THE FISHERY RESOURCES OF RABI

KAUBAIN MARAWA NA ORA AKE AR KATOBIBIA RABI

NA SASALU NI WAITUI MAI RABI

Fisheries Division
Ministry of Agriculture and Fisheries
Fiji

ACKNOWLEDGEMENTS

We thank the Rabi Island Council of Leaders or their request to undertake this survey and for funds to cover the costs of publishing this report, David Christopher's keen interest in the work and gentle pressure ensured it would be completed in good time.

On Rabi itself, John Kirite provided solid support in a variety of ways and John Kawate gave freely of his time and fishing knowledge. The hospitality of he people of Rabi generally and Buakonikai in particular helped make our all-too-brief stay very enjoyable. We ope this report goes some way towards repaying that hospitality.

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INTRODUCTION

1.1 BACKGROUND

Following resettlement of the Banaban community from Ocean Island to Rabi Island in 1945, agriculture in this more favourable location rapidly replaced fishing as the primary production activity of the Banaban people. This remained a subsidiary activity, as phosphate royalty payments were the main source of income.

With the knowledge that these payments were to cease in 1980, interest in fishing showed signs of revival in the mid-1960's, and a fishing venture operated under the auspices of Rabi Holdings Pty. Ltd. before that enterprise was wound up. The Fisheries Division itself made a two-day multipurpose fishery survey visit to Rabi Island in November 1979, but bad weather hampered this work and very little was achieved.

In 1980 the Overseas Development Administration (UK) formulated a Rabi development proposal involving a F$2,000,000 grant from the British Government, to be administered by the Fiji Government. This proposal initially included a fisheries component (F$105,000) which could not however be accomodated in the final programme.

The Rabi Island Council of Leaders continued to press for Fisheries Division involvement on the island, and following several visits by extension staff (the latest in July 1983) a formal request was made by the Council for the Fisheries Division to undertake a fishery resource survey of Rabi and surrounding waters". This was carried out in September 1983 over a five-day period and forms the basis of this assessment, together with information in Fisheries files and experience gathered on similar surveys in other parts of Fiji (eg. Anon. 1982, 1983).

1.2 LOCATION & GEOGRAPHY

Rabi lies off the eastern end of Natewa Peninsula, some twelve miles north of Taveuni. Approximately 26 square miles (680ha) in area, the island is roughly triangular in shape, with Mount Banaba, in the centre the highest point on the island at 1519 feet (463m).

The north west of the island is rugged, with a narrow coastal plain crossed by numerous short steep streams. The south east is more undulating in character, with several streams crossing through broader valleys to the sea. Rainfall is generally

heavy, with even the lee or western side receiving more than 100 inches per year. Most rain falls in the October-March period. A variety of soil types is present, but most are suitable for some form of agriculture and much of the interior remains covered in dense rain forest.

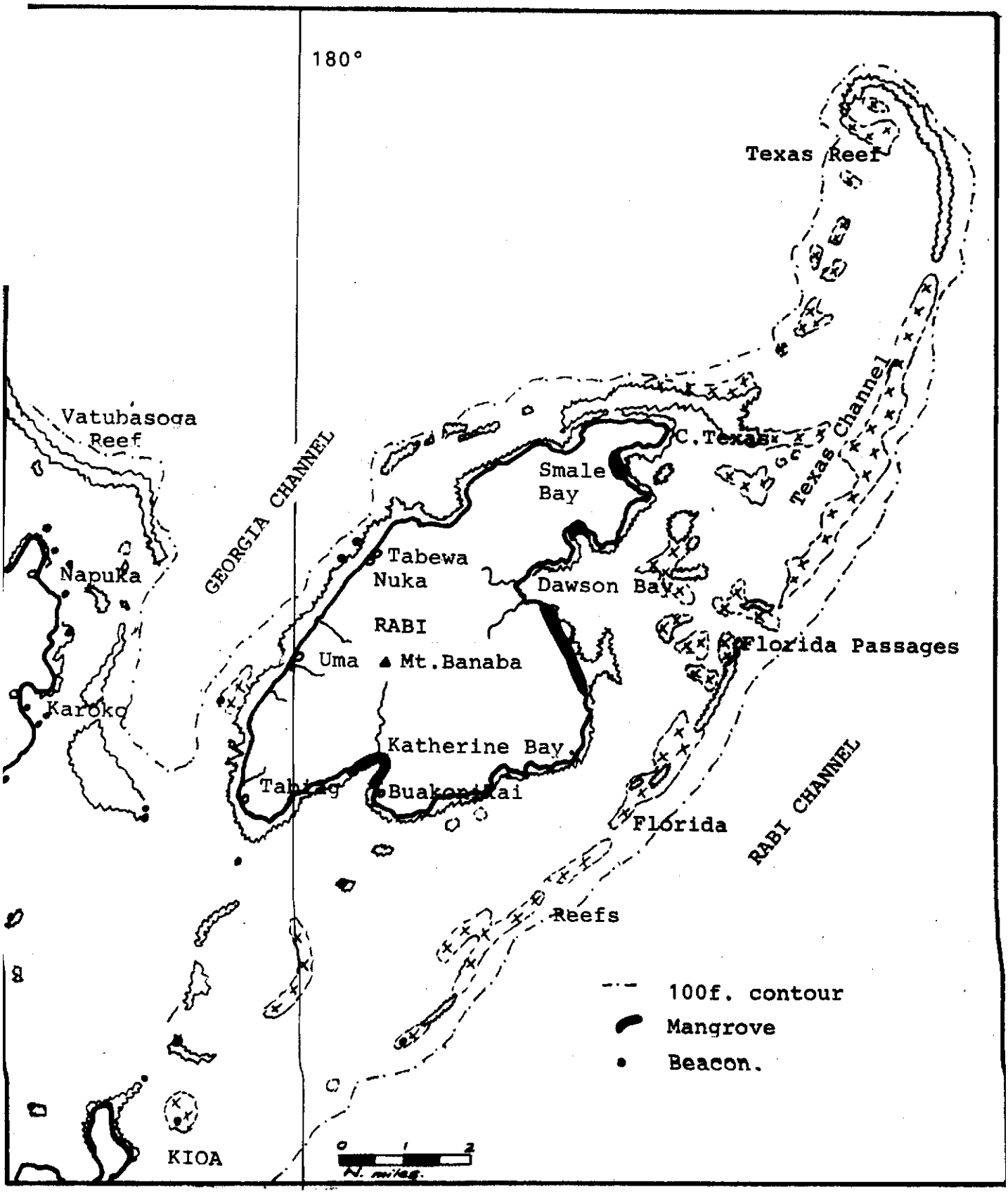
The inshore waters of Rabi are bordered on three sides by the deep waters of the Georgia and Rabi Channels. Narrow fringing reefs, descending quickly into deep water, line the western shores, whilst the Texas and Florida Reef complexes to the north-east and east respectively form a seaward barrier, some of which dries at low water, to a relatively deep lagoon beset with patch reefs. Texas Reef extends six miles beyond the island's northern tip, with many wide passages on its lee side. Florida Passages provide access through the eastern barrier from Rabi Channel. To the south of Rabi, variously developed patch reefs extend to the northern tip of Kioa Island where a marked passage provides the main southern access to Rabi. Mangrove stands line the foreshores of Katherine and Dawson Bays and several other smaller inlets.

Good shelter is available in Katherine and Dawson Bays, as well as in several narrow cuttings on the island's lee (western) side.

1.3. ADMINISTRATION, TRANSPORT AND COMMUNICATION

Although Rabi lies within the Northern Division, the Rabi Island Council of Leaders, established under the Banaban Settlement Act, administers the island. It is however ultimately responsible to the Government of Fiji. The major settlements on the island, Buakonikai, Tabiag, Uma and Tabewa / Nuka (Figure 1) which correspond to the original settlements on Banaba, each supply two members to the council which then eleGts a chairman. The council is responsible for civil works on the island, but with the cessation in royalty payments, there is a move towards closer involvement with Fiji Government Departments such as Public Works to enable civil works to continue.

Figure 1. Rabi & surrounding waters



Although power was generated on a centralized basis at Nuka in the past, this is no longer the case and individual households or establishments operate their own generators. Water supply to all villages has been made possible recently through the Development Programme. Recent completion of a road link between Tabiag and Buakonikai has meant that the four main villages are now connected by road. There are plans to eventually extend this road all the way around the island. The island is serviced by airflights twice a week, and inter-island vessels call regularly to load copra and unload consumer goods. A short boat trip to Karoko on the Natewa Peninsula provides road access to Savu Savu. There is a VHF Radio telephone link to the island.

Because of the relative prosperity of the island, approximately 40% of households have punts which are used for subsistence fishing and transport. There is also a number of half-cabin vessels, some of which have been allowed to deteriorate and are no longer seaworthy.

1.4 RESOURCES

The large areas of arable land, luxuriant vegetation and abundant rainfall are in strong contrast to the situation on Ocean Island, and although the agricultural potential is far from being fully exploited, increasing quantities of root crops (dalo, cassava, kumala, yams) are grown, and interest is being shown in cocoa and yaqona. It is to be expected that agricultural activities for subsistence and commercial purposes will increase now that royalty payments have ceased.

As the island was acquired as a copra plantation from Lever Bros, this crop has long been the agricultural mainstay of Rabi: Production has however shown a steady decline over the years and many trees are past optimum bearing age. The recently implemented Development Programme allocates a considerable sum for coconut replanting and copra development. Isolated communities on the east still produce a significant proportion of the copra harvest.

The marine resources are utilized for subsistence purposes, although as farming is a preferred occupation, heavy consumption of tinned fish supplements these catches. Attempts at commercial fishing have been made unsuccessfully in the past but are again attracting interest, particularly from Buakonikai. Construction of a new wharf at Tabiag under the Development Scheme should have some benefits for fishermen. No other infrastructure is currently available, although there are disused cold storage facilities at Nuka which could possibly be repaired and reactivated.

A 1979 survey placed the island's population at 2857, with 808 in Nuka-Tabewa, 714 in Uma, 289 in Tabiang and 440 in Buakonikai. Considerable movement-back to the island has however occurred since then and the current population may be close to 4,000. Land ownership is vested in the Council and subdivision for agricultural purposes is strictly controlled. Fishing rights however remain with the traditional owners, in this case shared between Tikina Cakaudrove (Cakaudrove, Somosomo, Sokula, Benau, Nasuva, Korocau and Nadarega) and Tikina Tunuloa.

1.5. EXPLOITATION OF MARINE RESOURCES

With the large number of punts available (see earlier), a high percentage of people undertake some form of subsistence fishing activity. Surveys indicate that there are upwards of sixty gillnets (mostly less than 50m in length) on the island, particularly in Uma and Tabiana; these are used to make small catches for household purposes. Fish is in strong demand on Rabi and any excess catch finds a ready market.

Crustaceans and shellfish (trochus, vasua) are not especially abundant (see later), but small quantities are taken by diviner and gathering at low tide.

Although conditions are very different from those prevailing at Ocean Island, some of the highly developed traditional skills have survived and are still used to some extent. Drop stone fishing for deep swimming tunas and bottom fish (the bait and chum are wrapped around a stone and released at the required depth by freeing a slip knot) produces catches of yellowfin and dogtooth tuna, snake mackerel (which is much sought-after) and oilfish. Trolling, using feather lures on a lines weighted by steel rod, is also productive.

Other traditional methods such as flying fish netting, capturing wahoo with a baited net and the use of stalactite tuna lures appear to be largely inapplicable to the Rabi situation. Hand lining and spear fishing using non-traditional materials, is widely practiced. Some fish is apparently salted or smoked on occasions.

Under the auspices of Rabi Holdings Ltd., a relatively large scale commercial fishing venture was conducted during the period 1975-80. A 13m mother vessel was constructed in Suva at a cost of approximately $40,000 and operated in conjunction with punts. The productive reefs to the east and north-east of Rabi, such as Nanuku, Adolphus and Wailagilala, were the main areas of operation and one exploratory trip was even made to the Great Sea Reef area, west of Labasa. Although catches of up to 3 tonnes in two week trips are reported to have been made, the venture folded when the operations of Rabi Holdings were wound up in 1980.

2. THE FISHERIES RESOURCES

Figure 2 shows a generalized east-west section through the island at about the level of Uma village, and gives some indication of the fisheries resources typically present in the various zones. The eastern lagoon, with depths as great as 44 fathoms and averaging more than 20f.,is relatively deep. The mangrove stands are generally narrow, consisting primarily of Rhizophora spp. (tiri) and more often on hard substrate rather than mud. The mangrove in Katharine Bay is the best developed of the stands on the island.

The survey operated in three teams. One 28' vessel concentrated on snapper fishing and trolling; a dinghy was used by a netting team to survey possible gill netting sites (usually near mangrove), whilst diving work and some hand lining and trolling was done from the larger vessel. Interviews were also carried out in the four main villages, and the experience and opinions of respected fishermen canvassed. Appendix Table 1 summarizes the various activities during the survey and Figure 3 their location.

As in previous reports, the fisheries resources are discussed in two parts -those of inshore i.e. on and inside the reef which are normally harvested by low technology methods for subsistence use, and those of offshore areas, outside the reef, which, may require a higher level of technology and larger vessels. In this case, the potential of adjacent areas considered.

2.1 INSHORE RESOURCES

2,1.1. Beche-de-mer

As the western coastline is essentially an unsuitable habitat for the main commercial beche-de-mer species, efforts were concentrated on the lagoon side. Work during the brief 1979 survey, although hampered by bad weather, yielded only small quantities of sucuwalu (Microthele fuscogilva) and loaloa (M. nobilis). Diving on this survey between Kioa and Florida

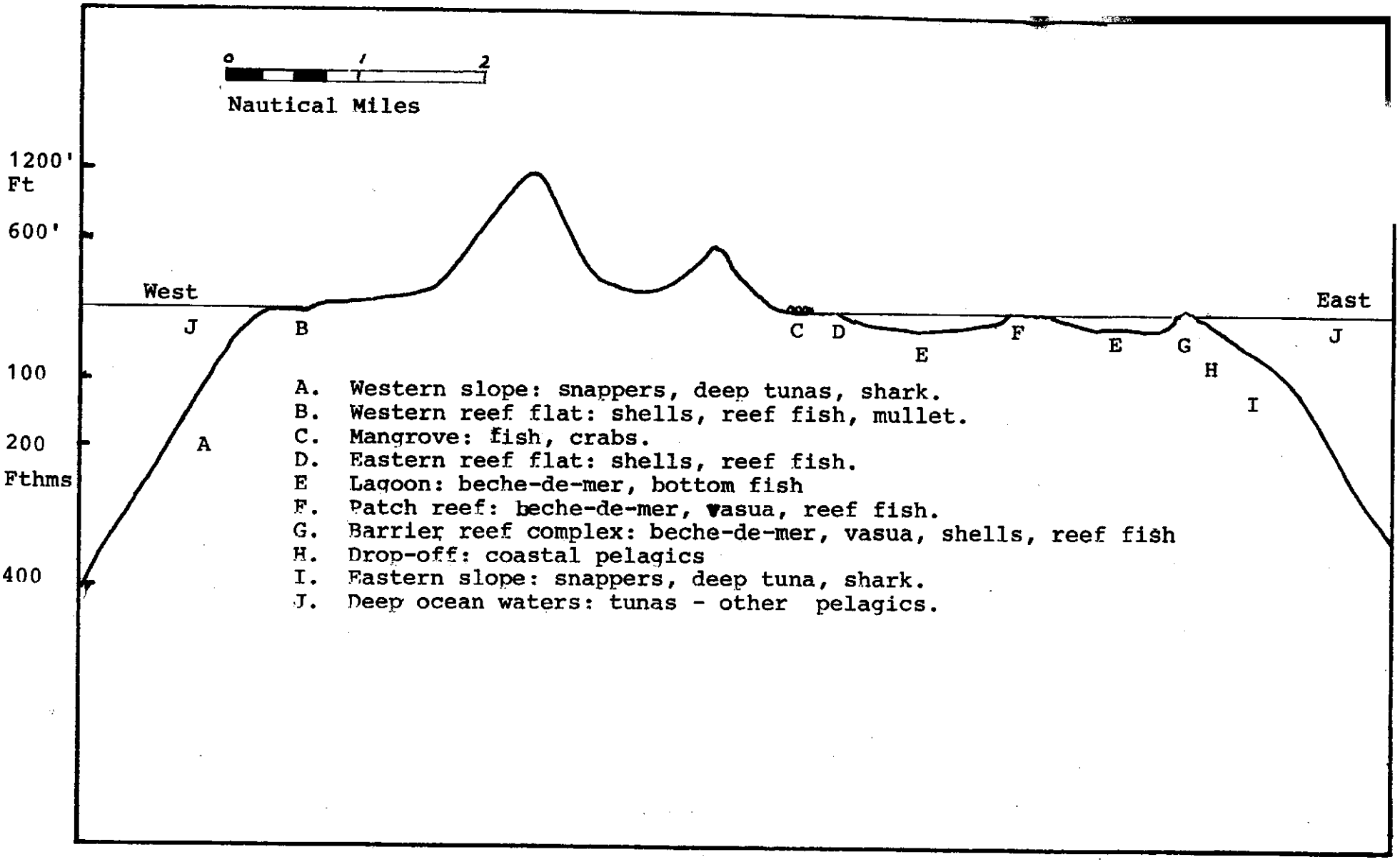


Figure 2 Generalized west-east section through Rabi and surrounding waters at about the level of Uma village.

passage, essentially reproduced this disappointing result. It is assumed that this area can be considered representative of the whole lagoon but this should be verified when time permits.

Scuba diving to depths of 15f along sandy drop-offs was done in case sucuwalu were in deeper in water but also failed to locate any numbers of sucuwalu. It seems likely that the depth of sucuwalu is narrow, supporting low population densities. Reasonable quantities

2.1.2 Shells for: industrial uses

Trochus or sici (Trochus nilotica) and black -lip pearl shell or civa (Pinctada margaritifera) are both exported from Fiji in quantity to S.E, Asian markets for button manufacture and inlay production.

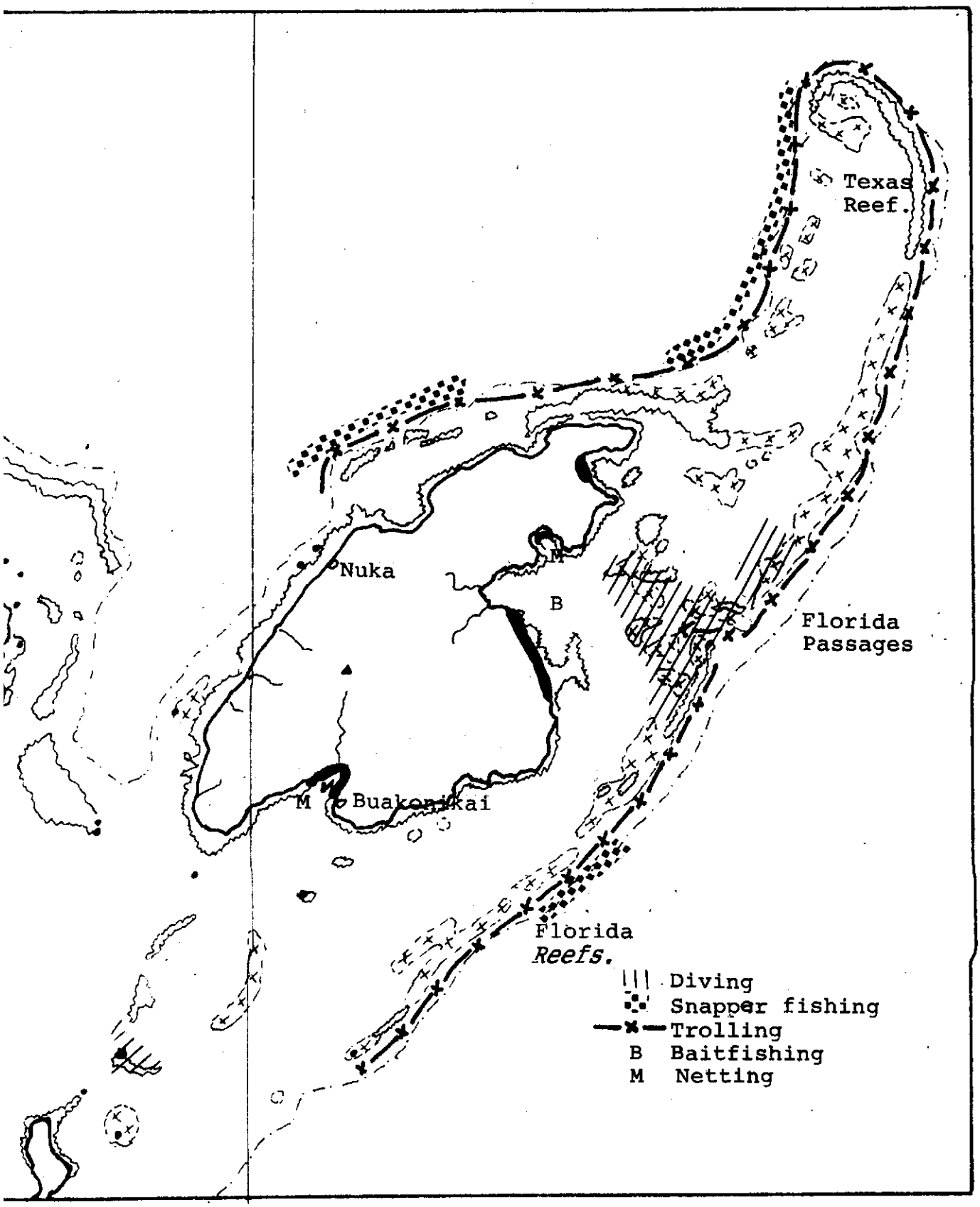
Current local purchase prices per kg for these shells are 80c, & $2.00 respectively, making them a useful source of supplementary income for villages in many parts of Fiji, particularly in view of their non- perishable nature. Low densities of trochus and no pearl shell were observed during diving surveys. This result was confirmed by local divers, indicating that the potential of these resources is low.

2.1.3. Other shells

Vasua (Tridacna maxima, T. squamosa) were observed in modest hummers, in zones" F & G. The larger T. derasa, usually found in deep water on the lagoon side of the barrier reef, were rarely encountered, probably because of the steep-sided nature of the lagoon. Interviews confirmed that vasua feature only infrequently in the diet and the potential for increasing production appears to be limited. Specimen shells, those purchased by tourists and serious shell collectors (Parkinson, 1982) providing sensible conservation practices are followed. This is probably true of Rabi, although no survey work for such shells was carried out on this occasion

Figure 3.

Location of various fishing operations during the survey.



2.1.4. Crustaceans

From the rather reduced condition of most mangrove stands and their typical location on hard coralline substrates (Zone C), it is unlikely that they would support quantities of qari (Scylla serrata), mana (Thalassina anomala) or kuka (Sesarma sp.) Our gill net sets immediately seaward of mangrove yielded only one qari and the people interviewed claimed no knowledge of them. It is likely however that low densities of qari and other crabs such as kuka (Sesarma erythrodactyla), suitable only for subsistence use, occur in some mangrove stands eg. Katherine Bay.

Few rock lobsters (urau) were observed during the limited amount of diving done, but both Panulirus penicillatus and P. verisicolol undoubtedly occur and are utilized for subsistence purposes. It is possible that some of the reef complexes in the eastern lagoon could produce small quantities of urau for commercial sale.

2.1.5. Reef fish

Visual observations whilst diving and a small amount of handlining at night indicated that the eastern lagoon, reef patches and outer reef (Zones E, F & G) hold good quantities of reef fish and appear not be heavily exploited. The western shore with its narrow fringing reef, proximity to the main villages and favourable fishing conditions associated with being on the side of the island, is much more heavily fished and fish densities appeared much lower.

The reef complexes on the eastern and north-eastern sides of Rabi would therefore seem to offer considerable potential for increased catches. Weather conditions would restrict fishing activity in small boats, particularly as much of the barrier reef is covered at all tides, and with the swell rolling across into the lagoon, does not offer complete protection from the open sea. Larger half-cabin vessels should however be able to operate in all but the most severe weather. Buakonikai is probably the village best located to exploit the reef fish resource.

2.1.6. Lagoon fish

Scouting along the entire shoreline of Rabi from a dinghy indicated that whilst schools of mullet (kanace) were present in sheltered bays, few suitable obstacle free areas exist to enable a verandah net specifically designed for efficient mullet capture to be used. Similarly, the rugged coralline foreshores generally preclude the use of beach seines, inshore netting for lagoon species was therefore confined to the use of gill nets set along the seaward margin of mangroves on night high tides.

SetS,using a makeshift 150m long net of 3" and 2 3/4" mesh, were made in Dawson Bay (once) and Katherine Bay (twice) These produced a total of 46kg, all fish species commonly found in association with mangroves on coralline fore shores throughout Fiji. Details of are given below (Table 1). Given the relatively small area of mangrove foreshore and the modest catch rates, fishing in these two areas, plus in Smale Bay and Albert Cove where similar areas for gill netting exist, is probably regarded as a reliable subsistence activity rather than a commercial prospect.

The rough bottom of the most of the lagoon would make most inshore gears other than hand lining unsuitable, but given the popularity of shark with the Rabi people, the use of small sunk nets or set lines to catch shark is a technique worth further investigation.

2.1.7. Fish poisoning

Interviews with the people of Rabi indicated that problems are rarely encountered with fish no underlining poisoning Cicthvosarrtrtoxism) even with species such as bati (Lutjanus bohar) which are frequently implicated elsewhere. The few cases of poisoning generally involved fish which had been caught on reefs well to the east and north east of Rabi.

2.1.8. Bait fishing and Night-light Fishing

The eastern lagoon of Rabi (Zone E) has most of the characteristics of a productive bait fishing area. i.e. where pole and line vessels, such as those operated by Ika Corporation, can attract quantities of bait using powerful lights and transfer them to tanks onboard.

Table 1.

Details of catches during gillnetting operations

Species	Number caught per location DB	KB(W)	KB (E)
Kanace (Valamugil seheli)	3	7	23
Tabutale (Valamugil buchanani)	-	-	4
——— (Liza tade)	-	-	2
Kava (Liza vaigiensis)	4	6	8
Damu (Lutjanus argentimaculatus)	2	-	3
Tanabe (L. fulvus)	10	7	19
Kake (L. russelli)	3	7	-
" (L. monostigma)	1	-	-
Sevaseva (Plectorhynchus nigra)	2	-	-
Kabatia (Lethrinus ornatus)	2	-	1
" (L. harak)	1	-	1
Kaikai (Leiognathus fasciatus)	42	-	-
Matu (Gerres sp.)	4	-	1
Ose (Mulloidichthys flavolineatus)	1	-	-
Ki (Upeneus vittatus)	-	-	1
Saku (Tylosurus crocodilus)	1	-	-
" (Strongylura sp.)	-	-	1
Nuqa (Siganus vermiculatus)	4	-	-
Saqa (Caranx melampygus)	1	-	-
" (C. sexfasciatus)	-	3	1
" (C. papuensis)	-	-	1
Saqa bilu (Gnathanodon speciosus)	-	2	-
Cumu (Rhinecanthus aculeatus)	1	-	-
Ulavi (Scarus ghobban)	-	1	-
Corocoro (Myripristis sp.)	-	2	-
Corocoro (Adioryx spinifer)	-	-	5
Salala (Rastrelliger kanagurta)	-	-	2
Lulu (Monodactylus argenteus)	-	-	4
Kawakawa (Epinephelus caeruleopunctatus)	-	-	1
Vuvula (Megalops cyprinoides)	-	-	1
Total Weight	15kg	15kg.	26kg.

Key: DB = Dawson Bay; KB = Katherine Bay; E=east, W=west.

The Tui-ni-Wasabula's bait lights (2 x 1000w) attracted good quantities on the one night they were set (13/9/83; E. of Dawson Bay, 50m depth). The area does unfortunately lack shelter from prevailing SE winds and for this reason, very little baitfishing has ever been undertaken there by pole-and-vessels.

The technique of fish attraction using lights is however applicable to artisanal fishermen. A pressure lantern is often enough on dark nights to attract schools of small fish which in turn attract larger predators such as walu, saqa and ogo. These can then be caught on lines baited with small fish caught around the light or on fish flesh. During the November-April period, when still nights are more frequent and catches are generally higher, this technique should prove productive in the eastern lagoon.

2.1.9. Summary-Inshore Resources

Whilst the inshore resources appear to offer limited prospects for generating income from resources such as beche-de-mer, trochus and civa, there is ample scope to increase the fish catch for local consumption. This will probably require that effort be directed to areas on the eastern side of the island. The unavailability of ice will constrain trio lengths to a day or less, and the productive areas north of Florida Passage, which are 10 miles or so from most villages, may however prove uneconomical to work on a day basis using outboards. Vessels based at Buakonikai may be best located to increase catches from these eastern areas, as well as those to the south, towards Kioa Is.

2.2. OFFSHORE RESOURCES

2.2.1. Coastal Pelagics

Coastal Pelagics, the larger predatory surface fishes such as walu, saqa and ogo, are usually taken by trolling just outside the reef, along the drop-off (Zone H) and in the deep passages. Best results are usually obtained where the reef drop-off is abrupt, and seaward reefs generally produce better results than leeward reef (Lewis et..al,1983). Trolling along the western side of the island produced poor results - the reef is broken in nature, with a shelving drop-off. Similarly, on the lee side of the northern reef spur (behind Texas Reef) the reef edge is indistinct, broken and difficult to follow for trolling purposes. The "hard" (steeply-shelving) edge of Texas Reef produced slightly better results.
South of this, the sunken barrier between Texas Reef and Florida Passages has many coral heads standing to seaward. Although difficult to work with the 28 vessel, this area still produces very good results.

South of this, the sunken barrier between Texas and Florida Passages has many coral head standing to seaward. Although difficult to work with the 28' inch vessel, this area still produces very good results (14kg/hr), mostly on small-medium size donu Plectropomus leopardus). A small vessel could work around this coral heads (bommies) much more effectively in good weather. Florida Reefs are similar in configuration and could be expected to produce comparable catches. A single trolling pass outside this bommie zone with the large vessel still produced one walu (Scomberomorus commerson) and one dogtooth tuna (Gymnosarda unicolorli).

The potential of Florida Passages for trolling appears good and this is a favoured trolling area of the Rabi people. Patch reefs inside the lagoon should produce good catches of saga (Caranx spp) and other species from time to time, particularly using small lures such as feathers and the potential of the lagoon for night light fishing has already been discussed. Appendix 2 summarizes all troll catches during the survey.

2.2.2. Deep water Snapper

Fishing for deep water snapper is a traditional method still practised by the Rabi people, using the drop stone technique described earlier, and good catches are made in favoured locations or "holes" (these are often marked with buoys) near the main villages on the western side. Tunas (yellowfin and dogtooth, snake mackerel and red snappers (Etelis spp.)are common captures. This technique can be used at most times on the lee shore and is also employed to good effect on the eastern side of the island in favourable weather.

Fishing from the 28' vessel during this brief survey, using Samoan handreels and gear as used in other surveys (Appendix 3), was reduced by rough weather to two areas, the sheltered western edge of the northern reef spur (Texas Reef) and off Florida Reefs (Figure 3), Catches were generally disappointing (Table 2). Nine hours fishing in the first locality produced only 65kgs, and 14 hours in the second only 89kgs i.e. an average catch per line hour (2 lines) of between 3 and 4kgs. This is less than half the catch rate achieved on surveys in other areas of Fiji (Mead 1981 in press).

These reduced catches are felt to be due in part to the bait used - tuna, generally regarded as the top bait, was not available. Reports from commercial deep water fishermen also indicated that the biting response was poor in other parts of Fiji at this time. It was encouraging to note on at least one occasion that dropstone fishing vessel produced a good catch of yellowfin tuna, and indicates that when biting is poor, conventional handline catches could be improved by the use of a chum bag or similar device to enhance the biting response

Although somewhat disappointing, the catch rates obtained were still well above most subsistence catches and the gear used aroused considerable interest among island fishermen.

Table 2

Catches made during deep-water handlining

Date	Locality Details	Catch (no., total wt.)	
13-17/9/83	Florida Reefs, 50-150f 9 hrs. fished	Pristipomoides flavipinnis	(2,2.0)
		P. multidens	(1,2.5)
		Lutjanus gibbus	(4,4.5)
		L. bohar	(3,7.5)
		L.sp. (near argentimaculatus)	(1,3.5)
		L. kallopterus	(3,5.5)
		L. monostigma	(1,1.0)
		Epinephelus microdon	(3,3.8)
		E. compressus	(1,35.0)
		Total - 65kg.	
15-16/9/83	Northern reef spur -western edge, 20-150f 14hrs fished.	Pristipomoides flavipinnis	(4,5.0)
		P. multidens	(1,1.5)
		Aphareus rutilans	(2,1.5)
		Gnath. mossambicus	(1,1.0)
		Paracaesio stonei	(1,1.0)
		Lutjanus gibbus	(4,4.0)
		L.bohar	(3,9.0)
		L. kallopterus	(6,9.5)
		Pinjalo pinjalo	(3,4.5)
		Lethrinus mahsena	(7,4.0)
		L. miniatus	(1,5.0)
		L. xanthocheilus	(2,1.5)
		Epinephelus microdon	(4,6.5)
		E. dictyophorus	(2,3.5)
		Adioryx spinifer	(2,1.0)
		Stegostoma varium	(1,30.0)
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		Lutjanus gibbus	(4,4.0)
		L.bohar	(3,9.0)
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2.2.3 Shark

Shark is generally valued as food on Rabi. (This is also the case on Rotuma, whereas in most parts of Fiji, shark is not generally eaten,partly because of various traditional taboos associated with it.) Thus, sharks captured during deepwater handlining, such as the 30kg leopard shark (Stegostoma - Table 2) are not discarded but become a valuable part of the catch. Some of the deepwater sharks (Squalus, Centrophorus) are in fact favoured above most fish species by the people.

The acceptability of shark therefore raises the possibility of carrying out limited sunk netting for them or least using appropriate wire trace when night handlining so that hooked sharks do not break away. The need to bleed and handle shark correctly seems to be appreciated, which may account for its popularity.

2.2.4. Tunas

Although tunas, particularly yellow fin tuna, are occasionally caught trolling inshore and form a sizeable part of the drop stone catch, an insignificant proportion of the tuna biomass which passes the island each year must be taken. The large surface schools of skipjack and yellow fin are either inaccessible using the available vessels or are not worth the expenditure of fuel to chase, despite their great popularity as food.
Given the background of the Rabi people in tuna fishing (both surface trolling and deep handlining), the Rabi area was therefore a logical place to deploy several FAD's.

Mindful of the need to anchor the FAD's in reasonable proximity to the villages, the survey team located one on a seamount just north of Kubulau Point Reef (Vatubasoga) in 205f, and another just outside the southern end of Florida Reefs in 210f. (Figure 4). Details of the FAD design are given in Appendix 4).
Information relayed from Rabi since the FAD's were deployed suggests that over 100 yellowfin were taken off the Kubulau FAD during the first four weeks plus some mahimahi and skipjack i.e. approx-one tonne. No deep handlining had been done up to that time so those catches can be expected to improve. The second FAD, as expected, was not producing as well, with only mahimahi (Coryphaena hippurus) being taken.

The favourable reaction of the Rabi people to the FAD's and the good catches taken so soon after deployment indicates there is an important role for them in the area. The need to properly maintain the FAD's once in position has been stressed.

2.2.5. Other Offshore Resources

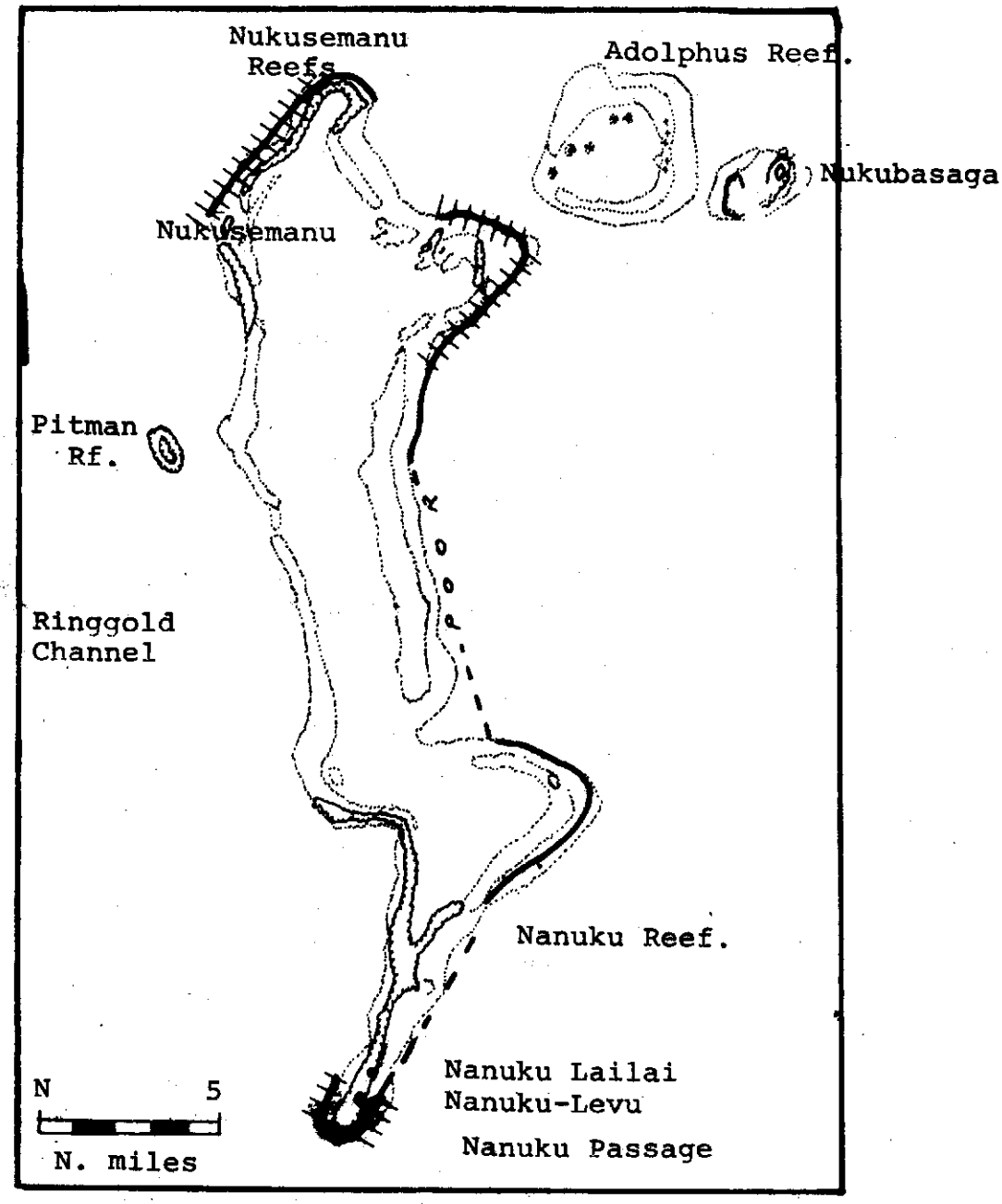
It is probable that the establishment of any commercial fishing venture in Rotuma on even a modest scale would require fishing to be carried out in areas beyond the immediate vicinity, as was the case with the earlier Rabi Holdings fishing scheme. Rabi has a geographical advantage in this respect in that to its east and north-east lie a complex of productive reefs, most of which are uninhabited (Figure 4). Providing permissive access to this area could be obtained from the traditional fishing right owners and provided suitable vessels were available, this area is the most logical one to consider. Although surveying all this area (which includes the Ringgold Group, Wailagilala, Duff Reef, Qelelevu, Thakau Vucovuco, T. Matacucu and Vetauua) was not feasible on this occasion, it was decided to briefly survey one of the larger reefs - Nukusemanu/Nanuku - to provide indicative data.

Since little or no information is available on this relatively remote area. The elongate reef is approximately 30 miles long, generally less than 5 miles wide and lies along a N-S axis. The western edge is broken, with many deep access channels, whereas the eastern edge is a mixture of abrupt drop-off and gently shelving reef slope, with relatively few passages through it. Two islets, Nanuku in the north and Nukusemanu in the south, lie close to the reefs seaward perimeter. Figure 5 shows the main features of the reef and areas fished during the brief visit.

Trolling produced very good results in good drop-off zones (25kg/hr average - see Appendix Table 2) and poor catches along gently shelving areas. Handlining at one site inside the lagoon, although restricted by bad weather, produced good catches which were however dominated by bati (Lutjanus bohar) within the vast lagoon area; it is likely that many productive locations could be found. The lee side of the reef and the northern rim appears ideally suited for napper fishing, but this would need to be verified.

Figure 5.

Details of the Nanuku-Nukusemani Reef complex. A heavy line indicates the areas trolled; this line is hatched where good catches were made.



Diving at the southern end of the reef showed vasua (especially Tridacna maxima and T. derasa) and trochus to be abundant.The area also contains several sea mounts of which the Wailagilala sea mount is the largest and probably most productive. (Figured) not all of the reefs offer secure anchorage in bad weather, but enough exist to be able to work the area with a reasonable margin of safety.

3. RESOURCE POTENTIAL

The fisheries potential of waters immediately surrounding Rabi appears modest, but certainly sufficient to satisfy demand on the island for fish and other seafood. The western side of the island, from Cape Texas to Cape Georgia, is already fished quite heavily because of its proximity to the main settlements. This area, with an estimated 15 km^2 of reef flat and lagoon, should yield a minimum of 15 tonnes of fish per year with existing gears.

Published estimates of annual yields from tropical coral reef and adjacent shallow areas range between 2 and 5 tonnes/km /year in most cases, although some estimates range upwards to nearly 30 tonnes/kg/year. A lower figure is used here (1.0 tonne/km^2/yr) since the herbivorous reef fishes, which make up much of the fish biomass, are assumed to be only lightly harvested in Rabi. Adding the deepwater and pelagic resource to this an annual harvest of 20 tonnes per year from the Western Shore or 5 kg per head annually for a population of 4,000 is estimated. Consumption figures for other situations range from 23kg (Suva) to 80kg (island fishing communities) (Zann-pers.comm.)
A consumption of 206kg has been estimated for outlying islands in Kiribati this may best approximate the original per-capita consumption on Ocean Island with the decline in usual sources of revenue, it is to be expected that consumption of tinned fish will decline and that demand for fresh fish will rise accordingly. Even at modest consumption levels, say 30kg/head/year, the suggested western shore yield of 20 tonnes would need to be increased to 120 tonnes. This is probably not achievable with existing techniques and species preferences.

The eastern lagoon and reefs from the northern reef sour to the southern end of Florida Reefs, have an area of approximately 120 km^2 At a yield of 1.0 tonne/km^2 year, it is clear that the target of 120 tonnes could be met from this area alone, even at this very conservative estimate of yield. By increasing the proportion

of herbivores (ulavi, balagi, ta, nuqa etc.), this figure could certainlv be increased. The survey results indicate that the reef rather than lagoon fishes have the greater potential, because of the general lack of good bottom for netting and the relatively great depth of the lagoon. Mangrove - associated fishes have limited potential, but techniques for catching shark are worthy of investigation.

The potential of resources such as beche-de-mer, trochus and mother of pearl, which generate useful cash income in other areas, is limited. Lobsters (urau) appear to offer little potential, although the twice-weekly air connection increases the long-term prospects of this high-value item.

To some extent overshadowing this are the reef complexes to the east, which clearly have considerable fisheries potential and which Rabi is well situated to take advantage of (see later).

4. DEVELOPMENT STRATEGIES

Future fisheries development on Rabi needs to be considered on two levels - development aimed at increasing catch for consumption on the island and commercial fisheries development earning income for the island.

(i) Increasing catch for local consumption

Increasing the subsistence catch, as we have seen, essentially involves bringing the resources of the eastern side of the lagoon into production. It is unlikely that the west coast resources can sustain sufficient increase in catch to achieve even a modest per-capita fish consumption. Development on the eastern side would require more vessels of half-cabin size (4 metres) than are currently operational on the island, since the use of punts would be restricted by weather on the seaward side of Rabi.

Outboard-powered half- cabin vessels have the advantage of speed, an important consideration when ice is not available, but have high running costs (fuel) and require a moderate amount of careful maintenance. The lack of ice remains a major constraint (see later) which would affect the operations of diesel-powered vessels as constructed by the Fisheries Division, since fishermen would have to steam to and from the grounds each day. In the case of Nuku fishermen for example, this may mean four hours' steaming on each day trip. With 'the completion of the road to Buakonikai however, unloading and re-provisioning at that point has become feasible.

Further road development along the east coast will greatly assist fisheries development Off the east coast, as will the construction of jetty at Tabiang. It would therefore be appropriate now to seek at least two of the Fisheries Division's vessels, one under the Fishermen's Training Scheme and one by direct purchase. Such vessels can work the eastern lagoon in most weather and could begin to venture further afield.

Consideration should also be given to harvesting more of the herbivorous species using techniques such as fish drives and spear fishing which may not be traditional Banaban fishing techniques. The possibility of shark fishing in the lagoon needs a closer look, perhaps in conjunction with the Fisheries Division, as does night light fishing. Finally, the deployment of FAD's has already had a measurable impact on fishing activity.

Whilst it may be possible to deploy more devices in the area, it is more important at this stage for fishermen to properly maintain the device (change palm fronds, check connections) and modify their own techniques to fully utilize the potential of each FAD i.e. surface tuna, deep swimming tunas, bottom fish, sharks etc?

Again, the Fisheries could assist in this regard. (ii) Commercial fisheries development AS indicated earlier, it is likely that any successful commercial fishing venture (i.e. one involving the sale of fish outside the island to earn income) would need to operate beyond the Rabi area and that the reef complexes to the east and north-east would be the most likely operational area. Such development would logically be initiated as the catch for local consumption begins to show a steady increase, rather than immediately. In this way, the experience gained in Litters would be a foundation for operating further afield. It should not be forgotten that the local market represents a significant and lucrative market in itself.

The major constraints to such commercial fish development are as follows:

(a) Lack of ice at Rabi

Although experience with the earlier Rabi. Holdings fisheries venture has clearly demonstrated that good management is the cornerstone of a successful fishing venture, the lack of ice on the island is probably the main constraint at this stage. Rehabilitation and repair of the Nuku coolers (cf. freezers) would not solve this problem since they are not capable of producing quantities of ice on regular basis. Whilst

small ice plant could be installed on Rabi at some time in the future as part of the Rural Fisheries Development Scheme(Aid-in-kind), this is a long-term prospect. The Division's Northern Division collection vessel is unlikely to operate again in Cakaudrove because of the poor response front fishing schemes (including Rabi) earlier this year. This leaves three possibilities:-

i)A suitable vessel, with ice box(es), could purchase ice from the ice plant at Waiyevo, Taveuni. This plant is currently underutilized and could readily supply as much ice as was needed in the foreseeable future.

ii)Regular delivery of ice (weekly?) and fish pick-up to Karoko, just opposite Rabi on Natewa Peninsula, by refrigerated vehicle. This could of course tie in with other ventures encourt and is a possibility the Island Council should explore with Fisheries/NMA.

iii)A private enterpreneur intends to establish at least one ice plant on the north-western shore of Natewa Bay and also collect fish for sale in Suva. Whilst this would be further to travel to than Taveuni), it may enable Rabi schemes to tie into this venture.

(b) **Transport to demand centres**

Transport facilities of perishable commodities such as fish from Rabi to major urban centres are poorly developed. It would be feasible to use the twice-weekly air service for the freight of high-value products such as lobster and off-season walu to Suva, but not for the routine shipment of large quantities of fish unless very favourable freight rates could be negotiated. This should however be investigated.

The possibilities of delivery to a weekly refrigerated vehicle service to Karoko and servicing by a private collection vessel are others which may assist in this regard. There seems little point at this stage in delivering fish to Taveuni which itself suffers from similar transport difficulties with its fish. On a smaller scale, the school at Napuka may represent an outlet for surplus catch.

(c) Shortage of suitable vessels

It is a common belief that a large vessel (12m plus) is a pre-requisite for a successful commercial fishing venture. From a comfort and safety viewpoint, this has some merit but is generally offset by the higher operating costs. When only simple fishing techniques such as handlining and diving are being used, the full potential of a larger vessel is also not utilized. Several fishermen from Suva regularly operate as far north as Wailagilala in 28' diesel vessels and make catches which produce good economic returns. With the strong seafaring Banaban tradition, it is reasonable to expect that 28' vessels could work the eastern reef complexes on a regular basis. If this proves successful, acquisition of a larger vessel may then become a viable option on the basis of experience and management expertise gained.

Rabi is relatively well supplied with good anchorages for small vessels, maintenance facilities and fuel. It is by no means remote and is well situated with regard to productive fishing grounds. It has probably a better chance than most island communities in Fiji to establish a profitable fishing operation if development proceeds in a logical step-by-step fashion as outlined previously and summarized in Figure 6 and if existing constraints can gradually be overcome.

5. REFERENCES

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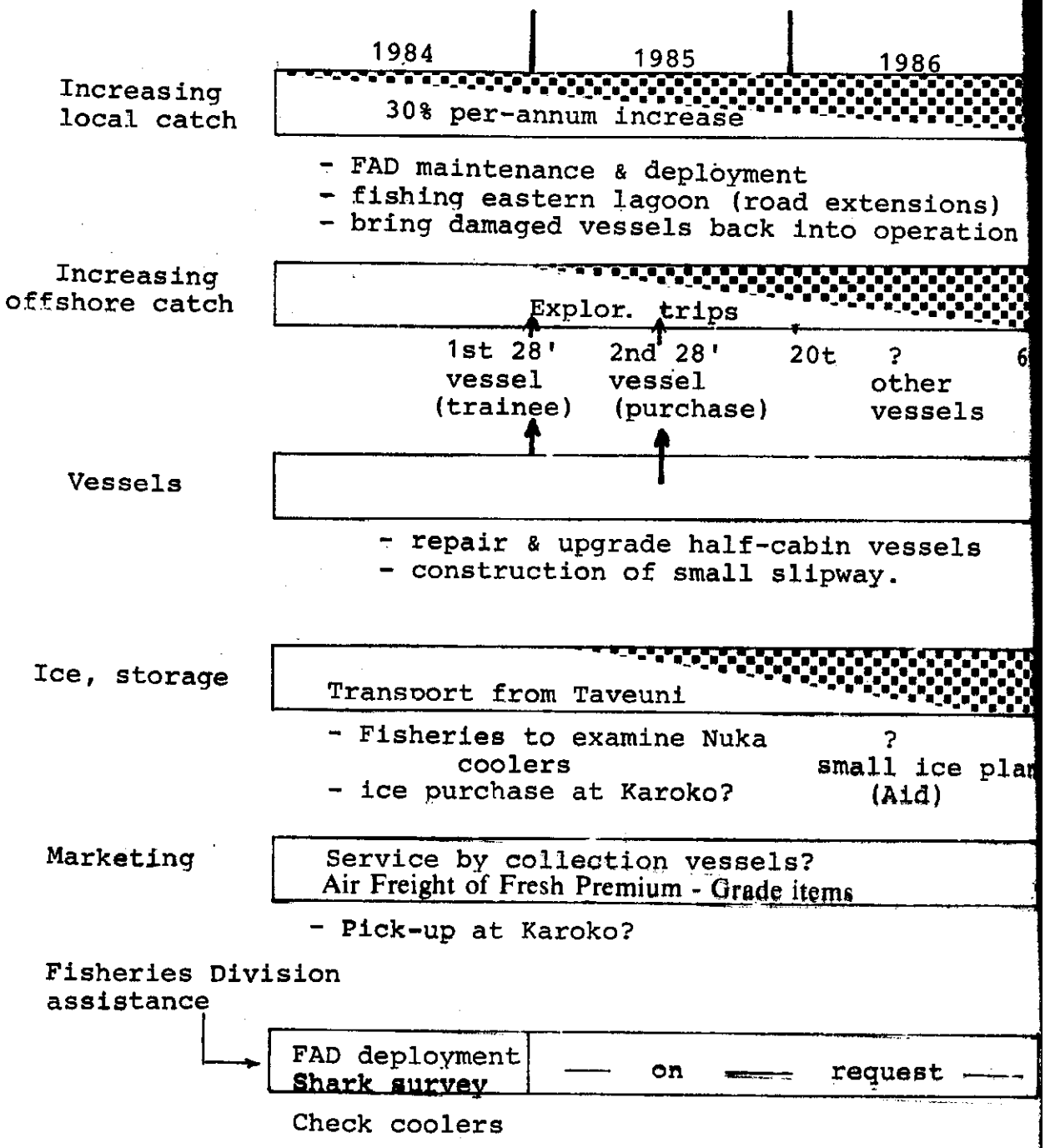
Figure 6. Suggested fisheries developments at Rabi, 1984-86



Appendix 1

Summary of Rabi Survey Activities, September 1983

Date	Activity
Monday 12th	Arrive Nuku 1645hrs; discussions with Island Manager, Councillors and fishermen.
Tuesday 13th	AM - Trolling from Nuka to Florida Passages (28' vessel),-FAD anchored north of Napuka; vessel steaming to Dawson Bay to anchor. PM - Diving survey; netting in Dawson Bay; set bait lights at night.
Wednesday 14th	AM - Trolling outside Florida Reefs; diving survey in Florida Passage area; second FAD anchored off southern end of Florida Reefs. PM - Deepwater handlining off Florida Reefs (28' vessel); larger vessel departed for Nukusemanu and anchored there after two hours trolling; dinghy to Katharine Bay for netting and interviews.
Thursday 15th.	AM - Trolling towards Nanuku; interviews in Buakonikai PM - Diving survey off Nanuku; return to Rabi; anchoring off Buakonikai; deepwater handlining off northern reef spur; Netting in Katherine Bay.
Friday 16th.	AM - Diving survey on reefs towards Kioa; interviews in Tabiag and Uma. PM - Reassemble at Nuka; final discussions with island people.
Saturday 17th.	AM - Depart for Suva, collecting fish from Taveuni en route.

Appendix 2,

Troll catches during the survey period.

Date	Location	Time	Catch	Remarks
13/9/83	Nuku N.end of Texas Reef	0600-0930	Nil	Broken reef edge, with gentle drop-off
"	Texas Reef	0930-1000	1 ogo (5.0kg)	Good drop-off but cat) poor
"	N.end of Texas Reef -Florida Passages	1000-1115	1 DTT (6.5)	Bonnies off reef edge could work well with saddler boat.
14/9/83	Florida Passages -S. end of Florida Reef.	0630-0830	1 DTT (5.0) 1 Walu (5.0)	As above;
"	N.W. Corner of Nanuku ReefS.	1600-1515	3 ogo (8.8) 2 walu (14.0)	Reef broken but steep drop-off. Good catch (20kg/hr)
15/9/83	Nukusemanu Is. -Nanuku Is. (E. side of reef.)	0700-1130	6 Scad (7.8) 4 Ogo (26.2) 7 DTT (36.0) 3 Saqa (22.5) 1 Donu (9.0) 1 Saku (1.5)	Catch rates varied from verv good to poor depending on steepnes of drop off much time spend steaming past poor areas in excess of 20kg/hr in good area

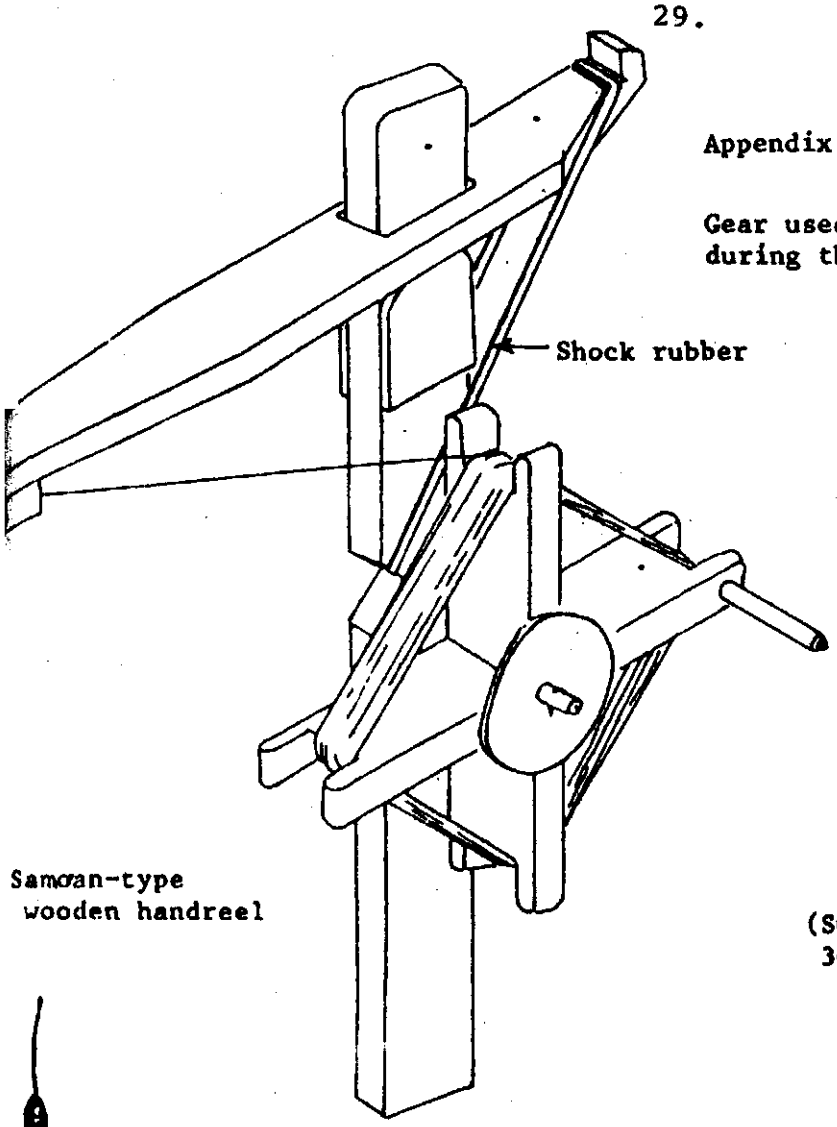
Key: DTT = dogtooth tuna (Gymnosarda unicolor) ogo = great barracuda (Sphyraena barracuda) /donu =coral trout (Plectropomus leoparrtus, P. sp)

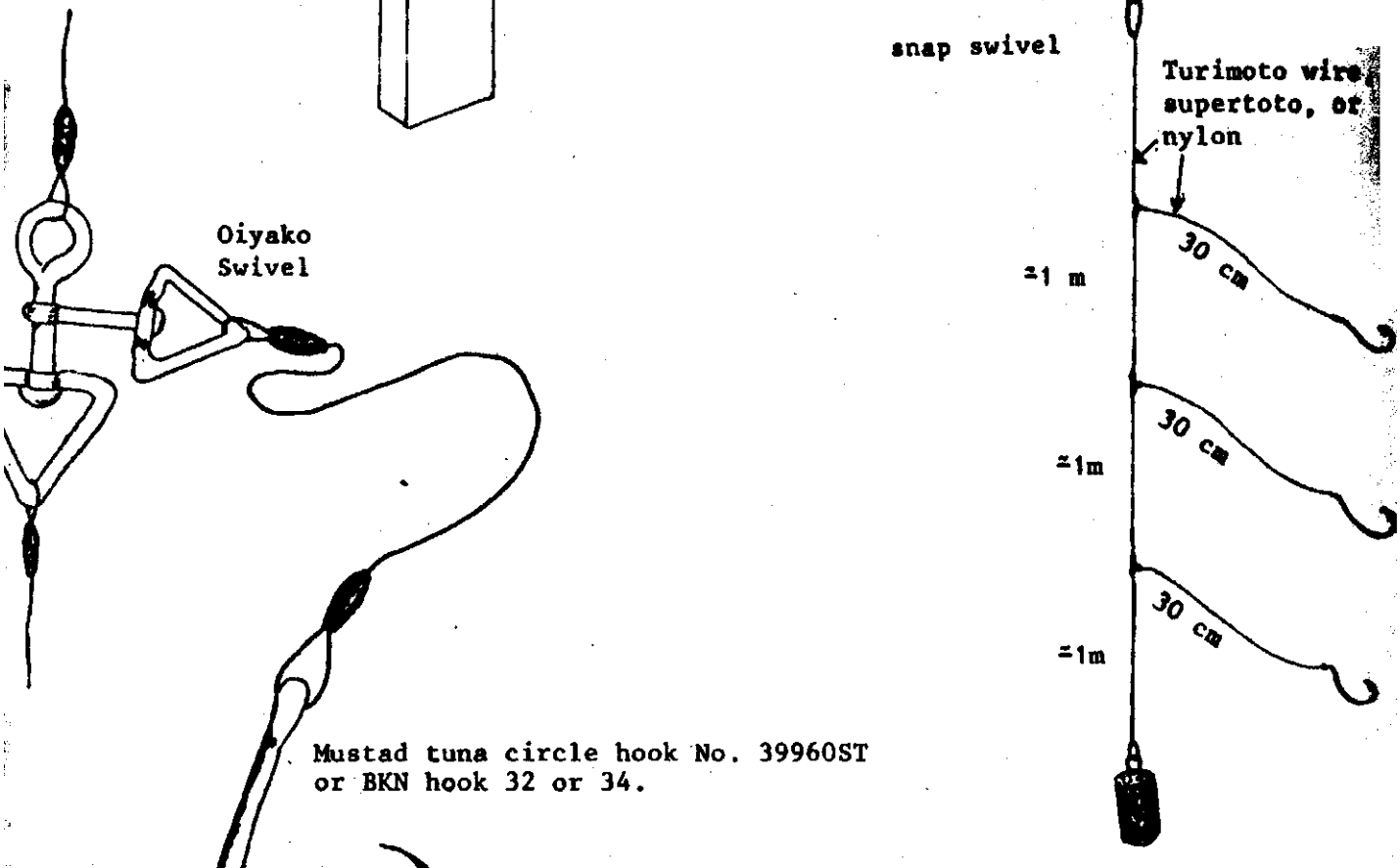
Notes (1) The more productive areas for trolling are marked on Figures 1 & 3

(2) Gear used was as described in previous reports (eg. Lewis et al, 1983; Anon, 1982.)

Appendix 3

Gear used for deepwater snapper fishing during the survey.





Appendix 4. Design of FAD's deployed near Rabi by the Fisheries Division.