# The Fourth Indian Fisheries Forum, Proceedings

**24-28 November, 1996**

*held at*

**School of Marine Sciences**
**Cochin University of Science and Technology**
**Kochi 682 014**
**Kerala, India**

**Asian Fisheries Society, Indian Branch**

**1999**

The Fourth Indian Fisheries Forum Proceedings
24-28, November, 1996. Kochi p. 91-93.
Published in 1999.

# Embryonic and Larval Development of the Penaeid Prawn *Metapenaeus dobsoni* (Miers) in Brackishwater Salinities

C. VASUDEVAPPA and C. SUSEELAN*

Fisheries Research Station,University of Agricultural Sciences, Hesaraghatta, Bangalore - 560 089.
*Central Marine Fisheries Research Institute, Cochin -682 031.

**Abstract**

The eggs spawned by *Metapenaeus dobsoni* in brackishwater salinities *viz.*, 22, 26, 28 and 30 ppt were hatched and the nauplii reared further up to protozoea stage and the possibility of completion of larval (naupliar) development in brackishwater salinities was studied. The results of 10 trials in different salinities indicate that the naupliar development can be completed in salinity as low as 22 ppt and the time taken for completing the naupliar stages I, II and III is not affected by variation in salinity. The total time taken to complete all the six naupliar stages however gradually increased (31 - 49.5 h.) with increase in salinity under normal water quality conditions.

## Introduction

Maturation, spawning and larval development is indicative of successful propagation of the organism in any environment. Though the penaeid prawns are reported to spawn in brackishwater salinities (Morris and Bennet, 1951; Rao and Kathirvel, 1973; Muthu and Manickam, 1973; George, 1974; Silas *et al.*, 1982; Yano, 1984; Potter *et al.*, 1986; Kathirvel and Selvaraj, 1989), information on completion of embryonic and larval development in brackishwater salinities and the effect of varying salinity on larval development are lacking. However the larval life history of penaeid prawns in seawater has been worked out for many species (Rao, 1971; Raje and Ranade, 1972; Thomas *et al.*, 1974; Muthu *et al.*, 1974; Devarajan *et al.*, 1978; Gopalakrishnan *et al.*, 1985; Nandakumar *et al.*, 1989).

The larval development of *M. dobsoni* has been studied by Thomas *et al.*, (1979). In the present study an attempt is made to study the larval development up to protozoea stage in different brackishwater salinities (22-30 ppt) in which the prawn bred successfully and the time taken for completing various naupliar stages was monitored to understand the effect of brackishwater salinities on larval development.

## Material and Methods

The eggs spawned in a series of maturation and spawning experiments in the laboratory in 22, 26, 28 and 30 ppt salinities using mature and impregnated females collected from perennial prawn culture field Kannuvilakettu in Vypeen Island were utilised. The prawns which showed signs of maturation in the perennial prawn culture field were acclimated to 22 ppt, 24 ppt and spawned in the laboratory. The eggs spawned in 22, 26, 28 and 30 ppt were further reared in plastic tubs providing continuous aeration till protozoea stage. The time taken for completing the embryonic development and various stages of nauplii was monitored. The larval samples (100 No.) fixed at very 1 hr. interval were analysed under the microscope for recording the time taken from initiation of metamorphosis of larvae to the next developmental stage for transformation of 50% of larvae to the successive stage. The water salinity was maintained at the desired level by adding required quantity of freshwater. Various physico-chemical parameters such as water temperature, pH, oxygen, nitrite and ammonia were monitored twice a day, morning and evening, following standard procedures.

## Results and Discussion

The details on date and time of spawning, fertilization, duration of embryonic development, time taken to complete successive larval stages and physico-chemical conditions of rearing media are presented in Table 1.

In 22 ppt salinity, each successive stage of nauplius, from I to III, took 3-4 h. The duration for further metamorphosis gradually increased and it was 4-5 h, 7-10 h and 11-15 h for completing the naupliar stages IV, V, VI for transformation to protozoea I.

In 26ppt, the embryonic development took 9-10 h. The time taken for completing nauplius I, II and III stages remained the same (3-4 h) in both the trials. The time for IV, V and VI stages of naupliar development varied between 4-6 h, 7-11 h and 11-16 h with an average of 4 to 5 h, 7.5 to 11 h and 11.5 to 16 h. respectively. On an average the total time required for completing naupliar development varied between 32 and 43.5 h with mean at 37.75 h.

In 28 ppt, the embryonic development was completed in 9-12 h with an average of 10 to 11.25 h. In this salinity also the duration required for naupliar development for stages I, II and

Table 1. Embryonic and larval development of *Metapenaeus dobsoni* in different brackishwater salinities

| Expts. in different salinities (ppt) | Time of Spawning (h) | % Fertilization | Time taken for embryonic development (h) | Time to complete 6 naupliar stages (h) | Water quality parameters | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Temperature (°C) | pH | Oxygen (mg/l) | Nitrate (µg at./l) | Ammonia (µg at./l) |
| 22 ppt | 2300 | 96.20 | 8-10 | 32-42 | 26.8-27.2 | 8.05-8.29 | 5.12-5.79 | 4.21 | 4-24 |
| **26 ppt** | | | | | | | | | |
| Exp. 1 | 0030 | 98.14 | 9-10 | 32-44.5 | 25.2-25.6 | 8.10-8.22 | 5.79-6.01 | 1-18 | 5-32 |
| Exp. 2 | 2345 | 91.10 | 9-10 | 32-45.0 | 26.0-26.5 | 8.08-8.32 | 5.15-5.40 | 4.23 | 3.28 |
| **Mean** | -- | **96.62** | **9-10** | **32-43.5** | **25.6-26.0** | **8.09-8.27** | **5.47-5.71** | **2.5-20.5** | **4-30** |
| 28 ppt | | | | | | | | | |
| Exp. 1 | 0200 | 91.60 | 9-10 | 34-45 | 28.2-28.4 | 8.00-8.12 | 5.61-5.85 | 2-14 | 4-25 |
| Exp. 2 | 0215 | 94.00 | 11-12 | 33-45 | 26.8-27.2 | 8.08-8.14 | 5.45-5.79 | 3-18 | 5-24 |
| Exp. 3 | 0100 | 94.80 | 11-12 | 35-48 | 26.3-28.5 | 8.05-8.27 | 5.89-6.12 | 4-24 | 4.30 |
| Exp. 4 | 0100 | 96.14 | 10-12 | 32-45 | 26.2-26.4 | 8.08-8.20 | 4.78-5.27 | 2-22 | 5-22 |
| **Mean** | -- | **94-14** | **10-11.25** | **34.95-47.7** | **26.9-27.3** | **8.05-8.18** | **5.40-5.80** | **5.5-19.5** | **4.5-25.30** |
| **30 ppt** | | | | | | | | | |
| Exp. 1 | 0100 | 94.40 | 10-11 | 34-46 | 28.2-28.4 | 8.05-8.18 | 5.32-5.61 | 3-18 | 2-17 |
| Exp. 2 | 0030 | 98.05 | 9-11 | 34-47 | 28.4-29.6 | 8.09-8.10 | 5.27-5.43 | 2-16 | 4-22 |
| Exp. 3 | 0245 | 93.65 | 11-13 | 33-47 | 26.1-26.5 | 8.06-8.18 | 4.98-5.27 | 2-18 | 6-32 |
| **Mean** | -- | **95.37** | **10-11.7** | **33.4-49.5** | **27.5-28.2** | **8.08-8.15** | **5.19-5.44** | **2-18** | **4-24** |

III remained the same (3-4 h). The time required for completing IV, V and VI stages was 4-7 h, 8-11 h, 12-18 h with an average of 5.7-7.7 h, 8-10 h and 12.25-18 h respectively. The total time taken to complete naupliar development varied between 34.95 and 47.7 h with mean at 41.3 h.

In 30 ppt salinity, in all the 3 trails, the time taken for embryonic development ranged from 9-13 h with an average at 10-11.7 h. In this case also the time taken for completion of nauplius I, II and III stages was found to be 3-4 h for each stage. The nauplius IV, V, VI stages took 4-6 h 7-11 h and 12-20 h with an average duration of 4-5.7 h, 7.6-10 h and 12.07-19 h respectively. The total time required for completing naupliar development ranged from 33.4 to 49.5 h with an average at 41.5 h

The results indicate that prawns in all salinities (22, 26, 28 and 30 ppt.) showed good spawning as evidenced by high fertilization rates (>>90%). The embryonic development took on an average 8.0-11.7 h. The duration of embryonic development marginally increased as the salinity increased from 22 to 30 ppt, however, the difference is not recognisable.

The time taken for completing naupliar stages, I, II and III is not affected by variation in salinity. It ranged from 3 to 4 h in all salinities. There appears to be some variation in duration of naupliar stages IV, V and VI. A gradual increase in duration for completing these stages was noticed as the salinity increased from 20 to 30 ppt.

This is more evident by total time taken for completing the naupliar development in salinities 22, 26, 28 and 30 ppt which ranged from 31-42 h, 32-43.5 h, 34.95-47.7 h and 33.40 -49.5 h respectively. The mean time required for completing naupliar development in salinities 22,26 28 and 30 ppt was found to be 36.5 h, 37.75 h, 41.3 h, 41.5 h respectively indicating a gradual rise in time taken for completing the naupliar development, as the salinity incised from 22 to 30 ppt.

The water quality parameters fluctuated within normal limits in all the trials with temperature showing variation of 25.6-28.2°c, pH 8.05-9.29, oxygen 5.12-5.79 mg/l, Nitrite 2.5-µg at/l and Ammonia 4-30µg at/l. Thus salinity has profound influence on embryonic and larval development of *M. dobsoni*, showing gradual increase in duration of naupliar development from lower (22 ppt) to higher salinities (30 ppt).

## Reference


George, K.V., 1974. Some aspects of prawn culture in the seasonal and perennial fields of Vypeen island. *Indian J. Fish.*, 21(1): 1-19.

Gopalakrishnan, P., Raju, V.K., Pillai K.M. and Thakar, S.R., 1985. Some observations on spawning and larval rearing of the ginger prawn. *Metapenaeus kutchensis* George and Rao. *Sea Food Export J.*, 17 (5): 5-8.

Kathrivel, M. and Selvaraj, V., 1989. Attainment of maturity in pond reared kuruma prawn *Penaeus japonicus* Bate. *J. Mar. Biol. Ass. India*, 31 (1 and 2): 110-116.

Morris, M.C. and Bennet, I., 1951. The life history of a penaeid prawn (*Metapenaeus*) breeding in a coastal lake (Tuggerah, NSW). *Proc. Lin. Soc. N.S.W.*, 76(5-6): 164-182.

Muthu, M.S. and Manikam, P.E.S., 1973. On the occurrence of

mature specimen of *Metapenaeus burkenroadi* kubno. In Pulicat lake. *Indian J. Fish.*, 20: 214-215.

Muthu, M.S., Pillai, N.N. and George, K.V., 1974. On the spawning and rearing of *Penaeus indicus* in the laboratory with a note on the eggs and larvae. Indian J. Fish., 21(2): 571-574.

Nandakumar, G., Pillai, N.N., Telang, K.Y. and Balachandran, K., 1989. Larval development of Metapenaeus moyebi (Kishinouye) reared in the laboratory. *J. Mar. Biol. Ass.* India, 31 (1 and 2): 86-102.

Potter, I.C., Penn, J.W. and Brooker, K.S., 1989. Life cycle of the western school prawn, *Metapenaeus dalli* Racek, in a western Australian estuary. *Aust. J. Mar.Freshw. Res.*, 37:95-103.

Raje, P.C. and Ranade, M.R., 1972. Larval development of Indian penaeid shrimps-II. *Metapenaeus monoceros* (Fabricius). *J. Indian Fish. Ass.*, 2(1 and 2): 30-46.

Rao, P.V., 1972. The influence of salinity and temperature on the breeding and development of some cultivable marine penaeid prawns. *Proc. Seminar on mariculture and mechanised fishing,* 28 - 29th November 1972, Madras, pp. 67-69.

Rao, P.V. and Kathrivel, M., 1973. On the breeding of a penaeid prawn *Metapenaeus dobsoni* in the brackishwater medium., *Indian J. Fish.* 20(1): 228-230.

Silas, E.G., Muthu, M.S., Pillai, N.N. and George, K.V., 1982. Breeding of the marine prawns *Metapenaeus dobsoni* in brackishwater ponds. *J. Mar. Biol. Ass. India,* 24(1): 147-149.

Thomas, M.M., Kathrivel, M. and Pillai, N.N., 1974. Laboratory spawning and early development of *Parapenaeopsis acclivirostris* (Alcock) (Decapoda: Penaeidae) *J.mar.biol. Ass. Ind.,* 16(3):731-740.

Yano, I., 1984. Maturation of kurma prawn *Penaeus japonicus* cultured in earthernponds. *Proc. Symp. U.S.- Japan Aquaculture* Panel on Reproduction maturation and seed production of cultured species. U.S. Rep. Commer. NOAA, Tech. Rep. NMFS.