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Dr. P. S. B. R. JAMES

Director

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Edited by

Dr. P. P. PILLAI

Shri A. A. JAYAPRAKASH

Dr. N. GOPALAKRISHNA PILLAI

Central Marine Fisheries Research Institute

COCHIN - 682 014

Cover Layout : Shri A. A. Jayaprakash

TUNA RESOURCES AND FISHERY IN THE INDIAN EEZ - AN UPDATE

P.S.B.R. JAMES and P.P. PILLAI
Central Marine Fisheries Research Institute, Cochin-31.

INTROUCTION

The scenario of tuna fishery in the Indian EEZ in recent years show that it is still limited to the small scale fishery sector with little inputs from the industrial sector. The results obtained till date from the surveys carried out by the Government of India vessels (FSI and CIFNET) in the EEZ beyond the traditional fishing grounds, the industrial longline operations of foreign fleets in the Indian EEZ and contiguous high seas, the rapid increasing rate of skipjack and yellowfin tuna production in the traditional sectors of the neighbouring insular states such as Maldives and Sri Lanka and the fast pace of growth, expansion and production in the tuna purse seine fishery of foreign fleets of France, Spain, Panama and Ivory Coast in the tropical Western Indian Ocean area - all these have indicated tuna resource availability and rich tuna fishing grounds in our EEZ and contiguous high seas. For more than a decade, the Central Marine Fisheries Research Institute has made earnest efforts to collate and disseminate the fishery dependent and fishery independent factors connected with tuna fishery, and urged in several platforms the necessity of immediate actions from the part of Government and Industry to modernise and expand the small scale sector and venture into high sea tuna fishery through charter arrangements/joint venture programmes, instead of waiting for indigenous development of vessels and expertise and cent percent data/information on the tuna resources of our EEZ. In several seminars and symposia and also in the International Meetings (FAO/IPTP) conducted recently, the fishery potential of tunas and related fishes in the oceanic sectors has been discussed, synthesised and strategies and policy plans for development of tuna fishery in India drawn. Despite its nature as one of the thrust areas of development of fishery in the Indian EEZ, the momentum towards it was in a slow pace, and the valuable and rich resources of skipjack and yellowfin tunas in our waters remain to be tapped commercially. However, the chartered vessel operations, which commenced from 1985, have landed about 855 tonnes of tunas and billfishes from the Indian EEZ during 1988.

The results of studies on the status of tuna fishery in the Indian EEZ are synthesised, and strategies/options open for the development and management of tuna fishery in the Indian EEZ.

REVIEW OF TUNA FISHERY

Presently, the tuna fishing activity in the Indian EEZ comprise of:-

(i) Fishing operations by small scale mechanised and non-mechanised vessels inside the 50 m depth zone all along the coast line of the mainland of India; (ii) Artisanal pole and line and trolling operations conducted in the vicinity of the oceanic islands of Lakshadweep; (iii) Operations by the oceanic survey/training vessels of the Government of India landing about 180 tonnes of tunas annually and (iv) Operation of the commercial longline owned by the private industry, and longline operations of the foreign vessels in the Indian EEZ under charter agreement which may be taking about 800-1200 tonnes of oceanic tunas (Sudarsan et al.,1988).

Small Scale Sector

Both mechanised and non-mechanised crafts are engaged in the exploitation of tunas in the mainland and operate multi-species gears such as the drift gill nets, purse seines and hooks and lines. The number of non-mechanised units such as the dugout canoes, plankbuilt boats and catamarans in 1983 amounted to 1,35,000 and about 20,000 mechanised boats were in operation in 1984. In Lakshadweep, mechanised boats (25' - 30') used for pole and line (live-bait) tuna fishing fishing number about 163 followed by those used for surface trolling which amount to 68 in recent years. Details of crafts and gears engaged in tuna fishery in the small scale sector have been described earlier by Silas and Pillai (1986 a, c).

Oceanic Sector

In the oceanic waters, large scale/commercial exploitation of tunas is yet to commence. Two longliners, Matsyasugandhi (OAL 31.5 m, GRT 245.8) and M.V. Prashikshani (OAL 34 m, GRT 211.99) conducted intensive surveys in the Arabian Sea up to lat. 16°N and preliminary surveys in the equatorial region and Bay of Bengal including Andaman Sea. The longliner-cum-purse seiner Matsyaharini (OAL 32.5 m, GRT 257.95) did intensive tuna exploration off the east coast

of India between latitudes 10°N and 17°N. As of 1988, 8 longliners (200-800GT) were operating in the Indian EEZ under charter arrangements.

PRODUCTION TRENDS

Small scale sector along the coastal waters of the mainland and around insular region.

The production trend in tuna fishery has recently been dealt with in detail by Silas and Pillai (1986 a, c), James and Pillai (1987 and James and Jayaprakash (1988) the average catch of tunas during 1983-88 amounted to 27,695 tonnes, the production reached an all time peak of 35,600 tonnes in 1986 and declined to 31,700 tonnes in 1987 (Figs. 1 and 2).

Average state-wise production of tunas for the years 1986-87 indicate that Kerala ranked first contributing to 42% of the total all India tuna catch followed by Karnataka (19%), Lakshadweep (14%), Tamilnadu (7%), Maharashtra (6%) and Gujarat (5%). As per recent estimates, the mechanised units landed about 52% of the total tuna catch on the west coast of India, whereas the non-mechanised units were responsible for about 73% of the catch from the east coast.

Tunas are occasionally caught in the coastal purse seiners (11.5-13.5 m OAL, 110 HP) which operate along the coasts of Kerala (60 units), Karnataka (405 units), Goa (80 units) and Maharashtra (40 units). Catch of tunas, effort expened and catch rate in the purse seine fishery during the period 1985-87 is given in Table 1. The incidental catch of tunas in the purse seine gear operations during 1987 was very poor.

Annual average contribution to the tuna fishery during 1983-87 by the west coast amounted to 69%, east coast 14%, Lakshadweep 15% and Andaman & Nicobar islands 2%. The SW and SE regions of the mainland contributed to the bulk of the tuna catch, but the landing from the NE region evinced a steady increased (Fig. 3) from 1981 onwards.

Seasonal pattern of distribution of tuna catch indicates that maximum productive season for tunas along the Kerala and Karnataka coasts is the pre-

monsoon-monsoon period, whereas in the Maharashtra-Gujarat coasts it is during the post-monsoon period indicating a seasonal shift in the concentration of tunas along the west coast of India. Such change in seasonal concentration was not observed along the east coast of India.

The catch rate (C/E) of tunas at the monitoring centres of CMFRI during 1987-88, as given in Table 2, indicate that the drift gillnetters, purse seiners, hooks and line units, pole and line and troll line units contributed to 40%, 11% 16% and 33% respectively during 1987-88 to the total tuna catch. C/E of drift gillnetters ranged from 8.7 to 121.0 Kg, purse seiners realised a catch rate of 22 to 805 Kg and that of hooks and line units 25 to 31 Kg. C/E in the pole and line fishery during the same period averaged to 313 Kg and that in the troll line fishery 14.0 Kg.

As an average, little tunny (Euthynnus affinis) contributed to 52% of the total catch, followed by frigate tunas (20%), skipjack tuna (16%), longtail tuna (2%) and other small tunas and billfishes (10%) (Table-3).

Recent studies by Silas and Pillai (1986 a, b and c), James and Pillai (1987), Varghese (1987), James et al. (1988 a, b), Pillai and Gopakumar (1988) Pillai et al. (1988) have dealt with the status of tuna fishery in Lakshadweep, and identified major constraints in further development and expansion of pole and line tuna fishery. Presently, mechanised boats of 2 sizes, viz. 7.9 m and 9.1 m OAL (10-40 HP) are employed for bait-fishing and tuna fishing, and non-mechanised boats of 3-5 m OAL are used for troll line fishery. Total catch of tunas by these gears in Lakshadweep during the period 1978-88 are presented in Table 4. During the period, the total tuna production fluctuated between 1769 tones and 6528 tonnes with an average catch of about 3410 tonnes of which skipjack tuna constituted about 86%, young yellowfin tuna 11% and tuna like - fishes 3% of the total catch (Fig. 2).

Average annual island-wise landing of tunas during 1978-88 period is presented in Table 4. Assuming this figures are indicative of the trend of production of tunas in Lakshadweep in recent years, it is estimated that tunas constitute about 85% of total marnie fish catch in this area and about 41% of the tuna production was from Agatti Island and neighbouring area.

In 1988, a total of about 5860 tonnes of tunas were landed in Lakshadweep

by the operation of 163 pole and line units and 68 troll line units. Island-wise tuna production indicates that Agatti and nearby Bangaram, Perumul Par areas contributed the bulk of the tuna catch (48%) followed by Minicoy (18%), Suheli Pars (10%), Bitra (7%) and the rest of other islands. In the pole and line fishery, skipjack tuna dominated the catch (75%) followed by yellowfin tuna (12%). In the troll line fishery, yellowfin constituted about 60% of the total catch followed by skipjack tuna (30%).

Silas et al. (1986 a, b), James and Pillai (1987 a), James et al. (1987), (1988), and Varghese (1988) discussed the status of exploited resources of tunas and their stock and potential at Minicoy and Agatti islands. It was observed that in recent years variation in the tuna catch, effort expended and catch rate are regular phenomena in these islands. Catch rate (C/E) recorded an increase since 1984-85 period to recent years (1987-88) at Minicoy, whereas at Agatti Island the catch rate evinced a steady decline. The stock structure analyses by the above authors (average standing stock, total annual stock, rate of exploitation and MSY and fMSY estimates) indicate that skipjack tuna is exploited below the level of MSY, and there is considerable scope for tapping the resource of this species from Lakshadweep area.

Operations by Survey/Training Vessels

Longlining:

Results of tuna longline surveys in the Indian EEZ for different periods from 1983 to 1988 have been discussed by various authors (Joseph, 1986; Silas and Pillai, 1986a, b; Sulochanan et al., 1986; Sivaprakasam and Patil, 1986; Swaminath et al., 1986; Joseph and John, 1986; James and Pillai, 1991; James and Jayaprakash, 1988; John et al., 1988; Sudarsan and Somavanshi,, 1988; Sudarsan et al., 1988a,b). The aggregate survey coverage of the three vessels viz., Matsyasugandhi, M.V. Prashikshani (longliners) and Matsyaharini (longliner-cum-purse seiner) extended north of equator upto lat. 16°N, between long. 67°E and 95°E (Sudarsan et al., 1988a). Altogether 8.3 lakhs hooks were operated during the five year period covering all seasons, and the fishing effort (number of hooks operated) by these vessels were at the rate of 43%, 37% and 20% respectively of the total during the five years' coverage.

The average hooking rate of yellowfin tuna (Thunnus albacares) during

the surveys was 2.62%. Among the three vessels, M.V. Prashikshani obtained 3.24% Matsyasugandhi 2.87% and Matsyaharini 0.9%. Average of hooking rates for yellowfin tuna recorded in the Indian Exclusive Economic Zone and contiguous areas are shown in Fig. 4. A high productive zone was identified between lat. 12°N - 16°N and long. 69°E - 74°E. Highest average hooking rates of 11.3% to 11.9% were obtained from the area 14° - 72°, 14° - 73° and 15° - 72° sectors and also off Tamilnadu Coast (Sudarsan et al., 1988a).

Seasonality in the hooking rates indicated that they evinced major seasonal fluctuations. High catch rates were obtained from the Arabian Sea from lat. 10° - 15°N; long. 65° - 70°E during September to November and May. In the adjacent area near the west coast, the productive season was found to extend from August to May, with peak HR (above 5%) during November to April. In the Bay of Bengal, however, the productive period was found to extend from January to April, with highest hooking rate of 2.1% obtained during January. Gafa (1986) reported the mean catch rate of yellowfin tuna taken by longline boats (100 GRT) in the Southern Andaman Sea as HR 1.4%, and observed that productive months were March-July period.

Purse seining:

Purse seining by fishery survey of India vessels in deeper waters (up to 200 m depth) on the east and west coasts have indicated good fishing grounds for little tunny and frigate tunas, the former dominated in the catches from lat. 12°, 13°, 15° and 21°N. According to Sudarsan and Somavanshi (1988), from the upper east coast the skipjack and yellowfin tunas could be pursed by tracking their schools/aggregations.

Operations by Industrial longline vessels of foreign countries

The hooking rate of yellowfin tuna realised by Japanese and Taiwanese longline fishery (1984) and Korean longline fishery (1980), and the quarterly average catch rate in terms of HR(%) of this species by the above fleets (IPTP, 1987; 1988) indicate that maximum production of yellowfin tuna was centred in the area 10° - 20°N and 70° - 95° E, which was also identified by the Indian longline vessels as productive yellowfin ground (Fig. 5).

DISCUSSION

With the declaration of Exclusive Economic Zone (EEZ) in 1977, an urgency and responsibility have crept into assess about the living resources of our seas to plan development programmes to judiciously exploit and utilize the resources.

Despite significant strides made by different coutries in the Indian Ocean in the exploitation of the scombroid fish stocks from their EEZs, tunas and billfishes remain as the least exploited resource of the Indian EEZ. Tuna fishery in India is limited to small scale sector with only marginal inputs from the industry. One critical factor which has a significant way in the development of tuna fishery in the Indian EEZ is the "resource availability". We have obsessions with pre-investment surveys and pre-feasibility studies, and seek a foolproof data base before venturing in high sea tuna fishery which is capital intensive and involving risk element. The summary of information presented earlier in this paper does indicate that information on resource is not a lacuna. It is time opportune to consider the options open, and procure the type of vessels, facilities an expertise that may be needed for developing industrial tuna fishery in the Indian EEZ through joint venture/chartering arrangements.

Estimating potential stocks, and assigning production targets and improving them with appropriate management measures are major requirements in planning tuna fishery development in the Indian EEZ. The estimated potential of tunas in Indian EEZ is 500,000 - 800,000 tonnes, and it is conservatively estimated that about 250,000 tones could be exploited by augmentation of inputs and expansion of the tuna fishery. George et al. (1977) estimated a potential yield of 2,40,000 tonnes of tunas from the EEZ of India. Silas and Pillai (1982, 1986c) opined that by encouraging further developments in the artisanal sectors, and by developing oceanic purse seining and longlining the production of coastal and oceanic tunas from the Indian EEZ could be enhanced to a sustainable level of 1,15,000 tonnes. James et al. (1987) observed that the rich resources of yellow-fin tuna, begeye tuna, oceanic skipjack, sailfish, marlins and oceanic sharks could profitably be exploited by the introduction of longlining and purse seining on commercial scale, and the total oceanic fish potential of these groups in the Indian EEZ is around 50,000 tonnes. Other estimates are those by Yesaki (1988) on potential yields of coastal (small) tunas as between 65,950 and 94,240 tonnes from the continental shelf areas of the west and east coasts of India and Anaman

and Nicobar Islands and Lakshadweep Island, and by Chidambaram (1987) on the potential stock of 1,00,000 tonnes of tunas from the Andaman and Nicobar Islands and 90,000 tonnes from the Lakshadweep.

Joseph (1987) estimated the pelagic resource including tunas of the Lakshadweep and Andaman & Nicobar areas as 63,000 t and 139,000 t respectively. Sudarsan et al. (1988b) estimated the potential yield of tunas and billfishes from the EEZ of SW coast of India as 18,500 tonnes.

STRATEGIES/OPTIONS OPEN FOR THE DEVELOPMENT OF TUNA FISHERY IN THE INDIAN EEZ.

Tuna fishery in the shelf and slope areas of Indian EEZ

Augmenting production of coastal tunas through diversification of crafts and gears in the small scale sector, especially through greater use of drift gillnets and other suitable gears has been recommended by Silas and Pillai (1986c) and James and Pillai (1987a). The stocks of longtail tuna (Thunnus tonggol), which holds potential in the export market and are tapped by the neighbouring countries could be effectively exploited by expansion of fishing up to the continental shelf area (Yesaki, 1988). Motorisation of the small crafts should be further encouraged for enabling the fishermen to expand their area of operation, resulting in higher yields as exemplified at Vizhinjam, SW coast of India. Mobility of purse seine vessels is a critical factor in tapping the large shoals of coastal tunas the occurrence of which has been reported by Sudarsan and Somavanshi (1988) in the neritic belt of Indian EEZ.

Tuna fishery in the oceanic areas and contiguous waters of Indian EEZ

Longline and purse seine fisheries

The different aspects of longline fishery, operational methods, constraints and management problems from within the Indian EEZ of India have been discussed by Silas and Pillai (1986c) and James and Pillai (1987a), and have recommend to introduce 150 longliners each with a capacity to produce around 450 tonnes of tunas annually.

It will be worthwhile to initiate oceanic purse seining in our EEZ. Recent

Development in the purse seining activity by the industrial sector and the resultant catch of skipjack and yellowfin tunas from the tropical waters of Indian Ocean by foreign fleets are summarised in Table 5. Marcille (1985) indicated successful purse seine seasons in Lakshadweep Area as November to May and in the Andaman Sea as March to May. Employment of 10-12 purse seiners (Industrial type 59-72 m OAL purse seiners), with an annual production capacity of 6000 tonnes, and 20 purse seiners each of 4000 tonnes production capacity would lead to the production of about 1,10,000 tonnes of tunas from the oceanic waters of the Indian EEZ and contiguous high seas (Silas and Pillai, 1986c).

Tuna fishery in the high seas should be planned through joint venture/charter arrangements, the details of which have already been recently synthesised by Chidambaram (1987).

Tuna fishery around the insular region of Indian EEZ

The potential resources of tunas in the EEZ around Lakshadweep has been estimated as 50,000 tonnes (George et al., 1977) and as 90,000 tonnes (Chidambaram 1987) as against the present production level of about 6,500 tonnes. Strategies for development and management of tuna fishery in the small scale sector in this region has been documented earlier (Silas and Pillai, 1982, 1986c; James and Pillai, 1987a; James et al. 1987; Varghese, 1987, 1988; Pillai et al., 1988). Status of tunas fishery in the Andaman Sea has been reviewed recently (BOBP,1987).

In view of the strategic importance of the area, coupled with the focus on conservation of ecosystem and anticipated imbalances in the small scale sector by the introduction of large scale inputs, the development plans are suggested for tuna fishery in the following lines:

- Existing mechanised pole and line boats (7-9 m OAL) could be effectively modified with chilling and storage facilities. Adoption of mechanised sea water spray system would economise utilisation of live-baits.

- Introduction of new generation of 15-20 m OAL boats with adequate navigational, chilling and storing facilities and for 2-3 days fishing would enhance the area and duration of fishing operations; introduction of 80 boats of this size would produce 60-100 tonnes of tunas per boat per annum;

- Shortage of manpower (fishermen) and expertise have been pointed out as constraints for developments of such enhanced programmes. This problem has to be solved by effecting interisland movement of fishermen/boats through appropriate incentive schemes. Required training for local fishermen in modern methods of tunas fishing under joint venture programmes needs further consideration;

- Experimental fishing by purse seines similar to the ones used in the Andaman Sea by Thailand (Vessels:- 14-24 m OAL, purse seine net 1400 m long and 120 m deep; 14-18 m OAL, purse seine net 665 m long and 100 m deep) for fishing surface schools of skipjack, longtail and little tunas and expertise developed by mainland fishermen could be tried to propagate purse seining around the islands, by training and involving the fishermen. The additional catch generated will be utilised in canning, mas production and processing into frozen round/fillets

- Construction and installation of cheaper and long lasting FADs which would reduce scouting time for fishermen require urgent attention.

- Fishery forecasting system be developed and the results extended to fishermen through extension service.

In order to increase the value added products, chilled water storage on board, and freezing the catch ashore should be tried. In Lakshadweep, the chief method of disposal of the catch is by converting to masmin. Approximately, in Lakshadweep, 600 tonnes of masmin are produced annually in recent years, which is worth of about 2 crores rupees. Priority areas which need attention are:-

- Masmin production should be taken up at community processing level by providing much needed fuel to process the tuna meat; steam cooking, smoke houses etc. should be introduced to ease the production process.

- Produce development such as granulated mas and improvement of the quality of riha akru would ensure more consumer acceptance and better returns to the fishermen;

- Quality control and hygeinic methods of masmin production especially in the northern islands should be demonstrated; in the northern islands nearly 30-35% of the body parts are wasted during the process of masmin preparation (At Agatti, the estimated waste from tunas in 1988 was about 1124 tonnes which would have fetched Rs. 16 - 17 lakhs worth first quality fish meal). Effective waste utilisation methods by converting them to fish meal or preserving these materials by ensilaging for preparation of cattlefeeds should be tried;

- Development of an organised marketing system of masmin will be beneficial to the fishermen in getting proper market and accounting for price falls;

- The existing canning factory at Minicoy should be fully utilised to its maximum capacity.

The entire success of the pole and line fishery expansion programme depends on a steady supply of live-baits. Due to shortage of baits fishermen suspend fishing even during the peak fishing season. At Minicoy, in addition to sprats, a number of other livebaits are utilised whereas in other islands sprats are the only live-baits used, and large amount of breeding stocks are removed from the natural populations. Recent aimed live-bait surveys conducted from Minicoy Research Centre have indicated that a number of other species suitable as live-baits are available in most of the northern islands. Priority areas which should be considered immediately for the effective utilisation and management of the live-bait resource are:-

- Diversified fishing techniques such as light attraction, operation of ring nets/small purse seining should be introduced to exploit them. Pilot project including the demonstration by and participation of Minicoy fishermen should be commenced on experimental scale to exploit additional live-bait species in the northern islands;

- Live-bait impounding cages/bays should be designed and installed in the lagoon itself with the participation of fishermen who can effectively manage these systems. Experiments to breed some of the common live-bait species may be attempted.

- Economic utilisation of live-baits should be demonstrated through experimental programmes by scaling down stock mortality, use of specified confinement cages and widespread use of mechanised spray system. Experimental studies on reducing mortality of live-baits during storage and transportation are underway at the Research Centre of CMFRI at Minicoy.

- Artificial live-bait habitats (ARs) should be experimentally studied in the lagoons where damage to coral colonies occurred, and the results of these studies made public to protect the coral ecosystem. An effort in this line has already been initiated at the CMFRI Research Centre at Minicoy.

CONCLUSION

The gap between the exploitable tuna resources of the Indian EEZ and the present level of production is very wide. The fishery at present is largely confined to the small scale sector for coastal species. Different estimates of tuna resources in the Indian EEZ indicate that there is great scope for expanding the present fishery and also for development of industrial type of fishing through longlining and purse seining. Experiments and recent surveys indicate that longlining off the west coast could be economical. Other areas have to be quickly surveyed for commercial viability. Chartering/joint ventures or bilateral arrangements, although initiated in 1985 should be given more attention for industrial development of the fishery through appropriate incentives and arrangements.

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TABLE 1. Catch (tonnes), Effort (Units) and C/E (Kg) realised by small purse seiners

	1985	1986	1987
KERALA			
Total fish	15,112	4,646	904
Effort	4,695	2,563	1,167
Tunas	1,328	2,326	100
C/E (tunas)	282	907	85
KARNATAKA			
Total fish	76,941	117,386	105,947
Effort	40,015	41,481	41,897
Tunas	2,511	5,839	1,954
C/E (tunas)	62	140	46
GOA			
Total fish	13,363	5,950	25,192
Effort	9,721	8,542	22,028
Tunas	209	0	9
C/E (tunas)	21	-	0.4

TABLE 2. Catch, Effort and C/E of tunas and billfishes observed at the monitoring centres (1987-88).

Centre	Gear	Effort (units)	Catch (tonnes)	C/E (Kg)
Goa	DGN (M)	10,297	90.4	8.7
Mangalore	DGN (M)	5,046	48.4	9.6
	PS	11,097	537.5	48.4
Malpe	DGN (M)	8,338	101.0	12.1
	PS	13,198	303.3	23.0
Calicut	DGN (M)	9,460	614.5	64.9
Cochin	DGN (M)	14,683	342.2	23.3
	PS	1,451	48.2	101.9
Vizhinjam	DGN (M)	26,148	772.5	29.5
	DGN (N)	1,770	22.6	12.7
	HL (M)	40,380	1032.8	25.6
	HL (N)	8,863	39.4	4.4
Tuticorin	DGN (M)	9,780	1049.2	107.3
Madras	DGN (M)	1,157	50.1	43.3
Waltair	HL (M)	34,664	190.3	5.5
Minicoy	PL (M)	3,509	1235.0	352.0
	TRL (N)	366	5.0	14.0
Agatti	PL (M)	4,724	1293.0	274.0

(DGN = Drift gill net - mechanised, non-mechanised;
PS = Purse seine; HL = Hooks and lines - mechanised, non-mechanised;
PL = Pole and line; TRL = Troll line).

TABLE 3. Average annual species composition of tunas in the small scale fishery sector, 1986-88.

	1986	1987	1988	Average for three years
Little tuna	18,218	14,008	14,977	15,734
Frigate tunas	8,485	4,456	5,482	6,141
Skipjack	4,063	5,550	5,458	5,024
Longtail tuna	246	444	1,300	663
Other tunas & Billfishes	2,763	5,703	2,812	3,759

TABLE 4. Annual production of tunas and tuna - like fishes in Lakshadweep (1978-88) and Average Annual Island-wise tuna catch (1983-88).

Year	Total marine fish catch (t)	Total tuna catch (t)	Skipjack tuna (t)	Yellowfin tuna (t)	Others (t)	Islands & Par Areas	Average annual catch (t) (1983-88)
1978	2780	1875	1612	206	57	Minicoy	761
1979	3846	2794	2403	307	84	Agatti	2020
1980	2909	1769	1523	193	53	Suheli Pars	625
1981	3300	2241	1927	247	67	Kavaratti	205
1982	4201	2966	2551	376	89	Amini	93
1983	4301	3037	2612	334	91	Kadamat	55
1984	5331	4312	3708	474	130	Kiltan	145
1985	4629	3775	3247	415	113	Androth	241
1986	5536	4807	4134	529	144	Chetlat	172
1987	7299	6528	5614	718	196	Bitra	322
1988	6809	5855	4976	644	205	Kalpeni	82

TABLE 5. Gear-wise production of yellowfintuna and skipjack tuna in the Indian Ocean, 1982-87.

	Long line	Pole & Line	Purse seine	Other gears
		YELLOWFIN TUNA		
1982	30,088	4,243	1,241	11,256
1983	27,857	6,453	12,023	14,332
1984	20,335	7,162	56,371	9,635
1985	27,182	5,839	56,153	11,594
1986	36,072	5,202	59,060	13,909
1987	34,921	6,531	67,474	19,950
	(27%)	(5%)	(52%)	(16%)
		SKIPJACK TUNA		
1982	74	17,695	3,469	31,382
1983	22	21,646	12,063	27,863
1984	24	33,378	43,046	25,474
1985	45	46,628	66,675	21,646
1986	10	45,785	75,224	27,091
1987	12	41,872	93,135	28,326
	-	(26%)	(57%)	(17%)

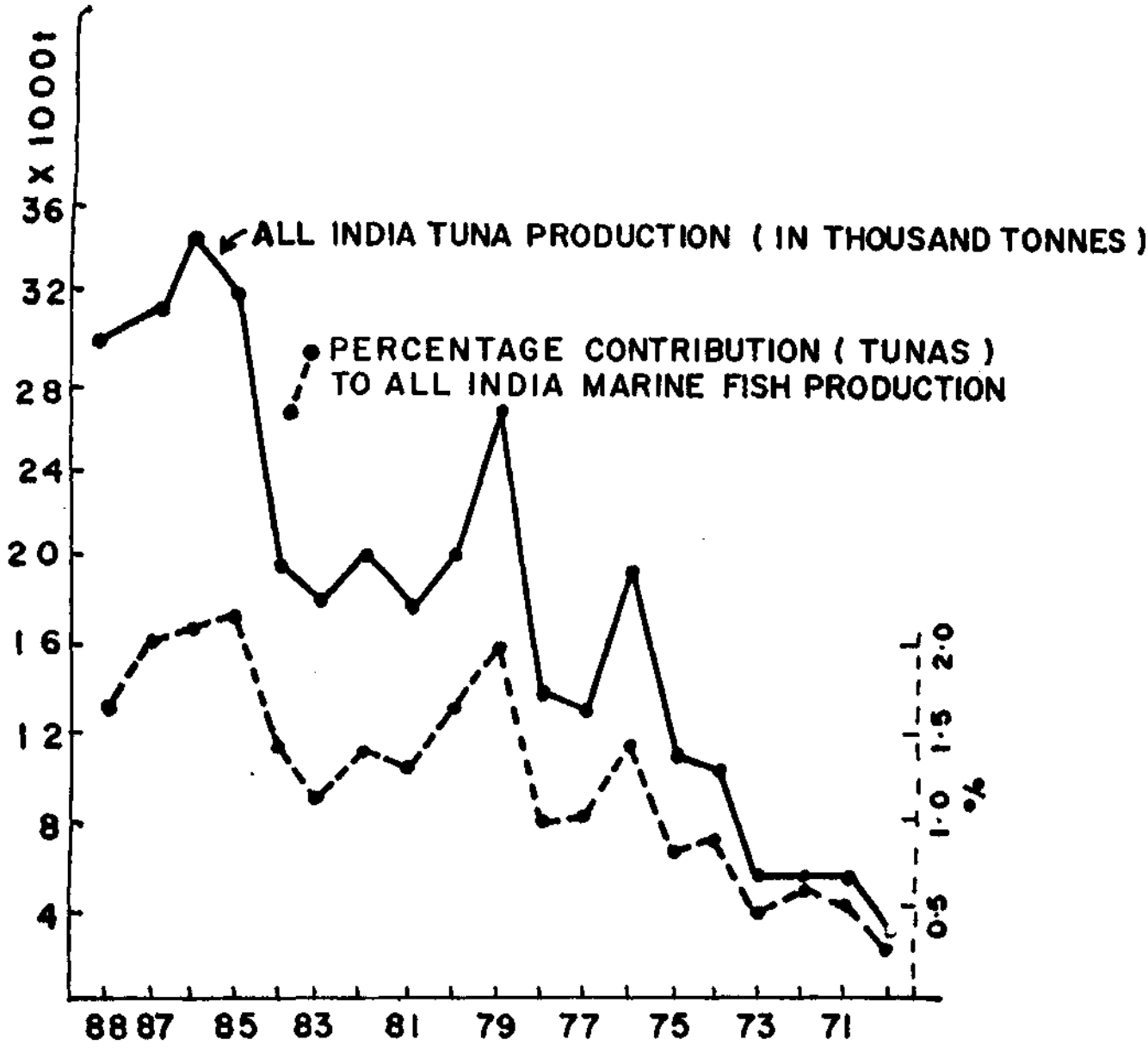

Fig. 1. ALL INDIA TUNA PRODUCTION AND ITS CONTRIBUTION TO TOTAL MARINE FISH LANDING IN INDIA, 1971-88

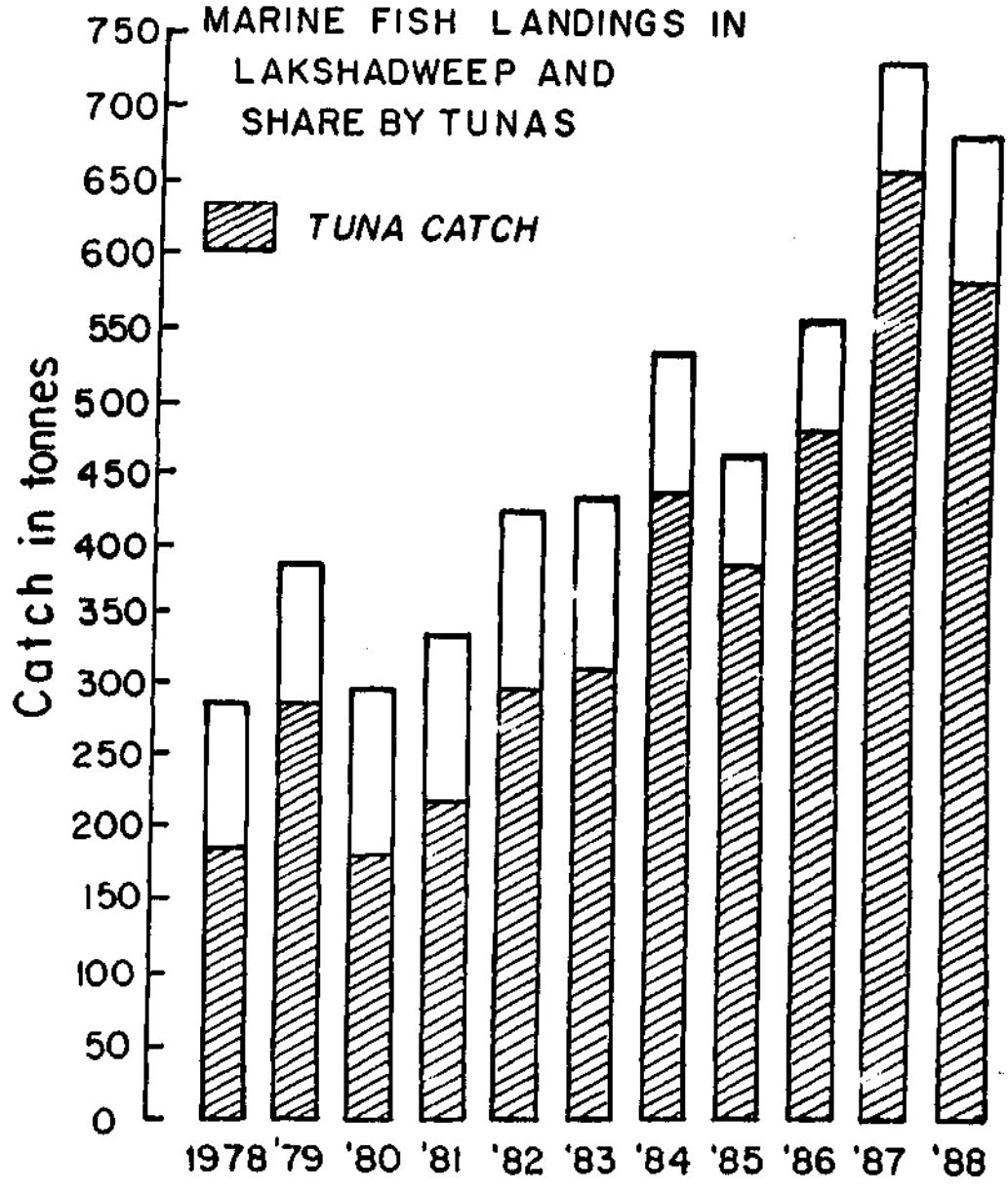

Fig. 2. MARINE FISH LANDING IN LAKSHADWEEP AND CONTRIBUTION OF TUNAS IN THE TOTAL CATCH, 1978-88

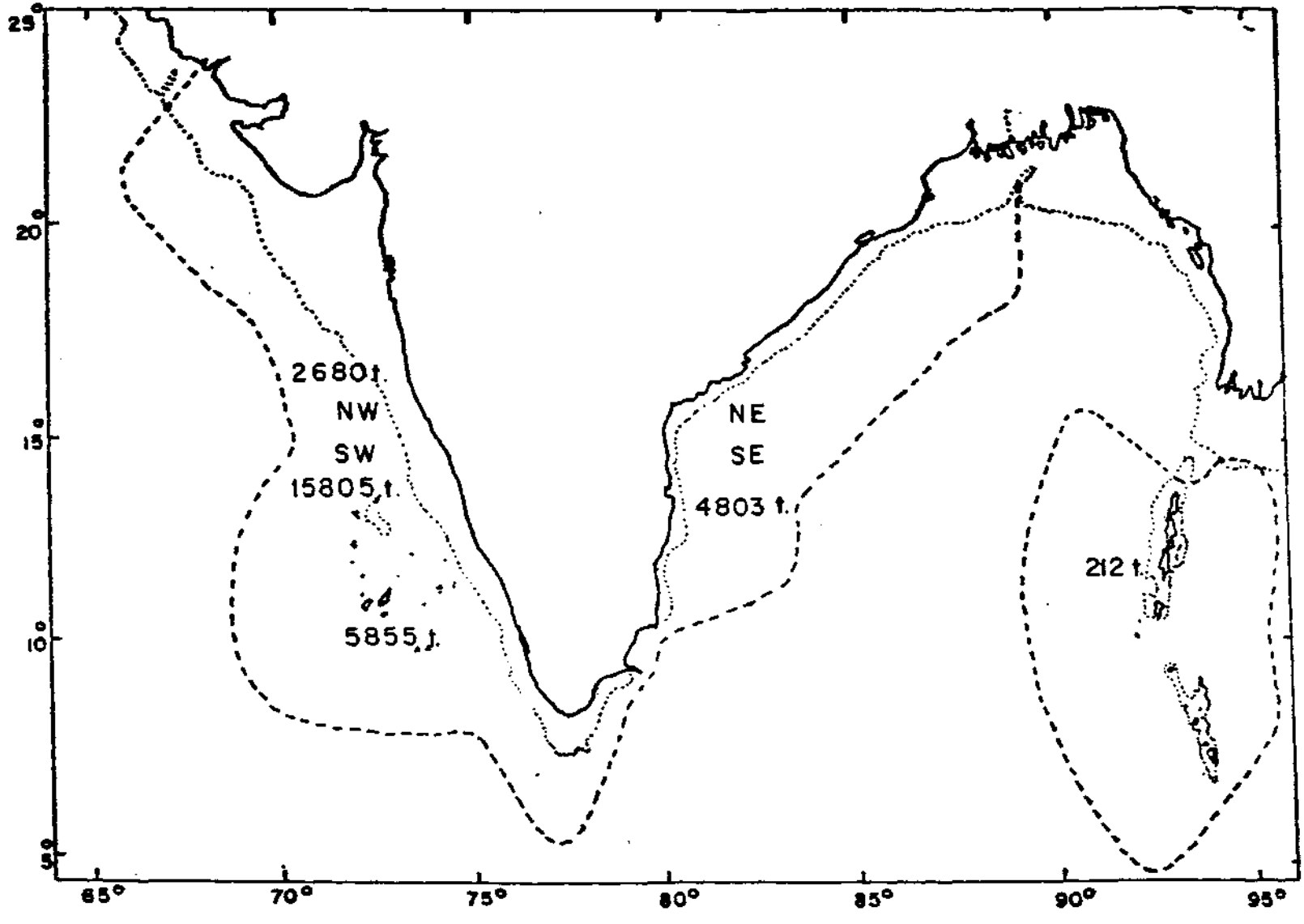

Fig. 3. PRESENT STATUS OF TUNA LANDING IN THE SMALL SCALE SECTOR FROM THE MAJOR REGIONS OF THE INDIAN EEZ

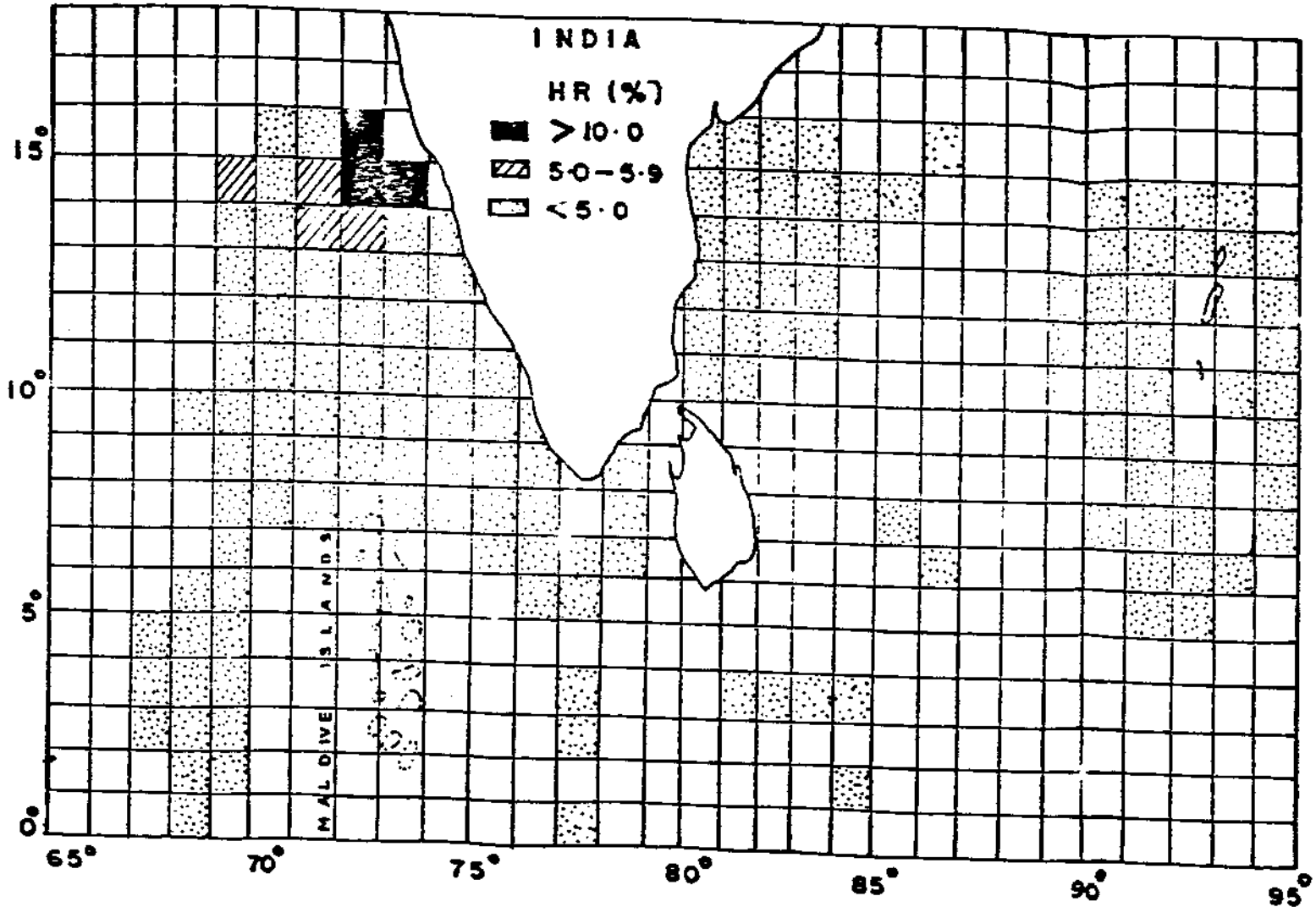

Fig. 4. PRODUCTION OF YELLOWFIN TUNA (HR %) BY THE EXPLORATORY/TRAINING VESSELS IN INDIAN EEZ AND CONTIGUOUS WATERS

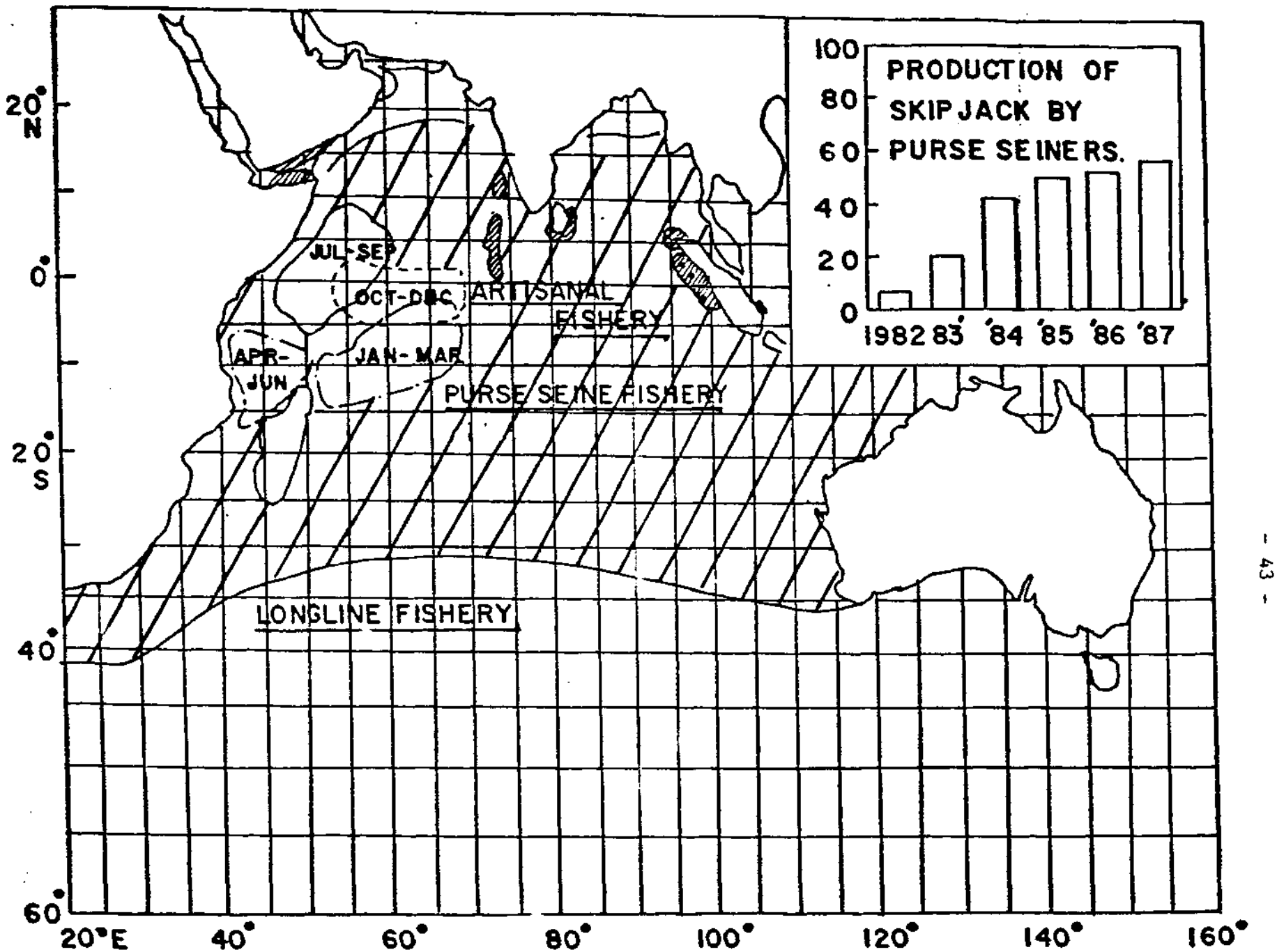

Fig. 5. TUNA FISHERY IN THE INDUSTRIAL AND SMALL SCALE SECTOR IN THE INDIAN OCEAN AND SHARE OF PURSE SEINE FISHERY IN THE TOTAL PRODUCTION OF SKIPJACK TUNA IN RECENT YEARS