

EVOLUTION OF THE SEYCHELLES SEMI-INDUSTRIAL LONGLINE FISHERY

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Abstract

The local pelagic long line fishery targeting swordfish started in the Seychelles in 1995. After increasing from 1 to 12 vessels in 2002, only 5 vessels were active in 2005. This document describes the evolution of catch in round weight from 1995 to 2005. Fishing effort increased from 31,480 hooks in 1995 to 510,584 in 2001. Fishing was concentrated on the northern part of the EEZ, in an area of approximately 240,000 km². The reported total catch of the semi-industrial longline fishery is estimated at 3,425 Mt. Swordfish catches in weight represents 56% of total annual catches, followed by yellowfin tuna 16%, then bigeye tuna with 14%. By-catches constituted of sharks (8%), sailfish (3%), marlin (2%) and other species (about 1%). Since the year 2000, some local longliners changed their fishing strategies to target sharks. The annual swordfish CPUE shows a significant decreasing trend from 0.75 Mt/1000hooks in 1998 to 0.50 Mt/1000hooks in 2002. No significant trend is observed for tunas. On a monthly basis, high CPUE's on swordfish are obtained from April to June (0.6 to 1.0Mt/1000hooks) and between December and May for tunas. Monitoring of size frequency carried out since 1995 shows an increasing trend of mean length since 1997, with PAL (Pectoral Anal Length) ranging from 44 to 52cm. Significant trend is observed in monthly analysis with increase in swordfish size from March to June.

The figures presented in this paper may differ from previously presented figures. In the current analysis the data have been raised to take into consideration missing logbooks and landings. Logbooks and landings data have been raised to round weights.

INTRODUCTION

The monofilament longline fishery targeting swordfish (*Xiphias gladius*) and tuna started in 1995 with experimental trips by the Seychelles Fishing Authority's (SFA) research vessel R/V Etelis. The trips and technical assistance, financed by " Association Thoniere" of the COI were aimed at evaluating the potential for local investors to exploit large pelagic fish, especially swordfish in the Seychelles EEZ using the mono filament long-line fishing method. Interesting results were obtained with catch rate averaging 0.9 kg/hook (Bargain *et al.*, 2000; Bargain, 2001). Following these promising results, commercial trips were considered by Seychellois operators and professional campaigns started in 1995. The fleet grew quite rapidly from only 1 vessel in 1995 to 12 in 2002. Likewise the number of fishing trips also grew from **8 in 1995** to a maximum of **171 in 2001**. Catches grew from only **34 metric tons** to a peak of **581 metric tons in 1999**. The fishery targets principally swordfish, but other species such as tuna (yellowfin and bigeye) and to a smaller extent marlin, sailfish and sharks are also landed.

Since the year 2001 there has been a continuous decline in the fishery whereby the number of trips and landed catch has all been on a downward trend. The decline has been more acute from 2002 onwards, where catch fell by 61% in 2003. Overall between 2001 and 2004, the catch fell by 83% to reach a mere 90 metric tons in 2004. The number of active vessels in the fishery has also declined to four vessels active in the long-line fishing in 2004. The number of trips conducted also fell from 171 in 2001 to a mere 22 trips in 2004. This sharp decline during the 2002-2004 period has been principally due to a restriction on the export of swordfish from Seychelles on the European market as a result of higher than permitted levels of cadmium in the swordfish. As a consequence most of the local long-line vessels diverted to shark fishing going mainly for the fins, which fetch high prices on the Asian markets. Although the restriction for export of swordfish on

the EU market has since February 2005 been lifted, most of the local vessels have not returned back to targeting swordfish and tuna as was expected.

The evolution of the local long-line fleet in terms of number of vessels and performance is summarized in figure 1 below.

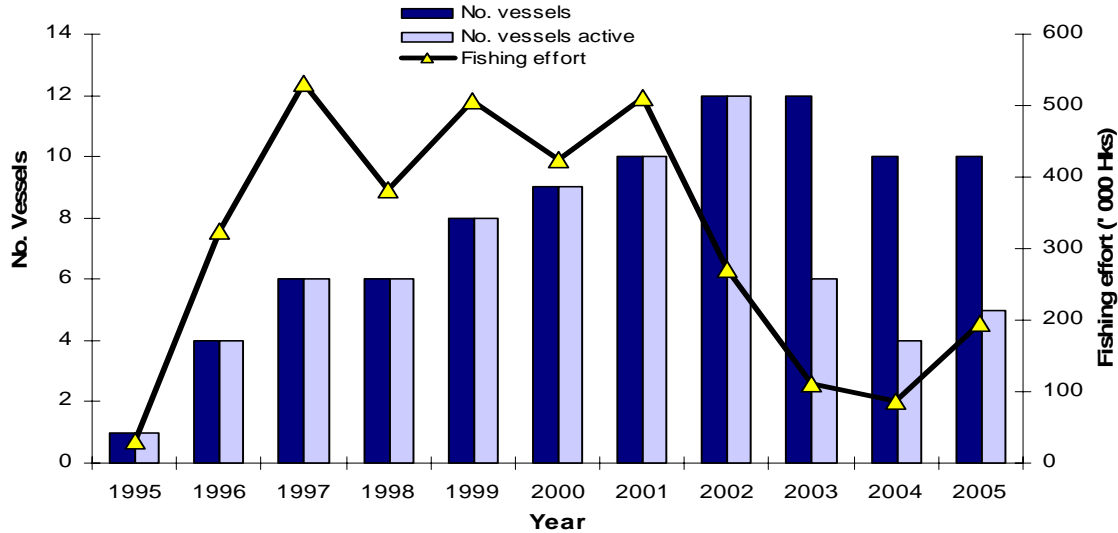


Figure 1. Evolution of number of vessels and fishing effort (number of hooks set) between 1995 and 2005 for the Seychelles semi-industrial longliner fleet.

A monitoring program was set up by SFA in 1995 to closely monitor the fishery. Several data were collected from logbooks filled by skippers and landed data from processors. Fish were also sampled to collect biometric data. Table 1 below summarises the reported and processed data and coverage. Logbook coverage was lower during the 2002 - 2003 period when fishing effort was directed towards sharks and skippers were not reporting such activity.

Year	Logbook Catch (Mt)	Landing Catch (Mt)	Logbook Effort (Hooks)	Round weight ¹ (Mt)	Effort Raised ² (Hooks)	%Missing Logbook	%Missing Landing
1995	20.17	26.36	31,480	34.22	31,480	0	0
1996	140.43	192.06	290,160	271.86	324,482	18	13
1997	153.40	296.58	320,930	403.97	529,052	40	7
1998	188.45	274.95	289,940	397.11	383,130	26	13
1999	214.65	453.35	407,040	580.61	506,539	19	1
2000	153.98	371.97	319,205	500.75	425,376	25	4
2001	168.41	395.79	423,944	535.60	510,584	23	2
2002	70.63	177.77	197,028	230.34	270,412	56	0
2003	26.47	69.57	83,651	90.87	111,531	57	0
2004	32.51	67.91	78,545	90.19	87,468	23	5
2005	112.94	221.21	194,298	290.32	196,005	5	0

Table 1. Summary of reported and processed data and coverage.

¹Round weight; landing data have been raised to take into consideration onboard processing and missing logbook data. Logbook data were also raised to account for missing landing data.

²Fishing effort (number of hooks) has been raised to take into consideration missing logbook.

1. 1. Fishing effort

Fishing effort fluctuates from year to year. However, overall, an increasing trend was observed from 1996 to 2001. Fishing effort increased from 324,482 hooks in 1996 to 510,584 in 2001, with a maximum of 529,052 hooks in 1997. Between 2001 and 2004, fishing effort dropped by 83% to reach a mere 87,468 hooks set in 2004. During the period 1996 – 2005, the mean number of hook set per year was 334,458 hooks.

The fishing effort deployed per set (figure 2) show a decreasing trend from 839 hooks in 1996 to reach around 450 hooks during the 2000 – 2001 period. An increase was then observed from 2002 to 2004 with between 614 and 675 hooks per set. This resulted from the arrival of two larger vessels (LOA 23m).

The monthly fishing effort doesn't show any significant trend except for a light increase from March to May and in October.

The evolution of mean fishing trip duration (figure 3) shows a gradual increase from 5 to 10 days between 1995 and 2003. The evolution of average fishing trip duration by month shows a decreasing trend (8 to 6 days) during the first semester of the year and an increasing trend (6 to 8 days) between July and November.

The geographical distribution (by 1 degree) of the fishing effort shows that effort is centred around the Mahé continental shelf, with a maximum on the North East of the plateau (figure 4).

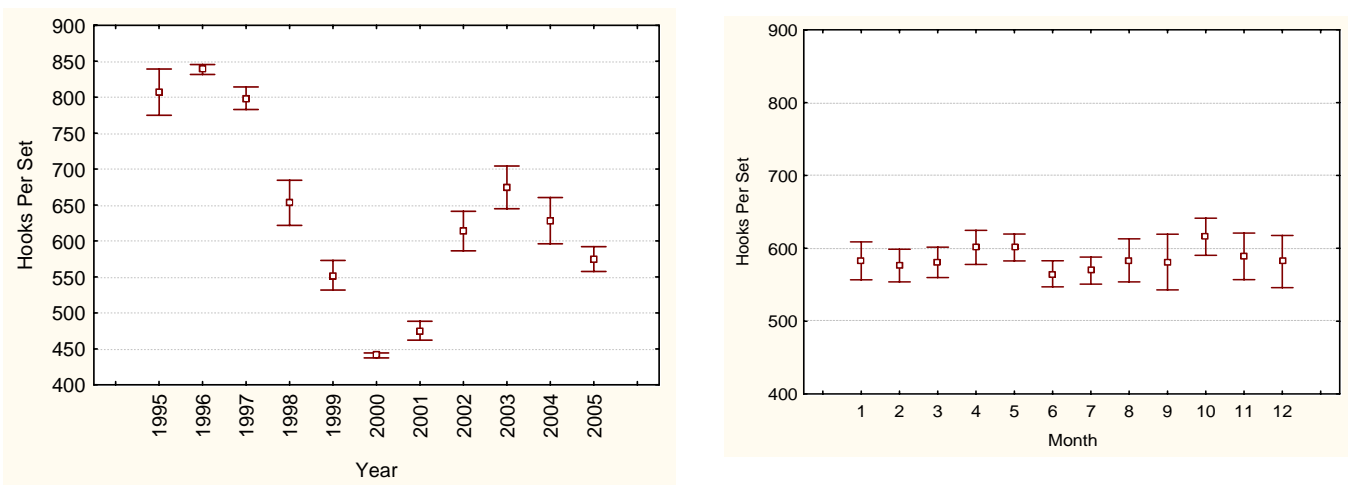


Figure 2. Fishing effort (in hooks) evolution by long line by year (left) and by month (right).

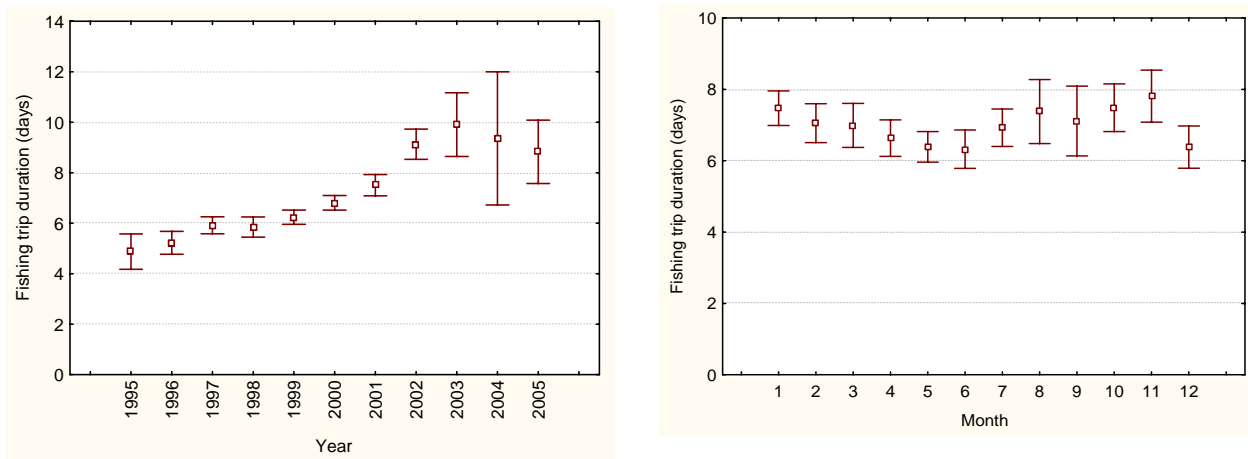


Figure 3. Duration of fishing trips (in days) evolution by long line by year (left) and by month (right).

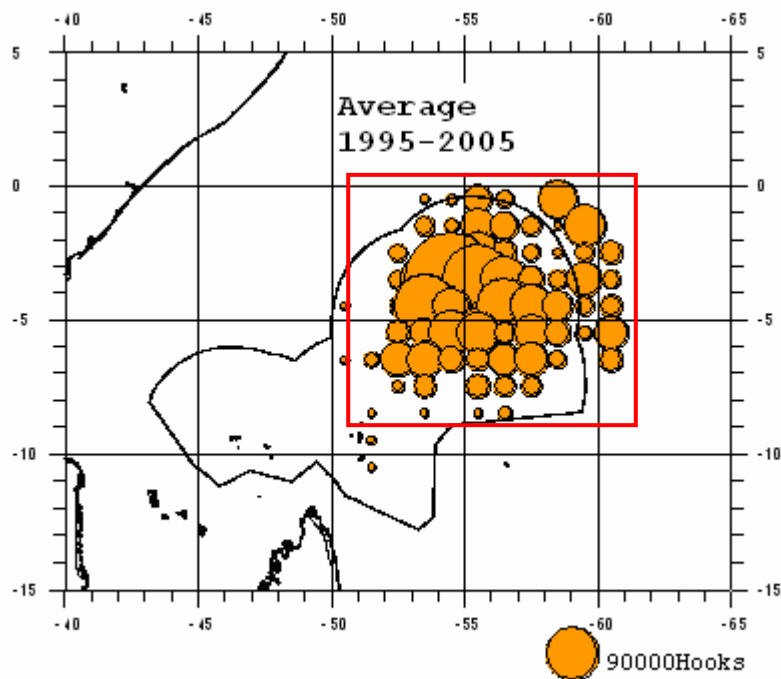
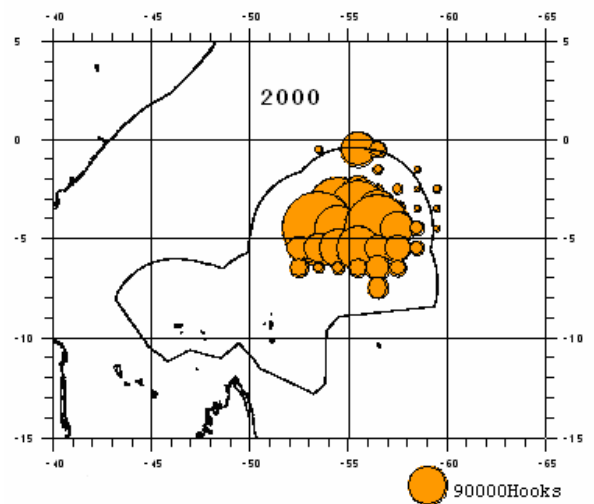
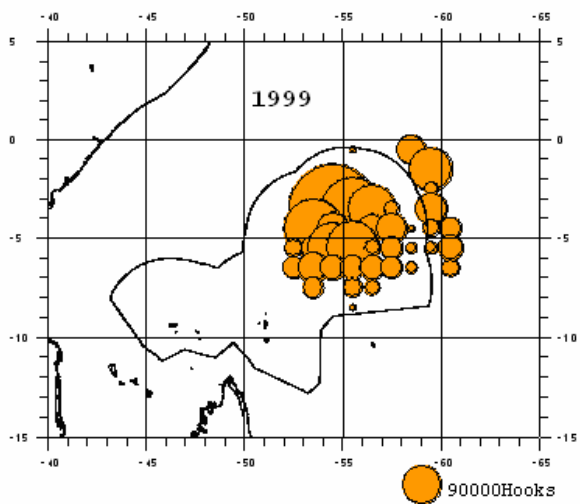
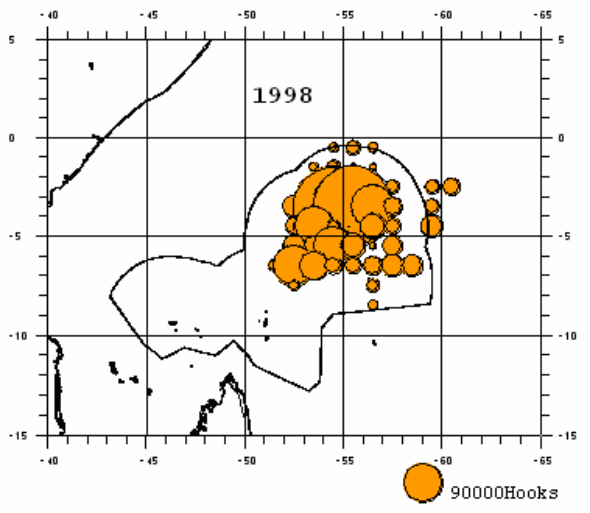
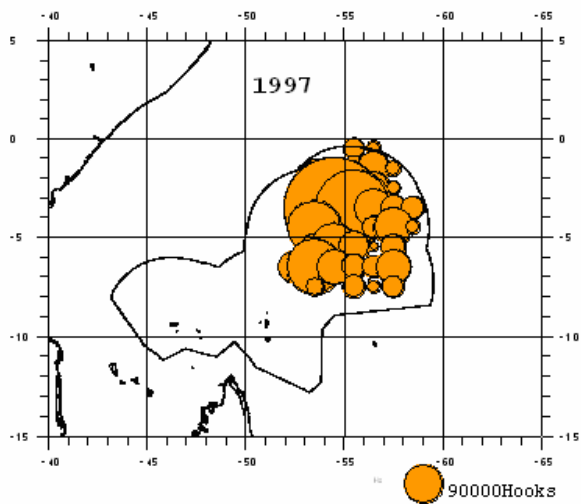
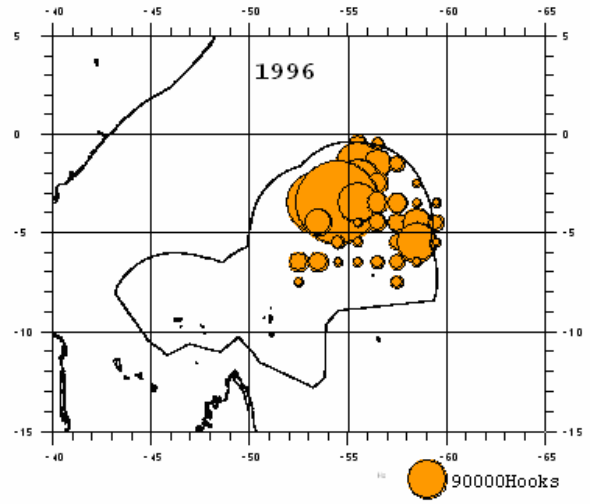
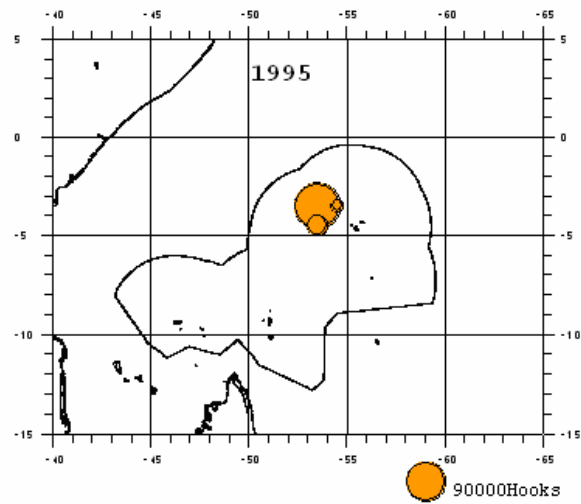


Figure 4. Mean fishing effort (in hooks) for the period 1995 - 2005 realised by local longliners in and around the Seychelles' EEZ.

Distribution of annual fishing effort from 1995 to 2005 is presented in figure 5. From 1996 to 2005 fishing effort is located in the North and North East of the plateau. From 1998 fishing effort started to spread just outside the Seychelles EEZ. The years 2002 –2004 are characterised by a decrease in the fishing effort probably caused by a switching of target species (sharks vs. swordfish) linked to exportation constraints. However in 2005 an increase in fishing effort can be observed. These representations show that over the 11 years period the range covered by the fleet is very small. Fishing effort is located on a sector of 4° of latitude and 7° of longitude (2° - 6° south and 52° - 59° East) .



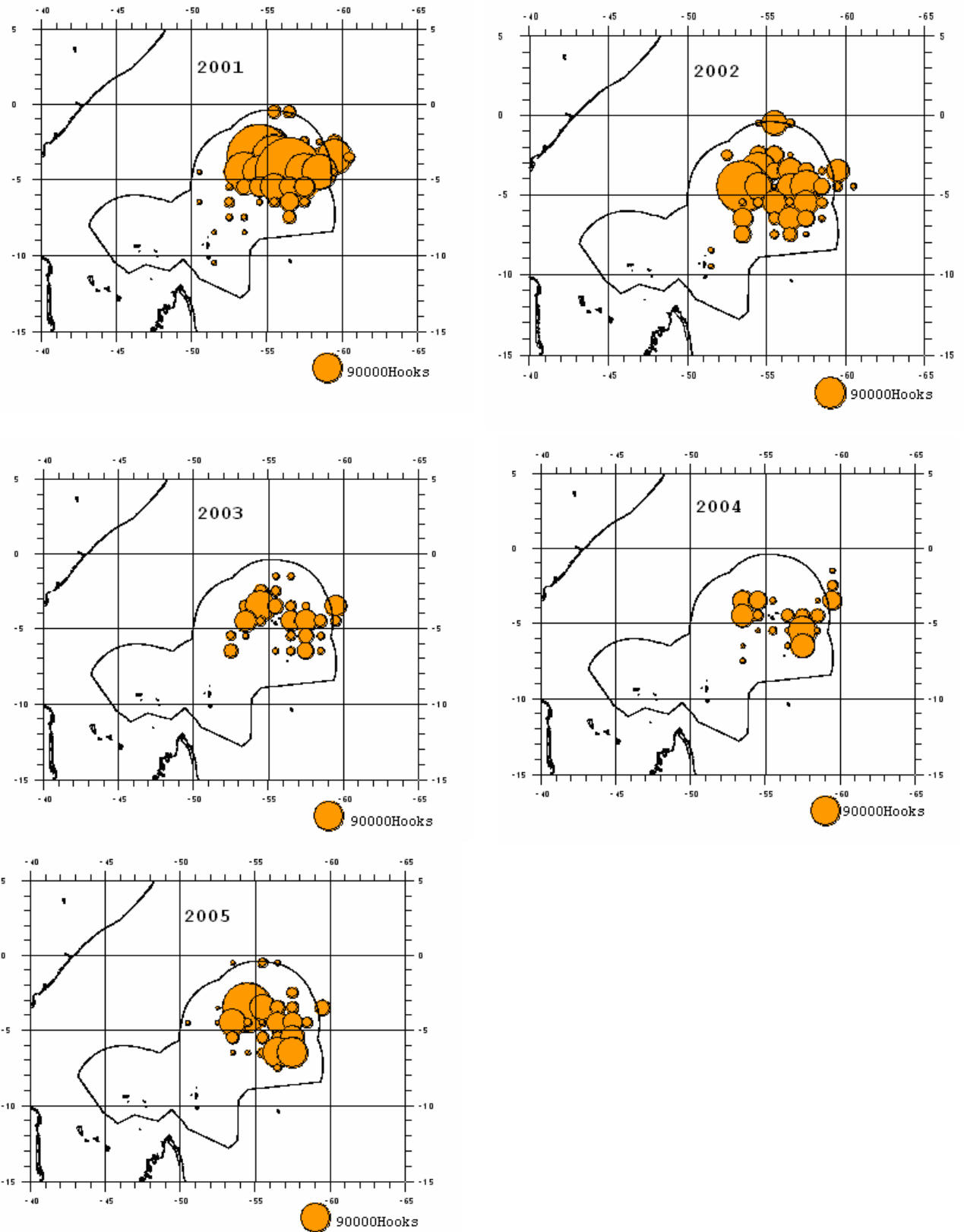


Figure 5. Total fishing effort (in hooks) from Seychelles' longliners, 1995 to 2005.

1.2. Catches

During the last 10 years (1995 excluded, considered as an exploratory year), the total estimated catch of swordfish (around 1, 889 Mt) represents 56% of total annual catches, followed by yellowfin tuna (*Thunnus albacares*) with 533 Mt (16%), then by bigeye tuna (*Thunnus obesus*) with 474Mt (14%). By-catches constituted of sharks (8%), sailfish (3%), marlin (2%) and other species (about 1%).

The annual evolution of catches does not show any significant trend (figure 6), except for the drop in swordfish catches after the year 2001.

Swordfish catches varies between 50% to 79%, and for yellowfin (8% to 20%) and bigeye (8% to 22%) .

A significant increase in shark catches was observed between 1995 and 2001. Since 2002, linked with decreasing swordfish CPUE and exportation constraints, several longliners have modified their fishing strategy to increase shark catches by fishing in specific areas and using specific gear (metal ganglion). These activities increased rapidly and in 2002 SFA estimated that 28% (and around 50% for the first semester 2003) of fishing effort was dedicated to targeting sharks.

In 2003 the SFA introduced a separate logbook system for shark fishing activities. The figures here represent only shark bycatches from longlining operations targeting swordfish and tuna. Fishing activities targeting sharks are analysed in section 1.5.

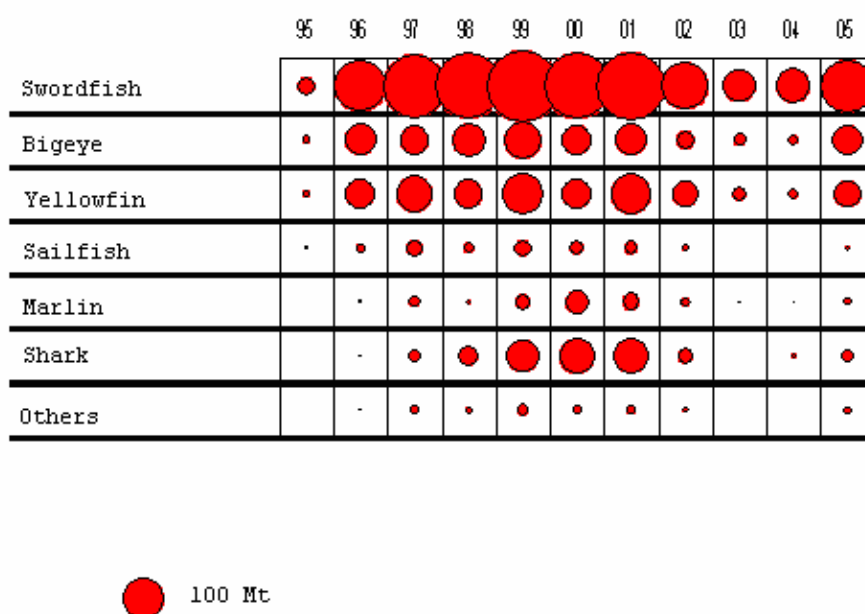


Figure 6. Estimated catches (tonnes) from 1995 to 2005 reported by the Seychelles' longliners.

Year	Swordfish	Yellowfin	Bigeye	Sailfish	Marlin	Shark	Others	Total
1996	154.19	50.19	59.16	1.36	5.74	0.45	0.76	271.86

1997	231.72	81.28	49.27	8.27	18.61	8.94	5.88	403.97
1998	241.89	50.79	64.90	2.07	8.82	24.92	3.73	397.11
1999	292.43	94.10	87.29	16.19	18.55	63.61	8.46	580.61
2000	259.67	50.41	57.14	35.70	13.89	78.03	5.90	500.75
2001	270.15	96.28	57.60	21.42	12.10	71.29	6.75	535.60
2002	135.12	41.94	24.08	7.56	3.92	14.79	2.92	230.34
2003	65.62	13.00	11.50	0.41	0.28	0.07	0.00	90.87
2004	70.97	7.65	7.20	0.76	0.38	3.05	0.19	90.19
2005	167.53	47.14	55.95	4.73	2.20	8.42	4.36	290.32
Total	1889.29	532.79	474.08	98.46	84.48	273.58	38.94	3391.62

Table 2. The main commercial species (tonnes) caught by the Seychelles's longliners from 1995 to 2005.

1.3. CPUE

From data recorded in logbooks, landing data from processors and sampling program, the CPUE (in Mt/1000hooks) was calculated for the period 1995 to 2005.

Annual swordfish CPUE (figure 7 - left) shows significant variations with a maximum of 0.85 Mt/1000 hooks in 2005. However this figure is not representative of the whole fishery as during 2004 and 2005 only two of the most efficient vessels were operating on a regular basis. Furthermore those two vessels were mostly operating during the period where historical data have shown that catches of swordfish were higher (April to July).

From 1998 to 2002, the swordfish CPUE shows a downward trend dropping from 0.75 Mt/1000hooks to 0.50 Mt/1000hooks. During the 2003 - 2005 period, the swordfish CPUE displayed an increasing trend.

On a monthly basis (figure 7 - right), 2 periods are observed; one with high CPUE between 0.6 to slightly over 1.0 Mt/1000 hooks from April to June and the other from July to February with catch rates of 0.4 to slightly over 0.5 Mt/1000 hooks.

For yellowfin and bigeye tuna no significant trend is observed except for a sharp increase in both bigeye and yellowfin CPUE reported during 2005.

Monthly variation of CPUE shows 2 periods. For yellowfin, between December and May, the average CPUE (0.18 – 0.25 Mt/1000hooks) is higher than the annual mean (0.15Mt/1000hooks). Between June and November, CPUE is minimum with approximately 0.1 Mt/1000hooks. A slightly similar, but less marked trend is observed for bigeye tuna.

CPUE of by-catches (figure 9) is inferior to 0.1Mt/1000hooks. However In 1998, shark CPUE increased significantly to reach a maximum of around 0.4Mt/1000hooks in 2001. A similar trend is observed for sailfish in 1999 and 2000. Marlin CPUE have remained constant

Unlike swordfish and tuna CPUE, no monthly trend is observed for sailfish and marlin CPUE. For shark the CPUE remains low and constant throughout the year except for August and September where a significant increase can be observed.

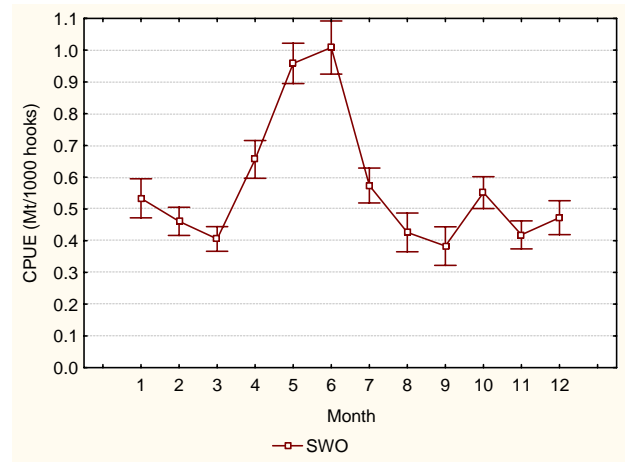
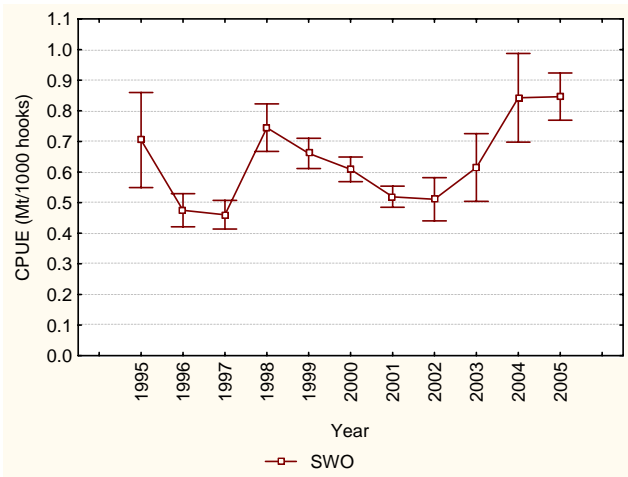


Figure 7. Swordfish CPUE evolution by year (left) and by month (right) for the Seychelles' longline fishery.

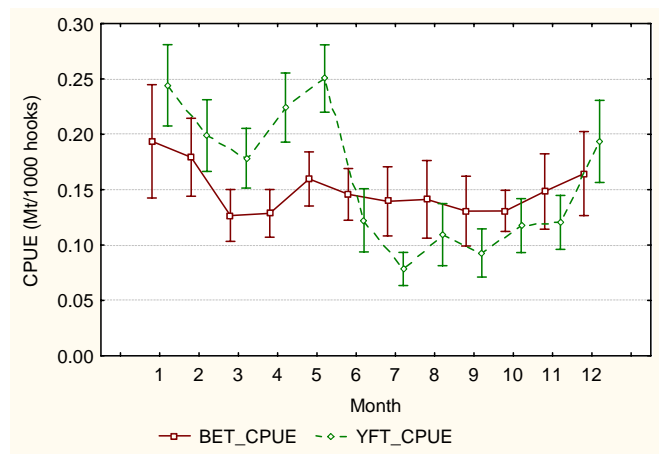
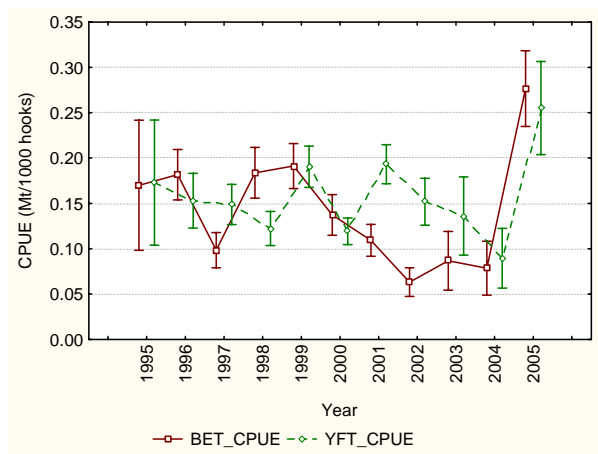


Figure 8. Yellowfin and bigeye tuna CPUE evolution by year (left) and by month (right) for the Seychelles' longline fishery.

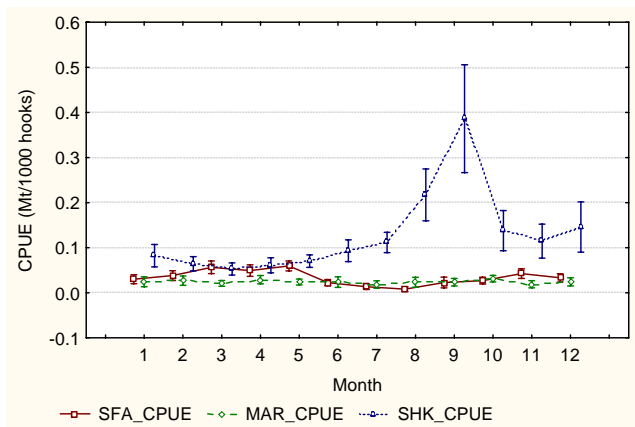
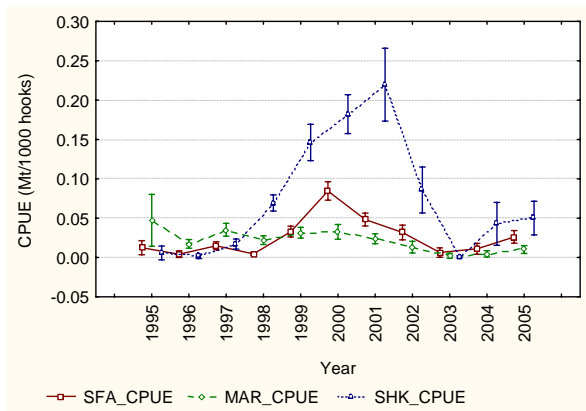


Figure 9. By-catch CPUE evolution by year (left) and by month (right) for the Seychelles' longline fishery.

The geographical distribution of swordfish's CPUE (figure 10), show homogenous repartition on the entire fishing area. Nevertheless, 2 sectors are distinguished by high CPUE; on the North of the EEZ around the Coco de Mer Seamount and on the north east of the continental shelf.

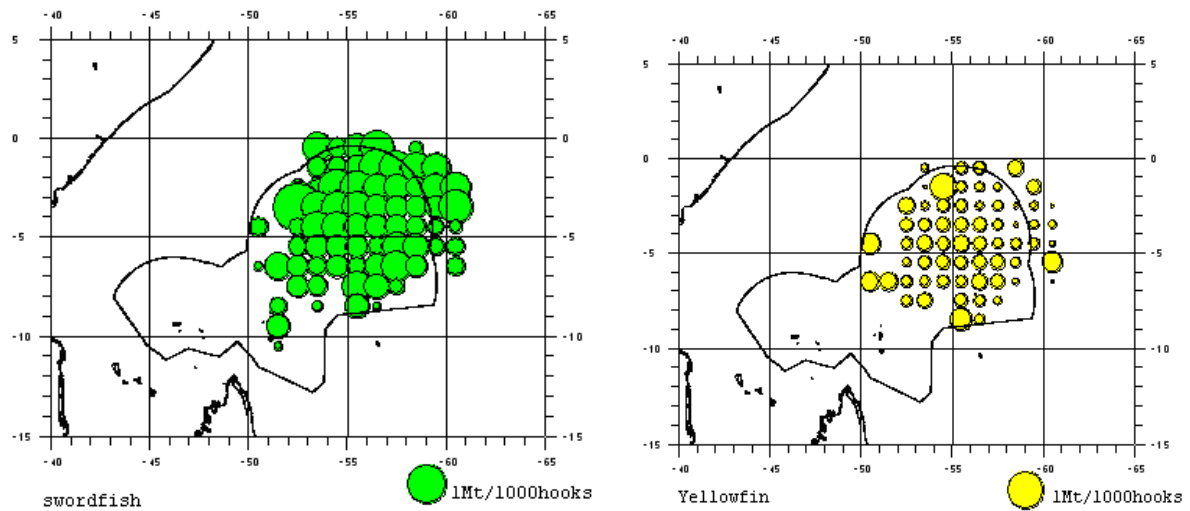


Figure 10. Spatial distribution of CPUE (Mt/1000hooks) for swordfish (left) and yellowfin tuna (right) by 1° square

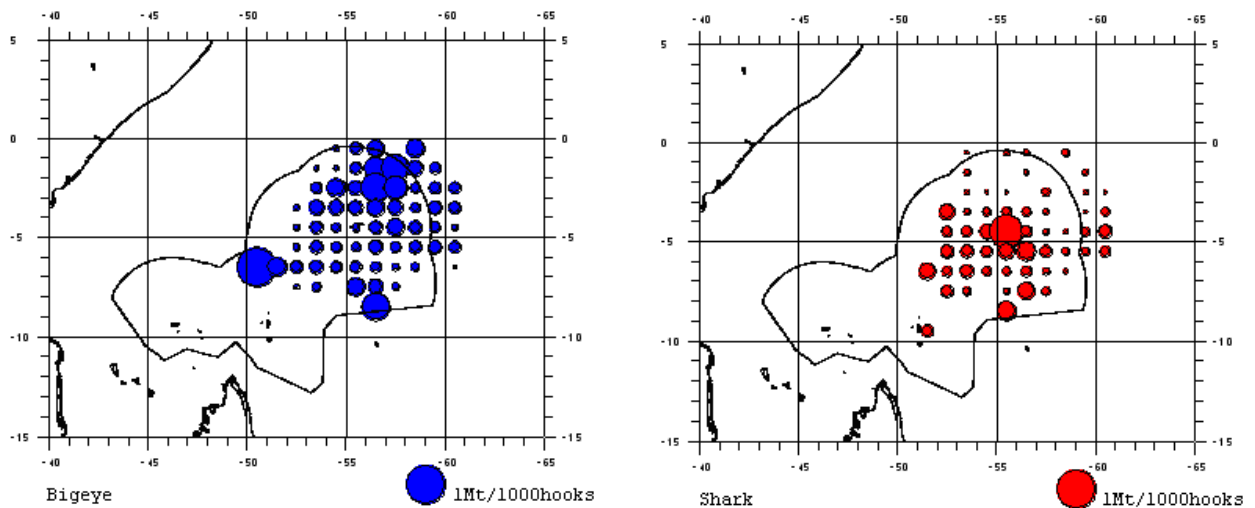


Figure 11. Spatial distribution of CPUE (Mt/1000hooks) for Bigeye (left) and shark (right) by 1° square

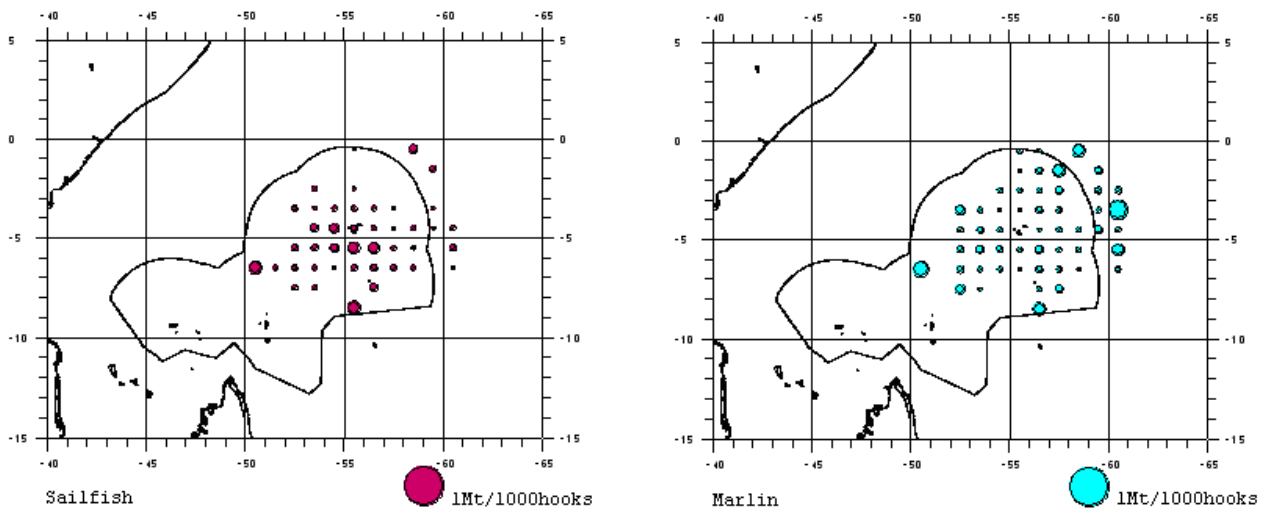


Figure 12. Spatial distribution of CPUE (Mt/1000hooks) for sailfish (left) and marlin (right) by 1° square

1.4. Monitoring of size frequency

The monitoring of size frequencies has been carried out by SFA staff since 1995 during the landing of fish. Analysis of size frequency were realised from Lower Jaw Fork Length (LJFL) and Pectoral Anal Length (PAL). The annual swordfish size frequency distributions are presented in figure 13[1]. The size class are in centimetres. Number of samples collected is low (less than 20% of total catch) for the period 1997 to 2005. Annual evolution of the mean length is presented in figure 13[2]. Between 1998 and 2001, the mean PAL does not show any significant trend, with a range between 47 and 48 cm (equivalent to MFL: 136 to 139 cm). An increasing trend can be observed in mean PAL between 2001 and 2005 ranging between 48 and 52cm.

Monthly evolution of the mean PAL aggregated by month show significant trends (figure 13[3]) with an increase in swordfish size from March (PAL: 45 cm) to June (PAL: 51 cm). From June to September PAL decreases to reach a minimum of 44.5 cm. This period is also the time of the year where maximum CPUE are observed (figure 7).

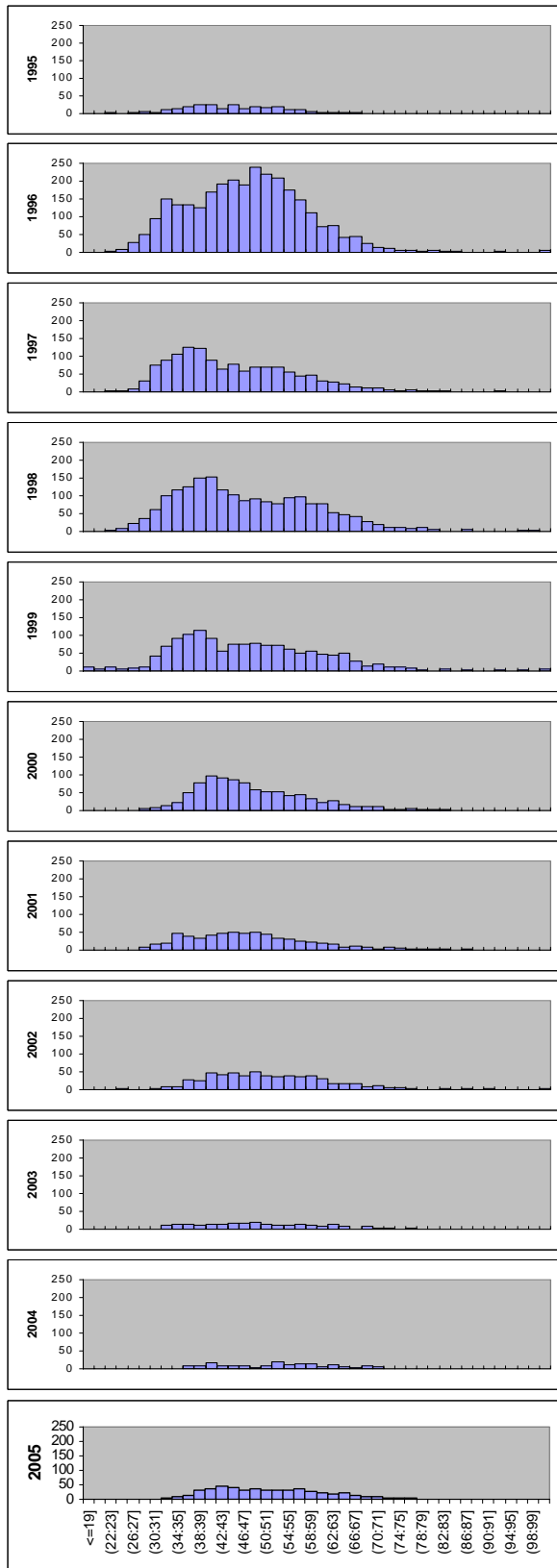


Figure 13.(1) Swordfish size frequency distributions (PAL in cm) from fish landed by Seychelles' longliners in Victoria for the period 1995 - 2005 (n 1995 = 261, n 1996 = 2899, n 1997 = 1351, n 1998 = 1933, n 1999 = 1409, n 2000 = 932, n 2001 = 650, n 2002 = 616, n 2003 = 242, n 2004 = 172, n 2005 = 528).

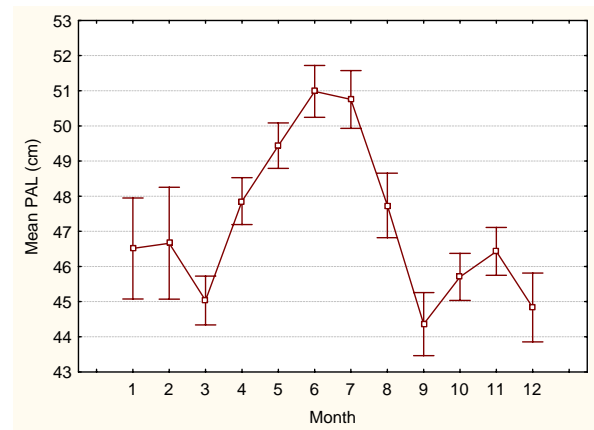
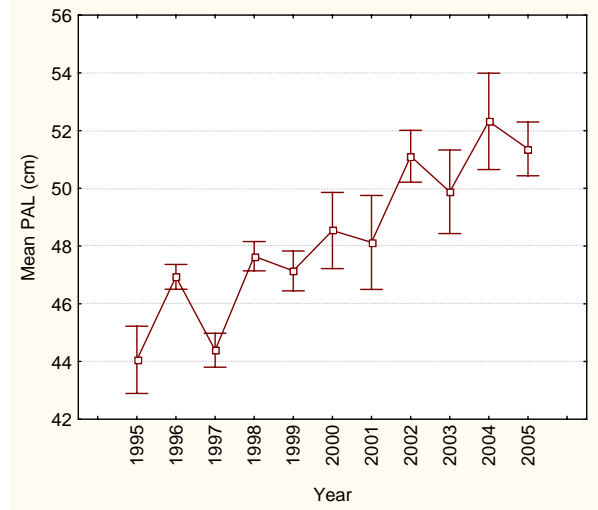


Figure 13.(2 & 3) Mean size (PAL in cm) evolution by year (up) and month (down) on the period 1996 - 2001 for Seychelles' longliners (n 1995 - 2005 (n 1995 = 261, n 1996 = 2899, n 1997 = 1351, n 1998 = 1933, n 1999 = 1409, n 2000 = 932, n 2001 = 650, n 2002 = 616, n 2003 = 242, n 2004 = 172, n 2005 = 528).

1.5. Shark fishing activities

Sharks' catches consisted of the blue shark (*Prionace glauca*), oceanic whitetip shark (*Carcharinus longimanus*), silky shark (*Carcharinus falciformis*), hammerhead shark (*Sphyrna spp*), mako shark (*Isurus oxyrinchus*), thresher shark (*Alopias sp*) and tiger shark (*Galeocerdo cuvieri*). The sharks landed are estimated around 8%, however, a significant percentage of catches are finned and the meat is discarded at sea taking into account the low commercial value of the meat.

After the introduction of a logbook for shark fishery and various meetings conducted with fishermen targeting sharks, there has been an improvement in the feedback from fishermen in terms of logbook returned.

In 2004 a total of 32.9Mt of shark meat and 11.4Mt of shark fins were landed. From January to September 2005 a total of 13Mt of shark meat and 11Mt of shark fins were landed.

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