

Discovery of Naturally Reproducing Striped Bass in Two Maryland Impoundments

Edward C. Enamait, *Maryland Department of Natural Resources, Freshwater Fisheries, Lewistown Work Center, 10932 Putman Road, Thurmont, MD 21788*

John E. Mullican, *Maryland Department of Natural Resources, Freshwater Fisheries, Lewistown Work Center, 10932 Putman Road, Thurmont, MD 21788*

Letha L. Grimes, *Maryland Department of Natural Resources, Freshwater Fisheries, Lewistown Work Center, 10932 Putman Road, Thurmont, MD 21788*

Abstract: Fishery surveys utilizing electrofishing and gill nets have documented natural reproduction of striped bass in 2 Maryland impoundments: Liberty and Piney Run reservoirs. Natural reproduction has occurred for 5 years, 1986 through 1990, in Liberty Reservoir; and for 3 years in Piney Run Reservoir, 1988 through 1990. It was initially thought that reproduction occurred in Liberty Reservoir because the relatively hard bottom and high dissolved oxygen levels allowed hatching of striped bass eggs that descended to the bottom. Recent discovery of natural reproduction in Piney Run Reservoir, a small eutrophic impoundment, supports the theory that striped bass eggs may float or remain suspended in the water column until hatching occurs in these impoundments.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 45:355-360

Introductions of striped bass (*Morone saxatilis*) into inland waters have generally been done to create a highly desirable sport fishery and to control shad populations (Bailey 1974). Prior to 1980 there had been a few experimental stockings of striped bass fry, yearlings, and adults into Maryland impoundments. During 1980 the striped bass stocking program began when the Joseph Manning Warmwater Hatchery, located in Cedarville, Maryland, began to culture striped bass fry and fingerlings. Brood fish for hatchery operations were obtained from Chesapeake Bay tributaries. Striped bass were introduced into several Maryland freshwater impoundments for the sole purpose of developing a dynamic sport fishery.

Striped bass numbers in Maryland impoundments were thought to be controlla-

ble by stocking rates because natural reproduction was not anticipated. Mansueti (1958) had implied that suspension of the semi-buoyant striped bass eggs by current was necessary for survival. No Maryland impoundments possess a tributary of sufficient length or current to suspend striped bass eggs for the required hatching time of approximately 48 hours. Minimum current velocities required to suspend striped bass eggs in freshwater have been reported as 30.5 cm/second (Albrecht 1964) and 15.2 cm/second for water hardened eggs (Crance 1985). Approximately 30 miles of water flowing at 30.5 cm/second would be required to suspend eggs throughout development (Albrecht 1964, Crance 1984).

Stocking programs in Maryland dismissed the possibility that natural reproduction of striped bass would occur in any of the impoundments because all lacked minimum riverine spawning habitat requirements and were extremely small in size. The Striped Bass Committee, American Fisheries Society, considers the minimum striped bass habitat size to be 1,215 hectares (Crance 1985). Bayless (1967) demonstrated that egg suspension was not necessary for successful hatching of eggs if silt and poor water quality were not experienced. In-reservoir spawning of striped bass in Lake Powell, Utah-Arizona (a 300-km long reservoir) was documented by Gustavenson and Pettengill (1984). It was then that we began investigating whether striped bass were reproducing naturally in Maryland impoundments. This investigation was possible because striped bass stocking was stopped in 1984 when a statewide moratorium was enacted on the possession of striped bass. As a result, all year classes after 1984 had to be the consequence of natural reproduction.

We would like to acknowledge Mike Shaw and Ray Richardson who assisted with field investigation on Liberty Reservoir from 1986 through 1988 and Mark Toms who was employed as contractual technical assistant. We appreciate the outstanding working relationships we have with Brent Hartley and Eugene Scarpulla at the Watershed Section, City of Baltimore and Jo Ann Hunter at Piney Run Park. We thank Bob Davis for reviewing this paper. This research was funded by Dingell-Johnson Federal Aid to Fish Restoration Project F-29-R and F-48-R, Maryland.

Methods

Study Areas

Liberty Reservoir is a 1,225-hectare impoundment located on the boundary between Carroll and Baltimore counties in the Piedmont Region of central Maryland. The reservoir is maintained by the City of Baltimore as a municipal water supply; however, fishing and boating are permitted. Primary tributaries are the North Branch Patapsco River (mean width, 10 m; mean depth, 0.6 m) and Morgan Run (mean width, 5 m; mean depth, 0.3 m). Neither is large enough to facilitate striped bass spawning. The reservoir length is 18 km, with a shoreline length of approximately 131 km. The average depth is 18 m and maximum depth is 44 m. The surface pH is generally neutral to slightly basic, ranging from 6.9–8.6; visibility averages 6 m; stratification generally begins in May and lasts throughout October. Liberty Reservoir is best described as a steep-sided, mesotrophic impoundment.

Piney Run Reservoir is a 121-hectare impoundment located in Carroll County within Piney Run Park. It is maintained by the Carroll County Department of Recreation and Parks. Fishing and boating are permitted. The primary tributary is Piney Run, a small feeder stream (mean width, 2 m; mean depth, 0.2 m). The shoreline extends for approximately 6.3 km, the average depth is 9 m, and the maximum depth is 17 m. The surface pH is basic ranging from 6.8–9.6. Stratification typically begins in April and extends to October. Piney Run Reservoir is best described as a eutrophic impoundment.

Field Methods

A 4.9 m Smith-Root electrofishing boat equipped with a 5 kw electrical generator was used for the electrofishing sampling. The electrical output was generally set between 8 and 12 amps, with a frequency of 60 pulses/second direct current. Annual fall electrofishing efforts ranged from 1 night on Piney Run Reservoir with 1.32 hours actual shocking time to 4 nights on Liberty Reservoir with 16.25 hours actual shocking time. Electrofishing catch-per-unit-effort (CPUE) rates were based upon actual shocking time and all sampling was conducted at night.

Gill nets used were 91 m and 45.5 m long by 2.4 m deep, with square mesh sizes of 3.8 cm, 5.1 cm, and 6.4 cm. Nets were fished from 2–4 hours during the day to minimize fish mortalities.

Shoreline seining was accomplished with a 15.2 m long by 2.4 m deep seine with 0.5-cm square mesh and a 9.1 m long by 1.2 m deep seine with 0.3-cm square mesh. Seine hauls were made during the day and at night in Liberty Reservoir. A total of 50 and 15 seining sites were sampled annually on Liberty Reservoir and Piney Run Reservoir, respectively.

A plankton net measuring 1.0 m at the mouth and 2.7 m in length was towed at the surface and sub-surface (approximately 1 m below surface). Tows were conducted during the day and at night in the spring when water temperatures were suitable for spawning of striped bass.

Aging of striped bass was accomplished by removing scales from the region behind the pectoral fin, examining the scales under a dissecting scope, and determining the number of annuli present. Scale samples were discarded if year class analysis by two biologists were not in agreement.

Results

A record of striped bass stockings in Liberty and Piney Run reservoirs is presented in Table 1. With the exception of the 1965 stocking in Liberty Reservoir, all stocked year classes have been recovered by subsequent sampling efforts.

Natural reproduction of striped bass in a Maryland freshwater impoundment was first documented while electrofishing on Liberty Reservoir on the night of 18 September 1986. Four young-of-year (YOY) striped bass ranging from 11.5–14.5 cm in total length (TL) were collected.

Since 1986, YOY striped bass have been collected in Liberty Reservoir by

Table 1. Record of striped bass stocking in Liberty and Piney Run reservoirs, Maryland.

Year	Liberty Reservoir	Piney Run Reservoir
1965	498 yearling	
1975		1,000 fry
1980		6,885 fingerling
1981	14,804 fingerling	
1982	967 fingerling	1,646 fingerling
1983	2,300 fingerling	2,000 fingerling
1984	21,213 fingerling	3,105 fingerling

Table 2. Summary of fall electrofishing catches of naturally reproduced striped bass, Liberty Reservoir, Maryland.

Year of collection	CPUE (N fish/hour)	N fish	Length range (cm)
1986	0.8	13	11.5–16.0
1987	17.7	96	11.3–18.3
1988	0	0	
1989	13.2	76	10.9–16.4
1990	4.8	16	11.4–16.5

electrofishing during fall 1987, 1989, and 1990. Electrofishing CPUE rates from 1986 to 1990 have ranged from 0 to 17.7 fish per hour (Table 2). No YOY striped bass were collected by seining and no striped bass eggs or fry were collected by plankton net in Liberty Reservoir. Limited number of tows and timing of towing efforts are possible reasons for failure to recover eggs or fry. Although no YOY were collected by electrofishing during fall 1988, 3 yearling striped bass ranging from 33.5–33.9 cm TL were collected by gill net during fall 1989. Scale analysis of these fish showed they were hatched in 1988. All naturally reproduced striped bass year classes were collected during 1990 (Table 3).

The first evidence of natural reproduction in Piney Run Reservoir was found 9 October 1990 when 33 YOY striped bass were collected by electrofishing. They ranged from 17.8–23.8 cm TL and averaged 21.1 cm. The electrofishing CPUE for YOY striped bass in Piney Run Reservoir during 1990 was 25 fish/hour. No YOY striped bass were recovered while electrofishing during the fall of 1989. During the spring of 1991, gill nets caught 3 striped bass from the 1989 year class (40.4–42.3 cm TL), as determined by scale analysis. One striped bass (55.0 cm TL) was also collected by gill net and determined to be a 1988 year class fish. The size ranges of these fish and clarity of the annuli on the scales assures us that they were hatched in 1988 and 1989. No young striped bass were collected in Piney Run Reservoir during the annual daylight seining. Plankton net tows were not conducted on Piney Run Reservoir because natural reproduction was not discovered until 1990.

Table 3. Total length ranges (cm) of naturally reproduced striped bass in Liberty Reservoir, Maryland, by year class, collected during spring and fall 1990. Number of fish in sample given in parenthesis.

Year class	Time of collection	
	Spring	Fall
1990		11.4 – 16.5 (16)
1989		31.6 – 36.3 (5)
1988	33.5 – 35.6 (5)	38.2 (1)
1987	38.8 – 46.1 (51)	45.2 – 53.8 (35)
1986	58.0 – 67.5 (10)	59.5 – 70.0 (15)

Discussion

Our evidence of in-reservoir reproduction indicates that Chesapeake Bay striped bass have the potential to reproduce in freshwater impoundments that lack the currents typically thought necessary for egg survival. Liberty Reservoir shares a similar morphology with Lake Powell; i.e. steep shorelines, little littoral zone, and clear water with high dissolved oxygen levels (>8 ppm) that extend to the bottom during the spawning period. Piney Run Reservoir, however, lacks most of these characteristics. It is not likely that eggs descending to the bottom in Piney Run Reservoir survive due to silt and low dissolved oxygen levels.

Harrell et al. (1990) reported that Chesapeake Bay striped bass eggs have large oil globules and float. Personnel at Joseph Manning Hatchery have observed that viable eggs from some female striped bass floated in freshwater without any agitation (M. Beaven, pers. commun.). Albrecht (1964) reported that 5.6 C temperature fluctuations between 14.4 and 22.8 C did not prevent hatching nor did exposure to sunlight. Hatching success was 93% after eggs were exposed to 5 hours of bright sunlight (Albrecht 1964). This suggests that striped bass eggs floating or suspended near the surface could hatch. We conclude that the slightly buoyant nature of the Chesapeake Bay striped bass egg accounts for natural reproduction of striped bass in Piney Run and Liberty Reservoirs. Slight wave action or turbulence would suspend these eggs just below the surface. Although the morphology of Liberty Reservoir favors the survival of negatively buoyant striped bass eggs, the buoyancy of the Chesapeake Bay striped bass eggs may be the major factor contributing to natural reproduction in this reservoir. Piney Run Reservoir does not have the substrate and water quality considered suitable for the survival of sinking eggs therefore egg buoyancy is thought to be responsible for natural reproduction.

Fishery managers stocking Chesapeake Bay strain striped bass into freshwater impoundments should consider the possibility that natural reproduction will occur. If naturally reproducing striped bass populations are desired in impoundments lacking riverine spawning habitat, stocking Chesapeake Bay striped bass may achieve this

objective. However, stocking Chesapeake Bay striped bass should be avoided where predator/prey relationships are critical and control of striped bass numbers is essential. A naturally reproducing striped bass population, especially in smaller impoundments, has the potential to become prey limited and exhibit a decline in growth rate and condition. To prevent this from happening in Liberty Reservoir, a 4 fish per day creel limit was imposed in September 1990 when the moratorium was lifted. The statewide creel limit on all other impoundments with striped bass is 1 fish per day. Pre-spawned adult alewives (*Alosa pseudoharengus*) were introduced in Piney Run Reservoir during the spring of 1991 to improve the forage base. Annual stockings are planned based upon striped bass year class strength.

Chesapeake Bay striped bass can naturally reproduce in impoundments lacking riverine spawning habitat. Fishery managers desiring to increase striped bass populations in such impoundments, especially if they possess ample prey, may want to consider stocking this strain of striped bass.

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