Breeding of the Sharknose Goby (*Gobiosoma evelynae*) in captivity with a comparison of substrates for spawning

CAPE ELEUTHERA INSTITUTE
Research Sustainable Development Outreach

THE ISLAND SCHOOL cape eleuthera bahamas

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Introduction

Due to overfishing in the Bahamas and its impact on marine ecosystems, aquaculture has been studied as an alternative method for producing fish. Aquaculture has supplemented the growing demand for fish as the worldwide human population continues to increase. Cobia (*Rachycentron canadum*) are the market fish (Figure 1) grown in the aquaculture systems (Figure 2) at the Cape Eleuthera Institute (CEI), the site of the current study.

Although cobia are strong candidates for aquaculture, raising them presents challenges. When cobia are stocked at high densities in cages, they become susceptible to parasitism. Two parasites that have been issues with cobia are *Amyloodinium ocellatum*, a parasite which attacks the gills of cobia and interrupts oxygen intake, and *Neobenedenia girellae*, which causes necrosis around the dorsal head and leads to blindness (McLean *et. al.*, 2008). Treatments for parasitism will become more sustainable replacing chemicals with cleaner fish, a biological parasite control.

Cleaner fish provide a multitude of services to their ecosystems. Sharknose gobies, *Gobiosoma evelynae*, are cleaner fish that live in Caribbean reefs and congregate in cleaning stations to rid clients of ectoparasites, old scales, and excessive mucus (Humann and Deloach, 1989). Gobies breed monogamously and lay adhesive eggs on reefs. In captivity, substrates such as PVC pipes and bivalve shells function as suitable breeding habitats. The eggs, usually 200-250 per spawn, can be easily collected and hatched when they are on substrates (Olivotto *et al.*, 2005). Therefore, if gobies are used as a biological parasite control, a more sustainable method than catching wild gobies must be established.

Providing gobies with a comfortable space to mate can be a challenge while breeding them in captivity. The objective of the current study is to identify which substrates gobies prefer to lay their eggs on. If gobies are provided with optimal living conditions and substrates such as PVC pipes and bivalve shells, then the gobies will breed in captivity.

Figure 1. Cobia (*Rachycentron canadum*) in a tank.

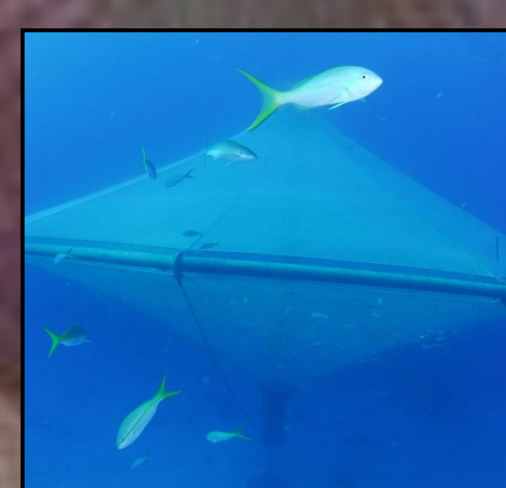

Figure 2. Seastation 3000, Cobia Cage

Methods

Twenty-four Sharknose gobies (*Gobiosoma evelynae*), bought from Ora Farms in Florida, arrived at CEI on March 26th, 2010. The gobies were divided evenly in two 64 L tanks (Figure 5: Alt 1 and Alt 2) for three weeks until they showed pairing behavior. Twelve gobies were then separated into pairs and placed in six 36 L tanks (Figure 5: T1-T6). The pairs were estimated to consist of one larger goby and one smaller goby to ensure one female and one male per tank. Two of the tanks had two bivalve shells (Figure 5: T1 and T5), two had two segments of PVC piping (Figure 5: T3 and T6), and two tanks had one bivalve shell and one PVC pipe (Figure 5: T2 and T4). Tanks were placed so that the substrate combinations were randomly distributed along the piping to avoid creating bias in the results due to the proximity of the tanks to the filters.

Five minute observations of the gobies were completed daily, which included recording the amount of time the fish spent together and on substrates. The gobies were fed *Artemia* and Fin Fish Starter Diet from Aquatic Systems, inc. until satiation in the morning and afternoon respectively. Dissolved oxygen levels, temperature, salinity, and behavioral observations were taken during each feeding. Twice a week ammonia and nitrite levels were measured. Whenever there was any amount of ammonia or nitrite, roughly 40% of the water was changed. The temperature was kept at 25±4˚C and salinity levels ranged from 31.4 ppt to 40.0 ppt. When the salinity exceeded 40.0 ppt, fresh water was added to the sump to reduce the salt concentration. The dissolved oxygen level varied between 4.45 to 7.9 mg/L. The pH ranged from 8.02 to 8.13. Gobies were exposed to natural light approximately 13 hours each day and were kept in a recirculating system as shown in figure 1.

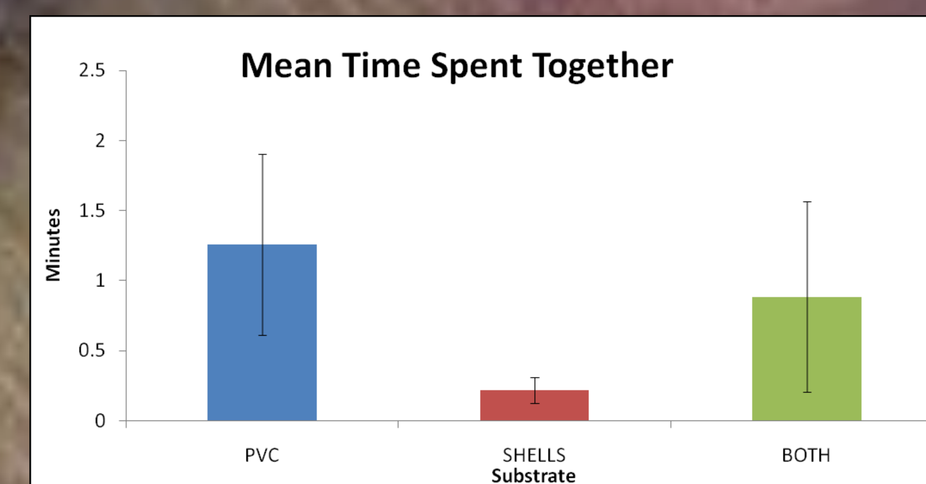

Figure 6: The mean time spent together for tanks with PVC, bivalve shells, and both substrates. The error bars represent standard deviation.

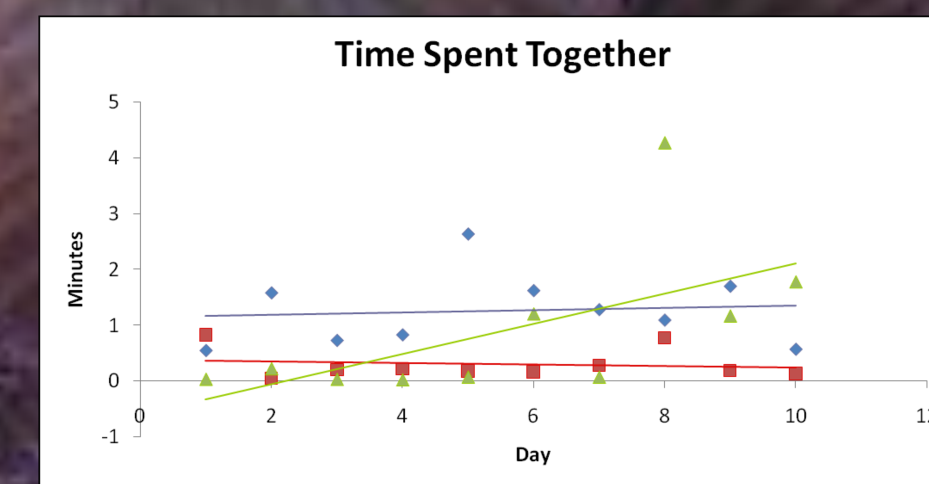

Figure 7: The time gobies spent within one inch of each other. The individual data is represented by the points, and a trend line was added to suggest possible patterns in behavior. The blue represents PVC, red represents shells, and green shows tanks with both substrates.

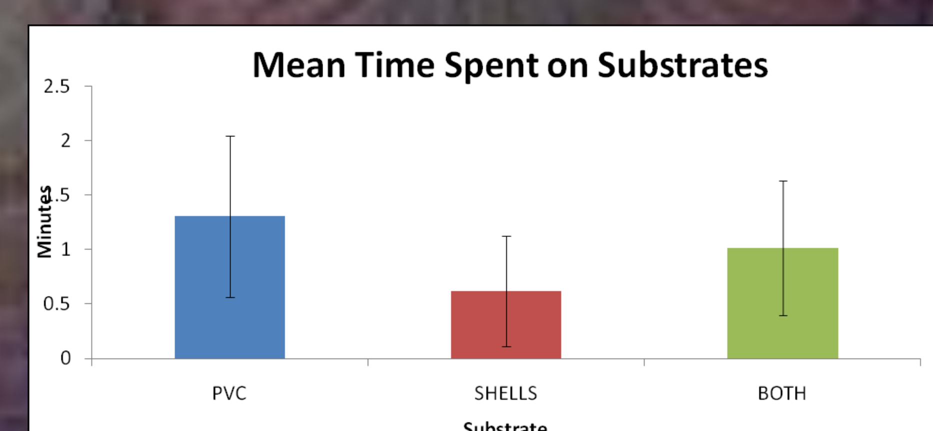

Figure 8: The average time the gobies spent on the substrates. The error bars represent the standard deviation.

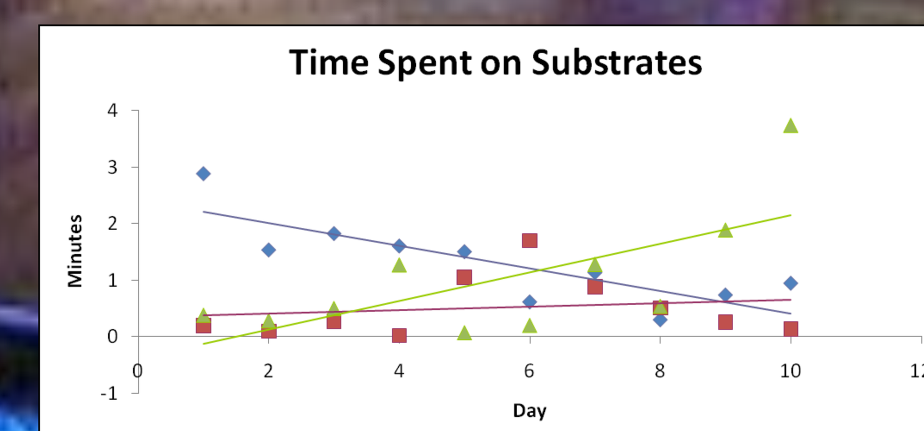

Figure 9: The time the gobies spent on the substrates. Each day of collected data is represented by the points. A trend line was added to suggest possible patterns in the behavior of the gobies. The blue represents PVC, red represents shells, and green shows tanks with both substrates.

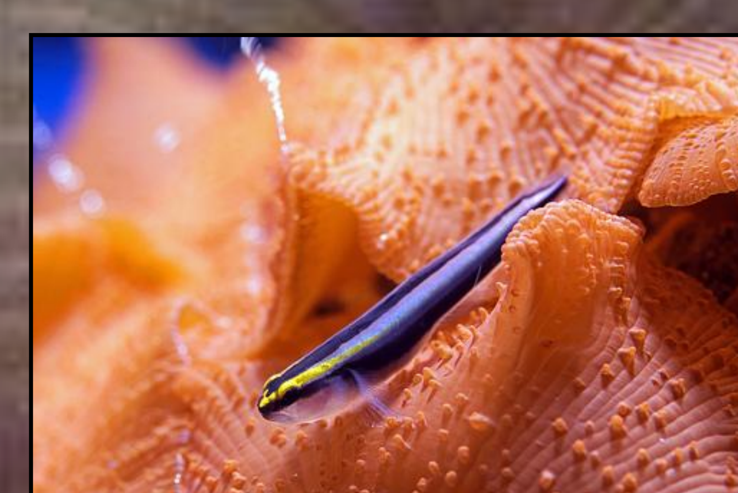

Figure 3: Sharknose Goby (*Gobiosoma evelynae*) perched on a cleaning station.

Figure 4: Measuring dissolved oxygen and salinity of acclimation tanks

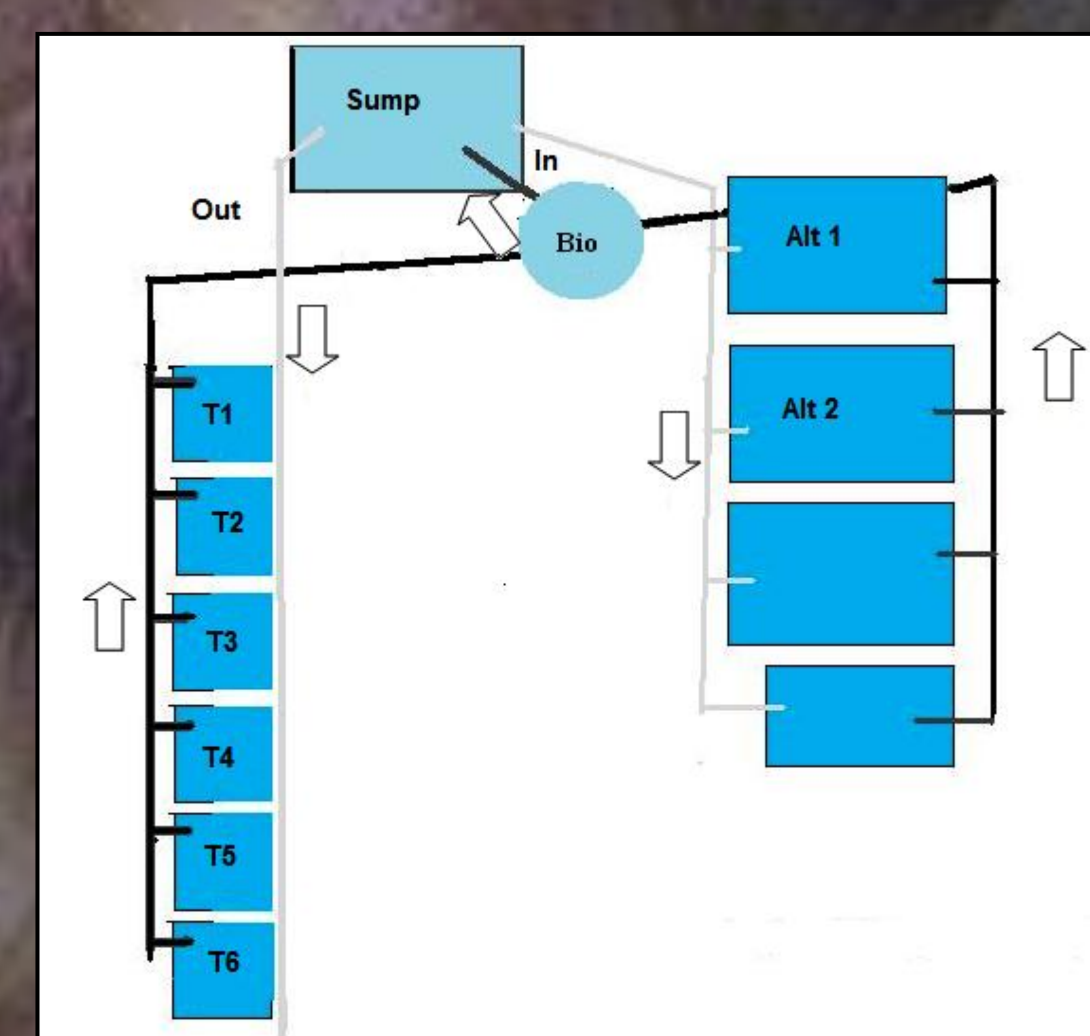

Figure 5: Water filtration and flow through goby tanks. Arrows show the direction of water flow through the six tanks (T1-T6) which contain varying substrates, the alternate tanks (Alt 1 and Alt 2), and the filter (bio) which contains mechanical sponge filtration and bioballs for biological filtration.

Results

There was no significant difference (Student's T-Test: P > 0.05) found between the mating behavior of gobies in tanks with PVC pipes and tanks with both PVC and bivalve shells. There was, however, a significant difference (Student's T-Test: P< .05) found between tanks with PVC and tanks with bivalve shells. As shown in Figure 6, the gobies in tanks with PVC substrates spent an average of 1.26 minutes together, which is significantly more than tanks with bivalve shells, in which the gobies spent an average time of 0.22 minutes together.

Throughout the observation periods it was found that there was no significant difference (Student's T-Test: P > 0.05) in time spent on substrates between tanks with PVC and tanks with both substrates. Gobies in tanks with PVC substrates spent significantly (Student's T-Test: P< 0.05) more time on substrates than gobies in tanks with bivalve shells. Gobies in tanks with PVC spent an average of 1.30 minutes on substrates during the 5-minute observation periods. Gobies in bivalve shell tanks spent an average of 0.62 minutes on the substrates, while gobies in tanks with both PVC and bivalves spent an average 1.01 minutes on the substrates. Figure 8 demonstrates the time spent on the substrates and the significant difference (Student's T-Test: P< 0.05) in the test results. In this study no eggs were produced in any of the tanks.

Discussion

The gobies did not produce eggs because of fluctuating temperatures and salinity, which were affected by direct sunlight and evaporation. Despite the fact they did not breed, gobies in tanks with PVC piping spent more time together and more time on substrates than the other test groups. This suggests that PVC is conducive to mating behavior. The study also proved that gobies will not produce eggs if they are not provided with optimal conditions.

If gobies are successfully bred in captivity, they can be used as a biological parasite control for the cobia in the offshore cage without depleting the natural stocks. Utilizing gobies to rid the cobia of parasites will increase the production capacity of the system at CEI while minimizing the marine impact. If the gobies can be used as effective cleaner fish, then the system can be a model for more sustainable practices of aquaculture.

Future studies can address other factors that influence goby mating behavior such as temperature, dissolved oxygen levels, and salinity, because these parameters did not remain constant throughout the study. It would also be beneficial to modify the experiment according to the results this study has provided. If a modified experiment is conducted within a longer time frame, incorporates a larger sump, and has shaded tanks to create a more controlled environment, then the gobies will be more likely to breed.

Work Cited

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The Aquaculture Team