Tuna Fishery Resources and their Exploitation by Low Energy Fishing Techniques

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The tuna resources landed by the small scale fishery sector in the neritic zone of the Indian EEZ evinced an increase of about 25,000 t in 1989 over that of 20,350 t in 1984. Of these, about 53% and 13% of the total tuna landings are contributed by the SW and SE coasts of India respectively in recent years. In the present communication, the recent trend of fishery for tunas along the coasts of India as a result of mechanisation of traditional fishing crafts and introductionof mechanised-cum-sail boats are quantitatively evaluated. Diversification in the small scale fishery sector is also dealt with and the resultant increased efficiency of the gear in the catch rate of tunas is discussed.

The impact of *Payaos* and rumpon (FADs) and Artificial reefs as tuna aggregating devices in the Indo-pacific Area is presented along with information on cost-benefits, direct operational costs (DOC), socio-economic aspects, recent trend in the decrease in fishing effort and increase in total catch and catch rate. Appropriate technologies such as low-cost fuel-flow monitoring devices, light luring purse seining, deploying tuna aggregators, utilising wind energy are options available for improving the efficiency of operational methods and economic utilisation of live-baits in the pole and line tuna fishery sector for the exploitation of tuna resources by low energy fishing from the coastal and insular realms of the Indian EEZ are also suggested and discussed.

Several communications in the recent past have dealt with the availability and abundance of tuna resources, both in the neritic and oceanic sectors of the Indian EEZ (Silas & Pillai, 1986; James, 1989a, James & Pillai, 1989;1991; James *et al.*, 1989). Further, Silas & Pillai (1986) estimated the potential of coastal tunas and the skipjack and yellowfin tuna resources from around the insular areas as 60,000 t and according to James *et al.* (1989) the potential of tunas is 0.1 million t in the Andaman and Nicobar waters, 50,000 t in Lakshadweep beyond 100 m depth, and about 90,000 t along the mainland coasts beyond 50 m depth. Sudarsan *et al.*(1988) estimated the potential yield of tunas and billfishes from the EEZ of the SW coast of India as 18,500 t.

In recent years, the tuna fishery in the Indian EEZ comprise of exploiting about 27,000 t exploited by the small scale operation of drift gillnets, hooks and lines and coastal purse seines along the mainland of India, artisanal pole and line fishery operations around Lakshadweep producing about 5,800 t of skipjack and yellowfin tunas, operation of Govt. of India Survey/Training Vessels landing about 250 t of larger tunas, and production by chartered vessels (Taiwanese longliners) around 1,100 t of oceanic tunas.

In the present communication, the recent trend of tuna fishery in India in the small scale sector is described, and the strategies of development of this sector through low cost fishing techniques quantitatively evaluated.

Recent trend of tuna fishery in India

Tuna production in India evinced fluctuations and oscillations since 1970, and in 1989 an all-time peak production of 45,230 t had been recorded. The average tuna production (excluding billfish landings)

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during the period 1984-89 has been estimated at 31,830 t and the total production of tunas evinced a spurt of 122% from 1984 (20,354 t) to 1989 (45,230 t). As an average, 69.8% of the total tuna landings are produced from the west coast of India and the rest from the east coast of the mainland, Lakshadweep and Andaman and Nicobar waters. A comparison of the tuna production indicate that the Kerala and Karnataka contributed to 51.8%, Goa, Maharashtra and Gujarat 18.1%, Lakshadweep 15.7% and the east coast of the mainland of India and Andaman and Nicobar waters 14.4% of the total tuna production in the country in recent years.

The causative factors for the recent increase in production are mainly (i) mechanisation/motorisation of the crafts extending the areas of operation beyond the traditional fishing grounds. (ii) introduction of improved gear and (iii) the increasing demand for tunas in the internal as well as the export markets. In the ensuing sections, the strategies and research priorities are summarised for the exploitation of tunas by low cost fishing techniques, based on a synthesis of published and unpublished information.

Impact of motorisation of fishing crafts and renovation of the gear:

The impact of motorisation of the country craft traditionally operating drift gillnets and hooks and lines on the increase in tuna production at Vizhinjam coast (SW coast of India) has been reported (Gopakumar *et al.*, 1986; Gopakumar & Sharma, 1989). According to them the significant advantages by adopting this technique and employing fibre-glass coated plywood boats of about 5.5 m OAL with OB engine are: the accessibility to new fishing grounds to areas 20-25 km off Vizhinjam, at a depth zone of 60-80 m (vs non-mechanised crafts operating in the area 40-50 m depth zone), increase in the catch rate of bullet tuna (*Auxis rochei*) and the ability of operations during periods of adverse weather also. The catch rate of tunas by drift gillnets operated from mechanised boats was reported to be 29.0 kg as against the same of 15.5 kg for non-mechanised crafts. Similiarly, hooks and line operations from motorised crafts recorded a high catch rate of 26.8 kg in contrast to 2.8 kg of non-mechanised crafts.

At Calicut, the motorisation of the country craft, introduction of new variety of boats and gear have been reported by Yohannan & Balasubramanian (1988, 1989) and Sivadas & Balasubramanian (1989). In 1984-85 the use of OB engines were introduced and this paved the way for popularising the cheaper, plank-built boats ('Kettuvallams') in 1986-87, all these units were mechanised, and tunas became their target species. Yohannan & Balasubramanian (1989) estimated the increase in tuna production due mainly to motorisation, as follows:

	1984-85	1987-88
Effort	2610	9460
Catch (kg)	77157	614521
C/E (kg)	29.6	64.96

Multi-meshed "ring net" at Calicut (Sivadas & Balasubramanian 1989) operated from large sized canoes fitted with OB engines of 25 HP, resulted in the increase of C/E of tunas and other large pelagics.

Jayaprakash (1989) opined that the effort by mechanised pablo boats using drift gill nets are more during the SW monsoon season (May-September) to tap the tuna resources such as the little tuna and frigate tuna, realising 42% to 62% of the yearly income. During 1981,1982 and 1987 the monsoon period realised the highest catch rate by the mechanised vessels and the percentage contribution of tunas varied between 60-77% of the total catch in the drift gillnet fishery.

Muthiah (1982) observed that tunas constituted 4.2% in the mechanised units in comparison to the catch of 3.0% in the non-mechanised drift gillnetters, in Dakshina Kanara sea.

Motorisation and the increased employment of mechanised boats along the SW coast produce about 52% of the total tunas in the small scale sector.

About 90 "Tuticorin Type" of boats have been fitted with inboard engines of 10 HP, operating chiefly drift gillnets and hooks and lines (Sam Bennet & Arumugham 1989). Marginal increase in the catch rate where tunas are the major components was observed (C/E 61.2 kg in non-mechanised boats vs 62.0 kg in mechanised boats). However, many of the boats switch over the fuel saving techniques such as use of sail when the wind is favourable. According to Satiadhas (1989) the non-mechanised sail boats operating drift gillnets are economically efficient. Recently Rao(1987) reported on the introduction of fibre glass mechanised-cum-sail boats at Kakinada (OAL 8.45 m,10 HP engines) operating at depth range of 70-90 m. The fuel requirement is 1.5 l diesel/h for running, which as an average is 6-8 h for to and fro trips.

The potential of pelagic resources, chiefly tunas of Lakshadweep had been estimated at 63,000 t and that of Andaman and Nicobar waters as 139,000 t (Joseph, 1987). Mechanisation in the small scale fishery sector (pole and line fishery) started in the early 60's has resulted in the increase of the catch of skipjack tuna and yellowfin tuna to the tune of 700% in recent years (Varghese, 1991).

The status of tuna fishery in the Andaman Sea has been reviewed by BOBP (1987). James (1989) opined that out of the

potential for marine fishery resources inthe EEZ of Andaman and Nicobar Islands (50,000 - 1,60,000 t), tunas account for about 1,00,000 t and this resource could be harvested by pole and line fishery techniques.

As the production of coastal tunas from the traditional ground has more or less reached the optimum level, it is envisaged that further increase in production could be from the offshore grounds beyond the traditional grounds and from around the insular realms of the Indian EEZ. The measures included:-

(i) Fish aggregating devices (Payaos/Rumpons) and artificial Reefs:

Recently James & Lazarus 1990 and Varghese 1991 reviewed the artificial reefs and their impacts in India. Little tuna constituted 0.22% of the total fish catch from around the artificial reef installed near Trivandrum, Kerala State.

Monintga (1988) analysed in detail the results of utilisation of 'rumpon' as FAD and skipjack pole and line fishery in Indonesia. According to him, the impact of 'rumpon' implementation in the skipjack fishery since 1985 are:-

- decrease in fishing effort (35.3%); increase in total catch (99.5%); increase in C/E (71.6%); decrease in live-bait consumption (6.0%) and decrease in fuel consumption (20%).

At present, a total of 171 units of deep sea FADs have been experimentally/commercially installed at Indonesia. Monintga (1988) estimated the benefit/cost ratio (B/C) at a discount factor of 18% for fishing units with FADs installed at Indonesia as 1.76 in comparison with the fishing units without 'rumpon' where the B/C ratio was 1.30. Similar FADs could be developed by low-cost techniques and installed along the SW coast of India, Lakshadweep and Andaman and Nicobar waters.

(ii) Diversification in Fishing operations

Silas & Pillai (1986) and James & Pillai (1989,1991) have presented the thrust areas in the development of tuna fishery in the small scale sector by low cost fishing techniques. Expansion of the operational efficiency of the vessels engaged in drift gillnet fishery to cover the continental shelf areas in the EEZ is of prime importance. Introduction of multi-day boats in the drift gillnet fishery, with better catch storage facility, employment of mechanised hauling system would increase the soaking time, and seasonal conversion of 9.6 - 13.0 m OAL shrimp trawlers with slight modification in the hauling system for drift gillnet operations are worthy of mention.

According to Maldeniya & Suraveera (1991) the rate of return on Abu Dhabi type of boats was 13.7%, and with the modification in the small scale sector for 8-10 day's trips, this rate could be increased to 15.7%.

Anderson & Waheed (1990) reviewed the exploratory drifnet fishing conducted in the 25-100 miles range in the EEZ of Maldives employing boat of size 15.8 m OAL and nets of 5 inches to 7 inches mesh size and concluded that 94% of the skipjack tuna were caught by drift gill nets during rough, cloudy and moonless nights.

Around the Lakshadweep Islands, it has been estimated that the 9.4 m OAL mechanised pole and line boats fetch an average of about 206 to 335 kg of tunas/day, and the total tuna catch in 1989 has been around 5880 t. The major catch consists of skipjack tuna and young yellowfin tuna.

Recently, James & Pillai (1989,1991), Pillai (1991a,b) and Gopakumar (1991) discussed the tuna fishery and live-bait problems in Lakshadweep, and suggested plans for the development of tuna fishery by the introduction of low cost, but effective technologies. For augmenting production of tunas from the insular realms of the Indian EEZ, the following additional points are suggested.

- Introduction of 10-20 m OAL multi-day fishing boats with adequate catch storage facility, mariner's compass for navigation and also adoption of modified water spray system (Namboodiri, 1988) for operation of boats beyond the traditional fishing grounds.
- Intensification of troll line fishery and handline fishery for yellowfin tunas as is being done on the SW coast of Sri Lanka during NE monsoon months (de Silva and Boniface, 1991). In this context, attention is drawn to the sail power in low energy fishing vessels (Fyson, 1981).
- Fuel economy can be realised by the introduction and utilisation of Chorkor Ovens (Anon, 1990).

Adoption of low cost technologies in the small scale sector for tuna fishery would considerably increase the production of protein rich food from the marine sector and enhance the export market in the years to come.

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