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Effects of Frequency of Egg and Fry Removal on Spawning by *Tilapia nilotica* in Hapas

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Abstract.—*Tilapia nilotica* were spawned in small-mesh net enclosures called hapas. During a 5-week period, eggs and fry were removed from mouth-brooding females at examination intervals of 2, 4, 7, or 10 d. A decrease in time between examination intervals increased the total number of spawns collected ($P < 0.05$), but more spawns were obtained per examination for the 7- and 10-d intervals ($P < 0.05$). For artificial incubation of eggs, the 7-d interval was considered optimal.

Fecundity of mouth-brooding tilapias (*Tilapia* spp.) is low compared to that of many other warm-water fishes. High numbers of brood fish must be maintained and spawned, therefore, to satisfy demands for fry and fingerlings (Mires 1982). Those

TABLE 1.—Spawning of *Tilapia nilotica* in hapas examined at different intervals during a 5-week period. Mean values without a letter in common are significantly different ($P < 0.05$).

Examination interval (d)	Number of examinations per hapa	Number of spawns per hapa	Number of spawns per hapa per interval	% of intervals with no spawns
2	16	12.7 z	0.79 z	46 z
4	8	10.0 zy	1.25 y	21 z
7	5	9.3 yx	1.87 x	0 y
10	4	6.7 x	1.67 x	17 y

tilapias most important for culture are successive spawners capable of brooding several clutches of eggs per season. Previous work has shown that the interval between spawns may be decreased by removal of eggs from mouth-brooding females (Peters 1963; Lee 1979). Frequent collection of eggs is one method used to increase fecundity.

Small-mesh net enclosures, called hapas, are commonly used for spawning tilapias (Hughes and Behrends 1983; Siraj et al. 1983; Santiago et al. 1985). The use of hapas increases management options available to the culturist including the frequency with which checks may be made for mouth-brooding females, free-swimming fry, or both. This examination interval is considered critical for maximum production of tilapia eggs and fry. The objective of our study was to evaluate the effects of different examination intervals on spawning by *Tilapia nilotica* in hapas.

Methods

This study was conducted at the Lajas Aquaculture Field Station, Department of Marine Sciences, University of Puerto Rico, in conjunction with the Puerto Rico Agricultural Experiment Station. Twelve 1.6-mm-mesh hapas (200 × 105 × 110 cm in size) were suspended at a depth of 70 cm in a 0.07-hectare pond 1.25 m deep. To control weed growth, the pond was stocked on June 11, 1985, with 150 male *T. nilotica* of similar size averaging 74 g each. The same day, each hapa was stocked with six pairs of similarly sized *T. nilotica* averaging 74 g (SE, 4.5 g). Fish in hapas were fed a 32% protein diet at 3% of body weight equally divided into two daily feedings.

Beginning 10 d after stocking, triplicate hapas were examined for brooding females either every 2, 4, 7, or 10 d. The number of spawns per hapa was recorded and any eggs and sac fry were removed. Brooding females could be recognized by the presence of eggs or sac fry in their mouths and by their enlarged buccal cavity. The hapas were last examined on July 19 for the 4- and 7-d intervals and on July 21 for the 2- and 10-d intervals.

Results and Discussion

Early morning water temperature, dissolved oxygen, and Secchi disk visibility averaged (±SE) 28 ± 0.7°C, 5.5 ± 0.94 mg/L, and 35 ± 4.4 cm, respectively. Minimum dissolved oxygen was 3.9 mg/L.

A decrease in time between examination intervals significantly increased ($P < 0.05$) the number of spawns obtained during the study (Table 1). This concurs with findings of Peters (1963) and Lee (1979). There was a significantly higher ($P < 0.05$) number of spawns per examination obtained with the 7- or 10-d intervals. Spawns were observed at each 7-d examination interval, whereas spawns were not always observed for the other intervals.

Eggs less than 3-d old are difficult to artificially incubate (Lee 1979), and eggs collected every 2 or 4 d were usually less than 3 d old. Conversely, with the 10-d interval, a wide range of age-groups of eggs and fry was often collected. Swim-up fry were only observed for the 10-d interval. More culture units would be required to rear spawns of different age-groups. A smaller range of age-groups was obtained with the 7-d interval, and the majority of spawns were old enough to be easily incubated in hatching jars.

Labor may also be of concern in selection of an examination interval. About 15 min were required for one worker to examine a hapa and collect eggs and sac fry. Therefore, each month, the 2-d interval requires 250% more labor than the 7-d interval. In our study, this resulted in only 37% more spawns.

In conclusion, the 7-d interval is advantageous because of the higher number of spawns collected per examination interval, the similarity in age-groups among spawns, of which a high percentage were suitable for artificial incubation, and the efficient use of labor. The regularity of weekly scheduling is also easier to plan.

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Use of Antimycin A in Live-Haul Tanks to Remove Scaled Fish from Fingerling Channel Catfish Populations

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Abstract.—Treatment concentrations and procedures are presented for using antimycin A in live-haul tanks to kill green sunfish (*Lepomis cyanellus*) without harming channel catfish (*Ictalurus punctatus*). Fish are exposed to antimycin A for 15 min and then transferred to a production pond. The concentrations required for an effective treatment vary from 25 to 200 μg/L, depending on water temperature and pH. Treating fish in live-haul tanks prior to stocking results in substantial cost savings when compared to a whole-pond treatment.

Wild fish are undesirable in commercial channel catfish (*Ictalurus punctatus*) production ponds. They prey on fry and small fingerlings, compete for feed, and act as a reservoir for parasites and diseases. In addition, processing plants penalize producers if a large number of wild fish are present in the harvest. Fingerlings contaminated with wild fish are considered an inferior product and are difficult to sell (Busch 1985). Green sunfish (*Lepomis cyanellus*) are the most common wild fish contaminating Mississippi catfish ponds.

Antimycin A (Fintrol®)[1] is often used to remove scaled wild fish from commercial catfish ponds. Application rates of 3–10 μg/L of antimycin A are used to eradicate scaled fish from a pond without harming the catfish (Avault and Radonski 1968). If a population of wild fish becomes established in a production pond, the entire pond must be treated to eradicate the undesirable fish. Application of antimycin A to a catfish production pond is costly and time consuming. Sometimes wild fish are introduced to catfish culture ponds with fingerling catfish at the beginning of the culture season. If the fish were treated in a small volume of water (such as a hauling-truck tank) just before they were transferred into the production pond, substantial cost savings would result.

Experiments were conducted at the Delta Branch Experiment Station, Stoneville, Mississippi, to determine treatment rates, for use in live-haul tanks, that would kill all sunfish without harming any channel catfish after a 15-min exposure. Experimental conditions were chosen to simulate conditions experienced by fish when they are transferred to a production pond in a live-haul tank. Therefore, pH was adjusted over a short time period just prior to treatment and fish were not acclimated to the lower pH. Fish were transferred to fresh water immediately after treatment.

Methods

Green sunfish 3–7 cm long were seined or trapped from catfish ponds and local creeks. Channel catfish 6–18 cm long were seined from fingerling production ponds. Fish were held in 300-L-capacity flow-through holding tanks for at least 5 d prior to use. Separate trials were conducted for channel catfish and green sunfish. Six glass aquaria, each containing 32.5 L of oxygen-saturated well water were used for each trial. Selected chemical characteristics of the water used were total alkalinity, 382 mg/L as $CaCO_3$; total hard-

[1] Antimycin A currently is approved by the U.S. Environmental Protection Agency for pond treatments only.