NON-SELECTIVE FISHING METHODS OF FUTUNA (HORN ARCHIPELAGO, WEST POLYNESIA)

by René Galzin[1]

ABSTRACT

Futuna, a high volcanic Pacific island without a lagoon, is surrounded by an "apron reef" which emerges at low tide. During spring tides, this reef flat is subject to heavy exploitation from the island's people and domestic animals (i.e. pigs) through fishing, collecting shells, crustaceans, and echinoderms, and turning over stones and corals.

We describe two non-selective fishing methods used by the island's women: application of futu (a toxic substance obtained from the seed of Barringtonia asiatica), and construction of small rock piles to attract juvenile fish and to be dismantled after a day or two to collect the fish hiding inside.

At three stations on the sites where these fishing methods are employed, we collected, through poisoning experiments, approximately 40 species of fishes belonging to 20 families. For each species we give the number, average length and weight of the catch. In the species taken, the length ranges from 1.5 to 17.2 cm and the weight varies from 0.1 to 90.4 g.

We feel that these two non-selective fishing methods may endanger the balance of the ichthyological fauna of this island, as almost 58% of collected species were juveniles, e.g. Sargocentron rubrum, Epinephelus merra, Lutjanus monostigmus, Halichoeres margaritaceus, Acanthurus triostegus, Ctenochaetus striatus, Naso unicornis.

INTRODUCTION

A study of the coral reefs and their potential resources was undertaken on Futuna (Horn Archipelago, 2000 km north-east of New Caledonia) in November 1980.

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Futuna is a high volcanic island, 18 km long and 6 km wide, situated at 14°15' latitude south and 178°10' longitude west. There is no lagoon, but the ocean shore includes a fringing apron-reef in places almost exclusively made up of eroded calcareous pavement reef-rock. This reef flat, of narrow and variable width (maximum width 500 m), is almost totally emerged at low spring tide, and is covered by less than 80 cm of water at high tide. The geomorphology, biology and socio-economy of the Futuna marine ecosystems have been discussed elsewhere by RICHARD et al. (1982). The geomorphological observations made on the fringing reefs at Poi and Toloke (Figure 1) are as follows. The inner Poi reef is a reef-rock pavement partly covered by sedimentary accumulations. Next on the seaward side is a reef flat with widely spaced transverse ridges and furrows and, further seaward, a slightly raised pitted area. Toward the ocean, there is an inner biogenic ridge with a fragmentary covering of Melobesia and beyond that, the spur and groove area. The Toloke reef comprises a reticulated reef flat with furrows edged with crown-shaped corals. There are megablocks in the innermost area, and, seaward, a raised central zone with several branching Madreporia and Melobesia, sloping at its outer edge to the furrowed area.

The Futuna population (about 3,000 inhabitants) does not seem to live in close association with the sea. According to FUSIMALOHI and GRANDPERRIN (1980), this situation arose from cultural and religious prohibitions and taboos regarding the marine environment and dates back more than a century. GAILLOT (1961) thinks that the decline of fishing both on the reef and along the coast of Futuna today results from the regular importation of canned fish and meat. The local Economic Service (Services Territoriaux de l'Economie Rurale) believes that the appeal of the sea disappeared amongst Futunans due to 1/ the spread of a colonial-style prejudice toward the canoes previously used on the open sea; 2/ difficulties in the construction and maintenance of the very heavy, traditional canoes; and 3/ religious and tribal interdicts. For the year 1979, the Economic Service estimates the catch of fish at 32 metric tons (30 tons of ocean fish and 2 tons of reef fish).

In this paper we describe the fishing methods used by the Futunans, emphasizing in particular two traditional methods which appear to endanger fish populations. These latter are stupefying fish with futu and trapping them in piles of stones. This is not the first time that these two methods have been described in literature on fishing in the Pacific islands. We can quote among others the works of STOKES (1921), BURROWS (1936), LEONARD (1938), KRUMHOLZ (1958), LEGAND (1950), GAILLAND (1961), RANDALL (1963), BAGNIS et al. (1973), GALZIN (1977), SALVAT et al. (1978). The biometric analyses of the fish caught on the reef were made from samples obtained by poisoning.

FISHING METHODS USED ON FUTUNA

Fishing on Futuna seems to have developed in three main stages. Originally, before the arrival of European explorers (the island was discovered in 1616 by the Dutchmen LEMAIRE and SCHOUTEN) and until the end of the 19th century, the Futunans, like other Pacific Maohi peoples, were probably expert in the use of reef and ocean resources. However, as pointed out by DOUMENGE (1966), one must be wary of attributing too readily to these Polynesians a natural vocation for the exploitation of the sea. The second stage spans the period from the end of the 19th to well past half of the 20th century. During this period, Futunans became almost exclusively farmers, this mainly due to the strong influence of catholicism (Fusinalohi and Grandperrin, 1980). Finally, since 1970, the Economic Service has been trying a program of subsidies and boat construction to "reteach the sea" to the Futunans.

Methods presently used on Futuna

All methods, apart from troll line fishing, are used from the reef or on its immediate outer slope.

Troll line fishing is mainly practised around the north cape of Futuna and the south cape of nearby Alofi island. Barracuda comprise more than 70% of the catch. Jacks, frigate mackerel, tuna, swordfish and dolphins are also fished.

Dropline fishing on the outer slope has always been practised by Futunans from their small kumete (small Futunan canoes adapted originally from food bowls and without an outrigger). New deep-sea fishing techniques for catching snappers (vivanos) are currently being developed by the South Pacific Commission and ORSTOM (FOURMANOIR, 1980) with a view to teaching the local fishermen. At present, there are six boats equipped for such fishing in Futuna.

Gill nets have always been used. They are now manufactured from synthetic material (nylon) and imported from Noumea. Collective fishing with long surrounding nets seems to have been more or less abandoned and replaced by permanently-anchored gill nets. For example, at Sigave Bay (Figure 1), the number of gill nets has increased in two years from about 10 to more than 50. Nets with a 3 cm mesh can stay anchored for three to four months with catches comprising mainly kingfish Selar crumenophthalmus (locally known as atule), jacks and mullet.

Line fishing takes place by day and night on the reef slopes. This method is practised by both men and women, with the catch consisting mainly of jacks, squirrelfishes, and snappers.

The first underwater harpoon was imported from Noumea in 1961. There are now nearly 100 in use by both men and women with the catch including mainly parrotfishes, jacks, surgeonfishes, rabbitfishes and

the snapper Macolor niger.

Fishing by torchlight is practised by women on the reef at low tide on nights without moonlight. Crustacea and shellfish are also caught by this method.

Fishing with barbed spears is done by the men either on foot from the reef or by diving, but this is now dying out.

Fishing with futu and fishing with piles of stones are two methods used by the women, and will be described in detail below.

Fishing for flying fish and fishing with the use of snares are two methods described by GREZEL (1878), but they seem no longer to be practised.

Fishing with explosives: we were unable to ascertain whether this method, frequently used on Wallis, and one of the reasons for the scarcity of fish in the lagoon of this neighboring island, is also practiced on Futuna.

Fishing with futu

This type of fishing observed at Poi, tends to prevent fish from escaping by stupefying them with a vegetable poison. Two or three times a week, at low tide, an area of the inner reef flat, covered by only a few centimeters of water, is surrounded with branches and dry leaves of coconut trees. A few days in advance, about 20 Barringtonia asiatica fruits are collected and their big, round seeds grated. The powder obtained by grating the Barringtonia seeds is put in a basket which is then submerged and shaken within the enclosed area. About half an hour later, the fish begin to flounder and break surface - they are then collected with a kind of skimming net called kukutsi.

Trapping with piles of stones

This method was observed at Toloke in an area of reticulated reef with residual pools and puddles. These depressions (3 m wide by 150 m long and 0.40 m deep) have a sandy bottom over the reef pavement. The women of the village build an artificial shelter from a pile of stones, about 1 sq. m in size in one part of a basin, and this is left for a few days without being touched. On fishing day, a basket woven from coconut leaves is placed between the pile and the edge of the basin, and then the stones are removed one by one from the side away from the basket. Two or three of them are put in the basket to constitute another precarious refuge and the rest are put in the other part of the depression. The fish, which had found shelter within the pile, gradually see their refuge getting progressively smaller. All or nearly all of them seek their last shelter under the two or three stones in the basket. These stones are then removed and the fishing

process is complete.

The two methods just described above have two characteristics in common; the catch is poor for the amount of work involved, and only small specimens can be caught (the maximum size of those taken during our observation was 17 cm). A list of all species thus collected is given in Table 1.

POISONING WITH ROTENONE POWDER

Not wishing to deprive the Futuna women of their catch, yet wanting to check the biometrical parameters of the fishes thus caught, we collected fishes with rotenone (GALZIN, 1979) in the same areas several days later. The results of these catches are summarized in Table 2. At Poi, near the beach, 102 fishes were caught, with a total weight of 153 g, i.e. 1.5 g per individual. The largest fish caught was less than 10 cm long. On the same reef, but along the biogenic ridge, we caught 94 fishes with a total weight of 237 g (average weight 2.52 g). Here again, the biggest fish (Halichoeres margaritaceus) was very small (10 cm long and weighing 19.5 g). At Toloke, the fishes caught were somewhat bigger. In a depression of 13 sq. m we caught 139 fishes with a total weight of 1031.8 g - an average weight of 7.2 g each. The largest was a serranid - Epinephelus merra, weighing 90.4 g and 17.2 cm long.

These figures give an idea of the size of fish caught at low tide by the women of Futuna who gather all they can find on the reef. Among the fishes caught (Table 1) at least 26 species (58%) were at a juvenile stage: included were, e.g. Sargocentron rubrum, Epinephelus melanostigma, E. merra, Lutjanus monostigmus, Halichoeres margaritaceus, Acanthurus triostegus, Ctenochoetus striatus and Naso unicornis.

CONCLUSIONS

At low tides, the reef flat is a "rendez-vous" for both the human and animal populations of the island. The inhabitants collect all that is edible, while pigs rummage and turn over every stone, causing the destruction of sciaphile flora and fauna. However, in the absence of quantitative information on harvest rates, it is not possible to confirm the occurrence of over-harvesting.

With the two traditional fishing methods described above (futu and stones), the fish caught are almost exclusively of very small size (as noted by BURROWS, 1936). These methods thus tend not only to cause the disappearance of sedentary fish populations of the reef flat, but also to contribute to reduce fish stocks living on the outer slope: juveniles of most of the fish species living as adults on the outer slopes have to find shelter in the calmer and more trophic environment of the apron-reef where they are harvested

indiscriminately. More information is needed on the behavior of all fish species as the tides go down.

Considering the current Futunan population size, with the survival of ancient techniques of fishing as well as the introduction of new fishing methods, we observe a considerable non-selective exploitation of the apron-reef fishes on Futuna. An information campaign concerning the problems of maintaining natural stocks of fish should be launched to complete the excellent initiative already undertaken to promote and develop offshore fishing.

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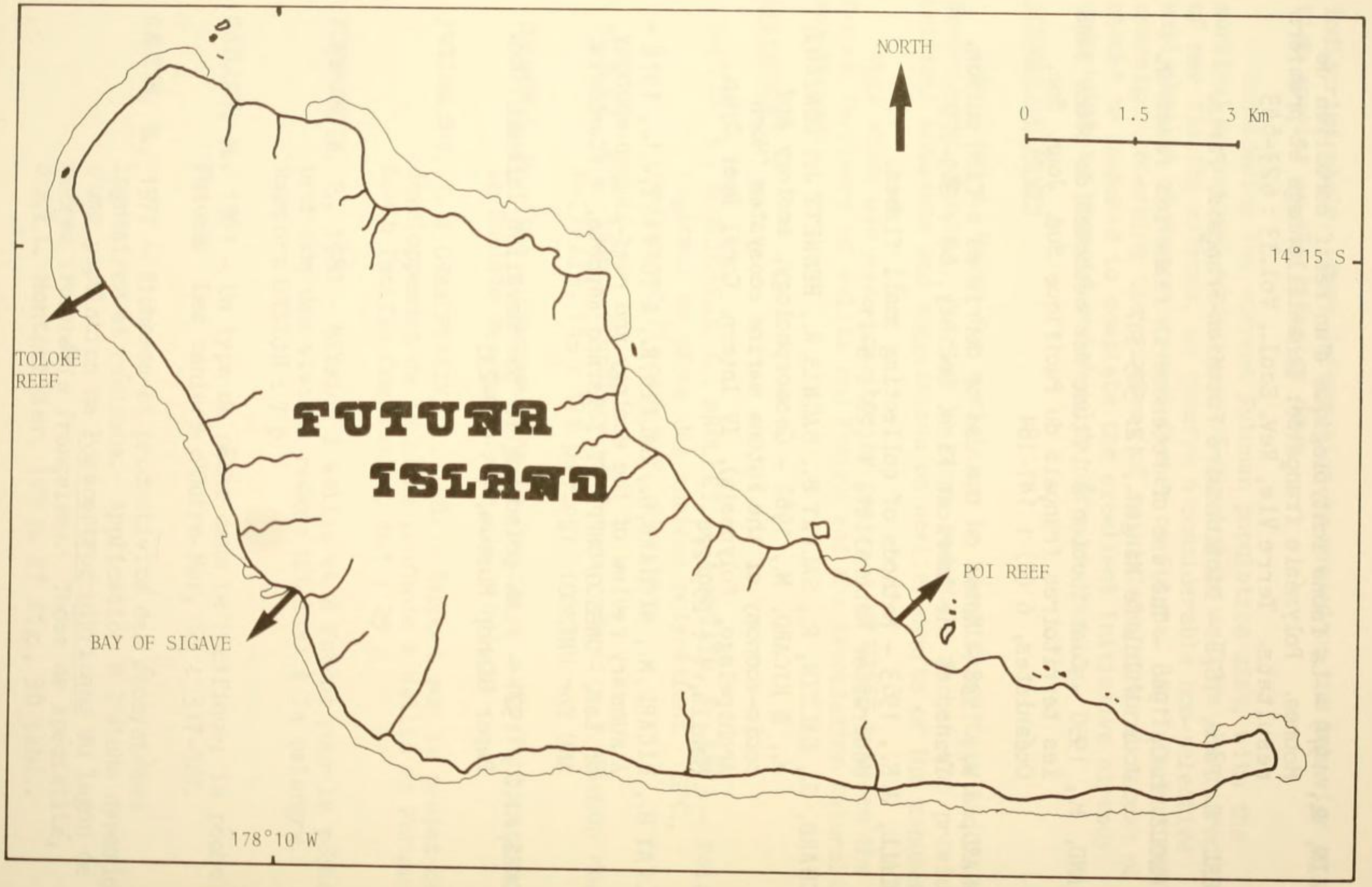

Fig. 1. Map of FUTUNA and location of the fishing sites cited in text: Poi reef - fishing with futu; Toloke reef - fishing with stone piles; and Bay of Sigave - fishing atule with nets.

		ROTENONE EXPERIMENT			Fishing with futu	Fishing with rock piles
		POI near the ridge	POI near the beach	TOLOKE		
MURAENIDAE	Echidna nebulosa (Ahl,1789)					+
	Lycodontis sp.			+		
CONGRIDAE	Conger cinereus Rüppell,1828	+				
HOLOCENTRIDAE	Sargocentron rubrum (Forskall,1775)				+	+
	" sp.			+		
SYNGNATHIDAE	Choeroichthys sculptus (Günther,1870)	+				
SCORPAENIDAE	Sebastapistes corallicola Jenkins,1902			+		
	Scorpaenodes guamensis (Quoy et Gaimard,1824)	+	+			+
SERRANIDAE	Epinephelus melanostigma Schultz,1953		+		+	
	" merra (Bloch,1793)			+		+
GRAMMISTIDAE	Grammistes sexlineatus (Thünberg,1792)	+	+	+		
PLESIOPIDAE	Plesiops caeruleolineatus (Rüppell,1835)			+		+
APOGONIDAE	Apogon aureus Lacépède,1803					+
	" cyanosoma (Bleeker,1853)	+		+		+
	" nubilus (Carman,1903)			+		+
LUTJANIDAE	Lutjanus monostigmus (Cuvier,1828)				+	
MULLIDAE	Parupeneus atrocingulatus (Kner,1870)			+		
CHAETODONTIDAE	Chaetodon citrinellus Cuvier,1831			+		
	" lunula (Lacépède,1802)	+	+		+	
	Pomacanthus imperator (Bloch,1787)	+				
POMACENTRIDAE	Abudefduf sordidus (Forskall,1775)		+			
	Stegastes nigricans (Lacépède,1803)			+		+
	Chrysiptera cyanea (Quoy et Gaimard,1825)			+		
	" glauca (Cuvier,1830)	+	+	+	+	
	" leucopoma (Lesson,1830)	+		+		
	Pomacentridae sp.1 (juv.)		+			
	" sp.2 (juv.)			+		
LABRIDAE	Halichoeres hortulanus (Lacépède,1802)			+		
	" margaritaceus (Valenciennes,1839)	+		+	+	
	" marginatus (Rüppell,1835)			+		
	Stethojulis trilineata (Bloch et Schneider,1801)			+	+	
	" sp.	+				
	Thalassoma hardwickei (Bennett,1830)			+		
	" umbrostygma (Rüppell,1835)	+		+		
BLENNIIDAE	Cirripectes variolosus (Valenciennes,1836)			+		
	Istiblennius cyanostigma (Bleeker,1849)				+	
	" edentulus (Schneider,1801)		+		+	
	" periophthalmus (Valenciennes,1836)	+		+		
TRIPTERYGIIDAE	Tripterygiidae sp.(juv.)	+				
GOBIIDAE	Bathigobius fuscus Rüppell,1828	+			+	
ACANTHURIDAE	Acanthurus nigrofuscus (Forskall,1775)				+	
	" lineatus Linné,1758			+		
	" triostegus (Linné,1758)	+	+	+	+	+
	Ctenochaetus striatus (Quoy et Gaimard,1824)					+
	Naso unicornis (Forskall,1775)					+
	Number of species	16	9	25	12	12

Table 1. List of fishes collected on the reefs of FUTUNA island.

		Number of species	WEIGHT in g			SIZE in cm		
			average weight	minimum weight	maximum weight	average size	minimum size	maximum size
POI	Conger cinereus	2	0.8	0.6	1.0	8.3	7.0	9.7
	Choeroichthys sculptus	1	0.2			4.1		
	Scorpaenodes guamensis	1	0.6			3.0		
NEAR	Grammistes sexlineatus	2	0.4	0.2	0.7	2.7	2.1	3.2
	Apogon cyanosoma	3	2.5	1.6	3.3	5.5	4.8	6.1
	Chaetodon lunula	2	3.9	0.6	7.3	4.2	2.4	6.0
	Pomacanthus imperator	1	1.3			3.2		
THE	Chrysiptera glauca	25	3.8	0.2	12.1	5.2	2.1	8.2
	" leucopoma	2	0.7	0.5	0.9	3.1	2.7	3.5
	Halichoeres margaritaceus	6	6.3	0.4	19.5	6.4	3.0	10.0
	Stethojulis sp.	1	0.7			3.5		
RIDGE	Thalassoma umbrostygma	3	0.2	0.1	0.3	2.4	2.0	3.0
	Istiblennius periophthalmus	4	0.8	0.5	1.2	4.1	3.5	4.7
	Tripterygiidae sp.	2	0.1	0.1	0.1	1.9	1.6	2.1
	Bathygobius fuscus	20	1.7	0.1	6.9	4.9	2.3	8.6
	Acanthurus triostegus	19	2.3	0.6	5.0	4.3	2.8	5.7
POI	Scorpaenodes guamensis	2	2.4	2.1	2.7	5.1	4.8	5.3
	Epinephelus melanostigma	5	2.7	1.2	6.3	5.5	4.3	7.8
	Grammistes sexlineatus	4	4.9	0.3	17.5	4.6	2.2	9.3
NEAR	Chaetodon lunula	1	0.2			1.9		
	Abudefduf sordidus	2	0.6	0.5	0.7	2.8	2.7	2.9
THE	Chrysiptera glauca	40	1.5	0.1	11.3	3.7	1.9	8.1
	Pomacentridae sp.	1	0.1			1.9		
BEACH	Istiblennius edentulus	1	2.0			5.8		
	Acanthurus triostegus	45	1.1	0.5	6.5	3.2	2.6	6.7
TOLOKE	Lycodontis sp.	4	6.9	1.2	16.5	13.5	8.4	17.2
	Sargocentron sp.	3	3.5	2.7	5.0	5.7	5.1	6.6
	Sebastapistes corallicola	1	5.8			6.0		
	Epinephellus merra	4	66.0	34.6	90.4	15.6	12.8	17.2
	Grammistes sexlineatus	1	0.3			2.6		
	Plesiops caeruleolineatus	1	1.6			4.8		
	Apogon cyanosoma	9	14.3	3.1	11.8	7.7	5.6	9.0
	" nubilus	1	7.7			6.6		
	Parupeneus atrocingulatus	1	3.5			6.7		
	Chaetodon citrinellus	4	9.1	4.4	13.6	7.0	5.7	8.0
	Stegastes nigricans	38	4.7	0.2	18.5	5.5	2.0	8.7
	Chrysiptera cyanea	3	0.1	0.1	0.2	2.1	2.0	2.5
	" glauca	3	3.8	2.3	6.8	5.6	4.8	7.1
	" leucopoma	1	0.1			2.0		
	Pomacentridae sp.	1	0.1			1.9		
	Halichoeres hortulanus	1	5.1			7.3		
	" margaritaceus	3	1.8	0.5	2.6	4.9	3.2	6.2
	" marginatus	6	1.2	0.1	4.1	3.5	1.7	6.4
	Stethojulis trilineata	7	5.3	1.0	12.4	6.8	4.2	9.2
	Thalassoma hardwickei	3	8.2	6.6	9.1	8.2	7.5	8.7
	" umbrostygma	8	16.8	4.7	25.8	10.3	6.8	12.0
	Cirripectes variolosus	1	0.2			2.4		
	Istiblennius periophthalmus	12	6.5	0.7	12.8	8.5	4.0	12.5
	Acanthurus lineatus	3	21.2	15.0	27.0	10.2	9.8	10.5
	" triostegus	20	2.9	0.7	8.1	4.7	3.2	7.0

Table 2. Rotenone experiments in 3 areas of the FUTUNA reef. For each station we give the number of fishes caught, the average weight and size of fishes, and the minimum and maximum weight and size of fishes.