Comparison of White Bass and Hybrid Bass Food Habits, Clarks Hill Reservoir

Jerome F. Germann, *Georgia Department of Natural Resources, Game and Fish Division, Rt. 1, Box 57, Dearing, GA 30808*

Zan E. Bunch, *Georgia Department of Natural Resources, Game and Fish Division, Rt. 1, Box 57, Dearing, GA 30808*

Abstract: Food habits of adult white bass, (*Morone chrysops*), were studied in Clarks Hill Reservoir from 1 July 1980 to 30 June 1981. Stomachs from 137 white bass ranging from 225 mm to 415 mm total length and 0.12 kg to 0.76 kg were examined. Overall, threadfin shad was the predominant food item of white bass (56% frequency of occurrence). Analysis by season indicated that insect larvae and non-shad fishes were of periodic importance. Similarities were found in frequency of occurrence and seasonal trends. Food habits of white bass were compared to hybrid bass using relative importance indices.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 39:200–206

Many southeastern state game and fish agencies have demonstrated the feasibility of stocking *Morone* hybrid bass (*Morone saxatilis* x *Morone chrysops*) to convert forage fish biomass to game fish biomass. The success of the technique is evident in Clarks Hill Reservoir. Since 1977, the hybrid bass creel has increased from 17,698 fish weighing 23,236 kg (Williams 1982) to 59,384 fish weighing 65,760 kg in 1984 (Hampton Williams, S.C. Wildl. and Mar. Resour. Dep., unpubl. data). Fingerling stockings have occurred annually since 1967 with hybrid bass fingerling rates increasing from 18/ha to 41/ha between 1977 and 1981.

The success of the hybrid fishery has prompted concern for its effects on the white bass (*Morone chrysops*) populations of the lake. This work was initiated to describe the white bass food habits and to compare the results with food habits of hybrid bass from Clarks Hill Reservoir (Germann 1982). Data for both species were collected concurrently. This work was funded through Dingell-Johnson Federal Aid to Fish Restoration, Project F-26, Georgia. Thanks are due to Jo Ann Henderson for typing this manuscript.

Methods

Clarks Hill Reservoir is a 28,340-ha multipurpose impoundment located on the Savannah River between Georgia and South Carolina. The reservoir is operated by the U.S. Corps of Engineers. Clarks Hill was divided into 5 areas for sampling *Morone* sp. Two areas were randomly selected for each month's sample.

Fish were taken in gill nets which were checked at 2-hour intervals either from before sunrise to midday or from mid-afternoon to mid-evening and later. Gill nets were the sinking type, with separate bar mesh sizes of 3.2 cm, 3.8 cm, 5.1 cm, 6.4 cm, or 7.6 cm. All nets were 1.8 m deep and either 30.4 m or 91.2 m long. Monofilament and multifilament nets were used prior to October 1980 with only monofilament being used thereafter.

Fish were weighed to the nearest gram and measured for total length (TL) in millimeters. Stomachs were excised, placed in numbered plastic bags and transported on ice. In the lab, stomach contents were removed, identified, counted, and volumetrically measured.

Food items of hybrid bass and white bass were compared using a relative importance index as described by George and Hadley (1979). In this study percent total volume was substituted for percent total weight. White bass $\leq$ 340 mm TL and hybrid bass $\leq$ 380 mm TL were included in the calculations. These size groups approximated young-of-the-year and age class I basses.

Results

From 1 July 1980 to 30 June 1981, 137 white bass stomachs from Clarks Hill Reservoir were examined for food contents. The examined fish ranged from 225 mm to 415 mm in length and 0.12 kg to 0.76 kg in weight. Sixty-eight percent of the fish had food items in their stomachs. White bass were not collected in gill nets in February, March, and April. Apparently, the fish had moved out of the main body of the lake into the riverine arms for the spawning season. Newton and Kilambi (1969) also noted migratory behavior of white bass during the same months in Beaver Reservoir, Arkansas. Gill netting was not conducted in the riverine areas of the lake.

Frequency of occurrence and percent composition by number and volume of the food items identified are presented in Table 1. Threadfin shad (*Dorosoma petenense*) occurred in 56% of the stomachs. No gizzard shad (*Dorosoma cepedianum*) were identified from the stomachs. Other fish, including darters (*Etheostoma* spp.), crappie (*Pomoxis* spp.), yellow perch (*Perca flavescens*), and unidentified remains, were found in 16% of the white bass stomachs. Sunfish, mainly bluegill (*Lepomis macrochirus*), occurred in 14% of the stomachs. Mayfly larvae were found in 8% of the white bass, while larvae of other insects (dragonfly, damselfly, caddisfly, and diptera) were found in 6% of the stomachs examined.

Shad comprised 24.4% by number and 67.5% by volume of all items identified from the stomachs. Insects, mainly dipteran larvae, accounted for 66.2% of the

Table 1. Stomach contents of 137 white bass from Clarks Hill Reservoir by frequency of occurrence, number, and volume (ml) July 1980 to June 1981.

	Stomachs With Item		Composition			
Food Item	*N*	%	Numerical	%	Volumetric	%
Ephemeroptera	8	8	29	5.6	2.6	1.2
Other insects	6	6	310	60.6	1.4	0.7
Shad	59	56	125	24.4	148.5	67.5
Sunfish (*Lepomis* spp.)	15	14	28	5.5	47.8	21.7
Crappie	1	1	1	0.2	2.0	0.9
Yellow perch	2	2	2	0.4	10.0	4.5
Darter	2	2	2	0.4	2.0	0.9
Fish remains	12	11	12	2.3	5.8	2.6
Total stomachs with a food item = 93 (68%)						

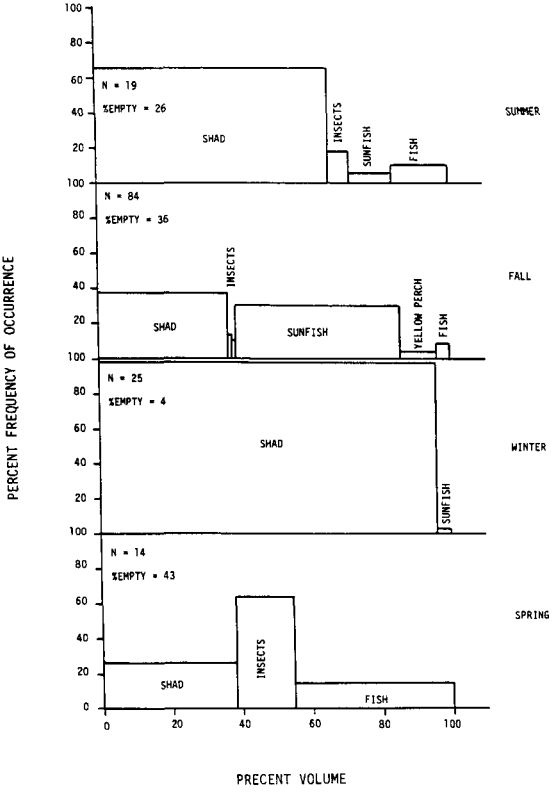

Figure 1. Seasonal food habits of white bass from Clarks Hill Reservoir, July 1980 to June 1981. Summer is made up of July, August, and September. *N* equals the number of white bass.

number of items but only 1.9% of the total volume. Sunfish were third in numerical composition and second in importance by volume.

Threadfin shad were the predominant food of Clarks Hill white bass in summer and winter (Fig. 1). Shad occurred in 98% of the stomachs and comprised 96% of the volume of items consumed during winter. Sunfish and fish remains were of greatest importance in fall and spring. Insect occurrence was highest in the spring.

The dominant size range of shad eaten increased as seasons changed (Fig. 2). In summer, white bass consumed shad ranging from 20 to 35 mm. By winter, this size shad was absent from the diet, and 50- to 70-mm shad had become dominant. Shad recovered from white bass stomachs in the spring were mainly in the 20- to 35-mm group. This pattern was similar to that demonstrated in hybrid bass (Germann 1982). However, the hybrid bass shift in diet from large shad in February to young-of-the-year shad in May was much clearer. Only 5 threadfin shad were recovered from 209 hybrid bass stomachs from February through April. When shad reappeared in the diet in May, >90% were in the 20- to 35-mm size group. Unfortunately, white bass were not collected in these months to describe their feeding patterns.

Relative importance indices were calculated for comparison of white bass and hybrid bass food habits (Table 2). Threadfin shad followed by dipteran larvae and pupae and bluegill were of greatest importance in white bass diets. Dipterans were

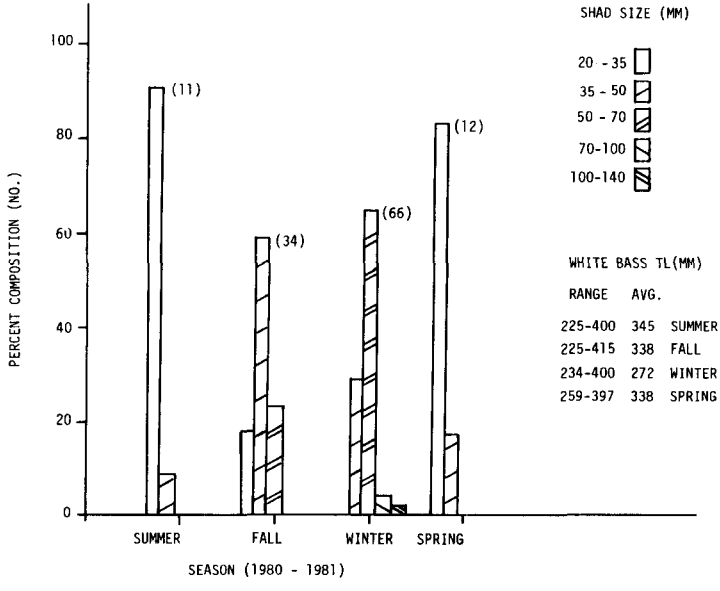

Figure 2. The seasonal frequency distribution of shad consumed by white bass from Clarks Hill Reservoir, July 1980 to June 1981. The number of shad recovered from the stomachs are in parentheses.

Table 2. Relative importance indices (RI) of the food items using percentage total numbers (% number) and total volume (% volume) of white bass ≤340 mm and hybrid bass ≤380 mm from Clarks Hill Lake, July 1980 to June 1981.

Species	Food Item	(%) Occurrence[a]	(%) Number	(%) Volume	RI
White bass					
	T. shad	56	19	63	47
	Crappie	1	<1	1	1
	Bluegill	11	5	18	11
	Sunfish (*Lepomis* sp.)	4	1	6	4
	Yellow perch	3	<1	6	3
	Darter	3	<1	1	1
	Fish remains	12	<1	3	5
	Diptera	4	68	<1	24
	Other insects	6	2	1	3
Hybrid bass					
	T. shad	60	26	88	57
	Largemouth bass	<1	<1	<1	1
	Bluegill	4	1	3	3
	Sunfish (*Lepomis* sp.)	1	<1	1	1
	Yellow perch	2	<1	2	1
	Darter	1	<1	<1	1
	Fish remains	5	1	2	3
	Mayfly	9	3	2	5
	Diptera	12	69	2	27
	Other insects	6	2	1	3

[a]Occurrence = percent of stomachs with food items in stomach.

composed mainly of *Chaoborus* sp. and were found in tens and twenties up to several hundreds in individual stomachs. Bluegill, as well as most other fish categories, were more important in the diet of white bass. Hybrid bass indices also reflected the importance of threadfin shad and dipteran larvae and pupae in the diets. Insect items overall were of greater importance in hybrid stomachs.

Discussion

Food habits of white bass demonstrated a predominance of threadfin shad (56% frequency occurrence) throughout the year except for fall and spring. Sunfish and insect items were of periodic importance in the fall and spring months. These data were generally similar to food habits reported for hybrid bass from Clarks Hill Lake by Germann (1982). Threadfin shad were found in 62% of the hybrid bass stomachs examined with insects and other fish being of intermittent importance.

Indices of relative importance also suggested common preference of the 2 basses for several food items. Some similarity of the dietary items overall and the relative importance of these items should be expected since hybrid bass are genetically one-half white bass. Parental characters passed on would include similar food preferences. Of concern was that hybrid bass demonstrated higher relative

importance indices for threadfin shad and insect forms. This could also be expected and may be indicative of growth patterns associated with the phenomenon of hybrid vigor.

Ager (1979) studied young-of-the-year white bass in Lake Sinclair, Georgia. He noted that white bass 112-153 mm fed almost exclusively on shad and suggested that a limited availability of shad could adversely affect white bass. The importance of shad in the diet of white bass led us to examine threadfin shad abundance in cove rotenone samples from Clarks Hill Lake (Table 3). Samples taken in 1982 and 1985 were included to facilitate regression analysis. Total weights of threadfin shad collected in 1976 were more than 4 times greater than total weights recovered in 1985. Declines in shad abundance occurred between 1976 to 1979 and 1982 to 1985. Regression of kilograms/hectare through time was significant ($B = 0$ at $p \leq 0.10$) and indicated that a real decline in threadfin shad abundance has occurred since 1976. These data were composites of 3 sample sites each year. Some variation within years occurred. However, the general decline in shad abundance should elicit concern for predator/prey relationships in Clarks Hill. One point of note was that in 1976, hybrid bass fingerling stocking rates increased to 22.1 fish/ha from 7.9 fish/ha in 1975 (Germann and Bunch 1983). Stocking rates have remained at or above this level since then.

Van Den Avyle et al. (1983) implied that fishes with similar distributions must have different or highly flexible feeding preferences in order to co-exist. In this study, white bass and hybrid bass were collected simultaneously from the same lake areas. Hybrid bass were encountered along the entire length of the gillnets. On overcast days or dark nights, hybrids were taken at the shore end of the nets as well as in deeper waters. White bass occurred in the gillnets in a similar pattern. However, white bass appeared somewhat more concentrated in the shallow depths in specific net sets. Our data did not suggest different or highly flexible food preferences.

Results of this study were indicative of substantial overlap in the hybrid and white bass food habits. Threadfin shad was the principal food of both species. The trend of abundance of threadfin in the rotenone data and the seasonal sizes of shad consumed by both species were indicative of a forage being fully utilized throughout the growing season. Current reservoir strategies which include annual or periodic heavy *Morone* hybrid stockings in lakes with white bass populations should

Table 3. Threadfin shad weights from rotenone samples on Clarks Hill Lake since 1976 expressed in size groups according to Surber (1959).

Year	Hectares Sampled	Weight (kg)			Total Wt. (kg)	Kg/ha
		Fingerling	Intermediate	Harvestable		
1976	3.5	24.5	12.4		36.9	10.5
1979	3.5	17.1	2.6	0.2	19.9	5.7
1982	3.5	16.1	3.3	0.2	19.6	5.6
1985	3.3	6.7	0.9		7.6	2.2

take into account the potential impacts to the white bass and the available threadfin shad forage base. Studies should be implemented to monitor threadfin shad population levels and to determine the factors affecting their abundance. Such a study should receive priority for the Clarks Hill Reservoir fishery.

Literature Cited

Ager, L. M. 1979. Food habits of young-of-the-year striped bass in Lake Sinclair. Game and Fish Div., Ga. Dep. Nat. Resour., Final Rep. Atlanta, Ga. 22pp.

George, E. L. and W. F. Hadley. 1979. Food and habitat partitioning between rock bass (*Ambloplites rupestris*) and smallmouth bass (*Micropterus dolomieui*) young-of-the-year. Trans. Am. Fish. Soc. 108253-261.

Germann, J. F. 1982. Food habits of *Morone* hybrid bass in Clarks Hill Reservoir, Georgia. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 36:53–61.

——— 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.

Newton, S. H. and R. V. Kalambi. 1969. Determination of sexual maturity of white bass from ovum diameters. Southwest Nat. 14:213–220.

Van Den Avyle, M. J., B. J. Higginbotham, Brian T. James, and Frank J. Burlow. 1983. Habitat preferences and food habits of young-of-the-year striped bass, white bass, and yellow bass in Watts Bar Reservoir, Tennessee. North Am. J. Fish. Manage. 3:163–170.

Williams, H. M. 1982. Fisheries investigations in lakes and streams—district II. S.C. Wildl. and Mar. Resour. Dep. Annu. Prog. Rep.—Supplement F-15-9, 10, 11. 11p.