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Abstract

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Initial Changes in Fish Species Composition in Two New Lakes of the Tennessee-Tombigbee Waterway, Alabama-Mississippi

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The Tennessee-Tombigbee Waterway, in western Alabama and eastern Mississippi, will be 232 miles long and will connect the existing Black Warrior-Tombigbee River navigation system with the Tennessee River navigation system. Ten locks and five dams will create ten lakes, totaling approximately 16,200 hectares and varying in individual size from approximately 364 hectares to 3,600 hectares. The initial changes in fish species composition were recorded for two new lakes on the Tombigbee River.

The impoundment of Gainesville Lake (2600 hectares), in Oct. 1978, and Aliceville Lake (3400 hectares), in Dec. 1979, changed many miles of flowing water of the Tombigbee River to lakes with moderate flow in the old channel. Lowland areas along the river became quiet backwaters with no flow and some very swift chutes became part of the deep channel bottom with moderate flow. Fishes that require current, and especially those that require clean gravel or sand bottoms, were affected by the loss of that habitat. The relative abundance of most species also would change as the habitat is altered from river to lake (Patriarche and Campbell 1958, Wahlburg and Nelson 1966, Fitz 1968, Gasaway 1970, Elrod and Hassler 1971). Gizzard shad, carp, bluegill, crappie, and largemouth bass often predominate in new southeastern United States reservoirs, as in West Point Reservoir, Alabama-Georgia (Timmons et al. 1977).

Caldwell (1969) and Boschung (1973) studied the distribution of fishes in the upper Tombigbee River drainage before changes had occurred as a result of the Tennessee-Tombigbee Waterway construction. The watershed includes all of the area above Demopolis, Alabama, where the Black Warrior River and the upper Tombigbee River join to form the lower Tombigbee River. All of Gainesville and Aliceville lakes are found within the Black Belt physiographic division of Fenneman (1938), except for a small part of Aliceville Lake, which is in the Fall Line hills.

Many of Caldwell's (1969) and Boschung's (1973) collections were from the areas that are now Aliceville and Gainesville lakes. They sampled habitats from swamps to the main river channel, and collected 109 species of fishes from the upper Tombigbee River drainage (Table 1), of which 75 were from the area that is now Gainesville Lake and 82 from what is now Aliceville Lake. Our post-impoundment collections included 75 species from Gainesville Lake (68 in 1979, 60 in 1980, and 59 in 1981) and 66 species from Aliceville Lake (63 in 1980 and 56 in 1981), for a total of 83 species from the two lakes combined (Table 1).

Post-impoundment collections were made at Gainesville and Aliceville lakes with experimental gill nets (5-20 cm stretch mesh) having seven 7.6 m long panels of each different mesh size, and with rotenone in large coves (0.5-1 hectares) or open-water areas (0.5 hectares) and small shoreline areas (0.015 hectares). Blocknets prevented the escape of fishes from rotenone sample areas.

Some species present in pre-impoundment surveys by either Caldwell (1969) or Boschung (1973) at both Gainesville and Alicevile lakes were absent from post-impoundment surveys: Alabama shad (*Alosa alabamae*), mooneye (*Hiodon tergisus*), stoneroller (*Campostoma anomalum*), speckled chub (*Hybopsis aestivalis*), rough shiner (*Notropis baileyi*), pretty shiner (*Notropis bellus*), mimic shiner (*Notropis volucellus*), Alabama hogsucker (*Hypentelium etowanum*), frecklebelly madtom (*Noturus munitus*), crystal darter (*Ammocrypta asprella*), harlequin darter (*Etheostoma histrio*), johnny darter (*Etheostoma nigrum*), rock darter (*Etheostoma rupestre*), blackbanded darter (*Percina nigrofasciata*), river darter (*Percina shumardi*) and saddleback darter (*Percina ouchitae*). Additional species collected by either Caldwell (1969) or Boschung (1973) in just one of the areas that are now lakes that were not collected during post-impoundment surveys are presented in Table 1.

Six species were collected that were absent from the early surveys of the upper Tombigbee River by Caldwell (1969) and Boschung (1973). One of those, the paddlefish (*Polyodon spathula*), which was represented by a few small individuals from Gainesville Lake, is probably more common than records suggest because individuals are difficult to catch except in nets with large mesh sizes or by snag lines. Also collected were a few stocked striped bass x white bass hybrids (*Morone saxatilis* x *Morone chrysops*). Brown bullheads (*Ictalurus nebulosus*), which are now common in gill-net samples from quiet backwaters, were formerly so rare that Boschung (1973) questioned their presence in the drainage. The dollar sunfish (*Lepomis marginatus*) and the swamp darter (*Etheostoma fusiforme*) are abundant in some littoral areas of the new lakes. These two species were also absent in pre-impoundment surveys on the Chattahoochee River, but later were common in littoral areas at the new West Point Lake (Timmons et al. 1977). A single red shiner (*Notropis lutrensis*) was collected (identification confirmed by John Ramsey, Auburn University) which certainly has resulted from a bait-minnow introduction, since red shiners are not present naturally in the Tombigbee or Alabama river drainages.

Ramsey (1976) listed six fishes as endangered or threatened from the Tombigbee River in Alabama, all of which share common habitat or distributional characteristics. These species are inhabitants of main river channels, a habitat that is disappearing because of impoundments, channelization, eutrophication, and siltation. Two of these, an undescribed sturgeon (*Scaphirhynchus* sp.) close to the shovelnose sturgeon (*Scaphirhynchus platorynchus*), and the frecklebelly madtom (*Noturus munitus*), were considered to be endangered, although these species are not presently listed as endangered by the office of endangered species. The sturgeon, which is endemic to the Mobile Bay basin, was last collected from the upper Tombigbee River by Chermock (1955). The frecklebelly madtom was common in some areas of the Tombigbee River now impounded by Aliceville Lake, according to field notes from Malcolm Pierson (Pers. Com. 1980) of the Mississippi Department of Wildlife Conservation.

Of the four fishes from the Tombigbee River listed as threatened by Ramsey (1976), only one, the blue sucker (*Cycleptus elongatus*) was present in collections from the new lakes. Although it may be common locally, this species was considered threatened because its main channel habitat is deteriorating. Caldwell (1969) and Boschung (1973) also collected it in pre-impoundment collections. The crystal darter (*Ammocrypta asprella*) was also collected in pre-impoundment collections, but has not been collected since the loss of current-swept sand and gravel beds. Caldwell (1969) collected the freckled darter (*Percina lenticula*) in the upper Tombigbee River, although not in the area of the new lakes. It has not been collected in the Gainesville and Aliceville lake area since impoundment. There appear to be no records from the upper Tombigbee River for the Atlantic sturgeon (*Acipenser oxyrhynchus*), an anadromous species that moves up rivers from the Gulf of Mexico to spawn, but which is unable to surmount dams along its migration routes (Ramsey 1976).

Table 1. List of fishes known to occur in the upper Tombigbee River system. C, collected by Caldwell (1969); B, collected by Boschung (1973); ●, collected during the present study.

	Upper Tombigbee River	Gainesville Lake				Aliceville Lake		
		Pre-impoundment	1979	1980	1981	Pre-impoundment	1980	1981
I. Petromyzonidae								
1. *Ichthyomyzon gagei* Hubbs & Trautman	C							
2. *Lampetra aepyptera* (Abbott)	C, B							
II. Polyodontidae								
3. *Polyodon spathula* (Walbaum)				●				
III. Lepisosteidae								
4. *Lepisosteus oculatus* (Winchell)	B	B	●	●	●	B	●	●
5. *Lepisosteus osseus* (Linnaeus)	C, B	C, B	●	●	●	C, B	●	●
IV. Amiidae								
6. *Amia calva* Linnaeus	C		●	●	●	C	●	●
V. Anguillidae								
7. *Anguilla rostrata* (Lesueur)	C, B		●	●				
VI. Clupeidae								
8. *Alosa alabamae* Jordan & Evermann	B	B						
9. *Alosa chrysochloris* (Rafinesque)	C, B	C, B	●	●	●	C, B	●	●
10. *Dorosoma cepedianum* (Lesueur)	C, B	C, B	●	●	●	C, B	●	●
11. *Dorosoma petenense* (Gunther)	C, B	B	●	●	●	C, B	●	●
VII. Hiodontidae								
12. *Hiodon tergisus* Lesueur	C, B	B				C, B		
VIII. Esocidae								
13. *Esox americanus* Gmelin	C, B		●	●	●	C	●	
14. *Esox niger* Lesueur	C, B		●	●	●	C, B	●	●
IX. Cyprinidae								
15. *Campostoma anomalum* (Rafinesque)	C, B	C, B				C, B		
16. *Cyprinus carpio* Linnaeus	C, B	B	●	●	●	C	●	●
17. *Ericymba buccata* Cope	C, B					C		
18. *Hybognathus hayi* Jordan	C, B	C, B	●	●		C, B	●	
19. *Hybognathus nuchalis* Agassiz	C, B	C, B	●	●	●	C, B	●	●
20. *Hybopsis aestivalis* (Girard)	C, B					C, B		
21. *Hybopsis storeriana* (Kirtland)	C, B	C, B	●	●		C, B		
22. *Hybopsis winchelli* (Girard)	C, B	C, B	●	●	●	C, B		
23. *Nocomis leptocephalus* (Girard)	C, B					C		
24. *Notemigonus crysoleucas* (Mitchill)	C, B	B	●	●	●	C, B	●	●
25. *Notropis atherinoides* Rafinesque	C, B	B	●		●	B		●
26. *Notropis baileyi* Suttkus & Raney	C, B	C				C		
27. *Notropis bellus* (Hay)	C, B	C, B				C, B		
28. *Notropis callistius* (Jordan)	B							
29. *Notropis candidus* Suttkus	C, B	C, B	●			C		
30. *Notropis chrysocephalus* (Rafinesque)	C, B	C, B	●			C		
31. *Notropis edwardraneyi* Suttkus & Clemmer	C, B	C, B				C, B	●	
32. *Notropis emiliae* (Hay)	C, B	B	●	●	●	C, B	●	●
33. *Notropis lutrensis* (Baird & Girard)			●					
34. *Notropis maculatus* (Hay)	B		●		●			●
35. *Notropis stilbius* (Jordan)	C, B	C, B			●	C, B		
36. *Notropis texanus* (Girard)	C, B	C, B	●	●	●	C, B	●	●
37. *Notropis venustus* (Girard)	C, B	C, B	●	●	●	C, B	●	●
38. *Notropis volucellus* (Cope)	C, B	C, B				C, B		
39. *Notropis welaka* Evermann & Kendall	C, B							
40. *Notropis* sp.(cf. *N. longirostris*)	C, B	C, B			●	C		
41. *Pimephales notatus* (Rafinesque)	C, B	C, B	●			C, B		
42. *Pimephales vigilax* (Baird & Girard)	C, B	C, B	●	●	●	C, B	●	●
43. *Semotilus atromaculatus* (Mitchill)	C, B	B						
X. Catostomidae								
44. *Carpiodes cyprinus* (Lesueur)	C, B	B	●		●	B	●	●
45. *Carpiodes velifer* (Rafinesque)	C, B	C, B	●	●	●	C, B	●	●
46. *Cycleptus elongatus* (Lesueur)	C, B	C		●	●	B		●
47. *Erimyzon oblongus* (Mitchill)	C,B		●	●	●	B	●	●
48. *Erimyzon sucetta* (Lacepede)	C, B							
49. *Erimyzon tenuis* (Agassiz)	C, B							
50. *Hypentelium etowanum* (Jordan)	C, B	B				B		
51. *Ictiobus bubalus* (Rafinesque)	C, B	C, B	●	●	●	C, B	●	●
52. *Minytrema melanops* (Rafinesque)	C, B		●	●	●	C	●	●
53. *Moxostoma carinatum* (Cope)	B	B				B	●	●
54. *Moxostoma duquesnei* (Lesueur)	C					C		
55. *Moxostoma erythrurum* (Rafinesque)	C, B	B			●	B		
56. *Moxostoma poecilurum* (Jordan)	C, B	C, B	●	●	●	C, B	●	●
XI. Ictaluridae								
57. *Ictalurus furcatus* (Lesueur)	C, B		●	●	●	C, B	●	●
58. *Ictalurus melas* (Rafinesque)	C, B	B	●	●	●		●	●
59. *Ictalurus natalis* (Lesueur)	C, B	B	●	●	●	B	●	●
60. *Ictalurus nebulosus* (Lesueur)			●	●	●		●	●
61. *Ictalurus punctatus* (Rafinesque)	C, B	C, B	●	●	●	C, B	●	●
62. *Noturus funebris* Gilbert & Swain	C, B							
63. *Noturus gyrinus* (Mitchill)	C, B	C, B	●	●	●		●	●
64. *Noturus leptacanthus* Jordan	C, B	C, B	●				●	
65. *Norturus munitus* Suttkus & Taylor	C, B	C, B				B		
66. *Noturus nocturnus* Jordan & Gilbert	C, B							
67. *Pylodictis olivaris* (Rafinesque)	C, B	C, B	●	●	●	C, B	●	●

	Upper Tombigbee River	Gainesville Lake Pre-impoundment	Gainesville Lake 1979	Gainesville Lake 1980	Gainesville Lake 1981	Aliceville Lake Pre-impoundment	Aliceville Lake 1980	Aliceville Lake 1981
XII. Aphredoderidae								
68. *Aphredoderus sayanus* (Gilliams)	C, B		●	●	●		●	●
XIII. Belonidae								
69. *Strongylura marina* (Walbaum)	C, B	C, B	●	●	●			●
XIV. Cyprinodontidae								
70. *Fundulus notatus* (Rafinesque)	C, B	C, B	●	●	●	B	●	●
71. *Fundulus notti* (Agassiz)	C		●	●	●		●	●
72. *Fundulus olivaceus* (Storer)	C, B	C, B	●	●	●	C, B		●
XV. Poeciliidae								
73. *Gambusia affinis* (Baird & Girard)	C, B	C, B	●	●	●	C, B	●	●
XVI. Atherinidae								
74. *Labidesthes sicculus* (Cope)	C, B	C, B	●	●	●	C, B	●	●
XVII. Percichthyidae								
75. *Morone saxatilis* (Walbaum)	C							
76. *Morone saxatilis* X *M. chrysops*			●					
XVIII. Centrarchidae								
77. *Ambloplites ariommus* Viosca	C, B			●			●	
78. *Centrarchus macropterus* (Lacepede)	B					C	●	●
79. *Elassoma zonatum* Jordan	C, B		●			B	●	●
80. *Lepomis cyanellus* Rafinesque	C, B		●	●		C, B	●	●
81. *Lepomis gulosus* (Cuvier)	C, B	B	●	●	●	C	●	●
82. *Lepomis humilis* (Girard)	C, B	C, B	●	●	●	B	●	●
83. *Lepomis macrochirus* Rafinesque	C, B	C, B	●	●	●	C, B	●	●
84. *Lepomis marginatus* Holbrook			●	●	●		●	●
85. *Lepomis megalotis* (Rafinesque)	C, B	C, B	●	●	●	C, B	●	●
86. *Lepomis microlophus* (Gunther)	C, B	B	●	●	●	C, B	●	●
87. *Lepomis punctatus* (Valenciennes)	C, B		●	●	●	C	●	●
88. *Micropterus punctulatus* (Rafinesque)	C, B	C, B		●	●	B	●	
89. *Micropterus salmoides* Lacepede	C, B	C, B	●	●	●	C, B	●	●
90. *Pomoxis annularis* Rafinesque	C, B	C, B	●	●	●	C, B	●	●
91. *Pomoxis nigromaculatus* (Lesueur)	C, B	C	●	●	●	C	●	●
XIX. Percidae								
92. *Ammocrypta asprella* (Jordan)	C, B	C				B		
93. *Ammocrypta beani* Jordan	C, B	C, B					●	
94. *Ammocrypta meridiana* Williams	C, B	C, B				C, B		●
95. *Etheostoma chlorosomum* (Hay)	C, B	B	●	●	●		●	●
96. *Etheostoma fusiforme* (Girard)			●	●	●		●	●
97. *Etheostoma histrio* Jordan & Gilbert	C, B	C				B		
98. *Etheostoma nigrum* Rafinesque	C, B	B				B		
99. *Etheostoma parvipinne* Gilbert & Swain	C, B		●					
100. *Eteostoma proeliare* (Hay)	C, B	C, B	●	●	●	C, B	●	●
101. *Eteostoma rupestre* Gilbert & Swain	C, B	C, B				B		
102. *Etheostoma stigmaeum* (Jordan)	C, B	C, B				C, B	●	
103. *Etheostoma swaini* (Jordan)	C, B					B	●	
104. *Etheostoma whipplei* (Girard)	C, B	C, B	●			C, B		
105. *Etheostoma zoniferum* (Hubbs & Cannon)	C, B			●				
106. *Etheostoma* (Ulocentra) sp.[1]	C, B				●			
107. *Percina* sp. (cf. *P. caprodes*)[2]	C, B		●	●		B	●	●
108. *Percina lenticula* Richards & Knapp	C							
109. *Percina maculata* (Girard)	C, B							
110. *Percina nigrofasciata* (Agassiz)	C, B	B				C, B		
111. *Percina sciera* (Swain)	C, B	C, B	●			C, B		
112. *Percina shumardi* (Girard)	C, B	C				B		
113. *Percina ouchitae* (Jordan & Gilbert)	C, B	C, B				B		
114. *Stizostedion vitreum* (Mitchill)	C, B	C, B	●	●	●			
XX. Sciaenidae								
115. *Aplodinotus grunniens* Rafinesque	C, B	C, B	●	●	●	C, B	●	●

[1]Page and Burr (1982, Misc. Publ. Nat. Hist., Univ. of Kansas) now refer this group to the subgenus *Nanostoma*.
[2]Undescribed according to Thompson (1980, Atlas of N.A. freshwater fishes, N.C. St. Mus. Nat. Hist.).

Pre-impoundment estimates of standing stocks are not available for Gainesville or Aliceville lakes. Only post-impoundment estimates for Gainesville Lake in 1979 (2 coves), 1980 (1 cove), and 1981 (1 cove), as well as Aliceville Lake in 1980 (4 open-water samples) and 1981 (4 open-water samples) are available. Bluegills (*Lepomis macrochirus*) were the most abundant species the first year after impoundment of Gainesville Lake, representing 29% of the standing stock by weight in the two coves sampled. Bluegills were followed in abundance by gizzard shad (*Dorosoma cepedianum*) (23-24%), channel catfish (*Ictalurus punctatus*) (7-9%), largemouth bass (*Micropterus salmoides*) (5-7%), redear sunfish (*Lepomis microlophus*) (4-7%), white crappie (*Pomoxis annularis*) (3-8%), warmouth (*Lepomis gulosus*) (1-3%), longear sunfish (*Lepomis megalotis*) (1-3%), black crappie (*Pomoxis nigromaculatus*) (1-2%), flathead catfish (*Pylodictis olivaris*) (1-2%), and threadfin shad (*Dorosoma petenense*) (1-2%). Gizzard shad was the most abundant species the next year in Gainesville Lake (34% of standing stock by weight), and was followed in abundance by bluegill (17%), threadfin shad (7%), largemouth bass (6%), channel catfish (5%), redear sunfish (3%), white crappie (2%), warmouth (2%), flathead catfish (2%), longear sunfish (1%), and black crappie (1%). Shad remained the dominant species in 1981: gizzard shad (36%), threadfin shad (17%), bluegill (15%), largemouth bass (7%), freshwater drum (*Aplodinotus grunniens*) (5%), white crappie (5%), redear sunfish (3%), common carp (*Cyprinus carpio*) (3%), channel catfish (3%), and spotted sucker (*Minytrema melanops*) (2%). Gizzard shad was the most abundant fish in the four open-water rotenone samples in Aliceville Lake the first year of impoundment (35-63% of standing stock), followed in abundance by bluegill (4-51%), threadfin shad (2-29%), black crappie (0-32%), redear sunfish (2-14%), largemouth bass (3-4%), white crappie (1-3%), and channel catfish (0-1%). There was often much variability in open-water samples, as shown by the range for bluegill (4% to 51%). Gizzard shad (73-95%) and threadfin shad (4-26%) were even more abundant in 1981, while bluegill (0-2%), redear sunfish (0-2%), and largemouth bass (0-1%) showed a decline.

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Estimates of standing stock are not available for the old river channel, since large numbers of block-off nets and personnel would be required to adequately sample this area. The samples for cove and open-water standing stocks in quiet backwater areas probably underestimate standing stocks for some species. Our gill-net samples indicated larger numbers of carp, smallmouth buffalo, and flathead catfish than the rotenone samples, and adults of these three species were often absent from these samples. Gill net samples showed that numbers of gizzard shad increased (21.7% to 43.2%) during the three year study of Gainesville Lake, and they also indicated the abundance of commercial and rough fish species. In 1979 five species each exceeded the gizzard shad (6.3% of total weight) in terms of weight: smallmouth buffalo *(Ictiobus bubalus)*(31.9%), carp (12.7%), highfin carpsucker (*Carpiodes velifer*) (11.0%), spotted gar (*Lepisosteus oculatus*) (8.9%), and bowfin (*Amia calva*) (7.3%), although in 1981 only smallmouth buffalo (25.9%) produced higher weight yields than gizzard shad (13.1%). Spotted gar decreased in numbers (6.5% to 1.8%) and by weight (8.9% to 3.8%), as did bowfin (1.9% to 0.1% by number and 7.3% to 0.8% by weight). Three important commercial fishes increased by weight from 1979 to 1981: blue catfish (*Ictalurus furcatus*) (2.4% to 3.4%), flathead catfish (3.4% to 8.8%), and channel catfish (0.6% to 2.0%). Most sport fishes did not change in importance by weight. White crappie increased the most (0.4% to 1.3%) by weight of all sport fish.

The gizzard shad was also the most abundant species by number (27.6% and 55.3%) in gill-net samples at Aliceville Lake in 1980 and 1981. Three other species were greater by weight: smallmouth buffalo (26.9% and 20.3%), bowfin (26.9% and 20.3%), carp (13.0% and 17.5%). Other commercial fishes of importance by weight included channel catfish (2.5% and 2.5%), blue catfish (1.0% and 1.4%), and flathead catfish (3.3% and 1.1%). Largemouth bass was the most abundant sport fish (4.1% and 4.5%), followed by bluegill (0.1% and 0.2%), black crappie (0.1% and 0.2%), and white crappie (0.1% and 0.2%).

The fisheries in the two lakes can best be compared by comparing the catch per unit of gill-net effort (CPE). CPE was calculated for the size of mesh that a species would be vulnerable. For example, blue catfish and carp could be caught in any one of the seven panels of mesh, while bluegill were restricted to the two smallest panels. CPE was greater for most species in Aliceville Lake than in Gainesville Lake, except for flathead catfish, white crappie, and highfin carpsucker. In 1981 the CPE of various species in Aliceville and Gainesville Lakes were 21.12 vs 1.29 for gizzard shad, 1.92 vs 0.26 for smallmouth buffalo, 1.32 vs 0.06 for channel catfish, 1.00 vs 0.03 for spotted sucker, 0.86 vs 0.04 for largemouth bass, 0.38 vs 0.03 for bluegill, 0.32 vs 0.06 for black crappie, and 0.24 vs 0.08 for white crappie. These values suggest greater total numbers of fishes in Aliceville Lake than Gainesville Lake.

In conclusion, the two new lakes have a reduced number of species present in those sections of river impounded. The number of species collected after impoundment declined from 75 in pre-impoundment surveys in Gainesville Lake to 59 in 1981, and from 82 species in pre-impoundment surveys in Aliceville Lake to 56 in 1981. Species absent from post-impoundment collections were those that require current and clean gravel or sand bottoms. Six species were collected that were not reported in the pre-impoundment surveys: paddlefish, striped bass x white bass hybrids, brown bullhead, red shiner, dollar sunfish, and swamp darter. The dominant species in both lakes by number and weight from cove samples in 1981 were gizzard shad, threadfin shad, and bluegill. Data from gill-net samples indicated that smallmouth buffalo, a commercially important species, represented a greater percentage of biomass than did shad.

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