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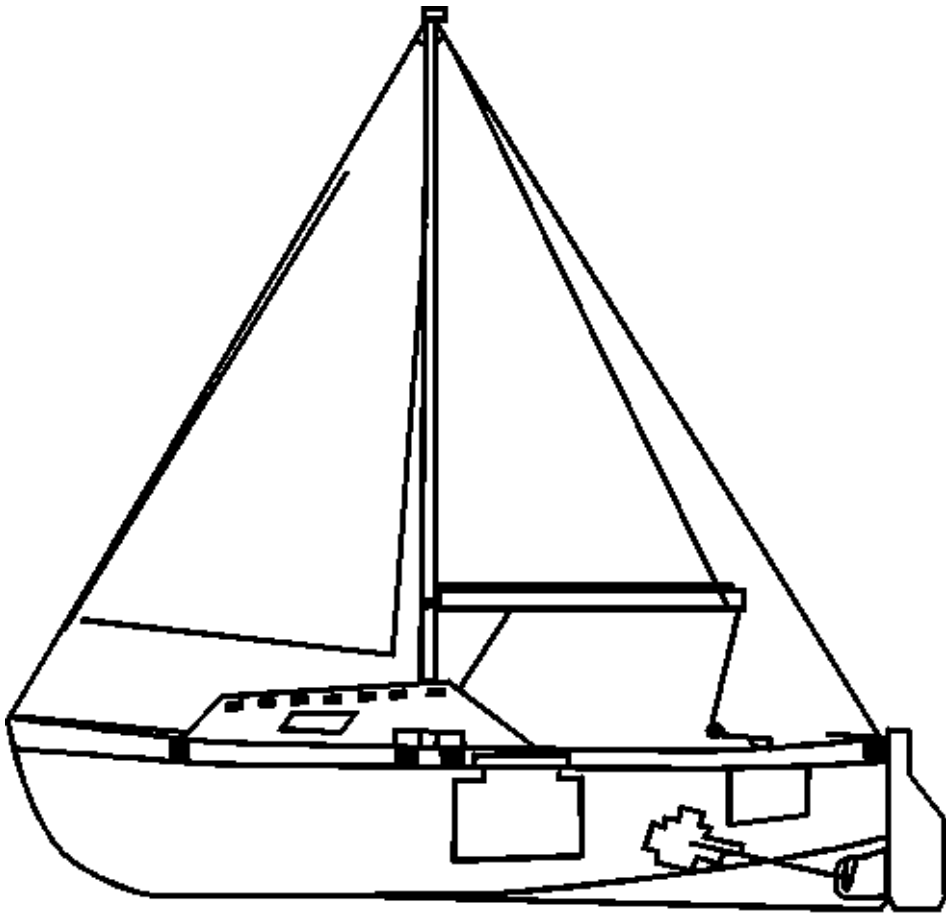
DEEP SEA FISHERIES DEVELOPMENT PROJECT



REPORT ON SECOND VISIT TO TUVALU 30 AUGUST—7 DECEMBER 1983

South Pacific Commission
Noumea, New Caledonia
1990

SOUTH PACIFIC COMMISSION

DEEP SEA FISHERIES DEVELOPMENT PROJECT

REPORT ON SECOND VISIT TO TUVALU

30 August — 7 December 1983

by

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and

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SUMMARY

The South Pacific Commission's Deep Sea Fisheries Development Project operated in Tuvalu for the second time between 30 August and 7 December 1983, under the supervision of SPC Masterfisherman Lindsay Chapman.

The objectives of this visit were to re-assess the state of deep-bottom fish resources at Funafufi and to conduct follow-up training in deep-bottom fishing techniques, as well as to survey deep-bottom fishing grounds and introduce deep-bottom fishing techniques at the islands of Vaitupu, Nukulaelae and Nukufetau.

Thirty-five fishing trips were completed during the Project's thirteen weeks of operations at the four islands, during which deep-bottom fishing, mid-water handlining, trolling and flying fish scooping were conducted. The various fishing methods employed were most often combined during any one trip, but with differing degrees of effort depending on the extent of local deep-bottom fishing grounds, weather and sea conditions, the requirements of the training programme and the availability of bait. Some fishing was opportunistic in nature and some was conducted solely to capture bait.

A total of 373 hours directly engaged in fishing, by all methods, produced a catch of 5042.4 kg, of which 665.9 kg, or 13.2 per cent of the total, comprised unsaleable species, including sharks and bottom fishes locally regarded as ciguatoxic.

Effort, catches, and catch rates for each fishing method varied widely. Deep-bottom droplining produced 3668.4 kg in 354.5 reel-hours for a catch rate of 10.4 kg per reel-hour, while the least productive method, lagoon trolling, recorded a catch of 28.7 kg in 62 line-hours for a catch rate of 0.5 kg per line-hour.

The species composition of the catch exhibited the diversity to be expected in fishing operations which target different habitats. Deep-bottom droplining, which was the Project's chief area of interest in Tuvalu, produced a satisfactory catch (23.6% by weight) of the deep-water snappers and jobfish which this technique targets, although a relatively high component (31.0% by weight) of less desirable gempylids, including oilfish and snake mackerels, was also recorded. The best catch rate by deep-bottom droplining was recorded at Nukulaelae (15 kg per reel-hour) where particularly large individual deep-bottom fish were taken, and the lowest deep-bottom catch rate, at Nukufetau (4.8 kg per reel-hour). Nukufetau also recorded the best catch rate for open-water trolling (7.0 kg per line-hour).

Training in deep-bottom fishing techniques was conducted at all locations, with most emphasis on giving trainees practical experience during actual fishing trips. Little time was spent on gear rigging, as local fishermen demonstrated general competence with the techniques and materials involved. A total of 78 trainees (68 island fishermen and 10 Tuvalu Fisheries Division staff) underwent some degree of formal training.

The results of fishing activities, and the surveys of deep-bottom fishing sites and resources, indicated that all four islands visited have deep-bottom fishing grounds with the potential for commercial exploitation to varying degrees. Some features of the local deep-bottom fisheries were identified as having the potential to hamper successful small-scale commercial development, and recommendations aimed at overcoming these are included in this report.

ACKNOWLEDGEMENTS

The South Pacific Commission acknowledges with gratitude the friendly support and co-operation afforded the Deep Sea Fisheries Development Project during its stay in Tuvalu by the Chief Fisheries officer and staff of Tuvalu Fisheries Division, by those government departments and personnel who had dealings with the Project, and by the fishermen of Funafuti, Nukufetau, Nukulaelae and Vaitupu.

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1. INTRODUCTION

The South Pacific Commission's Deep Sea Fisheries Development Project (DSFDP) is a mobile, village-level rural development project which operates in Pacific Island nations at specific Government request, and which has the following broad objectives:

– To promote the development or expansion of aritisanal fisheries throughout the region, based on fishery resources which are at present under-utilised, in particular the deep-bottom resources of the outer reef-slope;

– To develop and evaluate new simple technology, fishing gear and techniques suitable for use by village fishermen, which will enable fishermen to substantially increase catches while reducing dependence on cosily imported fuels;

– To provide practical training in appropriate fishing techniques to local fishermen and government fisheries extension workers.

The Project has operated in 17 countries or territories of the SPC region since its inception in 1978. This assignment was its 35th country visit and its second to Tuvalu.

The DSFDP first visited Tuvalu between November 1980 and February 1981 in response to a request from the Government of Tuvalu for an evaluation of the potential for development of an artisanal deep-bottom fishery at Funafufi. The catch rate recorded by the Project in the areas surveyed (8.0 kg per reel-hour, excluding sharks) was high in comparison to results obtained elsewhere in the region and it was reported that, although limited fishing grounds probably precluded the development of a large-scale or export deep-bottom fishery, the resource could well be developed sufficiently to meet local demand (Taumaia & Gentle, 1982), The first report recommended that, while closely monitoring the exploitation of this resource, the Government should assist local fishermen to develop improved techniques in a diverse range of fishing activities, including lagoon fishing and fishing offshore for pelagic species.

The specific objectives of the current visit were to re-assess the state of deep-bottom resources at Funafuti, to conduct follow-up training in deep-bottom fishing techniques and to extend Project activities to a number of the outer islands in Tuvalu's southern group. Gear development trials, targeted on a fish aggregation device (FAD) deployed at Funafuti, were also scheduled, but not undertaken due to the loss of this FAD just prior to the Project visit. The visit commenced on 30 August 1983 and continued through to 7 December 1983, under the supervision of SPC Masterfisherman Lindsay Chapman.

2. BACKGROUND

2.1 General

Tuvalu (formerly known as the Ellice Islands) consists of nine islands and atolls of coral formation lying between 5° and 11° South latitude and 176° and 180° East longitude (see Figure 1). Total land area is about 26 sq km, while the country's Exclusive Economic Zone encompasses some 900,000 sq km (SPC estimate) of the South Pacific Ocean.

The islands generally have sand and coral rubble soils which support coconut palms, pandanus, breadfruit, and some taro in cultivated gardens. The population of around 8,000 (SPC estimate, 1983) is 96 per cent Polynesian and the local tongue is akin to Samoan, although English is widely spoken.

Most of the work force is engaged in subsistence agriculture and fishing, although small handicrafts and copra industries, and remittances from expatriate Tuvaluans working in Nauru's phosphate industry or on overseas ships also contribute to the economy. Fishing access agreements negotiated with Korea and Taiwan generated some US$176,000 in fees during 1981 (Ellway et al., 1983).

The prevailing easterly trade winds have a moderating effect on temperature, which varies between a mean daily maximum of 31°C and a minimum of 25°C. Northerlies and westerlies become more frequent from November to February, with occasional periods of strong winds and stormy conditions. During storm periods lagoon waters can become very rough.

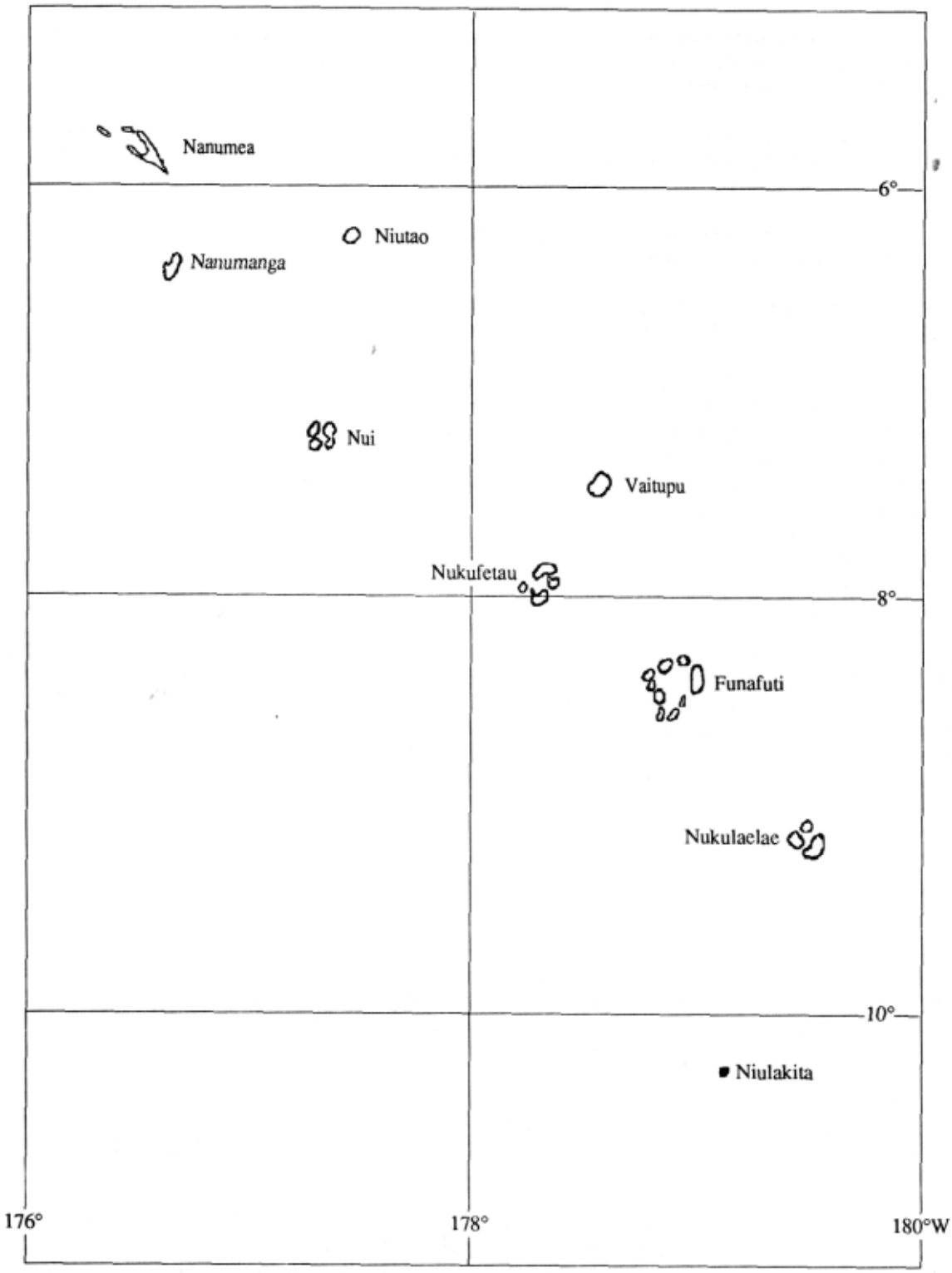


Figure 1: The islands of Tuvalu

2.2 Existing fisheries

While three islands in the group have large, open lagoons and extensive shallow-water fishing grounds, the others generally have only narrow bands of fringing reefs or small lagoons, and consequently limited inshore resources. Outer reef-slopes tend to be steep and deep-bottom fishing grounds exist close to shore in some locations.

Most local fishing effort has been concentrated on offshore trolling for tunas, either from powered canoes or, more recently, from powered aluminium skiffs. Tuna fishing is conducted all year round with the peak season around June and July. Bottom handlining is not usually conducted at depths greater than 50 m, although some mid-water handlining for deep-swimming tunas is conducted in favoured locations. Relatively little effort is put into fishing within the lagoons. By far the largest catches from Tuvalu's waters are taken by foreign fishing vessels; individual longline catches of tuna and billfish by Japanese, Korean and Taiwanese vessels averaged around 2,000 t in 1976 (Klawe, 1978).

The demand for fresh fish generally exceeds supply, which fluctuates irregularly. Fish caught by local fishermen are usually sold on the beach or in the village. At the time of this visit there were no cold storage facilities in place, although a fish market was scheduled for completion in 1984 under a British aid programme.

A 100 t capacity Japanese pole-and-line vessel supplied to Tuvalu under a Japanese Government aid programme generally fishes in Solomon Islands or Fiji due to the lack of bait resources and unloading facilities at Funafufi.

3. PROJECT OPERATIONS

3.1 General

Thirty-five fishing trips were completed during the Project's activities in four islands in the south of the group over the 13 weeks of the stay in Tuvalu. The movement of gear from island to island was effected by the vessel assigned for Project use, the *Tui Punga.* After operations at each island the Masterfisherman returned to Funafuti before proceeding to the next. Table 1 details the Project's movements.

Table 1: Movements of the Project

Location	Dates	Trips completed
Funafuti	30 August — 5 October	Trips 1 — 11
Vaitupu	6 October — 14 October	Trips 12 — 17
Funafuti	15 October — 2 November	Trips 18 —20
Nukulaelae	3 November — 11 November	Trips 21 — 26
Funafufi	12 November — 16 November	No trips
Nukufetau	17 November — 25 November	Trips 27 — 32
Funafuti	26 November — 7 December	Trips 33 — 35

Project operations were confined to Funafuti for the first month of the visit due to unseasonally strong south-east winds. During this period the *Tui Punga* was prepared for later operations in the outlying islands. One week was lost due to the Masterfisherman falling sick.

3.2 Boats and equipment

Two vessels were employed by the Project during the course of the visit. The first, a Fijian modified FAO-design 8.5 m dory, was powered by a Yanmar 20 hp diesel motor. This vessel (Figure 2) was fitted with two wooden handreels, which were used for both bottom-fishing and trolling, but lacked trolling booms or an integral ice-box. Although in basically sound condition, the boat was in need of painting and some mechanical repairs.

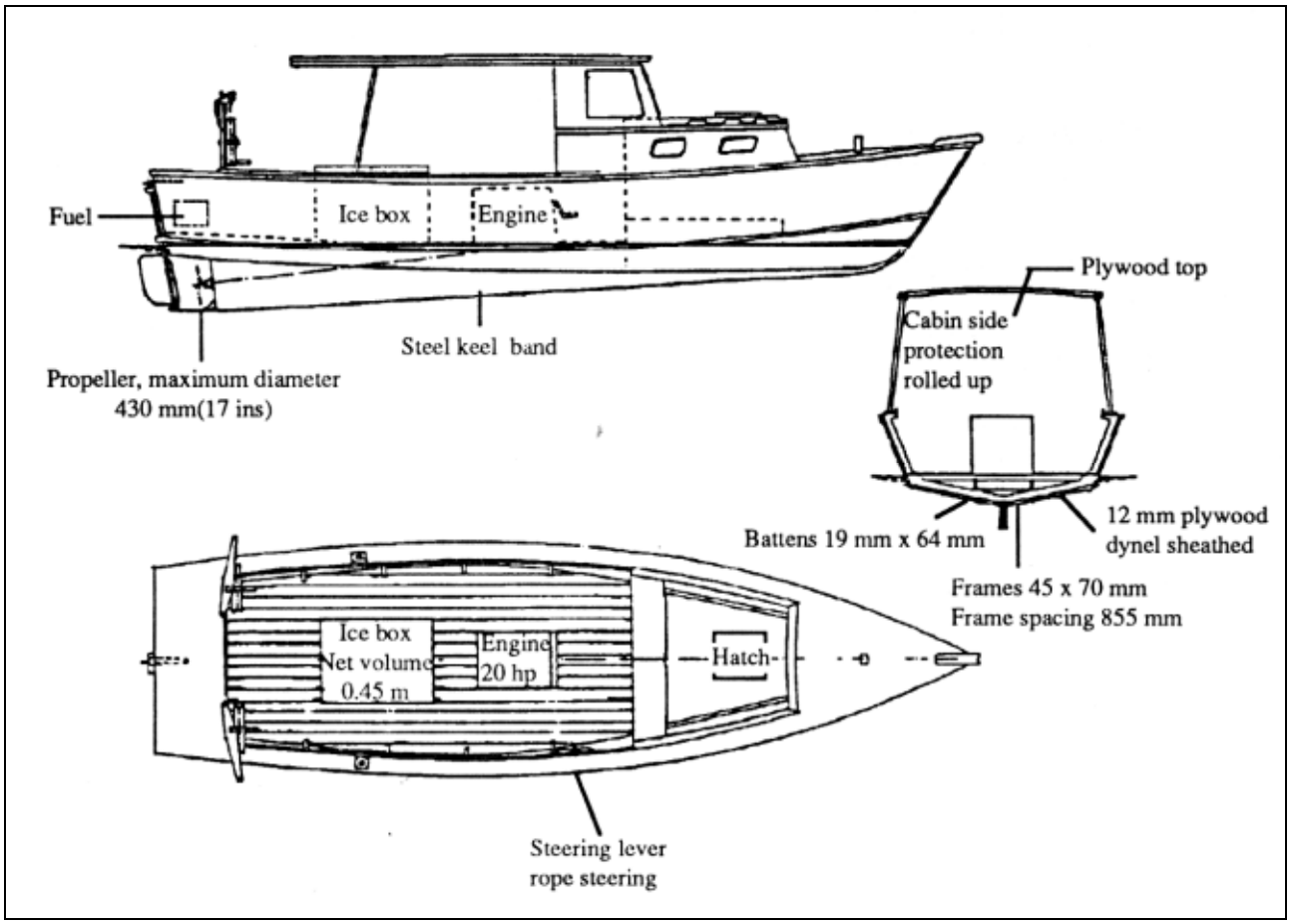


Figure 2: 8.5 m dory used at Funafuti (from Gulbrandsen & Savins, 1987)

The vessel employed by the Project for outer island visits, the *Tui Punga* (Figure 3), was a 9 m FAO-design, planked catamaran, built in Tonga and powered with two 18 hp water-cooled Volvo diesels. It had a cruising speed of 6 to 7 knots. The boat carried no trolling booms or ice box but was outfitted with an echo-sounder with a 120 m depth range, and a satellite navigator. Two of the Project's wooden handreels were fitted to the boat and the Project's JMC portable echo-sounder, with a depth range to 600 m, was carried to locate suitable deep-bottom fishing sites.

The *Tui Punga* was found to be in poor condition and its design and construction not suited to its assigned purpose. The use of very heavy materials in construction and a resultant deep draft (1.2 m) made the boat perform badly to windward and take a good deal of water over the deck in wind speeds greater than 15 knots. Some dry rot was apparent in the frames and hull, and the hulls were asymmetrical. Poor finishing caused leaks at many spots in the cabin. The integral fuel tanks were insufficient capacity and drums of fuel had to be carried on deck. The steering arrangement was inadequate and the steering cord was subject to stretching and failure.

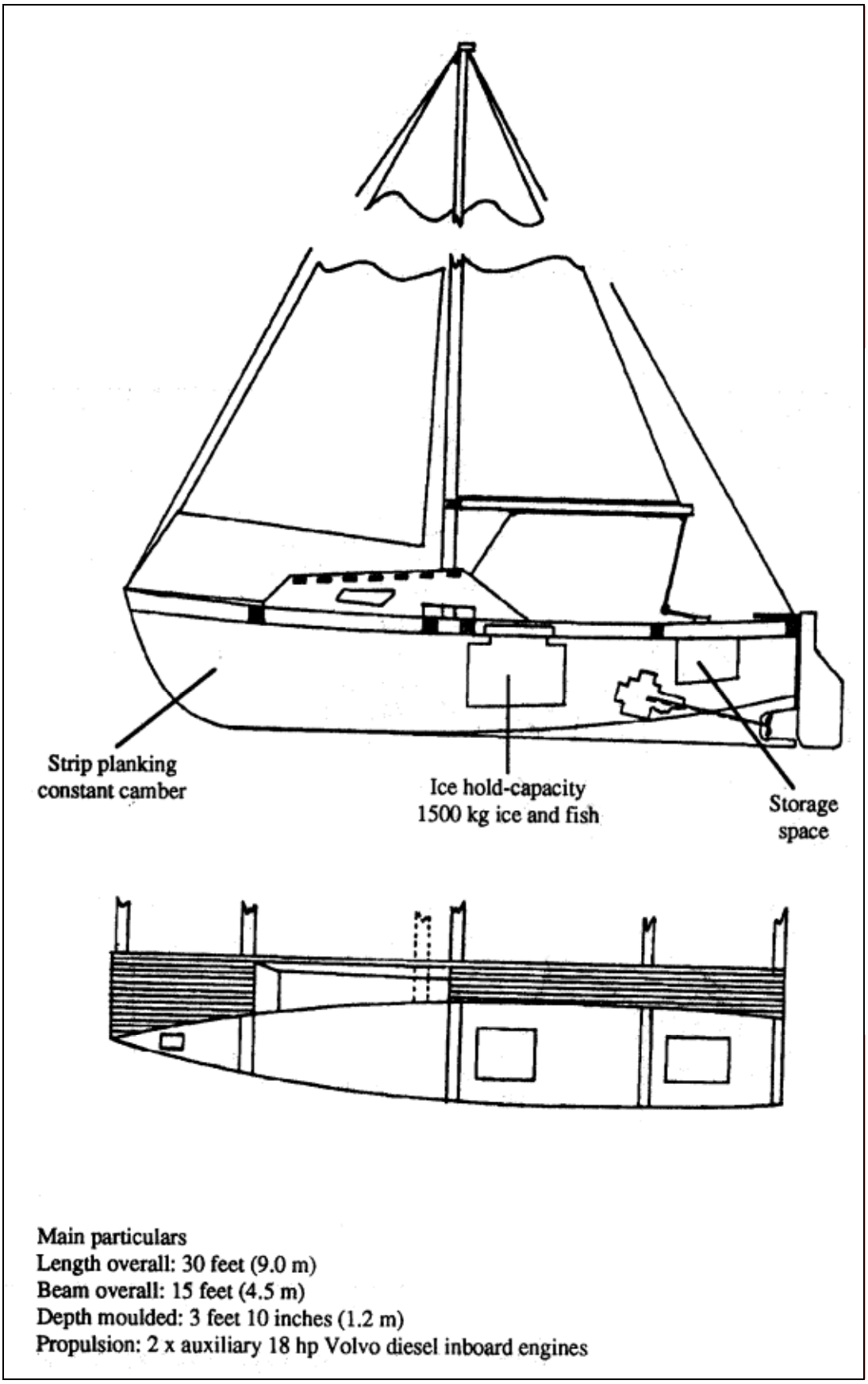


Figure 3: The *Tui Punga* catamaran

Two FAO-Western Samoan-design wooden handreels were carried on all fishing trips. The reels (Figure 4), which are standard equipment for the Project, were loaded with 500 m of 100 k or 130 kg test nylon monofilament and, for deep-bottom fishing, fitted with a wire terminal rig carrying three tuna circle hooks on short traces as depicted in Figure 5. When used for trolling, lines were, trailed directly from the handreels, lures and traces being attached to the mainline with a corkscrew or snap swivel. A variety of lures and strip baits were employed for trolling, with nylon monofilament leaders used when fishing for baitfish, and wire traces when targeting wahoo and other toothed species. The basic trolling rig employed is illustrated in Figure 6.

Anchoring gear for the 8.5 m dory consisted of 440 m of 12 mm polypropylene anchor rope and a simple grapnel anchor, made up from 6 m of 10 mm diameter steel reinforcing rod, as shown in Figure 7. The anchor was attached to the rope with 5 m of 12 mm diameter, galvanised steel chain. Anchoring gear for the *Tui Punga* was similar, although a much heavier grapnel anchor and 18 mm diameter anchor rope were used.

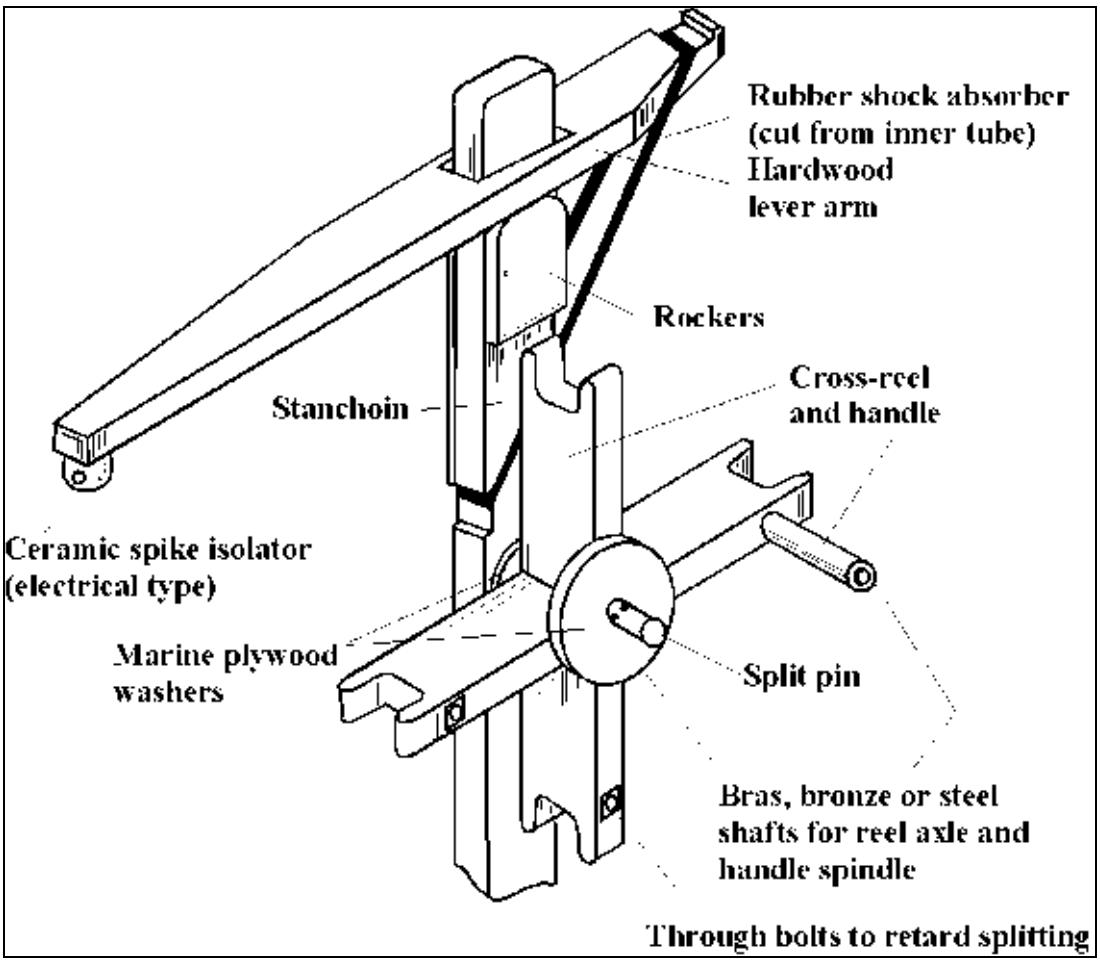


Figure 4: FAO-Western Samoan-design wooden handreel used by the Project

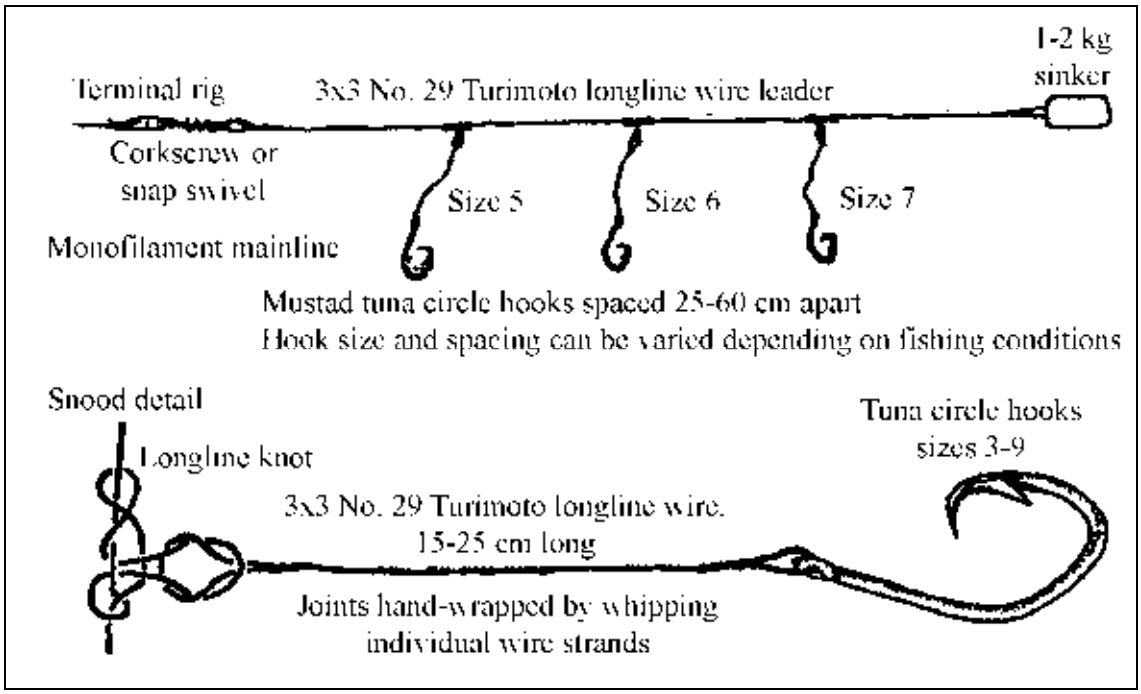


Figure 5: Typical terminal rig for deep-bottom fishing

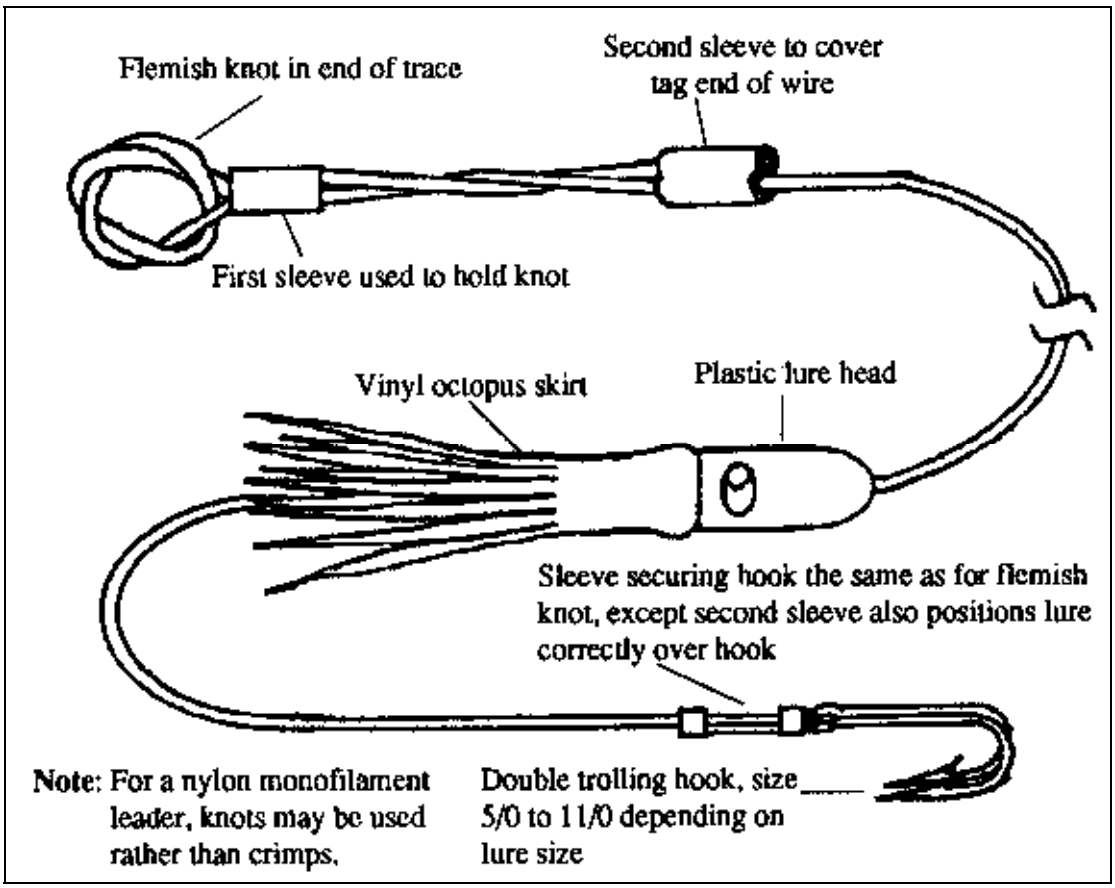


Figure 6: Basic trolling rig

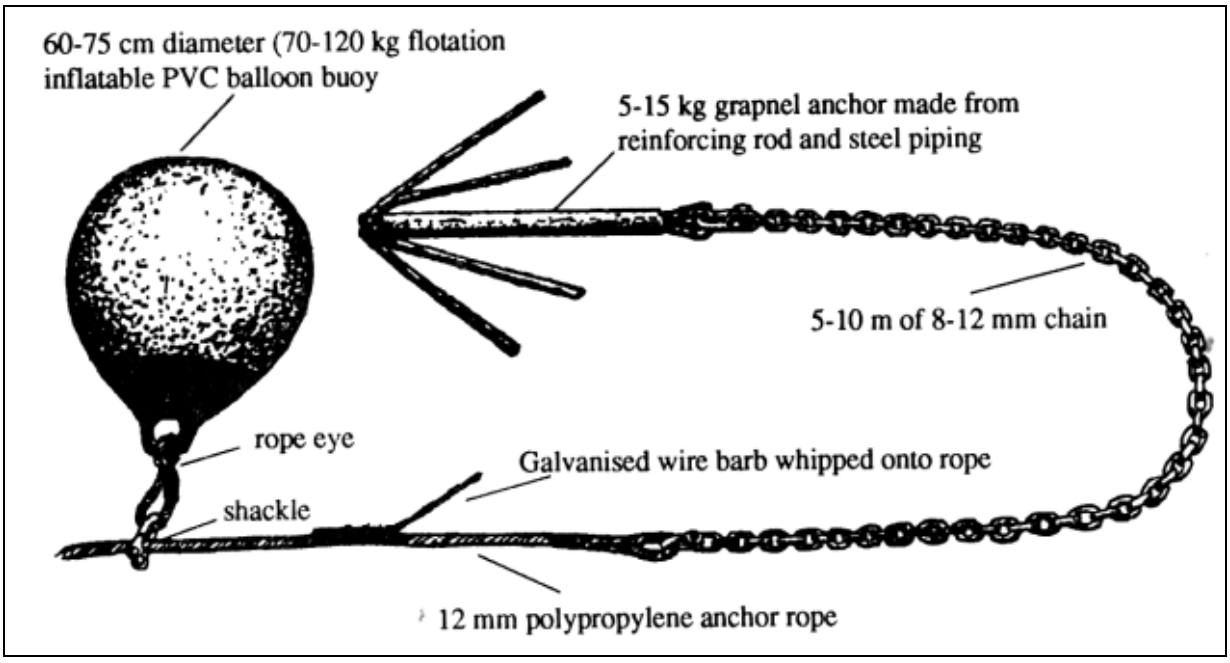


Figure 7: Anchor and retrieval gear used during deep-bottom fishing

3.3 Fishing techniques

Four basic fishing techniques were employed during this visit: bottom droplining using the wooden handreels or handlines, mid-water handlining, trolling, and the night-time capture of flying fish with scoop nets. The use of a particular method was determined by the purpose of each trip, the fishing site, training and bait catching requirements, and opportunity; but most trips involved a combination of methods.

At Funafuti, a number of trips involved trolling in relatively shallow lagoon waters while travelling to bottom-fishing sites. At Vaitupu, a scarcity of bait for deep-bottom fishing prompted a number of trips devoted to capturing flying fish with scoop nets, and at Nukufetau most effort was devoted to trolling the reef drop-off because strong currents interfered with deep-bottom fishing operations Mid-water handlining was only conducted opportunistically during night-time bottom fishing when fish were attracted to the boat by chum and the lights in use. Detailed descriptions of the techniques involved in each fishing method can be found in Section 4.

3.4 Training activities

Training in deep-bottom fishing techniques was an important activity of the visit. At each island, Fisheries Division staff arranged through the local Island Council to have three or four trainees participate in each day's fishing. Because local fishermen demonstrated great competence in handling the fishing materials, little time was spent on the demonstration of gear-rigging. Most effort was devoted to training in the selection of suitable deep-bottom fishing grounds, anchoring and recovery techniques, and the use of the wooden handreels. At Nukulaelae, particularly good deep-bottom catches generated such enthusiasm that up to six trainees were carried on each trip. At all sites participants shared half the catch

A total of 68 trainees and 10 Fisheries Division staff participated in the training programme. At Funafuti only 10 trainees were recorded as participating in the programme due to the Masterfisherman's illness there. Some fishing and training were conducted by Fisheries Division staff during this time, but records were not kept.

Table 2: Trainees participating at each location

Location	No. of trainees	No. of Fisheries Division staff
Funafuti	10	10
Vaitupu	15	
Nukulaelae	25	
Nukufetau	18	
Total	**68**	**10**

3.5 Disposal of the catch

Disposal of the catch was managed by the Tuvalu Fisheries Division. At Funafuti, all readily saleable fish were marketed from the Fisheries Division's retail outlet. Pelagic and semi-pelagic species, including tunas, wahoo and black trevally, were readily sold, gilled and gutted, at A$ 1.30/kg. Most fish taken by bottom-droplining were less popular and fetched A$ 1.10/kg in the round. Oilfish and snake mackerel were generally only saleable when salted and dried, and in this form were sold at A$1.60/kg; however, the 20—25 per cent recovery rate for this process made it barely economic. To meet local demand, some tuna and sailfish were smoked and this product sold for between A$3.00 and A$4.50/kg. Experiments with the smoking of shark flesh were also conducted, but there was a general consumer reluctance towards this product.

In the outer islands, 50 per cent of the catch was shared among the trainees participating in each trip, and the balance of the catch usually sold on the beach for between A$0.80/kg and A$1.00/kg in the round. Unsold fish, including oilfish, snake mackerel and large bottom fish (towards which there was consumer reluctance related to fear of ciguatoxicity), were usually salted and dried, or smoked, and carried back to Funafuti where there was some demand.

Five species locally reputed to be ciguatoxic *(Lethrinus kallopterus, Lutjanus monostigma, Lutjanus bohar, Plectropomus truncatus and Plectropomus* sp. were not sold, although they were readily eaten by villagers in the outer islands.

3.6 Data collection

South Pacific Commission Masterfishermen use a standard logsheet (shown at Appendix 1) to record catch, effort and other fishing data, and make detailed notes of their daily activities and of any supplementary information required. During this Project visit, data were collected at the end of each, trip and comprised: time spent travelling, anchoring and on each type of fishing; fishing depth or depth range; number of crew/trainees; quantity and type of fishing gear; fuel and bait used; the specific identity of each fish caught, where species could be determined; and the total number and weight of each species taken by each fishing method.

4. FISHING ACTIVITIES AND RESULTS

4.1 Deep-bottom droplining

Deep-bottom droplining using a multiple-hook terminal rig hauled by hand or reel was conducted during 30 of the 35 fishing trips completed. Although the wooden handreels are standard equipment for the Project, the number of trainees wishing to participate in fishing during some trips and the limited number of handreels carried on each vessel meant that some fishing was conducted using hand-lines.

Bottom fishing technique is basically similar regardless of depth fished or of whether handreels or handlines are used. Suitable deep-bottom fishing grounds were located using the echo-sounder, target depths being in the 150 m to 250 m range. Depth range was limited to less than the Project's usual 250 m to 300 m because of local consumer reluctance to eat the larger fish commonly taken at such depths.

Where possible, the anchor was dropped in water shallower than that of the chosen fishing site, in a position selected so that the prevailing wind and current would carry the boat back over the deeper area as the anchor warp was paid out.

Once the boat was resting at anchor, bottom fishing was conducted using the handreels or handlines fitted with terminal rigs, as described, and sinkers up to 2 kg, depending on depth and current. The sinker was lowered to the bottom and thereafter the line kept taut by hand to allow the fisherman to respond to bites by striking and to reduce the possibility of fouling other lines. Because of the elasticity of the long lengths of line in use, great reliance is placed on the self-hooking qualities of the tuna circle hooks.

The preferred baits for deep-bottom fishing are fresh skipjack, other tunas, or oily-fleshed fish such as scads, and these were used whenever available from catches taken while trolling to bottom the fishing site. On occasion, frozen bait was used quite successfully, and at Vaitupu flying fish taken at night using scoop nets proved satisfactory.

To recover the anchor at the end of fishing or preparatory to moving to a new fishing site, the boat was motored back over the anchor as slack line was taken up. Once the line was vertical , it was jigged to free the anchor or, if it would not come free, the line was made fast to the boat and the anchor broken out by motoring forward. Once free, the anchor, chain and line were hauled by hand. The use of a balloon buoy clipped onto the anchor line to slide back along it and support the out anchor (which is the Project's standard anchor recovery method) was unnecessary because the steep reef-slopes encountered allowed anchoring to be done in quite shallow waters and hand-hauling required little effort.

Target species for this fishing technique are deep-water snappers *(Etelis* spp.), jobfish *(Pristipomoides* spp.) and fusiliers *(Paracaesio* spp.), although a variety of other species are also taken, including a proportion of less desirable sharks and eels. Species characteristic of shallower waters also appear in the catch because the vessel usually swings at anchor, resulting in a considerable depth range being fished. The deep-living oilfish and snake mackerels also occur in night catches when they ascend to depths typically fished by this method.

A total dropline fishing effort of 354.5 reel- or line-hours (calculated as one line or reel in use one hour) produced a catch of 934 fish with a total weight of 3668.4 kg, giving a catch rate per unit of effort (CPUE) of 10.4 kg per reel- or line-hour. Some 625.2 kg of this catch comprised generally unsaleable species, including sharks and fish locally regarded as ciguatoxic, and the CPUE for saleable species only (3043.2 kg) was 8.6 kg/reel- or line-hour. If only sharks are excluded the catch the CPUE was 8.8 kg/reel or line-hour.

Catch rates varied Considerably from island to island, and, a variety of factors may account for this. At Funafuti extensive deep-bottom fishing grounds and a ready supply of bait contributed significantly to good catches; at Vaitupu there was persistent difficulty in securing bait supplies; at Nukufetau strong currents running parallel to the reef hampered operations considerably; at Nukulaelae excellent bottom fishing shoals extended off the points at a number of locations and, despite strong current requiring these shoals to be fished only at slack water, very good catch rates were recorded. Table 3 summarises the catch and effort by deep-bottom droplining at each location.

Table 3: Summary of deep-bottom catch and, effort at each location

Location	No.of trips	Fishing hours	Effort (reel- or line-hours)	Catch		CPUE*		Average catch per trip (kg)
				No.	Wt (kg)	No.	Wt(kg)	
Funafuti	16	95.5	238.0	547	2214.3	2.3	9.3	130.3
Vaitupu	3	11.0	22.0	29	180.7	1.3	8.2	60.2
Nllkulaelae	6	35.0	68.5	284	1113.4	4.1	16.3	189.2
Nukufetau	4	13.0	26.0	74	160.0	2.8	6.1	39.8
Total	**29**	**154.5**	**354.5**	**934**	**3668.4**	**2.6****	**10.4.***	**122.2.***

* Catch per unit of effort
** Denotes average figure over all locations f'ished.

Some 198 kg of bait were used during droplining operations, yielding a catch of 18.5 kg per kg of bait.

Deep-water snappers, the prime target species for this fishing method, comprised 23.6 per cent of the catch, with 313 fish taken, having a total weight of 866.8 kg. The most important species in this group were: short-tailed red snapper *(Etelis carbunculus),* with 85 individuals landed, a total weight of 368.2 kg; longtail red snapper *(Etelis coruscans),* represented by 30 fish with a total weight of 185.0 kg; and banded flower snapper *(Pristipomoides zonatus),* with 106 individuals and a total weight of 84.0 kg. Shallow-water snappers, including paddletail *(Lutjanus gibbus)* and the commonly ciguatoxic red bass *(Lutjanus bohar)* accounted for 3.5 per cent of the bottom catch, emperors 0.9 per cent, groupers and cods 9.2 per cent, and trevallies and jacks 15.6 per cent (of this group the locally much-prized black trevally *(Caranx lugubris)* was the most commonly taken species in the bottom catch, with 206 individuals landed).

The group accounting for the greatest proportion of the catch by weight was the gempylids, with a total weight of 1136.8 kg, or 31.0 per cent of the overall bottom catch. This group was represented by the two species commonly taken at night: oilfish *(Ruvettus pretiosus)* and snake mackerel *(Promethichthys prometheus).*

Sharks accounted for 14.9 per cent of the catch, with 22 individuals landed with a total weight of 545 kg. Although they could not be sold, they were often shared among the crew for consumption, or the fins removed for possible sale and the carcasses discarded.

4.2 Mid-water handlining

Mid-water handlining was conducted as a supplementary or opportunistic fishing activity during 15 night-time bottom fishing trips. A pressure lantern suspended at one side of the boat attracted predator fish, or baitfish which in turn attracted predator fish, to the vicinity of the boat; bait-scraps from bottom fishing activity probably also played a part in attracting fish to the area. Once fish were observed, a crew member not engaged in bottom fishing rigged a strip bait on a tuna circle hook fitted to a handline and allowed the unweighted line to drift below the boat. Strikes were often made quite close to the surface. Table 4 summarises the catch and effort by this method at each location fished.

Table 4: Summary of mid-water handline catch and effort at each location

Location	No.of trips	Fishing hours	Effort (reel- or line-hours)	Catch		CPUE*		Average catch per trip (kg)
				No.	Wt (kg)	No.	Wt(kg)	
Funafufi	10	49.0	57.0	96	117.7	1.7	2.1	11.8
Vaitupu	2	5.0	9.0	8	9.2	0.9	1.0	4.6
Nulmlaelae	1	1.0	1.0	1	16.0	1.0	16.0	16.0
Nuloafetau	2	4.5	8.5	20	40.5	2.4	4.8	20.3
Total	**15**	**59.5**	**75.5**	**125**	**183.4**	**1.7**	**2.4**	**12.**

* Catch per unit of effort

All fish taken by this method were saleable and included trevallies, dogtooth tuna, and barracudas. A total of 18.5 kg of bait was used for this technique, with a yield of 8.8 kg of catch per kilogram of bait. The CPUE recorded overall was 2.4 kg/line-hour.

4.3 Lagoon trolling

Trolling inside the lagoon was conducted only at Funafuti while motoring to bottom fishing sites. Small artificial octopus lures were rigged on monofilament nylon leaders and trolled from handreels. Most of the catch taken by this method was small tunas or jacks suitable for bottom fishing bait, and was used as such. Table 5 summarises the catch and effort by this method. The CPUE this method was 0.5 kg/line-hour.

Table 5: Summary of lagoon troll catch and effort at Funafufi

No. of trips	Fishing hours	Effort (line-hours)	Catch		CPUE*		Average catch per trip (kg)
			No.	Wt (kg)	No.	Wt(kg)	
17	28.5	62.0	43	28.7	0.7	0.5	1.7

* Catch per unit of effort

4.4 Open-water trolling

Trolling along the outer reef, or offshore around schools of pelagic species, was conducted both to capture bait and as an alternative activity when conditions prevented successful deep-bottom fishing, as at Nukufetau. A variety of lure sizes, strip baits and types were employed depending on the target species and the area fished. Lines were trolled directly from the handreels. Table 6 summarises the catch and effort by this method at each location.

Table 6: Summary of open-water troll catch and effort at each location

Location	No.of trips	Fishing hours	Effort line-hours)	Catch		CPUE*		Average catch per trip (kg)
				No.	Wt (kg)	No.	Wt(kg)	
Funafuti	17	33.0	73.5	165	173.8	2.2	2.4	10.2
Vaitupu	6	31.0	120.0	83	172.0	0.7	1.4	28.7
Nukulaelae	4	14.5	43.5	19	63.5	0.4	1.5	15.9
Nukufetau	6	42.0	102.0	84	717.0	0.8	7.0	119.5
Total	**33**	**120.5**	**339.0**	**351**	**1126.3**	**1.0**	**3.3**	**34.1**

* Catch per unit of effort

The catch consisted mainly of scombrids, including wahoo (*Acanthocybium solandri)*, 51.9 per cent of the total by weight; skipjack tuna *(Katsuwonus pelamis)*, 10.2 per cent; and yellowfin tuna *(Thunnus albacares)*, 9.5 per cent. Four sailfish *(Istophorus platypterus)* and a variety of trevallies and jacks were also taken. CPUE by this method was 3.3 kg/line-hour.

4.5 Flying fish scooping

The capture of flying fish at night, using a pressure lantern or battery-powered spotlight to attract and blind the fish and long-handled scoop nets to take them from the water, was conducted only at Vaitupu, in an attempt to obtain bait for deep-bottom fishing. Table 7 summaries the Catch and effort by this method. CPUE by this method was 1.8 kg/net-hour.

Table 7: Summary of flying fish scoop catch and effort at Vaitupu

No. of trips	Fishing hours	Effort (line-hours)	Catch		CPUE*		Average catch per trip (kg)
			No.	Wt (kg)	No.	Wt(kg)	
3	10.0	20.0	249	35.6	12.5	1.8	11.9

* Effort by this method is given in net-hours, calculated as one net in use for one hour.
** Catch per unit of effort

4.6 Species composition of the catches

The species composition of the catches by each method is given in Appendices 2A, 2B, and 2C. Table 8 summarises the species composition of the catch by all methods. The groupings used are based on the component species taxonomy, habitat and recognisable concurrence in the catch.

Table 8: Summary of the species composition of the catch by ail methods

Group	Catch		Percentage of tot. catch	
	No.	Wt (kg)	No.	Wt (kg)
Deep-water snappers including genera *Aphareus, Etelis, Paracaesio, Pristipomoide* s	328	880.8	18.8	17.5
Shallow-water snappers genus *Lutjanus*	89	131.1	5.1	2.6
Emperors genus *Lethrinus*	18	34.2	1	0.7
Groupers, cods and coral trouts including genera *Cephalopholis, Epinephelus, Plectropoma, Saloptia, Variola*	111	340.1	6.4	6.7
Jacks and trevallies including genera *Caranx, Elegatis, Seriola*	264	627.5	15.1	12.4
Mackerels and tunas including genera *Acanthocybium, Gymnosarda, Katsuwonus, Thunnus*	328	999.6	18.9	20.8
Oilfish and snake mackerels inclduing genera *Ruvettus, Promethichythys*	151	1136.8	8.6	22.5
Solderfish squirrelfish and glasseyes; including genera *Adioryx, Myripristis, Priacanthus, Ostichthys*	3	2.8	0.2	0.1
Barracudas and seapikes genus *Sphyraena*	46	90.0	2.6	1.8
Miscellaneous bony fishes incuding genera *Beryx, Coryphaena, Cypselurus, Istiophorus, Conger*	382	233.5	21.9	4.6
Sharks; including genera *Carcharhinus, Hexanchus*	25	566.0	1.4	11.2
Total	**1745**	**5042.4**	**100**	**100.0**

5. FISHING AREAS

5.1 Funafuti

Funafuti atoll consists of a string of islets and reefs surrounding a large, open lagoon, which may be entered by way of several deep-water passages. Most fishing effort was concentrated along the western reef, as persistent winds from the north-east and south-east, as well as strong currents at the points, made fishing along the eastern coast generally impracticable. Figure 8 shows the most productive deep-bottom droplining sites located in the area fished. The catch rate by deep-bottom droplining at Funafuti was 9.3 kg per reel-hour, indicating the presence of a significant deep-bottom resource. Table 9 summarises the catches at Funafuti by each fishing method employed. Detailed trip records for Funafuti are given in Appendix 3A.

Table 9: Summary of catch and effort by each fishing method at Funafuti

Fishing method	No. of trips	Fishing hours	Effort	Catch		CPUE* (kg)
				No.	Wt(kg)	
Deep-bottom droplining	16	95.5	238.0	547	2214.3	9.3
Mid-water handlining	10	49.0	57.0	96	117.7	2.1
Lagoon trollling	17	28.5	62.0	43	28.7	0.5
Open-water trolling	17	33.0	73.5	165	173.8	2.4
Total	**17 ****	**206.0**		**851**	**2534.5**	

* Catch per unit of effort
** All trips combined more than one fishing method.

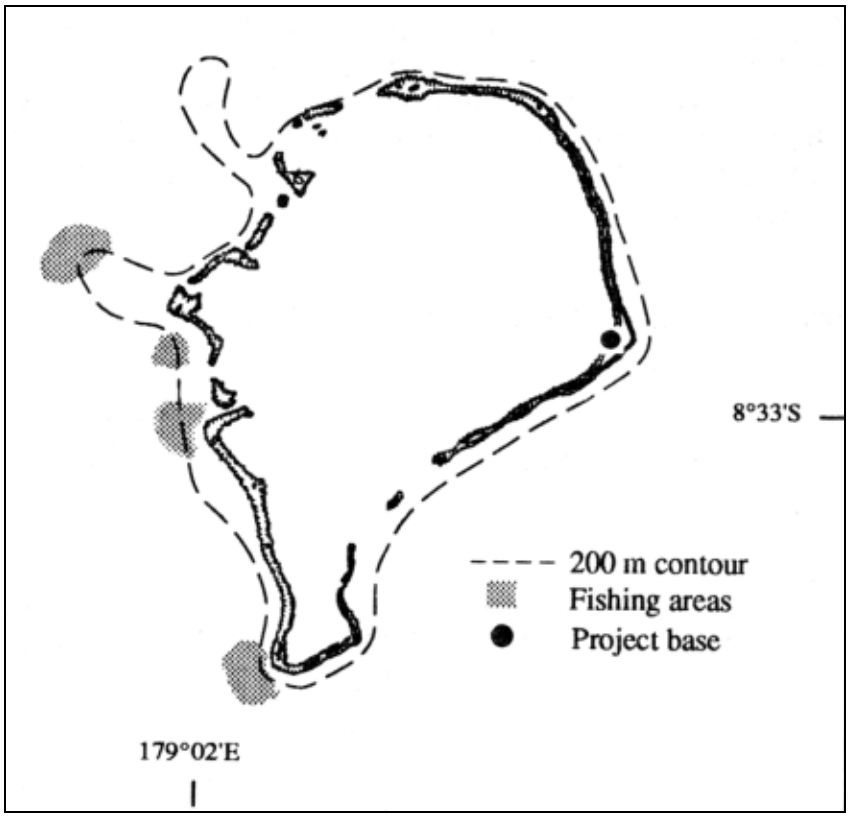


Figure 8: Funafuti

5.2 Vaitupu

Vaitupu island consists of one islet encircling two small, almost land-locked lagoons. The fringing reef lies dose to the shore and inshore fishing grounds are therefore very limited. The outer reef-slope drops away sharply and depths of 400 m and more are found quite close to the reef.

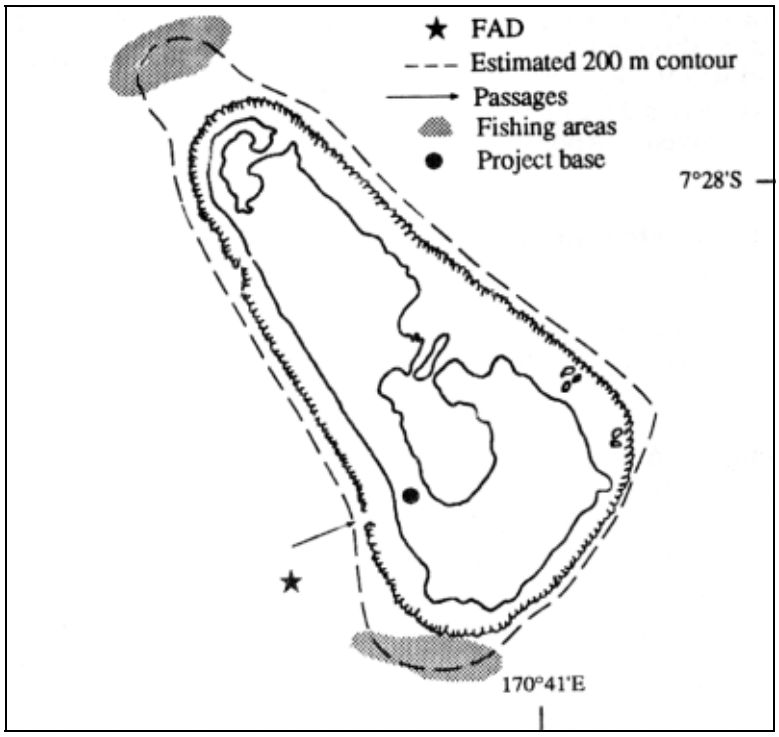


Figure 9: Vaitupu

Securing supplies of suitable bait was a persistent difficulty during operations at Vaitupu, although the catch rate of 8.2 kg per reel-hour for deep-bottom droplining was quite high, the better part of this catch consisted of off fish taken during one night-fishing trip. Better catches might well have been recorded if better bait had been obtainable. A large proportion of the troll catch was taken during the return trip to Funafufi. Table 10 summarises the catches at Vaitupu by each fishing method and detailed trip records will be found in Appendix 3B.

Table 10: Summary of catch and effort by each fishing method at Vaitupu

Fishing method	No. of trips	Fishing hours	Effort	Catch		CPUE* (kg)
				No.	Wt (kg)	
Deep-bottom droplining	3	11.0	22.0	29	180.7	8.2
Mid-water handlining	2	5.0	9.0	8	9.2	1.0
Open-water trolling	6	31.0	120.0	83	172.0	1.4
Flying fish scooping	3	10.0	20.0	249	35.6	1.8
Total	**6 ****	**57.0**		**369**	**397.5**	

* Catch per unit of effort
** All trips combined more than one fishing method.

5.3 Nukulaelae

The lagoon at Nukulaelae is encircled by a fringing reef and islets and there are no deep-water boat passages. Although the island has a generally steep outer reef-slope, some shelves are found extending offshore at the points. These areas proved to be particularly productive deep-bottom fishing grounds. Fishing access was limited, however, because strong currents over these shelves, caused by the rising and falling fide, determined that bottom fishing operations could only be conducted at slack water. Large individual specimens of seven-banded grouper *(Epinephelus septemfasciatus)* and short-tailed red snapper *(Etelis carbunculus)* were taken, but there was some local resistance to consuming large bottom fish. A large number of black trevally *(Caranx lugubris)*, which are much favoured as a food fish locally, was also taken. Table 11 summarises the catches at Nukulaelae by each fishing method and Appendix 3C details trips completed there.

Table 11: Summary of catch and effort by each fishing method at Nukulaelae

Fishing method	No. of trips	Fishing hours	Effort	Catch No.	Catch Wt (kg)	CPUE* (kg)
Deep-bottom droplining	6	35.0	68.5	284	1113.4.*	16.3
Mid-water h andlining	1	1.0	1.0	1	16.0	16.0
Open-water trolling	4	14.5	43.5	19	63.5	1.5
Total	**6*** **	**50.5**		**304**	**1192.9**	

* Catch per unit of effort
** Includes a small component of shallow-water droplining catch.
*** All trips combined more than one fishing method.

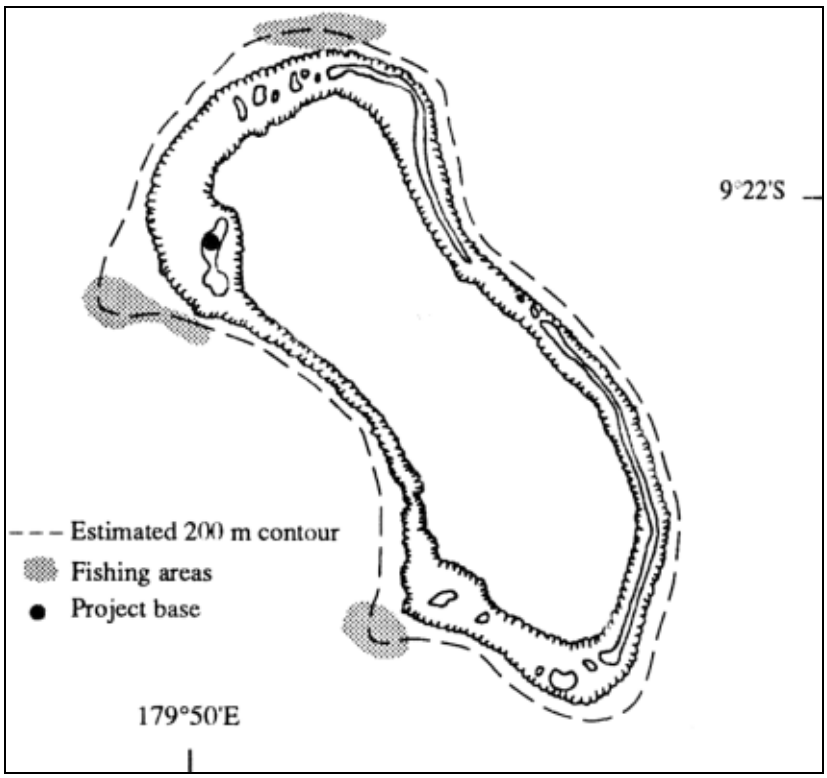


Figure 10: Nukulaelae

5.4 Nukufetau

Nukufetau atoll is similar to Funafuti in that a fringing reef and a number of islets encircle an open lagoon, which may be entered by way of two deep-water boat passages. Deep-bottom droplining was particularly difficult at Nukufetau because of strong currents running parallel to the reefs and over promising shelves located at the points. Open-water trolling both along the reef drop-off and offshore was conducted as an alternative fishing activity and resulted in good catches, especially of wahoo *(Acanthocybium solandri)*. Table 12 summaries the catches at Nukufetau by each fishing method and Appendix 3D details trips completed there.

Table 12: Summary of catch and effort by each fishing method al Nukufetau

Fishing method	No. of trips	Fishing hours	Effort	Catch No.	Catch Wt (kg)	CPUE* (kg)
Deep-bottom droplining	4	13.0	26.0	74	160.0	6.1
Mid-water handlining	2	4.5	8.5	20	40.5	4.8
Open-water trolling	6	42.0	102.0	84	717.0	7.0
Total	**6****	**59.5**		**178**	**917.5**	

* Catch per unit of effort

** Some trips combined more than one fishing method.

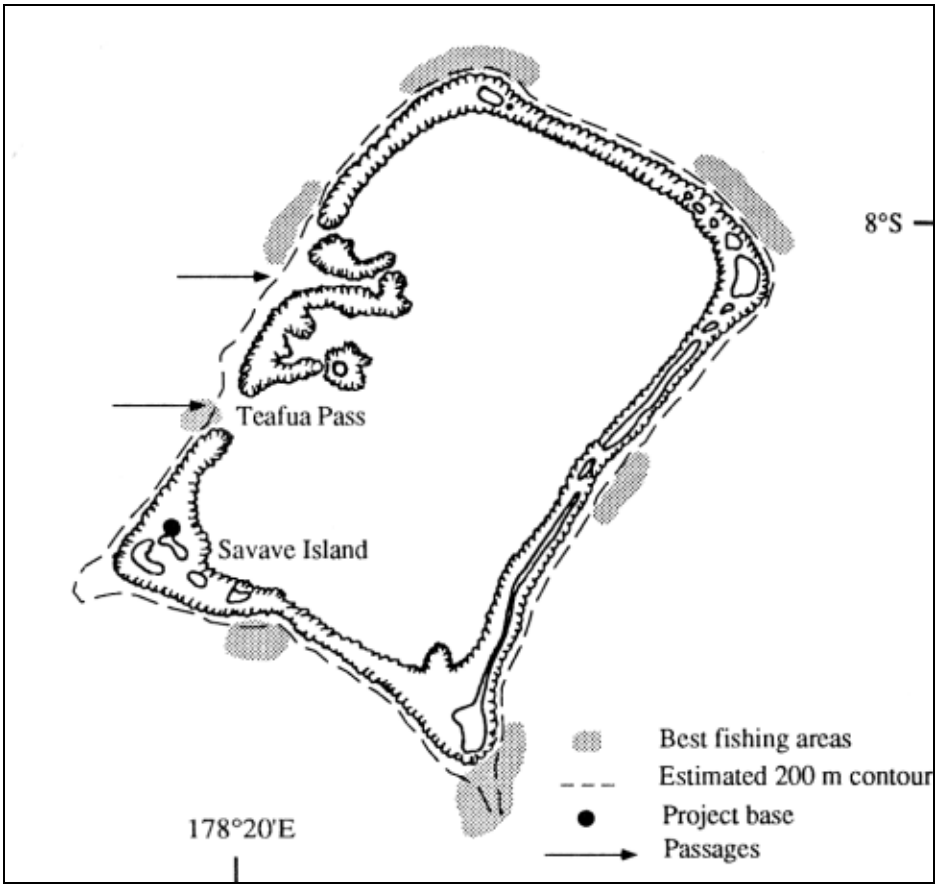


Figure 11: Nokufetau

6. ECONOMICS OF THE FISHING ACTIVITIES

6.1 Effort, fuel and bait expended in relation to catches

Table 13 summarises the fishing effort and the direct operational expenses for each fishing method in relation to the catches taken. Wages, replacement of gear, maintenance costs and the cost of salt are not included here, but are taken into account in Section 6.2 in calculation of overall fishing operation economics. A summary of direct operational expenses for each trip and for each kilogram of fish landed is given as an indicator of the running expenses most significant to small-scale subsistence operators. Calculations are based on local prices prevailing at the time of the Project visit: A$0.80/1 for the diesel fuel used by both vessels employed by the Pro3ect and A$1.20/kg for bait, based on the market value of the species so used.

Table 13: Summary of effort, fuel and bait expended by each fishing method in relation to catch

	Deep-bottom droplining	**Mid-water handlining**	**Lagoon trolling**	**Open-water trolling**	**Flying fish scooping**	**Total or average**
No. of trips	30	15	17	33	3	35
Fishing hours	154.2	59.5	28.5	120.5	10.0	373.0
Total bait (kg)	216.7	18.0	0	11.5	0	246.2
Average bait per trip (kg)	7.2	1.2	0	0.3	0	
Total fuel (l)*	**262.0**		**114.0**	**482.0**	**40.0**	**898.0**
Fuel per trip (1)	8.7		6.7	14.6	13.3	28.1 (average)
Total catch (kg)	3850.8		28.7	1 t26.3	35.6	5041.4
Catch per trip (kg)	128.4		1.7	34.1	11.9	157.4 (average)
Average cost of fuel and bait per trip	A$13.00		A$5.36	A$12.33	A$10.66	A$28.57 (average)
Cost of fuel and bait per kg of catch taken	A$0.10		A$3.17	A$0.36	A$0.89	A$0.19 (average)

* Does not include fuel consumed in travelling between operational bases.
Note: Fuel and catch records for deep-bottom droplining and mid-water handlining are combined because these fishing techniques were conducted in combination.

6.2 Income and expenditure

Table 14 is a projection of the likely income and expenditure of a small-scale fishing operation in Tuvalu, based on the effort and catches recorded during the Project's 13 weeks of operation and on the sale of all marketable catches (fresh or processed) at prices current in Funafuti at the time of the visit. No account has been taken of depreciation on boats and motor, nor of loan repayments interest charges which might be expected to affect new operators entering such fisheries on a commercial basis. Wages for one crew member are included. .

Table 14: Projections of income and expenditure over one year

INCOME (Fish sales)

Fish by market value		**Recovered catch after processing (kg)**	**Value (A$)**
Grade A fish:	Tunas, wahoo, dolphin fish, barracudas and black trevally, at A$1.30/kg gilled and gutted	1395.0.*	A$1813.50
Grade B fish:	Oilfish, snake mackerels and sailfish, salted or smoked, at average A$1.60/kg	307.7 **	A$508.32
Grade C fish:	All other saleable species, sold fresh in the round, at A$1.10/kg	1518.2	A$1670.00
	Total income	**3220.9**	**A$3991.82**

EXPENDITURE

Item	**Amount**	**Cost (A$)**
Diesel fuel at A$0.80/1	898 1	718.40
Bait at average A$1.20/kg	234.7 kg	281.64
Gear replacement (lures, hooks, line)		150.00
Maintenance (oil and grease, etc.)		100.00
Salt (for processing) at A$15.0/bag	10 bags	150.00
Wages (50% of gross sales)		1995.91
Total expenditure		**2644.45**
Surplus of income over expenditure		**595.87**

* Weight loss in processing 10 per cent
** Weight loss in processing 75 cent

It might be expected that a small-scale, well-equipped fishing operation engaging in diversified fishing methods and free of the restrictions imposed by the requirements of a training programme would improve on the catches taken by the Project. Familiarity with fishing grounds and effective organisation of bait supplies would also assist in improving catches. An operator prepared to process fish (by salting or smoking) and to chill or freeze fish for transport could be expected to realise better returns from sales than those generally obtained during this visit. It does appear, therefore, that scope exists for small-scale commercial development of fisheries in the areas surveyed. Problems which might arise could include overfishing of some deep-bottom sites and oversupply in the outer island locations. Monitoring of deep-bottom resources and the establishment of proper fish handling and transport procedures would be desirable to foster the industry. Additional recommendations are contained in Section 7.3.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Deep-bottom resources

The results of the deep-bottom fishing activities conducted during the Project's stay indicate that bottom-fishing grounds of limited extent, which have the potential for commercial exploitation to a greater or lesser degree, exist at the four islands surveyed.

Catch rates recorded at these sites were high in comparison to those recorded by the Project elsewhere in the region. Although little is currently known about the ability of deep-bottom resources to withstand sustained fishing pressure, a number of countries have developed this fishery to a limited degree without apparent detriment.

The generally prized deep-water species typically taken by this fishing method did not appear to be highly regarded in Tuvalu and fetched a lower price than pelagic species. Large individual fish in particular were difficult to sell at all, unless processed. However, improved marketing and processing techniques which might maximise returns from these catches, and Project operations here and elsewhere, indicate that this fishing method is more economic in terms of fuel and other running expenses than the trolling operations currently typical in Tuvalu.

The component of sharks and other unsaleable species was at a tolerable level and there were indications that smoked shark could gain consumer acceptance, particularly in Funafuti.

7.2 Development constraints

Despite the apparent existence of a deep-bottom resource capable of supporting small-scale commercial exploitation and economic circumstances which would provide a reasonable financial return on commercial fishing activities, there are a number of constraints which may hinder development of the fishery. Some of these relate to the infrastructure required to support fishing activities in remote areas or by small-scale operators.

Most local fishermen presently operate aluminium dinghies around 3.6 m in length, powered by various brands of outboard motors. While these boats are generally fast and easily handled, they can operate only at limited range and have little carrying capacity. Larger and more stable diesel-powered vessels such as the 8.5 m dory and the 9.7 m catamaran *Tui Punga* used by the Project have the range, the fuel economy and the carrying capacity which would be required for an economically viable fishery. Such vessels could be constructed locally at the 'Save the Children' boatyard although, as all materials are imported, costs would be beyond the reach of many local fishermen without some form of assisted purchase scheme. The diesel motors which power these vessels are low-maintenance and have a longer working life than outboards, though more specialised mechanical skill is required to service or repair them.

Irrespective of the vessel types employed in the fishery, the availability of fuel, oil, grease and spare motor parts will influence the efficiency of local fishing operations. Problems of availability will be more acute in the more remote areas, and in all cases will be exacerbated by the diversity of motor makes and models presently in use.

At a number of locations fishing gear was both scarce and expensive. Operators entering a relatively new fishery require access to adequate and reasonably priced equipment.

The lack of ice, freezers or even reliable refrigerated transport at some locations is a severe constraint to development, as it restricts market opportunities for unprocessed fish to immediate domestic demand. At some stages of development this lack of handling and storage facilities is likely to render the fishery unviable. In the short term, basic processing techniques such as salting, drying and smoking may have to be employed to store surplus catches or to transport catches to market at Funafuti or elsewhere.

7.3 Recommendations

The following recommendations stem from the Project's visit to Tuvalu:

(a) Financial assistance and managerial support

As the investment capital required to purchase and outfit vessels suited to the commercial exploitation of a deep-bottom fishery is unlikely to be readily available in remote rural areas, and because fishermen there are generally inexperienced in business management, the government should take responsibility for encouraging small-scale fishing ventures through a programme of financial assistance coupled with managerial support.

Financial assistance could be offered in variety of forms:

– lowering or abolition of import duties on boats, boat materials, motors, etc. to bona fide fishermen,

– provision of low-interest or interest-free loans for boat and motor purchase, subsidised local construction of boats,

– aid-in-kind grants (e.g. motors or fishing equipment supplied to fishermen under aid project funding).

Managerial support is an important component in the development of a commercial fishery among individuals with little or no business experience. Booklets, workshops or seminars, and extension officers could do much to assist novice entrepreneurs manage their affairs.

(b) Technical training

Workshops and extension courses, covering such topics as motor maintenance and repairs, repairs, handreel construction and perhaps basic fish processing techniques, would all be useful making fishermen in more remote areas self-reliant, and their fishing activities more efficient.

(c) Support services

In addition to the technical training outlined, government should aim to provide a range of technical support services which may be beyond the scope of individual fishermen, including:

– Establishment of a marine motor workshop and service facility, stocking motors and spare parts, and with the service of a competent mechanic,

– Stocking and sale of tools and materials for motor and vessel maintenance and rep including marine glues, paints, fastenings, etc.,

– Local construction and sale of basic items of equipment, including grapnel anchors, handreels and ice-boxes.

(d) Fishing gear supply

An outlet should be established, perhaps in conjunction with the proposed fish market, where adequate stocks of suitable fishing gear are available to fishermen at cost. Some attempt should also be made to make such gear available at outer island locations.

(e) Ice

The opening of the fish market at Funafuti will create a demand for fish products which are properly chilled or frozen. Efforts should be made to educate fishermen on the marketing advantages of chilling fish and freezing surplus catches and to ensure that ice and ice-boxes are obtainable at reasonable cost.

(f) Fuel

As fuel costs will remain the most significant operational expense in most local commercial fisheries consideration should be given to making fuel available under subsidy.

(g) Fisheries support vessel

Consideration should be given to acquiring a vessel capable of supporting fisheries throughout the group. A vessel with adequate ice-holds or freezer capacity, with a gear and materials store, and equipped with echo-sounding gear, could deliver ice to cool stores at outer islands and take chilled fish to the Funafuti market, as well as surveying bottom-fishing sites, selecting sites for FAD deployment, providing technical support on the spot (on-board mechanic), and carrying stocks of fishing gear and boat maintenance materials.

Finally, Tuvalu Fisheries Division should implement a programme designed to monitor the development and economic viability of the local deep-bottom fishery. Such a programme would record basic catch information, the species composition of catches, market trends and the economic circumstances of local deep-bottom fishermen. An accumulation of such information would allow for periodic assessments of the fishery to be made, with particular regard to the state of deep-bottom resources, and the detection of any significant changes in species composition or productivity of catches. Management strategies designed to foster the fishery could then be formulated with some confidence.

8. REFERENCES

Anon. 1969. *Pacific Islands Pilot* vol. II. 9th edition. Hydrographer of the Navy, Ministry of Defence, Somerset, U.K.

Anon. 1981. *Pacific Islands Yearbook.* 14th edition. Pacific Publications Ltd, Sydney, Australia.

Anon. 1986. *Atlas of the South Pacific.* Government Printing Office, Wellington, New Zealand.

Ellway, C.P., Farman, R.S., Argue, A.W. & Kearney, R.E. 1983. *An assessment of the skipjack and baifish resources of Tuvalu.* Skipjack Survey and Assessment Programme Final Country Report No. 8. South Pacific Commission, Noumea, New Caledonia.

Gulbrandsen, O. & Savins, M. 1987. *Artisanal fishing craft of the Pacific Islands.* FAO/UNDP Regional Fisheries Support Programme. Food and Agriculture Organization of the United Nations, Suva, Fiji.

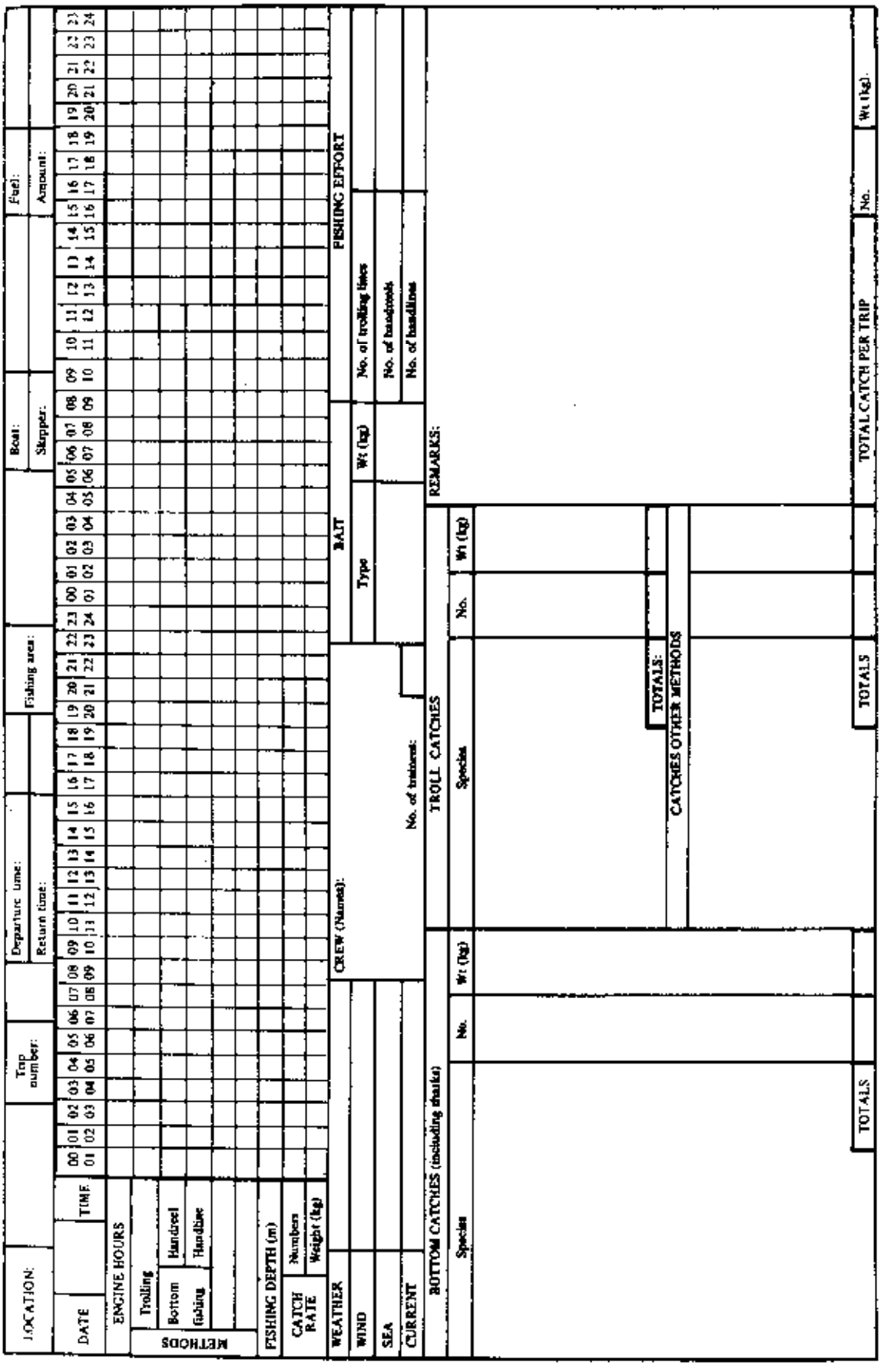
Klawe, W.L. 1978. *Estimates of catches of tuna and billfishes by Japanese, Korean and Taiwanese longliners from within the 200 mile economic zone of the member countries of the South Pacific Commission.* SPC Occasional Paper No.10. South Pacific Commission, Noumea, New Caledonia.

Mead, P.D. 1987. *Report of third visit to Tonga.* Deep Sea Fisheries Development Project. Pacific Commission, Noumea, New Caledonia.

Taumaia, P. & Gentle, M. 1982. *Report on the Deep Sea Fisheries Development Project in Funafuti Tuvalu.* South Pacific Commission, Noumea, New Caledonia.

APPENDIX 1

STANDARD LOGSHEET FOR DATA COLLECTION



APPENDIX 2A

SPECIES COMPOSITION OF THE BOTTOM CATCH AT EACH LOCATION

GROUP *FAMILY* *Species* English name	FUNATUTI		VAITUPU		NUKULAELAE		NUKUFETAU		TOTAL	
	No.	Weight	No.	Weight	No.	Weight	No.	Weight	No.	Weight
DEEP-WATER SNAPPERS										
LUTJANIDAE (sub-families ETELINAE, APSILINAE)										
Aphareus rutilans Small-tooth jobfish/silvermouth	15	47.7			4	6.5	4	9.5	23	63.7
Aprion virescens Green jobfish	3	8.9			6	22.0	4	9.5	13	40.0
Etelis carbunculus Short-tailed red snapper	59	184.2	2	2.0	15	165.0	9	17.0	85	368.2
Etelis coruscans Longtail snapper	19	97.0	1	11.0	7	63.0	3	14.0	30	185.0
Etelis radiosus					1	5.0			1	5.0
Paracaesio kusakarii Saddled fusilier					14	64.0			14	64.0
Paracaesio stonei Stone fusilier	1	2.8							1	2.8
pristipomoides auricilla Gold-tailed jobfish	11	7.3	2	2.0	1	1.0	1	1.0	15	11.3
Pristipomoides filamentosus Rosy jobfish	11	20.2					4	9.0	15	29.2

APPENDIX 2A

SPECIES COMPOSITION OF THE BOTTOM CATCH AT EACH LOCATION

GROUP ***FAMILY*** *Species* English name	**FUNATUTI**		**VAITUPU**		**NUKULAELAE**		**NUKUFETAU**		**TOTAL**	
	No.	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**
Pristipomoides flavipinnis Yellow jobfish	6	7.2			4	6.0			10	13.2
Pristipomoides zonatus Banded flower snapper	65	54.0	2	2.0	20	14.0	19	14.0	106	84.0
Sub-total	**190**	**429.3**	**7**	**17.0**	**72**	**346.5**	**44**	**74.0**	**313**	**866.8**
SAHLLOW-WATER SNAPPERS ***LUTJANIDAE (sub-family LUTJANINAE)***										
*Lutjanus bohar** Red bass	10	25.7	4	10.0	7	34.0	7	22.0	28	91.7
Lutjanus gibbus Paddletail	34	22.0			17	15.0			52	37.0
Lutjanus kasmira Blue-lined snapper	5	1.2	1	0.2	1	0.2			7	1.6
Lutjanus monostigma One-spot snapper	1	0.5							1	0.5
Lutjanus rufolineatus Rufous seaperch	1	0.3							1	0.3
Sub-total	51	49.7	5	10.2	26	49.2	7	22.0	89	131.1

APPENDIX 2A

SPECIES COMPOSITION OF THE BOTTOM CATCH AT EACH LOCATION

GROUP *FAMILY* *Species* English name	FUNATUTI		VAITUPU		NUKULAELAE		NUKUFETAU		TOTAL	
	No.	Weight	No.	Weight	No.	Weight	No.	Weight	No.	Weight
EMPERORS										
LETHRINIDAE										
Lethrinus amamianus			1	1.0					1	1.0
Lethrinus kallopterus Yellow-spotted emperor	3	4.5							3	4.5
Lethrinus miniatus Long-nose emperor	4	10.0			6	16.0			10	26.0
Lethrinus spp. Emperors	3	1.7			1	1.0			4	2.7
Sub-total	10	16.2	1	1.0	7	17.0	0	0.0	18	34.2
GROUPERS, CODS AND CORAL TROUTS										
SERRANIDAE										
Cephalopholis argus					1	0.4			1	0.4
Cephalopholis aurantius Orange rock-cod	1	0.7			5	3.0			6	3.7
Cephalopholis igarasiensis Yellow-banded grouper	1	1.0	1	1.0					2	2.0

APPENDIX 2A

SPECIES COMPOSITION OF THE BOTTOM CATCH AT EACH LOCATION

GROUP ***FAMILY*** *Species* English name	**FUNATUTI**		**VAITUPU**		**NUKULAELAE**		**NUKUFETAU**		**TOTAL**	
	No.	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**
Cephalopholis sexmaculatus					1	1.0			1	1.0
Epinephelus chlorostigma Brown-spotted grouper					2	6.0			2	6.0
Epinephelus maculatus Spotted grouper	9	8.6								
Epinephelus microdon Marbled cod	3	3.4								
Epinephelus miliaris	23	19.6								
Epinephelus morrhua Curve-banded grouper	2	7.3								
Epinephelus septemfasciatus Seven-banded grouper					1	7.0				
Plectropoma spp. Golden fish					2	1.0				
Variola albimarginata Lunar-tailed cod	3	1.1	1	1.0	7	4.0	1	1.0	12	7.1

APPENDIX 2A

SPECIES COMPOSITION OF THE BOTTOM CATCH AT EACH LOCATION

GROUP *FAMILY* *Species* English name	FUNATUTI No.	 Weight	VAITUPU No.	 Weight	NUKULAELAE No.	 Weight	NUKUFETAU No.	 Weight	TOTAL No.	 Weight
Variola louti Lunar-tail cod	8	5.7	1	2.0	1	1.0	6	7.0	16	15.7
Sub-total	**50**	**47.4**	**5**	**5.0**	**42**	**272.4**	**13**	**14.0**	**110**	**338.8**
JACKS AND TREVALLIES										
CARANGIDAE										
Caranx lugubris Black trevally	76	206.5			124	316.3	6	14.0	206	536.8
Seriola rivoliana Deep-water amberjack	5	14.7			2	17.0	1	1.0	8	32.7
Sub-total	**81**	**221.2**	**0**	**0.0**	**126**	**333.3**	**7**	**15.0**	**214**	**569.5**
MACKERELS AND TUNAS										
SCOMBRIDAE										
Acanthocybium solandri Wahoo			1	6.0					1	6.0
Gymnosarda unicolor Dogtooth tuna	1	7.0			1	4.0			2	11.0
Sub-total	**1**	**7.0**	**1**	**6.0**	**1**	**4.0**	**0**	**0.0**	**3**	**17.0**

APPENDIX 2A

SPECIES COMPOSITION OF THE BOTTOM CATCH AT EACH LOCATION

GROUP *FAMILY* *Species* English name	FUNATUTI No.	 Weight	VAITUPU No.	 Weight	NUKULAELAE No.	 Weight	NUKUFETAU No.	 Weight	TOTAL No.	 Weight
OILFISH AND SNAKE MACKERELS										
GEMPYLIDAE										
Promethicthys prometheus Snake mackerel	80	165.5							80	165.5
Ruvettus pretiosus Oilfish	62	830.3	9	141.0					71	971.3
Sub-total	**142**	**995.8**	**9**	**141.0**	**0**	**0.0**	**0**	**0.0**	**151**	**1136.8**
SOLDIERFISH, SQUIRRELFISH AND GLASSEYES										
HOLOCENTRIDAE										
Adyorix spp. Soldier fish	1	0.7							1	0.7
Myripristis violaceus Soldier fish			1	0.3					1	0.3
Ostichthys japonicus Deep-water squirrelfish	1	1.8							1	1.8
Sub-total	**2**	**2.5**	**1**	**0.5**	**0**	**0.0**	**0**	**0.0**	**3**	**2.8**

APPENDIX 2A

SPECIES COMPOSITION OF THE BOTTOM CATCH AT EACH LOCATION

GROUP *FAMILY* *Species* English name	FUNATUTI		VAITUPU		NUKULAELAE		NUKUFETAU		TOTAL	
	No.	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**
BARRACUDAS AND SEAPIKES										
SPHYRAENIDAE										
Sphyraena forsteri Forster seapike	1	1.2							1	1.2
Sphyraena qenie Seapike	6	18.0							6	18.0
Sub-title	**7**	**19.2**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**7**	**19.2**
MISCELLANEOUS BONY FISHES										
BERYCIDAE										
Beryx decadactylus Roughy	1	2.0							1	2.0
CONGRIDAE										
Conger cinerus Conger eel	1	4.0							1	4.0

APPENDIX 2A

SPECIES COMPOSITION OF THE BOTTOM CATCH AT EACH LOCATION

GROUP *FAMILY* *Species* English name	FUNATUTI		VAITUPU		NUKULAELAE		NUKUFETAU		TOTAL	
	No.	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**
MULLIDAE										
Parupeneus spp. Goatfish					2	1.0			2	1.0
Sub-total	**2**	**6.0**	**0**	**0.0**	**2**	**1.0**	**0**	**0.0**	**4**	**7.0**
SHARKS										
CARCHARHINIDAE										
Carcharhinus amblyrhynchus	4	20.0			8	90.0	3	35.0	15	145.0
Carcharhinus albimarginatus Whitetip shark	1	50.0							1	50.0
HEXANCHIDAE										
Hexanchus spp. Six-gill sharks	6	350.0							6	350.0
Sub-total	**11**	**420.0**	**0**	**0.0**	**8**	**90.0**	**3**	**35.0**	**22**	**545.0**
Total	**547**	**2214.3**	**29**	**180.7**	**284**	**1113.4**	**74**	**160.0**	**934**	**3668.4**

APPENDIX 2B

SPECIES COMPOSITION OF THE OPEN-WATER AND LOGGOON TROLL CATCH AT EACH LOCATION

GROUP *FAMILY* *Species* English name	FUNATUTI		VAITUPU		NUKULAELAE		NUKUFETAU		TOTAL	
	No.	Weight	No.	Weight	No.	Weight	No.	Weight	No.	Weight
DEEP-WATER SNAPERS										
LUTJANIDAE (sub-families ETELINAE, APSILINAE)										
Aphareus furcatus Blue jobfish	7	2.2							7	2.2
Aprion virescens Green jobfish	4	5.8			3	4.0	1	2.0	8	11.8
Sub-total	**11**	**8.0**	**0**	**0.0**	**3**	**4.0**	**1**	**2.0**	**15**	**14.0**
CORAL TROUTS										
SERRANIDAE										
Plectropomus truncatus	1	1.3								
Sub-total	**1**	**1.3**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**1**	**1.3**
JACKS AND TREVALLIES										
CARANIGIDAE										
Caranx melampygus Bluefin trevally	1	1.8			1	2.0			2	3.8

APPENDIX 2B

SPECIES COMPOSITION OF THE OPEN-WATER AND LOGGOON TROLL CATCH AT EACH LOCATION

GROUP *FAMILY* *Species* English name	FUNATUTI		VAITUPU		NUKULAELAE		NUKUFETAU		TOTAL	
	No.	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**
Caranx sexfasciatus Bigeye trevally	1	0.8							1	0.8
Elegatis bipinnulatus Rainbow runner	27	27.4	8	14.0	3	4.0	7	6.5	45	51.9
Seriola rivoliana Deep-water amberjack			2	1.5					2	1.5
Sub-total	**29**	**30.0**	**10**	**15.5**	**4**	**6.0**	**7**	**6.5**	**50**	**58**
MACKERELS AND TUNAS										
SCOMBRIDAE										
Acanthocybium solandri Wahoo	4	23.5	1	6.0	3	20.5	56	535.5	64	585.5
Auxis thazard Frigate mackerel	8	6.8							8	6.8
Euthynnus affinis Mackerel tuna	5	5.0	2	3.5			2	4.0	9	12.5
Grammatocynus bilineatus Scad	127	68.5					3	2.0	130	70.5

APPENDIX 2B

SPECIES COMPOSITION OF THE OPEN-WATER AND LOGGOON TROLL CATCH AT EACH LOCATION

GROUP *FAMILY* *Species* English name	FUNATUTI		VAITUPU		NUKULAELAE		NUKUFETAU		TOTAL	
	No.	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**
Gymnosarda unicolor Dogtooth tuna	2	9.5			1	2.5	2	14	5	26
Katsuwonus pelamis Skipjack tuna	13	32	38	71	1	4	3	7.5	55	114.5
Thunnus albacares Yellowfin tuna	5	13	30	65	5	21	2	8.5	42	107.5
Sub-total	**164**	**158.3**	**71**	**145.5**	**10**	**48**	**68**	**571.5**	**313**	**923.3**
BARRACUDAS AND SEAPIKES										
SPHYRAENIDAE										
Sphyraena barracuda Great barracuda					1	3.5	4	12	5	15.5
Sphyraena qenie Seapike					1	2			1	2
Sub-total	**0**	**0**	**0**	**0**	**2**	**5.5**	**4**	**12**	**6**	**17.5**
MISCELLANEOUS BONY FISHES										
BELLONIDAE										
Ablennes hianus Longtom	1	2.2							1	2.2

APPENDIX 2B

SPECIES COMPOSITION OF THE OPEN-WATER AND LOGGOON TROLL CATCH AT EACH LOCATION

GROUP *FAMILY* *Species* English name	FUNATUTI No.	 Weight	VAITUPU No.	 Weight	NUKULAELAE No.	 Weight	NUKUFETAU No.	 Weight	TOTAL No.	 Weight
Tylosurus crocodilus Longtom	2	2.7							2	2.7
CORYPHAENIDAE										
Coryphaena hippurus Dolphin fish			2	11.0					2	11.0
ISTIOPHORIDAE										
Istiophorus platyterus Sailfish							4	125.0	4	125.0
Sub-total	**3**	**4.9**	**2**	**11.0**	**0**	**0.0**	**4**	**125.0**	**9**	**140.9**
Total	**208**	**202.5**	**83**	**172.0**	**19**	**63.5**	**84**	**717.0**	**394**	**1155.0**

APPENDIX 2C

SPECIES COMPOSITION OF THE MID-WATER HANDLE CATCH AT EACH LOCATION

GROUP *FAMILY* *Species* English name	FUNATUTI		VAITUPU		NUKULAELAE		NUKUFETAU		TOTAL	
	No.	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**	**No.**	**Weight**
MACKERELS AND TUNAS										
SCOMBRIDAE										
Acanthocybium solandri Wahoo							1	9.0	1	9.0
Grammatocynus bicarinatus Double-lined mackerel	3	2.0							3	2.0
Gymnosarda unicolor Dogtooth tuna	6	27.5							6	27.5
Thunnus albacares Yellowfin tuna	1	4.8			1	16.0			2	20.8
Sub-total	**10**	**34.3**	**0**	**0.0**	**1**	**16.0**	**1**	**9.0**	**12**	**59.3**
TREVALLEIS AND JACKS										
CARANGIDAE										
Caranx lugubris Black trevally	2	4.0							2	4.0
Caranx sexfasciatus Big eye trevally	15	13.1	5	3.7					20	16.8

APPENDIX 2C

SPECIES COMPOSITION OF THE MID-WATER HANDLE CATCH AT EACH LOCATION

GROUP *FAMILY* *Species* English name	FUNATUTI		VAITUPU		NUKULAELAE		NUKUFETAU		TOTAL	
	No.	Weight	No.	Weight	No.	Weight	No.	Weight	No.	Weight
Elegatis bipinnulatus Rainbow runner							17	11.5	17	11.5
Selar crumenophthalmus Bigeye scad	12	3.5							12	3.5
Uraspis secunda	26	14.0							26	14.0
Sub-total	**55**	**34.6**	**5**	**3.7**	**0**	**0.0**	**17**	**11.5**	**77**	**49.8**
BARRACUDAS AND SEAPIKES										
SPHYRAENIDAE										
Sphyraena barracuda Barracuda			2	4.0					2	4.0
Sphyraena forsteri Seapike	20	16.8	1	1.5					21	18.3
Sphyraena qenie Seapike	10	31.0							10	31.0
Sub-total	**30**	**47.8**	**3**	**5.5**	**0**	**0.0**	**0**	**0.0**	**33**	**53.3**

APPENDIX 2C

SPECIES COMPOSITION OF THE MID-WATER HANDLE CATCH AT EACH LOCATION

GROUP *FAMILY* *Species* English name	FUNATUTI		VAITUPU		NUKULAELAE		NUKUFETAU		TOTAL	
	No.	Weight	No.	Weight	No.	Weight	No.	Weight	No.	Weight
SHARKS										
CARCHARHINIDAE										
Carcharhinus amblyrhynchus										
Sub-total	**1**	**1**	**0**	**0**	**0**	**0**	**2**	**0**	**3**	**21**
Total	**96**	**117.7**	**8**	**9.2**	**1**	**16**	**20**	**40.5**	**125**	**183.4**

APPENDIX 3A

SUMMARY OF TRIP RECORDS FOR FUNAFUTI

Trip no.	Fishing method	Trip hours	Fishing hours	Effort (See note)	Catch		Bait (kg)	Fuel (l)
					No.	Weight		
1	Bottom dropline		8.5	21.0	26	349.5	10.0	
	Mid-water handline		4.5	4.5	27	19.5	1.0	
	Lagoon troll		2.0	4.0	0	0.0	0.0	
	Open-water troll		0.5	1.0	1	3.5	0.0	
	Total	**15.5**	**15.5**		**54**	**372.5**	**11.0**	**20**
2	Bottom dropline		8.0	20.0	39	93.0	11.0	
	Mid-water handline		4.0	4.0	18	9.5	1.5	
	Lagoon troll		3.0	6.0	5	4.5	0.0	
	Open-water troll		2.0	4.0	7	16.5	0.0	
	Total	**18.0**	**17.0**		**69**	**123.5**	**12.5**	**30**
3	Bottom dropline		2.5	8.5	14	48.5	6.0	
	Lagoon troll		2.0	4.0	0	0.0	0.0	
	Open-water troll		1.5	3.0	10	5.5	0.0	
	Total	**7.5**	**6.0**		**24**	**54.0**	**6.0**	**20**
4	Bottom dropline		7.5	22.5	22	77.9	7.0	
	Mid-water handline		4.0	4.0	4	5.8	1.0	
	Lagoon troll		2.0	4.0	2	2.0	0.0	
	Open-water troll		1.5	3.0	7	5.3	0.0	
	Total	**17.0**	**15.0**		**35**	**91.0**	**8.0**	**25**
5	Bottom dropline		3.5	14.0	12	17.2	6.0	
	Lagoon troll		2.0	4.0	11	7.5	0.0	
	Open-water troll		2.0	4.0	30	17.8	0.0	
	Total	**10.0**	**7.5**		**53**	**42.5**	**6.0**	**20**
6	Bottom dropline		9.0	27.0	73	329.1	17.7	
	Mid-water handline		9.0	9.0	6	14.2	2.0	
	Lagoon troll		1.0	2.0	4	2.0	0.0	
	Open-water troll		1.5	3.0	9	8.0	0.0	
	Total	**16.5**	**20.5**		**92**	**353.3**	**19.7**	**16**
7	Bottom dropline		8.0	16.0	18	86.7	6.5	
	Mid-water handline		8.0	8.0	8	18.0	1.5	
	Lagoon troll		2.5	5.0	8	5.7	0.0	
	Open-water troll		2.5	5.0	14	16.3	0.0	
	Total	**17.0**	**21.0**		**48**	**126.7**	**8.0**	**20**

APPENDIX 3A

SUMMARY OF TRIP RECORDS FOR FUNAFUTI

Trip No.	Fishing method	Trip hours	Fishing Hours	Effort (See note)	Catch		Bait (kg)	Fuel (l)
					No.	Weight		
8	Bottom dropline		9.0	20.0	70	122.3	13.5	
	Mid-water handline		4.0	4.0	0	0.0	1.5	
	Lagoon troll		2.5	5.0	4	3.0	0.0	
	Open-water troll		1.5	3.0	7	3.0	0.0	
	Total	**18.0**	**17.0**		**81**	**128.3**	**15.0**	**16**
9	Bottom dropline		4.0	9.0	24	27.9	5.0	
	Lagoon troll		2.0	6.0	6	2.0	0.0	
	Open-water troll		2.0	6.0	14	7.5	0.0	
	Total	**10.0**	**8.0**		**44**	**37.4**	**5.0**	**20**
10	Bottom dropline		8.0	16.0	29	369.2	6.5	
	Mid-water handline		4.0	4.0	2	1.8	1,0	
	Lagoon troll		1.0	2.0	0	0.0	0.0	
	Open-water troll		2.5	5.0	27	40.5	0.0	
	Total	**17.0**	**15.5**		**58**	**411.5**	**7.5**	**25**
11	Bottom dropline		9.0	19.0	65	302.5	11.0	
	Mid-water handline		6.5	6.5	9	22.9	2.5	
	Lagoon troll		1.0	3.0	0	0.0	0.0	
	Open-water troll		2.0	6.0	11	5.5	0.0	
	Total	**20.0**	**18.5**		**85**	**331.3**	**13.5**	**40**
18	Bottom dropline		3.0	12.0	63	155.7	7.0	
	Lagoon troll		1.0	2.0	0	0.0	0.0	
	Open-water troll		1.5	3.0	4	2.8	0.0	
	Total	**8.0**	**5.5**		**67**	**158.5**	**7.0**	**15**
19	Bottom dropline		5.0	10.0	46	162.9	8.0	
	Mid-water handline		2.0	4.0	9	17.8	1.0	
	Lagoon troll		1.0	3.0	0	0.0	0.0	
	Open-water troll		1.5	4.5	4	1.6	0.0	
	Total	**11.0**	**9.5**		**59**	**182.3**	**9.0**	**20**
20	Bottom dropline		4.5	11.0	28	51.6	7.5	
	Lagoon troll		1.0	2.0	0	0.0	0.0	
	Open-water troll		1.0	2.0	1	0.5	0.0	
	Total	**9.5**	**6.5**		**29**	**52.1**	**7.5**	**20**

. **APPENDIX 3A**

SUMMARY OF TRIP RECORDS FOR FUNAFUTI

Trip no.	Fishing method	Trip hours	Fishing Hours	Effort (See note)	Catch		Bait (kg)	Fuel (l)
					No.	Weight		
33	Bottom dropline		1.5	3.0	7	9.9	2.0	
	Lagoon troll		1.0	3.0	0	0.0	0.0	
	Open-water troll		2.0	6.0	5	13.5	0.0	
	Total	**8.0**	**4.5**		**12**	**23.5**	**2.0**	**25**
34	Lagoon troll		2.5	5.0	3	2.0	0.0	
	Open-water troll		6.0	12.0	3	19.0	1.0	
	Total	**9.0**	**8.5**		**6**	**21.0**	**1.0**	**40**
35	Bottom dropline		4.5	9.0	11	10.0	3.0	
	Mid-water handline		3.0	9.0	13	8.2	1.0	
	Lagoon troll		1.0	2.0	0	0.0	0.0	
	Open-water troll		1.5	3.0	11	7.0	0.0	
	Total	**9.0**	**10.0**		**35**	**25.2**	**4.0**	**20**
TOTAL		**221.0**	**206.0**		**851**	**2534.6**	**142.7**	**392**

Note: Effort is given in reel or line hours
Reel hours = number of reels in use x number of hours fishing
Line hours = number of lines in use x number of hours fishing

APPENDIX3B

SUMMARY OF TRIP RECORDS FOR VAITUPU

Trip No.	Fishing method	Trip hours	Fishing Hours	Effort (Note)	Catch		Bait (kg)	Fuel (l)
					No.	Weight		
12	Bottom dropline		2.5	5.0	11	9.2	3.0	
	0 en-water troll		4.0	12.0	5	23.5	0.0	
	Total	**8.5**	**6.5**		**16**	**32.7**	**3.0**	**25**
13	Open-water troll		5.0	20.0	0	0.0	0.0	
	net		3.0	6.0	83	13.0	0.0	
	Total	**8.5**	**8.0**		**83**	**13.0**	**0.0**	**30**
14	Bottom dropline		7.0	14.0	14	168.0	8.0	
	Mid-water handline		4.0	8.0	8	9.2	1.0	
	Open-water troll		75.0	30.0	12	36.5	0.0	
	Flying fish scoop-net		2.0	4.0	51	6.6	0.0	
	Total	**18.5**	**20.5**		**85**	**220.3**	**9.0**	**25**
15	Open-water troll	5.5	5.5	22.0	11	33.0	0.0	15
16	Bottom dropline		1.5	3.0	4	3.5	1.5	
	Mid-water handline		1.0	1.0	0	0.0	0.5	
	Open-water troll		3.5	14.0	3	12.0	0.0	
	Flying fish scoop-net		5.0	10.0	115	16.0	0.0	
	Total	**14.5**	**11.0**		**122**	**31.5**	**2.0**	**30**
17	Open-water troll*	13.0	5.5	22.0	52	67.0	0.0	50
	*Return trip to Funafiti							
TOTAL		**68.5**	**57.0**		**369**	**397.5**	**14.0**	**175**

Note: Effort is given in reel hours, line hours and net hours
Reel hours = number of reels in use x number of hours fishing
Line hours = number of lines in use x number of hours fishing
Net hours = number of nets in use x number of hours fishing

APPENDIX 3C

SUMMARY OF TRIP RECORDS FOR NUKULAELAE

Trip no.	Fishing method	Trip hours	Fishing hours	Effort (Note)	Catch		Bait (kg)	Fuel (l)
					No.	Weight		
21	Bottom dropline			11		1	7.5	
	Open-water troll		4.5	13.5	6	19.0	0.0	
	Total	**12.0**	**11.0**		**73**	**215.2**	**7.5**	**25**
22	Bottom dropline		5.0	10.0	36	291.7	6.0	
	Open-water troll		3.5	10.5	6	26.5	0.0	
	Total	**12.5**	**8.5**		**42**	**318.2**	**6.0**	**16**
	Bottom dropline		5.5	11.0	40	83.7	7.0	
	Open-water troll		4.0	12.0	3	4.0	0.0	
	Total	**12.0**	**9.5**		**43**	**87.7**	**7.0**	**20**
24	Bottom dropline		7.5	15.0	63	133.6	0.0	
	Open-water troll		2.5	7.5	4	14.0	0.0	
	Total	**12.0**	**10.0**		**67**	**147.6**	**9.0**	**15**
25	Bottom dropline		6.5	13.0	53	201.1	8.0	
	Open-water troll		1.0	1.0	1	16.0	0.5	
	Total	**12.0**	**75.0**		**54**	**217.0**	**8.5**	**5**
26	Bottom dropline	6.0	4.0	8.0	25	207.1	6.0	5
TOTAL		**66.5**	**118.0**		**304**	**1192.9**	**44.0**	**86**

Note: Effort is given in reel and line hours
Reel hours = number of reels in use x number of hours fishing
Line hours = number of lines in use x number of hours fishing

APPENDIX 3D

TRIP RECORDS FOR NUKUFETAU

Trip No.	Fishing method	Trip hours	Fishing Hours	Effort (Note)	Catch No.	Catch Weight	Bait (kg)	Fuel (l)
27	Bottom dropline							
	Open-water troll		7.0	14.0	15.0	108.0	4.0	
	Total	**10.0**	**9.5**		**35.0**	**141.5**	**8.0**	**30**
28	Open-water troll	9.0	8.5	17.0	20.0	196.0	3.0	50
29	Bottom dropline		4.0	8.0	25.0	34.0	4.0	
	Open-water troll		6.0	18.0	7.0	69.5	3.0	
	Total	**12.0**	**10.0**		**32.0**	**103.5**	**7.0**	**40**
30	Bottom dropline		4.0	8.0	19.0	72.0	4.0	
	Mid-water handline		4.0	8.0	17.0	38.0	2.0	
	Open-water troll		6.0	18.0	15.0	108.0	3.0	
	Total	**11.0**	**'14.0**		**51.0**	**218.0**	**9.0**	**40**
31	Bottom dropline		2.5	5.0	10.0	19.5	2.5	
	Mid-water handline		0.5	0.5	3.0	2.5	0.5	
	Open-water troll		6.0	18.0	4.0	35.0	1.0	
	Total	**9.0**	**9.0**		**17.0**	**57.0**	**4.0**	**35**
32	Open-water troll	9.0	8.5	17.0	23.0	200.5	3.0	50
TOTAL		**60.0**	**59.5**		**178.0**	**916.5**	**34.0**	**245.0**

Note: Effort is given in reel and line hours
Reel hours = number of reels in use x number of hours fishing
Line hours = nurnber of lines in use x number of hours fishing