

RECENT TRENDS IN THE TUNA FISHERIES OF SRI LANKA

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ABSTRACT

*The tuna fisheries in Sri Lanka are undergoing significant developmental changes, with more and more tuna fishing boats making multi-day fishing trips in offshore waters. There are now about 1200 multi-day boats and more boats of larger size (>40 ft length) continue to enter these fisheries and stay out at sea for more than 10 days; some even fish in international waters. Gillnets and longlines are used in combination, and together account for more than 95% of the total fishing effort. The total production of large pelagic fish is in the region of 75,000 t, about 55,000 t of which is from offshore areas. The continuous expansion of the offshore fishing fleet and the extended area of operation have contributed to this increase in production. The average catch rates of the tuna-fishing fleet have remained about 200 kg/boat night, with some variations between different craft-gear combinations. All species of tunas together contribute about 50% of the catch of large pelagic species. Almost 60% of the tuna catch consists of skipjack tuna (*Katsuwonus pelamis*), followed by yellowfin tuna (*Thunnus albacares*), which represents 20%. Sharks and billfish also form a significant percentage of the large pelagic catch.*

*With the issuing of permits to local and foreign fishing companies to land the tuna caught by longliners operating in international waters, few local boat owners have started longlining for tunas at the 50-100m depth range to target the deep-swimming large yellowfin (*Thunnus albacares*) and bigeye (*Thunnus obesus*) tunas. It is expected that in future more boats will diversify their fishing to target these underutilized resources.*

INTRODUCTION

Sri Lanka is one of the oldest fishing nations in the Indian Ocean, with a long history of tuna fishing. In the past fishing for tunas and other large pelagic varieties was carried out in coastal waters less than 40 km from shore, where the boats could make single-day fishing trips. Although the first efforts to develop the offshore fisheries date back to the mid-1960s, there was no significant development until the early 1980s, when the government introduced a fleet of 34-ft 11-ton boats to conduct multi-day fishing operations in offshore waters. The success of these boats paved the way for the Sri Lankan tuna-fishing fleet to venture further offshore and conduct multi-day fishing operations. The fishing fleet, which at the time consisted of about 3,000 28-30-ft 3.5-ton boats, started offshore multi-day fishing by modifying existing fishing vessels. As a result there has been a gradual shift in the fishing area exploited by the tuna-fishing fleet from coastal waters to offshore deep-sea waters. Also, the size of the fishing boats has been increasing gradually, with a present tendency of building vessels of over 50 ft for offshore fishing. Drift gillnets/longline is the predominant gear combination used by the offshore fishing fleet.

With these changes the production of tuna and other large pelagic fish in Sri Lanka increased from about 20,000 t in

1970 to 54,000 t in 1993, as estimated by the Ministry of Fisheries and Aquatic Resources. Most of this production apparently now comes from the offshore areas. The Ministry of Fisheries Statistics indicated an annual production from the offshore sector in 1986 of 3,400 t (Anon., 1986). An estimate of offshore fish production in 1994, based on the sampling programme established by the National Aquatic Resources Research and Development Agency for monitoring the large pelagic fisheries, was 55,900 t.

Another important recent development in the Sri Lanka tuna fishery is the involvement of foreign boats. The Government issued permits to 6 local and foreign companies to land the tuna caught by their longliners. These longliners were permitted to fish outside the Exclusive Economic Zone (EEZ) of Sri Lanka.

The tuna fishery and its developmental changes have been well documented in the past (Sivasubramaniam, 1965; 1985). Since 1986, the biannual meetings of the Expert Consultation on Stock Assessment of Indian Ocean Tunas have documented the tuna fisheries in the past decade (Joseph & Moyiadeen, 1986; Dayaratne & Maldeniya, 1988; Dayaratne & De Silva, 1991; Dayaratne, 1993).

Table 1. A summary of the data on offshore multi-day fishing boats collected during log book survey.

<i>Boat size</i>			<i>Boat Year of manufacture</i>			<i>Engine HP</i>			<i>No. of Net Pieces</i>			<i>Gear No. of hooks - LL</i>			<i>Troll Lines</i>	
<i>Range (ft)</i>	<i>No</i>	<i>%</i>	<i>Range</i>	<i>No</i>	<i>%</i>	<i>HP</i>	<i>No</i>	<i>%</i>	<i>Range</i>	<i>No</i>	<i>%</i>	<i>Range</i>	<i>No</i>	<i>%</i>	<i>Range</i>	<i>No</i>
28-30	01	0.8	1981-83	02	1.6	30	02	1.6	05-10	02	1.7	050-150	49	43	1-10	29
30-32	09	7.4	1983-85	02	1.6	32	04	3.2	10-15	03	2.5	150-250	26	23	10-20	12
32-34	64	52.0	1985-87	02	1.6	34	01	0.8	10-20	12	10	250-350	11	9.6	20-30	13
34-36	39	32.0	1987-89	04	3.2	36	04	3.2	20-25	13	11	350-450	12	10.5	30-40	-
36-38	05	4.0	1989-91	12	10.0	38	01	0.8	25-30	15	12.6	450-550	11	9.6	40-50	05
38-40	02	1.6	1991-93	51	41.0	39	72	57	30-35	10	8.4	550-650	01	0.9	50-75	-
40-42	-	-	1993-95	49	40.1	39-45	02	1.6	35-40	16	13.4	650-750	02	1.8	75-100	08
42-44	-	-	-	-	-	45	17	13.6	40-45	03	2.5	750-850	-	-	100-125	06
44-46	01	0.8	-	-	-	50	01	0.8	45-50	23	19.3	850-950	-	-	125-150	02
46-48	-	-	-	-	-	52	01	0.8	50-55	05	4.2	950-1000	02	1.8	150-175	-
48-50	-	-	-	-	-	56	14	11.2	55-60	09	7.6	-	-	-	175-200	10
50-52	01	0.8	-	-	-	57	01	0.8	60-65	06	-	-	-	-	200-250	02
-	-	-	-	-	-	60	01	0.8	65-70	01	0.8	-	-	-	250-500	02
-	-	-	-	-	-	65	02	1.6	70-75	01	0.8	-	-	-	-	-
-	-	-	-	-	-	74	01	0.8	-	-	-	-	-	-	-	-
-	-	-	-	-	-	86	01	0.8	-	-	-	-	-	-	-	-
Fishing Equipment (all vessels)																
SSB Radio			Sat Nav/GPS			Echosounder			Net Hauler			Line Hauler				
No. - %			No. - %			No. - %			No. - %			No. - %				
Yes: 20 - 16%			Yes: 26 - 21%			Yes: 09 - 07%			Yes: 06 - 05%			Yes: 07 - 06%				
No: 102 - 84%			No: 96 - 9%			No: 113 - 93%			No: 116 - 95%			No: 115 - 94%				

The present paper examines trends in the tuna fisheries in Sri Lanka in 1992, 1993 and 1994, with special emphasis on the fast-developing offshore fisheries for tunas.

The fishing fleet

Tuna fishing in Sri Lanka is carried out mainly by a fleet of about 2000 vessels of 28-40 ft size range. About 1200 of these vessels conduct multi-day fishing operations covering the entire EEZ of Sri Lanka, and some even fish in international waters in the Arabian Sea. Approximately 30% of these vessels are modified 3.5 t (28-32 ft) class boats, while the others are boats over 34ft constructed for multi-day fishing. About 10% of the offshore multi-day fishing boats were sampled for detailed craft/gear information during a logbook distribution programme in early 1995. A summary of the results is given in Table 1. Although more than 80% of the sampled boats are within the size range of 32-36 ft, indications are that more and more larger fishing vessels are entering the multi-day fishery, with financial assistance from development banks in Sri Lanka. The majority of the sampled boats were constructed for this fishery and are less than four years old. A considerable number of these boats have navigational equipment such as satellite navigators and single-sideband radios, but lack fishing equipment such as echosounders, net haulers, and line haulers.

The tuna-fishing companies that have been permitted to land their catch in Sri Lanka have vessels of a relatively

larger size, ranging from 15 to 26 m. One company which started fishing in mid-1992 with 5 vessels of this type has now expanded the fleet to 12 vessels (22 vessels, unofficially). The fishing activities of this company have been quite successful for the last 3 years, and about 57% of the catch is exported. Another fishing company started fishing with larger 30-m vessels in March 1994, but discontinued the fishing after a few months, for unknown reasons.

FISHING EFFORT

The fishing effort exerted by the different categories of vessels is given in Table 2. The 3.5-4 t (28-34 ft) boats contributed almost 90% of the fishing effort in 1992 and 1993. However, in 1994 an increase to 30% in the contribution of the large boats (>34 ft) was observed; this is due to the entry of more and more large boats into the offshore tuna fishery. Overall fishing effort by these boats has increased during 1992-1994. Gillnets, used alone or in combination with other gears, are the main fishing method used in the tuna fisheries, contributing more than 95% of the fishing effort (Table 3). Gillnets alone are used mostly in the Southeast and East areas, while in other areas they are used in combination with other gears. Fishing with troll lines is limited to the South and Southwest areas.

Table 2. Fishing effort of the tuna fisheries in boat nights.

Craft Type	1992		1993		1994	
	No	%	No	%	No	%
Traditional dug-out canoes (5-6 m)	5,440	1.3	8,197	1.6	1,595	0.4
FRP boats (5-6m)	1,220	0.3	1,040	0.2	1,728	0.4
28-34 ft boats (3.5-4 t)	36,956	87.1	400,255	91.9	121,906	69.2
>34 ft	47,757	11.2	26,028	5.2	28,095	30.1

Table 3. Percentage distribution of effort by different fishing gears used in tuna fisheries for 1994. GN = Gillnet; GXL = Gillnet/Longline; TROLL = Troll-line; BB = Pole and line; GXT = Gillnet/Troll-line.

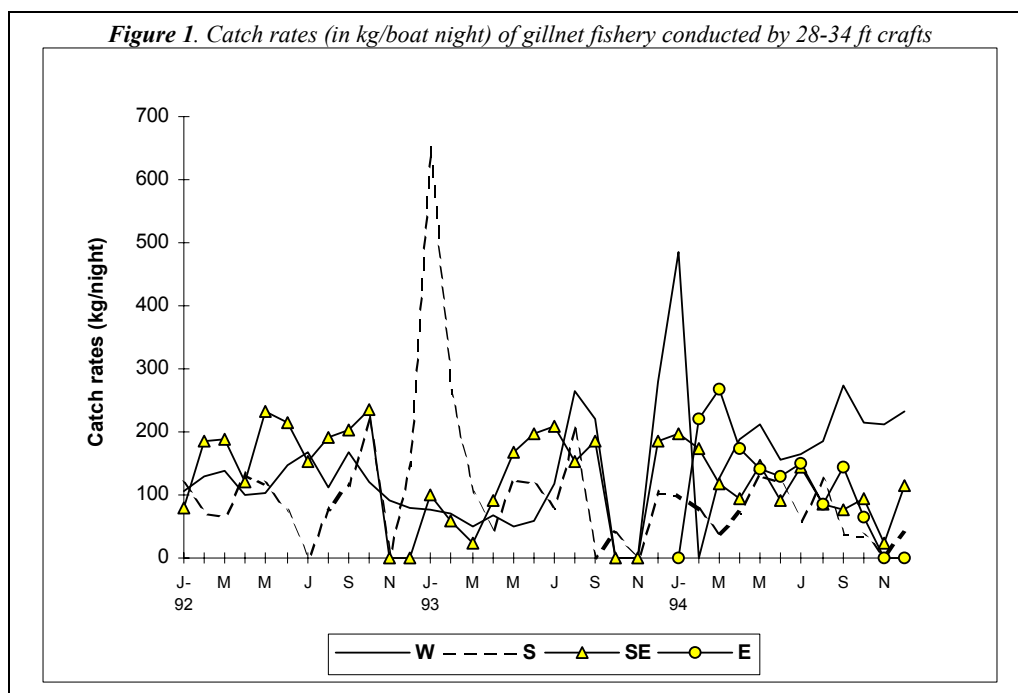
Area	W	SW	S	SE	E	NE
GN	31	9	34.4	89.9	99.3	15.6
GXL	69	31	21.4	9.5	-	62.9
TROLL	-	-	6.6	-	-	-
BB	-	-	0.2	-	-	-
GXT	-	60	33.2	-	-	-
OTHER	-	-	4.2	0.6	0.7	21.5

PRODUCTION TRENDS

The estimates of tuna production available at the Ministry of Fisheries and Aquatic Resources for the 10-year period from 1984 are given in Table 4, and estimates made by the NARA/IPTP sampling programme for the period 1988-1994 are given in Table 5. The NARA/IPTP estimates are generally higher than those of the Ministry of Fisheries. Although the NARA/IPTP programme did not cover the Northern area, the lack of oceanic fronts in that area restricts the distribution of tunas there, and hence the total annual production of tunas in Sri Lanka is probably about 40,000 t. The total production of large pelagic species is in the region of 75,000-80,000 t. The highest production of tuna came from the South, West and Southwest areas. Almost 60% of the tuna catch consists of skipjack tuna (*Katsuwonus pelamis*), followed by yellowfin tuna with 20%.

CATCH RATES

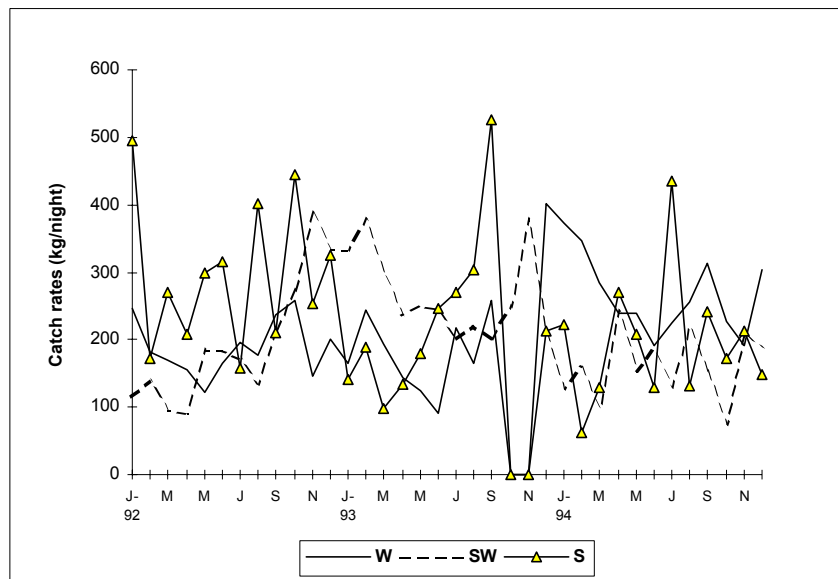
The average catch rate of the tuna-fishing fleet in Sri Lanka is about 200 kg/boat night. However, the different craft categories and gear combinations show some variation. (Figures 1, 2 and 3). Generally, gillnet fishing has low catch rates, with an average of about 145 kg/boat night for the 28-34ft craft category. However, for the same craft category, but using gillnets together with longlines, the catch rates are always high, averaging about 220 kg/boat night. The catch rates of the larger boats (> 34ft) average about 225 kg/boat night, which is no different to that of the 28-34 ft craft. The highest catch rate for this craft category was observed in the South area in 1992 (Table 6). Little seasonal variation in catch rates was observed in any area, except for gillnet fishing in the West and South areas.



TRIP DURATION

The number of boats making multi-day fishing trips continues to increase each year. Also, there is a tendency for more and more boats to stay at sea for longer periods. The number of tuna boats making single-day fishing trips operations is less than 5% in the West, Southwest and Northeast areas, and the number of such boats also continues to decrease in the South area. Only in the East area were almost 100% of the boats making one-day trips. More than 90% of the boats in the West and Southwest areas make fishing trips lasting more than 4 days. A considerable number of boats in the West (11%) and Southwest (23%) areas are staying at sea for more than 10 days (Table 7), a remarkable increase over the 1989-1991 period (Dayaratne, 1993).

Figure 2. Catch rates (in kg/boat night) of gillnet/longline fishery conducted by 28-34 ft craft.



SPECIES COMPOSITION

The percentage species composition of the catches in the tuna fishery is given in Table 8. Although the gillnet fishery targets mainly tunas, a large number of other large pelagic species are also caught incidentally. Among these are seerfishes, billfishes, and sharks. The longlines operated with gillnets target sharks, so this combination gear always catches more sharks. All species of tunas together contribute about 50% of the total catch of large pelagic fish. Among the tunas skipjack is the dominant species in all the areas, followed by yellowfin. Other tuna species such as kawakawa (*Euthynnus affinis*) and frigate tuna (*Auxis thazard*) have contributed significantly to the total tuna production during certain periods in some areas. Sharks and billfish also represent a significant percentage of the catch of large pelagic fishes in all the areas, particularly in the West, Southwest, South, and East. The percentage contribution by sharks is quite high in the West and Southwest. The catch of billfish is quite significant in the East area, forming 44% of the total catch of large pelagic fish from this area in 1994. Seerfish catch remains insignificant in all the areas.

DISCUSSION

The tuna fisheries in Sri Lanka now covers the entire EEZ, and some boats even fish in international waters in the Arabian Sea. More and more large boats with navigational equipment will continue to enter the fishery. The percentage contribution of the larger vessels (>34ft) to the fishing effort has increased from about 10% in 1992 to 24% in 1994. In this size category the trend is toward the construction of boats of over 50ft which can stay out at sea for longer periods. Although no government subsidies are

Figure 3. Catch rates (in kg/boat night) of the gillnet fishery/longline fishery conducted by craft > 34 ft.

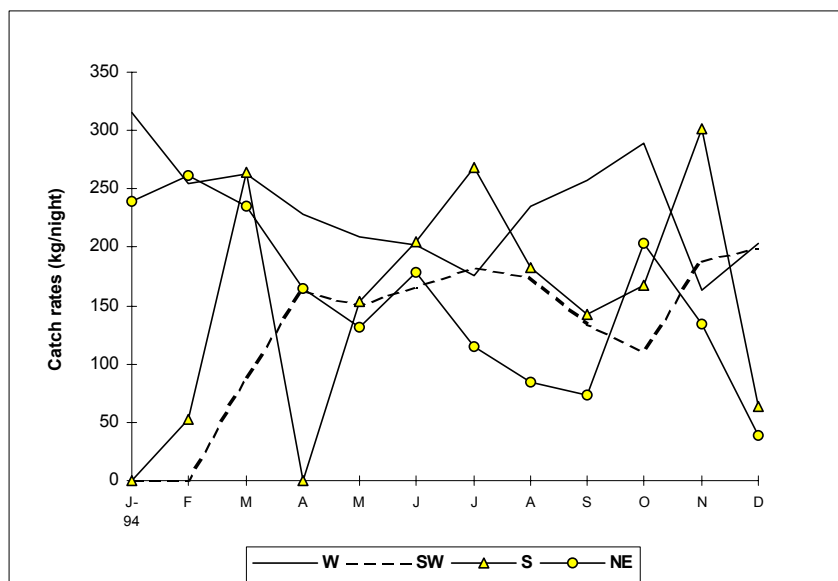


Table 4. Production of tunas and other large pelagic fish (t) in Sri Lanka.

<i>Species</i>	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Skipjack	14,195	11,805	12,118	12,463	12,896	13,398	13,597	12,237	16,690	18,359	19,316
Yellowfin	9,137	6,542	6,716	6,907	7,147	7,426	7,536	6,406	10,664	11,730	11,981
Other bolld fish	8,629	6,135	6,298	6,477	6,702	6,963	7,066	6,359	9,325	10,258	10,681
Seerfishes	3,429	3,385	3,475	3,575	3,698	3,842	3,899	3,314	3,916	3,524	3,369
Sharks	9,668	6,177	6,341	6,521	6,748	7,011	7,115	6,404	8,640	9,072	9,446
Total	45,058	34,044	34,948	35,943	37,191	38,640	39,213	34,720	49,235	52,943	54,793

* Source : Ministry of Fisheries & Aquatic Resources Development

Table 5. Estimates of production of large pelagic fishes (t) made by the NARA/IPTP sampling programme.

<i>Species</i>	1988	1989	1990	1991	1992	1993	1994
Skipjack	20,308	24,492	25,104	28,846	24,147	24,832	21,548
Yellowfin	8,604	10,133	7,903	12,116	10,300	10,706	11,101
Kawakawa	760	2,627	2,161	2,181	1,055	411	1,546
Frigate tuna	840	2,782	2,078	6,309	2,408	3,541	2,590
Bullet tuna	32	250	308	755	618	472	636
Other tunas	52	135	1,354	833	51	38	204
Total tuna	30,596	40,419	38,908	50,285	38,579	40,000	37,625
Seerfishes	287	524	968	346	256	608	471
Billfishes	5,687	4,049	6,424	7,780	6,473	11,024	13,436
Sharks	10,893	11,484	15,930	31,233	27,159	24,179	16,810
Others	4,456	2,335	3,575	4,774	5,284	4,132	6,700
Total	51,919	58,811	65,805	94,418	77,751	79,943	75,042

Table 6. Average catch rates of large pelagics in kg/boat night.

<i>Craft/Gear</i>	<i>Area</i>	1992	1993	1994
28 - 34 ft	W	121.9	125.5	222.6
Gillnet	S	113.9	172.3	115.6
	SE	149.3	137.4	113.6
	E	-	-	153.1
28 - 34 ft	W	187.8	200.3	265.8
Gillnet/	SW	193.7	266.7	161.0
Longline	S	296.0	230.2	197.1
> 34 ft	W	225.9	196.8	233.0
Gillnet/	SW	-	-	155.9
Longline	S	429.8	-	180.0
	NE	-	-	154.9

not available to many fishermen, they can obtain credit from the government's development institutions for investment in offshore fishing. Gillnet-longline combinations, with the longlines targeting sharks, are still the predominant gear in the tuna fisheries. However, a few newly-constructed offshore boats have recently started using longlines to catch large yellowfin and bigeye tunas for the export market. These operations are carried out jointly with foreign longline fishing companies in Sri Lanka.

The total production of large pelagic fish from the Sri Lankan EEZ in 1994 has been estimated at about 75,000 t. These estimates are based on data obtained through a NARA/IPTP project, in which the sampling programme was intensified on the eastern and northeastern coasts, and

are probably more accurate than those reported by the Ministry of Fisheries. The previously-reported production estimates for 1989-1993 based on the NARA/IPTP sampling programme (Dayaratne, 1993; Dayaratne & De Silva, 1990) were found to be underestimated due to a bias in the raising factor. They were corrected and are presented in this paper. These estimates indicate that the production of large pelagic species increased from about 50,000 t in 1988 to about 90,000 t in 1991, since when it has remained at 75,000 t.

In 1994, 73% (56,000 t) of the catch of large pelagic species came from offshore waters. This is a considerable increase over the 3400 t recorded in 1986 (Anonymous, 1986). The continuous expansion of the offshore fishing fleet and the extended area of operation have both

Table 7. Percentage number of tuna fishing boats operated for various trip duration in 1994.

Trip duration (days)					Sub Area					
	W	%	SW	%	S	%	E	%	NE	%
1	25	3	27	4	85	30	911	99	2	15
2 and 3	52	6	8	1	21	8	3	-	48	37
4 and 5	193	22	36	5	54	19	-	-	78	60
6 and 7	321	37	184	24	66	23	-	-	6	5
8 and 9	186	21	331	43	39	14	-	-	-	-
10 and above	95	11	176	23	18	6	-	-	-	-
Total number of boats sampled	872	-	762	-	277	-	914	-	130	-

Table 8. Percentage species composition of the Large Pelagic catch.

Species/group	1992				1993				1994					
	W	SW	S	SE	W	SW	S	SE	W	SW	S	SE	E	NE
Yellowfin tuna	18.4	13.7	11.0	12.5	25.0	7.8	10.6	13.7	28.3	9.4	12.4	21.2	4.6	29.9
Skipjack tuna	26.9	25.0	34.0	35.8	31.0	17.7	36.8	27.7	30.8	11.9	43.9	42.2	27.2	36.3
Kawakawa	0.7	1.3	1.7	0.4	1.1	13.3	0.5	40.3	3.6	2.1	1.8	0.9	1.4	-
Frigate tuna	11.1	0.1	4.4	16.0	3.2	0.0	5.6	0.7	0.7	2.2	4.8	12.6	0.2	2.4
Bullet tuna	0.1	0.1	1.1	0.2	0.4	0.0	0.9	0.2	0.6	0.6	1.8	0.1	0.7	-
Other tuna	0.0	0.1	0.0	0.6	0.1	0.1	0.0	0.0	1.2	0.0	0.1	0.2	0.1	0.2
Total Tunas	46.4	40.7	52	65.7	61.0	38.9	54.6	82.7	65.2	26.5	64.9	77.2	34.0	69.0
Seerfish	0.5	0.5	0.2	0.3	0.6	0.2	1.0	0.3	0.5	0.7	0.3	0.8	1.3	3.1
Billfish	7.5	11.3	7.8	9.0	6.2	23.3	10.3	6.3	7.6	22.4	12.7	7.7	44.0	9.9
Sharks	42.0	44.0	30.5	18.9	29.1	34.6	22.7	7.0	20.6	41.5	14.0	6.7	3.8	7.2
Other pelagics	3.4	3.2	9.0	5.8	2.6	2.9	7.2	3.6	5.9	8.8	7.9	7.4	16.8	10.7

contributed to this increase. The resumption of tuna fishing in the East and the Northeast areas in recent years also increased the overall tuna catch from Sri Lankan waters. It has also been estimated that about 2000 t of large pelagics were landed in 1993 by the foreign fishing companies permitted to land their catches in Sri Lanka (information available at the Ceylon Fisheries Cooperation ?). At least 50% of this catch, which consists mainly of yellowfin and bigeye, is exported.

The average catch rates of the tuna-fishing fleet show no apparent significant changes during the past few years. However, a slight increase in the average catch rates was observed for the gillnetting operations carried out by vessels in the 28-34 ft length category, 128 kg in 1992 to 145 kg in 1993 and 168 kg per boat night in 1994. For the same craft category, fishing with combination gear produced high catch rates of 225 kg, 232 kg, and 208 kg per boat night in 1992, 1993, and 1994, respectively. The catch rates estimated for the large boat category (>34ft) in that period are low compared to the previous period of 1989-1991. This is mainly because the number of actual fishing days has not increased with the increase in trip duration, since more time is spent reaching the fishing grounds, and the catch rates are calculated by dividing the total catch per trip by the number of days at sea. The actual catch per day's fishing is therefore higher. The seasonality of the catch rates observed in the past was not evident in the present tuna fisheries, particularly in the multi-day

fishing operations. In the past, the fishery had to depend on the seasonal migration of tunas to coastal waters, but now the fishermen are hunting for tuna schools even beyond the EEZ.

Tunas have been the major contributor to large pelagic fish production in Sri Lanka throughout history (Sivasubramaniam, 1965; Joseph *et al*, 1985; Joseph & Moiyadeen, 1987; Dayaratne & Maldeniya, 1988; Dayaratne & De Silva, 1991; Dayaratne, 1993). At present tunas constitute more than 50% of the catch, with skipjack and yellowfin contributing significantly. The estimates of the production of small tunas, particularly frigate and bullet tunas, could be underestimates, since the ringnet fishery for these species that has developed recently in the southwest and south targeting has not been adequately sampled. This is also the case with seerfishes: the sampling programme has not sampled the handline and troll-line fisheries which catch seerfishes in coastal waters, so the production of these species might be underestimated.

Although the use of combination gear increased the production of sharks and billfish, as reported by Dayaratne (1993), the proportion of sharks in the catch has fallen considerably in recent years, particularly in the West and South areas, and has remained unchanged only in the Southwest area.

More than 90% of the tuna-fishing fleet in the West, Southwest, and Northeast areas is now making multi-day fishing trips. Single-day fishing is now mostly limited to the east coast. Most of these developments started in the west and later extended to the other areas. The construction of 50-ft boats fitted with navigational and direction-finding equipment is a major activity in most of the boatyards in the west of Sri Lanka. The National Aquatic Resources Research and Development Agency (NARA) has initiated an Offshore Fisheries Resources Survey, using local multi-day fishing vessels to assist the local fishermen in diversifying from the drift gillnets presently used and to promote the use of longlines to target the underutilized deep-swimming component of the yellowfin and bigeye stocks.

The Draft National Fisheries Development Plan for 1995-2000 places more emphasis on the development of offshore fisheries, particularly the fishery for large pelagic species. It is envisaged that a total of 525 multi-day vessels for offshore fishing will be introduced within this period. Also planned is the fitting of navigational equipment such as single-sideband radios and satellite navigators to all the multi-day offshore fishing vessels. Development of infrastructure facilities such as fishing harbours, anchorages, ice-making plants, and roads is also to be carried out under the Fisheries Sector Development Project, funded by the Asian Development Bank.

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