

## **Development of Aquaculture in the Netherlands Antilles and Aruba**

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### **SUMMARY**

Aquaculture as an organized practice is a very recent event in the ABC islands. In the 1950's Carmabi was founded in part to develop aquaculture in the Netherlands Antilles, but partly due to negative results, this institute went in other directions. In 1980 the governments of Aruba, Bonaire, and Curaçao started a conch (*Strombus gigas*) rearing/releasing program. Success of this program inspired the participants to formalize the cooperation into a foundation; Marcultura. Objectives of this foundation are to research and develop aquaculture possibilities in these islands and to disseminate information. Marcultura has continued conch rearing and has investigated rearing of shrimp, Tilapia, and ornamental fish.

### **HISTORY OF AQUACULTURE IN CURAÇAO, ARUBA AND BONAIRE**

The geography of these islands are favorable for mariculture. We have many miles of coastline on the north shore of these islands with no agricultural potential and/or of marginal touristic use. With little possibility of damage by tropical storms, our climate favors year round growth. Our marine waters are extremely clear and relatively unpolluted. Further, the presence of a market that can absorb initial production and the possibility of export also favors the establishment of aquaculture. Unfortunately, freshwater and energy are expensive, as is the cost of labour, which is however, well educated.

Interest in aquaculture goes back to at least the beginning of this century. Boeke (1907, 1919) speculated that the mangrove oyster, which at that time was common in the Saint Anna bay (Curaçao), our present harbour, could be farmed. A marine institute, Carmabi, was founded on Curaçao in 1955 by the island government to do marine research and to investigate the potential of fishing and aquaculture. Under auspices of Carmabi, research was carried out in the 1950's and 1960's to examine the potential for farming of *Tilapia*, Spiny Lobster, shrimp, the clam (*Venus mercenaria*) and other species. De Kock and de Wilde (1964) investigated the fertility of some Curaçao bays for the same purpose. Eventually, however, it was decided that this institute would do more basic research on the coral reefs, and aquaculture was abandoned. In the 1960's and

1970's several consultants (notably Mr. Bodeke of the Dutch Institute for Fisheries Research and a team from British Petroleum, 1980) prepared several reports on possibilities, or lack thereof, of aquaculture in the ABC's.

In 1980 the islands governments of Curaçao, Aruba and Bonaire decided to join together in a project to breed and release Karko (queen conch, *Strombus gigas*). Research carried out at the University of Miami's Rosenstiel School of Marine and Atmospheric Science had proven that mass culture of conch was a possibility. A small laboratory was built on Bonaire which became operative in 1982. In 1983-1985 close to three million juvenile conch were released. This initial success demonstrated that aquaculture in these islands was well possible. In November 1983 the three governments signed an act which started the Marcultura foundation. Objective of the foundation: investigate and develop aquaculture. Aquaculture development was deemed necessary for the following reasons:

1. Rehabilitation of fisheries where overfishing is occurring.
2. Diversification of economy and increase in foreign exchange earnings.
3. Generate possibilities for culture of aquatic organisms for small holders, fishermen, private entrepreneurs and large investors.

It was felt that an institute geared to the problems of these islands was needed to fulfill the above mentioned goals and to develop or adapt technology applicable to local geographic, economic, and social conditions. Furthermore, a local institute could train low-and mid-level personnel.

#### INVESTIGATIONS

At Marcultura we have investigated several species for economic potential and applicability to culture under local conditions.

#### **Karko (Queen Conch, *Strombus gigas*)**

Karko, a traditional food and delicacy, has been severely depleted. At Marcultura we utilize two systems for larvae culture. The eggs are collected by diving, transported to the laboratory, and washed and placed in carrying nets; finally, these carrying nets are lowered in the rearing vats. We employ two systems; a system where we exchange water when needed and a flow-through system. In the first system densities can achieve 1000 larva/liter, but crashes in the system are frequent. For this system water has to be filtered to 1 micron and treated with ultra violet light. Feeding with unicellular algae cultures is started 4 days after hatching. The larvae are fed four times a day, temperature is maintained at 26°C, and water quality is monitored three times daily. Water exchanges take place at days 10, 16, 23, 30. At day 32 the larvae are induced to metamorphose by adding an aqueous extract of ground corraline alga (*Goniolithon* or *Lithothamnium* species). The metamorphosed conches remain in the tank three days before being transported to outside tanks, where they are fed

filamentous algae and grow to about 5 cm. At this size they are released into the natural environment.

In the continuous flow-through system, seawater is added at a slow rate (turnover rate 50%/day), and larvae are prevented from washing out by a 10 m screen. This system is able to reach densities of 50 individuals per liter. Growth is rapid and larvae are able to metamorphose after 16-20 days. Prior to fishing effort, which in some cases starts within one year after release, preliminary results indicate survival rates in excess of 70% after release .

### **Shrimp**

Several species of penaeid shrimp (*Penaeus vannamei*, *P. durarum*, *P. schmitti*, etc.) were tested for survivability, growth, feedconversion, maturation, fertility, hatching rates, larval growth, post larval growout, and productivity. *P. vannamei* gave the best results. We have achieved maturation of this species under natural conditions and have gone on from one importation of broodstock to produce six generations of shrimp. These results indicate that seedstock would not be a problem and that maricultura could produce post-larval shrimp for grow-out and export. Therefore, a plan was presented to the board of directors to set up a pilot scale hatchery and shrimp farm. This plan was accepted, and financing has been given by the Dutch development funds for Aruba, Bonaire, and Curaçao.

### **Fish**

Since there is a wealth of existing technology which could be adapted to local usage and since these fishes can possibly grow in saltwater, we chose to investigate *Tilapia*. We are presently engaged in research to identify the species or hybrids which give the best results and to devise a valid cost/benefit analyses. One problem with growing consumption fish, which are not to be luxury items, is that the cost per unit effort has to remain relatively low. For ornamental fish on the other hand the cost can be much higher. As fresh water is extremely expensive in these islands, methods have to be found to utilize freshwater as economically as possible. For instance one possibility is for vegetable farmers to grow a crop of ornamental fish in the same water which is to be used to irrigate their land.

### **FUTURE PROSPECTS**

Work has already begun to explore the feasibility of aquaculture in the ABC islands. The present site was chosen because of its accessibility for people and utilities; however, the area used is too small (1500m), and there is no possibility to expand. On the north-east coast of Bonaire we have found an excellent area of 22 hectares. Currently we are in the preparatory phase, and hope to start building in March 1988. The objectives of this new facility are:

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1. To continue conch production, and possibly sell juvenile conch throughout the Caribbean.
  2. To set up a small commercial shrimp hatchery and growout.
  3. To set up pilot scale fish cultivation units.
  4. To train people.
  5. To continue to do research in aquaculture.
  6. To generate results which can be used by financial institutions to finance developers interested in doing aquaculture.

Successful aquaculture in Aruba, Bonaire, and Curaçao is possible, but it is not only dependent on the choice of species to be cultured, but even more on the human, technical, and economic parameters of particular projects.

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