Population Characteristics of Largemouth Bass in Riverine Sections of the Tennessee-Tombigbee Waterway

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Abstract: Population assessments for largemouth bass (*Micropterus salmoides*) were conducted via electrofishing during 1987–1988 in tailwaters, bendways, and navigation channels of the Tennessee-Tombigbee Waterway below Aberdeen and Columbus Dams. Growth rates and asymptotic lengths did not differ significantly among locations or between systems. Proportional stock density (PSD), relative stock density (RSD), and catch per unit of effort (CPUE, fish/hour) did not differ significantly between years or systems. Tailwaters generally had the highest CPUE, while navigation channels generally had the lowest CPUE. Development of largemouth bass fisheries in these stream reaches, and especially those associated with tailwaters, could diversify angling opportunities for this species.

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The Tennessee-Tombigbee Waterway, located in eastern Mississippi and western Alabama, consists of a series of locks and dams, reservoirs, and navigation channels designed to accommodate barge traffic from the interior United States to the Gulf of Mexico. Construction was completed in 1985. Riverine environments of the waterway are associated with tailwaters immediately below dams, navigation channels, and bendways (original Tombigbee River channels cut off by the construction of navigation channels). Multispecies fisheries have become established in these riverine environments (Jackson and Dillard 1991) with largemouth bass (*Micropterus salmoides*) contributing approximately 10% to the harvest by weight.

The objective of our study was to characterize largemouth bass stocks and their distribution and abundance patterns in riverine sections of the Tennessee-Tombigbee Waterway. We focused on comparisons among tailwaters, navigation channels, and bendways in order to ascertain largemouth bass fisheries potential for these habitats.

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Methods

Largemouth bass were collected by electrofishing in tailwaters, navigation channels, and bendways downstream from Aberdeen and Columbus Dams on the Tennessee-Tombigbee Waterway (Fig. 1). Sample areas extended downstream approximately 10 km below the respective dams.

Tailwaters extended from each dam downstream to the junction of the lower end of the first bendway below the dam and were characterized exclusively by rip-rap lined shorelines. Navigation channels extended from the end of the tailwater to mile marker 352 in the Aberdeen system and downstream to the mouth of Luxapalila Creek in the Columbus system. Navigation channels had rip-rap lined shorelines in channelized areas, areas with no visible instream structure (sand bars and clay banks), and areas having numerous snags and fallen tree tops. Bendways were characterized by numerous snags, fallen tree tops, and areas containing aquatic macrophytes.

Twice each month from January 1987 through August 1988 we ran 2 independent 10-minute electrofishing runs in tailwaters, upper bendways, and lower bendways in both systems; we ran 3 independent 10-minute electrofishing runs in the respective navigation channels. From September 1988 through December 1988, sample frequency was reduced to once/month/system due to public relations considerations. Pulsator configurations were standardized at 240–275 V, pulsed DC (60 Hz), and 2–6 A with a boat-mounted VVP-15 Coffelt electrofishing unit. Water temperature (°C), conductivity (μmhos), and Secchi disc transparency (cm) were recorded in conjunction with each electrofishing sampling run.

All largemouth bass were measured in the field (total length, mm). Scales were taken from each largemouth bass at the tip of the depressed left pectoral fin, as recommended by Maraldo and MacCrimmon (1979) and Carlander (1982). After scales were collected, fish were immediately released. For each largemouth bass, 5–7 scales were mounted on glass microscope slides and the clearest scale was scored for age by taking measurements from focus to annuli and scale redius using a 40X Eberbach scale projector. Criteria described by Jerald (1983) were employed for annuli determinations. All measurements were independently identified by another researcher. Where disagreements occurred, scales were eliminated from analytical procedures.

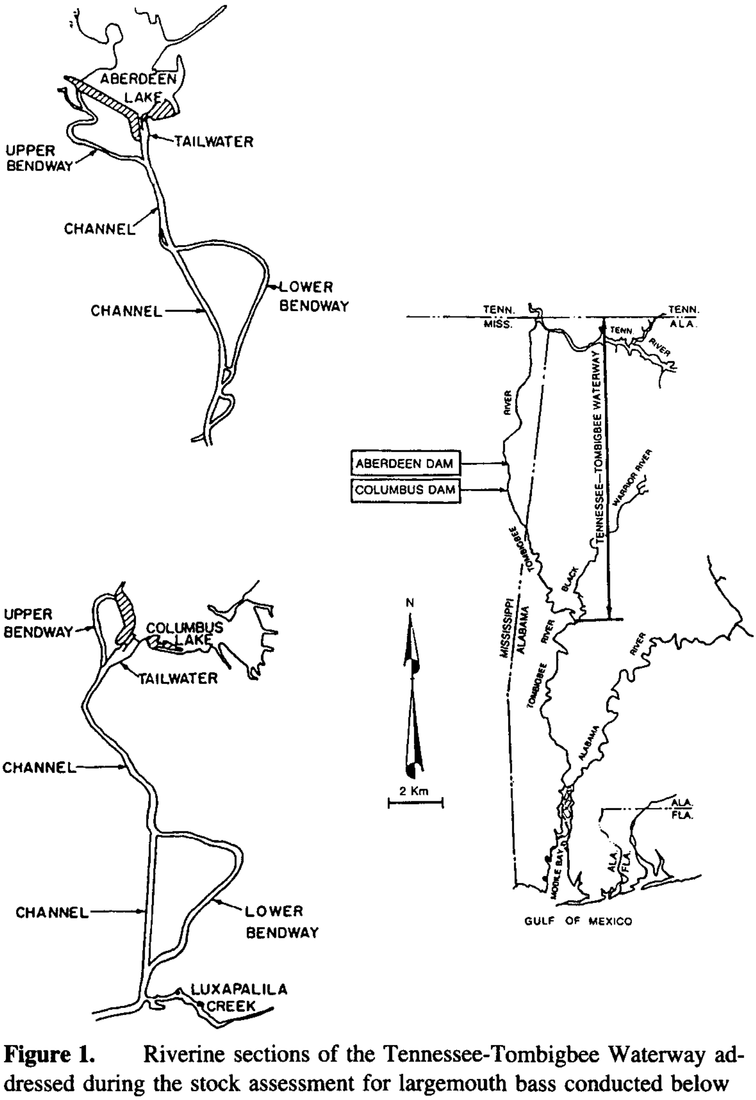

Figure 1. Riverine sections of the Tennessee-Tombigbee Waterway addressed during the stock assessment for largemouth bass conducted below Aberdeen Dam (Monroe County) and Columbus Dam (Lowndes County), Mississippi.

Data generated from scale readings were used to calculate mean length at age and to develop von Bertalanffy growth equations (Ricker 1975) for largemouth bass in each location within the Aberdeen and Columbus systems. Growth rates and asymptotic lengths from the von Bertalanffy regressions were compared among locations and within and between systems using a randomized complete block ANOVA.

Catch per unit of effort (CPUE, fish/hour) for small (≥200 mm–<300 mm), medium (≥300 mm–<380 mm), and large (≥380 mm) largemouth bass was calculated for each location. Mean monthly CPUE-values were calculated from daily means. A split plot ANOVA with a 2 x 3 factorial arrangement, randomized complete block design was used in whole plots (years = blocks; systems x locations = treatments). Whole plots were divided into sub-classes by months. For analytical purposes, bendway data were combined.

CPUE-values were $\log_{10}$-transformed to normalize distributions (Steel and Torrie 1980) and adjusted using analyses of covariance. Since electrofishing effectiveness is influenced by water temperature, conductivity, and Secchi disc transparency (Reynolds 1983), these parameters were used as covariates. Standard errors were calculated as per Steel and Torrie (1980).

Proportional stock density (PSD, Anderson 1980) and relative stock densities (RSD, Gablehouse 1984) for preferred (RSD-P), memorable (RSD-M), and trophy (RSD-T) largemouth bass were also calculated for each location. These structural indices are defined as the proportion of stock size fish (≥200 mm) which are of quality size (≥300 mm), preferred size (≥380 mm), memorable size (≥510 mm), and trophy size (≥610 mm). A non-parametric chi-square test for homogeneity (Daniel 1978) was used to test for significant difference between years, between systems, and among locations for PSD and RSD. Standard errors for PSD and RSD were calculated per Scheaffer et al. (1986).

Significance for all tests was established at $P \leq 0.05$. Means were separated using least-squares means separations.

Results and Discussion

During our study, 1,529 largemouth bass were collected from stream reaches of the Tennessee-Tombigbee Waterway below Aberdeen and Columbus Dams. Of these, 34.3% were small, 12.6% were medium, and 7.3% were large. Growth rates and asymptotic lengths did not differ significantly among locations or between systems (Table 1).

CPUE for small, medium, and large size largemouth bass did not differ significantly between years or systems. Tailwaters generally had the highest CPUE, while navigation channels generally had the lowest CPUE for all 3 size groups (Table 2).

PSD and RSD did not differ significantly between systems or years. PSD and RSD values (Table 3) indicate that largemouth bass stocks in the tailwaters and bendways were within acceptable ranges established by Gablehouse (1984). PSD and RSD-P were less than desirable in navigation channels. RSD-M could only be calculated for the tailwater and bendway habitats, and values for both were in the low end of the acceptable range.

Our study indicates that relative abundances of largemouth bass in tailwaters of the Tennessee-Tombigbee Waterway equal or exceed those associated with bendways and that stock structure of largemouth bass in these 2 habitats compare favor-

Table 1. Asymptotic lengths (L_∞), growth rates (k), and t_0-values from von Bertalanffy equations[a] generated for largemouth bass collected from stream reaches below Aberdeen and Columbus Dams, Tennessee-Tombigbee Waterway, 1987–1988.[b]

	Aberdeen			Columbus		
Stream reach	L_∞	k	t_0	L_∞	k	t_0
Tailwaters	647.7a	0.10a	−0.44a	777.9a	0.14a	−0.57a
Bendways	641.6a	0.15a	−0.79a	647.7a	0.18a	−0.44a
Channels	668.0a	0.16a	−0.42a	751.0a	0.14a	−0.51a
Collective	648.4	0.14	−0.57	725.5	0.15	−0.51

[a] von Bertalanffy equation:

$$l_t = L_\infty(1 - e^{-k(t-t_0)})$$

Where: l_t = total length-at-age
L_∞ = asymptotic total length
k = rate of growth
t_0 = theoretical age when total length = 0.

[b] Values for equation parameters within the respective system followed by the same letter are not significantly different ($P \geq 0.05$).

Table 2. Mean daily electrofishing catch per unit of effort (CPUE) for small (≥200 mm–<300 mm), medium (≥300 mm–<380 mm), and large (≥380 mm) largemouth bass from stream reaches below Aberdeen and Columbus Dams, Tennessee-Tombigbee Waterway, 1987–1988.[a,b]

	CPUE (fish/hour)		
Location	Small	Medium	Large
Tailwaters	7.93a	3.60a	2.43a
Bendways	4.69ab	1.73ab	0.90b
Channels	3.60b	1.19b	0.50c

[a] For purposes of analyses, means were adjusted using conductivity (µmhos), Secchi transparency (cm) and water temperature (°C) as covariates.
[b] Means within size groups of largemouth bass followed by the same letter are not significantly different ($P \geq 0.05$).

ably with each other. Navigation channels, however, support largemouth bass stocks less desirable from a fisheries resource perspective.

In spite of these resource patterns, Jackson and Dillard (1991) found that largemouth bass anglers tended to concentrate in bendways rather than in tailwaters. A perception apparently existed among anglers exploiting riverine locations below Aberdeen and Columbus Dams that largemouth bass have little affinity for tailwater environments.

Development of riverine fisheries for largemouth bass, and especially riverine fisheries associated with tailwaters, could diversify angling opportunities for this

Table 3. Proportional stock density (PSD, %) and relative stock density (RSD-preferred, %; RSD-memorable, %) for largemouth bass in stream reaches below Aberdeen and Columbus Dams, Tennessee-Tombigbee Waterway, 1987–1988.[a]

Location	PSD	RSD-preferred	RSD-memorable
Tailwaters	43a	18a	0.74a
Bendways	35ab	12ab	0.54a
Channels	30b	9b	*
Standards[b]	40–70	10–40	0–10

[a] Values within stock categories followed by the same letter are not significantly different ($P \geq 0.05$).
[b] Standards as per Gablehouse (1984).
*No memorable size fish caught.

species in the region surrounding the Tennessee-Tombigbee Waterway. While productive tailwater fisheries for smallmouth bass (*M. dolomieu,* Reed et al. 1991) and spotted bass (*M. punctulatus,* Jackson and Davies 1986) are well known in the southeastern United States, similar fisheries for largemouth bass are essentially undocumented.

Fajen (1975) states that although largemouth bass are often abundant in lotic environments throughout the southeastern United States, they are generally considered resources associated with lentic environments. Prior to construction of the Tennessee-Tombigbee Waterway, there were no tailwaters in the surrounding region and, in keeping with Fajen's (1975) observation, largemouth bass fisheries were associated primarily with lentic environments (i.e., small impoundments).

Although tailwaters associated with the Tennessee-Tombigbee Waterway are small when compared to major warmwater tailwaters in the southeastern United States (e.g., Arkansas River system, Alabama/Coosa River system, Tennessee River system), we contend that they have potential for contributing significantly to largemouth bass fisheries in the regions immediately surrounding the respective dams. Jackson and Dillard (1991) reported that approximately 80% of the anglers exploiting these fisheries originated their trip from within the county of location for the dams in question.

These tailwaters provide locational options for largemouth bass anglers not only in terms of diversifying exploitation of fish habitat but in fact also with regard to aspects of the angling experience itself. Jackson and Davies (1988) found that angler effort in tailwaters was associated with weather conditions and projected that the shelter provided by riverine environments (when compared to the open environments of reservoirs) was attractive to anglers when wind and/or low pressure systems were extant. However, well structured stocks with fish sufficiently abundant to be attractive would be a prerequisite to largemouth bass anglers following such trends. The tailwaters, and to a lesser extent, bendways of the Tennessee-Tombigbee Waterway fulfill these prerequisites.

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