NOTES ON THE BIONOMICS OF THE PRAWN
METAPENÆUS MONOCEROS, FABRICIUS

By M. J. George

(Central Marine Fisheries Research Station)

INTRODUCTION

Metapenæus monoceros, Fabricius is one of the three species of Penæids contributing to the commercial prawn fishery of the Cochin backwaters. The following notes have been prepared from a study of samples collected from both paddy field and backwater catches during the period 1952-55 and offshore trawl net catches during 1957. Samples of backwater catches were collected from places like Kumbalangi, near the southern end, Pallippuram at the northern end and Narakkal at about the middle of the Cochin backwaters. A total number of 15,899 specimens have been measured and studied during the period.

Panikkar (1937) and Menon (1951, 1952, 1953, 1954, 1955 and 1957) have studied the prawn fishery of the Malabar coast and the Cochin backwaters respectively in general and the bionomics and fishery of a few species in particular. Menon has described in his papers the paddy field and general prawn fishery of the backwaters of Cochin area. The fishing methods, etc., described by him apply equally to this species also.

The species *M. monoceros* grows to a maximum size of 17–18 cm. and has got a wide distribution in Indian waters especially in the backwaters, lakes and estuaries. On the west coast it is fished in large quantities from the Cochin backwaters and estuaries of big rivers. In the Gulf of Kutch medium-sized prawns of this species have been found to contribute to approximately 45% of the commercial catches in 1951–52 (Srivatsa, 1953). On the east coast also this species contributes to a certain extent to the commercial prawn fishery at Ennore, Pulicat, Akkiveedu, the delta of the Ganges etc.

Unlike *M. dobsoni* and *P. indicus* which contribute to both marine and backwater fisheries of this area, *M. monoceros* was found to contribute mainly to the backwater fishery. In spite of constant watch throughout the course of the study, at no time of the year was this species found to occur in any significant numbers in the ordinary inshore commercial catches of this area. In 1957 the catches of the trawl nets operated off Cochin in depths of 10–20

fathoms contained bigger specimens of the species on some days and these have also been studied.

GROWTH

From the month-to-month frequency curves for the year 1953–54 (Figs. 1 and 2), it can be seen that the length of the modal group is 86–90 mm. in August and September. In October and the following months the length of this group is less, reaching a minimum of 56–60 mm. in February. Later it increases reaching the maximum in August. So from 56–60 mm. in February, this group has grown to 86–90 mm. by August–September. From this the rate of growth works out to 5 mm. per month. The same trend of decrease in the length of the prominent age-group towards the minimum in the beginning of the year and increase towards the maximum in the latter half of the year was seen in the monthly frequency curves for 1954–55 also.

REARING EXPERIMENTS

1. *Experiments in the Laboratory.*—Observations on the rate of growth of the prawn in the early life were carried out in the laboratory by rearing post-larvæ collected from the plankton in large glass troughs. The results of these experiments are given in Table I.

TABLE I

Growth rates of M. monoceros *obtained from experiments in the laboratory*

Period of experiment	Initial size in mm.	Final size in mm.	Increase size in mm.	Rate of growth per month in mm.
1-5-1952 to 4- 9-1952 (4 months)	3·0	33·5	30·5	7·63
Do.	3·0	33·0	30·0	7·50
Do.	3·0	34·0	31·0	7·75
Do.	3·0	28·0	25·0	6·25
15-1-1953 to 20- 9-1953 (8 „)	3·0	60·0	57·0	7·13
15-1-1953 to 23- 5-1953 (4 „)	3·5	36·0	32·5	8·13
24-6-1954 to 31-12-1954 (6 „)	3·0	46·0	43·0	7·17
1-4-1955 to 2- 8-1955 (4 „)	3·5	44·5	41·0	10·25
1-4-1955 to 8- 8-1955 (4 „)	3·5	43·5	40·0	10·00
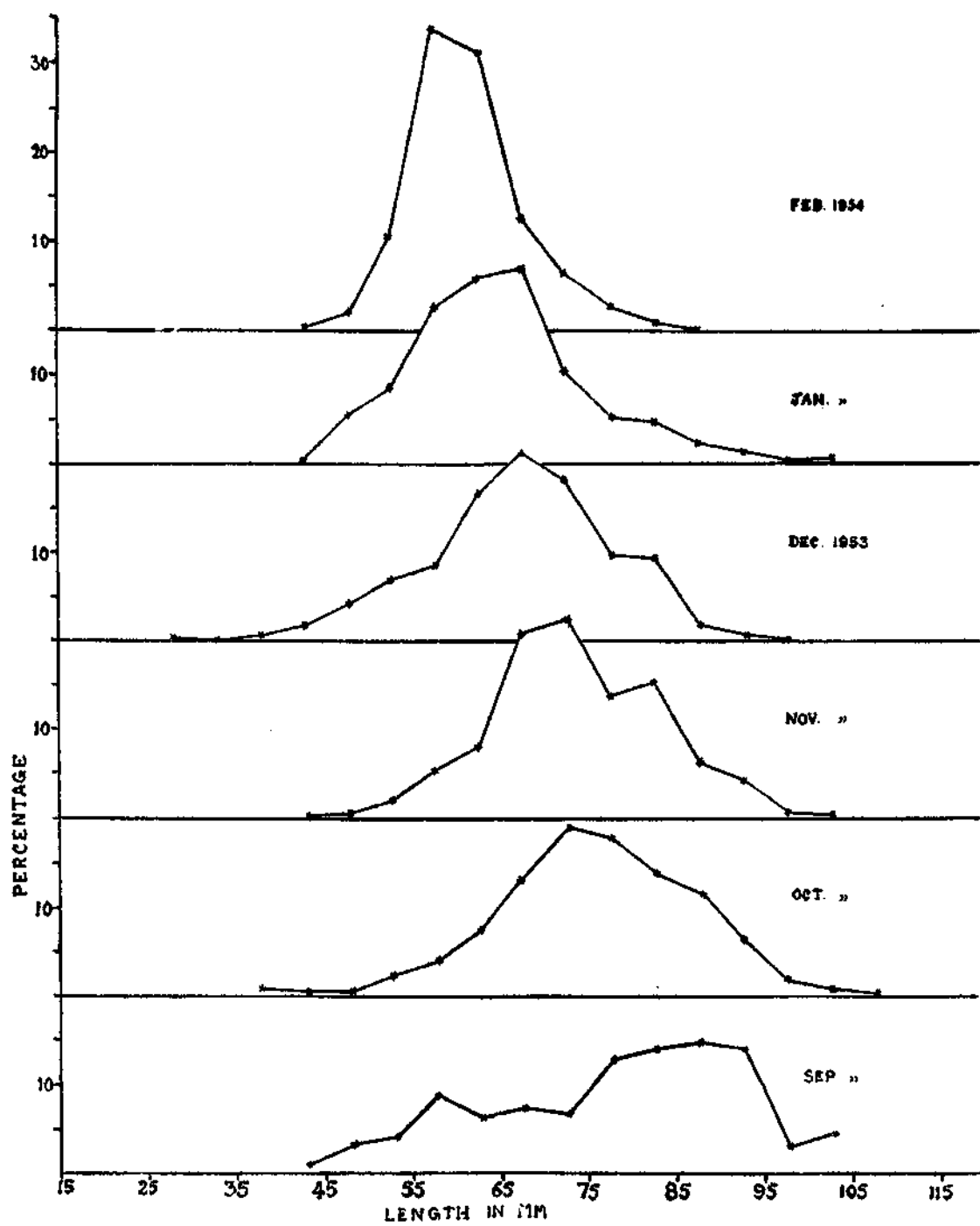
TEXT-FIG. 1. Length frequencies for the year 1953-54
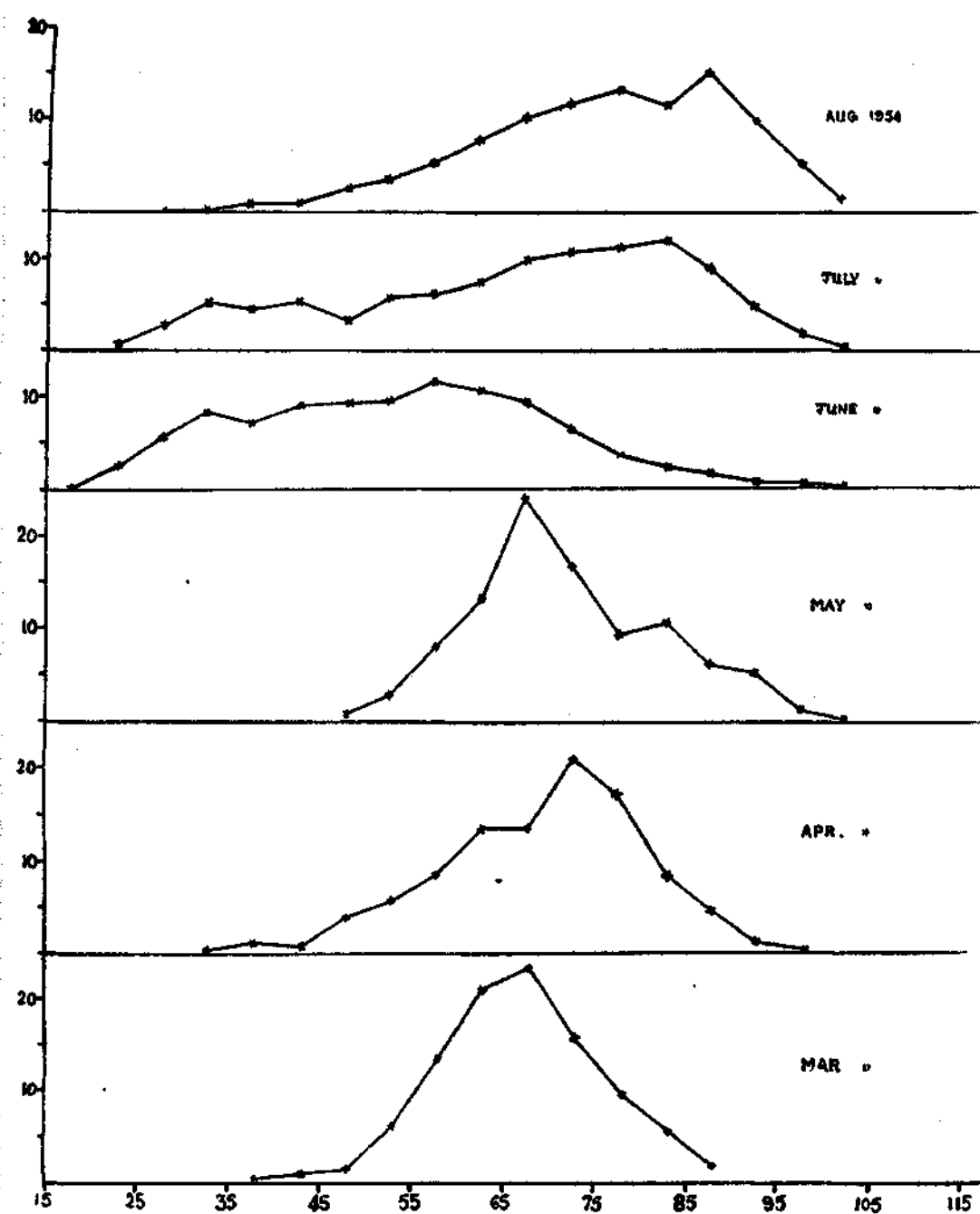
TEXT-FIG. 2. Length frequencies for the year 1953-54.

The rate of growth varies between 6·25 and 10·25 mm. with an average growth rate of 7·98 mm. per month.

2. *Experiments Conducted in the Departmental Prawn Farm.*—Experiments to study the rate of growth of *M. monoceros* were conducted twice in a small section of the departmental prawn farm at Narakkal. On both occasions, living healthy specimens were collected from fresh catches and after noting their initial lengths with the least possible handling, they were released into the experimental field which had been fished beforehand. These prawns were allowed to grow in their natural environments for about three months and then measurements were again taken.

In the first experiment conducted from 4th February 1954 to 6th May 1954, out of 303 specimens initially released, 82 were obtained when fished finally and in the second experiment lasting from 29th July 1954 to 6th November 1954, out of 416 specimens 198 were caught at the end of the experiment. Results obtained by plotting the initial and final length frequencies (Fig. 3) show a growth of 15 and 10 mm. respectively during the
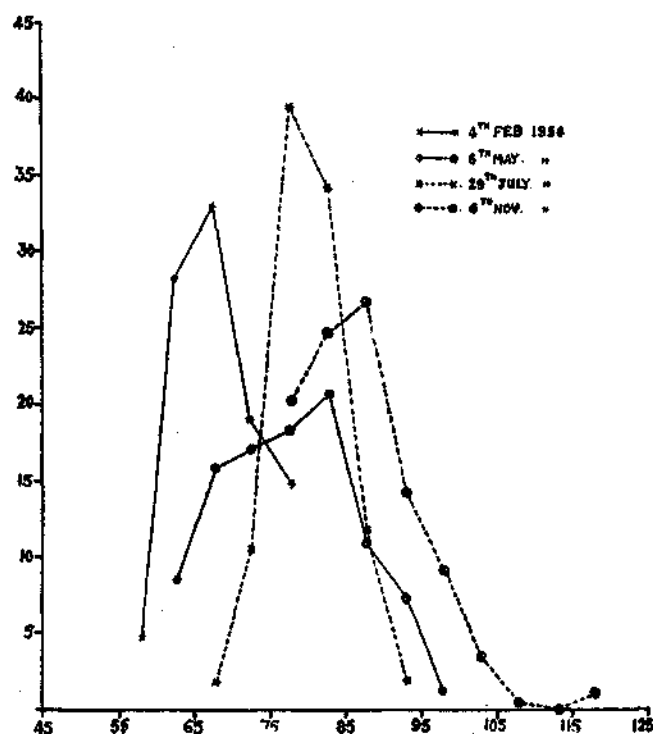

TEXT-FIG. 3. Showing the initial and final length frequency curves obtained in experiments to study growth rate.

course of about 3 months. The difference in the results of the two experiments may be attributed partly to the fact that the rate of growth diminishes with increase in size of the animals, for, the specimens for the second experiments were of bigger sizes than those of the first.

AGE COMPOSITION OF CATCHES

Curves of the total size frequencies for the three years 1953, 1954 and 1955 have been plotted separately and are shown in Fig. 4. Each curve
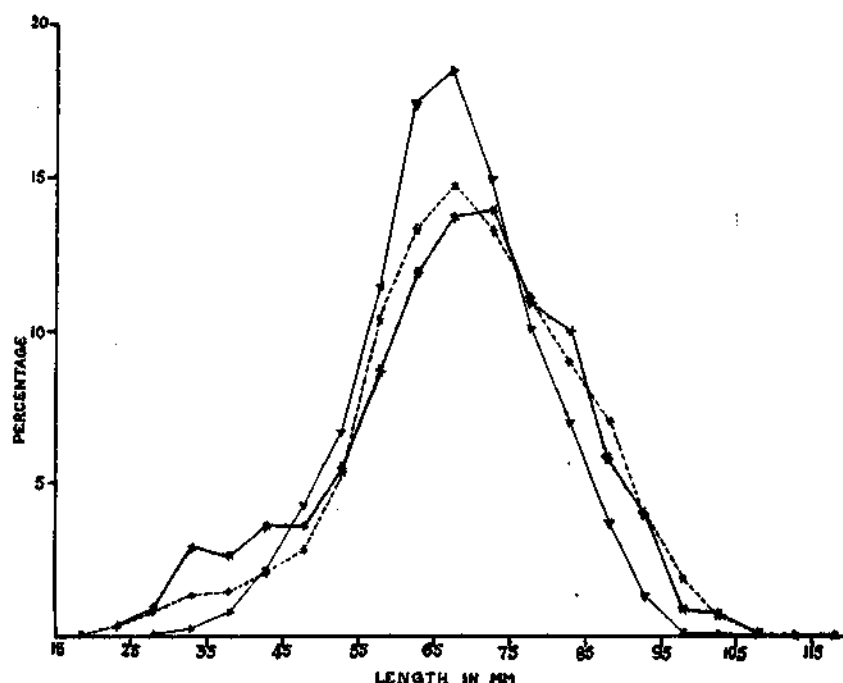
TEXT-FIG. 4. Curves showing the total size frequencies for the years 1953-55.
(×———× 1953;   ×---× 1954;   ▲———▲ 1955)

shows only a single prominent mode, at the 71-75 mm. group in 1953 and the 66-70 mm. group in both 1954 and 1955. Taking into account the growth rate of the prawn which is 5-10 mm. per month as was shown above, these groups may not be over 8 or 9 months old.   Hence it may be concluded that only one year group is represented in the backwater catches and the fishery is supported by the zero-year class.

The total size frequency curve plotted for the trawl net catches from deeper waters for 1957 is shown in Fig. 5.   Three clear modes *a*, *b*, *c* can be seen in the curve at 106-110 mm., 131-135 mm. and 156-160 mm. respectively.   Taking into account the rate of growth of the juveniles and the
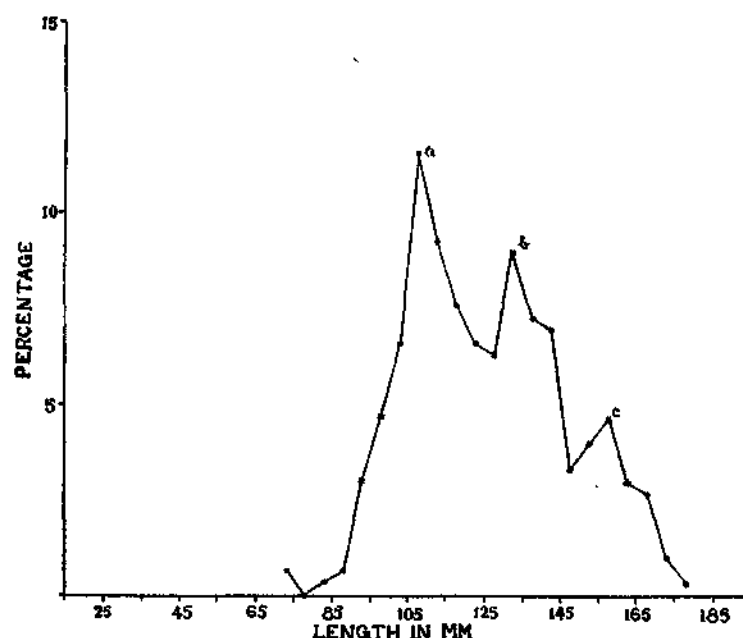
TEXT-FIG. 5.   Curve showing the total size frequencies of trawl net catches for 1957.

size attained in the backwaters, the mode at 106–110 mm. may be considered to represent the 1st year class. Since the rate of growth diminishes with increase in size, the next two modes in the curve can be taken to represent the second and third year classes respectively. Thus as in the case of *M. dobsoni* (Menon, 1955 and 1957) three distinct year classes are met with in the case of this species also.

LENGTH-WEIGHT RELATIONSHIP

The length-weight relationship in *M. monoceros* was determined by measurements of 175 specimens ranging in size from 25–105 mm. Only live specimens were selected for taking the measurements. The total size range was divided into 16 size-groups with a class interval of 5 mm. The mean lengths and weights of these groups were calculated from the observed data.

The conventional formula $W = aL^b$ (where 'W' is the weight and 'L' length of the prawn and 'a' and 'b' the constants to be found out) was fitted to this data. The formula for the size range mentioned above was found to be

$$W = 0 \cdot 01989 \, L \, 2 \cdot 7603$$

From the formula the theoretical value of 'W' for every given value of 'L' was calculated. The calculated and observed values for 'W' when

plotted against their respective values of 'L' indicate a close agreement between the two sets of values (Fig. 6). The increase in weight of the prawn is found to be at a rate slightly less than the cube of its length as in the case of *Leander styliferus* (Kunju, 1955).
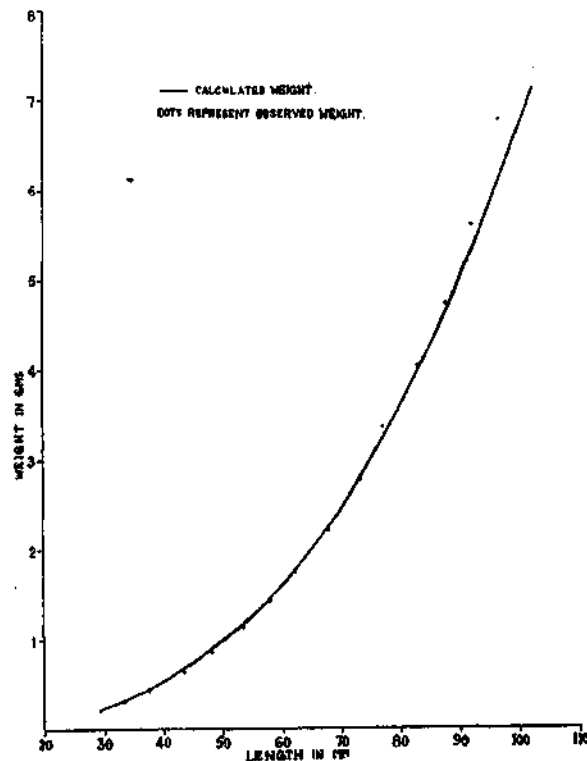
TEXT-FIG. 6. Calculated length weight curve fitted to average observed length weight value.

MOULTS

In experiments in which *M. monoceros* were reared in the laboratory, the number of moults undergone by the prawn during definite periods of growth was observed (Table II).

From the table it is evident that the number of moults during a period of growth from a length of 3 or 3·5–20 mm. is 6, 21–50 mm., 8 and 50–65 mm., 7, thus giving a total of 21 moults for a period of growth from 3–65 mm. length. This is found to coincide with the result obtained statistically by plotting the data obtained by calculating the total number of individuals for every mm. increase in size in the samples measured during one year as done by Menon (1952) in the case of *Neptunus sanguinolentus*. The data for the year 1953 alone were used in this connection. The total number of

TABLE II

Showing the number of moults of M. monoceros *observed in rearing experiments in the laboratory*

Period of experiment	Initial size in mm.	Final size in mm.	Number of moults
5-9-1953 to 12- 1-1954	50	65	7
24-6-1954 to 29- 8-1954	3	20	6
31-8-1954 to 31-12-1954	21	50	8
1-4-1955 to 19- 5-1955	3·5	20	6
1-4-1955 to 21- 5-1955	3·5	21	6
19-5-1955 to 20- 8-1955	20	50	8
21-5-1955 to 15- 8-1955	21	49	7

moults obtained thus by noting the modes in the graph, shown in Fig. 7, is 26 for a growth from 20-100 mm. Out of this the number of moults
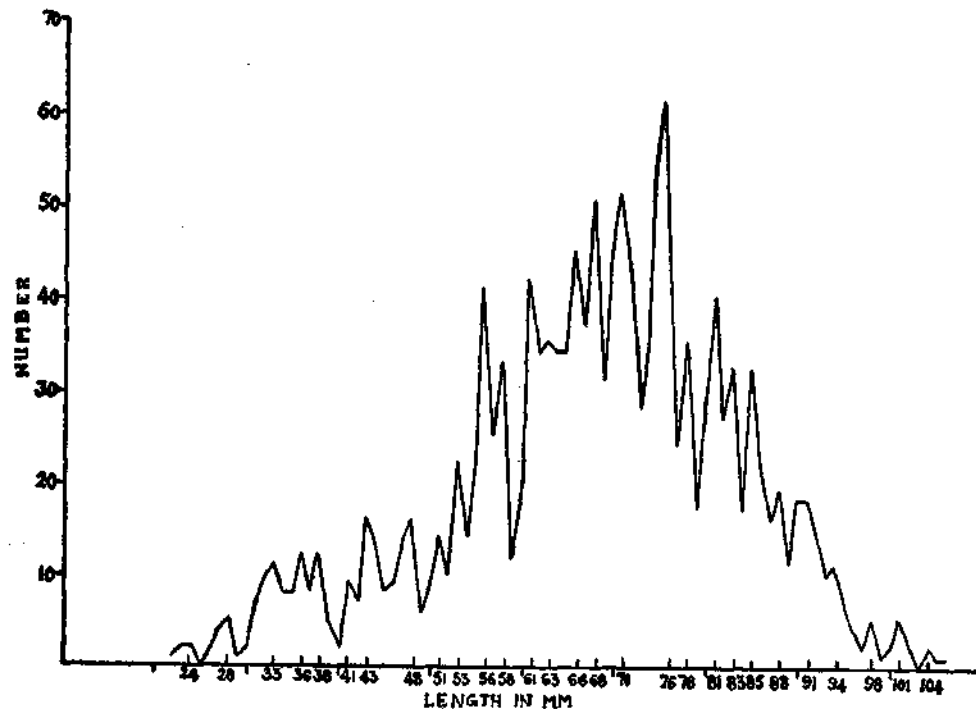
TEXT-FIG. 7. Curve showing probable number of moults during growth from 20 to 100 mm.

from 20–65 mm. is 15 which is the same as the result obtained in the rearing experiments. Unfortunately the result obtained statistically for lengths from 65–100 mm. could not be verified by rearing experiments due to the difficulties in rearing larger prawns in the laboratory. However, putting both results together, the number of moults for a period of growth 3 mm. to about 100 mm. is 32.

BREEDING AND MIGRATION

The only possible method for collection of evidence about breeding of this prawn was by carefully following the occurrence and variation in abundance of post-larvæ of the species in the backwater plankton and this was carried out by regular weekly examination of Narakkal bunder canal plankton. From a study of the monthly averages of the number of post-larvæ in these collections, it would appear that although the spawning season extends for some months, the peak is in November-December. This conclusion is further strengthened by the presence of specimens with mature ova in the trawler catches in 1957 during October–December.

Regarding the place of breeding of the species, no conclusive clue is available so far. According to Menon (1951), "Penæid prawns with the exception of *M. stebbingi* and *M. monoceros*, breed, as far as is known, only in the sea". *M. monoceros* has been observed to breed in the coastal lakes of New South Wales by Dakin (1946) and Muriel and Bennet (1952). Based on the occurrence of early post-larvæ of *M. monoceros* in the brackish waters of Adyar, Panikkar and Iyer (1939) have suggested the possibility of the species breeding in those waters. However the complete absence of adult prawns with mature gonads in the backwater catches and also absence of eggs and larval stages in these waters during the course of this study tend to show that breeding of the species does not take place in the Cochin backwaters. At the same time the presence of post-larval stages in the backwaters and large mature specimens in the catches from the sea (offshore waters) may be taken to indicate the possibility of breeding taking place somewhere in the sea and the early post-larvæ migrating to the backwaters, as observed by Menon (1955) in the case of *M. dobsoni*.

As has been pointed out earlier, a study of the length frequency curves shown in Figs. 1 and 2 indicate that the maximum length of the prominent age-group is reached in August and September. Thereafter this mode disappears. This indicates that specimens up to a certain length only are represented in the backwater catches. Prawns of this species measuring more than about 100 mm. in length are very scarce in these catches. In spite of intensive efforts not even a single specimen of more than 120 mm. in length

could be obtained during the course of the study. In the light of these facts it may be concluded that migration back to the sea commences after a length of about 100 mm. is reached and this in less than a year's time.

Food.—The analysis of the stomach contents of 1,173 specimens of *M. monoceros*, ranging from 20–100 mm. in length, indicates an omnivorous habit as in the case of other Penæid prawns (Gopalakrishnan, 1952 and Menon, 1951 and 1953).

Sex Ratio.—The determination of sex ratio in the catches for 1952–53, 1953–54 and 1954–55 shows a slightly higher percentage for females in all the years, the respective percentages of males and females being 48·24 and 51·76, 48·93 and 51·08, and 48·69 and 51·31 in the three years respectively.

SUMMARY

Some aspects of the bionomics of *M. monoceros* such as growth, age, composition of catches, length-weight relationship, number of moults, breeding and migration are dealt with.

Prawns born in November–December, which is the peak of the spawning season, grow to a length of 86–90 mm. by August–September and thereafter this mode disappears in the monthly length frequency curves, thereby showing that it is the zero-year class which supports the fishery in the backwaters whereas three year-classes are represented in the offshore catches. Early post-larvæ seem to migrate to the backwaters and migration back to the sea commences after a length of about 100 mm. is reached. The length-weight relationship shows the normal pattern, the formula being $W = 0·01989\ L\ 2·7603$. The number of moults for growth from 3–100 mm. is 32.

ACKNOWLEDGEMENT

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