Effects of an Increased Size Limit for Largemouth Bass in West Point Reservoir

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Abstract: The minimum legal size of largemouth bass *(Micropterus salmoides)* was increased from 305 to 406 mm in 1983 on West Point Reservoir to indirectly increase young-of-the-year recruitment by gizzard shad (*Dorsoma cepedianum*). Fish collections from 1982 through 1987 indicated that largemouth bass increased in abundance in response to the regulation change and their population structure shifted toward larger sizes. Concurrently, gizzard shad size distribution shifted downward. It appeared that the increased size limit for largemouth bass resulted in increased forage through increased gizzard shad recruitment. A survey of the sport fishery in 1984 and 1985 indicated effort and harvest similar to that before the regulation change.

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Availability of suitable prey is necessary for continued growth and development of fish of a given year class (Rainwater and Houser 1975, Kimsey 1958, Jenkins and Morais 1978). One of the challenges of trying to effectively manage a reservoir sport fishery is maintaining adequate stocks of prey within size ranges vulnerable to predators of interest (Noble 1981). Prey species most commonly utilized by predators in Georgia reservoirs are bluegill (*Lepomis macrochirus*), gizzard shad, and threadfin shad (*Dorsoma petenense*). These prey often become abundant and collectively comprise >75% of the standing crop of reservoirs (Weaver 1981). They often reach sizes which make them invulnerable to most predators which limits energy transfer from primary production to sportfish production and harvest (Carver et al. 1978).

West Point Reservoir is a 10,481-ha mainstream impoundment on the Chattahoochee River near LaGrange, Georgia. It was impounded in fall 1974 by the U.S. Army Corps of Engineers to provide flood control, hydroelectric power, and recreational facilities. Its reputation has become widespread as an outstanding fishery for largemouth bass, black crappie (*Pomoxis nigromaculatus*), and striped bass hybrids (*Morone saxatilis* x *Morone chrysops*).

The sport fishery and fish population of the reservoir was studied intensively through the first several years of impoundment. As early as 1977, Shelton et al.

(1979) noted that largemouth bass recruitment in West Point was probably limited by prey availability. Miranda (1981) and Davies et al. (1982) found that bluegill young-of-year (YOY) were critical for YOY largemouth bass transition from an invertebrate to fish diet. In addition, abundance of YOY bluegill throughout summer was an important determinant of largemouth bass recruitment.

Shortly after impoundment, gizzard shad became the most abundant species in West Point Reservoir, averaging 50% of the biomass in cove rotenone samples (Shelton et al. 1979). By the late 1970s the population was characterized by relatively large individual size (180 - 220 mm) and slow growth. The development of this large gizzard shad population had 2 important consequences for West Point Reservoir. First, the large average size of gizzard shad reduced their availability to all but the largest predators in the reservoir. Large populations of gizzard shad reduce bluegill recruitment (Stiefvater and Malvestuto 1985) by reducing the abundance and altering the size structure of the zooplankton forage base (Drenner et al. 1982). As a result YOY largemouth bass were likely subject to reduced availability of forage during the critical period of dietary change.

In an effort to channel the gizzard shad biomass into sport fish production and reduce competition between gizzard shad and bluegill, the states of Alabama and Georgia enacted a 406-mm minimum length limit regulation on largemouth bass on the lake in 1983. The purpose of the regulation change was to shift the length distribution of the largemouth bass population upward, thereby increasing predation on large gizzard shad, resulting in more YOY production by gizzard shad and bluegill. Ultimately, it was hoped that such changes in the forage base would stimulate both recruitment of largemouth bass to a harvestable size and the capacity of the lake to support other predators.

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Methods

The largemouth bass population was sampled by electrofishing for 30 minutes at each of 10 randomly selected, permanent stations on West Point Reservoir. Sampling was conducted diurnally once in the spring and again in the fall beginning in 1982. Total length (TL, mm) and weight (g) were recorded for each largemouth bass collected and for a randomly selected sample of the bluegill. Length frequencies for each species were compared using a Kolmogorov goodness of fit test (Conover 1971). Catch rates for largemouth bass were compared between years with a Mann-Whitney test (Gooch 1977). In all cases, differences were considered significant if $P \leq 0.10$.

Gizzard shad samples were obtained during overnight sets of monofilament gillnets at 10 randomly selected, permanent stations beginning in the fall of 1982 and continuing annually thereafter. Nets were 61 m in length with 5 equal-length panels of the following bar mesh sizes: 19 mm, 25 mm, 38 mm, 51 mm, and 64 mm. TL and weight (g) were recorded for each gizzard shad collected. Comparisons of length frequencies and catch rates between years were made as with largemouth bass.

A non-uniform probability, roving clerk creel survey (Malvestuto et al. 1978) was used on West Point to estimate angler effort and harvest. Effort was quantified as angler hours and harvest in numbers and kilograms (kg).

Results

Catch rates of largemouth bass in electrofishing samples in both the spring and fall collections increased significantly following the change in length limit. The spring 1982 and 1983 samples averaged 44.5 fish per hour and 16.8 kg per hour, while the 1984–87 spring samples averaged 63.9 and 33.7, respectively. Fall samples in 1982 and 1983 averaged 24.0 fish per hour and 17.7 kg per hour while the 1984–87 fall average was 52.7 and 29.4, respectively.

A significant shift towards larger size classes was evidenced in spring and fall largemouth bass length frequency distributions after 1983 (Fig. 1, 2). In contrast, no significant differences were detected in the length distributions of bluegills from 1982 to 1987 either in the spring or in the fall (Fig. 3).

Numbers and weight of gizzard shad per fall gillnet sample were significantly greater in 1985 and 1986 than in any of the previous years, but the 1987 samples were not higher than 1982–1984 (Table 1). Those same 2 years were not significantly different from each other in either numbers or weight.

In 1985, individuals $\leq$16 cm TL dominated the length-frequency of gizzard shad and were significantly more abundant than in any other year (Fig. 4). Similar differences were noted between 1987 and 1983–1984.

During 1985, total fishing effort was estimated to be 1.1 million hours (107 hours/ha) (Table 2). Approximately 58% of this effort was directed at largemouth bass. Total harvest by weight was estimated at 183,874 kg (17.5 kg/ha), of which 57% was largemouth bass. Overall harvest per unit of effort during 1985 was 0.163 kg/hour. Largemouth bass harvest rates were 0.08 kg/hour and 0.06 fish/hours, while the total bass catch rate (including fish released) was 0.37 fish/hour.

Discussion

Although the numbers of largemouth bass increased soon after the 406-mm minimum limit went into effect, increases in bass biomass were slower to occur. This is likely because a large portion of fishing mortality was incurred on legal-sized bass during 1983 just prior to inception of the new length limit. Typically between 25% and 30% of the bass fishing effort takes place in March and April on West Point (Bill Davies, personal commun.), and this may have been accentuated even further in 1983 when anglers knew that the restriction on harvest would begin on 20 April. Increased bass harvest just prior to inception of the new regulation could have depressed the population of bass. This would have increased the time necessary to accumulate a significant number of larger fish into the population.

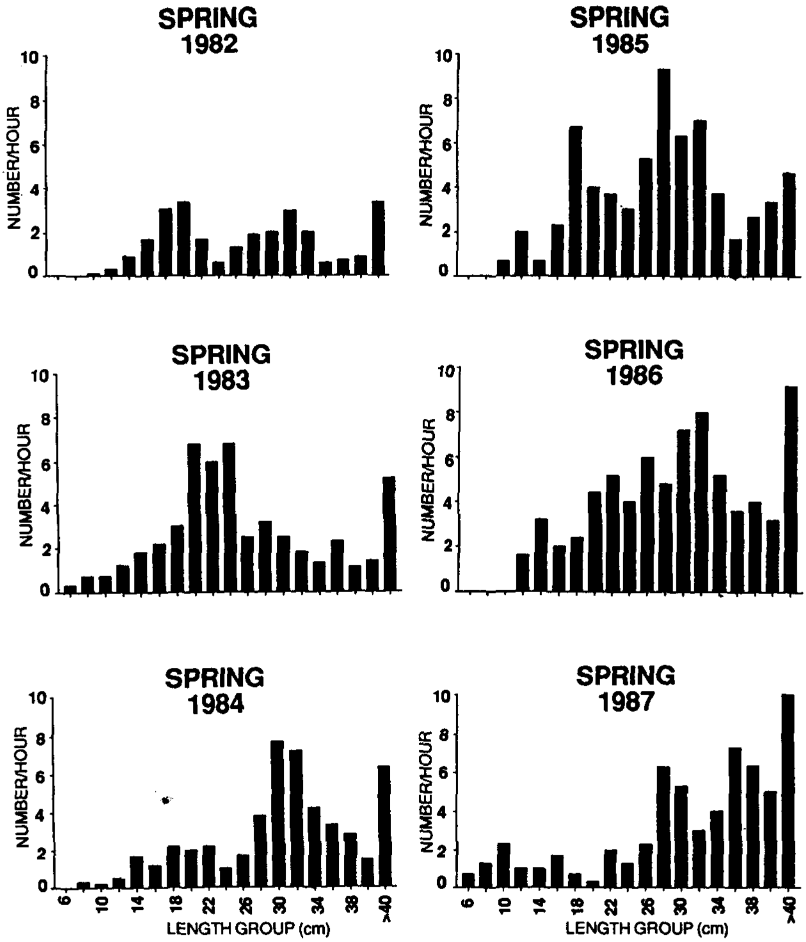

Figure 1. Length distribution of largemouth bass collected in the spring on West Point Reservoir, Georgia-Alabama.

Within 30 months of the change in length limit, abundance and average size of largemouth bass had increased as reflected in electrofishing data and length frequencies. At approximately the same time, abundance of gizzard shad increased and the length frequency shifted towards smaller-size individuals. Although no decrease in abundance of larger gizzard shad was detected, increased numbers of smaller shad indicated a higher level of successful reproduction during 1985–1987. While direct evidence is lacking, I believe that higher predation resulting from the increased biomass of bass reduced intraspecific competition between large gizzard shad to the point that successful reproduction resulted and continued through 1987.

No change was detected in the length structure of the bluegill population, although this could have been due to the overall increase in abundance of gizzard

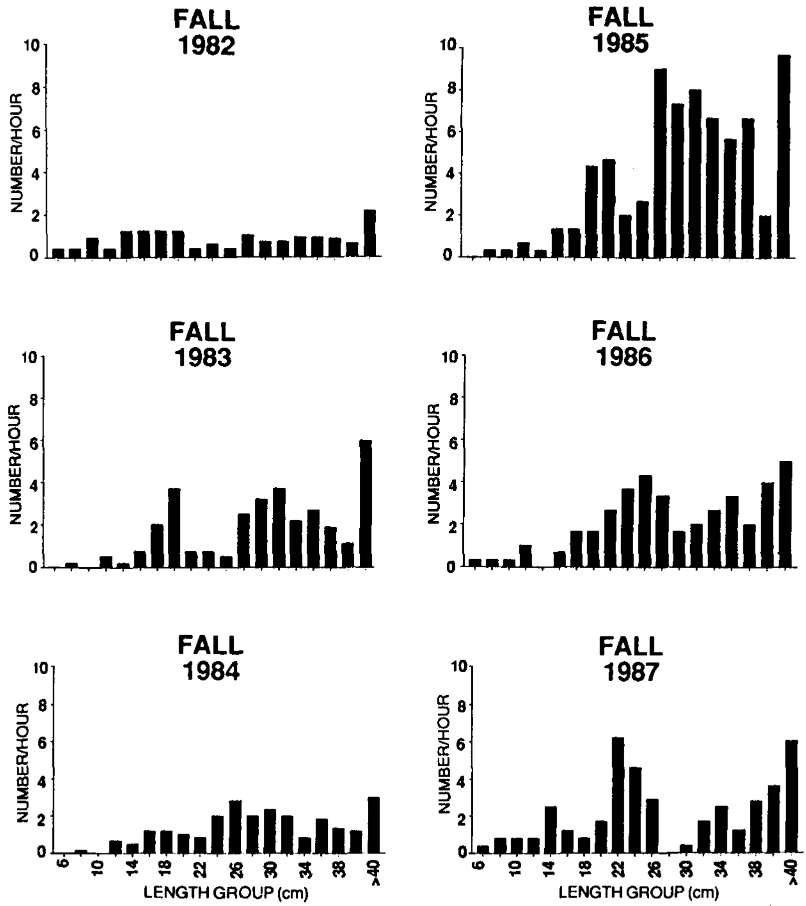

Figure 2. Length distribution of largemouth bass collected during the fall on West Point Reservoir, Georgia-Alabama.

shad and increased pressure on the zooplankton forage base. Another contributing factor that led to a lack of a detectable change may have been the inability to accurately sample all size ranges of bluegill. Similar to sampling largemouth bass, electrofishing is clearly biased towards larger bluegill and an increased abundance of smaller bluegill may not have been detected.

No change in the abundance of smaller largemouth bass is apparent from inspection of the length frequencies (Fig. 1, 2) although the overall population increase implies increased recruitment. It is quite probable that the electrofishing samples failed to accurately sample small largemouth bass and also failed to reflect increased abundance.

The sport fishery at West Point Reservoir was similar before and after the imposition of the 406-mm minimum length limit for largemouth bass (Table 3). In

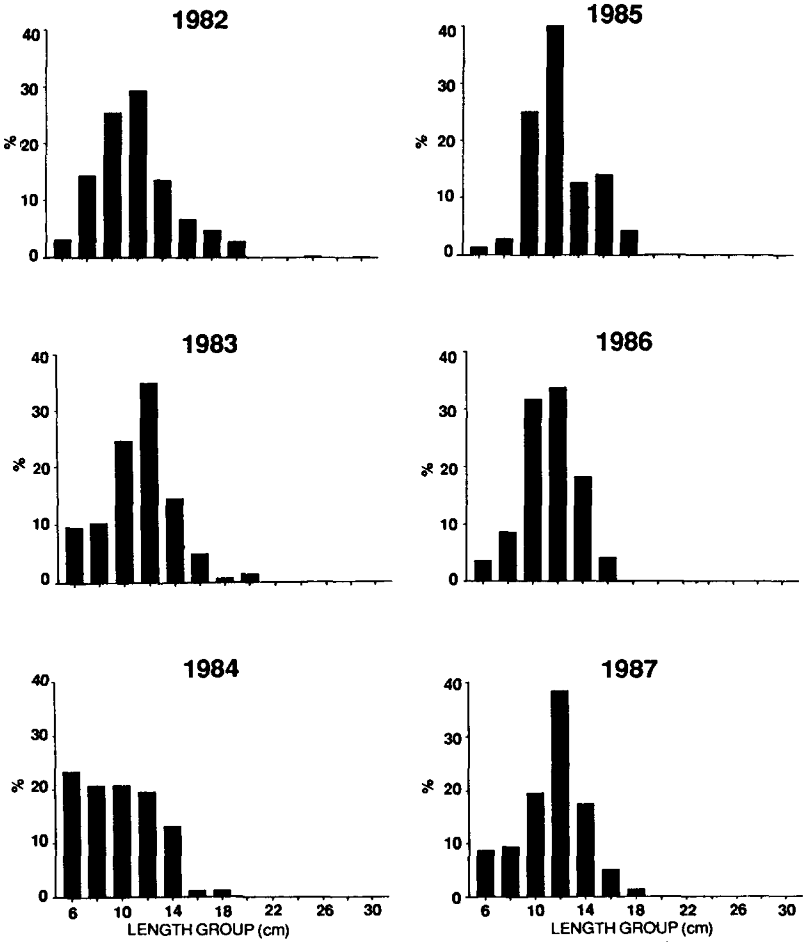

Figure 3. Length distribution of bluegill collected during the fall on West Point Reservoir, Georgia-Alabama.

Table 1. Mean catch per net per night of gizzard shad collected by gillnetting on West Point Reservoir.

	Catch/net/night					
	1982	1983	1984	1985	1986	1987
Numbers	16.1	16.8	19.1	101.0	35.3	21.3
Kilograms	1.1	1.1	1.3	4.2	2.0	1.2
	a	a	a	b	b	a

Note. Letters denote statistically similar catch rates ($P < 0.10$) in both numbers and weights.

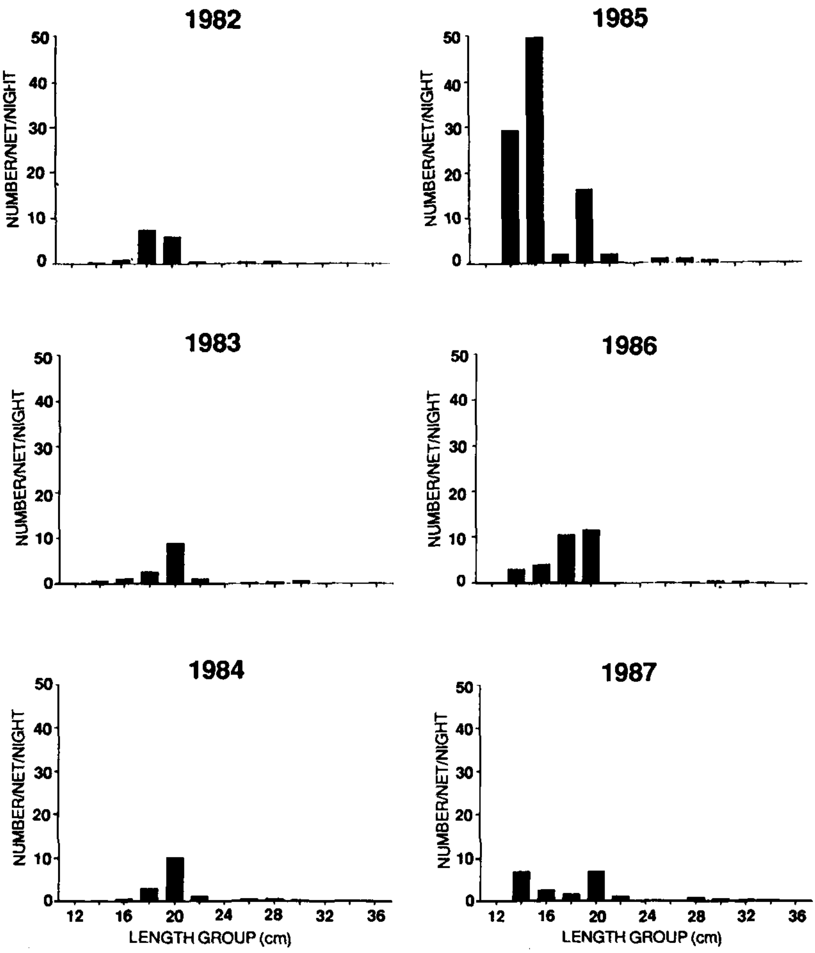

Figure 4. Length distribution of gizzard shad collected by gillnetting during the fall on West Point Reservoir, Georgia-Alabama.

1984, overall fishing pressure was about half that recorded in the years before the regulation change (Fig. 5). By 1985, however, fishing pressure had returned to a level approximating that recorded before the change in length limit. Effort directed at bass had increased substantially, however, to >62 hours/ha or about 60% of the total.

Trends in fishing effort are reflected in total harvest. By 1985, harvest had returned to a level equal to that observed prior to the change in regulation (Fig. 5). However, the level of largemouth bass harvest, >10 kg/ha, was the highest ever recorded. The decline in harvest in 1984 was almost entirely due to a decrease in the crappie harvest. Despite this continued low crappie harvest in 1985, however,

Table 2. Creel survey estimates for West Point Reservoir for the period 1 January 1985 through 31 December 1985 (NE = no estimate).

Species	Intended Effort (hours)	%	Intended Harvest Rate (fish/hour)	Intended Harvest Rate (kg/hour)	Total Harvest (All Anglers) *N*	%	Weight (kg)	%
Largemouth bass	653,923	58%	.061	.078	82,773	12%	104,971	57%
Crappie	225,809	20%	.999	.129	318,650	48%	40,555	22%
Striped bass hybrid	19,028	2%	NE	NE	6,772	1%	3,440	2%
Catfish	26,031	2%	.693	.117	114,608	17%	19,328	11%
Sunfish	39,631	4%	1.667	.098				
Bluegill			NE	NE	65,587	10%	4,770	3%
Redbreast			NE	NE	13,030	2%	770	0%
Redear			NE	NE	49,254	7%	3,806	2%
Other	80,121	7%	NE	NE	19,051	3%	6,235	3%
Any	78,390	7%	NE	NE				
Total	1,122,933	100%			669,725	100%	183,874	100%

Table 3. A comparison of creel survey estimates on West Point Reservoir, Georgia, during 1978–85.[a]

	1978	1979	1980	1981	1983	1984	1985
Pressure (hour/ha/year)							
Largemouth bass	16.02	22.39	27.14	17.71	26.09	23.79	62.39
Crappie	27.06	50.23	63.12	60.59	32.32	16.76	21.54
Total	71.62	91.53	118.49	96.28	66.31	54.83	107.14
Harvest (kg/ha/year)							
Largemouth bass	4.00	5.78	6.55	2.28	.74	2.81	10.02
Crappie	4.23	17.79	13.47	6.31	2.00	3.14	3.87
Total	13.31	25.78	26.83	12.47	3.16	7.01	17.54
Intended harvest rate (kg/hour)							
Largemouth bass	.21	.26	.22	.10	.07	.19	.16
Crappie	.16	.35	.21	.10	.09	.15	.18
Intended catch rate (*N*/hour)							
Largemouth bass				.16	.10	.35	.37
Overall harvest rate (kg/hour)	.19	.28	.23	.13	.05	.13	.16

[a]Data for 1978–1981 and 1983–1984 were compiled from Bayne et al. 1986.

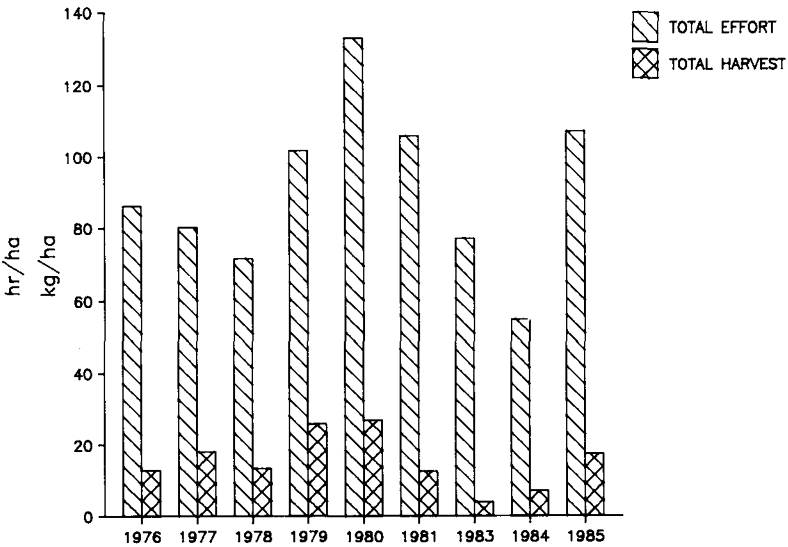

Figure 5. Total sport fishing effort and harvest on West Point Reservoir, Georgia-Alabama.

increased catches of largemouth bass caused the overall harvest to return to a level similar to that prior to the regulation change.

In summary, within 30 months of an increase in the minimum length limit for largemouth bass to 406 mm TL, the population increased in abundance, with a shift in population structure towards larger individuals. At the same time, small gizzard shad increased in abundance. Predatory pressure exerted by the bass on the gizzard shad population appeared to result in an increased level of shad recruitment in 1985 that continued through 1987.

Literature Cited

Bayne, C. R., W. D. Davies, S. P. Malvestuto and E. C. Webber. 1986. Fisheries and limnological studies on West Point Lake, Alabama-Georgia. Final Report. U.S. Army Corps of Engineers, Mobile District, AL. 68pp.

Carver, D. C., G. E. Hall and J. F. Hall. 1978. History and organization of the predator-stocking-evaluation by the Reservoir Committee, Southern Division, American Fisheries Society, Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 30:103–107.

Conover, W. J. 1971. Practical nonparametric statistics. John Wiley and Sons, New York, N.Y. 493pp

Davies, W. D., W. L. Shelton and S. P. Malvestuto. 1982. Prey-dependent recruitment of largemouth bass: a conceptual model. Fisheries 7(6):12–15.

Drenner, R. W., W. J. O'Brien and J. R. Mummert. 1982. Filter feeding rates of gizzard shad. Trans. Am. Fish. Soc. 111:210–215.

Gooch, B. 1977. The statistical analysis of gill net catches. Mont. Dep. Fish Wildl. Parks, Final Rep., Montana Fed. Aid Proj. F–4-R, Helena. 64pp.

Jenkins, R. M. and D. I. Morais. 1978. Prey-predator relations in the predator-stocking-evaluation reservoirs. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 30:141–157.

Kimsey, J. B. 1958. Fisheries problems in impounded waters of California and the lower Colorado River. Trans. Am. Fish. Soc. 87:319–332.

Malvestuto, S. P., W. D. Davies and W. L. Shelton. 1978. An evaluation of the roving creel survey with nonuniform probability sampling. Trans. Am. Fish. Soc. 107:255–262.

Miranda, L. E. 1981. Dynamics of young-of-the-year largemouth bass in relation to water level management. M.S. Thesis, Auburn Univ., Auburn, Ala. 63pp.

Noble, R. L. 1981. Management of forage fishes in impoundments of the southern United States. Trans. Am. Fish Soc. 110:738–750.

Rainwater, W. C. and A. Houser. 1975. Relation of physical and biological variables to black bass crops. Pages 306–309 *in* R. H. Stroud and H. Clepper, eds. Black bass biology and management. Sport Fish. Inst., Washington, D.C.

Shelton, W. L., W. D. Davies, T. A. King and T. J. Timmons. 1979. Variation in the growth of the initial year class of largemouth bass in West Point Reservoir, Alabama-Georgia. Trans. Am. Fish. Soc. 108:142–149.

Stiefvater, R. J. and S. P. Malvestuto. 1985. Seasonal analysis of predator-prey size relationships in West Point Lake, Alabama-Georgia. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 39:19–27.

Weaver, O. R. 1981. Georgia reservoir fish population statistics. Ga. Dep. Nat. Resour., Game and Fish Div., Final Rep., Fed. Aid Proj. F–25, Atlanta. 83pp.