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*Winter School on*

# Towards Ecosystem Based Management of Marine Fisheries – Building Mass Balance Trophic and Simulation Models

**INFORMATION ONLY**

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# Technical Notes

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# CRUSTACEAN FISHERY RESOURCES OF INDIA

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## Introduction

Crustaceans comprising numerous edible species of prawns, lobsters and crabs inhabiting different ecosystems form significant portion of the aquatic food resources of the world. The average annual production of edible marine crustaceans of India during 1995-2001 was 0.36 million tonnes. Due to ever increasing demand for edible marine crustaceans from foreign markets, there has been heavy exploitation of these resources in an unprecedented scale from the Indian seas. Enhancement of fishing effort in deeper grounds, modernization of craft and gears and intensive fishing has resulted in enormous fishing pressure on these resources.

## Craft and gear

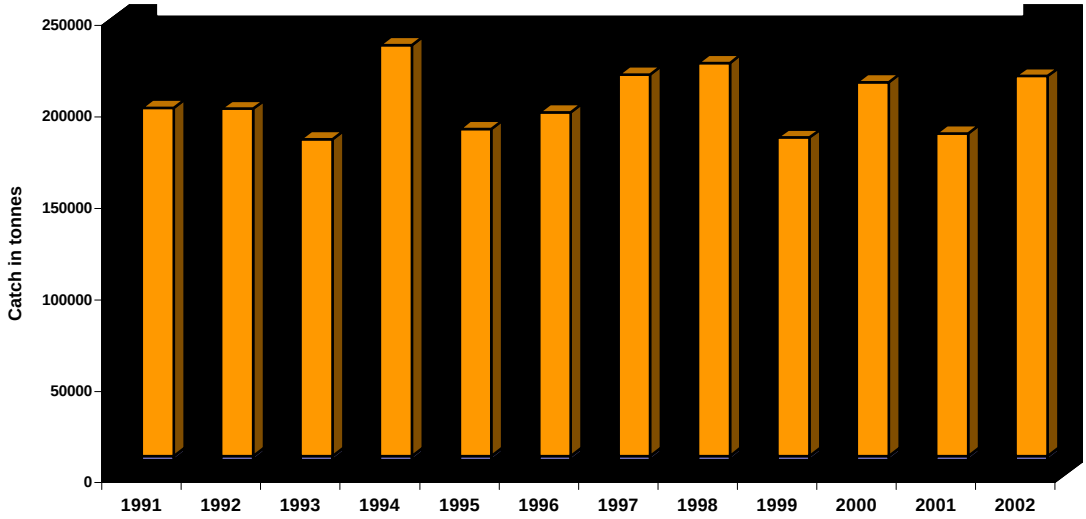
Mostly medium sized mechanized vessels (38-48') operate trawl net to exploit the marine crustaceans from inshore to deep sea grounds. During this decade trawlers contributed to about 80% of penaeid shrimp landing in the country. Mesh size of cod end of the trawl net measured between 18 and 20 mm in most of maritime states. In Gujarat the mesh size of cod end of trawl net was reduced to 12-15 mm in order to catch non-penaeids. From mid eighties most of the units operating along Indian coast switched over to multiday fishing operation in order to exploit midshelf grounds combining both day and night fishing which also saves the fuel cost. At present, the fishery operation by most of the units usually is carried out within 100 m. However, from late nineties some of the commercial boats having higher engine power with modification of winches and addition of wire ropes (upto 1800 m) started operating in deep sea grounds in the depth range of 175-400 m along the Kerala and South Kanara coast, to fish deep sea shrimps and lobsters. The traditional 'Dol nets' are operated along the northwest coast to fish non-penaeid shrimps and smaller varieties of penaeid shrimps. Mini-trawls and 'thalluvalai" (the smaller versions of shrimp trawl) are regularly operated by indigenous wooden crafts in the nearshore waters to catch juveniles of shrimps along the Kerala and Tamilnadu of coast, respectively. Trammel net along the Vizhinjam-Manakudy coast, bottom-set gill net and disco net along the southeast coast exploit shrimps, lobsters and crabs regularly. Stake nets are operated in the backwaters of both the coasts to fish juvenile shrimps. In addition to these gears, postlarvae and juveniles of shrimps are handpicked or collected by using mosquito nets from creeks in order to supply to the shrimp farms.

## Penaeid shrimps

Commercially important shrimps from inshore grounds are largely constituted by two groups namely penaeids mainly belonging to the family Penaeidae and non-penaeid shrimps belonging to Palaemonidae, Hippolytidae and Sergestidae. During 1991-2002 penaeid shrimps contributed to 56% of total edible crustacean landings along both the coasts. The all-India annual penaeid shrimp production during the above period ranged

from 1,73,204 tonnes (1993) to 2,24,621 tonnes (1994) with an average annual yield of 1,94,177 tonnes. Nearly 75% of the penaeid catch was harvested along the west coast. Kerala and Maharashtra were the major contributors to the penaeid shrimp fishery with an average annual landings of 51832 tonnes (27%) and 50975 tonnes (26%), respectively. Gujarat, Tamilnadu and Andhrapradesh are the other important maritime states contributing to the penaeid shrimp landings.

**Annual penaeid shrimp landing (1991-2002)**




*Species composition*

The major constituents of the shrimp fishery along the west coast during 1991-2002 were *Parapenaeopsis stylifera* (Kiddi prawn), *Metapenaeus dobsoni* (Flower tail prawn), *M. monoceros* (Speckled prawn), *Solenocera crassicornis* (Coastal mud prawn) and *Penaeus indicus* (Indian white prawn) However, with the extension of trawling operations in the midshelf waters and night fishing, species such as *Trachypenaeus curvirostris, S. choprai, P. canaliculatus* and *P. japonicus* were added to the shrimp resources. *S. crassicornis* emerged as the prime contributor to the fishery along the northwest coast and *S. choprai* as one of the main constituents in the shrimp fishery along the south Karnataka coast during 1999-2001. However, along the Kerala coast, *P. stylifera* and *M. dobsoni* remained the major contributors to the shrimp fishery. *P. semisulcatus, Metapenaeopsis stridulans* and *T. granulosus* were the major species along the southeast coast. *M. dobsoni* and *P. indicus* formed a good fishery along the Chennai coast. Along the Andhra coast, *M. monoceros, M. dobsoni, M. brevicornis* and *Solenocera* spp. were the main contributors. The shrimp catch of the commercial trawlers from the deep sea grounds of the southwest coast consisted of penaeid species namely, *Metapenaeopsis andamanensis, Aristeus alcocki, Penaeopsis jerryi* and *Solenocera hextii* and the pandalid shrimps such as *Heterocarpus woodmasoni, H. gibbosus* and *Plesionika spinipes*.

***Biological characteristics***

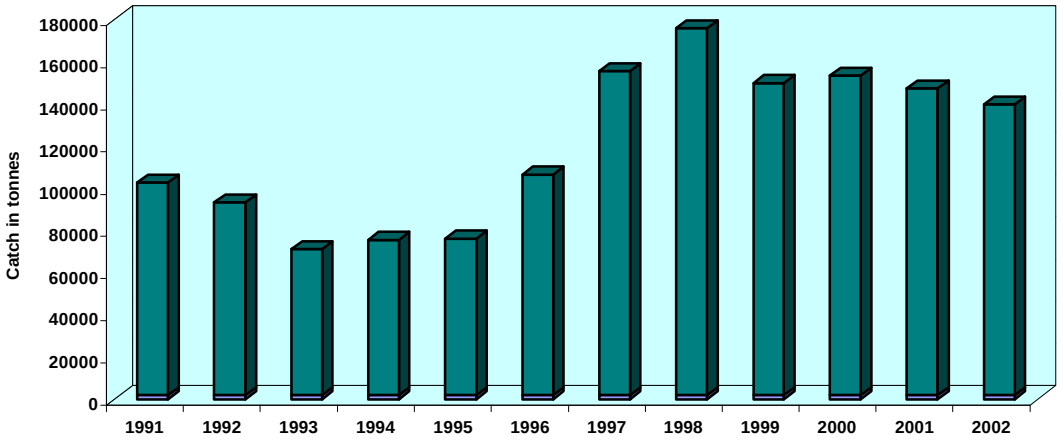
Among the marine penaeid shrimps, *Penaeus* species are larger in size. Penaeids are heterosexual and females are generally larger than males. Growth rate varies in different species and at different phases of life depending on the environmental conditions. Penaeids feed mainly on animal food items and decomposing organic matter. They have high fecundity and the number of eggs vary between species mainly in proportion to size of the females and the ovary weight. Eventhough the spawners are available throughout the year, there are certain peak spawning periods which vary sometimes between years. Life

span of penaeid shrimp is around two years and 0-year group contributes mainly to the fishery.

**Non-penaeid shrimps**

Non-penaeid prawns constitute one of the important fishery resources contributing to 5.8% of total marine fish production. This resource is characteristic of the northwest coast, which accounts for almost 90% of the total non-penaeid prawn production in the country. The annual average landing of non-penaeid prawns was 1.14 lakh tonnes during 1991-2000. Among the maritime states, Gujarat contributed maximum (57.5%) followed by Maharashtra (33.1%). The catches in the other states were sporadic and in negligible quantities. However, with the advent of trawlers in fishing non-penaeid prawns, the annual average catch in Gujarat increased from an average of 6,537 t during 1979-88 to 84,156 t in 1996-2000. Reduction of the cod-end mesh size of trawl nets and fishing operations in the coastal sea coupled with the development of fish meal industry at Veraval were responsible for the enormous landings of this resource in Gujarat.

**Annual non-penaeid shrimp landings during 1991-2002**




***Species composition***

The non-penaeid prawn resource is multi-species, mainly supported by tiny species of the genus *Acetes*, in addition to *Nematopalaemon tenuipes* and *Exhippolysmata ensirostris.* There are five species of *Acetes* namely *Acetes indicus, A. johni, A. sibogae, A. erythraeus* and *A. japonicus*. Among these the first two support the commercially important fisheries from marine waters. During 1991-2000, the percentage contribution of *Acetes* spp. *N.tenuipes and E. ensirostris* were 81.2%, 18.2% and 0.6% in *dol* nets and 0.3%, 97.3% and 2.4%, respectively in trawlers in Maharashtra. In Gujarat, these species formed 68.9%, 21.9% and 9.2% in *dol* nets and 98.9% , 0.8% and 0.2% in trawlers, respectively.

***Biological characteristics***

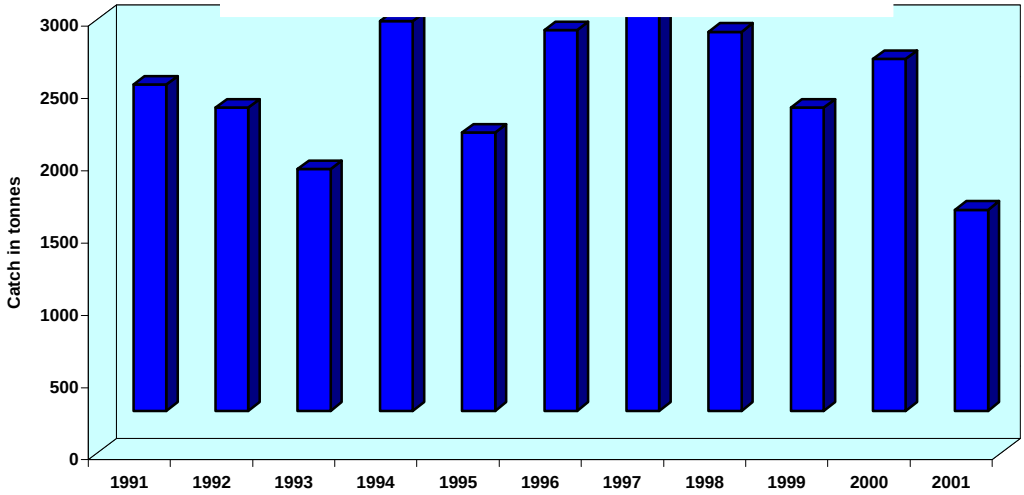
*Acetes indicus* is an epipelagic planktonic prawn, which forms large shoals in coastal waters. Generally, the size ranges from 8-38 mm. Their fishable life span is about 3-6 months. The species mainly feeds on detritus consisting of fibrous and granular material of phyto and zooplankton origin. *Nematopalaemon tenuipes* exhibits differential growth rates with males and females reaching 57 mm and 64 mm in total length, respectively at the completion of one year. The life span of the species is a little more than a year. Being a caridean prawn, they carry yolky eggs attached to their pleopods for

incubation. *E. ensirostris*, the largest among the coastal non-penaeids, is a hermaphrodite. It is highly predaceous and feeds on *Acetes*, polychaetes and young ones of fish and shrimps. It attains 92.8 mm at the end of one year and the fishable life span is about one year. *E. ensirostris* breeds throughout the year with peaks during May-September and December-January.

**Lobsters**

The annual catch of lobsters fluctuated from 1389t to 2787t during 1991-2001 Though lobsters are widely distributed in the coastal waters of India, major landings are reported from the northwest coast. The average annual landing during 1991-2001 were 1556 tonnes, 402 tonnes and 264 tonnes from the northwest, southeast and southwest coasts, respectively. Statewise, Gujarat contributed maximum (1018 tonnes) followed by Maharashtra (538 tonnes), Tamil Nadu (389 tonnes) and Kerala (249 tonnes). In Gujarat the catch declined from a maximum of 1305 tonnes during 1997 to 241 tonnes during 2002, in Maharashtra from 1132 tonnes during 1996 to 402 tonnes during 2002 and in Tamil Nadu from 998 tonnes during 1998 to 195 tonnes during 2002. However, Kerala showed an improvement in recent years due to landing of deep sea lobster *Puerulus sewelli*. The annual landings of *P. sewelli* in the state were 513 tonnes and 535 tonnes during 1999 and 2000, respectively. However, the catch decreased to 264 tonnes and 395 tonnes during 2001 and 2002, respectively. About 95% of the lobster landing along the northwest coast is by trawlers. However, lobsters are exploited by both trawlers and indigenous gears such as bottom set gill net and traps along the southeast coast.

**Annual lobster landing during 1991-2001**




*Species composition*

Four littoral and one deep sea species of lobster contribute to the commercially important fishery in the country. The slipper lobster *Thenus orientalis* and spiny lobster *Panulirus polyphagus* constitute the fishery along the Gujarat coast whereas the latter species dominates the fishery along the Maharashtra coast. The fishery for *T. orientalis* from Mumbai waters declined from an average annual landing of 185 tonnes during 1978-85 to 3.6 tonnes during 1993-94 and nearly disappeared by 1994-95. The scalloped spiny lobster *P. homarus* is the dominant species in the shallow waters along the southwest coast. The ornate spiny lobster *P. ornatus* forms a fishery along the southeast

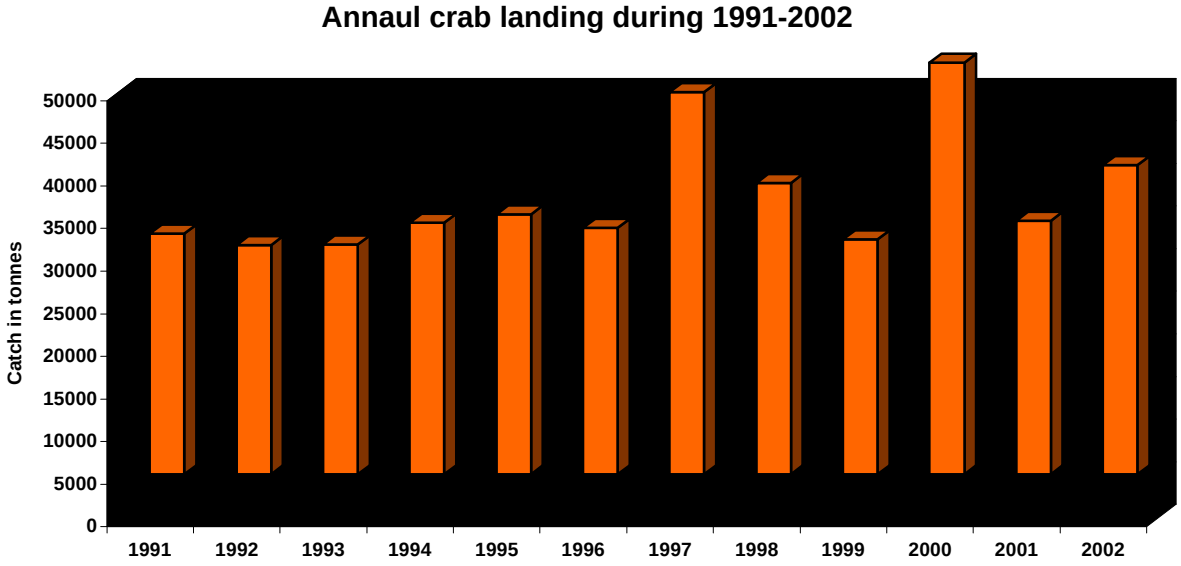
coast. *P. homarus* and *T. orientalis* are also landed along the southeast coast. While *P. homarus* occupies 1-10 m depth, adult *P. ornatus* are seen at 40-50 m depth.

***Biological characteristics***

Studies on food and feeding habits of lobsters show that these animals generally feed on smaller crustaceans, molluscs and polychaetes. Growth, as in other crustaceans, is manifested by periodical shedding (moulting) of exoskeleton. The size of lobsters in the fishery generally ranges from 35 mm to 125 mm carapace length. *P. homarus* attains a total length of 320 mm, *P. polyphagus* 450 mm and *P. ornatus*, 500 mm. Fecundity in spiny lobsters ranges from 50,000 to 10,00,000 eggs depending upon the species and size of the lobster. *T. orientalis* is however, low fecund with shorter larval phase (45-50 days).

**Crabs**

Marine crab is a valuable seafood which is in good demand in the domestic market as well as export industry of the country. The commercially important species such as *Portunus sanguinolentus* (Spotted crab), *P. pelagicus* (Reticulate crab) and *Charybdis feriatus* (Cross crab) belong to the family Portunidae. The average annual catch in the country during 1975-2001 was about 26,000 tonnes. Exceptionally high landings were recorded during 1997 (45,000 tonnes), 1998 (34,000 tonnes) and 2000 (48,380 tonnes). On an average crabs formed 8% of the total crustacean landing in the country. The catches ranged from 2,383 tonnes to 20,923 tonnes in Gujarat, 8,851 tonnes t to 14,242 tonnes in Tamil Nadu, 2,256 tonnes to 5,144 tonnes in Andhra Pradesh and 2,030 tonnes to 10,438 tonnes in Kerala. Only small quantities of crabs are landed along the southwest coast during July-October.




*Species composition*

A centre-wise study of the marine crab fishery shows that *C. feriatus* predominates the edible crab fishery at Veraval and Mumbai. The dominant species at Mangalore, Calicut and Cochin is *P. sanguinolentus*. The dominant species of marine crabs at Tuticorin and Mandapam are *P. pelagicus* and at Chennai and Kakinada, *P.*

*sanguinolentus*. Large quantities of non-edible crabs are landed at Kakinada with *C. callianassa* as the dominant species.

***Biological characteristics***

Studies on the food and feeding habits of crabs show that they generally feed on smaller crustacea,s fishes and molluscs. Detritus, bits of plant and other organic materials are also noticed in the stomach contents. The mean monthly growth rate ranges from about 8 mm to 11 mm. Sizes upto 160-165 mm (carapace width) are available in the fishery. The 50 % level of maturity is generally at 90-105 mm carapace width in *P. sanguinolentus* and *P. pelagicus*. These crabs breed throughout the year with peak seasons and spawning may take place twice or more in a season. Peak breeding and recruitment seasons vary from region to region. The number of eggs on ovigerous females ranges from about 50,000 to over a million. Eggs are attached to the endopodite setae of the swimmerets of the abdomen. The eggs that hatch out pass through a number of zoeal stages.

**Resource Management**

Detailed study on the population dynamics and stock assessment of commercially important shrimps showed that the average annual yield of most of the commercial species has reached the MSY level. It was observed that increase in fishing effort may not result in much improvement in penaeid shrimps yield, and further it is not economically viable. Reduction in the number of fishing vessels being operated and increase in the cod end mesh size at least to 25 mm are the possible management measures which can be effectively implemented to safeguard the resource from over-exploitation as well as to get a sustainable yield of this valuable resource. Marine fishing regulations have earmarked areas of operation for different gears and vessels to safeguard the interest of different sectors. Trawling within 10 m area by commercial vessels and mini-trawls should be stopped in order to prevent exploitation of juvenile prawns.

The studies showed that MSY of non-penaeid prawns is 64,686 tonnes in Maharashtra and 76,550 tonnes in Gujarat together forming MSY of 1.41 lakh tonnes for the entire north west coat of India. In order to achieve this MSY, which is only 20% higher than the present annual average catch, the effort required would be more than double (1.3 times of the present level). Being single most important group of forage organisms along the northwest coast, the non-penaeid prawns support huge biomass of economically important fishes such as Bombay-duck, sciaenids, polynemids, ribbonfishes, carangids, penaeid shrimp and the cephalopods in the region.

Unlike the single species fishery of the sub-tropical and temperate countries, the lobster resources in India is multispecies and exploited by divergent gears involving both traditional and mechanised sectors. On the northwest coast nearly 90% of the lobster catch is landed by mechanised trawlers in which lobsters are incidentally caught and therefore optimizing the trawling effort for spiny lobster alone cannot be implemented. Therefore, the only management option is to persuade the fishermen to return the egg bearing lobsters and undersized lobsters back to the sea so that the spawning stock could be conserved. In February 2003 the Ministry of Commerce, New Delhi issued a Gazette Notification fixing Minimum Legal Size (MLS) for export of four species of lobsters based on the recommendation of CMFRI. However, there is no regulation on fishing and marketing of lobsters in domestic market as there is no ban on fishing. The MLS for fishing undersized lobsters is to be fixed by the respective State Governments.