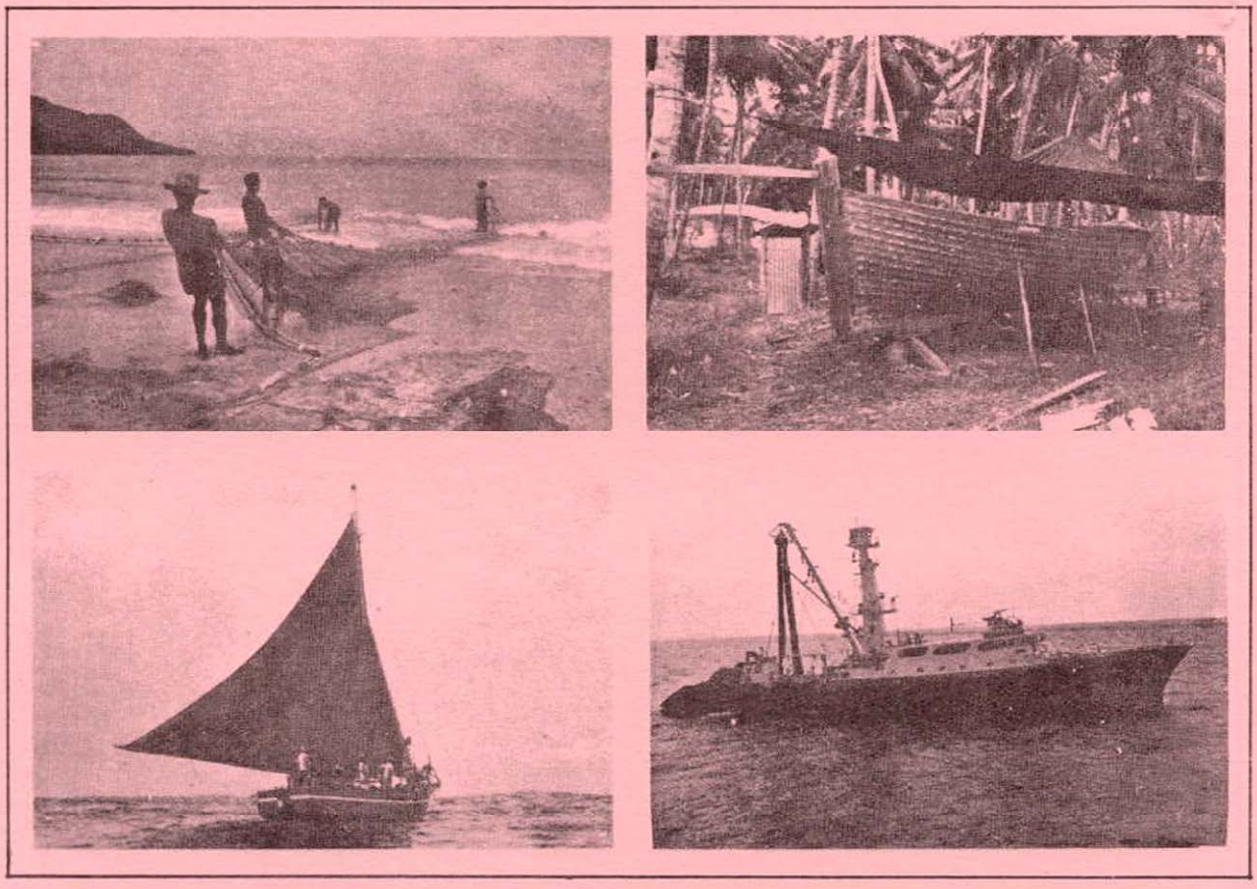
SEYCHELLES FISHING AUTHORITY

TECHNICAL REPORT

THE WESTERN INDIAN OCEAN TUNA FISHERY FROM 1980 TO 1985

A SUMMARY OF DATA COLLECTED BY COASTAL STATES



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A SUMMARY OF DATA COLLECTED BY COASTAL STATES

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I. INTRODUCTION

Purse seiners have fished for tuna in the Western Indian Ocean since 1979, when the Mauritian vessel *LADY SUSHIL* began operations, but it was not until 1983 that catches by purse seiners became significant. In that year, the number of vessels rose from five to fourteen, landing about 20 000 tonnes of skipjack (*Katsuwonus pelamis*) and yellowfin (*Thunnus albacares*). At the end of the following year, 1984, there were 49 vessels, mostly of French and Spanish registration, which together landed 100 000 tonnes. Thus in the space of two years, the purse seine fishery in the Western Indian Ocean grew to be of major importance.

At the time of writing, July 1986, it is still too early to assess the impact of the purse seiners on the resource, and on the longliners and artisanal fisheries also harvesting tuna in the Western Indian Ocean; however, it *is* considered timely to document the information currently available and perhaps identify trends which may warrant future research. For this report, we have assembled longliner and purse seiner catch and effort statistics collected by Mozambique, Seychelles and Somalia under access agreements with distant-water fishing nations, and we will attempt to summarize these data with this objective in mind.

The data were processed at a workshop funded and organized by the *FAO/UNDP Indo-Pacific Tuna Programme* and held at *Seychelles Fishing Authority* from July 10th to July 24th 1986. In addition to assembling the statistics reported below, a principal objective of the workshop was to train the participants in the use of microcomputers for data processing and research; all data processing was conducted on an *IBM PC AT* microcomputer, with *Ashton-Tate dBase III Plus* database software.

II. LONGLINERS

Industrial tuna fishing in the Indian Ocean began in 1952, when Japanese longliners first operated in the eastern Indian Ocean. By 1956, Japanese longliners were operating throughout the Indian Ocean. Taiwanese longliners began fishing in 1954, and South Korean vessels, in 1966. Longline effort increased steadily until the early 1970s, by which time Japanese effort had started to decline.

Over the years, the target species and location of fishing grounds for longliners in the Indian Ocean have changed. FIGURE 1 shows the annual catch of yellowfin by longliners in the Indian Ocean, and illustrates the predominance of the Japanese in harvesting yellowfin until the late 1960s, and the subsequent importance of the South Koreans. At present, Japanese and Taiwanese effort is concentrated in the southern Indian Ocean; the Japanese target on southern bluefin (*Thunnus maccoyii*) and bigeye (*Thunnus obesus*) for the domestic sashimi market, while the Taiwanese fish principally for albacore (*Thunnus alalunga*) for the canning industry. Compared to Japanese and Taiwanese longliners, which occassionally fish in the tropical Indian Ocean while in transit to and from regions to the south, South Korean longliners continue to maintain a relatively strong, though declining, presence in the area, targeting on yellowfin, bigeye and marlin (*Istiophoridae* spp).

TABLE 1 shows the number of South Korean and Japanese vessels calling and unloading at Victoria (SEYCHELLES) in 1985 and the first half of 1986, and illustrates the recent decline in South Korean vessels visiting the Seychelles. Though South Korean longliners continue to take out licenses to fish in Seychelles waters (see TABLE 3), the number of vessels calling in Victoria dropped to only two during the first half of 1986, compared to 26 for 1985. Meanwhile, though Japanese longliners have never been licensed in the Seychelles, they still call and unload; in 1985, a total of 58 vessels visited the

Seychelles, of which 38 vessels transhipped 10 700 tonnes of tuna and billfish.

Transhipment activity in the Western Indian Ocean also takes place in Mombasa (KENYA), Port Louis (MAURITIUS) and Reunion (FRANCE). According to statistics from the Mauritian Ministry of Agriculture, Fisheries and Natural Resources (TABLE 2), the number of Taiwanese vessels unloading in Port Louis during the period 1980 - 1984 ranged from 25 to 45 annually, while Japanese vessels transhipped only periodically. No South Korean vessels transhipped in Port Louis during 1982 - 1984.

2.1 LICENSING AGREEMENTS AND DATA COLLECTION

TABLE 3 gives the number of longliners licensed to fish in the EEZs of Mozambique, Seychelles and Somalia since 1980. The overall number of longliners licensed in the Western Indian Ocean has declined during recent years: in the Seychelles, about 100 South Korean vessels were licensed annually from 1980 to 1984 - with a high of 145 vessels in 1982 - while only 33 vessels were licensed in 1985. In Somalia, the number of South Korean vessels has remained constant, however no Japanese longliners have been licensed since 1984.

2.1.1 *Mozambique*

Industrial tuna fishing in Mozambique has consisted primarily of test-fishing by longliners, purse seiners and pole-and-line boats. Longliners from the Soviet Union were present in 1978 and 1979. In 1983 the Mozambican fisheries authorities began licensing foreign vessels; in late 1983 and early 1984 licenses were granted to seven longliners from Japan and the Soviet Union. No license fees were requested under the terms of licensing; the principal condition was the provision of catch and effort statistics.

The Fisheries Research Institute in Maputo (MOZAMBIQUE) receives daily catch and effort statistics from longliners

licensed to fish in Mozambican waters, together with details on the principal characteristics of the vessels. The data recorded in the logbooks give details of the daily catch in number and weight for the principal species, geographical coordinates to the nearest minute and number of hooks per set.

2.1.2 *Seychelles*

With the declaration of its Exclusive Economic Zone in 1978, followed by the ratification of the Foreign Fishing Vessels Decree, the Seychelles licensed some eighty longliners from South Korea in 1979. Licenses are granted on a monthly basis and are usually of short duration, ranging from one to three months. License fees for longliners are a fixed sum per month,. calculated on the basis of gross registered tonnage (GRT). Additional licensing conditions include the submission of catch and effort logbooks, and biweekly position reports by radio.

Longliners licensed in the Seychelles have usually been from South Korea, however, in 1981, two vessels from Kenya and two vessels from the Soviet Union were also granted licenses. The Kenyan longliners, of about 300 GRT, operated in the Western Indian Ocean from 1975 to 1983, and have since remained inactive in Mombasa. The Soviet Union longliners included one mother ship of 5300 GRT and five 12-metre catcher vessels, and a converted whaler of 840 GRT.

Catch and effort logbooks are submitted to Seychelles Fishing Authority either directly when the vessels call into port, or through their local agents. The logbooks give information on the daily activities of the vessel, including the daily position of each set (or if no fishing activity occurred, the vessel's noon position), the number of hooks set, and the total catch of each species. Since the vessels are usually licensed for only a few months at a time, they do not necessarily call into port upon the expiry of their licence to submit catch and effort logbooks; thus the return of catch and effort forms has proved to be difficult to

control. While most of the logbooks collected are obtained from vessels calling in the Seychelles, some data are received by telex from the shipowners in South Korea, though these data are usually provided on a weekly basis or cover the entire duration of the license. The coverage rate for vessels licensed in Seychelles remains about 15 percent. Whenever possible, catch and effort data submitted to Seychelles Fishing Authority are cross-checked against additional data sources obtained through transhipment, harbour inspections, aerial spot checks and weekly position reports.

2.1.3 *Somalia*

Offshore tuna fishing in Somali waters has never been carried out regularly, despite the potential yields indicated by commercial and scientific sources. Licensing of Japanese longliners for test fishing in Somalia's territorial waters began after Somalia became independent in 1960. In 1983, ten Japanese vessels were licensed to fish in the EEZ; during 1984, six Japanese and 19 Korean vessels were licensed. In 1985, the number of South Korean longliners increased slightly to 20 vessels; however, no Japanese longliners have been licensed since 1984.

Licenses for longliners in Somalia are issued on a monthly basis for a fixed sum per vessel per month. The provision of daily catch and effort statistics is a condition of licensing. The Ministry of Fisheries and Marine Resources has collected data from a variety of sources. These include daily reports of position and catch via radio, submission of daily catch statistics by shipowners via telex, or submission of logbooks through agents. In addition, observers were present aboard four Japanese longliners from December 1983 to March 1984, to collect research data.

2.2 CATCH STATISTICS

Longliner data collected under access agreements by Mozambique, Seychelles and Somalia are insufficient for

evaluating trends in catch rates for the tropical Indian Ocean as a whole, due to the low coverage rate for areas outside their Exclusive Economic Zones. Coverage rates for longliners licensed in Mozambique and Somalia have been relatively high, however effort has been low in those areas. In contrast, effort by South Korean longliners licensed in the Seychelles has been substantial, and, although the coverage rate has been low, the sample is sufficiently large and continuous to indicate trends in catch rates.

TABLE 4 summarizes catch statistics and TABLE 5 presents catch rates for a subset of data collected from 1981 to 1985 in the Seychelles. The statistics refer to an area roughly corresponding to the Seychelles EEZ, defined as those five-degree squares whose northwest corners on the Equator are 50°E, 55°E, and 60°E longitude, and whose northwest corners on the 5°S latitude are 50°E and 55°E longitude. FIGURE 3 shows maps of all longliner catch and effort sampled by Mozambique, Seychelles and Somalia, while FIGURE 2 shows recent yellowfin catch rates in the area for the Seychelles, as defined above.

It is apparent from FIGURE 3 that the area defined in the preceding paragraph is the only area consistently sampled from 1981 to 1985. At least 500 days fishing were sampled from this area annually, with the exception of 1983, during which only 180 days were sampled. While catch rates for bigeye do not indicate any definite trend, catch rates for yellowfin appear to have declined consistently since 1982, dropping to almost 50 percent of the 1982 level by 1985.

Though data are insufficient to compare catch rates over the long term, catch rates during the first quarter of 1984 for longliners licensed in Mozambique, Seychelles and Somalia are compared in TABLE 6. Whereas bigeye and yellowfin were taken in roughly equal proportion by vessels licensed in the Seychelles, yellowfin was dominant for vessels licensed in Mozanbique, while bigeye was dominant for vessels licensed in Somalia. Catch rates for yellowfin by vessels licensed in Mozambique were more than twice as great during the first quarter of 1984 than for vessels licensed in the Seychelles.

III. PURSE SEINERS

The development of purse seining in the Western Indian Ocean began with four years of prospecting commencing in 1979. Results during the first two years were not conclusive, but suggested that purse seining in the Indian Ocean might be economically feasible. Results during the third year proved successful and led to the arrival of four vessels the following year to commence fishing on a commercial basis. TABLE 7 lists the number of purse seiners active in the Western Indian Ocean from 1983 through June 1986. By late 1983, fourteen vessels were operating, and by the end of 1984 there were 49 vessels active. In 1985, the number of vessels active declined to 28 in July, then increased to 38 by December. A total of 52 different purse seiners were present in 1985, including 27 French vessels, 17 Spanish vessels, five seiners registered in Cote d'Ivoire, and individual vessels registered in Mauritius, Panama and the United Kingdom. In addition, it has been reported that two purse seiners from the Soviet Union were fishing for tuna in the region in 1985.

3.1 LICENSING AGREEMENTS AND DATA COLLECTION

At present, distant-water purse seiners have been licensed to fish in the EEZ's of the Seychelles and Madagascar. All vessels operating in the Western Indian Ocean have so far been licensed in the Seychelles, with the exception of the two Soviet Union purse seiners noted above, while only French vessels under an agreement with the *European Economic Community* (EEC) have been licensed in Madagascar.

In 1983, agreements to fish in the Seychelles EEZ were signed with the EEC, licensing 27 vessels of French registration, and the Spanish Government, for 19 Spanish vessels. These agreements will eventually be renegotiated to account for the recent entry of Spain into the EEC. The timing of such negotiations, however, has not yet been established. The current EEC agreement, which is of three years duration,

expires in January 1987, while the Spanish agreement, which is for five years, expires in November 1988.

Agreements with the Seychelles have also been signed with several private companies of different nationalities. These include companies owning vessels registered in Cote d'Ivoire, and "offshore" Spanish companies owning two vessels registered in Panama and the Cayman Islands (UNITED KINGDOM). One purse seiner from Mauritius has been licensed periodically, though without a formal agreement with the Mauritian government.

These agreements vary widely with respect to both the terms of payment of license fees and additional conditions, such as research programmes, technical assistance and joint ventures. French vessels operating under the agreement with the EEC pay a fixed rate on the tonnage caught within the Seychelles EEZ. Under the Spanish agreement, license fees are paid as a fixed percentage of the value of the total catch, both inside and outside the EEZ.

Catch and effort logbooks are submitted to Seychelles Fishing Authority at the end of each trip by all licensed vessels. The logbooks contain daily statistics on position, the number of sets made and the catch by species. Catch statistics reported on the logbooks are only rough estimates taken by eye while fishing operations are underway, and are subject to significant errors. Since the majority of the catch is transhipped onto refrigerated carrier vessels in the Seychelles, transhipment figures are usually available to cross-check the logbook data. While logbook errors can be often be large, on average it is found that the total catch from logbooks underestimates transhipment statistics by about ten percent.

3.2 CATCH STATISTICS

The total catch by purse seiners in the Western Indian Ocean grew from 19 700 MT in 1983 to 98 000 MT in 1984. Effort increased a further 30 percent in 1985, resulting in a total catch of 129 000 MT. While total catch rates for the first

half of 1986 have been 40 percent higher than in the first half of 1985, it is expected that effort in 1986 will decrease by about 10 to 15 percent. If catch rates for the remainder of the year remain as great as in 1985, the total catch for 1986 should be about 140 000 MT, around 5 to 10 percent greater than in 1985.

Monthly catch statistics for purse seiners are presented in TABLE 8 and catch rates for yellowfin and skipjack are given in TABLE 9, FIGURE 4 and FIGURE 5. Maps of annual purse seiner activity are shown in FIGURE 6 by five-degree square.

In compiling the catch statistics reported in TABLE 8, estimates of the total catch for each purse seiner trip has been taken from records of transhipment whenever complete unloading occurred in the Seychelles; otherwise total catch has been estimated from logbooks. The species composition for yellowfin and skipjack has been estimated from logbooks alone. Since transhipment records and logbooks both give unreliable estimates for the lesser-caught species, such as bigeye and albacore, these species are not reported separately in TABLE 8, but are included in estimates of the total catch.

In TABLE 8, "*VESSELS COVERED*" refer to those vessels for which a logbook has been received containing at least one day fishing during the month. "*DAYS FISHED*" refer to days spent at sea, except for days spent drifting due to mechanical breakdown or other work stoppages; days spent drifting by flotsam while awaiting a set are included.

Fishing patterns for purse seiners in the Western Indian Ocean have continued to evolve. Up until 1985, it appeared that the best fishing took place at the beginning of the year, from January to April, and at the end of the year, from September to December, with poor fishing from May to August due to bad weather conditions associated with the south-east monsoon. In 1985, however, that pattern changed, initially with poor catches due to bad weather conditions during the early part of the year, particularly in February. In April, ten vessels left the Indian Ocean for the Atlantic in

anticipation of poor catches during the south-east monsoon. Those vessels which remained, however, experienced catch rates 50 percent greater than in the previous year. It became widely known that good catches of skipjack were to be taken in the north of the Mozambique Channel in April and May, and in 1986 most of the fleet was operating in that area at that time of year. As early as 1983, good catches of skipjack were also taken to the north of the Seychelles EEZ later in the year. In 1986, catches of skipjack in that area averaged 21 MT per day during September and October.

Though the patterns observed at present will most probably change in the future, it would appear that the fishery is strongly seasonal. Yellowfin is the target species throughout the early months of the year, from January to March, and is fished primarily around the latitude of five degrees south, to the east of the Seychelles EEZ. During April and May, skipjack in the Mozambique Channel attracts a large proportion of the fleet. From June through August, the vessels move northwards, catching less skipjack and more yellowfin, in an opportunistic manner. In 1985, most purse seiners were fishing to the northwest of the Seychelles EEZ at this time of year, while in June 1986, many vessels were fishing to the east. From September to November, good catches of skipjack are taken to the north, then, in December, the fleet moves southwards once again, taking progressively more yellowfin.

TABLE 10 presents some statistics on production per unit area fished. Of interest is the increase each year of the proportion of one-degree squares that were fished with success. The fleet has learned progressively how and where to fish tuna in the Western Indian Ocean. In 1983, only 48 percent of the area searched was fished successfully. In 1984, the amount increased to 64 percent, then in 1985, 79 percent of one-degree squares searched were fished positively. TABLE 10 also shows that production per unit area of skipjack in 1985 was three times as great as in 1983, while production of yellowfin per unit area was more than twice as great.

It is evident from the statistics on production per unit area for positive one-degree squares in TABLE 10 and from the average monthly catch rates shown in FIGURE 4 that skipjack increased in importance in 1985, at the expense of yellowfin. However, whether this was due to a decline in absolute abundance in yellowfin, or simply to the discovery of production areas for skipjack, or a combination of the two, is not clear.

IV. CONCLUSION

Catch and effort data for longliners collected by Mozambique, Seychelles and Somalia under access agreements were assembled and summarized with a view to identifying recent trends in catch rates. The data were not considered sufficient to indicate trends for the Western Indian Ocean as a whole, but on examination of data for a relatively large and well-sampled area roughly corresponding to the Seychelles EEZ, it was found that catch rates for yellowfin had declined consistently from 1982 to 1985, to about half their former level.

Purse seiner data assembled by *Seychelles Fishing Authority* were summarized and seasonal patterns were described. Though the purse seine fishery is still evolving and the present patterns could well change, it was found that skipjack is dominant in the southern ranges of the fishery during April and May, the period following the north-west monsoon, and again in the northern area during September and October, the period after the south-east monsoon. During the monsoon periods, yellowfin are targeted over a broad area out to 70°E longitude, as the fleet moves from its northern and southern extents.

In 1985, an increase in skipjack production was observed, with a corresponding decrease in yellowfin production. This trend was even more in evidence during the first half of 1986, as the catch rate for yellowfin declined

from 13 tonnes per day in January to two tonnes per day in May, while good catches of skipjack were taken from April through early June in the north of the Mozambique Channel. It is expected that the total catch for 1986 will amount to about 140 000 MT.

Table 1. **Longliner Transhipment Activity in the Seychelles.**

(*Units:* MT)

	SOUTH KOREAN VESSELS			JAPANESE VESSELS		
MONTH	CALLING	UNLOADING	TONNAGE	CALLING	UNLOADING	TONNAGE
Jan/85	7	5	785	4	–	–
Feb	1	1	87	5	1	145
Mar	3	2	300	8	4	405
Apr	4	1	328	6	–	–
May	–	–	–	11	9	970
Jun	3	2	140	8	1	160
Jul	6	4	525	4	3	285
Aug	1	–	–	3	1	130
Sep	2	2	255	5	5	487
Oct	2	2	300	10	9	1605
Nov	–	–	–	12	9	1850
Dec	2	2	240	17	16	1705
Total	31	21	2960	93	58	7742
Vessels	26	17		58	38	
Jan/86	1	–	–	10	7	759
Feb	1	–	–	11	7	475
Mar	1	1	200	20	9	1010
Apr	1	–	–	4	1	105
May	–	–	–	9	5	560
Jun	–	–	–	1	1	47
Total	4	1	200	55	30	2956
Vessels	2	1		47	24	

Source: SFA Tuna Bulletin, Second Quarter 1986

Table 2. Longliner Transhipment Activity in Mauritius.
(*Units:* MT)

	JAPAN		SOUTH KOREA		TAIWAN	
YEAR	VESSELS	TOTAL	VESSELS	TOTAL	VESSELS	TOTAL
1980	-	-	13	2687	33	3654
1981	-	-	12	493	25	2627
1982	1	6	-	-	45	7190
1983	-	-	-	-	43	5465
1984	6	53	-	-	40	4863

Source: Fisheries Division
Ministry of Agriculture, Fisheries and Natural Resources
Port Louis, Mauritius

Table 3. Longliners Licensed in Mozambique, Seychelles and Somalia, 1980 - 1985.

Country	Vessel Flag	1980	1981	1982	1983	1984	1985
Mozambique	Japan	-	-	-	2	2	-
	Soviet Union	-	-	-	5	5	-
Seychelles	Kenya	-	2	-	-	-	-
	South Korea	106	89	145	110	102	33
	Soviet Union	-	2	-	-	-	-
Somalia	Japan	?	?	?	10	6	-
	South Korea	?	?	?	-	19	20

Table 4. Catch Statistics Sampled For Longliners Operating In the Seychelles. (Units: catch MT, percentage in brackets)

QUARTER	DAYS COVERED	CATCH BY SPECIES				
		YELLOWFIN	BIGEYE	MARLIN	OTHERS	TOTAL
1st/81	231	91 (44)	93 (44)	15 (7)	10 (5)	210
2nd	231	108 (42)	130 (50)	16 (6)	3 (1)	257
3rd	0					
4th	50	52 (61)	29 (34)	2 (2)	2 (3)	86
Total	512	252 (46)	252 (46)	33 (6)	16 (3)	553
1st/82	26	12 (42)	14 (48)	1 (4)	2 (6)	29
2nd	107	89 (50)	77 (43)	7 (4)	5 (3)	178
3rd	172	122 (51)	100 (42)	8 (3)	9 (4)	239
4th	565	485 (58)	276 (33)	38 (5)	40 (5)	840
Total	870	709 (55)	467 (36)	55 (4)	56 (4)	1286
1st/83	82	57 (58)	36 (36)	3 (3)	3 (3)	100
2nd	0					
3rd	37	15 (47)	14 (46)	1 (4)	1 (4)	31
4th	61	36 (49)	33 (44)	2 (3)	3 (3)	73
Total	180	108 (53)	83 (41)	6 (3)	7 (4)	204
1st/84	198	129 (51)	112 (44)	8 (3)	5 (2)	254
2nd	124	89 (53)	66 (40)	7 (4)	5 (3)	167
3rd	313	140 (43)	164 (50)	13 (4)	9 (3)	326
4th	281	96 (36)	149 (56)	10 (4)	10 (4)	265
Total	916	454 (45)	492 (49)	38 (4)	29 (3)	1012
1st/85	146	71 (50)	51 (36)	14 (10)	7 (5)	143
2nd	74	32 (55)	17 (28)	4 (7)	6 (10)	58
3rd	148	36 (38)	45 (48)	5 (5)	8 (9)	94
4th	176	95 (53)	63 (35)	8 (4)	15 (8)	181
Total	544	234 (49)	176 (37)	31 (7)	35 (7)	477

Table 5. Catch rates for longliners operating in the Seychelles.
(Units: hooks thousands)

		TONNES PER DAY		KILOGRAMMES PER 100 HOOKS		
QUARTER	DAYS	YELLOWFIN	BIGEYE	HOOKS	YELLOWFIN	BIGEYE
1st/81	231	0.40	0.40	637	14.35	14.56
2nd	231	0.47	0.56	594	18.18	21.82
3rd	0					
4th	50	1.05	0.59	63	82.85	46.45
Total	512	0.49	0.49	1295	19.46	19.45
1st/82	26	0.47	0.54	80	15.51	17.49
2nd	107	0.83	0.72	238	37.34	32.43
3rd	172	0.71	0.58	477	25.60	20.97
4th	565	0.86	0.49	1530	31.71	18.06
Total	870	0.81	0.54	2324	30.48	20.10
1st/83	82	0.70	0.44	235	24.38	15.32
2nd	0					
3rd	37	0.40	0.39	100	14.60	14.30
4th	61	0.59	0.53	173	20.73	18.87
Total	180	0.60	0.46	508	21.21	16.33
1st/84	198	0.65	0.57	578	22.30	19.41
2nd	124	0.72	0.53	361	24.66	18.37
3rd	313	0.45	0.52	681	20.52	24.09
4th	281	0.34	0.53	779	12.32	19.19
Total	916	0.50	0.54	2399	18.91	20.51
1st/85	146	0.49	0.35	395	18.05	13.00
2nd	74	0.43	0.22	206	15.52	8.03
3rd	148	0.24	0.31	377	9.55	12.02
4th	176	0.54	0.36	454	20.96	13.86
Total	544	0.43	0.32	1432	16.37	12.30

Table 6. Catch rates for longliners licensed in Mozambique, Seychelles and Somalia during the first quarter of 1984.
(Units: hooks thousands)

		TONNES PER DAY			KILOGRAMMES PER 100 HOOKS		
COUNTRY	MONTH	DAYS	YELLOWFIN	BIGEYE	HOOKS	YELLOWFIN	BIGEYE
Mozambique							
	Jan	9	2.31	0.06	23	89.49	2.30
	Feb	86	1.30	0.06	205	54.56	2.72
	Mar	34	1.35	0.06	98	46.86	2.02
	Total	129	1.38	0.06	326	54.73	2.48
Seychelles							
	Jan	62	0.36	0.35	176	12.71	12.40
	Feb	80	0.70	0.23	228	24.55	8.03
	Mar	94	0.75	0.91	277	25.64	30.75
	Total	236	0.63	0.53	681	21.93	18.40
Somalia							
	Jan	94	0.23	0.75	209	10.50	33.57
	Feb	89	0.38	0.84	201	16.80	37.07
	Mar	8	0.37	0.37	18	16.15	16.14
	Total	191	0.31	0.77	428	13.70	34.47

Table 7. Purse Seiners Active in the Western Indian Ocean, 1983 Through June 1986.

YEAR	FRANCE	IVORY COAST	MAURITIUS	PANAMA	SPAIN	UNITED KINGDOM	TOTAL
1983	11	2	1	–	–	–	14
1984	27	5	1	1	14	1	49
1985	27	5	1	1	17	1	52
1986	22	1	1	1	12	1	38

Table 8. Catch Statistics For Purse Seiners in the Western Indian Ocean.
(Units: catch MT, percentage in brackets, catch rate MT/day)

MONTH	VESSELS ACTIVE	VESSELS COVERED	DAYS FISHED	CATCH RATE	YELLOWFIN		SKIPJACK		TOTAL	CUMUL TOTAL
Jan/83	5	4	90	11.58	248	(24)	794	(76)	1042	1042
Feb	5	4	92	14.16	706	(54)	597	(46)	1303	2345
Mar	5	4	81	14.77	422	(35)	754	(63)	1196	3541
Apr	5	4	91	15.96	378	(26)	1067	(73)	1452	4993
May	5	4	95	4.84	133	(29)	273	(59)	460	5453
Jun	5	4	97	7.31	374	(53)	329	(46)	709	6162
Jul	6	5	97	6.57	504	(79)	130	(20)	637	6799
Aug	7	6	117	3.97	426	(92)	39	(8)	465	7264
Sep	6	5	118	7.24	435	(51)	420	(49)	854	8118
Oct	6	5	108	17.59	906	(48)	974	(51)	1899	10018
Nov	13	12	220	15.82	2461	(71)	1019	(29)	3480	13497
Dec	14	13	333	18.63	4247	(68)	1955	(32)	6202	19700
Total			1539	12.80	11240	(57)	8351	(42)	19700	
Jan/84	14	13	269	19.39	4100	(79)	1094	(21)	5217	5217
Feb	17	16	276	16.17	3666	(82)	798	(18)	4464	9681
Mar	22	21	473	17.50	6601	(80)	1678	(20)	8279	17960
Apr	27	26	499	10.67	2569	(48)	2719	(51)	5323	23283
May	32	31	795	8.09	4409	(69)	1933	(30)	6433	29716
Jun	32	31	631	5.15	2723	(84)	458	(14)	3247	32963
Jul	27	26	519	8.00	3359	(81)	708	(17)	4154	37118
Aug	29	28	618	8.79	3015	(56)	2416	(44)	5431	42548
Sep	37	36	756	15.55	3336	(28)	8413	(72)	11759	54308
Oct	41	40	744	19.93	4251	(29)	10465	(71)	14827	69134
Nov	46	46	1035	19.39	10354	(52)	9696	(48)	20066	89201
Dec	49	49	1052	8.41	6231	(70)	2608	(29)	8844	98044
Total			7667	12.79	54613	(56)	42985	(44)	98044	

Table 8 continued

MONTH	VESSELS ACTIVE	VESSELS COVERED	DAYS FISHED	CATCH RATE	YELLOWFIN		SKIPJACK		TOTAL	CUMUL TOTAL
Jan/85	49	49	1105	14.58	11370	(71)	4740	(29)	16111	16111
Feb	49	48	900	6.80	4071	(66)	2052	(34)	6123	22234
Mar	46	45	1120	11.75	10335	(78)	2789	(21)	13165	35399
Apr	45	43	935	7.36	2189	(32)	4689	(68)	6880	42279
May	35	34	853	9.58	5674	(69)	2389	(29)	8169	50448
Jun	34	32	724	11.65	6418	(76)	1828	(22)	8437	58885
Jul	28	28	518	12.92	4587	(69)	2104	(31)	6691	65576
Aug	30	30	567	12.41	2229	(32)	4805	(68)	7034	72610
Sep	33	33	659	25.19	3386	(20)	13218	(80)	16603	89213
Oct	36	36	755	26.02	3017	(15)	16588	(84)	19646	108859
Nov	37	37	841	12.45	2289	(22)	7922	(76)	10470	119329
Dec	38	38	1038	9.35	4257	(44)	5409	(56)	9702	129031
Total			10015	12.88	59820	(46)	68533	(53)	129031	
Jan/86	38	38	944	16.79	12683	(80)	3072	(19)	15852	15852
Feb	38	37	790	16.63	8978	(68)	3839	(29)	13137	28989
Mar	36	32	750	12.49	5060	(54)	4225	(45)	9364	38354
Apr	35	24	542	12.93	2124	(30)	4863	(69)	7008	45362
May	35	22	426	13.91	683	(12)	5241	(88)	5924	51286
Jun	34	14	277	12.83	757	(21)	2796	(79)	3553	54838
Total			3729	14.71	30285	(55)	24035	(44)	54838	

Table 9. Catch Rates For Purse Seiners in the Western Indian Ocean. (Units: MT per day)

MONTH	DAYS FISHED	CATCH RATES		
		YELLOWFIN	SKIPJACK	TOTAL
Jan/83	90	2.76	8.82	11.58
Feb	92	7.67	6.49	14.16
Mar	81	5.21	9.31	14.52
Apr	91	4.15	11.73	15.88
May	95	1.40	2.87	4.27
Jun	97	3.86	3.39	7.25
Jul	97	5.20	1.34	6.54
Aug	117	3.64	0.33	3.97
Sep	118	3.68	3.56	7.24
Oct	108	8.39	9.02	17.41
Nov	220	11.19	4.63	15.82
Dec	333	12.75	5.87	18.62
Average	128	5.83	5.61	11.44
Jan/84	269	15.24	4.07	19.31
Feb	276	13.28	2.89	16.17
Mar	473	13.95	3.55	17.50
Apr	499	5.15	5.45	10.60
May	795	5.55	2.43	7.98
Jun	631	4.32	0.73	5.05
Jul	519	6.47	1.36	7.83
Aug	618	4.88	3.91	8.79
Sep	756	4.41	11.13	15.54
Oct	744	5.71	14.07	19.78
Nov	1035	10.00	9.37	19.37
Dec	1052	5.92	2.48	8.40
Average	639	7.91	5.12	13.03

Table 9 continued

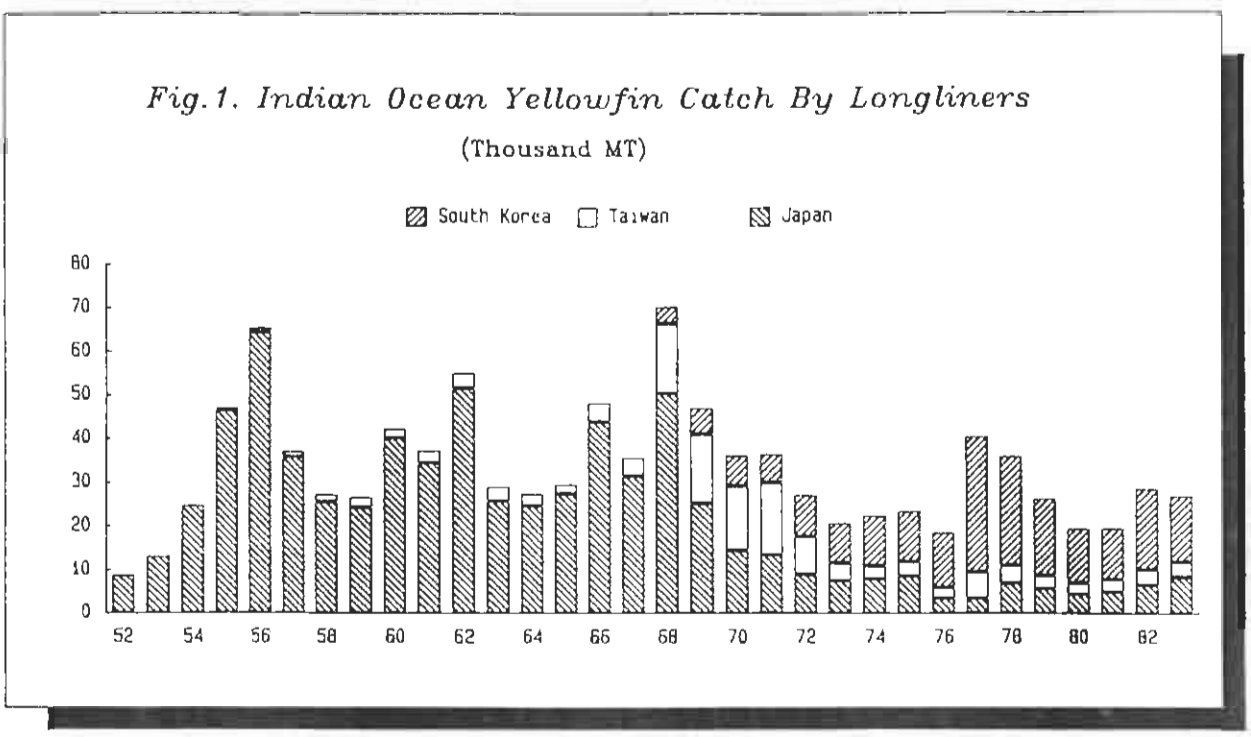
MONTH	DAYS FISHED	CATCH RATES		
		YELLOWFIN	SKIPJACK	TOTAL
Jan/85	1105	10.29	4.29	14.58
Feb	900	4.52	2.28	6.80
Mar	1120	9.23	2.49	11.72
Apr	935	2.34	5.01	7.35
May	853	6.65	2.80	9.45
Jun	724	8.86	2.53	11.39
Jul	518	8.85	4.06	12.91
Aug	567	3.93	8.48	12.41
Sep	659	5.14	20.06	25.20
Oct	755	4.00	21.97	25.97
Nov	841	2.72	9.42	12.14
Dec	1038	4.10	5.21	9.31
Average	835	5.89	7.38	13.27
Jan/86	944	13.44	3.25	16.69
Feb	790	11.37	4.86	16.23
Mar	750	6.75	5.63	12.38
Apr	(542)	3.92	8.97	12.89
May	(426)	1.60	12.30	13.90
Jun	(277)	2.73	10.09	12.82
Average	n/a	6.63	7.52	14.15

Table 10. **Purse Seiner Production By Unit Area.**

(Units: area 1000 km², production MT per 1000 km²)

	1983	1984	1985
Area Fished	2669	5932	6340
Yellowfin Production	4.21	9.20	9.43
Skipjack Production	3.13	7.24	10.81
Percentage of Positive One-Degree Squares	48	64	79
Area Fished in Positive One-Degree Squares	1285	3794	4980
Yellowfin in Positive One-Degree Squares	8.74	14.39	12.01
Skipjack in Positive One-Degree Squares	6.49	11.33	13.76

Fig.1. Indian Ocean Yellowfin Catch By Longliners



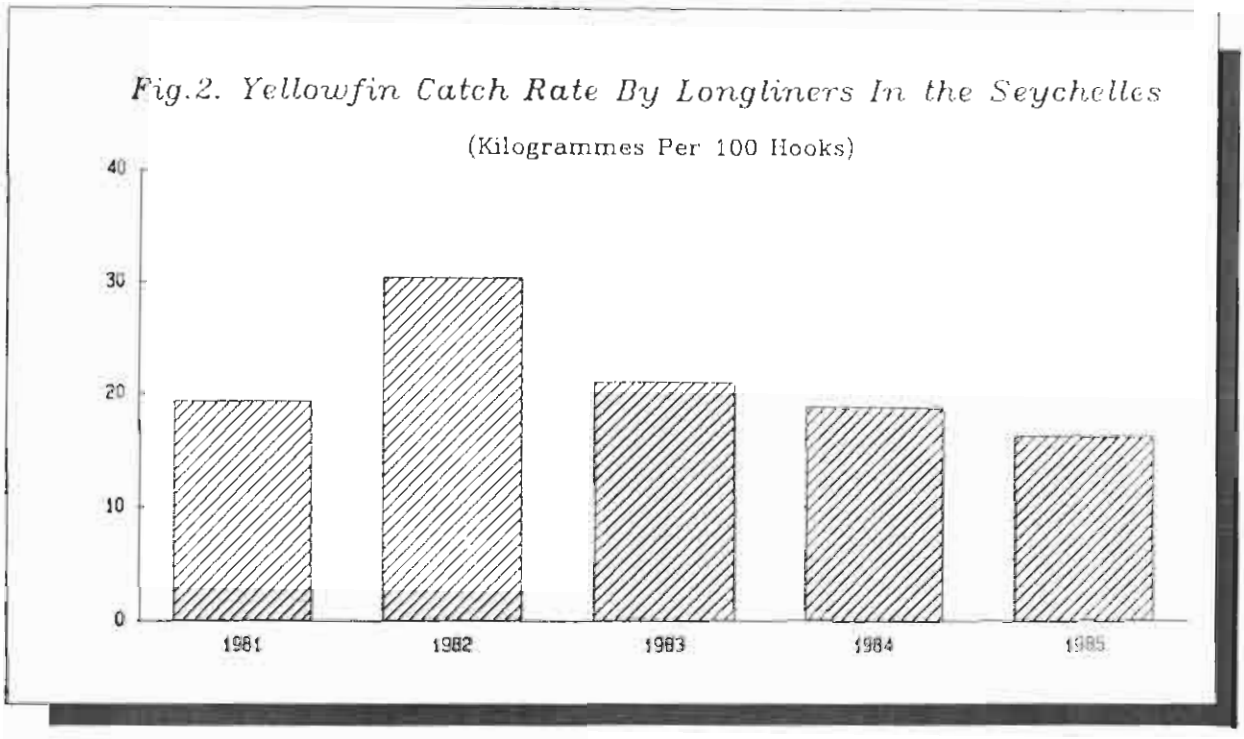
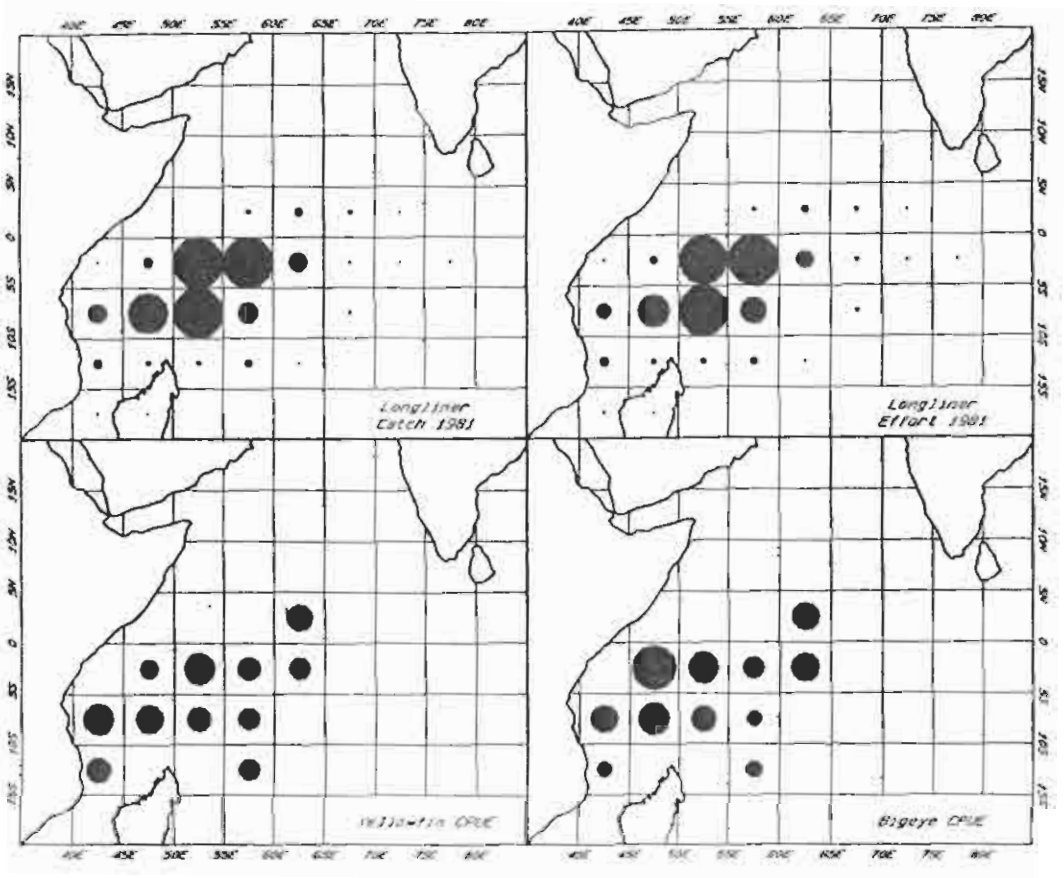
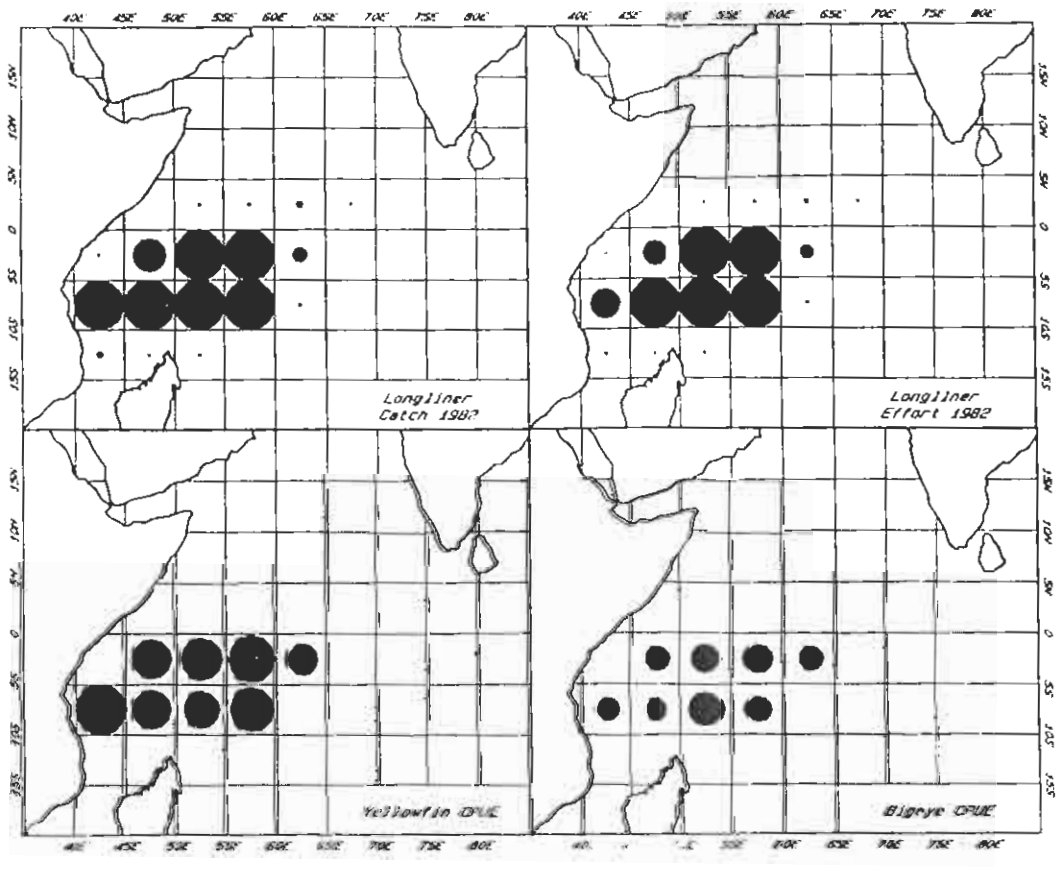
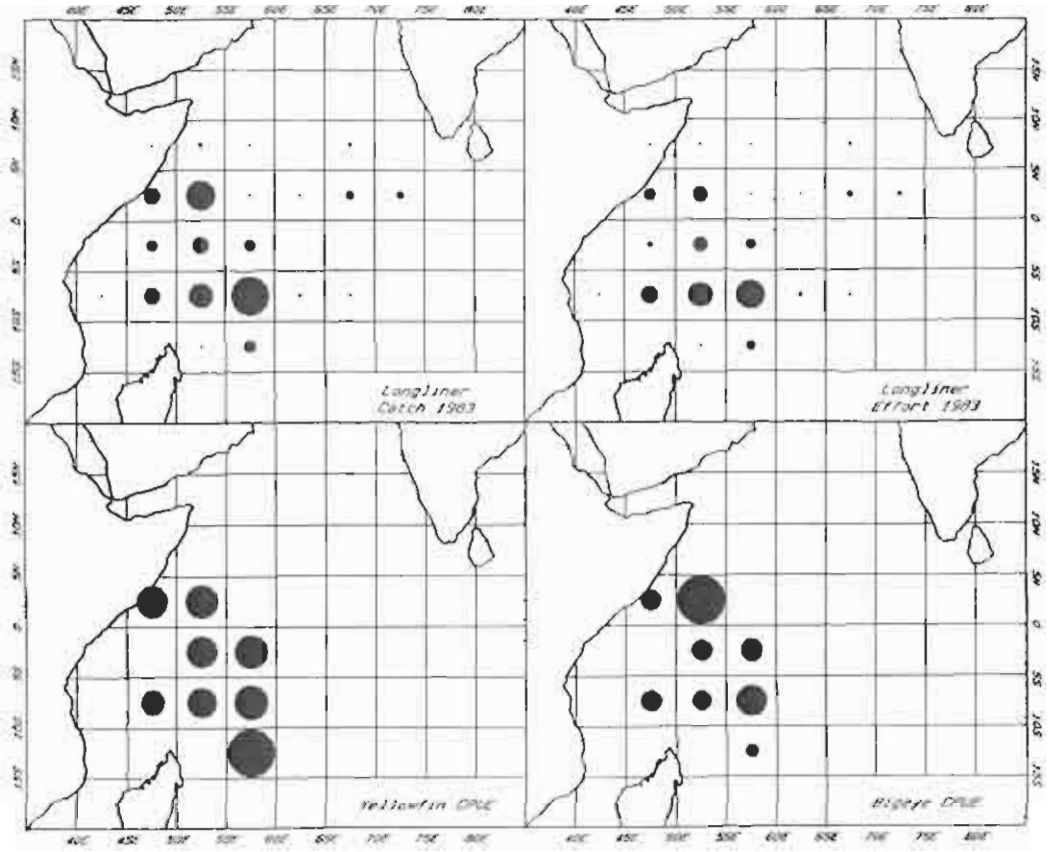


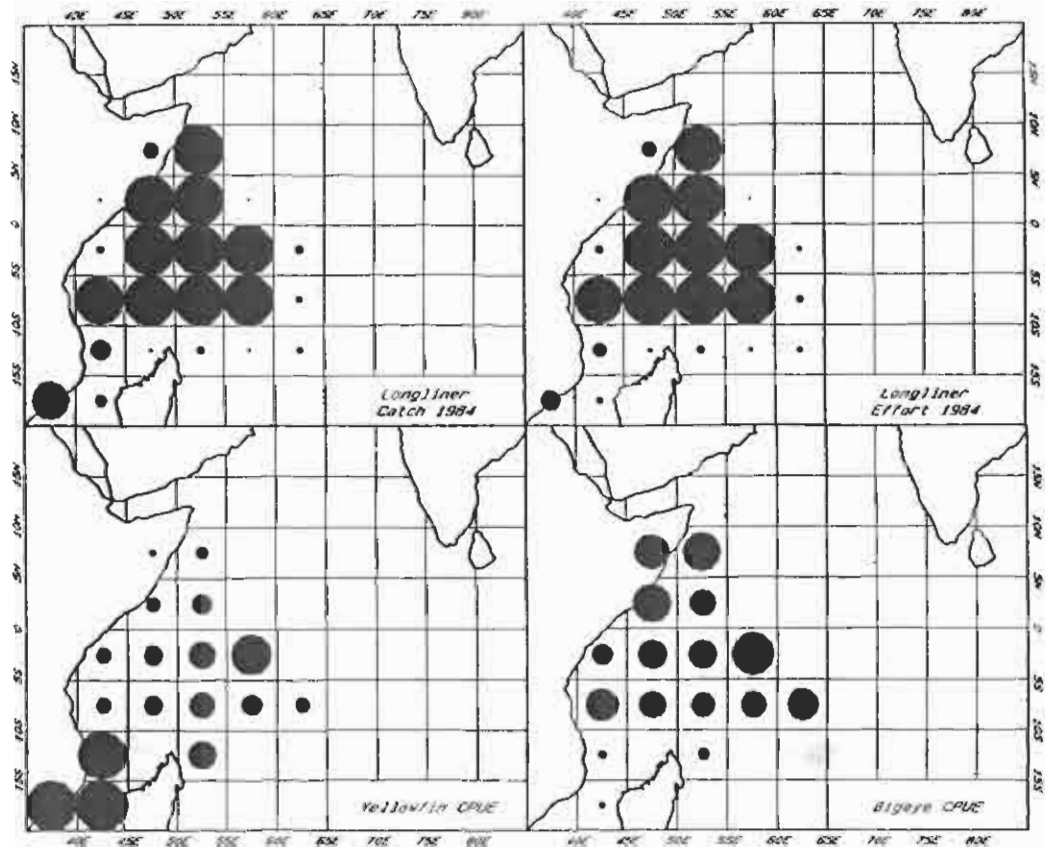
Figure 3. Catch Statistics Sampled For Longliners Licensed in Mozambique, Seychelles and Somalia.

The statistics represented are proportional to the diameter of the circle. A circle five degrees in diameter represents a total catch of 100 MT, a total effort of 100 days fished, or a yellowfin or skipjack catch per unit effort of one MT per day. Catch per unit effort statistics have been plotted if at least ten days fishing occurred, therefore these statistics should be interpreted with caution. The sample size for the catch and effort statistics might be considered adequate if the corresponding circles for total catch and effort are a full five degrees in diameter.


Longliner
Catch 1981
Longliner
Effort 1981
Yellowfin CPUE
Bigeye CPUE


Longliner
Catch 1982
Longliner
Effort 1982
Yellowfin CPUE
Bigeye CPUE


Longliner
Catch 1983
Longliner
Effort 1983
Yellowfin CPUE
Bigeye CPUE


Longliner
Catch 1984
Longliner
Effort 1984
Yellowfin CPUE
Bigeye CPUE

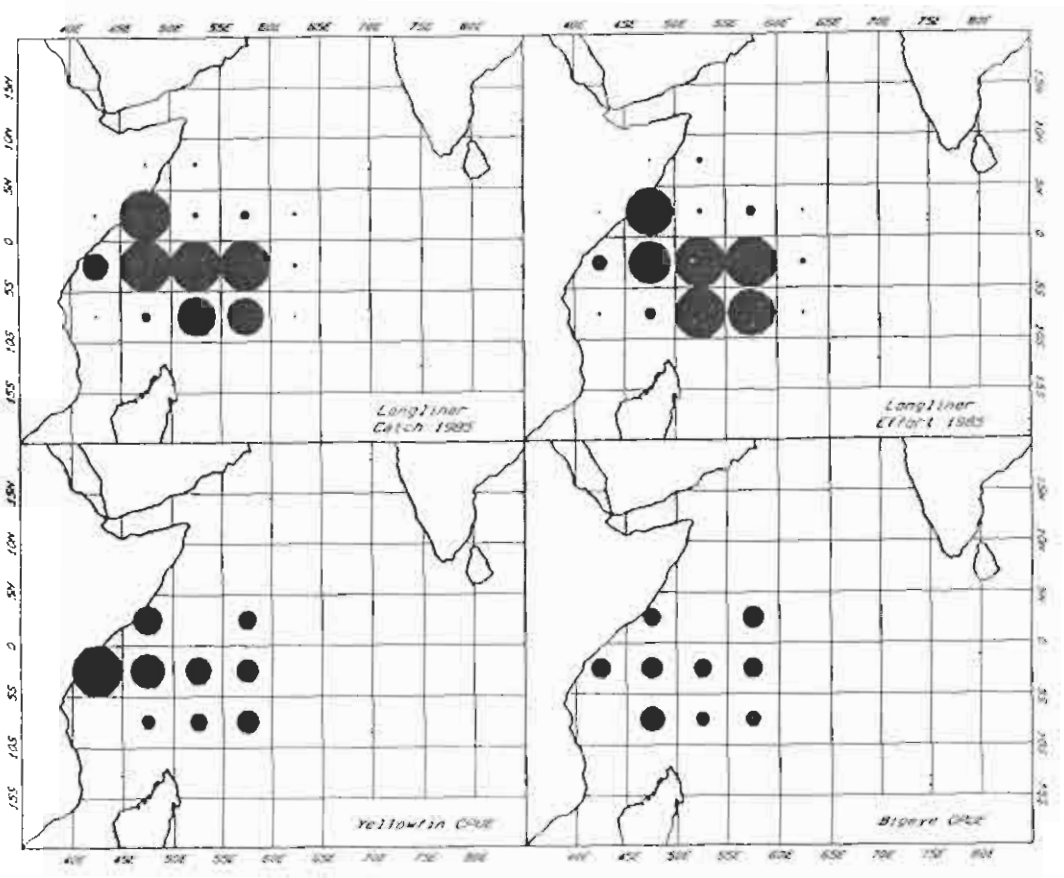
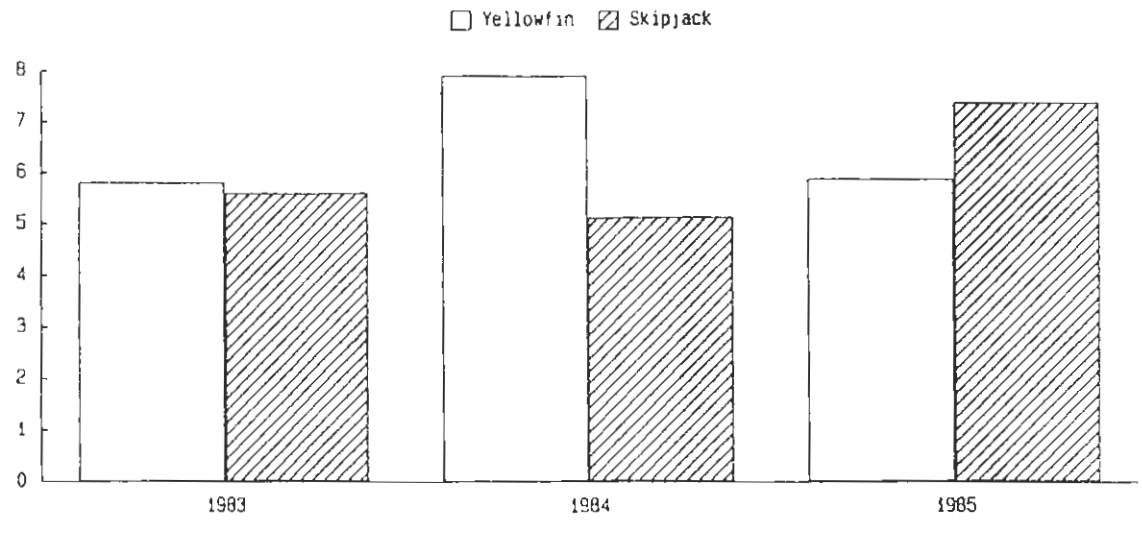


Fig.4. Purse Seiner Catch Rates in the Western Indian Ocean
(Tonnes Per Day)



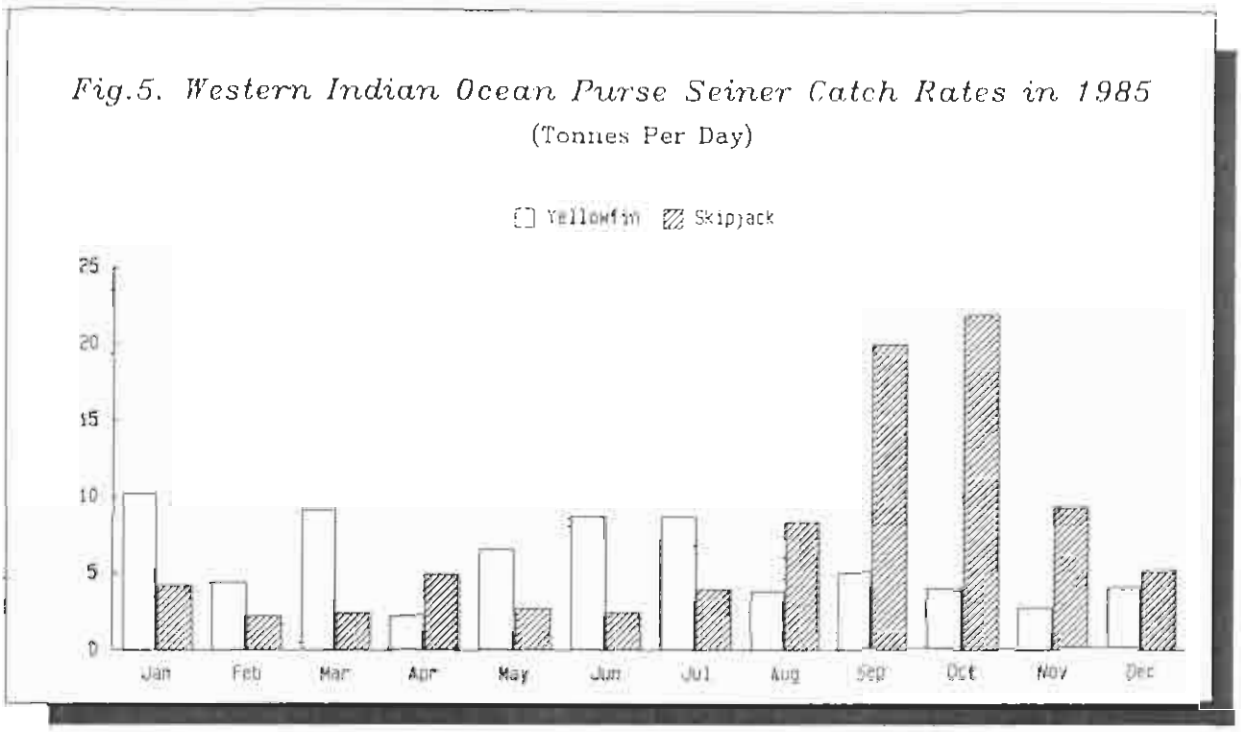
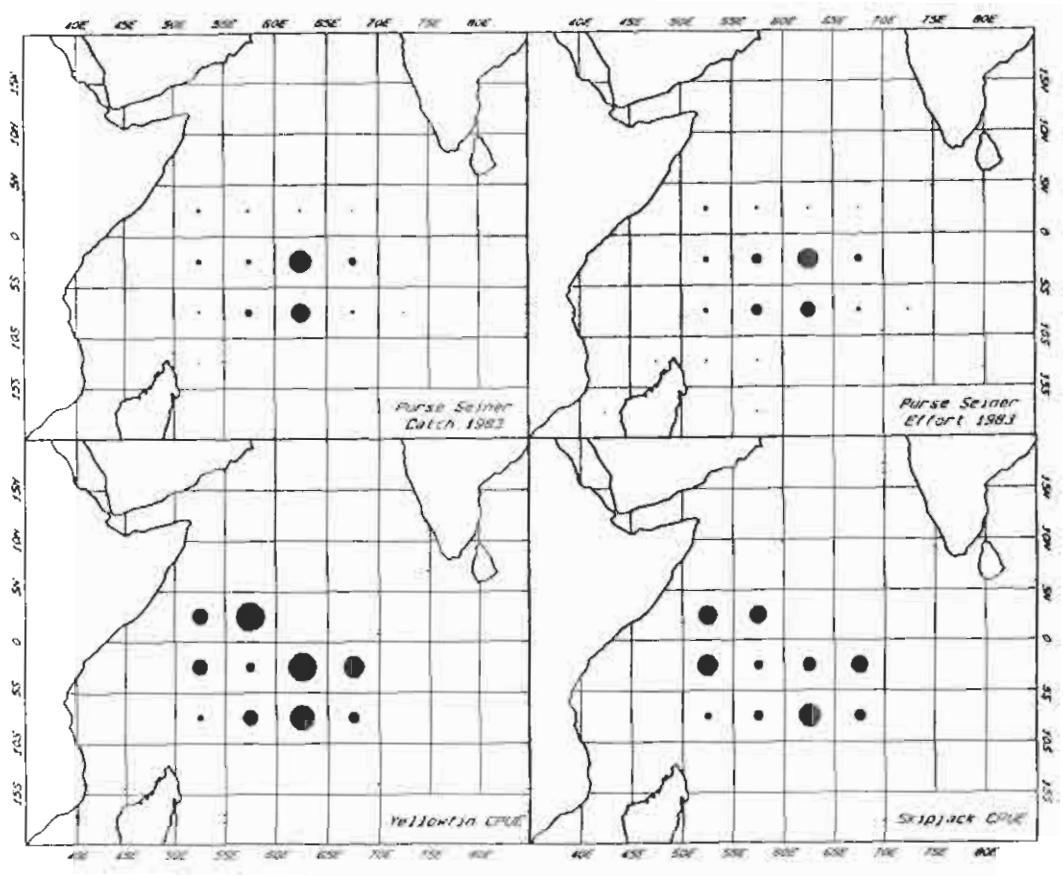
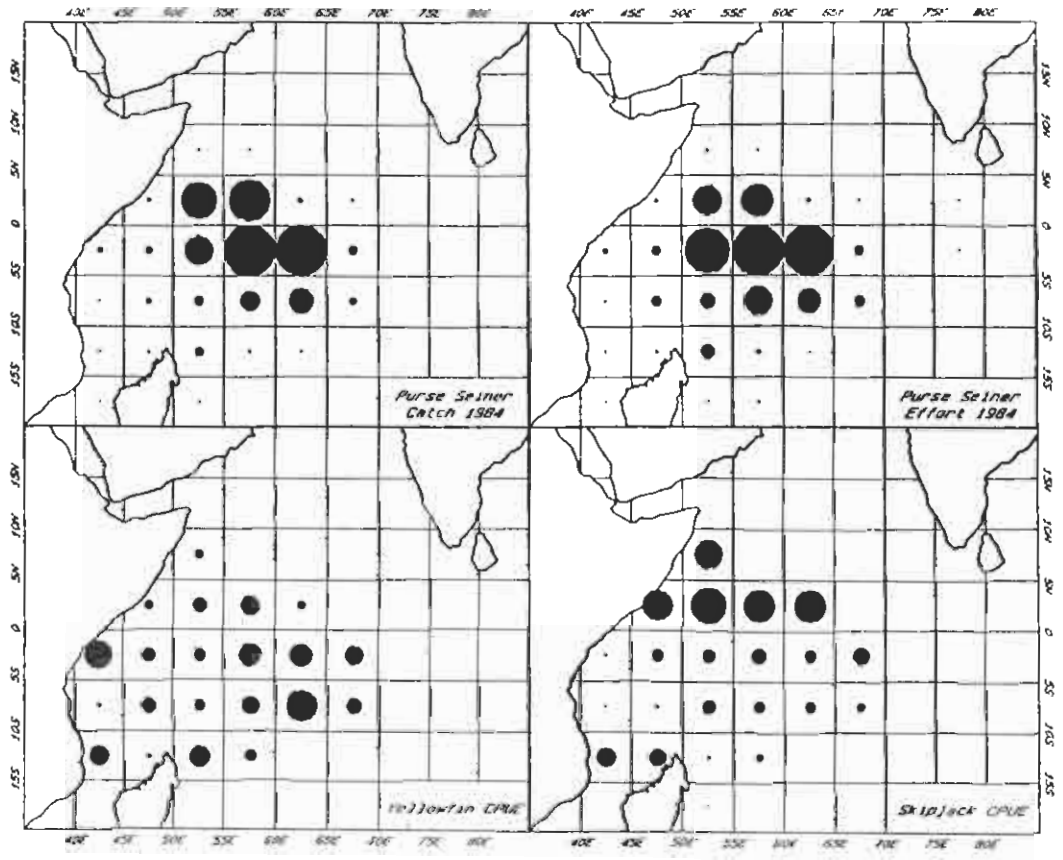
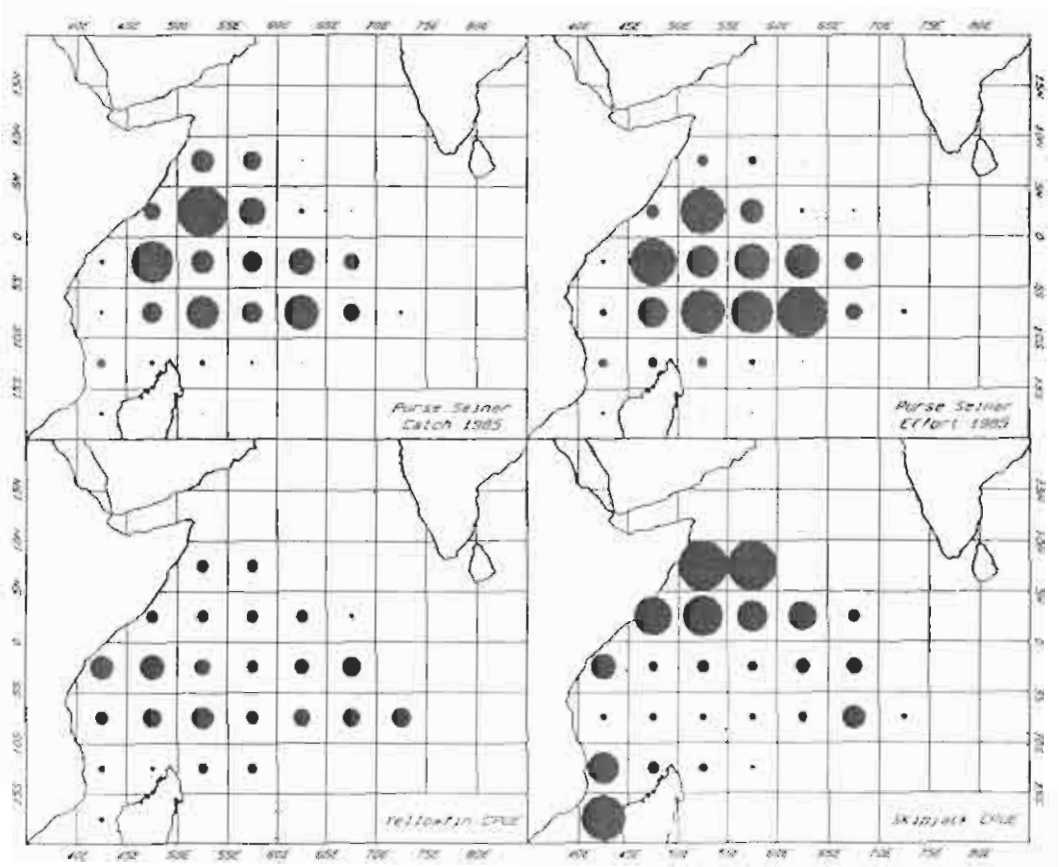


Figure 6. **Catch Statistics For Purse Seiners In the Western Indian Ocean, 1983 - 1985.**

The statistics represented are proportional to the diameter of the circle. A circle five degrees in diameter represents a total catch of 15 000 MT, total effort of 1 000 days, or a skipjack or yellowfin catch per unit effort of 15 MT per day. Catch per unit effort data have been plotted for five degree squares in which at least 15 days fishing occurred.


Purse Seiner
Catch 1983
Purse Seiner
Effort 1983
Yellowfin CPUE
Skipjack CPUE


Purse Seiner
Catch 1984
Purse Seiner
Effort 1984
Yellowfin CPUE
Skipjack CPUE


Purse Seiner Catch 1985
Purse Seiner Effort 1985
Yellowfin CPUE
Skipjack CPUE