Fish Breeding Program at Hofstra University

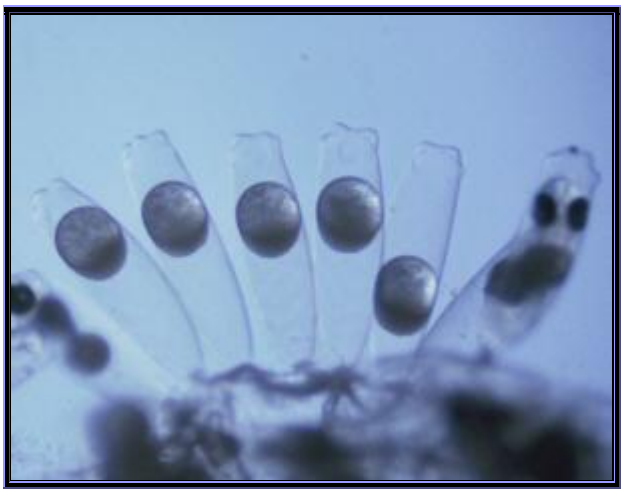
by Todd Gardner

Systems were constructed and a protocol implemented for the captive culture of gobies and other small marine fish species. To date,14 species, including 6 gobiids have spawned and been reared at our facility. The relatively inexpensive procedure described here has become a valuable tool for gathering developmental data to be used in the reorganization of gobiid systematics.

Introduction

Comprised of approximately 2000 species, the Gobiidae is the largest family of marine fishes (Robins et at.,1987) and probably one of he largest vertebrate families. Gobiids are an important component of the aquarium fish industry throughout the world (Burgess et al., 1988) and in some cultures, are used as food (Fishbase, 2000).

Despite numerous investigations, information regarding egg and larval development remains relatively scarce (Moser, 1983). One problem with many early life history studies on gobies and other marine fishes to date, is that larval specimens have historically been obtained from the wild, in plankton samples (Moser,1983; Van Tassell,1998). Larval fishes collected in this manner are often physically damaged and their exact age can be impossible to determine. The use of aquaculture techniques to spawn and rear marine fish species in the laboratory allows us to look at eggs and larvae at every day in their development, as well as courtship and spawning behaviors of mature adults. Furthermore, information gathered from laboratory culture investigations can be a valuable resource for people interested in developing aquaculture as an environmentally sound alternative to the exploitation of wild fisheries.



At the Hofstra University Marine Laboratory in Hempstead, New York we have constructed systems and initiated a protocol for the captive cultivation of gobiids and other small marine fish species. Presently two broodstock systems capable of holding a total of 36 spawning pairs of fishes are in place. Although a 300-gallon larval system of cylindrical polyethylene tanks is under construction, larvae are currently being raised in 10-gallon aquaria. The rotifer, *Brachionus plicatilis* , is used as a first food, followed by nauplii of *Artemia salina* , then commercially prepared dry foods. The marine alga, *Isochrysis galbana* is used as a water conditioner and as food for the zooplankton.

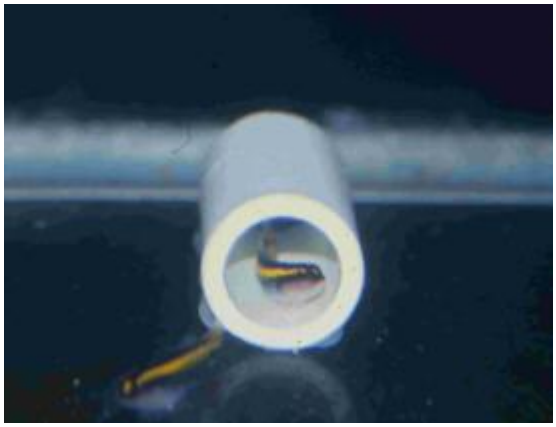
Broodstock Systems

Two systems, system A and system b (Figures 1 and 2, respectively), were built to hold pairs of mature fishes. System A consists of 7 10-gallon aquaria and 6 29-gallon aquaria. System B contains 5 10-gallon aquaria and 12 5-gallon aquaria. The number of aquaria in each system was determined by available space on the support structures that were scavenged for the project. The

filtration in each system is comprised of an open-cell foam prefiler, a 2100 cubic centimeter trickle filter with plastic Bio-balls and a 150cm x 10cm, cylindrical, acrylic protein skimmer (figure 3). All compenents in each system are powered by an 1800 gallon per hour (gph), Mag-drive submersible pump. All return lines and drain lines are constructed of standard PVC pipe and fittings (figure 4). Water flow to each tank is controlled by a 1/2 inch PCV ball valve. A lustar breeder box is placed in each 10-gallon tank allowing us to keep 2 spawing pairs in those tanks without danger of territorial aggression.

Broodstock specimens were collected by the authors in Puerto Rico, Panama, Honduras, Florida, and New York, or obtained from aquarium retail stores.

The broodstock is fed 3 times per day, once with each of the following foods: (1) a frozen, gelatin-based diet prepared with a blend of fresh seafood, vegetables,marine algae, Zeigler's salmon starter and a multi-vitamin suppliement; (2) a finely-chopped mixture of clams, shrimp, squid and capelin roe; and (3) frozen,HUFA- enriched *Artemia*.

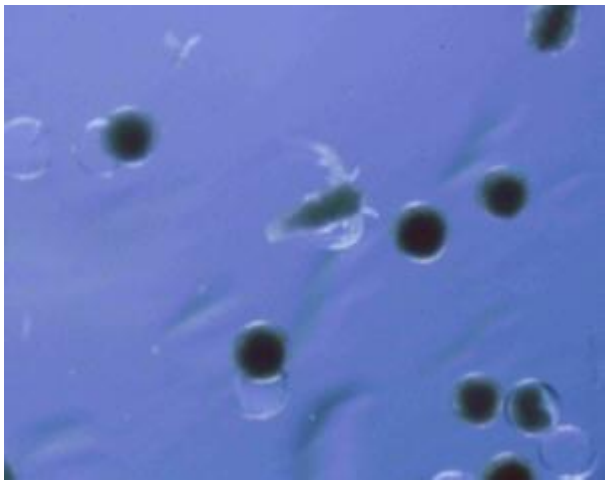


A short length of 1/2 inch PVC pipe is placed on the bottom of each enclosure to serve as a spawning substratum (figure 5). Eggs are adhered to the inside of the pipe by the female and fertilized externally by the male. The male then guards the eggs until hatching, which is usually 3-7 days, depending on the species and temperature. For studies of egg development, 2-5 eggs are removed from the pipe each day for microscoic examination and photography. For larval rearing investigations, eggs are visually inspected daily, but never physicaly disturbed until ready to hatch. At this point the entire pipe is removed from the aquarium and held under water in the larval rearing tank while water is gently pipetted over the egg mass to induce hatching. Goby eggs are considered ready to hatch when the eyes become fully pigmented and the yolk sacs are no longer visible.

Larval Rearing

In preparation for hatching, a 10-gallon larval rearing tank is filled with synthetic seawater (Instant Ocean) at a salinity of 30 parts per thousand (ppt) and gently aerated through a ceramic airstone. Then 1 liter of concentrated*Isochrysis* and approximately 40,000 rotifers, or enoughto bring the concentrationto 10 rotifer/ml, are added. After hatching, the rotifer concentrations is estimated daily by removing 1 ml of water and counting individuals in a depression slide, using the 40x magnification of a dissecting microscope. 1 liter of *Isochrysis* is added to the tank daily, and rotifer concentrations are maintained at approximately 10/ml.

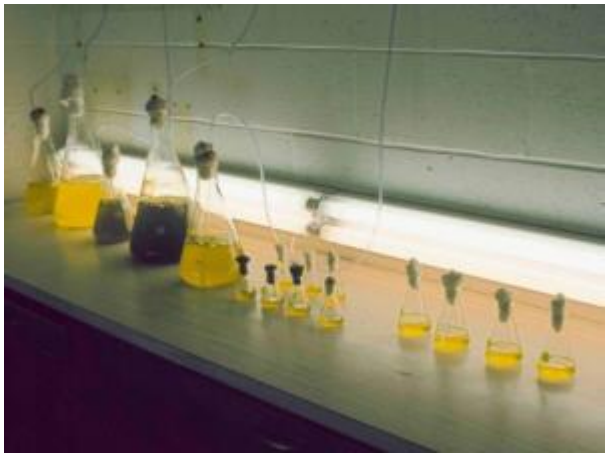
On or around day15 post-hatch, nauplii of *Artemia salina* are introduced to the diet. After a 5-10 day overlap period, the larvae are fed *Artemia* exclusively. All rotifers and *Artemia* are soaked in a commercially-prepared suspension of highly unsaturated fatty acids (HUFAs) for 12-16 hours prior to feeding. Once the rotifer diet has been completely replaced by *Artemia* alga is no longer added, and an air driven foam filte ris placed in the tank to help maintain water quality. Additionaly, a 50% water exchange is performed every 3-4 days by syphoning water out through a section of flexible air tubing inserted into a 500-micron Nitex sleeve submerged in the tank (figure 6). The sleeve functions to prevent larvae from being syphoned out. Replacement water is then syphoned back into the tank from a suspended bucket.



Most of the gobiids we have worked with reach metamorphosis around day 30 post-hatch, although some species such as *Tigrigobius puncticulatum* and *Coryphopterus personatus* can take 50-60 days. We define metamorphosis as a significant increase in pigmentation, usually coupled with setlement from a pelagic to a benthic mode of existence. Around the point of metamorphosis, dry feeds are introduced to the diet and become the exclusive food within 3 weeks. At this point, juveniles from various rearing tanks are consolidated into 29-gallon tanks in system A. During the larval period 2 larvae are removed from each rearing tank daily for observations of osteological development and photographing.

Plankton Culture

The microalga, *Isochrysis galbana* is cultured in an isolated room with fluorescent light banks (figure 7), according to the protocol outlined by Hoff and Snell (1987). Rotifers are cultured in 10-gallong aquaria at a salinity of 25ppt, on a combination of Culture HUFA (tm) from Salt Creek, inc.,and concentrated *Isochrysis* paste from Reed Aquaculture, inc. Culture densities typically range from 100-250/ml. *Artemia* cysts are decapsulated with household chlorine bleach, refigerated in a saturated salt solution, and hatched as needed.



Results and Discussion

As of this writing, 14 marine fish species including 6 species of goby, have been spawned and reared in our systems (table 1). Our ability to adapt commercial aquaculture techniques to a laboratory setting has enabled us to look at early development as a source of character data that has not been previously used in the structuring of gobid systematics.

Literature Cited

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