J. Mar. biol. Ass. India, 1968, **10** (1) : 95-98

DIURNAL ACTIVITY OF THE PRAWN *PENAEUS SEMISULCATUS* DE HAAN

By M. NARAYANAN KUTTY* AND G. MURUGAPOOPATHY
Central Marine Fisheries Research Institute, Mandapam Camp

INTRODUCTION

SEVERAL authors have reported that penaeid prawns remain active above substratum at night and stay quiet, buried in sand during the day (Fuss, 1964 ; Fuss and Ogren, 1966 ; Wickham, 1967 ; Hughes, 1968). Menon and Raman (1961) also suggested increased nocturnal activity in Indian penaeid prawns. Kutty (1967) pointed out the burrowing habit of *Penaeus semisculcatus* and estimated the metabolism of the buried prawn ; his short term observations, however, did not indicate that *Penaeus indicus* has the burrowing habit. Burrowing methods of *Metapenaeus mastersii* have been described by Dall (1958) and those of *Penaeus duorarum* by Fuss (1964). It appears that the burrowing habits of the penaeid prawns are more or less similar. As evident, precise information on the burrowing behaviour, emergence from the substratum and activity of the Indian prawns are wanting. The authors had occasion to observe the activity rhythm of a group of penaeid prawns, *Penaeus semisulcatus* reared in the sea water aquarium of the Institute primarily for a series of experiments on metabolic adptations. The present observations, though not strictly planned, appeared to be of interest especially since much is yet to be known about the behaviour of the Indian prawns and are therefore presented here.

MATERIAL AND METHODS

The prawns were caught from Palk Bay off Mandapam. Seven individuals of *P. semisulcatus* (12-16 cm. in T.L.) kept in running sea water in a rectangular tank (75×55×40 cm.) with glass walls on four sides were observed for over a fortnight. The depth of water in the tank was about 34 cm. with 5-10 cm. depth of sand in the bottom. The tank was kept open but for a plastic-meshed lid, to natural day light and was placed at a distance of one metre from a large open window. The sea water flowing through the tank was at a temperature of 28-30°C., salinity close to that of 100% sea water (35 p.p.t.) and dissolved oxygen near air saturation. The observations were made on the group of prawns only after they had been in the aquarium for over two months. Prior to the period of observations the animals were fed with chopped clam meat once daily at 10-11 a.m.

RESULTS AND DISCUSSION

The number of active (non-buried) prawns at different times of day observed for 16 days, from 5-10-1966 to 21-10-1966, is graphically shown in Fig. 1. Feeding times

* Present address : Department of Zoology, Madurai University, Madurai-2.

of the prawns during the experimental period are indicated in the figure. A clear indication of increased activity as judged from the number of prawns active (those

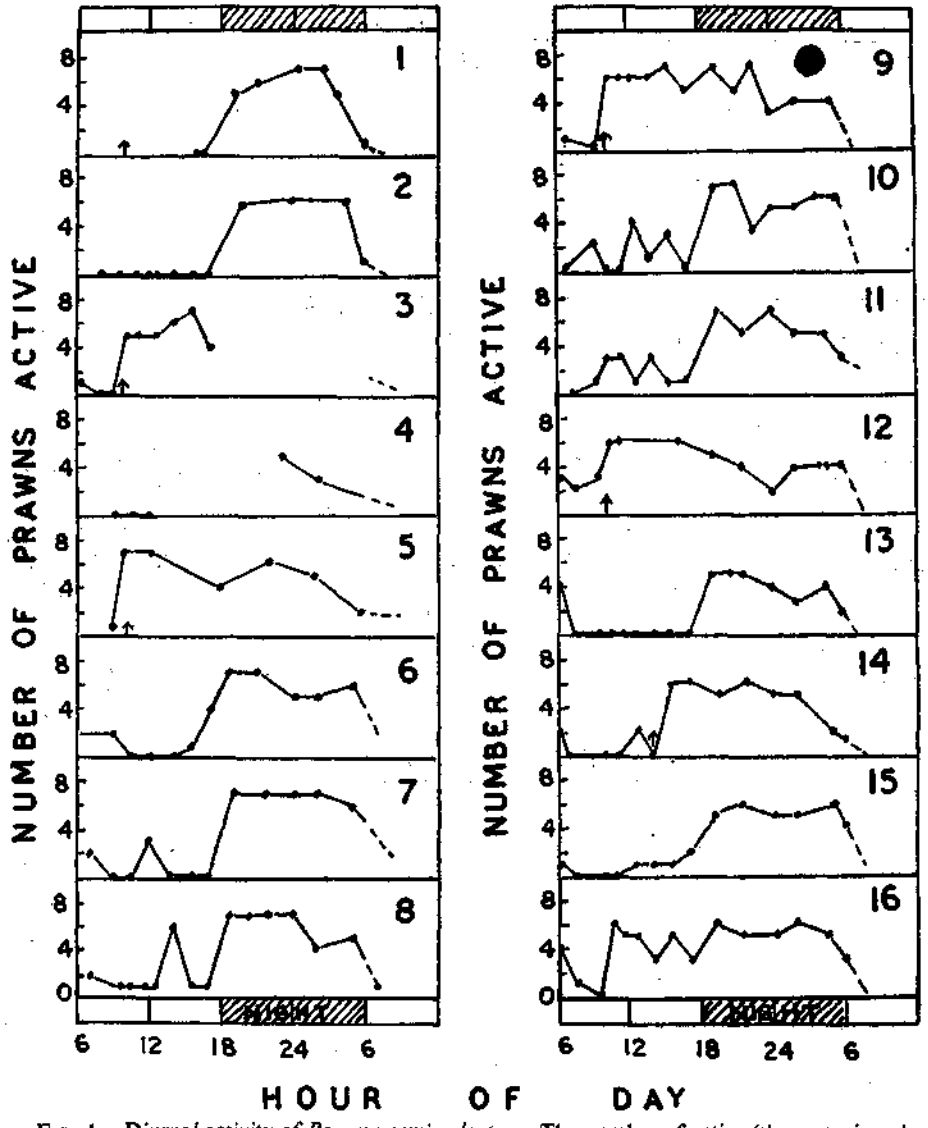

FIG. 1. Diurnal activity of *Penaeus semisculcatus*. The number of active (those staying above substratum) prawns is indicated against time of day for a continuous period of 16 days from October 5 to October 21, 1966. Serial order of the observation days is shown on the right of the respective curves. Day 1 stands for October 5-6. Observations were made on 7 individuals in one tank (see text). From the 12th day onwards the observation lot was of 6 prawns only, since one which moulted was removed. The small vertical arrows in the figure indicate times when the animals were fed. The solid circle shown on the 9th day indicates New Moon day.

remaining above the sand) during the night is quite evident. Wickham (1967) has found a direct correlation between activity measured as numbers of passes made

by a shrimp across a vertical line on the wall of the observation chamber and number of individuals exposed in a group. On both days 1 and 2 most of the prawns have emerged by dusk (19 hours) and by morning (6 hours) they have burrowed into the sand. On day 3 most of the animals have emerged on presenting the food, which is again observed on day 5. On days 6, 7 and 8 the animals were not fed but there is indication that some, if not all, of the prawns have emerged at times close to the time at which they were being fed previously. Such indications were noted on subsequent days (days 10, 11, 14 and 16) as well. Hughes (1968) has clearly demonstrated a feeding rhythm in *Penaeus duorarum*. It has been shown that the emergence cycle of prawns has a distinct endogenous component (Fuss and Orgen, 1966 ; Hughes, 1968). The latter is subject to modification by various environmental factors, the most important of which is light (Fuss, 1964 ; Fuss and Ogren, 1966 ; Wickham, 1967 ; Hughes, 1968). It appears that but for the influence of the feeding rhythm under the conditions prevailing in the present experiments activity of the prawns might have been suppressed considerably during the day light hours. This aspect cannot be elaborated further because emergence could be caused by various other factors also (Fuss and Ogren, 1966 ; Wickham, 1967 ; Hughes, 1968).

It has been suggested that prawns emerge at dusk and remain active at night to avoid their predators. The burrowing behaviour surely protects the prawns from the predators during the day. It also appears to be of advantage to the animals to stay quitely buried, for a buried prawn expends least energy, its metabolic rate being close to the standard (basal) level (Egusa, 1961 ; Kutty, 1967). The energy saved thus can be used for ' useful ' activities such as growth and reproduction. From this context it may be worthwhile comparing the food conversion efficiency and growth rate of prawns with and without the burrowing habit. Correlation of the behaviour of the commercially important prawns and the fluctuations in their diurnal and seasonal catches can inded be of much value (Subramanyam, 1965 ; George *et al.* 1967 ; Barr and Mcbride, 1967).

ACKNOWLEDGEMENT

We are grateful to Dr. S. Jones for his interest and encouragment.

REFERENCES

BARR, L. AND MCBRIDE, R. 1967. Surface-to-bottom pot fishing for pandalid shrimp. *Spec. Sci. Rept. Fish.*, No. 560 : 7 pp. U.S. Fish. Wildl. Serv. Washington, D.C.

DALL, W. 1958. Observations on the biology of the greentail prawn, *Metapenaeus mastersii* (Haswell) (Crustacea Decapoda : Penaeideae). *Australian J. Mar. Freshw. Res.*, 9 : 111-134.

EGUSA, S. 1961. Studies on the respiration of the ' Kuruma ' prawn, *Penaeus japonicus* Bate-II. Preliminary experiments on its oxygen consumption. *Bull. Jap. Soc. Sci. Fish.*, 27 : 650-659.

FUSS, C. M. JR. 1964. Observations on the burrowing behaviour of the pink shrimp, *Penaeus duorarum* Burkenroad. *Bull. Mar. Sci. Gulf Caribb.*, 14 (1) : 62-73.

——— AND OGREN, L. H. 1966. Factors affecting activity and burrowing habits of the pink shrimp, *Penaeus duorarum* Burkenroad. *Biol. Bull.*, 130(2) : 170-191.

GEORGE, M. J., MOHAMED, K. H. AND PILLAI, N. N. 1967. Observations on the paddy-field prawn fishery of Kerala, India. FR : BCSP/67/E/18. *FAO World Conference on the Biology and Culture of Shrimps and Prawns. Mexico*, 12-24/6/67.

HUGHES, D. A. 1968. Factors controlling emergence of pink shrimp (*Penaeus duorarum*) from the substrate. *Biol. Bull.*, 134 (1) : 48-59.

KUTTY, M. NARAYANAN. 1967. Oxygen consumption of the prawns, *Penaeus indicus* H. Milne-Edwards and *Penaeus semisulcatus* de Haan. E 55 *FAO World Conference on the Biology and Culture of Shrimps and Prawns*. Mexico, 12-24/6/67. Also *Adv. Abstr. Contr. Fish. Aquat. Sci. India*, 1 (3) : 24.

SUBRAMANYAM, M. 1965. Lunar, diurnal and tidal periodicity to the prawn abundance and migration in the Godavari Estuarine systems. *Fish. Tech.*, 2 (1) : 26-41.

WICKHAM, D. A. 1967. Observations on the activity patterns in juveniles of the pink shrimp, *Penaeus duorarum*. *Bull. Mar. Sci.*, IV (4) : 769-786.