

BRIEF ARTICLE

## Macrobenthic invertebrates as food for a penaeid shrimp pond farm in Brazil

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**Resumen:** El macrobentos de estanques de cultivo de *Penaeus subtilis* y *Penaeus schmitti* se estudió en la costa nordeste de Brasil durante 12 semanas. El poliqueto *Laeonereis culveri* (2 433 ind/0.1m<sup>2</sup>) y el anfípodo *Grandidierella bonnieroides* (2 726 ind/0.1m<sup>2</sup>) fueron intensamente depredados por los peneidos. Ningún individuo de *G. bonnieroides* sobrevivió más de seis semanas: en el tiempo restante *L. culveri*, que también puede reclutarse en el periodo, fue el principal recurso natural alimenticio disponible.

**Key words:** Macrobenthos, shrimp culture, *Penaeus*, *Laeonereis*, *Grandidierella*, natural food.

As the world's crustacean production in cultures increases, the need for an improved knowledge on the structure and functioning of commercial ponds becomes necessary to improve culture's yield. This need is specially strong for the cultures in Third World countries based mainly on extensive and semi-intensive systems where natural food organisms can play a crucial role in the nutrition of fish and shrimp (Tacon 1988). The importance of macrobenthic invertebrates as a source of natural food has been demonstrated (Anderson *et al.* 1987, Ordner *et al.* 1990) mainly when combined to supplementary food (Tacon 1988, Galgani *et al.* 1989). However, there is little knowledge about which species are most appropriate as a food source for this commercially important species. This study is an attempt to relate shifts in macrobenthic community to potential predation

by *Penaeus* spp. shrimps during their growth period in a commercial semi-intensive farm.

The data were gathered in farm from a inside mangrove area in Ceará State, northeastern Brazilian coast. Pond area was 7000 m<sup>2</sup> with 0.7 m mean depth. Before the beginning of the experiment, the pond was kept dry for two days, and fertilized with urea (21 kg) through the entire cycle. Two species of shrimps were cultivated: *Penaeus subtilis* and *Penaeus schmitti*, during a grow out period of 12 weeks (Nov./1988 to Feb/1989) with an initial density of 10 shrimps/m<sup>2</sup>. The culture was supplied with ration (ca. 5 to 10% of shrimp biomass) twice a day as usual in commercial farms in the area. Shrimps were sampled with a net for estimation of mean individual weight during the grow out period.

The macrobenthic sampling was carried out weekly using a 80 cm<sup>2</sup> cylindrical corer. Three replicates were collected in three different pond regions: entrance, centre and exit. Another sample was collected in the neighbouring mangrove at the same depth (0.7 m). Sediment was sieved in a 0.5 mm mesh, being fixed in a 10% formalin for sorting and identification. For the biomass measurement of the two dominant species (the polychaete *L. culveri* and the amphipod *G. bonnieroides*) the material was dried at 60°C for 24 hours and weighted.

The pond macrofauna was different in composition and richness from the macrofauna of the nearby mangrove. Pond was inhabited by the polychaetes *L. culveri*, *Capitella capitata*, *Marphysa* sp. and *Parandalia tricuspis* and the amphipod *G. bonnieroides*, whereas the mangrove was dominated by the polychaetes *Heteromastus filiformis* and *Glycinde multidentis*. The shrimp biomass variation during the monitoring period and abiotic data are shown in Fig. 1. Water temperature was not measured, but in this season it normally ranges between 25.0 to 31.0 °C.

*L. culveri* and *G. bonnieroides*, by far the dominant species with maximum densities of 2 433 and 2 726 individuals for 0.1 m<sup>2</sup>, were monitored during the entire grow out period (Fig. 2). Both the density and the biomass of *G. bonnieroides* decayed during the period being, after Dec./20, almost not found in the sediment. On the other hand, *L. culveri*, which also decreased in the beginning of the experiment, showed a recruitment in Dec./20, resulting in a biomass recuperation, that was kept stable until Jan./10. After that, no specimens of the polychaete were found in the sediment. Shrimp performance showed a initial increase (first 3 weeks) up to 8g, then a long period of biomass stability (ca. 4 weeks) was followed by a new growing period, reaching an estimated biomass of 12g in three weeks.

The decrease in density and biomass of the main macrobenthic species clearly shows

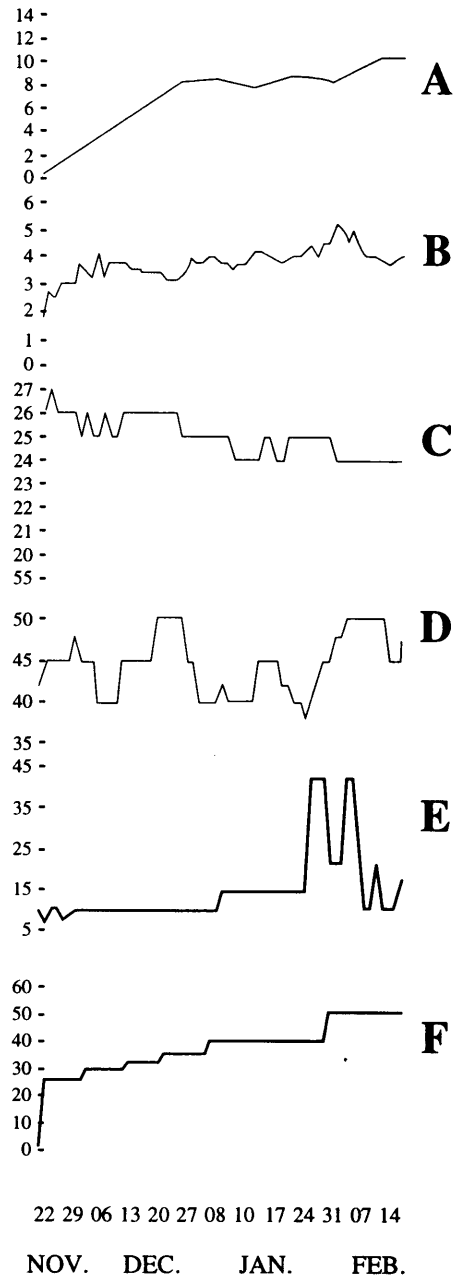


Fig. 1. Shrimp biomass and environmental variables during shrimps grow-out period. A: Shrimp biomass (g); B: Dissolved Oxygen (mg/l); C: Salinity; D: Transparency (cm); E: Renew rate (%) and F: Raion (kg).

the role of shrimp predation on pond biota. The amphipod *G. bonnieroides* seems to be the first

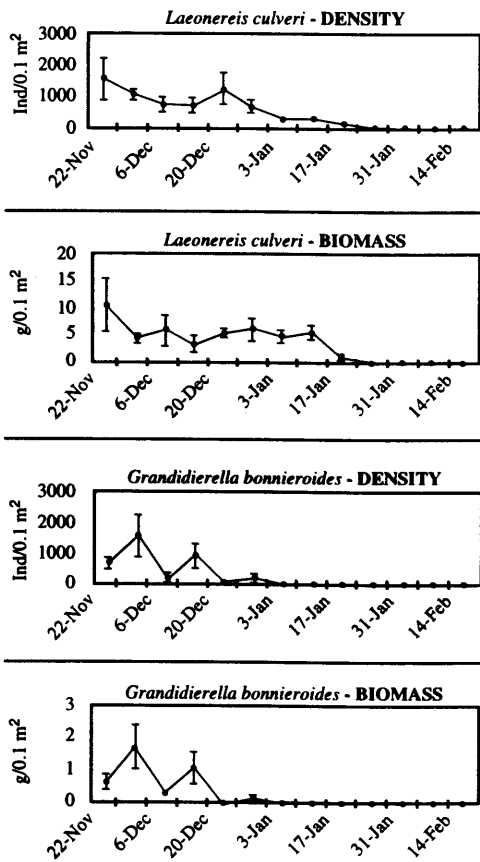


Fig. 2. Average density and biomass (+ standad error) of the polychaete *Laeonereis culveri* and the amphipod *Grandidierella onnieroides* during shrimps grow-out period. Biomass expressed as grams of wet weight.

choice of the shrimp, as can be seen from the large fluctuation in biomass and density of the amphipod in the first four weeks. After the *G. bonnieroides* disappearance from the pond, *L. culveri* was the only natural food resource for the shrimp, and thus, the shrimp fed on it intensively only after that. The density fall of *L. culveri* after the Dec./20 recruitment was not associated to a biomass fall, giving rise to the hypothesis that *Penaeus* spp. prey first the smaller recently recruited worms not important to overall polychaete biomass. This behaviour is associated to the greater availability of younger worms in the sediment surface

(Bemvenuti 1992). This happened when shrimp biomass was kept stable, thus the stabilisation of shrimp growth does not seem to be related to food availability, but to some other factor linked to pond management. The trigger to higher growth rates matches a strong fall on salinity. After the stabilisation, the shrimp population started to grow again in higher rates and worms of the higher size-classes are also preyed decreasing polychetes density until it is completely vanished.

As regards pond management, the pond drying prior to the grow out period seems to control the composition of the biota. *G. bonnieroides* is available in the water column, changing its benthic habit for a pelagic one as a strategy to avoid predation (Stearns & Dardeau 1990) and, by doing so, it is able to colonise the pond through inflowing water. On the other hand, *L. culveri* is capable of maintaining its eggs adhered to adults' tubes inside the sediment, being able to survive even when the pond was dry. It is shown herein that *L. culveri* can be used not only as natural pond food but can be transplanted for increasing the yield of tropical semi-intensive and extensive cultures. *L. culveri* seems to be an excellent food resource for the shrimp, specially when combined with an increasing fraction of supplementary ration. Exceeding ration supply is available for the shrimp in the form of polychaete biomass avoiding the eutrophication of the pond, as often occurs on semi-intensive shrimp cultures.

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