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THE STATUS OF FISHERIES FOR SMALL TUNAS IN INDIA*

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ABSTRACT

The tuna resources presently exploited in India essentially comprise the small tunas such as *Euthynnus affinis, Auxis thazard, A. rochei, Thunnus tonggol* and *Katsuwonus pelamis*. The non-mechanised and mechanised crafts engaged in the fishery have their operational range upto 50 m depth zone. The drift/gillnets, hooks and lines and purse seines presently employed by these units are multispecies gear and tunas form part of the catch. The pole and line units in Laksbadweep exploit mainly skipjack and young yellowfin tunas. Over the years the catch has increased considerably. The average catch (1984-86) was 28,093 tonnes. *E. affinis, Auxis* spp. and *K. pelamis* constituted 55%, 16% and 13% respectively of the total tuna catch. The Statewise, seasonwise distribution and abundance of small tunas are briefly mentioned. The results of the studies on stock assessment indicated that higher yield could be expected from the present fishing zone especially with respect to *E. affinis* and *Auxis* spp. Augmenting production should be through diversification of the effort as well as expansion of the fishing to the shelf edge. The pole and line fishing in Lakshadweep also offers scope for future expansion. The need for correlating the environment with the fishery at the microlevel has been stressed.

INTRODUCTION

THOUGH there is a growing and enlightened awareness of the resource potential, the tuna fishery in India is essentially an artisanal activity. Even after the declaration of the EEZ, the oceanic tuna resources existing beyond the traditional fishing ground remain virtually untapped without much inputs from the commercial sector. The exploitation of the oceanic tunas by the traditional fishermen at Lakshadweep also is only marginal. With practically little effort expended to tap the large growing oceanic tunas, the present fishing in the coastal zone of the mainland and in the vicinity of the island territories could exploit only the small sized as well as young ones of oceanic tunas. These include the little tunny *Euthynnus affinis*, frigate tuna *Auxis thazard* the bullet tuna *A. rochei*, longtail tuna *Thunnus tonggol*, oriental bonito *Sarda orientalis*, skipjack tuna *Katsuwonus pelamis* and juveniles of yellowfin tuna *Thunnus albacares*.

Over the years the catch of small tunas has increased considerably. The average catch (1984-86) was 28,093 t and the provisional estimate for 1987 amounted to 31,706 t. The drift gillnets, purse seines and hooks and lines operated in the mainland are multispecies gear and tunas form only part of the catch. The pole and line fishing in Lakshadweep is the only organised fishery for tunas in India. The Statewise, regionwise and seasonwise distribution and abundance of small tunas are briefly mentioned. The results of the stock assessment studies made on an all India basis to postulate management measures with respect to commercially important species of small tunas are highlighted.

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Future programmes of development of the tuna fishery in the small scale sector is possible by diversification of the fishing, improvement in craft and gear combined with an active programme of post-harvest technology and marketing within the country and for export. In Lakshadweep, man-power development, training of fishermen, inter-island mobility of fishermen/boat, demonstration programmes and improvement in infrastructure facilities are of prime importance. The need for correlating the environment with fishery is also of atmost importance in prediction and management.

Fishery and Exploitation

The exploitation of the small tunas are carried out all along the coastal belt of the mainland of India. The mechanised and non-mechanised fishing crafts engaged in tuna fishery are essentially small scale in nature and are operated within the 50 m depth zone. The pole and line operation, exclusively meant for tunas is carried out in the close range in Lakshadweep. The number of fishing crafts engaged (1980) in the tuna fishery is indicated in Figs. 1, 2 and 3. The important gears such as the drift gillnets, purse seines and hooks

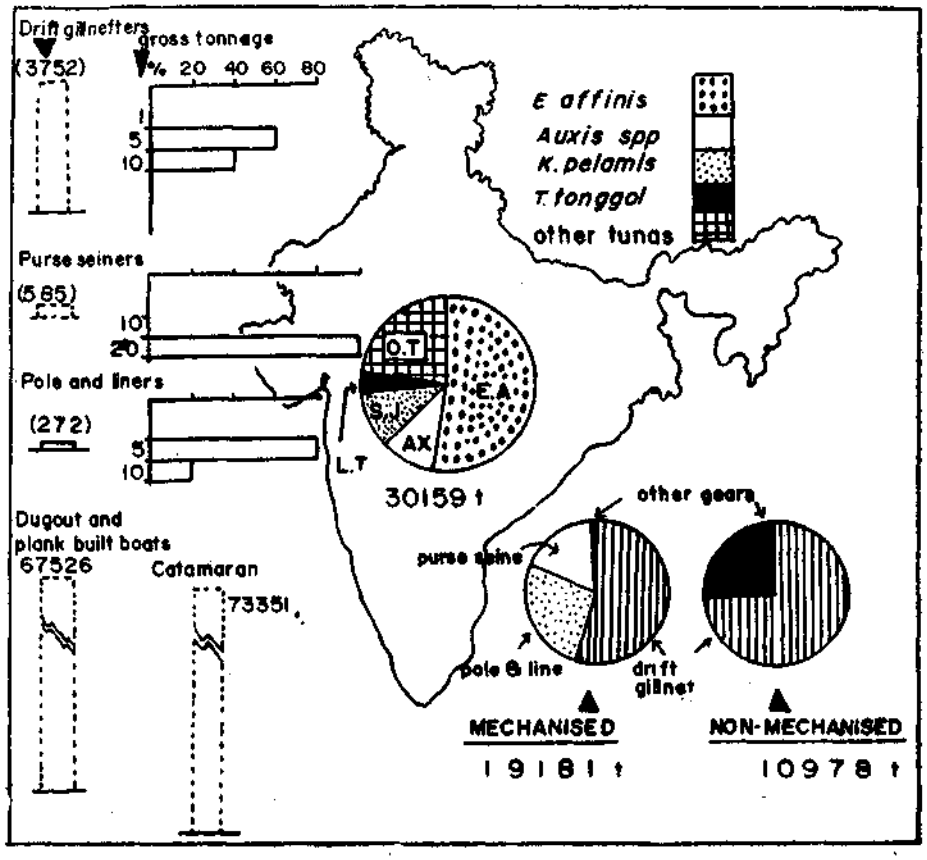

FIG. 1. All India tuna production, crafts and gears and catch (1985) from mechanised and non-mechanised sectors.

and lines have a mixed target to catch a variety of large and small pelagics. There are at present 3752 drift gillnetters and 585 small purse seiners. About 272 mechanised units are in operation in Lakshadweep, out of which 120 are pole and line units. The number of non-mechanised units have increased from 65,000 in 1951 to nearly 140,000 in 1983.

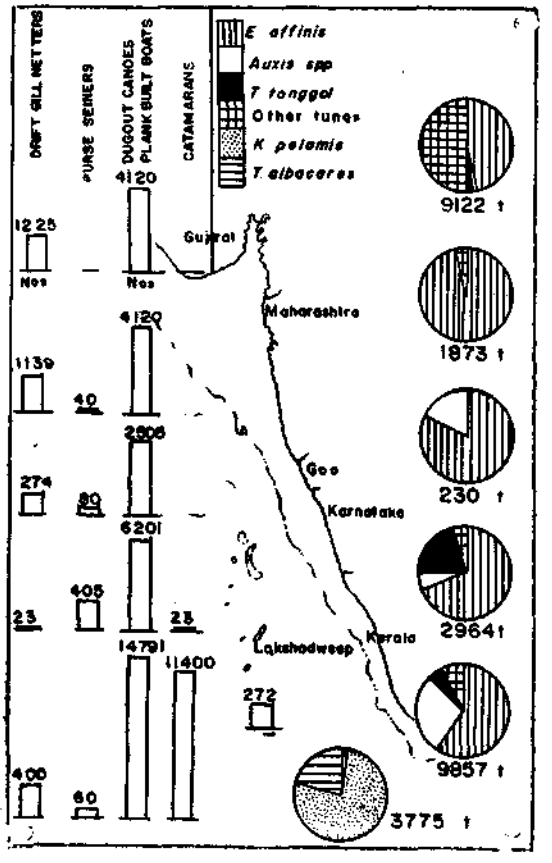

FIG. 2. Crafts and gears employed in tuna fishery along the west coast, Statewise catch (1985) and species composition of small tunas.

Production trend of tunas

The catch and effort in the tuna fishery in India including island territories for the earlier years have been discussed by Silas *et al.* (1979, 1984, 1986), Silas and Pillai (1982, 1983, 1985, 1986), James and Pillai (1987 a, b), Varghese (1987) and Varghese and Shanmugham (1983).

The coastal tunas as well as the juveniles of large tunas are considered here. The average all India tuna catch for 20 years (1965-84) was 11,560 t. During 1970-85 the average catch increased to 16,375 t. An average catch of 25,087 t was recorded during 1982-86.

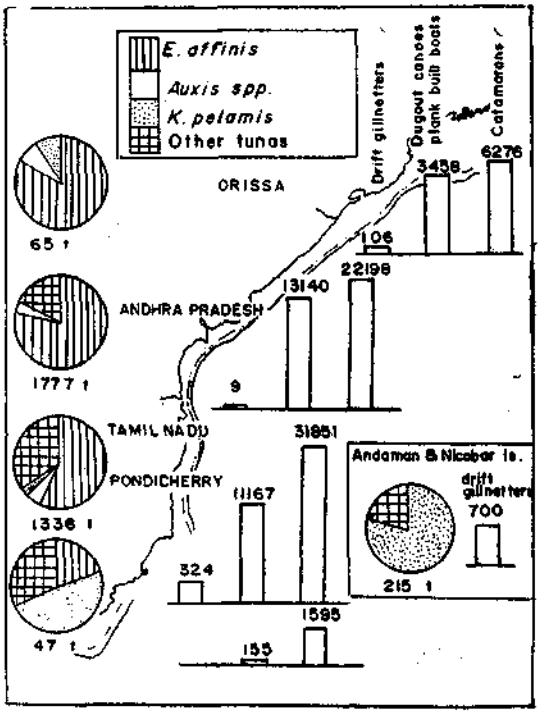

FIG. 3. Crafts and gears employed in tuna fishery along the east coast, Statewise catch (1985) and species composition of small tunas.

Though the catch showed fluctuations there was an overall increase from 1985 and it reached an all time record of 33,775 t during 1986 constituting 1.99% to the all India marine fish production (Fig. 4).

Statewise production

Statewise production of tunas is indicated in Fig. 2, 3 and 5. Kerala contributed to

36%, followed by Gujarat (15.2%), Karnataka (12.1%), Maharashtra (10.12%) and Tamil Nadu (9.12%). Production of tunas from Lakshadweep amounted to 15.2% of the all India tuna catch. Contribution (%) to the total tuna catch from the east coast, west coast and island territories are given in Fig. 6.

Contribution from mechanised and non-mechanissed sectors

The mechanised sector contributed to 19,181 t and non-mechanised sector 10,978 t during 1985 (Fig. 1). Statewise landings of tunas and total fish catch from both the sectors are given in Table 1. By contributing 3132 t (7.25%) the non-mechanised sector dominated

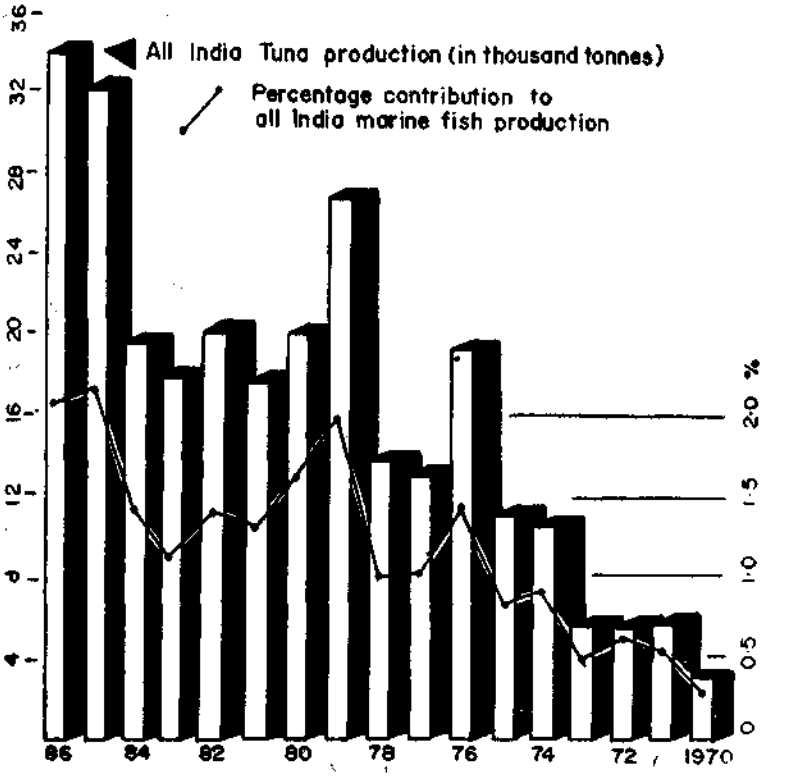

FIG. 4. All India tuna production and contribution (%) to all India marine fish production.

Production from four major regions

Of the four major regions, the contribution from the northeast is negligible. Though there is general increase in the production of tunas, recently the contribution from the northwest region has surpassed the landings from the southeast region. The main contribution came from the southwest region, though slight decline was noticed during 1981-85 period.

the mechanised sector along the east coast whereas on the west coast the mechanised sector contributing to 52% dominated the non-mechanised sector.

Gearwise production

The drift gillnetters seemed to be more popular among fishermen, because in the mechanised and non-mechanised sectors the contribution from these units surpassed the

landings of other gears. In the mechanised sector itself more than 50% of the catch came from units operating drift gillnets. Though the pole and line is operated in Lakshadweep, the contribution from this gear to the all India

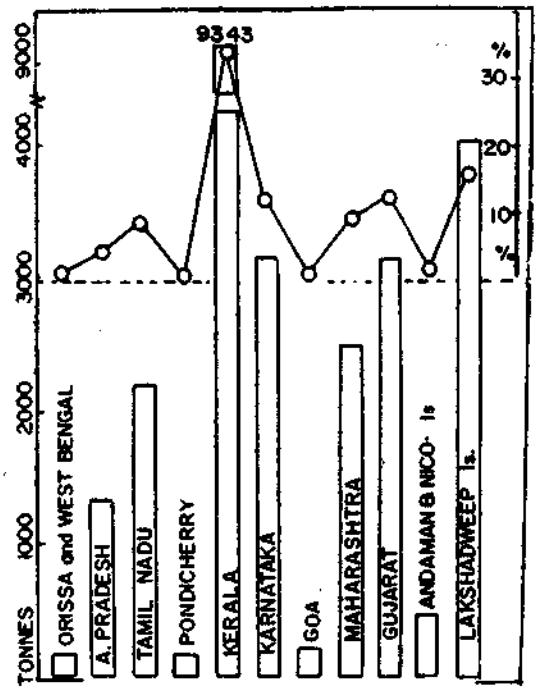

FIG. 5. Statewise landings of small tunas (Av. 1983-86) and contribution (%) to all India tuna production.

catch constituted 25% only. The purse seiners shared 18% and the rest of the catch was from gears such as hooks and lines and long lines (Fig. 1). In the non-mechanised sector also nearly 75% of the production was from those units operating drift gillnets.

Small tunas especially the little tunny, frigate and bullet tunas are caught occasionally by the purse seiners (11.5-13.5 m OAL, 110 HP). During 1985-86 there were 585 purse seiners in operation on the west coast of India, in Kerala (60), Karnataka (405), Goa (80) and Maharashtra (40). But due to various reasons all these units were not in operation during the subsequent years. The catch, effort and C/E of purse seiners are given in Table 2.

TABLE 1. *Statewise landings (tonnes) of tunas by mechanised and non-mechanised units*

States	Mechanised sector	Non-mechanised sector
West Bengal ..	—	—
Orissa ..	—	377
Andhra Pradesh ..	9	1,312
Tamil Nadu ..	977	1,433
Pondichery ..	203	10
Total from east coast ..	1,189	3,132
Percentage ..	27.5	72.5
Kerala ..	6,006	8,944
Karnataka ..	4,131	2,527
Goa ..	127	—
Maharashtra ..	1,144	822
Gujarat ..	1,787	44
Total from west coast ..	13,275	12,337
Percentage ..	51.8	48.2
All India total ..	14,464	15,469
Percentage ..	48.3	51.7

Production trends in Lakshadweep

In Lakshadweep the production of tunas varied from 500 t in 1968 to 4,807 t in 1984 (Fig. 8). Tunas formed 73.6% of the total marine fish production (1977-86) in Lakshadweep. Half of the tuna production (51%) in Lakshadweep came from Agatti. Suheli, Minicoy, Androth, Bitra and Kavaratti contributed to 626, 483, 218, 185 and 184 t respectively. From the other islands the production was less than 100 t (55-99 t). Agatti has become an important 'tuna town'. Here the catch has increased from 179 t in 1971 to 2054 t in 1984. The effort expended also showed increase from 816 units in 1978 to 4486 units in 1984. The C/E ranged from 209 to 384 kg (Varghese and Shanmugham, 1983).

Species and size composition

The little tunny *E. affinis* constituted more than 50% of the small tunas. The frigate formed 17.4% during 1985. The species composition of tunas at all India level and in the different maritime states (1985) are indicated in Fig. 1, 2 and 3. According to Varghese and Shanmugham (1983) the skipjack tuna formed 72-81%, yellowfin tuna 11%, little tunny 3-14% and frigate tuna 3-4.5% in the pole and line catch at Agatti group of islands. The size composition of tunas caught in the different gears at the tuna monitoring centres in the mainland as well as in Minicoy are indicated in Fig. 10.

TABLE 2. *Catch (tonnes), Effort (units) and C/E (kg) realised by small purse seiners*

	1985	1986	1987
KERALA			
Catch (tunas) ..	1,328	2,326	100
Total fish ..	15,112	4,646	904
Effort ..	4,695	2,563	1,167
C/E (tunas) ..	282	907	85
KARNATAKA			
Catch (tunas) ..	2,511	5,839	1,954
Total fish ..	76,941	1,17,386	1,03,947
Effort ..	40,015	41,481	41,897
C/E (tunas) ..	62	140	46
GOA			
Catch (tunas) ..	209	0	9
Total fish ..	13,363	5,950	25,192
Effort ..	9,721	8,542	22.028
C/E (tunas) ..	21	—	0.4

Seasonal pattern of abundance

Since the west coast (excluding Lakshadweep) accounts for 70% of the total tuna catch, the seasonal pattern of production in all India level is essentially a reflection of the production trends along this coast. Quarterwise production (Av. 1983-86) in the different States are indicated in Fig. 9. In Kerala the 2nd and 3rd quarter, Karnataka 4th and 2nd

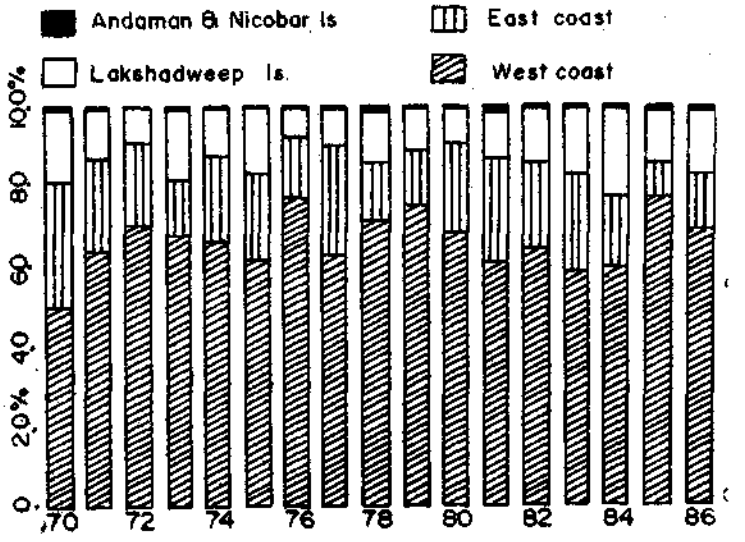

FIG. 6. Contribution (%) to the total catch of tunas from east and west coasts and island territories.

A. thazard and bullet tunas *A. rochei* together accounted for 8-25%. The longtail tuna Maharashtra 4th and 3rd, Gujarat 1st and last quarters are more productive. Along the

east coast. in Tamil Nadu 3rd and 2nd quarters and in Andhra pradesh 1st and 4th quarters are productive. In Lakshadweep higher yields are obtained during 1st, 2nd and 3rd quarters, whereas in Andamans the catch increased from 1st to 4th quarter.

Stock Assessment

The resource characteristics of tunas are continuously monitored at centres such as Minicoy, Goa, Mangalore, Calicut, Cochin, Vizhinjam, Tuticorin, Madras and Waltair for catch, effort, C/E, species and size composition and other biological parameters. The results of such studies conducted upto 1982 on the length composition, length - weight relationship, maturity, spawning, growth, mortality, cohort distribution, yield in weight per recruit, standing stock and fishing pressure along with future possibilities of exploitation of the stocks of these species have been described by Silas *et al.* (1985).

In the case of little tunny the average annual stock was estimated to be 270,000 t, standing stock being 32,000 t. The average annual stock of frigate tuna was 7,745 t, standing stock being 925 t. Expansion of the fishery to new grounds has been recommended, since any increase in fishing effort may not yield higher catches from the present fishing ground. In the case of yellowfin tunas (young ones) the present exploitation is beyond MSY level, while scope for higher yields has been indicated for skipjack tunas (Silas *et al.*, 1985).

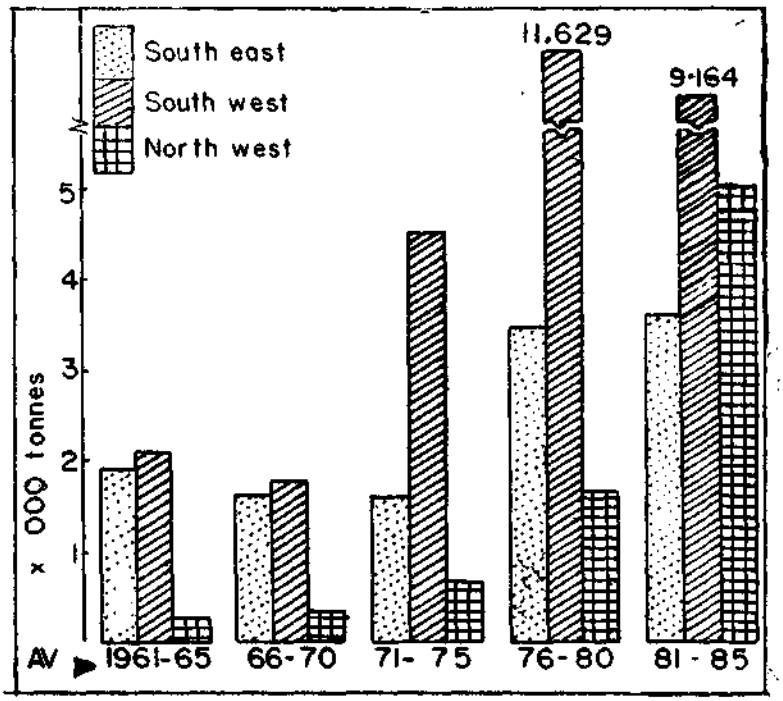

FIG. 7. Tuna landings in the four major regions (Contribution from northeast region is negligible).

Recent studies (based on 1982-83 to 1985-86 data) by James *et al.* (1987) indicated that increased exploitation is possible except at Mangalore and Vizhinjam in the case of little

tunny. There may not be significant yield at Cochin with regard to frigate tuna, but at Tuticorin promise of higher yield with increased effort has been indicated. At Minicoy there is scope for additional exploitation with increase in effort.

Discussion

There is consensus that the tunas hold great potential for exploitation. But the resource has not yet become a target species for the fishermen except in Lakshadweep. Urgent attention is to be paid to expand the fishing area further offshore. Some of the countries boardering Indian Ocean have achieved tremendous progress and India should not lag behind in effectively implementing the various developmental programmes. No doubt the production has increased during recent years, but the pace is slow. The introduction of inboard and outboard propulsion aids have enabled fishermen to expand the fishing area especially in Vizhinjam, resulting in higher yields. Along the west coast of Gulf of Mannar also the catch has considerably increased ever since the replacement of surface trolling by drift gillnetting.

Purse seining by FSI vessels in deeper waters (upto 200 m depth contour) on east as well as west coast have indicated good fishing grounds for little tunny and frigate tunas. The former species was found to dominate the catches from Lat. 12°, 13°, 15° and 21° N. From the upper east coast, the skipjack and yellowfin tunas could be pursed by tracking down their schools/aggregations. It is interesting to note that a maximum catch of 7,755 kg of skipjack tuna was obtained in a set made in the area 14-80 at 235 m depth (Sudarsan and Somavanshi, 1988). The drift gillnets being more popular among fishermen can be deployed to exploit the tuna resources with major improvements in storage facilities and mechanisation of hauling system (Silas *et al.*, 1984, Silas and Pillai, 1985 ; James and Pillai, 1987 b). They have recommended seasonal conversion of shrimp trawlers and small purse seiners into drift gillnet units to enhance operational range. Of the 400 purse seiners in operation along the Karnataka Coast, recent studies indicated that 280 will be adequate for exploitation of the various resources there. Some of the excess purse seiners can do drift gillnetting and purse seining on an experimental basis on the continental shelf edge. Extension of the fishing to the continental shelf edge can tap hitherto unexploited resource such as the longtail in the north western sector has been shown by Yesaki (1987).

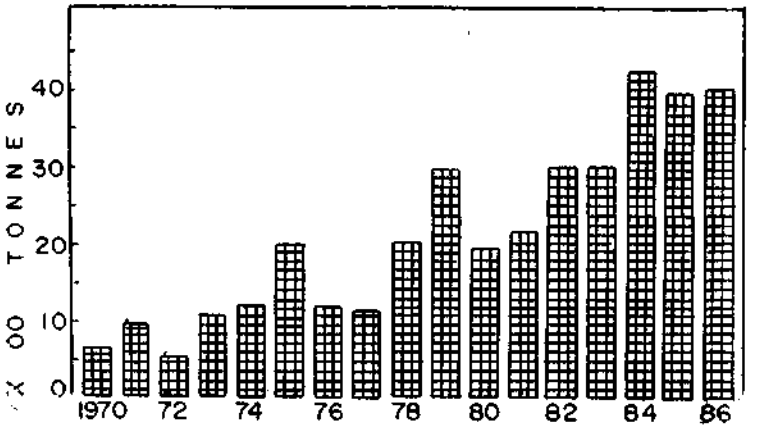

Fig. 8. Tuna production in Lakshadweep (1970-86).

Silas and Pillai (1985). James and Pillai (1987 b). Varghese and Shanmugham (1983) and Varghese (1987) have identified major contraints in further development and expansion of the pole and line fishery in Lakshadweep. Presently mechanised boats of two sizes *viz.* 7.9 m and 9.1 m OAL (10-40 HP) are employed for bait fishing and pole and line fishing. A new generation of large pole and line boats (15-20 m OAL) with navigational aids, fish storage facility and capacity for 4-5 days fishing can tap large quantities of skipjack. Initially 100 such boats could be introduced to attain a production target of 10,000 t by 2000 A.D. (Silas and Pillai, 1985). The entire success of the programme depends on a steady supply of live-baits. Already due to shortage of live-baits fishermen suspend fishing even during the peak season. In Minicoy in addition to sprats a number of other live-baits are used, whereas in other islands sprats are the only species of live-baits used. Earlier studies as well as the recent survey have indicated that a number of other suitable live-bait fishes are available in most of the northern islands A mini purse seine has been designed by CIFT for tapping small pelagics along the south-west coast. With some modifications to suit the island conditions this net could be effectively used to exploit the live-bait resources from

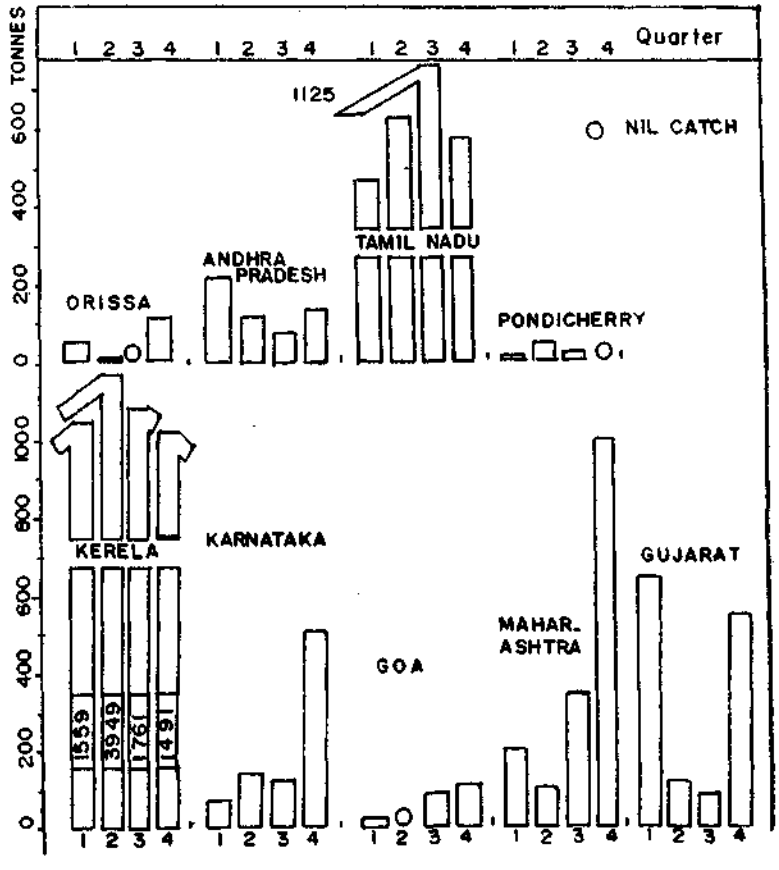

FIG. 9. Seasonal pattern of tuna production in the different maritime States (Av. 1983-86).

around the vicinity of the islands. Experiments to reduce mortality of live-baits during storage and transportation are underway at Minicoy. Future plans for expansion of the pole and line fishery have also brought into focus the need for breeding and culture of live-baits.

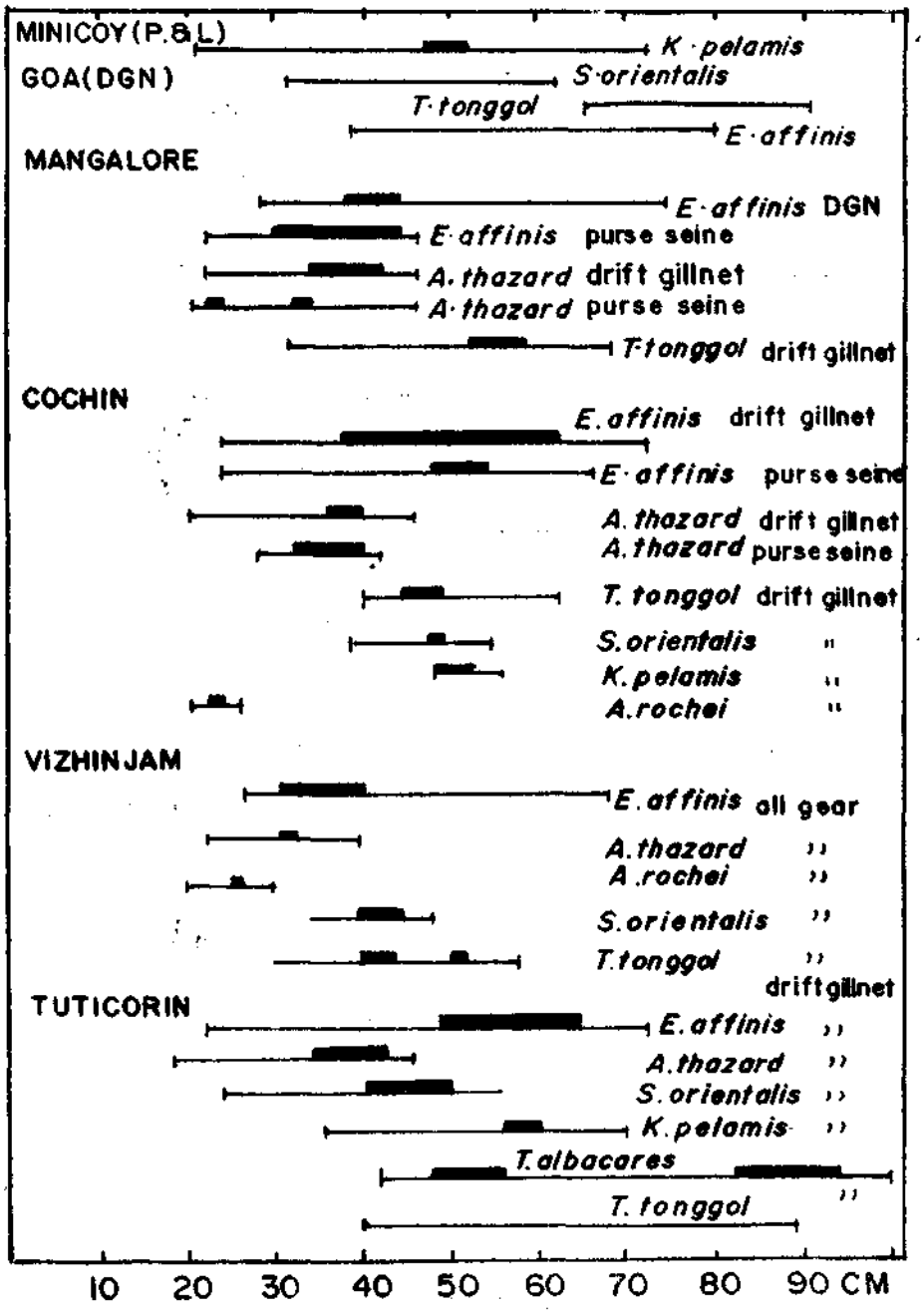

FIG. 10. Size composition of tunas caught in different gears at the tuna monitoring centres during 1985-86 (Source : Annual Report, CMFRI, 1985-86).

The skipjack tuna occur in good concentration around some of the northern islands and are not fully exploited due to shortage of fishermen (Varghese and Shanmugham, 1983). This problem has to be solved by effecting inter island movement of fishermen / boats through appropriate incentive schemes. It is all the more essential to provide the minimum infrastructure at least to the fishermen who migrate to some of the northern uninhabited islands for fishing during the season. The various developmental activities have aquired momentum thanks to the ceaseless effort made by the Lakshadweep Fisheries Department. Plans are also in the offing to operate larger purse seiners and pole and line units on collaborative terms with other countries. Appropriate training of local fishermen in modern methods of tuna fishing under joint venture programmes needs consideration. Trials to make cheaper and long lasting FADs also require sufficient attention.

In the mainland there is no demand for canned tuna since fishes in fresh condition are available. Most of the coastal tunas being red meat variety are not relished by most of the people. But there is good demand for them in the southern parts of Kerala. Even at Cochin people have an aversion to this fish. Iced tunas are transported in trucks from Mangalore, Malpe, Calicut, Cochin and Tuticorin to Quilon and Trivandrum. In Lakshadweep, the Fisheries Department is trying to evolve an organised marketing system for the 'masmin'. Nearly 70 t of tuna is canned at the factory in Minicoy. Agatti being an important 'tuna town' it is proposed to establish a canning factory there. Product diversification to suit consumer taste should get sufficient attention. James *et al.* (1987 b) have suggested that tuna waste during processing for 'masmin' could be utilised by converting it to fish meal or ensilage.

It is to be stressed here that in many areas of the world, tuna investigations have always been supported by large scale oceanographic studies. In our country, the need of the hour is to integrate the environmental features with the tuna fishery at the micro level. It is all the more essential to constantly monitor the catch, effort, size and species composition and other biological characteristics of this promising resource. A total 'systems approach' has to be followed to understand the complex multispecies multigear fishery. Resource response to management measures has to be closely watched to understand various interactions both technological and biological to arrive at meaningful measures.

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