Reef fish post-larvae collection and rearing programme for the aquarium market

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Report on the first year of operations at the AquaFish Technology farm in French Polynesia

This reef fish and invertebrate post-larvae collection and rearing programme was launched in 1999 by AquaFish Technology, a company based in Pérols, France, with the establishment of the AquaFish Technology pilot farm on Moorea Island, French Polynesia.

Like most marine organisms, reef animals experience a pelagic dispersal phase at the beginning of their life cycle, in the form of countless larvae. The purpose of this project is to collect the oldest larvae ('post-larvae') as they return to the reef environment to develop into juvenile fish or benthic invertebrates.

The project was designed after a scientific experiment carried out in 1978 involving American, Australian and French scientists that had made it possible to quantify the mortality occurring after the colonisation of coral reefs by larvae. This experiment on a species of unicornfish (*Naso unicornis*) in Moorea, French Polynesia demonstrated that 90% of the larvae reaching the reef have disappeared one week after their arrival. It was calculated that post-larvae mortality during the first 24 hours was as high as 60%. This experiment was repeated at various time scales and on other species by the French team at Moorea, in order to validate the feasibility of collecting post-larvae prior to reef colonisation. In this way, fish that would not otherwise have developed were 'saved'. Also, the reefs and their inhabitants remain intact, which is compatible with better conservation of fish already living in the protected marine area, which act as natural larvae spawners. The impact in terms of biomass loss for predators remains limited to the biomass taken, which is generally less than 1 kg per day.

Funding for this programme was provided by the AquaFish Technology company with assistance from the *Agence française de l'innovation* (ANVAR – French innovation agency) and the French Ministry of Research and Technology. In 2000, this technique was given 'good coral reef practice' status by the International Coral Reef Initiative (see their website: www.icriforum.org).

The pilot farm built in 2000 on Moorea Island was commissioned in late 2000 and production began on a regular basis early in 2001. The purpose of the farm was to demonstrate the technical and operational feasibility of this innovatory and environmentally safe process of exploitation and sustainable management of marine resources.

The commercial objective for the first year was the production of aquarium fish from collected larvae, essentially for the French market.

The collection technology is based on crest nets designed by the EPHE research team of Perpignan, France and the *Centre de Recherches Insulaires et Observatoire de l'Environnement* (CRIOBE, Moorea) extensively enhanced by AquaFish Technology.

A total of 25,000 aquarium fish were exported from French Polynesia to France in the first year. The fish were exported when they were fairly young so as to finish off their growth at a second AquaFish farm at Pérols. The first fish exported were low commercial-value species in order to test mortality at every stage of production. Then, once weaning and growth techniques had been mastered, exportation of the valuable species could begin.

Also, the number of fish post-larvae collected on the reef was much greater: some 50,000. Of this number, half were released alive on the reef because they were not export species. These species were predators such as snappers targeted by local fishers and species with no economic importance that could be re-introduced into this environment (cardinalfish, goatfish, etc).

As a result of the large numbers of fish released, AquaFish decided to develop the restocking activity by enabling species with potential value locally to be re-introduced into the environment after a short period of tank storage and feeding to satiation on live food. After having captured and reared thousands of post-larvae from over 150 species, we have clearly identified the transition stage from pelagic to reef behaviour for each species. We believe that the persistence of pelagic behaviour is highly prejudicial to the survival of fish in the natural environment and must be the cause of the very high predation observed during the early days of

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life. Thus, by keeping the fish for 48 hours in our farms and feeding them copiously on live food (plankton) we see the fish rapidly adapt to a benthic environment. They are then released into the natural environment. We are now going to monitor the fish released in 2002 with CRIOBE.

The species to be farmed showed promising growth rates. The great diversity of the species collected prompted us to implement multi-species rearing programmes, which is a new venture for aquaculture. However, we also noted the benefits of certain species associations. We worked extensively on weaning so as to deliver fish totally accustomed to inert food. To do so, we developed a specific feed making it possible to double the growth rate of certain species (damselfish and lionfish) as compared to rates obtained with industrial pellet-type feeds.

We also observed that the behaviour of species kept in captivity from the larval stage was like that of domestic animals. In other words, they behave differently from their older wild counterparts, even when they are kept under similar conditions. A striking example concerns the Holocentridae family, which lives in open water in aquaria, even when cover is available, and which are therefore more compatible with the interests of aquarium lovers.

Generally speaking, the species are more gregarious, accept much more varied food and are less sensitive to the stress effects engendered by this activity (especially delivery by air). The main consequence is a big reduction in mortality, usually 20–30% with this activity, which reduces in this case to 5%, for a much longer tank storage time.

Our efforts also revealed the essential influence of the quality of the environment for raising post-larvae. All the hatchery specialists know that water quality, food, light and other parameters (noise, daily feeding cycle) are essential to the development of the early larval stages. This is also true of reef fish post-larvae and water supply equipment must be top quality, otherwise many diseases may develop, in particular immediately after collection. These come from skin wounds or parasites.

The consequence is also that this type of collection work will continue for some time to be done by people with sufficient technical knowledge to handle it. The risk is of course that the larvae collected experience very high mortality, which would lead to overfishing to offset the losses. This would already appear to be the case for juvenile groupers (see article by Y. Sadovy, this bulletin, #8) while careful handling can considerably reduce mortality during collection and appropriate equipment can then provide suitable transport and tank storage.

Commercially speaking, the benefits of reef fish husbandry were enough to make the company well known quickly. Then the quality of our fish did the rest. Today, demand is much greater than what we can supply. This prompts us to develop a network of collection sites entirely based on this technique to expand and diversify our range.

As regards the other potential uses of this technique, we wish to develop the rearing of post-larvae of aquaculturally suitable species. We sold 4000 young groupers (*Epinephelus merra*, the only consumed local species) to a local fish farmer last year after one month of fattening. We also collect snappers, kingfish and other carnivorous species. However, French Polynesia is poor in sought-after species like the grouper, and we wish therefore to develop the local fattening of species like the unicornfish, which the local people like very much. The advantage of these fish is that they are herbivorous, meaning that they can be reared with cheaper and more environmentally appropriate food than the trash fish. Also, contrary to the grouper, the herbivores are more gregarious and clean the tanks by browsing on the algae. Lastly, in addition to the local population, many Latin residents also like this kind of fish. Our activity will therefore diversify through the development of larvae from products with less added value than aquarium fish, but which are popular locally and which would also make it possible to develop a form of aquaculture compatible with cheaper feeds.

The programme in French Polynesia will continue in 2002 with the development of a second farm entirely based on this technique and which was built in record time, taking into account the experience acquired in Moorea. This farm already produces several thousand fish per month and in particular species in great demand on the aquarium fish market. The case of the butterflyfish, which is difficult to rear in captivity, is a good example. This family is not used by the local population and its price as a farmed fish makes it an asset in our activity. The fish have recently been offered on the American market on which French Polynesia, by its geographical location, possesses an undeniable advantage.

AquaFish Technology has developed a new generation of post-larvae collectors (crest nets, light-traps) that enable collection work to be done at many reef locations. The collectors who wish to use this promising and environmentally sound method will be able to capitalise on the experience and the unique technology of AquaFish Technology. The main benefit for local communities will be the truly sustainable development of this new use of reef resources, through respect for the fauna and its environment.