

Crustacean fishery resources of India - An overview

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ABSTRACT

The recent trend in crustacean fishery of India has been reviewed based on the landings during 1984-1992. The fishery as a whole improved over the years reaching a record level of 0.39 million tonnes in 1991. Prawn landings, which accounted for about 72% of the crustacean fishery, showed a remarkable leap since 1988 as a result of extended fishing by shrimp trawlers over time and space, and the innovative fishing in the traditional sector. The changed fishing pattern in the mechanized as well as artisanal sectors, and its impact on catch and species composition are outlined. The average production of 0.225 million tonnes of prawns realized at present is very close to the estimated catchable potential of the 0-50 m depth zone. Stock assessments of important species also reveals that the coastal shrimp resource of India is fully exploited at present. Some species like *Metapenaeus dobsoni*, *Penaeus indicus* and *P. semisulcatus* are overfished in their respective areas of fishery.

The lobster fishery, on the whole, is in a state of decline. On the north-west coast, stock assessment of the principal species *Panulirus polyphagus* has shown that to reach the MSY level trawling effort would have to be considerably reduced which may not be feasible as this fishing effort is targeted for other resources. Proper conservation measures are therefore needed to improve the fishery.

The various problems faced by the fishery due to human activities and the measures to improve crustacean production are discussed.

India has ever remained major contributor to the world production of marine crustaceans. During 1984-1990, it contributed, on an average, 3.81 million metric tonnes (mt). The country's average annual production of 0.29 million m t for the same period formed about 8% of the total crustacean landings of the world and 60% of that of the Indian ocean. A retrospect of India's marine fisheries development during the past 3 decades would reveal that the period witnessed phenomenal increase in the exploitation of important varieties of crustaceans such as prawns and lobsters on account of their high export value. The dramatic growth of the seafood export industry based primarily on crustacean

products necessitated scientific management of this resource for its sustained fishery in the country. The Central Marine Fisheries Research Institute, realizing the need for relevant data, launched systematic investigations on the resource characteristics and biology of commercially important crustaceans provided by a wealth of information from various workers (Anon. 1986, Kagwade 1987, 1988, Lalithadevi 1987, Rao 1989, Manickam *et al.* 1989). Periodic evaluation of the fishery at regional as well as national levels and assessment of stocks of major species have also been attempted by many workers. Of these the contributions of Alagaraja *et al.* (1986), George *et al.* (1988), Rao (1988), Smitha Paralkar and Devaraj (1990), Suseelan *et al.* (1992) and Suseelan and Rajan (1993) on prawns, and of Kagwade *et al.* (1988)

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on lobsters are some of the recent ones. Silas *et al.* (1984), reviewing the shrimp fishery of India for 1962-81, discussed in detail the various management problems associated with the fishery and pointed out appropriate management techniques that could be adopted in India to ensure maximum sustainable yield. In the present account an attempt has been made to review the recent developments that have taken place in crustacean fisheries of the country, with reference to fishing pattern, production trends, problems and future prospects.

TREND OF FISHING

The later part of eighties witnessed considerable increase in the operation of shrimp trawlers which continued to be the major fishing units involved in the exploitation of crustaceans. The normal fishing grounds of small trawlers lie within the 50 m depth line in most parts of Indian coast, whereas the large trawlers of 20-25 m OAL operating in the north-eastern region cover deeper areas up to 100 m. In the traditional sector, a large variety of nets operated by mechanized and non-mechanized country crafts are involved in the fishery, of which *dol* nets, seines and gill nets are most important.

Changing pattern of fishing in the trawl sector

The increasing demand for prawns and lobsters for export coupled with the declining trend or stagnation in output from the conventional trawling grounds brought about considerable change in the pattern of trawler operations in recent years. Many of the small and medium vessels engaged in coastal fishing have extended the range of their operations to deeper waters up to about 80-90 m. Long trip operations involving 2-5 days fishing have also been resorted to on

large scale at many centres, particularly along the Karnataka and Saurashtra coasts. Trawling in nearshore waters, night trawling and reduction of cod-end mesh sizes of trawls to a very low level are some of the other notable changes that have been made recently in this sector in order to increase shrimp catch.

Changing pattern of fishing in the traditional sector

The aggressive efforts to motorize our country crafts during the past few years has been a revolutionary step in modernizing fishing in the traditional sector. On the gear side, though fixed bag-nets, including *dol* nets, operated in the northern regions have undergone little change over the years, many innovations have taken place on the gears used in other parts of the country, which have changed the whole scenario of capture fisheries in the traditional sector of these regions. The *mattu bale* of Karnataka coast and Ring seine of Kerala coast, introduced in 1984 and 1985, respectively, are smaller versions of purse seines. They have proved to be more efficient than the conventional boat seines for exploiting fish and prawns from the coastal waters. In Kerala, the ring seines have almost replaced the conventional boat seine, *thanguvallia*, the principal gear used for the Mud bank fishery (*chakara*) for ages. The mini trawls of Kerala operated from motorized country crafts and *thalluvalai* of Palk Bay-Gulf of Mannar region are recent introductions to catch shrimp from shallow coastal waters.

The bottom-set gill nets have become more popular than before for catching large-size prawns, and they are being increasingly used throughout the Indian coast. A more efficient selective gear recently introduced in the artisanal fishery is the trammel net commonly referred to as

'Disco vala'. This triple walled entangling net was first introduced along the coast of Kanyakumari district of Tamil Nadu in 1984, and soon it became very popular on account of its impressive performance. Presently this net is one of the most common nets operated in the traditional sector on the south-west coast and throughout the east coast.

PRODUCTION PROFILE

The crustacean resources, which include prawns, lobsters, crabs and stomatopods, accounted for about 16% of the total marine fish landings of the country, with an average annual production of 312 000 tonnes during 1984-1992. Of this, prawns constituted 72%, lobsters 1%, crabs 7%, stomatopods 20%. The year-wise break-up (in tonnes) of the

Year	Prawns	Lobsters	Crabs	Stoma- topods	Total
1984	192 012	3 23	28 708	28 852	252 795
1985	189 042	4 082	22 264	31 191	246 579
1986	210 616	3 057	20 780	48 110	282 563
1987	190 786	2 562	23 127	98 614	315 089
1988	202 496	1 587	17 424	68 981	290 488
1989	222 990	1 590	16 191	69 276	310 047
1990	244 353	2 556	24 243	65 471	336 623
1991	295 138	2 094	29 244	63 466	389 942
1992	278 154	2 011	27 090	72 688	379 943
Ave- rage	225 065	2 529	23 230	60 739	311 563

different components is as follows:

The annual trend of total crustacean landing shows a gradual increase over the years, attaining the maximum of 390 000 tonnes in 1991.

Prawns : The marine prawn production of India plays a crucial role in the export industry as 70-80% of the foreign exchange earnings from seafoods, which during 1991-

1992 amounted to Rs 14 500 million, comes from shrimp products. The estimated annual prawn production, after stagnating around 0.2 million tonnes till 1987, showed a steady improvement reaching the record level of 0.295 million tonnes in 1991. The provisional estimate for 1992, however, shows a decline by 17 000 t, which may not be significant at the moment considering the big leap recorded during the past 5 years. Generally, two-thirds of the landing is contributed by penaeid prawns which are of greater economic value than non-penaeids. The increase in prawn catch over the years occurred due to the changed fishing pattern of shrimp trawlers and the innovative fishing of the traditional sector directed towards penaeid prawns whose all-India production rose from 0.12 million t in 1985 to 0.19 million t in 1992.

Trends in state-wise annual production of penaeid prawns indicated that Kerala and Karnataka registered the maximum of increase (70 to 100%) after 1986. Introduction of more trawlers in the northern centres, night trawling, large-scale operation of ring seines, mini-trawls, trammel nets etc., along Kerala coast, and the voyage fishing of trawlers in extended areas and operation of *mattu bale* along Karnataka coast have largely contributed to this increase. Maharashtra showed a gradual decline in penaeid landings till 1989, but picked up in the subsequent years reaching a production level of 58 000 t in 1992. Along Gujarat coast, though the landing remained more or less steady until 1989, it shot up by about 30% in 1990 and continued to increase reaching the highest level of 27 000 t in 1992. Intensive voyage fishing and daily-trip operations conducted by shrimp trawlers along the Saurashtra coast accounted for this increase. East coast contributed about 25% of the total penaeid prawn landings

of the country. The annual trend and production remained more or less the same as in the west coast regions, with improved catches during 1989-92.

As regards non-penaeid prawns, the all-India annual production showed an increasing trend although a sharp fall occurred during 1987-88. The north-western region contributed over 90% of this fishery. The small sergestid shrimp *Acetes* accounted for about 70 to 80% of the non-penaeid catch. Normally this shrimp is almost exclusively caught by *dol* nets. However, from 1989 onwards enormous quantities of *Acetes* are caught by shrimp trawlers in Gujarat coast, with the result non-penaeid landing in the state shot up reaching a record level of 61 000 t in 1991.

Lobsters : The lobster resource of India, which consists of spiny lobsters and sand lobsters, has been under heavy fishing pressure during the past several years. As a result, the fishery showed a declining trend after reaching the highest production level of 4 000 t in 1985. The decline in landing was more pronounced in the case of the 2 major species of Maharashtra and Gujarat, viz. *Panulirus polyphagus* and *Thenus orientalis*, which are exploited by trawlers.

Crabs and stomatopods : Being a commodity of lesser export value, no commercial operations have been directed towards crab resource in a big way in the country. However, substantial quantities of crabs are landed every year as by-catches of shrimp trawlers and of indigenous fishing units throughout the country. The annual landings widely fluctuated between 16 000 and 29 000 t since 1984, the maximum production having been recorded in 1991. Over 50% of the catch was landed in Gujarat

and Tamil Nadu. In Kerala, crab landing showed a steady increase from 970 t in 1985 to 4 860 t in 1992. Occurrence of large quantities of non-conventional species, which inhabit the offshore fishing grounds, in trawler catches has contributed to this increase.

Stomatopods are caught exclusively in trawl nets as by-catches. Though this resource is not used for any edible purpose it is gaining importance in the country for other uses like manufacture of poultry feed, shrimp feed, etc. From 1984 to 1987 the stomatopod production shot up consistently reaching a maximum of nearly 0.1 million t in 1984 and thereafter maintained a production level of 60 000-70 000 tonnes. The west coast contributed more than 95% of this fishery.

CHANGES IN SPECIES COMPOSITION

The technological changes that have taken place in the exploitation of marine resources, particularly shrimps and lobsters, in the recent years, as already explained, has brought about perceptible changes in the composition of crustacean landings. As a rule, the penaeid prawn fishery is supported by a number of coastal species which are exploited by both traditional fishing units and shrimp trawlers which operate more or less in the same fishing grounds. The recent changes in trawl fishing involving night fishing and off-shore operations have resulted in the occurrence of a number of non-conventional species also in the fishery throughout the west coast and in the south-east coast.

In Karnataka and Kerala, the catch of *Metapenaeus monoceros* has increased considerably in the trawl landings as the trawlers have started operating outside the 50 m depth line where the species occurs in

greater quantities. Night fishing conducted by the vessels during voyage fishing has also increased the catch of this species as it is nocturnal in habit. Similar increase in the catch of *M. monoceros* and other co-existing species like *Penaeus canaliculatus*, *P. semisulcatus*, *Metapenaeopsis stridulans*, *Trachypenaeus* spp etc. has been observed in the night landings of shrimp trawlers operating from Kerala coast. In the Bombay waters also, the catches of non-conventional species like *M. istridulans*, *T. curvirostris*, *Parapenaeus longipes* and *Solenocera choprai* have also increased as a result of fishing in deeper waters. On the Tamil Nadu coast also a number of non-conventional species have made their appearance in sizable quantities in the trawl fishery due to extended fishing.

The change in the pattern of trawl fishing along Saurashtra coast has resulted in the occurrence of large quantities of *Acetes* in the trawl sector; this is quite new to this region. This non-penaeid species, being a coastal pelagic shrimp, is traditionally exploited by the indigenous gears especially dol nets throughout the N-W coast. With the reduction of cod-end mesh size of trawl nets to as low as 12-15 mm and the encroachment of trawlers in the traditional fishing areas, the catch of *Acetes* in trawlers has enormously increased. Normally, non-penaeid prawns, particularly *Acetes*, is poorly represented in the trawl catches as the trawler operation is always taking place outside the domain of this coastal shrimp.

A noteworthy change that has been noticed in the crab fishery is the occurrence of the offshore crab *Charybdis feriatus* (= *C. cruciata*) in large quantities in the trawler catches. Being a large size crab, it is gaining popularity for internal consumption in Kerala and neighbouring states.

POTENTIAL RESOURCES AND STATE OF EXPLOITATION

Varying estimates are on record as to the potential yield of marine living resources of EEZ of India, including crustaceans (James *et al.* 1987). According to George *et al.* (1977) the potential annual yield of crustaceans in Indian EEZ is estimated as 3 25 000 t. The recent revalidation of the potential marine fishery resources of Indian EEZ (Anon. 1991) has shown a potential shrimp stock of 232 000 t within the 50 m depth line. In addition to this, a potential stock of 4 000 t of prawn is also available in the 50-100 m depth zone in the N-E coast. A perusal of annual catch data of prawns shown earlier would indicate that the average production of 0.225 million t realized at present is very close to the estimated catchable potential. It is also apparent that the annual shrimp production has exceeded far beyond this level from 1990 onwards (0.244-0.295 million t). The present exercises on stock assessment of important species of prawns such as *Metapenaeus dobsoni*, *M. monoceros*, *Parapenaeopsis stylifera*, *Penaeus indicus*, *P. semisulcatus*, *P. monodon* and *Acetes indicus* also revealed that the coastal prawn resource of India is being fully exploited at present. In the case of some of the species like *M. dobsoni*, *P. indicus* and *P. semisulcatus* it is even seen that overfishing is taking place in their respective areas of fishery.

As regards the other components of the fishery, there are no reliable estimates of potential stocks in Indian coast. George (1973) estimated a potential yield of 1 000 t of spiny lobsters for the entire Indian coast. This estimate cannot be accepted as a reliable one since it was made at a time when the lobster fishery was mainly restricted to the coast of Kanyakumari district and neighbouring areas based on

indigenous craft and gears. In the estimate the author has apportioned 500 t of spiny lobsters as potential yield for the region between Trivandrum and Cape Comorin. Perhaps this stock size may be true as far as that region is concerned. However, the fishery has tremendously changed in the subsequent years with the recognition of good potential for spiny lobsters and sand lobsters in the N-W coast of India, and their commercial exploitation on a large scale which has increased the all-India lobster production many fold. As the north-western region now produces over 75% of the country's lobster catch it is likely that a revalidation of the potential stock of the lobster population in the country would yield a much higher value of estimate than what has been arrived at by George (1973) about 2 decades ago. As the spiny lobster *Panulirus polyphagus* is the major constituent of the lobster fishery of the N-W coast, the result of the present exercise on stock assessment of species throws light on the general situation of lobster fishery of the area. The assessment reveals a MSY of about 1 360 t for this species and considering the present rate of exploitation, fishing effort of trawlers involved in this fishery would have to be considerably reduced to reach the MSY level. Evidently, the lobster fishery of N-E coast of India faces over-exploitation.

PROBLEMS AND PROSPECTS

The foregoing account on the trend of crustacean fishery during the past few years would clearly indicate that the fishery faces a number of problems which are to be solved at State and National levels in order to improve the fishery. It is a generally accepted fact that the inshore waters up to 50 m depth are under heavy fishing pressure by various fishing methods, both by the industrial and artisanal units, which have

gone far beyond the recommended level, with the result most of the exportable varieties of crustaceans such as shrimp and lobsters have already reached the stagnation level of production. The unregulated fishing in these waters over the past 2-3 decades has also resulted in the depletion of some of the important resources like sand lobsters (*Thenus orientalis*), spiny lobsters (*Panulirus homarus* and *P. polyphagus*) and some of the penaeid prawn species, which necessitates proper conservation and management measures.

The recent changes in fishing pattern involving night trawling, reduction of cod-end mesh size of trawl nets and introduction of mini-trawls having very small mesh sizes (8-16 mm) in the traditional sector are destructive to many species of shrimp since the catch of these nets include enormous quantities of juvenile prawns/breeders, the exploitation of which may lead to recruitment overfishing. Besides biological damage to important species, this changed fishing pattern has also generated social problems in many parts of the country. The spurt in the landing of *Acetes* by shrimp trawlers along the Saurashtra Coast in recent years is a typical example of the impact of mesh size reduction and encroachment of trawlers into the traditional fishing grounds. This in the long run may pose social problems if this fishing practice is objected to by the *dol* netters. In the case of lobster fishery, various factors have combinedly influenced the present status of low production. A damaging practice noticed along the Gujarat coast for the past few years is the capture of baby lobsters in large quantities from their natural habitats for culture purpose. This practice has almost come to the level of a regular and established trade of the coastal fishermen. It is needless to say that it is injurious to the lobster fishery

and this practice has to be curtailed in order to protect the natural population in their nursery areas. Since lobster farming is also gaining importance these days, serious efforts are necessary to develop hatchery technology for these so that the pressure on the natural juvenile population can be reduced. Capture of berried lobsters during the peak breeding period which has already contributed to the decline in the fishery of the sand lobster *T. orientalis* and the spiny lobster *P. polyphagus* in Bombay waters (Kagwade, MS) has to be discouraged as a measure of conservation.

Estuaries and backwaters are excellent nursery grounds for many species of marine prawns, and constitute an important source of recruitment for the inshore stock. Therefore it is imperative to control large-scale exploitation of young juvenile prawns in this environment. Since complete prohibition of the backwater fishery for juvenile prawns would entail socio-economic implications the intensity of fishing may be reduced considerably by limiting the number of stakenets, dipnets and other fixed nets operating in the areas. Appropriate mesh regulations for these nets also may be resorted to for bringing down the catch of juvenile prawns in these nursery grounds. Environmental degradation of the nursery grounds of prawns is another threat to the prawn population in many parts of the country. Large-scale reclamation of water areas, construction of barrages, salt water barriers, spillways etc. are some of the important activities that alter the physico-chemical conditions of these environments. They adversely affect the growth and survival of prawns in their early life. Considering the inseparable link between the marine and estuarine environments in the life-history of commercially important prawns, man-made changes in the

brackishwater systems like reclamation, construction of engineering structures, dredging etc. may be effected only with due consideration on their impact on the shrimp resources. Similarly interference with mangrove areas, aquatic pollution etc. which adversely affect the riches of coastal crustacean species should be closely monitored and controlled. Shrimp species such as *P. semisulcatus* which have restricted distribution and are under heavy fishing pressure at juvenile as well as adult stages in areas like Gulf of Mannar and Palk Bay where stock assessment has shown over-exploitation, efforts to re-populate and strengthen the natural stock have to be considered through large-scale sea ranching. Similar efforts are also required on other endangered species of crustaceans like sand lobsters (*T. orientalis*) and spiny lobster species after proper hatchery technologies are developed in the country. To protect the juvenile population of these valuable species, minimum legal size may also be fixed for the capture fishery. Complete closure of fishing for short durations during peak breeding period of lobsters may also be considered in notified areas. A restriction on the export of undersized prawns and lobsters will discourage capture of smaller size groups of these resources by commercial nets and this will go a long way in improving their fishery.

The exploitation of crustacean resources of the inshore areas within 50 m depth has already reached the level of diminishing returns in most regions of the Indian coast; so very little scope exists for increasing the production from this zone. The only way of increasing production of these valuable resources is by extending fishing operations beyond the conventional fishing grounds which has already taken place to some extent now and proved successful by generating

additional catch formed by a number of non-conventional species which inhabit such underexploited fishing grounds. As regards the shrimp fishery of the north-east coast by large trawlers which has already grown to a damaging level to the shrimp stock of the area, proper regulation of fishing effort has to be resorted to for a sustained fishery. The past exploratory fishery surveys along Indian coast have indicated potential resources of deep-sea prawns and lobsters along the shelf-edge and upper continental slope of the south-west and south-east coasts of India. These offer scope for future exploitation by larger vessels and increasing the production of prawns and lobsters. The estimated catchable potential of deep-sea prawns for the south-west coast is 3 000 tonnes and for deep-sea lobster 5 000 tonnes (Mohamed and Suseelan 1973, Oommen 1980, 1985). Deep sea resource surveys conducted in Indian waters have also indicated potential resources of the deep-sea swarming crab *Charybdis smithii* throughout the west and east coasts (Silas 1969, Balasubramaniam and Suseelan, 1990). It occurs in swarms at bottom as well as in pelagic regions, and can be commercially harvested. Recent surveys of FORV Sagar Sampada have also indicated the occurrence of large-sized scarlet shrimp *Plesiopenaeus edwardsianus* at 800-900 m depth off Trivandrum. The surveys have also revealed the existence of good concentration of pelagic shrimps widely distributed in the Indian EEZ, particularly in the deep scattering layers. All these oceanic/deep-sea crustacean resources have great potential for commercial exploitation and it is suggested that tapping of these unexploited resources may be encouraged to increase the country's crustacean production in future and thereby augment our foreign exchange earnings.

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