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OBSERVATIONS ON POST-LARVAL PRAWNS FROM THE GODAVARI ESTUARINE SYSTEMS WITH A NOTE ON THEIR ROLE IN CAPTURE AND CULTURE FISHERIES

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ABSTRACT

The recruitment pattern of the larval and post-larval penaeids, *Penaeus monodon* and *Metapenaeus monoceros*, into the Godavari estuarine system on the east coast of India, during the years 1959-60, 1960-61 and 1961-62, are discussed in detail together with a note on their morphological features for distinguishing them from other post-larval penaeids. The flood waters supress the tidal oscillations in the estuary from July till October but from November typical estuarine conditions with flood and ebb tides, become established and remain so till June. The present observations were made during the latter period when the salinity and water temperature ranged between 4.85 ‰ and 31.21 ‰ and 21.2°C and 31.8°C respectively. The post-larvae of *P. monodon* and *M. monoceros* were available throughout the period of observation but their numbers were generally maximum during the periods November-January and April-June. The post-larval incursion was rich during both the full moon and new moon periods. The rate of recruitment was however, relatively more at night than during the day. The mysis stages of *Metapenaeus* spp. were generally found in more numbers near the bottom than at the surface.

INTRODUCTION

THE importance of the study of post-larval penaeid prawns needs no emphasis as it has become a potential source to indicate the nature and size of the prawn crop in estuarine systems. In India significant contributions have been made on the post-larvae of penaeid prawns by Menon (1951), George (1962, 1963), Mohamed *et al.* (1968) from Cochin Backwater, Subrahmanyam (1967) from the Chilka Lake and Subrahmanyam and Rao (1969) from the Pulicat Lake.

The Godavari estuarine systems support very valuable prawn fisheries consisting of a variety of prawns (Ganapati and Subrahmanyam, 1964), but the two penaeid prawns, *Penaeus monodon* and *Metapenaeus monoceros* are the most important species in the commercial catches from the estuary.

The object of the present report is to describe the recruitment pattern and growth of the post-larvae of *P. monodon* and *M. monoceros* into the Gautami which is the most important branch of Godavari estuary. The role of the post-larval forms in capture and culture fishery operations is also indicated.

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Material and Methods

The present observations were made opposite Neelapalli during the years 1959-60 and 1960-61 and near the mouth of the Bhairavapalem branch of the Gautami estuary during the year 1961-62 (Fig. 1). The collections were com-

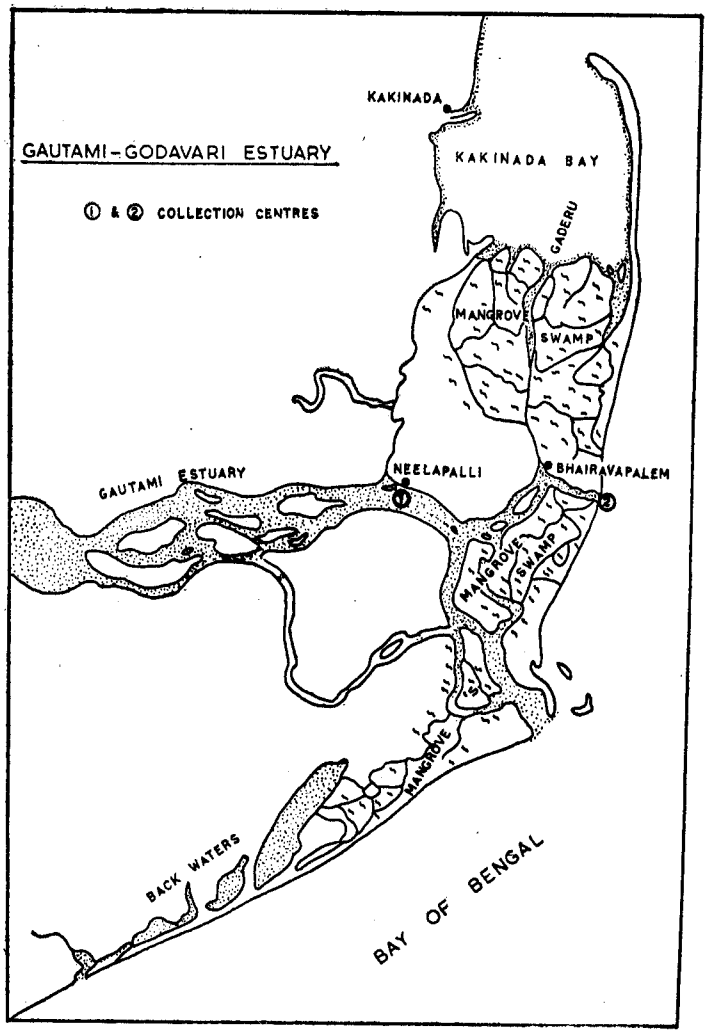

Fig. 1. Gautami-Godavari estuary showing the plankton collection centres.

menced after the floods receded in the estuary and terminated before the onset of the south-west monsoon, the period of collection usually falling between November and June. The collections were of ten minutes duration at high tide in the morning and at night, between 07.00 and 08.00 and 19.00 and 20.00 hours respectively, the day of collection usually coinciding with the full moon and new moon

days in each month. The day and night collections were made on the same day opposite Neelapalli while at the mouth of the estuary the day collections were always made on the following morning. Regular collections were sometimes hampered on account of inclement weather.

The surface plankton collections were made with a half-meter organdie net set against the flow of the high tide current from an anchored boat in all the years. The collections above bottom were made in 1960-61 by tying the organdie net to an anchor rope, about half a meter above the anchorage so that the net stands against the flow of the high tide current without touching the bottom. The bottom collections were usually made after making the surface collections. No bottom collections were made in 1959-60, and attempts to make such collections at the mouth of the estuary were not always successful.

The collections were examined in live condition before fixing them in 5% formalin. The post-larvae and mysis stages were sorted out and the counts of larval and post-larval stages from each collection were registered. Altogether 121 plankton hauls were examined for the present study. The average number of individuals recruited into the estuary in each month, during the full moon and new moon periods, the diel periods, and at the surface and bottom levels were determined by dividing the total number of individuals by the number of hauls made during the corresponding periods.

Growth studies were made in $61\times30\times30$ cm aquarium tanks and $122\times61\times61$ cm cement cisterns, using estuarine water. All measurements were from the tip of rostrum to the tip of telson.

Hydrographic Conditions

In all the three years the salinity ranged between 4.85 ‰ and 31.21 ‰ while the temperature ranged between 24.2°C and 31.8°C. The salinity and temperature were normally high from March till June in all the years. Minimum salinity and temperature were recorded in November and January respectively.

Systematics

The post-larvae of *P. monodon* are the largest forms in the collections (10-14 mm) with a reddish brown or bluish streak on the mid-ventral line of the body. The post-larvae of all the *Metapenaeus* spp. are smaller (3-4 mm) than those of *Penaeus* spp. The post-larvae of *M. monoceros* are the most dominant forms in the collections and could be distinguished from the others by their colouration. The body is deeply pigmented (Mohamed *et al.*, 1968) and the pigmentation is not so well developed in the post-larvae of *M. dobsoni* and *M. brevicornis* which are poorly represented in the collections. The few mysis stages belonged to *M. monoceros* as there is closer resemblance with the post-larvae in their colouration.

Distribution

Seasonal distribution :

The post-larvae were recorded throughout the period of study with two peaks of incursion, from November to January and March-April to June (Table 1). Apparently the post-larvae were available when the salinity and temperature were

low as well as when the same conditions were high. The mysis stages appeared in the collections in small numbers from February or March opposite Neelapalli

TABLE 1. *Recruitment of Post-larvae into the Gautami-Godavari Estuary*

Species/years	Average number/haul								
	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	Total
Penaeus monodon									
1959-1960	3	24	18.3	8.3	1	27	11.7	0.5	93.8
1960-1961	54	39.7	8.3	—	2.5	2.8	10.1	1	118.4
1961-1962	16.7	3.5	5.8	3.8	1.7	1.3	3.0	19.8	55.6
Metapenaeus monoceros									
1959-1960	383	657	41.7	28	13.5	19	77.3	9.2	1228.7
1960-1961	259.8	134.3	31.8	1	39.4	22.2	229.5	2.3	720.3
1961-1962	17	3.8	15.4	8.8	22.8	6.5	21.5	125	220.8

while they were available from January in the collections made at the mouth of the estuary. Apparently the mysis stages entered the estuary with the rise in water salinity unlike the post-larval forms.

Lunar and diel periodicity in recruitment :

The post-larval recruitment was observed on both the full moon and new moon days. In 1959-60, there was not much difference in the incursion pattern between the full moon and new moon days in the case of *P. monodon*, whereas more numbers were observed on the full moon day than on the new moon day in the case of *M. monoceros* (Table 2). In 1960-61, on the contrary, the recruitment was relatively richer

TABLE 2. *Lunar periodicity in relation to post-larval immigration*

Year	Average number/haul			
	Penaeus monodon		*Metapenaeus monoceros*	
	Full moon	New moon	Full moon	New moon
1959-60 ..	11.3	11.8	170.0	75.3
1960-61 ..	3.97	25.2	48.0	138.2
1961-62 ..	6.0	5.1	16.4	38.5

on the new moon day than on the full moon day for both species (Fig. 2). In 1961-62, the incursion pattern was almost similar to the observations made in 1959-60 in the case of *P. monodon* while in the case of *M. monoceros* the recruitment pattern was similar to the trend observed in 1960-61 (Table 2). The larvae in the night collections were invariably more plentiful than the day collections in all the years (Table 3). It was also observed that in the case of *P. monodon* the surface hauls contained more number of post-larvae than the bottom hauls both during the day and night. In *M. monoceros*, on the contrary, the bottom hauls contained more

individuals than the surface hauls during the day while at night the surface hauls were generally richer in the number of individuals (Table 3). The mysis stages

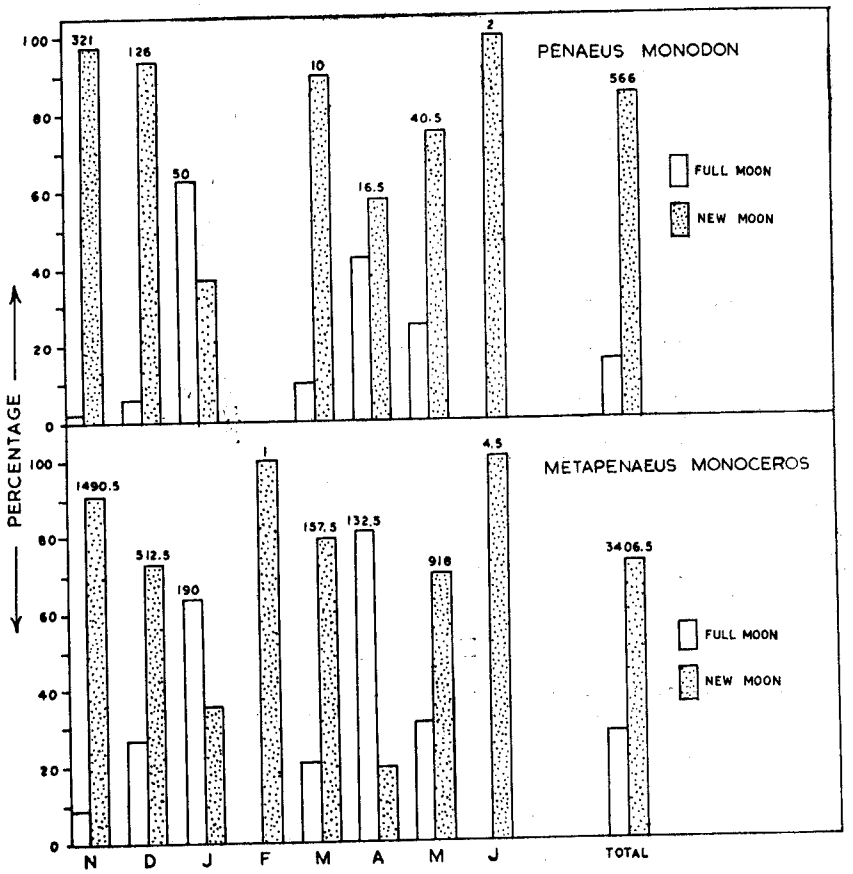

FIG. 2. Lunar periodicity in relation to post-larval recruitment into the Gautami-Godavari estuary during the period 1960-61. The number at the top of the monthly histograms indicate the total of the average number of the post-larvae recorded on the full- and new- moon days each month.

were recorded from both the day and night collections but it appeared that their numbers were invariably more near the bottom than at the surface.

GROWTH

Preliminary observations made on the rate of growth of the post-larval forms under laboratory conditions showed that in the case of *M. monoceros* the average growth rate was 16 mm/month upto 30 mm; 22.8 mm/month between 30 and 60 mm and 4.5 mm/month between 60 and 99 mm; and in the case of *P. monodon* the average growth rate was 15.44 mm/month from the post-larval stage to 150 mm total length.

TABLE 3. *Diel periodicity in relation to post-larval immigration* (1960-1961)

Species	Average number/haul								
	Nov.	Dec.	Jan.	Feb.*	March	April	May	June	Monthly average
Penaeus monodon									
Day— surface	0.5	27.0	—	—	—	0.7	0.5	3.0	3.8
bottom	1.0	6.0	—	—	—	0.7	2.0	1.0	1.1
Night—surface	160.5	80.0	29.7	—	9.0	9.0	34.0	—	45.5
bottom	1.0	18.0	3.7	—	1.0	0.7	4.0	—	3.2
Metapenaeus monoceros									
Day— surface	0.5	—	0.3	1.0	1.0 (0.25)	7.7 (5.7)	3.5 (1.5)	—	2.2
bottom	—	35.0	—	—	18.5 (7.5)	24.0 (14.0)	264.5 (18.5)	4.0 (2.0)	1.4 52.1 (8.5)
Night—surface	764.5	307.5	104.7	—	55.5 (1.5)	33.0 (5.0)	438.0 (2.0)	—	236.3 (2.9)
bottom	29.0	156.0	22.0	—	82.5 (31.25)	24.0 (15.7)	212.0 (12.5)	5.0 (1.0)	70.5 (15.7)

* Only day surface collection could be made due to inclement weather.
Numbers within parentheses indicate mysis stages.

DISCUSSION

M. monoceros is the most abundant species while *P. monodon* is a highly priced form in the Gautami-Godavari estuary. Both the species enter the estuary as post-larvae and larvae, as the case may be, and after a period of growth return to the sea for maturity and spawning. The post-larval recruitment was observed throughout the period of investigation with two peaks, from November to January and March or April to June. George (1962) reporting on the breeding of penaeids from the Cochin Backwater, indicated continuous spawning in case of *M. monoceros* with two peaks, during July-August and November-December, from a study of the post-larval forms. An almost similar peak for the post-larvae of *P. monodon* is reported from Chilka Lake (Subrahmanyam, 1967). Interestingly the two peaks of post-larval abundance coincided with periods of low and high salinity values and temperatures. The mysis stages of *M. monoceros*, however, entered the estuary with rise in salinity values indicating less tolerance to low salinity.

Both the full moon and new moon periods appear to be equally good for the post-larval recruitment, but as observed in the year 1960-61, the recruitment may become well pronounced on the new moon day.

The intensity of post-larval incursion is often related to diel phases, more number of individuals entering the estuary at night as in other estuarine and brackishwater systems (Williams, 1959 ; Bearden, 1961 ; Tabb, *et al.*, 1962 ; Subrahmanyam and Rao, 1969). On the contrary, the recruitment is at high tide but no day and night variations in recruitment are observed in Australian estuaries (Racek, 1959).

The surface-bottom differences noticed in the Gautami estuary are similar to the observations made in Neuse River, North Carolina (Williams, 1969) where the mean number of post-larval penaeids are greater in surface than in bottom samples. Eldred *et al.* (1965), however, recorded more post-larvae of *P. duorarum* in the surface hauls during the day time while at night the numbers are slightly more at the bottom than on the surface.

The prediction of the forthcoming prawn crop on the basis of the post-larval counts recruited into the estuaries is a recent advance in prawn capture fisheries (George, 1963). This is, however, governed by their growth estimations. The average modal size of *P. monodon* and *M. monoceros* in the commercial catches are 96-110 mm and 31-45 mm respectively, indicating that these sizes are attained in a few months duration on the basis of the growth estimations made under laboratory conditions. It is, however, believed that the growth rates would be faster in the natural environment than under laboratory conditions.

The current trend is to increase prawn production by culture methods in impoundments. The two species discussed here are fast growing varieties and suitable for culture in brackish water impoundments. They can also be cultured in freshwater after acclimatization since the two species have been observed in freshwater ponds adjacent to the estuary. Suitable centres for the collection of post-larvae in adequate quantities for culture practices can be determined by additional exploratory surveys in the light of the seasons of availability observed in the present study.

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