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Title	Recruitment of postlarval penaeid prawns in the Vellar estuary, South India.
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Citation	Ramasamy, A., Pandian, Al.P. (1985). Advances in shrimp culture in China (Abstract only). In Taki Y., Primavera J.H. and Llobrera J.A. (Eds.). Proceedings of the First International Conference on the Culture of Penaeid Prawns/Shrimps, 4-7 December 1984, Iloilo City, Philippines (pp. 176-177). Iloilo City, Philippines: Aquaculture Department, Southeast Asian Fisheries Development Center.
Issue Date	1985
URL	http://hdl.handle.net/10862/925

This document is downloaded at: 2013-07-02 09:22:38 CST



Morphometric Studies on Three Penaeid Shrimps, *Penaeus japonicus*, *P. vannamei* and *P. marginatus* in Hawaii

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Penaeus japonicus, *P. vannamei* and *P. marginatus* cultured at the Oceanic Institute in Hawaii, were sampled and measured. The shrimps sampled ranged from 1 to 15 g in body weight. The measurements included carapace length (CL), body length (BL), total length (TL) and body weight (BW). The results showed significant linear relationships between TL and CL, BL and CL. The relationships between CL and BW, BL and BW, TL and BW are well expressed by exponential curve. These relationships were found for all three species. However, *P. japonicus* has more similar morphometric characteristics to *P. marginatus* than *P. vannamei*. The carapace portion in *P. vannamei* is smaller than either *P. japonicus* or *P. marginatus*. In other words, *P. vannamei* has a greater edible portion than *P. japonicus* and *P. marginatus*. Equations for length-weight relationships can provide means of converting one characteristic into another.

Diseases, Parasites, Commensals and Fouling of Commercial Penaeid Prawns of the Portonovo Coast of South India

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There are very few reports on the diseases, parasites, commensals and fouling in penaeid prawns. During the regular collection of marine and estuarine prawns in the east coast of India, a number were found to be infested with various organisms.

The prawn *Penaeus (Fenneropenaeus) indicus*, was infested with a microsporidian which causes a condition known as milk or cotton prawn. The infestation was spread throughout the abdominal musculature of the prawn. The marine prawn *Parapenaeopsis styliifera* had epibiotic growth of athecate hydrozoans, probably of the genus *Tubularia*, on the dorsal side of the carapace and abdominal segments. This is the first report of athecate hydrozoans infesting the prawn. The prawn *Metapenaeopsis stridulans* was observed to be parasitized by a bopyrid isopod, *Orbione thielemanni* and the prawn *Sicyonia lancifera*, parasitized by another bopyrid isopod, *O. kemi*. The bopyrid isopod *O. kemi* infesting the prawn *S. lancifera* is also recorded for the first time. Both bopyrid isopods were found in the branchial cavity of the prawns. The Pontoninid prawn *Chernocaris placunae* is a commensal living in the mantle cavity of the

bivalve, *Placenta placenta*. Barnacles were found attached to the carapace and first abdominal segment of the prawn, *Parapenaeopsis uncta*, whereas they were found in the telson region also in the prawn *P. styliifera*. Most of the barnacles were very small with a basal diameter of less than 1.5 mm.

Seasonal and Local Occurrence of Adults and Postlarval Stages of *Penaeus merguensis* and *Penaeus indicus* in Batan Bay, Philippines

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Studies on seasonal and local occurrence of adults (spawners) and postlarval stages of *Penaeus merguensis* and *P. indicus* in Batan Bay and Banate Bay, Aklan yielded the following results: 1) small-sized *P. merguensis* and *P. indicus* dominated the rivers and interior bays, 2) *P. merguensis* and *P. indicus* spawners appeared throughout the year with varying monthly abundance in Batan Channel and Banate shoreline, and 3) larval stages of penaeids were found in interior bays but were more abundant in the channel and offshore areas. Postlarval stages of penaeids are more abundant along the shoreline than in water edges of mangrove swamps which indicate that channels and offshore waters may be primary spawning grounds while interior bays and rivers are secondary spawning grounds. Moreover, size distribution of carapace length of *P. merguensis* suggests that the channel and offshore areas are utilized as primary spawning grounds while the inner portions of the bay are nursery grounds and secondary spawning grounds.

Lunar phase did not show a positive correlation with abundance of both spawners and postlarval *P. merguensis* and *P. indicus*. The minimum size at sexual maturity for both male and female *P. merguensis* is about 11 mm CL. Female *P. indicus* appear to become sexually mature at a smaller size (13 mm CL) than males (20 mm CL).

Recruitment of Postlarval Penaeid Prawns in the Vellar Estuary, South India

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The northern bank of Vellar estuary (Parangipettai, India) is ideal for postlarval penaeid prawn recruitment. The annual recruitment, distribution and the substratum preference of postlarval immigrants at three different stations in the estuary were studied in detail.

Among the postlarvae of *Penaeus*, *P. (Fenneropenaeus) indicus* was dominant followed by *P. (Penaeus) monodon*, *P. (P.) semisulcatus*, *P. (F.) merguensis* and *P. (Melicertus) latisulcatus*. In *Metapenaeus*, postlarvae of *M. monoceros* were abundant followed by *M. dobsoni*, *M. affinis*, *M. brevicornis* and *M. lysianassa*.

Two peaks were observed in the postlarval penaeid prawn population. In *P. (F.) indicus* and *P. (P.) monodon*, the primary peak occurred from January to April and the secondary peak from July to September. In *M. monoceros* and *M. dobsoni*, the primary peak was from March to May and the secondary peak from August to September. The postlarvae of *P. (F.) indicus*, *P. (P.) monodon*, *M. monoceros* and *M. dobsoni* were available throughout the year while the others were seasonal. The distribution of postlarvae in the estuary is related to the type of substratum, salinity and temperature. The postlarval population declined during the northeast monsoon (November-December) and in peak summer (May-June). Their abundance decreased in the lower salinity areas of the upper reaches of the estuary.

Environmental Physiology of the Prawn *Penaeus (Melicertus) latisulcatus*

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There are a number of intrinsic and extrinsic factors which affect the normal routine activity of the prawn. The present study attempts to elucidate the optimum levels of various environmental factors for the culture of prawns.

The salinity tolerance capacity of *Penaeus (Melicertus) latisulcatus* was estimated in 13 different test salinities from 0 to 60 ppt (at 5 ppt increments). The prawns can tolerate a wide salinity range of 20-50 ppt. Maximum survival, however, was between 25 to 45 ppt. The extreme low (0-10 ppt) and high (60 ppt) salinities were highly lethal to the prawns. The change in acclimation temperature from 30 to 35°C increased the upper incipient lethal level from 38.5 to 39.5°C. The prawns acclimated to 30°C tolerated 42°C for 275 sec and 45.5°C for 13 sec, while prawns acclimated to 35°C tolerated 42°C for 505 sec and 46.5°C for 11 sec.

Prawns were acclimated to a salinity of 26 ppt and oxygen consumption was measured at 5, 15, 26, and 38 ppt in a continuous water-flow method. The total oxygen consumption showed an inverse relationship with weight. Oxygen consumption declined with increase in salinity. The resistance of prawns to hydrogen sulphide was tested in 18 different concentrations of sodium sulphide mixed with seawater. The prawns tolerated sodium sulphide concentrations up to 20 mg/l. The dissolved oxygen in the water was found to be reduced to very low levels with the increase in the concentration of sodium sulphide (from 5.9 ml O₂/l to 0.54 ml O₂/l). This may cause heavy mortality of the prawns.

Molt Staging in Adult *Penaeus monodon*

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Changes and formation of cuticular layers and setae bordering the uropods and endopodites of the pleopods of adult *Penaeus monodon* were examined under a light microscope. Observations and photographs were made at 0, 12 and 24 hours after molting and every 24 hours thereafter until second molting occurred. Results show that the internal structures of the setae and cuticle undergo marked changes throughout the molt cycle. It was possible to identify the molt stages A, B, C and D. Rapid examination of the molt stages allows the proper timing of eyestalk ablation to induce ovarian maturation.

Effect of Temperature and Salinity on the Hatching of Eggs and Larval Development of Supgo, *Penaeus monodon*

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Incubation of *Penaeus monodon* eggs and rearing of different larval stages were undertaken at nine temperature-salinity combinations. The eggs, nauplii, zoea and mysis from one spawner kept as stock culture at ambient temperatures of 26-30°C and salinity of 32-33 ppt were exposed to temperature levels of 23, 28 and 33°C and salinity levels of 23, 28 and 33 ppt.

Eggs and nauplii survived the sudden change of temperature and salinity (from ambient to experimental) but the zoea and mysis did not. However, salinities of 23 and 28 ppt in combination with any of the temperature levels produced weak larvae. Highest mean hatching rate was obtained at the temperature-salinity combination of 23°C-33 ppt, followed by 28°C-33 ppt and 33°C-33 ppt. Incubation periods for these treatments were 22, 16 and 14 hr, respectively. Survival rate of nauplius (taken from stock cultures) to first zoeal stage was highest at 28°C-33 ppt, followed by 33°C-33 ppt and 23°C-33 ppt with molting time of 50, 45 and 75 hr, respectively.

The nauplii exposed to 33°C-33 ppt molted to zoea stage within 38 to 40 hr but later died. Those exposed to 23°C-33 ppt and 28°C-33 ppt reached zoea stage within 57 to 60 hr and 48 to 50 hr, respectively. Similarly, the nauplii taken from the stock cultures and reared until postlarval stage (P₁) under experimental conditions completed the zoea and mysis