Notes on the Spawning in the Laboratory and Early Development of the Fish Siganus guttatus (Bloch)*

A. C. Alcala and J. A. Luchavez

The fish *Siganus guttatus*, which grows to 30 cm in standard length and over one kg in weight, is a valuable food fish in the Philippines, much sought after for its tasty flesh. Published studies on this species deal with the distribution of adults, juveniles, and fry in mangrove swamps, bays, estuaries, reef and grass flats, and rivers (Schultz et al., 1953; Lam, 1974; Alcala, 1979; Burgan and Zseleczky, 1979); high tolerance to low salinity (Von Westernhagen and Rosenthal, 1976; Carumbana and Luchavez, 1979a); behavior and food habits (Schultz et al., 1953; Tsuda et al., 1976; Burgan and Zseleczky, 1979; Alcala, 1979; Carumbana and Luchavez, 1979b); and growth rates of fry and juveniles in the laboratory, sea cages, and fish pens (Tahil, 1978; Carumbana and Luchavez, 1979b). Carumbana and Luchavez (1979c) produced a simple manual for culturing this fish in floating sea cages.

Although evidence exists that *S. guttatus* fry are available for culture from mangrove swamps throughout most of the year (Alcala, 1979), it seems preferable to produce fry by artificial breeding, to ensure a continuous fry supply and to prevent depletion of stock (Soh and Lam, 1973; Popper and Gundermann, 1976). This paper reports the laboratory spawning of *Siganus guttatus* and the early development of the larvae.

Acknowledgments

The financial assistance of Filipinas Foundation, Inc. is gratefully acknowledged. Several persons aided in the research and in the preparation of this paper: Esther Carumbana for laboratory observations, Zacharias Generoso for feeding the fish, Moses Alcala for drawing the illustrations, Teodulo Luchavez for photography, and Pacita Raterta for typing the manuscript.

Materials and Methods

The brood stock consisted of twelve individuals, standard lengths 95.5 to 132 mm (mean 109.18 mm), which were collected as fry from a mangrove swamp on North Bais Bay, Negros Oriental. They were probably two months old and had a mean weight of 6.68 g. The fry were reared in a floating cage for six months, after which they were transferred to a

* Contribution of the Marine Laboratory, Silliman University.
3000-liter concrete holding tank where they spawned six months later. The age of the spawners was therefore about twelve months from collection. Sexes of the fish were not distinguishable.

The water in the holding tank was changed at least once a week by draining most of it, then pumping in fresh sea water. The tank was also provided with two small aerators. The fish were fed daily with the algae *Enteromorpha* spp. and *Rhizoclonium* spp. A nipa roof (made from *Nipa fruticans* fronds) was provided to kept out sun and rain. The salinity in the tank was kept at 30 ppt; water temperature ranged from 26 to 27°C. After the spawning, the tank was supplied with filtered flowing sea water daily.

The larvae in the rearing tank were fed primarily with rotifers (*Brachionus*), ciliates (*Euplotes, Didinium*, etc.), and copepods (harpacticoid and cyclopoid). Feeding was twice daily, morning and afternoon, starting on the second day after spawning.

The larvae were examined daily under the microscope; drawings of the different developmental stages were made.

**Results and Discussion**

**Spawning.**

One-day old larvae were found in the rearing tank on March 19, 1980. Spawning probably occurred on March 17, 1980, one day after the new moon. Since our materials spawned only once, it is not certain that spawning normally occurs around the new moon, although two other species of *Siganus* (*canaliculatus* and *argenteus*) appear to spawn around that time (Manacop, 1937; Burgan and Zseleczky, 1979; unpublished notes).

**Larval Development and Behavior.**

It is not known whether the eggs of *S. guttatus* are demersal and adhesive or buoyant and free-floating. The larvae of *S. guttatus* tended to congregate along the sides of the tank away from the aerators, where they were undisturbed by the current created by the bubbles. They were also positively phototactic. When they were discovered, their yolk sacs were distinctly yellowish, in contrast to those of *S. argenteus*, which are transparent. The oil globule was also centrally located within the yolk sac, but it was smaller than that of the latter species (Fig. 1A). The average total length of the apparently one-day old larvae was 1.83 mm.
On the second day, the transparent larvae still contained their yolk and the pectoral fins were beginning to form. Pigmentation on the snout, yolk sac, gut, and ventral region was observed toward late afternoon. The gut was a simple tube (Fig. 1B). Average total length was 2.13 mm.

On the third day, the eyes of the larvae were entirely black; jaws and pectoral fins were well-developed and functional; the yolk was already completely absorbed; gill covers were evident. The gut now had a single loop, and the larvae were observed feeding near the sides of the tank. Average total length was 2.21 mm (Fig. 1C).

On the fourth day, the average total length of the larvae was 2.32 mm (Fig. 1D), and on the fifth day it increased to 2.38 mm. On these two days there were no further significant developmental changes.

All the larvae of *S. guttatus* were reared in the spawning tank outside the laboratory. Because of the limited supply of cultured food, they were given only small amounts of ciliates, rotifers, and copepods. Apparently, their diet was supplemented with wild plankton carried by the water that flowed directly from the sea. The larvae were observed actually feeding on the food organisms. However, all larvae were found dead, floating on the surface of the water, after five days in 30 ppt salinity and a temperature of 26°C. When the dead larvae were examined under the microscope, their guts were seen to contain food.

Our observations show that *S. guttatus* spawns in captivity without being stimulated by hormones. In this characteristic it is like *S. argenteus* (Burgan and Zseleczky, 1979; unpublished data) but unlike *S. verruculatus*, which spawned in captivity only with hormone injections. It is also possible that our specimens of *S. guttatus* were induced to spawn by the process of changing water in their tanks. Experiments continue on six survivors of the twelve adult *S. guttatus* referred to in this paper to determine what factors induce them to spawn under laboratory conditions.

Bibliography

Alcala, A. C., 1979. Ecological notes on rabbitfishes (Family Siganidae) and certain economically important marine animals in southeastern Negros and environs, Philippines. Silliman Journal 26:115-133.


Carumbana, Esther E. and Juleta A. Luchavez, 1979a. Oxygen consumption and short-term effects of reduction in salinity and dissolved oxygen concentration on *Siganus canaliculatus*, *S. spinus*, *S. guttatus*.
and *S. guttatus* under laboratory conditions. Silliman Journal 26:172-186.

---


---


