Tuna Resources of the Indian Seas - An Overview

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As a part of the national policy for the judicious exploitation of the living resources of the Exclusive Economic Zone (EEZ) of India, greater emphasis is to be given for the development of tuna fisheries, both in the artisanal sector and high seas. Tuna is one of the least exploited resources of the Indian seas, accounting for hardly 1.62% of the total marine fish catch in India at the 1980 level although there has been an appreciable increase in the landings of coastal species of tunas during the last 15 years. At present, the fishery is mostly supported by coastal species such as *Euthynnus affinis, Auxis thazard, A. rochei, Sarda orientalis* and *Thunnus tonggol*. The skipjack tuna *Katsuwonus pelamis* supports a surface fishery in the Lakshadweep, and in 1980 about 1760 t of this species was landed there in the pole and line (live-bait) fishery. Availability of live baits has been instrumental for the fluctuation in tuna catch in this area. A detailed analysis of the zone-wise landings of tunas along the Indian coast and in the Lakshadweep Sea is presented for 1965–1981, indicating the changing pattern and trend of the fishery. Information on the exploitation of the major tuna resources of the EEZ of India by the long-liners of Japan, Taiwan and Republic of Korea during the late 1970's is also presented. In order to comprehend the pattern of production of tunas and bill-fishes by the non-Indian Ocean countries (longline operation), Indian Ocean rim countries and oceanic islands in the Indian Ocean area, an analysis of the quantum of exploitation of these fishes during 1980 has been made and the results presented. Possible management for the development of tuna fisheries by India are also suggested and discussed.

Despite the fact that the past two decades have witnessed the augmentation of the indigenous production of coastal species of tunas and tuna-like fishes in the small scale fishery sector through mechanisation and increasing effort through drift gill-netting, pole and line (live-bait) fishing and purse seining, tuna remains to be one of the least exploited scombroid resources of Indian seas, and in 1981 it formed only 1.3% of the total marine fish landings in India. Tuna fishery is currently limited to the small scale sector, and except in the Lakshadweep Islands there is no organised fishery for tunas in vogue in our country. In India, no serious attempt has hitherto been made to exploit the tuna resources of the EEZ and contiguous high seas beyond the inshore shelf waters. Resource information collected during the past, clearly indicate the availability of the coastal and oceanic species of tunas and allied fishes in the EEZ of India, and at present these resources are exploited by the long-liners of Japan, Taiwan and Republic of Korea. The exploitation of tuna resources has received high priority in the fishery development programmes of many developing countries and in India also there is a growing interest for tapping these resources as a measure of diversification of the fishing effort. Further, the mechanisation of the exploitation of the fishery resources is gradually setting in this country and this require information on the areas and seasons of abundance of tuna resources in order to plan judicious exploitation of the stocks by economic employment of effort.

Recent trend in the tuna fishery in India has been documented by Silas *et al.* (1979) and Silas & Pillai (1982). The present overview is aimed at updating the information on the current status of tuna fishery in India and to focus attention on the potentialities for the development of the fishery for tuna resources in the seas around India. The Central Marine Fisheries Research Institute, furnishes the production figures of various species of marine fishes based on multi-stage stratified random sampling technique after classifying important groups of fishes. Basic data used in the preparation of this review was collected from the publications of the Institute on the trends in marine fish production in India during the past years (CMFRI, (1980, 1981, 1982).

Species of tunas and bill fishes in the Indian seas

The taxonomy and distribution of tunas, tuna-like fishes and billfishes of the Indian Ocean have been dealt with in detail by Silas & Pillai (1982). The common species of tunas and billfishes occurring in the Indian seas are:

Euthynnus affinis (Cantor)	Kawakawa
Auxis thazard (Lacepede)	Frigate tuna
A. rochei (Risso)	Bullet tuna

Sarda orientalis (Themminck & Schlegel)	Bonito
Thunnus tonggol (Bleeker)	Longtail tuna
Katsuwonus pelamis (Linnaeus)	Skipjack tuna
Thunnus albacares (Bonnaterre)	Yellowfin tuna
T. obesus (Lowe)	Bigeye tuna
Tetrapturus audax (Philippi)	Striped marlin
Makaira indica (Cuvier)	Black marlin
Istiophorus platypterus (Shaw & Nodder)	Sailfish

Of these species, skipjack tuna (*K. pelamis*) constitute more than 75% of the tuna catch in the Lakshadweep Islands. In the mainland of India, *E. affinis* contribute to more than 65% of the total tuna catch followed by frigate and bullet tunas (*Auxis thazard* and *A. rochei*). *S. orientalis* (Bonito) forms a seasonal minor fishery along the south-west coast of India. Among the billfishes, the sailfish (*I. platypterus*) commonly occurs in the coastal waters.

Fishing gear and craft

Common fishing gear and craft used at present for tuna fishing at different maritime states are listed in Table 1. In the mainland of India, drift gillnets catch majority of tunas. In the Lakshadweep Islands, pole and line (live-bait) fishing method is chiefly employed for catching skipjack tuna.

Annual all India production

The trend in the all India tuna production during 1965–1981 as estimated by the Central Marine Fisheries Research Institute is presented in Fig. 1. Average all India tuna catch for the 17 years period was 10,126 t. A progressive trend in the tuna catch was recorded from 1966 (3,063 t) which reached a peak value of 19,322t in 1976. After a decline in 1977 and 1978, tuna landing increased in the country and recorded an all time peak catch of 26,595t in 1979. The total annual landings indicated a downward trend during 1980, and in 1981 the total tuna and billfish landings in India was around 18,400 t of which *E. affinis* constituted 63.3%, *K. pelamis* 9.8%, *T. tonggol* 0.5%, other tuna-like fishes 23.7% and billfishes 3.2%.

The percentage contribution of total tunas in the all India marine fish production ranged from 0.3% in 1970 to 1.92% in 1979 (Fig. 1.) In 1981, tunas constituted 2.4% of the total landings of pelagic fishes.

Tuna landings in the west and east coasts of India

Production of tunas and billfishes from the west and east coasts of India and from the Lakshadweep Islands and Andaman-Nicobar Islands during the years 1965–1981 is shown as percentage of total annual production in Fig. 2. It can be seen that the average annual production of these fishes from the west coast alone accounted for about 67% of the total catch of tunas in the country, which is mainly contributed by the fishery of the Kerala State. Average tuna landing in the east coast during this period was 2,092 t, forming 21% of the all India average marine production and Tamil Nadu was responsible for about 78% of the tunas in this region.

State-wise production

State-wise distribution of the tuna landings for the period 1965-1981 is presented in Fig 1. Average annual State-wise production of tunas during this period indicates that the State of Kerala alone accounted for 51.2% of the total tuna catch in the country, followed by Tamil Nadu (17.8%), Maharashtra (6.5%) and Gujarat (3.1%). In the other maritime States, tuna catches were not significant. There was no tuna landing in the State of West Bengal. 11% of the total tuna landings of the country was contributed by the Lakshadweep Islands.

The percentage composition of tunas in the total marine fish landings in different States during 1980 and 1981 indicates that in the Lakshadewep Islands they constituted 60.5% and 67.8% respectively of the total marine fish production during these years. In all the other maritime states their contribution to the total state-wise marine fish production was uniformly less than 5% in recent years (Fig.3).

The percentage contribution of tunas in the total landings of pelagic groups of fishes in different States during 1981 indicates that they constitute 83.4% of the total pelagic fish produced in the Lakshadweep Islands. Except in Tamil Nadu, Kerala, Karnataka and Andaman and Nicobar Islands, they formed less than 2% of the total State-wise pelagic fish production in 1981 (Table 1).

An analysis has been made to assess the contribution of tunas to the scombroid landings of different States during the years 1976–1980. It would be seen that in the Lakshadweep Islands, tunas contributed to more than 94% of the production of scombroid fishes. In Kerala, Tamil Nadu, Maharashtra, Gujarat and Andaman and Nicobar Islands the contribution of tunas in the total scombroid landings fluctuated between 7–38% in these years (Fig. 4).

The state-wise production of tunas by mechanised and non-mechanised craft by the operation of indigenous gear during 1981 indicates that except in Pondicherry, Karnataka and Gujarat States, in all other maritime states in the country more than 50% of the production of tunas was by non-mechanised craft operating chiefly drift gillnets, hooks and lines, pole and lines and troll

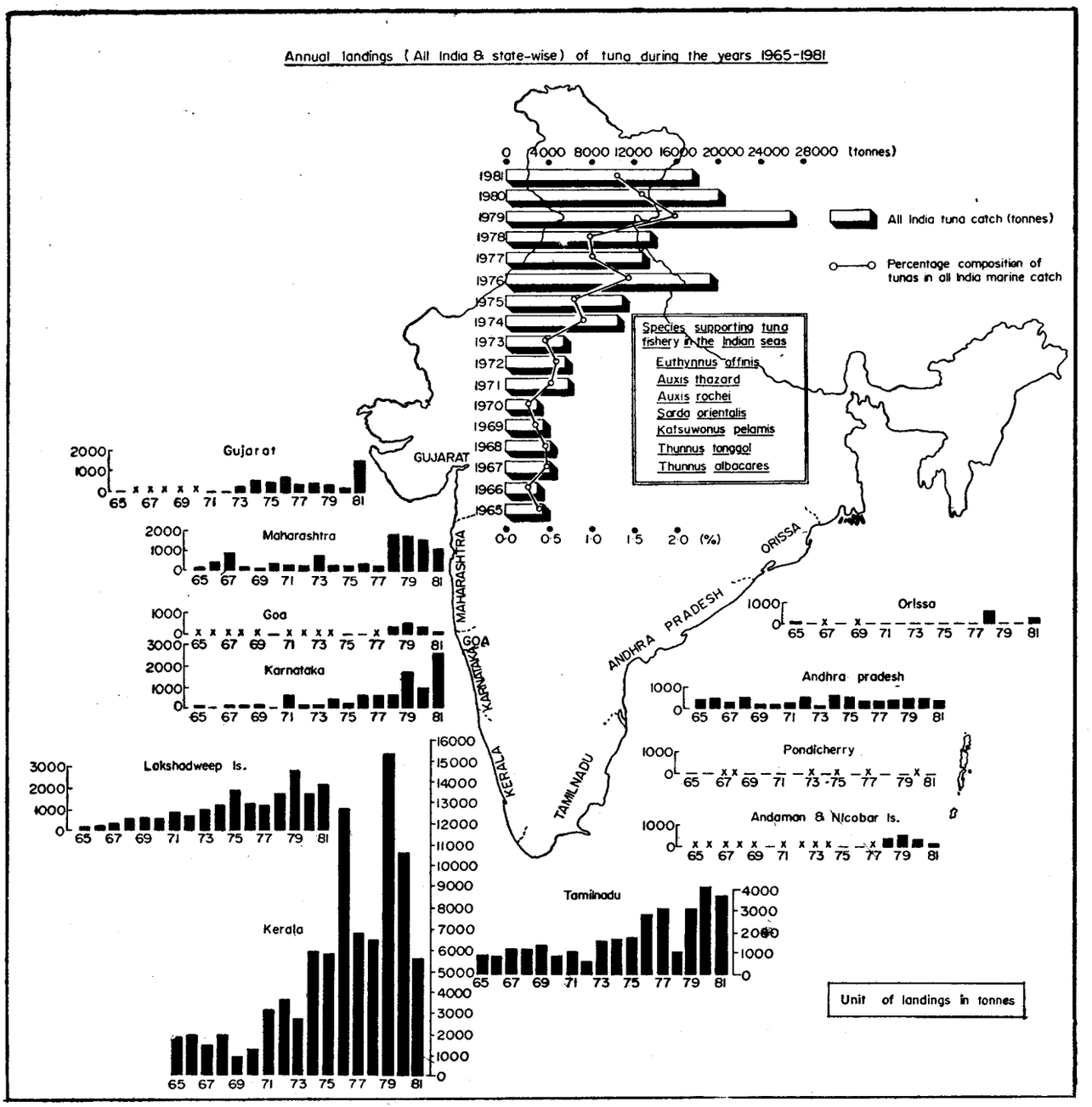

Fig. 1. Annual all India and state-wise landings of tunas during 1965–1981. Percentage composition of tunas in all India marine fish production during these years are also indicated.

lines. In Kerala and Karnataka purse seiners also landed tunas, and their contribution to the total state-wise catch of tunas were 4% and 91% respectively in these States.

The average annual catch of tunas during 1965–1981 and the trend of tuna fishery in different States are summarised below:

Orissa

The average annual catch of tunas in the State of Orissa during 1965–1981 was about 94 t, and in 1981 it formed 1.5% of the total production of pelagic fishes in the State. *E. affinis* contributed about 41% of the total tuna catch. Hooks and lines and drift gillnets were the major gears which landed tunas in this State.

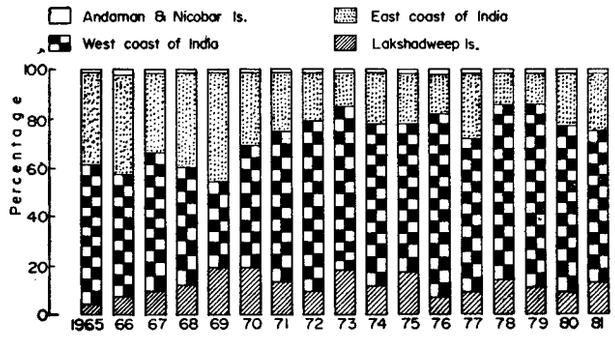

Fig. 2. Production of tunas from the west and east coasts of India, Lakshadweep Islands and Andaman Nicobar Islands in percentage of annual all India tuna landings, 1965–1981.

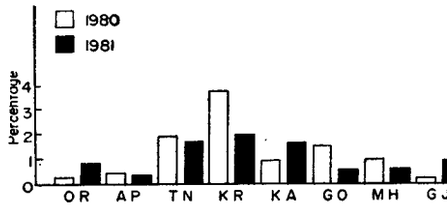

Fig. 3. State-wise percentage composition of tu fish production during 1980 and 1981.

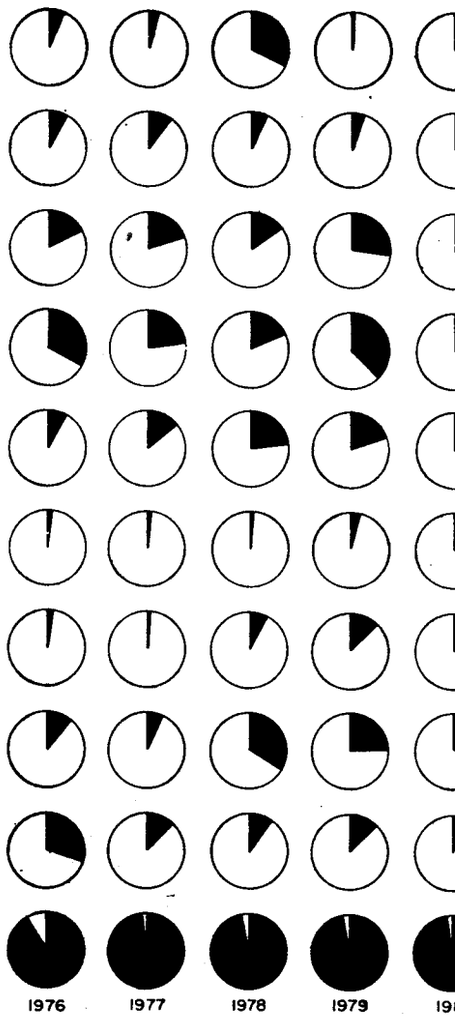

Fig. 4. State-wise percentage composition of t *tion)* in the total scombroid fish lan States, 1976–1980.

Andhra Pradesh

Tuna catch did not evince much fluctuation in Andhra Pradesh since 1974, and the average landings during 1965–1981 was 367t. *E. affinis* contributed 56% of the total tuna catch, which was about 1.1% of the total pelagic fish landed in the State during 1981. Drift gillnets and hooks and lines were responsible for the production of major share of tunas in the State.

Tamil Nadu

Tamil Nadu contributes more than 75% of the total tuna production from the east coast of India, and the average annual production of tunas in the State during 1965–1981 was 1799 t. There was a gradual increase in the tuna landings since 1973, and in 1981 it constituted 4.2% of the total pelagic fish catch in the State. 80% of the tunas landed was constituted by *E. affinis* followed by frigate and bullet tunas. Drift gillnet formed the major gear which landed tunas in the State followed by hooks and lines.

Kerala

The State of Kerala has been responsible for more than 70% of the total tuna production from the west coast of the country. Average annual landings of tunas in this State during 1965–1981 was 5,178t. Catches were relatively high since 1974, and a peak landing of 15,390t of tunas was recorded in 1979. During 1980 and 1981 tuna landings declined considerably in this State, and this was reflected in the total all India tuna production during these years also.

An indepth analysis of the data on the effort and catch in the tuna fishery during 1979–1981 has been made to assess the magnitude of declining trend in tuna production in the State in recent years, and the results presented in Fig. 5. Total effort (number of units) expended was more or less steady during these years, but the total catch and CPUE were observed to have declined since 1979. Month-wise data on the total tuna landing in the State during 1979–1981 i all these years the trend of tuna landing the same, with peak catches during Apr However, month-wise tuna landing in K

Table 1. *Production of tunas and billfishes during* 1981 *and the common craft and gear employed for tuna fishing*

	Total pelagic fishes (t)	Tuna and billfishes: Total catch (t)	Tuna and billfishes: % in pelagic fish catch	Tuna and billfishes: Catch by mechanised vessels %	Tuna and billfishes: Catch by non-mechanised vessels %	Craft	Gear
Orissa	16,528	251	1.5	4	96	Plank built boats; catamarans†; mechanised boats (Pablo type)	Hooks and lines; drift gill-nets; mesh-size 70–130 mm
Andhra Pradesh	63,663	542	0.9	2	98	Catamarans†; plank built boats; mechanised boats (Pablo type)	Drift gill-nets mesh size 70–130 mm hooks and lines
Tamil Nadu	95,609	3,968	4.2	15	85	Mechanised boats (Pablo type); catamarans†; dugout canoes, mechanised boats (Pablo) 'Tuticorin' type boats	Drift gill-nets; mesh size 90–140 mm; hooks and lines; troll lines
Pondicherry	6,421	72	1.1	64	36	Mechanised boats (Pablo type) dugout canoes; catamarans†	Hooks and lines; drift gill-nets, mesh size 90–140 mm
Kerala	203,431	5,638	2.8	30	70	*Mechanised boats (14.5 m); mechanised boats (Pablo type); dugout canoes; catamaran†	*Purse seines (400–600 x 40–60 m); drift gill-nets mesh size 90–130 mm; hooks and lines; shore seines
Karnataka	118,545	2,520	2.1	95	5	Mechanised boats (14.5 m), mechanised boats (Pablo type); dugout canoes	Purse-seines (400–600 x 40 x 60 m); drift gill-nets, mesh size 65–135 mm; hooks and lines
Goa	18,261	193	1.0	47	53	Mechanised boats (14.5 m), mechanised boats (Pablo type); dugout canoes	Purse seins (600 x 55 m); drift gillnets
Maharashtra	126,782	1,320	1.0	94	6	Mechanised boats (small); country craft with OB engine	Drift gill-nets, mesh size 90–130 mm
Gujarat	99,548	1,600	1.6	94	6	Mechanised boats (small); plank built boats and canoes	Drift gill-nets, mesh size 90–130 mm; hooks and lines
Lakshadweep	2,701	2,253	83.4	47	53	Special type mechanised boats (7.93 & 9.14 m); with bait tank; non-mechanised boats (12.5 m)	Pole and line, 3–4 m long; 35–40 mm at the bottom and 20–35 mm at the top; polythene line; barbless hook with lead coating; troll lines
Andaman & Nicobar Islands	1,263	42	3.3	—	—	—	—

† Kettumaram–Editor; * At Cochin 1980 onwards

a declining trend in 1981 when compared to that during the previous two years.

Zone-wise analysis of the catch and effort data during 1979–1981 indicate that about 70% of the total tuna landings in the State was contributed by the coastal fishery along the Trivandrum District and major portion of the rest by the fishery along the Quilon and Ernakulam Districts. A drastic decline in the total tuna landings at various landing centres in Trivandrum District was noted from 1979 (11,937 t) to 1981 (3845 t), although the total effort expended was around 1000 units in these years. A similar declining trend was noted in the Quilon District also where the total production of tunas decreased from 1881 t (1979) to 288 t (1981) without a concomitant reduction in fishing effort in these years. In the absence of information on the migratory pattern of tunas in our waters, no decisive conclusion could be made on the causative factors, for the declining trend in tuna catch in these years.

Karnataka

Tuna catch recorded a steady increase since 1975 and the average catch during the period 1965–1981 was 517 t. In 1981, tunas constituted about 2.1 % of the total pelagic fish production in the State. *E. affinis* formed about 91% of the total tuna catch in recent years. Purse-seines landed about 90 % of tunas in the State followed by drift gillnets and other gears.

Goa

Tuna production had been relatively high during 1978–1980, and in 1981 about 200 t. were landed which constituted about 1.0% of the total pelagic fish catch in Goa. *E. affinis* contributed to 60% of the total tuna catch. Drift gill-netters and purse-seiners were responsible for the production of tunas in the State.

Maharashtra

Annual average landing of tunas in the State during 1965–1981 was 660 tonnes. Tuna landings were relatively high since 1978, and in 1981 about 1,320 t. were landed, chiefly by drift gillnets in the State. Total tuna production was about 1.0% of the total pelagic fish produced in the State during 1981. *E. affinis* formed about 20% and other tuna-like fishes the rest of the total tuna catch.

Gujarat

Regular landing of tunas was recorded in the State of Gujarat since 1973 and the catch increased from 277 t. in 1980 to 1,600 t. in 1981. Average annual production of tunas in the State during 1965-1981 was 331 t. 80% of the total tuna catch was constituted by *E. affinis* and 5% by *T. tonggol.* Drift gill-nets and hooks and lines were responsible for tuna landings in the State.

Lakshadweep Islands

An average catch of 1,123 t. of tunas were recorded in the Lakshadweep Islands during 1965–1981. Tunas

KERALA STATE

District-wise tuna landing and effort

Effort (x 1000 units)			Catch (tonnes)			
1979	1980	1981	1979	1980	1981	
143	87	213	2	2	–	Cannanore
125	128	145	14	2	67	Calicut
92	77	80	9	–	–	Malapuram
161	103	162	4	–	63	Trichur
188	183	141	1496	1430	1242	Ernakulam
254	189	133	47	145	—	Alleppey
414	474	391	1881	930	288	Quilon
1210	1047	945	11937	8102	3845	Trivandrum

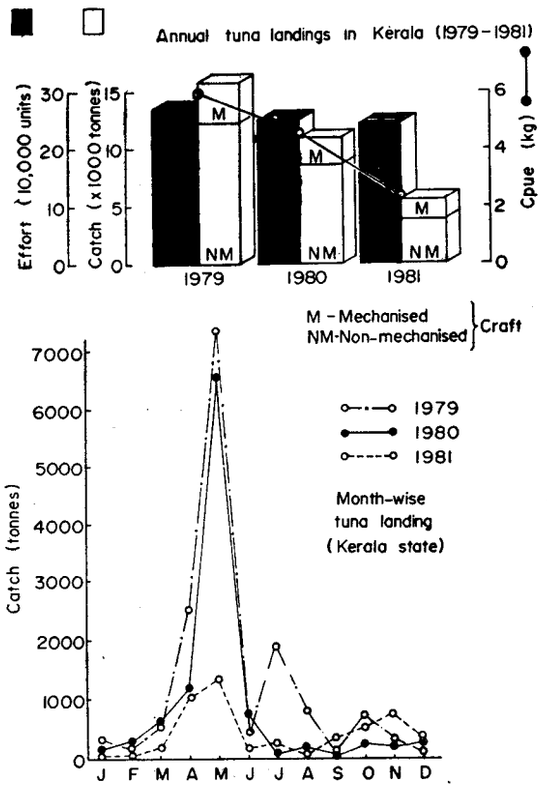

Fig. 5. Trend of tuna landings in the State of Kerala during 1979, 1980 and 1981. District-wise catch (tonnes) and effort expended (number of units) during 1979–1981 are also indicated.

contributed 83.4% of the total pelagic fishes produced in the Islands in 1981. Skipjack tuna constituted 77.4%, yellowfin tuna (young fishes) 20.8% and *E. affinis* and frigate tuna 1.8% of the total tuna catch. Pole and line (live-bait) fishery and surface trolling were responsible for the landing of tunas from around these Islands.

Andaman and Nicobar Islands

Regular landing of tunas was observed since 1978, and in 1981 the total tuna landing in these Islands was 55t. forming 3.3% of the total pelagic fish produced. Average catch of tunas during the period 1965–1981 was 20 t.

Seasonal pattern of tuna fishery

Data on the seasonal pattern of distribution of tuna landings during the period 1976–1980 has been analysed and results presented in Fig. 6. Average quarterly landing of tunas at all India level indicate that the two quarters of April to June and October to December are more productive for tuna fishery when compared to the other months. However, as an average of 66% of the landings of tunas occur along the west coast of India, the seasonal pattern of distribution of tuna landings at all India level is chiefly a reflection of the fishery pattern along the west coast.

Average coast-wise quarterly production of tunas during 1976-1980 indicates that it is relatively high during the months of April-May along the west coast of India and during July-September along the east coast. It would be seen that this pattern is the reflection of the production of tunas in Kerala and Tamil Nadu respectively.

Average quarterly production of tunas during 1976–1980 is presented in Fig. 6. It would be seen that the bulk of the landings of tunas were during January to March in the Lakshadweep Islands. Productive period for the tuna fishery was observed to be during April to June for the State of Kerala, July to September for Tamil Nadu and October to December for Orissa, Andhra Pradesh, Pondicherry, Karnataka, Goa, Maharashtra, Gujarat and Andaman and Nicobar Islands.

Discussion

As stated earlier, tuna is one of the least exploited resources of scombroid fishes in the Indian seas and the fishery at present is limited to the small-scale sector in this country. According to FAO, the present day exploitation of the resources of shelf-oriented species in the Indian Ocean amounts to 46,000 t. The tuna fishery by the countries bordering the Indian Ocean shows that this resource is very much underexploited. Species-wise production of coastal and oceanic species of tunas by (i) the non-Indian Ocean countries (ii) Indian Ocean rim countries and (iii) oceanic islands in the Indian Ocean

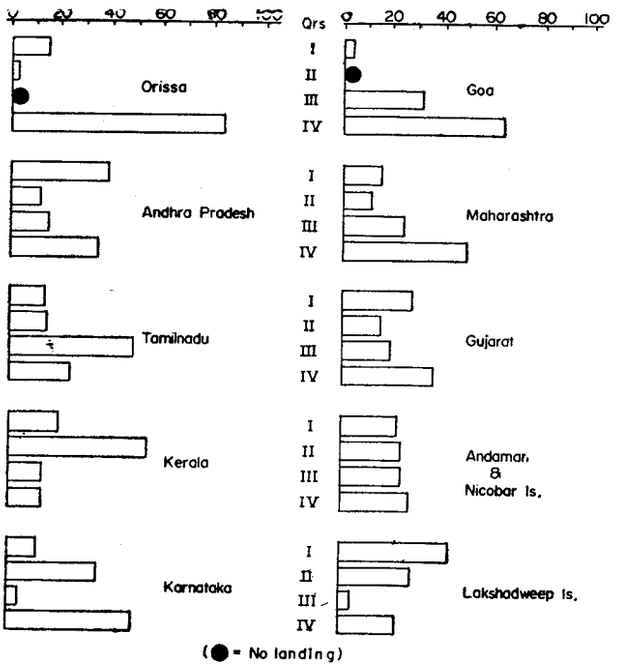

Fig. 6. Average seasonal (quarterly) distribution of tuna landings during 1976–1980.

area during 1980 (FAO, 1982) is presented in Fig. 7. It would be seen that hardly 33% of the tuna landings from the Indian Ocean was contributed by the coastal States.

With the declaration of the EEZ, India has added about 2 million km² of the sea area under her jurisdiction. Available information indicate that the tuna resources of the EEZ of India have been exploited by the long-liners of Japan, Taiwan and Republic of Korea, and between 1975 and 1977 there has been a major input by the Taiwanese in this fishery and about 200 tonnes of major species of tunas have been taken from the EEZ of India in 1977. The average long-line eatch for the period 1972 to 1977 indicate that the major species taken from this area are the yellowfin tuna (42%), bigeye tuna (24%) and striped marlin (19%) (Silas & Pillai, 1982).

Estimates have shown that *E. affinis, A. thazard, T. tonggol* and *K. pelamis* of the Indian seas are underexploited and there is considerable scope for increasing the production of these species from Indian seas (Silas *et al.*, 1976). The long range migratory nature of oceanic species of tunas and the fact that commercial operations by the distant water fleets of other countries are in vogue and considerable amount of data indicative of the nature, occurrence and abundance of different species are encouraging points for a positive decision for our immediate entry into tuna fishery.

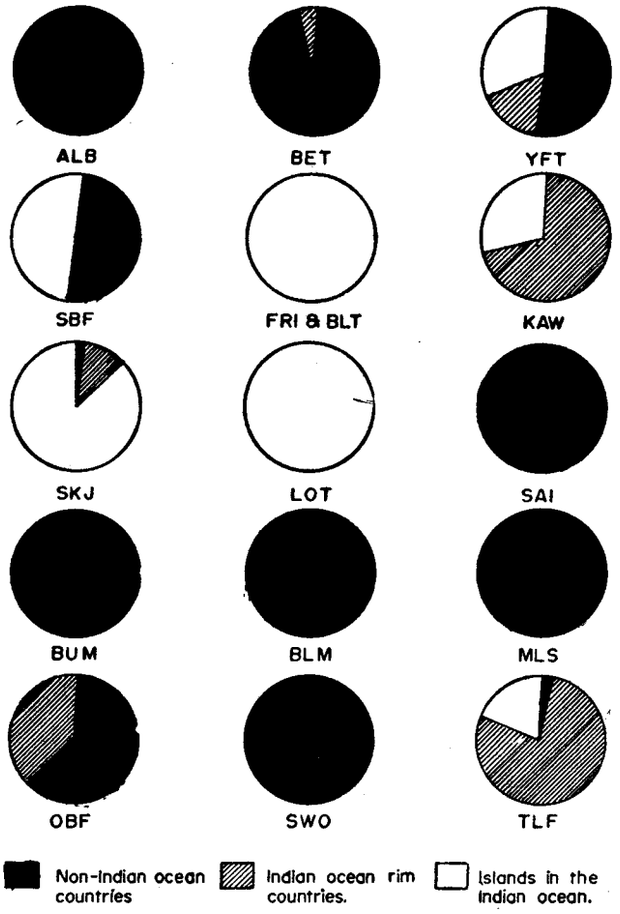

Fig. 7. Trend of production of different species of tunas and billfishes by (i) non-Indian Ocean countries (longline operation),(ii)Indian Ocean rim countries, and (iii) islands in the Indian Ocean during 1980.
(ALB-Albacore; BET-Bigeye tuna; YFT-Yellowfin tuna; SBF-Southern bluefin tuna; FRI & BLT-Frigate and bullet tunas; KAW-Kawakawa; SKJ-Skipjack tuna; LOT-Longtail tuna; SAI-Sailfish; BUM-Blue marlin; BLM-Black marlin; MLS-Striped marlin; OBF-Other billfishes; SWO-Sword fish; TLF-Tuna-like fishes)

George *et al.* (1977) computed the potential exploitable yield of tunas and allied fishes from different sea regions (0–200 m area) of the mainland of India and from around the oceanic islands within the EEZ of India as follows:

Area	Potential exploitable yield, t	Current yield (1981 landings) t
West coast of India	70,000	11,271
East coast of India	20,000	4,833
Lakshadweep Islands	50,000	2,253
Andaman and Nicobar Islands	100,000	42
Total	240,000	18,399

No attempt has been made in this report to assess the potential tuna resources from the EEZ of India. However, it is felt that by encouraging further developments of the artisanal fishery using drift gillnets and pole and line, and by the development of purse-seining for the surface species such as skipjack and long-lining mainly deep long-lining mainly for tunas and billfishes from our EEZ and contiguous seas, the commercial production of coastal and oceanic tunas in 1990 could be increased to the level of 115,000 t as against the total production of about 18,000 t of the present.

Currently existing constraints facing tuna fishery and industry are manyfold. Apart from the fact that tuna fishery at present is restricted to the small scale sector, a proper internal marketing system has not been developed in the country. Possibilities of export potential for the 'red meat tunas' is yet to be explored. Further the entrepreneur should be fully educated as to the problems and advantages of venturing into tuna fishery since it is capital intensive and involve expertise both in fishing operations and fishing fleet management.

The cardinal requirement in tuna fishery development programme in India should be the development of small scale fishery sector through improvements of craft and gear combined with an active programme of post-harvest technology and marketing of tuna within the country and for exports. Intensified fishing programmes will be necessary in the south-east and south-west coasts of India, Wadge Bank area, Lakshadweep Sea and Andaman Sea. Evaluation of the use of anchored rafts as tuna aggregating devices should be made particularly with regard to effects on long-term abundance of tunas. Fish aggregating devices should be tried in the deeper neritic waters along the mainland and in the Lakshadweep and Andaman Seas, which would enable efficient harvesting of tunas congregating under them. Employment of mechanised fishing vessels with chilling and storing facilities and with greater operational range to fish around insular regions should be encouraged. Adequate supply of suitable bait fishes are essential for any viable large scale pole and line fishery. Lack of bait or irregularities in supply are major problems limiting the development of sizeable skipjack fishery in our waters. In order to develop the tuna pole and line (live-bait) fishery, large scale culture of live-baits should receive priority.

The prime step in the development of high sea tuna fishery by India would be to utilise the technological capacity of vessels, equipment and expertise of the developed nations through joint venture/chartering arrangements. A crash training programme of personnel on the operational techniques of large purse seiners as well as deep long-lining will be necessary. Further, efforts should be made to develop the operational facility for surface tuna fishing and intensified effort should be concentrated in areas such as the Andaman Sea and Lakshadweep Sea, which hold high potential for surface species of tunas.

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