A Quantitative Comparison of Two Quality Tennessee River Tailrace Fisheries

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Abstract: Sportfishing in the turbulent waters downstream of Wilson and Wheeler dams on the Tennessee River is widely regarded as superior quality by anglers, sports writers, and fishery scientists. Access point creel surveys were conducted from February 1988 through January 1989 and January through December 1990 in the Wilson Dam and Wheeler Dam tailraces, respectively. The objectives of the surveys were to document fishing effort, catch, harvest, and other fishery characteristics, particularly for smallmouth bass (*Micropterus dolomieu*), in popular tailrace areas in the Alabama portion of the Tennessee River. During the 1988 Wilson Dam tailrace survey, 280,948 angler-hours of effort were expended, of which 117,207 hours (42%) were directed at smallmouth bass. Catfish (*Ictalurus spp.*) were the most exploited group, representing 29% of the harvest by weight, and temperate basses (*Morone spp.*) and smallmouth bass combined for almost 50% of the harvest. The overall catch rate of smallmouth bass was 0.51 fish/hour for anglers targeting this fish at Wilson Dam, and the catch rate was highest (0.80 fish/hour) for night fishing during summer. Similar rates were identified during the Wheeler Dam creel survey. Anglers expended approximately 244,012 hours of effort during the Wheeler Dam tailrace survey, and most anglers (43%) fished for catfish. Only 23% of the anglers fished specifically for smallmouth bass. Total harvest (136,000 kg) of all fish at the Wheeler Dam tailrace was approximately twice the total harvest at the Wilson Dam tailrace. Catfish, temperate basses, and sunfish (*Lepomis spp.*) were the principal fish groups harvested. The typical smallmouth bass angler fishing the Wilson Dam tailrace resided locally, fished frequently (23 days/year; 5.3 hours/trip), and considered catching modest-sized smallmouth bass (305–406 mm) as the most important characteristic of quality fishing. At the Wheeler Dam tailrace smallmouth bass anglers fished more often (40 days/year;

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6.5 hours/trip) and resided throughout north Alabama. These anglers considered catching trophy (>508 mm) fish to be the most important fishing characteristic. The majority of smallmouth bass anglers during both surveys were satisfied with fishing. These results provide management objectives for quality sportfishing in dam tailraces.

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The tailwaters below Tennessee Valley Authority (TVA) dams on the Tennessee River are popular fishing areas and attract anglers from around the nation. The Tennessee River system, which is well known for its diversity of fish species, lies within the native range of 3 species of black bass (*Micropterus spp.*) (MacCrimmon and Robbins 1975). The lower portion of the Tennessee River (Wilson and Pickwick reservoirs) constitutes the southern boundary of the natural range of the smallmouth bass. The rocky, turbulent tailwater areas provide prime habitat for smallmouth bass, (Janssen 1992; Weathers and Bain 1992), and the tailwater portions of both reservoirs receive the majority of smallmouth bass fishing effort. These fisheries are considered high-quality by biologists (Sample and Hubert 1978, Reed et al. 1991, Weathers and Bain 1992), and are often reported on in major sportfishing media. Although the Wheeler Dam tailrace is not as popular with smallmouth bass anglers as the Wilson Dam tailrace, large numbers of quality smallmouth bass are caught annually, and the Alabama state record smallmouth bass was caught from the Wheeler Dam tailrace in 1950.

While voluntary catch and release was identified as the factor that was responsible for continually high catch rates (Weathers and Bain 1992), a study in the Wilson Dam tailrace indicated that fishing effort in the area was high and considerable numbers of smallmouth bass were harvested annually. Results of the Wilson Dam study and increasing popularity of the smallmouth bass fishery below Wheeler Dam stimulated the need for a creel survey to evaluate the characteristics of the fishery in the tailrace portion of Wilson Reservoir, only 26 km upstream from Wilson Dam. Although results from the 1988 Wilson Dam creel survey previously have been reported (Reed et al. 1991, Weathers and Bain 1992), a summary of creel survey data from the tailraces was needed to document fishing quality for use by fishery managers. The objectives of this report were to compare fishing effort, catch, and harvest in the Wilson and Wheeler dam tailraces, compare the size distributions of smallmouth bass caught from the tailraces, and compare angler characteristics and attitudes of the fisheries.

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Methods

Wilson Dam (Tennessee River km 418), the largest hydroelectric producer in the TVA system, discharges into a turbulent river segment that is the upstream end of Pickwick Reservoir (17,440 ha mainstream impoundment) (Fig. 1). Discharge from Wilson Dam averages 1,871 m^3/second and mean residence time of the upstream impounded reservoir waters is short (6.2 days). The Wilson Dam tailrace, or Shoals Reach (Weathers and Bain 1992), retains its rocky, riverine characteristics for 20 km before entering the lentic waters of Pickwick Reservoir. The 2,080-ha Shoals Reach received the majority of fishing pressure very near (≤7 km) Wilson Dam (Sample and Hubert 1978, Reed et al. 1991, Weathers and Bain 1992), and bank fishing was negligible due to limited access.

Wheeler Dam (Tennessee River km 442) discharges into the upper end of the 6,720-ha Wilson Reservoir. The Wheeler Dam tailrace is relatively short and Wilson Reservoir is a deep (mean depth 12.4 m), fertile impoundment (Voightlander and Poppe 1989). Bank fishing access is very limited, and just 2 boat

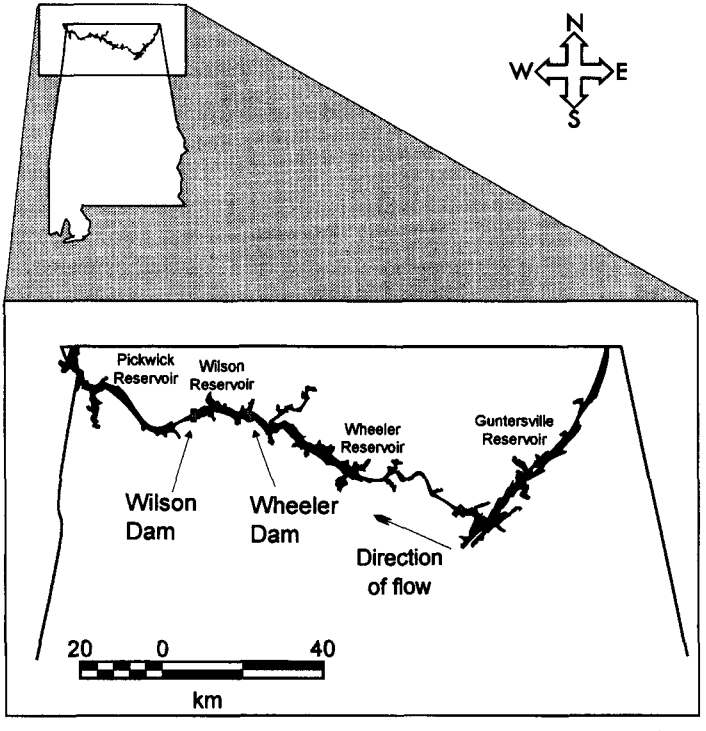

Figure 1. The Tennessee River in northern Alabama, featuring the Wilson Dam and Wheeler Dam tailraces.

ramps are located near the tailrace area. Unlike the Wilson Dam tailrace studied by Weathers and Bain (1992), no previous data existed on effort, catch, and harvest.

Access point creel surveys (Malvestuto 1983) were conducted at the Wilson Dam and Wheeler Dam tailraces to obtain information on effort, catch and harvest, emphasizing the smallmouth bass fisheries. The Wilson Dam tailrace creel survey (Wilson survey) was conducted from February 1988 through January 1989 (see Weathers and Bain 1992 for detailed description). The creel survey performed at the Wheeler Dam tailrace (Wheeler survey) lasted from January 1990 through December 1990 (see Janssen and Bain 1992). The creel surveys were based on a stratified, random design with nonuniform probabilities for selecting sampling units (Malvestuto et al. 1978). For the Wilson survey, day-of-week, time-of-day, and boat landing probabilities were determined by a preliminary creel survey (Bain et al. 1989), while seasonal probabilities were developed from previous research (Sample and Hubert 1978) in the study area. The Wheeler survey utilized similar day-of-week and time-of-day probabilities, and seasonal probabilities were based on the Wilson survey data. Boat landing probabilities were determined by preliminary trailer counts at the 2 tailrace landings.

Four 3-hour sampling units were used during daytime creel surveys (adjusted for daylight savings time, April–October), and 4 3-hour sampling units were used during night creel surveys. Two 3-hour units were sampled during each sampling block (day or night), and weekdays and weekend days were equally sampled. During the Wilson survey, 62 sampling days representing 124 sampling units were assigned to 4 seasonal effort periods: high effort (April–August), moderate effort (March, September), low effort (October, November), and very low effort (December–February). Sampling units assigned to the strata were 64, 36, 16, and 8, respectively. Twelve sampling days representing 24 sampling units were also included during a summer night fishing period (June through August). The Wheeler survey utilized 60 sampling days representing 120 sampling units. Three periods of angler effort were surveyed: high effort (April, May), moderate effort (June, October), and low effort (November–March and July–September). Sampling units assigned to the seasonal strata were 32, 24, and 64 respectively. The summer night fishing period was extended (May–August), and 16 creel days representing 32 survey units completed the design.

Angler interviews were conducted at boat launching sites by 1 or 2 creel clerks after anglers trailered their boats. Data collected included hours of angler effort, species composition, number, and weight (g) of all harvested fish. Lengths (mm TL) were also obtained for all black bass returned to the landing. Catch was estimated from harvested and reported numbers and lengths of released fish. Anglers were asked their county of residence, target species, and how they rated fishing on that particular fishing trip and fishing in the tailrace in general. Clerks also asked for comments and suggestions about the fishery. Smallmouth bass anglers were asked how often they fished for smallmouth bass and if they participated in catch-and-release fishing. Smallmouth bass anglers

were also asked to rank the importance of four fishing attributes: the frequency of catching smallmouth bass, the number of 305- to 406-mm smallmouth bass caught, the number of 407- to 508-mm smallmouth bass caught, or the number of smallmouth bass >508 mm caught. Smallmouth bass anglers were also asked about their satisfaction with the smallmouth bass fishery below Wilson Dam (1988 survey) and Wheeler Dam (1990 survey).

Fishing effort, catch, and harvest were estimated using the protocol and formulae of Malvestuto et al. (1978). Relative standard error or RSE (SE/mean × 100) was calculated for annual effort, catch, and harvest. Summary statistics were derived for 2 angler groups: all anglers and anglers fishing exclusively for smallmouth bass. We present a concise summary of the survey results for the Wilson Dam tailrace study (Reed et al. 1991, Weathers and Bain 1992) to allow a direct comparison of the fisheries and assemble the primary tailrace fishery data in 1 report.

Results

1988 Wilson Survey

Data were obtained from 1,679 anglers fishing the Shoals Reach below Wilson Dam during the 1988 creel survey. Approximately 280,948 hours of effort (RSE = 11.8%) were estimated to have been expended by all anglers during the 1988 study period. Forty percent of anglers targeted smallmouth bass and this accounted for 42% of the total fishing effort. The remaining angler effort concentrated on catching catfish, temperate basses, and sunfishes. Monthly effort ranged from 11,257 hours in November to 41,457 hours in June. In late spring, anglers principally targeted catfish and temperate basses. Temperate basses and smallmouth bass received the majority of fishing pressure during fall, and sauger (*Stizostedion canadense*) anglers were an important group during the winter months. Night fishing effort was dominated by smallmouth bass anglers fishing almost exclusively as part of fishing tournaments.

Anglers fishing the Wilson tailwaters in 1988 harvested 69,993 kg (RSE = 17.1%) of fish (Table 1). The harvest was dominated by catfish (29%) and temperate basses (26%). Although release rates were high during the study (68% for smallmouth bass anglers, 67% for all anglers), 15,168 kg of smallmouth bass (RSE = 24.5) were harvested in the tailrace in 1988. Largemouth bass (*Micropterus salmoides*), spotted bass (*M. punctulatus*), sunfish, and crappies (*Pomoxis spp.*) provided relatively unimportant fisheries. Freshwater drum (*Aplodinotus grunniens*) were frequently caught and harvested by anglers fishing for smallmouth bass during the fall months.

The annual catch rate for targeted (anglers indicating they were specifically fishing for smallmouth bass) smallmouth bass effort averaged 0.51 fish/hour, ranging from 0.22 fish/hour in November to 0.80 fish/hour during summer nights. While release rates averaged 53% by daytime anglers, night anglers

Table 1. Estimated annual harvest (kg) of fish groups in the 1988 Wilson Dam and 1990 Wheeler Dam tailraces.

Fish group	Wilson Dam tailrace	Wheeler Dam tailrace
Catfish	20,060	93,227
Temperate basses	18,198	19,678
Sunfish	3,423	9,659
Smallmouth bass	15,168	8,755
Other black basses	6,348	2,357
Crappies	3,395	606
Sauger	1,106	1,246
Freshwater drum	2,233	592
Other fishes	62	198
Total	69,993	136,318

Table 2. Estimated annual fishing effort and smallmouth bass catch, harvest, and release rates for the 1988–1989 Wilson Dam tailrace and the 1990 Wheeler Dam tailrace creel surveys. Estimates were computed separately for smallmouth bass anglers and anglers targeting other species.

Angler type, period of fishing	Fishing effort (hour)	Catch rate (fish/hour)	Harvest rate (fish/hour)	Release rate (%)
1988–1989 Wilson Creel				
Smallmouth bass anglers				
Daytime fishing	91,113	0.43	0.20	53
Summer night fishing	26,094	0.80	0.04	95
Total	117,207	0.51	0.16	68
Other anglers				
Daytime fishing	132,257	0.05	0.03	40
Summer night fishing	31,484	0.01	0.00	100
Total	163,741	0.04	0.02	44
1990 Wheeler Creel				
Smallmouth bass anglers				
Daytime fishing	35,976	0.49	0.19	60
Summer night fishing	50,440	0.47	0.03	93
Total	86,416	0.48	0.10	80
Other anglers				
Daytime fishing	140,179	0.03	0.01	49
Summer night fishing	17,417	0.00	0.00	
Total	157,596	0.03	0.01	49

achieved a 95% release rate (Table 2). Smallmouth bass caught during the 1988 survey ranged from 100 mm to 600 mm (Fig. 2). The annual harvest rate of smallmouth bass averaged 0.16 fish/hour, and the average size of these fish was 360 mm and 0.91 kg. Smallmouth bass anglers were predominantly local anglers and fished often (23 days/year). Most (59%) smallmouth bass anglers fishing the Wilson Dam tailrace were satisfied with the fishing quality. Catching modest size (305- to 406-mm) smallmouth was the most important fishing characteristic influencing satisfaction for these anglers. Catching quality (>508-mm) size

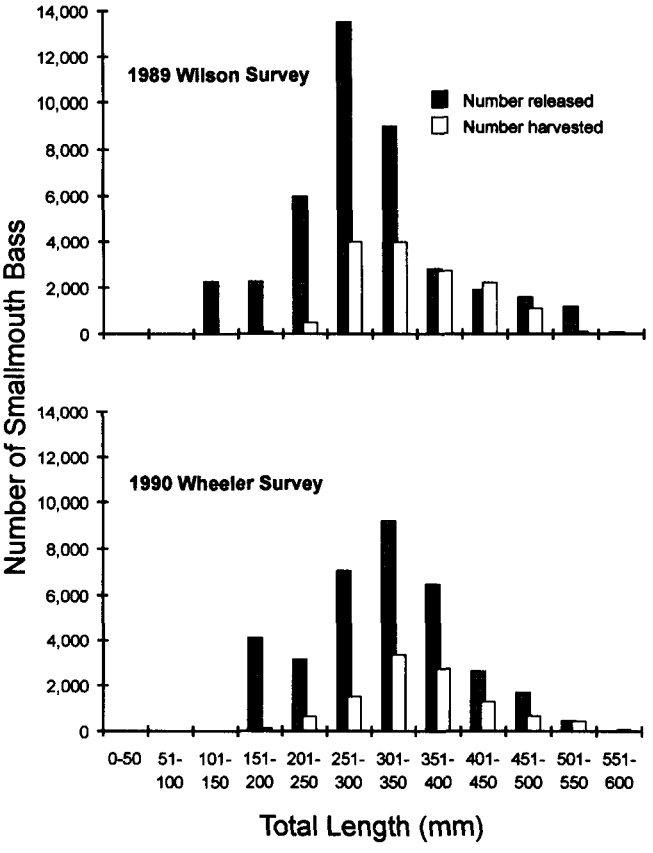

Figure 2. Size distribution of smallmouth bass caught and harvested during the 1988 Wilson Dam tailrace and the 1990 Wheeler Dam tailrace creel surveys.

smallmouth bass and overall high catch rates of smallmouth bass ranked next in importance (Table 3).

1990 Wheeler Survey

Creel clerks conducted 1,283 interviews representing 2,470 anglers. An estimated total of 244,012 hours (RSE = 9.3%) of effort were expended by all anglers during 1990, and 86,416 hours of effort were directed at smallmouth bass in particular. Daytime fishing effort varied considerably throughout the year, ranging from 856 hours in January to 34,185 hours in June. The majority of daytime anglers targeted catfish (43%), while the majority (74%) of night anglers fished specifically for smallmouth bass. Daytime smallmouth bass fishing effort was highest in September and October and lowest in February. Night fishing effort peaked in June and gradually declined until reaching negligible levels in August.

Catfish were the most sought after sport species during the study, and this taxa dominated in the harvest. Peak catfish catch and harvest occurred from

Table 3. Characteristics and interests of smallmouth bass anglers fishing in the Wilson Dam tailrace in 1988 and the Wheeler Dam tailrace in 1990.

Characteristic	Estimated value	
	Wilson Dam tailrace	Wheeler Dam tailrace
Annual number of days fished for smallmouth bass	23	40
Average trip length (hours)	5.3	6.5
Local anglers (%)	55	27
Alabama anglers (%)	85	62
Anglers satisfied with fishing (%)	59	77
Percent who replied		
Most important fishing characteristic		
Catch rate of bass	20	29
Number of bass 305–406 mm long	33	13
Number of large bass (407–457 mm)	19	11
Number of trophy bass (>508 mm)	28	47

June through September. Temperate basses represented the second most important fish group by weight, with an annual harvest of 19,678 kg. The temperate basses were targeted most often during September and October, but catch rates were also high during March and April when spawning behavior typically begins. Sunfish composed 7% of the Wheeler Dam tailrace harvest.

In 1990 an estimated 45,574 smallmouth bass (RSE = 11.5%) were caught by all anglers in an estimated 244,012 hours of fishing. Only 10,789 of the smallmouth bass were harvested because of a 76% release rate (79% by smallmouth bass anglers). Although release rates were high, smallmouth bass represented the fourth most harvested fish group by weight. Catch rates for smallmouth bass fluctuated throughout the year, with the highest rates occurring during daytime fishing in September (0.74 fish/hour) and during August nights (0.63 fish/hour). Anglers released the majority of smallmouth bass <381 mm, but harvest rates generally increased with increasing smallmouth bass length. Harvest rates peaked in late summer and early fall, averaging 0.10 fish/hour for 1990. The average reported size of released smallmouth bass was 325 mm and was 0.68 kg. Mean length and weight of harvested smallmouth bass was 354 mm and 0.82 kg, respectively.

Smallmouth bass anglers averaged 40 fishing trips annually, and trips averaged 6.5 hours in length. The majority of smallmouth bass anglers were from Alabama, but relatively few were local anglers (residents of counties bordering Wilson Reservoir). Eighty-eight percent of anglers fishing for species other than smallmouth bass were generally satisfied with fishing, while 77% of smallmouth bass anglers were satisfied with fishing below Wheeler Dam. Almost 50% of the anglers considered catching a trophy smallmouth bass as being the most important characteristic of their fishing trip. High catch rates were also prerequisites for quality fishing to smallmouth bass anglers.

Discussion

While the 2 Tennessee River tailraces differed in morphology, the fisheries of those systems were very similar. Both tailraces received relatively high fishing pressure throughout the year (244,012–280,948 angler-hours), with 35%–42% of the effort directed at smallmouth bass. Although smallmouth bass effort was lower in the Wheeler Dam fishery than in past Wilson Dam studies (Sample and Hubert 1978; Weathers and Bain 1992), seasonal trends in effort were similar. Daytime fishing effort was relatively consistent during spring and summer months, and peak effort occurred during the fall and summer nights. These peaks coincided with increased catch rates of smallmouth bass (up to 0.74 and 0.80 fish/hour). Although generally not considered a high effort period, night fishing constituted 22% and 58% of the fishing effort by smallmouth bass anglers in the Wilson Dam and Wheeler Dam tailraces, respectively. Frequent night tournaments were responsible for the inflated rates of effort.

Catfish and sunfish effort and harvest appear greater in the Wheeler Dam survey than the levels suggested by the past Wilson surveys. The 1990 catfish harvest below Wheeler Dam exceeded harvest of all species combined in past Wilson Dam tailrace studies, and was mainly from May through September. Sunfish harvest was probably higher in the Wheeler Dam creel survey study because Wilson Reservoir acts as a more lentic environment than the Shoals Reach of Pickwick Reservoir, and sunfish production is much higher in Wilson Reservoir (Voightlander and Poppe 1989). Sunfish anglers were a specialized group, fishing primarily during the spawning season (May through July).

Fishing effort by all anglers was unusually low during winter months. Effort for sportfishes such as sauger and white bass (*Morone chrysops*) followed similar patterns below both tailraces. Anglers targeted these pelagic fishes when they made seasonal migrations below Wilson Dam and Wheeler Dam during the fall and early winter months. White bass were frequently caught and harvested by catfish and smallmouth bass anglers in the tailraces during the fall months, and sauger were also taken by these anglers in late fall. Freshwater drum also moved into the tailraces during this period, and catch rates were high for this species.

The Wheeler fishery exhibited lower monthly catch rates for smallmouth bass than those found in the Wilson fishery, but both tailraces produced higher catch rates than other systems (Paragamian and Coble 1975). Peak catch rates occurred during fall daytime fishing and during summer nights in both tailraces. Smallmouth bass anglers accounted for 89% of the catch and 85% of the harvest of smallmouth bass at the Wilson tailrace. At the Wheeler tailrace, smallmouth bass anglers accounted for 90% of the catch and 77% of the harvested smallmouth bass. Monthly and annual harvest rates were similar for both tailraces.

Because of its reputation of producing large fish, smallmouth bass anglers fishing the Wheeler tailrace traveled from outside the local area and were more

trophy-oriented than Wilson tailrace anglers. The average size of harvested smallmouth bass was larger in the Wilson survey, but Wheeler anglers achieved higher release rates and released greater numbers of large fish. In contrast, Wilson tailrace anglers resided locally and preferred high catch rates of smallmouth bass. Smallmouth bass anglers at both tailraces were generally satisfied with fishing.

The combination of high catch rates and large average size of smallmouth bass harvested from the Wilson Dam and Wheeler Dam tailraces should serve as quality standards for other smallmouth bass fisheries and become objectives for fishery management in those systems. Other systems have previously reported higher annual catch rates of smallmouth bass, but no other fishery has achieved the quality of harvested fish in the Wilson and Wheeler surveys (see summary in Weathers and Bain 1992). Fishing effort, harvest rates, and size of harvested fish have remained relatively unchanged at the Wilson tailrace from past surveys (Sample and Hubert 1978), and the Wheeler tailrace fishery has probably functioned similarly. The presence of 2 well-known smallmouth bass fisheries just 26 km apart probably benefits both fisheries by distributing fishing effort, thus lowering the pressure on both fisheries. Both fisheries have been able to sustain relatively high catch and harvest rates, yet continue to produce quality-size and some trophy smallmouth bass fishing without minimum-length regulations. Anglers fishing both tailraces have realized the value of the catch-and-release ethic, and high overall release rates have probably been the most important factor influencing the consistently high catch rates and quality size of smallmouth bass caught from both fisheries. If implementation of harvest regulations is not a feasible alternative for fishery managers, an emphasis on catch-and-release fishing and education of anglers could be employed to attain high-quality fisheries.

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