Food Habits of Morone Hybrid Bass In Clarks Hill Reservoir, Georgia

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

Abstract: Food habits of hybrid bass *(Morone saxatilis* x *Morone chrysops)* were studied in Clarks Hill Reservoir from 1 JUly 1980 to 30 June 198I. Stomachs from 820 hybrid bass ranging from 221 mm to 736 mm total length and 0.13 kg to 4.21 kg were examined. Overall, threadfin shad was the predominant food item of hybrid bass (62% frequency of occurrence). Data indicated hybrid bass were fully utilizing the threadfin shad. Hybrid bass did not shift to gizzard shad despite the apparent winter depletion of threadfin shad. Analysis by season and by size group indicated that insect larvae and non-shad fishes were of periodic importance and occurred in the diets at levels higher than previously reported.

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Many southeastern state game and fish agencies have demonstrated the feasibility of the management techniques of stocking a predator fish to convert forage fish biomass to game fish biomass. The success of the technique is evident in Clarks Hill Reservoir. The *Marone* hybrid bass fishery is a significant one: 17,698 fish weighing 23,236 kg were creeled in 1977; 23,727 fish weighing 34,718 kg in 1978; and 48,780 fish weighing 65,786 kg in 1979 (Hampton Williams, S. Carolina Wildlife and Marine Resources Dept., unpublished data). Since 1967, over 40,100,000 hybrid bass fry and 5,300,000 hybrid bass fingerlings have been stocked into Clarks Hill Reservoir. Stockings have occurred annually. From 1977 to 1981, hybrid bass fingerling stockings have increased from 18/ha to 41/ha.

Investigations by Bishop (1967), Williams (1970) and Ware (1974) showed c1upeids *(Dorosoma petenense* or *D. cepedianum)* to be the principal food item of hybrids. The objectives of the present study were to describe the food habits of hybrid bass from a lake with an extended history of high stocking densities and to compare these results with food habits described within 3 years of the initial hybrid stockings (Williams 1970). This study was funded through Dingell-Johnson Federal Aid to Fish Restoration, Project

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Methods

Clarks Hill Reservoir is a 28,340 hectare 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 hybrid bass. Two areas were randomly selected for each month's sample. At least 25 hybrid bass were collected from each area so that a minimum of so fish were collected monthly for food habits.

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 mesh sizes of 3.2 em, 3.8 em, 5.1 em, 6.4 em, or 7.6 em. 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 in millimeters for total length. Stomachs were excised, placed in numbered plastic bags and transported on ice. Stomach contents were removed at McDuffie Fisheries office, identified, counted and measured volumetrically.

Results

From ı July 1980 to 30 June 1981, 820 hybrid bass stomachs from Clarks Hill Reservoir were examined for food contents. The examined fish

Table 1. Stomach Contents of 820 Hybrid Bass from Clarks Hill Reservoir by Frequency of Occurrence, Number and Volume (ml), July 1980 to June 1981

	Stomachs with Item		Composition			
Food Item	Number	%	Numerical	%	Volumetric	%
Ephemeroptera	128	20	812	8	83	3
Megaloptera larvae	32	5	387	4	18	1
Diptera larvae	68	10	5,997	58	28	1
Other insects	24	4	96	1	19	1
Shad[a]	395	62	2,807	27	1,946	69
Sunfish (*Lepomis* spp.)	39	6	76	1	262	9
Yellow perch	39	6	55	<1	298	10
Other fish	67	10	74	1	159	6
Total stomachs with a food item = 642						
% = 78						

• Includes 392 threadfin shad; 3 gizzard shad.

ranged from 221 mm to 736 mm in length and 0.13 kg to 4.21 kg in weight. Seventy-eight percent of the samples had food items in the stomachs.

Shad, which were almost exclusively threadfin shad *(Dorosoma petenense)*, occurred in 395 of the stomachs (Table I). Only 3 gizzard shad, *(D. eepedianum)*, were identified in the stomachs. Mayfly larvae, second in occurrence, were found in 20% of the stomachs. Sunfish, mainly bluegill *(Lepomis macrochirus)* occurred in 6% of the stomachs as did yellow perch *(Perea flavescens)*. Other fish, including darters *(Etheostoma* spp.), crappie *(Pomoxis* spp.), largemoillth bass *(Mieropterus salmoides)*, and serranids *(Morone* spp.), were found in 10% of the hybrid bass stomachs.

Shad comprised 27% by number and 69% by volume of all items identified from the stomachs. Dipteran larvae and pupae comprised 58% of the number of items but only [% of the total volume. Ephemeroptera were third in total numbers, while yellow perch and sunfish were second and third, respectively, in importance by volume.

Threadfin shad were seasonally the predominant food of Clarks Hill hybrid bass (Fig. I). Insects, sunfish and yellow perch were eaten in all seasons but appeared to be of greatest importance in the spring. In January threadfin shad comprised over 98% in occurrence and volume of the items consumed. No empty stomachs were found in January. However, in February and March shad occurred in less than 20% of the stomachs and accounted for only 20% of the total volume. Over 50% of the stomachs examined were empty. Insects and other fish increased in importance during this period. Insects and fishes other than shad comprised from 55% to 80% of the total volume of hybrid bass food items from February to June.

During monthly collections, it became apparent that the hybrid bass length population was composed of 3 distinct size groups which closely approximated young-of-year and age classes 1 and 2. Although some older fish were collected (Table 2), they were not included in the food analysis. January was excluded from winter because of its masking effect.

Young-of-year hybrid bass (size group I) consumed mainly shad in all months except February and March (Fig. 2). Older hybrids also heavily consumed shad from July to September, but shad utilization then decreased. Insect larvae and other fish, mainly sunfish and yellow perch, began to increase and continued in importance into the spring months. Shad was the dominant and almost exclusive food item of all hybrid bass in January, probably because shad were becoming impaired by cooling water temperatures.

In all seasons, hybrids of size group 1 had fewer empty stomachs than did the older, larger hybrids. The high percentage of empty stomachs in February and March was a composite of at least 4 separate sampling intervals and, therefore, would seem indicative of either a winter feeding characteristic or an index of food availability.

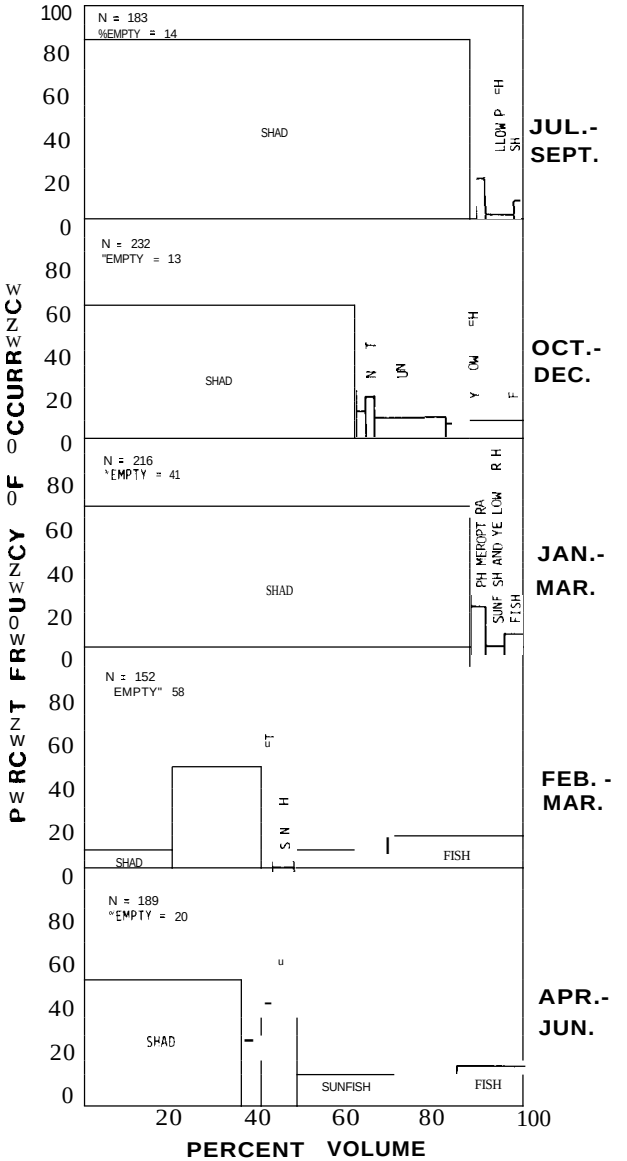

Figure 1. Seasonal food habits of hybrid bass from Clarks Hill Reservoir, July 1980 to June 1981.

Table 2. Average Weight in Kilograms and Size Range in Millimeters Total Length of Hybrid Bass Collected Monthly from Clarks Hill Reservoir 1 July 1980 to 30 June 1981. Number of Fish Are in Parentheses.

	Size Group							
	I		II		III		IV	
Month	Avg. Wt.	Size Range	Avg. Wt.	Size Range	Avg.Wt.	Size Range	Avg. Wt.	Size Range
July	0	0(0)	0.524	301-400(68)	1.147	421-500(19)	1.605	521-540(1)
August	0	0(0)	0.728	341-440(34)	1.285	421-540(28)	1.860	541-560(1)
September	0.232	221-320(12)	0.812	341-460(11)	1.481	441-540(9)	3.432	581-680(2)
October	0.251	221-340(58)	0.790	341-460(8)	1.519	461-560(13)	2.808	581-620(2)
November	0.300	261-340(51)	0.880	361-460(16)	1.548	461-540(7)	0	0(0)
December	0.296	241-340(50)	0.927	401-460(17)	1.509	481-520(8)	2.890	601-620(1)
January	0.290	221-340(43)	1.035	401-460(15)	1.496	461-520(5)	0	0(0)
February	0.335	241-360(34)	1.053	361-480(34)	1.695	481-560(12)	0	0(0)
March	0.291	261-340(14)	0.994	381-480(40)	1.732	481-560(17)	3.850	641-660(1)
April	0.358	261-380(8)	0.972	401-480(28)	1.493	481-560(20)	2.200	561-580(2)
May	0.326	281-380(26)	0.930	401-480(19)	1.589	481-560(16)	0	0(0)
June	0.348	281-400(47)	1.106	401-500(13)	1.760	481-580(10)	2.800	601-620(1)

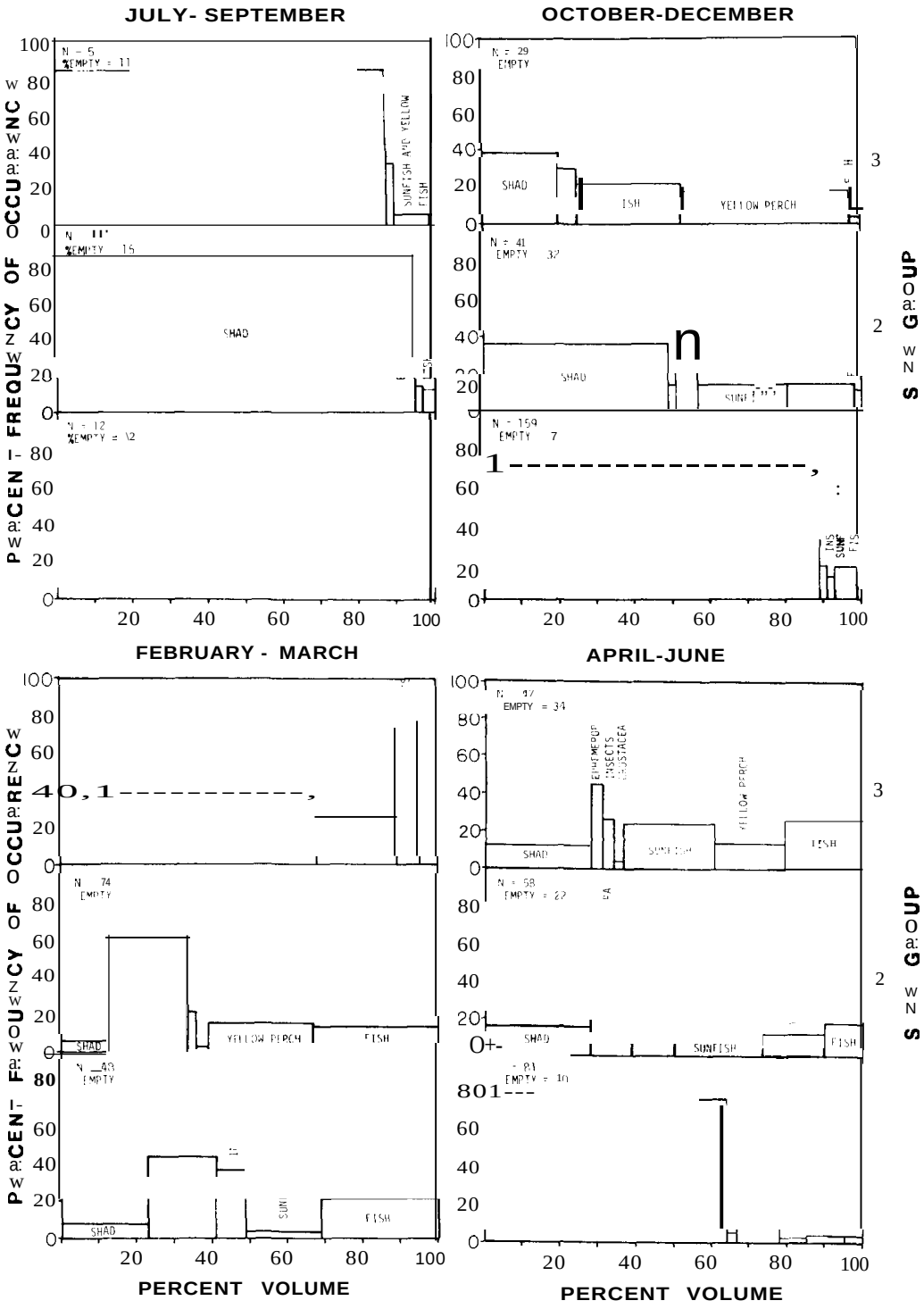

Figure 2. Hybrid bass food habits divided into size groups by seasons, Clarks HilI Reservoir, July 1980 to June 1981.

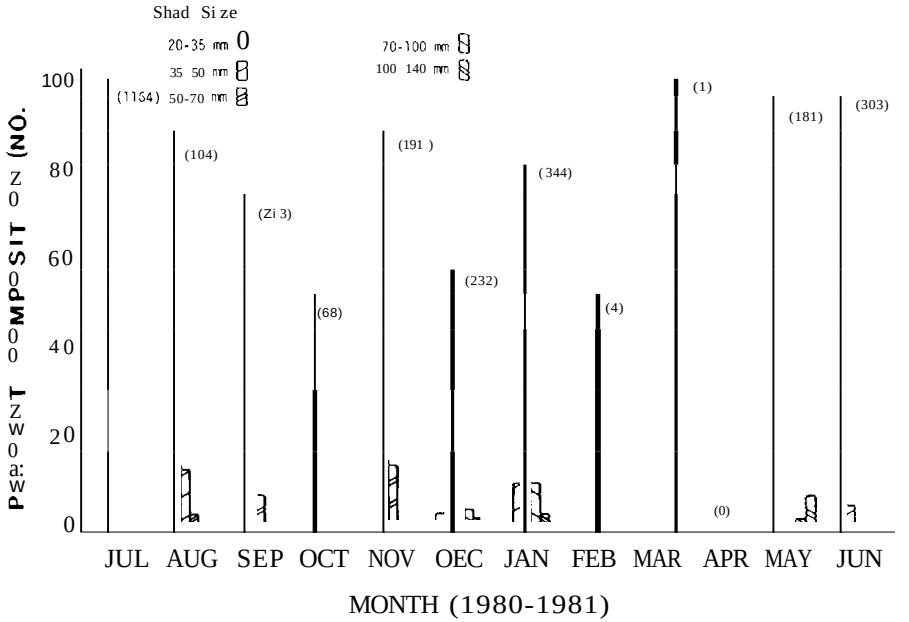

Figure 3. Monthly frequency distribution of shad consumed by hybrid bass from Clarks Hill Reservoir, July 1980 to June 1981. Number of shad recovered from all stomachs per month are in parentheses.

The dominant size range of shad eaten in July, August and September (Fig. 3) was 20-35 mm. As time progressed, the size of shad eaten increased. In January about 80% of the shad were 50-70 mm in total length. By February, small shad, i.e. < 50 mm, were absent from the diet. Shad were virtually absent from February until May when larval shad first reappeared in the stomachs. The size distribution of shad consumed through time (Fig. 3) suggested that the threadfin shad population was being fully utilized by hybrid bass.

Discussion

Hybrid bass food habits indicated a predominance of threadfin shad and an absence of gizzard shad in the diets (I%), while insects occurred in 30% of the stomachs having food. These data differed from findings of other studies. Williams (1970) reported that almost 20% of the stomachs he examined contained gizzard shad, while insects occurred in only 5% of the stomachs. Ware (1974) stated that clupeids were the principal hybrid bass forage and that insects oc:curred in only 4% of the stomachs examined from

Lake Gibson. Crandall (1978) noted that in Lake Bastrop, which did not support large standing crops of shad before or after hybrid stocking, threadfin and gizzard shad were the most utilized forage.

One possible reason for the difference in gizzard shad abundance between this study and Williams (1970) was that Williams included hybrid bass from Lake Hartwell as well as from Clarks Hill. Gizzard shad may be of greater importance in the diets of Lake Hartwell hybrids. Utilization of gizzard and threadfin shad in the same reservoir was also noted by Ott and Malvestuto (1981) in West Point Reservoir where gizzard shad made up 10% of the diet while threadfin shad accounted for 83%.

Data from cove rotenone studies indicated that the scarcity of gizzard shad in the hybrid bass stomachs may be directly related to the population levels of fingerling and intermediate gizzard shad in Clarks Hill. In 1976 and 1979 the average standing crop from 3 cove rotenone samples of fingerling gizzard shad (1 mm - 89 mm) was less than 0.1 kg/ha each year. No intermediate gizzard shad (90 mm - 140 mm) were collected in 1976 while an average standing crop of 0.7 kg/ha were collected in 1979. Apparently young gizzard shad were not readily available as forage for the hybrid bass. However, standing crop estimates of adult gizzard shad averaged 41.8 kg/ha and 29·9 kg/ha, respectively in the 1976 and 1979 samples.

Hybrid bass have been stocked in southeastern reservoirs to utilize the overly abundant gizzard shad populations. The idea was that the hybrid predator would feed on the most available forage first and then apply pressure to other forage stocks. Hybrids, it was thought, would feed through the threadfin shad, and then apply pressure to the gizzard shad. This predatory pressure would cause a shift in the population structure of gizzard shad toward smaller individuals which would then be available as prey to other predators. This has not happened in Clarks Hill. The hybrid bass fishery in Clarks Hill is one of the oldest and most notable in the southeast. It has received moderate to heavy stockings for over 16 years. Yet the established predator fishery has not effected a shift from threadfin shad to gizzard shad.

Ott and Malvestuto (1981) suggested that hybrids fed on individuals of approximately 65 mm regardless of their ability to consume larger-sized fish. Since the hybrid fishery they studied was still young, they suggested that larger hybrids may feed more actively on gizzard shad. In the present study also, no apparent relationship between prey/predator length was evident. Generally, all sizes of hybrid bass consumed the same size groups of shad in a given month.

However, there did appear to be a relationship between prey length and time of year (Fig. 3). Size of prey eaten increased from spring through winter from month to month. Stomach contents indicated that hybrid bass fed based on availability rather than selectivity. Based on these data, larger hy-

brid bass did not actively select larger forage and probably should not be considered as a viable tool for the management of larger gizzard shad stocks.

Data from this study indicated that threadfin shad were extremely important in the Clarks HiII hybrid bass fishery. Threadfin shad was the principal food of the hybrid bass in Clarks Hill, occurring in 62% of all stomachs with food. However, the shad monthly size distribution (Fig. 3) and seasonal food habits (Fig. 2) indicated that shad were generally not eaten after January and until May when larval shad began to appear in the stomachs. At the current stocking densities of 25 to 41 hybrid bass per hectare, a population has been created that is fully utilizing the threadfin forage base. It would be sound management to monitor the shad population levels in relation to extreme winters and hybrid bass stocking rates. Hybrid bass survival rates and condition factors should also be monitored at regular intervals as a means of developing management strategies for the lake.

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