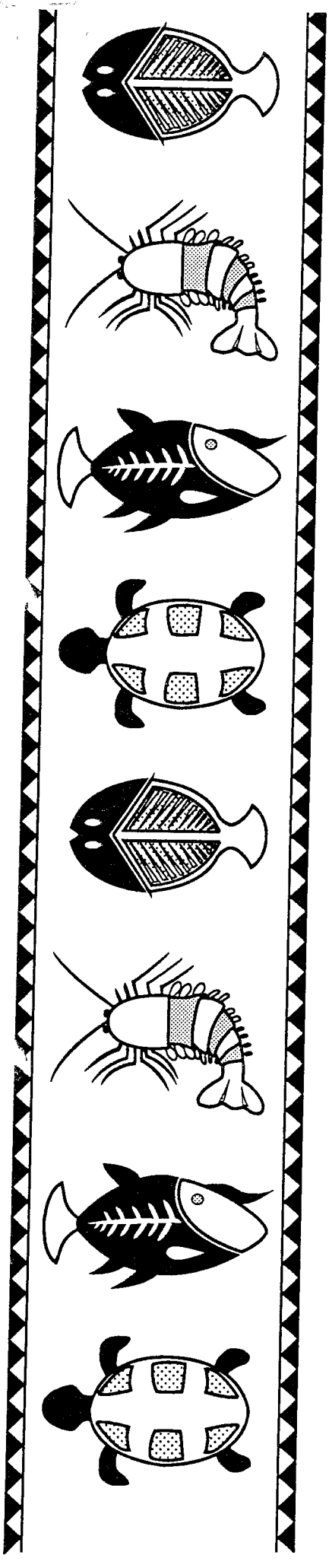


Inshore Fisheries Research Project
Country Assignment Report

COASTAL FISHERIES PRODUCTION ON NAURU

South Pacific Commission
Noumea, New Caledonia

Coastal fisheries production on Nauru

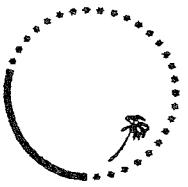
by

P. Dalzell[1] & Alan Debao[2]

March 1994

1. South Pacific Commission
BP D5 Noumea
New Caledonia

2. Department of Island Development
& Industry
Nauru



South Pacific Commission
Noumea, New Caledonia

Introduction

The Republic of Nauru is a single raised limestone island or *makatea* with a total area of only 22 km^2 (Figure 1), but with jurisdiction over 320,000 km^2 of ocean surrounding the island under the United Nations Law of the Sea convention. The island consists mainly of a flat plateau that descends to a narrow coastal fringe where most of the population dwell. The plateau interior contains extensive deposits of phosphate bearing rock which have been mined since the beginning of the twentieth century. There are no rivers or streams on the island but there is a small lake in Buada district at the south west corner of the plateau, known as Buada Lagoon.

Phosphate, mined by the Nauru Phosphate Corporation (NPC), provides most of the income for the island. Unworked phosphate deposits are likely to be exhausted in the near future, although residual mining of previously mined grounds may continue for some years. Money from phosphate mining is invested by the Government of Nauru in trust funds to ensure a continuing income when deposits are exhausted.

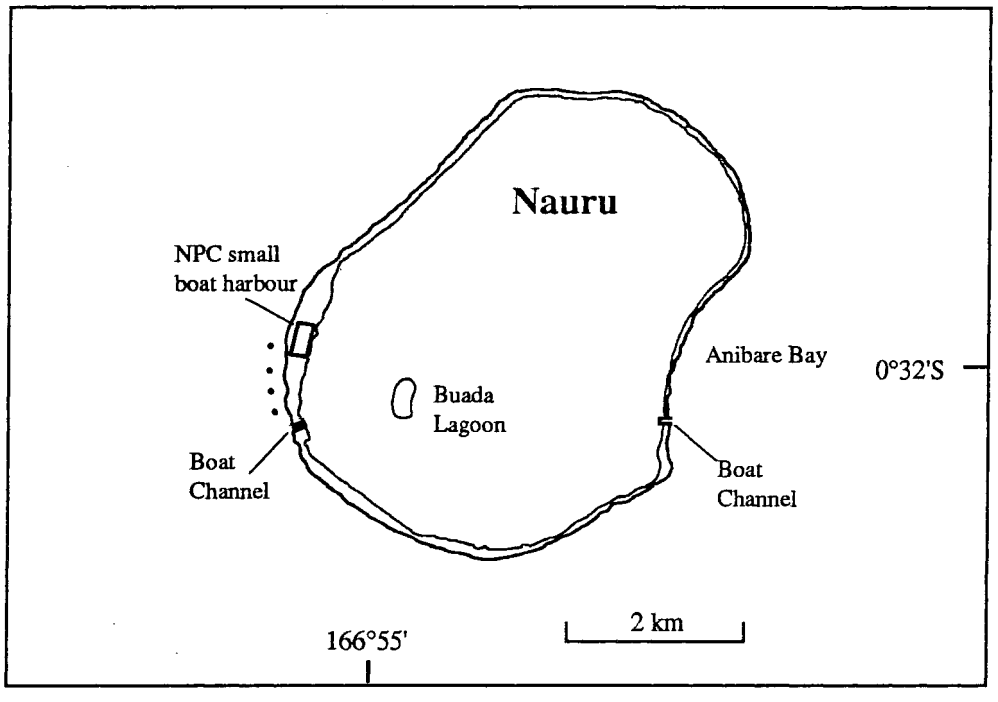


Figure 1. Map of Nauru showing places mentioned in the text

The population of Nauru is about 9800 people of which 60 % are Nauruans, whilst the remainder are other Pacific Islanders, Chinese, Philipinos, Indians and Europeans, employed by NPC or by the Government. Much of the coastal strip has been settled, with only a few households living in the interior around Buada Lagoon. Despite the relatively high incomes of the Nauruan population and the plentiful shops and restaurants, fish caught from around the island remains an important component in the diet.

Fish will continue to form a large part of the diet of Nauruans in the future, whatever the outcome of mining activities on the island. As such, it is important to know what are the present

levels of fishing activity and the volume and composition of landings for possible management of coastal fishing on Nauru. There has been increasing concern about the volume of landings on Nauru, particularly from the reef zone. Anecdotal information suggests that certain reef fish species are becoming scarce and the average size of these fish in catches is decreasing. Clearly, further information is required to understand the effects of fishing on reef fish stocks.

In this study, we report on observations made on fishing activity around Nauru between July 1992 and February 1993. The Commission's participation in this study was at the request of the Government of Nauru, which was concerned over the level of fishing around Nauru, particularly on the limited coral reef and the deep reef slope areas.

The coastal marine environment of Nauru

Nauru has an equatorial monsoonal climate with an average rainfall of about 1.5 m per year although this is very variable and droughts lasting over a year have been experienced in the past. The air temperature ranges from 24 to 34 °C, and the wettest period of the year is the north-westerly monsoon from November to February. During the remainder of the year the prevailing winds blow from the south-east.

The reef and shelf area around Nauru are very limited. The emergent portion of the narrow fringing reef has an area of about 3.5 km^2. The emergent reef plateau consists of tide-pools and coral pinnacles. A series of profiles of the reef were made at different points around the island by a member of the Nauru Divers Club in 1985, and these show that the hermatypic zone of the reef descends to between 15 m and 30 m, beyond which there is a transition zone with coral outcrops that descends to about 60 m.

A series of bathymetric measurements made by SPC masterfishermen in 1990 and 1993 (Mead & Cusack 1990; Watt 1993) showed that the Nauru shelf descends to 1000 m between 1.2 and 1.7 km from the shore. The 200 m isobath lies between 100 and 300 m from the shore, thus the fishable slope area for bottom fish amounts to about 3.9 km^2.

No account of the fish and other marine organisms found around Nauru appears to have been published. A checklist of fishes found from the coastal waters around Nauru is given in Appendix 2. This checklist was compiled from direct observations on fishermen's catches and by asking fishermen and divers to list fishes that they could positively identify from photographs in taxonomic works on Indo-Pacific fishes

Coastal fishing on Nauru

An account of the traditional methods of fishing on Nauru is given by Petit-Skinner (1981). In the past there were many different fishing methods that were used to catch both fish and invertebrates from the waters around Nauru. Reef fishing was mostly, but not exclusively, the preserve of females, whilst fishing beyond the reef was traditionally conducted only by men. As in many other parts of the Pacific, many of these traditional fishing methods and associated knowledge has been superceded by more modern fishing methods.

Presently, coastal fishing around Nauru is conducted from small skiffs or canoes, or by people walking and diving on the reef. Fish is caught both for subsistence and commercial purposes. Nauruans fish almost exclusively from small (4 to 5 m) outboard powered skiffs, launched from

two man made boat channels which give access to the sea through the narrow fringing reef. The most frequently used channel, the Gabab Channel (Figure 1), is situated at the south west of the island and permits access to the sea for about 9 to 10 months of the year, when the prevailing winds blow from the south east. When the prevailing winds blow from the north west, skiffs are launched from the other channel in Anibare Bay, which faces due east (Figure 1).

The main fishing activities carried out from powered skiffs are trolling for pelagic fish such as tuna, and bottom fishing for snappers and groupers. Trolling equipment may range from simple plastic reels to expensive game fishing rods and reels. A variety of lures are used including flying fish when they can be caught. During 1991 three fish aggregating devices (FADs) were deployed around Nauru by the Department of Island Development and Industry with assistance from the South Pacific Commission to improve fishing for pelagic fishes for local fishermen.

Bottom fishing from both skiffs and canoes is carried out with simple handlines and with a device known as a Christmas Tree which is a T shaped or cruciform wire framework attached to which are between 18 and 32 hooks (Figure 2). The most favoured bait for bottom fishing is skipjack tuna and imported milkfish bought from local stores

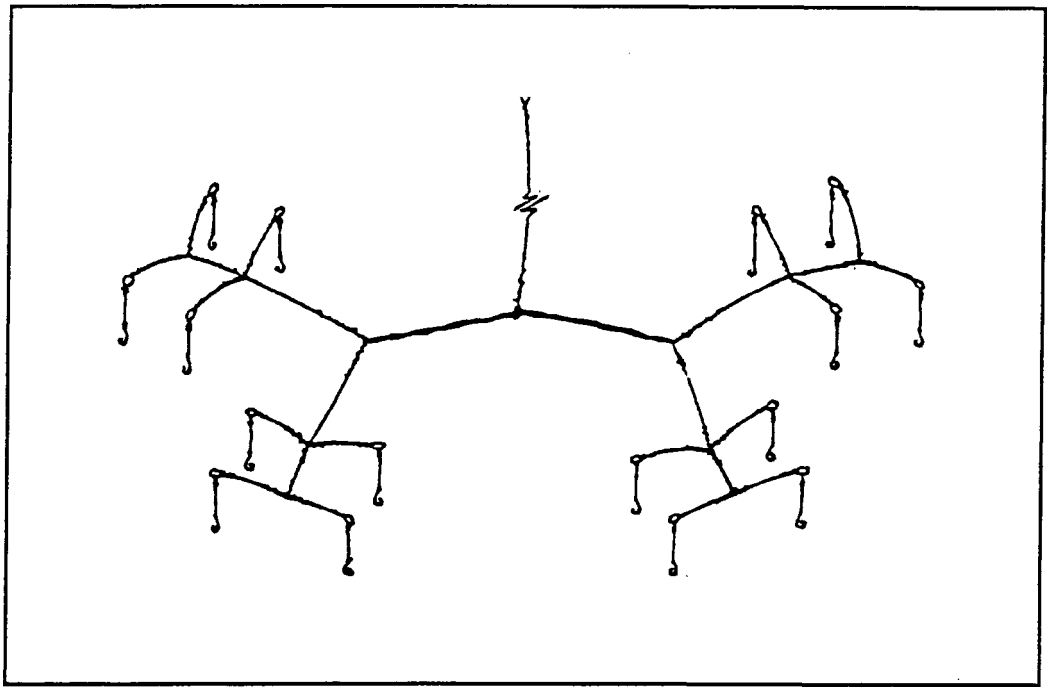


Figure 2. An example of a 'Christmas-tree' rig used for demersal handline fishing on Nauru

Catches from the Nauruan skiffs are mainly for recreational and subsistence purposes. Traditionally, much of the catch is given away to friends and family. Large catches may be sold for extra income and a few Nauruans fish regularly for catches that are sold to local stores.

The large population of migrant workers from Tuvalu and Kiribati, who work for NPC are also enthusiastic fishermen, both for subsistence and commercial purposes. These other Pacific

Islanders build and fish from their own canoes as well as using small (3.5 to 4.5 m) outboard powered skiffs. The small skiffs can be hand carried for launching in the NPC small boat harbour (Fig 1), which was created to permit barges to offload cargo from larger ocean going vessels. The canoes have access to the sea through a small passage in the reef about 50 m to the south of the boat harbour.

The powered skiffs are used by migrant workers for trolling and bottom fishing in the same manner as those employed by Nauruans. The principle fishing ground for the canoe fishermen are the large deep-water mooring buoys used by carrier vessels when loading phosphate. The mooring buoy system acts as a very effective fish aggregator and large schools of rainbow runner, (*Elegatis bippinulatus*) form beneath the buoys and are targetted by the canoe fishermen. Large pelagic species such as yellowfin tuna (*Thunnus albacares*) and wahoo (*Acanthocybium solandri*) are also occassionally taken by mid-water handlining. A description of fishing associated with the mooring buoys was given by Cusack (1987). The catches made by the migrant workers are used mainly to supplement their incomes and are sold on the road side above the NPC small boat harbour

Nauruans also fish on the reef flat with cast nets and seine nets. Cast nets are usually thrown over schools of fish in the surge zone at the reef edge and the target species are surgeon fish (Acanthuridae), drummers (Kyphosidae) and mullet (Mugilidae). Seine nets are deployed in an arc on the reef flat and fish are driven into the net by a number of men splashing the water and walking towards the net. The catches of seine nets are similar to those from cast netting. Most catches from cast netting and beach seining are for subsistence consumption. Reef fish are also caught by spear fishermen using SCUBA gear to fish between the surface and 60 m depth. Catches from SCUBA fishing comprise small snappers (Lutjanidae), groupers (Serranidae), squirrel fish (Holocentridae), jacks (Carangidae) and surgeon fish.

Nauruans also harvest the small turban shell *Trochus chrysostomus* from the reef flat and the surge zone during low tides. Lobsters are also taken occasionally by SCUBA divers. Both Nauruans and the migrant workers from Kiribati and Tuvalu catch flying fish during moonless nights throughout the year.

Buada Lagoon contains tilapia (*Tilapia mossambicus*) which were introduced to the island in the mid 1960s but these fish are not caught and eaten by Nauruans. There is a tradition of stocking Buada Lagoon with milkfish fry, caught from the shallow reef areas and harvesting these when grown to between 30 and 50 cm in length. More recently fry have been brought from Tarawa to stock an area of the Lagoon that was penned off specifically for milkfish culture (De La Cruz 1992)

Fishing vessels and fishing gear enumeration

Counts were made of the different fishing vessels, cast nets and beach seines on Nauru during July 1992. There were total 130 powered skiffs owned and operated by Nauruans, while 88 powered skiffs were counted in Location, the dwelling quarters of the NPC migrant workers. A total of 128 canoes were counted in Location and adjacent to the NPC small boat harbour.

Counts were of the visible beach seines and cast nets, hanging up to dry under garages and porches. Although these probably do not represent the total number of nets, they are a reasonable indication of the number of nets in use. A total of 39 beach seines and 28 cast nets were observed.

Fisheries survey methods

Fisheries production by the different fishing methods employed on Nauru was estimated from the product of the average catch rate for a particular gear, the average number of gears employed per fishing trip, the average length of the fishing trip and the average daily frequency of that particular fishing activity. Records of landings were collected through contact interviews with fishermen at Gabab Channel and the NPC small boat harbour. Most landings are made at both locations around about mid-morning (09.00 – 10.00 hrs) and during the late afternoon and evening (17.00 – 19.00 hrs).

Fishermen were interviewed using the form in Appendix 1. Information was recorded on the weight of the catch, the type and number of gear used, the fishing hours, location of fishing, the amount of fish sold and the species composition. It was usually possible to make counts of the number of fish at each landing and to record the total weight of the catch. However, fish were often taken or bought before individual fish weights could be recorded. For this reason, the species composition figures are given as numbers rather than weight.

Nearshore reef fishing activities such as spearfishing, cast netting, beach seining and reef walking or gleaning were not landed at the two principal landing sites. Regular patrols of the island during the day were conducted to count for persons engaged in fishing activity and to conduct interviews on an opportunistic basis. Two circuits of the island were made in mid-morning and mid-afternoon to monitor reef fishing activity and to count the number of individuals engaged in all fishing activity around Nauru. Counts of boat trailers at Gabab Channel and the NPC boat harbour gave the total numbers of skiffs deployed at any one time. The number of canoes fishing could be easily counted from the shore adjacent to the NPC small boat harbour. Other persons seen fishing on the reefs during the day were similarly counted. All counts of persons and boats out fishing were recorded on the log sheet in Appendix 2.

Results

General

The data summarised here were collected over an 8 month period between July 1992 and February 1993. Observations were not made on a regular basis due to the limited manpower of the Nauru Department of Island Development and Industry and altogether only 14 weeks of observations were made during this period. It was assumed, however, that the records of catches reported here represent the typical fishing conditions on Nauru throughout most of the year.

Catch composition

The same pelagic stocks are caught by troll fishing from Nauruan owned skiffs and those owned by migrant workers. Similarly, both groups of fishermen and migrant workers fishing from canoes target the same demersal stocks. Therefore, the species composition data from trolling and demersal handline fishing have been pooled regardless of origin. Troll fishing is the commonest fishing activity on Nauru and landings are dominated by tunas (Scombridae), namely skipjack (*Katsuwonus pelamis*) and yellowfin (*Thunnus albacares*), the only other prominent feature of the catch is rainbow runner, *Elagatis bipinnulata* (Carangidae). The balance of the

(*Acanthocybium solandri*), sailfish and marlin (Istiophoridae), barracuda (Sphyraenidae), and dolphinfish (Coryphaenidae).

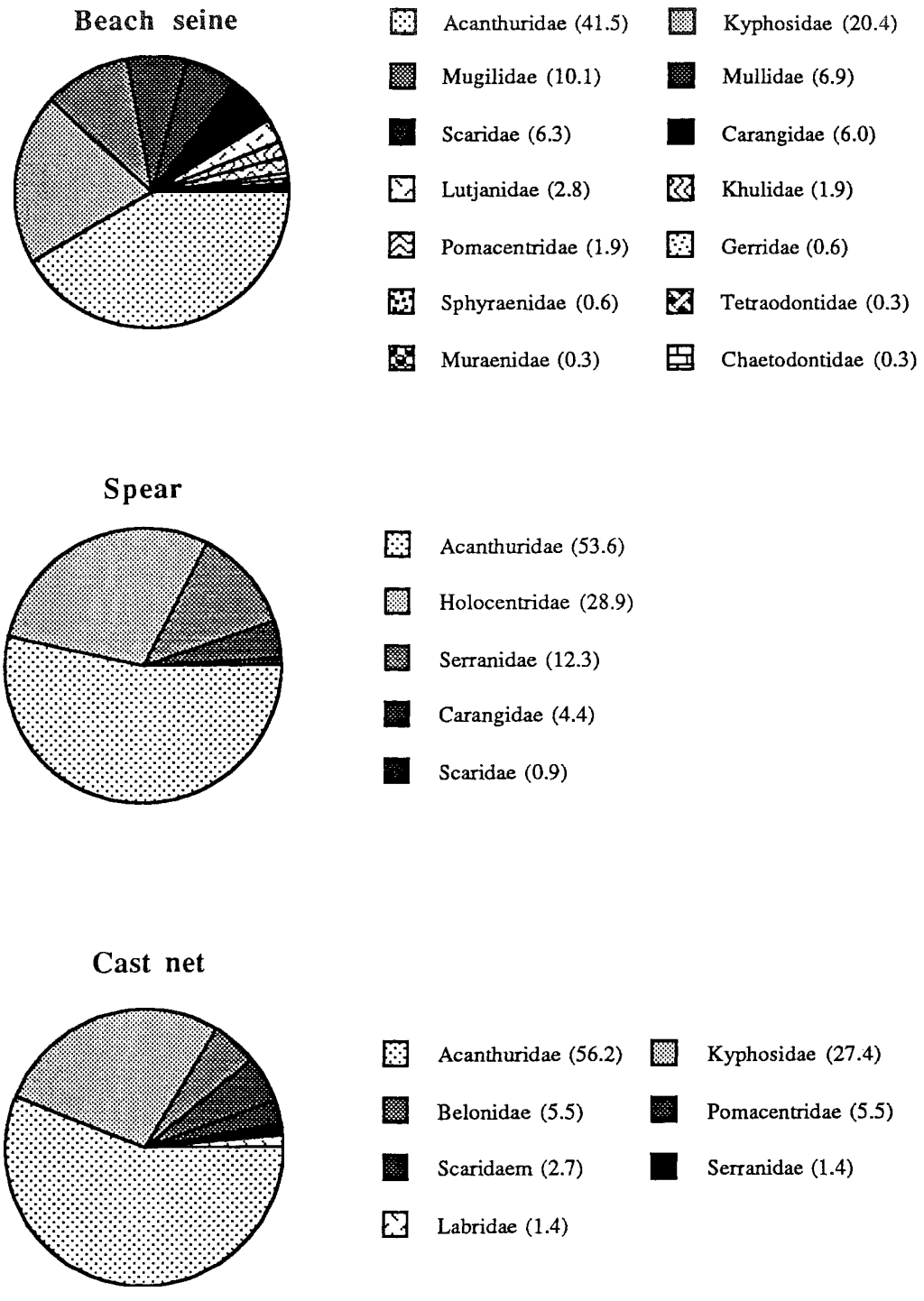


Figure 3. Composition by number of catches with different small scale fishing gears on Nauru

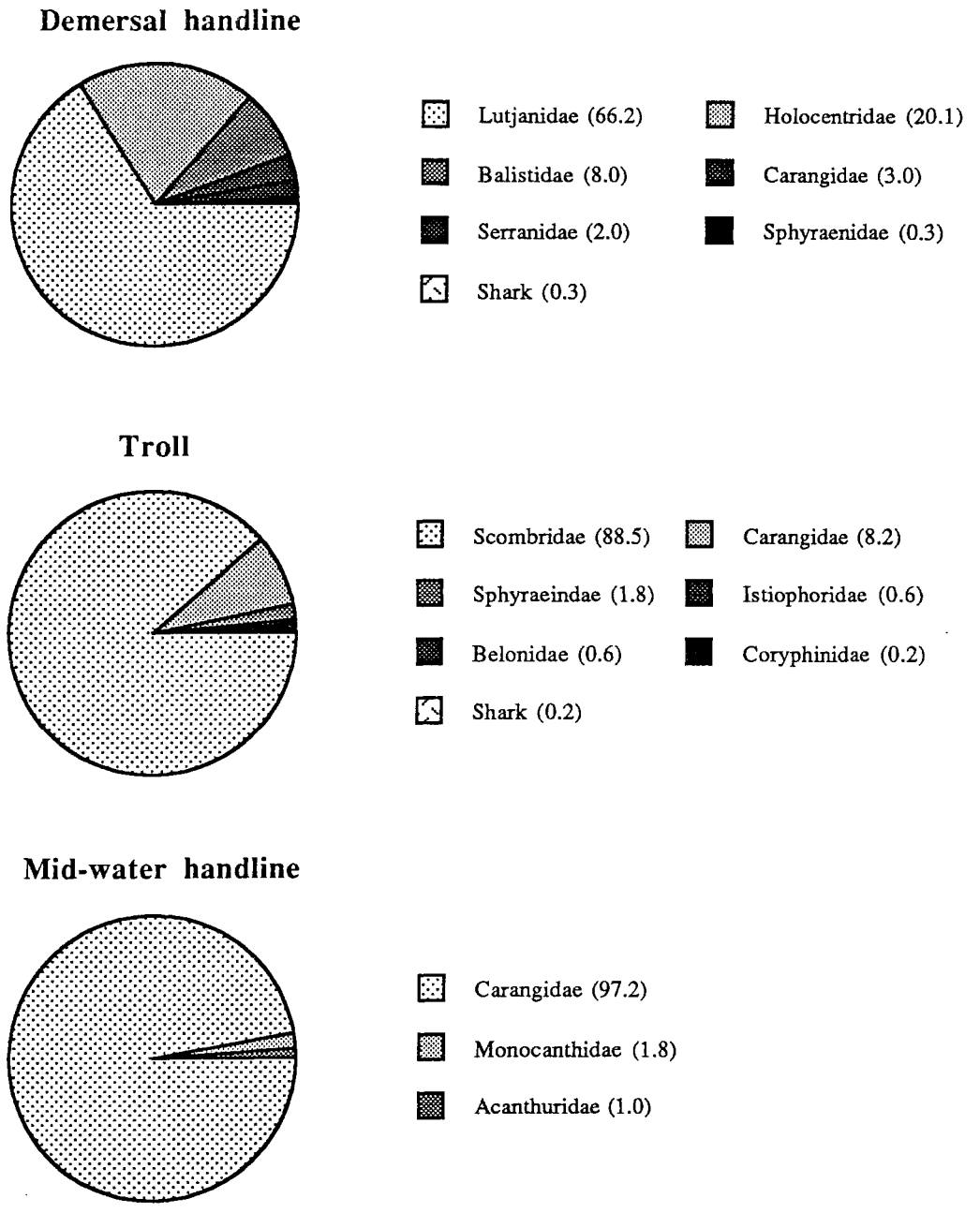


Figure 3. cont.

The rainbow runner forms virtually all the catch of mid-water handline fishing from canoes around the NPC mooring buoys. During the period of observations, small amounts of filefish (Monocanthidae) and unicornfish (Acanthuridae) were also caught by mid-water handline fishing. Cusack (1987) reports that other pelagic species such as roundscad (*Decapterus macarellus*), yellowfin tuna and wahoo may also be taken in the same location, but that the principle target of midwater handline fishermen is rainbow runner.

Demersal handline fishing targets mainly snappers (Lutjanidae), squirrelfish (Holocentridae) and triggerfish (Balistidae). Other species in the catch include jacks (Carangidae), groupers (Serranidae) and barracudas. The snapper catch was dominated by the blue-lined snapper, *Lutjanus kasmira*, with other species such as red bass (*Lutjanus bohar*), humphead snapper (*Lutjanus gibbus*), and *Paracaesio* spp. The squirrelfish were not classified to species level. The triggerfish catch was comprised mainly of pink-tail triggerfish, *Melichthys vidua*.

The greatest number of species were taken by beach seine fishing. Catches were dominated by surgeonfish (Acanthuridae), which was mainly *Acanthurus lineatus* and to a lesser extent *Acanthurus triostegus*. The drummers (Kyphosidae), mullet (Mugilidae), goatfish (Mullidae), parrotfish (Scaridae) and jacks (Carangidae) also made significant contributions to beach seine catches. Common species included the *Caranx sexfaciatus* and *Kyphosus vaigiensis*,

Spearfishing catches were also dominated by surgeonfish, with the balance of the catch being formed by squirrelfish, groupers, jacks and parrotfish. In common with beach seine fishing the surgeonfish catch was dominated by *Acanthurus lineatus*, with lesser contributions from *Acanthurus guttatus* and *Acanthurus nigricans*. The dominant squirrelfish in the catch were *Mypristis hexagonata* and *Sargocentron tiere*, whilst grouper catches were formed by *Cephalopholis spilopara*, *Cephalopholis miniata* and *Epinehelus merra*.

About half the catch of cast net fishing was formed by surgeonfish. Most of this was not broken down by species, but included *A. lineatus*, *A. guttatus* and *Acanthurus triostegus*. About one quarter of the castnet catch was formed by drummers, about half of which was *Kyphosus cinerescens*. Other common reef fish families such as needlefish (Belonidae), damselfish (Pomacentridae) and parrotfish (Scaridae), formed most of the remainder of the catch.

Catch rates and annual production

From the counts of persons or boats observed fishing it was possible to estimate and average daily frequency of each fishing activity during the seven days of the week. This in turn permitted estimation of the average daily frequency of each type of fishing activity on Nauru (Table 1). Most fishing activity is greatest during the weekends although the skiffs and canoes owned by the expatriate Tuvaluan and Kiribati mine workers are not deployed on Sundays for reasons of religious observance.

Table 1. Average daily frequency of observations of fishing craft and fishermen on Nauru, July 1992–February 1993

Day	Nauruan skiffs	Migrant worker skiffs	Migrant worker canoes	Spear-fishing	Cast-netting	Beach-seining	Reef-walking
Mon	3.3	4.4	8.9	0.8	1.1	0.8	1.7
Tue	3.1	6.0	9.0	0.8	0.5	0.8	1.0
Wed	5.8	7.9	11.8	0.8	0.1	0.6	0.3
Thu	5.3	7.2	13.0	0.0	0.5	0.0	0.1
Fri	6.9	9.2	10.2	0.5	0.3	0.0	0.0
Sat	16.4	19.5	24.0	1.5	1.0	0.4	3.3
Sun	8.2	0.0	0.0	1.5	0.7	0.0	7.3
Mean	7.0	9.0	11.0	0.8	0.6	0.4	2.0

A summary of the results from the landings survey is given in Table 2. For line fishing, the CPUE was expressed as kg/line-hr, whilst for the other gears the CPUE was expressed as kg/hr. Cast netting and reef walking are often solitary activities, or in the case of reef walking a mother might be accompanied by her children. Beach seining usually conducted a group of three to four individuals as is also the case with spearfishing. Spearfishermen employ SCUBA gear rather than free diving to catch reef fish and usually will stay submerged for about an hour.

Table 2. Summary of the results from the observations on fishing activity, estimation of the total catch by fishing method and value of the landings of coastal fisheries on Nauru

Fishing method and vessels type	Number of observations	Mean CPUE	Average number of gears deployed	Average fishing time (hrs)	Annual landings (t)	Value A $	Percent sold
Trolling (Nauruan skiffs)	38	4.7 kg/line-hr	2 troll lines	3.7	75.0	300,000	55.5
Trolling (Migrant worker skiffs)	18	5.8 kg/line-hr	2 troll lines	4.6	164.8	659,000	76.9
Demersal handlining (Nauruan skiffs)	7	3.0 kg/line-hr	1.7 handlines	4.9	9.9	9,800	71.4
Demersal handlining (Migrant worker skiffs)	1	3.0 kg/line-hr	1.7 handlines	4.9	4.9	19,800	76.9
Demersal handlining (Migrant worker canoes)	8	3.0 kg/line-hr	1 handline	5.1	15.5	31,000	75.5
Mid-water handlining (Migrant worker canoes)	22	6.6 kg/line-hr	1 handline	4.7	98.6	197,000	100.0
Spearfishing	5	8.1 kg/hr	4 spears	1	2.4	4,800	100.0
Cast netting	3	2.8 kg/hr	1 cast net	1.3	0.8	1,600	0.0
Beach seining	3	3.9 kg/hr	1 beach seine	3	1.7	2,400	0.0
Total					373.6	1,225,400	

The annual total fisheries production from one sector of the fishery on Nauru was the product of CPUE, daily frequency raised by 365, average number of gears deployed per vessel and average trip length. All the different fishing vessels used on Nauru are usually dual purpose, being used to catch demersal and pelagic fish. The annual number of fishing trips was therefore partitioned between the different fishing activities.

For example, there are on average about seven Nauruan-owned skiffs deployed each day (Table 1). Of the 45 landings records for Nauruan skiffs, (Table 2), 38 were from troll fishing and the remainder from demersal handlining. Using these using these proportions the annual estimated number of fishing trips (2,555) was divided into 2,158 trolling trips and 397 demersal handlining trips. The annual number of trips spent trolling was then multiplied by average CPUE

(4.7 kg/line-hr), average trip length (3.7 hrs) and average number of fishing gears deployed (2 troll lines) to give an annual total troll catch by Nauruan-owned skiffs of 75.0 t (Table 2)

The same procedure was used for the other combinations of gears and vessels. Only one handline catch by a migrant worker skiff was recorded, so the average CPUE, average trip length and average number of lines deployed for Nauruan skiffs were used instead. The catch rate of 8.1 kg/hr from spearfishing refers to the catch of the whole group, usually about four divers, and not to an individual unit of gear as in the case of the line fishing. The same applies to beach seine catches where the net is deployed by three or four fishermen. Catches from reef walking were not recorded here but may amount to about 1.0 kg per hour if targeting octopus and shellfish. This activity may generate another 1.0 t of production per year.

Based on these figures the total annual fisheries production on Nauru was estimated to be about 374 t. Of this about 10 % (35.7 t) comes from fishing on demersal stocks, with the remainder from pelagic catches. About three quarters of the total fisheries production is generated from the activities of migrant workers who are estimated to catch about 283 t/yr or just over 75 % of the total. Catches by Nauruan owned vessels amount to about 85 t annually, with an additional 5 t from spearfishing, cast net fishing, beach seining and miscellaneous reef walking.

Prices paid for fishes on Nauru range from about A$ 2.00/kg for reef fish and rainbow runners to A$ 3.00/kg for skipjack and A$ 4.00/kg for wahoo and A$ 5.00/kg for yellowfin tuna. If an average of A$ 4.00/kg is used for troll caught species and A$ 2.00 for the remainder then the total value of the catch on Nauru is estimated to be about $A 1,225,400 if it was all to be sold at commercial rates.

Nauruan fishermen sell on average about half of the troll catch and just over 70 per cent of the demersal catch. Over three quarters of the troll catch taken by migrant worker skiffs is sold and it is assumed that this also applies to the small amount of demersal catch taken by these vessels. About the same quantity of demersal catch is sold by the migrant worker canoes, whilst all the midwater handline catch comprising mainly rainbow runners is sold. The main buyers of commercial fish sales on Nauru are Nauruans and the relatively large number of Chinese restaurants that cater to the local population. the total value of commercial fish sales is about $A 914,000.

Discussion

The data collected here refer entirely to fishing activities conducted during the day. Some night fishing also occurs on Nauru, mainly for flyingfish, and some reef walking activity also takes place at night to collect the molluscs. However, most fishing activity is confined to daytime and the estimates of production given here are likely to reflect the production of fish on the island. The fisheries production on a per capita basis amounts to about 38 kg/yr for a population of 9,800 people.

The present estimates of total catch by the different fishing methods based on small sample sizes for the landings, particularly from reef and demersal fishing activities. The observation frequency data in Table 1 shows, however, that reef and demersal fishing is a relatively unimportant activity on Nauru and most fisheries production comes from pelagic fisheries where smaple sizes were reasonable. Clearly, it would be beneficial to improve the number of observations on the reef fishing activities, however. the figures obtained from these limited observations are comparable to those for similar activities elsewhere in the Pacific (Dalzell 1994).

The present estimate of production from demersal or reef fish stocks is about 35 t per year. Of this about 60 % is captured by migrant worker canoes and skiffs. The yield of reef fish when expressed as in terms of the reef area (3.5 km^2) is about 10.0 t/km^2. However, the demersal catch is taken on the reef and from the reef slope in deeper waters down to 200 m. The yield in terms of reef area and slope area (7.4 km^2) is about 4.8 t/km^2.

Much concern was expressed about the effect of spear fishing by SCUBA divers on reef fish stocks. Three effects appear to have been noted by divers and fishermen.

1. Stocks of snappers and groupers have been depleted and are not as plentiful as in the past.

2. Most large snappers and groupers have disappeared and spear fishermen are taking smaller specimens than in the past.

3. To escape the spear fishermen, snappers and grouper populations have retreated into deeper water

These are all based on anecdotal information but are a common theme amongst Nauruans and expatriates who dive regularly around Nauru. Further, similar responses have been noted in exploited popualtions of coral reef fishes in the Philippines (Russ 1991)

Spear fishing with SCUBA gear grew in popularity during the 1970s and 1980s and there were regularly up to 30 persons a day fishing in this fashion in the past. As fish stocks were depleted, however, this method of fishing was only practised by fewer people. During the initial period of this survey only one group of dive fishermen were active on a regular basis. In general there appears to be a lack of interest in spear fishing with SCUBA gear due to reasons given above, and to such factors as breakdowns with compressors. According to one source, there was a 6 month hiatus from all spear fishing activity during 1991.

Migrant workers presently produce 283 t of fish per annum or about three quarters of the total fisheries production on Nauru. About 85 per cent (240 t) of the migrant worker catch is sold with the balance being retained for supplementing the diets of fishermen and their families[1]. Most of the commercial landings of fish are bought by Chinese restaurants with some sales through stores and by selling on the road in front of the NPC small boats harbour. As the level of phosphate mining is scaled down due to the exhaustion of deposits, the migrant worker population will decrease and so will the supply of fish for the island. Greater fishing effort will be required by Nauruan fishermen to make up the shortfall in production.

Acknowledgements

The South Pacific Commission's Inshore Fisheries Research Project and the Nauru Department of Island Development and Industry wish to acknowledge the support and co-operation of fishermen and other individuals who provided information for this survey of Nauru's fisheries resources. We would like to thank in particular Mr Chris Cawley for giving information on the reefs of Nauru and providing the reef profiles; Mr Paul Bird of the Nauru Secondary School for taking the time to list the species of fish seen on the reefs at Nauru; Mr Sean Oppenheimer for

---

1. **NPC mine workers receive dry rations (tea, sugar, corn beef etc.) as part of their employment conditions, and receive a hot meal each day when working on site.**

giving information on commercial reef fish landings, and on the imports of canned and frozen fish; Mr Karl Hartman for allowing us to examine his catches and discussing spear fishing on Nauru, and Mr Richard Lewis for information on the frequency of spear fishing by SCUBA divers on Nauru.

References

Cusack, P.(1987). Phosphate FADs and fish. *South Pacific Commisssion Fisheries Newsletter* No. 43

De La Cruz, E. 1992. Buada Lagoon experimental milkfish pilot project. FAO-South Pacific Aquaculture Development Project, 8 pp.

Masuda, H., C. Araga, & T. Yoshiro. 1975. *The Coastal Fishes of Southern Japan.* Tokai University Press, Tokyo, Japan, 382 pp.

Mead, P. & P. Cusack. 1990. Deep Sea Fisheries Development Project, Report on the first visit to the Republic of Nauru 4 April–4 May 1990: Phase 1 of the Nauru fish Aggregation Device (FAD) Project. South Pacific Commission, Noumea, New Caledonia, 24 pp.

Myers, R. 1989. *Micronesian Reef Fishes*. Coral Graphics, Guam, 298 pp.

Petit-Skinner, S. 1981. *The Nauruans*. MacDuff Press, San Francisco, 292 pp.

Russ, G.R. 1991. Coral reef fisheries: effects and yields. **In**, P. Sale (ed), *The Ecology of Fishes on Coral Reefs*, Academic Press, Inc., London, 601–635.

Watt, P. 1993. Offshore Fisheries Development Project. FAD project phase III, bottom contour survey, Nauru, April 28–May 2 1993. South Pacific Commission, Noumea, New Caledonia.

Appendix I

SPECIMEN OF THE CATCH LANDING OR CREEL CENSUS FORM USED FOR NAURU FISHERIES MONITORING PROGRAMME

NAURU CREEL CENSUS DATA FORM								
Interviewer								
Date:___/___/19___ Time:_____								
Name of fisherman/fishermen								
Landing site: Gabab Channel / NPC Boat Hbr / Other:_____								
Fishing area or FAD location								
No of fishermen: 1 / 2-4 / 5-10								
Boat type: Canoe Powered skiff								
Gear type:	Troll lines	Mid-water hand lines	Bottom hand reels	Shallow reef hand lines	Spear	Cast net	Beach seine	Scoop net
Numbers								
Fishing hours								
Total no of fish								
Total wt of fish (kg)								
Percentage kept:								
Percentage sold:								
Weather:								
Moonphase: NM FQ FM LQ								

SPECIES COMPOSITION					
Species	No	Wt (kg)	Species	No	Wt (kg)

Appendix II

SPECIMEN OF WEEKLY FISHING ACTIVITY LOG FORM USED FOR NAURU FISHERIES MONITORING PROGRAMME

NAURU FISHERIES STATISTICS WEEKLY FISHING ACTIVITY LOG								
Dates __/__/__ to __/__/__								
Day	**Time**	**Gabab skiffs**	**NPC skiffs**	**NPC canoes**	**Spear fisher men**	**Cast netters**	**Beach seiners**	**Reef walkers**
M	**M**							
	A							
T	**M**							
	A							
W	**M**							
	A							
T	**M**							
	A							
F	**M**							
	A							
S	**M**							
	A							
S	**M**							
	A							

Appendix III

CHECKLIST OF FISHES OBSERVED AND REPORTED TO BE PRESENT IN WATERS AROUND NAURU[2].

CHARCARINIDAE

Carcharinus albimarginatus
Carcharinus amblyrhynchos
Carcharinus melanopterus

SPHYRINIDAE

Sphyrna lewini

MOBULIDAE

Manta alfredi

DASYITIDIDAE

Hymantura uarnak
Taeniura melanospilos

MYLIOBATIDAE

Aeobatis narinari

MURAENIDAE

Enchelynassa canina
Gymnomuraena zebra
Gymnothorax fimbriatus

SYNODONTIDAE

Synodus variegatus

HOLOCENTRIDAE

Mypristis ameana
Mypristis berndti
Mypristis hexagona
Mypristis praliana
Mypristis violacea
Neoniphon opercularis
Neoniphon sammara
Sargocentrum caudimaculatum
Sargocentrum microstoma
Sargocentrum spiniferum
Sargocentrum tiere

FISTULARIDAE
Alustomus chinensis

SCORPAENIDAE

Scorpaenopsis diabolus
Scorpaenopsis macrochir
Scorpaenopsis oxycephala
Synaceia verrucosa
Dendrochirus biocellatus
Dendrochirus zebra
Pterois antennata
Pterois radiata
Pterois volitans

SERRANIDAE

Pseudanthias dispar
Cephalopholis argus
Cephalopholis boenack
Cephapholis leopardus
Cephalopholis miniata
Cephalopholis spiloparaea
Cephalopholis urodeta
Epinephelus fasciatus
Epinephelus hexagonatus
Epinephlus merra
Epinephelus microdon
Epinephelus spilotoceps
Epinephelus fuscoguttatus
Epinephelus lanceolatus

---

[2]. **Checklist was complied from direct observatvions on fishermen's catches made here and by Mead & Cusack (1990), from identifications made by fishermen and divers in *The Coastal Fishes of Southern Japan* and *Micronesian Reef Fishes* (see bibliography) and from information supplied by R. Myers, Division of Aquatic and Wildlife Resources, Guam, (pers. comm.).**

GRAMMISTIDAE

Pogonoperca punctata
Grammistes sexlineatus

CIRRHITIDAE

Cirrhitichthys falco
Cirrhitichthys oxycephalus
Paracirrhites arcatus
Paracirrhites fosteri
Paracirrhites hemisticus

MALACANTHIDAE

Malacanthus brevirostris
Malacanthus latovittatus

CARANGIDAE

Gnathanodon speciosus
Carangoides orthogrammus
Caranx ignobilis
Caranx lugubris
Caranx melampygus
Caranx sexfasciatus
Decapterus macarellus
Elagatis bipinnulata

LUTJANIDAE

Aphareus furca
Aprion virescens
Macolor macularis
Macolor niger
Lutjanus bohar
Lutjanus erhenbergi
Lutjanus fulvus
Lutjanus kasmira
Lutjanus monostigmus
Paracaseio sp
Pristopomoides multidens

CAESIONIDAE

Caesio kuning
Caesio teres

HAEMILIDAE

Plechtorinchus chaetodonoides

NEMIPTERIDAE

Scolopsis lineatus

LETHRINIDAE

Monotaxix grand
Lethrinus elongatus

MULLIDAE

Mulloides flavolineatus
Parupeneus barberinus
Parupeneus multifasciatus

PEMPHERIDIDAE

Pempheris oualensis

KYPHOSIDAE

Kyphosus cinarescens

EPHIPPIDAE

Platax orbicularis
Platax teira

CHAETODONTIDAE

Chaetodon auriga
Chaetodon citrinellus
Chaetodon ephippium
Chaetodon kleinii
Chaetodon lunula
Chaetodon melanotus
Chaetodon meyeri
Chaetodon octofasciatus
Chaetodon reticulatus
Chaetodon speculum
Chaetodon trifascialis
Forcipiger flavissiumus
Forcipiger longirostris
Hemitaurichthys polylepis
Heniochus accuminiatus
Heniochus chrysostomus
Heniochus monocerus

POMACANTHIDAE

Apolemichthys trimaculatus
Aploemichthys xanthopunctatus

Centropyge bicolor
Centropyge colini
Centropyge flavissimus
Centropyge multicolor
Centropyge shepardi
Pygoplites diacanthus
Pomocanthus navarchus
Pomocanthus xanthometapon
Pomocanthus semicirculatus

POMACENTRIDAE

Amphiprion chrysopterus
Amphiprion perideraion
Chromis margaritifer
Chriomis xanthura
Dascyllus trimaculatus
Dascyllus reticulatus
Abudefduf saxtalis
Chrysiptera caeruleolineata
Chrysiptera oxycephala?
Chrysiptera talboti
Plectroglyphidodon dickii
Pomacentrus coelestis
Pomacentrus emarginatus

LABRIDAE

Bodianua mesothorax
Chelinus fasciatus
Chelinus undulatus
Chelinius unifasciatus
Novaculichthys taeniourus
Anampses meleagrides
Anampses twisti
Coris aygula
Coris gaimard
Gomphosus varius
Halichoeres biocellatus
Halichoeres hortulanus
Halichoeres sp.
Hemigymnus fasciatus
Macropharyngodon meleagris
Thalasoma lunare
Thalasoma lutescens
Thalasoma quinquevittatum
Labroides pectoralis
Labropsis xanthonota

SCARIDAE

Bolbometopon muricatum
Cetoscarus bicolor
Scarus altipinnis
Scarus albipectoralis
Scarus dimidiatus
Scarus festivus
Scarus flavipectoralis
Scarus rubrioviolaceous
Scarus sordidus

SPHYRAENIDAE

Sphyraena barracuda
Sphyraena fosteri

PINGUIPEDIDAE

Parapercis clathrata
Parapercis millipunctata

BLENIIDAE

Escenius bicolor?
Ecsenius opsifrontalis
Apsidontus taeniatus
Meiacanthus grammistes
Plagiotremus rhynorhynchus

GOBIIDAE

Lotilia graciliosa
Valencienna strigatus

ACANTHURIDAE

Acanthurus achilles
Acanthurus blochi
Acanthurus dussumieri?
Acanthurus guttatus
Acanthurus lineatus
Acanthurus mata
Acanthurus nigricans
Acanthurus nigricauda
Acanthurus nigroris
Acanthurus olivaceous
Acanthurus pyroferus
Acanthurus triostegus
Acanthurus xanthopterus
Ctenochaetus striatus
Paracanthurus hepatus
Zebrasoma scopas
Naso annulatus
Naso hexacanthus

Odonus niger
Rhinecanthus aculeatus
Rhinecanthus rectangulus
Sufflamen bursa
Sufflamen chrysoptera

MONOCANTHIDAE
Alutera scripta
Cantherines dumerili
Oxymonocanthus longirostris
Paraluteres prionurus
Pervagor aspricaudus?
Pervagor janthinosoma

OSTRACIIDAE
Ostracion cubicus
Ostracion meleagris?
Ostracion solorensis

TETRAODONDITAE
Arothron manilensis
Arothron hispidus
Arothron melagris
Arothron mappa

Prometichthys prometheus
Ruvettus pretiosus

CORYPHAENIDAE

Coryphaena hippurus

ISTIOPHORIDAE

Makaira indica
Istiophorous platypterus

BELONIDAE

Tylosaurus crocodilus crocodilus

Naso lituratus
Naso tuberosus
Naso unicornis
Naso vlamingi

ZANCLIDAE

Zanclus cornutus

SIGANIDAE

Siganus argentus
Siganus doliatus
Siganus lineatus
Siganus punctatissimus

BOTHIDAE
Bothus mancus

BALISTIDAE
Balistapus undulatus
Balistoides conspiculum
Balistoides viridescens
Melichthys niger?
Melichthys vidua
Arothron nigropunctatus
Arothron stellatus
Canthigaster bennetti?
Canthigaster compressa?
Canthigaster janthinoptera?

DIODONTIDAE

Diodon hystrix
Diodon liturosus

SCOMBRIDAE
Acanthocybium solandri
Euthynus affinis
Gymnosarda unicolor
Katsuwonus pelamis
Thunnus alalunga
Thunnus albacares
Thunus obesus

CHANIDAE

Chanos chanos

GEMPYLIDAE