Breeding *Coryphopterus personatus* in Aquaria
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Introduction

One of the first problems often encountered in the first larval rearing attempts of marine fish species, is finding an appropriate first food. Although rotifers, particularly those of the genus,*Brachionus* are probably the most important and widely used first food in marine fish culture today (Hoff and Snell, 1993), many species will not eat them (Young, 1995). Rotifers often constitute a major portion of the zooplankton in estuaries. Therefore it is likely that many fish species whose larval stages develop in estuaries are adapted for utilizing them as a first food (Hoff and Snell, 1993). Stomach content analyses of oceanic species such as groupers however, have revealed a larval diet dominated by copepods (Grover et al.,1998). Young (1993) states, after more than 20 years of rearing marine fish, that there are two major factors influencing prey selection in marine fish larvae: prey size relative to mouth size, and prey movement. Our inability to provide live foods of appropriate size and exhibiting an appropriate swimming motion to elicit a feeding response, may be a major impediment to the advancement of aquaculture.

The purpose of these experiments was to investigate the Carribean goby, *Coryphpterus personatus*, as a candidate for commercial production at a marine ornamental fish hatchery in Puerto Rico. This paper describes the development of a technique for feeding and rearing the larvae of *C. personatus* which was found in early trials, not to accept rotifers as a first food.

Materials and Methods

Five adult specimens of *Coryphopterus personatus* were placed in a 20 gallon aquarium with three 2-inch lengths of 1-inch PVC pipe. The aquarium was part of a 5000 gallon broodstock system consisting of 200 20 and 40 gallon aquaria. Central filtration was achieved with two Magnum‘ 1/2hp Jacuzzi pumps and a 400 gallon sump. One pump circulated water between the sump and aquaria with approximately 20% flow being bypassed through a foam fractionator (protein skimmer). The other pump circulated water between the sump and the remaining filter elements which included, in series, a Hayward‘ rapid sand pool filter, an ultraviolet sterilizer (six bulbs, 48" each), and an 800 gallon container filled with plastic bio balls. The broodstock system was maintained at ambient temperature (23-30 C) in a semi-enclosed greenhouse. Broodstock fish were fed four times per day with a gelatin-based diet containing a variety of fresh seafood and vegetables, kelp meal, powdered *Spirulina*, lecithin, pelleted salmon food and a multi-vitamin formulated for marine fish.

16 days after the *C. personatus* were introduced into the system, a spawn of approximately 300 eggs was found in one of the PVC pipes. Although the eggs were not accurately counted or measured, initial inspection revealed that they are considerably smaller than eggs of *Gobiosoma*species. This first spawn was left in the broodstock tank and sacrificed in order to determine incubation time. On the morning of the sixth day, the eggs were gone and a few Larvae were observed in the aquarium. Three larvae were removed and measured (approximately) under a dissecting scope, at 2 mm.

Three days after the first hatch, another spawn was found and estimated to be about 20% larger than the first spawn. On the afternoon of the fifth day after spawning, the PVC pipe containing the eggs

was removed and placed in a 300 gallon, round black polyethylene larval rearing tank filled with sterilized seawater and pre-inoculated with Isochrysis galbana and six million rotifers (*Brachionus plicatilis*). A ceramic air stone with moderate flow was placed halfway down the center standpipe. The PVC pipe was suspended vertically, one inch below the surface and a second air stone with light air flow was positioned just below it, so that the entire interior of the pipe was brushed with a slow, steady stream of bubbles. The larval rearing tank was part of a 30,000 gallon system with filtration identical to that of the broodstock system except that the bio ball filter was replaced with an 800 gallon fluidized bed filter utilizing beach sand as the filter medium. Tanks in trials 1-6 of this experiment were never connected to the system. The only water exchange in these tanks was in the form of daily additions of approximately 20 gallons of moderately dense Isochrysis in seawater. Pelagic microalgae acts as a natural water conditioner and food for planktonic larval foods such as rotifers. No attempt was made to count algae cells. The system was outdoors and covered with 85% shadecloth.

The next morning, the spawn was found to have hatched completely and larvae were observed drifting around the tank, evenly dispersed. By the afternoon of day 2, post-hatch, the larvae were exhibiting negative phototaxis, congregating in the shadow of the tank wall. At this time, they also began to exhibit hunting behavior, swimming up to rotifers and other particles in the water column and occasionally striking at them; however no successful strikes were observed and microscopic examination of three larvae revealed no food in their digestive tracts. By day 5, post-hatch, the number of larvae appeared to be in decline and by day 7, no larvae could be found in the tank.

For the remainder of these rearing trials, a spawn of approximately 300-500 eggs was encountered in the adult tank every 7-10 days. No further attention will be given to spawning in this paper.

Trials 2-6 were treated exactly as trial 1 except that rotifers were replaced with a variety of unidentified ciliate species, ranging in size from 25m to 80 m. The ciliates were obtained from contaminated rotifer cultures by passing culture water through 2 consecutive Nitex‘ sieves of 80m and 25m , respectively. This procedure was repeated each morning. Ciliate concentrations in the larval rearing tanks were counted twice each day under a dissecting microscope, and averaged 20 organisms/ml, one hour after feeding, and 3/ml immediately before the next feeding, 24 hours later.

In trials 2, 3, 4 and 6 no larvae were seen after day 7 post-hatch.

In trial 5 larvae were observed eating after day 3. At day 10 the number of larvae appeared to be significantly reduced and no growth was apparent. On day 12, only 3 larvae were seen. The last larva was spotted in the beam of a flashlight on the night of day 15.

At the beginning of trial 7, a contaminating dinoflagellate caused the *Isochrysis* cultures to crash. As a result, an algae substitute was developed in order to sustain zooplankton populations in larval tanks. The preparation consisted of 3g of powdered *Spirulina*, 1g of Protein Selco‘ and 2 cups of water, blended in an electric mixer for 1 minute. For trial 7 this preparation was used daily in place of *Isochrysis*. Ciliates were added on day 1, using the technique described above. On day 2 no new ciliates were added as the concentration in the rearing tank was found to be greater than 20/ml. The ciliate concentration remained high (greater than 10/ml) through day 20. Additionally, rotifers appeared in the tank and were at a concentration of 12/ml by day 20, although no rotifers were intentionally introduced.

On day 20 larvae were observed feeding on rotifers, although it is likely that they had already been eating rotifers for several days. On day 21 water in the larval rearing tank was tested for ammonia using an Aquarium Systems' ammonia test kit, however an accurate measurement could not be achieved as the ammonia concentration in the tank exceeded the range of the kit. The tank was immediately connected to the larval rearing system and the water supply was opened sufficiently to acheive an exchange rate of approximately one gallon per hour (a moderate drip). The water flow was gradually increased over the next five days until a rate of approximately 40 gallons per hour was attained.

Beginning on day 22, 5-10 million rotifers (depending on availability) were added, daily to replace those lost to water exchange and increased fish predation.

At day 40, a large number of fish larvae were still seen in the tank. One fish was removed and measured at 8mm. A small number of one-day-old *Artemia* nauplii were introduced into the tank and were rapidly consumed. Beginning on day 40 three feedings of approximately 250,000 *Artemia*nauplii would be administered each day. All *Artemia* were enriched for at least 12 hours with Protein Selco' prior to feeding. Rotifer additions to the larval rearing tank were discontinued after day 45.

On day 58, several fish were found to have taken on the pale, silvery-orange, characteristic of adult *C. personatus*. Approximately 90% of the fish had undergone the change at day 65, and by day 68, metamorphosis appeared to be complete. Between days 58 and 70, 14 dead larvae and juveniles were found and removed from the tank. These were the only mortalities observed in trial 7. Gradually, over the next 3 weeks the water flow rate was increased to 200 Gallons per hour and the juvenile gobies were weaned onto a diet of commercial dry food.

Results and Discussion

Ten months after trial 7 began, 544 adult *C.personatus* were counted, moved into a new tank and sold on the wholesale market for $7.50 each. The procedure described for trial 7 was repeated three more times with *C. personatus* and once with *C. dicrus*, with nearly identical results achieved each time. The procedure was also repeated numerous times with the small larvae of *Ptereleotris zebra* , *Liopropoma eukrines* and *Gobiodon citrinus* with zero survival after day 10, each time.

Since no serious effort was made to identify the many species of zooplankton present in the larval rearing tanks in these experiments, it is impossible to say what the larvae were feeding on prior to accepting rotifers. Although the reasons for larval survival in trial 7 remain unknown, here are three likely possibilities : 1. The algae substitute stimulated a bloom of some ciliate species that were an acceptable food for larval *C. personatus* and were not available in sufficient numbers in the presence of natural algae; 2. the algae substitute, fed on by ciliates acted to enhance the nutritional value of the ciliates, making them a healthier diet; and 3. the larval fish ingested the algae substitute, directly. Our inability to successfully rear the larvae of *P. zebra ,L. eukrines* and*G. citrinus* using this technique, may have resulted from a lower tolerance for elevated environmental ammonia concentrations in these species, or from specific dietary requirements which as yet, have not been met. These are questions to be answered in future investigations.

Literature Cited

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