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Recreational and Angler Survey of the Buffalo National River, Arkansas

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Abstract

The Buffalo River in northern Arkansas was surveyed for recreator and angler use in 1991 and 1992. The river was divided into three reaches and numbers of boats, recreators, anglers, and catches were compiled by creel clerks at nine selected take-out points. Outfitter rental receipts were used to estimate rental boats, and the proportion of rental to private boats creeled was used to correct for private boats not counted on the rental receipts. A total of 1,656 boats containing 3,071 recreators was contracted by the creel clerks during 1991 and 1992; 9.2% of the recreators were anglers. Expansion of the creel data indicates an estimated 192,348 people floated the river during 1991 and 1992, resulting in annual averages of 116 and 73 boats/ha, 214 and 135 recreators/ha, and 20 and 12 hours of angling/ha on the river during those two years. Smallmouth bass was the principal game fish and accounted for a harvest of 4.6 and 1.3 fish/ha and a catch rate of 0.08 and 0.03 fish/hrs. However, catch and release, estimated at 1.0 fish/hr, may have biased harvest and catch rates. Smallmouth bass harvest was low when compared to other waters and is not likely impacting the population.

Introduction

The Buffalo River in northern Arkansas is one of the last free-flowing rivers in the Arkansas Ozarks. It originates in the Boston Mountains, Newton Co., in the Upper Buffalo River Wilderness Area on the Ozark National Forest and flows eastward for 238 km before joining the White River (Whisenant and Maughan, 1989). Approximately 90% of the Buffalo River mainstream is within National Park Service (NPS) boundaries; it was the first National River to be designated by Congress (1972, PL 92-237). There are 22 NPS maintained access points on the mainstream Buffalo River and perhaps four times that many informal access points used infrequently by local anglers and recreators. Water quality of the Buffalo River is high, especially in the upper reach, and the substrate is gravel, boulder, and rock. Pools are long and deep, and the riffles short. It is the most popular floating stream in Arkansas (Arkansas Game and Fish Commission, 1992).

Boating on the Buffalo River increased dramatically after it received national recognition as the Nation's first National River. In 1963, NPS estimated 5,500 canoes floated the river. By 1981, that number had increased by an order of magnitude, to 51,000 canoes (Whisenant and Maughan, 1989). There are presently 25 outfitters on the Buffalo River that arrange float trips of a few hours to several days, depending upon distances floated. In an attempt to regulate recreators on the Buffalo National

River, NPS placed limits on the number of boats (1,250 canoes, 110 jonboats, 56 rafts/day) outfitters could rent to the public; nothing limits the number of private boats that float the river.

Angling on the Buffalo River is principally for smallmouth bass (*Micropterus dolomieu*), with sunfishes including Ozark bass (*Ambloplites constellatus*) and longear sunfish (*Lepomis megalotis*) and catfishes including flathead catfish (*Pylodictis olivaris*) and channel catfish (*Ictalurus punctatus*) accounting for less than 20% of the catch (Whiseant and Maughan, 1989). The overall fish community is rich, with Cashner and Brown (1977) recording 59 species. Channel catfish no longer maintain a viable population in the Buffalo River due to the lack of a spring spawning migration from the cold, hypolimnetic waters of the White River (Siegwarth and Johnson, 1994). Sometime prior to 1977, NPS estimated total angler use of the Buffalo River at 27,380 anglers/yr (calculated from NPS, 1977), and in their River Use Management Plan (NPS, 1983) suggested 33,000 anglers used the river in 1981. The purpose of this study was to determine recreational use and angling harvest on the Buffalo River in 1991 and 1992.

Materials and Methods

A stratified random design was used by the creel clerks to interview recreators as they came off the Buffalo

River at selected access points. Nine stations were chosen from NPS access points in order to best represent the overall traffic on the river (Fig. 1). Data collection design utilized both access point and roving creel clerk techniques, similar to the "bus-stop" survey suggested by Jones and Robson (1991) for fisheries with many well-defined access sites. Each month the clerks gathered information for 8 days (4 week days, 4 weekend days), spending two hours/station and sampling three stations/day. Which eight days of each month to sample and which stations to begin sampling were selected by blindly choosing numbered markers. Sampling then continued downstream. The survey began on March 1, 1991, and ended December 31, 1992.

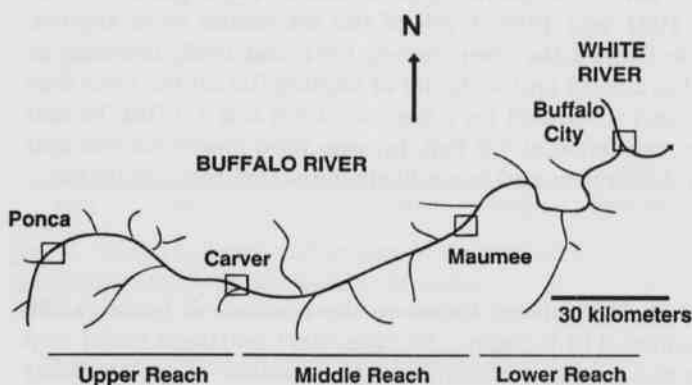


Fig. 1. Map of Buffalo River, Arkansas, showing divisions of the river.

Only 202 km of the Buffalo River below Ponca, AR are normally floated or fished by boat. The stream above Ponca is usually intermittent and may be floated only at the highest water levels; any fishing in that uppermost reach is usually from the bank. I divided the 202 km of the Buffalo River into three reaches (Fig. 1) with three sampling stations in each reach. The upper reach from Ponca to Carver (56.2 km) is one of the most popular canoe streams in Arkansas during high water in the spring, but becomes intermittent during summer and autumn months. The middle reach extended from Carver to Maumee (77.6 km) and is floatable except during the driest years when its upper portion may become intermittent. The lower reach extended from Maumee to Buffalo City (68.4 km) at the confluence of the White River; this reach is always floatable and consists mainly of long pools and few riffles. Gradients in the river are: upper reach 2.5 m/km, middle reach 1.0 m/km, lower reach 0.6 m/km (NPS, 1977).

Boat rental data on the Buffalo River were obtained from NPS, which required outfitters to maintain rental

receipts that included data and location of departure and pickup and number of individuals per boat. The creel clerks counted private and rental boat landings at each station during their two hour period, as well as number of people per boat. This provided a proportion of private to rental boats on the river. If recreators possessed fishing gear, clerks asked if they fished, if their catch could be identified and measured, and how many hours/day they spent fishing (line in the water). During 1992, anglers were also asked how many fish they captured and released. These latter two estimates are biased as they are dependent upon memory, but provide the only method of calculating number of fish caught and the time needed to catch a fish. The total number of boats per reach per year was calculated by determining the proportion of private to rental boats creeled and expanding the number of rental boats as determined from outfitter receipts.

Results

Table 1 provides numbers of boats, recreators, and anglers contacted on the Buffalo River in 1991 and 1992. An ANOVA test failed to find differences for numbers of boats ($P = 0.49$), recreators ($P = 0.90$), and anglers ($P = 0.71$) between 1991 and 1992, so those data were combined. The creel clerks sampled 375 stations during those two years and contacted 1,656 boats containing 3,071 recreators, for an average of 1.85 ± 0.28 (mean ± 2 SE) people per boat. During that same period, 283 recreators stated that they fished at least once during their trip, indicating $9.2\% \pm 0.05$ of the people floating the Buffalo River engaged in fishing.

Table 1. Sampling of boats and recreators on the Buffalo River, 1991/1992.

Reach	Total Stations Creeled	Recreators Contacted		Anglers Contacted	Percent Anglers
		Boats	People		
Upper	48/41	408/128	525/262	18/22	3.4/8.4
Middle	75/73	253/246	564/531	46/28	8.2/5.3
Lower	61/78	262/359	474/715	94/75	19.8/10.5
SUBTOTALS	184/192	923/733	1563/1508	158/125	10.1/8.3
TOTALS	376	1656	3071	283	9.2

Using the observed proportion of rental to private boats on each reach for each year (Table 2), a calculated number of private boats was added to the known number of rental boats to provide annual boat traffic on the river (Table 3). Data for 1991 and 1992 were not combined, as significant differences existed between years on several data sets. April, May, and June were the principal use months in the upper reach for both 1991 and 1992, as

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Table 2. Numbers of rental and private boats surveyed in 1991/1992 on the Buffalo River and numbers of boats recorded as being rented by outfitters by reach.

MONTH	UPPER REACH			MIDDLE REACH			LOWER REACH		
	CREEL		OUTFITTER	CREEL		OUTFITTER	CREEL		OUTFITTER
	Rental	Private		Rental	Private		Rental	Private	
Jan	*/0	*/0	*/10	*/0	*/0	*/0	*/0	*/0	*/0
Feb	*/4	*/0	*/19	*/0	*/0	*/6	*/0	*/0	*/0
Mar	24/11	33/1	*/890	0/45	0/7	486/235	0/5	0/1	98/262
Apr	39/7	9/7	4761/1468	6/15	3/0	582/648	5/11	0/6	378/626
May	129/2	133/1	2844/4163	11/0	4/2	2068/1832	48/7	16/0	2272/2047
Jun	30/68	11/19	5005/3187	124/18	7/16	5366/1649	62/74	19/12	7672/1784
Jul	a/8	a/0	313/1041	48/66	0/8	4858/2356	36/28	0/12	5484/3243
Aug	a	a	a/451	31/20	6/3	2561/2008	60/107	6/15	4256/2378
Sep	a	a	a/73	10/19	0/20	962/691	10/55	1/6	1084/1095
Oct	a	a	20/27	3/3	0/2	600/261	0/13	0/7	1146/718
Nov	0/a	0/a	20/37	0/0	0/0	42/50	0/0	0/0	22/99
Dec	0/a	0/a	12/32	0/1	0/1	22/1	0/0	0/0	0/0
TOTALS	222/100	186/28	12,975/11,398	233/187	20/59	17,547/9,737	221/300	42/59	22,412/12,252

a Data not available. Upper reach is usually intermittent except during spring months.

*Data not available. Project began collecting data March 1, 1991.

might be expected due to periods of intermittent flow. In the middle reach, June and July were principal use months in 1991, but use shifted to July and August in 1992. The lower reach had active boat traffic from May through September in both years. Annual estimated boat traffic was fairly equally divided among the three reaches, with each reach receiving 30 to 40% of the total traffic during both years.

Table 3. Estimated total number of boats, recreators, and angling pressure on the Buffalo River, 1991/1992. Number of recreators was calculated by multiplying number of boats by 1.85. Number of anglers was calculated by multiplying number of recreators by 0.092. Number of angler hours was calculated by multiplying number of anglers by 2.3.

1991				
Reach	Boats	Recreators	Anglers	Angler Hours
Upper	18,890	34,947	3,215	7,395
Middle	18,934	35,028	3,223	7,413
Lower	<u>25,919</u>	<u>47,950</u>	<u>4,411</u>	<u>10,145</u>
TOTALS	63,743	117,925	10,849	24,953
1992				
Reach	Boats	Recreators	Anglers	Angler Hours
Upper	13,891	25,698	2,364	6,856
Middle	12,072	22,333	2,055	5,960
Lower	<u>14,266</u>	<u>26,392</u>	<u>2,428</u>	<u>7,041</u>
TOTALS	40,229	74,423	6,847	19,857

Anglers accounted for 9.2% of the recreators contacted by the creel clerks (Table 1). Expanding this proportion to the estimated number of recreators using each reach of the river each year, the upper reach of the Buffalo River supported a mean of 2,790 anglers during 1991 and 1992; the middle reach 2,639 anglers, and the lower reach 3,420 anglers.

Thirty of the 158 anglers (19%) interviewed in 1991 caught and retained 156 fish for consumption, including 29 smallmouth bass, numerous shadow bass and longear sunfish; no catfishes were creeled during the study. Mean length of the smallmouth bass was 29.6 cm and mean weight was 397 g. In 1992, only 10 of 125 anglers (8%) interviewed had fish in their possession, and 13 of the 15 fish creeled were smallmouth bass. Mean length of smallmouth bass was 28.2 cm and mean weight 354 g. In 1992, 120 of the 125 anglers surveyed (96%) reported having caught and released fish. Combining both years of catch, 64% of the harvested fish came from the lower reach, as did 54% of the released catch in 1992. The middle reach accounted for 30% of the harvested fish and the upper reach only 6%. However the upper reach accounted for 29% of the released catch.

Fishing pressure can be compared between reaches and streams by calculating the number of anglers/surface area of stream (anglers/ha) or the number of angling hours/surface area of the stream (hr/ha). Anglers found it very difficult to estimate the number of hours spent angling, as many trips were overnight and much time on the river was taken up by non-angling activities. However, in 1991 anglers estimated they spent 2.3 hours with their

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Table 4. Boating pressure, recreation pressure, angling pressure, catch per unit effort, and smallmouth bass (SMB) catch per unit effort on the Buffalo River in 1991 and 1992. Weighted means calculated from totals and total surface area of river (550 ha).

1991						
Reach	Boats/ha	Recreators/ha	Anglers/ha	Angling Hours/ha	SMB Harvest/ha	SMB Harvest/h
Upper	225.7	417.5	38.4	88.3		
Middle	77.5	143.3	13.2	30.0		
Lower	114.8	212.5	19.5	44.9		
WEIGHTED MEANS	115.9	214.4	19.7	45.4	4.6	0.08
1992						
Reach	Boats/ha	Recreators/ha	Anglers/ha	Angling Hours/ha	SMB Harvest/ha	SMB Harvest/h
Upper	166.0	307.0	28.2	81.8		
Middle	49.4	91.4	8.4	24.4		
Lower	63.2	116.9	10.8	31.2		
WEIGHTED MEANS	73.1	135.3	12.4	36.1	1.3	0.03

lines in the water/day and 2.9 hours/day in 1992, for an average of 2.6 hours of fishing /day. Surface areas for the three reaches of the Buffalo River were calculated by measuring widths at 10 points along each of the three reaches to determine a mean width. Reach lengths were obtained from NPS maps. The upper reach averaged 14.9 m wide and was 56.2 km long (83.7 ha), the middle reach averaged 31.5 m wide and was 77.6 km long (244.4 ha), and the lower reach averaged 33.0 m wide and 68.4 km long (225.7 ha). The mean width for the Buffalo River was 27.2 m and its length 202.2 km for a total surface area of 550 ha. Table 4 estimates the anglers/hectare and angling hours/hectare for the Buffalo River for 1991 and 1992.

During the two years of the study, the upper reach of the Buffalo River received more intense recreational pressure (boats, recreators, anglers, hours) per hectare than did the rest of the river combined (Table 4). In part, this is due to the reduced area of the river in the upper reach, which is less than half as wide as the middle and lower reaches. However, it should also be remembered that the pressure was concentrated into the months March through June due to intermittent flows. Mean number of recreators on the entire river over the two years of the study, weighted by area, was 174.9/ha/yr and mean number of anglers was 16.1/ha/yr. Expanding this by 2.9 hours/angler indicates 46.7 hr/ha/yr of fishing pressure was expended on the Buffalo River.

Fish harvest rate for the Buffalo River in 1991 was 19.4 fish/ha for all fishes and 4.6 smallmouth bass/ha; it took anglers 12.5 hours to harvest one smallmouth bass (0.08 smallmouth bass/hour) during that year. In 1992, harvest fell to 1.5 fish/ha, 1.3 smallmouth bass/ha, and 0.03 smallmouth bass/hour. However, in 1992, over 40 fish/ha were caught and released.

Discussion

Recreational pressure on the Buffalo River has not increased since the 1981 figure of 51,000 boats/year, with the present study estimating almost 52,000 boats/year in 1991 and 1992. NPS efforts to control boating pressure on the river appear to be working. Mean number of recreators in boats exceeded 96,000 people each year in 1991-1992. The proportion of recreators that were fishing (9.1%) is slightly lower than an earlier estimate of 13.5% by Ditton (1979). However, the average annual number of anglers on the Buffalo River in 1991/1992 (8,848) is greatly reduced from the 27,380 to 33,000 anglers/yr estimated by NPS (1977, 1983) in 1977 and 1981.

Angling pressure on the Buffalo River was 19.7 anglers/hr and 45.4 hr/ha in 1991 and fell to 12.4 anglers/ha and 36.1 hr/ha in 1992. This can be compared to 130 to 275 anglers/ha (considered heavy pressure) and 17 anglers/ha (considered light pressure) on the Housatonic River in Connecticut (Barry, 1991). Sample and Hubert (in Reed, et al., 1981) considered 77 hr/ha on the Tennessee River in Alabama to be moderate angling pressure. Arkansas Game and Fish Commission (1992) estimated 73 anglers/ha and 300 hr/ha on Crooked Creek, AR, a slightly smaller stream just north of the Buffalo River that flows parallel to it. Funk and Fleener (1975) found 130 to 275 hr/ha finishing pressure on Big Piney River in Missouri and suggested the quality of the smallmouth bass fishery would decline under continued fishing pressure of >250 hr/ha. It appears angling pressure on the Buffalo River was light to moderate during 1991 and 1992.

Harvest of smallmouth bass on the Buffalo River was

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4.6/ha and 0.08/hr in 1991, and 1.3/ha and 0.03/hr in 1992. Reed et al. (1991) summarized harvest of smallmouth bass for 12 streams and found a range of from 0.05 fish/hr in the Maquoketa River, Iowa, to 1.3 fish/hr in the New River, Virginia. Arkansas Game and Fish Commission (1992) estimated catch (almost all of which was harvest) of 50.6 smallmouth bass/ha and 0.16 fish/hr from Crooked Creek. Coble (1975) considered a harvest rate of 1.0 smallmouth bass/hr to be good, and Barry (1991) found smallmouth bass harvest rates of 0.42 to 2.8 fish/hr on the Housatonic River and considered the higher levels to be very good. Paragamian and Coble (1975) found harvest rates of smallmouth bass in many locations often were less than 0.1 fish/hours. Whisenant and Maughan (1989) reported on angler harvest on the Buffalo River in 1981 and 1982. They surveyed 343 anglers and found a harvest rate of 0.29 smallmouth bass/hr. My summed results of interviewing 283 anglers found a harvest rate of 0.06 smallmouth bass/hr, 20% of the harvest rate of only a decade ago on the Buffalo River.

Compared to these reports, harvest rate of smallmouth bass on the Buffalo River appears to be low and to have declined over the past decade. However, the high rate of catch and release noted in this study (96%) may strongly influence harvest data. Clark (1983) suggested high release rates could bias catch statistics and invalidate comparisons with historic data.

Fewer anglers are floating the river and fewer fish are being harvested by those that recreate on the Buffalo River. Ditton (1979) asked recreators on the Buffalo River to categorize their reasons for being on the river and found that of 36 possible categories including viewing scenery, change from daily routine, and peace and calm, that fishing came in second to the last, only above testing equipment. With recreation remaining constant and harvest of fishes declining on the Buffalo River, NPS and Arkansas Game and Fish Commission may consider catch-and-release or on-the-spot consumption of fish as practical management options for our first National River.

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