tions of 400 adult blue shrimp (*Penaeus stylirostris*) from wild and cultivated (F_6) populations, were applied (wild females and males, wild females and cultivated males, cultivated females and wild males, and cultivated females and males). Females were inspected every third day. Those observed with spermatophores were captured and transferred to individual 100-ℓ spawning tanks. Water was treated with EDTA and erythromycin phosphate. More than 300 individual spawns were evaluated within a 180-day period. To evaluate the nauplii production per female, an analysis of variance for a factorial arrangement ($4^3 \times 2$) was conducted. The factors considered were: the abovementioned treatments, different ovarian maturation stages, adhesion of the spermatophore, and kind of spawning (complete or partial). The mixed populations had higher nauplii production than the cultivated broodstock. All the females were tagged around an eyestalk and examined for rematuration. Up to six rematurations per female were registered as well as a minimum of four days between successive spawnings for the same female. The effect of rematuration on the quantity of nauplii is discussed. Gonadosomatic index for wild and cultivated females is compared. Selective criteria for spawners are given.

Nutritional Value of Marine Yeast Fed to Larvae of *Penaeus monodon* in Combination with Algae

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Saccharomyces cerevasiae and *Rhodotorula aurantica*, two marine yeast species, were fed to *Penaeus monodon* larvae (N_6 to M_1) singly and in combination with *Tetraselmis* sp. and *Chaetoceros calcitrans* in varying proportions. Larvae fed combination diets gave survival rates comparable to or higher than those fed algae or yeast alone. Chemical analyses show that the yeasts have low fat, moderate protein and high carbohydrate content. They also contain essential amino acids but are different in the fatty acids found to be essential for prawns. When used in combination with algae, the nutritional value of the yeasts seemed to have been improved.

The use of marine yeasts in larval rearing could reduce economic and technological inputs in the production of natural foods for larval rearing. They are cheaper and easier to mass produce. They can be grown to very high densities using cheap carbon sources like molasses, brown sugar and coconut water with added nutrients in relatively shorter periods of time.

The Growth of a Bialgal Culture and its Use as Food for Shrimp Larvae

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The cultivation of the microalga *Tetraselmis chuii* with the protection of the extracellular products of *Chlorella kessleri*, grown in a bialgal culture, allows its development in outdoor tanks without special conditions of sterilization or aeration. Fish meal and agricultural inorganic compounds are used as fertilizers. The growth of the mixed species is analyzed comparing it with monoalgal cultures. The best fit of growth data to a logistic curve is performed and the whole curve is compared using a covariance analysis. The stratification of *T. chuii* in the tank favors its harvest at high concentration. A bialgal culture (based on *T. chuii* at 50 cells/mm³) as food for the larvae of the shrimps *Penaeus notialis* and *P. schmitti*, together with hard boiled egg yolk and rotifers, achieves good development and survival.

The Integrated Use of *Artemia* in Shrimp Farming

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The use of freshly hatched *Artemia* nauplii in penaeid hatcheries is a common practice, although a broader application of *Artemia* in shrimp farming is gaining more and more interest. In this regard, an integrated use of *Artemia* in shrimp culture is presented in this paper.

Artemia booster in combination with Fleischmann yeast has been proven to be a suitable algal substitute and the early feeding of decapsulated *Artemia* cysts at protozoea I to II stages has been shown to improve larval growth. Freshly hatched *Artemia* nauplii may be introduced at protozoea II to III and the use of enriched nauplii from mysis stage on clearly improves postlarval production. Enriched nauplii, pre-adult and adult *Artemia* can be successfully used in a nursery phase in order to improve weaning success and performance in grow-out ponds. Furthermore, the use of adult *Artemia* in broodstock feeding has been shown to be effective for inducing maturation.

All *Artemia* products mentioned can be purchased from commercial dealers but can be produced as well on the spot in most cases. *Artemia* cysts may be harvested from natural or inoculated populations occurring in adjacent salt works while decapsulation of the cysts can be done in the hatchery. Enrichment of *Artemia* nauplii can be done routinely using enriched formulated diets during hatching of the cysts or after separation of the nauplii. Pre-adult and adult *Artemia* can be produced either extensively in nearby salt ponds or intensively in flowthrough raceway systems using nutrient-rich effluent water from the hatchery.

In this regard, an integrated use of *Artemia* in shrimp farming will not only increase postlarval production but will decrease costs as well by production on the spot of the most expensive and valuable live food: *Artemia.*

Heterotrophic Bacteria Associated with Eggs and Larvae of *Penaeus indicus* in a Hatchery System

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Total viable aerobic heterotrophic bacteria (THB) associated with egg, nauplius, zoea, mysis and postlarva of *Penaeus indicus* and seawater in a hatchery system were estimated for three years from 1981 to 1984. The bacterial population varied from 1.3×10^4 to 8.72×10^7/g in egg, 1.5×10^4 to 6.17×10^7/g in nauplius, 4×10^3 to 3.14×10^7/g in zoea, 1.35×10^6 to 1.25×10^8/g in mysis, 1.6×10^5 to 8.44×10^6/g in postlarva. Water contained a THB population of 1.2 X 10^5 to 2.8×10^8/100 ml.

Species of *Vibrio, Pseudomonas, Aeromonas, Acinetobacter, Moraxella,* members of the family Enterobacteriaceae, *Micrococcus, Bacillus*, and Coryneform group were encountered. Gram-negative bacteria were found to be dominant in all stages and showed an increase from egg (81.3%) to postlarva (92.7%). However such an increase was not recorded in the respective water samples even though gram-negative bacteria were found to be dominant. *Vibrio* spp. were found in high numbers in postlarvae and it was to be increasing from egg (10.4%) to postlarva (80%). The number of larvae in culture pools gradually declined as the nauplii metamorphosed to postlarvae through zoea and mysis. In general, coincidence of higher percentage of *Vibrio* spp. and larval mortality was recorded. Physico-chemical factors such as salinity, temperature, pH, oxygen, inorganic phosphorus, organic phosphorus, inorganic nitrogen and organic nitrogen of water did not show much variation in the same set of pools. Relationship between the physico-chemical parameters, bacterial population and the number of larvae is discussed.

A New Approach in Intensive Nursery Rearing of Penaeids

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The need for a nursery phase between the hatchery and the growing pond to avoid mortalities of young postlarvae, and provide a better assessment of stocked animals is general in crustacean aquaculture.

The Centre Oceanologique du Pacifique recently developed a new culture technique using strong aeration, no water exchange and no external filter or artificial substrates. The technique relies on the development of a phytoplankton and bacterial medium with both nutritive and purifying qualities. Early postlarvae (PL_3) are grown for a month or less up to 0.1 g mean weight, in 10 to 100 m^3 tanks, at densities of 1 to 10 individuals/ℓ. The mean daily growth rates are around 20% for *Penaeus indicus, P. stylirostris* and *P. vannamei* and only 12-15% for *P. monodon.* For all species tested, density has little or no influence on growth. The final survival rates are generally high.

Floating Cage Nursery Culture System for *Penaeus monodon*

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The use of floating cages as nursery for *Penaeus monodon* postlarvae was tried at the Batan, Aklan Substation of the SEAFDEC Aquaculture Department. The cages were made of bamboo and measured 2 × 5 × 1.5 m (effective volume 10 m^3) with cement-coated styrofoam sheets as floats. Two nets were installed inside a cage. The outer net (3 mm mesh size) protects the inner net (0.5 mm mesh size) from floating debris in the bay. The cages were installed offshore where water depth was at least 2 m during the lowest tide, and were attached to bamboo posts by metal rings. Postlarvae were stocked at ages ranging from PL_5 to PL_{16}. Feed consisted of raw ground fish paste applied to a feeding net which also served as substrate. Average survival based on 25 production runs was 40.98% after 2 to 3 weeks of culture. Stocking density ranged from 4,000 to 16,895 PL/m^3.

Unlike nursery tanks, this system is easier to manage and needs no aeration and pumping, thus reducing operational costs. Floating nursery cages should be located in protected areas; they can also be installed inside fishponds.