

Interactive effects of temperature and salinity on developmental biology of *Penaeus monodon* in Rufiji Delta, Tanzania.

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Background

Prawns are commercially one of the most important marine resources. Prawn fishery play an important role as it enhances the economy of the coastal people through food security and income generation. These species have been facing a number of challenges due to changes in physico-chemical marine environments leading to low production. The study was conducted to investigate the interactive effects of temperature and salinity on egg incubation time, hatching success, larval and postlarval growth and survival of the giant tiger prawn, *Penaeus monodon* in coastal waters of Tanzania of Western Indian Ocean. During their development prawns pass through various stages. Their early developmental stages are specifically delicate and vulnerable to physico-chemical environmental changes that may be resulted from the climate change and variability. Salinity and temperature are two of the most important aquatic environmental factors that affect incubation time, hatching rate, hatching time of eggs, larval and postlarval survival rate and growth prawns. Little information exists on the optimal salinity and temperature for egg incubation time, hatching success, survival and growth of different larvae and postlarvae stages of the giant tiger prawn *P. monodon* obtained from coastal waters of Tanzania, hence the need for this study.

Methods

The adult females *Penaeus monodon* collected offshore of Rufiji delta were allowed to acclimatize at 28.5 ± 0.5 °C and 32 ppt in the hatchery. The individual prawns were put into maturation tanks of 8000 litres capacity and then transferred to spawning tanks of 500 litres. Spawning eggs were collected using 1µm mesh size sieve, counted and incubated at temperature 27 °C, 31 °C and 35 °C with three subgroups of salinities 30 ppt, 35 ppt and 40 ppt, and incubation time, hatching rate, hatching time of eggs, larval and postlarval survival rate and growth prawns were assessed at different temperature-salinity combinations.

Results

The incubation time was longest (15.9 hours) at temperature 27 °C and salinity 30 ppt and shortest (10.7 hours) at temperature 35 °C and 40 ppt. Hatching rate was highest (85.28%) at temperature 31 °C and salinity 30 ppt and lowest (69.45%) at temperature 35 °C and salinity of 40 ppt. All larval stages were observed to survive better at temperature 31 °C and salinity 30 ppt with nauplii larvae survival rate being 90.53%, protozoa larvae 80.01% and mysis larvae

77.71%. Optimal postlarvae survival was 77.70% obtained at temperature 27 °C and salinity 35 ppt while low survival was obtained at temperature 35 °C and salinity 40 ppt. Maximum growth in total length of 7.89 mm for the early developmental stages to the termination of experiment was obtained at temperature 31 °C and salinity 40 ppt while minimum growth was obtained at temperature 27 °C and salinity 30 ppt. The highest performance index from growth and survival data was 14.75 obtained at temperature 31 °C and 30 ppt while the lowest was 2.96 obtained at 35 °C and salinity 40 ppt.

Conclusion

The marine physico-chemical environmental changes may affect the early development stages *Penaeus monodon*. Increase in temperature and salinity although shorten incubation time of *P. monodon* eggs, they were seen to reduce hatching rate, survival and growth especially at the early developmental stages which are more sensitive to environment changes. Based on the performance index, the best (or optimum) rearing temperature and salinity of *P. monodon* obtained in the coastal waters of Tanzania, offshore of Rufiji Delta ranged from 27-31 °C and 30-35 ppt. Increases in temperature and salinity above this optimum range will definitely affect prawn productivity within the coastal waters of Tanzania, and the WIO region as a whole.