A Note on the Bionomics and Fishery of the Swimming Crab *Neptunus sanguinolentus* (Herbst) on the Malabar Coast*

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With 3 Text-figures

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I—Introduction

Large numbers of the swimming crab *Neptunus sanguinolentus* are caught and marketed at Kozhikode and the neighbouring places on the West Coast of the Madras State from January to April or May. It has been obtained in fairly good numbers during these months in the regular departmental catches of fish. Two other species also, *N. pelagicus* (Linn.) and *Charybdis natator* (Herbst) have been captured sporadically; but they were always few and did not make any appreciable contribution to the crab fishery of this place during the seasons of 1950 and 1951. The results of the study of this material, collected in the course of the last two years, are embodied in this note.

Very little work has been done on the biology of Indian crabs. Macann's studies (1939) on the land crab *Paratelphusa* (*Barytelphusa*) *guerini* of Salsette, Miss Naidu's (1951) on *Ocypoda platytarsis* are perhaps the only papers that have been published. Both these species have little economic importance. Prasad and Tampi (1952) have recently published an account of the fishery for

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Neptunus pelagicus near Mandapam. It is, therefore, hoped that the publication of this note on a commercial species may be worthwhile.

Material has been collected from the shallow waters off West Hill, usually up to a depth of 4 fathoms, but occasionally up to about 8 fathoms also. Three types of nets, the boat seine, the gill net and the cast net have been used. The boat seine was smaller than those commonly used in commercial fishing on this coast, the meshes of the bag varying in size from $\frac{1}{2}$ to about 1 cm. In taking measurements the distance between the tips of the largest spines has alone been noted for each individual.

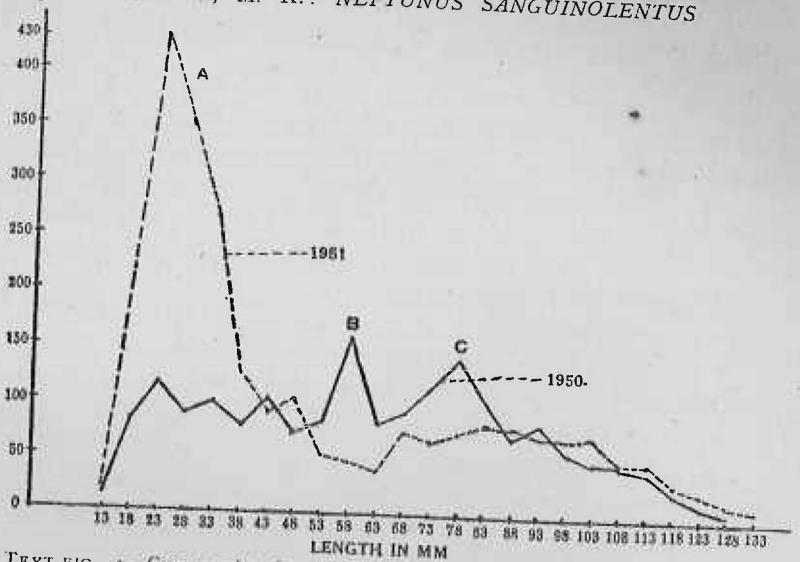
II—Breeding

In the months of February and March, which usually register the peak of the fishery, numerous berried females have been observed in the market and some have been obtained in our collections as well. In the succeeding months there is a marked fall in their numbers, although a few may be caught even as late as June. During these months they have been rarely seen in our collections. There is little doubt, therefore, that the breeding period of the species coincides largely with the fishery season and that the maximum numbers breed during these two months.

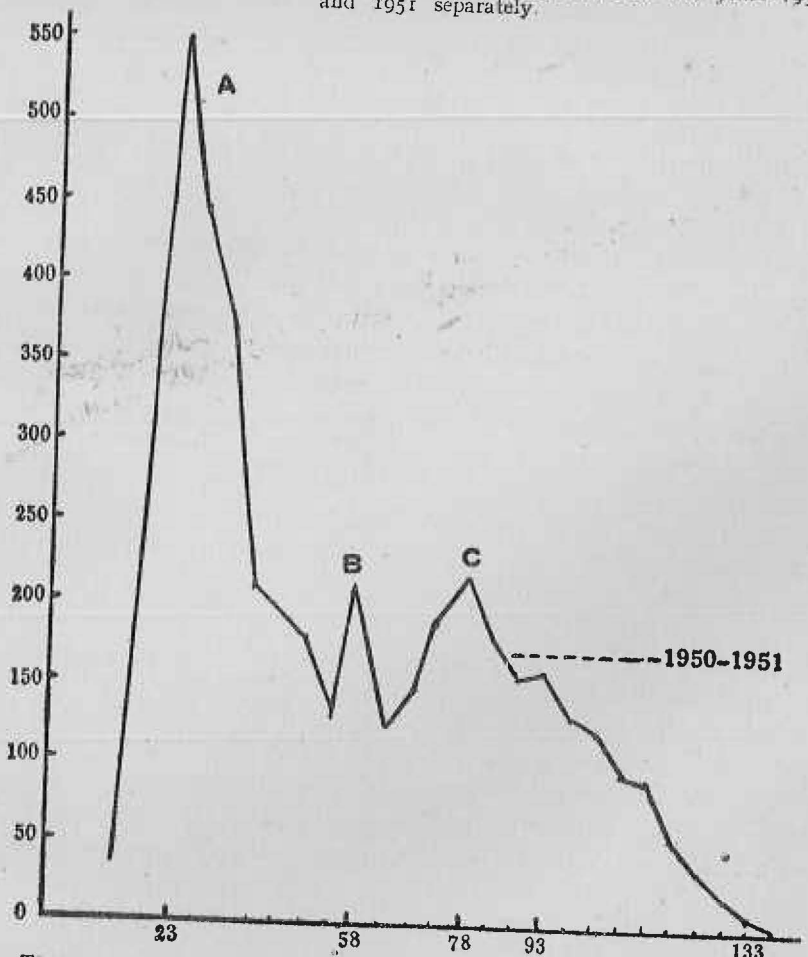
The commercial catches are usually made at about the same depths; but the plankton collections from this area have seldom contained their larvae in appreciable numbers. The smallest crabs captured in the boat seine have a carapace width of about 13-14 mm., even though the meshes of the net are small enough to have caught much younger forms if they were present in considerable numbers in the fishing grounds. These two facts would seem to indicate that hatching of the eggs takes place elsewhere, probably in deeper water, though there is no positive evidence for this conclusion. In the absence of larval material nothing about the early life history is known; but it is possible that in general characters the larvae may resemble those of *N. pelagicus* described by Delsman and De Man (1925).

III—Growth

Two specimens, one of which was apparently in the first post larval stage, and the other having a carapace width of about 8 mm. were obtained from the marine plankton at Madras. Both of them were reared in the laboratory, being fed on minced clam meat which they readily accepted. The first one lived for a month, from 24-11-48 to 26-12-48 and reached a carapace width of *31* mm. The other experiment lasted for a month and 20 days, from 3-1-49 to 23-2-49 and the final size reached was *41* mm. Unfortunately the exact number of moults and the increase in size at each were not recorded at the time. Though the conditions were practically indentical growth in the second experiment was slower the increase of about *33* mm. being the result of about 50 days' growth.



TEXT-FIG 1—Curves showing the total size frequencies for the years 1950 and 1951 separately.



TEXT-FIG. 2—Curve showing the combined frequencies for 1950 and 1951.

IV—Age Composition

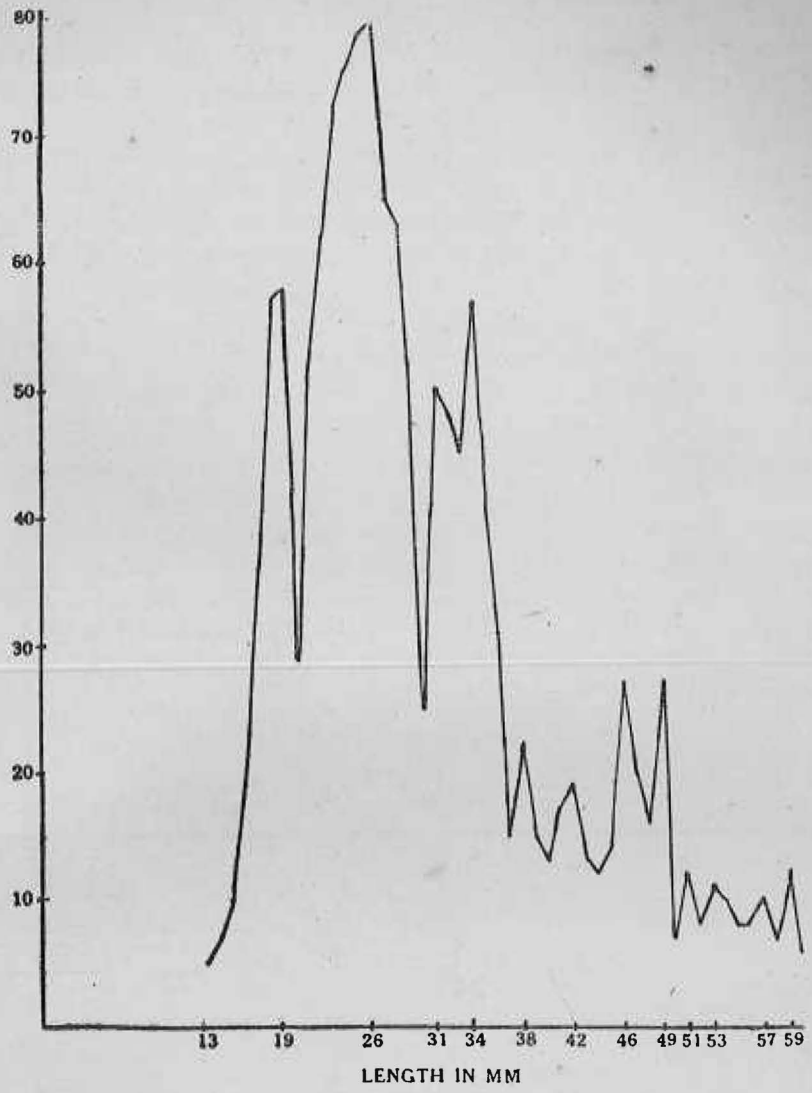
The result of an attempt at estimating the age composition of the collections by preparing curves of their size frequencies are given below. The graphs drawn by plotting the total frequencies for the two seasons separately and together are shown in Text-figures 1 and 2. While that for the 1951 season shows only one prominent mode representing the 21-25 mm. group those for 1950 and the two years together show two other well-defined modes (B and C) representing the 56-60 mm. and 76-80 mm. groups respectiveiy. If the rate of growth in their natural environments is comparable to that under laboratory conditions then both these groups may not be older than 3-4 or 5 months and probably some of the higher groups likewise may not be over an year old. Even allowing for a progressive slowing down in growth rate, as usually happens, it is by no means certain that the groups mentioned above could consist of animals older than one year. With the data available at present, therefore, the method does not permit of any definite conclusions. It would seem, however, that a large proportion of the catches is composed of crabs belonging to the generation produced during the immediately preceding breeding season.

V—Moults

The fact that growth in these animals is not a continuous process, but is effected in a series of leaps at the time of moulting makes it possible to arrive at some idea statistically of the number of times these moults take place during a particular period of growth. For this purpose the total number of individuals for every millimetre increase in size from 13 mm. (the smallest in the collection) to 60 mm. was calculated. The data for 1951 alone were used in this connection. These Text-figures were plotted and the graph prepared is shown in Text-figure 3. The curve exhibits a number of modes representing the following sizes 19, 26, 31, 34, 38, 42, 46, 49, 51, 53, 57 and 59, and thus obviously illustrates the discontinuous manner of growth. As each increase is the result of a moult, there were apparently 11 moults during growth between 13 mm. and 60 mm. In the absence of any other method, except that of rearing them, to decide whether so many moults have actually taken place, it will be necessary to accept this number with some caution.

VI—Food

The stomach contents of a number of specimens ranging in size from 25 mm. to 90 mm. have been examined; but it has not been possible to discover any marked change in the diet at different stages of growth except in the size of the organisms making up the food. As in the case of all bottom feeding crustaceans the food consisted of varying amounts of organic matter mixed with sand and



TEXT-FIG. 3—Curve showing the probable number of moults during growth from 13 mm. to 60 mm.

mud. Except in two or three, plant material, other than diatoms, was absent and even in the few in which it was present, it was perhaps taken in accidentally along with the other constituents. Among the animal fragments bivavle molluscs and crustaceans, especially amphipods and decapods, predominated. Small gastropods, copepods and polychaet worms also formed an appreciable part of the food of several crabs. Scales and vertebrae of bony fishes and the Cypris larvae of barnacles were also occasionally noticed.

VII—Sexual Maturity

Fully developed spermatozoa have been observed in males measuring about 80 mm. and upwards so that it may be safely assumed that individuals of this sex become mature when they reach a size of 80-90 mm. Among the berried females captured the smallest measured 78 mm. It is probable, therefore, that the females also attain maturity at about the same size as the males. In the light of what has been stated above in connection with the age composition of the catches, it is quite likely that some individuals of both sexes may become mature in the first year itself.

VIII—Proportion and Size of the Sexes

The sexes in each day's collection have been usually sorted out separately and their numbers determined, excluding the smallest, whose sex could not be distinguished. Their total number for the entire season has also been calculated. In the 1950 collections males outnumbered females, their proportions being *54.3%* and *45.75%* respectively. In the current year, however, the total number of males is less, forming only *46.8%*. It has been pointed out by Mackay (1946) in the case of the Pacific edible crab *Cancer magister* that though the sexes may occur in approximately equal numbers in the total population, due to intense fishing or their segregation, one may be found in much larger numbers than the other in a particular area.

In regard to the maximum size attained by the two sexes, not much disparity has been noticed; the largest males and females obtained so far being 144 mm. and *142* mm. respectively. The number of males and females of 100 mm. and over was also estimated for each year. In 1950 their proportion was *59.1%* and *40.9%* respectively; for the previous year it is *50.8%* and *49.2%*. The higher percentage for the previous year is in agreement with the corresponding larger proportion of the total number of males for that year; but during 1951, although the males were less, the proportion reaching the size specified is slightly higher. In view of this, it seems likely that in this species also, the rate of growth of males after reaching maturity may be higher than that of females, as happenes in the case of *C. magister*.

IX—Migration

The fact that large numbers of all sizes have been captured in shallow water near the coast in the months of January to May, while few or none have been obtained from the same area in most of the other months points to the probability of an annual migration. During this season young ones seem to ascend into river mouths, as they have been captured from the mouth of the Elathur river, a few miles north of Kozhikode. Panikkar and Aiyyar (1939) have reported the occurrence of the species in the Adyar backwaters during the period when the bar is open. At other times, when the communication is cut off, they were absent

and they, therefore, think that it is only a casual migrant. The species practically disappears from the coastal waters at West Hill after the monsoon rains start and in all likelihood moves into offshore waters. The European crab *Cancer pagurus* has been observed to perform similar annual migrations, away from the shore during the autumn and towards the shore in the spring. Further work is required to confirm this observation as well as to determine the area covered by these migrations.

X—Fishery

It has been mentioned already that the fishery is of short duration commencing in January or February and ending in May. The largest numbers are caught in February, March and probably April. The fishing area does not usually extend beyond 7-8 fathoms, a good part of the catch being made by cast net in water not more than 2-3 fathoms and the rest in boat seines and gill nets. It is said that some are caught by hand from between stones by divers. Practically the entire catch seems to be disposed of locally. When compared to the prawn fishery of this coast that of crabs appears to be of little importance at present, as, according to Chidambaram and Raman (1944) the average annual landings amount to only 23 tons.

In the absence of any provision to regulate the fishery, there is indiscriminate fishing and large numbers of berried females are also caught. If the capture of such females could be prevented so as to allow most of them to breed normally there may be increase in the population of the crabs which may lead to an improvement of the fishery. Fishing with the boat seine inevitably leads to the destruction of numerous young, which, if allowed to grow and reach maturity, may be expected to enhance the value of the fishery.

XI—Acknowledgement

I wish to express my thanks to Dr. N. K. Panikkar, Chief Research Officer, Central Marine Fisheries Research Station, for kindly going through the paper and suggesting improvements.

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