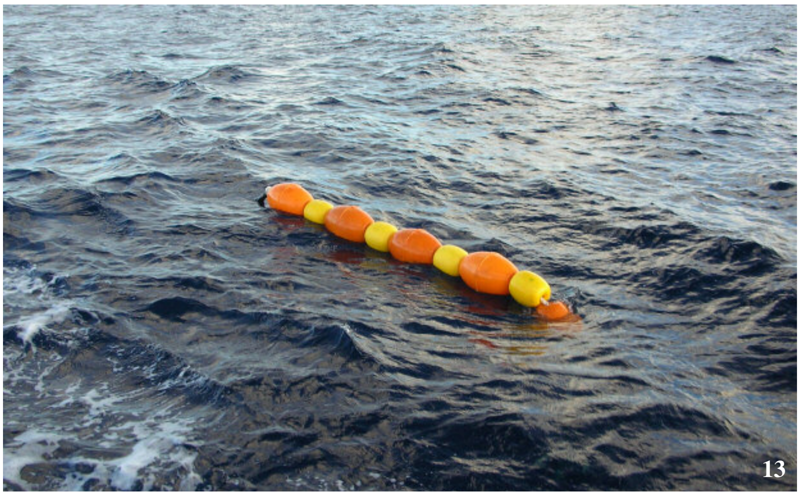
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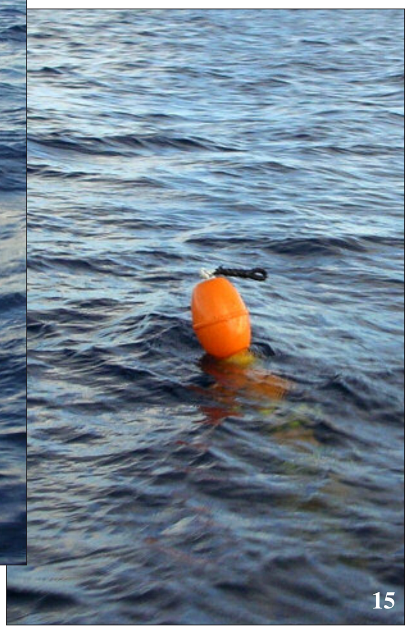
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Figure 12: Inshore FAD and grapnel anchors loaded on the *Doguo* for deployment

Figure 13: Inshore FAD settled in the water after deployment

Figure 14: Ijuw FAD submerged to 3 floats at high tide

Figure 15: Ewa FAD submerged to one float at high tide

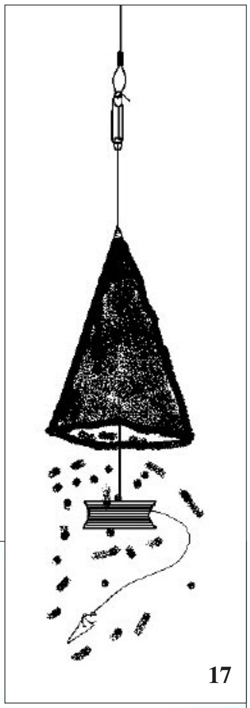

Figure 16: Surface indicator floaters for the sub-surface FAD

Figure 17: The main components for scatter-bait fishing method

Figure 18: A workshop participant with an 8-kg tuna caught using the scatter-bait method

phenomenon is most likely due to a lack of buoyancy in the upper component of those two FADs. Therefore, NFMRA was advised to attach additional floats. FADs at other locations were riding well on the surface with all floats clearly visible. The sub-surface FAD at Anibare was still in position with its surface indicator (two purse-seine floats) clearly visible (Fig. 16).

Practical canoe fishing exercises

The practical fishing exercises were conducted by the FDO early in July. Training took place at the Denig FAD and around the mooring buoys of the RONPHOS company. FADs on the eastern side of the island were not used for training because the weather conditions there were not considered suitable for beginners, although they would have been appropriate for experienced canoe fishermen.

Although participants were keen to fish at the Denig FAD because of the presence of 'easy-to-catch' rainbow runners, the FDO encouraged them to target the bigger and deeper-swimming yellowfin tunas using the scatter-bait jigging method (Fig. 17). This was the main fishing method used during the fishing exercises. Secondary methods included jigging for smaller pelagic fish and trolling with lightweight gear. Chum bait contributed significantly to the success of the scatter-bait fishing method. Chum bait is usually made from waste food ground into a moist, almost paste-like form or made from discarded fish and animal offal ground into minced pieces. However, because of the large volume of chum material needed each day for the training, boiled rice mixed with canned mackerel and soy sauce was used (effectively) during the practical fishing exercises.

Overall, three practical fishing exercises were conducted, for a total of 18 hours of fishing time resulting in a catch of 150 kg of yellowfin tuna (12 fish), 12 kg of rainbow runner (7 fish), 12 kg of skipjack tuna (6 fish), and 5 kg of frigate mackerel (2 fish). Only three of these fish were retained and sold after each day in order to purchase ice and bait for the next fishing trip. The rest of the catch was shared among the fishermen to take home as proof of their newfound abilities (Fig. 18).

Canoe monitoring logbooks

A basic but comprehensive logbook had been produced by SPC prior to the second phase of the project. A logbook is an essential tool for monitoring the use of fishing canoes and related catches in Nauru. Many logbooks were printed and taken to Nauru before the practical fishing exercises began.

NFMRA currently assigns a person to record the movements and catches of canoe fishermen operating out of Gabab Channel and the NPC (Nauru Phosphate Corporation) harbour. The data related to use of the community canoes built during this project are recorded separately by a community representative specifically assigned to that task. At the time of the FDO's visit in July, the need to monitor inshore FAD catches and canoe use was quickly catching on with most of the canoe fishermen, including those who attended the workshops and others who were voluntarily coming forward to the NFMRA officer to have their catches recorded.

Conclusion

The canoe project is an ongoing activity that will be monitored and expanded as events dictate. So far, the project is generating considerable interest in Nauru and has started off on a high note.

After each phase of the project, SPC made several recommendations to help NFMRA make this project a success for Nauruan communities. The onus is now on NFMRA as it will need to continue to assist communities with their canoe activities. This assistance will include the management of the canoe building tools, the coordination of materials procurement for future canoes, the ongoing monitoring of canoe use and FAD catches, the management of the inshore FAD programme including regular maintenance and replacement of lost FADs and, very likely, the organisation of additional canoe safety and fishing workshops for communities. SPC is very keen to monitor the lifespan of the various FAD types used in this project. The concept of using inshore FADs to provide alternative fishing and food-security or small income opportunities is one that is increasingly relevant in the region, and the Nauru project may become a model to follow.

CANOE/FAD MONITORING LOGSHEET	
DISTRICT:	NAME OF CANOE:
NAME OF FISHERMAN:	SIGNATURE:
DATE:	
TIME OUT:	NAME OF FAD(s) FISHED:
TIME IN:	
FISHING METHODS:	DID YOU CATCH ANY FISH TODAY?

CATCH			COMMENTS
SPECIES	PIECES	WEIGHT	
FISH RETAINED	Pieces :	Weight :	
FISH GIVEN AWAY	Pieces :	Weight :	
FISH SOLD	Pieces :	Weight :	Income :

Figure 19: Logbook used for monitoring canoe use and inshore FAD catches in Nauru