Food Habits and Growth of Young-of-Year White Bass in Two East Tennessee Reservoirs

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Abstract: A total of 791 young-of-year white bass (*Morone chrysops*) from 2 East Tennessee reservoirs were examined to determine food habits and growth. An effort was made to determine when they switched from an insectivorous to a piscivorous diet. White bass in Cherokee Reservoir consumed primarily insects (Chironomidae) during their first year and in Norris Reservoir, primarily zooplankton (Cladocera). When they began consuming fish, young-of-year white bass in Cherokee Reservoir were between 2.5 and 5.0 cm in length while white bass in Norris Reservoir were between 5.0 and 7.5 cm. Numbers of fish consumed by white bass were analyzed as a percentage of numbers of all foods consumed, and as a percentage of foods occurring in the guts of all fish in the study. White bass grew larger (18.4 cm) in Norris than in Cherokee (14.0 cm) during their first year, although mean condition factors were similar in both reservoirs (Norris 0.67 to 1.1, Cherokee 0.86 to 1.21).

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The white bass (*Morone chrysops*) is an important, native game fish in East Tennessee reservoirs. This fish is often particularly important in older reservoirs because it continues to support a sport fishery when the initial high production of other game fishes declines. White bass are well-adapted to the periodic water fluctuation in most Tennessee Valley Authority (TVA) reser-

voirs in Tennessee. Their spring runs have become famous in East Tennessee, often attracting thousands of fishermen to a few miles of popular shoreline.

The purpose of this investigation was to describe the diet of young-of-year white bass from 2 East Tennessee reservoirs and to determine the point at which fish become an important part of the diet. In addition, growth increments and condition values for young-of-year white bass from both lakes are presented.

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Methods

This study encompasses data collected from Cherokee and Norris Reservoirs in East Tennessee. Cherokee Reservoir is located on the main stem of the Holston River and is surrounded by agricultural and industrial development. This eutrophic, multipurpose storage reservoir was formed in 1941 by the Tennessee Valley Authority (TVA). At full pool this reservoir covers 12,591 ha with a maximum depth of 46 m. Norris Reservoir is located on the main stem of the Clinch River and has very little agricultural and industrial development surrounding it. This mesotrophic multipurpose reservoir was completed by TVA in 1936. Norris covers 13,840 ha with a maximum depth of 61 m. Both reservoirs are used for power generation, flood control, and recreational purposes (Saul 1981, Richardson 1982).

White bass were collected from June 1979 through January 1981. They were collected in samples containing young-of-year striped and hybrid bass for other studies. Fish samples were collected twice a month from June 1979 through October 1979 and once a month from November 1979 through May 1980. A similar schedule was maintained in 1980–81, ending in January 1981. Fish were collected with a 1.8 m × 15.2 m straight seine (9.5-mm mesh) on each sampling date at 5 to 8 sites per night until the winter and spring months. Gill nets 45.7 m long by 1.8 m deep with mesh sizes of approximately 13-, 19-, 25-, and 32-mm, were employed throughout the study. Electrofishing was also utilized on most collection dates using a boom-type 230-volt (5000 watt) high cycle AC generating unit. All collections were made at night when young-of-year fish moved inshore to feed. Specimens were preserved in 10% formalin for later analysis in the lab.

Gut analyses were performed on all white bass collected during the study (the gut included the entire digestive tract from the esophagus to the anus). Food items were identified to the lowest practical taxa under a 40× binocular dissecting scope. Unidentifiable debris were classified as miscellaneous. Total length (cm) and weight (g) were recorded for each fish.

Numerical abundance of foods (by actual numbers consumed) and frequency of occurrence of foods in all fish captured were tabulated by length classes. Coefficients of condition (K) were calculated using Hile (1936)

$K = \frac{100W}{L^3}$, with weight in g and total length in cm.

Results and Discussion

Of the 556 stomachs examined from Cherokee, only 4 (0.7%) were empty. Young-of-year white bass consumed more Chironomidae than any other food organisms. By numerical abundance, their diets consisted of 43% Chironomidae, 14% Crutacea, and 12% fish (Table 1). Chironomidae occurred in 47% of stomachs with food, Crustacea in 16%, and fishes in 8.5% (Table 2). Of the 235 young-of-year white bass collected in Norris, only 7 (3%) did not contain food items. These fish consumed more Crustacea than any other food item. By numerical abundance, their diets consisted of 74% Crustacea, 10% Chironomidae, and 3% fish (Table 1). Crustacea occurred in 30% of stomachs with food, Chironomidae in 51% and fish 66% (Table 2).

Table 1. Percent of Total Numbers of Food Items in Guts of Young-of-Year White Bass

Food Organism	Cherokee	Norris
Chironomidae larvae	22.5	5.0
Chironomidae pupae	20.7	5.0
Chaoborus larvae	8.3	7.0
Copepoda	5.7	23.0
Cladocera	4.3	51.0
Argulus sp.	2.3	
Amphipoda	0.6	
Ostracoda	1.1	
Clupeidae	6.7	1.0
Unidentified fish	3.1	2.0
Larval fish	1.5	
Morone chrysops	0.6	
Centrarchidae	0.3	
Hymenoptera pupae	1.5	
Ephemeroptera	0.8	2.0
Hydracarina	0.1	
Neuroptera larvae	1.1	
Ceratopogonidae		
Megaloptera		
Hemiptera		
Annelida		
Miscellaneous	15.2	2.0

Table 2. Frequency of Occurrence (percent) of Food Items in Guts of Young of Year White Bass

Food Organism	Cherokee	Norris
Chironomidae larvae	33.4	51.0
Chironomidae pupae	14.4	[a]
Chaoborus larvae	7.5	16.0
Copepoda	7.6	24.0
Cladocera	6.0	20.0
Argulus sp.	1.0	
Amphipoda	0.2	
Ostracoda	0.2	1.0
Clupeida	7.9	24.0
Unidentified fish	1.6	36.0
Larval fish	1.4	
Morone chrysops	0.5	
Centrarchidae	0.2	10.0
Hymenoptera pupae	1.2	1.0
Ephemeroptera	0.5	16.0
Hydracarina	0.1	
Neuroptera larvae	0.1	
Ceratopogonidae		9.0
Megaloptera		5.0
Hemiptera		3.0
Annelida		4.0
Miscellaneous	9.5	37.0

[a] Included in counts for Chironomidae larvae.

While Cherokee white bass consistently consumed Chironomidae in terms of abundance and occurrence, Norris white bass consumed more Crustacea, although fish occurred in a wider range of their stomach samples. Cherokee Reservoir, being eutrophic, would have more Chironomidae than Norris Reservoir, a mesotrophic system. Due to a slower warming trend in Norris, more forage fish of smaller sizes were available for the young-of-year white bass to consume. This differentiation could explain why more fish occurred in the diets of Norris white bass than in Cherokee white bass.

When the young-of-year white bass are divided into 2.5-cm size classes, the effects of size on food item consumption can be examined. White bass in Cherokee between 2.6 and 5.0 cm total length consumed Chironomidae and Crustacea in approximately the same proportions, 37.9% and 42.1%, respectively (Table 3). Centrarchidae were 10% of the total items in each stomach sample within this size range. Fish between 5.1 and 12.5 cm consumed relatively constant amounts of Chironomidae, from 31% to 59% of total items consumed. Although fish first appeared in Cherokee white bass stomachs in the 5.1 cm length classes, they did not become an important food

Table 3. White Bass Food Consumption (percent of total) by Length Classes in Cherokee (C) and Norris (N) Reservoirs

	Length Classes[a]													
	1		2		3		4		5		6		7	
Food Organism	C	N	C	N	C	N	C	N	C	N	C	N	C	N
Chironomidae larvae	36.6	8.0	42.1	21.0	37.4	4.0	29.4	4.0	18.3	3.0	18.1	1.0	26.0	2.0
Chironomidae pupae	1.3	8.0	12.1	7.0	20.5	4.0	19.4	2.0	13.5	2.0	19.2	9.0	8.1	22.0
Chaoborus larvae			13.6	2.0	8.6	7.0	3.6	22.0	0.2	1.0	0.5	7.0	1.0	
Copepods	37.5	55.0	10.5	33.0	13.3	41.0	2.9	38.0	0.3		0.3	1.0		
Cladocera	4.6	16.0	9.9	25.0	2.2	40.0	14.9	21.0	4.8	68.0	1.7	77.0		69.0
Argulus sp.			1.2		2.2		0.1		0.1		0.2			
Amphipods			0.2		0.4									
Ostracoda			0.3		0.1									
Clupeidae			1.1	1.0	2.4		11.0	1.0	26.7	2.0	22.7	1.0	9.8	1.0
Unidentified fish			0.4	5.0	0.9	1.0	4.9	1.0	1.0	5.0	2.1		6.6	1.0
Larval fish			1.9		3.2									
Morone chrysops					0.3		0.3		17.2				1.0	
Centrarchidae	10.0			2.0	0.3		0.2							
Hymenoptera pupae			0.3		2.2		1.0		0.8		5.2			
Ephemeroptera			0.9		1.3		0.6	5.0	0.6	14.0		2.0		3.0
Hydracarina			0.1											
Neuroptera larvae			0.1		0.2		0.2							
Ceratopogonidae		7.0		1.0										
Megaloptera										1.0				
Hemiptera				1.0										
Annelida										2.0				1.0
Miscellaneous	10.0	3.0	5.3		4.5		9.7	5.0	16.5	2.0	13.6	1.0	15.9	1.0

[a] Length classes are as follows:
1 = 2.6– 5.0 cm
2 = 5.1– 7.5 cm
3 = 7.6–10.0 cm
4 = 10.1–12.5 cm
5 = 12.6–15.0 cm
6 = 15.1–17.5 cm
7 = 17.6–20.0 cm

Table 4. Published Data Concerning Primary Food Items Consumed by Young-of-Year White Bass

Author	Study Location	Fish Length (cm)	Food Item
Richardson (1982)	Norris Reservoir,TN	3.5–18.4	Crustacea
Saul (1981)	Cherokee Reservoir,TN	3.5–14.0	Chironomidae
Clark and Pearson (1980)	Ohio River,KY,OH	y–o–y	Larval fish
Griswold and Tubb (1977)	Sandusky Bay,OH	y–o–y	Fish, aquatic insects
Voigtlander and Wissing (1974)	Lake Mendota,WS	y–o–y	Crustacea, Chironomidae
Simms (1972)	Dale Hollow Reservoir,TN	y–o–y	Crustacea
Olmsted and Kilambi (1971)	Beaver Reservoir,AK	y–o–y	Fish, aquatic insects, Crustacea
		up to 5.0	Crustacea
		5.0 to 10.0	Chironomidae
Ruelle (1971)	Lewis and Clark Reservoir,SD	over 9.0	Fish
Priegal (1970)	Lake Winnebago,WI	y–o–y	Zooplankton
Moser (1968)	Lake Texoma,OK	y–o–y	Crustacea, fish
Webb and Moss (1967)	Center Hill Reservoir,TN	y–o–y	Larval fish
Bonn (1953)	Lake Texoma,TX	y–o–y	Crustacea, Chironomidae, fish

Table 5. Published Growth Estimates of White Bass for First Year of Growth

Author	Study Location	Actual or Backcalculated Total Length (cm) at Age 1
Richardson (1982)	Norris Reservoir,TN	18.4
Saul (1981)	Cherokee Reservoir,TN	14.0
Baglin and Hill (1976)	Lake Texoma,OK	21.1
TVA (1975)	Cherokee Reservoir,TN	15.0
Voigtlander and Wissing (1974)	Lake Mendota,WS	10.6
Simms (1972)	Dale Hollow Reservoir,TN	19.3
Olmsted and Kilambi (1971)	Beaver Reservoir,AK	24.5
Ruelle (1971)	Lewis and Clark Reservoir,SD	10.8
Myhr (1971)	Dale Hollow Reservoir,TN	19.3
Priegal (1970)	Lake Winnebago,WI	9.7
Pelren (1970)	Pool 19,Mississippi River	13.9
Houser and Bryant (1970)	Bull Shoals Reservoir,TN	19.0
Webb and Moss (1967)	Center Hill Reservoir,TN	20.6
Nichols and Turner (1966)	Dale Hollow Reservoir,TN	17.8
Forney and Taylor (1963)	Oneida La,NY	13.5
Bonn (1953)	Lake Texoma,TX	11.7
Moyle (1952)	Minnesota	9.4
Tompkins and Carter (1951)	Kentucky	17.3
Tompkins and Peters (1951)	Herrington Lake,KY	21.3
Patriarche (1951)	Norfolk Lake,MO	17.8
Sigler (1949)	Spirit Lake,IA	12.9
Van Oosten (1942)	Lake Erie,NY	11.9
Van Oosten (1942)	Norris Lake,TN	16.0
Roach (1948)	Ohio	14.0
Howell (1945)	Wheeler Reservoir,AL	15.5

Table 6. Mean Condition Values (K) for Young-of-Year White Bass in Cherokee and Norris Reservoirs

Total Length (cm)	Cherokee		Norris	
	No.	K	No.	K
2.6– 5.0	5	0.86	15	0.67
5.1– 7.5	264	0.99	92	0.85
7.6–10.0	169	1.02	52	0.92
10.1–12.5	53	1.13	37	0.96
12.6–15.0	65	1.21	19	1.05
15.1–17.5	64	1.17	29	1.05
17.6–20.0	52	1.16	16	1.11

item until the white bass reached 12.5 cm; at this point fish consumption totaled 33%. In Norris, Crustacea was the most abundant item consumed in all young-of-year length classes (Table 3). Fish first appeared in the gut contents of white bass 5.1 to 7.5 cm TL. but did not appear to dominate the diet. Chironomidae did not appear to be present in large numbers except in the 5.1 to 7.5 cm length classes.

A comparison of white bass food habits as determined in this study and other published accounts is presented in Table 4. Ruelle (1971) revealed that white bass in Lewis and Clark Reservoir, S.D., consume more fish after the white bass reaches 9.0 cm in length. The Cherokee study revealed a 4-fold increase in fish consumption in approximately the same length range. This same increase wasn't apparent in Norris fish. Simms (1972) revealed that white bass in Dale Hollow Reservoir, Tennessee, consumed primarily Crustacea their first year. He also indicated that fish were consumed by white bass of 4.4 cm. The Dale Hollow ecosystem is similar to that of Norris, and this is somewhat reflected by similar diets of white bass in both reservoirs. Young-of-year white bass in Cherokee and Norris did not consume over 33% fish in their diets (Saul 1981, Richardson 1982).

White bass in Cherokee Reservoir grew to an average of 14.0 cm in 1 year. This is a much lower figure than most published data, and the lowest first year's length reported in any Tennessee Reservoir (Table 5). Norris white bass grew to 18.4 cm in their first year, a size similar to those reported in other studies. The reduced lengths of Cherokee white bass, when compared to other estimates, could be a result of overcrowding of young-of-year white bass as 1979 and 1980 appeared to be "boom years" in terms of white bass produced.

Mean condition values (K) for white bass in Cherokee and Norris Reservoirs are presented in Table 6. Condition values in Cherokee ranged from 0.86 to 1.21 and were slightly higher than Norris values of 0.67 to 1.11. Although Norris fish were longer at the end of their first year, they were less plump than their Cherokee counterparts. These values are slightly lower than Pelren's (1970) data on young-of-year white bass from Pool 19 of the Mississippi River which ranged from 1.2 to 1.3. Simms (1972) found that condition values of young-of-year white bass in Dale Hollow Reservoir, Tennessee, ranged from 0.85 to 1.3.

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