

Hybrid Striped Bass Movements and Habitat in Ross Barnett Reservoir, Mississippi

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Abstract: Fourteen radio-tagged adult hybrid striped bass (female *Morone saxatilis* x male *M. chrysops*) were tracked from February to November 1987 in Ross Barnett Reservoir, Mississippi. Radio-tagged hybrids moved into the Pearl River in early March and remained upstream until water temperatures exceeded 27° C and dissolved oxygen decreased below 4 mg/liter at which time all except 2 fish returned to the main lake. These 2 fish, remaining in a well-aerated refuge at a lowhead dam, died in July when water temperatures exceeded 30° C. The fish which returned to the main lake showed decreased movements and remained near mid-lake in 4 small areas in and adjacent to submerged oxbows and/or the Pearl River channel. Mean monthly dissolved oxygen was significantly higher in mid-lake than elsewhere. Adult hybrids avoided depths of 0–2 m. Concurrent radio telemetry studies of 5 largemouth bass (*Micropterus salmoides*) showed little overlap of habitat.

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Hybrid striped bass (*Morone saxatilis* x *M. chrysops*) have been increasingly stocked into warmwater eutrophic reservoirs in the southeast (Axon and Whitehurst 1985) to provide an additional, possible trophy, sport fish and an open-water predator of shad (*Dorosoma* spp.) (Ott and Malvestuto 1981). Limited information is

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available on the habitat preferences of hybrid striped bass (Yeager 1982, Austin and Hurley 1987, Douglas and Jahn 1987). Adult hybrid striped bass are believed to prefer open water as shown by their absence in cove-rotenone samples (Crandall 1978), their frequent capture in open water gillnet sets (Crandall 1978, Layzer and Clady 1981, Germann and Bunch 1985, Austin and Hurley 1987, Kinman 1987), and their selection of pelagic foods (Ott and Malvestuto 1981, Borkowski and Snyder 1982, Austin and Hurley 1987, Jahn et al. 1987, Kinman 1987). Habitat preferences, responses to water conditions, and movements of adult hybrid striped bass are important for evaluating their potential availability to anglers and their impacts on other sport and forage fishes. This study investigated the habitat use and preference, movements, and possible habitat overlap with largemouth bass of hybrid striped bass.

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Methods

Study Area

Ross Barnett Reservoir, in southcentral Mississippi near Jackson, was impounded in 1962 (Barkley 1971) inundating 12,545 ha (Fig. 1) to an average depth of 3 m. At normal level (92.2 m above mean sea level) the reservoir has a storage capacity of 15,317 ha/m and an average turnover time of 45 days at a discharge of 100.4 m³/sec. Annual water level fluctuation during the study period was approximately 1 m which included a 0.3 m fall drawdown. The surface area changed 809 ha with a 0.3 m water depth variation.

Ross Barnett Reservoir consists of the main lake and the less riverine Pearl River. Lake depths are 0–4 m in the flats, 4–11 m in the flooded lakes and sloughs, and 8–13 m in the flooded Pearl River channel. Tree snags and stumps surrounded many of the inundated lakes and oxbows. The less expanded Pearl River extends 39 km upstream above the main lake to a lowhead dam. Average river depth range from 7 to 10 m, depending on river stage. River flow ranged from >32,000 cfs in February to <100 cfs in October, 1987. The Reservoir is managed by the Pearl River Water Supply District as a water supply, flood control unit, and recreational area. The MDWC stocked hybrid striped bass fingerlings from 1983 through 1987 at annual rates of 105,000, 150,000, 70,000, 380,000 and 1,000, respectively (Cross 1987).

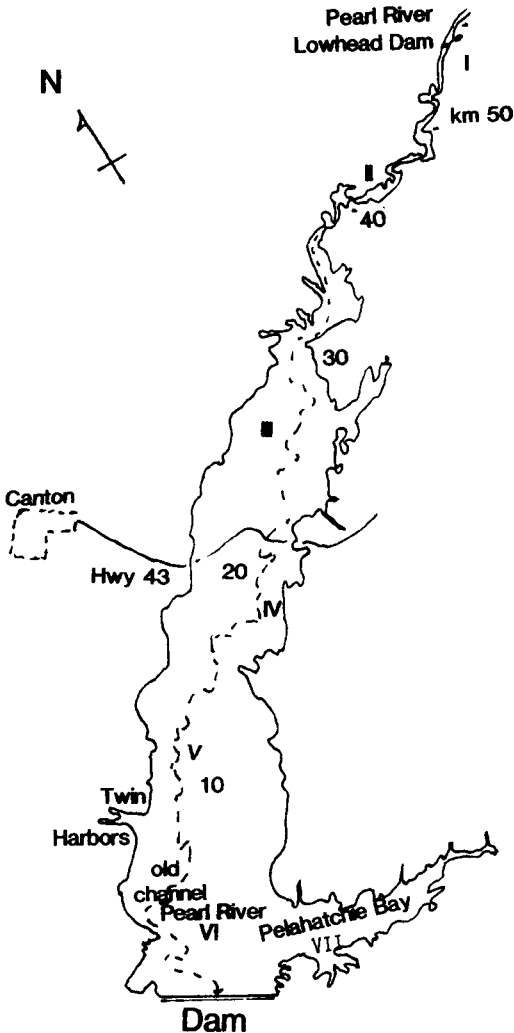


Figure 1. Ross Barnett Reservoir and Pearl River northeast of Jackson, Mississippi. Distances above Ross Barnett Dam are listed in kilometers and water quality sampling stations are shown as Roman numerals (I-VII).

Data Collection and Analysis

The MDWC captured hybrid striped bass from the lake in February 1987 with gillnets and with electroshocking equipment from the river in May. Gillnets were set during early evening and morning at locations used for annual MDWC hybrid striped bass surveys and checked every 2 hours.

Internal coil antenna radio transmitter were implanted into hybrid striped bass abdominal region as described by Brown and Richards (1979). The 26-g transmitters were <2% of the fish's body weight and had a life expectancy of >300 days. The weight, total length, and sex of each fish were recorded and an anchor tag was

inserted along the dorsal fin. An anesthetic, tricaine methane sulfanate (MS-222) was used on the first group of fish captured. This practice was discontinued when 8 of 9 fish captured died soon after release.

Fish were located once during the night, day, and dawn or dusk every week by tracking from a 5-m fiberglass boat. A scanning receiver with headphones was equipped with a whip antenna to detect a signal, then a directional loop antenna was substituted to locate the radio-tagged fish more precisely. Fish locations, water depth, water temperature, dissolved oxygen (DO) at 3-m intervals, Secchi disc reading, and bottom and fish depths were recorded. Mortality dates and locations were also recorded.

Physicochemical characteristics of available habitats in Ross Barnett Reservoir were determined by monitoring DO, temperature, and Secchi disc readings weekly at 7 stations on the reservoir (Fig. 1). River flows were obtained from the U.S. Geological Survey.

A largemouth bass (*Micropterus salmoides*) habitat study was conducted by the MDWC during May-July 1987 (Cross 1988). Five largemouth bass implanted with radio transmitters were tracked using the same methods described for hybrid striped bass. Water quality, water depths, and location data were used to investigate possible habitat differences and overlaps with hybrid striped bass.

Comparisons of temperature, DO, and Secchi disc readings between water quality stations and between fish locations and water quality stations were analyzed using the ANOVA and LSD Tests (SAS 1985). Water quality parameters were compared when water temperatures equal to or exceeded 25° C. Preference or avoidance of water depths by hybrid striped bass were determined using the Preference Assessment Program (Johnson 1980).

Results

Hybrid Movements

Thirty-six hybrid striped bass were radio-tagged during 1987. Mortality related to implantation was 61% (N = 22). Of the surviving 14 fish, 6 were males and 8 were females, with total lengths from 470 to 613 mm. These fish were considered age 3 years or older based on scales and length frequency analyses developed for Ross Barnett Reservoir (Cross 1988).

Of the 14 fish, 3 were followed throughout the study period, 5 died, 1 radio transmitter failed, and the fate of 5 was unknown (Table 1). Of the 5 fish with unknown fates, 1 left the study area through the spillway, and the other 4 fish may have represented mortalities (natural or fishing) or transmitter failure. Mortalities occurred during April, at the end of the "spawning run" when 3 of the radio-tagged fish in the river died, and during mid-July, when the 2 radio-tagged fish that remained in the river died. River temperature at this time had exceeded 30° C.

Radio-tagged fish moved from release sites to offshore areas within 9 hours after tagging. Seven of the 9 fish moved up the river ("spawning run") between

Table 1. Periods of telemetry monitoring for 14 radio-tagged hybrid striped bass in Ross Barnett Reservoir, Mississippi, 1987. T = radio tagged; M = mortality; U = unknown outcome; F = radio failure; _____ = survival entire period; --- = fish escaped through spillway into river.

Tag no.	Sex	1987										
		Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	
27	F	T—————>										
35	M	T—————		M								
37	M	T—————		M								
41	F	T—————>										
42	F	T—————		-----U								
50	F	T—————>										
49	F	T—————		M								
46	F	T—————								U		
43	F	T—————		U								
59	F				T—————			U				
61	M				T—————			M				
51	M				T—————			U				
53	M				T—————							F
71	M				T—————			M				

February 27 and April 19. The other 2 radio-tagged fish primarily remained in the lower reservoir, 1 left the reservoir through the spillway in mid-April. While in the river, fish moved upstream in response to increased flow rates. The “spawning run” ended May 12 when all but 2 fish returned to the lake. After the fish returned to the main lake, movement decreased. During the summer fish stayed primarily in 4 small areas (Fig. 2). In September, as the water cooled, the hybrid striped bass were observed surfacing. The remaining 3 radio-tagged fish appeared to disperse and move throughout the main lake in early fall.

Mean river and lake temperature ranged from 10° C in February to >29° C during July and August (Muncy and Phalen 1988). Temperatures ≥25° C were observed between June and October. During those months temperatures did not differ significantly between station ($P > 0.05$).

The lowest DO values were measured in the reservoir during July and August. The lake sites had higher DO values ($P < .05$) than the river sites except at the lowhead dam. Mean monthly DO values at the mid-lake station were highest of all stations and were significantly ($P < 0.05$) higher than the mean monthly DO values in the upper lake during all months. The mid-lake site DO values were significantly higher than the lower lake site during July and August ($P < 0.05$).

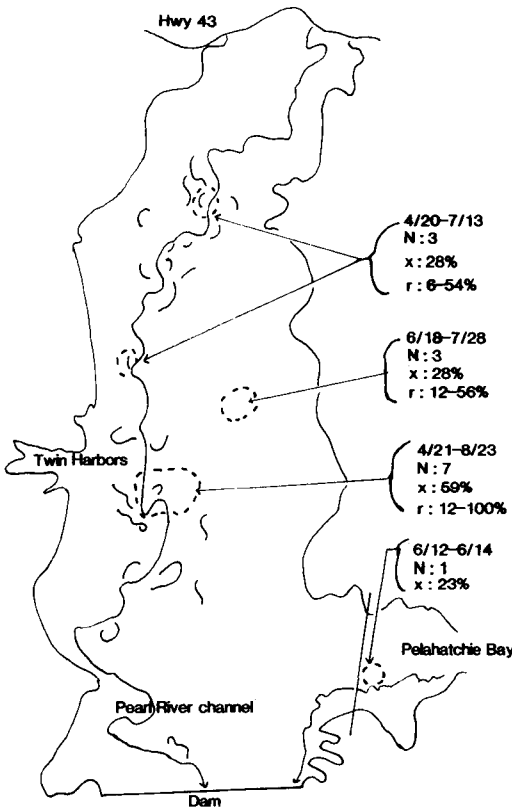


Figure 2. Centers of activity for radio-tagged adult hybrid striped bass based upon mean (\bar{x}) and range (r) of percentage of occurrence for individual fish tracked from May to August 1987 in Ross Barnett Reservoir.

Habitat Use

During the “spawning run,” radio-tagged hybrid striped bass were frequently located outside of strong currents, in eddy areas behind log jams in bendway cut-offs, behind sandbars, and at the mouths of deep backwater oxbows along the upper Pearl River. Angler’s catches and electrofishing also indicated that the hybrids used these habitats. The spillway pool below the lowhead dam was used frequently while the fish were in the river.

Following the “spawning run,” when the hybrids re-entered the lake, deep inundated oxbow slough areas and the submerged Pearl River channel at midlake were important activity centers (Fig. 2). Comparisons of the frequencies at which hybrids were located at different depths to the availability of depths in Ross Barnett Reservoir, (Fig. 3) revealed that depths of 4–7 m were preferred ($P < 0.05$). Depths of 0.3–2 m were avoided and ranked significantly lower than all other depths ($P < 0.05$). ANOVA tests on DO in the lake for June-July and August-September showed that DO at fish locations were higher ($P < 0.03$) than those at other stations during June-July and the upper and lower lake stations in August-September.

Summer interaction between hybrid striped bass and largemouth bass appear

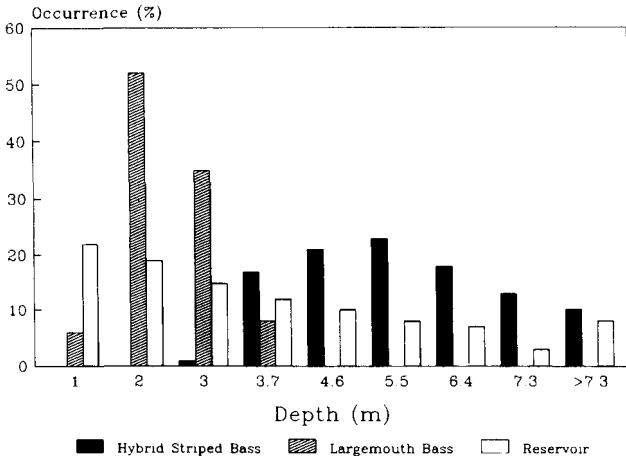


Figure 3. Frequency of occurrence by water depths for separate daily radio contacts with 12 hybrid striped bass (179 observations) and 5 largemouth bass (50 observations) during May-August 1987, contrasted to percentage of those depths available within Ross Barnett Reservoir. The largemouth bass data are from Cross (1988).

to be minimal with different preference in water depths and associated edge effects. Radio-tagged hybrids avoided the 2–3 m depths preferred by largemouth bass (Fig. 3) in Ross Barnett Reservoir. Largemouth bass in Ross Barnett were located in close proximity to surface edge such as aquatic vegetation (Schlagenhaft and Murphy 1985, Mesing and Wicker 1986). The hybrid striped bass were never observed to be associated with this type of habitat.

Discussion

The high mortality of adult radio-tagged hybrid striped bass was not inconsistent with MSDWC's December 1986 through February 1988 gillnet sampling on Ross Barnett Reservoir which indicated a major reduction in numbers of 1984 and 1985 year classes (Cross 1988). Other studies have documented high mortality of 3-year-old fish (Gleason 1982, Germann and Bunch 1983, Champeau 1984, Austin and Hurley 1987, Jahn et al. 1987). Mortality appear to be related to the spawning run and water temperature $>30^{\circ}\text{C}$.

Monitoring of radio-tagged adult hybrid striped bass in Ross Barnett Reservoir showed that fish moved freely between the lake and river in spring before adverse conditions created by temperatures $>24^{\circ}\text{C}$ and $\text{DO} < 6$ ppm. Windham (1986) reported that sonic-tagged adult hybrid striped bass in Clark Hill Reservoir during early summer selected water 3–6 m deep where temperatures were $18^{\circ}\text{--}24^{\circ}\text{C}$ and DO exceeded 6 mg/liter. Douglas and Jahn (1987) found hybrid striped bass in Spring Lake, Illinois, tolerated DO as low as 2 mg/liter to avoid water temperatures above 27°C . Hybrid striped bass in Ross Barnett Reservoir preferred areas with

highest available DO. This occurs in mid-lake, where deeper waters receive the most mixing from wave action by the prevalent winds (NOAA 1987).

Summer interaction between hybrid striped bass and largemouth bass appear to be minimal with different preference in water depths and associated edge effects. These results are supported by other studies which found largemouth bass located in close proximity to surface edge such as aquatic vegetation (Schlagenhaft and Murphy 1985, Mesing and Wicker 1986).

Literature Cited

- Austin, M. R. and S. T. Hurley. 1987. Evaluation of a striped bass (*Morone saxatilis*) × white bass (*M. chrysops*) hybrid introduction into East Fork Lake, Ohio. Ohio Dep. Nat. Resour. Final Rep., Fed. Aid Proj. F-29-R-23. Xenia. 44pp
- Axon, J. R. and D. H. Whitehurst. 1985. Striped bass management in lakes with emphasis on management problems. Trans. Am. Fish. Soc. 114:8–11.
- Barkley, H. 1971. Ross Barnett Reservoir Fisheries Investigation. Miss. Game Fish Comm., Compl. Rep., Fed. Aid Proj. F-12-R, Jackson. 83pp.
- Borkowski, W. K. and L. E. Snyder. 1982. Evaluation of white bass × striped bass hybrids in a hypereutrophic Florida lake. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 36:74–82.
- Brown, L. A. and R. H. Richards. 1979. Surgical gonadectomy of fish. A technique for veterinary surgeons. Vet. Record 104:125.
- Champeau, T. R. 1984. Survival of hybrid striped bass in central Florida. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 38:446–449.
- Crandall, P. S. 1978. Evaluation of striped bass × white bass hybrids in a heated Texas reservoir. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 32:588–598.
- Cross, T. 1987. Central Reservoir Investigations. Statewide Fisheries Management 155. Miss. Dep. Wildl. Conserv., Fish Rep. 58, Annu. Rep., Fed. Aid Proj. F-68. Jackson. 76pp.
- . 1988. Central Reservoir Fisheries Management Investigations Annual Report 1987. Miss. Dep. Wildl. Conserv., Annu. Rep., Fed. Aid Proj. F-68, Jackson. 59pp.
- Douglas, D. R. and L. A. Jahn. 1987. Radio tracking hybrid striped bass in Spring Lake, Illinois, to determine temperature and oxygen preferences. North Am. J. Fish. Manage. 7:531–534.
- Germann, J. F. and Z. E. Bunch. 1983. Age, growth, and survival of *Morone* hybrids in Clarks Hill Reservoir, Georgia. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 37:267–275.
- and ———. 1985. Comparison of white bass and hybrid bass food habits, Clarks Hill Reservoir. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 39:200–204.
- Gleason, E. V. 1982. A review of the life history of striped bass (*Morone saxatilis*) and white bass (*M. chrysops*) hybrids and an evaluation of their suitability for stocking. Calif. Dep. Fish, Game, and Inland Fish. Adm. Rep. No. 82–9. 19pp.
- Jahn, L. A., D. R. Douglas, M. J. Terhaar, and G. W. Kruse. 1987. Effects of stocking hybrid bass in Spring Lake, Illinois. North Am. J. Fish. Manage. 7:522–530.
- Johnson, P. H. 1980. The comparison of usage and availability measurements for evaluating resource preference. Ecology 61:65–71.

- Kinman, B. T. 1987. Evaluation of hybrid striped bass introductions in Herrington Lake. Ky. Dep. Fish and Wildl. Resour. Fish. Bul. 82. 52pp.
- Layzer, B. J. and M. D. Clady. 1981. Evaluation of the striped bass \times white bass hybrid for controlling stunted bluegills. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 35:297-310.
- Mesing, C. L. and A. M. Wicker. 1986. Home range, spawning migrations, and homing of radio tagged Florida largemouth bass in two central Florida lakes. Trans. Am. Fish. Soc. 115:286-295.
- Muncy, R. J. and P. Phalen. 1988. Hybrid striped bass evaluation. Habitats used by radio tagged adult hybrids in Ross Barnett Reservoir. Miss. Dep. Wildl. Conserv. Freshwater Fish Rep. 65. Jackson. 39pp.
- National Oceanic and Atmospheric Administration (NOAA). 1987. Local climatological data 1986. Jackson. ISSN 0198-2796:1-2.
- Ott, R. A. and S. P. Malvestuto. 1981. The striped bass \times white bass hybrid in West Point Reservoir. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 35:641-646.
- Schlagenhaft, T. W. and B. R. Murphy. 1985. Habitat use and overlap between adult largemouth bass and walleye in a west Texas reservoir. North Am. J. Fish. Manage. 5:465-470.
- SAS. 1985. SAS User's Guide: Statistics. SAS Inst. Inc. Cary, N.C. 1,290 pp.
- Windham, W. T., Jr. 1986. Summer temperature selection of striped bass \times white bass hybrids in a southeastern reservoir. M.S. Thesis, Univ. of Ga., Athens. 53pp.
- Yeager, D. M. 1982. Ultrasonic telemetry of striped bass \times white bass hybrids in the Escambia River, Florida. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 36:62-73.