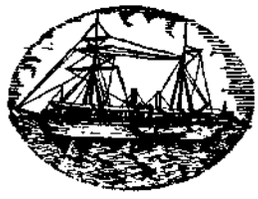
SYMPOSIUM ON CRUSTACEA

PART IV



MARINE BIOLOGICAL ASSOCIATION OF INDIA

MARINE FISHERIES P.O., MANDAPAM CAMP

INDIA

PROCEEDINGS

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SYMPOSIUM ON CRUSTACEA

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PART IV

SYMPOSIUM SERIES 2

MARINE BIOLOGICAL ASSOCIATION OF INDIA

MARINE FISHERIES P.O., MANDAPAM CAMP

INDIA

OBSERVATIONS ON THE BIOLOGY AND FISHERY OF THE SPINY LOBSTER *PANULIRUS HOMARUS* (LINN.)*

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ABSTRACT

Panulirus homarus (Linn.) supports an active fishery along the south-west coast of India. The main areas of fishing lie between Trivandrum and Cape Comorin in the south and between Tikkoti and Cannanore in the north. The trends in the seasonal and annual production at the two zones are described and discussed. The fishing season is from November to April in the southern region whereas in the north it commences in August and lasts only for a couple of months. The fishing methods which are different in the two areas are outlined.

Length-frequency studies reveal that larger sizes enter the fishery in the commencement of the season and smaller sizes are recruited into the fishery towards the latter half. The peak of the breeding season is from November to January as revealed by the high percentage of berried females in the catches and no segregation of of sexes is noticed in the fishing ground at any part of the year.

Results of the preliminary experiments to evolve suitable tagging technique for the lobster are given. The factors that contribute to the large annual fluctuations in the fishery and the influence of the pressure of fishing on the conservation of stocks are discussed.

THE spiny lobster *Panulirus homarus* (Linn.) contributes to a fairly good seasonal fishery on the south-west coast of India and supports a lobster tail freezing industry. Although a general account of the fishery and some results of experimental fishing for these lobsters respectively have been recently published by Miyamoto and Shariff (1961) and Balasubramanyan *et al.* (1960 and 1961) no attempt has been made so far to study the different biological aspects of this fishery. Prasad and Tampi (1959) described the phyllosoma stage of *Panulirus burgeri*. During the years 1958 through 1964 a study has been conducted on this fishery with special reference to growth and age class representation of the lobsters in the fishery and certain other biological aspects and the results are presented here.

Holthuis (1946) proposed synonymising *Panulirus dasypus* and *Panulirus burgeri* as *Panulirus homarus* and this was accepted by later authors (Gordon, 1953; George, 1963 and 1964 and Kubo, 1963). However so far all the authors studying these species from Indian waters including the recent, Miyamoto and Shariff (*op. cit.*) have mentioned the two species, namely *P. dasypus* and *P. burgeri*, as separate. In the present report the two species are treated as synonyms and recorded as *Panulirus homarus*.

On the south-west coast of India the fishery of this species is restricted to two areas, the rocky coast south of Trivandrum extending from north of Colachel to Cape Comorin and another small strip north of Kozhikode. Details regarding the topography of the area of the fishery, fishing methods, etc., of the Cape Comorin–Colachel area is given by Miyamoto and Shariff (*op. cit.*). The northern fishing area consists of 4 fishing villages in a stretch of 2·5 miles about 15 miles north of Kozhikode. The villages are (1) Tikkoti Kodikal, (2) Vanmukkam, (3) Kadaloor and (4) Nandi Light House shore. For the present study 2 of the important fishing villages of the southern area, namely Muttom and Colachel [Ref.: map given by Miyamoto and Shariff (*op. cit.*)] and Tikkoti Kodikal and Kadaloor centres of the northern area (from 1963 onwards) have been selected and lobster landings from these centres regularly sampled.

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Fishing Season and Methods

The fishing season at Colachel-Muttom zone commences by November or December and ends by April. The season at Tikkoti is very short and usually lasts for one or two months in August to October period.

The gear and methods employed in the fishery at Colachel-Muttom, namely anchor hook, lobster trap and scoop net are fully described by Miyamoto and Shariff (*op. cit.*). In addition to these three, bottom set gill nets are also employed to a certain extent, mostly in the villages south of Muttom. At Tikkoti mainly 2 types of gear are used in the lobster fishery. The most important gear is a type of cast net locally called *Muru vala* with mesh size 4·5–5·0 cm. and made of hemp twines. The net is operated from a dug-out canoe at a depth of 2–3 fathoms mostly during daytime and when the water is clear. Another type of cast net, *Kara vala* with the only difference of mesh size which is 3·0 cm. also is in use.

The second type of gear is a bottom set gill net locally called *Kantati vala*. The length of one piece of this net measures 40 feet long and 12 feet in depth, with a mesh size of 8·0 cm. also made of hemp twines. Eight to twelve pieces of these nets are attached together to form one unit and set at the bottom at a depth of 2–3 fathoms during night at the rocky region. Occasionally few lobsters are caught on hooks and lines operated mainly for perches.

Catch Variations

The estimated total landings of lobsters by the different gears employed at Muttom and Colachel for the years 1958–62 and at Tikkoti for the seasons 1963–64 and 1964–65 are shown in Table I.

Among the three gears employed at Colachel-Muttom zone, trap is the most important. Anchor hook is equally, if not more, important in catching ability at Muttom. But at Colachel this is not so, as is evident from the table. Scoop net is more prevalent in Colachel than at Muttom. It is also clear from the table that December and January are the more productive months in the fishery of the area.

It is noticed that there is a gradual decline in the catches of all the gears at both Muttom and Colachel from 1958–59 season to 1960–61 season. However 1961–62 season shows considerable improvement in the catches, although not equalling the catches of 1958–59 season. This might indicate that the decline noticed in the earlier seasons may probably be due to natural fluctuations rather than due to overfishing. Nevertheless a close watch on the fishery is necessary to determine the effect of the fishing on the stock available.

In the Tikkoti fishery the catches of 1964 shows an improvement over that of 1963.

Breeding Season

By taking the indirect evidence of the maximum percentage frequency of occurrence of females with berry on the underside of the abdomen the breeding season appears to be in the early months of the season, namely November-December. These months show the maximum number of females with berries at both Muttom and Colachel (Table II), although small percentages of berried females are present in the catches in all the months of the fishery as can be seen from the table. De Bruin (1962) also observes the peak of breeding of the species in Ceylon water in December, though he gives the breeding season as prolonged from August to March. It is also seen from the table that there are more berried females occurring in the catches at Muttom than at Colachel, which might indicate that the breeding area is likely to be nearer to Muttom.

TABLE I

Showing landings of P. homarus (in numbers) *by different gears at Muttom, Colachel and Tikkoti*

Season	Months	Muttom Trap	Muttom anchor hook	Muttom Scoop net	Colachel Trap	Colachel anchor hook	Colachel Scoop net	Tikkoti cast net
1958–59	December	7,359	46,286	..	16,398	..	3,560	..
	January	4,608	5,212	22	18,228	..	1,064	..
	February	6,920	2,222	58	9,196	60	50	..
	March	2,752	57	..	3,255	70	...	..
	April	328	267	..	1,114	..	...	..
1959–60	December	4,866	12,852	..	6,616	..	338	..
	January	4,608	5,212	22	4,046	1,370	120	..
	February	3,244	2,342	..	1,919	...	...	..
	March	926	212	..	745	...	...	..
1960–61	December	6,754	11,409	...	5,226	1,346	953	..
	January	4,960	8,786	...	4,210	247	32	..
	February				No data			
	March	2,186	112	...	1,064	...	..	..
	April	496	...	...	776	...	..	..
1961–62	November	3,028	14,050	...	2,844	1,534	808	..
	December	7,930	31,870	..	4,820	2,404	964	..
	January	10,537	18,340	...	3,026	1,154	1,355	...
	February	1,942	1,486	...	1,484	786	216	...
	March	192	22	...	295	547	32	..
1963	August	...	...	...	...	...	...	50
	September	...	...	..	...	...	..	1,535
	October	...	...	...	..	..	..	3,040
1964	August	..	..	..	..	..	..	35
	September	..	..	..	..	..	..	6,011

TABLE II

Showing the percentage of berried females in the lobster catches at Muttom and Colachel for the seasons 1958–59 to 1963–64

Season	Percentage of berried females											
	Muttom						Colachel					
	Nov.	Dec.	Jan.	Feb.	March	April	Nov.	Dec.	Jan.	Feb.	March	April
1958–59	..	70·9	36·1	51·6	40·0	22·5	..	57·1	52·7	42·9	17·2	17·0
1959–60	..	78·0	36·1	20·7	13·5	..	..	65·4	38·0	19·6	14·6	..
1960–61	..	60·4	43·8	27·5	18·4	7·8	..	54·7	25·6	17·1	11·5	11·4
1961–62	81·3	72·6	51·1	28·8	43·3	..	63·1	49·3	24·7	26·0	44·4	..
1962–63	..	..	..	7·7	..				No data			
1963–64	..	60·0	28·0	46·9	40·6	21·2	..	..	32·1	..	44·9	..

During the months of the fishery at Tikkoti region percentage of berried females obtained in the catches are considerably less (only 8·3 per cent. in 1963 and 35·3 per cent. in 1964), indicating that these months of the fishery are not the breeding months of the species there. It is possible that the population supporting the fishery at both the areas are derived from the same stock having a common breeding ground.

Sex Ratio

The overall monthly sex ratios of 11,072 lobsters observed from 1958–64 show 53·0 and 51·9 per cent. males and 47·0 and 48·1 per cent. females in Muttom and Colachel respectively. At

Table III

Showing the sex ratios of P. homarus *by months at Muttom and Colachel during the years* 1958–64

Months	Muttom		Colachel	
	% males	% females	% males	% females
November ..	55·8	44·2	54·3	45·7
December ..	50·3	49·7	58·2	41·8
January ..	51·8	48·2	55·8	44·2
February ..	50·2	50·8	50·3	49·7
March ..	56·3	43·7	48·8	51·2
April ..	54·2	45·8	44·3	55·7
Total ..	53·0	47·0	51·9	48·1

Muttom in March, April months there seem to be slightly more of males, whereas at Colachel in these months female percentage is slightly on the higher side. Except for these the sex ratio is almost 1 : 1, not showing any segregation of sexes.

The sex ratios in the catches at Tikkoti area show a slight preponderance of females in both seasons of observation.

Growth Rate

Growth rates of several of the commercially important lobsters such as *Panulirus argus*, *P. japonicus*, *P. interruptus*, *P. longipes*, *Jasus lalandii*, etc., have been either fully or partially studied by different authors by using either one or other or all the three methods, namely length-frequency, tagging and holding. Attempts have been made in the present investigations to determine the growth rate of adult lobsters of the present species by the length-frequency method. Though De Bruin (*op. cit.*) gives length-frequency polygons of *P. dasypus* from Ceylon waters during the fishery of the species in 1960 and 1961 no attempt is made by him, however, to determine its growth rate and age composition of the catches.

Length Frequencies

During the period 1958–64 a total of 11,072 lobsters were measured from the catches at Muttom and Colachel. The measurements are made from the rostrum (between the horns) to the end of the telson. The combined data from the two centres for length frequencies in intervals of 10 mm. for the season December 1960 to April 1961 for males and females separately is shown in Fig. 1.

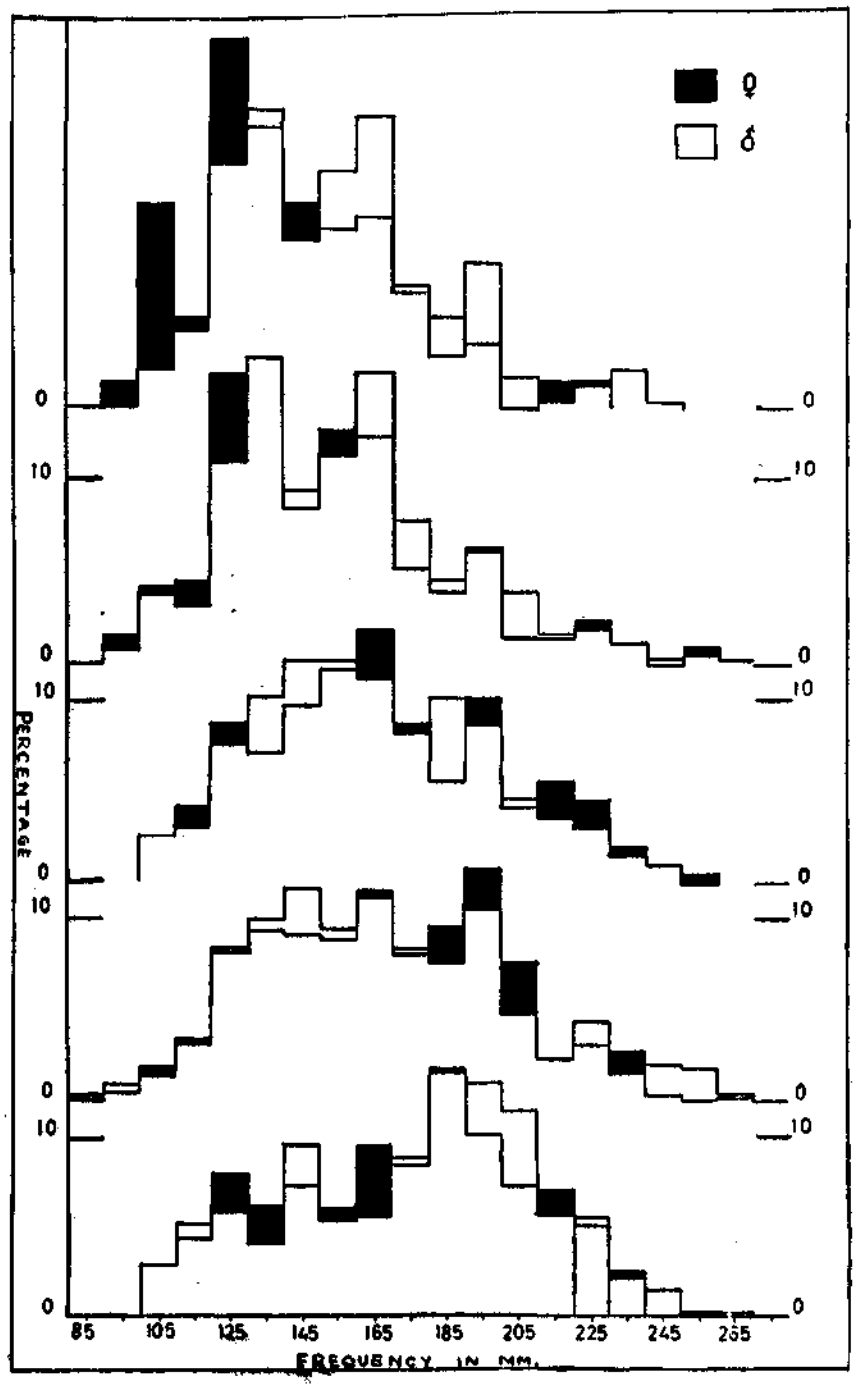

FIG. 1. Length-frequency distribution for the season 1960–61.

Although the number and complexity of the modes preclude the possibility of identifying the various age groups and of tracing their growth rates, shifting of some modes are apparent so that some deductions are possible as to the average length increments. Length frequencies for most of the seasons show more or less a similar pattern. In the case of males it can be seen from the figure that the mode at 141–150 mm. length group in December shifts to 161–170 mm. by April, thus showing a growth of 20 mm. in 4 months. But the mode at 181–190 mm. in December shifts to only 191–200 mm. by April, showing only 10 mm. growth in 4 months. Similarly in the case of females also the mode at 141–150 mm. group in December shifts to 161–170 mm. by April and shows a growth of 20 mm. in 4 months. Another December mode at 181–190 mm. moves only to 191–200 mm., again 10 mm. in 4 months. Other minor modes also could be traced to show shifts of 10 mm. during a period of 4 months. This gives an average growth rate of about 30–40 mm. per year which compares very well with the results obtained in other lobsters.

Age Composition and Population Characteristics

Monthly size frequency modal distribution in the fishery for the seasons 1958–59 through 1963–64 are given in Fig. 2. Plotted serially for all the years under observation and fitted with

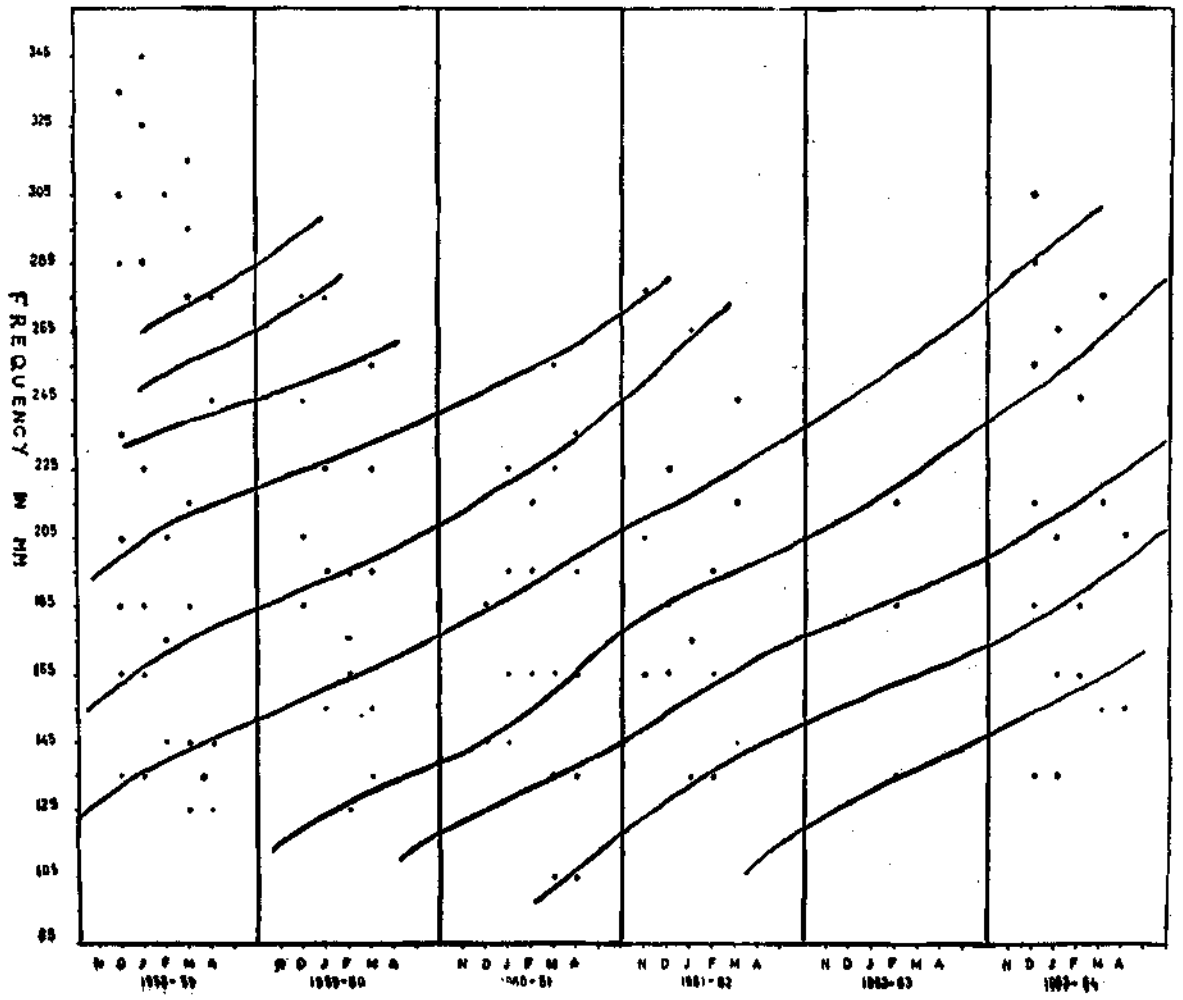

FIG. 2. Length-frequency modal distribution of *P. homarus*,

smooth curves the size distribution modes can be seen to trace each brood from its recruitment to its disappearance from the fishery. From the curves the interrelationships of successive broods seem to be sufficiently clear. However, slight variations in the fitted lines do pose a question regarding their causes. Perhaps part of this variation could be attributed to sampling error and disproportionate availability and differential growth in sexes.

A close scrutiny of the figure will show that about 6 year groups are represented in the fishery. An year group which comes into the fishery at 131–140 mm. size is seen to be represented in subsequent 5 years, reaching by that time a size of about 300 mm. The representation of the year groups which could be made out from the figure is shown in Table IV.

TABLE IV

Showing the year class representation in the fishery

Season	Year classes in February (length group mm.)							
1958–59	141–150	171–180	231–240	251–260	..	..	..	..
1959–60	161–170	191–200	251–260	271–280	121–130	..	..	..
1960–61	191–200	221–230	..	..	161–170	131–140	..	..
1961–62	215–225	261–270	..	..	191–200	161–170	131–140	..
1962–63	251–260	..	..	..	210–220	181–190	161–170	131–140
1963–64	291–300	..	..	..	241–250	210–220	181–190	161–170

The yearly progression of the modes can be clearly seen from the table. The year class with the mode at 141–150 mm. length coming into the fishery in 1958–59 reaches 291–300 mm. length in 1963–64 (Fig. 2 and Table IV). So it may not be far from the truth if it is concluded that altogether 6 year classes are represented in the fishery. The growth increase per year varies from 20–40 mm. The average annual growth rate works out to 28 mm. which compares very well with that obtained by the monthly length-frequency progression.

Taking into account the yearly growth rate obtained above and the fact that growth may be faster in younger stages, it may be concluded that the year class which gets recruited into the fishery at 131–140 mm. or 141–150 mm. size may probably be the 3rd year class, thus making a total of 9 year classes to reach a size of about 300 or 310 mm. In other words a lobster measuring 300 or 310 mm. length may be said to be 10 year old. This estimated age of *P. homarus* compares very well with the age obtained by other workers in other species of lobsters. In *P. interruptus* a specimen measuring about 260 mm. in total lengths is 7–8 years according to Lindberg (1955). In *P. argus* Travis (1954) observed the same age. In the case of *Jasus lalandii* according to Fielder (1964) specimen measuring about 250 mm. in total length is 10+ years, which, however, shows a slightly lesser growth rate in this species.

The actual growth rate obtained in the present species *P. homarus* is quite similar to the rate of growth observed in other lobsters. In the case of *Panulirus japonicus* (Von Siebold) Nakamura (1940) found that animals between 22 and 40 mm. carapace length increased in length 9·4–16·7 per cent. at moult. In *P. interruptus* (Randall) Lindberg (1955) arrived at a yearly growth increase of 3–4 cm. (1¼–1½ inch) by means of tag recoveries and holding experiments. For the same species Backus (1960) estimated a yearly growth of 2·0 cm. for females and 1·7 cm. for males for animals between 27 and 40 cm. total length. Smith (1948 and 1951) reported an annual growth of 1 inch for the species *P. argus* (Latreille). In the same species Dawson and Idyll (1951) observed annual growth of 1¼–1½ inch. Travis (1954) showed an annual increase of 9–12 mm. carapace length, also for *P. argus*. In the case of *P. longipes* (M. Edw.) Sheard (1962) estimated growth by tagging and

he calculated mean carapace length increments of 0·31 inch and 0·61 inch for females and 0·44 inch and 0·62 inch for males for animals free for 1 and 2 years respectively. In *Jasus lalandii* (M. Edw.) Bradstock (1950) noted an increase of 1·9 cm. and 2·1 cm. for two-tagged animals recovered after 1 year. For the same species Fielder (1964) records an annual growth of 1 inch total length in animals between 4·0 and 7·9 cm. carapace length and 0·6 inch in animals between 8·0–9·0 cm. carapace length. The average annual growth rate of about 30 mm. observed in the case of *P. homarus* as a result of the present investigations seem to be quite in agreement with the earlier observations on other species.

Experiments in Tagging

Early in 1964 some preliminary experimants in tagging the lobsters were conducted at Muttom. Dart tag similar to the one used by Dawson and Idyll (1951) and others has been used. Few lobsters were tagged with this tag and kept in the sea inside experimental lobster traps. Feeding was done every alternate day. These lobsters were alive in these traps for nearly 2 months during which time some underwent moulting. Final measurements of the lobsters could not be taken since the traps were lost and could not be tracad after about 2 months due to very heavy seas. However the experiment has proved beyond doubt the suitability of the tag for field studies. It has also shown that mortality due to the effect of tagging is quite negligible.

Discussion

Miyamoto and Shariff (1961) describing the lobster fishery of Kanyakumari District gives certain observations of the local fishermen with the suggestion that it should be pursued and investigated by fishery biologists. One of such observations is "female lobsters caught throughout the fishing season bear eggs". Data presented in Table II gives the percentages of berried females occurring in the fishery during the entire period of present investigation. The observation seems to be partly correct. Even though their percentages are very low in the latter half of the fishing season berried females do occur in the fishery throughout the 4 or 5 months of fishing there. But the females occurring in the fishery are not all berried at any time. Another observation is that small lobsters 1–1½ inches in body length are caught during the season in traps fixed near the coast. This observation does not appear to have any truth in it since throughout the period of observation of the present study of 7 years not a single specimen of such small lobster was obtained from these catches. The minimum size obtained in the trap is about 80–90 mm. in total length which is very much larger than the size mentioned.

The trend of the total landings of lobsters in Muttom Colachel zone seems to suggest that stocks are not seriously depleted. Because of the lack of data available on total landings of lobsters for the seasons 1962–63 and 1963–64 this conclusion must be tentative. But the earlier data shows that but for some natural fluctuations taking place in the fishery the stocks are not much low as is evident from the decline in the catches from 1958–59 season onwards and later increase in the catches in 1961–62 season to almost the 1958–59 level. The temporary decline in catches noticed in 1959–60 and 1960–61 seasons may be due to natural fluctuations caused by any one or more of a combination of factors such as temporary hydrographic barriers like unfavourable currents, temperature variations, etc., scarcity of food and unfavourable meteorological conditions. However, observations made throughout the present study tend to indicate that indiscriminate capture of all sizes of lobsters including the smaller sizes from 90–140 mm. total length, which are not favoured by the freezing industry and thus fetch only very low price and are fished mostly by traps, might sooner or later affect the total production at a later stage. It is felt that fixation of a minimum size limit for lobster catches might be useful to avoid this. Hence it is suggested that a minimum size limit of about 130 or 140 mm. total length should be enforced in the fishery, prohibiting the landing of lobsters of lesser sizes.

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