

Freshwater Aquaculture and Mariculture Prospects in Andaman and Nicobar Islands, India

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Introduction

Andaman & Nicobar group of Islands is situated between 60° 14' N and 92° 94' E in the south-east of Bay of Bengal. Though the total coastline of the islands is 1,962 km which is about one fourth of the total coastline of India, the continental shelf area is only 16,000 km² because the seas around the islands are deep within a short distance from the shore. The exclusive economic zone (EEZ) of the Bay Islands is 0.6 million km² accounting to about 30% of the Indian EEZ (2.02 million km²) (Arif, 1983, Alagaraja, 1987). Andaman & Nicobar group of islands fall under the Agro-ecological Region 21 (hot humid to par humid island eco-region) has an estimated annual fishery potential of 1.48 lakh tonnes which is about 3.8% of the national fishery potential (39 lakh tonnes). The important oceanic fisheries constitute about 60,00 tonnes consisting 46,700 tonnes of tuna (77.83%) of the marine species. Out of projected potential of oceanic fisheries, only 19% are presently being utilized giving much scope for future exploitation of the oceanic species.

Some of the important species as per their landings are:

1. sardines (*Sardinella*, *Dussumieria*, *Pellona*, *Herkilotischthys* and *Anadontostma* species),
2. anchovies (*Thryssa* and *Stolephorous* species),
3. perches (*Lethrinus*, *Lutjanus*, *Lates*, *Pomadasy*, *Epinehhelus* species),
4. silver bellies (*Leognathus* and *Gazza* species),
5. carangids (*Carax*, *Salar*, *Chorinemus*, *Elegatus* and *Decapterus* species),
6. mackerels (*Rastrelliger kanagurta* and *R. brachysoma*),
7. seerfish (*Scomberomorus guttatus* and *S. commersoni*),
8. mullets (*Mugil cephalus* and *Liza tade*),
9. elasmobranchs (*Carcharinus*, *Scoliodon*, *Shpyrna*

species including *Centrophorus acus* and *Squatius megalops*),

10. prawns and other crustaceans (Paulinose and George, 1976, Thomas, 1977, Silas *et al.*, 1983, Rajaram and Neduraman, 2009, Rajan *et al.* 2012).
11. About 19 species of penaeid prawns and
12. 6 species of lobster are part of the landings (Dorairaj and Soundararajan, 1985; Soundararajan, 1985; Dam Roy and George, 2010, Venkataraman *et al.*, 2012).
13. Among mollusks, the most important are *Trochus*, *Turbo* shells, pearl oysters, giant clams, mussels and oysters (Dorairaj and Soundararajan, 1985, Rajaram and Murugan, 2012, Venkataraman *et al.*, 2012).

The marine fishing in the islands is mainly traditional in nature. The Andaman & Nicobar administration has demarcated **nine fishing zones for organized fishing in these islands**. About **6,340 marine fishers** are active and use about **1,451 country crafts, 1,257 motorized boat and 12 mechanized vessels for fishing**. There are 72 fish landing centers at the beach site and one organized fish landing centre. The fishing gears used is gill nets, hook and lines, long lines, cast nets, shore seines/anchor nets. The traditional fishing crafts and gears used by the tribes of Car Nicobar have been highlighted by Zamir Ahmed *et al.* (2013). Details regarding aqua-resources as well as fish and fisheries of Andaman & Nicobar Islands are being summarized in Table 1.

In inland waters, freshwater fishes like the Indian major carps (*Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*) are cultivated in ponds. The number and area of minor irrigation ponds in major places of Andaman & Nicobar Islands where freshwater fishing is being practiced are given in Table 2.

In general, the annual marine fish landings in

Table 1: Some facts about fish and fisheries of Andaman & Nicobar Islands.

| | |
|--|-----------------------|
| Fishery resource potential | 1.48 lakh tons |
| Production | 26,000 tons (2005) |
| Demersal resources | 32,000 tons |
| Pelagic resource | 56,000 tons |
| Oceanic resource | 60,000 tons |
| Total catch | 28,800 tons (2008) |
| Diversity of marine fishes | 1,330 taxa |
| Family | 169 |
| Genera | 300 |
| Species | 547 |
| Number of fisherman engaged in fishing (2010) | 17,498 |
| Skilled fisherman | 7,500 |
| Unskilled fisherman | 5,000 |
| Gear used (2010) | |
| Gill net | 1,715 |
| Shore seine | 10 |
| Anker net | 1 |
| Cast net | 517 |
| Hooks & lines | 1,850 |
| Trawl net | 6,787 |
| Disco net | 10 |
| Fishing craft used (2010) | |
| Country craft | 546 |
| Mechanized boat | 436 |
| Local Boat | 566 |

Table 3: Marine and freshwater fisheries in Andaman & Nicobar Islands.

| Sl. No. | Item | 2000-01 | 2005-06 | 2007-08 |
|---------|--|---------|---------|---------|
| 1 | Marine fish production (000' tones) | 27.6 | 12.0 | 28.8 |
| 2 | Freshwater fish production (000' tones) | 0.07 | 0.04 | 0.15 |
| 3 | Freshwater fish seed production & supply (Rs. in lakh) | 4.50 | 7.13 | 5.10 |

Table 2: Minor irrigation ponds used for aquaculture in Andaman & Nicobar Islands.

| Sl. No. | Place | Number of ponds | Water area (ha) |
|---------|---------------|-----------------|-----------------|
| 1 | South Andaman | 382 | 22.00 |
| 2 | Baratang | 25 | 1.60 |
| 3 | Billiground | 255 | 16.80 |
| 4 | Diglipur | 465 | 27.28 |
| 5 | Havelock | 63 | 3.36 |
| 6 | Mayabunder | 89 | 5.20 |
| 7 | Neil Island | 37 | 2.80 |
| 8 | Hut Bay | 75 | 3.20 |
| 9 | Rangat | 118 | 5.76 |
| 10 | Kadamtala | 134 | 7.60 |
| 11 | Car Nicobar | 07 | 0.56 |
| 12 | Campell Bay | 26 | 2.08 |
| 13 | Nancowry | 02 | 0.12 |
| | Total | 1,678 | 100.68 |

Survey in the year 2010 showed the total number of ponds 2,200.

(Source: Directorate of Fisheries, Andaman & Nicobar Administration, 2007-08)

Table 4: Fish export and revenue earned by Andaman & Nicobar Islands.

| Sl. No. | Item | 2000-01 | 2005-05 | 2007-08 |
|---------|-----------------------|---------|---------|---------|
| 1 | Export (000' tones) | 0.17 | 0.32 | 0.32 |
| 2 | Revenue (Rs. in lakh) | 14.68 | 12.28 | 9.90 |

these islands have increased gradually from a meager 44 tonnes in 1950 to 28,800 tonnes in 2008. However, in the last 8 years, the fish landing from about 27,600 tonnes in 2000-01 to 28,800 tonnes in 2007-08 (except a drop to 12,000 tonnes in 2005-06 after tsunami) remained nearly static (Table 2). In fact, the fish potential of the islands is hardly being exploited with the present level of catch of only 28,800 tonnes (18.29%). It has been estimated that tuna fish alone account for 44% (64,500 tonnes) of the total fish resource of the Andaman & Nicobar Islands (1.48 lakh tonnes).

The seed of the Indian major carps (*Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*) are produced through induced breeding, reared for 30-45 days and supplied to the farmers for stocking in the ponds for further rearing. The seed production and supply of freshwater fish and its production are given in Table 3.

Most of the fish landed in these islands is consumed locally in fresh form. The current trend is for fishing high value finfish such as groupers, snappers, emperors and shell fishes such as crabs, lobsters and shrimps. These fishes are also exported in live, chilled/frozen/salted/dried form either to mainland or to foreign countries by fish traders. Transportation of fish outside the jurisdiction of the islands attracts payment of royalty to the government at the prescribed rate. The details of fish and fishery products exported and revenue collected by Andaman & Nicobar Administration, Port Blair are given in Table 4.

Andaman & Nicobar islands are bestowed with rich marine biodiversity. Proper harnessing of these resources is only possible when various mariculture practices such as culture of mussels, edible oyster, pearl oyster for pearl production etc are being taken up in the earnest (Thomas, 1977, Silas *et al.* 1983). Even land-based oyster culture, lobster culture in FRP tanks/cement tank can also be undertaken which will cater to the demand of tourists who are arriving here in large number. Since there is a wide gap between the level of exploitation and the estimated fishery potential, fishery has been identified as a priority sector for socio-economic development of the islands.

Cage culture

There is vast scope of cage culture of commercially important fishes like groupers, snappers, seabass,

milkfish, mullet etc. These fishes can be cultured in cages in the innumerable bays and creeks of Andaman & Nicobar Islands. Eco-friendly brackishwater aquaculture has been standardized during past two decades by Central Agricultural Research Institute (ICAR), Port Blair. Experiments were conducted on various candidate species in the brackishwater fish farm at Sippighat, South Andaman and the production achieved for mullet (*Liza tade*), milkfish (*Chanos chanos*), seabass (*Lates calcarifer*), tilapia (*Oreochromis urolepis*), prawn (*Penaeus monodon*, *Penaeus merguensis*) and mudcrab (*Scylla serrata*) were 342 kg/ha/yr, 600 kg/ha/yr, 119 kg/ha/yr, 1,036 kg/ha/yr, 1,200 kg/ha/4 months and 878 kg/ha/yr, respectively.

Tsunami

As it is well known that on 26th December 2004, an earthquake measuring 8.9 Richter scale struck Andaman & Nicobar group of Islands at early hours. This was followed by Tsunami, causing destruction of very high magnitude both in terms of loss of property as well life. Consequent to the earthquake, there was subduction of land of more than a meter and half with a result sea water intruded inland area to a large extent, thereby inundating the lands which were previously used for agriculture. About 1,300 ha area got permanently inundated, particularly in South Andaman. The areas where the effect was maximum are Sippighat, Chouldari, Teylarabad, Badmaspahar, Port Mount, Methakhari, Dundas Point, Namunagar etc.

The lands which were used hitherto for paddy cultivation have become useless due to increase in salinity. As a result, the farmers who were practicing agriculture are now forced to search for a viable alternative livelihood. Andaman & Nicobar Administration being aware of the emerging situation, has taken up proactive action by constituting a Project Implementation Committee for Aquaculture in the inundated lands. The objective of the Committee is to implement the Aquaculture Projects in the submerged areas of South Andaman. The survey showed an area of 830 ha suitable for brackishwater aquaculture wherein primarily shrimp culture is being advocated. Post-larvae produced from mother prawn of Andaman waters will be used for culture purpose thereby giving an alternative livelihood to the farmers of the area. Reservoir resources in Andaman and Nicobar Islands have been given in Table 5. Scientific exploitation of fisheries will

Table 5: Reservoir resources in Andaman and Nicobar Islands.

| Sl. No. | Name | Location | Area (ha) |
|---------|-----------------------|----------------|------------|
| 1 | Dhanikari Reservoir | South Andaman | 65 |
| 2 | V. K. Puram Reservoir | Little Andaman | 48 |
| 3 | R.K.Puram Reservoir | Little Andaman | 65 |
| 4 | Dilthamam Tank | South Andaman | 03 |
| 5 | Chakkargaon Tank | South Andaman | 03 |
| 6 | Nayagaon Tank | South Andaman | 03 |
| 7 | Kalpong Reservoir | North Andaman | 180 |
| | Total | | 367 |

certainly enhance fish production from such water bodies (Sugunan and Sinha, 2001).

There are about of 1,678 minor irrigation ponds existing in farmers field in Andaman & Nicobar Islands, some new ponds are also being constructed day-by-day for fish culture. The details of major culture ponds are summarized in Table 6.

These ponds are of the average size of 30x20 m (600² m each) with the depth of 2-3 m. Under the Departmental Plan Programme, seed of the freshwater Indian major carps (catla, rohu and mrigal) only are being supplied presently to the pisciculturists on the nominal price @ Rs. 100/- per thousand seeds. The Department is also maintaining a Freshwater Fish Seed Farm for production of freshwater fish seed at Nayagon in South Andaman District. In the Departmental Farm, only seeds of the Indian major carps are being produced because the brood stock of exotic carps (silver carp and grass carps) are not available in the Islands.

Carp culture

For optimum utilization of water bodies, combined culture of Indian major carps along with exotic carps (grass carp, silver carp and common carp) are being practiced in the mainland which is popularly known as Composite Fish Culture, it is a scientific technology for maximum fish production from a pond through utilization of fish food organisms available in the water body. According to food and feeding habits,

Table 6 : Details of major culture ponds in Andaman & Nicobar Islands.

| Sl. No | Place/Tehsil | Number of ponds | Water area (ha) |
|--------|---------------|-----------------|-----------------|
| 1 | South Andaman | 382 | 22.92 |
| 2 | Baratang | 25 | 1.50 |
| 3 | Billiground | 255 | 15.30 |
| 4 | Diglipur | 465 | 27.990 |
| 5 | Havelock | 63 | 3.78 |
| 6 | Mayabunder | 89 | 5.34 |
| 7 | Niel Island | 37 | 2.22 |
| 8 | Hut Bay | 75 | 4.50 |
| 9 | Rangat | 118 | 7.08 |
| 10 | Kadamtala | 134 | 8.04 |
| 11 | Car Nicobar | 07 | 0.42 |
| 12 | Nancowry | 02 | 0.12 |
| 13 | Campell Bay | 26 | 1.56 |
| | Total | 1678 | 100.68 |

the three feeding zone of Indian major and exotic carps are given in Table 7.

Diversification of indigenous species

There is a urgent need of diversification of fish species in Inland water. Some important species of air-breathing fishes such as *Clarias batrachus*, *Heteropneustes fossilis*, *Channa striatus*, *Channa punctatus*, *Anabas testudinus* and *Notopterus chitala* is also available in Andaman & Nicobar Islands (Chaturvedi et al, 2013). One catfish hatchery as developed for the seed production of singhi and magur and the induced breeding technology has been standardized (Chaturvedi and Pandey, 2012). Recently *Pangasius sutichi* catfish (exotic) is introduced in Andaman and Nicobar in the year 2010. The scope, demand and potential of *P. sutchi* is very high in recent year. There is a vast scope of culture of *P.sutchi* and seed production unit of diversified species of catfishes is present demand although the demand of catfish seed is too much in Bay Island but hatchery development of such species is the present demand of the thrust area for Islands

Table 7: Food, feeding habits and zones of the cultured carps

| Sl. No. | Species | Feeding habit | Feeding zone |
|--------------------------|------------------------------------|--------------------|----------------|
| India major carps | | | |
| 1 | <i>Catla catla</i> | Zooplankton feeder | Surface feeder |
| 2 | <i>Labeo rohita</i> | Omnivorous | Column feeder |
| 3 | <i>Cirrhinus mrigala</i> | Deterious feeder | Bottom feeder |
| Exotic carps | | | |
| 4 | <i>Hypophthalmichthys molitrix</i> | Plankton feeder | Surface feeder |
| 5 | <i>Ctenopharyngodon idella</i> | Aquatic vegetation | Column feeder |

development. *Pangasius sutchi* production is (40 ton/ha) very high as it is tested in different part of the country. This species is quite good for cage culture in Inland

water or low saline water after or inundated Tsunami water areas.



Fig. 1: Brood fish for ultrasonography.



Fig. 2: Ultrasonographic assessment of maturity.



Fig. 3: Hatching in hapa.



Fig. 4: Magur traditional hatchery.



Fig. 5: Flow-through hatchery.



Fig. 6: Hatchlings of *Clarias batrachus*.



Fig. 7: Fry rearing in two-tier system.

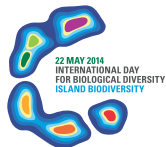


Fig. 8: Fingerling rearing in three-tier system.

Seed requirement

Catfishes such as *Heteropneustes fossilis* (singhi), *Clarias batrachus* (magur) and *Pangasius sutchi* have been identified as potential candidate species for diversification of aquaculture in the Bay Islands. The seed required for the culture were initially procured from Bangladesh by the traders from West Bengal and distributed to different states. Now hatcheries have been established in West Bengal, Andhra Pradesh and Chhattisgarh to meet out the demand by the farmers. We successfully induced-bred the Asian catfish, *Clarias*

batrachus under agro-climatic conditions of Andaman & Nicobar Islands (Chaturvedi and Pandey, 2012) (Fig. 1-8). The present production of *P. sutchi* seed in the country is estimated to be around 40-50 million. Among the catfish, *P. sutchi* has rapid growth and attains 1-2 kg in 8 month of the cultured period, thus having tremendous culture potential in Bay Islands. This species can be cultured in ponds, seasonal tanks, abandoned shrimp ponds, cages, reservoirs and landlocked water bodies in Andaman & Nicobar Islands.



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