BREEDING MARINE AQUARIUM ANIMALS:

The Anemonefish

VERONICA R. ALAVA
and LUIZ A. O. GOMES

The aquarium fish industry is a fast-growing and promising enterprise in many countries. The USA alone imports over US$500 million worth of ornamental tropical fish yearly; and aquarium-keeping is said to rank second to photography as the largest hobby. It is also a popular hobby in Canada, western Europe, South America, the Middle East, Japan, Singapore and Taiwan.

However, the increasing demand for marine aquarium animals has led to over-exploitation in tropical seas. Collectors often resort to cyanide poisoning for easy harvest. Aside from delivering "sick" fish to the market abroad, these illegal practices kill large numbers of fish and invertebrates, destroy reef areas and lower their productivity, thus severely reducing the livelihood of small fishermen and causing heavy losses for tourism. Protective management of reefs and aquaculture are badly needed.

Freshwater aquarium fish have been extensively bred in captivity, but there have been few developments in breeding marine aquarium fish. Within a few years, however, faster developments are expected, considering the demand, the high price and advances in the reproductive manipulation of marine fish.

Aquaculture may be the answer to the demand for live tropical marine aquarium animals

Anemonefish

The pomacentrid *Amphiprion* is comprised of several species of marine reef fish, commonly known as clownfish or anemonefish. Distributed in tropical and subtropical seas, anemonefish are omnivorous and attain a standard length of about 100 mm, depending on the species. They are popular among marine aquarists all over the world because they are generally small and hardy, have attractive colors, are highly adaptable to life in captivity and display interesting behavior.

One of their singularities is their common dependence upon an anemone host. Sea anemones sting their prey with poisonous nematocysts embedded in their tentacles, then draw the victim into a saclike digestive opening to be eaten. When the anemonefish feels threatened, it quickly dashes into the sanctuary of its host anemone.

Experiments in breeding anemonefish

In 1987-1988, we conducted studies on breeding anemonefish at the Southeast Asian Fisheries Development Center, Aquaculture Department (SEAFDEC AQD), Philippines. We successfully reproduced the species *Amphiprion clarkii* and *Amphiprion percula*.

The fish apparently form lifetime pairs and, being territorial, drive away other fish which venture close to their nest. In a pair, the male is smaller than the female. They may spawn year round and most of the species of this genus do not show sexual dichromatism.

We collected broodstock of these species from the reefs of Guimaras and Panay Islands in the Visayas, Philippines, and maintained them in conditioned seawater tanks. We observed their courting, nesting and spawning behaviors. Swimming side by side, each pair quickly and repeatedly ascends and descends near the future nest site, biting and nudging each other and sometimes jerking their bodies. Later, one or both fish clean the future spawning site.

The fish spawned several times during the study between 1300 and 1800 hours. No clear relationship with the lunar cycle was observed. With refinement of techniques, we were able to obtain spawnings every 10 to 12 days per pair for both species. Depending on their size, the females each spawned about 400-1,500

*A Black Clownfish (*Amphiprion melanopus*) in the sanctuary of its host anemone (Photo courtesy of the Aquarium de Noumea, New Caledonia)*

eggs per cycle. They deposited capsule-shaped eggs in nearly rounded patches.

Approximately 2-3 mm long with a diameter of 1 mm, each egg adhered to the substrate through a stalk. Newly spawned eggs were bright orange because of the yolk. As the embryo developed, these turned dark brown and later silvery, the color of the larvae's large eyes. During the incubation period, the male carefully looked after the eggs.

In 6-7 days, at 28-30°C, the hatchlings emerged, tail first. Invariably, hatching took place shortly after sunset and we could manipulate light to advance or delay hatching. We experimented with different concentrations of thyroxine hormone which proved to influence egg development and hatching rates. (The results are being prepared for publication.)

The newly hatched larvae measured 4-5 mm in length. Each had a transparent body, large eyes, visible mouth and a small yolk sac. As soon as they hatched or a few hours after, they were free-swimming. Initially, we fed them *Brachionus plicatilis*, gradually shifting to *Artemia* sp. nauplii. To keep the water green, we added a mixed culture of phytoplankton.

At day 8-9, the first signs of normal coloration appeared. At day 15-17, most fry resembled juvenile-adult fish and began to shift from partially pelagic to epibenthic behavior. They started eating minced shrimps, fish flesh, mussel meat, etc. (artificial dry diets may also be fed during the larval stage) and began searching for shelter or possible anemones for their home. For further studies, we have formulated coloration-enhancing microparticulate diets for the larvae.

Prospects for aquaculture studies and application

Based on the results of our study, we believe that anemonefish (and other marine aquarium fish) are candidates for reproductive physiology research. Anemonefish produce large eggs and larvae, may spawn frequently in captivity, are hardy to handle and can be maintained in small tanks, making their study very promising. *Amphiprion* spp. also show fascinating reproductive behavior.

Besides, much of the knowledge on inducing reproduction in fish was gathered from aquarium fish, like goldfish (*Carassius* sp.), guppy (*Poecilia* sp.), and other freshwater fish, like catfish (*Clarias* sp.), trout (*Salmo* sp.), carp (*Cyprinus* sp.), etc. Anemonefish are marine by nature and may be closely related to other marine fish which have been receiving increasing interest for aquaculture purposes.

Despite the problems involved, we believe that the culture of marine aquarium fish and other animals, will become more popular. Experience in breeding these can help improve techniques for induced spawning and larval rearing of other valuable food fish. The future holds great potential for tropical marine aquarium animals. In any business, diversification is important, and certain marine reef animals can serve as alternative culture species in commercial shrimp and fish hatcheries.

Aquaculture may be the answer to the demand for live tropical marine aquarium animals. (Interested persons may contact the authors for more information.)

VERONICA R. ALAVA is a Research Associate of SEAFDEC AQD (P.O. Box 256, Iloilo City, Philippines) involved in finfish and crustacean nutrition and feed development research; LUIZ A. O. GOMES, a native of Brazil, completed his M.S. in Fisheries at the University of the Philippines in the Visayas. He is currently in Taiwan conducting aquaculture studies.