

RESEARCH UPDATE: MUDCRAB ... FROM PAGE 20

Disease problems in mudcrab larval rearing include severe fouling of eggs and larvae with filamentous bacteria and protozoans, and sporadic fungal infection in egg mass (see photos). These may result in poor hatching. Mortality of larvae in the hatchery is mainly due to systemic bacterial infection and occasionally, fungal infection. Monitoring of various larval rearing runs revealed the following main sources of bacterial pathogens in the hatchery: developing eggs, untreated water supply, and natural food, mainly *Brachionus* and *Artemia*. Although the water supply can be effectively rid of bacterial pathogens by chlorination (minimum of 10 ppm active chlorine), such technique does not remove pathogenic bacteria from the other sources.

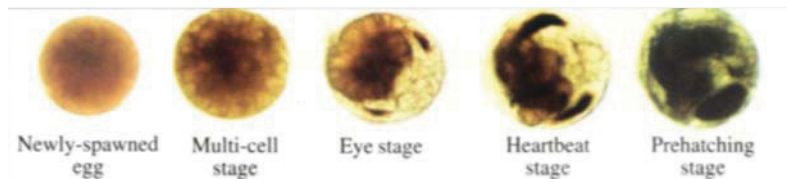
Fungi isolated from eggs and larvae of *Scylla* spp. are either vesicle-formers or non-vesicle-formers. The first are *Lagenidium*-like while the latter are *Sirolopidium*-like. In both fungal types, spore formation and release were inhibited by 10 ppm formalin bath for 24-40 h, but the fungi remained viable and grew when replanted on peptone yeast extract agar. Fungal hyphae exposed to 50 and 100 ppm formalin for the same period did not produce nor release spores and were not viable after exposure.

Nursery

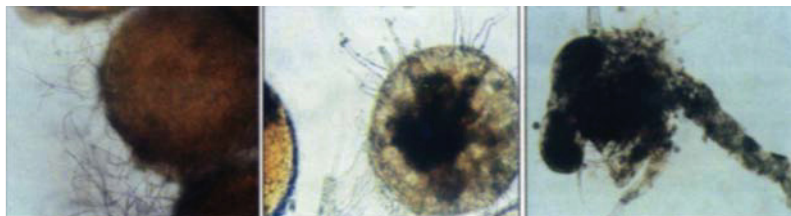
Juveniles produced from rearing megalopae for a month in net cages ('hapa') may have to be grown to a bigger size to meet preference of most growers. Thus, a method for extension of nursery rearing has to be developed. A comparison was made among stocking densities and between net cages and ponds as rearing systems for growing small juveniles to the preferred size. The hapa



Net cages for rearing megalopae to juveniles



Some of the embryonic stages of mudcrab



Egg infected with filamentous algae

Egg and larva (right) infected with fungi

net rearing system, regardless of stocking density, resulted in a higher mean survival (78%) than the pond system (46%). However, juveniles harvested from the hapa nets were smaller (3-7 g body weight) than those grown in ponds (10-16 g). Stocking densities did not significantly influence survival in either nets or ponds.

S. serrata seems to prefer more saline waters than *S. tranquebarica* and *S. olivacea* and may have different responses to salinities with respect to growth. The effect of salinity on molting was investigated in crab instar (<0.5 cm carapace width) and juveniles (1.5 to 2.5 cm). In *S. olivacea* crab instar 1, the survival was similar in salinities of 12, 16, 20, 24, and 32 ppt. The mean body weight after 1.5 months was highest in 12 and 16 ppt and lowest at 32 ppt. Crabs at 32 ppt had a mean of four molts while those in other test salinities had undergone five. Tests on *S. serrata* and *S. tranquebarica* are ongoing.

Juveniles previously reared for at least a week in 32 ppt were transferred abruptly to salinities of 8, 16, 20, 24, and 32 ppt. Among *S. serrata*, survival after third molt (2.5 months after stocking) and the molt intervals were similar in all salinities. Among *S. olivacea*, lowest survival was obtained at 8 ppt (23%) and highest at 16 (76%). At 32 ppt, survival was 48%.

Cannibalism is a common problem in mudcrab juveniles. The agonistic behavior of juveniles was studied to develop strategies to minimize cannibalism.

Aquasilviculture

Grow-out mangrove pen systems suitable for coastal communities have been developed by SEAFDEC/AQD over the years. Dependence on "trash fish" or fish biomass, used as food by low income groups, remains a problem in farming mudcrabs. To reduce if not completely eliminate such dependence, the project is currently testing a low cost, incomplete pellet on crabs reared inside mangrove pen systems. The first run gave generally low crab survival and production because wild juveniles of *S. olivacea* - a species that is relatively aggressive and does not grow fast - were stocked. The ongoing run uses hatchery/nursery-reared juveniles of *S. serrata* and *S. tranquebarica*.



GROWTH AND YIELD OF ASIAN CATFISH ... FROM PAGE 5

TABLE 3 Proximate whole body composition* (% on dry matter basis \pm SEM) of *C. macrocephalus* fed four diets for 120 days (means of three replicates)

	Initial value	At harvest			
		Diet 1	Diet 2	Diet 3	Diet 4
Crude protein	65.4	51.8 \pm 1.0 ^b	54.5 \pm 0.6 ^a	56.1 \pm 0.4 ^a	49.8 \pm 1.5 ^b
Crude fat	9.7	27.8 \pm 0.5 ^b	28.3 \pm 0.3 ^b	22.0 \pm 0.2 ^c	34.5 \pm 1.5 ^a
NFE	10.0	5.8 \pm 0.9 ^b	3.0 \pm 1.2 ^b	9.4 \pm 0.6 ^a	5.1 \pm 1.2 ^b
Moisture	91.1	70.9 \pm 0.9 ^a	71.0 \pm 0.5 ^a	73.7 \pm 0.5 ^a	60.7 \pm 1.5 ^b
Ash	14.7	14.5 \pm 0.2 ^a	14.2 \pm 0.3 ^a	12.4 \pm 0.1 ^b	10.6 \pm 0.3 ^c

Means within a row with different superscripts are significantly different ($p < 0.05$).

*Crude fiber was 0.14% at the start of the experiment; levels were lower than 0.05% in all treatments at the end

D.O. recorded was 1.3 ppm, but *Clariid* catfishes have arborescent organ for breathing air that could increase tolerance to adverse D.O. conditions.

Taste test analysis showed that odor, flavor and appearance were "slightly like" by the panel, and were not significantly different among treatments.

C. macrocephalus fed a diet of 34.2% crude protein attained the best growth and yield with 93.3% of the harvested catfish weighing more than 80 g. Average body weight of catfish fed Diet 2 was 72%, 46% and 38% higher than catfish fed Diets 1, 3 and 4, respectively. Catfish harvest is usually 5 to 6 months of culture, but using Diet 2 can shorten the culture period with the same average weight and therefore beneficial to farmers.

The significantly higher growth of catfish fed Diet 2 may be attributed to the composition of Diet 2 that could have approximated the nutritional requirement of *C. macrocephalus* juveniles. Among the treatments. Diet 2 had the highest amount of crude protein, the lowest amount of energy and the highest P/E ratio. The P/E in Diet 2 could have explained the good growth and feed efficiency in catfish fed this diet. Catfish are carnivorous and require great amount of protein for growth. Furthermore, survival rate of 68-81% is not influenced by the diets used. One way to increase survival of catfish is to select bigger and uniform-sized fingerlings to minimize cannibalism.

Diet 1 was formulated as a protein supplement to the natural food in the pond. The amount of natural food in the pond may not have been enough to compensate for the protein deficiency in Diet 1 that had resulted in slow growth and low yield.

The catfish fed commercial fish pellets (Diet 3) had similar growth to those fed chicken entrails and rice bran (Diet 4) but catfish fed Diet 4 contained the higher amount of crude fat and yielded fatter fish. Fattiness in catfish has been identified as a major problem in commercial catfish industry. An increased in fat content is responsible for the poor keeping quality and decreased yield of processed products. Using chicken entrails as feed has many disadvantages such as. storage and availability, difficulty in preparation and blanching may not sufficient to eliminate bacteria. Although the taste test showed no off-flavor

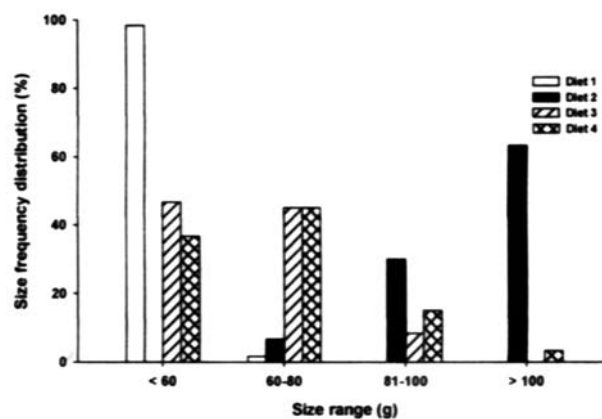


FIGURE 1 Size distribution of Asian catfish *Clarias macrocephalus* fed four different diets for 120 days

in fish fed Diet 4. or in any diet, the use of chicken entrails maybe practical for a backyard fishpond operation but not in intensive commercial culture. Under experimental conditions, a diet of about 34% crude protein resulted in the best growth and yield of *C. macrocephalus* in a relatively shorter period. #####

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Fisheries and population dynamics

In addition to crab culture in pens or ponds, stock enhancement has been proposed to compensate for declining wild catches. However, baseline information on crab population dynamics is needed before interventions can be implemented. Wild populations in natural (Ibajay, Aklan) and planted (Kalibo) mangroves were monitored monthly using catch data from two native gears - crab dip net ('bintol') and bamboo trap ('tapangan'). Consisting predominantly of *S. olivacea* in both places, crab populations showed smaller sizes but greater numbers in Kalibo compared to Ibajay. *S. tranquebarica* and *S. serrata* were rare inside the

mangroves but *S. tranquebarica* comprised 5-65% in a channel draining the Kalibo mangroves. Females with attached egg mass and small crabs (1-3 cm CW) were caught mainly in Ibajay starting September and later in November, respectively. #####

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European Union's special project on mudcrab

By SEAFDEC/AQD/AQD's mudcrab R&D team

The European Union through the European Commission is funding a project on the "Culture and Management of *Scylla* Species." which is being undertaken by four institutions worldwide—University of Wales (Bangor) in the United Kingdom, Artemia Reference Center of the University of Ghent in Belgium, Can Tho University in Vietnam, and SEAFDEC/AQD in the Philippines.

The overall aim is to improve the reliability and economic viability of mudcrab hatchery and nursery production for mangrove-pond aquasilviculture production systems and stock enhancement. The project will run for three years beginning January 2002 with funding from the European Union. It is divided into six work packages: improvement of broodstock and larval quality, bacterial disease control in the hatchery, technical identification of larvae of four crab species, nursery and aquasilviculture, crab fisheries and population dynamics, and stock enhancement.

Broodstock and larval quality

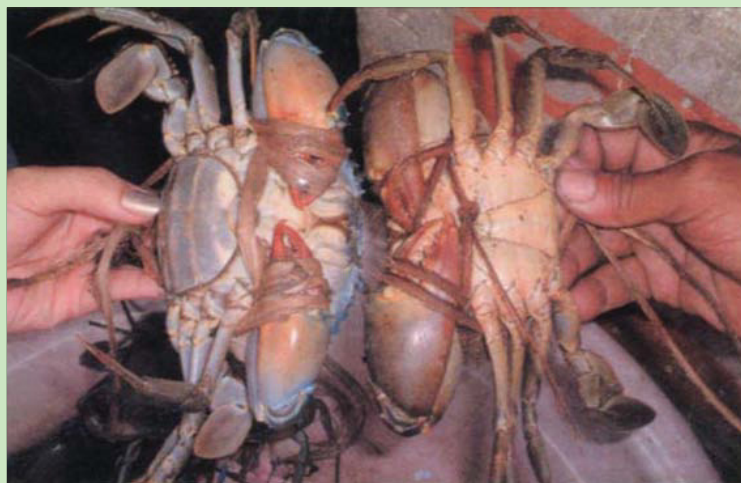
Ovarian maturation of wild and pond-sourced *S. serrata* was classified into 6 stages (immature to spent) based on external and histological descriptions of the ovary. During maturation, protein, lipids, minerals and ascorbic acid were accumulated in the ovaries indicating the importance of these nutrients in the reproductive process. Of the ten essential amino acids in wild-sourced crabs, arginine, isoleucine, leucine, methionine and valine increased in mature ovaries: triglycerides and phosphatidylcholine were accumulated, and 22:6n-3 (docosahexaenoic acid, 20:5n-3 (eicosapentanoic) and 20:4n-6 (arachidonic acid) levels were high. In pond-sourced crabs, lipids in newly spawned eggs and the more advanced eye stage were comparable. However, lipids in the heart-beat stage to newly hatched zoea significantly decreased indicating utilization.

Rotifers are routinely used as feed for crab larvae and as an alternative; the efficacy of oyster (*Crassostrea iredalei*) trocophores was evaluated. Trocophores were acceptable as food but survival and growth were better in larvae fed rotifers alone or trocophores in combination with *Artemia*.

Body measurements, development of the external sexual characters and gonad were determined in hatchery-reared *S. serrata*, *S. tranquebarica* and *S. olivacea* grown to maturity. There is an increase in the abdominal width per unit increase in carapace width (ICW) in females in the three species. Mating readiness of *S. olivacea* occurs at smaller body sizes (7.9 cm ICW female, 7.8 cm male) than in *S. tranquebarica* (9.1 cm female ICW, 8.7 cm male) and *S. serrata* (9.9 cm ICW female, 9.4 cm male).



Mudcrab fishers in Kalibo. Aklan tying their crabs collected by bamboo traps (tapangan) in preparation for sale in local markets



The color morph "sinaw" of *Scylla olivacea*, preferred for culture or fattening to other *S. olivacea* morphs



Stocking of mud crab juveniles inside mangrove pens for comparison of growth on fish biomass vs low-cost pellets

Diseases

Disease problems in broodstock after they were held for 3 months in tanks include shell disease due to a combination of fouling organisms and chitinolytic bacteria. Shell disease first manifests as off-white and black patches on the shell, progressing to become perforations through which nematodes and other saprophytic organisms gain entry. The fouling problems that affect the integrity of the shell are considered to reduce the life span and reproductive potential of broodstock under tank conditions.