Florida Largemouth Bass Raceway Spawning Substrate Evaluation

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Abstract: Six different nest substrates, including combinations of rock, gravel, and black fibrous synthetic spawning mats, were evaluated for the raceway spawning of Florida largemouth bass (*Micropterus salmoides floridanus*). Sixty-nine of the 74 spawns (93%) were deposited on fibrous spawning mats. Raceway spawning on fibrous mats enabled the intensification of Florida largemouth bass culture.

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Largemouth bass (*Micropterus salmoides*) are among the most sought after freshwater sportfishes in the United States. To keep pace with ever increasing stocking requests, hatchery biologists have improved and standardized many aspects of largemouth bass culture (Snow 1968, Hutson 1990). However, most fry are still produced in ponds. Various approaches to intensify largemouth bass fry production have been attempted, including several investigations that centered around finding a spawning substrate which, once spawned on, could be removed for egg incubation. Birge (1907) experimented with taking eggs from largemouth bass nests and incubating them on trout screens, but did not report results. Green (1962) placed 6 mats of upholstery material composed of latex-coated hair in a largemouth bass spawning pond that had no vegetation. All the mats were used, but only 1 spawn was successfully removed for incubation. The eggs were incubated on the mat in a catfish incubator and 90% hatched. Chastain and Snow (1965) used nylon felt mats in 3 largemouth bass spawning ponds and observed that 56% to 79% of the spawns were on the mats. Preliminary testing showed that mats with eggs could be removed from the ponds and transferred to rearing ponds or artificially incubated. Snow (1972) further reported removing egg-laden nylon felt mats from 7 0.04 ha ponds and incubating the eggs in hatching jars to produce 1,564,000 fry.

Other materials have also made successful spawning substrates for largemouth bass. Workers at the Jake Wolf Hatchery in Manito, Illinois, first used brown indoor/outdoor carpet and then rock nests covered with Saran® mesh for raceway spawning

of northern largemouth bass. Spawns were removed, enumerated, and incubated in hatching jars. Production at that facility in 1990 was approximately 2,000,000 fry (S. Steuwe, pers. commun.).

These results led Texas Parks and Wildlife Department (TPWD) culturists to attempt controlled spawning and incubation methods for largemouth bass. In 1987 and 1988 TPWD culturists used brown indoor/outdoor carpet and cured Spanish moss in raceways and tanks to spawn female largemouth bass (>6.0 kg obtained from a Texas volunteer angler program) with hatchery-reared Florida largemouth bass males (*Micropterus salmoides floridanus*). Eleven spawns were produced from 23 pairings in the 2 years (D. L. Campbell, pers. commun.). In 1989 TPWD workers at the A. E. Wood State Fish Hatchery in San Marcos, Texas, attempted to spawn Florida largemouth bass broodstock in indoor raceways using brown indoor/outdoor carpet. These fish failed to spawn even after injections of human chorionic gonadotropin (C. W. Bowling, unpubl. data). Because the Florida largemouth bass did not spawn, it was suspected that the fish might have a spawning substrate preference different from northern largemouth bass. The objective of this study was to determine the spawning substrate preference of Florida largemouth bass in raceways using materials that could be removed for controlled egg incubation.

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Methods

The study was conducted at the A. E. Wood State Fish Hatchery in San Marcos, Texas, in early 1990. Facilities used included indoor raceways (24 x 2.4 x 1.3 m) and fiberglass troughs (7 x 1 x 0.6 m) equipped with low pressure air outlets for aeration and water movement. Water furnished to the raceways and troughs was from the spring-fed San Marcos River which has a temperature of 22° ± 3° C or from a 3.8-ha reservoir with more variable water temperatures. Test substrate materials included rocks, gravel, and mats of synthetic spawning material (Spawntex®, Blocksom & Co., Michigan City, Ind.). Spawntex material is a combination of hog hair and plant fiber coated with black latex and is manufactured as a substitute for cured Spanish moss, which is commonly used in bait fish culture (Duffy 1966). This material probably is very similar to the material used by Green (1962). Spawning substrate combinations were: 1) rocks (25–102 mm diameter) placed in wooden boxes (0.5 m^2 x 150 mm deep) similar to those used in Illinois (S. Steuwe, pers. commun.), 2) gravel (6–13 mm diameter) in round galvanized metal oil drain pans (0.4 m diameter), 3) gravel (6–13 mm diameter) glued to synthetic marble slabs (0.5 m^2 x 6 mm thick), 4) identical gravel/slab combinations with the addition of 4 sprigs of artificial aquatic vegetation glued to the corners of each slab, 5) mats of Spawntex (approximately 0.5 m^2 x 40 mm thick), and 6) identical mats with 4 to 8 rocks (75–

125 mm diameter) placed on the mat. Broodstock used in the study were 5-year-old, hatchery-reared largemouth bass that were produced from fish originating from Florida. Stock genetics were certified using electrophoresis methods of Philipp et al. (1983).

On 20 February 1990, broodstock were harvested from outdoor ponds. Fish were separated by sex and allowed to acclimate in an indoor raceway for 15 days. During this time, water temperature was maintained at 17° C–22° C and the photoperiod was set at approximately 13 hours of light. Three nests of each substrate were placed approximately 1 m apart along each wall of 2 raceways (raceway A and B). Nest placement sequence differed in the 2 raceways; however, both arrangements insured that identical substrates were not immediately adjacent to each other and that each type was represented at or near the front, middle, and back of the raceway. Multiple replication was not possible due to hatchery production considerations.

On 7 March, broodstock were paired into the 2 raceways furnished with nests at a ratio of 1 M to 1 F. Sixteen pair were stocked into raceway A and 17 pair into raceway B. Hatchery activities were reduced in the area except for observation and spawn removal. Twelve to 24 hours after spawns were sighted, egg-laden nests were removed without enumeration and transferred in water to the troughs for incubation. To encourage further spawning, nests were replaced with the same substrates. As fry hatched in the troughs they were harvested, enumerated, and stocked into fertilized rearing ponds.

After a 15-day spawning period, broodfish were stocked into a single raceway for 4 days and offered 23 kg of forage. On 27 March, broodfish were restocked into 2 raceways for another 15-day period, following the same protocol as described for the first spawning period. During each spawning period, nest types and spawn locations were recorded and totaled for comparison and evaluation.

Results and Discussion

A total of 74 spawns was harvested during the 2 spawning periods (Table 1). Spawn harvest began 9 days after raceways were stocked for the first period and 6 days after stocking for the second period. The largemouth bass spawned on 3 substrates: 1) Spawntex with rocks (N = 38), 2) Spawntex without rocks (N = 31), and 3) oil drain pans with gravel (N = 5). Approximately 700,000 fry were produced from the 66 broodfish in 34 days.

A lack of adequate replication precluded statistical analysis. However, since spawns were deposited on Spawntex in all areas of both raceways and not on most of the other materials which were also present, it appeared that substrate preference was the determining factor in nest selection. Spawntex was the preferred substrate, perhaps because it resembles submerged vegetation or root fibers often exposed under natural spawning conditions (Kramer and Smith 1962, Chew 1974). The fish in this study did not choose rock nests similar to those used at the hatchery in Illinois, possibly due to inherent differences between the natural habitats of northern and

Table 1. Numbers of Florida largemouth bass spawns collected by nest substrate, raceway, and spawning period.

Substrate type	Spawning period 1		Spawning period 2		Substrate total
	Raceway A spawns	Raceway B spawns	Raceway A spawns	Raceway B spawns	
Gravel on slab with artificial plants	0	0	0	0	0
Rocks in wooden box	0	0	0	0	0
Spawntex mats with rocks	11	8	10	9	38
Spawntex mats without rocks	6	6	9	10	31
Gravel on slab no artificial plants	0	0	0	0	0
Gravel in glavanized metal oil drain pan	0	1	2	2	5
Total	17	15	21	21	74

Florida largemouth bass. Inquiries into the type of mats that Chastain and Snow (1965) used indicated that the product they used was no longer available.

Raceway spawning of Florida largemouth bass had several advantages over traditional pond spawning methods. Broodfish were used more intensively in a smaller amount of culture space. The raceway stocking rates in this study (0.35 kg females/m^2) were 4.5 times the rate Snow (1972) used for 5-year-old fish in outdoor ponds (0.077 kg females/m^2) and 25 times the 0.014 kg females/m^2 Hutson (1990) recommended for pond spawning. Additionally, spawn removal and nest replacement allowed fish to resume spawning activities much sooner than in traditional pond culture where males guard either eggs or fry. This study completed two spawning periods in 34 days, whereas a single pond spawning cycle can take up to 30 days (Hutson 1990). Finally, broodfish nest desertion, typically caused by predators or sudden weather changes in ponds (Jurgens and Brown 1954, Kelley 1968) was eliminated through controlled spawning and egg incubation. These improvements increased fry production from 6,533 (Snow 1972) to 17,000 fry/kg of female and provided excellent quality fry for fingerling production.

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