Proceedings of
Brainstorming Session on

Development of
Island Fisheries

(Held on 21-22 June 2008)

Fisheries Science Division
Central Agricultural Research Institute (ICAR)
Port Blair - 744 101
Andaman & Nicobar Islands

भाकृअनुप
ICAR

CARI
ICAR
तमसो मा ज्योतिर्गमय

Development of Tuna Fisheries in Andaman and Nicobar Islands

N.G.K. Pillai and
E.M. Abdussamad
Central Marine Fisheries
Research Institute, Kochi-18
drngk48@yahoo.com

1. Introduction

The Andaman and Nicobar group of Islands consists of 572 islands, islets and rocky out crops and have an aggregate coastline of 1,912 km, which is about a fourth of the coastline of India. The continental shelf area is very limited with an estimated area of 16,000 sq. km and the sea is very deep within a few kilometers from the shore. The Exclusive Economic Zone (EEZ) around the Islands encompasses around 0.6 sq. km, which is around 30% of the EEZ of India. This provides a great opportunity to exploit the vast resources of the seas around these Islands to our advantage. The water around Andaman and Nicobar Islands possesses a rich diversity of fishery resources. Over 1,200 species of fishes and shellfishes belonging to 507 genera under 151 families have been identified. More than 2.4 lakh tonnes of potential pelagic, demersal and oceanic fishery resources are estimated to be available for exploitation. Many reports are available on the fisheries around the Island region (Anon, 1990; Dam Roy *et al.,* 2002), which show that the present level of annual exploitation is only 31,000 tonnes. It means at present, only around 13% of the potential is being harvested.

Tuna form one of the important fishery resources of India with an estimated potential of about 2.78 lakh tonnes in the EEZ. The current annual production of tuna is 60,374 tonnes (2007) and contributes to the annual marine fish production to the tune of 2%. Seas around Andaman and Nicobar Islands are one of the best tuna fishing grounds with an annual potential of 180,000 tonnes. Fishery and status of exploitation of coastal tunas has been reviewed by Dam Roy *et al.,* (2002) and Madhu *et al.,* (2002). Contribution of tuna from this region to the total production of the country is meager and is represented entirely by coastal tunas. The oceanic tunas remain un-exploited.

Reports are also available on the biology of tunas and related fishes of Andaman seas (Vijayakumaran *et al.*, 1992; Sivaraj *et al.*, 2005a,b). The scientific databases generated by them are of great use in understanding the resource characteristics of several major species.

2. Fishery resources and potential

Marine fishery resources of Andaman and Nicobar Islands are vast and abundantly diversified (Table 1). Various experts have estimated the marine fishery potential in the EEZ of A&N Islands, mostly based on assumptions derived from scanty data (George *et al.* 1977; Sudarsan *et al.*, 1990). Fishery Survey of India (FSI) had carried out exploratory surveys to assess the potential of demersal, neritic, pelagic and oceanic resources in the Andaman and Nicobar water by diversified methods. The surveys during the past three decades have provided very valuable information on the composition and magnitude of harvestable resources in the EEZ around the island groups. Their latest estimate (John *et al.*, 2005) which is very close to several earlier estimates was used in this paper. According to these estimates, EEZ of A&N Islands has a fishery potential of 243,500 t. Coastal pelagics constitute 57.1% with a potential of 19,000 t and demersal resources 9.2% with 22,500 t. Oceanic tunas and related groups represent 33.7% with a potential of 82,000 t.

Table 1. Major marine fishery resources of Andaman & Nicobar Islands and their potential

Category of resource	Estimated potential (t)
Pelagic Resources	
Mackerel	5,000
Lesser Sardines	10,000
Anchovies	1,000
Other clupeids	10,000
Coastal tunas	100,000
Carangids	1,000
Seer fish	5,000
Pelagic sharks	5,000
Others	2,000
TOTAL	**139,000**
Demersal Resources Perches and others	22,500
Oceanic Resources Oceanic tuna	82,000
GRAND TOTAL	**243,500**

Apart from the above fishery resources, there are several other resources like deep sea crustaceans (lobsters and shrimps), edible and other commercial mollusks, sea cucumbers, soft corals, seaweeds, etc., for which actual magnitude and potential have not been assessed.

2.1 Fishery

The exploitation of fishery resources at present is restricted to near shore waters. There are about 2,973 active and full time fishermen. There is no traditional fishing population in A & N Islands. Fishermen from Andhra Pradesh, Tamil Nadu and West Bengal, who settled in the Islands about six decades ago are engaged in fishing. In a few Islands, fishing is done by the aborigines and Nicobari tribes in traditional way using bow and arrow and spears.

There are about 1,810 fishing boats in operation along the coast during 2005. Split up details of which are; mechanized boats (140), motorized boats (102) and non-mechanised boats (1568). The major fishing gears operated along the region are drift gillnets, shore seine, hook and line, cast net, anchor net and stick net. Mechanized boats are engaged in gillnetting, trawling and hand lining. Over 40% of the catch is contributed by drift gillnets and the rest by other gears. Marine fish production registered a steady increase over the years in the Islands. Estimated marine fish landing was 1104 t (1975) and it increased to 31,000 t (2004) but still forms only 13% of the estimated annual potential yield of its EEZ.

Table 2. Estimated annual yield (in t) of major pelagic and demersal resources from the coastal waters of Andaman and Nicobar Islands during 2003-04.

Pelagic resource	Present Harvest	Demersal resource	Present harvest
Mackerel	1,520	Perches	1,820
Lesser sardines	2,990	Mullets	1,320
Anchovies	830	Pomfrets	320
Other clupeids	340	Polynemids	20
Carangids	4,570	Sciaenids	60
Seerfish	1,680	Silver bellies	750
Pelagic sharks	70	Catfish	130
Coastal tunas	810	Prawns	120
Others	13,160	Crabs	550
Total pelagic catch	25,970	Total demersal catch	5,090

Table 3. Comparison of catch index of A&N Islands with other neighboring countries

Country	EEZ area million km^2	Coast length km	Continental shelf area '000 km^2	Primary productivity $(mgC/m^2/day)$	Marine Fish production (million MT)	Catch index (Catch/EEZ areax100)
Indonesia	3.1	81,000	1,713	685	4.51	145
Thailand	1.76	2,624	39	702	2.92	166
Malaysia	0.45	4,810	418	1401	1.28	284
Sri Lanka	0.52	1,770	28	609	0.3	57
Maldives	0.92		35	387	0.16	17
India	2.02	8,041	500	979	2.70	1.33
A&N islands	0.6	1,192	32	459	0.03	5

Major share of the catch was constituted by pelagic resources (25,970 t) and the rest by demersal resources (5090 t) (Table 2). It means on an average only 19% of the pelagic resources and 23% of the demersal resources are being exploited. When compared to the potential, almost all resources are grossly underexploited and there is vast scope to increase the exploitation of all resources. Catch index of Andaman and Nicobar Island is very low compared to all of its neighboring countries (Table 3).

2.2 Potential and fishery of tuna resource

The most abundant resource of the coastal and offshore waters of Andaman and Nicobar is tunas. Their annual potential of the region has been estimated by George et al. (1997), Joseph (1986), Sudarsan et al. (1989) and (John et al., 2005). These estimates indicated an annual potential of 1,00,000 t for coastal tunas and 82,000 t for oceanic tunas. They together represent nearly 75% of total marine fishery potential in the EEZ of the Island territory. As per the estimates based on exploratory long line survey conducted by FSI, this region has some of the world's richest tuna stocks. But the contribution from this region to the tuna fishery of the country is meager. Present average annual production is only 810 t and is contributed entirely by coastal tunas.

The oceanic tuna resource is represented mainly by yellowfin (Thunnus albacares) and skipjack (Katsuwonus pelamis). These two species represent 52 and 47% respectively of the oceanic tuna potential and the stock, as a whole is inaccessible to Islanders and remain un-exploited. Though the catch details of the yellowfin tuna caught by FSI survey vessels from the EEZ of Andaman varied widely between 0.08 to 1.54%, it was relatively large compared to many other areas (Sivaraj et al., 2005b).

The available catch statistics shows that presently only about 0.8% of the coastal tuna or less than 0.5% of the annual tuna potential alone is exploited from the region.

2.3 Constraints in the development of fishery

In the light of the stock position and exploitable potential of various resources, the primary focus of marine fisheries development of the Island should centre around the unexploited coastal and oceanic tunas available for exploitation. Despite the richness of the resources, fishes of the region have only a limited tradition of tuna fishery and at present it is restricted to coastal species.

There are several constraints in developing a large scale commercial fishery in the region. The major factor responsible for the poor and staggered development of fisheries in the Island territory is the limited capability of the presently available traditional crafts and gears. This prevents the expansion of fishing operation to still deeper waters and endurance fishing for exploiting commercial stocks like coastal and oceanic tunas. Other issues in the development are lack of trained / skilled manpower to take up the fishing operation in high seas, lack of modern and adequate infrastructure for handling, preservation, storage, processing and transportation of fish and fishery products, remoteness of the Islands from rest of the country and limitation in fish trade between the Islands and Indian mainland, poor information and communication linkage, scanty resource database and lack of concerned action plans.

2.4 Commercial tuna fisheries development

Several development schemes had been proposed by various expert groups and task forces in the past. However, concreted efforts are yet to be made and the fishery resources in the Andaman and Nicobar waters by and large remain under exploited. Since the marine fisheries development of the Andaman and Nicobar Islands depends mainly on the success of tuna fishery, any strategy for fisheries development should include the exploitation of primarily coastal tunas together with pelagic sharks, barracudas and seerfishes. It can be achieved through the introduction of new small vessels in a phased manner for drift gillnetting and small long lining and by creating more conducive investment climate for the private sector. Another component which has been hitherto unexploited is the oceanic tunas, which is to be targeted using ocean-going longliners and factory-cum collector vessels with high investment particularly for the harvest of sashimi-grade tuna. As a natural corollary to this development and investment, adequate infrastructure by way of modern fishing harbours, processing fishery estates, power and water suppliers and communication and marketing channels are required to be established.

3. Upgradation of traditional fishing crafts and gear

The main net used in the A&N Islands is gill net, which forms 39% of the total fishing gear units and the next important gear is hook & line, which forms 34%. These gears are mainly used to exploit coastal small to medium pelagics. These gears are designed to exploit mainly small and medium sized fishes available along the shallow coastal region. They have lot of limitations and may not be efficient in deeper areas especially for exploiting larger pelagics. New designs of gillnets of appropriate mesh and body size and also hooks and lines according to the behaviour of target resources have to be introduced for exploiting the targeted tuna resources.

Presently most of the local fishermen are using non-motorized traditional boats (donghies) for fishing. Their operation is limited in the coastal waters within 6 to 7 km from the shore. They have added disadvantage of short life span of about five year. Under these circumstances motorisation will increase the harvest only marginally. Moreover a large number of such boats were already destroyed by tsunami. By providing upgraded boats with distant-water fishing capability and increased carrying capacity in the place of lost ones and also by the phased replacement of the existing ones, the fishing ability can be improved to exploit coastal resources including tunas.

3.1 Introduction of new motorized crafts

Table 4. Cost/ investment involved (in lakhs) in development of Craft and Gear.

Details of craft & gear	Cost of craft and gear	Total Cost of craft and gear/vessel	No. of vessels	Grand total cost
Introduction of new boat-Motorized / Sail fitted with gill nets and lines. FRP:LOA- 10-12 m, B-3.7 m, D-1.5 m Gear : Gillnets/lines (1000 m)	Craft : 7.0 Gear :1.0	8.0	125	1000
8.0 125 1000.0 Introduction of new craft: Mechanized /sail fitted gill netter. FRP hull fitted with wooden deck- LOA-12.5 m, B-3.75 m, D-1.6 m Gear: Gillnets (1500 m)	Craft : 10.0 Gear :2	12.0	200	2400.0
Introduction of new craft : mechanized long liners FRP hull fitted with wooden deck – LOA-12.5 m, B- 3.75 m, D-1.6 m Gear: longlines (1000 hooks)	Craft :10.0 Gear: 2.5	12.5	200	2500.0

Present fishing practices could exploit only the coastal tuna resources marginally. They can be exploited more effectively by introducing more efficient motorized gillnetters of LOA 10-12 m to harvest coastal resources including coastal tunas. It will act especially as an alternate option to traditional fishes. Potential resources like coastal tuna, shark and seerfish resources can be exploited by introducing large (12.5 m LOA) gillnetters and longliners. The cost involved in the development of craft and gears are shown in Table 4.

3.2 Pilot demonstration fishing trials

There will be an aversion to accept any introduction including advanced crafts and gears and modern technologies among traditional fishes, especially due to their confusion over its operational and economic viability. Hence, all new introductions of craft and gear or technology to harvest unexploited potential resources should start as pilot demonstration fishing trials to show the techno-economic viability of such new introductions to the end users. Demonstrable techno-economic viability is the only means to attract private investment in to the sector.

3.3 Development of harvest strategies for oceanic tunas

As discussed above, the oceanic tuna resource with an estimated potential of around 82,000 t is totally unexploited. Considering the high economic value of large oceanic tunas in international markets as 'Sashimi grade' tuna, there are lot of chances for exploiting them profitably. This resource can be exploited by introducing large sea going vessels of LOA 24-27 m with 50 t storage capacity and -60°C freezing facilities for pelagic longlining and gillnetting. It involves setting a main line of many kilometers long with branch lines coming off it. A typical longline carries over 2,000 baited hooks and targets fishes at depths between 50 and 400 metres. The main species targeted by longliners are yellowfin and skipjack. Longline fleets will also catch many billfish species like marlin, wahoo, mahimahi, swordfish, and other species like sharks. There are two broad categories of longliners determined based on the length of time the vessel can be at sea. Large-scale longliners with ultralow temperature freezer capacity can stay at sea for months at a time and only need to come into port to transship or obtain additional supplies. Small-scale longliners fish on an average for two weeks at a time and return to port. However, such commercial tuna long lining is not currently practiced in Indian mainland. The FSI has been carrying out fishery surveys in the Indian seas using tuna longlining. The CIFNET provides training on the use of this method of fishing. The recommended mesh sizes and number of hooks per vessel for coastal and oceanic region are given in Table 5.

Joseph, K.M. 1996. Some observation on the potential fishery resources from the Indian EEZ. *Bull. Fish. Surv. India*, 14:20 pp.

Madhu, K, Rama Madhu, S.P.S. Ahlawat, E.K. Ravindran and S. Dam Roy 2002. Status of exploitation of tuna, mackerel and seerfish in Andaman and Nicobar Islands. In N.G.K. Pillai, N.G. Menon, P.P. Pillai and U. Ganga (Eds). *Management of Scombroid Fisheries*, CMFRI, Kochi 49-55.

Sivaraj, P., S.A. Rajkumar, M.K. Sinha, A.B. Kar and S.K. Pattanayak, 2005a. Distribution, abundance and biology of Indo-Pacific sailfish in Andaman seas. In: V.S. Somavanshi, S. Varghese and A.K. Bhargava (Eds). *Proc. Tuna Meet-2003*:: 216-225.

Sivaraj, P., M.K. Sinha, S.A. Rajkumar, A.B. Kar and S.K. Pattanayak. 2005b. Fishery and biology of yellowfin tuna in Andaman and Nicobar waters. In: V.S.Somavanshi, S. Varghese and A.K. Bhargava (Eds). *Proc. Tuna Meet-* 2003 : 153-167.

Sudarsan, D, T.E.Sivaprakasam, V.S. Somavanshi and M.E. Hohn 1989. Assessment of oceanic tuna and other fish resources of Indian EEZ based on exploratory surveys. *Proc. National Tuna Conference*, CMFRI, Kochi. 44-66.

Sudarsan, D, M.E. John and V.S. Somavanshi, 1990. Marine fishery resource potential in the Indian Exclusive Economic Zone. An update, Bull. Fish Surv. India, 21: 20-27.

Vijayakumaran, K., P.S. Parasuram, S.A. Rajkumar and G. Nagarajan 1992. A study on the food and feeding habit of yellowfin tuna (*Thunnus albacares*) caught in Andaman waters of Indian EEZ by tuna longline. *Bull. Fish. Surv. India*, 24 : 40-48.