Evolution of the swordfish longline fishery of Mauritius

By

D. Norungee[1], Y.T.N. Wan Sai Cheong[2], R. Runnoo[3] and B.D.Rathacharen[4]

1. Introduction

The Mauritian surface longline fishery targeting mainly swordfish (*Xiphias gladius*) started fairly recently. During experimental longlining for tuna in 1986-88, a few swordfish were caught in the coastal waters of Mauritius (Roullot *et al*, 1988). Presence of swordfish in the local waters was also reported by some local fishermen.

In 1996 the feasibility of the swordfish fishery in Mauritian waters was demonstrated by the ex-Regional Tuna Project (RTP) of the Indian Ocean Commission by using the semi-industrial longline fishing techniques. The project (RTP) had laid much emphasis on the development of the semi industrial swordfish fishery in the member states of the Indian Ocean Commission. It had provided funds to equip the local research vessel *Sphyrna II* and the consultancy of a master fisherman to demonstrate fishing, handling and processing of the swordfish.

Commercial fishing started in 1999 when a small surface longliner started fishing for swordfish in the Mauritian waters. Since then, the number of vessels has been increasing and the fishery is being developed as promoters are encouraged to exploit the swordfish resource.

2. Local fleet operating in the Swordfish fishery

The local vessels operating in the swordfish fishery can be classified into two groups according to their length: (i) less than or equal to 20 meters (small sized vessels) and (ii) over 20 meters (large vessels). The first surface longliner that operated during 1999 measured 13 meters. The following year (2000), it was joined by three vessels with length less than 20 metres. During 2001 the number of surface longliners increased further to six. All of them measured less than 20 meters. However, in the year 2002 three of them joined another fishery and consequently only three were fishing for swordfish. The same number of small vessels operated in 2003

[1]Scientific Officer
[2]Senior Technical Officer
[3]Technical Officer
[4]Divisional Scientific Officer

A further development in the Mauritian swordfish fishery occurred in 2002 when a longliner of 48 meters started fishing for swordfish. During 2003 two more longliners measuring 40 and 48 meters respectively joined the fishery.

The evolution in the number of vessels and trips involved in the fishery during 1999 to 2003 is shown in figure 1.

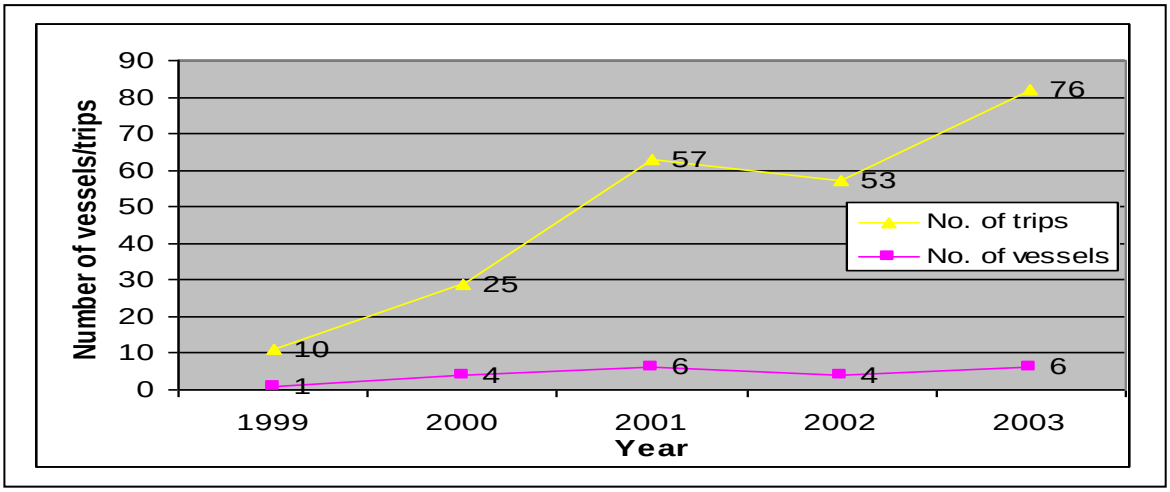


Figure 1: Number of vessels and trips involved from 1999 to 2003

The gears of the surface longliners consist of a mainline of a diameter of 3.6 mm extending from 25 to 50 km. Lines (diameter 2.6 mm) with hooks are attached to the main line. Float lines are used to fix floating buoys and are clipped to the main line. Each basket consists of 6-8 hooks. The number of hooks varies from 700 to 1500. Squids are mostly used as bait, however during some trips a combination of squids and mackerels is used. After every 3 hooks, a light stick is attached at about 3 meters above the hook to attract the fish. The long line is normally set after the sunset to maximise swordfish catch and hauled after sunrise.

3. Monitoring of the Swordfish Fishery

Since 1999, a system of data collection and processing has been set up at the Albion Fisheries Research Centre to closely monitor the fishery.

3.1 Data Source

3.1.1 Logbook

Fishing logbooks are regularly provided to licensed and local vessels. The skippers on board have to provide daily catch statistics on these logbooks. These catch data include fishing position,

catch by species, number of hooks used per set, and environmental parameters. The fishing logbooks are collected on the arrival of vessels at the port or from the fishing companies.

3.1.2 Landing statistics

Landing statistics (or total catch landed by species) are provided by the fishing companies. These data include total catch landed and efforts (in terms of hooks and number of sets). These data are used to correct the estimated catch provided on logbooks.

3.1.3 Length Frequency Data

Length frequency data are recorded during each landing of the vessels. Length as well as the species of the fish is noted. The swordfish is headed and gutted on board the vessels. Two different types of measurements are taken at the landing site: pectoral-caudal and pectoral- anal lengths. For the small size vessels, all the swordfish and tuna are measured. For the catch of bigger vessels, random samplings are conducted during which 150 – 200 fish are measured at three intervals.

4. Analysis of catch and effort data of the Mauritian swordfish longline fishery

4.1 Catch

The swordfish catch data (dressed weight) from 1999 to 2003 is summarized in table.1 and figure 2. Analysis of data shows that the catch of swordfish increased from 4.4 tonnes in 1999 to 601.5 tonnes in the year 2003. The sharp increase during 2002 and 2003 (189 tonnes and 601.5 tonnes respectively) was mainly due to the contribution of the bigger vessels which had landed 161 tonnes and 447 tonnes in 2002 and 2003 respectively. A similar trend (figure 3) is also noted in the number of swordfish caught during the corresponding years from 136 in 1999 to 10 795 in 2003.

Table I: Swordfish catch from 1999 to 2003 (tonnes)

Year	1999	2000	2001	2002	2003
Catch of swordfish (tonnes)	4.4	10.3	37.1	189.1	601.5

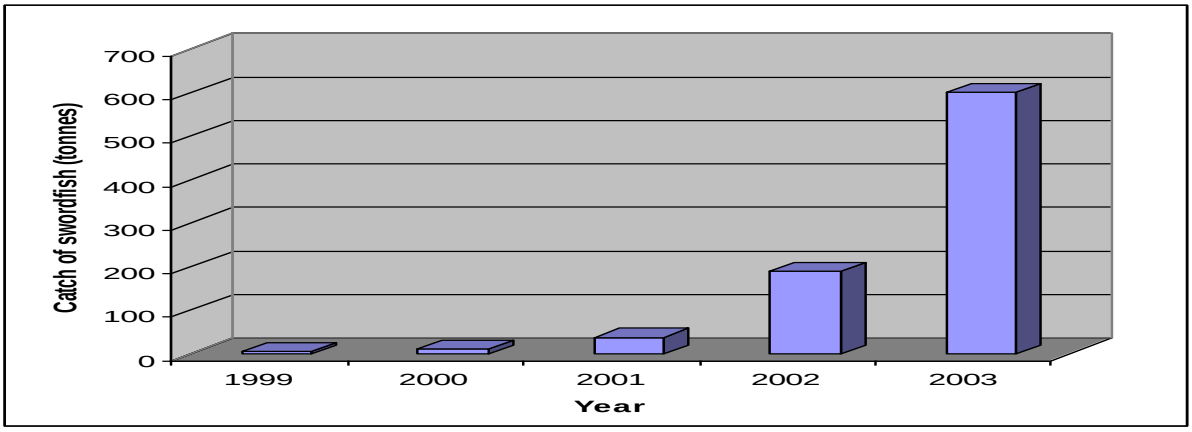


Figure 2: The swordfish catch data (dressed weight) from 1999 to 2003

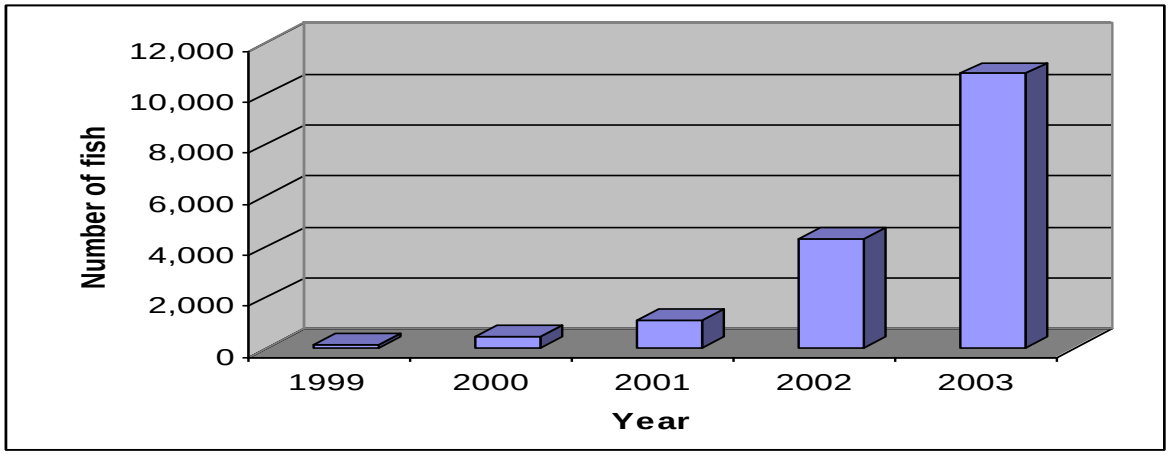


Figure 3: Number of swordfish caught from 1999 to 2003

4.2 Species composition

The species composition of the catch of the Mauritian longliners is shown in table II and figure 4. Average species composition of the catch during the five years shows that the majority (60.5%) was composed of swordfish. The remaining consisted of sharks (25.0%), yellowfin (5.1%), albacore (4.5%), marlins (1.6%) and miscellaneous fish (1.6%).

Table II: Species composition of Mauritian longliners catch (tones)

Year	Bluefin	Yellowfin	Bigeye	Albacore	Swordfish	Marlin	Shark	Others	Total
1999		0.92		0.45	4.39			0.54	**6.3**
2000		2.64	1.21	5.56	10.32	0.74		4.71	**25.18**

2001		24.62	5.37	17.8	37.05	2.67	2.4	2.61	**92.52**
2002		9.92	3.24	8.39	189.08	4.19	36.59	4.17	**255.58**
2003	0.4	33.2	10.89	31.7	601.52	14.41	309.53	9.89	**1011.54**
TOTAL	**0.4**	**71.3**	**20.71**	**63.9**	**842.36**	**22.01**	**348.52**	**21.92**	**1391.12**

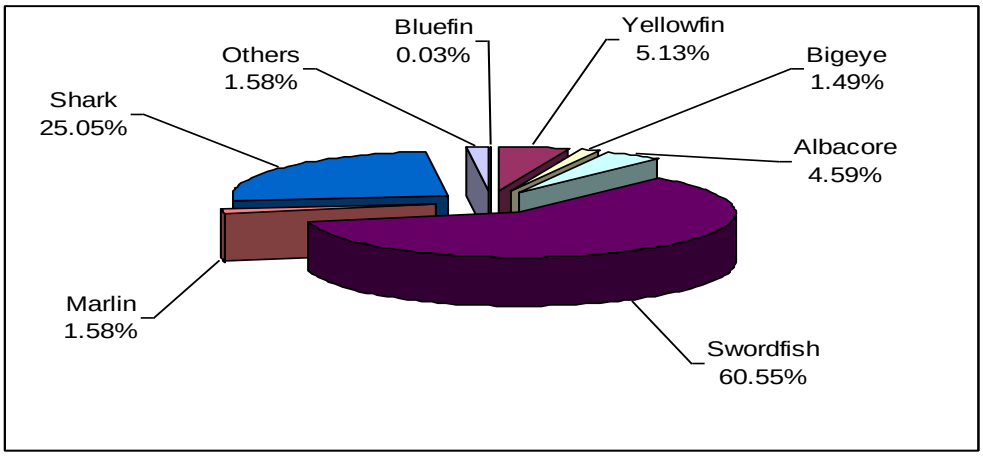


Figure 4: Species composition of the catch of Mauritian longliners (%)

4.3 Effort

The effort of the local longliners is expressed as the number of hooks set by these vessels (figure 5). The yearly total number of hooks increased from 13 595 in 1999 to 321 182 in 2002 and 873 832 during 2003. A corresponding trend in the number of trips is also noted, from 10 to 79 for the same period. The large sized longliners which joined this fishery (1in 2002 and 2 in 2003) accounted for the increase in the effort. The number of days at sea varied according to vessel size, autonomy and weather conditions. The small sized vessels stayed at sea for 4-5 days while the larger vessels remained at sea up to 90 days.

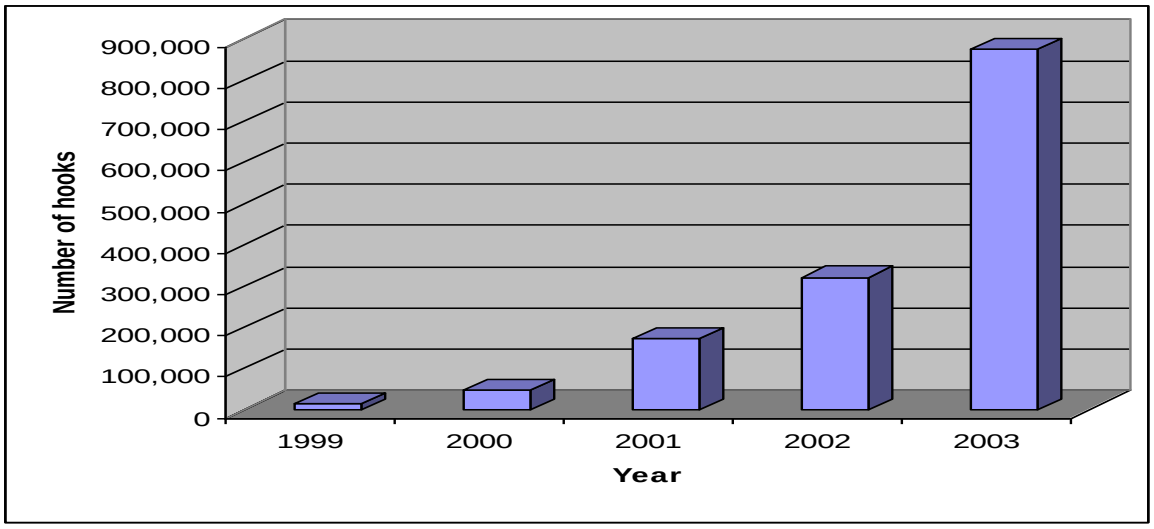


Figure 5: Number of hooks used from 1999 to 2003

4.4 Catch per unit effort (CPUE)

The catch per unit effort (number of swordfish fish / 1000 hooks and kg of dressed weight / hook) for the years 1999 to 2003 are shown in figures 6 and 7. Annual CPUE (in number/1000 hooks) for swordfish decreased from 10 in 1999 to 6.3 in 2001. It then increased in 2002 to 13.4 before dropping slightly to12.3 during 2003.

A similar trend is also observed in the CPUE (in weight). It shows a downward trend from 0.32 kg/hook in 1999 to 0.28 kg/hook in 2001.It then increased to 0.58 kg/hook in 2002 and decreased slightly to 0.55 kg /hook in 2003.

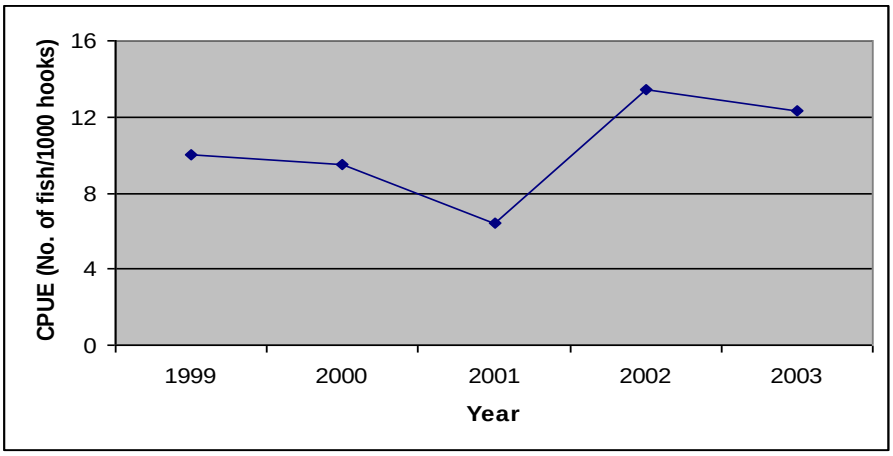


Figure 6: CPUE from 1999 to 2003 (No. of swordfish/1000 hooks)

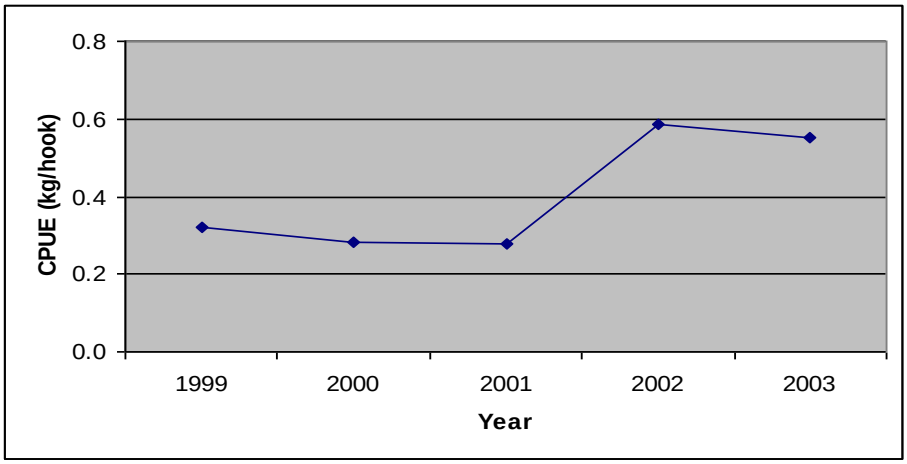


Figure 7: CPUE from 1999 to 2003 (kg/ hook)

The increase in the CPUE during the last two years was due to the contribution of the large vessels which had separately a CPUE of 21.77 swordfish/1000 hooks in 2002 and 14.92 swordfish/1000 hooks during 2003.In terms of weight, it was 1.09 kg/hook and 0.48 kg/hook in the two years respectively.

The monthly catch per unit effort (figure 8) shows two periods of higher catch rates (March to June and September to November). Lower catch rates were recorded during December to February and July to August.

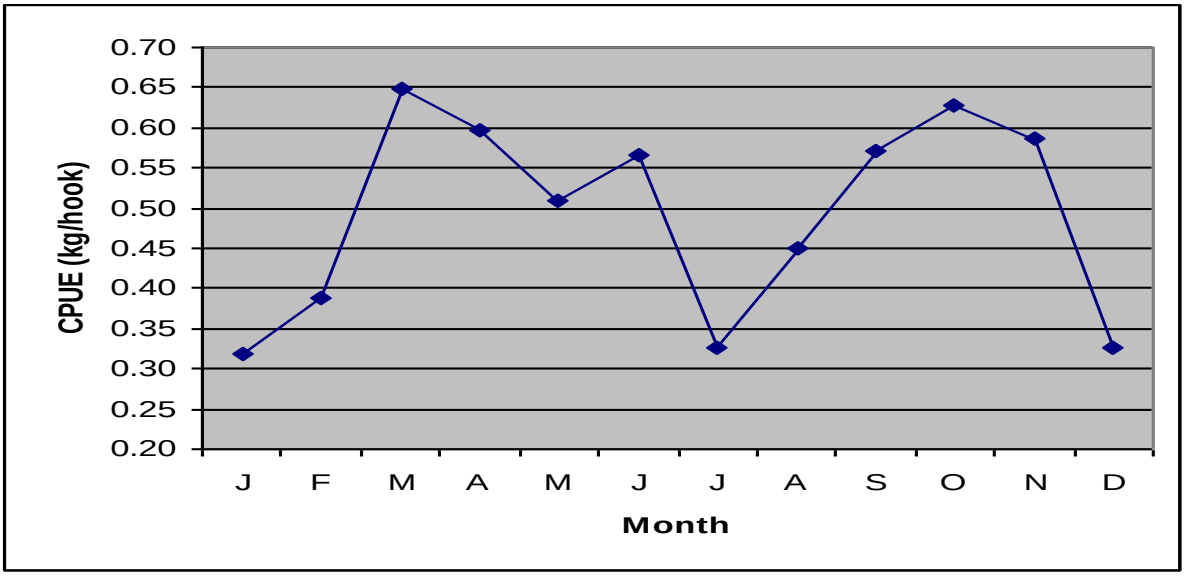


Figure 8: CPUE by month (kg/ hook)

5. Spatial distribution of the catches of the Mauritian long liners

The spatial distributions of the catches of the Mauritian longliners from 1999 to 2003 are shown in figures 9, 10, 11, 12 and 13. Analysis of the data collected shows that the fishing zones of the Mauritian longliners were widespread from 15°S to 30 °S and 55°E to 90 °E. Two prominent fishing zones were observed. The small longliners operated mostly close to Mauritius between 15°S to 25°S and 55°E to 60 °E. The fishing areas of the large longliners were located further south, from 20°S to 35°S and 65°E to 90 °E.

1999	2000

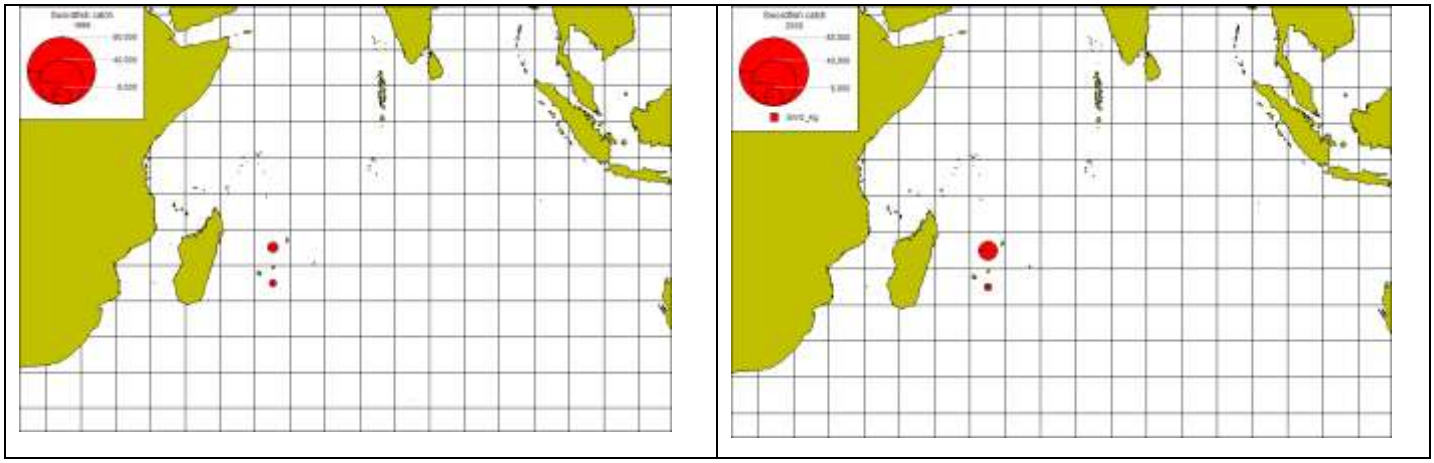
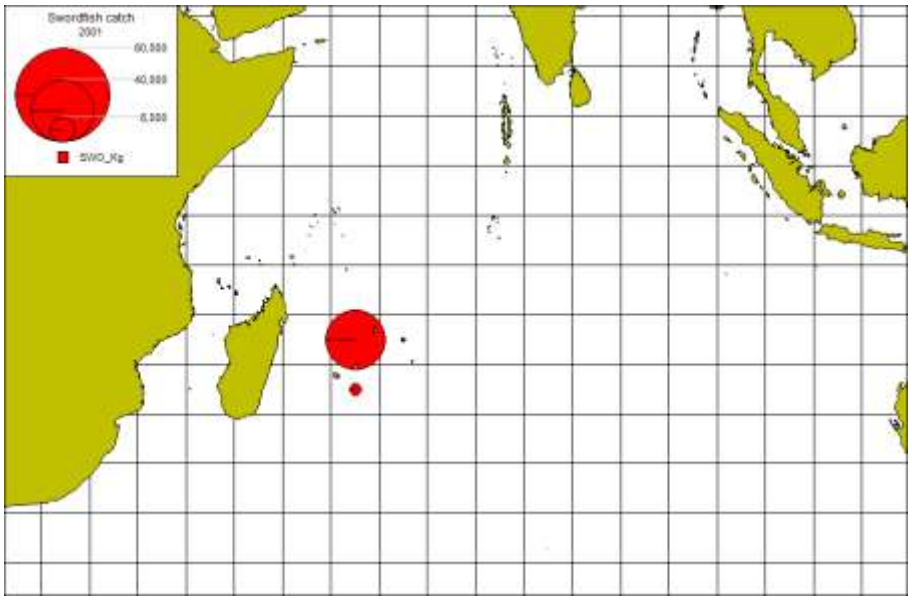
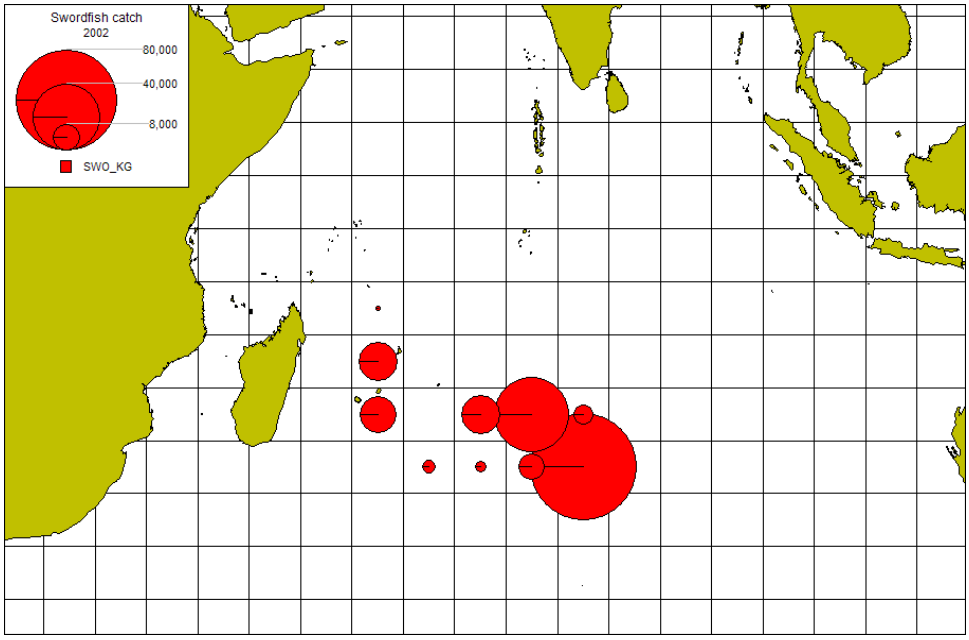


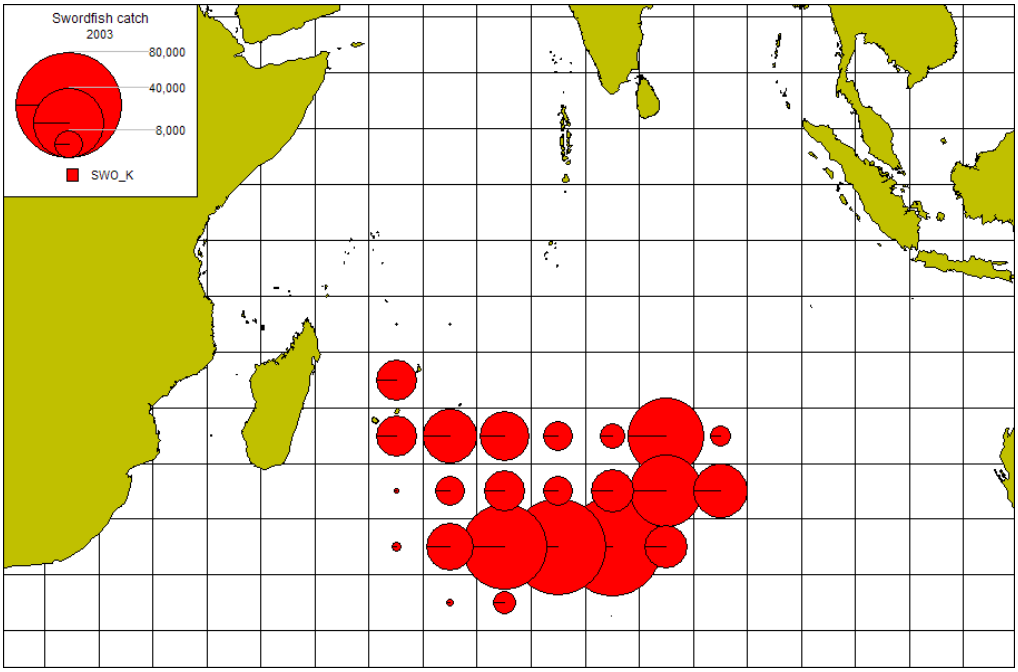
Figure 9 & 10: Spatial distribution of swordfish catch from 1999 and 2000



Figures 11 : Spatial distribution of swordfish catch in 2001



Figures 12: Spatial distribution of swordfish catch in 2002



Figures 13: Spatial distribution of swordfish catch from 2003

When the spatial distribution of the catches and efforts are compared, certain areas seem to be more productive than others. Thus for the large longliners, the region between 20°S and 25°S and 85 °E and 90 °E was very productive with a CPUE of 24.43 swordfish per 1000 hooks. It was followed by the fishing zone between 30°S to 35 °S and 60°E to 65 °E where a CPUE of 20.46 swordfish per 1000 hooks was noted.

For the small longliners, the spatial distribution of the catch rate shows a homogeneous repartition with a CPUE of about 6.7 swordfish per 1000 hooks over its fishing area.

6. Length frequency distribution of the swordfish landed

The length frequency data were collected during the landings of the local vessels since 2000. Two types of length were recorded. The pectoral-caudal length (PCL) and pectoral-anal length (PAL). The annual length frequency distributions are shown in figures 14, 15, 16 and 17. The pectoral-caudal length of the swordfish ranged between 53 and 183 cm during 2000, the majority being between 80 and 140 cm. Slightly bigger ones were noted during 2001, when the range recorded was between 68 cm and 198 cm. In the 2002, the pectoral-caudal length of the swordfish sampled varied from 59 cm to 213 cm, the major part being between 67 cm to 110 cm.

For the year 2003, the PCL of the swordfish ranged from 55 to 194 cm with the larger number in the range from 71 to 125 cm. The mean pectoral-caudal length was 121.3 cm in 2001, 105.4 cm in 2002 and 105.7 cm in 2003.

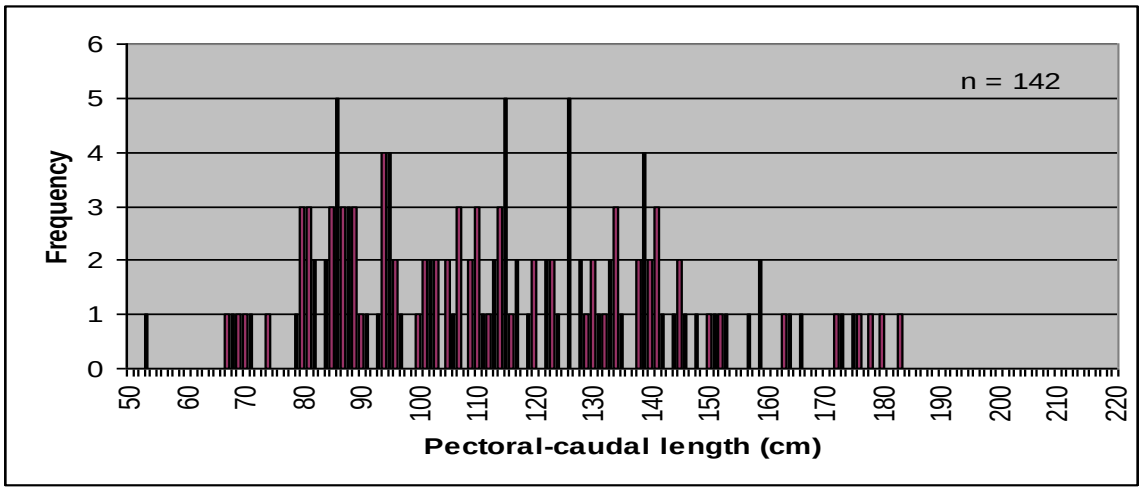


Figure 14: Length frequency distribution of swordfish in 2000

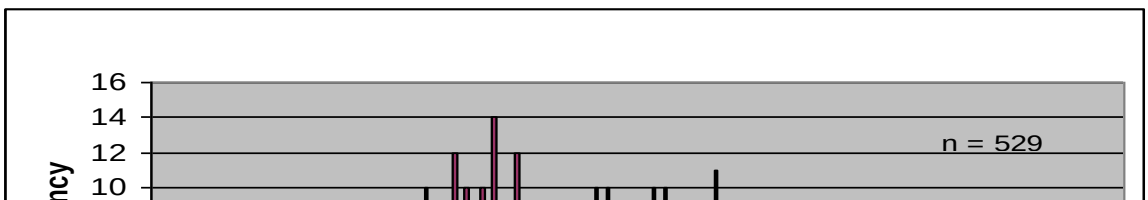


Figure 15: Length frequency distribution of swordfish in 2001

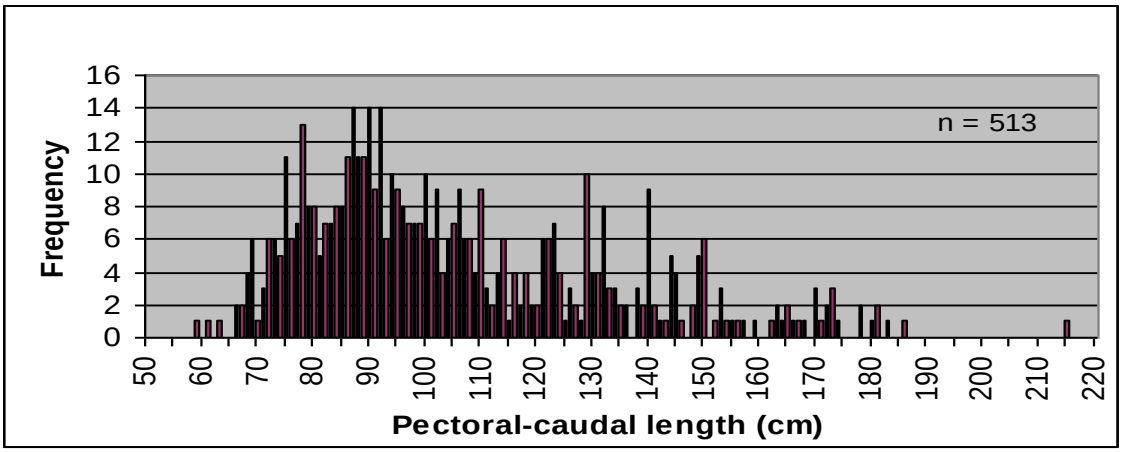


Figure 16: Length frequency distribution of swordfish in 2002

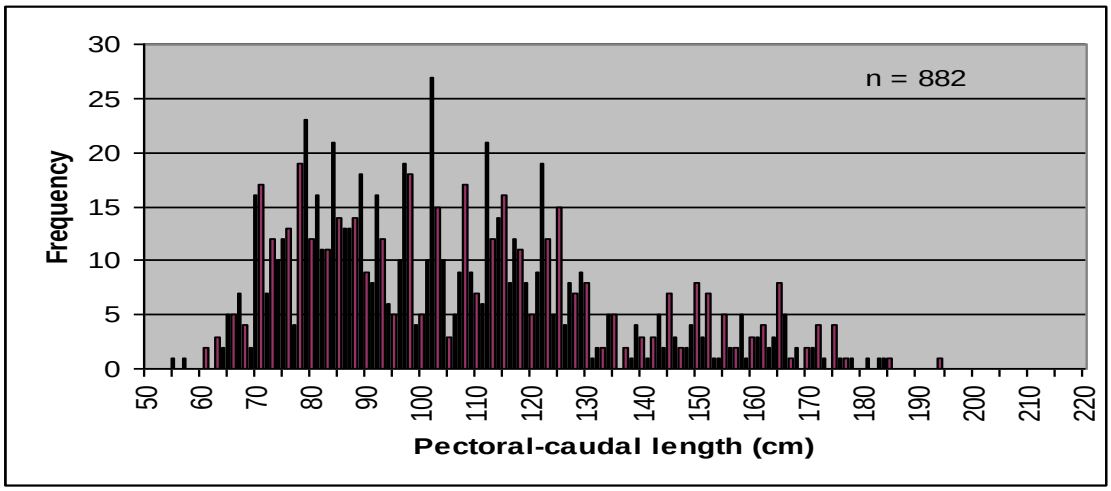


Figure 17: Length frequency distribution of swordfish in 2003

7. Sport fishery

Sport fishing activities constitute a source of attraction for professional anglers and tourists in general. The target species in this fishery are mainly blue marlin (*Makaira mazara*), black marlin (*Makaira indica*), striped marlin (*Tetrapturus audax*) and tuna such as yellowfin (*Thunnus albacares*), albacore (*Thunnus alalunga*) and bigeye (*Thunnus obesus*).

Data available in this fishery are very less and no quantitative analysis can be undertaken. Due to the importance of this sector and absence of statistics, the Ministry of Fisheries is giving much emphasis on the collection of good standard data.

Since recently a system of data collection has been set up at the Albion Fisheries Research Centre. The promoters involved in this fishery have been requested to submit on a monthly basis catch and effort data on specially designed data collection forms

8. Conclusion

With the growing importance of the local swordfish fishery, AFRC is giving much importance th the collection and processing of good standard data. Licensed vessels have to deposit a fee of 500 US dollars which is refunded after submission of properly filled logbooks.

Considering the fact that the data collected so far is limited, no concrete conclusions can be drawn. However certain observations can be made. The landings of catch from this fishery have been increasing and are expected to increase further with more vessels joining the fishery under joint ventures with local counterparts. The smaller vessels operated close to Mauritius, especially in its northern and southern parts, with a CPUE of 6.3 swordfish per 1000 hooks (0.30 kg per hook). The spatial distribution of the catch of the large vessels has shown that they had operated mainly in the southern waters, certain areas had been very productive with CPUE reaching 1.14 kg/hook (24.43 swordfish/1000 hooks). The species composition of the catch of the longliners showed that it was composed mostly of swordfish, which contributed more than 60.5% of the total catch. A slight decrease in the mean pectoral-caudal length was noted. Being given that the number of swordfish sampled was quite small, more data should be collected and analysed to follow the trend.

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