

# **Profiles of Shenandoah River Anglers Fishing under Three Black Bass Length Limit Regulations**

**Louis A. Helfrich**, *Department of Fisheries and Wildlife Sciences, Virginia Tech, Blacksburg, VA 24061*

**Brian D. Chipman**, *Vermont Fish and Wildlife Department, Essex Junction, VT 05452*

**John W. Kauffman**, *Virginia Commission of Game and Inland Fisheries, Free Union, Virginia 22940*

---

*Abstract:* An on-site interview and mail questionnaire survey of 409 anglers on the Shenandoah River, Virginia, was conducted to compare the characteristics, motivations, perceptions, and preferences of anglers fishing under 3 different minimum black bass length limit regulations (no size limit, a 279–330 mm slot length limit, and a 305 mm minimum limit). Considerable uniformity was found in the 3 regulation areas in harvest behavior, equipment expenditures, perceptions of fish quality (size), components of fishing enjoyment, motivations for fishing, and fisheries management and regulation preferences among anglers regardless of length limit regulations. Anglers in the 3 length regulation zones differed significantly only in their trip expenses, travel distances, catch and harvest rates, knowledge of existing regulations, and preferred length limits. Factors unrelated to preferred bass length limits, such as travel costs and distance, and prior success rates may have determined where our respondents elected to fish and influenced their perceptions and preferences. Partitioning Shenandoah River anglers into subgroups corresponding to their favored bass length regulation offered little management utility.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 41 :178–186

---

Resource agencies must develop a clear understanding of their public constituencies to effectively manage sport fisheries in a manner that accommodates their user groups. User-oriented management has been recognized as lacking in many fisheries programs (Bennett et al. 1978). The traditional focus of agencies has been on the resource rather than the resource user. More recently, however, the perceptions, preferences, and motivations of anglers as related to their fishing experience have received considerable attention (Smith 1980, Carl 1982, Hudgens 1984, Renyard and Hilborn 1986).

As a result of these and other studies, fisheries managers are beginning to consider the heterogeneous nature of the angling public when making management decisions. Bryan (1979) emphasized that anglers should be considered a collection of distinct subgroups each with differing characteristics, motivations, objectives, and expectations. Novinger (1984) recommended that the diversity of angler expectation be considered when planning for and evaluating harvest restrictions. Renyard and Hillborn (1986) found variation in angler preferences toward sports fishing regulations. They recommended user preference surveys to clarify the acceptability of alternative regulations and as a substitute for complex social motivation research.

In this study, we compared the demographic characteristics (age, sex, marital status, residence, education, occupation, and income), angling-related expenditures (equipment and travel costs), travel distance, harvest behavior, catch and harvest rates, regulation knowledge, motivations for fishing, contributing factors to fishing enjoyment, and fisheries management perceptions (quality size) and preferences (creel and length limits) of Shenandoah River angler fishing under 3 bass length regulations (no size limit, a 279–330 mm slot length limit, and a 305 mm minimum length limit).

Angler awareness and compliance with bass length limit regulations are related and play an integral part in the success of many fisheries management programs (Paragamian 1984). Glass and Maughan (1984) reported 3 primary reasons for a large illegal bass harvest (35% of the anglers) on Sooner Lake, Oklahoma: lack of angler knowledge, poor understanding of the purpose of the regulations, and inadequate enforcement. We hypothesized that anglers, when provided options, would elect to fish under that bass length regulation they perceive will promote their fishing success and enjoyment. Moreover, we hypothesized that each of the 3 bass length regulations in effect on the Shenandoah River would attract anglers with relatively consistent perceptions and management preferences.

## Methods

The Shenandoah River in Virginia is a popular sport fisheries resource. Smallmouth bass (*Micropterus dolomieu*) is the dominant sportfish (Surber 1969). Minimum length limits (305 mm) on black bass were established on the Shenandoah in 1965. In 1982, 2 experimental regulations (a 279–330 mm slot length limit and the removal of length limits altogether) were imposed on the middle section (Luray Dam downstream to the confluence with the North Fork) and upper section (upstream from Luray Dam) of the South Fork Shenandoah River, respectively, and the 305 mm in minimum was retained on the North Fork and Main Stem.

We surveyed a total of 409 Virginia anglers fishing in the Shenandoah River between September 1984 and August 1985. Because of the numerous public and private access points, a roving survey, consisting of floating the study sections in a canoe and administering a short interview to all adult anglers encountered, was used. Anglers were interviewed about their fishing methods, success rates, and trip

details and were subsequently sent a 33-question mail-back questionnaire which queried their fishing preferences, perceptions, and motivations. Of the total 409 anglers contacted, none refused the interview, but 44 declined to receive the mail questionnaire and 7 were repeat contacts. Of the 358 deliverable questionnaires posted, 280 anglers (a response rate of 83%) returned usable forms.

Anglers were contacted using a stratified random sampling procedure (Babbie 1983, Malvestuto 1983). Our sample population was first partitioned into 3 river study sections corresponding to the 3 bass length regulations on the Shenandoah River. Each section was then stratified by season (fall 1984, spring 1985, summer 1985) and day type (weekday, weekend/holiday). A nearly equal number of anglers were contacted in each of the 3 river regulation sections and during each of the three seasons. Approximately 73% of the anglers were interviewed on weekend days and 27% on weekdays.

Questionnaire format and survey management followed Dillman (1978). Two follow up reminders were mailed at 1 and 3 weeks after the initial mailing. Travel costs per angler-trip and smallmouth bass catch rates were calculated using mean ratio estimators (Malvestuto 1983). We tested for differences in angler responses among river sections by analyzing the frequencies of respondents using Chi-square tests or a Wilcoxon rank sums when appropriate (Conover 1971). Chi-square values were generated for comparisons between river sections (within row comparisons).

## Results and Discussion

### Demographic Characteristics

The average Shenandoah River angler surveyed was a white (97% of respondents) male (89%), between 25 and 44 years old (58%), married (67%), a high school graduate (57%), who resided in a small town or rural environment (68%), and was employed in a professional or skilled occupation (67%), earning between \$10,000 and \$30,000 (50%) annually. The demographic characteristics of our sample were comparable with data from the 1980 National Hunting and Fishing Survey (U.S. Fish and Wildl. Serv. 1982) that found the average Virginia angler was a white (93%) male (73%) between 25 and 44 years old (50%), married (69%), a high school graduate (38%), who resided in a small town or rural environment (66%), and was employed in a professional or skilled occupation (52%), earning between \$10,000 and \$30,000 annually (55%).

Demographic characteristics of anglers among the 3 study sections differed significantly in residence size ( $P = 0.002$ ) and income level ( $P = 0.027$ ). Anglers in sections 2 (slot length) and 3 (305 mm minimum) were more likely to live in an urban environment (40%, 35%, respectively) than those in section 1 (unrestricted zone, 28%) and to earn a higher mean annual income averaging greater than \$20,000 for most anglers in sections 2 and 3 and less than this amount for the majority (64%) in section 1.

Expenditures and Travel Distance

Our respondents' overall financial investment in angling was assessed by asking them to estimate their trip expenses and total dollar investment in fishing-related equipment (Table 1). Mean trip expenditure for anglers in section 2 (\$21.91) was significantly greater than those for anglers in each of the other river sections and the \$11.00 trip average reported for freshwater anglers in Virginia during 1980. (U.S. Fish and Wildl. Serv. 1982).

The greater expenditures of anglers in section 2 may be a function of the greater travel distances and availability of additional recreational opportunities. A majority of anglers (51%) in section 2 travelled longer distances, 51 miles or more, than those in the other river sections, most of whom travelled less than 25 miles. The existence of commercial canoe outfitters and the close proximity of Shenandoah National Park likely contributed to the higher travel costs reported by section 2 anglers. Estimated total dollar investment in fishing-related equipment items and the number of equipment items owned (average was 6) were not significantly different among the regulation sections sampled.

**Table 1.** Fishing-related expenditures, travel distances, harvest behavior, catch and harvest rates, and regulation knowledge, of Shenandoah River anglers fishing under 3 different bass length regulations (% respondents).

Items	Shenandoah River sections		
	1 (unrestricted)	2 (slot)	3 (305 mm minimum)
Equipment costs	(N = 72)	(N = 115)	(N = 92)
<\$100	19.4	14.6	23.9
\$101-500	37.5	39.1	32.6
\$501-2,000	37.5	27.0	30.5
≥\$2,001	5.6	18.3	13.0
Mean trip expenses (\$ per angler)	(N = 94)	(N = 158)	(N = 153)
	4.77	21.91	7.36 <sup>a</sup>
Travel distance	(N = 94)	(N = 158)	(N = 153) <sup>b</sup>
0-25 miles	55.3	26.6	52.3
26-50	18.1	21.5	19.6
≥51	26.6	51.9	28.1
Harvest behavior	(N = 70)	(N = 116)	(N = 93)
Always keep (100%)	17.1	19.0	21.5
Sometimes keep (50%)	75.7	76.8	75.3
Never keep (0%)	7.1	4.3	3.2
Catch rate/angler/hour	0.83	1.67	1.40 <sup>a</sup>
Harvest rate/angler/hour	0.25	0.31	0.07 <sup>a</sup>
Regulation knowledge	(N = 54)	(N = 94)	(N = 86) <sup>a</sup>
Correct	29.6	70.2	73.3
Incorrect	70.4	29.8	26.7

<sup>a</sup>In-row frequencies differ,  $P < 0.001$ .

<sup>b</sup>In-row frequencies differ,  $P < 0.05$ .

### Harvest and Regulation Awareness

Consumptive behavior, assessed by asking anglers how often they kept the legal-size bass they caught, did not differ among river sections (Table 1). The majority (75%) of anglers in all sections indicated they kept bass occasionally (50%). Actual catch and harvest rates, however, differed significantly ( $P < 0.001$ ) among sections. The highest catch and harvest rates occurred in section 2 (slot length). The relatively low harvest to catch ratio exhibited by anglers in section 3, regulated by the 305 mm minimum length, reflects the abundance of small, sublegal size bass in this area. The high harvest to catch ratio of anglers in the unrestricted section 1 is assumed to be a function of the absence of bass length limits and a tendency of these anglers to keep their catch. About 30% of the catch in section 1 was harvested, in contrast to 19% and 5% in sections 2 and 3, respectively.

The majority (>80%) of anglers surveyed in all 3 river regulation sections were considered black bass anglers. A minority of anglers were targeting catfish (8%) and a combination of other species (panfish, walleye, muskellunge, and striped bass). Species preferences among anglers in the 3 regulation sections were not significantly different ( $P = 0.195$ ).

Anglers in the various sections differed in their knowledge of the existing bass length regulations. It was generally understood by most anglers that size regulations for black bass exist, but over 25% of those surveyed in all sections were not knowledgeable of the specifics. The majority (70%) of anglers fishing in section 1 were unaware that no length regulation was in effect (although they exhibited the highest harvest to catch ratio), whereas the frequency of knowledgeable anglers in sections 2 and 3 was significantly higher, averaging 71%. Surprisingly, angler awareness of the relatively complex and unique slot length limit was no different than that of the traditional 305 mm minimum limit. Both experimental regulations (unrestricted and slot) had been in effect since 1982. However, greater awareness of the slot limit among section 2 anglers was probably due to a publicity campaign instituted by the Virginia Commission of Game and Inland Fisheries in 1982.

Although we did not attempt to monitor compliance rates, it seems likely that the relatively low level of awareness of the prevailing length regulations (27% to 70%) may increase the potential for a substantial illegal harvest. The successful application of length regulations requires an effective public education and publicity program to help promote knowledgeable anglers and their compliance.

### Motivations

Motivations for fishing, assessed by asking anglers to rank their top 3 reasons for fishing from a list of 9, did not differ in the 3 river sections ( $P > 0.05$ ). Enjoying the outdoors (88%), fishing for sport (59%), and escape (51%), respectively, were the top choices, whereas fishing to be with friends (32%) or family (20%), for food (18%), to test angling skills (17%), for trophies (13%), and to compete with other anglers (3%), were less frequently cited. A number of investigators have reported similar motivations for angling (Driver and Knopf 1976, Dawson and Wilkins

1981). Motives related to pleasure, personal identity, and general recreation appear to be most important to anglers (Smith 1980, Hudgins 1984).

Perceptions of Harvest

The perceptions of anglers on what constituted a “quality-sized” and a “keeper-sized” bass were similar in all river sections (Table 2). The majority (90%) of our respondents considered a bass  $\geq 305$  mm in length to be a quality-sized fish, but many (43%) of our respondents considered bass  $< 305$  mm in size to be “keeper-sized” if no size regulations were in effect. Our respondents’ perceptions

**Table 2.** Comparison of perceptions and management preferences of Shenandoah River anglers fishing under 3 bass length limit regulations (% respondents).

Perception	Shenandoah River sections		
	1 (unrestricted)	2 (slot)	3 (305 mm minimum)
Quality-size bass	(N = 71)	(N = 114)	(N = 93)
<305 mm	7.0	11.4	11.8
305–355 mm	43.7	45.6	34.4
>356 mm	49.3	43.0	53.8
Keeper-sized bass	(N = 70)	(N = 112)	(N = 92)
<305 mm	42.9	55.4	47.8
305–355 mm	35.7	32.1	37.0
>356 mm	11.4	4.5	13.0
Undecided	10.0	8.0	2.2
Fishing enjoyment	(N = 71)	(N = 113)	(N = 92)
Quantity of fish	23.9	20.4	25.0
Quality of fish	36.6	38.1	32.6
Natural setting	39.4	41.6	42.4
Length regulation	(N = 71)	(N = 115)	(N = 93) <sup>b</sup>
No length limit	21.1	13.9	8.6
305 mm minimum	45.1	43.5	49.5
279–330 mm slot	11.3	27.0	17.2
Not sure	22.5	15.6	24.7
Creel limit	(N = 72)	(N = 115)	(N = 91)
2/day	12.5	2.6	3.3
5/day	20.8	20.0	27.5
8/day	40.3	50.4	47.2
$\geq 10$ /day	26.4	26.9	22.0
Management action	(N = 69)	(N = 111)	(N = 93)
Habitat improvement	39.2	46.9	46.2
More public access	24.6	18.9	24.7
Stocking bass	18.8	13.5	15.1
More harvest limits	17.4	20.7	14.0
Regulation action <sup>a</sup>	(N = 89)	(N = 108)	(N = 95)
Catch and release only	37.0	25.9	28.4 <sup>b</sup>
Close for spawning	22.6	34.3	37.9
Increase length limit	20.2	22.2	22.1
Artificial lures only	20.2	17.6	11.6

<sup>a</sup> Each variable was treated as a separate binomial (favor vs. oppose, % in favor is shown).  
<sup>b</sup> In-row frequencies differ,  $P < 0.05$ .

of what constituted “keeper” and “quality-sized” smallmouth bass were similar to those categories (279 and 356 mm, respectively) reported by Gablehouse (1984).

When asked to select 1 of 3 factors (quantity of catch, quality of catch, and natural setting) that contributed most to their angling enjoyment, all were judged equally important. No differences in these factors were detected among anglers in the 3 river sections ( $P > 0.05$ ). Our respondents held catch-related factors (numbers and sizes) in high esteem but also favor the environmental setting of the angling experience. In contrast, Weithman and Anderson (1978) found that catching fish was the single most common attribute in the analysis of memorable fishing trips of Missouri anglers.

### Fisheries Management Preferences

Preferences for the 3 bass length regulations differed significantly among anglers in the river regulation sections (Table 2). Our respondents appeared to be selecting those regulations with which they were most familiar. Of the existing length regulations, the traditional 305 mm minimum length limit (in effect on much of the river since 1965) was preferred by most anglers (>40%) in all sections, followed by the size regulation in effect in the river section on which they were fishing. The prevailing 8 fish per day creel limit was favored by most respondents, regardless of river section. There was no significant difference in creel limit preferences nor notable consensus of anglers in any of the sections to alter the existing regulations.

Fisheries management preferences of anglers did not differ significantly among river sections (Table 2). Of the 4 general fisheries management activities suggested, habitat improvement was most frequently perceived as the action that would best improve fishing success. Providing increased public access was viewed as the next most important management action preferred. More restrictive harvest regulations and stocking were the least favored management practices.

Preferences for 3 of 4 hypothetical bass regulations did not differ ( $P > 0.05$ ) among anglers in the 3 river sections (Table 2). The only detected difference was that a significant ( $P < 0.01$ ) majority of respondents in section 1 favored catch-and-release regulations. Catch-and-release bass fishing and a closed season during spawning periods received the most support by anglers in all sections.

The greater appeal of catch-and-release fishing to anglers in section 1 may be related to the mercury pollution problem. Fish consumption was banned as a result of mercury contamination on most of the South Fork Shenandoah River from June 1977 to September 1980, resulting in a “fish-for-fun” only policy (Felvey 1977, Kauffman 1980). Mercury contamination was particularly severe in the headwater areas including section 1. In response to the evident health hazard, more anglers in section 1 may have complied with the ban and favorably experienced catch-and-release fishing.

Though catch-and-release regulations have been widely used to enhance the quality of salmonid sport fisheries (Caverhill 1977, Deinsteadt 1977), applications

to warmwater fisheries have been limited to small private impoundments (Weithman and Anderson 1977), self-regulating professional bass tournaments (H. Bryan, unpubl. rep., Sport Fishing Inst., Washington, D.C., 1980) and at least 1 public smallmouth bass stream (Fajen 1981). Bryan (unpubl. rep., Sport Fishing Inst., Washington, D.C., 1983) found that 91% of presidents of Bass Angler Sportsmen Society (B.A.S.S.) affiliate clubs favored catch-and-release regulations and indicated that the nonconsumptive ethic may be gaining popularity with the general angling public. Anderson and Nehring (1984) noted that special no-kill and limited-kill regulations will become an increasingly important management tool as greater fishing pressure impacts quality fisheries. Our results suggest that human health advisories concerning fishing in polluted waters may facilitate a greater public acceptance of catch-and-release regulations.

Our initial hypothesis stated that anglers hold strong preferences for bass length limits and would elect to fish under that regulation which would least impede their angling success and enjoyment. Further, we hypothesized that when presented with regulatory options, anglers would aggregate themselves into distinct subgroups (by regulation section) having similar characteristics, perceptions, and preferences. The results of the survey do not support our hypotheses. We determined that our respondents, regardless of the river section (bass length regulation), exhibited relatively uniform perceptions and preferences with respect to the fishing experience. No significant differences were detected among anglers in the 3 river sections concerning their harvest behavior, perceptions of quality-size and keeper-size bass, factors contributing to their fishing enjoyment, motivations for fishing, and preferences for bass creel regulations, and management actions needed.

Possibly, factors other than bass length regulations, such as prior experience, travel distance, access, and the availability of facilities or alternative forms of outdoor recreation were principal determinants of where anglers choose to fish. It is conceivable that the relatively new (2-year-old) experimental length regulations (unrestricted length and slot length), were not in effect for a period of time sufficient to stimulate anglers to alter their traditional fishing locations.

## Literature Cited

- Anderson, R. M. and R. B. Nehring. 1984. Effects of a catch-and-release regulation on a wild trout population in Colorado and its acceptance by anglers. *North Am. J. Fish. Manage.* 4:257-265.
- Babbie, E. R. 1983. *The practice of social research.* Wadsworth, Inc., Belmont, Calif. 551pp.
- Bennett, D. H., E. L. Hampton, and R. T. Lackey. 1978. Current and future fisheries management goals. *Fisheries* 3:10-14.
- Bryan, H. 1979. Conflict in the great outdoors. *Sociological Studies* No. 4, Bureau of Public Administration. Univ. Ala., Tuscaloosa. 98pp.
- Carl, L. 1982. Social impacts of a stream reclamation project on urban anglers. *North Am. J. Fish. Manage.* 2:164-170.

- Caverhill, P. T. 1977. The B.C. experience in catch-and-release fishing. Pages 151–160 in R. A. Barnhart and T. D. Roelofs, eds. *Catch-and-release fishing as a management tool*. Humboldt State Univ., Arcata, Calif.
- Conover, W. J. 1971. *Practical nonparametric statistics*. John Wiley and Sons, New York. 462pp.
- Dawson, C. P. and B. T. Wilkins. 1981. Motivations of New York and Virginia marine boat anglers and their preferences for potential fishing constraints. *North Am. J. Fish. Manage.* 1:151–158.
- Deinstadt, J. W. 1977. Catch-and-release angling in California's wild trout streams. Pages 119–136 in R. A. Barnhart and T. D. Roelofs, eds. *Catch-and-release fishing as a management tool*. Humboldt State Univ., Arcata, Calif.
- Dillman, D. A. 1978. *Mail and telephone surveys: the total design method*. John Wiley and Sons, New York. 325pp.
- Driver, B. L. and R. C. Knopf. 1976. Temporary escape: one product of sport fisheries management. *Fisheries* 1:21, 24–29
- Fajen, O. F. 1981. Warmwater stream management with emphasis on bass streams in Missouri. Pages 252–265 in L. A. Krumholz, ed. *The Warmwater Streams Symp.* South. Div. Am. Fish. Soc., Bethesda, Md.
- Felvey, T. M. 1977. Heavy metals pollution in the upper Shenandoah River. *Proc. 2nd Annu. Am. Fish. Soc., Potomac Chap.* 2:8–15.
- Gabelhouse, D. W. Jr. 1984. A length-categorization system to assess fish stocks. *North Am. J. Fish. Manage.* 4:273–285.
- Glass, R. D. and O. E. Maughan. 1984. Angler compliance with length limits on largemouth bass in an Oklahoma reservoir. *North Am. J. Fish. Manage.* 4:457–459.
- Hudgins, M. 1984. Structure of the angling experience. *Trans. Am. Fish. Soc.* 113:750–759.
- Kauffman, J. 1980. Effect of a mercury-induced consumption ban on angling pressure: South Fork of the Shenandoah River, Virginia. *Fisheries* 5(1):10–12.
- Malvestuto, S. P. 1983. Sampling the recreational fishery. Pages 397–419 in L. A. Nielsen and D. L. Johnson, eds. *Fisheries techniques*. Am. Fish. Soc., Bethesda, Md.
- Novinger, G. D. 1984. Observations on the use of size limits for black basses in large impoundments. *Fisheries* 9(4):2–6.
- Paragamian, V. L. 1984. Evaluation of a 12.0-inch minimum length limit on smallmouth bass in the Maquoketa River, Iowa. *North Am. J. Fish. Manage.* 4:507–513.
- Renyard, T. S., and R. Hilborn. 1986. Sports angler preferences for alternative regulatory methods. *Can. J. Fish. Aquat. Sci.* 43:240–242.
- Smith, C. L. 1980. Attitudes about the value of steelhead and salmon angling. *Trans. Am. Fish. Soc.* 109:272–281.
- Surber, E. W. 1969. Effects of a 12-inch size limit on smallmouth bass populations and fishing pressure in the Shenandoah River, Virginia. *Proc. Annu. Conf. Southeast. Assoc. Game and Fish Comm.* 22:300–311.
- U.S. Fish and Wildlife Service. 1982. 1980 national survey of fishing, hunting, and wildlife associated recreation. Virginia. U.S. Dep. Int., Fish and Wildl. Serv., Washington, D.C. 156pp.
- Weithman, A. S. and R. O. Anderson. 1978. A method of evaluating fishing quality. *Fisheries* 3:6–10.