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ECOLOGY OF THE FISHES OF THE INNER CORAL REEF FLAT IN TULEAR (MADAGASCAR)*

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ABSTRACT

The scope of this paper, the first part of a general ecological study of fishes living in the coral reef of Tuléar, is restricted to the fishes of the inner reef flats. A residual sheet of water, individualised at very low tide between the boulder tract and the sandy deposit, enables the development of an original reef fish population. 231 species belonging to 52 families were indentified.

Two primary ichthyological stocks are distinguished : a permanent stock and a temporary stock. The inner flat is divided into three geomorphologically distinct zones; their ichthyological peculiarities are described and each of them is characterised by some species of the permanent populalion; the species of this population are distributed into seven ecological categories, according to their habitat and feeding behaviour. The permanent stock composition is the same during the day or at night, but active populations vary greatly. On the contrary, the species composition of the temporary stock is quite different.

INTRODUCTION

NUMEROUS taxonomic studies have already been carried on the coral reef fishes in Madagascar. Unfortunately, the ecological data are, most of the time, restricted to the name of the locality where the species were collected.

The ecology of coral reef fishes has already been studied in Red Sea by Abel (1960), Fishelson (1964) and Zander (1967), in the Indian Ocean by Talbot (1965), in the Pacific by Harry (1953), Hiatt and Strasburg (1960) and Plessis (1968), and, in the tropical Atlantic by Bardach (1958) and Randall (1963). In the reefs of Madagascar, only data on the distribution of the reef fishes are given by Angot (1950) and Fourmanoir (1963).

The fishes living in or in connexion with a coral reef tract do not constitute one homogeneous community, but on the contrary they represent several communities, partly interpenetrating, each of them being more or less specific of one zone of the reef. These communities are included in the coral reef ecosystem and have to be taken in account when analysing coral reef trophic structures. For these reasons, I had to study jointly in Tuléar (Madagascar) the species distribution and their feeding behaviour.

As shown by the general catalogue published by Mauge (1967), the ichthyofauna of this area is very rich. Consequently, it was not possible to start

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a study of the whole fish fauna. In a first step, such a study has been restricted to the fish communities of the inner reef flat. In the present paper are given the results concerning the ecology and distribution of the fishes on the inner reef flat.

ENVIRONMENTAL FACTORS

The coral reefs in the vicinity of Tuléar (Fig. 1)

In the vicinity of Tuléar, the tides are of semi diurnal type. During spring tides, the maximum range is 3.2 m. The reef front is constantly under a heavy swell from the South West, frequently strengthened by winds flowing from the same direction. More details concerning the environmental factors can be found in Pichon's papers (1964, 1970).

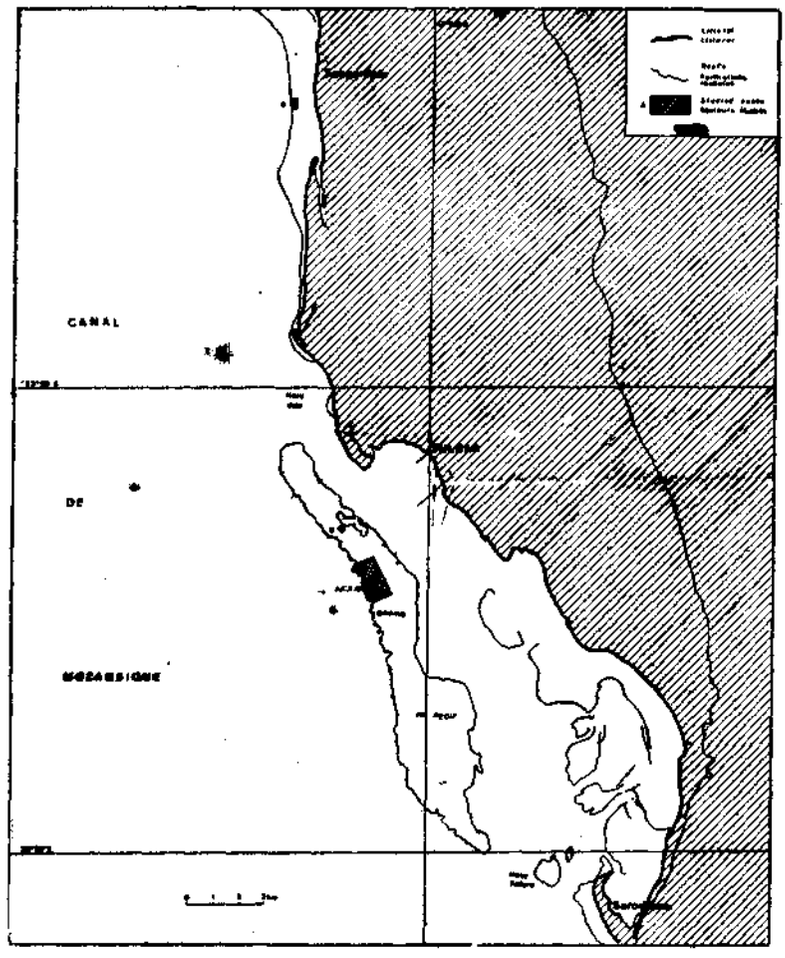

Fig. 1. Map of the reefs in the vicinity of Tuléar.

The "Grand Récif" of Tuléar extend over 18 kilometres, from North to South. Its width varies from 1.8 to 2.9 Km. Between the reef and the shore, the lagoon or channel is not deeper than 10 m execept towards its North and

South ends. From the open sea to the lagoon, the coral reef can be divided into several geomorphological units, as follows : outer slope*, outer reef flat,* boulder rampart*, inner reef flat*, sandy deposits* covered by sea-grass beds* and lagoon slope*.

About 20 km northward, the fringing reef of Songoritelo shows a narrow and shallow boat channel. Its main features are the lack of boulder rampart and, consequently, of a true inner reef flat.

The inner reef flat (Fig. 2a, b; 4 a)

The inner reef flat is localised between the boulder rampart and the sandy deposit, which embank at extreme low water a residual sheet of water from 0.3 to 1.5 m deep.

The inner reef flat is a relatively sheltered place. The waves and swell, breaking on the reef front at low tide and on the boulder rampart at high tide are of lesser effect. More important are the tide currents. The currents have a general direction from the reef front towards the lagoon. Nevertheless at the beginning of the ebb-tide the drainage also occurs in the direction of the reef front, until the boulder rampart is completely emerged. After that moment the

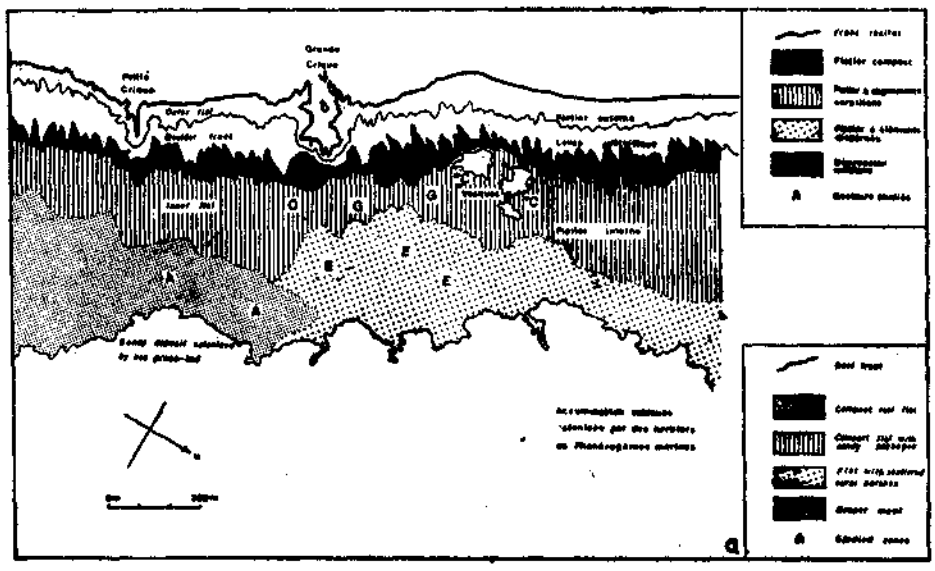

Fig. 2 a. Details of the studied areas: 'Grand Récif' of Tuléar.

water-flow partly continues in the same direction, through the boulder rampart, but most of the water remaining on the inner reef flat flows towards the lagoon until the emersion of the sea grasses beds.

Zonation of the inner reef flat

The inner reef flat is divided into several distinct zones, which are, from the boulder rampart to the sandy deposits:

*A definition of the terms of reef morphology marked with an asterisk is given in Clausade *et al.* (1971) Morphologie des récifs coralliens de la région de Tuléar (S-W de Madagascar) : Elément de terminologie récifale.

– the compact tabular reef flat
– reef flat with alined coral growth
– reef flat with scattered coral growth
– microatoll reef flat

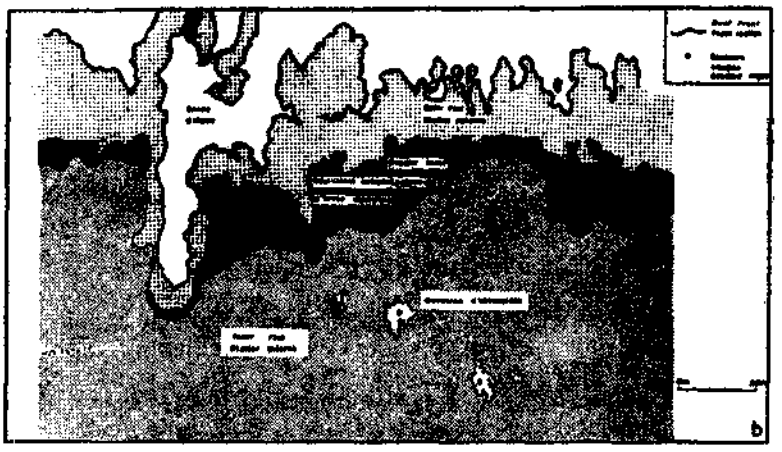

Fig. 2 b. Details of the studied areas: Reef of Songoritelo.

An inner moat may wholly or partly replace these zones, which are defined in Clausade *et al.* (1971).

The coral growth found on the inner flat has a flat, levelled, upper surface and emerges at very low tide. On the contrary, the coral growth of the inner moat never reaches the surface of the residual sheet of water.

An original fish community occurs in the residual sheet of water which is found on the inner reef flat.

METHODS

Fish collecting was made at extreme low tide, during the day and at night, after poisoning a defined area of the reef flat. No method can give the totality of the fishes living in a given area. Poisoning with Rotenone is the method that gave the best results when the depth of water on the reef flat is low, but it has some disadvantages: The Rotenone works on the fishes respiratory centers, which then tend to get out of their holes and come to the surface. Some of them, however, are wedged in the anfractuosities. Others burrow in the sediment or, after sinking on the bottom, become the prey of invertebrate scavengers or even of fishes which are not yet affected by the Rotenone. The biggest species (and the faster swimmers) swim away from the poisoned zone. To catch them, a fishing net was disposed downstream the poisoning line.

Fish poisoning at high tide was not possible with the "Rotenone method" which I constantly utilised. Fish collecting at high tide will require the use of other ichthyotoxics, of dynamite, and of nets and traps. To fill such a gap, I performed numerous divings on the whole reef flat and on the reef slopes, at high spring tide as well as at high and low neap tides.

COLLECTING LOCALITIES

From October 1969 until March 1970,22 poisonings have been carried out on the "Grand Récif" of Tuléar and 5 on the reef of Songoritelo (Fig. 1).

On the "Grand Récif" we paid special attention to the following areas:

- part of the reef flat between small pools in the North and a small creek in the South. It has been divided into 3 zones corresponding to three morphological units.

- pools (zone C)

- reef flat hollows lying North West of the "Grande Vasque" (zone B) These different zones are indicated in Fig. 2a.

On Songoritelo coral reef, small ponds are to be found at a place equivalent to that a boulder tract or inner flat would have, if they were present. They correspond to zone D (Fig. 2 b).

No poisoning has been made in the two following zones :

- the compact tabular flat in which no grooves occur (It would have been necessary to dynamite the reef flat to collect the species living there).

- The microatoll reef flat (Microatolls are generally very compact and hiding places for the fishes are scarce. The fish fauna is poor and chiefly composed of Chaetodontidae and Pomacentridae).

THE FISH FAUNA OF THE INNER REEF FLAT

A list of the fishes collected on the inner reef flat of the "Grand Récif" and on the reef flat of Songoritelo is given in Table 1. For each species are given the numbers of specimens collected in the various poisoning places and also during the day and at night. It is necessary again to point out that poisoning took place only at low spring tide.

231 species belonging to 52 families have been identified. 25 of these species had never been recorded before in Tuléar.

Although taxonomic papers on tropical marine fishes are numerous, there are still numerous points of disagreement between authors, and also large gaps such as the lack of description of ephebic stages for most of the species. Therefore, such a list is probably incomplete.

The fishes spending all their life or only a part of their life on the inner reef flat can be referred to two main communities : a *permanent community*, the composition of which is not altered by the tides; a *temporary community* depending on the depth of water on the reef flat. We will only study the first of them.

For the whole reef flat, I have established an order of importance of the fish families by considering for each of them the number of species and the number of collected specimens (Table 2). The families Pomacentridae (28 species, 2256 specimens), Apogonidae (12 species, 1039 specimens) and Labridae (31 species, 382 specimens) are major components of the community. We find next, in order of decreasing importance : Muraenidae (14 species, 144 specimens), Chaetodontidae (10 species, 137 specimens), Acanthuridae (6 species, 187 specimens), Gobiidae (10 species, 108 specimens), Eleotridae (10 species, 104 specimens), Scaridae (6 species, 165 specimens) Scorpaenidae (13 species, 71 specimens), Serranidae (10 species, 65 specimens), Salariidae (6 species, 82 specimens) and some other families of secondary importance.

The lack of large-sized species(a few Muraenidae excepted) in the permanent fish community of the inner reef flat is at first sight surprising. This comes from two reasons: First, the specimens belonging to 27 families that were collected, a standard length below 10 cm when adult and, second, the species with a standard length of 30 cm and more, were only in ephebic stage when collected. The coral growth of the reef flat emerging at low spring tides, large-sized fishes cannot hold there. Younger stages find on the reef flat a natural protection against the large predators and the adults of their own species. This almost general phenomenon in the Serranidae (*Epinephelus areolatus, E. fario, E. merra...*) is found also in a few species of the family Labridae *Cheilinus diagrammus, C. oxycephalus, C. trilobatus, Coris africana, C. caudimacula, Pteragogus taeniops*). Although some Muraenas, more than 1 m long have been collected, the number of young specimens is by far greater than the number of adults. On the outer slope, the size of the fishes increases with the depth. Numerous specimens tend to live deeper when they become older. Besides the protection eusured by the tide rhythm, the small sized families find on the very anfractuous reef flat particularly convenient life–conditions. Thus families Pseudochromidae, Pseudogrammidae, Eleotridae, Tripterygiontidae, Brotulidae and Gobiesocidae take a great numeric importance.

The species of the permanent fish community can therefore be divided in two groups: the species which remain all their life on the inner reef flat and the species which live on the inner reef flat for only a period of their life-cycle.

HORIZONTAL DISTRIBUTION OF REEF FISHES ON THE INNER REEF FLAT

The inner reef flat is divided into several, geomorphologically distinct zones. It is interesting to know how far this situation would have influence on the fish fauna and if an horizontal distribution of the species could be noticed.

The coral-reef fishes, although they are well-known for their sedentary habits, can move within a zone, the dimensions of which vary according to the species and the age of the specimens. It was therefore difficult to expect a zonation on such a restricted area as the inner flat is.

Forty six species (which are among the commonest numerically) are constantly found along a transect from the boulder rampart to the sea grass beds, across the reef flat with alined coral growth, the reef flat with scattered coral growth and the inner moat. After excluding these species, it becomes possible to make clear the characteristics of each geomorphological unit. Table 2 shows that the order of importance of the families is different in each geomorphological unit, some of these families being particularly important in one or another of the various zones.

The results of the present study will be given in the following order: zones A,E,G, corresponding to three of the reef flat geomorphological units, then zone B, C, D, which are considered here as "accidents" when compared to the normal reef zonation.

Zone A : Inner moat

A few living coral colonies grow on a dead and very anfractuous basement, the lower part of which is embedded in a thick layer of sediment. On dead blocks the brown algae *Sargassum* and *Turbinaria* are very common.

Two factors influence the composition of the fish population : the lack of coral built tabular flat,and the high rate of sedimentation. Nine species of the family Gobiidae are present, 3 of which (*Drombus irrasus,D. plumatus,* and *Zonogobius corallinus*) were collected only in the inner moat. The families Syngnathidae and Eleotridae are very important, when compared to the others. *Coerithoichthys haematopterus,* and *Doryramphus melanopleura* for the first of these two families, *Asterropterix semipunctatus, Eviota nebulosa* and *E. stigmapteron* for the second one, seems to prefer the inner moat. It is to be noticed that *Myripristis bowditchae* has not been collected there, the environmental conditions being not suitable to that species.

The lack of Scaridae and the scarcity of fast swimmers is a consequence of the methods we initially used for fish collecting: The laying of a net around coral patches, then of a tilt (to prevent a large diffusion of the Rotenone) provoked the flight of the fast-swimming fishes. The use of the tilt was rapidly abandoned, and the net, disposed across a sandy groove was only used to catch the species swimming away from the poisoned zone.

The influence of the height of water (1 m to 1.5 m), more important in that part of the reef flat than in the others has not been studied. The best swimmers should preferentially gather in the inner moat, at low tide.

Zone E: Reef flat with scattered coral growth

The sandy deposits are all the more important as we move away from the boulder rampart. Some places are covered with the brown algae *Turbinaria* and *Sargassum.* This zone of the reef flat has the richest ichthyological fauna. We collected there 154 species and only 92 in the inner moat and 104 in the reef flat with alinged coral growth.

The fish community is characterised by an increased importance of families Scorpaenidae, Salariidae and Scaridae. Twelve species of Scorpaenidae live in the anfractousities and only one: *Scorpaenodes guamensis* (which is found on the whole reef flat) in zone Aa nd four in zone G. *Scorpaenopsis gibbosa, Sebastepistes kowiensis, Parascorpaena aurita* and *P. picta* seems to be characteristic of zone E. The same conclusion applies to two of the six species of the family Salariidae: *Cirripectes variolosus* and *Istiblennius periophthalmus.* Schools of *Scarus sordidus,* most of them being composed of young specimens, are common. *Leptoscarus vaigiensis,* which is found in the sea grass beds during the day, has been collected only at night in zone E, where it finds shelter to sleep.

Zone G: Reef flat with alined coral growth

The sandy deposits become organised in passages, in which the thickness of the sand decreases near the boulder tract. The sand can be replaced by coarse fragments of dead corals, a few centimeters in size. In some places, the basement of the reef can be seen. When the coral growth becomes alined, the following families become predominant, Haliophidae (*Haliophis guttatus*), Ophichthidae (*Myrichthys maculosus*), Serranidae and Holocentridae. These fishes live in cavities and under overhanging corals. The number of *Myripristis bowditchae* increases when the coral growth is important and arranged in well-defined alinements, and is maximun in pools, where overhanging rocks are much developed.

Young specimens of *Scarus forsteri, S. sordidus* and *S. taeniurus* are numerous.

Zone B: A reef flat hollow lying North West of the "Grande Vasque" ("Grand Récif" of Tuléar)

The maximum width of the reef flat hollow is about twenty meters, and its depth varies between 1.5 m and 3 m. A thick layer of sediment covers the bottom on which tall colonies of *Millepora* live.

Fish poisoning gave poor results, but they show nevertheless that Mullidae are numerous. The fish population of that reef flat hollow (which is indirectly connected to the "Grande Vasque" by sandy grooves) is closely related to that of the lagoon. In the lagoon, indeed, we find again *Parupaeneus barberinus, P. luteus, P. macronema. P. pleurospilos,* which are characteristic of sheltered areas with calm water, always covered with a sufficient depth of water, and where the sediment is abundant.

Zone C: Pools on the "Grand Récif" (Fig. 3 a)

The diameter of the small pools which we have poisoned varies from 5 to 15 m and their depth is about 4 m. They are surrounded by a very flourishing reef flat. Numerous coral colonies actively grow along the walls.

The families Holocentridae and Serranidae find there very convenient life conditions, because of the development and number of overhanging rocks and holes. Species diversification in the family Serraridae is maximum. Two out of the 6 species which were collected, are particularly frequent: *Epinephelus fuscogutta tus* and *E. hexagonatus.*

The persistance of an important depth of water at extreme low tide, and the position of the pools on the outer part of the reef flat have consequences on their fish population. Thus, we have noticed species normally living on the outer slope, such as *Pempheris oualensis, Gaterin gaterinus* but especially *Lutianus johni* and *L. fulviflamma.*

The pools are also convenient places for *Parupaeneus macronema,* which finds there calm bottom-water and a sandy floor. The fast-swimming species of the reef-flat gather in the pools at low tide, as shown by the important number of *Abudefduf leucogaster, A. saxatilis, A. sexfasciatus, A. sparoides.* On the contrary *Chromis ternatensis* lives permanently in the pools.

Zone D: Small ponds of the reef flat of Songoritelo (Fig. 3 b).

These small ponds or hollows are about 10 m long and 1.5 m deep, at most. They are localised in the outer part of the inner reef flat equivalent, or even in the boulder tract equivalent. The surface of the reef flat is consolidated by calcareous algae. A net of tunnels across the outer reef flat keep an indirect permanent connection between the small ponds and the reef front. Thus, switf

currents are to be observed in the small ponds during spring tides. Thanks to this situation, *Pempheris oualensis* is to be found in the outermost of them.

The abundance of the species living in the reef flat is to be correlated with the development (which is here very important) of a net of cavities. *Plesiops melas, Dinematichthys illuocoetoides, Haliophis guttatus, Scorpaenodes guamensis, Echidna polyzona* and *Lycodontis undulatus* are very numerous.

Remarks on the fish community of the inner reef flat

We have specified with fat type, on Table 1, the species belonging to the permanent fish community of the inner reef flat. However, numerous species belonging to the families Holocentridae, Acanthuridae, Pomacentridae, Labridae an Scaridae, live also on the slopes, everywhere when coral growth is

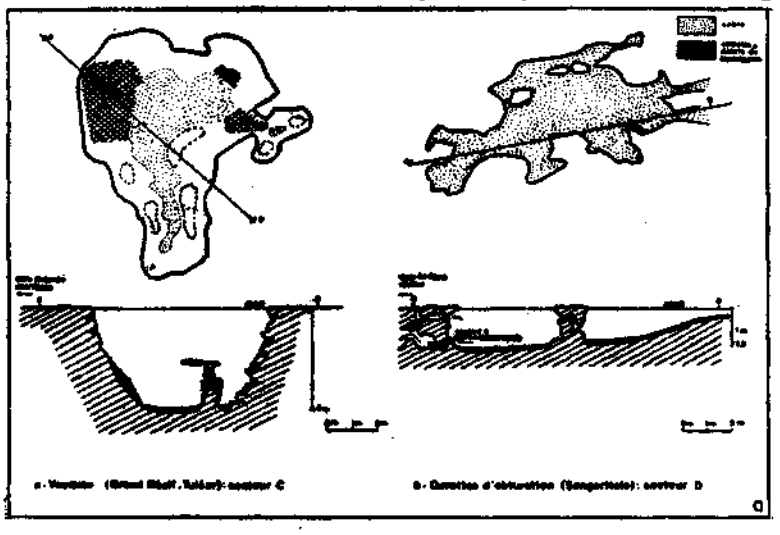

Fig. 3 a. Plane views and cross sections showing the differences between "reef pools" and "reef ponds"

present. It will be therefore necessary to collect fishes on both outer and lagoon slopes, in order to determine the bathymetric limit of these species, and, above all, to define with certainty the composition of the fish community of the inner reef flat.

It is to be considered nevertheless, that most of the species which we have named for a tentative characterization of the various reef flat zones belong to essentially sedentary families : Syngnathidae, Gobiidae, Eleotridae, Salariidae, Scorpaenidae, Haliophidae.

THE ECOLOGICAL CATEGORIES AND THEIR VERTICAL DISTRIBUTION

The species behaviour of coral reef fishes are diversified and complicated. It was not possible, within the frame of that work, to undertake their detailed study. Several times, we alluded to the more or less remarkable mobility of some species. We have defined 7 ecological categories, founded also on the fish habitat, on their trophic relations with the reef flat, and on their position within the water mass. They frequently correspond to a specific feeding behaviour.

The use of scuba for field work on the reef slopes and in the pools led to a discrimination between categories 1 and 2 which are always intimately mixed on the inner reef flat, where the depth of water remains shallow.

Category n° 1

Fishes swimming around, and especially above the coral heads or patches and moving away from them farther than 3 m (in the vertical direction), when the depth of water allows it (reef slopes, pools). Partially or totally plankton feeders. Their relations with the reef flat are rather loose. *Abudefduf septemfasciatus, A. sexfasciatus, A. saxatilis, A. sparoides.*

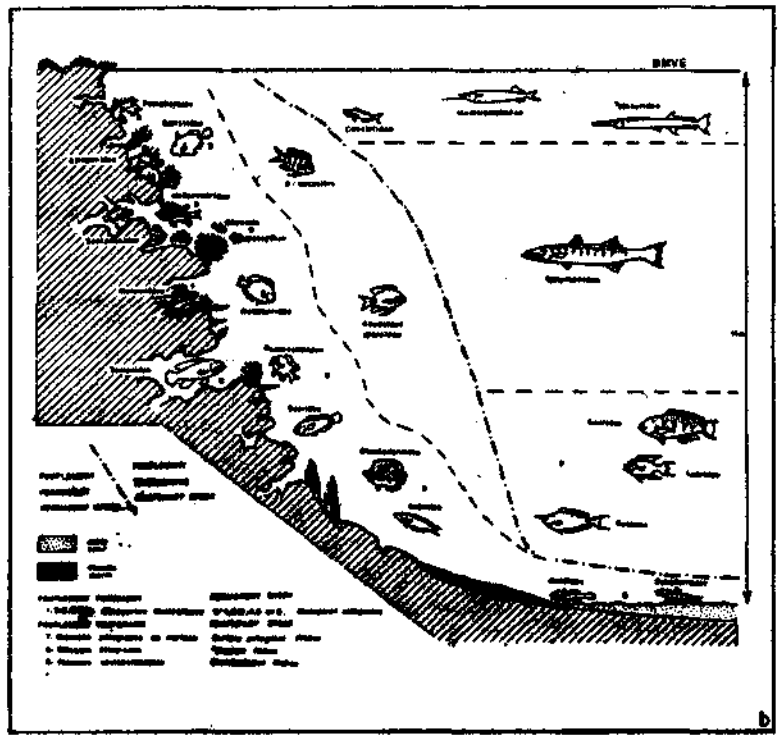

Fig. 3b. Fish zonation in a pool at low water of spring tide.

Category n° 2

Fishes swimming around and above the coral heads and patches, but never swimming away farther than 2.5 m. They totally depend on the reef flat for their food. Acanthuridae : *Acanthurus, Ctenochaetus*; Chaetodontidae, Pomacanthidae : *Pomacanthus, Centropyge;* Pomacentridae: *Pomacentrus;* Labridae : *Gomphosus, Halichoeres, Thalassoma;* Scaridae: *Calotomus, Scarus.* The Labridae excepted, all are herbivorous or omnivorous.

Category n° 3

Fishes living (during daytime) under overhangs. They are carnivorous, but feed also on planktonic and nectobenthic organisms. Holocentridae: *Holocentrus, Myripristis;* Apogonidae *: Apogon, Apogonichthyoides, Fowleria, Ostorhynchus, Pristiapogon;* Pempheridae : *Pempheris oualensis.*

Category n° 4

Fishes living in the network of cavities in the reef flat. Most of them are carnivorous : Pseudogrammidae, Plesiopidae, Serranidae, Brotulidae, Haliophidae, Scorpaenidae, Muraenidae, Congridae.

Category n° 5

Fishes living in connection with the sediment. They turn up the sand or catch the preys venturing near the bottom. Torpedinidae, Synodontidae, Bothidae, Soleidae, Mullidae, Gobiidae.

Category n° 6

Fishes linked to branching Madreporarian corals. They can be divided into two groups:

-species swimming around the Madreporarian colony, where they take refuge when a danger is approaching : *Chromis caeruleus, Chromis dimidiatus, Dascyllus aruanus.* They often gain a greater independence towards the coral colony when growing up.

- bad-swimming species, living in the colony, between the branches. These are microcarnivorous. *Gobiodon citrinus, G. rivulatus, Paragobiodon echinocephalus, Taenionotus triacanthus; Caracanthus unipinnus.*

Category n° 7

Fishes living in symbiosis with reef invertebrates other than Madreporarian corals. We have only collected fishes living in symbiosis with Actinia (*Stoichactis, Radianthus*). *Amphiprion akallopisos, A. ephippium, Dascyllus trimaculatus.* The two species of *Amphiprion* are never found on the same host, whereas *D. trimaculatus* occurs together with *A. akallopisos.*

There is therefore a vertical zonation of the species according as they live in between, or above the coral heads or patches. Such a zonation is to be observed on the reef flat at high water of spring tides and during all the neap tide. In the pools, the fish zonation is permanent but furthermore, because of the important depth of residual water, some species belonging to the temporary community. Fig. 3b gives the sh zonation in a pool, at low water of spring tides.

SUCCESSION OF ACTIVE FISH POPULATIONS WITHIN THE INNER REEF FLAT ACCORDING TO A NYCTHEMERAL RHYTHM

Composition of day/night populations, in relation with the real composition of the community

The lack, the diminution or the augmentation of some families in the night poisonings come from the differences existing between diurnal behaviour and nocturnal behaviour of the fishes on the one hand, and of the reef invertebrates, on the other hand. The Muraenidae get out of their holes, at night, and swim more easily away from the poisoned zone. The opposite phenomenon takes place in the families Scaridae and Labridae which, at night, sleep in the holes of the reef flat. The Eleotridae and Trypterygiontidae are apparently lacking. This can be explained by the activity of invertebrate scavengers (especially Paguridae) which devour the small sized species as soon as they are reached by the Rotenone.

In fact, there is no noticeable change, at night, in the composition of the permanent fish community of the inner reef flat.

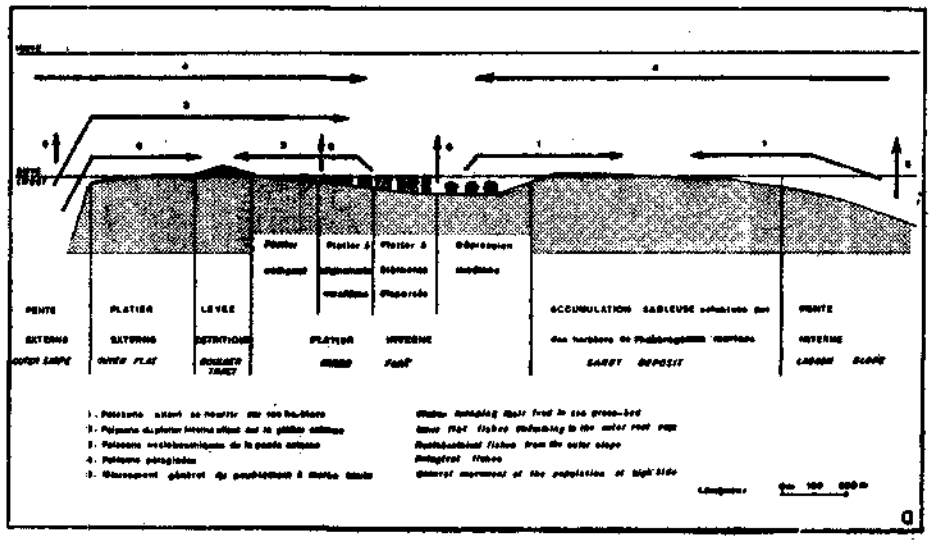

Fig. 4a. Movements of the various groups of fishes during flood tide across the inner reef flat

Differences in the appearence of the permanent community during the day and at night

Although the composition of the commuhity is unvarying, its appearence is deeply altered with sunset. Pomacentridae, Labridae, Acanthuridae, Scaridae cease any activity and take refuge in the anfractuosities. On the contrary, the families belonging to the ecological categories n°3 and n°4 leave their shelters and swim in quest of their preys. The Holocentridae and especially the Apogonidae gather under overhangs during the day, but at night they hunt individually.

There is, therefore, a succession of active fish populations within the inner reef flat, according to a nycthemeral rhythm. Such a phenomenon takes a great importance when we envisage the dynamics of the food webs in a coral reef. The active population during daytime include a majority of herbivorous and omnivorous (to which we can add a very special category of carnivorous) species whereas the whole nocturnal population is composed of carnivorous species.

MIGRATIONS OF THE TEMPORARY COMMUNITY WITH THE TIDE

As a general rule, twice every 24 hours (on the morning and in the evening), the reef is covered over by the sea during spring tides. The depth of water on the reef flat reaches 3 m at high water slack. Fishes spread over the reef flat in quest of a shelter or of food. We call *temporary community* all the species found on the reef and depending on the tide. They belong to two ecological groups : pelagic species and necto-benthonic species.

Pelagic fishes

When they come on the reef, they are always in the upper layer of water. They are plankton feeders or fish eaters. We frequently find young specimens of *Carcharinus leucas*, schools of Tylosuridae, Hemiramphidae, Atherinidae, Fistulariidae, but also schools of Caesiotidae : *Caesio caeruleaureus, C. lunaris* and of Carangidae. They are the only fishes (the Caesiotidae excepted, apparently) to accomplish nocturnal migrations.

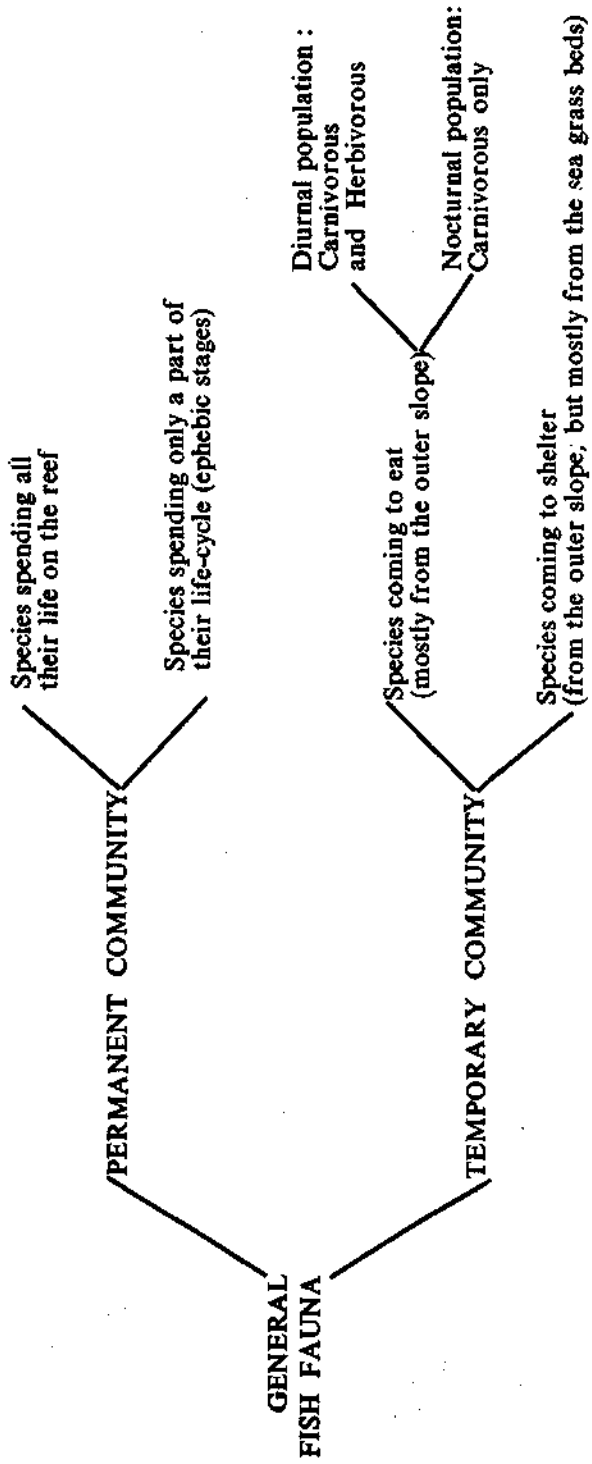

Fig. 4 b. Synopsis of the various groups of fishes living on the inner reef flat.

Necto-benthonic fishes

They generally live in schools on the reef slopes and most of them are herbivorous. We notice schools composed of adult specimens of *Scarus gibbus, Scarus sordidus, Scarus taeniurus* or of Acanthuridae: *Acanthurus elongatus, A. lineolatus, Ctenochaetus striatus*, the youngs of which belong to the permanent community of the reef flat. A few large specimens of Labridae, Pomacanthidae, and Balistidae, always alone, have the same behaviour. Fig. 4 a is an attempt to point out the movements of the various groups of fishes during flood tide. During ebb-tide, some specimens of the temporary community, which are weakened by a stay in an environment to which they are not adapted, may remain wedged in the reef flat or the boulder tract. They will become usually, at the next high tide, a prey for the large carnivorous.

CONCLUSIONS

Several authors have been interested in reef fishes ecology. However, they started their work in very dissimilar ways, making the comparisons difficult. On the other hand, difficulties come from

- zoogeographical differences (the fish fauna of Madagascar, mostly composed of Indo-Pacific species is notably different from that of the Red sea, and completly different from that of the tropical Atlantic)
- morphological differences between the various reef that were studied (Barrier reef in Tuléar, Pacific atolls, reefs of the Red Sea and of the Atlantic)
- differences in the environmental factors (sea conditions : rhythm and tide range)

Moreover, this work is restricted to the community of the residual sheet of water, the existence of which is a consequence of the occurrence of a boulder tract and of important tidal fall.

The fishes living on the inner reef flat do not constitute an homogeneous community. Fig. 4b, is a synopsis of the conclusions of the preceding paragraphs, in which we have tried to make clear the differences between the various groups of fishes.

The specific composition of a given community depends on the chosen geomorphological zone. In this way, the reef flat with alined coral growth is characterized by the abundance of Holocentridae (*Myripristis bowditchae*), Serranidae, Haliophidae (*Haliophis guttatus*) and of Ophichthidae (*Myrichthys maculosus*). The reef flat with scattered coral growth is characterised by *Scorpaenopsis gibbosa, Sebastapistes kowiensis, Parascorpaena aurita, P. picta* (Scorpaenidae), *Cirripectes variolosus* and *Istiblennius periophthalmus* (Salariidae). The inner moat is characterised by *Drombus irrasus, D. plumatus, Zonogobius corallinus* (Gobiidae), *Asterropterix semipunctatus, Eviota nebulosa, E. stigmapteron* (Eleotridae) and by the abundance of two species belonging to the family Syngnathidae : *Coeritholchthys haematopterus* and *Doryramphus melanopleura.*

Besides differences in the species composition, the variety of ecological categories contribute to the heterogeneity of the fish communities. We have defined and for the species of the sole permanent community, seven ecological categories depending on the habitat and the feeding behaviour. We have to point out that they differ from the "habitats groups" described by Hiatt and Strasburg (1960). They belong to two different populations, one being active during the day, and the other at night.

The existence of a temporary community, migrating with the tide and whose specific composition varies at night, clearly shows that the fish community of the inner reef flat cannot be dissociated from that of the nearby areas. A detailed study of the fishes of the slopes and of the sea grass beds on coral reefs must be worked out before we can define the truly *Characteristic species* for each zone of the reef system.

TABLE 1. *List of species of Fishes collected on the inner Flat (Tuléar great reef and songoritelo reef—Madagascar)*

	Number of individuals collected in every sampling zone						No. of individuals collected by day	No. of individuals collected by night
	A	B	C	D	E	G		
SELACHII								
HYROTREMATA								
TORPEDINIDAE								
Torpedo marmorata Risso	—	—	1	—	3	—	1	3
TELEOSTEI								
SYNODONTIDAE								
***Synodus indicus** (Day, 1873)	4	—	2	—	5	6	15	2
***Synodus variegatus** (Lacépède, 1803)	2	5	1	5	21	9	32	11
HEMIRAMPHIDAE								
Hemiramphus sp.	—	—	—	2	—	—	—	2
HOLOCENTRIDAE								
***Holocentrus diadema** Lacépède, 1802	9	4	3	3	43	24	52	34
Holocentrus lacteoguttatus C. & V. 1829	1	—	—	2	—	—	3	—
***Holocentrus sammara** (Forsskål, 1775)	2	—	1	—	1	2	5	1
Holocentrus spiniferus (Forsskål, 1775)	—	1	1	—	7	4	10	3
Myripristis bowbitchae Woods, 1953	—	—	39	4	5	22	45	25
BOTHIDAE								
Bothus pantherinus (Rüppell, 1830)						1	1	—
SOLEIDAE								
Pardachirus marmoratus (Lacépède, 1802)	1					1	2	—
SYNGNATHIDAE								
Choeroichthys brachysoma (Bleeker, 1855)	—	—	1	—	—	—	—	1
Choeroichthys sculptus (Gunther, 1870)	—	—	—	1	—	—	1	—
***Corythoichthys haematopterus** (Bleeker, 1851)	16	—	5	+	41	7	38	4
Doryrhamphus melanopleura (Bleeker, 1858)	5	—	—	—	—	—	5	—
Ichthyocampus belcheri Kaup, 1856	—	—	—	—	2	—	1	1
Microguathus mataafae (Jordan & Seale, 1906)	1	—	—	—	—	—	1	—
Syngnathus cyanospilos (Bleeker, 1854)	1	—	—	—	—	—	1	—
AULOSTOMIDAE								
Aulostomus valentini (Bleeker, 1853)	—	—	1	—	—	—	1	—

	Number of individuals collected in every sampling zone						No. of individuals collected by day	No. of individuals collected by night
	A	B	C	D	E	G		
PARAPERCIDAE								
Parapercis cylindrica (Bloch, 1792)	—	1	—	—	1	1	2	1
CALLIONYMIDAE								
Diplogrammus infulatus Smith, 1963	1	—	—	—	—	—	1	—
CIRRHITIDAE								
Cirrhitichthys aprinus C. & V. 1829	—	—	—	1	8	—	8	1
Cirrhitoidea bimacula Jenkins, 1902	—	—	—	—	1	—	1	—
PSEUDOCHROMIDAE								
***Pseudochromis natalensis** Regan, 1925	1	1	—	7	25	5	28	11
PSEUDOGRAMMIDAE								
***Pseudogramma polyacanthus** Bleeker, 1856	2	—	—	—	21	6	23	6
PLESIOPIDAE								
***Plesiops melas** Bleeker,	6	—	—	66	68	17	65	92
SERRANIDAE								
Cephalopholis argus (Bloch and Schneider, 1801)	2	—	3	3	12	7	15	11
Chorististium susumi (Jordan and Seale, 1906)	—	—	1	—	—	—	1	—
Epinephelus areolatus (Forsskål, 1775) jur.	—	—	—	1	—	—	1	—
Epinephelus fario (Thunberg, 1793) jur.	—	—	1	—	—	1	1	1
Epinephelus fuscoguttatus (Forsskål, 1775) jur.	1	—	3	—	—	—	1	3
Epinephelus hexagonatus (Bloch and Schneider, 1801)	—	—	3	—	2	2	6	1
Epinephelus macrospilos (Bleeker, 1885) jur.	—	—	1	—	—	—	1	—
Epinephelus megachir (Richardson, 1846) jur.	—	—	—	—	1	—	1	—
***Epinephelus merra** (Bloch, 1793)	1	—	—	1	12	6	10	10
Grammistes sexlineatus (Thunberg, 1792)	—	—	—	—	1	1	2	—
APOGONIDAE								
***Apogon coccineus** Rüppell, 1835	1	1	3	—	15	10	24	6
Apogon semiornatus Peters, 1876	—	—	—	1	4	—	5	—
Apogonichthyoides fraxineus Smith, 1961	—	—	—	—	10	53	38	25
Apogonichthys oecellatus Weber, 1913	—	—	—	4	3	—	3	4
***Fowleria aurita** (C. & V. 1831)	29	—	1	2	22	156	158	52
***Ostorhynchus angustatus** (Smith & Radcliffe, 1911)	25	—	22	3	84	102	158	48
Ostorhynchus cyanosoma (Bleeker, 1856)	2	4	—	—	—	10	16	—
Ostorhynchus endekataenia (Bleeker, 1852)	—	—	2	82	42	—	38	88

[17]

	Number of individuals collected in every sampling zone						No. of indievidiuals collcted by day	No. of individuals collected by night
	A	B	C	D	E	G		
APOGONIDAE (Contd.)								
Osterhynchus savayensis (Günther, 1871)	—	—	59	—	3	35	83	14
Paramia quinquelineata (C. & V. 1828)	5	1	3	—	—	13	16	6
Pristiapogon frenatus (C. & V. 1828)	—	—	1	—	—	2	3	—
***Pristiapogon snyderi** (Jordan & Evermann, 1902)	20	6	13	10	106	69	134	90
MULLIDAE								
Parupaeneus barberinus (Lacépède, 1802)	—	3	1	—	2	2	7	1
Parupaeneus indicus (Shaw, 1803)	—	—	—	1	2	—	2	1
Parupaeneus luteus (C. & V. 1831)	—	2	—	—	—	—	2	1
Parupaeneus macronema (Lacépède, 1802)	—	2	7	—	—	—	9	—
Parupaeneus pleurospilos Bleeker,	—	3	—	—	—	—	2	—
POMACANTHIDAE								
***Centropyge bispinosus** (Günther, 1860)	2	—	1	—	5	2	10	—
Pomacentrus semicirculatus (C. & V. 1831)	1	—	1	—	1	—	3	—
CHAETODONTIDAE								
Chaetodon auriga Forsskål 1775	—	—	10	—	12	20	32	10
Chaetedon falcula Bloch, 1793	1	—	1	1	—	—	2	1
***Chaetodon guttatissimus** Bennett, 1832	1	—	—	—	1	1	3	—
Chaetodon kleini Bloch, 1790	—	—	—	—	1	—	1	—
Chaetodon lineolatus C. & V. 1831	—	—	1	—	—	—	1	—
Chaetodon lunula (Lacépède, 1803)	—	—	2	—	—	—	2	—
***Chaetodon melanotes** Bloch and Schneider, 1801	1	—	—	—	1	3	3	2
***Chaetodon trifaciatus** Mungo Park, 1797	4	—	31	1	17	13	54	12
***Chaetodon vagabundus** L. 1758	1	—	—	1	4	1	6	1
***Chaetodon xanthocephalus** Bennett, 1832	1	—	1	—	3	2	5	2
ACANTHURIDAE								
Acanthurus elongatus (Lacépède, 1803)	1	1	2	4	4	—	7	5
Acanthurus fuliginosus Lesson, 1830	3	—	—	—	—	—	3	—
Acanthurus triostegus (L. 1758)	—	—	—	25	39	1	18	74
***Ctenochaetus striatus** (C. & V. 1835)	5	—	25	2	18	11	55	6
***Zebrasoma flavescens** (Bennett, 1828)	3	—	1	—	2	3	6	3
***Zebrasoma veliferum** (Bloch, 1795)	3	—	2	—	1	4	7	3

	Number of individuals collected in every sampling zone						No. of individuals collected by day	No. of individuals collected by night
	A	B	C	D	E	G		
NASIDAE								
Naso unicornis (Forsskål, 1775)	—	—	1	—	1	—	2	—
PEMPHERIDAE								
Pempheris oualensis C. & V. 1831	—	—	5	158	—	—	162	1
LUTIANIDAE								
Lutianus fulviflamma (Forsskål, 1775)	—	—	4	4	1	—	9	—
Lutianus johni (Bloch, 1792)	—	—	5	—	—	—	5	—
GATERINIDAE								
Gaterin flavomaculatus (Ehren.) in C. & V. 1830	—	—	—	3	—	1	2	2
Gaterin gaterinus (Forsskål, 1775)	1	—	3	—	1	—	5	—
LETHRINIDAE								
Lethrinus crocineus (Smith, 1959)	—	—	—	—	1	—	1	—
Abudefduf anabatoides (Bleeker, 1847)	—	—	—	—	3	—	3	—
Abudefduf biocellatus (Q. & G. 1824)	—	—	—	1	—	—	—	1
Abudefduf cingulum (Klunzinger, 1871)	1	—	—	—	—	—	1	—
Abudefduf dicki (L. 1839)	—	1	—	—	—	—	1	—
POMACENTRIDAE								
Abudefduf glacus (C. & V. 1830)	—	—	—	—	1	—	1	—
***Abudefduf lacrymatus** (Q. & G. 1825)	2	—	15	—	21	34	55	17
Abudefduf leucogaster (Bleeker, 1859)	—	—	22	—	—	1	22	1
Abudefduf melas (C. & V. 1830)	—	—	1	—	—	—	1	—
Abudefduf saxatilis (L. 1758)	—	—	17	3	5	—	5	20
Abudefduf septemfasciatus (C. & V. 1830)	—	—	2	—	—	—	2	—
Abudefduf sexfaciatus (Lacépède, 1802)	—	1	29	—	—	14	21	23
***Abudefduf sparoides** (C. & V. 1830)	2	—	238	—	45	44	308	21
Abudefduf xanthozonus (Bleeker, 1853)	—	—	—	12	4	—	4	12
Abudefduf xanthurus (Bleeker, 1853)	1	—	—	—	—	—	—	—
Abudefduf zonatus (C. & V. 1830)	—	—	—	7	32	—	32	7
Amphiprion akallopisos Bleeker, 1853	2	—	—	—	—	—	2	—
Amphiprion ephippium (Bloch, 1790)	—	1	2	—	—	—	3	—
Chromis caeruleus (C. & V. 1830)	—	12	4	—	—	44	49	11

	Number of Individuals collected in every sampling zone						No. of individuals collected by day	No. of individuals collected by night
	A	B	C	D	E	G		
Chromis dimidiatus (Klunzinger, 1871)	2	11	11	—	7	—	30	1
Chromis ternatensis (Bleeker, 1856)	—	3	123	—	—	—	126	—
***Dascyllus aruanus** (L. 1758)	13	32	—	—	5	69	103	16
Dascyllus trimaculatus (Rüppell, 1828)	1	2	—	—	—	—	3	—
Pomacentrus littoralis (Cuvier, 1830)	—	1	9	23	18	1	34	23
Pomacentrus nigricans Lacépède, 1801	1	—	11	—	—	—	1	11
Pomacentrus pulcherrimus Smith, 1960	—	1	1	—	12	2	14	2
Pomacentrus sulfureus Klunzinger, 1871	—	1	44	—	11	16	54	17
Pomacentrus taeniurus Bleeker, 1856	—	—	—	—	1	—	1	—
***Pomacentrus tripunctatus** (C. & V. 1830)	130	6	9	20	600	331	1040	156
LABRIDAE								
Anampses caeruleopunctatus Rüppell, 1828	—	—	—	—	1	—	1	—
Cheilinus diagrammus (Lacépède, 1802) juvenile	—	—	—	3	7	2	2	10
Cheilinus oxycephalus Bleeker, 1853 juvenile	—	—	—	1	1	5	5	2
Cheilinus trilobatus (Lacépède, 1802) juvenile	—	—	—	7	5	2	6	8
Cheilio inermis (Forsskål, 1775)	—	—	—	1	4	3	4	4
Coris africana Smith, 1957 juvenile	—	—	—	—	1	—	—	—
Coris caudimacula Q. & G. 1834 juvenile	—	—	—	1	3	—	2	2
Duymaeria flagellifera (C. & V. 1839)	—	—	—	2	3	—	1	4
Epibulus insidiator (Pallas, 1770)	3	—	—	—	—	4	6	1
Gomphosus caeruleus (Lacépède, 1802	—	—	—	—	1	—	1	—
***Gomphosus varius** (Lacépède, 1802	1	1	16	—	6	4	10	18
Halichoeres centriquadrus (Lacépède, 1802)	—	2	25	5	9	2	19	24
Halichoeres hortulanus Lacépède, 1802	—	1	1	—	—	—	2	—
Halichoeres margaritaceus (Valenciennes, 1839)	1	—	—	2	15	—	17	1
Halichoeres marginatus Rüppell, 1835	—	—	—	1	1	—	2	—
Halichoeres notopsis C. & V. 1839	—	—	—	—	1	—	1	...
***Halichoeres scapularis** (Bennett, 1831)	1	—	—	—	7	1	9	—
***Labroides dimidiatus** (C. & V. 1839)	1	—	2	—	8	1	9	1
Pseudocheilinus hexataenia (Bleeker, 1857)	3	1	1	—	1	3	8	1
Pteragogus taeniops Peters, 1855	—	—	—	—	3	1	1	3
Stethojulis albovittata (Bonnaterre, 1788)	—	—	—	3	3	—	4	2
Stethojulis axillaris (Q. & G. 1824)	—	—	—	9	19	1	20	9
Stethojulis kalosoma (Bleeker, 1852)	—	—	—	—	3	—	—	3
***Stethojulis strigiventer** (Bennett, 1832)	3	—	—	6	15	9	28	5
***Thalassoma hardwicke** (Bennett, 1830)	4	—	25	3	14	8	46	8

	Number of individuals collected in every sampling zone						No. of individuals collected by day	No. of individuals collected by night
	A	B	C	D	E	G		
***Thalassoma hebraicum** (Lacépède, 1802)	2	—	26	3	13	2	11	30
Thalassoma lunare (L. 1758)	—	—	1	—	—	—	1	—
Thalassoma quinquevittata (Lay and Bennett, 1839)	—	—	—	6	1	—	2	5
Thalassoma umbrostygma (Rüppell, 1835)	1	—	—	5	3	—	4	5
Thalliurus chlorurus (Bloch, 1791)	1	—	—	—	—	3	1	3
Weitmorella philippina Foweler and Bean, 1928	1	1	1	—	—	—	3	—
SCARIDAE								
Calotomus spinidens (Q. & G. 1824)	—	—	—	—	1	—	—	1
Leptoscarus vaigiensis (Q. & G. 1824)	—	—	—	11	10	1	5	17
Scarus enneacanthus Lacépède, 1802	—	—	7	—	—	—	2	5
Scarus forsteri C. & V. 1839	—	—	—	—	2	14	11	5
Scarus sordidus Forsskål, 1775	—	—	4	—	45	54	64	39
Scarus taeniurus (C. & V. 1839)	—	—	—	—	5	11	7	9
ATHERINIDAE								
Atherina sp.	3	—	2	4	—	—	3	6
SIGANIDAE								
Siganus oramin (Bloch and Schneider, 1801)	—	—	3	8	19	8	27	11
GOBIIDAE								
***Acentrogobius aestuarius** Smith, 1959	4	—	—	—	1	11	13	3
***Acentrogobius cauerensis** (Bleeker, 1853)	7	—	1	—	25	13	39	7
Drombus irrasus Smith, 1959	1	—	—	—	—	—	1	—
Drombus plumatus Smith, 1959	2	—	—	—	—	—	2	—
Fusigobius neophytus africanus Smith, 1959	6	—	—	—	—	9	6	9
***Gobiodon citrinus** (Rüppell, 1835)	4	—	—	—	1	2	7	—
***Gobiodon rivulatus** (Rüppell, 1828)	1	4	1	5	3	—	13	1
Paragobiodon echinocephalus (Rüppell, 1828)	—	—	1	—	—	—	1	—
Quisquillus eugenius J. & E. 1902	1	—	—	2	2	—	3	2
Zonogobius corallinus Smith, 1959	1	—	—	—	—	—	1	—
ELEOTRIDAE								
Asterropterix semipunctatus Rüppell, 1828	3	—	—	—	—	2	5	—
Coryogalops anomulus Smith, 1958	—	—	—	—	1	—	1	—
Dactyleotris tentaculatus Smith, 1958	1	—	—	—	—	—	1	—
Eleotriodes strigatus (Broussonet, 1782)	—	—	—	—	4	—	4	—
Eviota nebulosa Smith, 1958	3	—	—	—	2	—	5	—
Eviota stigmapteron Smith, 1958	2	—	—	—	—	—	2	—

	Number of individuals collected in every sampling zone						No. of individuals collected by day	No. of individuals collected by night
	A	B	C	D	E	G		
Eviota verna Smith, 1958	2	—	—	—	66	—	68	—
Lioteres vulgara (Klunzinger, 1871)	—	—	—	—	1	—	1	—
Satulinus zanzibarensis Smith, 1958	—	—	—	—	14	—	14	—
Xenithmus africanus Smith, 1958	—	—	—	—	3	—	3	—
BLENNIDAE								
Aspidontus tractus Fowler, 1903	1	—	—	—	—	—	1	—
Meiacanthus mossambicus Smith, 1959	—	—	—	—	—	2	2	—
Runula rhynorhynchos (Bleeker, 1852)	—	1	—	—	—	—	1	—
SALARIIDAE								
Cirripectes cruentus Smith, 1959	—	—	1	—	3	—	4	—
Cirripectes perustus Smith, 1959	—	—	1	—	1	1	2	1
Cirripectus variolosus (C & V. 1836)	—	—	—	1	19	—	18	2
Istiblennius periophthalmus (C. & V. 1836)	—	—	—	1	10	—	11	—
***Salarias fasciatus** (Bloch, 1786)	5	—	—	—	23	12	21	19
Salarias sinuosus indicus Smith, 1959	—	—	—	3	1	—	1	3
TRIPTERYGIONTIDAE								
Tripterygion hemimelas (Kner and Steindachner, 1866)	—	—	—	4	5	—	9	—
Tripterygion minutus (Günther, 1877)	—	—	—	—	2	1	3	—
Tripterygion nanus Schultz, 1960	—	—	—	3	13	—	16	—
Tripterygion sp.	5	—	—	—	—	3	8	—
BROTULIDAE								
Brotula multibarbata (Schlegel, 1842)	—	—	—	3	3	1	6	1
***Dinematichthys iluocoetoides** Bleeker, 1855 .	4	—	3	53	6	7	20	53
HALIOPHIDAE								
Halimuraena hexagonata Smith	1	—	—	1	—	1	3	—
***Haliophis guttatus** (Forsskal, 1775)	8	—	3	21	93	64	130	59
TETRAROGIDAE								
Taenionotus triacanthus Lacépède, 1802	—	—	—	—	1	—	1	—
CARACANTHIDAE								
Caracanthus unipinnus (Gray, 1831)	1	—	—	—	—	—	1	—
SCORPAENIDAE								
Dendroscorpaena cirrhosa (Thunberg, 1793)	—	—	—	—	2	—	2	—
Parascorpaena aurita (Rüppell, 1838)	—	—	—	1	4	—	—	5
Parascorpaena maculipinnis Smith, 1957	—	—	—	—	1	—	1	—
Parascorpaena picta (C. & V. 1829)	—	—	—	—	3	—	2	1

	No. of individuals collected in every sampling zone						No. of individuals collected by day	No. of individuals collected by night
	A	B	C	D	E	G		
Parascorpaena sp.	—	—	—	—	1	—	1	—
Pterois volitans (L. 1758)	—	—	—	—	1	1	2	—
***Scorpaenodes guamensis** (Q. & G. 1824)	3	—	2	12	5	6	12	16
Scorpaenodes varipinnis Smith, 1957	—	—	—	3	—	2	4	1
Scorpaenopsis gibbosa (Bloch, 1801)	—	—	—	—	4	—	3	1
Sebastapistes asperella Bennett, 1828	—	—	—	—	14	—	12	2
Sebastapistes kowiensis Smith, 1936	—	—	—	—	3	2	3	2
Sebastapistes nuchalis Günther, 1874	—	—	—	—	1	—	1	—
PLATYCEPHALIDAE								
Platycephalus pristis (Peters)	—	—	1	1	—	—	1	1
GOBIESOCIDAE								
***Lepadichthys coccinotaenia** Regan	8	—	—	—	50	4	60	2
MURAENIDAE								
Anarchias seychellensis Smith, 1962	—	—	—	—	1	—	1	—
Echidna nebulosa (Ahl, 1789)	—	—	—	—	1	—	1	—
***Echidna polyzona** (Richardson, 1844)	2	—	—	6	2	1	5	6
Echidna unicolor Schultz, 1953	—	—	2	—	—	—	2	—
Echidna zebra (Shaw, 1797)	—	—	—	1	2	—	2	1
Gymnothorax pindae Smith, 1962	—	—	2	—	—	—	1	1
Lycodontis barocusis (Bleeker, 1857)	3	—	—	1	6	—	10	—
Lycodontis chilospilus (Bleeker, 1865)	—	—	—	—	1	—	1	—
***Lycodontis margaritophorus** (Bleeker, 1865)	6	1	—	—	11	2	17	3
Lycodontis meleagris (Shaw and Nodder)	1	—	—	—	1	—	2	—
Lycodontis ruppelli (McClelland, 1845)	—	—	—	—	4	—	4	—
***Lycodontis undulatus** (Lacépède, 1803)	5	2	—	20	52	4	76	7
Siderea picta (Ahl, 1789)	—	—	—	1	—	—	—	1
Uropterygius tigrinus (Lesson, 1828)	1	—	—	—	2	—	3	—
OPHICHTHIDAE								
Caecula fusca (Zuiew, 1793)	—	—	—	2	1	—	3	—
Leiuranus semicinctus (Lay and Bennett, 1839)	—	—	—	—	2	—	2	—
Myrichthys maculosus (C. & V. 1817)	—	—	—	—	1	4	4	1

	Number of Individuals collected in every sampling zone						No. of individuals collected by day	No. of individuals collected by night
	A	B	C	D	E	G		
ECHELIDAE								
Muraenichthys laticaudata (Ogilby, 1897)	—	—	—	—	—	1	1	—
Myrophis uropterus (Temminck and Schlegel, 1842)	1	—	—	—	—	—	1	—
MORINGUIDAE								
Moringua bicolor (Kaup, 1856)	—	—	—	—	—	1	—	1
***Moringua microchir** Bleeker, 1853	8	—	—	2	15	8	23	10
CONGRIDAE								
Conger cinereus (Rüppell, 1828)	—	—	1	9	9	1	11	9
MONACANTHIDAE								
Oxymonacanthus longirostris (Bloch & Schneider, 1801)	—	—	—	3	—	—	—	3
Pergavor melanocephalus (Bleeker, 1853)	—	—	4	—	7	3	7	7
BALISTIDAE								
Balistapus undulatus (Mungo Park, 1797)	—	—	2	3	6	5	10	6
Pseudobalistes flavomarginatus (Rüppell, 1829)	—	—	—	1	—	—	—	1
Rhinecanthus rectangulus (Bloch & Schneider, 1801)	—	—	—	—	3	—	—	3
OSTRACIIDAE								
Ostracion tuberculatus (L. 1758)	1	—	—	—	—	1	2	—
CANTHIGASTERIDAE								
Canthigaster bennetti (Bleeker, 1860)	—	—	—	—	1	—	1	—
***Canthigaster jonthinopterus** (Bleeker, 1860)	1	—	—	1	3	2	6	2
***Canthigaster margaritatus** (Rüppell, 1826)	3	—	—	2	25	5	21	14
***Canthigaster valentini** (Bleeker, 1865)	3	—	1	—	8	7	15	4
ANTENNARIIDAE								
Antennarius nummifer (Cuvier, 1817)	—	—	—	—	—	1	1	—

The species of the Permanent Stock are indicated with fat type.
The species of the Permanent Stock which are wide spread over the whole inner reef flat are indicated with an asterisk*

TABLE 2. *Order of decreasing importance of the fish families, depending on the number of species and the number of specimens in the various investigated reef zones*

A	E	G	B	C	D
POMACENTRIDAE	POMACENTRIDAE	POMACENTRIDAE	POMACENTRIDAE	POMACENTRIDAE	LABRIDAE
APOGONIDAE	LABRIDAE	APOGONIDAE	APOGONIDAE	LABRIDAE	APOGONIDAE
LABRIDAE	APOGONIDAE	LABRIDAE	MULLIDAE	APOGONIDAE	POMACENTRIDAE
GOBIIDAE	MURAENIDAE	SCARIDAE	LABRIDAE	CHAETODONTIDAE	ACANTHURIDAE
MURAENIDAE	SCORPAENIDAE	CHAETODONTIDAE	HOLOCENTRIDAE	HOLOCENTRIDAE	PEMPHERIDAE
SYNGNATHIDAE	SALARIIDAE	HOLOCENTRIDAE	MURAENIDAE	ACANTHURIDAE	MURAENIDAE
ACANTHURIDAE	ACANTHURIDAE	GOBIIDAE		SERRANIDAE	BROTULIDAE
ELEOTRIDAE	SCARIDAE	HALIOPHIDAE		SCARIDAE	PLESIOPIDAE
CHAETODONTIDAE	CHAETODONTIDAE	SERRANIDAE		LUTIANIDAE	SCORPAENIDAE
HOLOCENTRIDAE	HOLOCENTRIDAE	ACANTHURIDAE		MULLIDAE	HALIOPHIDAE
CANTHIGASTERIDAE	GOBIIDAE	CANTHIGASTERIDAE		MURAENIDAE	HOLOCENTRIDAE
	SERRANIDAE				SERRANIDAE

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