Appendix 3

ANALYSIS OF SPECIES COMPOSITION AND CATCH AND EFFORT DATA FOR THE RURAL FISHING ENTERPRISES PROJECT AT TATAMBA, ISABEL, SOLOMON ISLANDS

By

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Table of contents

List of Tables

List of figures

Appendices

SUMMARY

1. During the period 16.1.92-21.2.92 a study was undertaken to ascertain the main species being landed at the RFE project, Tatamba, Isabel Island and to collect length-weight measurements in order to calculate the parameters of the length-weight relationship. Following this, an analysis of the catch and effort data for the project boats, collected since the project started in March 1991, was undertaken.

2. During the study period a total of 1547 fish from both project and local boat cathes were identified, measured and weighed. Over 87% of the fish in the catches examined were made up of 16 species from the families Lutjanidae, Serranidae, Lethrinidae and Sphyraenidae, with three species (*Lethrinus rubrioperculatus, Lutjanus gibbus* and *Pristipomoides filamentosus*) making up 52% of the total catch examined.

3. A division of the total fishing grounds into three areas ((i) Ramos, (ii) Mahige/Nalignagho/Fulakora, and (iii) Thousand Ships Bay) shows a difference in the dominant species caught in each area and, due to the grading system currently applied to the catch at Tatamba, a difference in the proportion of first and second grade fish from the three areas. The highest proportion of first grade fish came from Thousand Ships Bay with *Lutjanus timorensis* and *Pristipomoides filamentosus* making up almost 60% of the fish in the catches from this location that were sampled.

4. Length frequency distributions are presented for the seven most abundant species present in the catches examined (i.e. *Lethrinus microdon, Lethrinus rubrioperculatus, Lutjanus bohar, Lutjanus gibbus, Lutjanus malabaricus, Lutjanus timorensis,* and *Pristipomoides filamentosus*). The length-weight relationship parameters have been calculated for the above species with the exception of *Lutjanus malabaricus* and *Lutjnaus timorensis* where insufficient ungutted fish were sampled.

5. Over the period March 1991 - February 1992, the Tatamba, Takutu, Nagalau and Poro project boats all show a similar fishing performance with mean cpue values between 4.21 kg/hr (Tatamba) - 5.65kg/hr (Nagalau). The trimaran shows a significantly lower mean cpue (2.89 kg/hr) compared with the other four project vessels. The cpue values for the project boats are similar or greater than cpue values from artisanal droplining in the Solomon Islands, but are towards the lower end of the range of cpue values from experimental bottom fishing surveys in the Solomon Islands and deep-bottom fishery projects in other Pacific countries.

6. Monthly mean cpue's for the project boats over the period March 1991 - February 1992 are variable and do not appear to indicate an increase since the project started. However, it is felt

that due to the effect of various start up problems during the first year of operation of the project, an analysis of catch rates over a second year will provide a truer picture of the fishermen's performance.

7. The fishing effort of all five project boats appears to be fairly well spread out over a large part of the total fishing grounds, although there has been a concentration of effort in two grid reference sites (D4 and E4) which are close to Tatamba. The areas of highest catch do not generally correspond with the sites of highest cpue.

8. For a greater understanding of the fish stocks exploited by the Tatamba fishery it would be useful if additional studies were undertaken; it may be possible to incorporate the measuring and weighing of individuals of specific species with the routine weighing of the catch.

1. Introduction

The rural fishing enterprises (RFE) project was initiated at Tatamba, Isabel Island, in March 1991. Utilising the basic facilities already established at the Tatamba Fisheries Station, the RFE project has established a regular supply of fish (currently ≈1000 kg/week) based on a deep water drop line fishery. There are five project boats (four 6.2m plywood monohulls and a plywood trimaran) currently operating under the project and a variable number of local boats (primarily GRP canoes).

The project boats are powered by an 8hp Mercury outboard motor, and fishing is undertaken using two hand reels which have been mounted on the boats. Fishermen in the local boats use hand-held drop lines for fishing.

Each of the five project boats have been allocated to a particular village and for each boat there are two or three skippers who take it in turns to operate the boat, selecting their crew from a group of interested fishermen in each village.

During the period 16.1.92 - 21.2.92 a study was undertaken to ascertain the main species being landed at the Tatamba fisheries centre. An analysis of the catch and effort data that has been collected for the five project boats during the period March 1991 - February 1992 has also been undertaken. This report describes the results of that study and the catch and effort data analysis.

2. Methods

2.1 Species composition / length-frequency analysis of the catch

Fish were measured in the marketing room of the Tatamba Fisheries Station immediately after being landed by the fishermen. Prior to landing, the fish would have been stored in an ice slurry (0°C) in an esky onboard the fishing boat for anywhere between 3 - 10 hours, depending on the distance to the fishing grounds.

Fish were identified to species using the following references (Gloerfelt-Tarp & Kailola (1981), Allen & Talbot (1985), Grant (1987), Myers (1989)). The family Lethrinidae proved to be fairly problematical to identify to species due to the lack of any comprehensive literature on this particular group at the time the study.

The fork length of each fish was measured to the nearest mm, and the fish were weighed to the nearest 10g. Many of the fishermen cleaned their fish before landing at the fisheries centre, so the

majority of the weights recorded were gutted weights. However, if the fish had not been gutted on arrival at the centre, they were weighed whole.

Due to other work commitments at the fisheries centre during the period, only a proportion of the project and local boat catches were included in the study.

2.2 Catch and effort data

Fishing information (catch (kg), fishing time, petrol and ice usage, fishing area, and sea conditions) has been collected for the project fishing boats since the operation started in March 1991 (Figure 1 shows a sample Fishing Information Sheet used for the project). This data was used for an analysis of the fishing activities of the project boats for the period March 1991 - February 1992.

The main areas examined were:

(i) Mean catch-per-unit-effort (cpue) for each project boat and for individual skippers during the period March 1991 - February 1992;

(ii) mean cpue per month for each project boat during the period March 1991 - February 1992;

(iii) total catch per project boat during the period July 1991 - February 1992;

(iv) percentage of each grade (see section 2.3) making up the total catch for each project boat during the period July 1991 - February 1992;

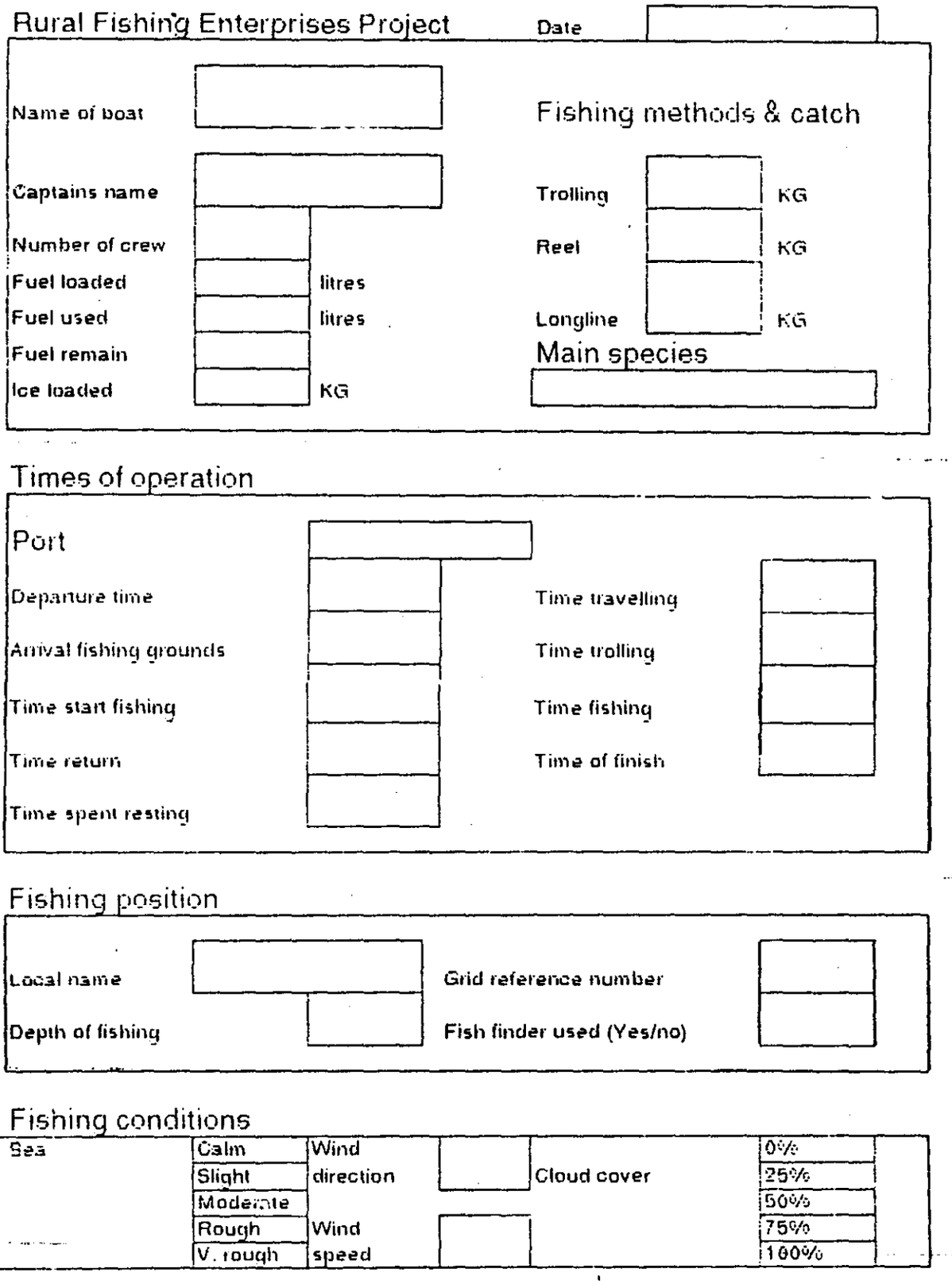
(v) total catch per grid reference for the project boats during the period July 1991 - February 1992; and

(vi) mean cpue per grid reference for the project boats during the period July 1991 - February 1992.

In some instances, Fishing Information Sheets (FIS) were not completed. In such cases, the data for these particular fishing trips were not included in the analysis. Due to the lack of information for one particular group during the June 1991, some areas of the analysis only cover the period July 1991 - February 1992 (i.e. (iii), (iv), (v), and (vi) above).

As stated in section 1, the Tatamba RFE project is based on a deep water dropline fishery. During the time since the project started, the project boats have undertaken some trolling trips.

Figure 1. Sample of the Fishing Information Sheet used by the RFE project.



The troll fishing catch is discussed separately (section 3.3.3), and unless otherwise stated, the results of the analysis refer only to the deepwater line fishing.

Table 1 shows the number of reel and troll trips undertaken by each project boat during the period March 1991 - February 1992, and indicates how many records were utilised in each area of the analysis.

The conventional cpue unit for deepwater bottom fisheries using hand reels is generally kg/reel hour. However, for this analysis the cpue unit of kg/fishing hour has been selected. The reason for this is that although each project boat has two reels mounted on it, during any given fishing trip the number of fishermen per boat may be up to 5 and, depending on the success of the reel fishing, the additional crew members may also use hand-held lines for fishing. There is no information available as to the effect of using additional hand lines on the catch, or how frequently handlines are utilized on a fishing trip, therefore it was felt that a cpue unit of kg/fishing hour would be more applicable. It should be noted here that the cpue unit used in the economic analysis of the performance of the project boats is kg/fishing trip.

Less detailed information is routinely collected for the local fishing boats, but during this particular study, no analysis of this data was undertaken.

2.3 Grading of fish

After fish are landed at the fisheries station, the total catch for each boat is graded and each grade weighed separately. Grading is carried out according to the system employed by the main buyer of the Tatamba catch in Honiara and is primarily based on species, although small fish (<1kg), or those in poor condition, will be downgraded. The grading system according to species landed at Tatamba is shown in Appendix 1; this refers to fish >1kg.

3. Results

3.1 Species composition

The total fishing area generally used by the fishermen (although a few trips are occasionally made outside of this) has been divided up into a grid with each grid reference square having an area of 20 nm^2 (see Figures 2(a) and 2(b)). For part of this study it was felt that three main fishing areas could be distinguished: (i) Ramos; (ii) Mahige/Ngalignaho/Fulakora; and (iii) Thousand Ships Bay. These are shown on Figure 2.

Table 1. Number of reel and troll trips undertaken by each project boat during the period March 1991 - February 1992, and the number of reel trip records used during the analysis.

Group	Total no. reel trips	Total no. troll trips	Number of reel trips used in the analysis Mar 91- Feb 92	July 91- Feb 92
Tatamba	107	0	103	88
Takutu	77	3	72	46
Nagalau	74	1	65	44
Poro	75	11	73	53
Trimaran	73	1	71	65

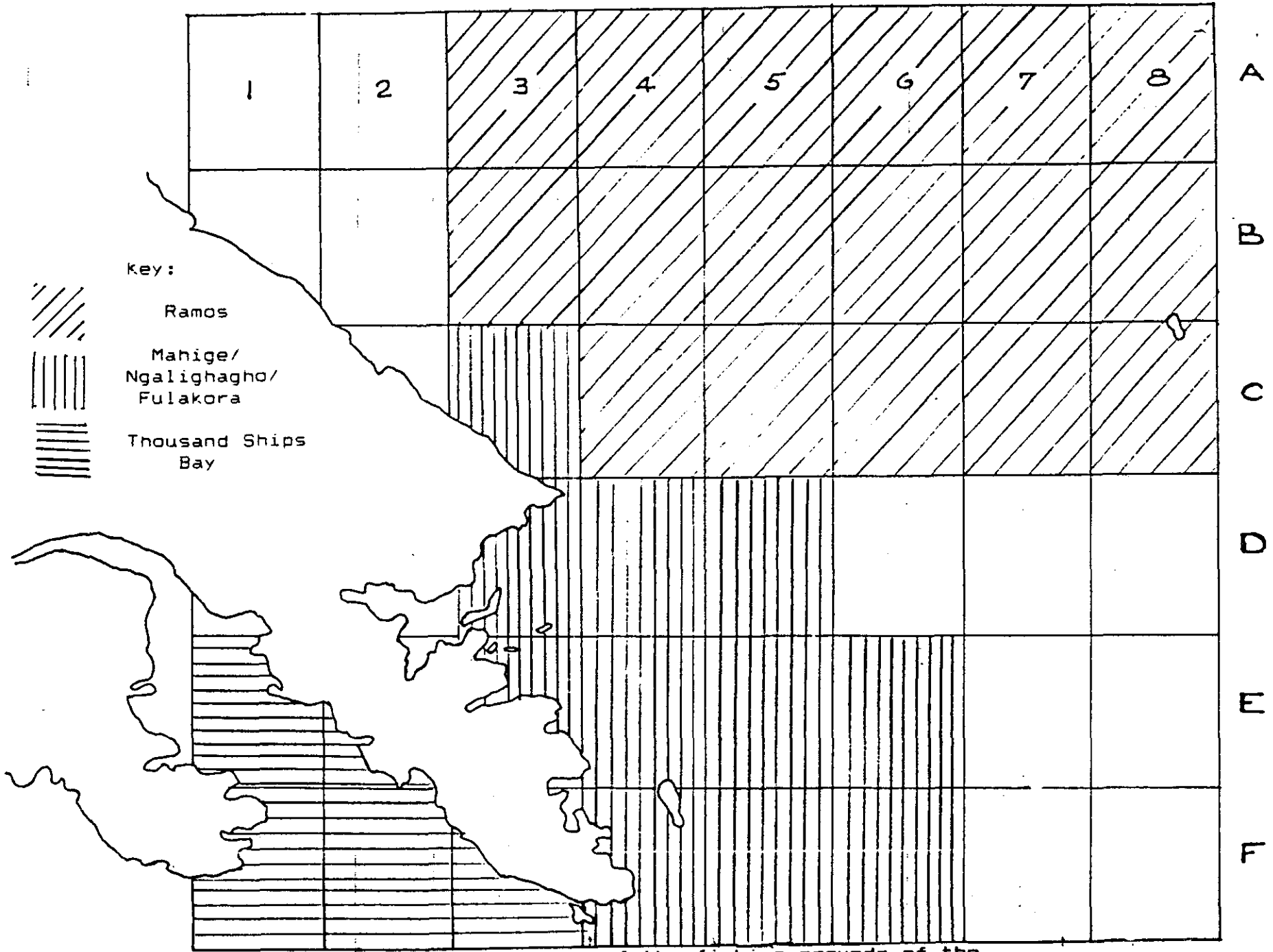


Figure 2(a). Grid reference map of the fishing grounds of the RFE project boats at Tatamba, showing the areas covering the (i) Ramos, (ii) Mahige/Ngalignagho /Fulakora, and (iii) Thousand Ships Bay sites.

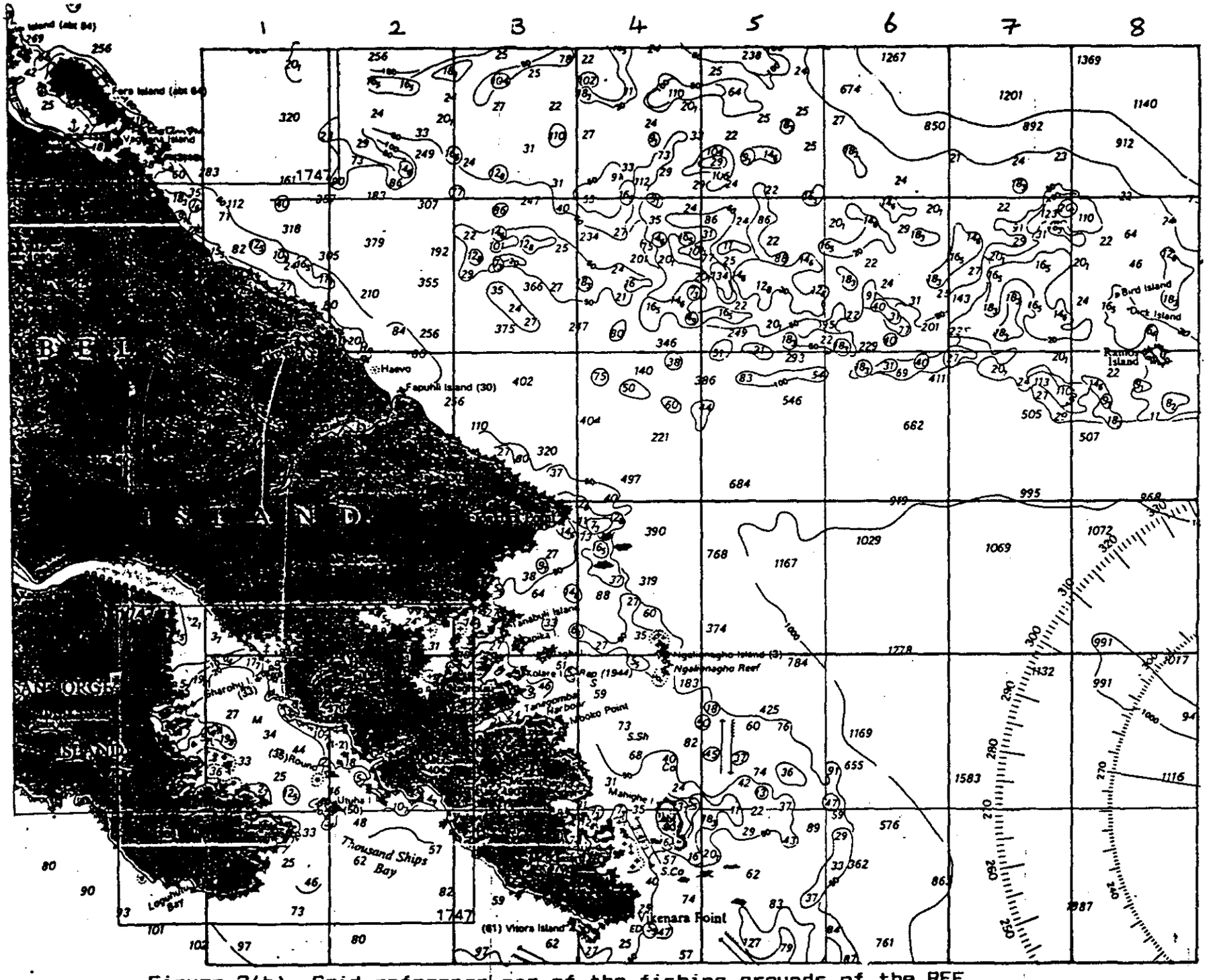


Figure 2(b). Grid reference map of the fishing grounds of the RFE project boats at Tatamba, showing the main depth contours of the fishing sites. Depth in metres

During the period 16.1.92 - 21.2.92 a total of 1547 fish were measured and weighed; these included a mixture of catches from both project and local boats. A total of 78 species from 12 families were identified. A list of the species landed at Tatamba during the period, along with the total number of fish of each species measured is shown in Table 2.

There were some obvious differences in the catches between the three areas, notably for various lutjanid, serranid and lethrinid species. The percentage of the total numbers of these species landed from the three areas is shown in Table 3.

From Tables 2 and 3 it can be seen that during the period 16.1.92 - 21.2.92, over 87% of the fish occuring in the catches examined at the Tatamba Fisheries Centre were made up of 16 species from the families Lutjanidae, Serranidae, Lethrinidae and Sphyraenidae, with 52% of the total catch examined comprising of three species (*Lutjanus gibbus, Pristipomoides filamentosus,* and *Lethrinus rubrioperculatus*).

Although the division of the total fishing ground into three main areas is somewhat arbitrary, there are some interesting differences between the species compositions of the catches from the different fishing locations and also in the proportion of grades from the total catches (see section 3.3.2). The dominant species landed from the three sites during the study period were as follows:

(i) Ramos : *Lutjanus gibbus* (43.3% of the catches examined)
Lethrinus microdon (13.3% of the catches examined)

(ii) Mahige/ Ngalignagho/ Fulakora : *Lutjanus gibbus* (27% of the catches examined)
Lethrinus rubrioperculatus (9.5% of the catches examined)

(iii) Thousand Ships Bay : *Pristipomoides filamentosus* (49.9% of the catches examined)
Lutjanus timorensis (9.35% of the catches examined)

Table 2. List of species landed at Tatamba Fisheries Centre during the period 16.1.92 - 21.2.92 and the number of each species from each main fishing area. An '*' in the TOTAL column indicates a species that was identified but was not included in any length or weight measurements.

(Family) Species	Ramos	Mahige/ Ngalinagho/ Fulakora	Thousand Ships Bay	TOTAL
(Lutjanidae)				
Aprion virescens	4	18	4	26
Aphareus rutilans	0	1	0	1
Etelis radiosus	0	4	0	4
Lutjanus argentimculatus	2	3	1	6
Lutjanus bohar	49	40	14	103
Lutjanus boutton	0	0	11	11
Lutjanus carponotatus				*
Lutjanus fulvus	0	1	0	1
Lutjanus kasmira	1	1	0	2
Lutjanus gibbus	255	164	4	423
Lutjanus malabaricus	2	40	13	55
Lutjanus monostigma	4	7	0	11
Lutjanus rivulatus	0	4	1	5
Lutjanus sebae	0	4	5	9
Lutjanus semicinctus	0	3	0	3
Lutjanus timorensis	1	8	33	42
Lutjanus vitta	0	2	9	11
Macolor macolor				*
Macolor macularis	2	1	0	3
Pinjalo sp.	2	3	4	9
Pristipomoides filamentosus	2	18	176	196
(Serranidae)				
Cephalopholis argus	1	1	0	2
Cephalopholis macrospilis	1	0	0	1
Cephalopholis miniata	1	2	1	4
Cephalopholis sexmaculata	0	0	1	1
Cephalopholis sonnerati	0	1	2	3
Epinephalus areolatus	0	8	17	25
Epinephalus maculatus	0	4	0	4
Epinephalus malabaricus	1	0	1	2
Epinephalus microdon	1	1	4	6
Epinephalus quoyanus	0	1	0	1
Epinephalus tauvina	0	2	0	2
Epinephalus undulosus				*
Epinephalus sp.	0	0	1	1
Plectropomus leopardus				*
Plectropomus oligacanthus	1	0	0	1
Plectropomus pessuliferus	0	1	0	1
Variola albmarginata	16	14	5	35
Variola louti	4	16	1	21
Aethaloperca sp.	1	0	0	1

Table 2. (cont.)

(Family) Species	Ramos	Mahige/ Ngalinagho/ Fulakora	Thousand Ships Bay	TOTAL
(Lethrinidae)				
Lethrinus chrysostomus	9	5	0	14
Lethrinus conchyliatus	2	19	0	21
Lethrinus elongata	4	12	11	27
Lethrinus harak	0	1	0	1
Lehtrinus kallopterus	2	0	0	2
Lehtrinus lentjan	3	2	0	5
Lethrinus microdon	78	40	1	119
Lethrinus miniatus	0	2	0	2
Lethrinus nebulosus	0	4	1	5
Lehtrinus ornatus	1	4	0	5
Lethrinus rubrioperculatus	121	58	1	180
Lethrinus sp.	0	4	0	4
Gymnocranius robinsoni	0	4	11	15
Gymnocranius (griseus?)	0	1	0	1
(Carangidae)				
Decapterus sp.	0	6	0	6
Alectis sp.	0	0	1	1
Caranx caeruleopinnatus				*
Caranx ignobilis	0	4	8	12
Caranx melampygus	4	4	0	8
Caranx orthogrammus	1	0	0	1
Caranx sexfaxciatus	2	2	0	4
Caranx tille	0	0	3	3
Carangoides fulvoguttatus	0	3	0	3
Caranx sp.	1	0	0	1
Elegatis bipinnulatus	3	0	0	3
Seriola sp.	0	0	1	1
(Scombridae)				
Scomberomorus commersoni	1	0	0	1
Euthynnus affinis	0	1	0	1
(Sphyraenidae)				
Sphyraena forsteri	0	40	5	45
Sphyraena putnaminae	1	3	1	5
(Haemulidae)				
Plectropomus flavomaculatus	1	0	0	1
Diagramma punctatum	0	9	0	9

Table 2. (cont.)

(Family) Species	Ramos	Mahige/ Ngalinagho/ Fulakora	Thousand Ships Bay	TOTAL
(Acanthuridae)				
Acanthurus xanthopterus	0	0	1	1
(Mullidae)				
Parupeneus cyclostomus	0	2	0	2
Parupeneus sp.	0	1	0	1
(Coryphaenidae)				
Coryphaena hippurus				*
(Priacanthidae)				
Priacanthus sp.	1	0	0	1
(Holocentridae)				
Sargocentron spiniferum	2	2	0	4
TOTAL	588	606	353	1547

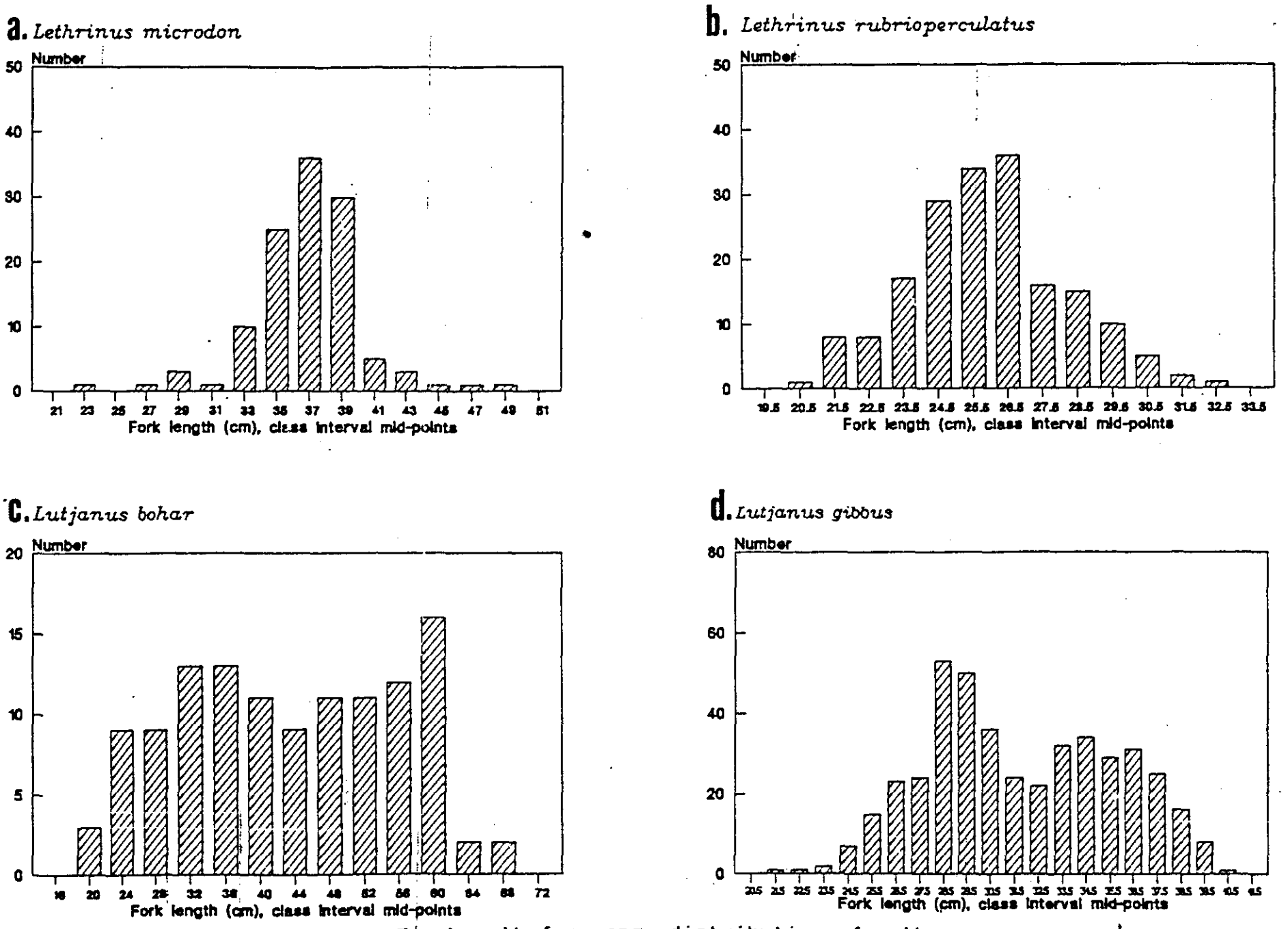
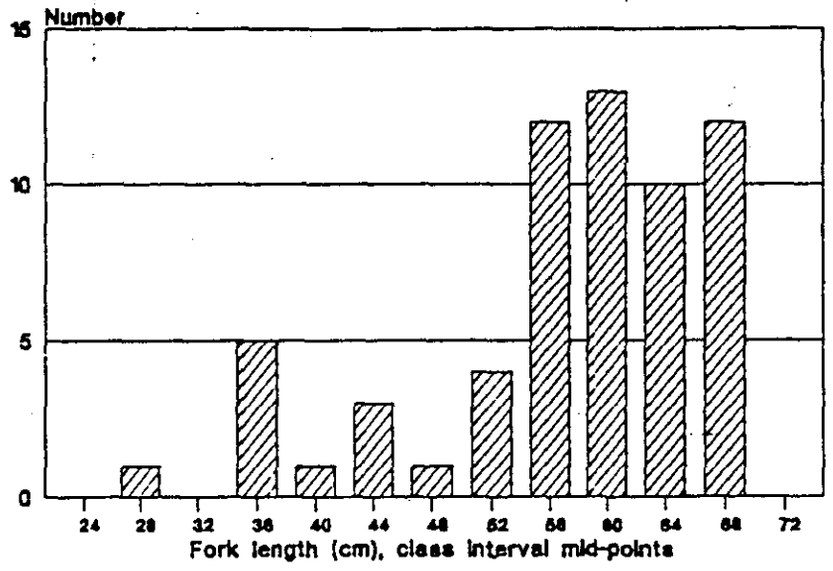
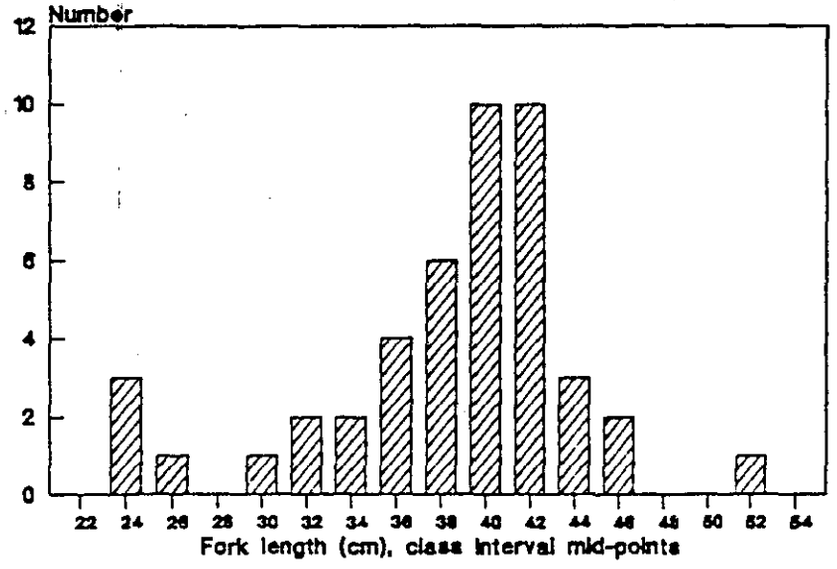


Figure 3. Length frequency distributions for the seven most abundant species in the catches examined during the period 16.1.92 - 21.2.92.

e. *Lutjanus malabaricus*



f. *Lutjanus timorensis*



g. *Pristipomoides filamentosus*

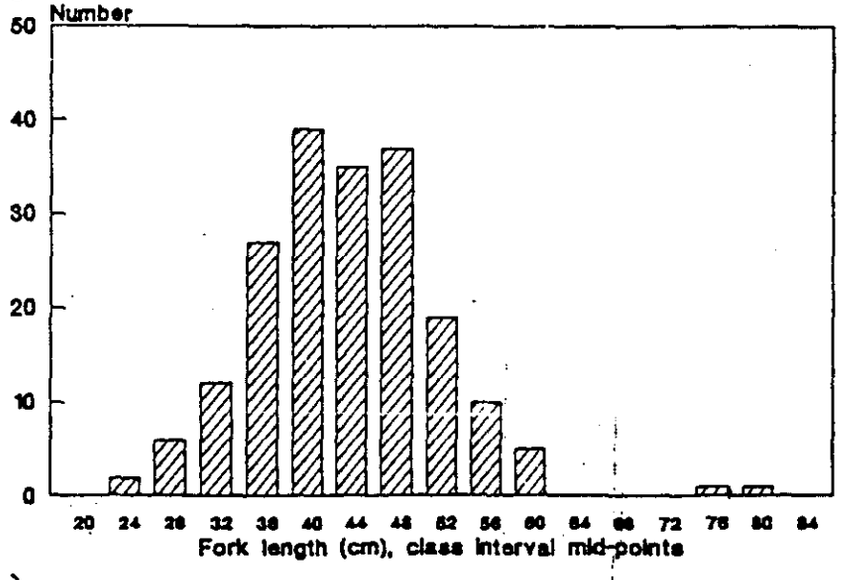


Figure 3. (cont.)

The situation regarding the mean cpue for individual skippers is somewhat complicated if all the skippers who have operated project boats (if only for 1 fishing trip) are included. Therefore, to simplify the situation, only the performance of those skippers currently operating the five project boats are considered (Table 6). Of these skippers, only Willie Katovai, Ferguson Vae (Takutu) and David Lapa (Nagalau) have been operating project boats since March 1991, all the others having joined the project at later times during 1991.

The mean cpue (kg/hr +/- 95% CL) for selected skippers along with the maximum and minimum cpue for a single fishing trip is shown in Figure 5. The mean cpue values all fall within the range 2.88 - 6.92 kg/hr, with the two highest values belonging to Ferguson Vae (6.92 kg/hr) and Albert (6.33 kg/hr). The mean cpue of Nathanial Koli (2.88 kg/hr) is significantly lower (as indicated by a comparison of the 95% CL) than those for Justin Mai (mean cpue = 5.18 kg/hr), David Lapa (6.07 kg/hr), Albert and Ferguson Vae, whilst the mean cpue of Zepheniah (3.20 kg/hr) is significantly lower than those for the latter three skippers.

The monthly mean cpue for the project boats is shown in Figure 6. For all boats, the monthly values are very variable with most showing a decrease in mean cpue over the period July 1991 - September 1992. Consistent with the results for mean cpue/boat for the whole period (Figure 4), apart from July - September 1991 and November 1991 - January 1992, the Nagalau boat displays the best performance.

3.3.2 Total catch, cpue and catch per grid reference and grades of fish

Figure 7 shows the total catch (kg) for each grid reference over the period July 1991 - February 1992. From this it can be seen that the grid references D4, E4, F1 and F2 provided the majority of the catch. However, comparison of this result with Figures 8 and 9 which show the fishing effort (hrs) and cpue (kg/hr) per grid reference, respectively, it can be seen that most fishing time was spent in these four sites and that in terms of cpue, the most profitable grid references would appear to have been B4, C6, C8 and B3.

Using the same division of the total fishing grounds into three sites as described in section 3.1, it can be seen (Figure 10) that the greatest catch over the period July 1991 - February 1992 was obtained from the Mahige/Ngalignagho/Fulakora area (5.719 tons), with the second largest catch from Thousand Ships Bay (2.9335 tons) and the smallest catch from the Ramos area (1.7375 tons) even though the latter is where the four highest values for cpue/grid reference occured.

Table 6. Skippers currently operating the five project boats (February 1992)

Project boat	Skippers	Abbreviation used in Figures
Tatamba	Albert	(A)
	Zepheniah	(Z)
	Justin Mai	(JM)
Takutu	Willie Katovai	(W)
	Ferguson Vae	(F)
(W. Katovai and F. Vae often operate the Takutu boat together, this is denoted by the abbreviation W/F in the Figures)		
Nagalau	David Lapa	(DL)
	Curthis Kikolo	(CK)
Poro	Mathew	(M)
Trimaran	Nathanial Koli	(NK)

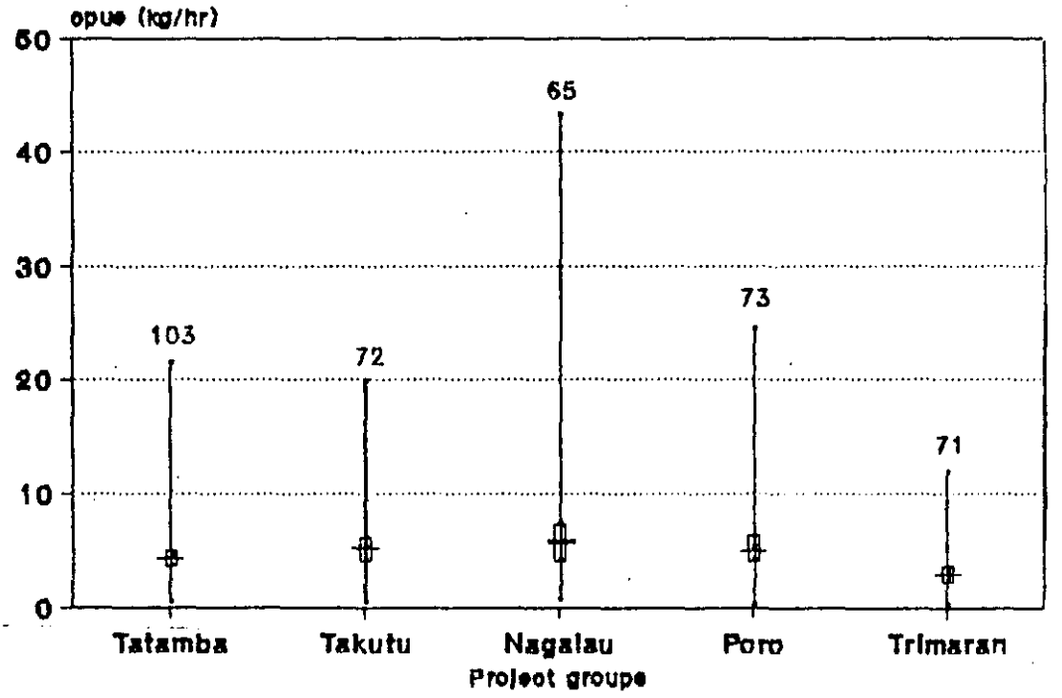


Figure 4. Mean cpue (kg/hr) for each project boat during the period March 1991 - February 1992. Boxes show the 95% confidence limits and the vertical lines show the maximum and minimum cpue for a single fishing trip. Numbers at the top indcate the number of fishing trips.

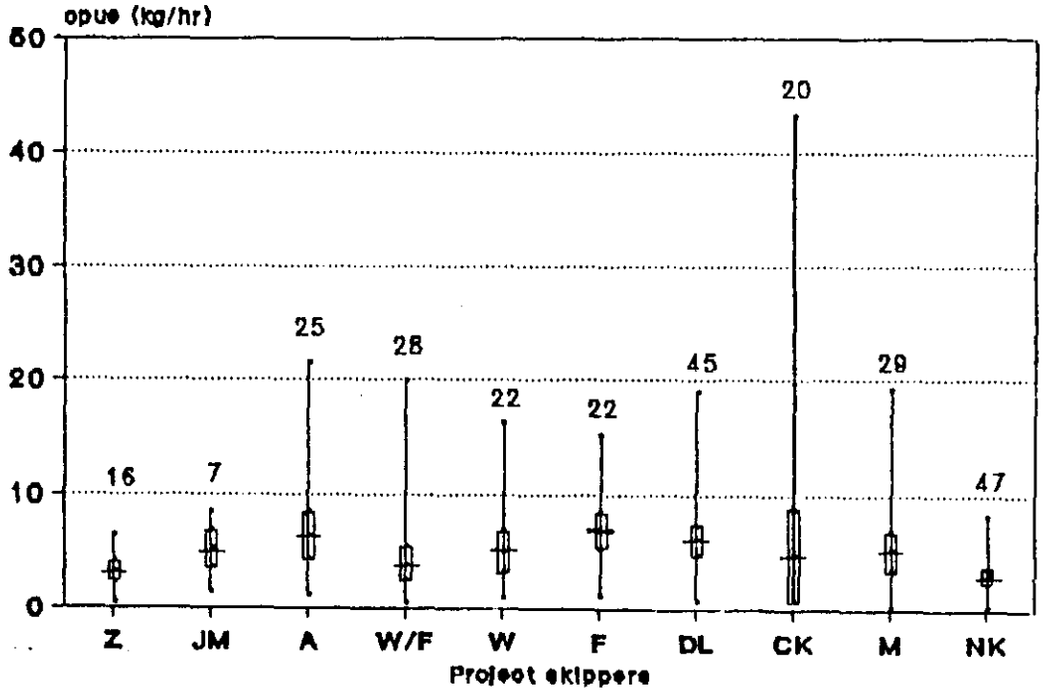


Figure 5. Mean cpue (kg/hr) for selected project skippers over the period March 1991 - February 1992. Boxes show 95% confidence limits, and the vertical lines show the maximum and minimum cpue for a single fishing trip. Numbers indicate the number of fishing trips undertaken by each skipper.

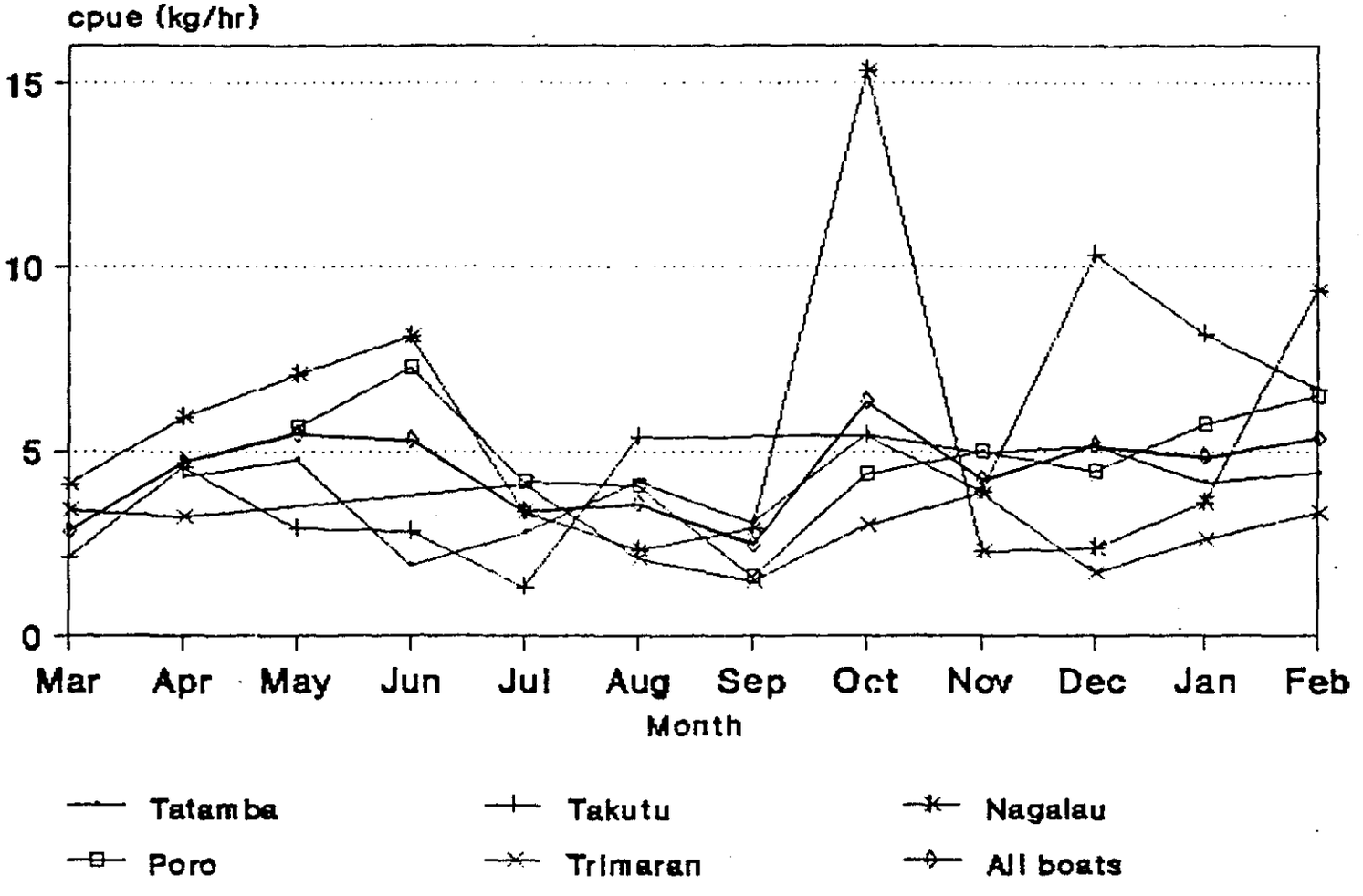


Figure 6. Mean cpue (kg/hr) per month for the project boats over the period March 1991 - February 1992.

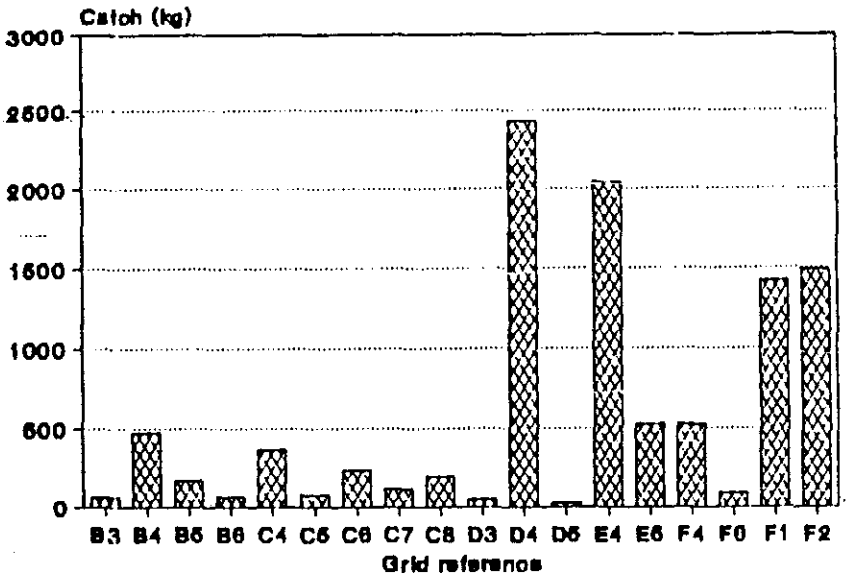


Figure 7.

Total catch (kg) for the project boats from each grid reference over the period July 1991 - February 1992.

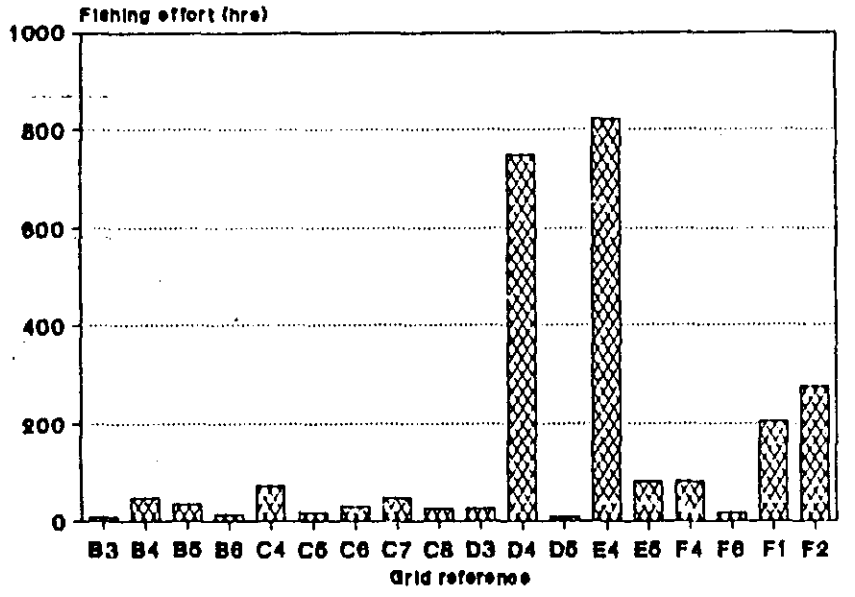


Figure 8.

Total fishing effort (hrs) of the project boats in each grid reference over the period July 1991 - February 1992.

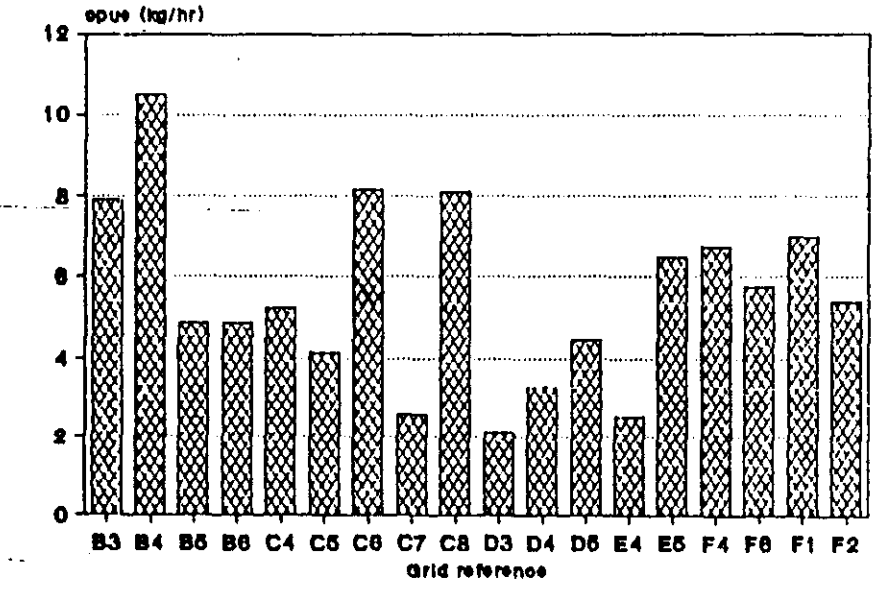


Figure 9.

cpue (kg/hr) per grid reference for the project boats over the period July 1991 - February 1992.

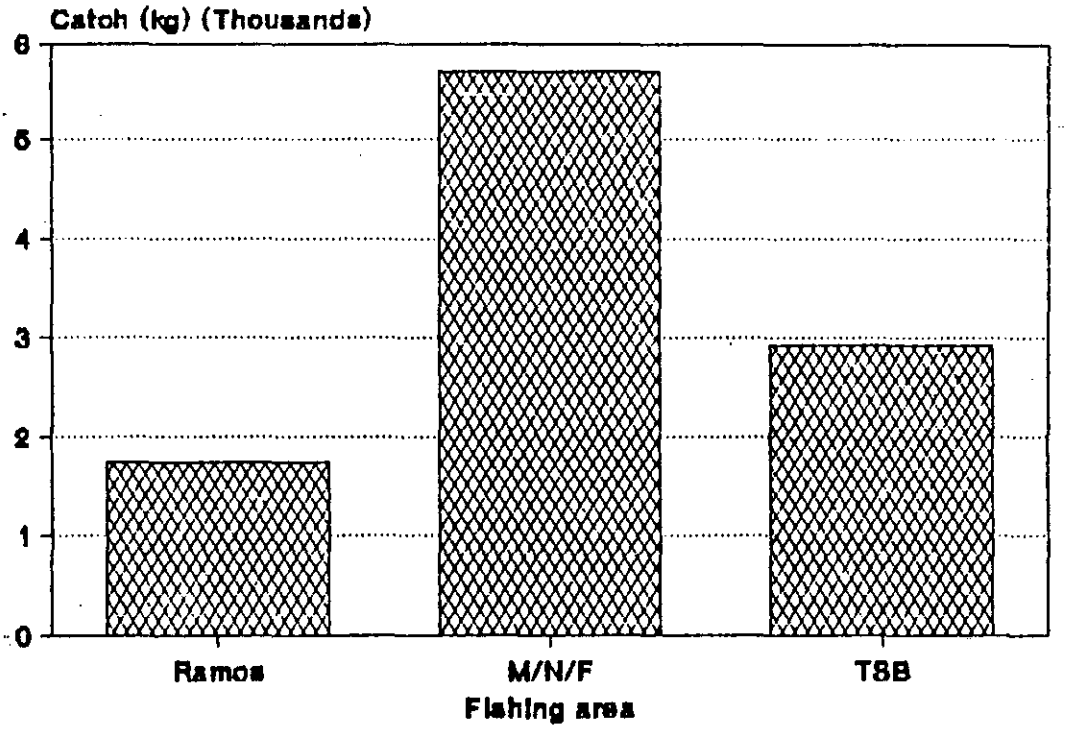


Figure 10. Total catch (kg x 1000) for the project boats from the (i) Ramos, (ii) Mahige/Ngalignagho/Fulakora (M/N/F), and (iii) Thousand Ships Bay (TSB) areas over the period July 1991 - February 1992.

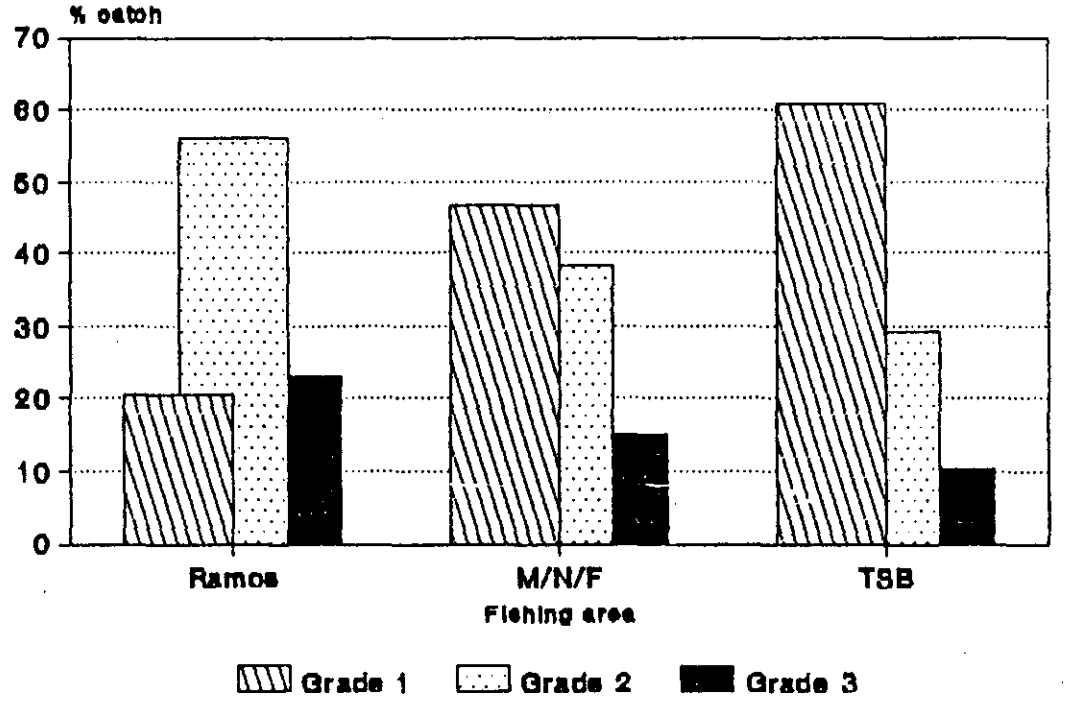


Figure 11. Proportion of each grade making up the total catch from the (i) Ramos, (ii) Mahige/Ngalignagho/Fulakora (M/N/F) and (iii) Thousand Ships Bay (TSB) areas over the period July 1991 - February 1992.

A breakdown of these catches into grades (Figure 11) shows that the greatest proportion of Grade 1 fish was caught in Thousand Ships Bay, while the highest proportion of Grade 2 fish was caught in the Ramos location. These results show a similar trend to the species composition of the three sites (section 3.1) even though the data for this was collected over a short period of time; over 59% of the catches examined from Thousand Ships Bay were made up of *Pristipomoides filamentosus* and *Lutjanus timorensis* (both Grade 1 fish), whereas the catches from Ramos were dominated by two Grade 2 fish, *Lutjanus gibbus* and *Lethrinus microdon* (over 56% of the catches examined).

Total catch (kg) per group over the period July 1991 - February 1992 (Figure 12) shows that the Tatamba boat achieved the highest catch, with the Trimaran obtaining the lowest catch. A breakdown of these catches/boat into grades (Figure 13) shows that despite the lower total catches of the Nagalau and Trimaran vessels, these boats caught the highest proportion of Grade 1 fish.

Figures 14-18 show (a) the catch (kg) and (b) the cpue (kg/hr) per grid reference for each project boat over the period July 1991 - February 1992. In most cases, as with Figures 7 and 9, these results indicate that the areas of highest catch/boat rarely coincide with the sites of greatest cpue. Although not shown in Figures 14-18, the figures for fishing effort (hrs/grid reference) for each boat show a similar result to the total effort/grid reference (Figure 8), with a general preference by individual boats for sites D4 and E4, with these two locations receiving the greatest fishing effort in all cases. The Tatamba boat has the highest effort in the Ramos area (94 hrs) while the Takutu boat has spent the longest time of all the vessels fishing in Thousand Ships Bay.

3.3.3 Troll fishing

As shown in Table 1, during the period March 1991 - February 1992, 16 troll fishing trips were undertaken by four of the project boats, with by far the largest proportion of these being carried out by the Poro group (11 trips).

The targest fish on trolling trips is primarily the Grade 1 Kingfish (*Scomberomorous commersoni*) and around the southern end of Isabel during the spawning migration of this species fish catches can be high. The mean cpue for the Poro group is 19.49 +/- 13.27 kg/hr, which is particularly high due to five very successful trips during February 1992. The mean cpue for the other three project boats lie in the range 1.40 - 2.50 kg/hr. For all the trolling trips undertaken, the maximum and minimum cpue for a

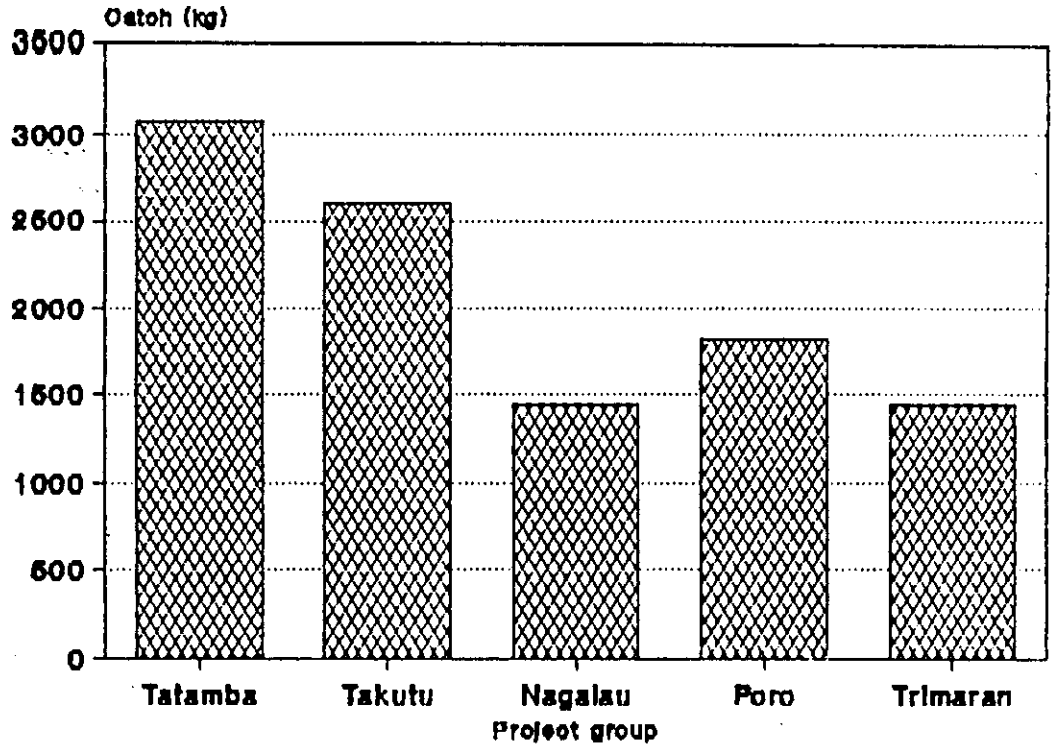


Figure 12. Total catch (kg) per project boat over the period July 1991 - February 1992.

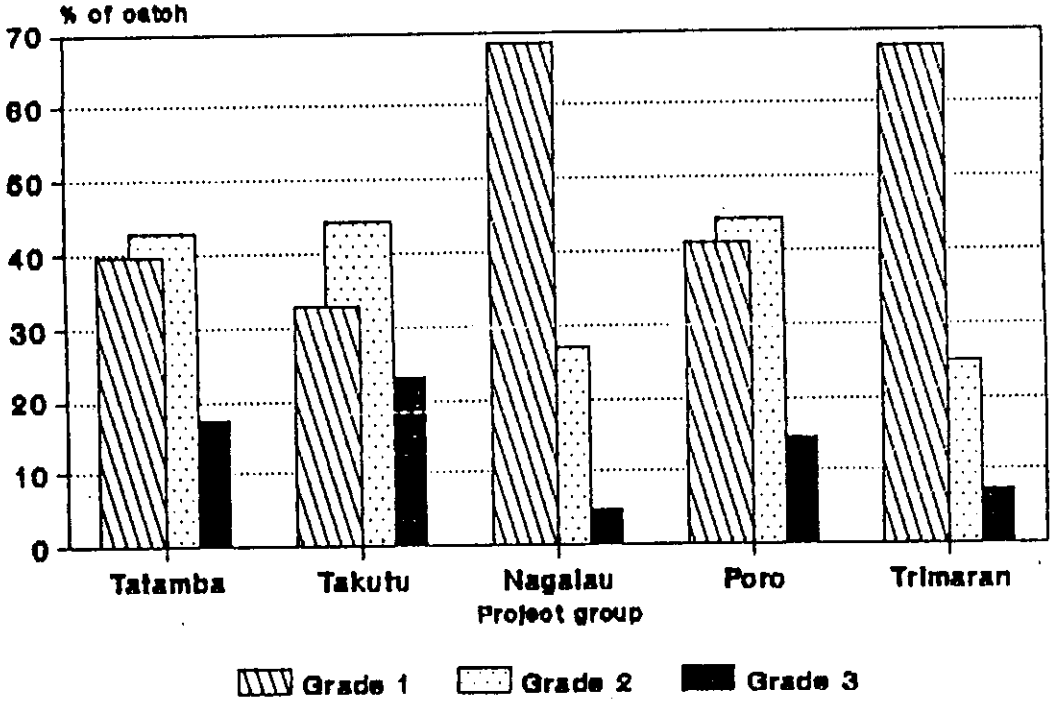


Figure 13. Proportion of each grade making up the total catch for each project boat over the period July 1991 - February 1992.

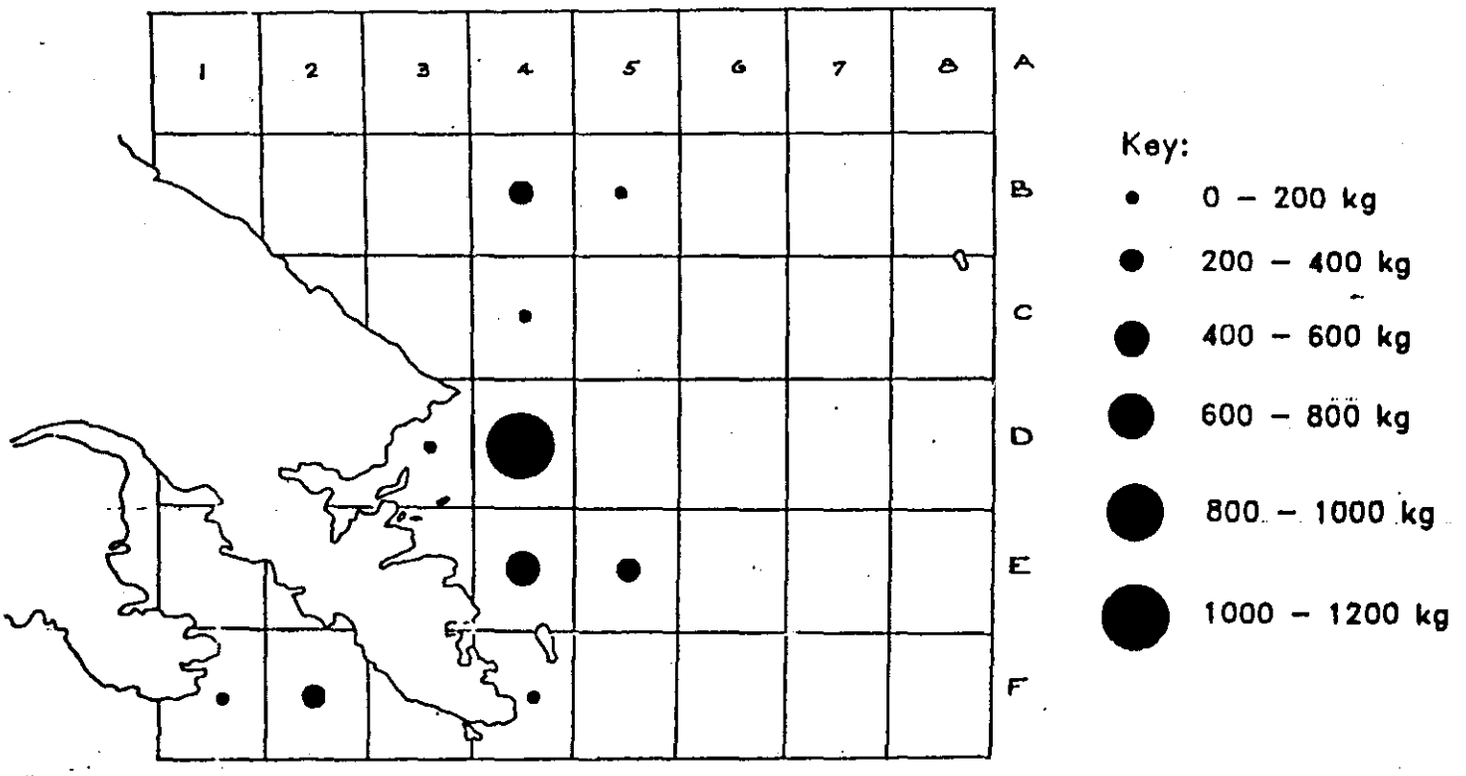


Figure 14(a).Catch/grid reference for the Tatamba boat (July 1991 - February 1992).

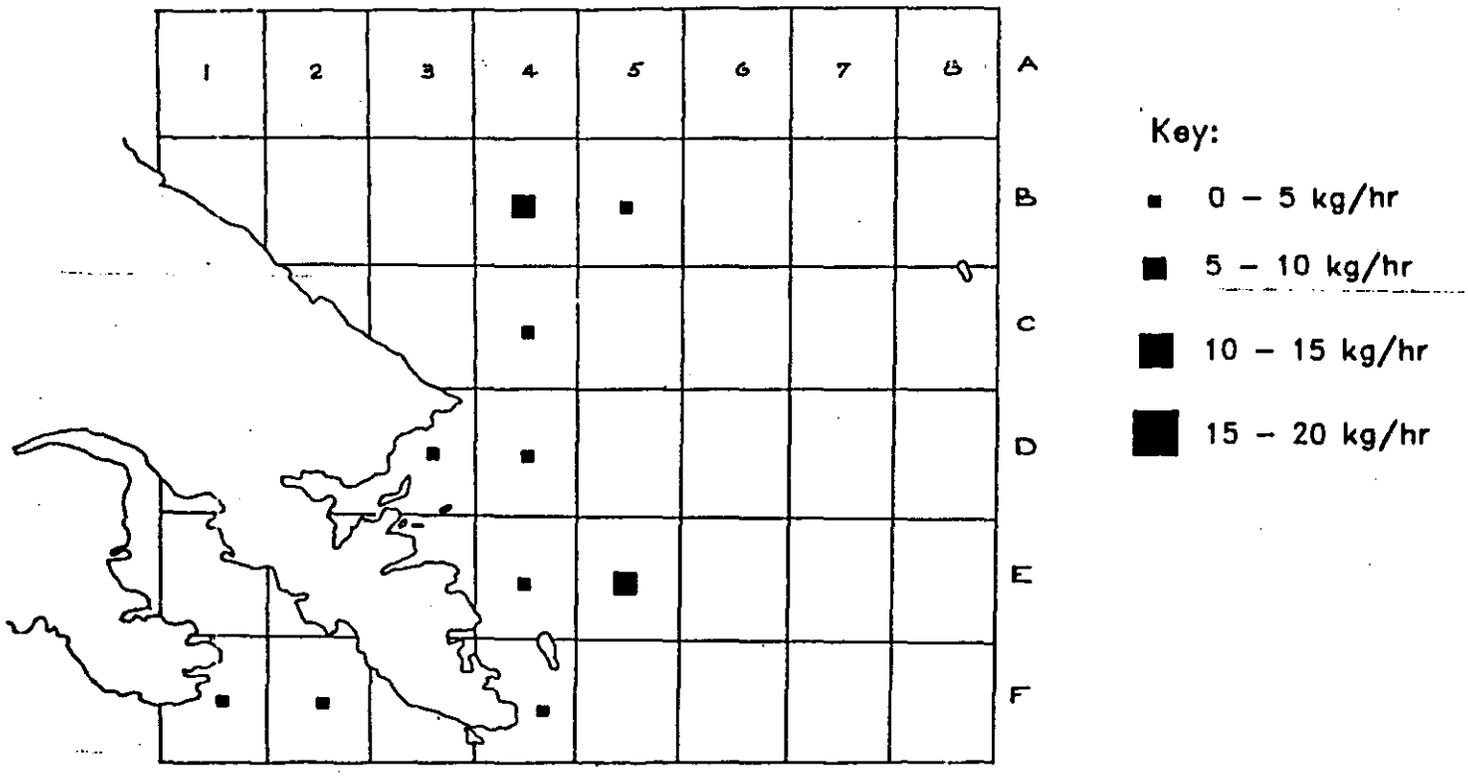


Figure 14(b). Mean cpue (kg/hr) per grid reference for the Tatamba boat (July 1991 - February 1992)

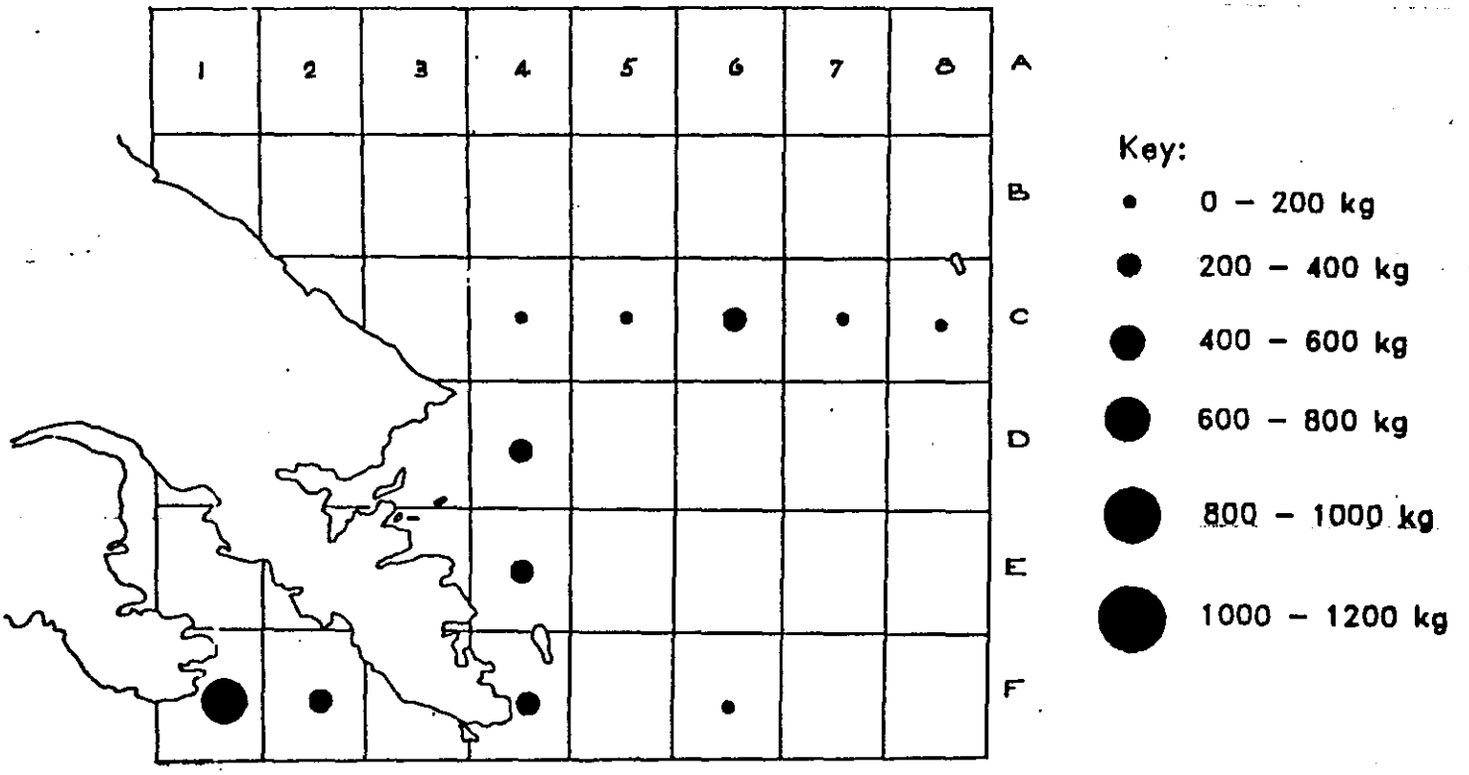


Figure 15(a). Catch/grid reference for the Takutu boat (July 1991 – February 1992).

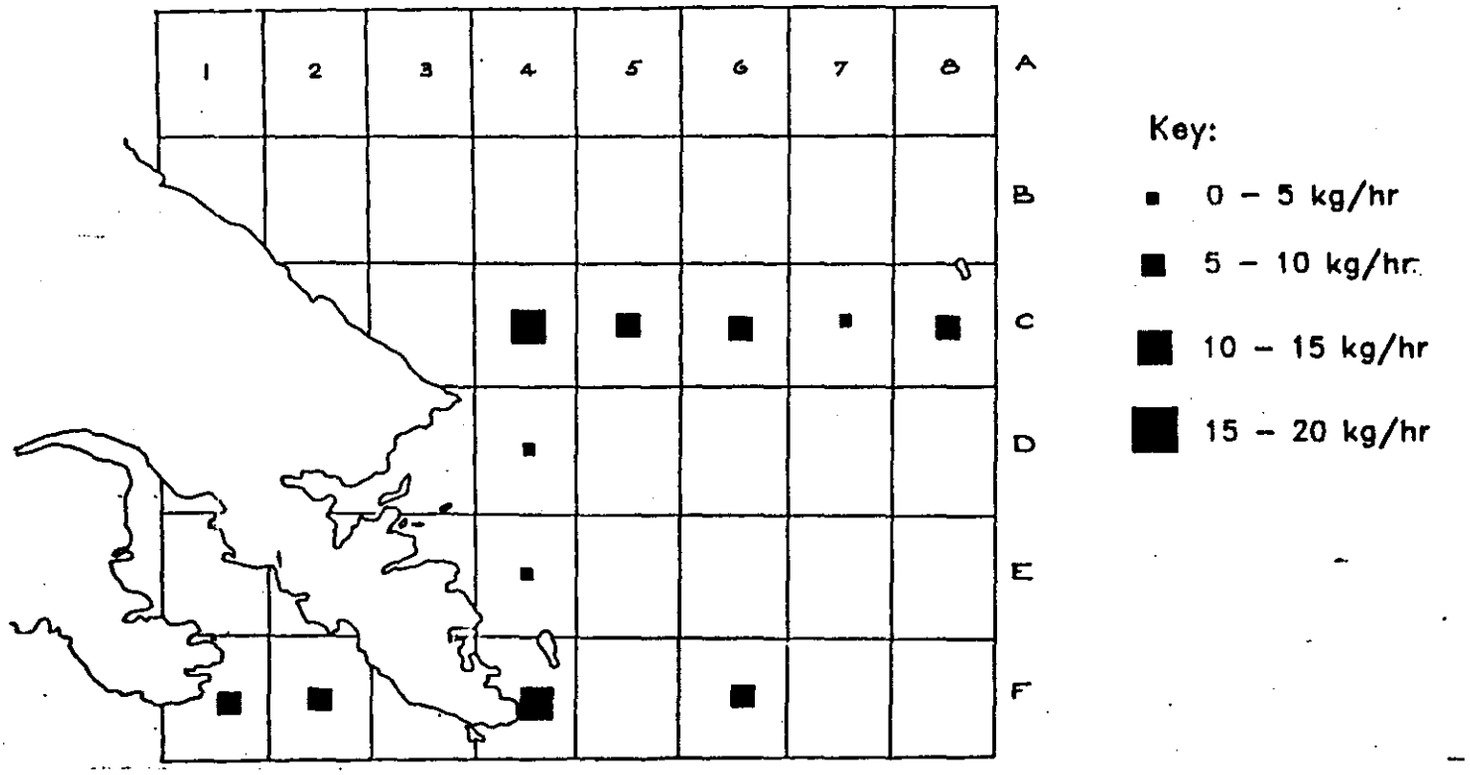


Figure 15(b). Mean cpue (kg/hr) per grid reference for the Takutu boat (July 1991 – February 1992)

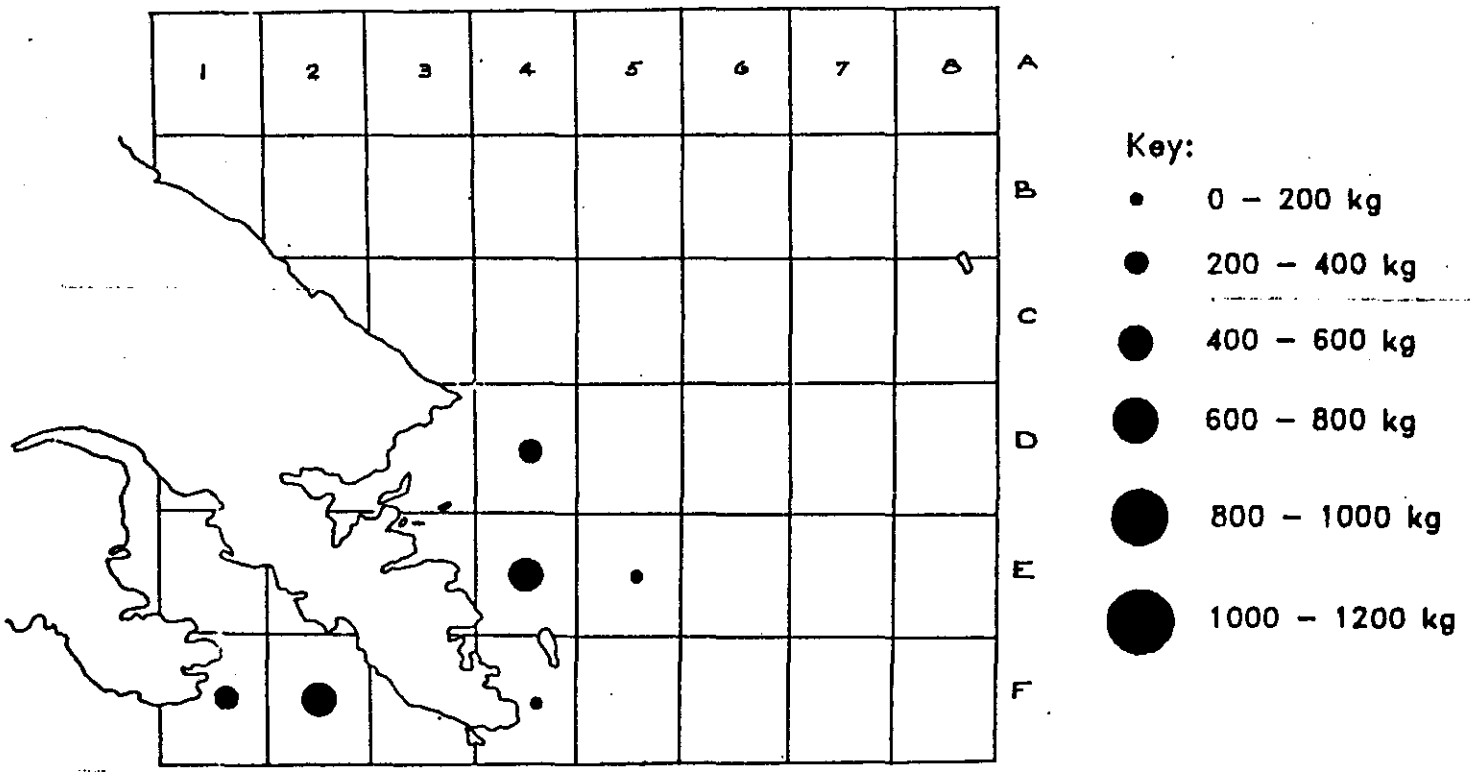


Figure 16(a). Catch/grid reference for the Nagalau boat (July 1991 - February 1992).

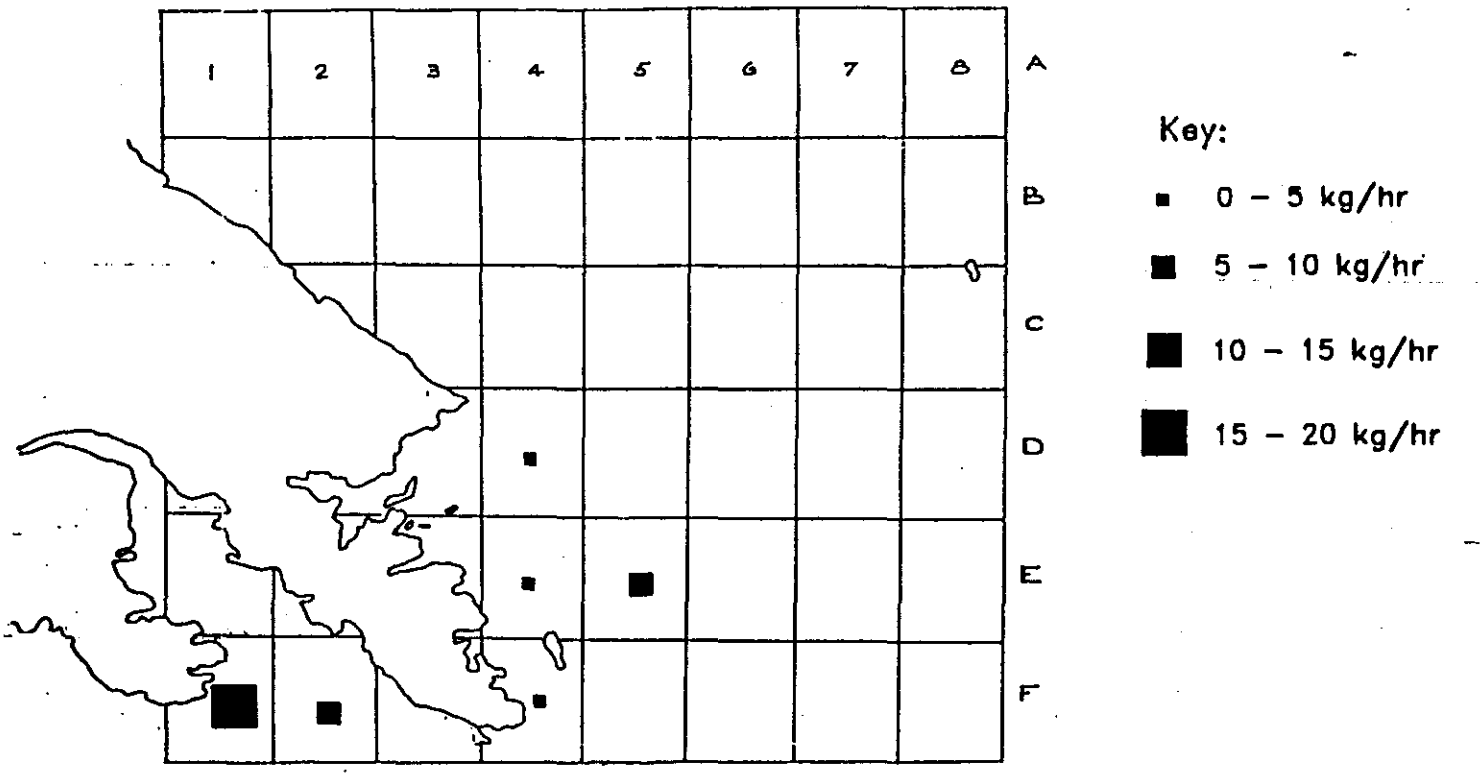


Figure 16(b). Mean cpue (kg/hr) per grid reference for the Nagalau boat (July 1991 - February 1992)

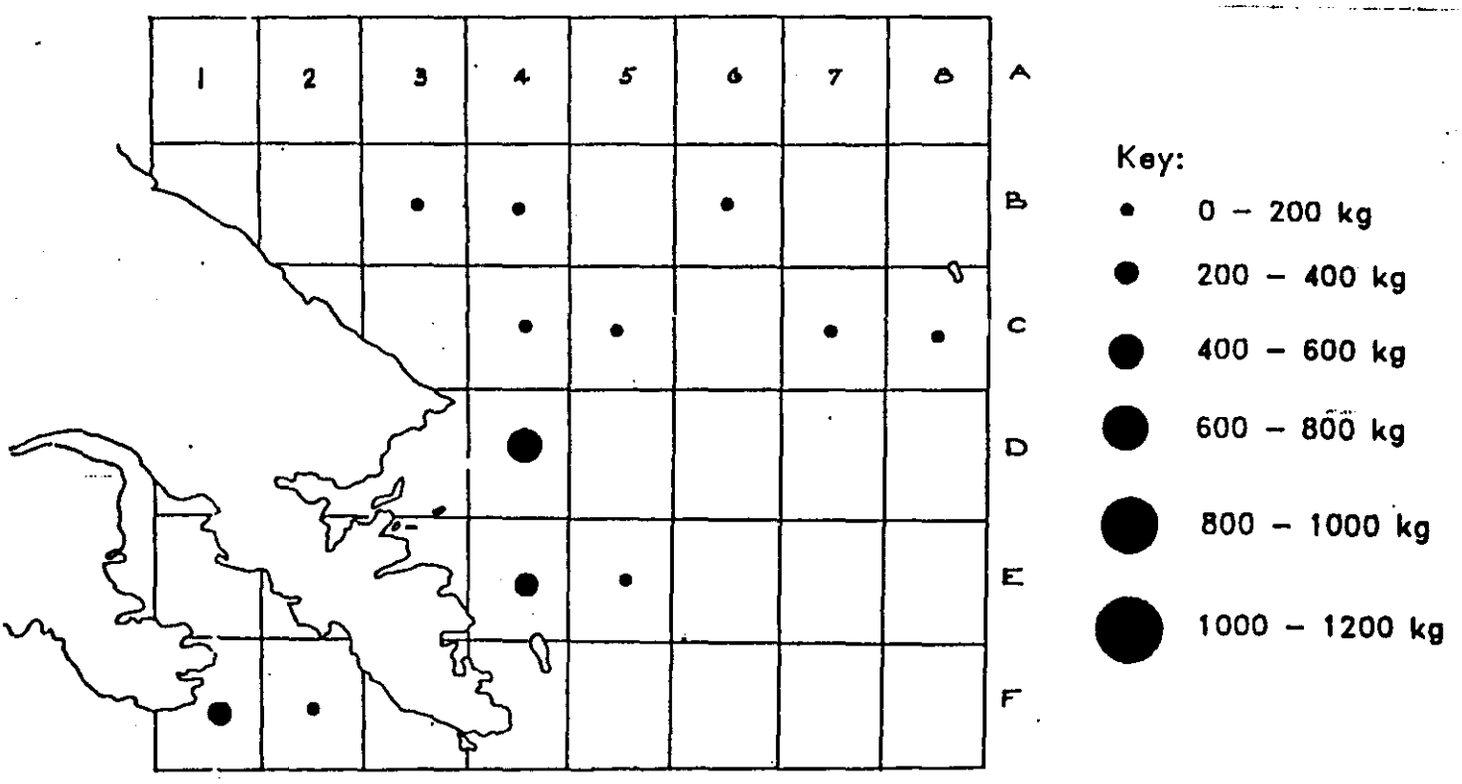


Figure 17(a). Catch/grid reference for the Poro boat (July 1991 - February 1992).

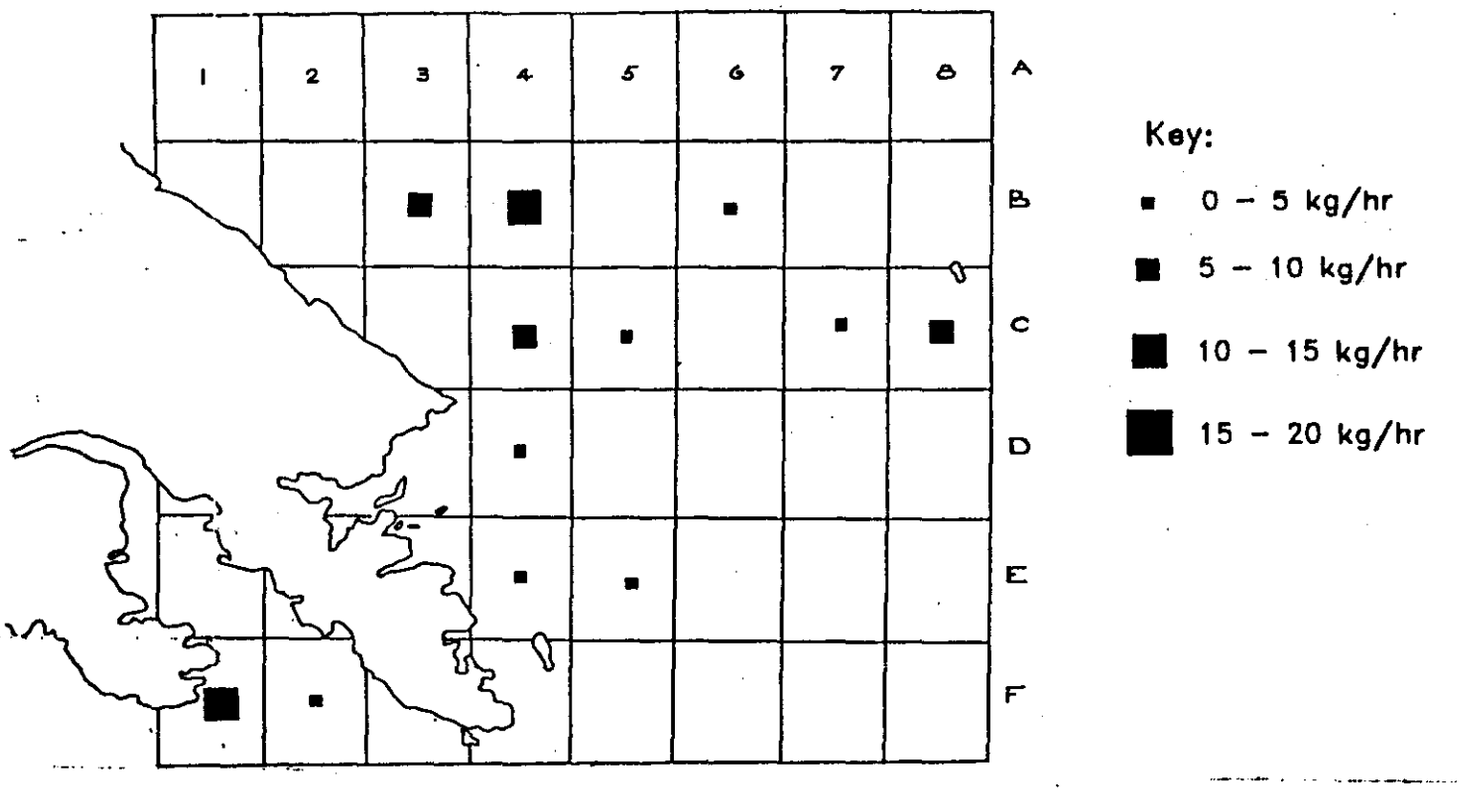


Figure 17(b). Mean cpue (kg/hr) per grid reference for the Poro boat (July 1991 - February 1992)

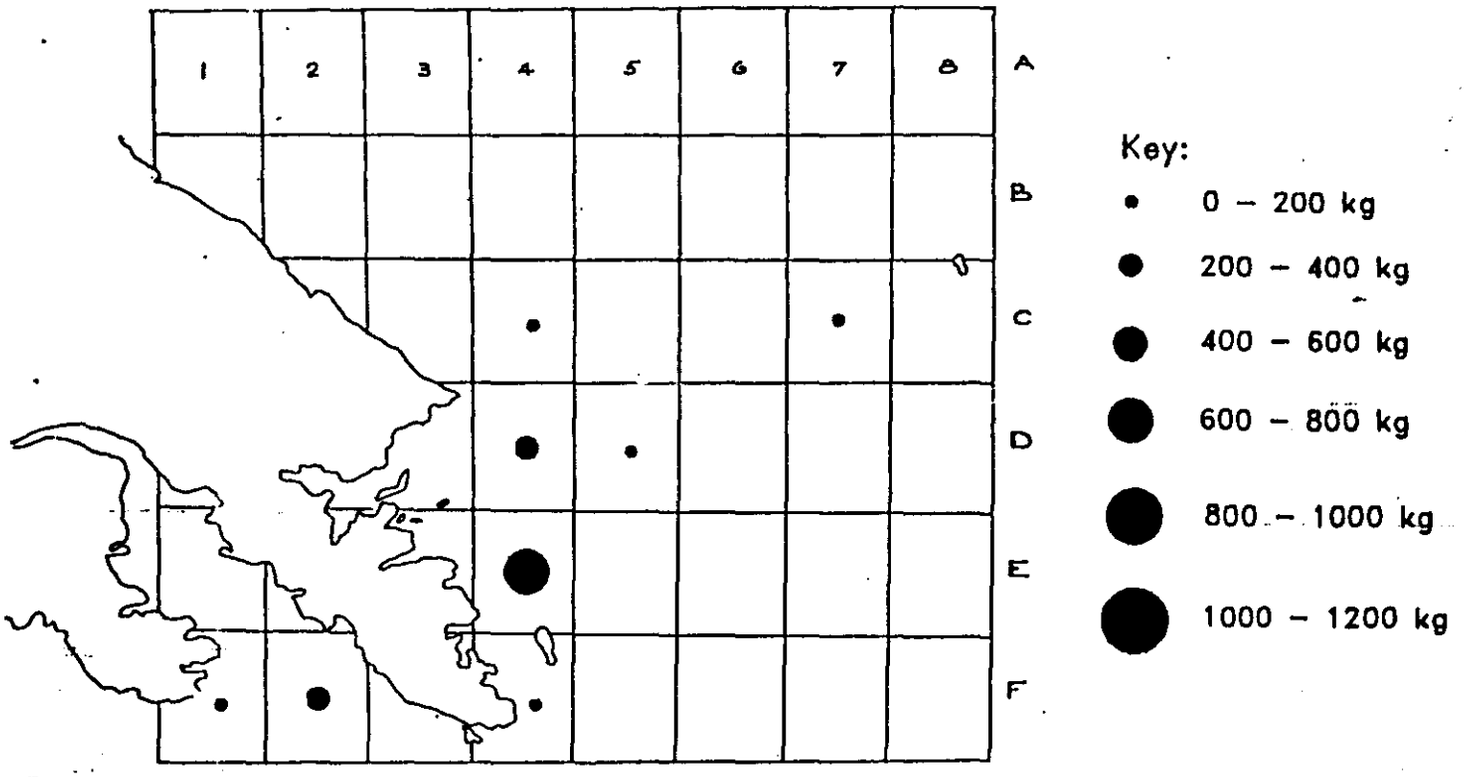


Figure 18(a). Catch/grid reference for the Trimaran (July 1991 - February 1992).

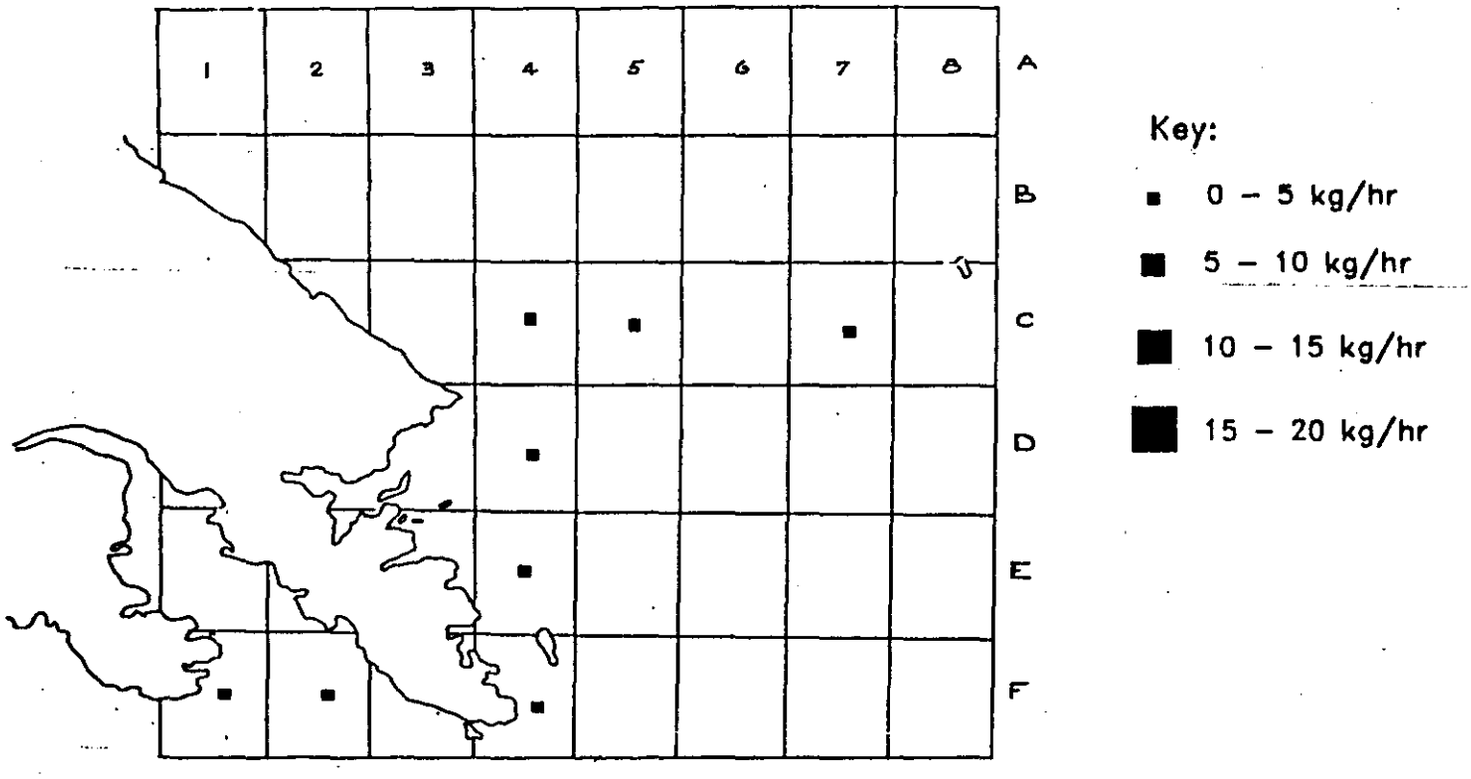


Figure 18(b). Mean cpue (kg/hr) per grid reference for the Trimaran (July 1991 - February 1992)

single fishing trip are 64.00 kg/hr and 1.40 kg/hr, respectively. It is interesting to note that all but two of the troll fishing trips by project boats were in grid reference D4.

4. Discussion

Although the results of the species composition survey carried out during the period 16.1.92 - 21.2.92 only provide data for the RFE project at that particular period of time during the fishing year, they do give an important 'snapshot' view of the catch being landed.

There are two factors of particular interest from the results on species composition and occurence (Table 2):

(i) The differences in the species composition of the catch landed from the Ramos, Mahige/Nalignagho/Fulakora and Thousand Ships Bay areas; and

(ii) the lack of several deepwater fishes (particularly snapper species such as *Etelis carbunculus*, *Etelis coruscens*, *Pristipomoides flavipinnis* and *Pristipomoides multidens*) that are generally reported as comprising a significant proportion of the catch from deep-bottom fisheries in other Pacific nations and from trial fishing surveys carried out in the Solomon Islands (Brouard & Grandperrin (1985), Cillaureen (1988), Itano (1988), Lewis, Sesewe & Adams (1988), Wata (1988)). Although *Aphareus rutilans* and *Etelis radiosus* were landed during the time of the study, they comprised only 5 individuals in the catches examined.

The values obtained for the growth parameters 'a' and 'b' in the length-weight relationship equation will assist any further length weight studies carried out at the Tatamba fishery by enabling an estimate of the catch to be made on the basis of fish lengths. It would be useful if any future studies are undertaken to ascertain the growth parameters for additional species.

The length-frequency distributions for the seven most abundant species in the catches examined (Figure 3) provide an indication of the maximum size of fish from these species that were measured. The values for the maximum and mean lengths recorded for the main species landed can help to provide an indication of the duration of fishing in one area; in a virgin stock, large individuals are more abundant and are more frequently caught compared with an area where a fishery has been established for some time. The maximum length of fish caught can also vary with the depth at which the fish resides, with smaller fish being more abundant in shallower water (e.g. <200m), although this is not true for all species. This phenomenon was not investigated during the current study.

Overall the catch data for the project boats over the period March 1991 - February 1992 shows quite a large amount of variation from trip to trip, and this is reflected in the montly cpue per project boat (Figure 6); however, due to the frequently clustered distribution of deepwater species, variable catches can generally be expected (Brouard & Grandperrin, 1985). While it does not appear that catch rates per boat have increased since the project started, as might be expected as skippers become more experienced with their equipment and a fishing technique that has many new aspects to it, these results need to be seen against the background of initial start-up problems, difficulties with fishing gear, and the occurance of a dispute over land ownership to the site of the fisheries centre at Tatamba, which caused the temporary closure of the project. An analysis of the catch rates over a second year of operation of the project is likely to provide a truer picture of the improvement, or otherwise, of the fishing activities of the project boats.

Even though the Tatamba and Takutu project boats had the highest total catches over the period July 1991 - February 1992 (Figure 12), from the results for mean cpue for each project boat and selected skippers (Figures 4 and 5), apart from a significantly lower mean cpue for the trimaran and two of the skippers, all the mean cpue values fall within a similar range.

If, bearing in mind the potential errors in choosing a unit of fishing effort (section 2.2) the mean cpue values are halved to provide a cpue value of kg/reel hour, it appears that although the catch rates for the RFE Tatamba project are similar or higher that those for artisanal droplining in the Solomon Islands (Wata, 1988), they are towards the bottom of the range for catch rates recorded from experimental bottom fishing surveys in the Solomon Islands (Wata, 1988) and deep bottom fisheries in other Pacific Islands (Brouard & Grandperrin, 1985).

Although the greatest fishing effort by the project boats has been concentrated in two grid reference sites (Figure 8) these locations do not correspond with those showing the highest cpue. However, the results for the grid reference sites with the greatest cpue were often based on records from <5 fishing trips and it is therefore really too early to determine any firm conclusions regarding the most profitable areas (in terms of cpue) of the available fishing grounds. For any given fishing trip, a skipper will have to weigh up the cost of travelling to a more distant fishing ground against the potential of obtaining a good catch. Many of the project skippers (and local fishermen) at Tatamba regard Thousand Ships Bay as being a prime fishing area; the highest proportion of grade 1 fish is obtained from this area (Figure 11) which will help contribute to a higher return for

the fishermen, and although the cpue for this area is not outstandingly high it is amongst the top 50% of cpue values per grid reference.

The stocks of deepwater fishes are potentially vulnerable to overexploitation, with those existing in deeper water appearing to be more sensitive to fishing pressure than those in shallower waater, although the shallow water species are more easily fished (Brouard & Grandperrin, 1985). Even though the total area of the possible fishing grounds for the Tatamba project is quite considerable and the current fishing effort and catch lower than that originally proposed for the project operation, to reduce the possibility of localised depletion of the stocks in the long term operation of the project it is desirable to ensure that fishing effort does not become concentrated in just one area.

There are many factors which influence the size and species composition of the catch, e.g. depth and time of fishing, seasonal fluctuations in the stock, skippers skill, gear efficiency, weather conditions, strength of currents, bottom substrate, bait quality and moon phase. With the current data available for the RFE project it would be impossible to carry out a thorough analysis of the effect of all these factors on the catch, and it is, therefore, difficult to explain the variation in species composition occuring in different areas. Brouard and Grandperrin (1985) carried out a detailed study on deep-bottom fishes in Vanuatu and showed that the abundance of different species varies with depth, and that some species show an upward nocturnal migration of 40-80m. They classified deep-bottom fish in Vanuatu into shallow species (<120m), intermediate species (120-240m) and deep species (>240m). From Figure 2(b) it can be seen that the depth indicated in the areas commonly fished by the project boats at Tatamba are <120m, and this may partly explain the absence or low catch of certain species which are generally found at depths >120m. Due to technical problems with the echo sounders fitted to the boats, fishing depth has usually only been estimated; therefore, although data on the depth of fishing is included on the fishing information sheets, it was felt that it was not sufficiently accurate for analysis of the catch data by depth.

Commercial fishing for deep-bottom species in Pacific nations has often occured without the initiation of any systematic recording system, and has therefore meant a lack of an information base upon which future development guidelines for such fisheries can be based. The establishment of a routine recording programme for the RFE project at the start of fishing operations is extremely valuable; needless to say, without the data from this no quantitative analysis of the fishing activities of the project boats could have been undertaken. It is important that this data collection process continues and every effort is made to ensure that the information recorded is as accurate as possible. The latter comment is made particularly in regard to the information re-

quired in the FIS regarding the duration of the fishing trip where it appeared there was some confusion as to the exact information required in each section.

For a greater understanding of the fish stocks exploited by the Tatamba fishery, it would be useful if additional studies e.g. on the species composition of the catch, sexual maturity of target species, affect of depth of the catch rate and species composition of the catch and the collection of length and weight measurements and data on length frequency distributions over a longer time period were undertaken. Given the frequently busy working schedule of the project and fisheries staff at Tatamba, it would be unreasonable to expect that a large proportion of time be devoted to this. It may, however, be possible to include in the routine weighing of the catch, the collection of length and weight data for a defined list of important target species which could be confidently identified by the fisheries staff.

The results given in this report only cover the fishing activities of the five project boats. There are, however, a considerable number of locally owned boats that are also involved in the fishery and, as their catch is a significant part of the total monthly catch landed at Tatamba (usually ≈50%), it would be useful to undertake a similar study on the fishing activities of these vessels as well.

5. References

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Appendix 1

Grades of selected species as in use during the time of the study

Grade 1

Aphareus rutilans
Aprion virescens
Etelis radiosus
Lutjanus malabaricus
Lutjanus rivulatus
Lutjanus sebae
Lutjanus timorensis
Pinjalo sp.
Pristipomoides filamentosus
Plectropomus leopardus
Gymnocranius robinsoni
Scomberomorus commersoni

Grade 2

Lutjanus bohar
Lutjanus gibbus
Lutjanus fulvus
Macolor spp.
Cephalopholis spp
Epinephalus spp.
Lethrinus spp.

Grade 3

Carangoides spp.
Caranx spp.
Euthynnus affinis
Sphyraena spp.