**Draft Report, 1997**

# Distribution of commercially important fish species of Curieuse Marine National Park

**Simon J. Pittman**
Seychelles Marine Conservation Expedition, Nov-Dec, 1996

## Introduction

Coral reef associated fisheries provide an important source of economically affordable animal protein for the populations of the Seychelles. In addition to satisfying the domestic market, demersal fishery supports a buoyant export market of fresh and frozen fish. Demersal nearshore fish are primarily caught from *small boats*, including pirogues and small boats with both outboard and inboard motors using a variety of gear types. Highest effort and catch rates are from outboards using handlining, traps and encircling gill nets.

From 1990 to 1994, the catch from the small boat fishery of Praslin and La Digue includes a large range of demersal and pelagic species. Pelagics comprise a large proportion of the catch recorded at landings from small boats, including Carangidae (Jacks), Scombridae (Tuna/Mackerels) and Caesionidae (Fusiliers) and others. This accounted for some 47% of the catch from 1990 to 1994. The remaining component of the catch were species associated with coral reefs or have largely nearshore demersal life histories. These fish were largely the Lutjanidae (Snappers) and Lethrinidae (Emperors) 18.8%; the Siganidae (Rabbitfish), 15.2%; other trapfish including Acanthuridae (Surgeonfish), Scaridae (Parrotfish), Haemulidae (Sweetlips) and Mullidae (Goatfish) and others, 12.8%; Serranidae (Groupers), 3% and Sphyraenidae (Barracuda) caught mainly with handlines making up a very small proportion. Other significant catches included sharks, rays and octopus. These figures give some indication of the importance of particular target fish families to the artisanal fishery of Praslin. Further analysis shows a declining catch rate over 5 years from 54.2 kg/boat/day in 1990 to 36.03 kg/boat/day in 1994. Although these types of statistics are prone to large variations and a longer time scale study would be necessary to elucidate a trend. Most notably, landings of grouper have declined significantly from 16.8 MT in 1990 to 4.4 MT in 1994 in the Praslin and La Digue fishery. In this time statistics show a general increase in effort i.e. mean number of boats (SFA, 1990-94).

Fisheries biologists in the Seychelles have suggested that the average catch of recent years is close to sustainable levels and that future exploitation must be closely monitored (Khadun, 1991). Efforts are being taken to encourage exploitation of fish stocks further offshore by improving the design and long-range efficiency of boats and their engines. This is a management strategy designed to relieve pressure on near shore populations and provide a refugia that will allow populations to increase to a more sustainable level and provide for a smaller scale nearshore artisanal fishery. Statistics show a general decrease in mean number of Pirogues operating per month (185 in 1985 to 64 in 1994) and increase in number of whalers (from 37 in 1985 to 91 in 1994) indicating an increased mechanisation of the Seychelles artisanal fishery fleet.

Data collected from landing sites within the Curieuse MNP boundary (Anse Boudin, Baie Pasquiere and Anse Possession) by the SFA show a small increase in the number of outboards and inboards used and a general decrease in catch. This may not necessarily include catch within the MNP, but rather gives an indication of local fishing intensity and perhaps a reflection of the larger trends in the Seychelles artisanal fishery. Data is unavailable for catch composition at these landing sites. The recorded catch landed at Curieuse MNP sites on Praslin comprised some 8 % of the total Praslin small boat fishery catch. This is not a large proportion and it has become smaller over the 5 year period between 1990 and 1994. Although catch data was not analysed prior to 1990 it is likely that this area yielded a greater proportion of the total Praslin catch in earlier years. This assumption is supported by comments from local fishermen. However, it may also be the case that fisherman land larger catches at other sites, such as Anse Volbert which is within economical range.

At some sites in the park, broken and discarded fishing lines were found, particularly at the Praslin coast site at Anse Petit Cour. This particular site had been cleared of lines some months before by local divers and this

then would indicate the importance of this reef to local fisherman. It is not known whether the lines belonged to licensed fishermen.

In order to quantify the distribution of commercially important food fish in coastal waters, visual census was used with estimates of species diversity, abundance and size recorded at each site. This technique together with a knowledge of fishing activity in an area is often used to help assess the status of these populations and to provide resource managers with baseline information which may help in the design of management plans.

## Methodology

Transect based visual census was undertaken at 9 sites within Curieuse MNP. Non-transect observations were made at an additional site in the park and two sites further afield and outside the park (Ile aux Cocos and Marianne). The technique used followed that outlined for the Reefwatch methodology for non-commercial fish assemblages, but included size estimation. At the two sites outside the park single 20 minute counts were undertaken.

**Size estimation** - it is important to estimate the size of fish in the census area in order to be able to extrapolate information on the age class structure i.e. relative numbers of juveniles and adults. In fished areas population age structures often become distorted, whereby older and larger fish become increasingly rare. Information can also be collected from fisheries depots for comparison. This study used 3 size classes for recording estimated individual fish lengths; < 20 cm, including juveniles; 21-30 cm and 31-50 cm; no individuals were recorded above 50 cm within the transect survey band.

The survey for commercial species targeted four families; Serranidae (Groupers), Lutjanidae (Snappers), Lethrinidae (Emperors) and Haemulidae (Sweetlips).

**Groupers** typically include many of the largest fish seen on the reef. They are the largest top quality edible fish (target fish) and of considerable commercial value and often the fish that are first depleted as fishing pressure increases. Estimates of size and abundance provides important information for assessing the impact of fishing and for monitoring the reef community.

**Snappers, Emperors and Sweetlips** are three related families of similarly typically shaped medium sized fish. All are important predators of invertebrates and fish. After the grouper these types of fish are usually the next to decline in number as fishing intensity increases.

Trap fisheries include many reef associated fish species that will not be dealt with in this section.

## Commercial fish survey results

**Groupers -** Throughout the survey area 15 species of Epinephelini groupers were identified, however, only 10 species were recorded within the survey band. These species and the mean abundance per size class at each site are shown in the table fig. 1c. Fig. 1a and fig. 1b show the abundance and species richness at each site.

Highest abundance and species richness was found at coralline reefs. Anse Petit Cour yielded greatest diversity and abundance. Most of these individuals were less than 20 cm in length. Most noticable were the relatively large number of juvenile *Anyperodon leucogrammicus* and this reflected the complexity or rugosity of the substrate and the preponderance of prey species. This species is shy and quickly retreats to cover if approached. *Plectropomus* species were also comparatively abundant at this site with juveniles appearing to prefer deeper areas on the reef slope. *Cephalopholis argus* a primary target species for the artisanal fishery is well represented at all size classes across the survey area, but is only found at full adult size at Anse Petit Cour and Turtle Reef. The coralline sites at Coral Gardens with similar reef substrate complexity have fewer grouper species and lower abundance than Anse Petit Cour. Another primary target species is *Aethaloperca rogaa*. This species is represented in highest abundance at Point Rouge and Coral Gardens. Generally, granitic sites yielded lower abundance and diversity than coralline sites. Wolfgang Wall had highest diversity of the granitic sites but showed low abundance and a preponderance of small

individuals (all <30 cm). Fully grown adult individuals of *A. rogaa* and *C. argus* (primary target sp.) were only recorded for coralline reefs, with highest abundance on the Praslin coastline at Anse Petit Cour and Turtle Reef (refer to table fig. 1c).

Previous surveys at Baie Ternay and Beau Vallon show similar size class distribution and diversity but slightly higher abundance with a preponderance of small - medium individuals (<30 cm). However, diversity and abundance at Anse Petit Cour exceeds all sites thus far surveyed by our group on Mahe or Praslin. Comparison with surveys in Kenya using the same techniques and some of the same observers show similar size structure to those recorded in fished areas of marine reserves but abundance more closely to records of fish in protected parks i.e. with lower fishing intensity (Watson and Ormond, 1994, TMRU, 1993, TMRU, 1994, TMRU, 1995). Results from studies in Kenya also suggest a slower recovery time for populations of Serranids depleted by artisanal fisheries than for other commercial families such as the Lutjanids.

Habitat correlates are an important consideration and Serranidae are generally found in higher abundance at coral rich areas with plentiful prey species and adequate substrate structure providing refuge or hiding places. This is evident at Anse Petit Cour but does not account for the comparatively low abundance and species diversity at Coral Gardens, since this site is also coral rich with high rugosity and high prey fish abundance. Differences may be due to extraction due to fishing since individuals at these two sites were almost all less than half fully grown. However, differences could be attributed to spatial patterns in recruitment and site preferences such as reef profile and physical protection through embayment as at Anse Petit Cour and Turtle Reef.

St. Pierre, a shallow granitic transect showed lowest abundance and diversity and largely this can be attributed to habitat type. Shallower transects on granitic reefs may also have excluded larger Serranidae which generally prefer deeper water coral rich sites.

Other studies in Seychelles have compared reef fish assemblages exposed to varying levels of fishing intensity to show significant differences in Serranidae abundance and biomass, suggesting Serranids are particularly effective direct indicators of fishing pressure. Jennings (1994 draft, 1996) showed that primary target species including *Cephalopholis argus* were found to contribute significantly to total biomass of the reef fish community in the well protected areas with no or little fishing effort. Although estimated biomass calculations were not used in this current study, data on size and abundance show that primary target species of Serranidae would not contribute a significantly high proportion of biomass within the fish assemblages at most of the sites in Curieuse MNP.

Relatively high site attachment for groupers would suggest increased importance in the protection of coralline reefs, particularly areas such as Anse Petit Cour and Turtle Reef since these areas appear to be importance nursery areas maintaining high diversity and abundance of important piscivores and commercially valuable Serranidae.

**Snappers, Emperors and Sweetlips -** 7 species of Lutjanids, 10 species of Lethrinids and 4 species of Haemulids were identified throughout the marine park. 5 species of Lutjanids, 8 species of Lethrinids and 3 species of Haemulids were recorded within the survey bands. These were almost all primary target species for the artisanal fishery. Highest abundance was recorded at Coral Gardens 1 with high mean abundance being comprised primarily of small-medium (<20) *Lutjanus kasmira;* medium-large (31-50 cm + several larger) *Aprion virescens*; a large group of medium sized and juvenile *L. bohar* and small-medium (<20) Lethrinid species (refer to fig. 2c) Highest diversity was recorded at Turtle Reef with a higher diversity of Lethrinids and Haemulids than other sites. *L. kasmira* defined as a secondary target species was only recorded at the Coral Garden sites (refer to figs. 2a, 2b).

Several small *Lethrinus nebulosus* were recorded foraging close to the substratum at granitic sites with expanses of sand and rubble, particularly at Roche Canon. Solitary *L. obsoletus*, *L. mahsena* and *L. harak* were more commonly seen over coralline reefs. *Monotaxis grandoculis* was recorded at all sights apart from Coral Gardens 1. Most of these fish were juveniles showing distinctive juvenile colouration and particularly young/small individuals were recorded at Anse Petit Cour and Turtle Reef. Two large adults were recorded at Coral Gardens 2.

In addition, coralline reefs were characterised by large mixed species shoals of Caesionidae (Fusiliers) and occasional groups of large roving Carangids. A large group of *Caranx melampygus* were observed feeding on a cluster of fish larvae at Anse Petit Cour.

Granitic sites are characterised by large aggregations of boulders which in many places create ideal protective habitats with caves, gullies and overhangs. At other areas in the Seychelles this type of habitat is often occupied by mixed aggregations of Lutjanids and the more recluse Haemulids. At Roche Canon a small group of *L. fulviflamma* were recorded amongst the boulders and a large group of small *Plectorhynchus* sp. sheltered in cave like structures at Roche Canon and St. Pierre. However, to some extent this type of habitat appeared under utilised at many of the granitic transects at Curieuse MNP. Particularly low abundance and diversity at Wolfgang Wall may in part be linked to limited habitat diversity with large areas of monospecific soft coral covered granite and low sand and rubble cover within the transect band (refer to fig. and fig. 4). Other authors (Sainsbury, 1988) have recorded shifts away from community dominance of Lutjanids and Lethrinids with a decrease in structural heterogeneity of the substrate.

For comparative purposes additional sites were visited, primarily for observations of commercial species. One site within the park which was poorly known and not as easily accessible from the shoreline and two sites (Ile aux Cocos and Marianne South) several kilometres outside the park were visited. Reconnaissance of a 9-10 m sand and patch coral plateau in the middle of the park revealed strikingly different assemblage structure to any of the other areas surveyed. Shoals of some 400 *Lutjanus kasmira* were recorded, large numbers of adult and juvenile *L. sebae*, moderate numbers of Lethrinids and the only sightings of *Lethrinus enigmaticus* and the distinctive looking emperor *Gnathodentex aurolineatus*. In addition, several conger eels (*Conger cinereus*) and large numbers of the grouper *Epinephelus fasciatus* were seen. Pelagic species were also abundant and large numbers of Carangids and Caesionids were common. Animals were noticeably more curious than at any other site and this reflected the absence of any significant disturbance.

Counts at Marianne were undertaken over granite boulder/cliff and sand substrate. Moderate numbers of commercially important species were recorded including 37 medium-large *L. kasmira*, 18 medium *L. fulviflamma*, 30+ large *Macolor niger* high in the water column between granite boulders, 7 juvenile *Monotaxis grandoculis*, several large Haemulids and solitary *Lethrinus* sp.

Counts at Ile aux Cocos were undertaken over living coralline substrate, wave damaged coral and sand/rubble. One large shoal of *L. kasmira* (300+) were recorded. Lethrinid species were not well represented and included *L. obsoletus* and *L. nebulosus*. 8 *L. bohar* were recorded, 5 of which showed advanced juvenile colouration and one swam around with a large fishing hook with a length of nylon line embedded in its flank.

Visual fish census at Baie Ternay and Beau Vallon (TMRU, 1996) showed lower diversity and abundance at almost all survey sites. This reflects a higher fishing intensity as might be expected nearer a larger fishing population. Jennings (1994 draft, 1996) found correlation's between Lutjanid and Lethrinid species diversity and fishing intensity whereby significantly less species were recorded in areas of higher fishing pressure. In the current study at Curieuse MNP, diversity of commercial species alone can not be used as an indicator since large site to site variations in substrate were found and adequate measures of fishing effort per site could not easily be estimated. If a general correlation is accepted patterns of distribution recorded at Curieuse MNP would indicate highest fishing intensity at Wolfgang Wall and Coral Gardens 2. Studies by the TMRU in Kenya show comparable counts at coralline sites in a reserve having been exposed to moderate - heavy fishing pressure. However, the large numbers of Lutjanids recorded at the mid-park plateau and the large abundance and diversity of both Lethrinids and Lutjanids at Coral Gardens 1 more closely resembles counts at some of the protected park sites in Kenya. This may suggest that commercial fish populations at Curieuse MNP are intermediate between that expected for a protected park and that expected for an area subjected to moderate-heavy fishing intensity, if habitat differences were not highly correlated with observed patterns. Results show many habitats in the park with low populations of commercial species and highlight the importance of undisturbed areas for the maintenance of commercially viable populations.

Commercial fish utilization of Mangroves at Baie Laraie, Curieuse

Extensive stands of mangrove species grow landward of a stone causeway at Baie Laraie on Curieuse. The plant species include *Rhizophora mucronata*, *Sonneratia* sp., *Lumnitzera* sp., *Avicennia marina*, *Xylocarpus granatum* and *X. moluccensis*. The enclosed area is subjected to the tidal regime and regularly flushed although never entirely emptied at low tide. Substrate is fine-coarse sediment with dense molluscan assemblages contributing to the coarser sediment. Brackish water algae is abundant and in some areas forms extensive floating mats. Seaward of the causeway is a fringing reef with relatively young hard coral communities and extensive algae growing over older carbonate structures. In some deeper areas *Acropora* sp. form thickets and reef associated species are diverse.

Observations were made at low tide (0.2 - 1 m deep) along the seaward edge of the vegetation. Juveniles of *Monodactylus argenteus* were abundant and this habitat provides for the young of the larger populations (200+) of adults observed at Roche Canon. Other juveniles included *Sphyraena* sp. (Barracuda), *L. fulviflamma* inside and on surrounding algal flats and several juvenile parrotfish. *L. harak* and *L. obsoletus* adults and adult Haemulids were seen sheltering under algal mats and around the raised pipeline which appeared to act as an attractant, providing a permanent structure across the sediment. Larger numbers of unidentified commercial juvenile fish and prawn were seen amongst the plant roots. It is likely that this habitat has significant value as a nursery for some species and a feeding area for others. Monodactylids are intimately associated with this type of habitat and adults were also seen in large numbers over shallow reef areas near the mangroves at Baie Ternay. Survey at high tide may reveal a higher proportion of reef associates utilizing this habitat.

## References


**Jennings, S., Grandcourt, E.M. and Polunin, N.V**. (Draft copy, 1994) Effects of fishing on the diversity, biomass and trophic structure of Seychelles' reef fish communities.

**Jennings, S., Marshall, S., and Polunin, N. V.** (1996). Seychelles marine protected areas : Comparative structure and status of reef fish communities. *Biological Conservation*, **75**, 201-209.

**Khadun, A.** (1991). Ecological research in the coastal lagoons of the Republic of Seychelles. In *Workshop on Tropical Coastal Lagoon Ecosystems*, Inhaca Island, Mozambique. Dec 3-5, 1991. SAREC DOCUMENT.

**Sainsbury, K.J.** (1988). The ecological basis of multispecies fisheries, and management of a demersal fishery in tropical Australia. In *Fish Population Dynamics* eds. J.A. Gulland. pp. 349-382. Wiley.

**SFA, 1990-1994.** Seychelles Artisanal Fisheries Statistics. SFA Technical Report. SFA, P.O. Box 449, Mahe, Seychelles

**TMRU** (1993) Report on the distribution of fish species between Kisite Marine National Park and Mpunguti Marine National Reserve. Tropical Marine Research Unit, University of York.

**TMRU** (1994) Habitats and species of the Diani coast, Kenya. Tropical Marine Research Unit, University of York.

**TMRU** (1995) Habitats and species of the Malindi and Watamu National Marine Reserve, Kenya. Tropical Marine Research Unit, University of York.

**TMRU** (1996) Habitats and species of Baie Ternay MNP and Baie Beau Vallon, Mahe. Tropical Marine Research Unit, University of York.

**Watson, M. and Ormond, R. F. G.** (1994) Effect of an artisanal fishery on the fish and urchin populations of Kenyan coral reef. *Mar. Ecol. Prog. Ser.*, **109**, 115-129.

**Fig 1a. Serranid abundance and species richness at Curieuse Marine National Park**

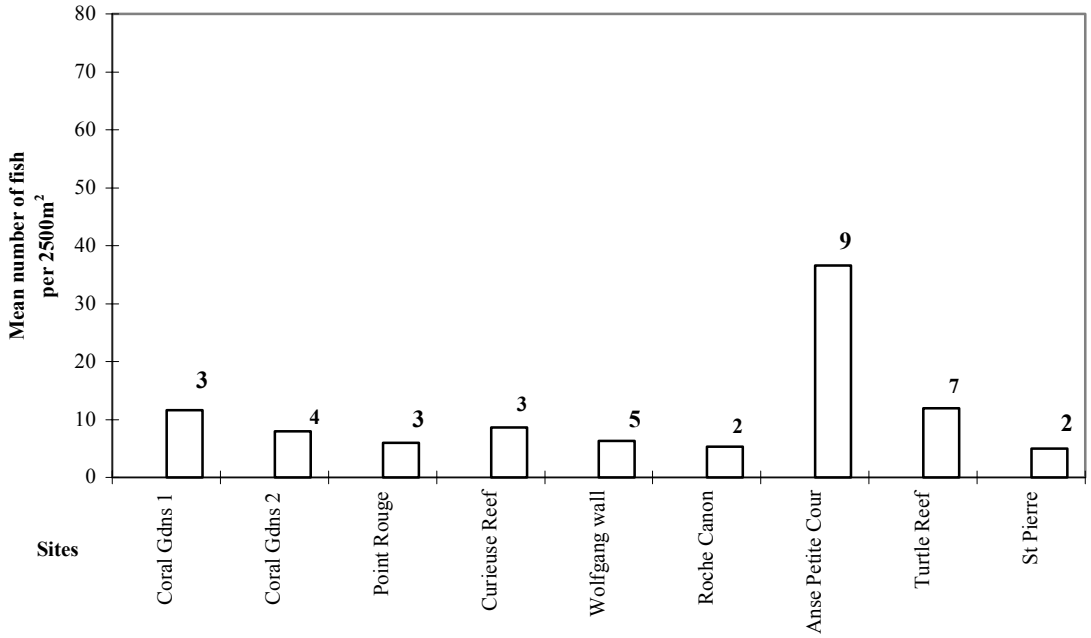


**Fig 1b. Serranid abundance classes for Curieuse Marine National Park**

| Species \ Sites | CG1 | CG2 | Point Rouge | Curieuse Reef | Wolfgang Wall | Roche Canon | Anse Petite Ceour | Turtle Reef | St. Pierre |
|---|---|---|---|---|---|---|---|---|---|
| *Aethaloperca rogaa* | • | • | • | • | • | • | • | • | o |
| *Anyperodon. leucogrammicus* | • | • | o | o | • | o | ● | • | • |
| *Cephalopholis argus* | ● | • | • | • | • | • | ● | • | • |
| *C. miniata* | o | • | • | • | • | o | • | • | o |
| *Epinephelus caeruleopunctatus* | o | o | o | o | o | o | o | o | o |
| *E. tauvina* | o | o | o | o | o | o | • | o | o |
| *E. fuscoguttatus* | o | o | o | o | o | o | • | o | o |
| *E. malabaricus* | o | o | o | o | o | o | o | • | o |
| *E. polyphekadion* | o | o | o | o | o | o | • | o | o |
| *Plectropomus laevis* | o | o | o | o | o | o | • | • | o |
| *P. punctatus* | o | o | o | o | • | o | ● | • | o |

| | |
|---|---|
| o | 0 |
| • | 1-5 |
| ● | 6-10 |
| ● | 11-20 |

Key for abundance classes
(individual fish per 2500 $m^2$)

**Fig 2a. Lutjanid, Lethrinid and Haemulid abundance and species richness at Curieuse Marine National Park**

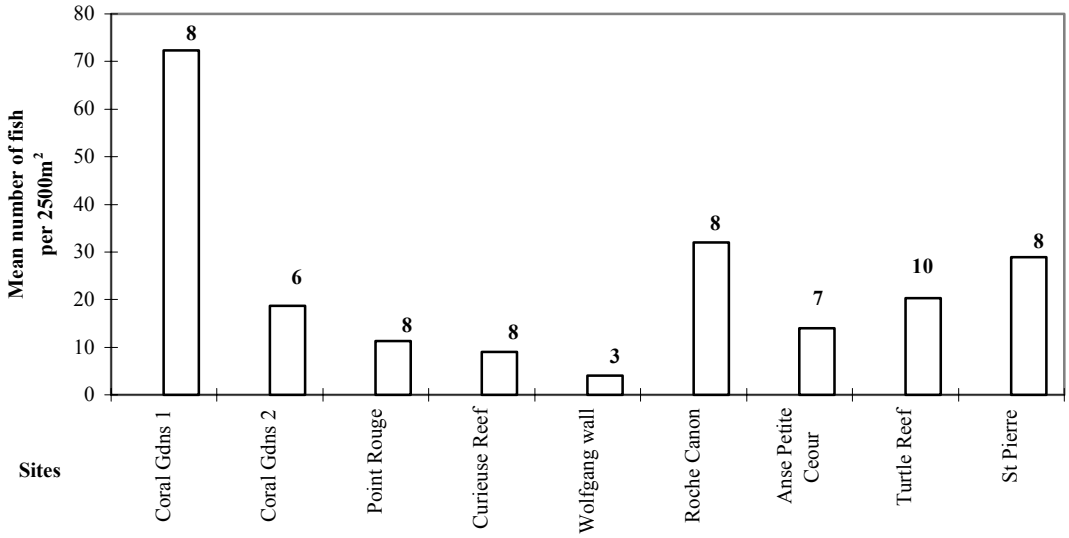


**Fig 2b. Lutjanid, Lethrinid and Haemulid abundance classes for Curieuse Marine National Park**

| Species \ Sites | CG1 | CG2 | Point Rouge | Curieuse Reef | Wolfgang Wall | Roche Canon | Anse Petite Ceour | Turtle Reef | St. Pierre |
|---|---|---|---|---|---|---|---|---|---|
| *Lutjanus fulviflamma* | o | o | • | o | o | ● | o | o | o |
| *L. bohar* | ● | o | o | • | o | • | • | • | ● |
| *L. gibbus* | o | o | o | o | o | o | o | o | o |
| *L. kasmira* | ⬤ | • | o | o | o | o | o | o | o |
| *Macolor niger* | • | ● | • | o | o | o | • | • | ● |
| *Lethrinus harak* | o | • | • | • | • | • | • | • | • |
| *L. elongatus* | o | o | o | o | o | o | o | • | • |
| *L. mahsena* | • | • | • | • | o | o | o | o | o |
| *L. microdon* | • | o | o | o | o | o | o | o | o |
| *L. nebulosus* | • | o | o | • | o | • | o | • | o |
| *L. obsoletus* | • | o | • | • | • | o | • | • | • |
| *L. variegatus* | o | • | • | • | o | o | o | • | o |
| *M. grandoculus* | o | • | • | • | • | • | • | • | • |
| *Aprion virescens* | ● | o | o | • | o | • | • | • | • |
| *Plectorhynchus spp.* | o | o | • | o | o | • | • | • | ● |

| | |
|---|---|
| o | 0 |
| • | 1-5 |
| ● | 6-10 |
| ● | 11-20 |
| ⬤ | 31-50 |

Key for abundance classes
(individual fish per 2500 $m^2$ )