Chapter
04

Status of Molluscan Fisheries of India

K. Sunil Mohamed
ICAR - Central Marine Fisheries Research Institute, Kochi

Introduction

Molluscs are a fascinating and varied group of animals and although their outside features may vary greatly in form and colour, their internal structure are constant. The invertebrate phylum Mollusca with more than 80,000 species is second only to Arthropoda in number of species.

In India, the molluscs contribute to important fisheries, providing nutritious food, and are also foreign exchange earners to the country. The shell has many industrial uses and is the object in making eye-catching articles by deft craftsmen. Men, women and children participate in fishing molluscs, which provide employment and income in coastal rural areas.

Magnitude of Molluscan Fisheries in India

Cephalopods are by far the most important group with an average annual production of about 1,05,000 tonnes (see Fig.1). They are landed as by-catch and as a targeted fishery mostly in mechanized trawlers operating up to 200 m depth for subsoil shell deposits for industrial purposes is a major activity in the Ashtamudi and Pulicat Lakes. Kerala dominates bivalve production, which includes oysters, mussels and clams. However unlike cephalopod production estimate which is based on a scientifically valid methodology; the estimates for bivalve production is mostly region specific, and therefore, the error of the estimates are likely to be high.

TN and KL states contribute to almost all of the production. These estimates are likely to be gross underestimates due to low taxonomic resolution of the data set.

Adapted from Winter School Notes on ICT-oriented Strategic Extension for Responsible Fisheries Management

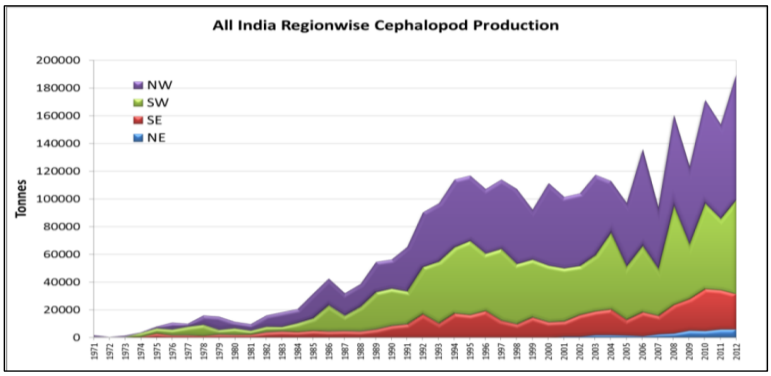


Figure 1: Region wise estimated cephalopod production from Indian seas during 1971-2012. Note the overall dominance of northwest and southwest coasts.

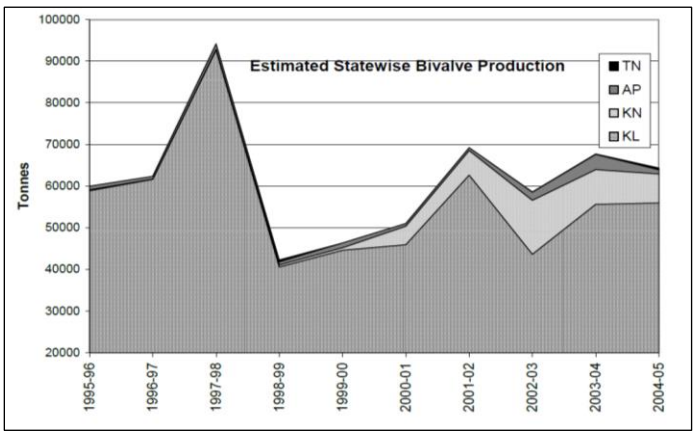


Figure 2: Estimated state wise bivalve production in India.

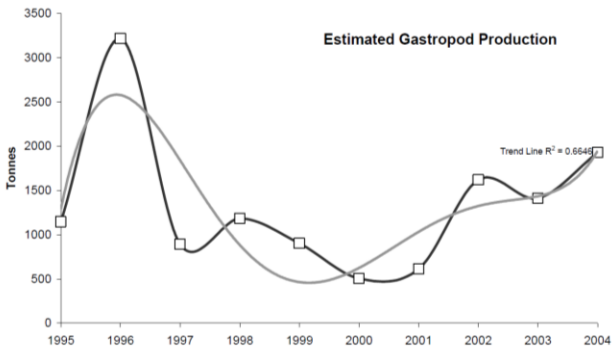


Figure 3: Estimated annual gastropod production in India along with trend line.

Bivalve Fishery

A variety of clams, oysters, mussels and the windowpane oysters are distributed along the Indian coastline where they are fished by the local people. Clams and cockles form 73.8%, followed by oysters (12.5%), mussels (7.5%) and windowpane oysters (6.2%). The major bivalve resources and their total landing are given in Table.1 and Fig.2. The production levels in other states are meagre. Information on the bivalve production from the NE and NW states are scanty.

Utilization

India has been exporting bivalves especially clam and mussel meat to other nations (Fig.4). The average foreign exchange earned by the nation during 1991-2003 through bivalve and gastropod exports is Rs.13 crores from the export of 1998 t of various products like frozen, smoked and dried meat and seashells. Bivalves fished along the West Coast are utilized for human consumption. Some bivalve products like smoked and canned oysters have good market in Indian metro cities. In Kerala and Andhra Pradesh part of the clam landings are used as a major ingredient of shrimp feed. The extensive shrimp farms also use dried and boiled clam meat as shrimp feed. Apart from these, the shells of bivalves are used in the manufacture of cement, calcium carbide, sand–lime bricks and lime. The lime shell is used as manure in coffee plantations, as mortar in building construction, in the treatment of effluents, as a pesticide by mixing with copper sulphate and in glass, rayon, polyfibre, paper and sugar industries. Bivalve shells with attractive sculpture are used by the ornamental shell craft industry. The shells of giant clams, winged oysters and black lip pearl oysters are used as curios in the Island territories.

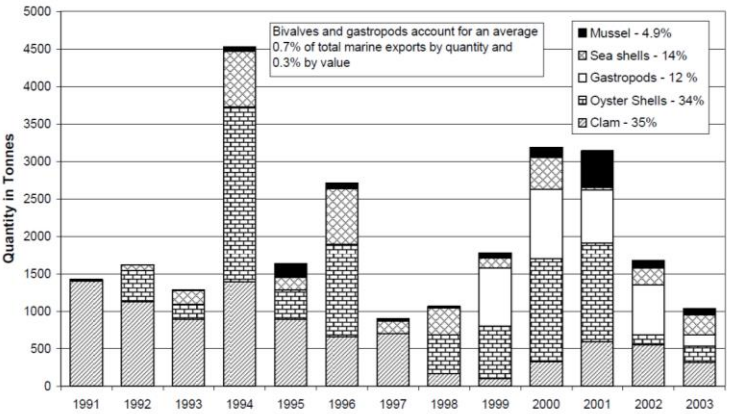


Figure 4: Export of bivalve and gastropod products from India.

Major contributors are clams and oyster shells. There is great scope for increasing the quantity and value through product diversification and addressing niche markets. (Data source: MPEDA, Cochin).

Stock assessment

Only few studies have been made to assess the stock of bivalves. However, short term surveys have been conducted in the estuaries and coastal regions of maritime states to study the standing stock bivalve resource. Using the standing stock estimates by CMFRI the potential yield of bivalves has been estimated (Table.1). The present status shows that the clam and oyster resources are underutilized in Gujarat and Maharashtra and effort to utilize these resources should be enhanced. However bivalves have varied reproductive potential hence these resource estimates have to be revalidated frequently. In other states like Kerala and Karnataka the resources are utilized and in some regions they require conservation.

Management Strategies

Bivalves offer one of the important examples of marine resource management along the Indian coast. However, apart from the restriction on the pearl oyster fishery by the Government of Tamil Nadu, and the management measures on the short-neck clam fishery of Ashtamudi Lake, Kerala, there are no regulations for effective utilization and conservation of these sedentary marine resources. One of the major bivalve resources, the short-neck clam (*P. malabarica*) is well protected by the following regulations formulated by the Government of Kerala based on recommendations made by CMFRI. a) Ban on fishing 28 Winter School on ICT-oriented Strategic Extension for Responsible Fisheries Management activity during breeding season (September to February), b) use of gears with 30 mm mesh size to avoid exploitation of smaller clam, c) Restrict the grade of export of frozen clams meat to 1400 nos/kg and above and d) Initiate semi-culture or relaying of small clams. One of the major drawbacks in bivalve fishery management is that there is no proper data collection system on the fishery landings. A proper database on the resource availability and their utilization pattern is essential.

Table 1. Standing stock and potential yield estimates of bivalves

Resource/State	Estimated Standing Stock	Potential Yield Estimate
Clams and Cockles		
Maharashtra	4000	5000
Goa	1200	2000
Karnataka	8027	6823
Kerala	65000	55250

Tamil Nadu & Pondicherry	5770	4905
Andhra Pradesh	58000	49300
Total	141997	123278
Oysters		
Gujarat	1500	1050
Maharashtra	335	235
Karnataka	450	315
Kerala	4200	2940
Tamil Nadu	19032	13322
Andhra Pradesh	23000	16100
Total	48517	33962
Mussel		
Maharashtra	1800	1260
Goa	1120	784
Karnataka	9800	6860
Kerala	17473	12231
Tamil Nadu	350	245
Andhra Pradesh	1000	700
Total	31543	22080
Windowpane Oysters		
Gujarat	5000	3500
Goa	120	84
Andhra Pradesh	12420	8694
Total	17540	12278
Grand Total	**239597**	**191598**

Ashtamudi Lake Clam Fisheries Management Plan

Part of Zone I, under and west of the Neendakara Bridge should be declared as a no-take zone for clams all through the year. This will function as a protective zone where in regenerations of stocks will take place continuously and this will also help re-populate clams in other zones. This zone can function as a CLAM SANCTUARY. The provision of Declared Fisheries Zone (DFZ) of the Kerala Inland Fisheries Act may be invoked for this purpose by the State.

Seed clams can be transplanted and cultured in shallow areas having similar water and sediment conditions of the clam beds. The suitable areas for such transplant culture are indicated in the report of Suja (2012) and an example GIS map is shown below (Fig.9). The optimum stocking densities are also indicated in this report.

Seed clams below 20 mm APM should not be allowed to be harvested, and if harvested, they should be relayed. This size may be declared as the Minimum Legal Size (MLS) for harvest by the DOF.

As a long-term conservation measure, hatcheries have to be developed within the next 10 years for breeding the clams and spats can be relayed in suitable locations (indicated above) in Ashtamudi Lake.

Transplantation of clams from one estuary to another must not be permitted as the ecological effects cannot be easily judged beforehand.

No species introductions should be permitted in Ashtamudi Lake without a comprehensive study by a research institute and permission of the SFD.

Ashtamudi Lake – A managed Clam Fishery

The short-neck clam fishers (numbering about 500 fulltime and part time fishers) of Ashtamudi Lake are perhaps one of the best examples of a well-managed local fishery benefiting the fishers and maintaining sustainable harvests. The management practices are implemented by the cooperative societies with the active scientific support of CMFRI.

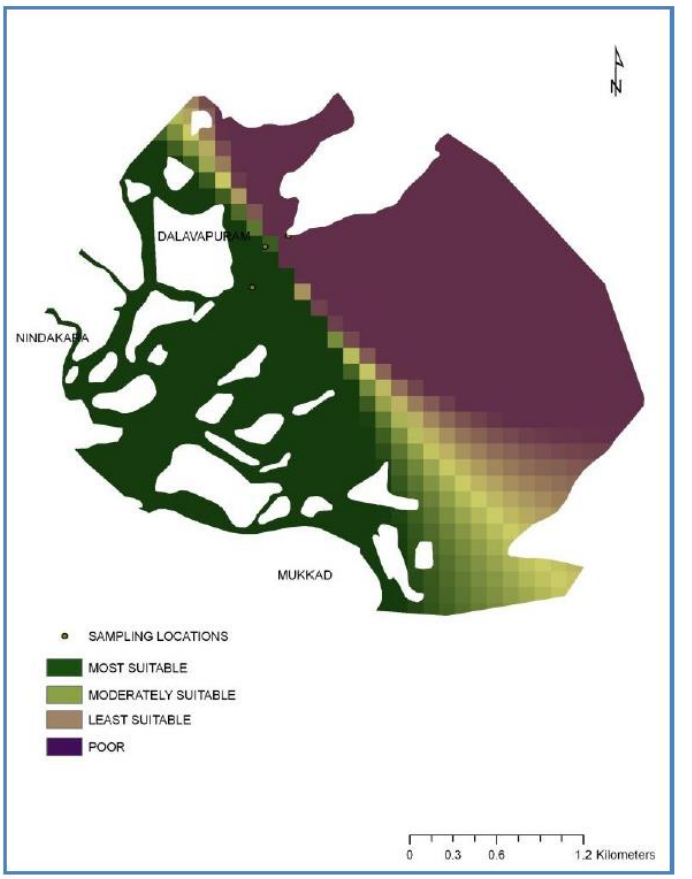
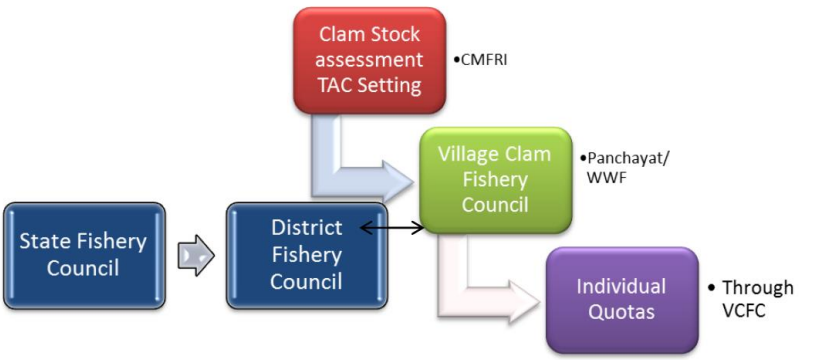


Figure 5: GIS map showing areas suitable for clam transplantation (farming) in Ashtamudi Lake. From Suja (2012)

A system of licensing of clam fishers in the Lake and registration of boats and gears used for clam fishing should be urgently carried out by the SFD.

No mechanical devices should be permitted for the harvest of clams in the Lake. The CMFRI should conduct clam biomass surveys in Jan-Feb every year, and come out with estimates of fishable stock in the ensuing season. The CMFRI should provide sufficient information to generate a Total Allowable Catch (TAC) which can be later converted to individual quotas for fishers on an annual basis. 30 Winter School on ICT-oriented Strategic Extension for Responsible Fisheries Management. For effective management of the clam resources of the Ashtamudi Lake, a stakeholder council or Village Clam Fishery Council (VCFC) should be formed by the administration. This council should have representation from panchayat, Department of Fisheries, CMFRI, NGO‟s working in the area and clam societies. They should meet once in a quarter. The Council should have powers to debate and formulate rules as necessary for effective management of the clam fisheries.

Following the participatory mode 3-tier fishery management system, the VCFC should report to the District Fishery Council (DFC) and ultimately to the State Fishery Council (SFC). The modalities of such a management regime should be enunciated by the DOF.



The southern and northeastern parts of the Ashtamudi Lake are currently devoid of clam populations. It was not so many years ago. This has happened due to deterioration in water quality in these regions through increased urbanization and unregulated waste dumping. This part of the Ashtamudi Lake needs special focus to improve the habitat quality for ecological sustainability of the Lake.

Zones I to V as demarked in the map may be declared as Clam Management Area (CMA) of Ashtamudi Lake by the DOF for the purpose of framing necessary rules and regulations to govern the clam fisheries by the VCFC.

Depuration of clams for hygienic consumption may be encouraged. This could be done by the fishers or processors or agents. A scientific depuration and meat shucking process has been developed by CMFRI and this maybe initially financially supported by the DOF as a scheme.

Cephalopod Fishery

Cephalopods are a marine fishery resource of increasing importance and many species are exploited as by-catch by trawlers from throughout the Indian coast. Although they form only 4-5% of the total marine fish landings, cephalopod stocks are under heavy fishing pressure because of their high value as an exportable commodity. So much so, of late, they are even targeted by the trawl fleet in certain seasons of the year along parts of the west coast of India. The CMFRI has initiated studies on cephalopod stock from Indian waters during the seventies. The initial results of this programme on the taxonomy, biology, fishery and stock assessment of cephalopod stocks pertaining to the seventies were published as a bulletin. Subsequently a major exercise on the stock assessment of Indian cephalopod stocks with data of 1979-89 was made by CMFRI. These studies indicated that squids were exploited at optimum level on both coasts and cuttlefishes were optimally exploited along east coast and under exploited along west coast.

Exploited Cephalopods

Cephalopods exploited from Indian seas can be broadly divided into three, viz.,squids (order Teuthoidea), cuttlefishes (order Sepiiodea) and octopuses (order Octopodidea). The dominant species occurring in commercial catches are *Loligo duvauceli*, *Sepia pharaonis, S.aculeata* and *Octopus membranaceous*.

Methods of Exploitation

Although about 40% of the world's cephalopod catches are taken by squid jigging and 25% by trawling, in India, cephalopods are principally caught by bottom trawlers operating upto 200m depth zones. While most of the catch is brought in as by-catch from the shrimp and fish trawls employed by the trawlers, of late, there is a targeted fishery for cuttlefishes during the post monsoon period (Sep-Dec) using off bottom high opening trawls along the SW and NW coast. Prior to the seventies traditional gears like shore seines, boat seines, hooks and lines and spearing were the principal gear employed to capture cephalopods.

These traditional gears continue to be used especially for cuttlefishes at Vizhinjam, where there is no trawl fishery. Experimental squid jigging has been tried with Japanese expertise along the west coast by GOI vessels with considerable success. However, commercial squid jigging is not practised in India.

Cephalopod Production

Cephalopod production, which remained at very low level upto the early seventies, has shown a remarkable increase crossing the 100,000 tonne mark in 1994 (Fig.1). From 1973 onwards the commencement of export of frozen cephalopod products to several countries saw the transition of the resource from a discard to a quality resource fetching high foreign exchange. Thereafter its production showed a steep increase (Fig.1). The west coast maritime states, Gujarat (GUJ), Maharashtra (MAH), Goa (GOA), Karnataka (KAR) and Kerala (KER) contribute to the bulk (86%) of the production. While the production from the east coast amounts to only 14%, of which, Tamil Nadu (TN) contributes the maximum followed by Andhra Pradesh (AP). The states of West Bengal (WB), Orissa (OR) and Pondicherry (PON) contribute only a small percentage. Overall, KER ranks first contributing a third of the all India production followed by MAH, GUJ and KAR. At the national level, Jan-Mar and Oct-Dec were the most productive period. Along the upper east and west coast, the above months were the most productive, while in KAR, KER, TN and AP Jul-Sep was also equally productive.

Utilization and Marketing

There is very little internal market demand for cephalopods and consequently almost all the catch is exported. Export of cephalopods from India during 1991 to 2003 is shown in Fig 5. While the quantity peaked in 1995, when cephalopods formed about the 45% of the total quantity exported, the annual average is about 24%. However, the value of cephalopods in total marine exports has remained at 15% from 1992 onwards without much variation. In 2006 the value of cephalopods exported amounted to more than Rs 1000 crores. Category-wise, squid products are the maximum in all years followed by cuttlefish products. The products include dried, frozen whole, filleted, tentacles, rings, roe, wings, IQF and bones and ink. Octopus products exported are meagre, but from 1994 onwards there is rising trend in its exports. The main markets for export of Indian cephalopods are Europe, Japan and China.

Although the quantity exported has remained steady at around 75,000 tonnes, the value has shown a consistent increase in recent years. (Data source: MPEDA,

Cochin) The emergence of cephalopods as an important marine fishery resource of the country with almost cent percent export potential warrants careful monitoring and appropriate management particularly because we are exploiting above the revalidated potential yield of 101,000 tonnes. Several gaps exist in our knowledge of these valuable resources, especially on the life histories of our species. For example, we still have not resolved the question of semelparity of most of our species. At present we know that most Cephalopods constitute an average 24% of total marine exports (range 15-43%) in quantity of the species lay their eggs in the shallow inshore waters. These grounds are subjected to sedimentation due to man-made causes such as dumping of sludge. This might degrade the benthic conditions with a negative impact on cephalopod egg laying and consequently on the recruitment.

Gastropod Fishery

The exploitation of gastropods in India is age-old for both as food and as curios. The famous money cowries used as currency and the religious sentiments attached to the sacred chank are well known. The gastropod biodiversity in Indian waters is very large and no systematic effort has been made to document this qualitatively and quantitatively, apart from few works. Considering the intense exploitation of these shelled animals in certain areas of the country as a raw material for the shell-craft industry, a number of these ornamental molluscs have been declared as endangered and are protected under the Indian Wildlife Protection Act.

Chank Fishery

Chanks (*Xancus pyrum*) are fished mainly for the shell and an organised fishery of considerable magnitude exists along the southeast coast of India. They are also collected at a few other places along the Indian coast. Major chank resources occur in the Gulf of Mannar, particularly along the Ramanathapuram – Tirunelveli coast. Other areas are Tanjavur, South Arcot and Chingelpet in Tamil Nadu, Trivandrum coast in Kerala, the Gulf of Kutch in Gujarat and the Andamans. Unlike pearl oysters, the chanks are regularly fished with few exceptions. The estimated the average annual chank production in India at 12,56,000 chanks comprising 8,77,000 from Tirunelveli coast, 3,00,000 from Ramanathapuram coast, 40,000 from Thanjavur – South Arcot – Chingelpet coast, 22,000 from Kerala state, 12,000 from the Gulf of Kutch and 5,000 from the Andamans. In terms of weight, chank production would be 1250 t/year (see also Figure 3).

Whelk Fishery

The whelks come under the order Neogastropoda and family Buccinidae. They are mostly carnivorous and scavengers. The meat is edible and the shell is used in the shell craft industries. In India, two species namely, *Babylonia spirata*, and *B. zeylanica* are landed as by-catch, mostly in the bottom trawls. The former species is more abundant and most of the production is exported. Except for some fishery data in the by-catch of shrimp trawls, no information seems to be available on *B. zeylanica*.

Fishery for ornamental gastropods

There are several economically important species of gastropods which are regularly collected for meat / and or shell. They come under many families, extensively used in shell craft industry and are popularly called as ornamental gastropods. Many of them live in coral reef habitat in regions such as the Gulf of Kutch, Gulf of Mannar, Palk Bay, Andaman and Nicobar Islands and the Lakshadweep group of Islands.

Future of Molluscan Exploitation

- The following are areas of concern with regard to exploitation of molluscs in India:
- Exploitation of cephalopods above the potential yield estimate and localized over-exploitation of stocks
- Oceanic cephalopod potential to the tune of 20-50,000 t which are yet to be exploited
- Grossly under-reported catches of bivalves and gastropods
- No major studies in the country on bivalve and gastropod biology and no information on the magnitude and economics of the shell-craft industry
- Conservation and stock rebuilding strategies with respect to endangered molluscs are not in place
- In the light of this, it is important to determine the science, management and institutional requirements needed to obtain the tremendous potential value from molluscan resources to the country and to make a path for sustaining molluscan fisheries and rebuilding protected species stocks to realize their long-term potential.

Further Reading

Appukuttan, K.K. and Ramadoss, K. (2000) Edible and ornamental gastropod resources. In: Marine Fisheries Research and Management. (Eds. V.N.Pillai and N.G.Menon), Central Marine Fisheries Research Institute, Cochin: 525 – 535.

Kripa, V and Appukuttan, K.K. (2003). Marine Bivalves. In: M.M. Joseph and A.A. Jayaprakash (Eds). Status of Exploited Marine Fishery Resources of India. Cent. Mar. Fish. Rs. Inst. Cochin, India. 211-220.

Meiyappan, M, M and Mohamed, K.S. (2003). Cephalopods In: M.M. Joseph and A.A. Jayaprakash (Eds). Status of Exploited Marine Fishery Resources of India. Cent. Mar. Fish. Rs. Inst. Cochin, India. 221-227.

Mohamed, K.S. (2006). Molluscan Fisheries, In: (S. Ayyappan, et al. Eds.) Handbook of Fisheries and Aquaculture, Indian Council of Agricultural Research, New Delhi.

Narasimham, K.A. (2005). Molluscan fisheries of India. BR Publications, New Delhi, 348.

Ramdoss, K. (2003). Gastropods. In: M.M. Joseph and A.A. Jayaprakash (Eds). Status of Exploited.

Marine Fishery Resources of India. Cent. Mar. Fish. Rs. Inst. Cochin, India. 203-210.

Silas, E.G (1985). Cephalopod fisheries of India - An introduction to the subject with methodologies adopted for the study. In: (E.G. Silas Ed.) Cephalopod bionomics, fisheries and resources of the EEZ of India. Bull. Cent. Mar. Fish. Res. Inst. 37, 1-4.