MARINE ORNAMENTALS

Captive Culture Progress At Oceanic Institute

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The abundance of yellow tangs in Hawaii supports wild collection to supply the aquarium trade.

Flame angelfish (top left) and Potters angelfish are top ornamental fish exported from Hawaii's reefs.

Hawaii, USA, is a major supplier of marine ornamental fish to the worldwide aquarium trade. At present, most marine ornamental species traded on the world market cannot be reared in captivity due to bottlenecks in captive production. With funding from the National Oceanic and Atmospheric Administration and the Center for Tropical and Subtropical Aquaculture, however, the Oceanic Institute (OI) is working to overcome those bottlenecks to meet the future demands of the growing industry.

Main Species

Flame and Potters angelfish and yellow tang have become the major ornamental species of focus at OI in Waimanalo, Hawaii, USA, since they perennially rank as the top ornamental fish exported from Hawaii's reefs and are good representatives of many difficult-to-rear species.

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The Potters angelfish, *Centropyge potteri*, is the more commonly collected pygmy angelfish species in Hawaii, while the less-abundant flame angelfish, *Centropyge loriculus*, is generally transhipped from Christmas Island through Hawaii. The brilliant yellow tang, *Zebrasoma flavescens*, is extremely abundant in Hawaii. Wild collection of these fish suppies the aquarium trade worldwide.

Major Bottlenecks

Two major bottlenecks have impeded the progress of captive rearing these species over the last several decades: captive reproduction and the delivery of sufficient quantities of high-quality eggs for larval-rearing research, and a lack of appropriate diets for the very small mouth sizes seen in pelagic larvae of many high-value species.

Captive Spawning Research

Broodstock populations of *Centropyge* angelfish and yellow tangs ob-

Pygmy angelfish proved relatively easy to spawn and within several month were producing good numbers of viable eggs.

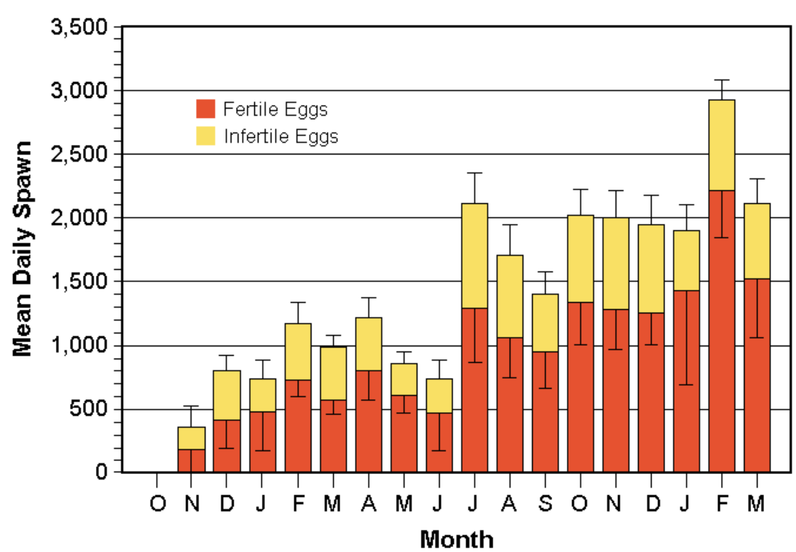
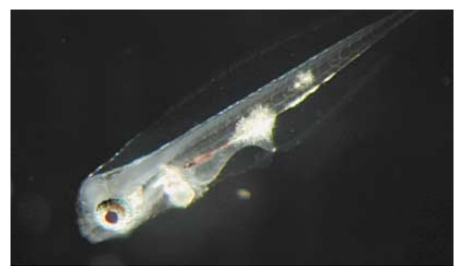


Figure 1. *Mean daily egg production per tank from captive flame angelfish broodstock, from stocking in October 1999.*

Tank size affected egg production and fertility in Centropyge *angelfish. Relatively large 750-l cylindrical tanks are now used for* Centropyge broodstock.

After screening a range of small zooplankton, researchers isolated a local Parvocalanus *sp. copepod as an effective first feed for the world's first captive-reared flame angelfish.*

Flame angelfish juvenile at day 25.



Prefeeding yellow tang larva.

tained from the pet trade or by collection in local waters were established in flow-through tank systems at OI's Makapuu campus under ambient photoperiod and relatively constant water temperatures of 26-27° C throughout the year.

The stocks were fed mixed diets composed of a complex variety of raw components including shrimp, krill, squid, and seaweed supplemented with artificial flaked food. Under these protocols, the pygmy angelfish proved relatively easy to spawn and within several month were producing good numbers of viable eggs (Figure 1). The size of the *Centropyge* broodstock tank system had a large effect on egg production and egg fertility rates, which led to the relatively large 750-l cylindrical tank system used today.

Varied Spawning Results

Both *Centropyge* species successfully spawned throughout all months of the year, with spawn sizes as large as 5,000 eggs/female recorded. Several pairs of flame angelfish spawned every day of the year for several years running, while the Potters angelfish appeared to exhibit several breaks in spawning activity. Current research is focusing on optimizing diets, photoperiod, and water temperature, and switching to water reuse systems for long-term stock health and egg quality.

Yellow tangs proved considerably more difficult to spawn in captivity. However, captive spawning populations of the fish have been established at the Makapuu campus, yielding the first glimpses of delicate yellow tang larvae. An intriguing finding was that in captivity, yellow tangs demonstrated a cyclical pattern of spawning with maximal egg production centered around the full moon each month. However, despite spawning throughout the year, most tang spawns yielded infertile eggs with mean fertility rates below 5%, which has limited larval-rearing research efforts.

Rearing Ornamental Larvae

The second bottleneck addressed was the rearing of the extremely small pelagic larvae characteristic of angelfish and tangs. The mouths of these and many other marine fish larvae are simply too small to consume conventionally cultured prey such as rotifers and *Artemia*.

After several years of screening a variety of small zooplanktonic prey, OI researchers isolated a local species of calanoid copepod whose nauplii stage proved effective as a first feed for small red snapper and bluefin trevally larvae, as well as the world's first captive-reared flame angelfish.

Conclusion

Although there is considerable work ahead to make captive culture technology for marine ornamental species commercially viable, recent successes in spawning and larval rearing at the Oceanic Institute have generated excitement within the industry. It is believed the resulting technology will help wean the industry from its current primary dependence upon wild collection, further propagate the hobby, and assist in sustaining coral reef environments worldwide.

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