Secretariat of the Pacific Community

FIELD REPORT No. 16

on

TECHNICAL ASSISTANCE TO THE REPUBLIC OF NAURU TO PROVIDE TRAINING IN MID-WATER FISHING TECHNIQUES THAT CAN BE USED IN ASSOCIATION WITH FISH AGGREGATING DEVICES (FADs)

14 February to 25 May 2002

by

William Sokimi
Fisheries Development Officer

and

Lindsay Chapman
Fisheries Development Adviser

Secretariat of the Pacific Community
Noumea, New Caledonia
2002

This field report forms part of a series compiled by the Fisheries Development Section of the Secretariat of the Pacific Community's Coastal Fisheries Programme. These reports have been produced as a record of individual project activities and country assignments, from materials held within the Section, with the aim of making this valuable information readily accessible. Each report in this series has been compiled within the Fisheries Development Section to a technical standard acceptable for release into the public arena.

Secretariat of the Pacific Community
BP D5
98848 Noumea Cedex
New Caledonia

Tel: (687) 26 20 00
Fax: (687) 26 38 18
E-mail: fishdev@spc.int
http://www.spc.int/coastfish

Prepared at
Secretariat of the Pacific Community headquarters
Noumea, New Caledonia, 2002

ACKNOWLEDGEMENT

The Secretariat of the Pacific Community acknowledges with gratitude the support, cooperation and assistance provided to the Fisheries Development Officer by the administration and staff of the Nauru Fisheries and Marine Resources Authority (NFMRA) during the course of the project.

Special appreciation and thanks are directed to: Mr Godfrey Thoma, Minister for Justice and Fisheries; Mr Peter Jacobs, Acting Chief Executive Officer of NFMRA; Mr Charleston Deiye, Administration Manager and acting CEO in Peter Jacob's absence; Mr Ellington Dowabobo, General Manager Commercial Fisheries Section; Mr Roland Kun, Marketing Manager; Mr Ken Detudamo, Commercial Fisheries Operations Manager; Mr Monte Depaune, Senior Administration Officer; Mr Sakaraia Vinaka, Masterfisherman and skipper of the F/V *Victor Eoaeo II*; Mr David Uera, Senior Fisheries Officer Coastal Section; Mr Ricky Starr, Senior Fisheries Officer Coastal Section; Mr Alan Debao, Projects Officer; Mr Michael Quadina, Technical Section Skipper; and Mr Bjorn Detageouwa, Mr David Rodiban, Ms Ebelina Tsiode, Mr Gary Degia, Mr Jake Debao, Mr Jiovanni Goura, Mr O'Brien Aboubo, Mr Peter Waidabo and Mr Slade Benjamin, Fisheries Staff that participated in the fishing trials and workshop.

Gratitude is also conveyed to Mr Sean Oppenheimer, General Manager of Capelle & Partner Company; Mr Suliana Jiare, Refrigeration Supervisor Capelle & Partner, Mr Leslie Thaggard, Vessel Maintenance Manager — National Phosphate Company and Mr Robert Grundler, Nauru Power Station Supervisor, for the interest they showed in the project, the information and views they shared from the private sector, and their companionship during the project.

The Australian Government, through AusAID, and the Government of Taiwan/ROC provided funding for the fieldwork carried out during this project, and SPC acknowledges with gratitude this funding support.

SUMMARY

Technical assistance was provided to the Republic of Nauru following an official request that lead to the signing on a Memorandum of Agreement between the Republic and SPC on 10 January 2002. The project commenced on 14 February 2002 with the arrival of SPC's Fisheries Development Officer, William Sokimi in Nauru. The main objective of this project was to have the SPC Fisheries Development Officer work with the fisheries staff and interested fishermen to introduce mid-water fishing techniques that can be used in association with FADs. The secondary objectives were to provide assistance to the Nauru Fisheries and Marine Resources Authority's (NFMRA's) FAD programme if the materials were available, to assist with training on the NFMRA tuna longliner if required, and to provide training on the correct on board handling, processing, and chilling procedures that ensures quality products are presented for the export market and local sales.

Problems were encountered with the availability of materials for both FAD rigging and for making up some of the fishing gear. This led to revised activities being undertaken, which involved the compiling of an Operations Procedures Manual, coaching the commercial fishing team in getting the tuna longliner F/V *Victor Eoaeo II* operational again, and getting the commercial fishing team to know and familiarise themselves in detail with the systems on the vessel.

Schematic diagrams were drawn of the F/V *Victor Eoaeo II*'s hydraulic system and the wiring system for the vessel's electronic steering. This was a major task as there were no documents with the vessel, and several problems needed to be rectified. The Fisheries Development Officer also drew up checklists for different operations on the vessel. These were all made available for inclusion in the procedures manual.

The Fisheries Development Officer worked with the Technical and Coastal Section in conducting one workshop. A total of 20 fisheries staff and 6 local fishermen were trained in mid-water fishing techniques, especially vertical longlining and ika-shibi fishing. A total of 10 fishing trips were undertaken, six with fisheries staff and four with private sector fishermen. Catches were low as there was very little tuna activity around the island and there were no FADs to fish around. Nevertheless, adequate fish were caught to show fishermen that the methods worked, with vertical longline trails catching fish during both day and night sets.

There are several recommendations made in this report to assist and advise the NFMRA with the their future training and development programme, as well as the operation of their longline vessels.

CONTENTS

1. INTRODUCTION AND BACKGROUND

1.1 The Republic of Nauru

The Republic of Nauru (Figure 1) is an isolated single landmass that is located just south of the Equator at Latitude 0˚ 32' S and Longitude 166˚ 55' E (Anon 2000a). It has a total land area of 21.1 km^2 (6 km x 4 km — 5,263 acres), with a population of 11,500 people and an annual growth rate of 1.8 per cent (SPC 2000). The island has an average height of 50 m above sea level, and a coral 'belt' ranging from 150 to 300 m wide surrounds the 19 km circumference of the island (Williams and MacDonald 1985).

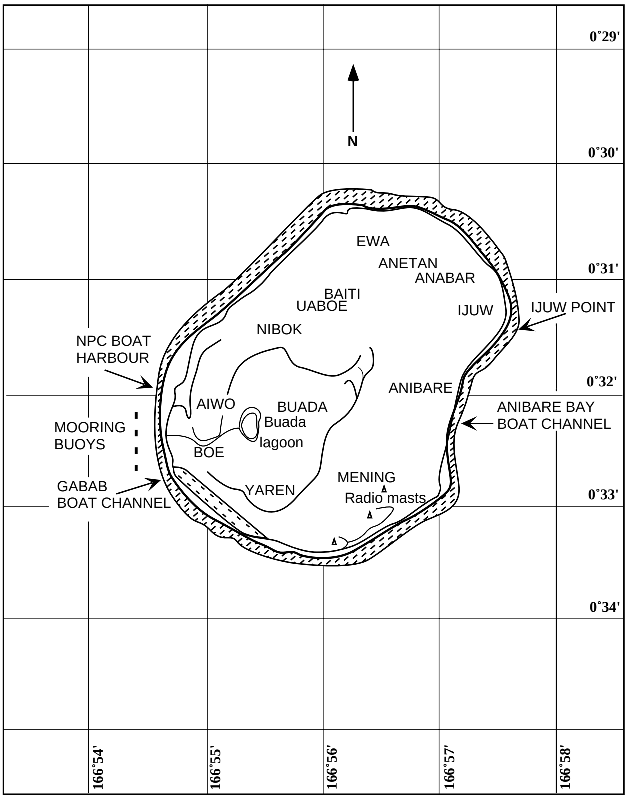


Figure 1: Nauru Island

Daily temperatures range from 24˚ to 34˚ C. The island has a tropical climate with northeast trade winds that blow from March to October, and a monsoon season from November to February. The average annual rainfall is 2060 mm and occurs unpredictably (Anon 2000b).

Nauru is comprised mainly of raised coral limestone with rich deposits of guano phosphate, resulting from seabird droppings over the centuries. Because of the agricultural demand overseas and the economic viability of guano phosphate as a fertilizer, much has been mined and exploited to supply overseas markets over the years. This has also been the main source of income that has propped up the Nauruan economy since the island obtained independence in January 1968 (Anon 2000c).

Excessive mining over the years has resulted in the depletion of the stock on hand, and since guano phosphate is not an easily replaceable commodity, the leaders of Nauru are now looking to other natural resources to aid in the recovery of an ailing economy.

1.2 Fisheries

Being an island nation surrounded by the sea, Nauru relies heavily on the harvesting of marine resources to provide food, and more recently, a source of income for its inhabitants. Traditionally, Nauruans gleaned the limited reef areas and fished outside the reef. Nauru has no lagoon.

The main fishing area off Nauru is the mooring buoys anchored in the vicinity of the Nauru Phosphate Corporation's (NPC's) phosphate cantilever loading facility. These deep-water moorings are used to tie the bulk carriers during the loading of phosphate. The buoys are good fish aggregating devices (FADs), especially for fishermen doing scatter-bait (drop-stone) fishing and trolling (Cusack 1987).

Nauru has attempted to develop commercial fisheries in the past, with the purchase of two purse seiners in the 1980s. Unfortunately this venture failed, as it was realised the nets were too shallow for fishing in the region (Chapman et al 1998). In the 1990s, Nauru looked at FADs as the basis for small-scale tuna development. Between 1990 and 1997, SPC conducted four projects in Nauru that culminated in the deployment of several FADs around the island (Chapman et al 1998). These FADs assisted the local fishermen greatly, especially in the capture of pelagic fish such as billfish, mahi mahi, wahoo and tuna; but the continued exposure to open ocean and weather elements resulted in a continuous loss, and a replacement exercise that proved expensive.

The Fisheries Department became the Nauru Fisheries and Marine Resources Authority (NFMRA) in the mid-1990s. NFMRA has undertaken several projects since its formation, including FAD work and the purchase of a tuna longline vessel, F/V *Victor Eoaeo II* (Figure 2). SPC provided assistance to the operation of this vessel in 2000, with training initiated with the crew (Sokimi and Chapman 2001).

Figure 2: Nauru's tuna longliner F/V **Victor Eoaeo II**

Fisheries products are naturally considered for further development by NFMRA and the Government of Nauru, hence the introduction of a National Fisheries Development Plan targeted on utilising the readily available fisheries resources and to provide employment and initiate backup commercial businesses to support the industry (Anon, 2000b).

NFMRA also generates income from issuing licenses to foreign purse seiners and tuna longliners to fish within Nauru's EEZ. The current licensing policy for foreign vessels may change as NFMRA develops their domestic tuna longlining capacity, including expansion in the private sector.

1.3 Initiation of the project and its objectives

The advancement of fisheries in Nauru has progressed steadily over the years resulting in the NFMRA prompting moves to further develop its Commercial Fishing Section, of which the fish market and the tuna longline unit figure prominently. NFMRA has identified that in order to further advance the commercial fisheries department, it has to focus on developing the infrastructure and meet the training needs of the fisheries staff and the private sector. To develop better marketing of fish products, the fishermen need to be trained to produce quality fish and to target the species required by export markets. By doing this, NFMRA hopes to divert fishing effort away from the reef or bottom species to offshore pelagic species.

In support of this approach, technical assistance was requested from SPC to assist NFMRA in achieving their goals. A Memorandum of Agreement was signed between the Government of Nauru and SPC on

10 January 2002 to formally establish agreement between the two parties. The Memorandum of Agreement identified the roles and responsibilities of both parties, and the objectives to be met during the project.

The primary objective of the project was to have an SPC Fisheries Development Officer work with the fisheries staff and interested fishermen to re-introduce mid-water fishing techniques that can be used in association with FADs. Several workshops would have to be conducted to demonstrate the main FAD-associated fishing methods used in the region: ika-shibi, palu-ahi, vertical longline, and a 50 hooks horizontal longline.

The secondary objectives were to provide assistance to NFMRA's FAD programme if the materials were available, to assist with training on the NFMRA tuna longliner if required and to provide training on the correct methods that ensures quality products are presented for the export market and local sales. These processes deal with correct handling, on board and shore processing, and chilling procedures.

2. PROJECT ACTIVITIES

2.1 General

Although the activities for the project were planned well in advance, the execution of the project did not go accordingly. This was mainly due to the FAD materials and the gear for mid-water fishing methods not being available during the time of the project. Much of the project was done with improvised fishing gear and gears borrowed by NFMRA's Technical and Commercial Fisheries Sections.

The initial plan for the project was for the Fisheries Development Officer to work with the NFMRA officers in the Coastal Fisheries Section, to organise and rig several FADs and to deploy them when ready. While waiting for the FADs to aggregate fish, at least two workshops were to be conducted. The first workshop was to demonstrate to the fisheries staff from the Coastal, Technical, and Commercial Sections the type of mid-water fishing methods that would be tried out around the FADs. A talk on safety and small craft handling was to be undertaken at the commencement of the workshops.

The revised activities involved assisting the Commercial Fishing Section. Assistance included compiling an Operations Procedures Manual, coaching the commercial fishing team in getting the tuna longliner F/V *Victor Eoaeo II* operational again, and getting the commercial fishing team to know and familiarise themselves in detail with the systems on the vessel. Having completed this, and with the commercial section back on track, the Fisheries Development Officer worked with the Technical and Coastal Section in conducting one workshop and six-demonstration fishing trips.

2.2 F/V *Victor Eoaeo II*

At the time of the project, F/V *Victor Eoaeo II* was in port and had been broken-down for two months. The Fisheries Development Officer was requested to assist the management team to get the vessel operational again. He refrained from actually doing the repairs himself or leading the repair team. However, the management team was coached in how to handle the situation.

The Fisheries Development Officer used this opportunity to get the management team to familiarise themselves with the vessels systems, as the vessel was sold to Nauru without a general arrangement plan or a structural, stability and systems information document. The information derived from this exercise was an important input to compiling the operations procedures manual and crew training.

Several areas of concern are identified below. These areas need to be addressed to improve the vessel's operational capabilities and as a precaution in the event of emergencies.

2.2.1 Assessment of the hydraulic machinery for fishing operations

Examination of the set up of the hydraulic system on board F/V *Victor Eoaeo II* revealed several flaws that contributed to the slow setting operations experienced by the skipper and crew of the vessel. Details of the vessel and fishing gear specifications can be found at Appendix A, with other details in Sokimi and Chapman (2001).

The installation of the hydraulics was professionally done, but the advice given for the set up was probably given according to the preferences of the fishing master who was in charge at the time. The problem with this set up is that it will not allow for a variation in the gear performance during fishing operations, or cater to the preferences of different skippers.

The whole hydraulic system is enclosed without any valves in between the lines to set or reset configurations while the operation is underway. The present setting allows the reel to release sufficient line to meet a boat speed of six knots at the beginning of the operation. As the mainline on the reel diminishes, the vessel speed has to be reduced to meet the reel speed. The reel speed cannot be increased, with the diminishing diameter, to keep up with a constant boat speed. Not only does this slow operations down, but it also stops the skipper from achieving deeper sets, maintaining consistency, or allowing alternate preferences during line setting. Appendix B provides a list of the hydraulic hoses and fittings used on F/V *Victor Eoaeo II*, plus a line diagram of the set up.

Another problem is that the line shooter has a fixed speed that is pre-set before the line setting operation. This has to be done with an ‘Alan’ key, which is not a practical way to perform adjustments while an operation is underway. To get the line setting operation started, the system has to go through a ‘jerky’ start before the reel finally catches up to the shooter speed. Coordination has to be established between the fixed shooter speed and the person releasing the reel. This is the reason that line burns are visible on the mainline.

A simple solution to this would be to install a valve in the hydraulic lines just before the reel that would allow the reel to free spool. A valve should also be installed on the shooter in place of the Alan key screw adjuster. This will allow the skipper to set whatever speed he wants on the shooter and to begin and end the line setting operation with ease.

Alternatively, a slightly more expensive system exists. Seamech Ltd in Suva currently uses this system and it is proving popular in the region. Special valves are installed in the system to establish a coordinated function between the shooter and the reel. This system is easier to operate as the operation is controlled from a single point, the valve on the shooter. Once the valve is turned on, the reel begins to rotate to match the speed of the shooter. As the diameter of the mainline on the reel diminishes, the reel rotates faster to keep in constant coordination with the shooter speed. If for any reason a fault occurs and the mainline jumps off the shooter, the reel will make only two to three turns before stopping. This prevents line over-spill.

2.2.2 Steering system

F/V *Victor Eoaeo II* has an electronic steering system. There are three stations from which to steer and command the vessel. The fly bridge, wheelhouse, and aft hauling station (Figure 3). At each of these stations there is a steering toggle.

***Figure 3: Aft hauling station on F/V* Victor Eoaeo II**

The set up is such that when the steering toggle is moved either to the port or starboard, the message is electronically relayed to a master control panel in the wheelhouse, where the command is transferred to the steering solenoid, which directs the hydraulic flow in the desired direction. The set up of the steering system is quiet complex. Several components are interconnected to form a complex web of wiring. The whole system consists of an auto pilot, master compass, three steering stations, three rudder indicators, an auto pilot main switch on the panel board, port and starboard rudder main switches (two rudders as this is a catamaran hull), master control unit, auto pilot tiller sensor, and the solenoid unit in the engine room. Appendix C provides a series of wiring diagrams for the electronic steering system.

The set up in the engine room onwards is typical for hydraulic steering systems where you have a hydraulic tank and filter, a steering pump, steering solenoid, solenoid power system, steering ram and rudders. The connection from steering stations to the solenoid is all electronics and wiring. Should an emergency arise, the only way to steer the vessel back to safety would be to disconnect the hydraulics and to find some way to coordinate the rudders from aft.

While the electronics steering system is suitable for developed countries, it should not have been chosen for isolated islands such as Nauru where the access to high tech electronic parts is difficult to come by. If an electronic error occurs, even a minor one, an electronics technician would have to be flown in from elsewhere to rectify the problem. There is no manual system available in case of power failure or electronic errors. The electronic steering system is an excellent supplement to vessel operations but a manual system should also have been in place. This is easier to service in the islands and should a fault arise in the electronics system, the vessel would still be able to return to port or to continue with fishing trips while awaiting parts for the electronics system.

2.2.3 Fuel tank calibrations

A calibration table was made up for the two main service tanks and a dipstick was constructed to take regular soundings. These tanks are identical in configuration. The new calibration tables will enable the skipper and the management to know exactly the rate of fuel consumption per trip and it is useful for predicting the amount of fuel to be ordered for the vessel. The tank configuration is: length 137 cm, width 98 cm, and height 148 cm. The calibration table is at Appendix D.

2.2.4 Nauru Fisheries Corporation tuna longline operations procedures manual

Part of the process in developing the tuna longline operations procedures manual was to observe the system that was in place, and to improve on this while discarding the burdensome items and implementing new ones that conform to the current trends of medium-scale tuna longline operations in the Pacific. The areas that were evaluated were: shore operations management procedures; ship to shore arrangements; fishing vessels standing orders and crew arrangements; vessel management and maintenance procedures; fishing gears and fishing operations assessment; vessel machinery assessment; and fish handling, storage and packing procedures.

The system that was in existence at the time of the project was symptomatic to an operation that deals with matters as they arise. The operations were built around first obtaining the vessel, then setting up systems as the operations progressed and as new functions were identified. One of the problems associated with operating a vessel this way is that a less detailed plan might be derived to plot the vessel's future movements and requirements for maintenance schedules and work programme.

It would have been ideal to first have a standard plan in place, then upgrade it as unperceived functions arise. With this in mind, it was decided to revamp the current system and at the same time commence working on an operations manual. This would give the whole operation a written platform to refer to in future, and should movement of staff occur over the years, new staff will at least have a guideline to follow.

The Fisheries Development Officer provided a list of procedures and checklists to aid in the compilation of the NFMRA tuna longline procedures manual. Appendix E summarises the checklists developed for NFMRA during the project and covers different scenarios from liaison to procedures to requirements.

2.3 Workshop and fishing activities

The delay in obtaining the fishing gears that were on order incited the move to hold only one workshop for the fisheries staff, to enable them to become proficient in the fishing techniques before inviting the private sector to participate. A workshop for the private sector would also be more organised with the proper gear in place and with the fisheries staff knowledgeable in the subject areas. Twenty fisheries staff attended the workshop that was held at the new fisheries complex in Anibare. These were officers from the Commercial, Coastal, Technical and Fisheries Projects sections.

Several enterprising fishermen from the private sector later requested the Fisheries Development Officer to demonstrate to them the mid-water and FAD fishing methods. This was done after hours and during the weekends to construct their gear and do fishing trials. These fishermen supplied their own gear, which they had ordered from the Fiji Fish Company in Fiji. The order for their gear was placed one week prior to it being delivered to the island.

The topics dealt with during the workshop covered safety at sea measures, small craft handling and care, detailed outline of the three types of fishing methods (vertical longline, ika-shibi and palu-ahi), construction of gear using basic materials or improvised gear, construction of gear using advanced gear, and the use of a sea anchor. The workshop concluded with a question and answers session.

2.3.1 Materials for the construction of fishing gear

Before conducting the workshop, it was decided to first collect the materials for constructing the fishing gears for vertical longline, ika-shibi and palu-ahi and the necessary sea safety equipment. Fortunately, the Commercial Section and the Technical Section were interested in the trials of these fishing methods, so they supplied most of the equipment. Other materials were purchased from the local shops. Most of the materials were on hand to make up the required gears for the three fishing methods. Where ideal components were not available, substitutes were used. When collected, a display was made of the gear (Figure 4) so that all fisheries staff knew what each component was and what it was used for.

Figure 4: Display of the sea safety and fishing gear

In a way, it was a good exercise for the fisheries staff to work with improvised gear, as one of the items on the agenda for the workshop was on how to use basic gear and substitute items to construct fishing gear. The details of the materials used for constructing fishing gear for each fishing method can be found at Appendix F.

2.3.2 Vertical longline

Vertical longline fishing is effective when used around FADs. Catch results pertaining to size and species may vary depending on the time of the year, location and the duration the FAD has been in the water. The depth positioning of the hooks, the spacing between hooks and the number of hooks also play a role in selecting species and fish size, and determining the maximum depth at which to fish.

While vertical longlining is an effective method for fishing around FADs, it can also be used in offshore waters, preferably where tuna schools frequent. Positive results have occasionally been achieved by fishermen who randomly set their vertical longlines in areas readily accessible to them but with less surface signs of fish activity.

The construction and composition of a vertical longline varies according to the preferences of the fishermen and his judgement of the target species and area that he will fish. It is basically a series of baited branchlines connected at a pre-determined distance to a mainline that is suspended vertically in water by a sinker at the bottom and supported by a float or several floats on the surface (Preston et al 1998). Figure 5 depicts a common construction for a vertical longline.

A vertical longline is made up of five components. These are the flag/light marker buoys, mainline support buoy, mainline, branchlines and weight. Each item is also broken down into several components and these vary according to the fisherman's preference.

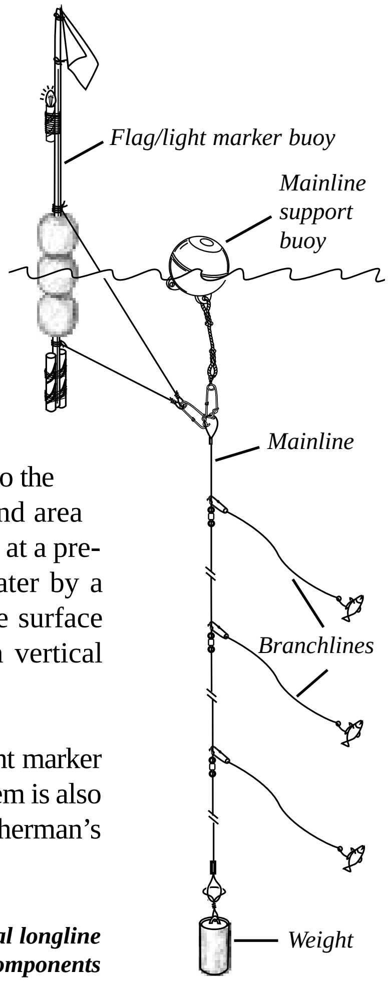


Figure 5: Construction of a common vertical longline showing the main components

Flag/light marker buoy

This is a buoyant flagpole with a weight attached to the bottom. The weight should be sufficient to keep the pole in an upright position when it is attached to the mainline support buoy and counter the weight of the flag and/or the strobe light. Normally bamboo poles are used but light gauge steel or aluminium pipes, old radio beacon antennas and other such poles are just as good. Two types were used during this project: old radio beacon antennas for the fisheries trials and bamboo poles in the private sector trials.

The poles were guided through the centre hole of three used purse seine floats. A bridle made of 6 mm green polypropylene rope, with a 2.6 mm x 100 mm B.L. swivel snap was attached to the pole (Figure 6). The snap was used to connect the flagpole to the mainline and mainline support buoy. The lower bridle length was made shorter than the upper bridle length to allow the flag to stay upright when floating. A 40 cm x 40 cm flag was attached to the top of the pole and a strobe light was taped to the centre of the pole (Figure 6), about 1.5 to 2 m above the floats.

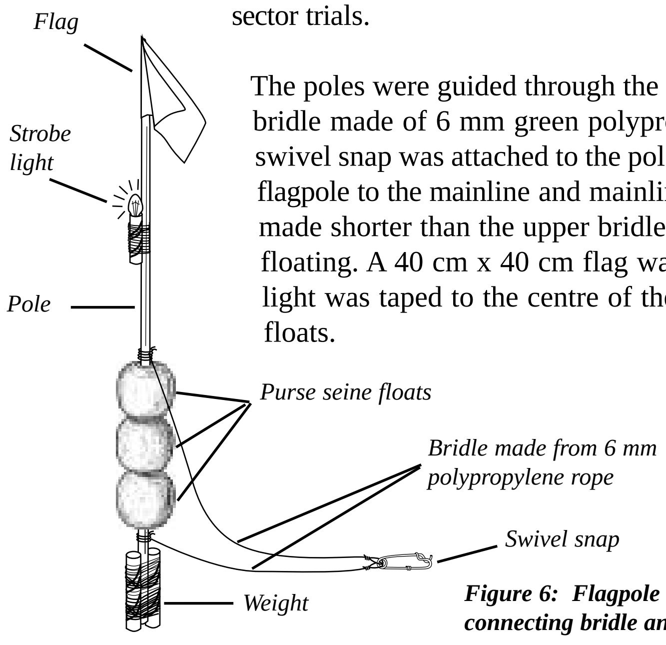


Figure 6: Flagpole arrangement with mainline connecting bridle and strobe light

Mainline support buoy

The type of buoy selected for vertical longlining has to be durable and be able to withstand the weight and force of the current on the gear suspended below it. The buoys used during the project were green hard plastic trawl floats with a diameter of 240 mm and a working depth to 300 m. These were the only floats available. Normally, orange hard plastic floats with diameters of 300 to 360 mm are used.

The attachment line connected to the float can be done in several ways. It can be attached by splicing one end of the rope through the eye and the other end to a swivelled snap (Figure 7) or it can be segregated into pieces where the segments are: buoy, strop and snap (Figure 8). A strop can be constructed by splicing one end of the rope onto its other end. This is then passed through the swivel on the snap then looped through its own bight and pulled tight. The same method is used for connecting to the buoy. This method of securing the connecting lines is useful for buoys that may be used for two different fishing operations. When required for other fishing purposes than vertical longline, the strop and snap can be removed.

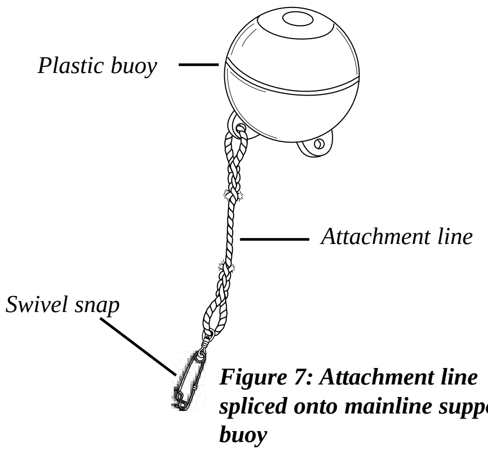


Figure 7: Attachment line spliced onto mainline support buoy

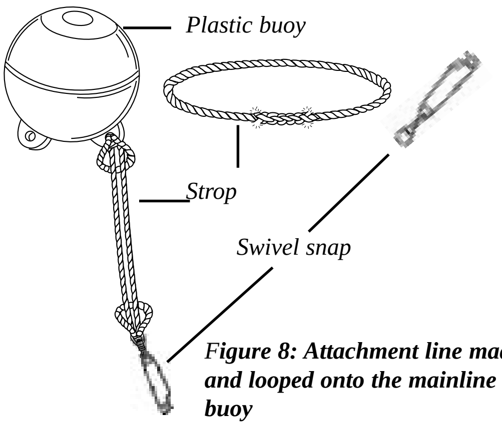


Figure 8: Attachment line made separately and looped onto the mainline support buoy

Mainline

Mainline size can vary depending on the operator's preference. Normally lines ranging in size from 2.1 mm (200 kg test) to 2.5 mm (270 kg test) are used as mainlines operated from small craft. These are easy to wind onto reels and will fit snugly on a 1.0 m circumference Alvey reel or the FAO wooden handreels. Heavier gauged lines are sometimes used on bigger vessels. These are usually from 2.5 mm (270 kg test) to 4.0 mm (540 kg test) diameter.

Ropes can also be used. Mainly tarred Kurolon ropes are used, as these are sinking lines and are more resistant to the lifting effects of the current. In the absence of other mainline materials, polypropylene rope can also be used but a heavier sinker has to be attached to the bottom. As polypropylene has floating qualities, the rope tends to lift when moving with the current thus forming a bigger belly in the centre.

During the project, four sets of vertical longlines were constructed for the initial fishing trials. Two sets consisted of 400 m x 6 mm green polypropylene mainline ropes and two were constructed from 3.0 mm (320 kg test) monofilament lines. The rope lines were flaked into plastic baskets 60 x 45 x 35 cm, and the monofilament lines were rolled onto two 1.0 m circumference FAO wooden handreels.

Only 19 x No. 6 box swivels and two 60 g lead barrel swivels were available for the construction of the mainline. This was sufficient to construct one full mainline with accessories. The other mainlines were constructed from rudimentary gear.

The two lead barrel swivels were crimped onto the ends of the mainline – one on each end. The box swivels were crimped on every 20 m. At every swivel, double crimping was done about 10 cm apart. This allowed a gap for the snap to be attached (Figure 9) to prevent it from sliding along the mainline when a fish is caught. The branchline is normally snapped on above the swivel.

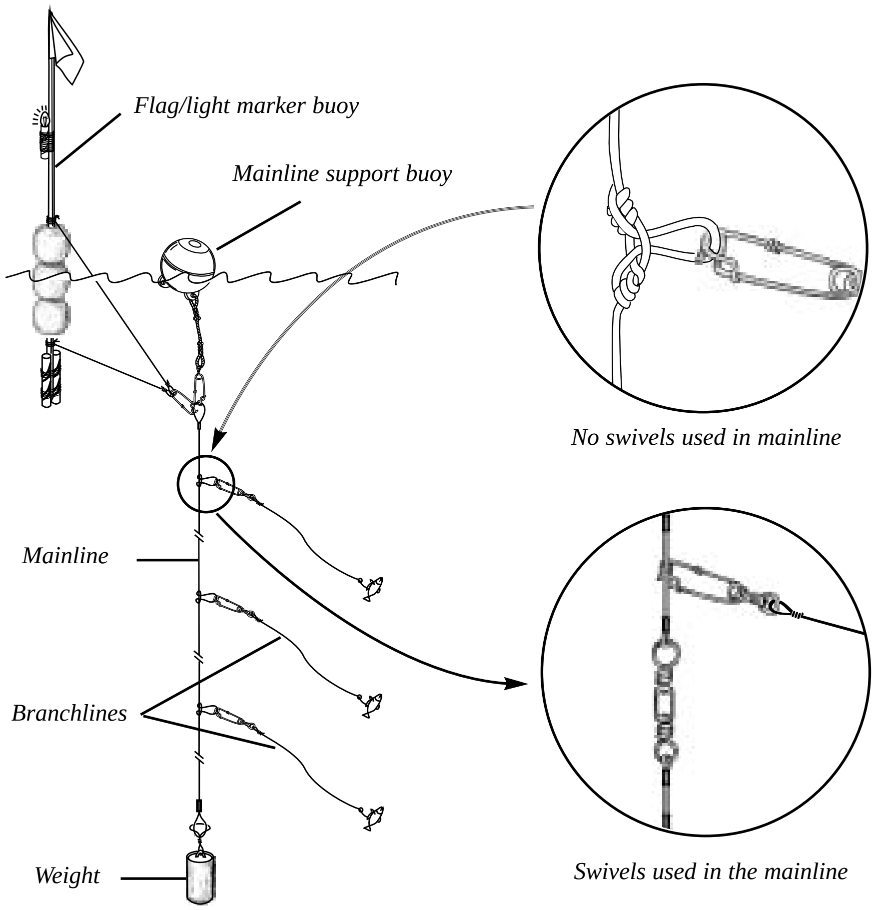


Figure 9: Two types of attachment points for connecting branchlines to the mainline

Butterfly knots were constructed to mark the snap on points on the other monofilament mainline and the two rope mainlines (Figure 9).

After the first fishing trials, the rope lines were dismantled and stored as these had faster drift rates than the monofilament lines. With the limited gear available, it was decided to use only the two monofilament lines.

Branchlines

Branchline sizes are chosen according to the fisherman's preferences or experiences shared by other fishermen, but also the targeted species and the size of the mainline influences this decision. Branchlines are lighter than the mainline, so that in times of high stress that ends in line breakage, a lighter branchline will part, thus saving the rest of the mainline, which is more expensive to replace.

When deciding on the length of the branchline, several factors also need to be taken into consideration. While a long branchline is ideal in keeping the fish alive longer by giving it more play, the spacing between hooks and the effort of deploying and hauling the line back in should be considered, aside from the cost. The spacing of hooks should be at least 2.5 times the length of the branchline. This allows a caught fish to swim in an arc that is clear of other branchlines and prevents line tangles.

The branchlines used during the project were constructed from 6 m of 1.8 mm (135 kg test) clear monofilament line. One end was crimped on to a 2.6 mm x 100 mm B.L. swivel snap and the other end was crimped on to a 15/0 stainless steel tuna circle hook. Clear plastic chaffing tubes were placed through the eyes of the snap and hooks.

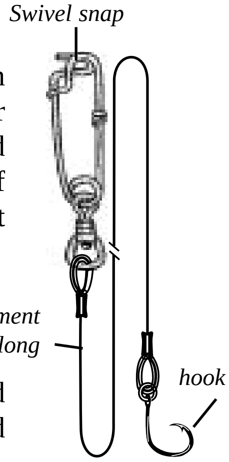


Figure 10: Branchline construction

Sinker (weight)

Any heavy object, at least 2 to 4 kg in weight, can be used as a sinker for a vertical longline. Some fishermen use heavier sinkers when using rope gear or when the current is running strongly in a particular area. The weights used during the project were cut-off pieces from links of discarded mooring chains. These weighed 2.5 kg and were 8 cm in diameter and 20 cm in length.

A lug was welded to the top of the weight to allow an attachment line to be spliced on. A strop without a snap was connected to the sinker and was attached the same way as for the buoy attachment line.

2.3.3 Ika-shibi

The ika-shibi method involves two types of fishing: for squid or small baitfish (scads, garfish, etc) and for pelagic species such as yellowfin tuna, bigeye tuna, rainbow runner, mahi mahi, barracuda, wahoo, etc. This is a nighttime fishing method and requires the use of lights to attract fish to the boat. Moonless nights are best for this type of fishing although several fishermen have also had a degree of success when the moon is up. This may probably be due to the area fished and the abundance of baitfish around the vessel.

The basic idea is to have at least a bright overhead light and a bright underwater light to attract baitfish to the vessel, mainly squid. The aggregation of baitfish and squid around the vessel also attracts tuna and other pelagic species to the area. The fisherman jigs for the baitfish or squid and attaches this to his line for catching the tuna and pelagic species.

In the absence of tuna or other pelagic species, the squid and baitfish that are caught are also delicacies on the islands, so these can be taken home instead. Some fishermen who have done ika-shibi fishing frequently use this as a gauge to judge when their fishing area will become active again. When pelagic fish move away from an area and baitfish or squid is scarce or vice versa, this can clearly be noticed when doing ika-shibi. While a certain amount of squid will continually be noticed around the lights, scads, garfish and sardines are seasonal and an abundance of these means good tuna fishing for most areas. The squid numbers also increases tremendously during these times.

The demonstration ika-shibi fishing trials had to be done during the full moon period as the Fisheries Development Officer had little time left at the end of the project. One demonstration was also done during a dark night but the results were the same. A small amount of baitfish and squid congregated around the vessel, but only barracuda and trevally were caught with handlines and the ika-shibi lines.

Construction of the ika-shibi gear

The ika-shibi gear was made up of three components: the mainline, sinker and trace. Rope of 5 to 7 mm is normally used for mainlines but some fishermen use Dacron line or similar multiplaited rope material. These are more expensive but also good for mainlines as they are smaller to handle but have good gripping qualities.

Three sets of mainline gear were constructed from 6 mm green polypropylene rope, each 150 m long. One end of each line was secured to a plastic basket in which the line was coiled. As an added precaution, the baskets had styrofoam floats secured to the sides (Figure 11) for buoyancy. An eye splice was made in the top end of the rope.

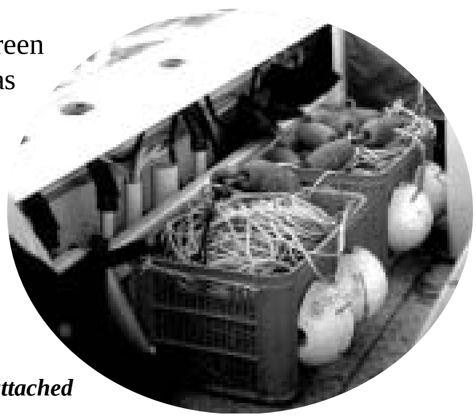


Figure 11: Baskets of gear with styrofoam floats attached

A 40 cm x 2.5 cm copper pipe was filled with lead that was obtained from old discarded batteries. This was to be used as the sinker. Before pouring the melted lead through the copper pipe, a stainless steel wire was put through the pipe and a leaded barrel swivel was connected on each end of the wire. The sinker weighed 1.5 kg. The end of the mainline was spliced to the swivel on one end of the sinker (Figure 12).

The trace line was constructed using 2 m of flexible stainless steel wire (7 x 7 x 1.08 mm x 96 kg test) with one end crimped to the swivel on the other end of the sinker and the other end crimped onto a 15/0 tuna circle hook (Figure 12). Green spring-wire protectors were used to protect the wire at the connection joints.

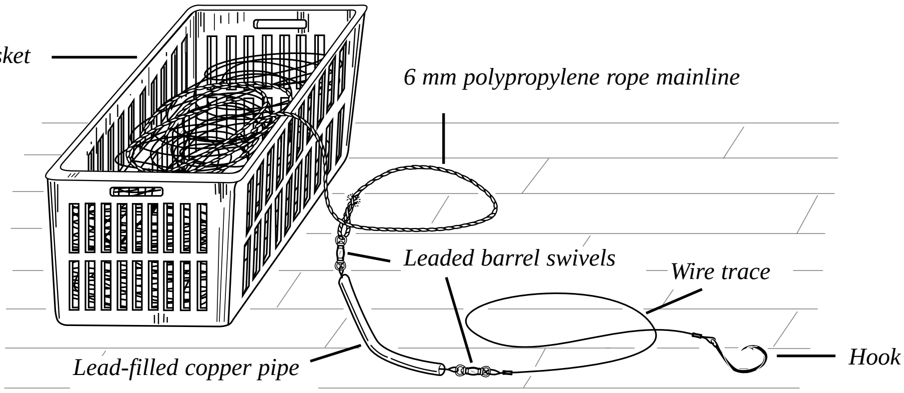


Figure 12: Ika-shibi fishing line arrangement

Ika-shibi — squid fishing

Although the timing of the ika-shibi demonstrations was not ideal, the fisheries staff that participated in the demonstrations saw the possibilities of using this method effectively at the opportune time.

Two 100 watt underwater lights were hung from the vessel about 1 m below the surface, to attract baitfish to the boat. The light unit consists of a sealed quartz halogen globe that has a 3 m cord connected with two battery attachment clips at the end. These were connected to a fully charged N 70 car battery. It would have been ideal to have a dimmer switch or rheostat connected between the light and the battery. This would allow the fisherman to dim the lights and draw the fish closer to the vessel. The fishing vessels deck lights were turned on for added attraction while the vessel lay drifting.

Squid lures could not be purchased anywhere on the island so improvised lures were constructed instead. These were made from cut-off pieces of 5 mm stainless steel cable strands. Twelve strands were lashed together with one of the strands longer than the rest. This was for binding the group of strands onto a 1/0 crane swivel at one end. The other ends were sharpened then bent so as to form 12 x 1 cm barbs. A 3.5 cm squid skirt lure was put over the top of this and secured at the crane swivel end (Figure 13).

Casting for squid using these lures did not produce any results but when four of the lures were rigged for jigging (Figure 13), big fish, probably barracuda, struck the line the minute it was lowered to a depth of around 30 m and short jerky movements applied. All except one lure was lost in this way.

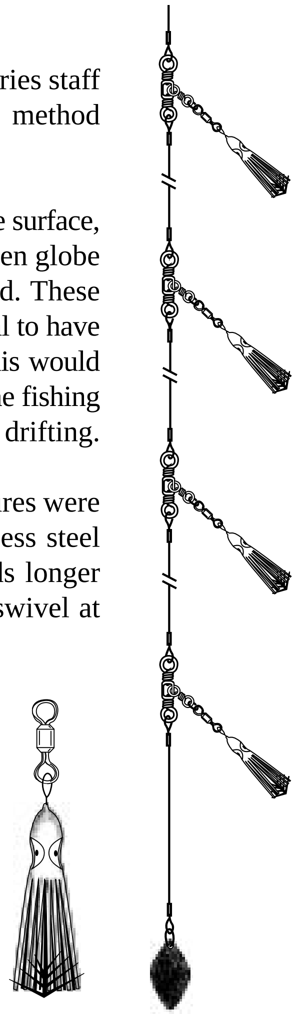


Figure 13: Squid lures made up during the project

Sea anchor

An important requirement for ika-shibi fishing is to have a sea anchor available. The sea anchor size must match the size of the fishing vessel. It should be effective enough to hold the boat's head into the weather and reduce drifting speed. A sea anchor that allows the boat to ride side-on to the weather is too small and should be replaced.

The sea anchor used during this project was factory made and came with the boat when purchased. The sea anchor was made of canvas in the shape of a cone, The cone was 1 m in length and had a 0.5 m opening at the large end and 0.2 m opening that the other. The main opening had four bridles around 1 m long each, spaced evenly around it (Figure 14), with the bridles connected to a single rope to the boat. A trip line was connected to the small end for easy retrieval of the sea anchor.

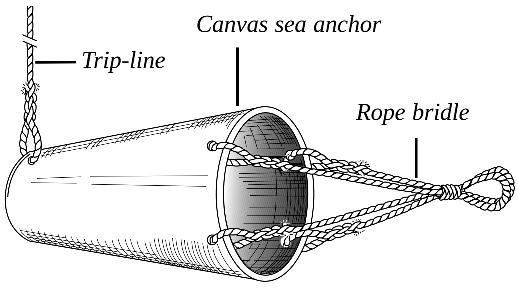


Figure 14: Sea anchor made up for project ika-shibi fishing trials

2.3.4 Palu-ahi

The palu-ahi fishing method is similar to 'drop stone' fishing. Generally it is a perfection of the drop stone fishing method where chum and bait is lowered to the desired depth and released, while the baited hook floats free of the stone, at the same depth, in readiness for any approaching fish.

While the drop stone method requires the fishermen to cart at least a bag load of stones out to sea, the palu-ahi method is compact using a weight attached to the line. The idea is to attach a flat weight to a 1/0 crane swivel and rove this through the mainline above the swivel connecting the mainline to the trace. A square denim cloth is also attached to the same swivel as the flat weight. Chum and bait is placed in the denim cloth together with the coiled trace line. This is then wrapped up into a 'parcel' and secured by the mainline with a few turns and a slipknot.

The palu-ahi method was not used during the fishing demonstration trips as the idea was common to the islanders and did not need to be elaborated on aside from constructing a demonstration line.

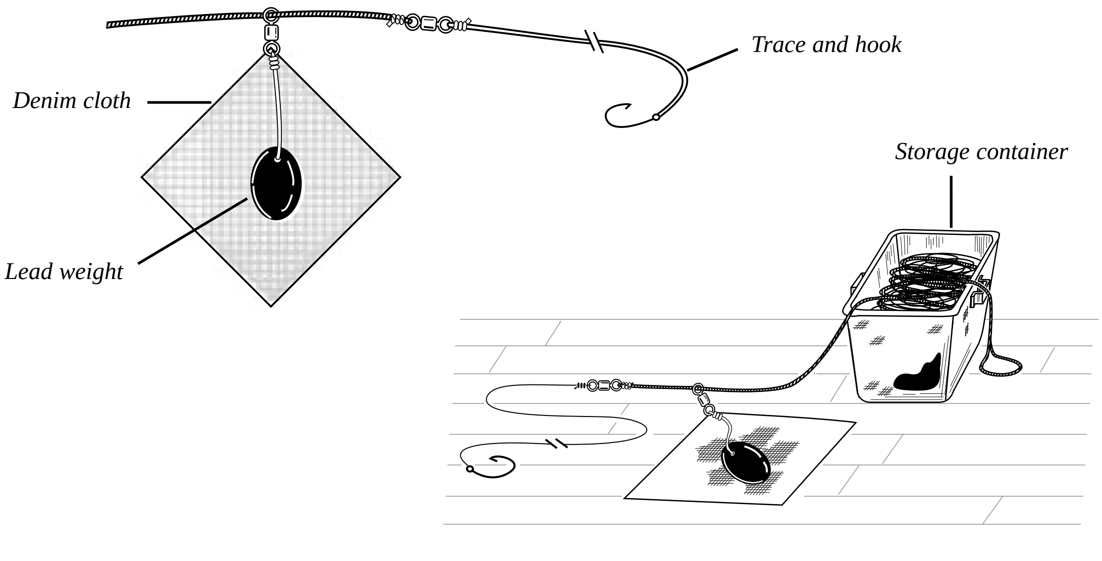


Figure 15: Palu-ahi fishing gear arrangement

2.4 Results of fishing demonstrations and training

Six demonstration fishing trips were carried out with the fisheries staff, with 20 staff trained in the different mid-water fishing techniques. The private sector did three trips with two of the fisheries officers who had been through the workshops and seconded to the project. Appendix G summarises the fishing activities and catch recorded during the demonstration training trips.

Four of the fisheries trips were during the full moon phases and two after. The trips undertaken with the private sector were done after the full moon. Yellowfin and bigeye tuna were the target species but none were caught during the gear demonstrations and training. The private sector trips, however, did manage to produce yellowfin tuna by ika-shibi and trolling, but these fish were small and in the 5 to 10 kg range. One blue marlin was taken on the vertical longline (Figure 16), with pomfrets and barracuda also taken on some trips.

Figure 16: Blue marlin taken on the vertical longline

Observations of the fish activity while ika-shibi fishing showed little sign of life except for the occasional small school of squid and baitfish. This coincided with the overall catch effort on the island. Yellowfin or bigeye tuna were scarce on the island for almost two months before and during the fishing demonstrations. Fishermen would infrequently return with a 5 to 10 kg yellowfin during this period. The local consensus was that this was normal for this period of the year with the tuna expected to come in abundance from the end of May onwards. The presence of pomfrets indicates that the 400 m line depth is sufficient to catch bigeye tuna. Pomfrets are normally found together with bigeye tuna, but not in large numbers. During the fishing demonstrations only pomfrets were caught accentuating the absence of bigeye tuna in the area for that period.

The fishing trips alternated between night and day trips. Three of the fisheries trips were done at night to try out the ika-shibi method while soaking the vertical longline at the same time, and three trips were done during the day to observe the vertical longline around fish schools. Two of the private sector trips were done during the day while the first trip was done at night. On all trips conducted during the day, trolling was done to fill in the waiting periods.

3. DISCUSSION AND CONCLUSIONS

The depletion of phosphate reserves on the island of Nauru will continue to put pressure on the government to exploit and develop its other major natural resources — fisheries and marine products. This will include controlled development, training and improved fishing operations.

3.1 Development and training

NFMRA has the task of drafting and enforcing development and management plans to ensure that the marine resources are exploited sensibly and conservatively. As the reef and bottom species of marine products are slow to recuperate, focus should be placed on exploiting the offshore pelagic fishes.

Fishermen should be encouraged to assist in preventing over-exploitation of the reef and bottom species through including them in consultations as stakeholders.

The development of a commercial fishing section, and training of the fisheries staff and private sector fishermen to partake in the commercial development of offshore fisheries, is a step currently being undertaken by NFMRA. The work that was done during the current project was a continuance of this scheme, although there is scope for more training such as this to occur in the future. To support this, NFMRA should conduct periodic fishing trials and carry the different fishing equipment in stock for these trials and to sell these materials to local fishermen.

The senior fisheries staff and the fishermen from the private sector were enthusiastic and very eager to participate in the development and demonstration of the mid-water and FAD fishing methods. The junior fisheries officers and the younger generation, however, were less enthusiastic and some looked as if they were just going through the motions of passing through another day. The fisheries staff that participated in the workshop and fishing trials are now capable of running similar workshops in the future, and NFMRA should encourage this.

NFMRA should work closely with the private sector to achieve the ultimate goal of developing industrialised commercial tuna longline fishing operations on the island that will conform to a controlled exploitation programme that ensures a sustainable supply and harvest of the resource. In doing this, skippers, engineers and crew will need to be trained up to man the vessels. NFMRA needs to consider this now, before additional boats are purchased, as it will take some time to get the appropriate people trained up, especially engineers which may take several years.

The Fisheries Development Officer has identified five potential skippers among the ranks of NFMRA's Commercial Fishing Section. These personnel should be prepared for a Master Class 6 Certificate of Competency. The course is conducted at most maritime colleges around the region. NFMRA needs to identify funding to allow these and/or other staff to be sent to the appropriate institution to be trained. NFMRA's goal is to increase their fleet of tuna longline vessels. This is an achievable goal, although the infrastructure needed to support any increase in fleet numbers also needs to be considered carefully. The new boat harbour can accommodate more vessels for loading and unloading, however, the availability of freight space, fuel, water, bait etc need to be taken into account as basic infrastructure needs in support of increased vessel numbers. Also, NFMRA needs to come up with an emergency plan for protecting their vessels in the event of extreme weather conditions hitting the island.

It would have been ideal if the fishing demonstrations were conducted around active FADs and during the season when tuna frequent the island. NFMRA needs to get their FAD programme running again with the purchase of materials and the rigging and deploying of two or three FADs around the island. These FADs will need to be maintained and spare materials kept in reserve on-island to replace lost moorings as soon as possible or practical. NFMRA may need to seek funding for this if it is not already built into future budgets.

A suitable echo sounder is needed by NFMRA to assist in FAD deployment programme and deep-water bottom fishing surveys. The sounder should be capable of sounding depths of 3000 – 4000 m and have 3 kW power. An electronics sales technician should be consulted to provide information on a suitable model for Nauru's requirements. A duel frequency deep-water echo sounder would be best with 50 kHz and 28 kHz being the two frequencies.

NFMRA should do further investigations in identifying marketable offshore target species and fishing methodologies to harvest these species. Squid, sardines, scads and garfish are some of the species to consider. For the longlining industry, this could be a means of providing bait for the industry.

A means of getting the private sector to fully contribute to the progress of the commercial fishing industry is to put in place an attractive scheme that would enable the fishermen to receive good prices for their fish. At present fish is bought off the local fishermen at prices dictated by the fish market. If the prices offered are not competitive to that elsewhere on the island, the fishermen will first try to sell his catch outside before approaching the fish market. By this time the quality of the fish will have deteriorated. For local sales the impact may not be so great but when targeting the export market, potential income generating fish could go to waste.

As the industry develops and the export of quality fish is advanced, the local fishermen will get to hear of the attractive prices that are received by the fish market and they will want to export their fish as well, instead of selling to the fish market for a fixed price. Some might not want to get involved because of the cost of processing, packing and freight involved. Others would find it difficult because they do not have the facilities to pursue such venture but would like to try anyway.

The fish market can encourage the private sector to participate in exporting by offering to process, pack and market the fish for a percentage of the final sales figure. The market would do the work for the fisherman on a commission basis. All the cost of the operations would have to be paid for by the fisherman himself from the money earned on fish sales. This would encourage the fisherman to handle and preserve their fish well, so as to deliver a top quality product that may earn him a higher price.

3.2 Operation of NFMRA's longline vessels

The long delay of F/V *Victor Eoaeo II* in port and the continued blunders that developed during the repairs of this vessel could have been avoided had a proper management plan and vessel operations system been in place at the time the vessel was delivered to Nauru. This would include vessel deck and engine room details, crew and operations standing orders, engine service information, maintenance programme, etc. To overcome this, NFMRA needs to develop an operations and procedures manual for their longline fleet. The manual should include the different checklists and procedures covered in this report (Appendix E), which were developed by the Fisheries Development Officer specifically for NFMRA's tuna longline vessels.

Such a manual should enable the NFMRA to keep a consistent operation in the commercial section despite the movement of staff in or out of the organisation. The initial manual should be a guideline for newcomers who join the fisheries without proper hand-over from his/her predecessor. The manual should be developed along with the progress and demands of the commercial fisheries section. Innovative materials should be included and defunct ones should be discarded. As the industry progresses, it should become a manual moulded to produce efficiency for the commercial fisheries section.

Additional to the operations and procedures manual, plans should be developed for vessel management, and vessel operations and maintenance. These plans should be developed and made effective as soon as possible.

The mechanical problem that developed while the vessel was waiting for bait to arrive on the island, is a direct result of the vessel not having a schematic diagram to display the wiring arrangements. It is also due to negligence on the part of the vessel's engineer and his shore counterpart in that they did not seek further professional advice when dealing with the vessels electrical system. Professionally though, schematic diagrams and information documents are required to be carried on vessels that are operated commercially.

The vessel does not have a schematic diagram for any of the equipment on board. A simple servicing of the starters and alternators and a modification of the12 volt supply system to 24 volts resulted in costly downtime. Schematic diagrams of wiring and hydraulic piping of all the systems on board should have been made available for tradesmen who are engaged to carry out repair work on the vessel. To overcome this, the Fisheries Development Officer worked with the vessel skipper and operations manager, and drew up schematic diagrams for the electrics (Appendix C) and different hydraulic systems (Appendix B). The skipper and the operations manager are now capable of producing such diagrams if the need arises for future vessels. For a fisheries vessel with unpredictable crew and management movements, the schematic diagrams and information documents should be kept on board and also filed with management.

The hydraulic system on the F/V *Victor Eoaeo II* and other future longline vessels should be upgraded to perform operations that can be alternated during the fishing operation. The system should be user friendly to allow for smooth setting and hauling operations. It is best to go with proven brands that are widely used in the region. In the interim though, there is a need to install a valve in the hydraulic lines on F/V *Victor Eoaeo II*, just before the reel that would allow the reel to free spool. A valve should also be installed on the shooter in place of the Alan key screw adjuster. This will allow the skipper to set whatever speed he wants on the shooter and to begin and end the line setting operation with ease.

The F/V *Victor Eoaeo II* is aging, and safety requirements have fallen behind regional standards, and this needs to be remedied. This and future vessels should be upgraded to meet fishing vessel safety standard requirements that are compatible to the region, and maintained at this standard.

Problems were encountered with the steering system on F/V *Victor Eoaeo II*, which could have rendered the vessel helpless while out at sea as there was no back up or hand steering capability. It should be ensured that all future vessels, including the F/V *Victor Eoaeo II*, have a manual steering system on board, even as a complementary system to other modern versions.

4. RECOMMENDATIONS

The following recommendations are provided based on the Fisheries Development Officer's observations during the project, his past experiences in Nauru and other locations around the region, and from results of the mid-water and FAD fishing workshops and fishing trips. The recommendations are made following the same headings as presented in the previous section.

4.1 Development and training

It is recommended that NFMRA:

a) Focus future fisheries development work on exploiting the offshore pelagic fishes;

b) Encourage local fishermen to assist in preventing over-exploitation of the reef and bottom species through including them in consultations as stakeholders;

c) Continue to expand its current programme of training fisheries staff and fishermen from the private sector with the use of appropriate offshore fishing methods;

d) Use existing staff that have received training to run future workshops on mid-water fishing methods for other fisheries staff and local fishermen;

e) Conduct periodic fishing trials and carry the different fishing equipment in stock for these trials and to sell to local fishermen;

f) Encourage the younger generation to be more interested and involved in commercial tuna fishing activities;

g) Identify training needs in regard to skippers and engineers and start the process of getting suitable people trained in these areas;

h) Prepare several of their staff to undertake training for a Master Class 6 Certificate of Competency at a suitable maritime college in the region.

i) Assess and review infrastructure needs and requirements for maintaining a tuna fleet, and make changes to adequately achieve this;

j) Look at emergency plans to be put in place to deal with the likely situation of protecting their tuna longline vessels when bad weather hits the island;

k) Seek funding to purchase FAD materials and rig and deploy two or three FADs at strategic sites as soon as funding/materials are available;

l) Ensure they order sufficient materials to allow spares to be kept on-island for maintaining the FADs, and in the case of loss, replacing the FAD;

m) Purchase a 3 kW power echo sounder rated to 3000–4000 m with duel frequencies of 50 kHz and 28 kHz.

n) Do further investigations in identifying marketable offshore target species (eg squid, sardines, scads and garfish) and fishing methods to harvest these species;

o) Develop a scheme that would encourage local fishermen to deliver quality fish products for the fish market and/or for export;

p) Look closely at the pricing of the fish they purchase to reward fishermen for producing high quality fish; and

q) Encourage local fishermen to export their catch through the fish market, where the fish are packed and shipped either at a fixed cost or a percentage of the sale price.

4.2 Operation of NFMRA's longline vessels

It is recommended that:

a) The Commercial Fisheries Section of NFMRA develop an operations and procedures manual for the tuna longline fleet as a matter of urgency;

b) The manual include the checklists and procedures suggested in this report (Appendix E);

c) When the manual is developed, it is implemented immediately;

d) The manual be monitored and reviewed annually with any obsolete information discarded and new information included to keep it current and useful;

e) The schematic diagrams developed for F/V *Victor Eoaeo II* for the wiring and hydraulics be copied, with copies held on board the vessel as well as being filed with the operations manager;

f) Plans be developed and implemented as soon as possible for vessel management, and maintenance of the NFMRA tuna longline fleet;

g) The hydraulic system on the F/V *Victor Eoaeo II* and other future longline vessels be upgraded using proven brands of machinery that are widely used in the region;

h) As an interim measure, a valve be fitted in the hydraulic lines on F/V *Victor Eoaeo II*, just before the reel that would allow the reel to free spool;

i) A valve be installed on the shooter in place of the Alan key screw adjuster, to allow the skipper to set whatever speed he wants on the shooter and to begin and end the line setting operation with ease;

j) F/V *Victor Eoaeo II* and future vessels be upgraded to meet fishing vessel safety standard requirements that are compatible to the region, and maintained at this standard; and

k) All future vessels, including the F/V Victor Eoaeo II, have a manual steering system on board, even as a complementary system to other modern versions.

5. REFERENCES

Anon, 2000a. Air Nauru – Company Profile. The Republic of Nauru, 1 – 6, Retrieved 23 February, 2001 from the Web: http://www.airnauru.com.au/naurumain.html

Anon, 2000b. CIA – the World Factbook, 1, Retrieved 23 February, 2001 from the Web: http://www.cia.gov/cia/publications/factbook/geos/nr.html

Anon. 2000c. The Republic of Nauru (5 pages), retrieved February 23, 2001 from the web: http://www.earth.nwu.edu/people/emile/nauru.html

Chapman, L., P. Watt, P. Wellington and P. Mead. 1998. Capture Section Report of Fish Aggregating Device (FAD) site surveys, construction and development assistance to the Republic of Nauru (4 April to 2 May 1990; 15–26 October 1991; 6–14 March 1993; 28 April to 2 May 1993; and 14–23 November 1997). Secretariat of the Pacific Community, Noumea, New Caledonia. 42 p.

Cusack, P. 1987. Phosphate, FADs and fish. South Pacific Commission, Fisheries Newsletter No. 43, Noumea, New Caledonia. pp 34–40.

Preston, G., L. Chapman and P. Watt. 1998. Vertical longlining and other methods of fishing around fish aggregating devices (FADs): a manual for fishermen. Secretariat of the Pacific Community, Noumea, New Caledonia. 64 p.

Sokimi, W. and L. Chapman. 2001. Small-scale tuna longlining assistance and training for the Republic of Nauru. Fisheries Development Section, Fiend Report No. 9, Secretariat of the Pacific community, Noumea, New Caledonia. 19 p.

SPC. 2000. Pocket statistical summary. Brochure produced by the Secretariat of the Pacific Community, Noumea, New Caledonia.

Williams, M & B. MacDonald. 1985. The phosphateers. Melbourne University Press, Carlton, Victoria, Australia. 586 p.

Appendix A

Vessel specifications, electronics and safety equipment carried on F/V *Victor Eoaeo II*

Year built:	1993
Dimensions:	18 m x 5.2 m
Hull material:	Aluminium
Main engine:	Twin 6BTS 6 Series Cummins diesel
Auxiliary engine:	4 cylinder Isuzu
Generator:	26 kVa Mako Alle Spa generator
Freezers:	2 fish holds — capacity 7 t
Cool room/freezer:	1.8 m x 1.8 m x 2 m
Radios:	1 x Wagner SSB radio 1 x GME Electrophone GX558A VHF radio
Echo sounder:	JRC JFV-120 colour echo sounder 200 & 50 kHz frequency, Hummingbird.
Autopilot:	TMQ Electronics
GPS and plotter:	JRC GPS & plotter (C – Plot) with Omega Computer. (*At the time of this assignment, this equipment was removed from the vessel for repairs and replaced with a Magellan hand held GPS.)*
Radio direction finder:	Koden KS – 511

Domestic fridge & freezer

Microwave oven

Anchor winch

Boom winch

Six-person liferaft

Flares

Eight lifejackets

Appendix B

Hydraulic hoses and fittings used on F/V Victor Eoaeo II, with line diagram of the set up

From shooter (line setter) to deck

– 1 hose x 0.94 m x 19 mm (3/4"). Shooter end has a 19 mm (3/4") fitting to 25 mm (1") fitting. The deck end has a 19 mm to 19 mm fitting. (Both straight).

– 1 return line hose x 19 mm x 0.94 m. Both end fittings are 19 mm, straight.

From below shooter deck to hydraulic oil tank and stainless steel line leading to starboard storage room / engine room bulkhead.

– 1 hose for main supply line x 19 mm x 1.70 m. Both ends 19 mm fittings, straight. (From the deck to the tank)

– 1 hose for return line x 19 mm x 3.10 m. Both ends 19 mm fittings, straight. (From the deck to the bulkhead).

From the hydraulic tank to the starboard storage room /engine room bulkhead

– 1 hose for main supply line from the tank to pump x 76 mm x 0.90 m.

– 1 hose x 25 mm x 0.50 m. Both ends 25 mm fittings – one end straight fitting, the other end elbow fitting.

– 2 hoses x 19 mm x 1.2 m (return lines). Both ends 19 mm fittings, straight.

Engine room hydraulic hoses

– 1 hose x 76 mm x 0.63 m (main supply line from tank to pump).

– 1 hose x 25 mm x 1.0 m. 25 mm fittings both ends, straight. (From bulkhead to heat exchanger).

– 1 hose x 25 mm x 1.80 m. Both ends 25 mm elbow fittings. (From heat exchanger to engine room control valve).

– 1 hose x 25 mm x 1.0 m. Both ends 25 mm. One end straight fitting, the other end elbow. (From engine room pump to red pressure valve).

– 1 hose x 19 mm x 1.0 m. Both fittings 19 mm, straight. (From pump to bulkhead).

– 1 hose x 25 mm x 0.94 m. 25 mm fittings both ends. One end elbow, the other straight. (From the red pressure valve to the engine room control valve).

– 1 hose x 19 mm x 1.70 m. 19 mm fittings both ends. One end elbow, one straight. (From engine room control to the bulkhead).

– 2 hoses x 25 mm x 1.70 m. 25 mm elbow fittings both ends. (From control valve to deck).

– 1 hose x 13 mm x 0.56 m. 13 mm fittings both ends. One end elbow, the other straight. (From the pump to the engine room control)

- 1 hose x 19 mm x 2.10 m. 19 mm fittings both ends. One elbow, the other straight. (From deck to bulkhead).

Topside connections

- 2 hoses x 25 mm x 1.30 m. 25 mm fittings both ends. Both straight. (From stainless steel line to reel valve.

- 2 hoses x 25 mm x 0.60 m. 25 mm fittings both ends. Both straight. (From reel valve to reel pump).

- 1 hose x 19 mm x 0.60 m. 19 mm fittings both ends. One elbow, the other straight. (From stainless steel line to reel pump).

- 2 hoses x 25 mm x 0.70 m. 25 mm fittings both ends. Both straight. (From engine room deck to stainless steel line).

- 1 hose x 19 mm x 1.10 m. 19 mm fittings both ends. Both straight. (From engine room deck to stainless steel line).

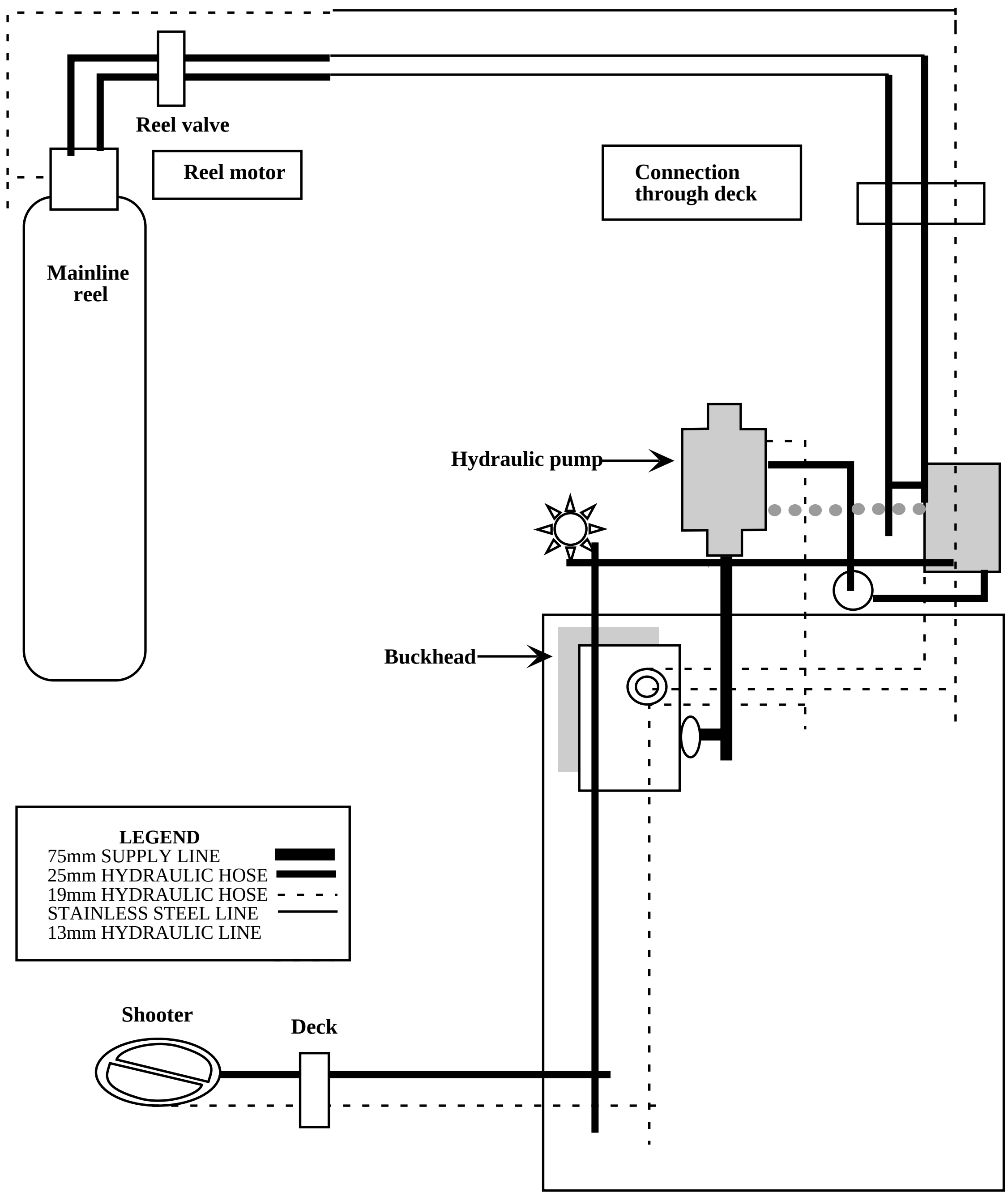
Emergency repair fittings for hydraulic connections. Screw on type.
NOTE: These items are to be kept on board for emergency repairs.

For repairing hose centre breakage:
2 x 25 mm.
2 x 19 mm.
2 x 13 mm.

For repairing end leakages:
2 x 25 mm.
2 x 19 mm.
2 x 13 mm.

For repairing end leakages with elbow fittings:
2 x 25 mm elbow fittings.
2 x 19 mm elbow fittings.
2 x 13 mm elbow fittings.

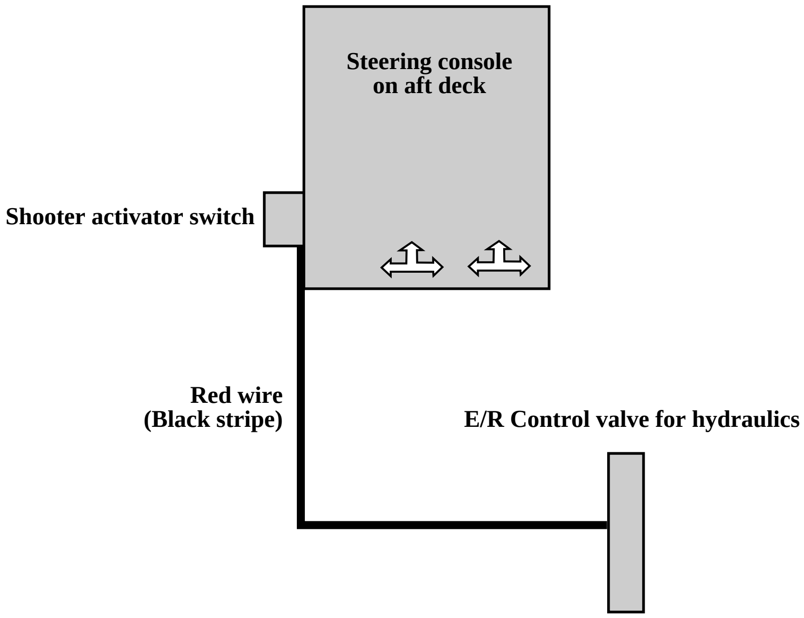
Hydraulic line system



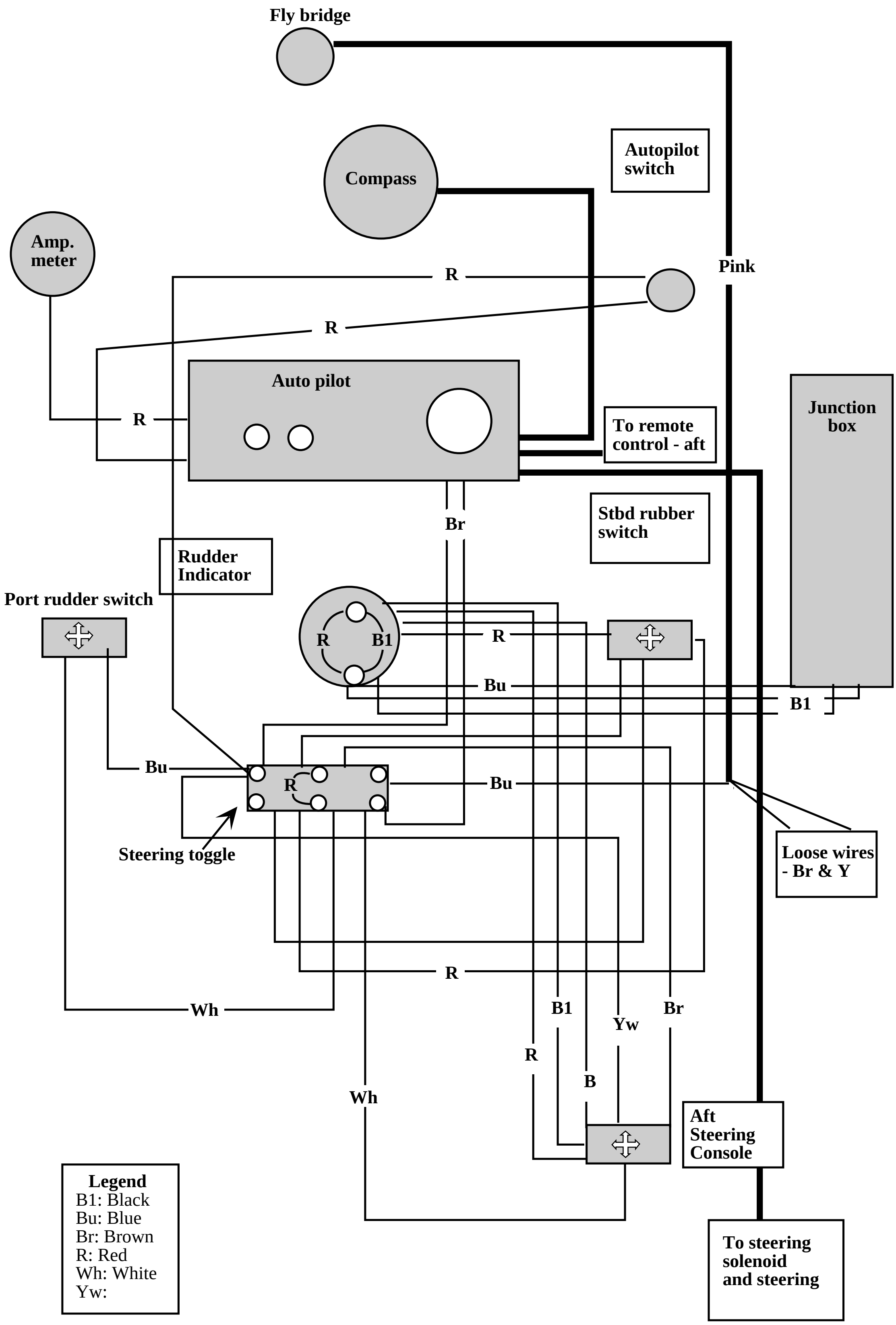
Appendix C

Wiring diagrams for the different components of the electronic steering system on F/V *Victor Eoaeo II*

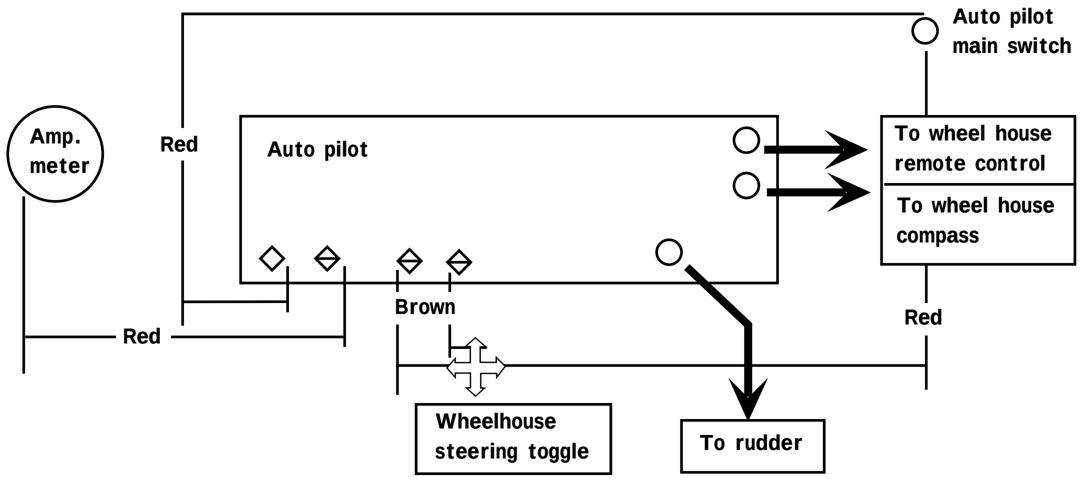
Shooter Activator Wiring



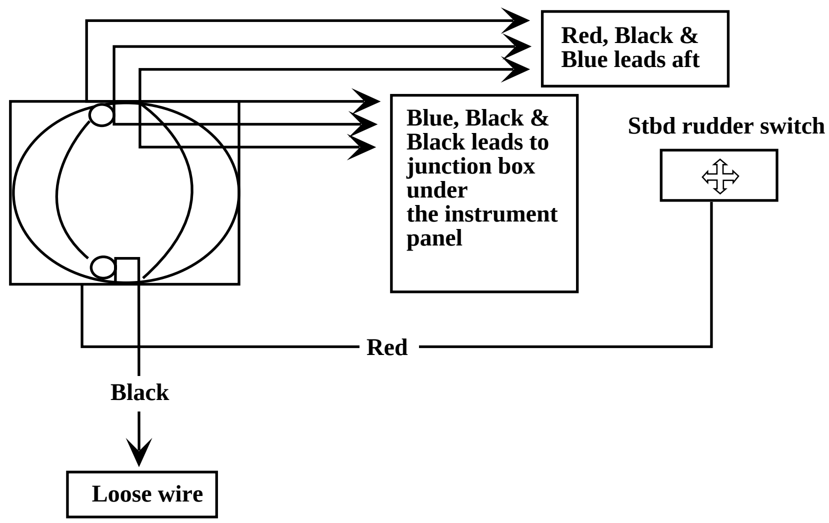
Wiring for steering toggle and auto pilot



Wiring leading out of Autopilot



Wiring for Rudder Indicator



Appendix D

Calibration table for the fuel tanks on F/V *Victor Eoaeo II*

cm	litre	cm	litres	cm	litres	cm	litres	cm	Litres
1	**13.426**	*31*	**416.21**	*61*	**818.986**	*91*	**1221.8**	*121*	**1624.5**
2	**26.852**	*32*	**429.63**	*62*	**832.412**	*92*	**1235.2**	*122*	**1638**
3	**40.278**	*33*	**443.06**	*63*	**845.838**	*93*	**1248.6**	*133*	**1651.4**
4	**53.704**	*34*	**456.48**	*64*	**859.264**	*94*	**1262**	*124*	**1664.8**
5	**67.13**	*35*	**469.91**	*65*	**872.69**	*95*	**1275.5**	*125*	**1678.3**
6	**80.556**	*36*	**483.34**	*66*	**886.116**	*96*	**1288.9**	*126*	**1691.7**
7	**93.982**	*37*	**496.76**	*67*	**899.542**	*97*	**1302.3**	*127*	**1705.1**
8	**107.41**	*38*	**510.19**	*68*	**912.968**	*98*	**1315.7**	*128*	**1718.5**
9	**120.83**	*39*	**523.61**	*69*	**926.394**	*99*	**1329.2**	*129*	**1732**
10	**134.26**	*40*	**537.04**	*70*	**939.82**	*100*	**1342.6**	*130*	**1745.4**
11	**147.69**	*41*	**550.47**	*71*	**953.246**	*101*	**1356**	*131*	**1758.8**
12	**161.11**	*42*	**563.89**	*72*	**966.672**	*102*	**1369.5**	*132*	**1772.2**
13	**174.54**	*43*	**577.32**	*73*	**980.098**	*103*	**1382.9**	*133*	**1785.7**
14	**187.96**	*44*	**590.74**	*74*	**993.524**	*104*	**1396.3**	*134*	**1799.1**
15	**201.39**	*45*	**604.17**	*75*	**1006.95**	*105*	**1409.7**	*135*	**1812.5**
16	**214.82**	*46*	**617.6**	*76*	**1020.38**	*106*	**1423.2**	*136*	**1825.9**
17	**228.24**	*47*	**631.02**	*77*	**1033.8**	*107*	**1436.6**	*137*	**1839.4**
18	**241.67**	*48*	**644.45**	*78*	**1047.23**	*108*	**1450**	*138*	**1852.8**
19	**255.09**	*49*	**657.87**	*79*	**1060.65**	*109*	**1463.4**	*139*	**1866.2**
20	**268.52**	*50*	**671.3**	*80*	**1074.08**	*110*	**1476.9**	*140*	**1879.6**
21	**281.95**	*51*	**684.73**	*81*	**1087.51**	*111*	**1490.3**	*141*	**1893.1**
22	**295.37**	*52*	**698.15**	*82*	**1100.93**	*112*	**1503.7**	*142*	**1906.5**
23	**308.8**	*53*	**711.58**	*83*	**1114.36**	*113*	**1517.1**	*143*	**1919.9**
24	**322.22**	*54*	**725**	*84*	**1127.78**	*114*	**1530.6**	*144*	**1933.3**
25	**335.65**	*55*	**738.43**	*85*	**1141.21**	*115*	**1544**	*145*	**1946.8**
26	**349.08**	*56*	**751.86**	*86*	**1154.64**	*116*	**1557.4**	*146*	**1960.2**
27	**362.5**	*57*	**765.28**	*87*	**1168.06**	*117*	**1570.8**	*147*	**1973.6**
28	**375.93**	*58*	**778.71**	*88*	**1181.49**	*118*	**1582.3**	*148*	**1987**
29	**389.35**	*59*	**792.13**	*89*	**1194.91**	*119*	**1597.7**		
30	**402.78**	*60*	**805.56**	*90*	**1208.34**	*120*	**1611.1**		

Appendix E

Procedures and checklists for the NFMRA commercial tuna longline operations

(a) Arrival procedures

Liaison and transfer of documents

* On arrival the vessel's skipper is to hand over the following documents to the fleet coordinator or his representative:
  - fishing log;
  - trip defect list to be attended to before the next fishing trip; and
  - engine room and deck orders list.
* The fleet coordinator is to:
  - hand over to the skipper the fish export report on fish exported the previous trip.
  - hand over any new memorandums or company standing orders issued while the vessel was out at sea; and
  - brief the Skipper and crew on any other matters that are of relevance to the vessel's operations or crew's welfare.

Berthing and offloading

* On arrival secure the vessel at the offloading berth.
* Liase with shore party (fleet coordinator or representative) on the offloading arrangements.
* Clear deck and prepare for unloading. This includes:
  - clearing branchline bins and other obstacles from the work area;
  - positioning buffer mattress for receiving fish from the fish hold;
  - transferring fish from the fish hold to the mattress; and
  - pump down slurry level if necessary.
* Transfer fish from the mattress to the ice slurry on the transfer vehicle.
* Remove slinging strops from the fish and return to the vessel.
* On completion of discharge, pump out the fish hold(s) and clean them properly.
* Depending on the shore arrangement, the ship's crew may also have to assist in transferring fish from the transfer vehicle to the processing plant.
* Secure all fishing and working items on board the vessel.
* Fishing crew to retire for the day.

Processing Procedures

* Offload fish from the transfer vehicle slurry to a weighing scale.

* Record received weight.

* Transfer fish from the scale to the processing table.

* Carry out final cleansing preparation.

* Transfer fish to the grading table for fish grading and market destination selection.

* Transfer fish to the export coffin.

* Pack with suitable numbers of gel-ice packs. Preferably not less than 6 x 500 gram packs.

* Wrap fish in packing plastic sheets then tape up coffin ready for export.

* Label coffins for the appropriate market destination stating species, number, weight, destination and origin (vessel that the fish was discharged from).

* Re-weigh export cartons and record.

* Transfer to cool storage or airport transfer vehicle. Ensure that the vehicle is suitably protected from direct sunshine. Preferably a refrigerated vehicle.

* Transport cargo to the airport cargo check-in counter. This has to be done two hours before departure. Careful consideration has to be taken in regards to the volume required for export.

* Obtain airway bill with details for the export. Note the weight at the airport.

* Ensure that the airport personnel store the fish export cargo in a properly shaded area and that the cargo is handled delicately.

* Compile all documents for the export shipment in a file. This should contain all paperwork recorded from the processing facility to the airport check-in.

(b) Onshore vessel servicing, maintenance and replenishment in preparation for the next fishing trip

* The fleet coordinator is to supervise preparations for getting the vessel ready for the next fishing trip. He is to be assisted by the two port handlers and the returning crew.

* Clean out fish holds, tidy up vessel and load fishing gears as required.

* Replenish vessel as per engine room and deck orders list.

* Arrange for work on the defects list to be carried out by the appropriate parties.

* Bunker fuel as required.

* Top up fresh water tanks.

* Carry out the recommended routine service in the engine room as required after every trip, e.g. check/change filters, oil, belts, alternator, wiring, etc.

* Laundry linen.

* Replenish victuals and stores as per orders list.

* Load bait and/or ice.

* Commence chilling refrigerated sea water (RSW) at least 24 hours prior to departure. A port handler may have to supervise this overnight while the crew are on shore break.

(c) Departure procedures

* Upon boarding the vessel, the skipper and chief engineer are to ensure that the items requested on the orders list and the defects list have been implemented.

* Ensure all crew are on board and capable of making the trip.

* Check all items on the pre-departure items checklist and the engine room checklist.

* Carry out pre-departure tests:

  – start up main engine and check generator. The generator should already be running to operate the refrigeration for chilling down the RSW. The main engine, generators and refrigeration system should all be in satisfactory running condition;

  – turn on all electronics and check for defects;

  – check all radio beacons are fully charged and registering on the line master;

  – operate and ensure that the steering system is functioning well;

  – check that all pumps are performing;

  – run the mainline reel and shooter and note performance;

  – test that all navigation lights are functioning; and

  – check communications system.

* Hand over crew list to the fleet coordinator.

* Ascertain weather conditions.

Engine room operations checklist

* Check fuel water separator and drain water and sediments if necessary.

* Check that the fuel tanks are free of water and that the level is maintained at ‘full’ level as much as possible. Slack tanks contribute to ‘free surface’ action and allows moisture to build up within the tank thus causing contamination. The fuel tanks should be drained out and cleaned regularly to avoid build up oil gel.

* Open up the supply line from the fuel tanks to the main engine and auxiliary.

* Check the engine oil level. Top up to the maximum level indicated on the dipstick. Never operate the engine with the oil level below the low-level mark or above the high-level mark.

* Check coolant level and refill if necessary.

* Check that all drive belts are adequately tensioned and inspect visually for wear and tear or damage. Transverse cracks are acceptable while longitudinal cracks are not.

* Check the sea water suction strainer and clear it of all sediments or materials. Ensure that the valve is open.

* Check all battery water levels and top up if necessary. Ensure that all connections are secure and the terminal points greased. Check also for corrosive action especially at the terminal connections and the holding down brackets.

* Inspect all lines, gaskets and seals for water, oil and fuel leaks.

* Check gearbox oil level and maintain the correct level.

* Take readings from all gauges and observe for irregularities.

* Check that the steering system is functioning normally and that it is oiled and greased where necessary.

Refrigeration operations checklist

* Check the compressor oil and refill to the full level mark if necessary.

* Check refrigeration line for corrosion, exposed insulation and leakages.

* Check that the freezer compressor is functioning correctly — pulley belt OK, no abnormal sounds, etc.

* Verify that the temperature gauges are functioning.

* Observe the temperature of the RSW brine tanks and the freezer storage room to see whether the chilled temperature coincides correctly with the running time.

* Check that the circulation pumps and drain pumps in the RSW tanks are functioning correctly.

* Check that the level of refrigerant gas (Freon R12) is sufficient for several trips. Place an order for new stock if this is low. Verify that the lines are open and that the gas is being circulated.

Mainline spool and Line setter (Shooter) operations checklist

* Grease and oil all line setter and reel components.

* Ensure that the reel level wind drive link belt is connected and in good condition.

* Ensure that the level winder is working correctly and a spare level winder pawl is on board.

* Check for wear and tear on the shooter rubber and ensure that it is gripping the mainline correctly.

* Ensure all setting valves are functioning.

* Check the hydraulic oil level in the holding tank.

* Clean out the hydraulic oil strainer and open up supply line.

* Visually inspect the hydraulic lines for leakages and corrosion.

* Inspect along the hose line for chaffing. If an area shows sign of chaffing, wrap a rubber insulator around the hose at that particular area.

* Ensure that the hydraulic pump is in perfect working condition.

* Check that the switches and electrical connections to the hydraulic pump are intact and functioning.

* Inspect the cable from the engine room hydraulic control levers to the deck control are intact and in good condition.

* Operate the hydraulic system and check that all components are functioning satisfactorily.

* Check that the temperatures on the main hydraulic pump, shooter and the reel drive pump are normal.

Pre-departure deck items checklist

Item	Required	Checked
Ice/refrigerated sea water	Sufficient for trip	
Bait	Sufficient for trip	
Victuals and stores	As requested	
Fishing logbook	1	
Radio beacons	4	
Branchline bins	4	
Total branchlines	1500	
White buoys x 200mm	80	
Orange buoys x 360mm	50	
Buoy, F-type (red)	2	
Gaff 9"	2	
Gaff 6"	2	
Hand gaffs	4	
General purpose knife x 20"	1	
Gilling and gutting knives	3	
Bleeding knives	2	
Harpoon	1	
"T" spike	2	
Corer	2	
Tuna bag x 150/cheese cloth	1 roll	
Scrub brushes	4	
Shears	2	
Gloves	24 pairs	
Hand press crimping tool	2	
Crimping tool die A	1	
Crimping tool die D	1	
Crimping tool die E	1	
Crimping tool die 6	1	
Mono line cutter	2	
Strobe lights with holders	4	
Buckets	3	
Water containers	4	
Batteries size E (medium)	1 box	
Torches 6V	3	
Dry cell batteries for torches	1 box	
Rubber boots	6 pairs	
Weather gear (top and bottom)	6 sets	
Rope (6 mm)	1 roll	
Floatlines	100	
Flag markers	4	
Spare snaps	100	
Chaffing tube	1 coil	
Crimps (to suit 1.8 to 2.0 mm mono)	500	
Monofilament line 1.8 to 2.0 mm	2 coils	
Joining swivels	100	

Item	Required	Checked
Armour springs	1 pkt x 500	
Tuna circle hooks sizes 13/0 ~ 16/0	1 box of each	
Grapples	2	
Fish mattresses	2	
Fish clubs	2	
Hook remover	1	
Bow saw/hacksaw	1	
Hanging strops	200	
Salt	20 kg	

Pre-departure engine room checklist

Item	Required on board	Checked
Main engine filters	6	
Air filters	2	
Battery water (distilled)	4 litres	
Battery water level	Full level mark	
Charged batteries	4	
Spare battery (12 volts)	1	
Engine oil level	Full level mark + 30	
Transmission oil level	Full level mark + 20	
Main engine spare starter	1	
Generator spare starter	1	
Spare main engine alternator	1	
Spare generator alternator	1	
Main engine impeller — key	2	
Generator impeller — spline	2	
Drive belt — main engine	1 + 3	
Drive belt — generator water	1 + 2	
Drive belt — gen. alternator	2 + 2	
Spare link belt	10 m	
Electrical fuses	5 spare each	
Steering electronics	Spare accessories	

Appendix F

Fishing gear requirements and components

(a) Vertical longline requirements for constructing one unit of 20 hooks x 20 m spacing.

1. A bamboo pole or equivalent of 3 m length x 3 cm diameter with a 40 cm x 40 cm flag attached and a blinker light indicator secured or taped on. The bottom of the pole should have a 2–3 kg sinker securely attached and a 1 m bridle connected. A snap (.135,8/0) should be attached to the bridle for snapping onto the mainline float.
2. Mainline up to 400 m long. The mainline size can vary according to preference. Normally 2.1 mm (200 kg test) to 3.0 mm (320 kg test) monofilament lines are used. The 2.5 mm (270 kg test) is ideal.
3. 1 packet sleeves suitable for mainline size.
4. 21 crane swivels — size 9/0 or 11/0. Lead swivels (38 or 60 g) can also be used.
5. Sinker x 1.5 – 2.0 kg.
6. 1 x 300 mm moulded plastic longline float with 0.5 m x 6 mm polypropylene rope with a swivel snap (3.5 x 125 mm) spliced on.
7. 20 stainless steel tuna circle hooks x 14/0 or 15/0 size.
8. 120 m x 1.8 mm (135 kg test) monofilament for 20 branchlines x 6 m/branchline.
9. One packet size 'E' crimps for 1.8 mm monofilament for branchlines.
10. One branchline bin — plastic basket at least 60 cm x 44 cm.
11. 5 m flexible wire trace. (7 x 7 x 1.08 mm, 96 kg test).
12. 1 packet sleeves to suit 1.5 mm wire trace.
13. 0.5 m clear plastic protector tubes.
14. 40 spring wire protectors.
15. 1 roll reflector tape.

Tools required for constructing vertical longline and during fishing operations.

1. 1 bench crimper with dyes to suit sleeves being used in the construction of the lines.
2. 1 hand crimper.
3. 1 monofilament cutter.
4. 1 wire cutter.
5. 2 small fid spikes.
6. 1 FAO wooden handreel set up or Alvey reel.
7. Insulation tape.
8. 1 box light sticks.
9. Two fish gaffs.
10. 1 drop blood knife.
11. 1 processing knife.
12. 1 fish club.
13. 1 fish spike.
14. Hand gloves sufficient for crew.
15. 15 kg bait - preferably squid.
16. 15 kg chum bait.

(b) Ika-Shibi fishing gear requirements for three units.

1. 1 sea anchor appropriate for vessel size.
2. 3 coils x 150 m x 6 mm polypropylene rope for mainline.
3. 1 coil x 12 m flexible stainless steel wire (7 x 7 x 1.08 mm, 96 kg test).
4. 6 lead swivel (38 or 60 g) or Crane swivel (9/0 or 10/0).
5. 6 stainless steel tuna circle hooks x 14/0 or 15/0.
6. 12 spring wire protectors.
7. 1 packet sleeves to suit 1.50 mm wire.

8. 1 x 300 mm moulded plastic float with a 1 m polypropylene rope and swivel snap (3.5, 125 mm) spliced on.
9. 3 copper pipes x 19 cm or 38 cm filled with lead and with swivels (lead or crane) attached at both ends. Sinkers weigh from 500 g to 1.5 kg.
10. At least one 12 volt overhead all round light, 25 to 100 watt.
11. 1 x 12 volt x 100 watt underwater light connected to a dimmer switch if possible.
12. Two fully charged car batteries or preferably a portable generator with 12 volt inverter.
13. Assortment of squid jigs preferably those with a battery operated light built in. This is more effective.
14. At least 3 sets of 10 kg test lines for using with the squid jigs.
15. 6 chum bags.

Tools required for Ika-Shibi gear construction and fishing operations.

1. 2 small fid spikes.
2. 1 hand crimper.
3. 1 wire cutter.
4. 1 roll insulation tape.
5. 2 fish gaffs.
6. 1 fish spike.
7. 1 drop blood knife.
8. 1 processing knife.
9. 1 fish club.
10. Sufficient hand gloves for fishing crew.
11. 15 kg bait — preferably squid.
12. 15 kg chum bait.

(c) Palu-Ahi fishing gear requirements for three units.

1. 3 sets 1.80 mm (135 kg test) monofilament line or braided rope (nylon or polyester) x 500 m per unit. Dacron cord or other synthetic braided ropes are preferable as these are easier to wrap the chum cloth.
2. 1 to 2 kg sinker moulded to a flat oval shape.
3. 6 x 25 – 30 cm square denim or suitable strong material.
4. 6 crane swivels, 9/0 or 11/0.
5. Flexible stainless steel wire 0.81 mm (54 kg test) or 1.08 mm (96 kg test).
6. 1 packet sleeves to fit wire and monofilament line.
7. Tuna circle hooks 13/0 to 16/0.
8. 6 rolling swivels with dual lock snap.
9. 1 packet spring wire protectors.
10. 1 m clear plastic protector tubes.

Tools required for Palu-Ahi gear construction and fishing requirements.

1. One hand crimping tool.
2. One monofilament cutter.
3. One wire cutter.
4. 15 kg bait — preferably squid.
5. 15 kg chum bait.

Summary of fishing activities and catch during training trips

Trips conducted with fisheries staff			
Trip #/time/date	**Crew**	**Fishing method**	**Catch and weight**
Trip 1 17/04 to 18/04 1840hrs to 0630hrs	Michael Quadina Ricky Starr Garry Degia Slade Benjamin David Rodiban Tom Dongobir William Sokimi	Vertical longline Ika-shibi	2 pomfrets x 16 kg 1 snake mackerel x 2 kg 1 oil fish x 25 kg 3 barracuda x 18 kg 1 trevally x 2 kg **Total weight: 63 kg**
Trip 2 19/04 to 20/04 0400hrs to 1730 hrs	Michael Quadina David Uera Ebrina Tsiode Garry Gioura Bjorn Deta Geoua Sakaraia Vinaka O'Brien Aubobo William Sokimi	Vertical longline Trolling	1 pomfret x 12 kg 1 blue marlin x 44 kg 3 frigate mackerels x 4.5 kg **Total Weight: 60.50 kg**
Trip 3 23-avr 0400hrs to 1530hrs	Ricky StarrJake Jake Debao O'Brien Aboubo William Sokimi	Vertical longline	1 pomfret x 5.0 kg **Total weight: 5.0 kg**
Trip 4 25/04 to 26/04 1700hrs to 0830hrs	Michael Quadina David Uera Ricky Starr Slade Benjamin Garry Gioura William Sokimi	Vertical longline Ika-shibi	1 hammerhead shark x 40 kg 1 pomfret x 6 kg 1 trevally x 2.6 kg **Total weight: 48.8 kg**
Trip 5 07/05 to 08/05 1700hrs to 0900hrs	Michael Quadina David Uera Ricky Starr William Sokimi	Vertical longline Ika-shibi	1 pomfret x 5.4 kg 2 barracuda x 3.2 kg 1 trevally x 2.5 kg **Total Weight: 11.1 kg**
Trip 6 08/05 to 09/05 0400hrs to 1650hrs	Michael Quadina David Uera Ricky Starr William Sokimi	50 hooks horizontal longline. Vertical longline Trolling	28 skipjack tuna x 59.4 kg **Total weight: 59.4 kg**
Overall total weight:			**247.80 kg**

Trips conducted with the private sector			
Trip #/time/date	**Crew**	**Fishing method**	**Catch and weight**
Trip 1 13/05 to 14/05 1900hrs to 0700hrs	Sean Oppenheimer Michael Quadina David Uera Suliana Jiare	Vertical longline Ika-shibi	2 pomfrets x 7 kg 1 yellowfin tuna x 5 kg **Total weight: 12 kg**
Trip 2 19-mai 0600hrs to 1600hrs	Sean Oppenheimer Suliana Jiare David Uera Michael Quadina	Vertical longline	8 pomfrets x 48 kg 1 hammerhead shark x 64 kg 1 oilfish x 7 kg **Total weight: 119 kg**
Trip 3 26-mai 0600hrs to 1600hrs	Sean Oppenheimer Michael Quadina David Uera Suliana Jiare	Vertical longline Trolling	8 yellowfin x 40 kg 1 wahoo x 3 kg 5 pomfrets x 55 kg 1 blue shark x 45 kg 1 trevally x 4 kg **Total weight: 147 kg**
Overall total weight:			**278 kg**