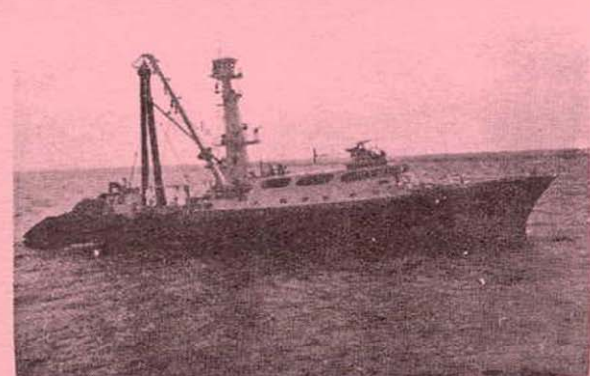




SEYCHELLES FISHING AUTHORITY

TECHNICAL REPORT

NET FISHING AND ITS MANAGEMENT IN SEYCHELLES



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MANAGEMENT
IN SEYCHELLES**

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Abstract

Net fishing is an important component of the artisanal fishery of the Seychelles. It is composed of beach seine, encircling and set gillnets. This report reviews net fishery and its impact on the environment and fish stocks and provides a framework for its management. There are no current management measures for the traditional net fisheries except that all nets above 50 metres requires a license with a lead seal bearing the licence number. Certain irresponsible uses of these nets have been acknowledged, principally the 'Met outaz' fishing strategy, incidental catch of marine mammals and the presence of commercially important juvenile fish in the beach seine fishery. SFA has addresses these issues rationally and management options are explored followed by recommendations.

and 5 am.”. This would in effect control the amount of mackerel discarded as they are often a market driven commodity and ultimately stop the ‘met outaz’ fishing strategy.

The mackerel fishery involves both beach seines and encircling gill nets, the latter accounting for the majority of the catch (Table 1).

Table 1: Mackerel landings by gear (Anon, 1986-1995).

Gear type	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Circle net	27.88	148.1	364.1	504.6	299.6	522.6	308.8	415.9	754.7	317.7
Set net	2.08	0.3	0	0.5	31	49.3	21.8	0	0	97.6
Beach seine	3.97	7.1	63.2	14.2	20.1	47	99.9	45.2	91.7	108.9
Total	33.93	155.5	427.3	519.3	350.7	618.9	430.5	461.1	846.4	524.2

Table 1 indicates the high variability in the landings from 1986 to 1995. Peak catches were recorded in 1991 (618.9 t) and 1994 (846.4 t). This variability can be explained by the independent environmental factors which includes planktonic distribution and hydrographic factors such as temperature, salinity, pH, etc., changes in the fishing conditions and/or fluctuations in recruitment.

Biological research on the Indian mackerel (*Rastrelliger kanagurta*) started early in 1976 but ceased a few years later. It was observed that mackerel have consistently been in the size range 22-25 cm with a dominant size class of 23.5 cm (Nageon, 1981) with continuous spawning from September to May, with a major peak for females in September/October (Lablache *et al.*, 1987). They also estimated the growth parameters (Von Bertalanffy) of $K = 0.62$ per year with a length at infinite (L_{∞}) 31.7 cm, the natural mortality coefficient (M) to be 1.3 per year and with correction for schooling species $M = 1.0$ per year.

There is little information available on the resource, although it seems that the stocks are presently under-utilised.

4. Set gill nets

Set gill nets are used to exploit the shark and rays (elasmobranchs) resources around the Mahe plateau and the offshore banks of the Seychelles Islands. These gill nets range from 100 - 400 metres with a stretch mesh size of 6 inches. The shark is gilled or wedged but are often entangled in the net. There are few of these net in operation as they are expensive and are not easily available locally and the shark meat is of low value. It must be stressed that shark fishing intensifies during the S.E monsoon. It gains popularity during this season because of its ease of operation, effectiveness and can be set near

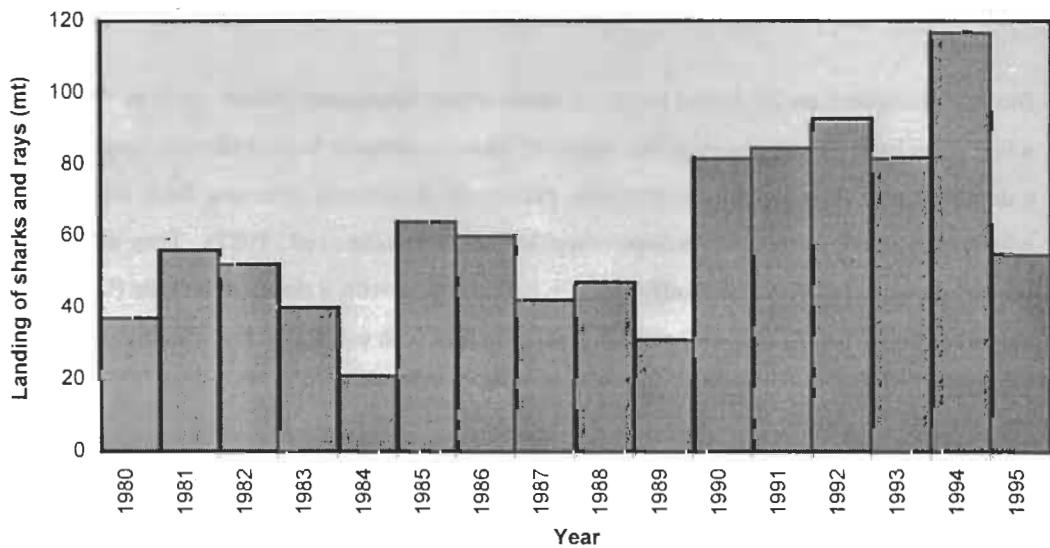
the coast as fishermen can not go far out to fish due to bad weather and rough seas. This has ultimately instigated conflicts among the different users of the marine coastal zone as the nets have often been found to have incidentally caught some protected marine species e.g. turtles and whale sharks.

Sharks are not specifically targeted by the artisanal fishery in the Seychelles. However, during the rough weather season (S.E monsoon) shark fishing is has a socio-economic importance. Sharks do not command a high price, but they fetch a high price for their fins (150/wet and 200/dry SR per kg).

The catch assessment survey records sharks and rays as a bycatch of the artisanal fishing fleet. Sharks are retained only for their fins although some meat is consumed locally (fresh or salted) and also exported.

The most common sharks landed by artisanal fishermen are the rekin nene pwent (*Carcharchinus sorrah*); and the rekin bar (*Carcharchinus amblyrhynchos*). Other species includes rekin bonder (*Loxodon macrorhinus*); spinner shark (*Carcharchinus brevipinna*); the black tip shark (*Carcharchinus limbatus*) and rekin waro (*Carcharchinus albimarginatus*).

Figure 1: Sharks and rays landings in metric tonnes (Anon, 1980 - 1995)



Though shark fishing in the Seychelles is not a cause for concern, the gear (gillnets) used have incited other users of marine environment (diving institutions) to question the method. It has frequently been utilised incidentally or purposely to entangle protected marine mammals, turtles and certain sharks species.

5. Beach seining

Beach seine or fishing with beach hauling nets, is a very old fishing method in the coastal fisheries (Brandt, 1984). In Seychelles beach seining is a traditional fishing method practiced since the 1800s. Presently only one fishing unit is involved in the fishery which is situated at Beau Vallon. The main species targeted are Indian mackerel (*Rastrelliger kanagurta*), scads and sardines which includes a by-catch of some commercial valued species.

The setting of the gear from a beach, by means of a pirogue, is done in such a way that the drag line of one wing remains fastened to the beach, whilst one wing, the net bag and then the other wing with its drag line taken out in a wide arc and then brought back to the beach. The gear is similar to gill nets except that the center of the net has been reinforced and is of a smaller mesh size of 1 to 1.5 inches with a hanging ratio of 3:1. The beach seine net for mackerel and bait fish (sardines) are usually similar in design and measures up to around 110 metres long. The beach seine acts as a trawl as it is dragged through the grass beds upon reaching the shallow waters which causes the by-catch of some commercially important juvenile fish species (table 2).

Beach seining usually intensifies during the SE trade winds as the North West of Mahe is sheltered. However, continues throughout the year when weather conditions are favourable to set the net. Beach seine requires a fairly smooth bottom and not too much swell and Beau Vallon Bay bottom topography is ideal for such operation.

6. By catch - Beach Seining

A great deal of concern has been expressed by fishery managers and conservation/Environmental groups that bycatch and discards may be contributing to biological overfishing and altering the structure of marine ecosystems. Such claims have frequently been based on observations of larger numbers of discards and high discard rate, but less infrequent on detailed population assessment of impacted stock.

The SFA initiated a beach seine project in August 1992 through to March 1993 to investigate the bycatch of the Beach Seine fishery at Beau Vallon including the Mare Anglaise area. Though limited data was collected a preliminary analysis was performed. A total of 24 set were sampled and the results are given below.

Table 3 indicates the diversity and mean length of species in the by-catch of the beach seine fishery. Immediately apparent from the table is the mean length of the species caught which provide reasons to reconsider the way the beach seine net is designed and rigged. It is the small mesh size (1 inches) of the bunt that prevents the escapement of those species. Probably the effect on their population structure is not the essence but damages to the habitat, that is the grass beds caused by the dragging of the net. However, this damage might not be significant, since only one fishing unit is presently

Table 3: Species composition of the by-catch and mean length per set (Commercially valued species in bold)

Species	Mean Length (cm)
Rouge local	7.52
Rouge tas	9
Rouge kanon	10.9
Rouge disable	9.17
Rouge Capsen	8.31
Kordonnyen blan	11.11
Kordonnyen soulfamme	11.92
Pret	7.2
Lascar	7.84
Bekin gomon	13.3
Tazar	20.1
Penis	16.5
Madras	9.3
Makro kanal	5.3
Pyes madame	7.23
Therese	6.4
Banane	16.1
Marar	7.6
Korn	5.49
Kaptenn rouge	6.7
Baksou	9.67
Guel long	4.7
Zekler	9.31
Macro ver	9.35
Tronpet	35.25
Miskaden	9.12
Breton nene pwent	11.7
karang	13.18
Zegwir	27.55
Sole	13
Kakatoi brino	9.16

Table 4: Kg of by-catch per Kg landed including catch and effort.

Set no	Targeted catch -kg	By-catch landed -kg	kg bycatch per kg landed	Fishing time (hrs)	number of men	kg /man CPUE
1	1.24	32.9	26.5	1.5	7	4.87
2	30.4	11.4	0.37	1.5	8	5.23
3	3	0	0	1.25	12	0.25
4	104.6	11.2	0.1	1	9	12.86
5	0	0	0	1	9	0
6	458.7	0	0	0.75	10	45.87
7	38	0	0	0.916	10	3.8
8	36.1	0.3	0.0083	1	10	3.64
9	40.8	0	0	1	10	4.08
10	0.8	6.75	8.47	1.58	9	0.84
11	25.1	0	0	1.58	9	2.78
12	16.1	0	0	1.5	12	1.34
13	10.7	41.8	3.92	1.5	8	6.56
14	19.8	56.3	2.8	1	11	6.92
15	38.9	139.4	3.58	1	8	22.3
16	13	0	0	1	10	1.3
17	14.7	0.28	0.02	0.75	9	1.66
18	1.2	3.5	2.9	1	10	0.47
19	92.4	0	0	0.75	11	8.4
20	98.9	0	0	0.8	11	9.98
21	23.5	0	0	0.8	11	2.13
22	0	0	0	0.75	11	0
23	0	0	0	0.75	10	0
24	139.2	0	0	0.66	10	13.92

involved in the fishery. In this context fishers must be encouraged to set their net responsibly, with care to avoid damaging the grass beds as they offer breeding grounds, camouflages and predator protection for those species; and to release any unwanted catch promptly to reduce the discarded mortalities.

Gear modification and alternative approaches have the potential of reducing the catch of unwanted species, but at what expense to target catch and processing or handling rates. Break-even results may not be good enough to induce fishers to shift practices; that is unless real financial benefits can be

associated with the new practices. Although regulation mandating the use of new modified gear is imposed, their effectiveness may be negated if there is a strong user-group resistance to employ the new or modified practiced or gear. The alternative then becomes the development of fisheries management options that encourage fishers to adapt low by-catch rate practices.

Table 4, shows a high variability in the ratios (Kg of bycatch per Kg landed). In the 24 sets sampled the highest ratio was 26.5 Kg of by catch per Kg of fish landed and the lowest being no bycatch per Kg landed. From this observation it is difficult to conclude if the impact on recruitment is significant. An average of 2.03 kg of by catch per kg landed per set is relatively high for the fishery. However, it can be seen that on 14 occasions no by-catch was observed and the high variability which exists indicates the nature of the fishery and there is limited data .

The catch per unit effort fluctuates considerably with the highest at 45.87 kg per man per haul and the lowest at 0.0 kg per man per haul. The average catch per unit effort stands at 6.63 kg per man per haul.

7. Effects of discarded nets on the environment

An important property of synthetic netting materials is that they are not biodegradable, and this had led to fears that of loss on discarded nets will continue to fish almost indefinitely. In Seychelles there has been very few occasions where fishermen have abandoned or discarded their gear. This is primarily due to the high cost of the nets and their availability. The importance of having a lead seal or plastic slates bearing the licenses number attached to the net will deter fishers firstly from abandoning or discarding the nets and secondly will reduce the illegal use of nets in protected marine areas.

Marine mammals are occasionally caught and drown in gill nets during normal course of fishing operation. This has been particularly the case for set gill net for sharks. Although these mortalities are thought unlikely to present a serious threat to any one species as a whole there are concerns for the impact on the tourist industry and their recreational users.

8. Management Considerations and regulations

There are three distinct and often conflicting aims for Management of Fisheries.

- Bio-protection of fish stocks - to maintain a breeding population within "safe biological limits" which is capable of providing maximum recruitment to the fishery in favorable environmental conditions;
- Fisheries economics - to achieve a high and sustainable yield from stock resources, as either quantity or value of landed fish in relation to fishing costs;

- Social consideration - to provide adequate employment and recreational opportunities and safeguard the wild life and environment

Considering the above it is very difficult to satisfy without a compromise somewhere. In previous section mentions have been made of the problems that have arisen with the expansion in the use of gill nets. In general, conflicts rose between fishermen for the limited resource; between gill nets fishermen and the recreational sector and the associated social and economic constraints.

8.1 Regulations

The most important management requirements for the Seychelles net fisheries are as follows:

- Only nets over 50 meters are required to be licensed (regulation of the Fisheries Act. 1986.
- No persons shall fish in a protected area with any net which is generated by being dragged across the sea bed (Part IV - Regulation 15 (2))
- No persons shall place any nets in any reef passes or channel in such a way as to obstruct the passage of fish.

Presently there are 33 persons who have licensed nets in Seychelles of which 8 are shark nets and others are mackerel nets. Fishers with fishing nets above 50 meters pay a license fee of SR 100.00 including SR 25 processing fee. The licensed net have to be marked by an authorized officer with a lead seal or other mark bearing the license number of the net. However, this is not enforced as there are no available means of marking these nets. The Seychelles Licensing Authority only issues a license number.

The boat survey (Payet, 1995) enumerated 43 vessels full time or seasonally active in net fishery (Mahe, Praslin and La Digue). The discrepancy may be due to a number of unlicensed nets actively involved in the fishery or net fishing as an seasonal fishing method. Most are small open deck 16-20 ft fibre glass boats or pirogues (unpowered) manned by 3-4 fishers and at least one net.

8.1.1 Implications

Since only nets above 50 meters require a license and not marked with their respective license number it has been difficult for the Seychelles Fishing Authority to monitor and control the use of nets efficiently. It is recommended as a precautionary approach all nets irrespective of size would require a license. The regulation mandating that nets should have lead seal marking the license number attached to it should be enforced. Consequently this will allow the SFA with the collaboration of the police effectively monitor and control the net fishery.

8.1.2 Minimum mesh

In addition minimum mesh sizes should be imposed on the gill nets (encircling and set gill nets). Minimum mesh sizes affects the composition of the fish caught, and usually aim to prevent the capture of too many small and immature fish. Roughly speaking, it ensured that a high proportion of fish had the opportunity to spawn at least once. However, it does restrict the total quantity of fish caught and other direct measures needs to be implemented if fishing effort increases such as to avoid depleting the spawning stock associated with excessive catches.

Mackerel matures at a minimum size of 21.0 to 21.9 cm and Lablache et al. (1987) showed that the near inshore fishery is based on fish belonging to the 1-3 years age-group with the majority of fish caught being matured two-year old. The identity of the stock is unknown that is how far they migrate and whether they are subject to exploitation elsewhere and the stock size is virtually unknown. Thus this give reasons to consider the imposition of a minimum mesh for the mackerel fishery as a precautionary measure. The present mesh size employed in mackerel encircling nets is between 1.5 - 2.5 inches (5.7 - 6.4 cm) which is not legislated. All nets intended for mackerel fishery should have a minimum mesh size of 2.5 inches or 6.4 cm.

In the case of set gill nets for sharks the current mesh size is 6 inches (15.25 cm). We suggest that the *status quo* should be mandated as the minimum mesh size for the shark fishery. The use of these nets should be limited to a defined distance from any reef and the mandatory of the minimum mesh size and its sole use is for shark fishing.

For bait fishery (sardines) nets should be set at a minimum mesh size of 1.0 inches. Although the sardine stock is not a cause for concern it is important that such fishery is regulated so as to allow the management and conservation on a sustainable basis rather that on a *laissez-faire* attitude.

8.1.3 Met Hotaz

Probably the greatest disadvantage of such fishing strategy is that a higher fishing pressure is being applied on the migrating stock which could in effect reduce the spawning stock biomass to low levels. Secondly, fishers have complained that such fishing strategy does not allow a fair share of the resource and the amount that could be discarded if no markets are found is substantial. Consequently the amount of stress exerted on the fish, say after three or four days will cause deterioration in the quality of the meat due to starvation and its only use is for bait. If they are released their probability of dying is increased. On the other hand one should not disregard the economic and social aspects of such fishing strategy. Financial returns might be higher and with much ease. It could even be indicating the status of our coastal fishery resources and desperation for fishers to make a profit. One might argue that

there is nothing wrong with “met outaz” but is the fishing strategy ethically acceptable or is it seen as a destructive fishing method. What remains therefore is to encourage responsible fishing practices.

Biologically “met outaz” fishing strategy may be detrimental to stock on a long term scale but on the economic and social aspect fishers find this strategy rewarding. We cannot ban such an activity but instead indirectly mandate legislation to discourage fishers to employ such fishing strategy. Such measure could be the imposing of restricted time limits for the mackerel fishery.

8.1.4 Reef fisheries

All gill nets and/or any other types of nets should be prohibited in reef lagoons. The reef resources are fragile and the harm that can be caused by the use of nets being dragged or set on the highly vulnerable coral beds is drastic. Further, coral reef fish species needs to be protected and harvested sustainably. It is recommended that gill nets should not be used for the purpose of catching certain fish species. The proposed species are as follows:

Rouze : *Parupeneus* spp

Zourit vov: *Loligo* spp

Kakatwa: *Scarus* spp

Marar: *Lespocanus vagienis*

Cordonnyen: *Siganus* spp

Carang: *Caranx* spp

8.2 Monitoring, control and surveillance

To monitor and control fishing nets SFA should be the designated agency to screen applications for the imports of nets to ensure its conformity with the present legislation and followed by inspection upon arrival in the country.

Ways to enforce the time restriction on the mackerel encircling nets and compliance by fishers has to be decided. The most appropriate monitoring and surveillance method would be the fishers themselves with mean of contacting the ‘Authorised Officers’ of SFA and the police coupled with at-sea and shore-base enforcement.

A phase out period of the illegal nets has to be determined if the minimum mesh sizes are imposed. All nets active in the fishery should be licensed and registered with its mesh size measured and monitored.

9. Management recommendations

Three main issue has been raised in this report and management recommendation are listed below:

1. As a precautionary management measure, minimum mesh size should imposed on the different net fisheries; mackerel: 2.5 inches mesh size; sardines: 1 inch mesh size and sharks: 6 inches mesh size. All nets must have a license irrespective of its length and should be licensed to target a particular species .
2. To allow better management of the fishery all nets imported should be screened by the Seychelles Fishing Authority and a time period be set for the phase out of the illegal nets in the fishery. All active nets should be registered and licensed.
3. The legislation mandating that nets should have a lead seal or plastic seal bearing the license number attached to it should be enforced.
4. Setting of nets in reef lagoons should be prohibited.
5. The use of gillnets for the purpose of catching fish listed in this report should be prohibited.
6. No person shall be allowed to fish with a gillnet within the outer edge of a reef around any island between the hours of 4 p.m. and 5 am and consequently address the issue of 'Met hotaz'.

10. Conclusions

There will be no one 'best situation' for a fishery to be in. Nevertheless, it may be possible to find some situation which forms an acceptable compromise from the view point of most people concerned with the net fishery and those affected by it. Clearly a laissez-faire policy cannot be relied upon to ensure the net fisheries success. Some form of fisheries management is generally necessary as there is no place for complacency.

It is imperative that management measures, such as technical conservation measures (minimum mesh size) be imposed in the net fisheries and alternative measures as suggested in the report. In addition fishermen must be educated on the importance of exploiting the near-shore fisheries resources sustainable and the objective of managing a fishery.

The objective of such management measures is to ensure that responsible fishing practices are encouraged and to remove any laissez-faire attitude in the net fishery.

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