EVALUATION OF THE TROUT FISHERY IN THE TAILWATER OF BULL SHOALS RESERVOIR, ARKANSAS, 1971-73

LARRY R. AGGUS, National Reservoir Research Program, U. S. Fish and Wildlife Service, Fayetteville, AR 72701

DAVID I. MORAIS, National Reservoir Research Program, U. S. Fish and Wildlife Service, Fayette, AR 72701

ROBERT F. BAKER, Arkansas Game and Fish Commission, Route 1, Mountain Home, AR 72653

Abstract: The fishery for rainbow trout (*Salmo gairdneri*) in the Bull Shoals tailwater has developed as a seasonal boat fishery which in peak years provides more than 250,000 angler days of fishing, and a catch of more than 750,000 trout. Use was concentrated along the upstream one-third (48 km) of the tailwater in 1971-73, where about 60 percent of the total fisherman effort, 50 percent of the catch, and 75 percent of the total guided fishing occurred. Since many anglers traveled long distances, rented boats and motors, and employed guides to fish the tailwater, the economic value of the fishery was high.

As in most fisheries in cold tailwaters in the South, erratic patterns of water release strongly influenced fisherman use and harvest. During 1971 and 1972, years of below average water release, fishermen caught about 95 percent of the trout stocked. Sustained high water releases at Bull Shoals Dam in 1973 were associated with marked reductions in angling effort and in numbers of fish caught/hr, but with only a slight reduction in the weight of fish harvested/hr. Regression equations are presented to describe relations between angling activity and patterns of water release over a wide range of flows.

Proc. Annual Conf. S.E. Assoc. Fish & Wildlife Agencies 31:565-573

The construction of large dams on the White River in Arkansas and Missouri have created cold tailwaters well suited to the production of trout. The tailwater formed by the construction of Norfolk Lake in 1944 and Bull Shoals Lake in 1952 is the oldest and largest of these White River fisheries, and supports a nationally renowned put-and-take fishery for rainbow trout and brown trout (*S. trutta*) along a 160 km portion of the lower White River (Baker 1959). The fishery has yielded the state record rainbow trout (7.4 kg) and brown trout 15.2 kg). A large tailwater trout fishery also developed in 704 ha Lake Taneycomo, Missouri, after impoundment of Table Rock Lake in 1958 (Fry 1965, Fry and Hanson 1968) and more recently a trout fishery has been established in a 10 km reach of the White River below Beaver Lake.

The complex White River system provides flood control, hydropower production, and water for recreational, domestic, and industrial uses. Integrating these multiple-use needs into an all-inclusive water management plan is a formidable task. To better understand the importance of the tailwater below Bull Shoals and Norfolk Lakes to other resource demands, the Arkansas Game and Fish Commission, the U.S. Fish and Wildlife Service, and the U.S. Army Corps of Engineers (Little Rock District), cooperated in a creel census of the tailwater fishery in 1971-73. The study was designed to provide an accurate estimate of angler use and harvest, a measure of the factors influencing use and harvest, a measure of the factors influencing use and harvest, and related information needed for the development of optimum management of the fishery. Preliminary findings were presented by Morais and Jenkins (1974) in a report to the cooperators. This report details results of the 3 yr study and identifies factors that influenced fishing in the tailwater.

DESCRIPTION OF THE TAILWATER

Penstock releases through Bull Shoals Dam control the flow of water throughout the 160 km tailwater area. Releases from Norfolk Dam dominate flow of the Norfolk River for a distance of 7.2 km to its confluence with the White River 64 km below Bull Shoals Dam, and represent about 20 percent of the flow volume of the White River at this point. The Norfolk discharge exerts a relatively small effect on the total tailwater, but serves to reduce water temperatures during periods of low flow from Bull Shoals Dam.

Water temperatures in the upper tailwater average from 10 to 13 C, and range from about 6 to 17 C annually (Hoffman and Kilambi 1971). However, when power generation is stopped for extended periods in the summer, water temperatures in the tailwater may

increase to levels critical for trout survival. To avoid this problem, the U.S. Army Corps of Engineers makes periodic power releases through informal agreement with the Arkansas Game and Fish Commission (Baker 1959).

The tailwater includes a river surface area of about 2,537 ha. The White and Norfolk Rivers within this reach are characterized by alternating riffle and pool areas with substrates ranging from bedrock in scoured areas to some silt in the pools. Amphipods, isopods, chironomids, and oligochaetes make up most of the macroinvertebrate fauna (Hoffman and Kilambi 1971). A number of warm water streams including Crooked Creek, Buffalo River and Sylamore Creek, flow into the White River tailwater, but these tributaries do not warm the river sufficiently to eliminate trout downstream from their mouths.

METHODS

Rainbow trout for the Bull Shoals tailwater are produced at the USFWS Norfolk National Fish Hatchery located below Norfolk Dam. Although natural reproduction of trout has been reported in the tailwater, it represents an insignifican source of recruitment to the fishery (Baker 1959). Rainbow trout are stocked at an average total length of 22.5 cm and an average weight of 0.14 kg. Stocking is conducted throughout the year, although it is seasonally adjusted to coincide with patterns of angler use. Bank access to the tailwater is limited, and most fishing is by boat.

The creel census was designed by D. Hayne in collaboration with representatives from the participating agencies. A stratified random sampling design was developed to provide an estimate of angler use from aerial counts and success from angler interviews. These data were combined to obtain estimates of harvest.

The tailwater was divided into 3 zones for the present study (Fig. 1): Bull Shoals Dam to Buffalo City (Zone 1), Buffalo City to Calico Rock (Zone 2), and Calico Rock to

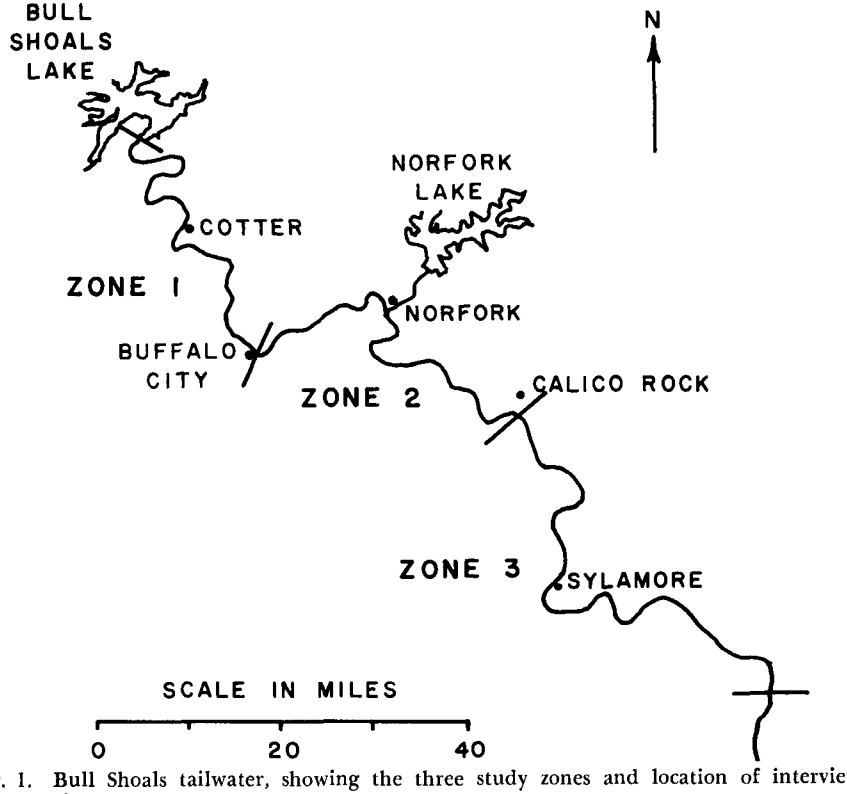

Fig. 1. Bull Shoals tailwater, showing the three study zones and location of interview sites.

Lock and Dam 3 (Zone 3). Angler use was measured by counts from aircraft about 70 times each year. The counts were stratified by season, weekdays, weekend days and holidays (combined) and time of day. An average of 1.5 hr was required to fly and count fishermen along the 160 km study area. Estimates were made only during daylight as tailwater use is strongly oriented toward float fishing, and is therefore almost exclusively a daylight fishery.

Creel clerks interviewed anglers at 5 major access points located at Cotter, Buffalo City, Norfolk, Calico Rock, and Sylamore (Fig. 1). Interviews were also stratified by location, season, weekdays, weekend days and holidays, and time of day. Creel clerks interviewed fishermen 155 days each year; a standard workday was 8 hours. Workdays began at 0700 or 1100 hours to conform with the completion of most float fishing trips. Fishermen interviewed at the completion of fishing trips provided information on hours fished, number of fishermen in party, use of guides, and distance traveled from their homes to the fishing area. Data collected also included species and number of fish caught by each party, total length of each fish, and total weight of fish caught. Use and harvest estimates were computed for weekdays (Monday through Friday) and weekend days and holidays, by zone, monthly, from March to October each year. Estimates were combined for January-February and November-December each year because little fishing was done during these periods.

This sampling design yieled estimates of angler use in hours, and harvest as number and weight of trout, with coefficients of variation ranging from 5.3 to 7.7 percent of the annual estimate for the entire tailwater. When measured by zone, coefficients of variation ranged from 5.2 to 22.5 percent of the estimate. Monthly estimates for these parameters varied substantially, depending on sample size.

Because releases from Bull Shoals Lake are primarily for hydropower production, flows in the tailwater are erratic. They can vary from 100 to 22,500 cfs, often over short intervals of time. The historical average annual discharge through Bull Shoals Dam is 6,040 cfs. During the 1971-73 study period, averages were 4,320, 3,340, and 10,100 cfs, respectively. Average daily release values ranged from 380 cfs in December 1971 to 17,390 cfs in May 1973. Records of daily water-release volumes through Bull Shoals and Norfolk Dams were provided by the Little Rock District, Corps of Engineers.

RESULTS

Angler Use

Angler use varied widely among seasons. Use was lowest during late fall and winter (November-March) and highest during late spring and summer (May-August). During the 3 yr study period, 60 to 62 percent of the total trips were made during the May-August period. Peak angler use occurred during June or July each year, although total fisherman effort varied substantially from year to year (Fig. 2). Seasonal use patterns in each of the tailwater zones were similar.

Total angler use (Table 1) was similar in 1971 and 1972 (225,000-250,000 man days and 1,100,000 man hr) but decreased substantially in 1973 to 139,000 man days and 780,000 man hr. Average length of an angler day was 4.2 hr in 1971, 4.9 hr in 1972, and 5.6 hr in 1973.

About 60 percent of the total annual fishing pressure occurred on the upstream one-third (Zone 1) of the tailwater (Table 1). Effort on this reach was about twice that of the middle reach (Zone 2) and 4 to 6 times that of the lower reach (Zone 3) throughout the study period. Angler use per ha of river in Zone 1 was approximately 770 hr (169 and 144 man days) during 1971 and 1972, and about 54 hr (94 man days) in 1973). In Zone 3 these values ranged from 116 to 143 hr and from 28 to 45 angler days during the 3 yr period. Angler use on weekdays nearly equaled use on weekend days and holidays throughout the period. Length of an angler day was consistently longer on the upstream reach, where the float fishery is most highly developed.

Many of the anglers using the Bull Shoals tailwater traveled long distances and employed guides (Table 2). About 60 percent of the total trips were by anglers who traveled more than 320 km (one way), and about one-half of these anglers traveled more than 640 km. Local anglers (those traveling less than 80 km) made up 17 to 25 percent of the total angler trips, and a sizable number of these were guides.

More than one-third of the total fishing trips and nearly one-half of the total angler hr were guided (Table 3). This reflects a much longer angling day by guided fishermen. As with total fisherman effort, guided-trips were concentrated in Zone 1. From 70 to

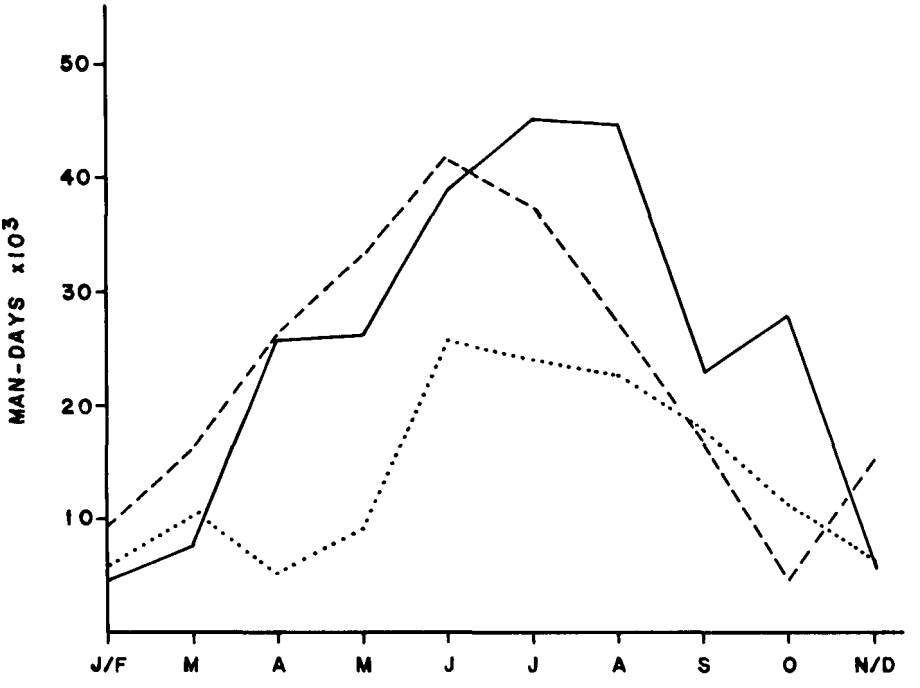

Fig. 2. Estimated number of angler trips per month on the Bull Shoals tailwater during 1971 (solid line), 1972 (dashed line), and 1973 (dotted line).

Table 1. Estimated angler use in hours and days, and length of fisherman day on the Bull Shoals tailwater, 1971-73; per ha values are shown in parentheses.

Year and zone	*Angler use*		*Length of angler day (hr)*
	Hours	*Days*	
1971			
Zone 1	636,900 (768)	140,200 (169)	4.5
Zone 2	302,700 (415)	76,900 (105)	3.9
Zone 3	113,100 (116)	33,100 (33)	3.4
Total	1,052,700 (415)	250,200 (99)	4.2
1972			
Zone 1	640,600 (771)	119,500 (144)	5.4
Zone 2	322,400 (442)	64,100 (88)	5.0
Zone 3	141,100 (143)	43,900 (45)	3.2
Total	1,104,100 (434)	227,500 (89)	4.9
1973			
Zone 1	452,400 (546)	77,900 (94)	5.8
Zone 2	211,500 (289)	33,900 (46)	6.2
Zone 3	119,700 (121)	27,200 (28)	4.4
Total	783,600 (309)	139,000 (55)	5.6

Table 2. One-way distance traveled by anglers to fish the Bull Shoals tailwater in 1971-73, expressed as percentage of total anglers in each zone traveling less than 80 km, 81-160 km, 161-321 km, and more than 321 km.

Year and zone	*One-way distance traveled in km*			
	Less than 80	*81-160*	*161-321*	*More than 321*
1971				
Zone 1	26.9	0.9	6.1	66.1
Zone 2	23.6	3.2	22.0	51.1
Zone 3	18.2	8.2	29.2	44.4
Average	25.0	2.4	13.1	59.5
1972				
Zone 1	26.1	3.6	11.9	58.3
Zone 2	17.9	5.3	18.0	58.9
Zone 3	10.9	8.1	53.1	27.8
Average	21.9	4.7	18.7	54.7
1973				
Zone 1	17.0	0.1	7.4	75.5
Zone 2	17.1	7.4	21.5	54.0
Zone 3	14.9	11.6	20.0	53.6
Average	16.7	3.8	14.3	65.5

Table 3. Estimated guided fishing effort by zones, as number of guided days, number of guide days, length of guided days, guide use as percent of total use, and distribution of guided fishing on the Bull Shoals tailwater 1971-73.

Year and zone	*Number of guided days*	*Number of guide days*	*Length of guided days (hr)*	*Guide use as percent of total days*	*Percent of total guided days*
1971					
Zone 1	57,400	18,450	6.4	41.0	74.9
Zone 2	16,390	5,270	4.7	21.3	21.4
Zone 3	2,810	1,030	4.2	8.5	3.7
Total	76,600	24,750	6.0	30.6	
1972					
Zone 1	57,100	20,790	7.8	47.8	74.1
Zone 2	16,570	5,800	8.5	25.9	21.4
Zone 3	3,505	990	4.6	8.0	4.5
Total	77,180	27,580	7.8	33.9	
1973					
Zone 1	39,400	9,890	6.5	50.6	70.2
Zone 2	12,020	3,230	7.9	35.5	21.4
Zone 3	4,740	1,180	4.1	17.4	8.4
Total	56,160	14,300	6.6	40.4	

75 percent of total guided effort occurred along this reach, whereas Zone 3 accounted for only 4 to 8 percent. Total guided effort was similar in 1971 and 1972, but decreased appreciably in 1973.

Harvest

Rainbow trout made up 99 percent by number and 98 percent by weight of all fish creeled in the tailwater during the 1971-73 study. In both 1971 and 1972 fishermen harvested more than 750,000 trout weighing over 113,600 kg, but in 1973 they caught only slightly more than 400,000 fish weighing 86,350 kg (Table 4). This amounted to 95, 96,

Table 4. Estimated number and weight of rainbow trout harvested in three zones of the Bull Shoals tailwaters 1971-73; number and weight of trout stocked, average weight of trout harvested and (near bottom of table) stocked, and catch-rate as number and weight of fish per hour. Per ha values are shown in parentheses.

Year and zone	Trout harvested or stocked			Catch rate per hr	
	Number	Weight (kg)			
		Total	Average	No.	Kilogram
Trout harvested					
1971					
1	457,740 (552)	167,020 (73.2)	0.15	0.72	0.11
2	275,830 (378)	96,730 (48.2)	0.14	0.91	0.13
3	112,530 (115)	36,650 (13.4)	0.13	0.99	0.13
Total	846,100 (333)	300,400 (42.8)	0.15	0.80	0.12
1972					
1	359,900 (310)	135,950 (58.9)	0.15	0.56	0.09
2	234,870 (322)	75,970 (37.5)	0.13	0.73	0.10
3	188,130 (192)	52,980 (19.6)	0.11	1.33	0.15
Total	782,900 (309)	264,900 (37.5)	0.14	0.71	0.10
1973					
1	187,100 (226)	103,690 (45.5)	0.22	0.41	0.09
2	112,240 (154)	52,080 (25.9)	0.19	0.53	0.10
3	108,650 (110)	33,830 (12.5)	0.13	0.91	0.11
Total	408,000 (161)	189,600 (26.8)	0.19	0.52	0.10
Trout stocked (all zones)					
1971	859,800 (338)	267,000 (38.4)	0.13		
1972	814,200 (320)	243,800 (34.8)	0.12		
1973	884,400 (349)	270,200 (38.4)	0.13		

and 46 percent of the total number of trout stocked in the respective years. Although annual harvest of stocked fish was efficient, there were large seasonal variations in harvest each year. During months of high angler use, it was not uncommon for harvest to exceed the total number of trout stocked. In 1971 and 1972 the number of trout stocked exceeded the number harvested from late fall to early spring, but harvest generally exceeded stocking from late spring to early fall (Fig. 3). In 1973, stocking exceeded angler harvest throughout the year. Number of fish caught per hour was not significantly correlated to the amount of angling effort through the study period.

Fishermen harvested 15,150 and 9,570 kg (4.7 and 2.9 kg/ha) more trout than were stocked in 1971 and 1972, respectively. In 1973, they caught 3,560 kg (11.5 kg/ha) less than were stocked. The average weight of trout harvested exceeded that of fish stocked by 16, 13, and 48 percent during the 3 respective years. Large trout were caught in the winter and early spring in 1971 and 1972, and throughout the year in 1973 (Fig 4). This corresponded to times of reduced effort and harvest, and periods of sustained high

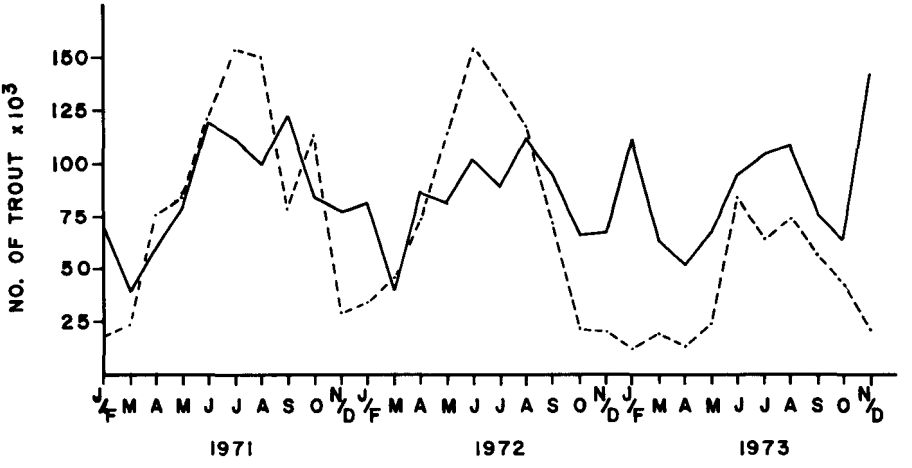

Fig. 3. Number of rainbow trout stocked (solid line), and estimated number harvested (dashed line) from the Bull Shoals tailwater, 1971-73.

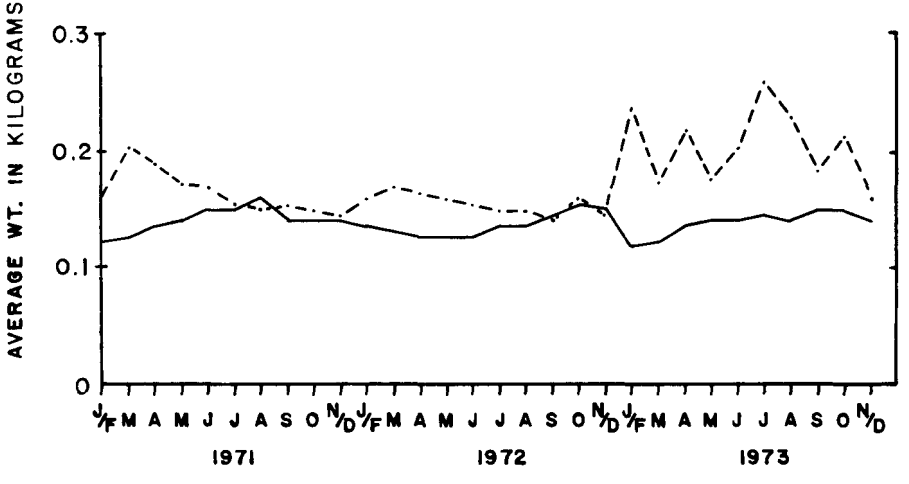

Fig. 4. Average weight of rainbow trout stocked (solid line) and harvested (dashed line) from the Bull Shoals tailwater, 1971-73.

water release through Bull Shoals Dam. During periods of high angler use, the average weight of trout harvested was about equal to that stocked. Much of the variation in the average weight of trout creeled occurred in the upstream portion of the tailwater (Table 4). The largest trout were consistently creeled in this zone throughout the study period, and during the sustained high water release in 1973, the average weight of trout creeled in this region was even greater.

During the 3 yr study period, about 50 percent of the total number and 54 percent of the total weight of trout were harvested in Zone 1. Harvest decreased progressively downstream (Table 4). Both number and weight of fish caught per hour was lowest in

Zone 1 and increased downstream. Although this suggests a negative relationship between total harvest and catch rate, the lower catch rate may have reflected a regulation which prevented guides from creeling fish. Under the regulation, fish creeled by guides counted against the guided-anglers' limit of 6 fish. Catch-rates were computed for all fishermen, and those for guided and unguided fishermen could not be separated.

Influence of Water-Release Patterns on Angler Use and Harvest

To explore the relation of variable water-release patterns to fisherman use and harvest, we used regression analyses to compare the data for the 3 yr period. Angler use as man hr and man days, and harvest as number and weight of fish caught/hr, were compared with the average volume of water released daily through Bull Shoals Dam. Because of large seasonal variations in angler use, we compared these parameters only during times of high angler use (May-August) of each year. Angler use as total days and hours of effort, and catch-rate as fish per hour were negatively related ($P < .01$) to the average daily discharge volume through Bull Shoals Dam (Table 5). The weight of trout harvested per hour was not significantly related to discharge volume. This relation reflects the harvest of fewer, but larger trout during periods of sustained high water releases, and suggests that the potential for trout production in the tailwater is good, but often not realized because of varying effects of water releases on angling pressure and harvest. Over the range of discharge volumes (1,920-17,390 cfs), highest flows indicated reductions over lowest flows of about 60 percent in angler-trips, 45 percent in hr of effort, and 40 percent in numbers of fish caught per hour, but only 10 percent in the weight of fish harvested per hour.

Table 5. Linear regression equations relating angler use (as total angler h and trips per day), and harvest (as number and weight of fish caught per h) to average volume (m^3/s) of water released through Bull Shoals Dam during May through August (1971-73). The symbol R^2, the coefficient of determination, indicates the percentage of variability in each of the dependent variables explained by variations in release volume. The value (P) is the probability of obtaining an R^2 as large or larger by chance when the hypothesis of no correlation is true.

Dependent variable	*Constant*	*Regression coefficient*	*Independent*	R^2	*P*
Hours per day	= 6395	−6.4750 x	release	0.54	0.01
Trips per day	= 1370	−1.7720 x	release	0.69	0.01
Number of fish per hour	= 0.785	−0.000675 x	release	0.75	0.01
Pounds of fish per hour	= 0.118	−0.0000575 x	release	0.10	NS

DISCUSSION

The Bull Shoals tailwater provided 250,000 angle trips in 1971 and 225,000 in 1972. This compares to an estimated 479,000 and 423,000 angler trips on 18,200 Bull Shoals Lake during the same period (Morais and Jenkins 1974), and 250,000 trips on the Lake Taneycomo (Table Rock Lake tailwater) trout fishery in 1974 (Willis Hanson, personal communication). The fisheries in the 2 tailwaters are about equal to that of the reservoir, and represent a highly specialized recreational resource. The float fishery on the Bull Shoals tailwater attracts anglers from long distances who make extensive use of guide services. The value to the local economy is therefore high.

Extended periods of high water release through Bull Shoals Dam have occurred every 5 to 7 yr in response to above normal rainfall over the upper White River Basin. The 1973 releases resulted in a large decrease in angler use, but there was a substantial increase in the size of fish harvested. This increase, particularly in the upstream area, suggests that trout stocked in excess remain in the tailwater and grow rapidly during these periods. These trout likely enhance the fishery when water releases decrease. A greater-than-usual number of "residual" rainbow trout were reportedly caught in 1974, and it was postulated that the fish entered the tailwater from Bull Shoals Lake in late 1973 as oxygen levels in the hypolimnion declined (Axon 1975). However, the low rate of harvest in the tailwater in 1973, and the marked increase in size of trout harvested throughout the year indicates that the large trout creeled in 1974 were stocked in the tailwater in 1973.

The tailwater creates habitat suitable for trout over a 160 km reach of the White River, but fisherman use and harvest is concentrated on the upstream portion. Baker ((1959) defined water temperature as the over-riding factor for survival of rainbow trout in the tailwater, and stressed regular power releases as a means of maintaining desirable temperatures. Over the 20 yr development of the fishery, the upstream portion of the tailwater has provided the most stable water temperatures, and the heaviest use.

Although the existing stocking program resulted in little net gain in the total weight of trout harvested compared with the weight stocked, growth of trout was excellent in tailwaters below White River impoundments when stocking programs began. Baker (1959) reported that trout stocked in the Bull Shoals tailwater grew 2.3 and 1.7 cm/mo in 1957 and 1958, respectively. Fry and Hanson (1968) found that trout stocked at lengths of 17.8-25.4 cm in Lake Taneycomo grew an average of 1.0 cm/mo.

Heavy angler use and efficient harvest from May through August of most years has limited management at these times to intensive stocking and manipulation of stocking schedules and release points to conform to the distribution of anglers within the tailwater. Since 1975, the Arkansas Game and Fish Commission has been stocking up to 13,600 kg of 0.34 to 0.45 kg trout to provide more large trout during this period. In the present study, the mean weight of trout harvested increased rapidly during periods of low harvest, suggesting that the productive capability of the tailwater is not being fully used. Increased stocking during periods of low angler use (November-March) should be explored to determine if additional production can be obtained at this time for harvest during the high use period.

Erratic patterns of water release through Bull Shoals Dam create management problems common to many other cold, southern tailwaters (e.g., Parsons 1957; Pfitzer 1962, 1968; White 1969; and Axon 1975). Although effects of minimum releases on trout survival could not be quantified in this study, relations between a wide range of water releases and fisherman use and harvest can be approximated from the regressions presented.

Bull Shoals Lake has a large flood pool, which affords considerable storage for downstream water release control. Peak angler use on the tailwater in the summer coincides with young-of-year production of most warmwater species in upstream Bull Shoals Lake. Survival of young largemouth bass (*Micropterus salmoides*) is positively related to the amount of flooding that occurs within the flood pool during early summer (Aggus and Ellitt 1975). In years of above average rainfall, management of both the reservoir and tailwater fisheries could be enhanced by increasing water storage and smoothing water releases from Bull Shoals Lake.

LITERATURE CITED

Aggus, L. R., and G. V. Elliott. 1975. Effects of cover and food on year-class strength of largemouth bass. Pages 317-322 *in* Henry Clepper and R. H. Stroud, eds. Black bass biology and management. Sport Fishing Institute, Washington, D.C.

Axon, J. R. 1975. Review of coldwater fish management in tailwaters. Proc. Annual Conf. Southeastern Assoc. Game and Fish Comm. 28:351-355.

Baker, R. F. 1959. Historical review of the Bull Shoals Dam and Norfork Dam tailwater trout fishery. Proc. Annual Conf. Southeastern Assoc. Game and Fish Comm. 13: 229-236.

Fry, J. P. 1965. Harvest of fish from tailwaters of three large impoundments in Missouri. Proc. Annual Conf. Southeastern Assoc. Game and Fish Comm. 16:405-411.

----------, and W. D. Hanson. 1968. Lake Taneycomo: A cold-water reservoir in Missouri. Trans. Am. Fish. Soc. 97(2):138-145.

Hoffman, C. E., and R. V. Kilambi. 1971. Environmental changes produced by cold-water outlets from three Arkansas reservoirs. Arkansas Water Resources Research Center, Pub. No. 5. University of Arkansas, Fayetteville. 169 pp.

Morais, D. I., and R. M. Jenkins. 1974. Estimates of sport fisherman use and harvest, Bull Shoals Reservoir and tailwater, 1971-1973. Report to cooperating agencies. National Reservoir Research Program, Fayetteville, Arkansas. 32 pp. (Mimeo.)

Parsons, J. W. 1957. The trout fishery of the tailwater below Dale Hollow Reservoir. Trans. Am. Fish. Soc. 85 (1955):75-92.

Pfitzer, D. W. 1962. Investigations of waters below large storage reservoirs in Tennessee Tennessee Game and Fish Commission, D. J. Report, Project F-1-R. 225 pp. (Mimeo.)

----------. 1968. Evaluation of tailwater fishery resources resulting from high dams. Pages 477-488 *in* Reservoir fishery resources symposium, Athens, Ga., April 1967. South. Div., Am. Fish. Soc.

White, R. L. 1969. Evaluation of catchable rainbow trout fishery. Texas Parks and Wildl. Dept. D-J, F-2-R-16 Job Prog. Rep. 18 pp.