

stages in 9 to 11 days at 28°C C-33 ppt, 7 to 9 days at 33°C-33 ppt, and 13 to 15 days at 23°C-33 ppt.

Statistical analysis showed that salinity had highly significant effect on rates of hatching of eggs and survival from nauplius to first zoeal stage but not temperature although the latter had an apparent effect. However, both factors affected time of hatching of eggs and time of molting from nauplius to zoea. Interaction effect was significant only on rate and time of hatching. Different sources (spawners) of eggs and nauplii did not have significant effect on time of hatching and molting from nauplius to zoea, but significantly affected the hatching rate of eggs and survival rate of nauplii to zoea stage.

### The Influence of Temperature and Salinity on Oxygen Consumption of *Penaeus monodon* Postlarvae

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The effect of salinity and temperature on oxygen consumption at different developmental ages of *Penaeus monodon* postlarvae (P<sub>5</sub> to P<sub>60</sub>) was studied. The design was a 2 × 5 factorial, using two levels of temperature (15 and 30°C) and 4 levels of salinity (10, 15, 20 and 30 ppt). One-day old postlarvae (P<sub>1</sub>) were acclimated to various salinities prior to the start of the experiments. Oxygen consumption was determined after three hours using a YSI dissolved oxygen meter *vis-a-vis* Winkler titration method.

Respiratory activity as affected by temperature and salinity varies, dependent on the postlarval stage tested. Statistical analyses showed that temperature did not significantly influence oxygen uptake at early stages (P<sub>5</sub>-P<sub>8</sub>) until P<sub>25</sub>-P<sub>28</sub>. Its effect started to become apparent when the postlarvae were P<sub>35</sub>-P<sub>38</sub> and was most pronounced at P<sub>49</sub>-P<sub>52</sub>. In general, the postlarvae consumed more oxygen at higher temperature and the variation in the oxygen consumption of the postlarvae under the two temperatures become less obvious as the postlarvae were older. Salinity seemed to affect the oxygen consumption of the young postlarvae, P<sub>5</sub>-P<sub>8</sub> and P<sub>25</sub>-P<sub>28</sub>, more than temperature. Differences in rate of oxygen consumption at various salinities were greater in younger postlarvae (P<sub>5</sub>-P<sub>38</sub>) than in older postlarvae (P<sub>42</sub>-P<sub>60</sub>). The relationship between rate of oxygen consumption and body weight is nearly linear in the various salinity-temperature treatments. In all cases, the regression was significant at 1% level. *P. monodon* postlarvae behaved as respiratory conformers in all the salinities tested at ambient temperatures.

The least oxygen consumption rate was noted at salinities of 20 and 30 ppt at low temperature (15°C) and 20 ppt at high temperature (30°C). The importance of these findings is discussed and related to improvement of postlarvae transport methodology.

### Effect of Carrageenan Micro-Binded Diet on the Larval Stages of *Penaeus indicus*

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At present, most hatcheries depend on live food like diatoms, *Chlorella*, rotifer and brine shrimp to rear the larval stages of various penaeid species. Mass production of live feed requires much space (tanks) and labor, and is often affected by environmental conditions. The possibility of substituting live food with artificial diet for *Penaeus indicus* larvae was evaluated. Carrageenan micro-binded diet (C-MBD) was selected as test diet and its composition was modified from C-MBD designed for *P. japonicus* (about 45% protein).

Larvae stocked at 100/l and fed five times/day at 0.8 mg/larva/day had an average survival rate of 45% from Z<sub>1</sub> to M<sub>1</sub>. Water temperature was 26.5-30.5°C and salinity 32-33 ppt. An average survival rate of 70.2% from M<sub>1</sub> to PL<sub>1</sub> was attained when the stocking density was 30/l and feeding was three times/day at 0.3 mg/larva/day (water temperature 25.5-28.5°C, salinity 27-32 ppt). From PL<sub>1</sub> to PL<sub>5</sub> at stocking density of 20/l with feeding rate of 0.3 mg/larva/day (fed 3 times a day), the average survival rate was 64.9% (water temperature 25.5-28.5°C, salinity 28-32 ppt).

The results show that the present composition of C-MBD is highly effective for mysids up to the early postlarval stages of *P. indicus*.

### Effects of Diet on Reproductive Performance of Ablated *Penaeus monodon* Broodstock

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Four practical diets were compared for their effects upon ovarian maturation and spawning of ablated *Penaeus monodon* broodstock. Diets were formulated based upon the fatty acid profile of wild *P. monodon*. Diets 1 and 3 were cod liver oil-based while Diets 2 and 4 were soybean oil-based. Experimental treatments consisted of each of the formulated diets given in combination with natural food (squid, mussel, and annelids). An all-natural diet served as control. The fatty