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Assessment of deep-bottom fishes of Solomon Islands

by

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INTRODUCTION

In keeping with Solomon Islands Govenment's (SIG) policy of decentralisation, increasing attention has been given to promoting fisheries development in rural areas. Whilst this development has created employment and cash-income opportunities in the rural areas, it has also resulted in the increase of fishing effort on reef and lagoon resources. To divert or reduce the effort on these resources, a number of fishing surveys have been executed to assess the potential of under-utilised fisheries resources. One such resource is the deep bottom fishes such as snappers and allied species.

A number of fishing surveys on deep bottom fishes have been carried out over the years, beginning with an experimental bottom fishing by Solomon Taiyo Ltd in 1976 (Honda, 1976). A list of such surveys include:

1. Experimental Bottom Fishing	1976	Solomon Taiyo Ltd
2. Deepwater Reef Fishing	1977-79	U.K. Government
3. Outer Reef Artisanal Fisheries Project	1978	SPC
4. North Malaita Deepwater Survey	1980	SIG
5. South Malaita Deepwater Survey	1980	SIG
6. Deepwater Survey	1981	SIG
7. Isabel Island Fishing Survey	1982	SIG

It was known from these surveys that a substantial resource of deep bottom snappers and other species exist in offshore bottom waters inhabiting sea mounts and reef slopes. In 1985, a six-month survey (January to June) on deep bottom fish was carried out. A brief report on this survey by the author (Wata, 1985) gives the objectives of the survey, the fishing activities and preliminary results.

Despite the findings of the several exploratory fishing surveys, the deep bottom fishery is still in the initiation phase of development. A prefeasibility study in Lambi (N.W Guadalcanal) and Russell Islands at the end of 1986 (Wata, 1986) has led to the establishment of a Coastal Bottom Fishery Project under the assistance of the Overseas Fishery Coorporation Foundation (OFCF) of Japan in 1988 to assess the suitability of fishing in the Lambi area.

This paper deals mainly with the data gathered in the 1985 six-month survey.

METHODS OF SURVEY

The general objective of the survey was to study the feasibility of deep bottom fishing in Solomon Islands and , among other things, to identify areas with concentrations of bottom fish. For this survey, the Kanagawa Prefectural Federation of Fisheries Cooperative Associations of Japan chartered the "DAIKATSU MARU" (29m, 100GRT).

The vessel was equipped with a wet paper echosounder and a chromascope fish finder which were used jointly in determining the suitable depths, bottom profiles and the fish density at the fishing grounds. Stehouwer (1981) provides a good description of the operation of the fish finder in a similar survey in Australia.

Fishing Methods

Two fishing methods employed during the survey were vertical longlining (droplining) and bottom longlining, with the former being the most commonly used. Seven electric reels were installed on the starboard gunwale but up to eight (and some times nine) fishermen could fish at any one time. An average of seven hooks per line or reel were used for droplining.

Bottom longlining was carried out in only few of the fishing grounds. An average of thirteen hooks per branch line and about 80 branch lines, spaced at about 20m intervals, were attached to the main line. The sea bed has to be relatively flat as an irregular bottom may result in fouling of the gear.

Taxonomy

The fish species caught were identified using such sources as Masuda et al (1975), FAO (1974) and Munro (1967). In cases where the scientific names differ, the tendency is to follow the South Pacific Commission publications (eg. Crossland, 1980). The snappers are all classified in the family Lutjanidae and not as in the separation by Brouard and Grandperrin (1985).

Data Collection

The data collected at the fishing grounds included the position, depth, gear type, fishing time and the total number and weight for each fish species as well as the total catch. These data are used in the catch and effort analysis.

For biological purposes, length (fork length) and weight data were recorded for most fish species that came on board. This data is used in length frequency distributions and length-weight relationships for the dominant species. Attempts were also made to collect otoliths, and to determine sexes and gonadal conditions but as the fish were sent to Japan for marketing studies, it was felt that as little damage as possible should be incurred on the fish. However, otoliths were collected for some of the abundant species (eg. Etelis coruscans, E.carbunculus).

Fishing Effort and Catch Rate

The unit of effort for droplining is expressed as reel-hour and the catch rate (catch per unit effort, cpue) as kilogram/reel-hour. To compare the catch rates between droplining and bottom longlining, the unit of effort is expressed as hook-hour (hk hr).

RESULTS AND DISCUSSION

Catch and Catch Rates

A total of nine fishing trips were undertaken during the survey period with trip lengths ranging from seven to nineteen days (average of 11 days/trip). Thirteen different fishing grounds (most of them being offshore seamounts) were fished but only six of them were visited more than once and showed good catches. These include Nura Island (Guadalcanal Province), South Russells (Central Province), Brougham Shoal (Western Province), North Malaita (Malaita Province), Three Sisters Islands (Makira Province) and Rua Dika Rock (between South Isabel and Florida Group). Data from areas of close proximity to each (eg. Ndai Island and seamounts and to tip of Malaita as North Malaita) have been grouped together.

The total catch was 49.5t for an average of 5.5t/trip. Table 1 lists the catch and catch rates at each fishing ground for both fishing methods. The catch rates for droplining varied from 3.0 kg/reel hr (N.W Vella la Vella) to 14.6 kg/reel hr (Rua Dika Rock) with an average of 10.2 kg/reel hr. For comparison, the catch rates for some of the work done by SPC Deep Sea Fisheries Development Project in member countries/territories are shown in Table 2 and Tables 3 and 4 list the summary of catch and catch rates in other surveys in Solomon Islands. The catch rate for a prefeasibility survey in 1986 (November-December) for the OFCF project are 2.72 kg/reel hr and 5.4 kg/reel hr for Lambi and Russell Islands respectively. When the catch rates in Solomon Islands are compared to those in other Pacific Island countries that have established a deep bottom fishery, they are similar or better at similar stages of development (exploratory fishing).

Using hook-hour as the unit effort to compare the two fishing methods, the catch rates vary from 0.4 to 2.0 (average 1.4) kg/hook hr 0.002 to 0.2 (average 0.04) kg/hook hr for droplining and bottom longlining respectively. It shows that droplining is a better fishing method than bottom longlining. It was also observed during the fishing operations that more than 90% of the bottom longline branch lines were discarded (except swivels and hooks) after hauling due to entanglements. Therefore, it can be said that it is an inefficient method in terms of catch rates and wastage of fishing gear.

Not all areas were fished to the same degree of effort. Most of the droplining effort was concentrated in Southern Russells (seamounts, not same area as in 1986 survey), North Malaita, Rua Dika, Brougham Shoal(seamount in the vicinity of Kavachi submarine volcano), Three Sisters Islands and Nura Island. For bottom longlining, significant catches were made at Nura, Brougham Shoal, North Malaita and Rua Dika. 79% and 41% of the catches at Nura (total catch, 6.4t) and Brougham Shoal (total catch, 8.3t) respectively were taken by bottom longlining.

Fig. 1 a and b shows the catch composition by area in terms of

numbers and weights. The same areas with high effort show high catches.

Species Composition and Relative Abundance

Six families of deep bottom fish are represented in the catch: Lutjanidae (snappers), Serranidae (groupers), Lethrinidae (emperors), Pentapodidae (breams), Carangidae (jacks, trevally) and Scombridae (tunas). Sharks were not recorded. The fish species caught and identified are listed in Table 5. More than sixty species were recorded. A large number of the species are snappers (27 species) followed by the serranids (16 species). Erythrocles schlegeli was caught only in N. Malaita.

The dominance of the snappers is indicated in Fig. 2 and Table 6 (bottom of table) which show that the family accounted for 82% and 81% of the catch by numbers and weight respectively. It is found in the tropical Pacific that lutjanids are dominant in catches of deep bottom fish (Crossland, 1980). Table 6 lists the fish species in decreasing numerical order in terms of total catch. The overall catch was dominated by Pristipomoides flavipinnis (19.2%), P.filamentosus (17.7%), Aphareus rutilans (11.3%), Paracaesio kusakarii (8.9%), Etelis coruscans (8.8%) and E.radiosus (6.9%). These six species of snappers alone make up about 73% and 72% of the numbers and weights of the total catch respectively. Gnathodentex mossambicus is the only other species that was caught in large numbers.

Table 6 also shows the total number and weight of each fish species by fishing area. However, the numerical order and, hence, the species composition varies with certain species being dominant in particular areas. Nevertheless, the same species appear in the catches as being common at most fishing grounds.

The family Pentapodidae is second in position to lutjanids in numerical abundance but is dominated by G.mossambicus. The carangids is composed mainly of Caranx lugubris and Seriola rivoliana. Whilst the serranids are dominated by Epinephelus morrhua and E.chlorostigma, the capture of the giant grouper, E.septemfasciatus (52 fish) accounts for 62% (1.2t) of the total weight (1.95t) for the family. The catch for the scombrids is represented mainly by Gymnosarda unicolor.

Fig. 3 shows the depth range of most of the identified species. Table 7 lists the species distribution by numbers and Fig. 4 is the plot of the same data for 14 species which shows the depth ranges of maximum concentration. Brouard and Granperrin (1985) classified deep bottom fish caught in Vanuatu into shallow (less than 120m), intermediate (120-240m) and deep species (greater than 240m) but the distinction is not quite clear for the results of our survey. However, the same authors suggested that vertical distribution may vary with location and season.

Length Studies

Fig. 5 shows the length frequency distribution for 9 species - Aphareus rutilans, Etelis coruscans, E.radiosus, E.carbunculus, Paracaesio kusakarii, Pristipomoides filamentosus, P.flavipinnis, Seriola rivoliana and Gnathodentex mossambicus. There appears to be two peaks in the lenth frequency distribution of P.flavipinnis but it became obvious late in the survey that P.multidens was included in the data for the species so the second peak may be for the latter species.

At the time of the survey (and even now), the deep bottom fish in the areas fished were hardly exploited so that large fish specimens were commonly seen in the catches. It was also observed in some of the subsequent trips to the same fishing grounds that the catches dropped and the size of the fish caught were smaller than previous trips. This observation supports the finding that deep bottom fish are vulnerable to exploitation (Brouard and Grandperrin, 1985).

The length-weight relationship is in the form:

$$W = aL^b$$

where W = weight (kg), L = length (cm), and a and b are growth coefficients. The values of a and b for 8 species are listed below.

Species	a	b
Aphareus rutilans	4.11×10^{-5}	2.74
Etelis carbunculus	2.61×10^{-5}	2.92
E.coruscans	4.40×10^{-5}	2.75
E.radiosus	3.96×10^{-5}	2.77
Gnathodentex mossambicus	4.28×10^{-5}	2.86
Paracaesio kusakarii	1.14×10^{-4}	2.54
P.stonei	2.12×10^{-4}	2.39
Pristipomoides filamentosus	3.61×10^{-5}	2.81

The establishment of length-weight relationships is to allow the estimation of of fish weights on the basis of fish lengths as the latter are relatively easier to measure on a moving boat.

Age determination

Due to the absence of facilities and expertise locally to read daily growth rings on the otoliths collected, it is not possible to determine the age of the fish species for which samples were extracted. Attempts were made for the otoliths to be read by outside institutions but was not successful.Attempts at using ELEFAN to estimate growth parameters from length frequency data were also not successful.

Using growth curves established for Vanuatu deep bottom fish (Brouard and Grandperrin, 1985), it can be extrapolated from our length frequency distributions that old Etelis coruscans (5-12

years) and E.carbunculus (8-14 years) were common in the catches.

CONCLUSIONS

The general aim of the survey was to study the feasibility of deep bottom fishing in Solomon Islands and to identify areas of concentrations of deep bottom fish. The main constraint to the identification of fishing grounds was the reluctancy of Provincial Governments to let the survey vessel to carry out trial fishing in waters under their jurisdiction (within 3 miles from low water mark). Most of the grounds fished were offshore seamounts which are inaccessible to small-scale fishermen. However, the survey was able to collect data that showed areas of concentrations of deep bottom fish, the catch rates and species depth distribution which should be useful to fisheermen.

Analysis of the catch data shows variable catch rates according to fishing grounds and from trip to trip. However, the overall results for each area fished showed good catch rates that compare well with those of other island countries (Table 2) and other surveys in Solomon Islands (Tables 3 and 4).

The species composition and relative abundance shows the dominance of the family Lutjanidae which make up the large bulk of the species, and total numbers and weights. The depth distribution by numbers shows the depths of most concentrations for most of the species. As all of the fishing was done during the day, no analysis could done on fluctations of C.P.U.E and distribution with regards to depth and time of day or night.

It is known that deep bottom fish are slow growing (eg. Brouard and Grandperrin, 1985) and vulnerable to exploitation. Thus, catch rates at this stage should not be expected to be sustained. Deep bottom fish on remote seamounts can be thought of as isolated or discrete and as such could be sequentially exploited by fishermen by fishing the nearby ones and moving on when catch rates drop. While the total catch may not show downward trends, the total resource may be depleted sequentially. Therefore, it is important to collect data for individual seamounts or outer reef slopes along the coast line.

No attempt has been made to estimate the production for Solomon Islands or particular fishing grounds using either the data collected or comparison with areas of similar environmental characteristics as has been done for Vanuatu (Brouard and Grandperrin, 1985).

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TABLE 1 DROPLINE AND BOTTOM LONGLINE SUMMARY OF EFFORT, CATCH AND CATCH RATES

FISHING AREA LOCATION	DROPLINE						BOTTOM LONGLINE				TOTAL AREA CATCH (KG)
	FISHING HOURS	CATCH (KG)	FISHING HOOK HOURS	EFFORT REEL HOURS	CATCH KG/ HK HR	RATE KG/ REEL HR	FISHING HOURS	CATCH (KG)	EFFORT HK HRS	CATCH RATE KG/HK HR	
HAMMONDSPORT BANK	7.8	564.1	472.3	67.6	1.2	8.3	0	0	0	0	564.1
SE.MARAU SOUND	0	0	0	0	0	0	3.2	7.7	3438.7	.002	7.7
NURA ISLAND	31.1	1354.4	1746.5	257.3	.8	5.3	65.8	5010.3	113316	.04	6364.7
N.MALAITA	99.2	7960.6	5700	802.5	1.4	9.9	19.1	1196.5	28016	.04	9157.1
W.FAUABU BAY	.5	7.8	21.7	3.1	.4	2.5	0	0	0	0	7.8
S.RUSSELLS	104.8	8805.5	6294.8	885.2	1.4	9.9	9.5	277.3	19998	.01	9082.8
BROUGHAM SHOAL	60.3	4898.6	4425.4	494.5	1.1	9.9	47.7	3398.4	75850	.04	8297
NW.VELLA	5	123	287.6	41.2	.4	3	0	0	0	0	123
EDWARDS BANK	10.9	1051.7	644.4	92.1	1.6	11.4	0	0	0	0	1051.7
THREE SISTERS	55.4	4439.5	3332.8	447.2	1.3	9.9	0	0	0	0	4439.5
STAR HARBOUR	13.7	1002.6	747.1	107.3	1.3	9.3	2.8	158.9	2541.5	.06	1161.5
SANTA CRUZ	8.6	566.2	490.6	68.8	1.2	8.2	0	0	0	0	566.2
RUA DIKA	62.2	7806.1	3968.9	534	2	14.6	3.6	866.6	5353.5	.2	8672.7
TOTAL/AVERAGE	459.5	38580	28132	3800.8	1.4	10.2	151.7	10916	248513	.04	49496

TABLE 2 SPC Deep Sea Fisheries Development Project Catch Rates

ountry	Catch Rates kg/reel hr	Author(s)
American Samoa	4.4	Mead (1978)
Niue (1978)	2.8	Fusimalohi (1978)
Niue (1979)	7.0	Mead (1980b)
Tonga (1978)	3.6	Mead (1575)
Tonga (1979)	5.7	Mead (1980a)
Solomon Is (Gizo)	5.7	Eginton & James (1979)
Tanna (Vanuatu)	3.1	Fusimalohi (1979)
Vanuatu (1980-1981)	6.2	Fusimalohi & Preston (1983)
Kosrae	9.6	Mead & Crossland (1979)
New Caledonia	7.6	Fusimalohi & Grandperrin (1979)
Yap	6.9	Mead & Crossland (1980)
New Britain (PNG)	4.9	Fusimalohi & Crossland (1980)
Truk	4.1	Taumaia & Crossland (1980)
Palau	3.3	Taumaia & Crossland (1980)
Fiji	9.3	Mead (1980c)
Kiribati	7.2	Taumaia & Gentle (1983)

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Fiji	9.3	Mead (1980c)
Kiribati	7.2	Taumaia & Gentle (1983)

TABLE 3 SUMMARY OF GEAR-SPECIFIC CATCH RATES DATA - DROPLINING

REF.No	LOCATION PROV/FISHING GROUND	TYPE OF FISHING	DATE	GEAR SPECIFICATION	DEPTH RANGE FISHED (M)	EFFORT MAN-HRS /REEL-HRS	CATCH (KG)	CATCH COMPOSITION	C.P.U.E (KG/MAN OR REEL-HR)
1	RINGI COVE WESTERN PROV.	ARTISAN	3/76-6/76	NOT AVAILABLE (NA)	NA	1049	3283	MIXED REEF FISH	3.1
1	"	"	"	"	"	38	105	——"——	2.8
1	"	"	"	"	"	1560	988	——"——	.6
2	GHIZO(Various) WESTERN PROV.	SURV/ COMM.	'78-'79	ELECTRIC REELS (2); 3 HOOKS/REEL OR LINE	NA	NA	12005	DEEP WATER SNAPPERS JACKS	1.7
3	MANDY/RAMOS BK	SURV	3/80-4/80	HAND OPERATED REELS(2) WITH 200-400LB B.S NYLON LINES, 2 HOOKS/LINE	7-36	70	271	MIXED BOTTOM FISH	3.9
3	MANDY/RAMOS BK		"	——"——	"	144	761	——"——	5.3
3	SUAVA BAY, N.MALAITA	SURV	3/80-4/80		100-400	96	146	DEEP WATER SNAPPERS EMPERORS, JACKS	1.5
	——"——	SURV	"	——"——	100-400	80	77	——"——	1
3	MBITA'AMA, N.MALAITA	SURV	3/80-4/80		"	48	39	——"——	.8
	——"——	SURV	"	——"——	"	96	104	——"——	1.1
3	BASAKANA IS., N.MALAITA	SURV	"	——"——	"	72	121	——"——	1.7
3	WAISISI, S.MALAITA	SURV	4/80-5/80	——"——	"	5	16	——"——	3.2
3	ROHINARI, S.MALAITA	SURV	"	——"——	"	48	83	——"——	1.7
3	——"——	SURV	"	——"——	"	120	240	——"——	2
3	ROKEKA, S.MALAITA	SURV	"	——"——	"	24	32	——"——	1.3
4	S.MALAITA (VARIOUS)	SURV	3/80-7/80	HAND OPERATED REELS(4) WITH 90-120KG B.S NYLON LINES, 3 MUSTAD TUNA CIRCLE HOOKS (NO.6) PER LINE	75-250	301	902	——"——	3
4	E.MALAITA (VARIOUS)	SURV	"	——"——	"	204	470	——"——	2.3
4	FAUABU-FIU, W.MALAITA	SURV	"	——"——	"	625	874	——"——	1.4
4	KIU-KOA'A, W.MALAITA	SURV	"	——"——	"	346	855	——"——	2.5
4	LANGA LANGA, MALAITA	SURV	"	——"——	"	296	196	——"——	.7
5	ISABEL MAHINGE IS.,	SURV	6/82	HAND OPERATED REELS(4) WITH 250m, 80Kg B.S NYLON LINE, 3 HOOKS, MUSTAD TUNA CIRCLE NOS. 3-7	130-140	12	22	——"——	1.9
5	MANDY/RAMOS BK	SURV	"	——"——	38	32	246	——"——	7.7
5	TATABA,			——"——	78-180	32	12	——"——	.4
5	BAOLO REEF,	SURV	"	——"——	100-150	8	33	——"——	4.1
5	"	SURV	"	——"——(2 REELS ONLY)	40	6	39	——"——	6.5
5	HETA-HETA IS.,	SURV	"	——"——(4 REELS ONLY)	60-100	18	54	——"——	3
6	S.W. RUSSELLS CENTRAL PROV.	SURV	1/84	——"——	160-400	36	44	——"——	1.2
6	NW.GUADALCANAL	SURV	"	——"——	180-260	8	3	——"——	.4
6	NW.FLORIDAS, CENTRAL PROV.	SURV	"	——"——	150-230	20	36	——"——	1.8

ABBREVIATIONS:
ARTISAN- ARTISANAL FISHING
SURV- SURVEY FISHING
COMM- SMALL-SCALE COMMERCIAL FISHING
NA- NOT AVAILABLE

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TABLE 4 EXPERIMENTAL BOTTOM FISHING GYOSHU MARU (SOLOMON TAIYO LTD), 1976

DATE	AREA(S)	DEPTH RANGE(m)	NO. REELS	NO. HOOK	TIME (HOUR)	CATCH (KG)	KG/REEL HR
1-6 Oct	N.MALAITA	100-350	8	5-6	?	535	?
8-16 Oct	TOTAL	100-350	8	5-6	?	1535	?
	RUA SURA					100	
	UGI IS					700	
	3 SISTERS					15	
	S.MALAITA					720	
17-21 Oct	N.MALAITA	100-350	8	5-6	?	495	?
23-31 Oct	TOTAL	100-350	8	5-6	13.5	210	1.94
	N.ISABEL		8		4	100	3.13
	W.MALAITA		8		3.5	80	2.86
	E.FLORIDA		8		3	30	1.25
2-8 Nov	TOTAL	100-350	8	5-6	16	1590	12.42
	W.GUADALCANAL		8		?	20	
	S.VANGUNU		8		8	1350	21.09
	SW.RUSSELLS		8		3	150	6.25
	S.RENDOVA/TETEPARI		8		2	30	1.88
	S.VONAVONA		8		3	40	1.67
9-14 Nov	TOTAL	100-350	8	5-6	10	1625	20.31
	GIZO		8		?	275	
	S.SIMBO		8		3	300	12.50
	W.RANNONGA		8		?	50	
	W.VELLA		8		7	1000	17.86
15-22 Nov	TOTAL	280-350	8	5-6	10	500	6.25
	MONO		8		?	30	
	S.SHORTLANDS		8		6	170	3.54
	W.VELLA		8		4	300	9.38
23-28 Nov	N.ISABEL	280-350	8	5-6	19	2070	13.62
	BANK 1	07125158315	8		5	630	15.75
	BANK 2	07465159425	8		7	340	6.07
	BANK 3	08165159565	8		7	1100	19.64
TOTAL						8550	

Table 5. Common Fish Species Caught During the Survey

Scientific name	English name	Japanese name
LUTJANIDAE		
Aphareus rutilans	small-tooth jobfish	oguchi-isi-chibiki
Aprion virescens	green jobfish	
E.carbunculus	short-tailed red snapper	hachijo-akamutsu
E.coruscans	long-tailed red snapper	onagadai
E.radiosus	long-jaw red snapper	
Lutjanus bohar	red bass	
L.gibbus	paddletail seaperch	
L.kasmira	blue-lined seaperch	
L.sanguineus		
Paracaesio caeruleus		aodai
P.kusakarii	Kusakar's fusilier	shima-aodai
P.stonei	Stone's fusilier	
P.xanthurus		
Pinjalo sp.		
Pristipomoides auricilla	gold-tailed jobfish	
P.filamentosus	rosy jobfish	hime-edai
P.multidens		
P.flavipinnis	yellow jobfish	kimefu-edai
P.sieboldi	jobfish	
Lipocheilus carnolabrum		
Tropidinius argyrogrammicus	large-eyed flower snapper	
T.zonatus	banded flower snapper	shima-chibiki
SERRANIDAE		
Cephalopholis aurantius	orange rock-cod	
C.igarasiensis		
C.sonnerati	tomato rock-cod	
Epinephelus chlorostigma	brown-spotted grouper	hoseki hata
E.hoedti		
E.morrhua	brown-striped grouper	hata
E.septemfasciatus	giant grouper	
Saloptia powelli		
Variola louti	lunartail rock-cod	
LETHRINIDAE		
Lethrinus kallopterus		
L.miniatus	long-nosed emperor	kitunefu-efuki
L.rubrioperculatus		
PENTAPODIDAE		
Gnathodentex mossambicus	large-eyed bream	kokenokogiri
Gymnocranius griseus		
G.japonicus		
G.robinsoni		

Table 5. (continued)

CARANGIDAE		
Caranx ferdau		
C.ignobilis	lowly trevally	
C.lugubris	black trevally	
C.melampygus	bluefin trevally	
Elegatis bipinnulatus	rainbow runner	
Seriola rivoliana	deepwater amberjack	hirenaga-kampachi
SCOMBRIDAE		
Euthynnus affinis	island bonito, mackerel tuna	
Gymnosarda unicolor	dogtooth tuna	iso-maguru
Katsuwonus pelamis	skipjack	katsuo
OTHER SPECIES		
Ariomma evermanni		
Erythrocles schlegeli	red fish (protractile mouth)	akasaba

TABLE 6. Species Composition and Abundance

Species	Hammondsport Bank		Nura Island		South Russells		Broughton Shoal		North Malaita		Ano Bika		Edwards Bank		Three Sisters		Star Harbour		Santa Cruz		Other Areas		Total		% Composition	
	No.	Wt(kg)	No.	Wt(kg)	No.	Wt(kg)	No.	Wt(kg)	No.	Wt(kg)	No.	Wt(kg)	No.	Wt(kg)	No.	Wt(kg)	No.	Wt(kg)	No.	Wt(kg)	No.	Wt(kg)	No.	Wt(kg)	No.	Wt
Pristipomoides flavipinnis	0	0.0	77	120.3	474	460.3	422	420.3	85	111.1	1050	5695.2	77	71.0	294	286.9	80	155.1	44	50.0	0	0.0	3411	7387.0	19.23	14.93
P. filamentosus	6	10.5	38	49.5	722	1053.5	1041	1780.5	121	171.3	299	767.1	10	21.1	795	1546.0	96	100.0	53	63.1	1	0.7	3132	5492.1	17.66	11.10
Aphareus rutilans	1	2.4	355	1665.0	774	2963.9	160	447.6	40	145.7	286	830.4	49	204.1	202	950.3	104	460.6	40	179.4	0	0.0	2011	7857.4	11.34	15.87
Paracaesio kusakarii	5	11.6	359	979.7	621	1419.3	236	833.9	142	437.3	28	80.6	72	150.1	91	237.4	15	37.9	5	14.0	0	0.0	1574	4210.6	8.87	8.51
Etelis coruscans	0	0.0	376	1608.0	105	897.9	333	919.3	596	2205.9	6	24.0	6	0.6	91	174.2	15	44.3	9	26.0	1	0.5	1560	5917.5	8.84	11.96
Etelis radiosus	0	0.0	69	385.6	123	544.5	290	862.5	564	2393.7	76	279.0	15	54.6	10	64.4	53	162.7	4	16.9	2	16.5	1222	4781.2	6.89	9.58
Gnathodentex mossambicus	5	15.4	122	122.4	253	290.7	389	595.3	85	118.6	54	80.7	57	83.2	122	210.0	37	53.4	2	2.4	5	4.7	1131	1574.0	6.38	3.18
Etelis carbunculus	0	0.0	63	243.0	49	176.9	80	440.9	279	1632.7	9	25.1	0	0.0	14	76.7	28	43.4	3	4.7	1	6.4	526	2649.0	2.97	5.35
Paracaesio stonei	0	0.0	85	180.2	64	106.2	173	279.1	67	74.0	0	0.0	22	26.3	29	47.3	7	11.2	5	0.0	0	0.0	452	653.1	2.55	1.32
Gymnosarda unicolor	9	63.1	55	406.3	27	214.0	42	221.0	60	416.6	33	163.5	37	174.0	50	252.1	1	0.3	11	60.6	2	10.1	327	1999.2	1.84	4.04
Elagatis bipinnulatus	21	30.9	1	4.0	53	142.3	97	274.7	25	56.1	1	3.2	10	41.0	0	0.0	0	0.0	10	30.2	10	52.6	252	651.0	1.42	1.32
Seriola rivoliana	2	6.7	38	222.3	10	120.0	62	310.0	8	46.0	67	346.2	4	17.7	24	76.7	0	36.1	4	16.2	0	0.0	235	1280.3	1.32	2.44
Epinephelus morrhua	0	0.0	17	39.1	52	70.0	30	59.3	15	32.6	50	73.1	7	10.2	21	34.6	6	10.9	2	3.6	0	0.0	200	350.2	1.17	0.71
Caranx lugubris	26	94.7	7	26.9	28	83.0	31	95.1	40	122.9	0	0.0	33	80.6	29	83.4	0	0.0	5	12.9	2	7.0	201	615.3	1.13	1.24
Epinephelus chlorostigma	0	0.0	27	50.3	35	52.0	52	70.6	3	7.0	24	40.1	1	2.4	11	16.2	7	13.0	0	0.0	0	0.0	160	261.2	0.90	0.53
Lethrinus miniatus	0	0.0	9	20.1	26	83.2	32	133.9	11	30.9	24	70.5	7	23.6	42	179.3	1	6.2	3	11.2	0	0.0	155	582.9	0.87	1.18
Paracaesio caeruleus	0	0.0	25	14.0	66	57.0	16	13.0	6	4.5	3	2.2	3	1.9	24	16.1	2	1.0	1	1.1	0	0.0	146	114.0	0.82	0.23
Tropidinius zonatus	2	1.4	37	20.7	17	13.0	24	10.4	12	0.0	0	0.0	4	3.1	19	13.0	2	1.4	6	5.4	0	0.0	123	93.2	0.69	0.19
Lutjanus bohar	64	130.2	0	0.0	4	23.4	15	63.5	15	57.5	1	5.0	4	22.0	4	25.7	0	0.0	0	0.0	5	11.0	112	346.3	0.63	0.70
Tropidinius argyrogrammicus	0	0.0	30	10.7	17	7.1	13	4.5	4	1.2	1	0.3	1	0.5	2	0.6	0	0.0	3	0.0	0	0.0	71	25.7	0.40	0.05
Ariomma evermanni	0	0.0	27	132.1	11	47.0	19	61.0	11	45.9	0	0.0	1	3.5	1	2.0	0	0.0	0	0.0	0	0.0	70	293.1	0.39	0.59
Lethrinus rubrioperculatus	22	16.1	0	0.0	0	0.0	10	17.0	2	2.3	1	1.2	1	1.6	12	15.1	1	1.1	0	11.1	7	0.0	64	73.5	0.36	0.15
Aprion virescens	29	106.0	0	0.0	2	15.0	15	64.5	2	6.4	1	4.9	3	13.7	0	34.0	0	0.0	2	7.5	0	0.0	62	252.0	0.35	0.51
Erythrocles schlegeli	0	0.0	0	0.0	0	0.0	0	0.0	57	150.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	57	150.5	0.32	0.30
Epinephelus septemfasciatus	0	0.0	3	87.0	5	142.4	0	224.3	32	710.0	1	2.2	0	0.0	3	43.4	0	0.0	0	0.0	0	0.0	52	1210.1	0.29	2.44
Pristipomoides sieboldi	0	0.0	21	19.6	10	12.7	12	7.3	0	0.0	0	0.0	0	0.0	1	0.6	0	0.0	1	1.2	0	0.0	45	41.4	0.25	0.08
Lipocheilus carnolabrum	0	0.0	0	10.6	3	9.0	7	20.7	5	13.5	2	3.2	2	6.0	0	0.0	0	0.0	1	3.4	0	0.0	20	83.2	0.16	0.17
P. auricilla	0	7.1	3	0.0	1	0.4	2	0.7	3	1.4	0	0.0	0	0.0	2	0.6	0	0.0	0	0.0	0	0.0	19	11.0	0.11	0.02
Saloptia powelli	0	0.0	5	3.2	2	1.1	1	0.9	2	1.0	0	0.0	0	0.0	4	2.5	0	0.0	2	1.5	0	0.0	16	11.0	0.09	0.02
Variola louti	5	2.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	4	1.6	0	0.0	0	0.0	0	0.0	9	4.5	0.05	0.01
Lutjanus argentimaculatus	0	0	1	3.9	0	0	5	22.0	0	0	1	4.7	0	0	1	7.7	0	0	0	0	0	0	8	39.1	0.05	0.08
Lethrinus kallopterus	1	0.5	0	0	0	0	0	.0	0	0	0	0	1	2.3	3	4.6	0	0	1	1.4	1	1.7	7	10.5	0.04	0.02
Gymnocranius griseus	0	0.0	0	0.0	2	2.0	1	0.0	0	0.0	0	0.0	0	0.0	2	0.9	0	0.0	0	0.0	0	0.0	5	4.5	0.03	0.01
Seriola sp.	0	0.0	0	0.0	0	0.0	5	2.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	2.5	0.03	0.01
Gymnocranius robinsoni	0	0.0	0	0.0	2	3.3	0	0.0	1	2.9	0	0.0	0	0.0	0	0.0	0	0.0	1	1.6	0	0.0	4	7.0	0.02	0.02
G. japonicus	0	0.0	0	0.0	0	0.0	0	0.0	2	2.3	0	0.0	0	0.0	2	0.0	0	0.0	0	0.0	0	0.0	4	3.1	0.02	0.01
Lethrinus sp.	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.4	0.01	.00
Various snapper spp.	10	10.4	12	16.0	16	25.7	12	37.5	1	4.0	1	1.3	0	0.0	3	4.0	0	0.0	0	0.0	7	4.0	62	105.3	0.35	0.21
Epinephelus spp.	2	2.7	12	33.5	16	13.7	6	7.9	7	18.9	1	1.3	1	0.9	0	6.4	7	7.3	1	0.7	1	0.6	62	93.9	0.35	0.19
Various Scombrid spp.	2	4.1	2	11.9	2	10.0	1	3.0	3	6.0	40	145.1	1	1.3	1	4.6	0	0.0	0	0.0	2	2.7	54	190.3	0.30	0.38
Caranx spp.	6	13.6	0	0.0	0	0.0	0	21.0	1	2.0	4	13.0	0	0.0	5	9.3	0	0.0	1	1.3	0	0.0	25	61.0	0.14	0.12
Cephalopholis spp.	13	15.0	2	1.0	2	1.9	1	1.2	0	0.0	0	0.0	0	0.0	3	1.9	0	0.0	0	0.0	3	1.0	24	23.6	0.14	0.05
Other spp.	1	2.0	2	0.6	3	6.2	3	5.3	29	112.4	0	0.0	0	0.0	0	0.0	0	0.0	1	3.6	1	0.6	40	130.7	0.23	0.26
Total	298	564.1	1080	6363.5	3686	9082.0	3670	8297.0	2336	9157.1	2792	8672.7	445	1051.7	1975	4442.1	412	1161.5	237	566.2	59	138.5	17740	49497.2	100	100

Family	No.	Wt(kg)	%	
			No.	Wt
Lutjanidae	14572	39982.0	82.1	80.8
Pentapodidae	1144	1590.2	6.5	3.2
Carangidae	710	2530.9	4.1	5.1
Serranidae	531	1954.5	3.0	4.0
Scombridae	381	2189.5	2.2	4.4
Lethrinidae	227	660.3	1.3	1.4
Other Families	167	574.3	0.9	1.2

TABLE 7 Fish species depth distribution by numbers

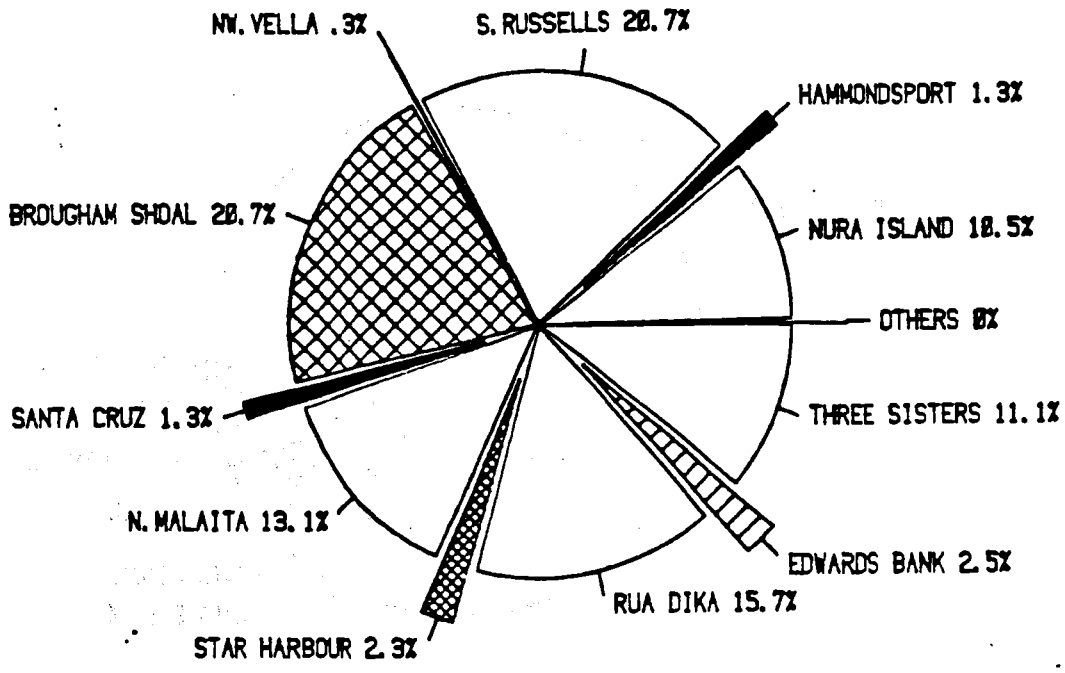
Depth (m) - mid-range	85	95	105	115	125	135	145	155	165	175	185	195	205	215	225	235	245	255	265	275	285	295	305	315	325	335	345	355	365	375	TOTAL
Species																															
Aphareus rutilans			1		30	61	238	335	188	183	210	68	56	27	17	16	1	1													1432
Aprion virescens	2		2	1	2	5	1	8	3	3							3														30
Etelis radiosus			1			4	3	4	11	17	56	8	62	25	19	20	15	14	101	43	50	16	19		81	32	39	10		11	741
Etelis coruscans								2		7	18	9	36	38	66	38	50	25	165	98	48	6	27	6	37	45	36	20	1	3	709
Etelis carbunculus								1		1	3	2	11	8	17	14	28	3	67	33	23	8	6	2	21	26	33	19	1	1	328
Lutjanus kasmira	1	1	1	1	5	18	5	6			3	5																			38
Paracaesio caerulens						3	18	33	35	12	16	3	1		2	1															124
P. kusakarii					13	72	183	260	119	181	98	76	59	24	56	34	24	5	11	3											1058
P. stonei					1	13	1	5	18	18	23	19	18	10	23	29	12	6	13	4	1		2								200
Pristipomoides auricilla										3			1		1	1															6
P. filamentosus		3	26	28	185	232	672	581	333	329	400	56	70	7	52	5	12	7													2918
P. flavipinnis			6	18	35	134	243	338	297	550	1129	81	37	22	21	5	5	2													2915
P. sieboldi						2	1			1	1			2	4																11
Lipocheilus carnolabrum											2	2	1	2	1	2		1													11
Trapidinius argyrogrammicus										1		1	4	1	7	5	5		1												25
T. zonatus					1	1		5	5	3	5	5	4	9	8	6	5	1		2											60
Lethrinus kallopterus					2																										2
L. miniatus				6	6	21	17	30	19	11	25	2	2	1	1																144
L. rubrioperculatus	1	3		1	6	3	5	2	1																						22
Gnathodentex aossanbicus					16	79	98	172	166	162	160	50	43	17	2	7	6	1	6												985
Epinephelus chlorostigma				1		10	20	25	34	14	28	4	1	1	4		2														144
E. morrhua						9	6	18	27	23	45	7	13	7	5	2	1	1	6	1			1								172
E. septenfasciatus						1		1			1	1	4	4	3	2	4	3	15	2											41
Saloptia powelli					1							1	4	1	1		2														10
Variola louti					1	2																									3
Caranx lugubris			1	2	7	20	21	33	17	6	15	1	5	1	4		4	1													141
Seriola rivoliana						7	11	9	10	12	38	7	8	2	10				4	5											131
Gymnosarda unicolor			5	1	8	21	20	27	20	15	35	9	5	3	8	1		6	25	1			2								212
Erythrocles schlegeli																			9	2			2		2	3	2	2			22
Brionne everanni						1	2	1	4	2	1				5		1			1					1					1	20
TOTAL	4	7	43	51	239	714	1488	1896	1307	1466	2312	417	445	212	337	188	180	77	583	195	122	30	59	8	142	186	118	51	2	16	12735

Depth range fished: 85-424m

Fig 1

(a) CATCH COMPOSITION BY AREA

% BY NUMBERS OF FISH CAUGHT



(b) CATCH COMPOSITION BY AREA

% BY WEIGHTS OF FISH CAUGHT

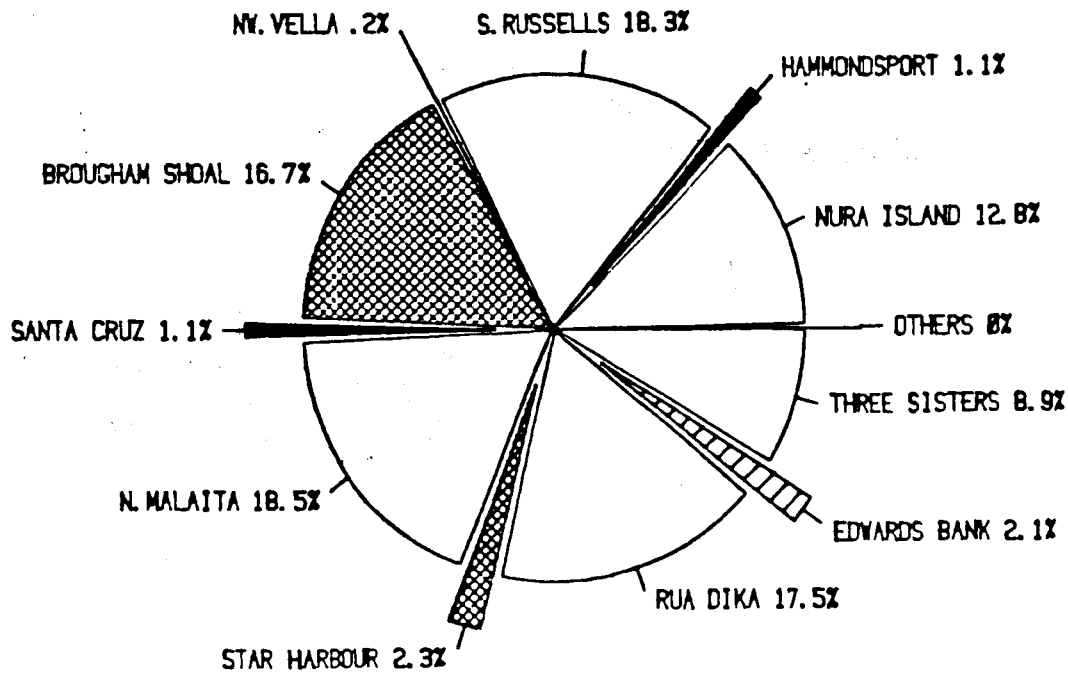
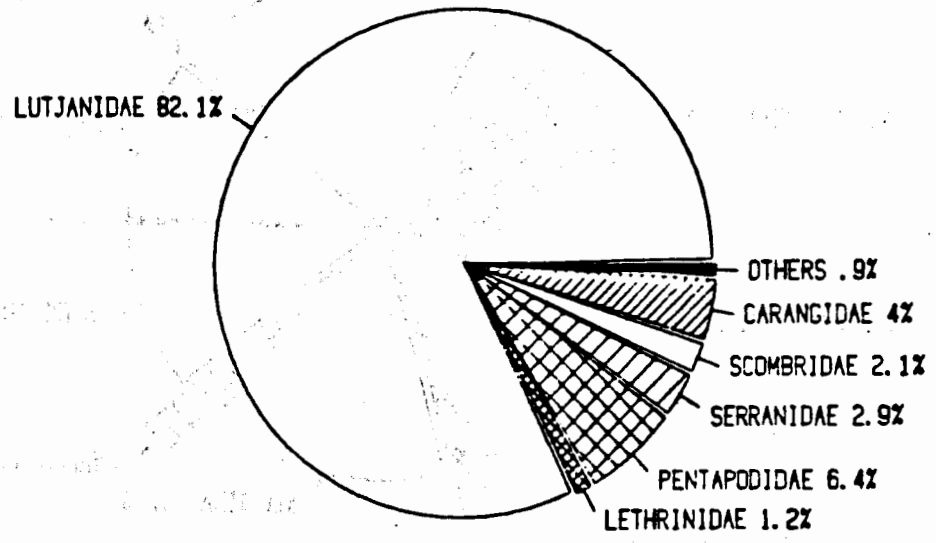


Fig 2. (a) BOTTOM SURVEY CATCH COMPOSITION

% BY NUMBERS OF FISH CAUGHT



(b) BOTTOM SURVEY CATCH COMPOSITION

% BY WEIGHTS OF FISH CAUGHT

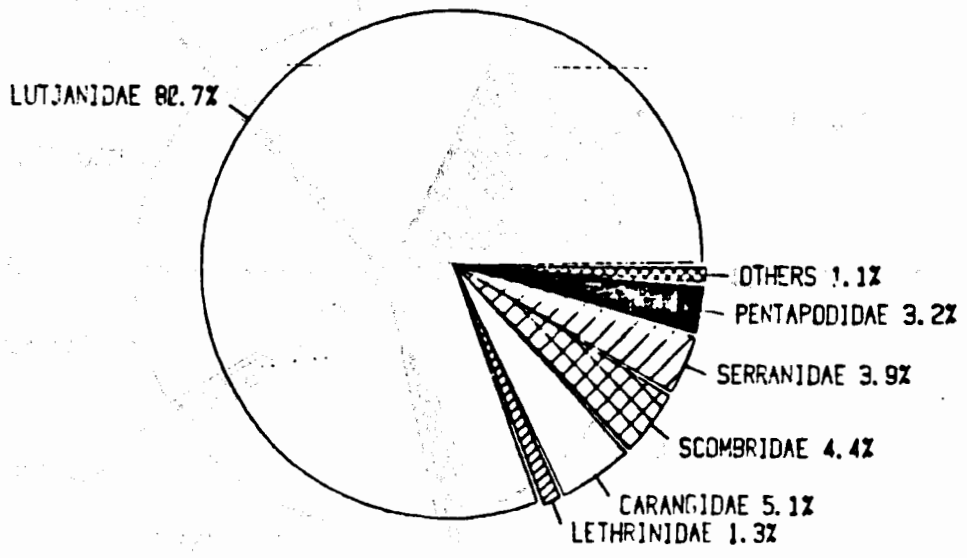
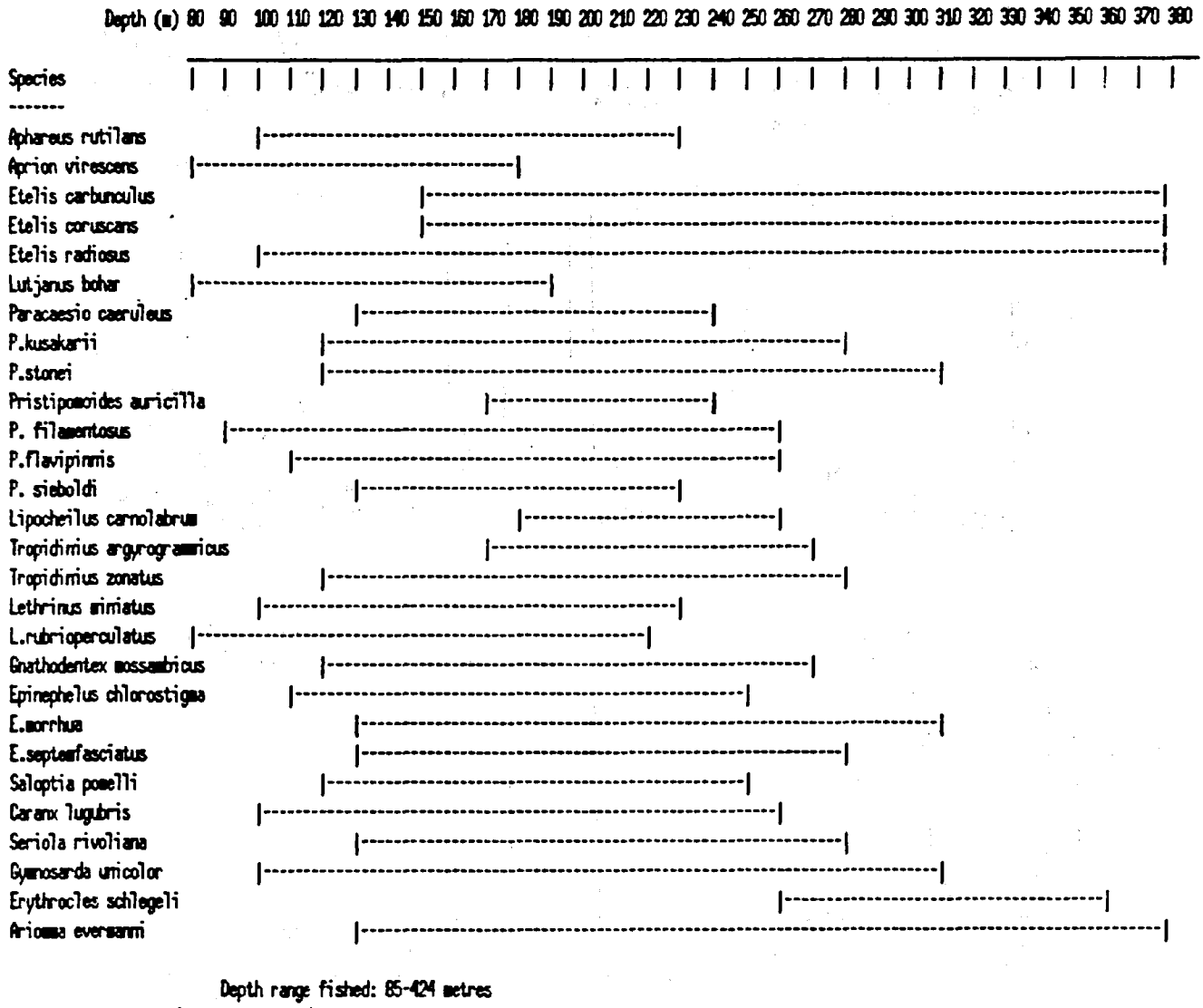


Fig 3 Depth range of deep bottom fish



Depth range fished: 85-424 metres

Fig 4. Depth Distribution

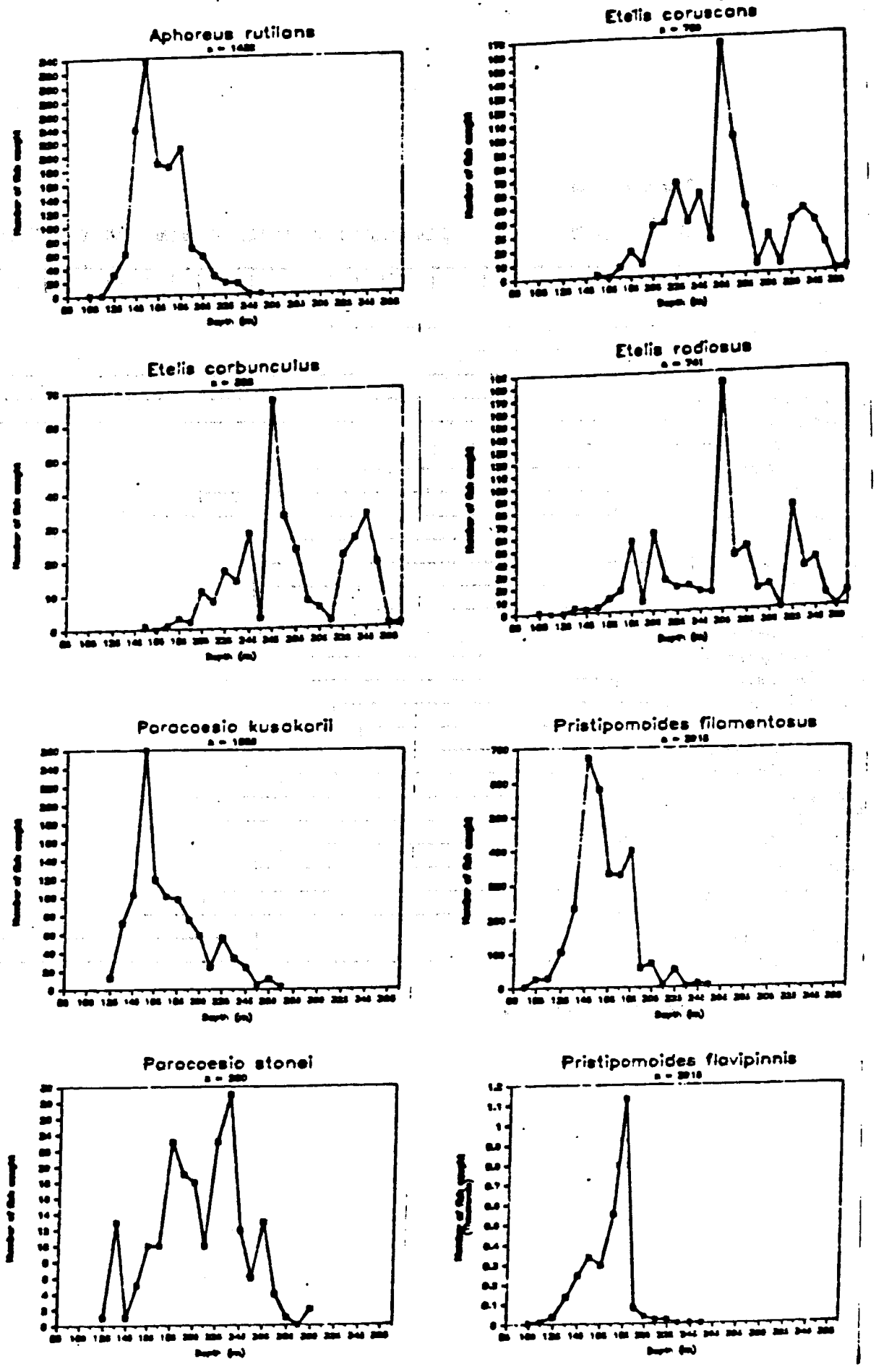
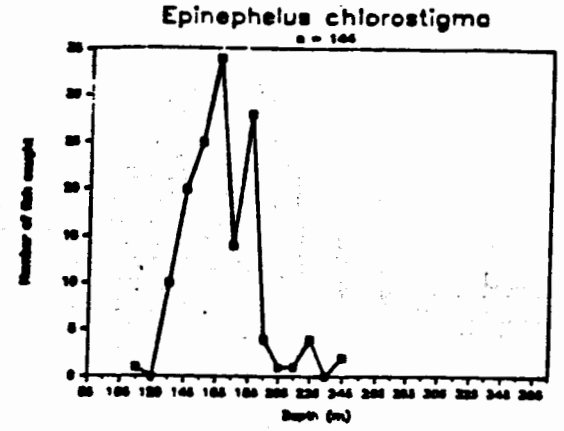
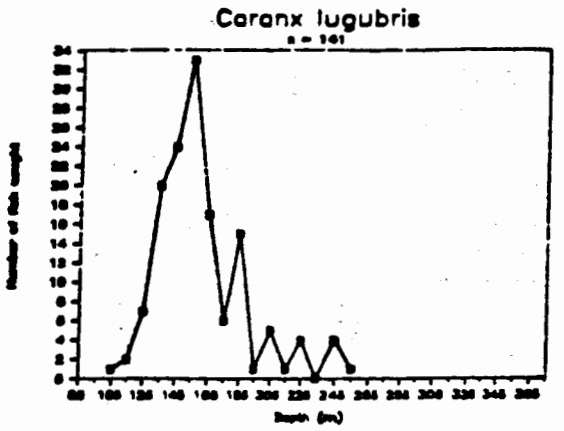
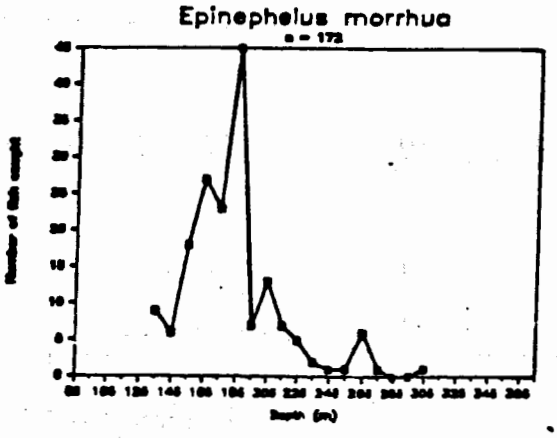
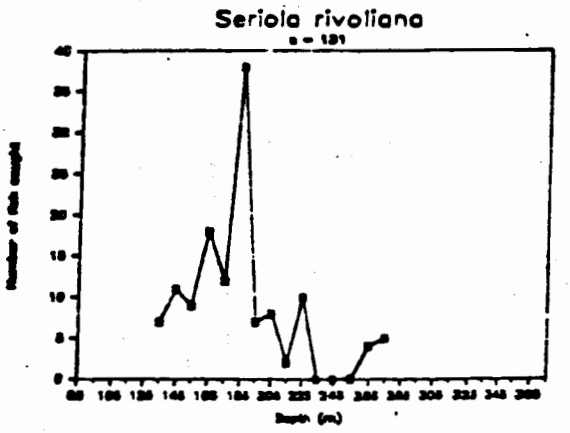


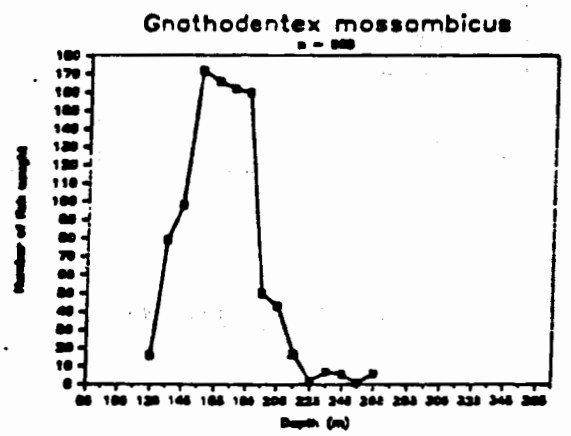
Fig 4. Contd.


Epinephelus chlorostigma


Caranx lugubris


Epinephelus morrhua


Seriola rivoliana


Gnathodentex mossambicus

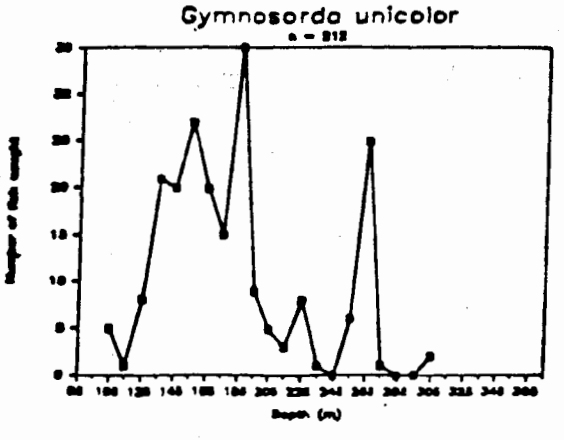

Gymnosarda unicolor

Fig 5. Length Frequency Distribut. n