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966 Status and management of lobster fishery resources in India

In India, though lobsters form only $0.12 \pm 0.06\%$ of total marine landings, they form an important export product comprising $1.07 \pm 0.44\%$ in quantity and $2.59 \pm 1.15\%$ in value. Total annual landings have been fluctuating between 1587 to 2917 tonnes for the past fifteen years (1985-2000) with the highest landing of 4075 tonnes in 1985 (Fig.1). Heavy demand and attractive price for lobsters in the international market have resulted in increased exploitation of lobsters. Unless new grounds are located, scope for improvement in the fishery in the coming years is limited. The multi-species and multi-gear lobster fishery involving both traditional and mechanised fishermen poses multitude of problems for management of this valuable resource from overexploitation and conservation. An assessment of the current status of lobster

quantities are landed in Karnataka and Andhra Pradesh. State-wise landing of lobsters during 1996-2000 is shown in Table 1.

TABLE 1. State-wise landing of lobsters
Quantity in tonnes

Year	Tamilnadu	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

Although there are nine species of spiny lobsters (Palinuridae) distributed along the Indian coast, only four are commercially exploited (three shallow and one deep). Among eight species of slipper lobsters (Scyllaridae) recorded from Indian coast, only one species is fished in commercial quantities.

In India, trawls bring 75% of the lobsters which are caught along with shrimps as a by-catch. On the NW, almost 95% of the catch is by trawls, whereas on the SW, landing is mainly by indigenous gears such as traps, gillnets and trammel nets. On the SE, lobsters are caught in trawls as well as in traditional gears.

The major mechanised lobster landing centres on the NW coast are Veravel in Gujarat and Mumbai in Maharashtra. In Veravel, annual average catch during 1980-85 was 270 t with a CPUE of 3.02 Kg/U whereas it was 200 t in 1987 to 1997. The peak period of lobster fishing along the Veravel coast is between October and February. *P. polyphagus* constituted 45% of the total catch at Veravel and the rest is contributed by *T. orientalis*. The average annual catch of *T. orientalis* at Veravel also shows a similar trend of decline. The average annual catch during 1980-85 was 148.3 t at the rate of 1.66 Kg/U, which was reduced to 113 t in 1987-97. The average annual catch at Mumbai during 1978-85 was 402 t which was declined to 113 t in 1987-97. Species-wise, the average annual catch of *P.*

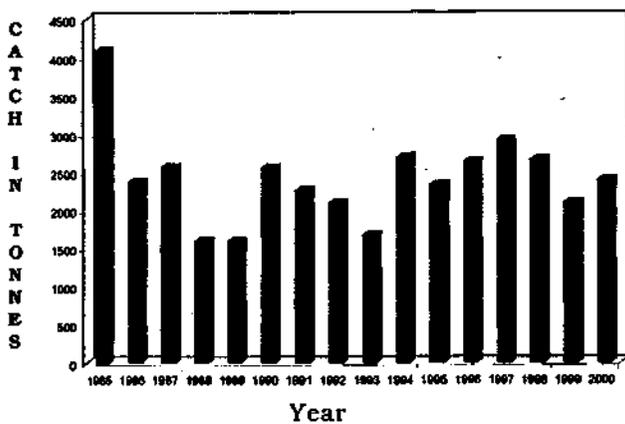


Fig.1 All India lobster landings in India during 1985-2000

fishery in India along with various options for management are presented.

Lobsters are distributed all along the Indian coast. However, major landings come from the northwest coast (NW), southwest coast (SW) and southeast coast (SE). Sector-wise, NW consisting of Gujarat and Maharashtra contributes 69% of the total lobster landings. State-wise, Gujarat contributes 43.7% of the total lobster catch, Maharashtra, 25.4%, Tamilnadu, 14.6% and Kerala, 12.5%. Small

polyphagus (1978-85) declined from 217.5 t with a catch rate of 5.11 Kg/U to 96 t (1987-97). The species is available year round, but the fishery displayed seasonal abundance during September-December. The size of lobsters in the fishery range from 70-395 mm in total length (TL). Growth studies show identical growth in juveniles and differential growth rate in adults.

Sexual maturity size (50% level) is 175 mm TL for females, whereas physical maturity is reached at 265 mm TL for males. Females start breeding at 205 mm TL (218 g). *P. polyphagus* spawns throughout the year, but majority of females in berried condition are noticed during August-October, when 80% of females are egg bearing. Fecundity range from 1,43,000 (180 mm TL) to 4,723,000 (353 mm TL). Recruitment of young lobsters measuring below 100 mm (<50 g) generally takes place during December-January.

Stock assessment studies have indicated high annual exploitation ratio (0.81 for males and 0.68 for females) for *P. polyphagus*. For a slow growing species, this exploitation rate is alarming. As the peak breeding (September-October) coincide with peak fishing, *P. polyphagus* is facing recruitment overfishing and the situation warrants immediate management regulations.

The fishery of the slipper lobster *T. orientalis* at Mumbai yielded 184.9 t (1978-85) at the rate of 4.35 Kg/U, forming 46% of the total catch. The catch declined from a peak of 282 t in 1985-86 to 53 t in 1987-88 and the species completely disappeared from the fishery in 1994-95. The causative factors leading to disappearance of the species from the fishery needs a detailed investigation.

On the southwest coast, lobsters are fished in almost all the fishing villages starting from south of Thiruvananthapuram up to Kanyakumari and 90% of the catch is contributed by *P. homarus*. The main gears used for lobster fishing are traps, gill nets and trammel nets. Total landings gradually decreased from 301 t in 1966 to 7.6 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 a major portion of the females caught during this period are 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 landings.

Tuticorin to Rameswaram in the Gulf of Mannar and Kanyakumari to Tiruchendur (Tirunelveli coast) are potential fishing ground for lobsters. The dominant species is *P. homarus*. Adult *P. ornatus* (1 to 2 Kg) are fished from Tiruchendur by chank fishermen. The fishery has been showing wide fluctuation and an overall fall in catches was noticed. The annual average landing of lobsters at Tuticorin was 12 t at the rate of 4.39 Kg/U, which gradually attained the peak catch of 125.3 t in 1994-95. Nearly 43% of the lobster catch is by trawlers. *P. ornatus*, *P. homarus* and *T. orientalis* are the major species occurring in trawl fishery. In the trawl fishery, lobster catch increased from 37 t in 1993-94 to 51 t in 1994-95 and then came down to 20 t in 1995-96. Though lobsters are caught through out the year, larger quantities are landed during August to February and May to July. At Mandapam, an average 3 to 4 tonnes of lobsters are landed of which 75% is constituted by *P. ornatus* and 20% by *P. homarus*. The fishery commences in October and extends up to May with the peak from December to March.

The spiny lobster *P. ornatus* is the most important species from the live lobster export point of view which grows to a maximum weight of 4.0-4.5 Kg and are caught almost through out the year. The highest catch is in May, forming almost 54% of the total catch. The size of *P. ornatus* ranged between 113 and 233 mm TL in males and 128-452 mm TL in females with 41% falling in the size range of 181-190 mm TL, which are juveniles. Females of *P. ornatus* attain first sexual maturity at a carapace length of 90-mm (250-mm TL). Berried females are very rarely encountered in the catches as the breeding ground is in deeper waters.

P. homarus is also an equally important commercial species, landed both by trawls and gill nets. An average 30% of the catch is constituted by *P. homarus*. The catch of *P. homarus* shows high fluctuation. The lobsters caught in trawls have been reported to be mostly undersized. Operation of trammel nets bring in large quantity of juveniles. Though this species is caught almost through out the year, peak fishing is during the summer months of May to September.

The deep sea lobster *P. sewelli* is under high fishing pressure and is one of the species exploited from the fishing grounds located off the south west (Quilon) and south east (Gulf of Mannar) at depths ranging from 150 to 400 m. MSY of the species on the southwest coast was estimated as 8,000 tonnes and 1,200 tonnes for the southeast coast. This species is highly vulnerable to fishing as breeding activity brings them to the limit of their distribution. A new resource of the deep sea lobster, *Linuparus somniosus* was located by Fishery Survey of India in Andamans. During 1999-2000 nearly 10 tonnes of *Nephropsis stewarti* was landed along with deep sea prawn at Cochin and Mangalore.

In India, nearly 75% of the lobster catch comes from trawlers as by-catch and therefore no direct regulations can be enforced to control fishing of lobsters alone. In the traditional sector, it may be easier to impose restrictions, as fishermen venture exclusively for lobster fishing in certain months. Potential earnings of the fishermen can be maintained or even enhanced with proper management and enforcement of fishing regulations. Unfortunately, peak fishing coincides with peak breeding in most of the fishing areas. Fishing of juveniles and egg bearing females during peak breeding season can bring in regative impact upon the recruitment and on the breeding stocks. Seasonal closures around the time of breeding and limited entry have been effectively used as a regulatory measure in single species fishery of the subtropical seas. How far these measure could be applied under Indian conditions needs to be examined.

Currently, no management regulations are strictly enforced to regulate lobster fishing in India. There are no restrictions on the minimum size of capture, type of gears used for lobster fishing, number of crafts engaged in lobster fishing and on the fishing seasons. The fishermen lured by the high prices for lobsters are exploiting the resource indiscriminately. Therefore, formulation and enforcement of regulatory measures is highly imperative. Framing and implementation of management measures will have to take into account the biological, economic and social aspects. Protection of egg bearing lobsters by enforcing mandatory release of ovigerous females back into the sea, implementation of a Minimum Legal Size (MLS) for export and ban on operation of destructive gears like trammel nets, are regulatory measures, which are to be considered for sustainable exploitation of the resource. Considering the biological aspects, especially the size at maturity and first breeding, the Minimum Legal Size recommended for fishing and export of each species is: *Panulirus homarus* 65 mm carapace length (CL); *Panulirus polyphagus* 70 mm CL; *P. ornatus* 80 mm CL; *T.orientalis* 60 mm CL; Lobsters below this size are to be prohibited from fishing and export.

While regulatory measures are to be strictly enforced, there shall be simultaneous education and awareness creation on the negative impacts of fishing of juveniles and egg bearing lobsters for sustaning the fishery. Establishment of sanctuaries with controls on fishing, installation of artificial reefs for providing additional shelter for juveniles and ovigerous females are measures for increasing lobster production. Development of hatchery technology for seed production and searanching needs to be given high priority. Therefore, a holistic approach on lobster resource management with the main objective of sustainable exploitation and conservation of the resource for future generation is required.

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