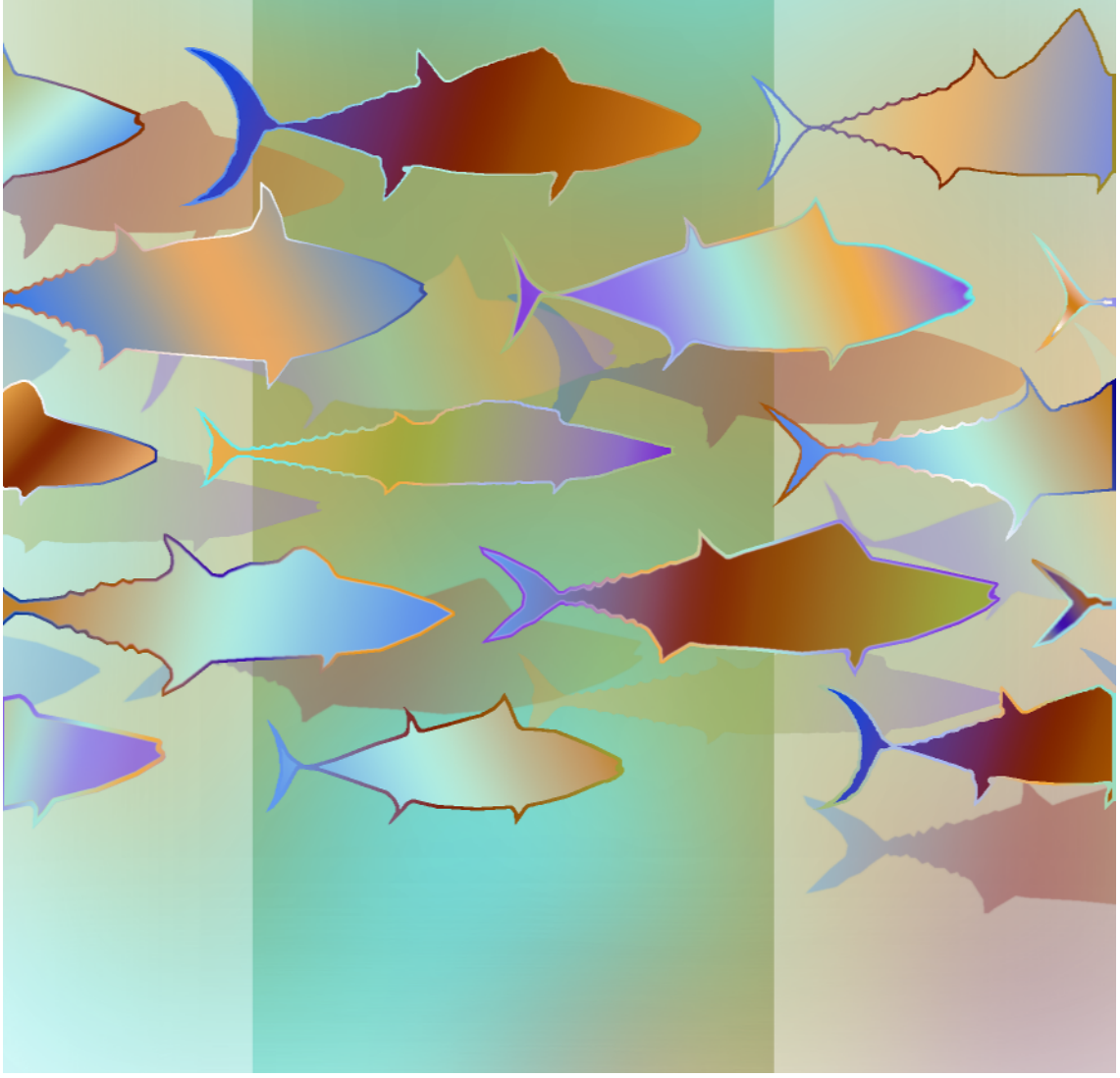
Status of Exploited Marine Fishery Resources of India



STATUS OF EXPLOITED MARINE FISHERY RESOURCES OF INDIA

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Lobsters

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1. Introduction

Lobsters are one of the most valuable and highly priced seafoods. Among them, the spiny lobsters (rock lobsters), especially the live ones fetch the highest price. In India, though lobsters form only 0.12± 0.06% of total marine landings, they are an important export commodity comprising 1.07±0.44% in quantity and 2.59±1.15% in value. Heavy demand and attractive price for lobsters in the international market have resulted in increased exploitation of lobsters in recent years. The multispecies and multigear fishery involving both traditional and mechanised sectors pose problems for effective management. A review of the current status of lobster fishery in India along with various options for their management and conservation is presented here.

2. Production trends

The total annual landing of lobsters in India during 1965-2000 is presented in Figure 1. The fishery improved from 347 t in the year 1965 to 2,991 t in 1975 and attained the maximum landing of 4,083 t in 1985, but has been fluctuating around 2,400 t since then.

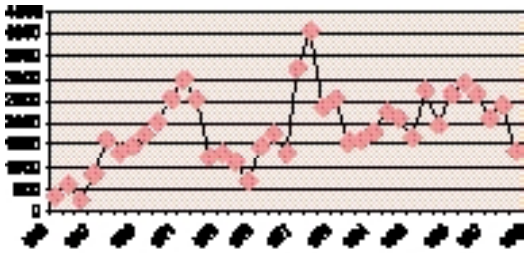

Fig.1. Lobster landings (tonnes) in India during 1965-2001

Statewise contribution

Lobsters are widely distributed all along the Indian coast. However, the major landings come from the northwest, southwest and the southeast coasts. The northwest sector comprising Gujarat and Maharashtra contributed to 69% of total landings during 1996-2000. Statewise, Gujarat contributed 43.7%, Maharashtra 25.4%, Tamil Nadu 14.6% and Kerala 13% (Fig. 2). The average annual catch from Gujarat during 1996-2000 was 1110 t. Maharashtra landed an average 659 t during the same period. Lobster landing in Kerala was 147 t during 1996-98. However, the catch increased to 524 t during 1999-2000 due to landing of deepsea lobsters. Average annual landing in Tamil Nadu was 404 t during the five year period (Table 1).

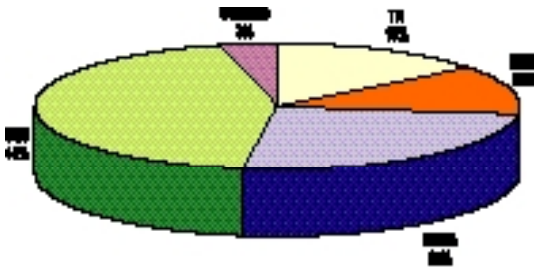

Fig. 2. Statewise contribution of lobsters (Av. 1996-2001)

Table 1. Statewise landing of lobsters (in tonnes)

Year	Tamil Nadu	Kerala	Maharashtra	Gujarat	Others	Total
1996	252	112	1132	1130	5	2631
1997	375	265	818	1405	54	2917
1998	998	64	442	1054	101	2659
1999	254	513	291	975	60	2093
2000	142	535	611	1036	63	2387
2001	160	264	506	403	56	1389

Species composition and distribution

Although the lobster fauna of commercial fishing grounds comprises 14 species of littoral and 6 species of deep sea forms, only four littoral and one deep sea form contribute to commercial fishery (Fig. 3). The northwest coast fishery is mainly constituted by the spiny lobster Panulirus polyphagus (mud spiny lobster) and the slipper lobster Thenus orientalis (shovel-nosed lobster) which inhabit at 20-50 m depth. The shallow water P. homarus (scalloped spiny lobster) occupying 1-10 m depth range is the most dominant species along the southwest coast, whereas P. ornatus (ornate spiny lobster) (Fig. 4), P. homarus (Fig. 5) and T. orientalis contribute to the fishery on the southeast coast. Small quantities of P. versicolor are also landed along the Trivandrum and Chennai coasts. P. penicillatus and P. longipes are the two other species, which are not important from the fishery point of view. Adult P. ornatus inhabits relatively deeper areas (40-50 m). The spiny lobster Puerulus sewelli (Fig. 6) occupy the upper continental slope between 175-200 m

depth off the southwest and southeast coasts from where they are fished along with deepsea prawns by trawlers. Linupurus somniosus is another species of spiny lobster recorded from the Andaman waters. P.polyphagus is called Titan in Gujarathi, Shevand in Marathi, Chittakonju/Kadal konchu in Malayalam and Katearatiroyya in Telugu. P.homarus is called Thala eral in Tami and Bama reya in Telugu. The vernacular name of P.ornatus is Mani eral in Tamil. In the export trade P. ornatus is commonly known as Tiger and others as Greens.

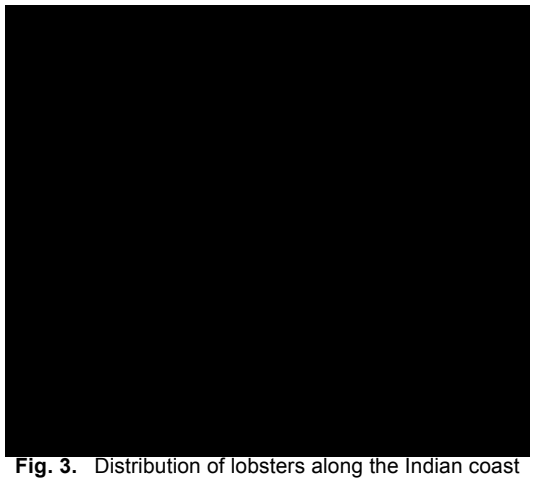

Fig. 3. Distribution of lobsters along the Indian coast

The trawlers operating for shrimps land 75% of the lobster catch. Along the northwest coast 95% of the lobsters, appear in trawls, whereas on the southwest coast, indigenous gears such as traps, gill nets and trammel nets are used for shallow water lobster fishing. On the southeast coast, lobsters appear both in the trawls as well as in the indigenous gears.

Fig. 4. Panulirus ornatus

On the northwest coast, lobsters are caught incidentally in trawl nets operating for shrimps. The mean total estimated landing of lobsters at Veraval during 1978-85 was 270 t with a catch per unit of effort (CPUE) of 3 kg. Total landings declined gradually and in 1999-2000, the estimated landing was 69 t with a CPUE of 1.2 kg. P. polyphagus constitutes 45% of total catch and the rest is by T. orientalis. The size of P. polyphagus ranged from 36 to 125 mm Carapace Length (CL) and the modal classes for males and females were 81-85 mm and 76-85 mm, respectively. The smaller size of females appear more during February-March. In the case of T. orientalis, the sizes ranged from 31 mm to 100 mm CL with the modal classes at 66-70 mm for males and 71-80 mm for females. In Mumbai, the estimated annual average catch of lobsters for 1978-85 was 402 t with CPUE of 9.5 kg. P. polyphagus constituted 54% and the rest was contributed by T. orientalis. The average annual catch of the latter declined from 185 t in 1978-85 to 3.6 t in 1993-94 and by 1994-95, the species completely

disappeared from the fishery. The annual average catch of P. polyphagus during the period 1996-2000 was 160 t, which indicated a reduction by 57% compared to 370 t landed during 1986-90. P. polyphagus is available round the year. However, the fishery displayed seasonal abundance and recorded good catches during September-December.

Stock assessment studies carried out at Mumbai indicate high annual exploitation ratio (0.81 for males and 0.68 for females) for P. polyphagus. Studies conducted during 1996-2000 revealed increasing fishing pressure on the stock with exploitation rate reaching as high as 78%. For a slow growing species with 7-8 years of fishable life span, such a high exploitation rate is alarming.

Fig. 5. Panulirus homarus

On the southwest coast, lobsters are fished in almost all the fishing villages starting from Kollam to Kanyakumari. Nearly 90% of the catch is constituted by P. homarus. Total landings gradually declined from 301 t in 1966 to 8 t in 1995-96. The fishery is seasonal and extends from August to May with peak catches from November to January. Fishing season coincides with peak breeding season (November-December) and the major portion of females caught during this period is egg bearing. Increase in fishing effort, exploitation of juvenile lobsters by trammel net and heavy exploitation of ovigerous females have led to overall decline in the landings.

The entire southeast coast, except from Rameswaram to Point Calimer is a potential lobster fishing area. The annual average landing of lobsters at Tuticorin increased from 12 t during 1978-85 to 125 t in 1994-95. Trawlers land 43% of the catch. P. ornatus forms the major component of the trawl catch. In the trawl fishery, lobster catch increased from 37 t in 1993-94 to 51 t in 1994-95 and then decreased to 20 t in 1995-96. Though lobsters are caught throughout the year, larger quantities are landed during August to February and May to July. P. ornatus appears throughout the year, but highest catch is in May, forming almost 54% of the total catch. The size of lobsters in the fishery ranges from 113 to 233 mm Total Length (TL) in males

Fig. 6. Puerulus sewelli

and 128-452 mm TL in females with 41% falling in the size range of 181-190 mm TL, which are juveniles. In the traditional fishery, lobster catch increased from 4 t in 1992-93 to the peak catch of 74 t in 1994-95. However, the landings decreased to 38 t in 1995-96. At Pamban, an average 3 to 4 t of lobsters are landed, of which 75% is constituted by P. ornatus and the rest by P.homarus.

In Chennai, lobsters are landed both by trawls and artisanal gears. During 1978-85, the average annual catch was 11 t. In 1994-95 small trawlers landed an average 124 t of lobsters of which 92% was constituted by T. orientalis. Gill nets landed an average 3 to 4 t annually of which P. homarus constituted 68%, P. ornatus, 18% and P. versicolor, 13%. The size of lobsters caught in trammel net ranged from 21mm to 100 mm CL, with nearly 50% in 35-45 mm size range. In the gill net catch, the length varies from 31mm to 100 mm CL. Studies show that 50% of the lobsters caught in trammel net are below 55 mm CL.

The spiny lobster, P. sewelli is the only deepsea species exploited in commercial quantities. During 1998-2000, an average 524 t of deepsea lobsters were landed at Cochin and Sakthikulangara. The maximum sustainable yield (MSY) was estimated to be 8000 t for the west coast and 1200 t for the east coast. However, these figures seem to be highly speculative. Studies on the biology of P. sewelli were carried out during 1999-2000. The sizes of P. sewelli ranged from 76-80 mm to 176-180 mm in males and from 81-85 mm to 176-180 mm in females. 26% of the females were found in fully mature/berried stage. The deepsea lobsters, P. sewelli and Nephropsis stewarti were also landed at Mangalore during 1999-2000. The catch of P. sewelli from Tuticorin during 1993-94 was 90 t with a CPUE of 15kg/hr. The landing decreased to 56 t during 1997-98.

3. Biology

Studies on biology and fishery of important species are carried out at Veraval, Mumbai, Calicut, Vizhinjam, Tuticorin, Mandapam and Chennai Research Centres of Central Marine Fisheries Research Institute. Growth, as in other crustaceans, is manifested by periodical shedding of exoskeleton (moulting). Studies on food and feeding habits of lobsters show that these animals generally feed on smaller crustaceans, molluscs and polychaetes. P. polyphagus is normally found in muddy substrates and sometimes on rocky bottoms whereas P.homarus and P. ornatus inhabit rocky and reef areas. Berried females of P. homarus are normally observed in inshore areas. Size of lobsters in the fishery generally ranges from 35-125 mm in carapace length. P. homarus attains a total length (TL) of 320 mm, P. polyphagus, 450 mm and P. ornatus 500 mm. Growth is identical in juveniles but differential in the adults. In P. polyphagus, sexual maturity (50% level) is attained at 175 mm TL for females, whereas majority of males mature at 265 mm TL. P. polyphagus breeds almost throughout the year, but maximum number of females in berried condition are noticed during August-October, when about 80% of females are egg bearing. Spiny lobsters are highly fecund and fecundity ranges from 50,000 to 10,00,000 eggs depending upon the species and the size of lobster. In P. polyphagus,

recruitment of young lobsters measuring below 100 mm (<50g) generally takes place during December-January. The occurrence of berried females in the 25-40 m depth zone indicates that there is no large scale movement of females to deeper waters for breeding. P.homarus attains sexual maturity at 55 mm carapace length and majority of females start breeding at sizes above 60 mm CL. Though the species breeds throughout the year, peak breeding is from November-December along the southwest coast and January-March along the southeast coast. P. ornatus, on the other hand, starts breeding at 90 mm CL (250 mm TL). P. homarus normally breeds in the shallow waters. Occurrence of adult P. ornatus at 40-60 m depth indicates that the species breeds probably at relatively deeper areas.

Eggs are attached to the endopodites of the pleopods and after incubation for 25-30 days, phyllosoma larvae hatch out and are carried on to offshore areas by currents. The final stage phyllosoma larvae metamorphose into postlarvae (puerulii), which swim towards the nearshore areas for settlement. Juveniles of P. polyphagus occupy the shallow inshore sea and adults move to the deeper areas where they are recruited into the fishery. T. orientalis attains first sexual maturity at 124 mm TL. Studies on the reproductive biology of T. orientalis at Mumbai indicate extended spawning from September to April with high incidence of berried and spent individuals from November (peak) to January, when they form about 25-57% of the total females caught. T. orientalis is low fecund with shorter larval phase (45-50 days). After final metamorphosis, the postlarva (nisto) settles in inshore areas.

4. Stock assessment

Maximum landing of shallow-water lobsters is reported from the northwest coast with P. polyphagus as the dominant species. In a recent study of P. polyphagus from Mumbai waters, the age and growth was determined based on the length-frequency method. Growth during the first 3 years was found to be identical in both sexes. The species attained 85 mm, 145 mm and 205 mm at the end of I to III year respectively. Thereafter, the males grew faster than females, measuring 265 mm, 315 mm, and 355 mm successively till the end of sixth year. Females measured 255 mm, 290 mm, 320 mm, 345 mm and 365 mm respectively by the end of 4^{th} to 8^{th} year. The frequency of moulting is more and the intermoult period is shorter in juveniles. With the advance in age, the intermoult period gets prolonged and the number of moulting gets reduced. The length increment per moult is nearly constant during the juvenile and adult phases. Six to seven broods appear to be recruited annually to the fishery. November – December is the peak period of recruitment for small sized juveniles. Stock studies reveal that total mortality coefficient 'Z' is 1.76 for males and 1.15 for females and the natural mortality coefficient 'M' is 0.33 for males and 0.35 for females. The fishing mortality coefficient 'F' deduced from these equals 1.43 for males and 0.8 for females. The total stock estimated is 453 t, the standing stock 271 t and the maximum sustainable yield 168 t.

5. Management

Currently, no management regulations are in force to control fishing of lobsters in India. There are no restrictions on fishing such as minimum size of capture, types of gears used, total number of crafts employed and season of fishing. Unlike the single species fishery of the temperate and sub-tropical countries, the lobster fishery in India is multispecies and exploited by divergent gears involving both traditional and mechanised sectors. The fishermen lured by the high prices offered for lobsters are exploiting the resource indiscriminately, in the absence of any regulation or control on fishing activity. Therefore, framing and implementation of management measures will have to take into account the biological, social and economic aspects.

On the northwest, available scientific information clearly indicates that the resources of the spiny lobster P. polyphagus and the sand lobster T. orientalis are overexploited. The current landing of lobsters in India constitutes only 58% of the peak catch once obtained in 1985 and consists of smaller specimens, which bring lesser value. In Mumbai, average landing during 1996-2000 has come down by 57% compared to production during 1986-90. The situation is similar at Veraval and at other major fishing centres along the southwest and southeast coasts. At Tuticorin, nearly 43% of the lobster landings are by trawlers and a situation similar to the northwest prevails here also. But, one of the major constraints is that lobsters appear only as by-catch in trawl fishery and no direct regulations can be enforced to control fishing of one resource alone. But restrictions on juvenile fishing in inshore waters by gill nets, dol nets, stake nets and cast nets will have to be enforced so that overexploitation could be contained. Similarly, large scale exploitation of egg bearing females during peak breeding season have an adverse impact on the breeding stocks as it will affect release of eggs and thereby recruitment. Unfortunately peak fishing coincides with peak breeding season of the lobsters in most of the fishing areas. Seasonal closures around the time of breeding have been effectively used as a regulatory measure in single species fishery of the subtropical seas. Along the southwest and southeast coasts, the operation of trammel nets brings in substantial quantities of juveniles. Trammel net is a destructive gear for lobsters. With the beginning of live lobster export, exploitation of juveniles and undersized lobsters has been on the increase. The overseas demand is higher for smaller sizes. India exports undersized lobsters also while other countries have enforced strict regulations on size of these shellfishes fished and exported. This situation has affected the lobster resource of the country to a great extent. Therefore, regulatory measures need to be formulated and enforced for sustainable exploitation of lobsters in the country.

The following management measures are recommended. Impose ban on both capture and export of egg bearing lobsters. Releasing of berried lobsters back into the sea is to be made mandatory. Enforce Minimum Legal Size for capture and export. Minimum Legal Sizes recommended are: P. homarus - 60 mm CL, P. ornatus - 80 mm CL , P. polyphagus - 70 mm CL, T. orientalis - 60 mm CL.

Implement ban on operation of trammel nets. It is necessory to create awareness among fishermen on negative impact of fishing of juveniles and egg bearing lobsters. Restrictions on deepsea lobster fishing and regulation to limit entry for deepsea fishing for lobsters may be considered. Installation of artificial habitats along identified coastal areas for stock enhancement should recieve priority attention. Further, a technology has to be developed for breeding and seed production of lobsters for searanching to augment the natural population.

6. Suggested reading

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