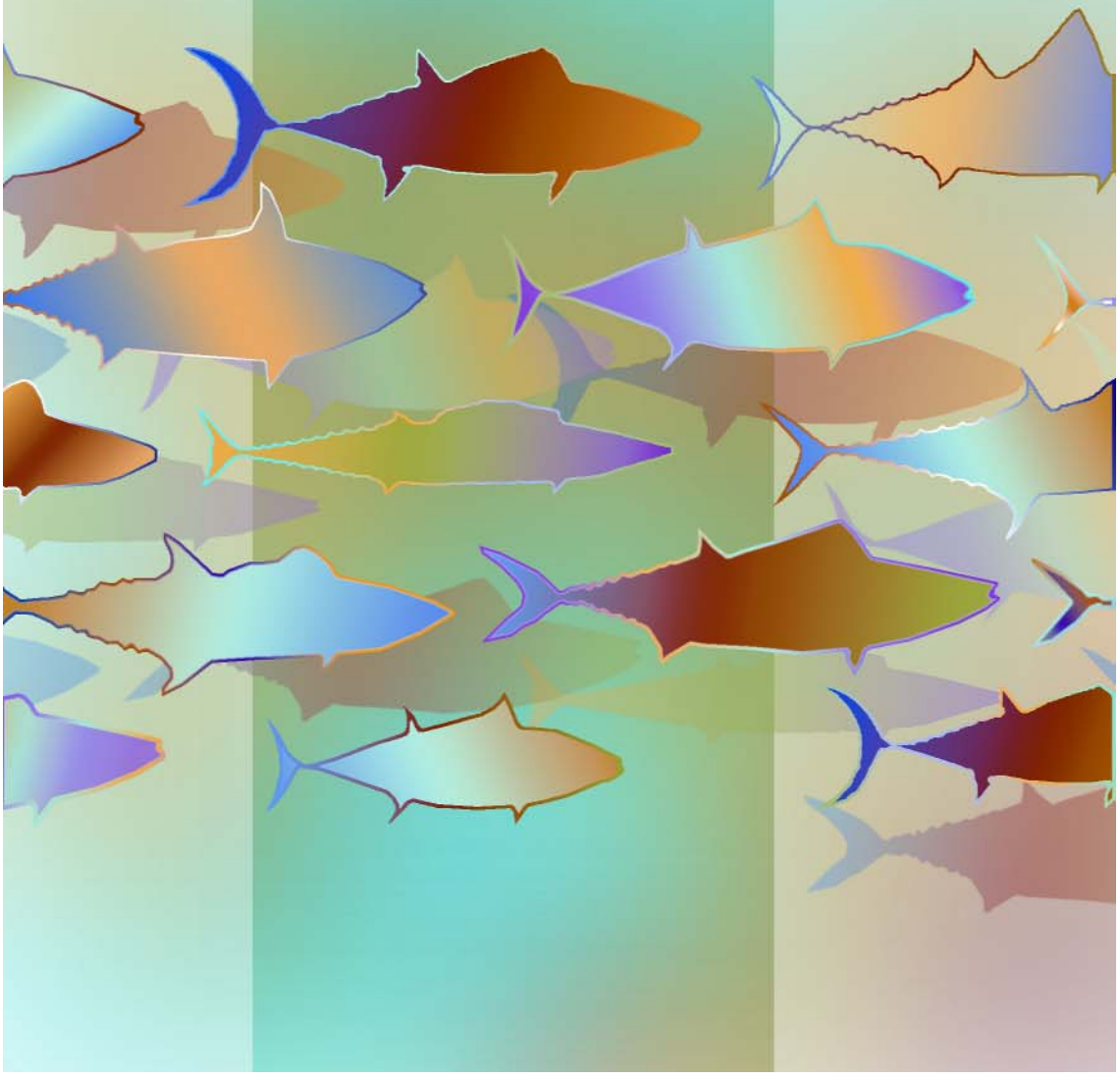
Status of Exploited Marine Fishery Resources of India



STATUS OF EXPLOITED MARINE FISHERY RESOURCES OF INDIA

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Tunas

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1. Introduction

Tunas constitute one of the economically important marine fisheries resources and during 1985-99, their production from Indian seas fluctuated between 24,287 t (1987) and 53,662 t (1992) with an annual average production of about 40,200 t forming 3.6% of the total pelagic fish production. The status of exploitation of coastal tunas occurring in the Indian seas in recent years has been dealt with elsewhere. The stock assessment of tunas occurring in the Exclusive Economic Zone (EEZ) of India has been attempted at periodic intervals. After the published studies based on data during the period 1984-88, considerable changes in the trend of production were recorded since 1989, making it imperative to carry out a re-examination of the population parameters, status of exploitation and stock assessment of tunas from the Indian seas.

The potential of marine fishery resources from the Indian EEZ has been estimated at 3.92 million tonnes and the tunas, billfishes and pelagic sharks together amount to about, 2,46,000 tonnes, which is around 6.3% of the estimated potential. The tuna fisheries in India are limited to the small-scale sector with negligible inputs from the industrial sector. During 1985-2000, the average annual production of tunas from Indian seas was around 37,000 t contributing to 3.6% of the total pelagic fish production and 1.8% of the total marine fish production. Despite the fact that there has been a noticeable increase in the landings of coastal tunas during the last three decades, the tuna stocks remain to be one of the least exploited pelagic resources from the EEZ of India. The commonly occurring tuna species in the small-scale fisheries are Euthynnus affinis (Little tuna/Kawakawa), Auxis thazard (Frigate tuna),

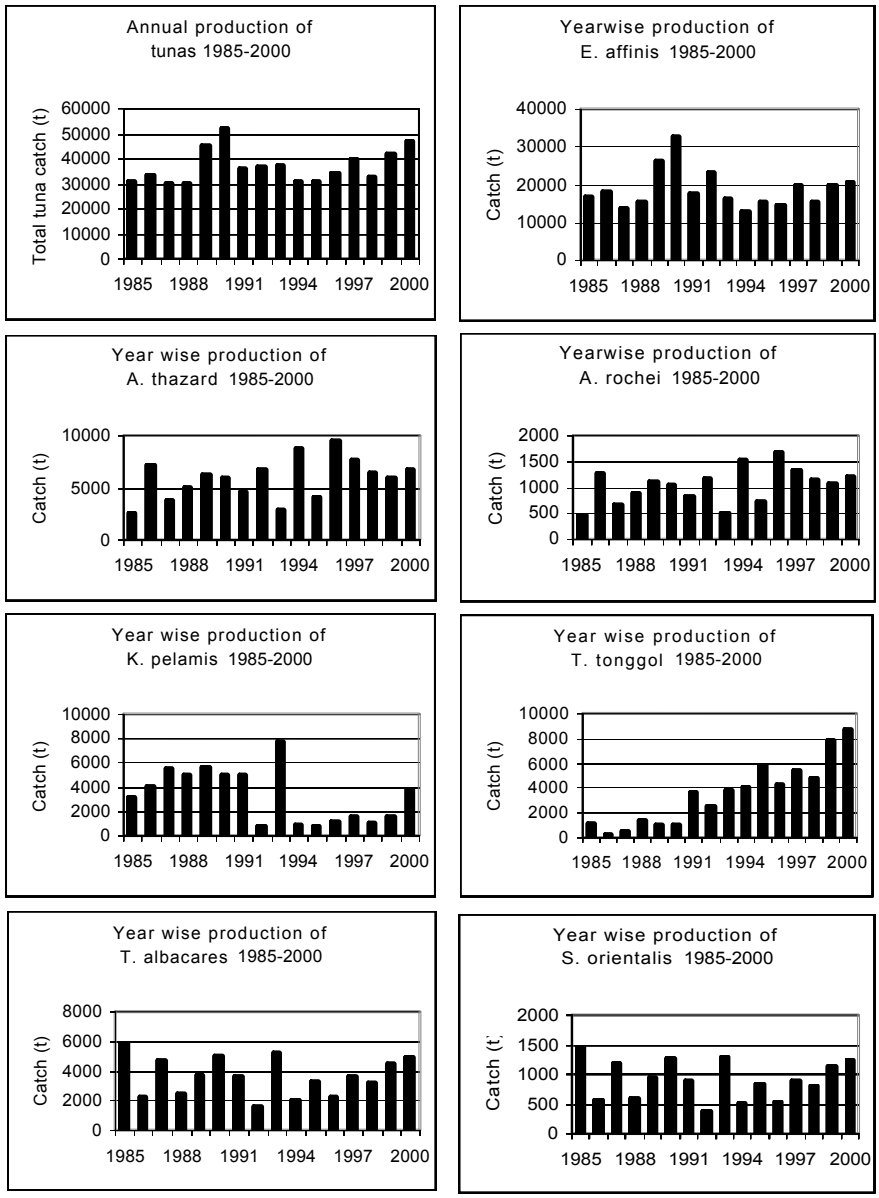

Fig. 1. Yearwise landings of tunas and the constituent species

A.rochei (Bullet tuna), Katsuwonus pelamis (Skipjack tuna), Thunnus tonggol (Longtail tuna), T.albacares (Yellowfin tuna) and Sarda orientalis (Striped bonito). The sources of information on tuna fishery and biology are those from the Central Marine Fisheries Research Institute; Exploratory survey results of Fishery Survey of India and from the commercial chartered, joint venture and leased fishing vessel operations.

2. Production trends

Regional, temporal and gearwise production

The annual production of tunas from Indian seas during 1985-2000 fluctuated between 30,285 t (1987) and 52,060 t (1990) (Fig.1). Region-wise production indicated that the northwest coast contributed (24.1%), southwest (41.2%), southeast (16.6%), northeast (1%), Andaman-Nicobar Islands (2.5%) and Lakshadweep (14.8%) of the total tuna landings. State wise production indicated that among the maritime states Kerala contributed 36% of the total landings, followed by Gujarat (18.1%), Tamil Nadu (11.6%), Maharashtra (5.9%), Karnataka (5.3%), Andhra Pradesh (4.4%), Goa (2.2%) and the rest by the Andaman-Nicobar and Lakshadweep islands.

The overall seasonal pattern of tuna fishery indicated that the pre-monsoon and monsoon seasons are the productive periods along the southwest coast of India and the post-monsoon period along Maharashtra and Gujarat coasts, thereby indicating a seasonal shift in their concentration. Along the east coast, the fourth quarter of the year yielded the maximum tuna catch. The productive periods for tunas in Lakshadweep and Andaman-Nicobar islands were December-February and March-August respectively.

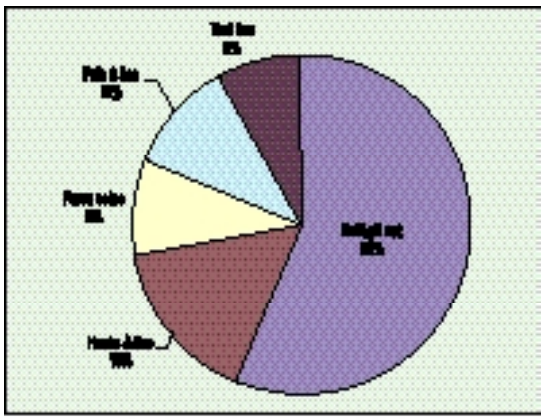

Fig. 2. Gearwise landings of tunas

The major gears employed in the tuna fishery are drift gill nets, hooks & lines, purse seines, pole & lines and troll lines. Long line gear is employed in the fishery for yellowfin and bigeye tunas in the oceanic waters. Drift gill nets contributed 56%, hooks & line (16%), pole & line (11%), purse seine (9%) and troll line (8%) as shown in the Figure 2.

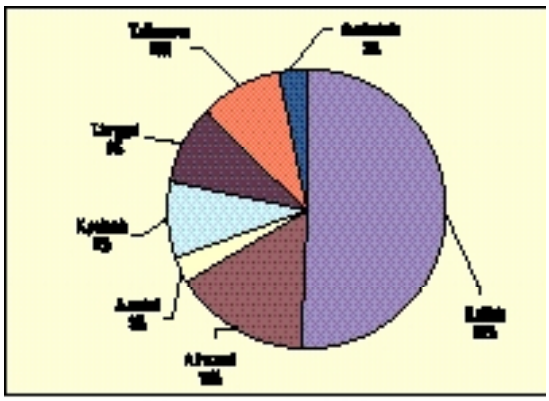

Fig. 3. Species composition of tunas

Species composition

The species (Fig. 3) which contributed to the tuna fishery

were Euthynnus affinis (51%) (Fig.4), Auxis thazard (16%), A.rochei (3%), Katsuwonus pelamis (9%), Thunnus tonggol (9%), T.albacares (10%) (Fig.5) and Sarda orientalis (3%). E.affinis and A.thazard constituted the major species along both the coasts whereas T.tonggol and T.albacares along the northwest coast.

Fig. 4. Euthynnus affins

Fig. 5. Thunnus albacares

The yearwise landings of major species of tunas are given in Figure 1. The ranges in the catch, average annual catch and percentage contribution to the total annual tuna landing of different species are given in Table 1.

Table 1. The range in the catch, average annual catch, percentage contribution to the total annual tuna landings of different species

Species	Range in the catch (t)	Average annual catch (t)	Range of % contribution to the annual tuna catch	Average % contribution
E. affinis	12890-32820	18708	42.0-64.0	50.6
A. thazard	2615-9470	5900	7.6-28.4	15.9
A. rochei	460-1670	1041	1.3-5.0	2.8
K. pelamis	795-7760	3312	2.3-20.6	9.0
T. tonggol	245-8700	3491	0.7-18.8	9.4
T. albacares	1560-5820	3643	4.2-18.6	9.8
S. orientalis	390-1450	911	1.1-4.7	2.5

The species of tunas caught vary in different gears (Table 2). The drift gill net is operated all along the Indian coast, the purse seine along the southwest and the hooks and line off Vizhinjam. The pole and line, and troll line are operated in Lakshadweep Islands.

Table 2. General trend of gearwise species composition (%) of different tuna species

Gear	species						
	E.affinis	A.thazard	A.rochei	T.tonggol	T.albacares	K.pelamis	S.orientalis
Drift gill net	43	19	6	12	10	4	6
Hooks & line	21	8	66	-	2	2	1
Purse seine	45	32	16	5	2	-	-
Pole & Line	-	-	-	-	12	88	-
Troll Line	-	-	-	-	60	40	-

Length composition

The size range of E.affinis in the fishery was 10-78 cm, A.thazard 16-52 cm, A.rochei 15-34cm, T.tonggol 30-100 cm, T.albacares 50-150 cm and K.pelamis 35-80 cm. The major length groups that supported the fishery were 30-56 am, 34-42 cm, 22-26 cm, 60-88 cm, 46-108 cm and 48-60 cm respectively.

All the major gears employed in the tuna fishery except the purse seines are selective ands hence the variation in the average length of the different species of tunas exploited over a period of times is only marginal. Though the purse seines exploited the surface schools, the size ranges of the two major species taken by this gear viz. E.affinis and A.thazard are comparable to those taken by drift gill nets.

Oceanic tuna resources

Tunas of the oceanic region largely remain under-exploited in the Indian EEZ. The Fishery Survey of India has been undertaking survey programmes to study the spatial distribution and abundance of these highly migratory groups in the Indian EEZ and equatorial waters by long lining since 1983. Among the resources identified, the yellowfin tuna constituted the major species in all the regions. Bigeye tuna was dominant in the equatorial region, while skipjack tuna was abundant in the northwestern region. The southwest sector registered the highest average hooking rate (3.1%) for yellowfin tuna. The aggregate hooking rate from Andaman and Nicobar, southeast and equatorial sectors was about 2%. The commercial exploitation of tunas by the chartered vessels under the joint venture programme in the Indian EEZ was at its peak in 1990 when 12,571 t of oceanic tunas comprising 83% of yellowfin tuna were harvested. Average annual exploitation by these vessels was 5,180 t. Presently the production of Indian owned joint venture and leased vessels is in the range of 315 t to 5,768 t with and average of 1,246 t per annum indicating an urgent need to build up oceanic tuna fishing fleet.

Tuna live-baits

The total catch of baitfishes from pole and line fishing areas of Lakshadweep is estimated to be 125 tonnes. At Minicoy, the average annual catch is 9 t and at Agatti 51 t. Data from other bait fishing areas such as Suheli, Valiyapaniyam and

Cheriapaniam are virtually non-existent. The major live-baits exploited include the sprats, apogonids, caesionids, artherinids and pomacentrids.

Utilization of the tuna landings

On an average about 74% of the total tuna landed are iced and marketed fresh for consumption. About 10% of the landings are utilized for masmin production; 9% are frozen, chilled and exported chiefly to the Gulf countries; 4% utilized for canning and 3% are salt dried for interior market.

3. Biology

Spawning

The size at first maturity of E.affinis has been estimated as 43-44 cm; that for A.thazard 30 cm; A.rochei 23cm and K.pelamis 44-45cm. The spawning periods of different species vary considerably. However, it can be generally stated that E.affinis spawns during the pre-monsoon (April to May) and post-monsoon (October-November) periods; A.thazard mainly during August-November; and A.rochei during August-October. A spawning peak for skipjack tuna has been noted during January to April although the species spawns almost throughout the year in Lakshadweep. The spawning seasons of yellowfin tuna were during January-May, November-April and December-June in different oceanic sectors of the Indian EEZ.

Recruitment

The recruitment of the following species (Table 3) in the Indian seas was found to be in different pulses of unequal strengths.

Table 3. Recruitment pattern of different species of tunas

E. affinis	March and June
A. thazard	April and August
A. rochei	February and June
T. tonggol	April and June
K. pelamis	May-June & September-October

Food

Tunas are carnivores and the major food items include crustaceans (larvae, juveniles and adults especially of shrimp and crabs), cephalopods (juveniles and adults), eggs, larvae and juveniles of fishes, whitebaits and other small pelagics.

Growth and lifespan in the fishery

The estimates of length (cm) attained at different ages by the major species of tunas are given in Table 4.

Table 4. Estimated length (cm) attained by different species of tunas in different years

Species	1st year	2nd year	3rd year	4th year	5th year	6th year
E. affinis	31.4	46.6	57.1	64.4	69.5	-
A. thazard	29.2	42.2	50.3	55.0	-	-
A. rochei	16.7	25.8	30.9	33.6	35.2	-
T. tonggol	42.3	61.9	74.0	81.3	85.9	-
K. pelamis	36.7	57.3	69.0	77.7	-	-
T. albacares	51.3	84.4	105.6	119.3	128.1	133.8

The dominant age groups exploited in the commercial fishery for E.affinis are 2nd to 3rd year, A.thazard 2nd to 3rd year, A.rochei 2nd year, T.tonggol 3rd to 5th year, T.albacares 1st to 3rd year and K.pelamis 2nd to 3rd year.

4. Stock assessment

Based on the population parameters and stock estimates, the coastal tunas have been found to be exploited at or above the optimum levels. Along the coastal waters the exploitation rate of E.affinis vary in different states (Kerala 0.86; Karnataka 0.86; Gujarat 0.77 and Tamil Nadu 0.75) whereas the optimum exploitation rate of E.affinis was estimated at 0.4 only. This indicates that the exploitation of this species in the current fishing grounds is relatively high. The exploitation rates of A.thazard, T.tonggol and T.albacares were 0.72, 0.35 and 0.81 respectively whereas the optimum exploitation rates were at 0.40, 0.42 and 0.37 indicating that there is further scope for increasing the exploitation of T.tonggol while the other species are exploited relatively at high rates in recent years in the coastal waters.

However, the stock estimates made on tunas have several limitations. Except for the pole and line fishing at Lakshadweep, there is no aimed fishery for tunas in the coastal seas along the main land. The gears in which tunas caught are not operated exclusively for tunas. The highly migratory and straddling nature of tunas and the occurrence of multiple fisheries which are seasonal and very short at different localities makes it difficult to arrive at realistic conclusions on their stock positions. Hence any decline in the catch rate with time and size cannot be attributed unambiguously to fishing pressure as opposed to migration.

The operational range of fishing for coastal tunas has been constantly increasing in recent years with the proliferation of motorization and consequently the earlier estimates of maximum sustainable yields of different species have to be updated. With regard to oceanic tunas the stock estimates are made based on fishes caught from Lakshadweep, which constitute skipjack and juveniles of yellowfin tuna. These stock estimates have to be taken only as indicative with relevance to the segment of population from which the sampling was made. Reliable fishery data from the whole range of distribution of different species is the prerequisite for more precise and comprehensive sock estimates.

5. Management

Introduction of improved varieties of gears and mechanization/motorization have enabled fishermen to enhance the area of tuna fishing. This has resulted in the enhanced exploitation of bullet tuna (A.rochei) from the southwest coast and longtail tuna (T.tonggol) and young yellowfin tuna (T.albacares) along the northwest coast. Similar strategy may be adopted along the other parts of the Indian coast.

Diversification of the crafts and gears

(1) Mechanized vessels for drift gill netting in traditional and offshore grounds, (2) deployment of idling deep sea shrimp trawlers for monofilament tuna long lining, (3) initiation of commercial purse seining in the EEZ of India and contiguous high seas for skipjack and yellowfin tunas (successful purse seine seasons were demarcated in the Lakshadweep as November-May and in the Andaman Sea as March to May), and (4) upgradation of the pole and line tuna fishing operation in Lakshadweep from the small-scale level to that of an industry by increasing the size of the boat and providing with chilling and storage facilities require priority attention.

The existing resource database has to be strengthened by improving the system of data collection through enhancing the sampling coverage for obtaining realistic picture on the stock structure of tunas. The production models employed in the stock assessment of tunas may be critically evaluated and suitably modified. In view of the migratory nature of tunas, the application of the 'system' approach and 'simulation' to estimate stock structure is recommended for the management of the fishery. Tagging experiments for studying the migration of skipjack and yellowfin tunas may be initiated in the Indian EEZ in collaboration with neighbouring countries and international agencies.

Available environmental data needs to be analyzed and correlated with the commercial tuna fishery data to derive at conclusion on the fishery and biological issues. The real time application of the imageries derived from OCEANSAT for locating tuna concentration may be developed and user interaction programme for educating the fishermen on the usefulness of satellite data implemented.

The availability and abundance of tuna live-baits in space and time in the Andaman-Nicobar and Lakshadweep Islands have to be explored for developing and expanding pole and line tuna fishery.

In order to reduce the scouting time for locating tuna shoals by the fishermen, feasibility studies on the installation of cheaper and long lasting FADs may be conducted.

Presenlty, the knowledge on the availability and abundance of oceanic tunas in the Indian EEZ is based on the results of exploratory surveys conducted by the FSI, CIFNET and the commercial fishing operations under chartered and joint venture programmes. Although indicative data has been generated on these aspects, a comprehensive picture on the areas and seasons of abundance of tunas is urgently

needed for viable commercial tuna fishing operations. In view of this the economic viability of tuna fishing may be assessed and established in the different regions of the Indian EEZ by simulated commercial fishing operations.

Shortage of trained manpower in the operation of purse seines and long lines is one of the major constraints for the development of tuna fishery in India. Development of suitable manpower for such fishing operations has to be given priority consideration. Development of value added products from tunas might be taken up on a priority basis for the domestic and international markets.

6. Suggested reading

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