OBSERVATIONS ON THE SIZE GROUPS OF *PENAEUS INDICUS* (MILNE EDWARDS) IN THE COMMERCIAL CATCHES OF DIFFERENT NETS FROM THE BACKWATERS OF COCHIN

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With the establishment of the frozen shrimp industry in Cochin during the past few years the demand for large-sized prawns is ever on the increase both from the backwater as well as marine prawn fishery. Out of the three or four species of prawns contributing to the commercial fishery of the backwater area, *Penaeus indicus* is the most important species which is utilised in the frozen shrimp industry because of the comparatively larger size it attains in the backwater before migrating back to the sea. According to Menon and Raman (1961) the biggest prawns of this species caught in the stake nets of Cochin backwater measured between 130 and 140 mm. in total length. As a result this particular species is in great demand, especially the large-sized specimens. So with a view to determine the availability of the larger sizes of this species in the commercial catches throughout the year the catches were sampled and analysed regularly. The catches of the important types of nets employed in the fishery were analysed separately in order to find out the advantage, if any, in using a particular gear for obtaining the larger size groups required for the industry. The results of the study carried out during the four years 1955 to 1958 are presented here.

Methods and Materials

Weekly samples from the catches of the three different nets, the *chinese dip net*, *stake net* and *cast net* from Thevara and Azhikal area [*Ref.*: map given by Menon and Raman (*op. cit.*) for location of the two places] were analysed throughout the four years 1955 to 1958. Samples from the two areas were collected at random from whichever place they were available. The method and time of operation of the stake nets, the mesh sizes of these nets, etc., are given by Menon and Raman (*op. cit*). The mesh size of this net (from knot to knot when stretched) diminishes from about 85 mm. near the mouth to 10 mm. at the cod end. Gopinath (1953) describes the Chinese net and its method of operation. The mesh size of this net varies from 20 to 25 mm. near the edges and 10 to 15 mm. at the cod end. The cast

net mesh measures about 28 mm. near the edges and 20 to 25 mm. towards the inside.

Statistical treatment.—The method used by Williams (1955) is employed here in the comparison of length-frequency distribution in monthly samples as shown in Figs. 1 and 2. In each of the graphic figures the range of

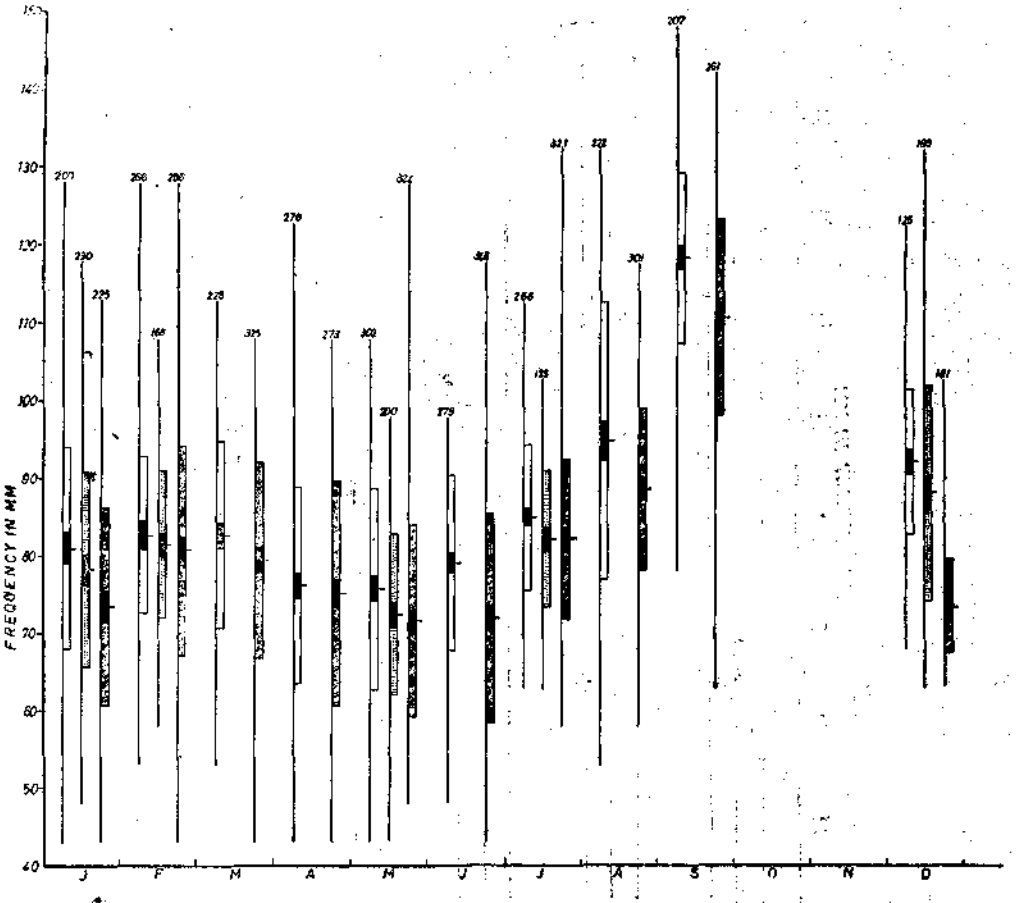

FIG. 1. Monthly length-frequency distribution of *Penaeus indicus* in the catches of different nets for the year 1955.

variation is represented by the vertical line, the mean is shown by the horizontal line, one standard deviation on each side of the mean is indicated by the hollow and shaded rectangles for different nets, and twice the standard error on each side of the mean is represented by the solid rectangle. The number of specimens in the monthly samples is shown adjacent to the vertical line. The method is used to describe the monthly samples as well

as the data pooled for the years from the different types of nets and to demonstrate the difference in the sizes obtained in the different nets.

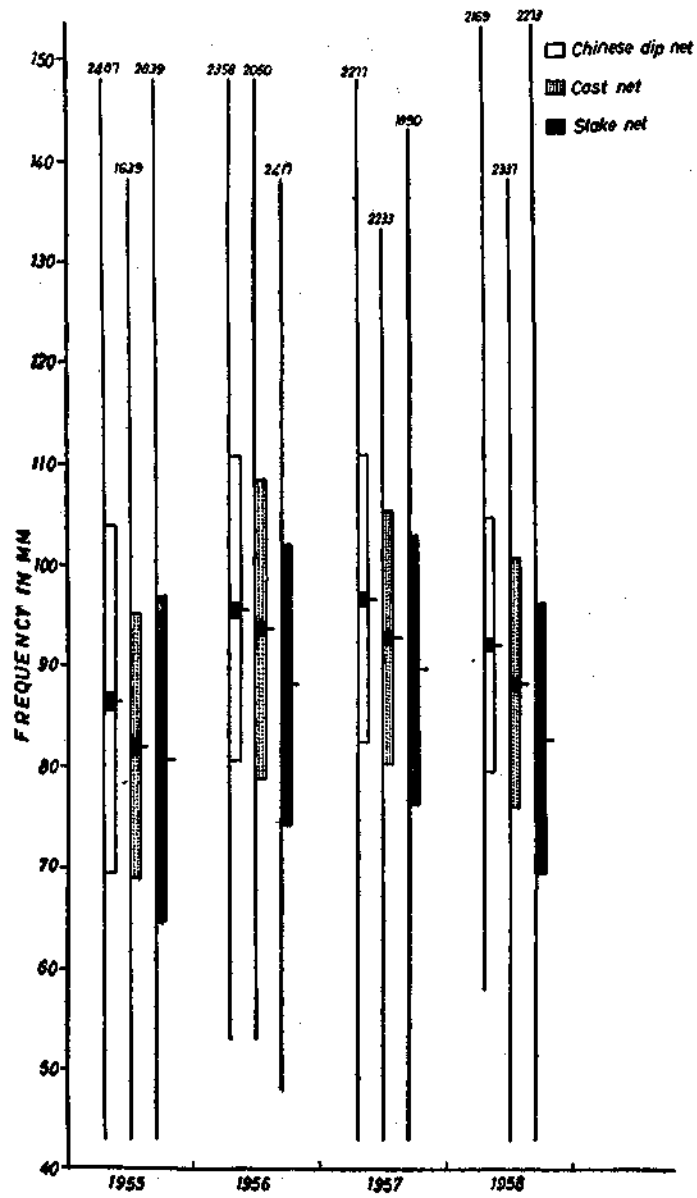

FIG. 2. Length-frequency distribution of *Penaeus indicus* in the catches of different nets for the years 1955–1958.

OBSERVATION

Size differences in the catches of different nets.—Length-frequency distribution of monthly samples from the three nets showing the range of variation and mean for 1955 is shown in Fig. 1 and the same for 1958 showing the modal lengths in Fig. 3. A study of these figures will clearly show that there is a marked difference in the size composition of the catches in the three nets. The figures show the highest population

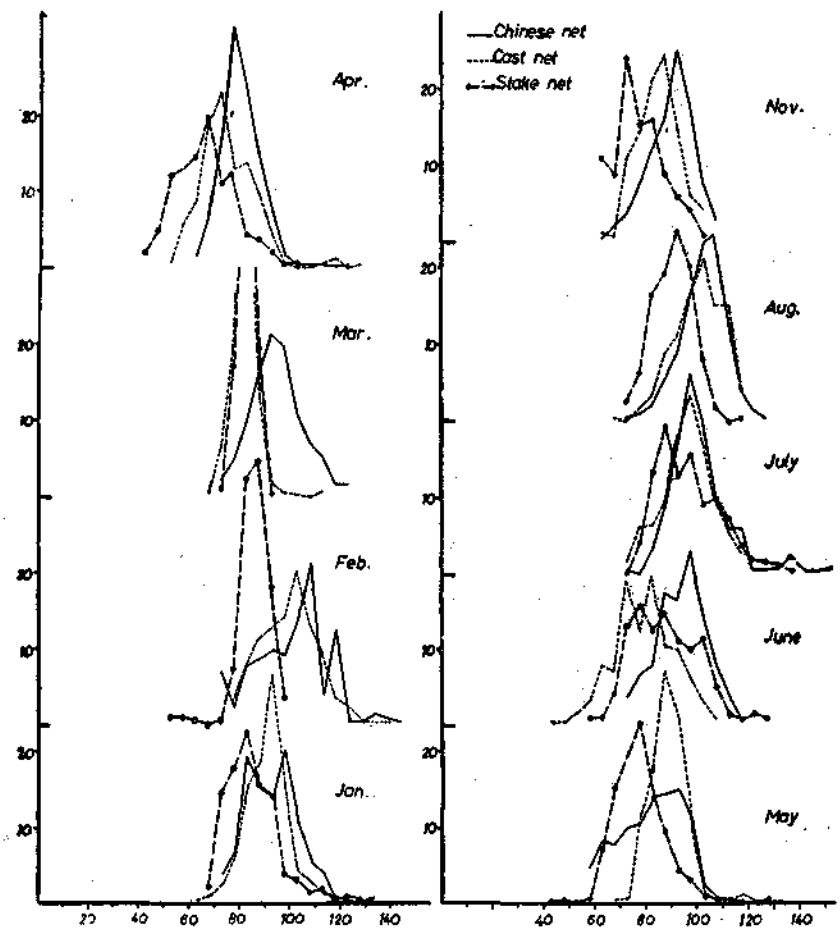

FIG. 3. Length-frequency distribution of *Penaeus indicus* in the catches of different nets for the year 1958.

mean as well as the mode at the largest length group in the case of Chinese net catches. The cast net catches come next in size and the stake net catches show the lowest mean as well as mode. Figure 2 represents

the monthly data pooled together and a comparison of the catches of the three nets during the four years. The same differences in the population mean are noticed in all the years invariably.

Growth and Migration

A close study of Figs. 1 and 3 indicates that the population mean and the modal length for the species remain less than 90 mm. in the first few months of the year, except for the slight difference noticed in the Chinese and cast net catch modal lengths in January and February of 1958. But from May onwards there is a shifting of the mean as well as mode towards larger sizes. In 1955 (Fig. 1) in September the mean reaches the maximum, *i.e.*, above 110 mm. in size, in the catches of the different nets. In the case of modal length (Fig. 3) September data are not available in 1958, but in August the mode reaches 110 mm. in the case of Chinese net catches. So an appreciable amount of growth is indicated in these months. After September both mean and modal lengths go considerably down as can be seen from the figures, probably due to migrations of the larger size groups back to the sea during the south-west monsoon period. George (1962) has observed the peak spawning period of this species in this area to occur in November-December. So it may be concluded that the brood which comes into the backwater in these months grows to about 110 mm. in size by next September-October and then migrates back to the sea. So the growth of the species for one year may probably be about 110 to 120 mm. and the migration back to the sea takes place after this length is achieved in the backwaters. This, more or less, is in agreement with the view expressed by Menon and Raman (*op. cit.*) that "most of the prawns pass out into the sea or are caught before they are about 100 mm. in length although the adults may reach even double that size", and Menon (1957) that "the vast majority captured from backwater do not exceed 120 mm. in length".

Discussion

Differences in the sizes of the prawn *P. indicus* caught in three different types of nets from the same locality are evident from the data collected and can be seen from the difference in the population mean as well as modal lengths of the samples from these net catches. The explanation for this difference in sizes of the prawns of the same species caught from the same area and time have to be sought in such factors like net mesh selectivity, mode of operation of the different nets or behaviour of the animals concerned. That mesh selectivity does not play any significant part in this

variation in the size of catches is evident from the fact that among the three types of nets, cast net has got maximum size meshes while the Chinese net and stake net have more or less similar meshes at the cod end. If net selectivity had some influence on the catches cast net ought to show the maximum sizes and the other two similar sizes. Since that is not the case mesh selectivity may be ruled out. Another factor which might influence the catch sizes is the mode and time of operation of these nets and it is likely that it is this factor combined with the behaviour of the prawns that cause the difference in sizes of the catches.

The Chinese net is operated in such a way that the mouth of the net does not reach the bottom. The net is so to say dipped in the water from time to time so that the mouth of this net which is more or less square reaches only slightly lower than midwater level except in very shallow waters where it is seldom operated. It is mostly operated during nights using powerful lights to attract prawns. Only those prawns which move about either in search of food or carried by currents and tides or attracted towards light will be caught in this net. Dall (1958) reports about the diurnal behaviour of *Metapenaeus mastersii* in Australian waters, remaining buried in mud during daytime and moving about actively in night. And it is quite likely that bigger sized prawns move about like this and thus get caught in this net. Dall (*op. cit.*) also observes that the diurnal rhythm does not appear to be as firmly established in juveniles of smaller lengths. In that case the largest modal lengths of these prawns caught in this net could be explained by that.

In the case of the cast net the operation of the net is such that every time a net is cast a column of water from the surface to the bottom is covered and during this whichever prawns available in this column either moving about or remaining on the bottom or remaining half buried in the mud are all caught. The operation of the stake net is dependent on the tidal flow. The net is operated against the flow of the tide during low tide as explained by Menon and Raman (*op. cit.*). The catches are mostly dependent on the tidal current and those prawns which are brought along with the current are caught in the net. Some of the bigger prawns may be able to escape from the mouth of the net by jumping and swimming against the current and that might explain the smallest sizes in the catches of these nets. The fact that some of the bigger prawns may be escaping against the current can be proved by a close examination of the data on length frequency of some of the species in the stake net catches presented by Menon and Raman (*op. cit.*). A sudden shifting of the mode towards bigger size which could not be due to growth is noticed in the months after the onset of the monsoon

when there is maximum current flow towards outside due to the outflow of water brought by the rains, rivers, etc. Because of the heavy currents of the outgoing tides the bigger prawns also may not be able to escape by jumping against the very strong currents and hence more of bigger sizes also may probably be caught thereby showing the sudden shifting of the modes in these months. Evasion of capture by prawn stocks by burying, migration and even schooling well above the bottom has been reported by Racek (1959). According to him "during diving operations on trawling grounds it has been noticed that prawns are also able to dodge the oncoming net by shooting high above the cork line".

Along with the mode of operation of the nets the behaviour of prawns directly or indirectly plays an important part in influencing the catch sizes of the nets. Diurnal behaviour observed by Dall (*op. cit.*) and Racek (1959) and on which characteristic the entire shrimp fishery of the species *Penaeus duorarum* of the South Atlantic and Tortugas fishing grounds is dependent (Idyll, 1957; Iversen and Idyll, 1960), the reaction of Crustaceans to direct and diffused light as reported by Schallek (1943), and the effect of intensity and colour of light on catches reported by Kurien *et al.* (1952) are factors which might have either direct or indirect influence on the sizes of prawns caught in these nets. Kurien *et al.* (*op. cit.*) actually observed a difference in size of *Penaeus indicus* in Chinese net catches by using different lights. However, in order to conclusively prove these influences on the catch sizes further investigations on behaviour studies and experimental fishing with these nets are necessary.

Summary

The backwater catches of *Penaeus indicus* from three different nets, the Chinese dip net, the stake net and the cast net for the years 1955 through 1958 have been analysed and it is found that the Chinese net catches show the maximum sizes in population mean and modal lengths. Cast net catch sizes come next and stake net catches show the minimum sizes. The probable factors influencing the size distribution in the catches of the same species caught in the different nets from the same area of operation are discussed.

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