

TRENDS IN THE ABUNDANCE INDICES OF YELLOWFIN AND SKIPJACK TUNAS IN THE INDIAN EEZ

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SUMMARY

The fishery pressure on the tuna resources especially the Yellowfin tuna and Skipjack tuna in the EEZ's of the coastal nations differ from country to country. The fishing activity on the tuna resources of the Indian Ocean was on the increase during past few decades in most cases the production level has reached the MSY level. In order to understand the health of the stock in the two region of the Indian EEZ an attempt is made in this paper to study the differential rate of fishery by considering the two abundance indices, the hooking rate and catch rate based on the data collected during 1994-2000. The data has been dealt in two components, one for the Arabian Sea part and the other one for Andaman and Nicobar waters within the Indian EEZ. The hooking rate of yellowfin tuna in Arabian Sea shows a fluctuating trend while the catch rate has increased from 1994 to 1998 and declined thereafter. The seasonal variation in the hooking rate indicated that the pre-monsoon season is the best fishing season for both the species in Arabian Sea. In Andaman and Nicobar waters a drastic reductions in the both the hooking rate and catch rate was observed during certain years, for the two species. The seasonal abundance shows that both monsoon and post – monsoon seasons are productive for yellowfin tuna in Andaman and Nicobar waters. The mean length of Yellowfin tuna in Arabian Sea is observed to be 103.3 cm while the species from Andaman and Nicobar waters registered a mean length of 126.7 cm for the same period. In the case of Skipjack tuna the mean length recorded in the Arabian Sea was higher (69.94 cm) than that of individuals caught in the Andaman and Nicobar waters (57.83 cm).

INTRODUCTION

In the Western Arabian Sea the main producers of tuna are India, Iran, Pakistan, Oman and UAE and the remaining nations contribute only marginally to the catches. The gears employed are mostly longlines, gillnets and troll line. The present scenario of tuna production in the Indian waters is that coastal tuna are harvested by traditional fishing vessels employing methods like pole and line, gillnets, hand lines and troll lines. There is no organized fishing by coastal nations for these resources.

The fishing pressure on tuna resources in the EEZs of the coastal nations differ from country to country. This differential rate of fishing has bearing on the abundance indices as well as on the size of the tunas caught. It is therefore, essential to examine the trend in the abundance indices and the size of tunas over a period of time so as to study the impact of fishing effort on the stocks. As tunas have longer life span, the differential fishing pressure on different size classes may take quite sometime to manifest its impacts on their stocks. The fishing activities on the tuna resources of the Indian Ocean have been on the increase during past few decades. The tuna production especially the YFT has already reached a plateau (IOTC, 2001).

Considering the various developments, an attempt has been made here to study the catch indices of YFT and Skipjack tunas occurring in the Indian EEZ in order to understand the health of the stock in the region. The two indices considered in this paper are the Hooking rate and CPUE index. The data collected during the year 1994-2002 is analysed on the above lines and presented here.

MATERIAL AND METHODS:

The data on Yellowfin tuna, Skipjack tuna and other fin-fish species caught in the longline surveys conducted by FSI in Indian EEZ during the period 1994-2002 was analysed. The abundance indices such as hooking rate (HR) i.e. number of fish caught per 100 hooks and catch rate (CR) i.e., weight of fish (kg) caught per 1000 hooks were computed. These abundance indices have been studied with respect to Arabian Sea and Andaman & Nicobar waters of Indian EEZ for the period from 1994 – 2002. The size distribution of the species during this period with their mean length was also analysed for the corresponding period. The seasonal variations in the hooking rates and catch rates were examined with respect to different months and seasons.

I. ARABIAN SEA (NORTH-WEST COAST)

1 YELLOW FIN TUNA (YFT)

(i) Trend in hooking rate

Table 1 shows the No. of hooks operated, hooking rate and catch rate recorded in respect of YFT and Skipjack from the Arabian Sea for the period from 1994 to 2002. The percentage contribution of Yellowfin tuna to the total fish caught (in numbers) during the above period is also worked out. Percentage contributions of YFT was highest during 2002 (44%) followed by 1997 (43.6%), 1998 (36.8%), 2001 (34.8%), 1999 (23.1%), 1996 (22.5%) and 2000 (19.6%). During 1994 and 1995, the share of YFT to the total catch was less than 10%. Fig. 1 shows the hooking rate and catch rate of YFT and Skipjack tuna from Arabian Sea. Highest hooking rate for YFT was recorded during 1997 with a hooking rate of 0.98% followed by 0.75% during 1998 and

0.50% during 2002 (Fig.1). Hooking rate of the species during rest of the period was negligible. The hooking rates registered during different years show an increasing trend with increase in number of hooks operated.

(ii) Trend in Catch rate

The CPUE index is worked out with respect to the catch rate recorded per 1000 hooks (in kg) in each year (Table 1). The CPUE index of YFT for the period from 1994 to 2002 has been in the range of 78 kg to 188 kg/1000 hooks. The highest catch rate of 188 kg was registered during 1998, the next highest catch rate of 170 kg during 1997 and 127 kg during 2002. In general it is observed that there was an increase in the CPUE index from 1994 to 1998 and a declining trend thereafter until 2002 (Fig 1). The hooking rate of YFT was higher during 1997, 1998 and 2002 with a hooking rate of 0.98% and 0.75% and 0.50% respectively.

2. SKIPJACK TUNA (SKJ):

(i) Trend in hooking rate

The Hooking rate and catch rate recorded for Skipjack tuna in the Arabian Sea (Table 1) reveals that the percentage contribution of SKJ to the longline catches are low. However, the percentage of SKJ was fairly high during 1996-2000. The highest number of SKJ was recorded during 1997 (109 nos) and in 2000 respectively (168 nos) forming 12.5% and 14% of the total catch. During the period from 1996 to 2000, the percentage contribution of SKJ to the total catch ranged between 11.5% and 14.5%. In terms of hooking rate, this species recorded the highest hooking rate of 0.28% each during 1997 and 2000 respectively.

(ii) Trend in Catch rate

Abundance index in terms of catch rate of the species shows that during 1997 and 2000 SKJ recorded a catch rate of 22 and 26 kg respectively. Rest of the years the catch rate was less than 10 kg indicating a low abundance index in the longline catches. The hooking rate and catch rate recorded in respect of SKJ is independent of the fishing effort expended and aggregate catch of all fishes.

3. SEASONAL ABUNDANCE OF TUNAS IN THE ARABIAN SEA

(i) Yellowfin tuna

In order to understand the seasonal abundance of the species in the Arabian Sea, the hooking rate has been worked out for different months as well as by pooling the data into three seasons viz. pre-monsoon (Jan-April), monsoon (May-August) and post-monsoon (September to December). Fig. 2 indicates the hooking rate recorded during different months and for the three seasons respectively. The monthwise hooking rate shows that the period January to March registered higher hooking rate varying from 0.34 in (Jan) to 0.82 (March). The hooking rate registered an increasing trend from January to March and declined thereafter upto November. The results obtained during the three seasons indicate that the pre-monsoon period (Jan – May) registered the maximum hooking rate of 0.54% for YFT, and a

declining trend is observed during monsoon (0.16%) and post-monsoon season (0.13%). The aggregate hooking rate for all fish recorded was also higher in the same pattern, the pre-monsoon season being productive for YFT and all fish. The best fishing season for yellowfin tuna in the Arabian Sea could be predicted as the pre-monsoon period (Jan – May).

(ii) Skipjack tuna

The monthwise as well seasonal hooking rates (Fig. 2) are worked out in respect of this species to understand the seasonal abundance. The maximum hooking rate was obtained during March (0.43%), followed by 0.19% in February and 0.13% in the remaining months. Similarly, the hooking rate recorded during the three seasons show that the pre-monsoon months gave better results with a hooking rate of 0.21% and during the other two seasons, the hooking rate for SKJ was quite low. For both the species of tunas, YFT and SKJ the pre-monsoon period is the best fishing season as evident from the hooking rates obtained.

II. ANDAMAN & NICOBAR ISLANDS

1. YELLOW FIN TUNA (YFT)

(i) Hooking rate

The hooking rate and catch rate recorded for YFT from Andaman waters for the period 1994-2002 is given in Table 2 & Fig.2.

The hooking rate of Yellowfin tuna was highest during 1994 and 1995 registering 1.6% each respectively (Fig.3) while the hooking rate registered during remaining years was very low. However, the percentage contribution of YFT to the total catch was appreciably high during 1994-2000 (13.3% to 61.3%). The highest percentage of 61.3% was observed during 1995 and 40.3% during 1996. The yearwise results further indicates a declining trend in the hooking rate from 1999 onwards.

(ii) Trend in Catch rate

The abundance index in terms of catch rate (kg/1000 hooks) in respect of YFT recorded from Andaman and Nicobar waters during 1994-2002 is shown in Table 2 Fig.3. The lowest catch rate of 28 kg/1000 hooks was obtained in 2000 while a highest catch rate of 478 kg was recorded during 1995. In general the period 1994 to 1999 recorded a fairly high catch rate ranging between 126 and 478 kg and a drastic reduction in the catch rate is observed from 2000 onwards (28 – 60kg).

2. SKIPJACK TUNA (SKJ)

(i) Trend in hooking rate

The Hooking rate and Catch rate obtained from Andaman and Nicobar waters in respect of Skipjack tuna (Table 2 and Fig. 3) shows that the contribution of SKJ from Andaman waters is comparatively at very low scale. The percentage contribution of this species to the total catch during 1994-2002 varied from 0.5% in 1996 to 5.7% in 2002. The Hooking rate recorded during different months do not show any significant variations.

ii) Trend in Catch rate

Abundance index of SKJ, the catch rate, in Andaman and Nicobar waters was found to range from 0.18 to 2.07... The yearwise catch rate indicates that catch was recorded during the above period. The maximum catch rate of 2.07 kg/1000 hooks was observed during 1997, 1.3 kg during 2002 and 1.02 kg during 1994. During rest of the years the catch rate recorded was less than 1 kg/1000 hooks. Considering the number of hooks operated and the total catch recorded during these years, the contribution of SKJ from Andaman and Nicobar waters is insignificant.

Though there is no continuous declining trend observed in the case of SKJ, the fluctuation registered appears to be specific to short lived species like Skipjack tuna both in Arabian sea and Andaman and Nicobar waters.

3. SEASONAL ABUNDANCE OF TUNAS IN ANDAMAN AND NICOBAR WATERS

(I) YELLOWFIN TUNA

Fig. 4 shows the monthwise and seasonwise hooking rate recorded for YFT from Andaman and Nicobar waters. Unlike in the Arabian Sea, fairly good hooking rate, above 0.5% was recorded for YFT during all the months except during October and November. The highest hooking rate was obtained in June (0.89%) followed by July and January (0.85%). Among the three seasons, the monsoon season (May – August) recorded the highest hooking rate of 0.72%, followed by pre-monsoon months (0.64%) and post-monsoon months (0.28%). Both monsoon and post-monsoon months are good fishing seasons for YFT in Andaman and Nicobar waters.

The quantity of Skipjack tuna caught by longliners from Andaman and Nicobar waters is very low showing its insignificant in the catches from the island waters. However, the species was present in the catches during all the months though in small numbers.

4. LENGTH FREQUENCIES OF YELLOW FIN TUNA & SKIPJACK TUNA

The length frequencies and mean lengths of YFT and Skipjack tuna from Arabian Sea and Andaman waters for the period from 1992-2002 is given in Fig. 5 & 6. The minimum length of 41 cm was recorded during 1996 and the maximum 239 cm during 2002. The mean length obtained during different years show that mean length was maximum during 1992 (130 cm) showing a declining trend thereafter upto 1996 (80.6 cm). From 1997 the mean length started increasing (96.4 cm) with a decline in 2001 (85 cm) and again registering an increase in 2002 (118.3 cm). In Andaman & Nicobar waters, the minimum length recorded is 38 cm and maximum length 198 cm, both in 2001. The minimum mean length (121.9 cm) was observed in 1998 and maximum (140.5 cm) in 2001. The decreasing trend in the mean length from both the regions during the period 1992-96 could be due to operation of chartered fishing vessels in the Indian EEZ and large scale commercial fishing operation in the adjacent international waters during the above period;

which exerted considerable fishing pressure on the stocks of Yellowfin tuna in both the regions.

SKIPJACK TUNA (SKJ):

The size range and mean length of Skipjack tuna registered a fluctuating trend both in the Arabian Sea and Andaman and Nicobar waters. The smallest specimen (41 cm) was recorded in the year 1995 and the largest specimen (101 cm) was caught in the year 1993 in Arabian and Nicobar waters. The smallest species recorded measured 44 cm in 2001 and largest species of 69 cm is 2002. The mean length of SKJ recorded from these waters indicate a minimum value of 64.7 cm in 1995 and maximum 73.6 cm in 2000. In Andaman waters the minimum mean length (54.8 cm) was observed in 2001 and maximum length of 66 cm in 1993 in this region.

As mentioned earlier the mean length of SKJ was found to be fluctuating from year to year which is typical of a species having smaller life span. However the SKJ caught from Arabian Sea was found to be larger in size (64.78 to 73.6 cm) than those caught from the Andaman and Nicobar waters (66 cm).

DISCUSSION

The IOTC Working Party on Tropical Tunas (WPTT) had shown concern about the stagnation of the production of YFT, BET and increasing catch of large quantities of juveniles in the catches landed by purse seiners from the Indian Ocean (IOTC, 2001 & 2002). In this context the data obtained through the exploratory tuna long line surveys by India from the North Western Arabian Sea and in the waters around Andaman-Nicobar Islands was examined for the period 1994-2002. The abundance indices of Yellowfin tuna in the Arabian Sea have shown declining trend since 1997. The hooking rate for all fish reached its peak of 2.24% in 1997 and declined to 0.46% in the year 2001. The hooking rate in respect of Yellowfin tuna was also found declining after the peak of 0.98% in the year 1997 to 0.16% in 2001. Similarly the hooking rate reached a peak (0.28%) in the year 1997 and repeated in the year 2000 in respect of Skipjack tuna and registered its lowest (0.05%) in the year 2001. A clear trend of decline in the abundance index (Hooking rate) in the Andaman & Nicobar waters was observed from 1994 to 2001 in respect of all the constituents of the longline catches. The catch rate of Yellowfin tuna, and all fish caught in longline from Arabian Sea in terms of weight (kg per 1000 hooks) was found to be at its peak in 1998 (188 & 604 kg respectively). The Skipjack tuna recorded the highest catch rate of 26 kg in 2000.

In the case of Andaman & Nicobar waters the peak catch rate for the three categories, All fish, Yellowfin tuna and Skipjack tuna were attained during three different years, namely 1431 kg for all fish in the year 1994, 478 kg for Yellowfin tuna in 1995 and 2.1 kg for Skipjack tuna in the year 1997. Thus the trend in the catch rate for the Yellowfin tuna in general was of declining type, whereas trend in respect of Skipjack tuna was fluctuating type. The seasonal

variation in the hooking rate of YFT and Skipjack tuna in Arabian Sea indicates higher hooking rate during pre-monsoon season (Jan-May) for both the species suggesting that the period January to May could be predicted as the best fishing season in this region of the EEZ. In Andaman and Nicobar waters, unlike in the Arabian Sea fairly good hooking rate was recorded during all the three seasons. However, the monsoon season (May – August) and post-monsoon season were found to register higher hooking rate for YFT. The contribution of Skipjack tuna from this region of the Indian EEZ was found to be negligible although this species was present during all the seasons.

The Yellowfin tuna having longer life span, the manifestation of declining trend over the time period is indicative of component wise built-up of the fishing efforts

probably in whole Indian Ocean. The fluctuating trend in the catch rate as well as hooking rate of Skipjack tuna are characteristics of fisheries having comparatively short life span. The mean length of Yellowfin tuna in Arabian Sea was observed to be 103.3 cm (1994 to 2002), whereas the specimens caught from Andaman and Nicobar waters were having the mean length 126.7 cm for the same period. The Skipjack tuna caught from Western Arabian Sea were found to have greater mean length (69.94 cm) than those caught from Andaman and Nicobar waters (57.83 cm). In view of these results, it is essential that detailed analysis of trends both in abundant index as well as size ranges of Yellowfin tuna and Skipjack tuna are carried out and used for devising future fishing strategies and evolving conservation and management measures for the tuna stocks.

REFERENCES

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Table .1 YFT and SKJ tuna recorded from Arabian Sea during 1994-2002

1) Hooking rate for YFT

Latitude	Longitude	Parameter	1994	1995	1996	1997	1998	1999	2000	2001	2002
15-24	69-74	Hooks	32095	48315	52625	59825	47475	64475	38625	44177	23275
		All(No)	241	443	576	1341	969	900	763	176	265
		YFT(No)	9	36	130	585	357	208	150	33	117
		All(HR)	0.75	0.92	1.09	2.24	2.04	1.40	1.98	0.46	1.14
		YFT(HR)	0.03	0.07	0.25	0.98	0.75	0.32	0.39	0.16	0.50

2) Catch rate of YFT

Latitude	Longitude	Parameter	1994	1995	1996	1997	1998	1999	2000	2001	2002
15-24	69-74	Hooks	32095	48315	52625	59825	47475	64475	38625	44177	23275
		All(wt)	5192	6403	11811	24518	28697	20765	18912	3791	6044
		YFT(wt)	184	577	2364	10200	8917	5698	2284	1361	2963
		All(CR)	161.77	132.53	224.44	409.83	604.47	322.06	489.63	85.81	259.68
		YFT(CR)	5.73	11.94	44.92	170.50	187.83	88.38	59.13	30.81	127.30

3) Hooking rate for SKJ

Lat	Long	Parameter	1994	1995	1996	1997	1998	1999	2000	2001	2002
15-24	69-74	Hooks	32095	48315	52625	59825	47475	64475	38625	44177	23275
		All(No)	241	443	576	1341	969	900	763	176	265
		SKJ(No)	8	33	66	168	63	94	109	15	23
		All(HR)	0.751	0.917	1.095	2.242	2.041	1.396	1.975	0.456	1.139
		SKJ(HR)	0.025	0.068	0.125	0.281	0.133	0.146	0.282	0.051	0.099

4) Catch rate for SKJ

Lat	Long	Parameter	1994	1995	1996	1997	1998	1999	2000	2001	2002
15-24	69-74	Hooks	32095	48315	52625	59825	47475	64475	38625	44177	23275
		All(wt)	5192	6403	11811	24518	28697	20765	18912	3791	6044
		SKJ(wt)	36	108	484	1304	391	586	1017	166	154
		All(CR)	161.77	132.53	224.44	409.83	604.47	322.06	489.63	85.81	259.68
		SKJ(CR)	1.12	2.24	9.20	21.80	8.24	9.09	26.33	3.76	6.62

Table . 2 YFT and SKJ recorded from Andaman Sea during 1994-2002

1) Hooking rate for YFT

Latitude	Longitude	Parameter	1994	1995	1996	1997	1998	1999	2000	2001	2002
04-15	89-96	Hooks	77135	60000	45625	25120	47782	29725	44535	39575	76250
		All(No)	3247	1565	563	219	624	288	292	268	743
		YFT(No)	1233	960	227	86	205	115	39	71	138
		All(HR)	4.27	2.61	1.23	0.87	1.31	0.97	0.66	0.51	0.97
		YFT(HR)	1.60	1.60	0.50	0.34	0.43	0.39	0.20	0.04	0.18

2) Catch rate of YFT

Latitude	Longitude	Parameter	1994	1995	1996	1997	1998	1999	2000	2001	2002
04-15	89-96	Hooks	77135	60000	45625	25120	47782	29725	44535	39575	76250
		All(wt)	110375	49957	24329	9227	18195	10917	9161	9330	18681
		YFT(wt)	31424	28654	10506	3639	6013	5389	1253	2528	4590
		All	1430.93	832.62	533.24	367.32	380.79	367.27	205.70	235.75	245.00
		YFT	407.39	477.57	230.27	144.86	125.84	181.30	28.14	63.88	60.20

3) Hooking rate for SKJ

latitude	long	Parameter	1994	1995	1996	1997	1998	1999	2000	2001	2002
04-15	89-96	Hooks	77135	60000	45625	25120	47782	29725	44535	39575	76250
		All(No)	3247	1565	563	219	624	288	292	268	743
		SKJ(No)	26	16	3	15	4	1	3	12	43
		All(HR)	4.265	2.608	1.234	0.872	1.306	0.969	0.656	0.510	0.974
		SKJ(HR)	0.034	0.027	0.007	0.060	0.008	0.003	0.007	0.021	0.056

4) Catch rate for SKJ

latitude	long	Parameter	1994	1995	1996	1997	1998	1999	2000	2001	2002
04-15	89-96	Hooks	77135	60000	45625	25120	47782	29725	44535	39575	76250
		All(wt)	110375	49957	24329	9227	18195	10917	9161	9330	18681
		SKJ(wt)	79	41	43	52	28	4	8	27	98
		All(CR)	1431	833	533	367	381	367	206	236	245
		SKJ(CR)	1.02	0.68	0.94	2.07	0.59	0.13	0.18	0.68	1.29

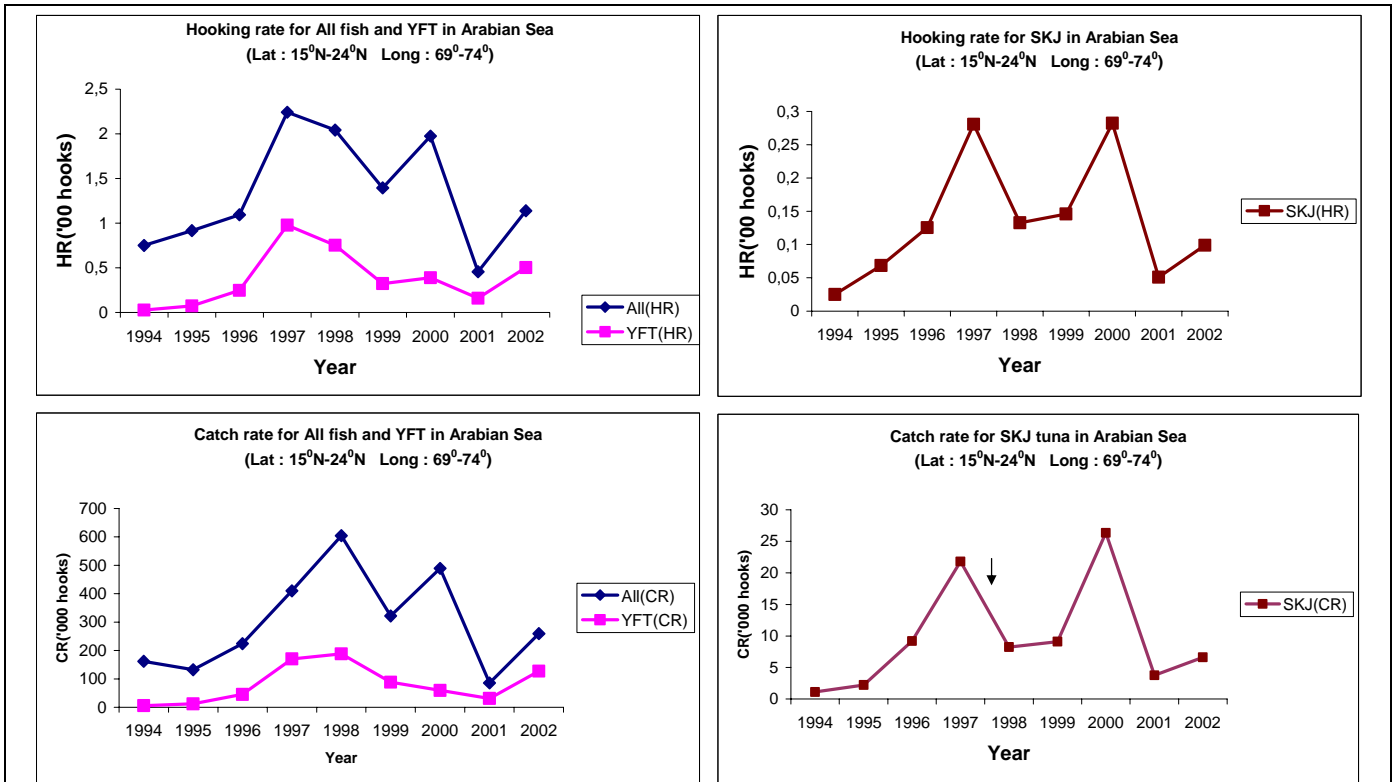


Figure .1 Abundance indices of Yellowfin tuna and Skipjack tuna from Arabian Sea (1994-2002)

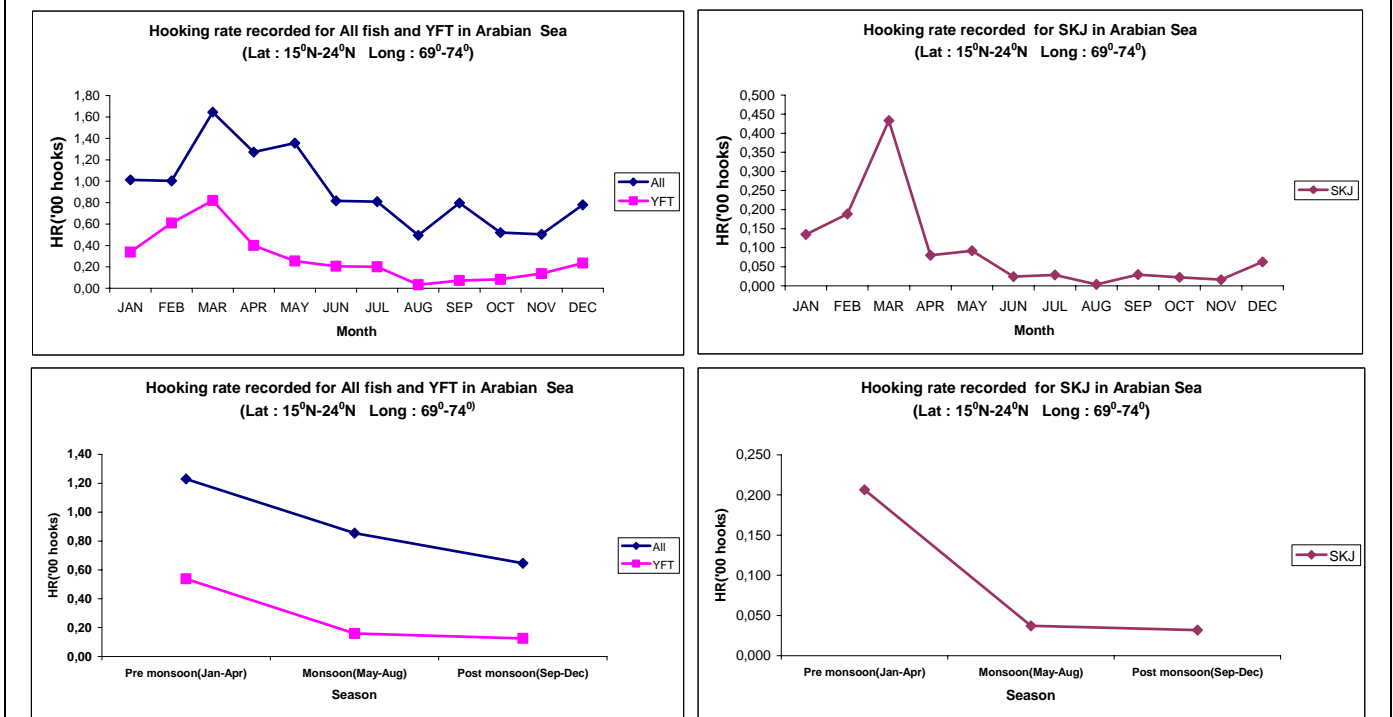


Figure 2. Monthly and seasonal hooking rates recorded for Yellowfin tuna and skipjack tuna in Arabian Sea (1994-2002)

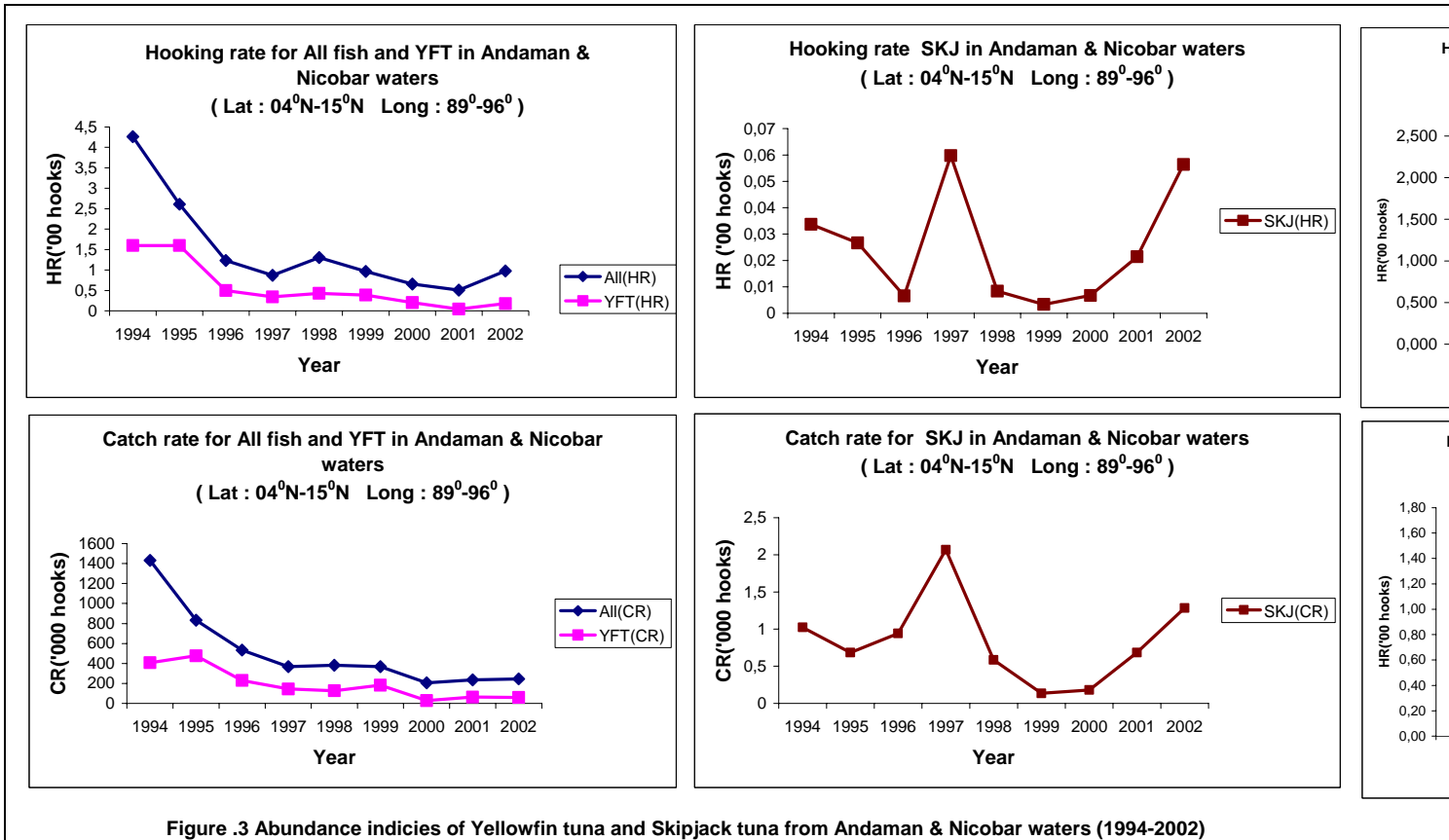


Figure .3 Abundance indices of Yellowfin tuna and Skipjack tuna from Andaman & Nicobar waters (1994-2002)

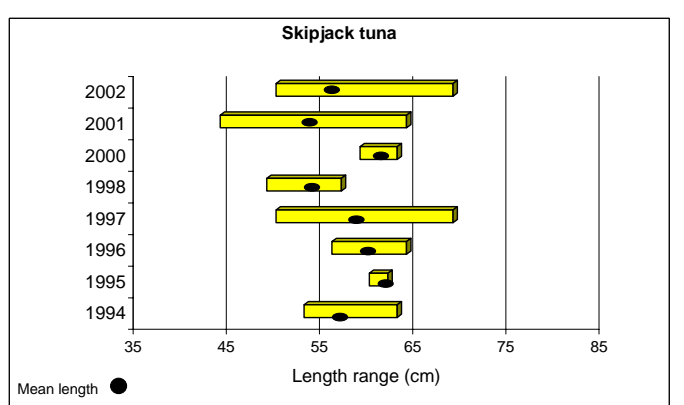
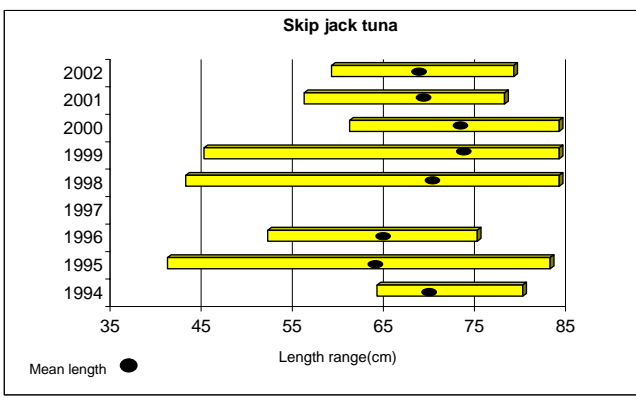
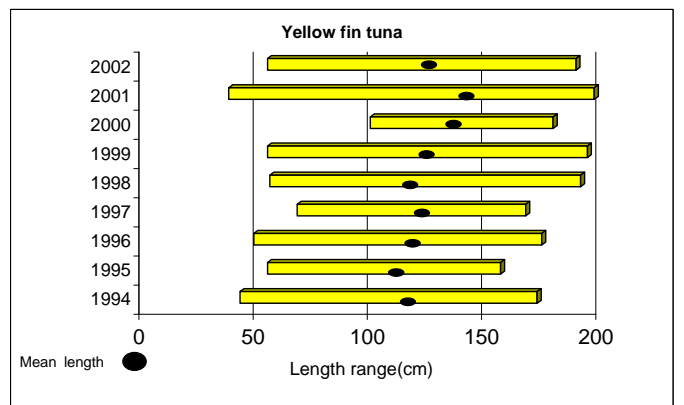
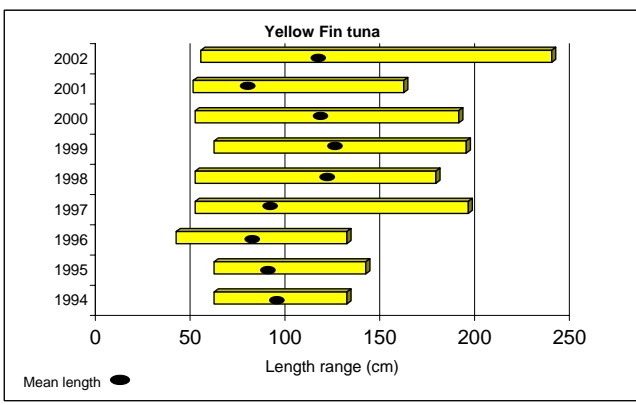


Fig 5 Length range and mean length of YFT and SKJ caught from Eastern Arabian sea

Fig 6 Length range and mean length of YFT and SKJ caught from A&N waters