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NATURAL REPRODUCTION BY STRIPED BASS IN KENTUCKY AND BARKLEY RESERVOIRS, TENNESSEE

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ABSTRACT

The first records of natural reproduction by striped bass, *Morone saxatilis* (Walbaum), in Tennessee are noted. Spawning was speculated to have occurred in the tailwaters below Pickwick and Cheatham Dams.

INTRODUCTION

Striped bass, *Morone saxatilis* (Walbaum), have been successfully "landlocked" in freshwater impoundments throughout the Southeast (Bailey, 1974) and, in instances, have reproduced naturally. Natural reproduction in the southeastern states has been documented in Santee-Cooper Reservoir, South Carolina (Scruggs, 1955); Kerr Reservoir, North Carolina-Virginia (Bailey, 1974); and Dardanelle Reservoir, Arkansas (Bailey, 1974). Natural reproduction by striped bass has occurred also in Keystone Reservoir, Oklahoma (Mensinger, 1970). Keystone and Dardanelle Reservoirs are both located on the Arkansas River System; these are the only reservoirs where natural reproduction is successful that did not have a native population or natural spawning run in the river prior to impoundment (Bailey, 1974).

There has been no formal documentation of natural reproduction by striped bass introduced into the Cumberland and Tennessee River Systems by Tennessee and Kentucky state fisheries personnel. Danny G. Scott, Rockfish Project Leader, Tennessee Wildlife Resources Agency, did collect young-of-the-year striped bass in Cherokee Reservoir, Tennessee, in 1974 that were likely the result of natural reproduction (William J. Campbell, 1975, Pers. Comm.).

METHODS

Ichthyoplankton samples were taken in 1975 adjacent to Cumberland Steam Plant on Barkley Reservoir, Johnsonville Steam Plant on Kentucky Reservoir, and the proposed Saltillo steam plant site on Kentucky Reservoir by Tennessee Valley Authority (TVA) fisheries personnel as part of an extensive program aimed at assessing thte impacts of steam-electric power plant operations on fisheries resources (Public Law 92-500, Section 316b compliance studies). A description of the various gear in use when striped bass were collected, and the manner in which these gear were utilized, is detailed in Table 1.

Samples were processed at TVA's ichthyoplankton laboratory in Muscle Shoals, Alabama. Striped bass specimens were tentatively identified by Robert Wallus and Larry Kay; identifications of prolarvae were verified by Ronnie J. Kernehan, Biologist, Ichthyological Associates, Ithaca, New York (Pers. Comm., 1975). Reference was made to the following published papers to ensure valid identifications of all striped bass specimens collected: Pearson, 1938; Merriman, 1941; Mansueti, 1958 and 1964; Bayless, 1967; Taber, 1969; Yellayi and Kilambi, 1970; and Bayless, 1972. Reference was also made to a series of larval yellow bass, *Morone mississippiensis*, reared by Patricia W. Smith, TVA Fisheries Biologist.

RESULTS

A total of 43 striped bass larvae were identified in samples taken on Barkley Reservoir on May 28 and 29 (Table 1). In addition, one juvenile was taken on July 23. Larvae ranged in total length from approximately 4.0 mm to 7.0 mm, and the juvenile was approximately 49 mm in total length (Table 1). Associated water temperatures ranged from 22.4 C to 23.8 C for striped bass larvae collected (Table 1). Associated water temperature was 30.5 C for the juvenile collected.

One striped bass egg and one larva were found in samples taken on Kentucky Reservoir (Table 1). The larva was approximately 6.0 mm in total length (Table 1). The egg was approximately 3.5 mm in diameter and contained an advanced embryo (approximately 3.2 mm in total length). Associated water temperature was 19.0°C for the striped bass larva collected and 19.5°C for the egg collected (Table 1).

DISCUSSION AND CONCLUSIONS

There were no introductions of fertile striped bass eggs or larval striped bass into the Cumberland and Tennessee River Systems in 1975 by the Tennessee Wildlife Resources Agency (C. Wayne Pollock, 1976, Pers. Comm.). There were fry introductions in 1975, but the introduction dates and localities were such that it was concluded that the 49.0 mm total length juvenile collected in Barkley Reservoir (Table 1) was also produced naturally.

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TABLE 1: *Summary Collection Data for* Morone saxatilis *taken in Barkley and Kentucky Reservoirs in 1975.*

Reference No. (TVA Ichthyoplankton Collection)	Date Collected	Military Time (CDT)	Number Collected	Total Length (to nearest mm)	Gear*	Location**	Water Temperature (C)***
Barkley Reservoir							
CU002	5-28	2110	1	6	1	Left shoreline; CRM 98.6	22.5
CU003	5-28	2112	2	6, 6	1	Midstream; CRM 98.6	22.5
CU004	5-28	2130	1	4	1	Midstream; CRM 98.6	22.5
CU005	5-28	2143	1	6	1	Right shoreline; CRM 98.6	22.5
CU011	5-28	2247	1	6	1	Left shoreline; CRM 95.5	22.5
CU020	5-29	0100	3	5, 6, 7	2	Left shoreline; CRM 98.6	22.5
CU022	5-29	0110	2	6, 6	2	Midstream; CRM 98.6	22.5
CU024	5-29	0120	1	6	2	Right shoreline; CRM 98.6	22.5
CU001	5-29	2040	2	6, 7	2	Left shoreline; CRM 103.8	23.8
CU004	5-29	2103	2	6, 6	2	Midstream; CRM 103.8	23.8
CU006	5-29	2112	2	6, 6	2	Right shoreline; CRM 103.8	23.8
CU016	5-29	2237	1	6	1	Midstream; CRM 107.8	23.8
CU021	5-29	2311	1	6	2	Midstream; CRM 107.8	23.8
CU023	5-29	2322	8	6, 6, 6, 6 6, 6, 6, 7	2	Right shoreline; CRM 107.8	23.8
CU024	5-29	2327	7	6, 6, 6, 6 6, 6, 6	2	Right shoreline; CRM 107.8	23.8
CU032	5-29	2055	2	6, 6	3	Cumberland Steam Plant discharge channel	22.4
CU033	5-29	2055	1	5	3	Cumberland Steam Plant discharge channel	22.4
CU034	5-29	2100	3	6, 6, 6	3	Cumberland Steam Plant discharge channel	22.4
CU035	5-29	2100	1	6	3	Cumberland Steam Plant discharge channel	22.4
CU036	5-29	2100	1	6	3	Cumberland Steam Plant discharge channel	22.4
CU001	7-23	2240	1	49	4	Left shoreline; CRM 95.5	30.5
Kentucky Reservoir							
SA002	4-30	2105	1 (egg)	–	5	Left shoreline; TRM 173.9	19.5
NJ008	4-30	2245	1	6	2	Left shoreline; TRM 100.5	19.0

*Gear: All nets were made from 0.79 mm mesh nylon netting.

1. 1 m diameter conical net; 3.1 m long; passive samples were taken from bottom to a depth of 1 m in high flow areas.
2. 1 m diameter conical net; 3.1 m long; active, horizontal, surface samples were taken at a sampling speed of approximately 1.27 m/sec; the net was bow-mounted.
3. 0.5 m diameter conical net; 3.1 m long; passive samples were taken at the surface, mid-depth or bottom of the water column.
4. 1.88 m^2 beam net; 2 m long; dropped to bottom with mouth horizontal and lifted to a depth of 1 m where the net was tripped and quickly retrieved to exclude the upper 1 m.
5. 0.5 m diameter conical net; 3.1 m long; active, horizontal, surface samples were taken at a sampling speed of approximately 1.5 m/sec; the net was bow-mounted.

**Location: The designations shoreline and midstream refer to those locations in a bank-to-bank transect at the allocated river mile.

CRM — Cumberland River Mile TRM — Tennessee River Mile

***Water Temperature: Taken at mid-depth of the stratum sampled.

All of the striped bass larvae identified were not developed to the degree that they could be capable of upstream movements even during periods of low flow. It is logical to assume that spawning occurred between the collection sites and the upstream dams (Cheatham and Pickwick). There is an outside possibility that spawning occurred at some point above the dams, and the developing eggs and/or larvae survived dam passage; but when consideration is given to the damages expected upon passage resulting from abrasion, general trauma, shear forces, and pressure changes, the likelihood for such survival is low.

Spawning by striped bass has been associated with rivers characterized by rapids and strong current (Pearson, 1938), with spawning activities occurring near the water surface in usually fast and turbulent waters (Surber, 1957). Of the habitats and locales available for spawning along the stretches of river above collection sites, the tailwater areas below the dams provide the most suitable spawning habitat for striped bass.

There were angler reports in 1975 of surface activities by adult striped bass in the tailwaters below Cheatham Dam. This could have been spawning activity (C. Wayne Pollock, 1976, Pers. Comm.); however, this was not substantiated by a Tennessee Wildlife Resources Agency fisheries biologist.

No attempt was made to determine points-of-origin (spawning site; where the inception of life began) for striped bass larvae collected. Such determinations could be made based on approximated age and water mass time-transport computation. Too little is known regarding variability of growth rates, rate of development, rheotactic responses, and swimming abilities for larval stages of this species. Designation of point-of-origin for the striped bass egg collected is more feasible since the organism cannot actively select for preferred environs.

The striped bass egg collected (Table 1) was encountered 32.8 miles below Pickwick Dam. This developing egg should have experienced a fairly constant incubation temperature of about 19.5°C since lower mainstream Tennessee River Reservoirs are characterized by a lack of thermal stratification. The embryo was approximately 48 hours old, based on information gleaned from pertinent literature (Bigelow and Welsh, 1927 and Mansueti, 1958). Fertilized striped bass eggs are semibuoyant (Pearson, 1938) and, at all sizes and states of development, have a specific gravity slightly greater than that of water (Albrecht, 1964). Although a slight movement of water will float fertilized eggs (Pearson, 1938), a current velocity of about one foot per second is required to ensure egg suspension in fresh water (Albrecht, 1964).

The water mass in which the egg occurred was estimated to have been discharged from Pickwick Dam approximately 23 hours earlier at about 2205 CDT on April 29 (based on a time-transport computation provided by TVA's Data Services Branch). Thus, the net downstream movement of the discharged water mass was at a rate of approximately 2.1 feet per second, which would have been adequate to keep the striped bass egg suspended and moving along at about the same rate, provided the egg was not swept into low flow areas (backwaters) or caught in eddies. Due to the nature of waterflow between Pickwick Dam and the collection site (certainly not laminar), and due to the fact that viable striped bass eggs do have a specific gravity greater than that of water, it is logical to assume that egg transport rate would lag behind net water transport rate.

The above discussion lends support to the speculation that spawning very likely occurred in the tailraces below Cheatham and Pickwick Dams. Further field studies will be necessary to document areas utilized for spawning by striped bass in the Cumberland and Tennessee River Systems. After these areas have been identified, further study may show that habitat manipulation and/or water control manipulations may hold promise for the establishment of (a) self-perpetuating striped bass population(s) and concomitant fishery(ies) in the Tennessee Valley.

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