Aquaculture Research on Giant Clam, *Tridacna derasa*, at the Marcultura Foundation, Bonaire, Netherlands Antilles

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ABSTRACT

Fundashon Marcultura has been conducting experiments with the giant clam, *Tridacna derasa*, since February 1988 on Bonaire, Netherlands Antilles. The goal is to find economically feasible ways of cultivating these clams in the Lesser Antilles. Special care was taken to prevent the clams or their larvae from escaping out of the laboratory into the natural environment.

The first shipment of clams from Indonesia did not adapt very well to local conditions, such as high temperatures and high salinity. This resulted in a high mortality in the first months and a very slow growth rate thus far (30 months after shipment). The second shipment from Palau showed almost no mortality and showed rapid growth almost immediately.

Besides testing the clams for data relevant to aquaculture, we also started experiments to determine the effects they might have on local marine organisms, especially those that carry a similar type of zooxanthellae such as corals, anemones, and some sponges.

Preliminary results of these experiments are reported.

INTRODUCTION

The clear blue marine waters of the Caribbean together with abundant sunlight are a great economic inducer for the number one Caribbean industry-tourism. The ABC islands, Aruba, Bonaire, and Curaçao, are will-known tourist destinations. The aquamarine waters around these islands, are however, oligotrophic and extraction of food from these waters by fishery or aquaculture is done at great cost to the natural resource as well as to monetary resources. A similar situation exists in most of the Caribbean island nations.

Fundashon Marcultura is engaged in research to find the most economically viable techniques for aquaculture in the Netherlands Antilles and Aruba. Several mollusc species were investigated, foremost the queen conch (*Strombus gigas*) and the mangrove oyster (*Crassostrea rhizophora*).

Larva culture of the queen conch is mostly under control at Marcultura. Egg masses are collected in season from natural breeding populations and brought to the laboratory. The eggs are hatched and the larvae reared under controlled conditions. Metamorphosis is induced with a red algal extract (*Laurencia*). The post-larva are collected and reared in specially prepared troughs with an algal turf. As soon as the ability of the juveniles to eat exceeds the ability of the workers to feed them, they are released in the marine environment.

Great care is taken to select a site with sand for the juveniles to bury themselves. Shallow water sand flats with a good algal growth not too far from seagrass beds are the best but they are limited in area in the ABC islands. Bonaire for instance has only 2 km^2 of prime juvenile conch seeding habitat. They can be seeded in deeper waters, however at much lower densities as algal biomass is much lower.

On the islands of Aruba, Bonaire, and Curaçao, in areas with good growing conditions the density of the harvestable conch population does not exceed 400 to 500 animals per year per hectare, if one wants to maintain a sustainable yield. Five hundred queen conch yield about 100 kg of meat with a value of Nafl 1000 (about US$ 450).

In the ABC islands, all submerged land is public land and therefore ranching conch on the seagrass beds cannot be done by one or more companies with restricted access. To grow conch for economic gain is not possible.

Marcultura has therefore opted for managing the juvenile grow-out of queen conch. The fishery will be managed by the government. Laws managing this fishery are in place. However, public awareness has to grow before the queen conch fishery can be effectively managed.

The mangrove oyster (*Crassostrea rhizophoreae*) occurs on all three islands in small scattered locations. Due to the oligotrophic conditions, the total biomass of oysters can be counted in tens of kilos. There is no existing fishery on oysters. Research done by Marcultura indicated that the total yield per hectare, in natural situations, would be on the order of US$100/year (if one could lease or buy submerged land). To increase the nutritional value of the nearshore water does not seem practical due to pollution and loss of clarity.

TRIDACNA CULTURE

The Pacific reef dwelling molluscs of the family Tridacnidae seem to be eminently cultivable. These animals harbor a symbiotic zooxanthella. These symbionts convert sunlight, carbon dioxide, and dissolved nutrients into photosynthates, some of which are released directly into the bloodstream of the host. Energy loss between trophic levels is minimized. The clams grow faster and become larger than conventional filter feeding bivalves.

Interest in cultivating giant clams began in the 1970's when Jameson (1976) and LaBarbera (1975) demonstrated the feasibility of small-scale laboratory culture of giant clams. Jesslinga *et al.* (1984) have described the mass culture of giant clams and are currently operating a facility in Palau, the Micronesian Mariculture Demonstration Center. Marcultura obtained, on a trial basis, 30 clams from Indonesia in April 1988. Survival was good but growth was lagging. In July 1989, 600 juvenile *Tridacna derasa* were obtained from Palau. Survival and growth of these clams has been excellent.

Fundashon Marcultura is very concerned about introduction of diseases and exotic organisms in the marine environment around Bonaire. To eliminate introductions of any exotic and unwanted organisms related to aquaculture, Marcultura directs its discharge to the local solar salt works, a distance of over 4 km away from the sea intake. Over this distance, the salinity of discharge water increases, pH changes drastically, temperature increases, etc.

Experiments were set up to investigate the effect of giant clams on molluscs. A study was started comparing the survival and growth rates of local bivalves and gastropods under monitored conditions with and without the presence of giant clams.

Conch larvae were reared with giant clams and without. When metamorphosis took place, the survival and the phenotype of the juvenile conch was equal to those grown without the clams. This experiment was replicated four times, and we will continue to do so next year.

Giant clams were also grown in the presence of oysters (*Isognomon* sp. and *Crassostrea*), mussels (*Mytella guyanensis*), scallops (*Argopecten*) since April 1988 and no deleterious effects were noted.

Currently, we are investigating the effect of *Tridacna* growth on other zooxanthellae-bearing organisms. This experiment has only been in operation for four months. So far, we have not noticed any effects, but we will continue this experiment for another two years at the very least.

The clam is grown for its meat and we have done some small scale trials with palatability of the giant clam to a few select individuals who thought it to be very tasty. This trial will be replicated.

We are very aware of the deleterious effect some introduced organisms can have on the environment. On the other hand, most farmed organisms are introductions. The difference between a farmed organism and a pest is management. *Tridacna* does seem to be an animal that can be managed (extensive trials are taking place) and we cannot ignore the potential of the only known phototrophic farm animal to the Caribbean.

LITERATURE CITED

Hesslinga, G.A., F.E. Perron, and O. Orak. 1984. Mass culture of giant clams in Palau. *Aquaculture* **39**:197-215.

Jameson, S.C. 1976. Early life history of the giant clams *Tridacna crocea, T. maxima,* and *Hippopus hippopus. Pac. Sci.* **30**:219-233.

LaBarbera, M. 1975. Larval and postlarval development of giant clams *Tridacna maxima* and *Tridacna squamosa. Malacologia* 15:69-79.