

DEEP-SEA SPINY LOBSTER, *PUERULUS SEWELLI* RAMADAN: ITS COMMERCIAL POTENTIALITIES

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ABSTRACT

Recent exploratory cruises carried out along and outside the continental shelf off the west coast of India have brought to light the existence of spiny lobster in considerable numbers. The trawling operations conducted in areas of depths between 200 to 305 metres have revealed potential commercial concentrations of *Puerulus sewelli* from the region south of Calicut, especially off Ponnani, Quilon and Colachel, dispersed over an area of about 4,790 square kilometres. Based on the results of these operations, studies on the fishing ground and the assessment of the potential resources together with some aspects of the biology of the species have been made. The possibility of better exploitation of the resource by employing special gears is stressed.

THE spiny lobsters inhabiting the rocky patches of the inshore waters along the coasts of India. have attracted much attention recently due to their commercial value as an export commodity. Information on any deep water species is scanty and restricted to the occasional records of specimens caught by expeditions and exploratory fishing cruises. *Puerulus sewelli*, one of the deep water spiny lobsters, has been reported from the Indian waters as early as 1901 by Alcock under the name *Panulirus angulatus* Spence Bate. His collection included 24 specimens obtained from Gulf of Mannar and Arabian Sea off Travancore at depths 260, 410-520 and 330 metres. Later, John and Kurien (1959) collected 19 specimens from somewhat lesser depths of 200-275 metres, off the area from Vizhingam to Anjengo on the south-west coast. Although this record confirmed the existence of the species in the deep water areas off this coast, their potential commercial concentration was brought to light during the recent exploratory survey conducted by the Indo-Norwegian Project along and outside the continental shelf off the south-west coast of India [Tholasilingam *et al.* (MS)].

The rapid increase in demand for lobsters has made it necessary to undertake a detailed study of the resources of our deeper waters in order to explore new or little used lobster stocks and bringing them to utilisation. In the present contribution, an effort is made to assess the potential resources and to study certain biological aspects of the deep water lobster, *P. sewelli*.

DISTRIBUTION

The genus *Puerulus* Ortmann includes three valid species, viz., *Puerulus angulatus* (Bate), *P. sewelli* Ramadan, and *P. velutinus* Holthuis. All these species occur in the Indian Ocean region. *P. sewelli* has been reported from the Gulf of Aden, Arabian Sea, off Kerala coast, Gulf of Mannar and Ceylon, at depths varying from 73 to 1,309 metres (refer: Holthuis, 1966).

FISHERY AND BIOLOGY

The materials for the present study were chiefly from the catches of the vessels of the Indo-Norwegian Project. Although, Research Vessel *VARUNA* (27.98 metres) occasionally recorded

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P. sewelli during her exploratory fishing cruises, regular catches in appreciable quantities were obtained when deep water fishing operations of the other vessels, viz., *TUNA* (21.88 metres), *VELA-MEEN* (21.79 metres) and *KALUS SUNNANA* (18.41 metres) commenced from October, 1967. During the period from October 1967 to February 1968, these vessels conducted 18 cruises, each trip extending for a period varying between 3 and 6 days. Shrimptrawls of different sizes from 35.0 to 46.8 metres in head rope length were the gears employed for trawling.

Fishing Ground

The fishing ground covered by these vessels are the same that have been charted out for the Government of India vessels based on latitudes and longitudes (Kagwade, 1967) (Fig. 1). In the course of exploratory operations most of the trawl hauls were made between 180–395 metres, especially in the areas 8–75 to 9–75 off Quilon, 10–75 off Cochin and 11–74 off Calicut. The detailed distribution of *P. sewelli* as revealed by the catches landed is shown in Fig. 1. Although the recorded minimum depth at which the species was caught is 73 metres, during the present investigation, lobsters were generally encountered beyond 200 metres. Unlike the coastal species (*Panulirus* spp.) that abound in rocky bottom, *P. sewelli* was caught in even ground with a mixture of coarse sand and shells as also observed by John and Kurien (1959) and Kurien (1965). It was less frequent on muddy bottom. The bottom temperature at 200 metres varied from 13.92° C to 17.00° C and at 300 metres it was between 11.82° C and 11.95° C. The salinity at both these depths was more or less same, near about 35‰.

Catches

The details of the catches obtained from different vessels along with effort expended during the period October to February are given in Table I.

It is clear from Table I that *P. sewelli* occur in the ground throughout the period. However, all the vessels record better catches during December–January. On an average, *P. sewelli* contributes about 1.0% of the total catches landed by these vessels and the catch rate per hour of trawling is 2.1 kg. A depth-wise analysis of the catches indicate slightly improved catches at 350–365, 315–330 and 275–290 metres areas.

Size Distribution

The size composition of the lobsters caught at different periods is shown in Fig. 2. In the samples analysed from the catches of R. V. *VARUNA* in July, larger specimens measuring between 121–125 mm and 186–190 mm with modes at 161–165 mm for both the sexes were caught. In October and November, the sizes varied from 36–40 mm to 181–185 mm. Smaller specimens measuring below 100 mm appeared in October and again in April–May. In one of the hauls taken off Ponnani in October, the catch was exclusively composed of smaller specimens with the modal size at 76–80 mm. The recruitment of the smaller sizes into the ground seem to be mainly in October. No appreciable difference was seen in the sizes of the sexes, although the males (55%) slightly dominated the catches. But, it is interesting to note that males have greater carapace length when compared to the females of the corresponding sizes; the relationship between the carapace and total length (Fig. 3) being expressed by the formula $Y = -4.0721 + 0.4647 X$ for males and $Y = -2.6160 + 0.4410 X$ for females, where 'Y' is the carapace length and 'X' the total length.

Since usually the weight is recorded in the fishery log reports, the relationship of weight and length was found out in order to get the conversion from the available data. As the regression of Log W against Log L was found to be a straight line, the relationship was determined by employing the formula $W = CL^n$, where 'W' is the weight in grams, 'L' is the length in millimetre and 'C' and 'n' are constants. The equation of Log W to Log L was found to be, $\text{Log } W = -4.9523 + 3.1708 \text{ Log } L$ for males and $\text{Log } W = -4.8332 + 3.1130 \text{ Log } L$ for females (Fig. 4).

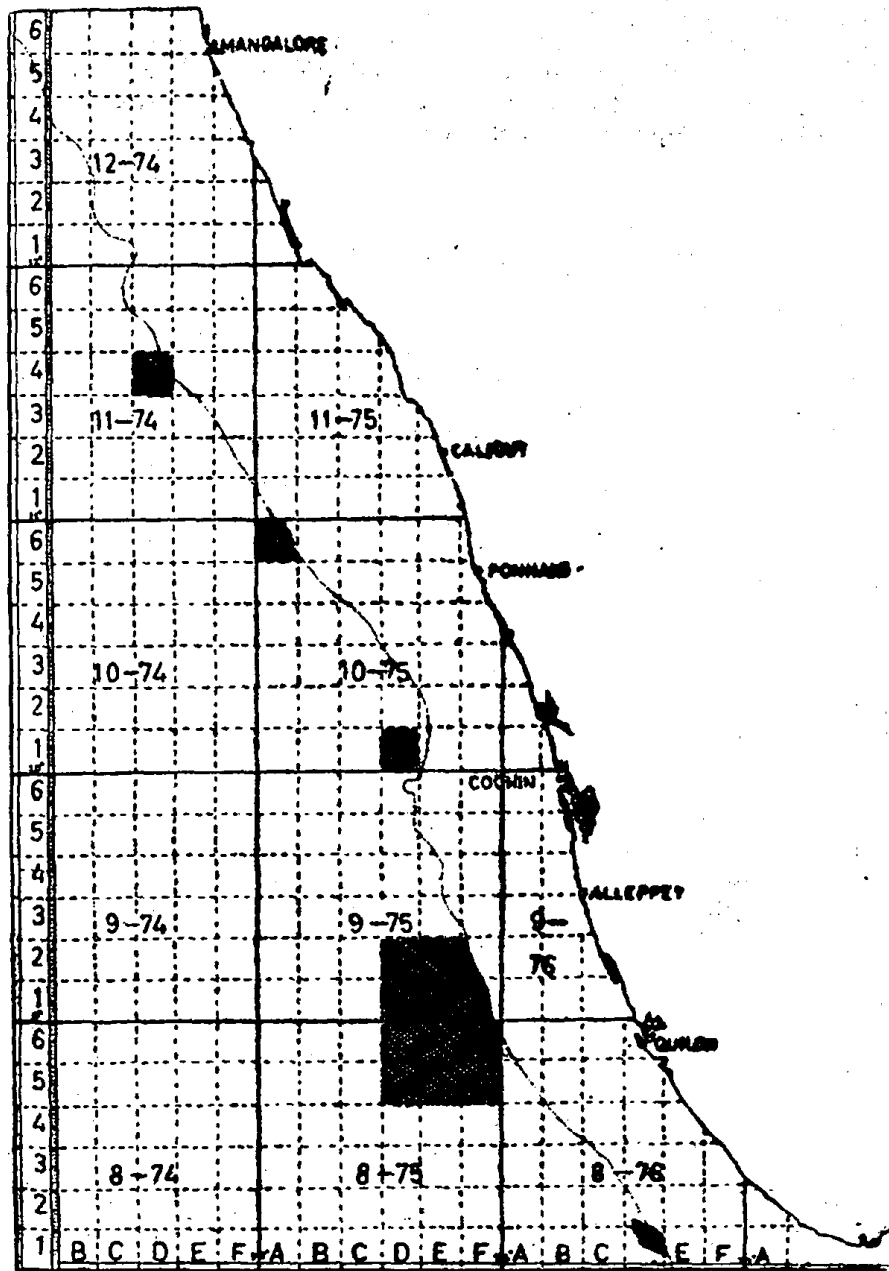


FIG. 1. Areas from which *Puerulus sewelli* was caught during the exploratory cruises.

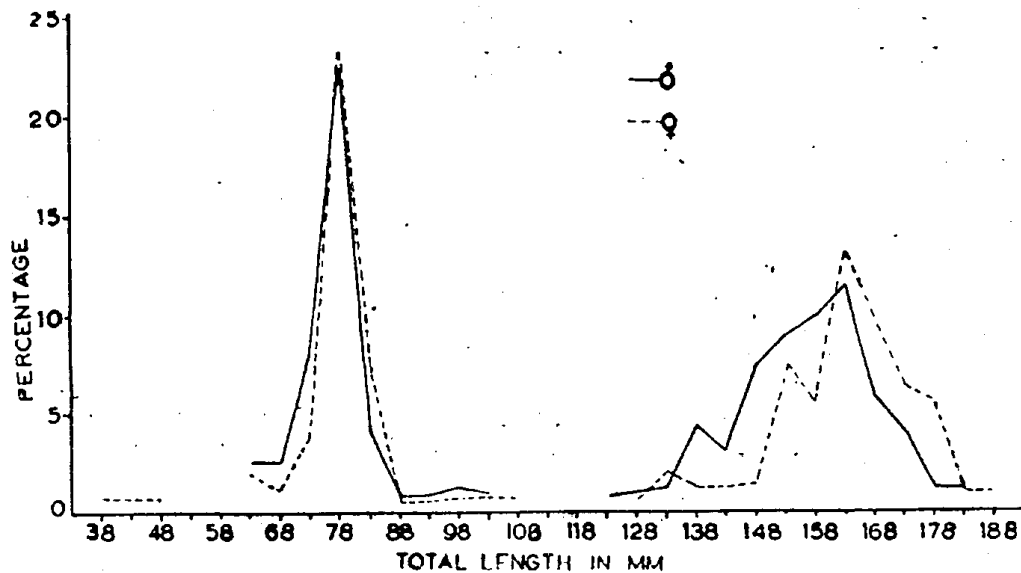
Food

The analysis of the stomach contents of 25 specimens measuring between 80–160 mm showed that they feed on fishes, crustaceans and gastropods. In one specimen (80 mm), the gut contents were exclusively composed of crustacean appendages. In general, the species is mainly carnivorous, feeding on fishes and crustaceans available on the ground.

TABLE I

Details of lobster landing by the vessels of the Indo-Norwegian Project from October 1967 to February 1968

Month	Area operated	Depth in metres	Total trawling hours	Total catch in kg	Total lobsters caught in kg
Vessel: <i>KLAUS SUNNANA</i>					
October	.. 8-75: 5D, 6E, 5E, 10-75: 1D	275-325	20.42	2,762	22
November	.. 8-75: 6F, 5F, 6D; 9-75: 1E	290-350	13.65	4,286	10
December	.. 8-75: 5D, 6E; 9-75: 1E, 1D	290-365	19.38	4,672	55
January	.. 9-75: 2D, 5E, 1D	310-395	48.32	10,328	133.5
February	.. 9-75: 1D, 2E, 2D	275-365	26.53	3,223	7
Vessel: <i>TUNA</i>					
October	.. 8-75: 6E; 9-75: 1E	200-360	2.15	13.51	1.5
November	.. ..	..	..	..	..
December	.. 9-75: 1E, 1F	355-370	8.23	3,943	47
January	.. 9-75: 1E, 1F	360-370	7.67	3,472	..
February	.. ..	..	..	..	..
Vessel: <i>VELAMEEN</i>					
October	.. 8-75: 6D, 5D	315-325	2.50	273	23
November	.. ..	..	..	..	..
December	.. ..	..	..	..	..
January	.. 8-75: 6D, 6E, 5D; 9-75: 1E, 1F	320-365	22.16	8,539	69
February	.. 11-74: 4D, 2F; 9-75: 1E, 1F; 8-75: 6E, 5E	245-350	15.17	2,670	22

FIG. 2. Size frequency distribution of *Puerulus sewelli* in the catches by INP vessels.

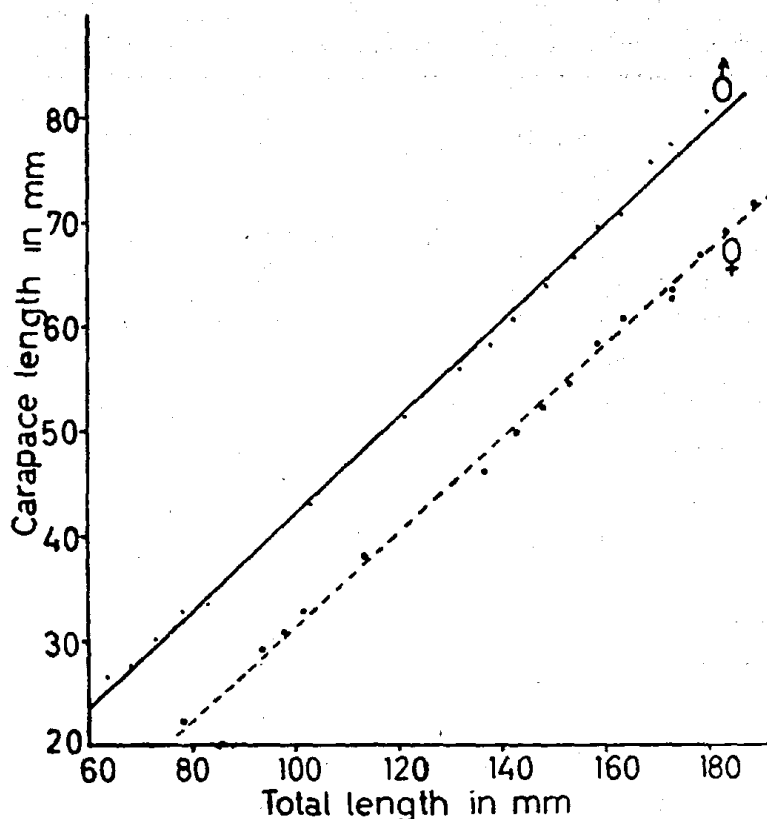


FIG. 3. Relationship between carapace and total length of *P. sewelli*.

Reproduction

Berried specimens occurred throughout the period, but the maximum numbers were observed from October to December-January and again in April, thus indicating a protracted breeding season with two peaks. The smallest specimen carrying the berry was 136 mm. Since egg carrying setae of the pleopods are found to develop in specimens measuring above 120 mm, it is possible that the lobster might attain maturity at this size.

The fecundity of 10 specimens varying from 136 mm to 196 mm size was estimated by counting the number of eggs contained in a sample weighing one gram and multiplying it by the total weight of the egg mass. The total number of eggs carried by the females ranges from 10,170 to 37,440 and the relationship between the length of the lobster and the fecundity is found to be linear logarithmic form and is expressed by the formula:

$$\text{Log } F = -1.9334 + 2.8201 \text{ Log } X$$

where 'F' is the fecundity and 'X' is the length.

The diameter of the eggs carried by the pleopods varies from 0.690 mm to 1.050 mm and the eggs get transferred to the pleopods when they attain a size of about 0.670-0.725 mm in diameter.

ESTIMATION OF POTENTIAL RESOURCE

For estimating the potential resource, area-wise total catches of lobsters and effort expended to catch these were used to get the average catch per one hour of trawling for each vessel. Taking

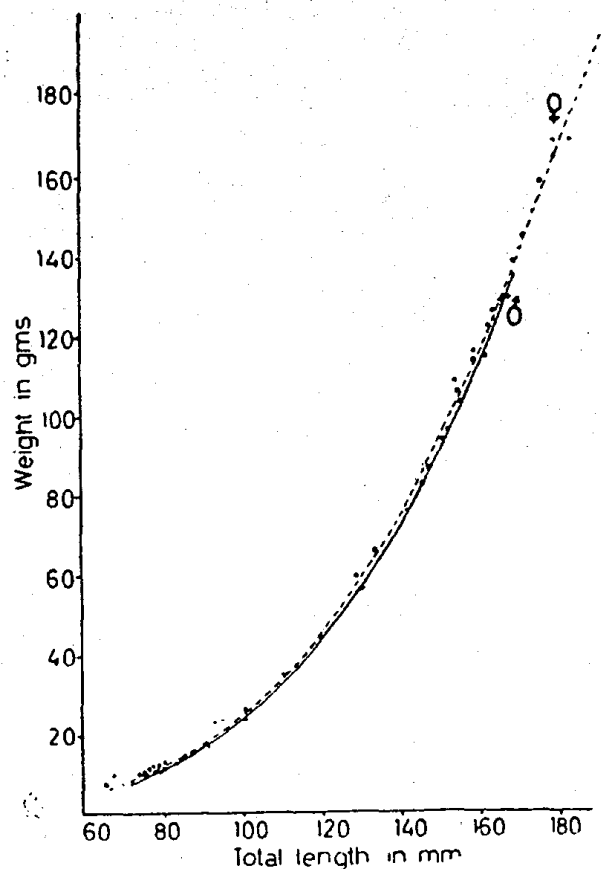


FIG. 4. Relationship between length and weight of *P. sewelli*.

the average speed of trawling as 2 knots per hour and the average horizontal mouth opening of the nets as 25.3 metres, it is calculated that an area of 0.094017 square kilometre is covered by the trawl during one hour of trawling. Considering the average catch per hour as an index of abundance of the lobster found in the area covered, the potential resource of each area is found out by multiplying the average catch per hour with the total area and dividing the same by the area covered in one hour of trawling. The average catch per hour is 2.7 kg, 2.5 kg and 2.1 kg respectively in the areas of operation of the vessels off Quilon (3,773 square kilometres), off Cochin (343 square kilometres) and off Calicut (343 square kilometres). The potential yield of these areas are 28.7 kg, 26.6 kg and 22.3 kg respectively per one square kilometre area. From this it would appear that the fishing grounds off Quilon is more productive, the estimated potential resource of the areas covered during the present exploration being 108 tonnes. However, the above estimation of the population of these lobsters based on the data obtained by a few exploratory cruises can only be tentative until further extensive investigations are carried out in these areas*.

Though the estimated potential resource of *P. sewelli* in some of the areas and the report of its occurrence off the south-west coast of India along with prawns belonging chiefly to the family Pandalidae point to its commercial potentiality, the status of the fishery is still in an exploratory stage. The present studies show that these lobsters are available in commercial concentration off the region south of Calicut to Colachel, especially, off Ponnani, Cochin, Quilon and Colachel;

* Since presentation of this paper, heavy catches of *P. sewelli* have been reported from slightly shallower (160-190 m) region off Quilon.

they occur in most of the months in depths of 180–365 m and are chiefly found in places with sandy bottom, where the temperature varies from 11° C to 17° C. However, in order to delineate the best grounds intensive studies on the environmental factors such as bottom temperature, type of substrate and their variation in different seasons of the year along with their abundance in different depth zones are essential.

The fact that these lobsters are caught in trawl nets which are mainly used for prawns and other ground fishes might account for the low catch rate obtained at present. But more effective gears and methods of fishing designed to catch this particular species may yield better results. In this connection, mention may be made about the recent experiments conducted in lobster fishing along the continental shelf and slope off the North Atlantic region in 255–275 metres area with specially designed steel pot (trap) fishing gear (Anon., 1968). The encouraging results obtained there indicate that specialised pot fishing is commercially feasible in deeper waters. The commercial evaluation of the fishery based on the present observations show that with the private industry taking to it, a profitable deeper water lobster fishery could be developed from the resources available in the area covered.

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