Sport Fisheries Exploitation in Riverine Sections of the Tennessee-Tombigbee Waterway

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Abstract: Principal fisheries in riverine sections of the Tennessee-Tombigbee Waterway below Aberdeen and Columbus dams are associated with tailwaters and bendways (original Tombigbee River channels cut off by the construction of navigation channels). Navigation channels contributed little to the fisheries. Approximately 80% of the anglers interviewed originated their trip from within the county where the respective dam was located. Blue catfish (*Ictalurus furcatus*) dominated the harvest from the Aberdeen system while white crappie (*Pomoxis annularis*) dominated the harvest from the Columbus system. In the Aberdeen tailwater, catfish anglers prevailed while in the Columbus tailwater, anglers fished for crappie as well as catfish. In both systems, most anglers in bendways were fishing for crappie. Within navigation channels, no pattern was apparent regarding fish preference by anglers. As the waterway matures and if access to bendways declines as a result of siltation, the riverine section fisheries, especially those associated with tailwaters, will likely become increasingly dominated by catfish fisheries.

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The Tennessee-Tombigbee Waterway (completed in 1985) has resulted in the establishment of major fisheries in northeast Mississippi. The waterway incorporates 9 lock-and-dam systems to provide slack water impoundments for barge traffic and 35 cutoffs which were dredged along the course of the original Tombigbee River to shorten the navigation channel (Boschung 1987).

Stream fisheries associated with the original Tombigbee River were essentially eliminated along most reaches of the system due to comprehensive and severe impacts from damming, clearing, dredging, snagging, and channelization. However, the U.S. Army Corps of Engineers (1983) concluded that fishery mitigation was unnecessary for the project because of net gains associated with the creation of

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numerous reservoirs, shallow water areas, deep pools, and bendways (original Tombigbee River channels cut off by construction of navigation channels).

Angling opportunities in lotic environments of the waterway are now essentially confined to those associated with tailwaters, navigation channels, and in some cases, bendways. In this regard, sections of the waterway located in northeast Mississippi immediately downstream from Aberdeen Dam (Monroe County) and Columbus Dam (Lowndes County) (Fig. 1) are principal fisheries resources. These 2 facilities were completed in 1983 and 1980, respectively. This study is the first documentation of exploitation patterns for these 2 fisheries.

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Methods

Daily estimates of angler effort (hour), harvest (kg), and catch per unit of effort (CPUE; kg/hour) were determined from a roving creel survey modified after Malvestuto et al. (1978) from January 1987 through December 1988. Sampling incorporated the tailwaters of both systems and their respective downstream reaches. Tailwaters were defined as extending from the face of the dam to a point 0.5 km downstream from the dam. Sampling of downstream reaches in each system incorporated approximately 10 km of navigation channel along with associated bendways.

In 1987, each system was sampled during 6 randomly selected days/month. From January through June 1987, 4 sample days/month were allocated to each of the tailwaters and 2 sample days/month were allocated to each of the downstream reaches. More sample days were assigned to the tailwaters because their variances for harvest and angler effort were expected to be greater.

Beginning in July 1987, coverage of entire systems during sample periods was initiated to improve precision of estimates and to determine the relative distribution patterns of anglers within respective systems. In addition, during the second year of the study (1988) sample size was increased from 6 to 8 days/month in each system.

Because of anticipated differences between weekend and weekday fishing effort, weekends and weekdays were defined as separate strata. Sample effort (days) was equally divided between strata. Each selected sample day within a stratum contained 2 or 3 4-hour time periods, depending on time of year. Time periods within sample days were assigned equal probabilities and 1 time period was randomly selected for each sample day. From October–March, time periods were 0800–1200 hours and 1201–1600 hours, while from April–September time periods were 0600–1000 hours, 1001–1400 hours, and 1401–1800 hours. No night sampling was conducted due to uncertainties regarding angler counts after dark.

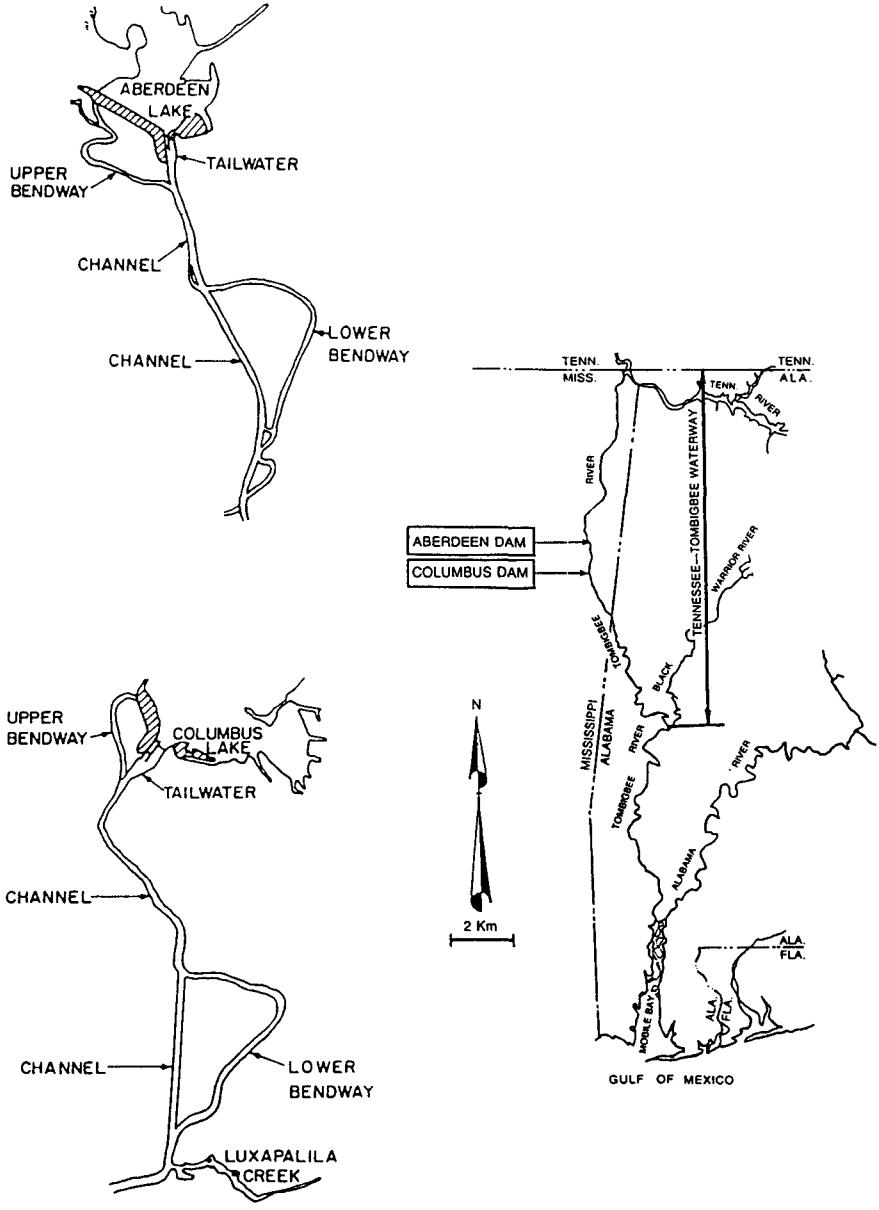

Figure 1. Riverine sections of the Tennessee-Tombigbee Waterway addressed during the creel survey conducted below Aberdeen Dam (Monroe County) and Columbus Dam (Lowndes County), Mississippi.

Anglers were approached and interviewed while fishing. Fish harvested by anglers were identified to species (Robins et al. 1980) and individually weighed (g). Elapsed time spent fishing was estimated by anglers and utilized to determine CPUE.

Months were grouped into seasons for comparative purposes. Seasonal classifications consisted of winter (January–March), spring (April–June), summer (July–September), and fall (October–December). Comparisons of daily harvest, daily angler effort, and daily CPUE were made among systems, years, and seasons with analyses of variance (GLM procedure, SAS Inst. 1985). Means were separated using the Least Squares Means (LSMEANS) subroutine.

Data collected from July 1987 through June 1988 were used to determine angler preferences regarding targeted fishes and angling location. Percentages of anglers within groups were calculated on a monthly basis for each of the 2 systems and arcsin transformed to normalize distributions (Steel and Torrie 1980). Using months as replications, transformed percentages were compared using analyses of variance.

Data collected from both years were combined to describe species composition of the total angler harvest for each system. The percentage of the total angler harvest contributed by each species of fish was calculated based upon weight (kg).

Results and Discussion

During our 2-year study we interviewed 827 anglers in riverine sections downstream from Aberdeen Dam and 1,247 anglers in riverine sections downstream from Columbus Dam. In both systems, approximately 80% of the anglers interviewed originated their trip from within the county where the respective dam was located (Fig. 2).

The Columbus system received 2.4 times more angler effort than did the Aberdeen system (Table 1). This difference generally reflects the population size of the 2 principal communities located in the regions surrounding the fisheries. At the time of our study the city of Columbus (pop. 27,383) was 3.8 times larger than the city of Aberdeen (pop. 7,184). Palm and Malvestuto (1983) have demonstrated that distance to a fishery and human population density account for most of the variation

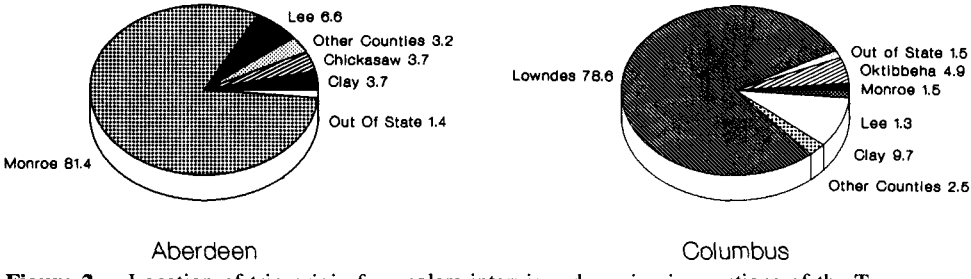

Figure 2. Location of trip origin for anglers interviewed on riverine sections of the Tennessee-Tombigbee Waterway below Aberdeen Dam (Monroe County) and Columbus Dam (Lowndes County), Mississippi.

Table 1. Mean daily angler effort (hours) from riverine sections of the Tennessee-Tombigbee Waterway below Aberdeen and Columbus Dams, Mississippi (1987–1988).

System	Season	1987			1988			Seasonal[a] mean
		N(days)	$\bar{x}$	SE	*N*(days)	$\bar{x}$	SE	
Aberdeen	Winter	18	76.0	20.2	19	82.3	17.7	79.2cd
$\bar{x}$ = 66.7	Spring	18	88.7	15.6	24	132.6	21.0	110.5c
SE = 5.7	Summer	18	28.0	5.8	24	49.1	10.4	38.5de
	Fall	18	32.9	4.4	22	34.6	7.7	33.7e
	Annual means		56.3a			74.6a		
Columbus	Winter	18	152.1	36.3	24	217.3	39.8	184.7g
$\bar{x}$ = 158.3	Spring	18	311.1	65.4	23	254.3	37.7	282.7f
SE = 13.2	Summer	18	116.8	19.3	24	88.1	12.4	102.4h
	Fall	18	81.8	13.9	24	56.3	7.9	69.1h
	Annual means		165.4b			154.0b		

[a]Means followed by the same letter are not significantly different ($P > 0.05$).

Table 2. Mean daily angler catch per unit of effort (kg/hour) from riverine sections of the Tennessee-Tombigbee Waterway below Aberdeen and Columbus Dams, Mississippi (1987–1988).

System	Season	1987			1988			Seasonal[a] mean
		N(days)	$\bar{x}$	SE	*N*(days)	$\bar{x}$	SE	
Aberdeen	Winter	18	0.17	0.09	19	0.03	0.01	0.10d
$\bar{x}$ = 0.15	Spring	18	0.11	0.03	24	0.10	0.03	0.10d
SE = 0.03	Summer	18	0.32	0.13	24	0.02	0.01	0.17c
	Fall	18	0.38	0.17	22	0.14	0.06	0.26c
	Annual means		0.24a			0.07b		
Columbus	Winter	18	0.07	0.03	24	0.06	0.02	0.07e
$\bar{x}$ = 0.07	Spring	18	0.04	0.01	23	0.09	0.03	0.07e
SE = 0.01	Summer	18	0.05	0.01	24	0.09	0.02	0.07e
	Fall	18	0.05	0.01	24	0.09	0.02	0.07e
	Annual means		0.05b			0.08b		

[a]Means followed by the same letter are not significantly different ($P > 0.05$).

associated with angler effort. Our investigation indicates that angling benefits derived from riverine sections of the Tennessee-Tombigbee Waterway below Aberdeen and Columbus Dams are primarily local in their extent.

Mean daily CPUE (Table 2) in the Aberdeen system was significantly greater than that of the Columbus system during 1987, but in 1988, CPUE values for both

systems were essentially the same. Drought conditions extant during the summer of 1988 may have differentially affected catch rates from the Aberdeen system.

Blue catfish (*Ictalurus furcatus*) and white crappie (*Pomoxis annularis*) were the 2 principal species harvested from both systems (Fig. 3). Blue catfish dominated the harvest from the Aberdeen system and white crappie dominated the harvest from the Columbus system. In both systems, the crappie fishery prevailed during late winter and early spring while the catfish fishery developed later in the year (May–July). In 1988, crappie fishing was essentially over before extreme drought conditions affected the region. However, catfish fishing occurred when drought conditions prevailed. Since effort on the 2 systems was consistent between years, we assume that catch rates and, subsequently, harvest (Table 3) were environmentally influenced. Harvest in the Columbus system, primarily a crappie fishery, was consistent between years. Harvest in the Aberdeen system, primarily a catfish fishery, declined.

Seasonal differences were apparent with regard to angler effort, CPUE, and harvest, and generally reflected the prevailing character of the respective fishery (i.e., catfish fishery or crappie/catfish fishery). Although angler effort was greatest during spring in both systems, CPUE was higher during summer and fall in the Aberdeen system (principal angling periods for catfish), but constant throughout the year in the Columbus system (crappie early in the season; catfish later in the season). No significant difference in harvest could be detected among seasons for the Aberdeen system (CPUE was higher when angler effort was lower) while spring and summer yielded the greatest harvest in the Columbus system (constant CPUE is reflective of the more stable nature of this system as a multispecies fishery; angler effort subsequently affected harvest).

In the Aberdeen system, 60.5%, 29.9%, and 9.5% of the anglers encountered and interviewed were fishing in the tailwater, bendways, and navigation channel, respectively. In the Columbus system, 56.3%, 36.5%, and 7.2% of the anglers encountered and interviewed were fishing in the tailwater, bendways, and navigation channel, respectively. These trends reflect the popularity of fishing in tailwaters

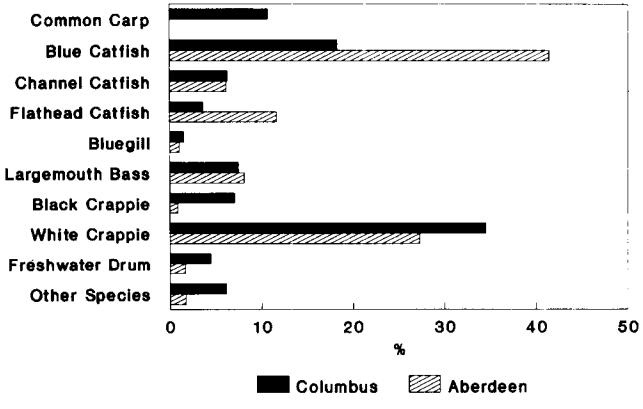

Figure 3. Catch composition (% weight) from sport fisheries exploitation on riverine sections of the Tennessee-Tombigbee Waterway below Aberdeen Dam and Columbus Dam, Mississippi.

Table 3. Mean daily harvest (kg) from riverine sections of the Tennessee-Tombigbee Waterway below Aberdeen and Columbus Dams, Mississippi (1987–1988).

System	Season	1987			1988			Seasonal[a] mean
		N(days)	$\bar{x}$	SE	*N*(days)	$\bar{x}$	SE	
Aberdeen	Winter	18	9.0	3.5	19	2.4	0.9	5.7d
$\bar{x}$ = 7.7	Spring	18	10.1	2.8	24	13.8	4.3	12.0d
SE = 1.3	Summer	18	11.6	5.6	24	1.1	0.6	6.3d
	Fall	18	10.8	5.7	22	3.3	1.1	7.0d
	Annual means		10.4a			5.2b		
Columbus	Winter	18	8.5	2.5	24	14.9	4.6	11.7e
$\bar{x}$ = 10.4	Spring	18	15.0	5.0	23	18.8	3.5	16.9f
SE = 1.2	Summer	18	5.4	1.0	24	9.4	2.4	7.4f
	Fall	18	4.0	1.3	24	5.3	1.6	4.7g
	Annual means		8.3a			12.1a		

[a]Means followed by same letters are not significantly different ($P > 0.05$).

Table 4. Distribution of anglers (%) in riverine sections of the Tennessee-Tombigbee Waterway below Aberdeen and Columbus Dams Mississippi according to fish preferences.

System	Fish preference	% Anglers		
		Bendways	Channel	Tailwater
Aberdeen	Black bass	44.7a[a]	31.6a	23.7a
	Catfish	4.7b	9.9b	85.4a
	Crappie	58.8a	16.2b	25.0b
	No preference	22.2a	11.1a	66.7a
Columbus	Black bass	58.7a	10.0b	31.3ab
	Catfish	32.5ab	12.2b	55.3a
	Crappie	48.6a	6.5b	44.9a
	No preference	47.2a	21.3a	31.5a

[a]Percentages within species preferences (read horizontally), followed by the same letter are not significantly different ($P > 0.05$).

(Eschmeyer and Miller 1949, Hall 1951, Miller and Chance 1954, Fry 1965, Moser and Hicks 1970, Groen and Schmulback 1978, Jackson and Davies 1986) and also impacts to fisheries which can result from channelization and associated clearing, dredging, and snagging of streams (e.g., Jackson and Jackson 1989 and references therein).

In both systems, most anglers in bendways were fishing for crappie (Table 4). In the Aberdeen tailwater, catfish anglers prevailed while in the Columbus tailwater, anglers fished for crappie as well as catfish. Black bass anglers were dispersed

throughout the Aberdeen system but tended to concentrate in the tailwater and bendways of the Columbus system. Relative abundances of anglers expressing no fish preference were not significantly different among locations. Within navigation channels no pattern was apparent regarding fish preference by anglers.

Angler distributions within each system generally corresponded well to distribution patterns reported by stock assessments of exploitable fisheries resources in the Tennessee-Tombigbee Waterway. Pennington and Baker (1982) found that CPUE was consistently higher in bendways than in navigation channels. Jackson et al. (1989) reported that crappie composed a large proportion of the available fishery resource in bendways and that crappie were relatively more abundant in bendways than in tailwater or channel habitats. In the Aberdeen system, Jackson et al. (1989) reported that CPUE for catfishes in the tailwater and navigation channel habitats were greater than those of bendways whereas in the Columbus system CPUE values for catfishes were less clearly defined. In both systems, CPUE for largemouth bass was greatest in the respective tailwater.

Evidence from this study suggests that the principal fisheries in riverine sections of the Tennessee-Tombigbee Waterway are associated with tailwaters and bendways. Navigation channels as yet contribute little to the fisheries.

During the construction phase of the waterway, the importance of tailwaters and bendways to the angling public was recognized. Fishing piers were constructed to address the needs of tailwater anglers for safe fishing locations. Bendways, however, have been neglected and, via siltation processes, they are evolving into oxbows. If these processes continue, access to bendways will be affected and their contribution to fisheries in riverine sections of the waterway will be impacted. Navigation channels are subject to periodic maintenance activities (e.g., dredging and snagging) to ensure clear passage for barge traffic. These channel maintenance activities disrupt the evolution of instream habitat features conducive for fisheries development.

As the Tennessee-Tombigbee Waterway matures and if access to bendways subsequently declines, we project that fisheries in riverine sections, especially fisheries associated with tailwaters, will become increasingly dominated by catfish fisheries.

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