

**A Fisheries Survey of the Oconee River Between
Sinclair Dam and Dublin, Georgia**

**By
James W. Evans**

**Georgia Department of Natural Resources
Wildlife Resources Division
Social Circle, Georgia**

April 1994

**This study was funded through the Federal Aid in Sport Fish Restoration Act
under Dingell-Johnson Project F-33, Georgia**

TABLE OF CONTENTS

ABSTRACT	1
INTRODUCTION	2
STUDY AREA	7
METHODS	17
Fish Population Sampling	17
Physical Data	19
Data Analysis	21
Age and Growth	26
Water Quality and Quantity	26
RESULTS	27
Sample Characteristics	27
Distribution	39
Relative Stock Density	50
Relative Weights	53
Species Richness, Evenness, and Diversity	56
Rarefaction Analysis	62
Cluster Analysis	64
Age and Growth	66
Redbreast Sunfish	66
Bluegill	68
Largemouth Bass	71
Black Crappie	71
Water Quality and Quantity	75
Index of Biotic Integrity (IBI)	83
DISCUSSION	87
The Impacts of Impoundments on Downstream Ecology	87
Water Quality	87
Temperature	90
Sediment Transport and Stream Morphology	93
Flow Regime	96
Energy Source and Biotic Interactions	100
Characteristics of the Oconee River Fish Community below Lake Sinclair	103
Fish Species Composition, Abundance, and Distribution	104
Richness, Evenness, and Diversity	116
Age and Growth	122
Redbreast Sunfish	122
Bluegill	122
Largemouth Bass	125
Index of Biotic Integrity (IBI)	125
Fish Species Introductions	129
A Rediscovered Species - the Robust Redhorse	133
SUMMARY OF MAJOR FINDINGS AND IMPLICATIONS	137
RECOMMENDATIONS	144
ACKNOWLEDGEMENTS	145
LITERATURE CITED	145
APPENDIX	156

FINAL REPORT

State: Georgia

Project Number: F-33

Project Title: West Central Fisheries Investigation

Study XIV Title: A Fisheries Survey of the Oconee River Between Sinclair Dam and Dublin, Georgia

Period Covered: 1 July 1991 to 15 March 1994

Study Objective: To describe and evaluate characteristics of the Oconee River fish community downstream of the Lake Sinclair hydroelectric project.

ABSTRACT

Fish community characteristics of the Oconee River below Sinclair Dam were evaluated in 1991 and 1992 with special emphasis placed on assessing the impacts of hydropower operations. A total of 11,565 fish comprising 54 species were collected by boat and backpack electrofishing. Catch rate comparisons, structural indices, species diversity and richness, cluster analysis, the Index of Biotic Integrity, and growth rate studies were utilized to characterize fish communities in tailrace, typical riverine (non-tailrace), and oxbow habitats. These techniques, when integrated and compared with similar analyses conducted on other rivers, indicate a measurable degree of degradation in the Oconee River fish community. Major causes include the impacts of hydropeaking operations on fish habitat and trophic relationships, probably in association with intrinsic attributes of the pre-development habitat. Relative magnitude of the degradation throughout most of the study area is difficult to assess in the absence of requisite pre-impoundment data, or a comparable control stream. The introduction of flathead catfish (*Pylodictis olivaris*) into the Ocmulgee River in the mid-1970's has resulted in the establishment of the species in the Oconee River and significant impacts to the native fish community were documented. A species of redhorse sucker (*Moxostoma* sp.) native to the southern Atlantic slope, and previously known to ichthyologists by only a few specimens, was discovered in the Oconee River below Sinclair Dam.

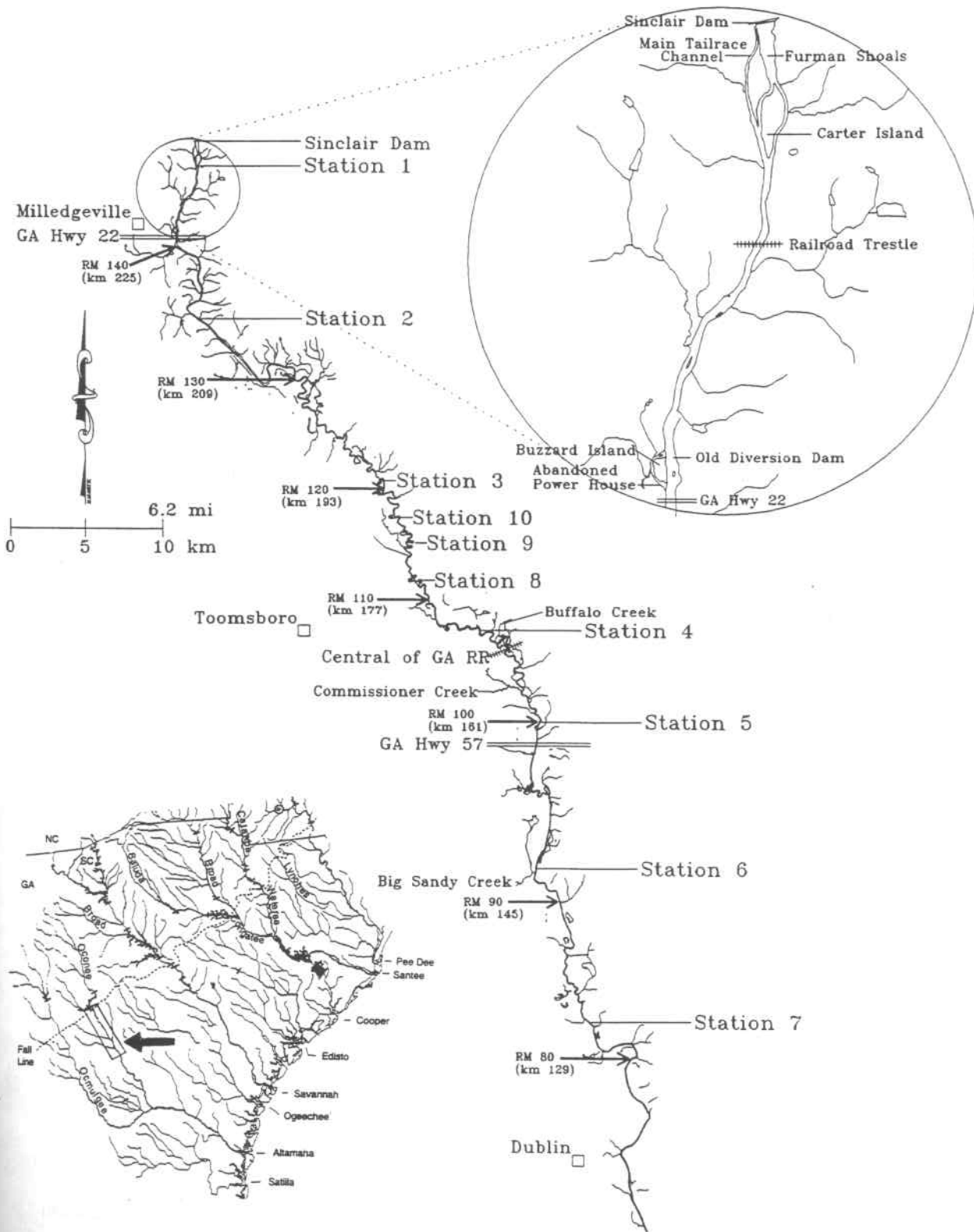


Figure 1. Map of the Oconee River study area indicating the ten fish population sample stations. Stations 1-7 are located in the mainstream and Stations 8-10 are in oxbows.

observed during various sampling details. Data on grass carp collections statewide seem to indicate an unusually high occurrence in the Oconee River (GADNR, unpublished data). Sampling conducted in 1991-1992 demonstrated a clear preference for oxbows where aquatic vegetation is more abundant. Sources of these grass carp are unknown although large stockings have been made over the years in at least two large lakes within the Oconee River watershed below Lake Sinclair (Les Ager; Jim Nix, GADNR, personal communications). Migration over spillways of these and other lakes constructed on large streams within the watershed is the most probable source of the grass carp observed in the Oconee River. Blood samples from four grass carp from the Oconee River were analyzed using a Coulter Counter and three possessed a diploid genotype, which indicates at least some potential for successful reproduction (Mike Spencer, GADNR, personal communication).

A rediscovered species - the robust redhorse

Five large catostomids were collected from the Oconee River near the mouth of Commissioner Creek on 8 August 1991. Meristic characteristics did not correspond precisely to any known species and average length exceeded that of all catostomid species known to occur in the Altamaha River drainage. Preserved specimens were sent to Dr. Henry Bart, then curator of the Auburn University fish collection. He indicated that these fish might belong to what was then believed to be an undescribed species known to ichthyologists by only two existing specimens - one collected from the Savannah River, Georgia/South Carolina in 1980 and a second from the Pee Dee River, North Carolina in 1985. Informal names applied at the time to the species represented by the two Savannah/Pee Dee river specimens were the bighead redhorse and the Savannah River redhorse. The status of this species was being investigated by Dr. Robert Jenkins of Roanoke College, Virginia; by personnel from the National Fisheries Research Center in Gainesville, Florida; and by Dr. Byron Freeman, curator of the University of Georgia fish collection. All investigators subsequently concluded that the Oconee, Savannah, and Pee Dee river specimens represented a single species.

Prior to the discovery of the Oconee River population, during the period 1981-1990, ichthyologists, biologists, and consultants in Georgia and the Carolinas had been consulted and portions of the Savannah River were sampled in an effort to obtain more specimens. None were found.

Initially, the Oconee, Pee Dee, and Savannah river specimens were believed to represent a new species, probably an Atlantic slope form of the river redhorse, *Moxostoma carinatum*. The species is now believed to have been described by master naturalist Edward Cope in 1870 from specimens collected from the Yadkin River, North Carolina and given the scientific name *Ptychostomus robustus* (*Ptychostomus* is synonymous with the present genus designation *Moxostoma*). Cope's original type specimens were apparently lost and later workers erroneously labeled specimens of other species as types. The scientific name *P. robustus*, which Cope had intended to be applied to the robust species represented by the Oconee, Pee Dee, and Savannah river specimens, was instead misapplied by later revisionists of the Catostomidae to a smaller species. This smaller species, sympatric with the larger more robust form, has since 1956 been known in the scientific literature, incorrectly, as *Moxostoma robustum* - the smallfin redhorse. As a result of these investigations, the scientific name *Ptychostomus (Moxostoma) robustus* will be transferred as *Moxostoma robustum* (Cope) (robust redhorse) to the species known from the Oconee, Pee Dee, and Savannah river specimens. The smallfin redhorse will be placed in the jumprock genus (*Scartomyzon*) and given the common name brassy jumprock (Jenkins and Freeman, in preparation; Jenkins, in preparation).

Subsequent to the discovery of the Oconee River population, investigations by Jenkins and Freeman (in preparation) into the status of this species included a review of "gray literature" such as federal aid reports, state fisheries reports, and biological surveys as well as studies of museum fish collections. In a further attempt to locate other remnant populations, the Pee Dee and Yadkin rivers, North Carolina and the Ogeechee River, Georgia were sampled by personnel from a variety of agencies as well as by companies with hydropower interests in these rivers.

No conclusive evidence of the existence of other remnant populations have been found but

skeletal remains of an additional specimen from the Savannah River were discovered at the University of Georgia. Anecdotal reports of large redhorse suckers persist from portions of the species' former range, specifically from the Pee Dee River, North Carolina, and from the Savannah, Ogeechee, and Ochoopee rivers, Georgia. The general consensus of most authorities is that small, isolated remnant populations of the species could exist in one of these rivers, or perhaps elsewhere, but that the Oconee River below Sinclair Dam contains the largest remaining population. All authorities agree that the species is in danger of extinction, perhaps within the next decade, and that recovery efforts should be initiated as soon as feasible (Jenkins and Freeman, in preparation). The robust redhorse will probably be granted federal endangered status in late 1994 (Robert Butler; USFWS; Jacksonville, Fl.; personal communication).

Other significant findings to date from literature reviews, museum research, and field investigations on the Oconee River and elsewhere are outlined below.

- 1). The historic range of the species is believed to be Piedmont and upper Coastal Plain areas from the Altamaha River drainage in Georgia through the Atlantic slope drainages of the Carolinas to at least the Pee Dee River, North and South Carolina. The known range of the Oconee River population is from approximately 1.6 km below the Ga. Hwy. 22 bridge at Milledgeville downstream to about 18 km above Dublin, a distance of approximately 85 km. Several attempts to collect additional specimens from the Oconee River below Dublin were unsuccessful. A review of available data and anecdotal information from throughout the Altamaha River drainage, including the Oconee River above Lake Sinclair, has produced no verifiable evidence of the presence of this species outside the area delineated above. It is probably reasonable to assume, however, that isolated individuals could exist in the Oconee River below Dublin or perhaps even in the Altamaha River.

- 2). Preferred habitat for non-spawning adults is typically in deeper, moderately swift areas in or near outside bends, often in association with accumulations of woody debris. Spawning behavior

is apparently similar to that of the river redhorse, and occurs over large redds constructed in gravel patches. Spawning seems to occur over both deep and shallow water gravel patches from mid-May to early June at water temperatures from 18 to 24°C.

3). A total of 36 robust redhorse were dart tagged in May and June 1992 and four have been recaptured to date. Recapture locations indicate significant variability in movement patterns among individuals. Of four individuals tagged near km 167, two were recaptured approximately one year later at the same location and two others had moved distances of 14 and 27 km downriver. Estimated population size is 1,000 to 2,000 adults based on Peterson and Chapman mark-recapture estimates (Ricker 1975).

4). Analysis of stomach contents indicates a diet consisting almost entirely of Asiatic clams (*Corbicula* sp.) which are crushed with large molariform pharyngeal teeth. Similar dentition is found in two other species of redhorse, the river redhorse (*Moxostoma carinatum*) and the copper redhorse (*M. hubbsi*) (Robert Jenkins; Roanoke College, Salem, Va.; personal communication).

5). Two independent age and growth investigations of three robust redhorse through the use of opercles produced estimated ages of eight to ten years for a 523 mm individual and 21 to 22 years for a 578 mm individual. Scales are apparently unreliable indicators of age in many catostomids. Age and growth studies using various bony structures have shown other members of this family to be generally long-lived (Robert Jenkins; Roanoke College, Salem, Va.; personal communication).

6). Length-frequency analysis of 85 robust redhorse collected from August 1991 to June 1993 shows no evidence of recent recruitment. Total length range is 495 to 698 mm, yet 75% of the sample lies between 600 and 660 mm, or within a 60 mm (2.4 inch) range. A single individual (495 mm) may have been a juvenile with the remainder clearly adults (Robert Jenkins; Roanoke College; Salem, Va.; personal communication). Seining, backpack electrofishing, and boat electrofishing have been utilized extensively in backwater areas near known spawning sites in an attempt to collect young-of-the-year (YOY) and document successful reproduction. Little or no successful reproduction or

recruitment is evidenced by the absence of any YOY in these samples (Ron King; EA Engineering, Science, and Technology, Inc.; Smyrna, Ga.; personal communication).

Based on length-frequency and age and growth analysis, the last successful reproduction may have occurred in the mid-1980s. The absence of robust redhorse recruitment may be correlated with the appearance of flathead catfish in the Oconee River in the early 1980s, one or more aspects of the operation of the Sinclair and Wallace Dam projects, or some as yet unknown factor. As part of the IFIM study currently being conducted on the Oconee River below Sinclair Dam, known habitat suitability criteria for the robust redhorse will be correlated with flows resulting from various project operational scenarios. These results will hopefully be applied to the future recovery and management of this species.

SUMMARY OF MAJOR FINDINGS AND IMPLICATIONS

1). **Sample Size and Species Totals.** A total of 11,656 individuals comprising 54 fish species were collected during August 1991 - August 1992 from the Oconee River between Sinclair Dam and Dublin, Georgia by boat electrofishing, backpack electrofishing, and with a special catfish electrofisher. Cumulative species totals per station ranged from 25 to 40 with higher totals documented for the tailrace area (Stations 1 and 2) where average sample size was greatest.

2). **Catch Rates.** When threadfin shad are included, highest boat electrofishing catch rates, by both number and weight, were found in the tailrace area. The high catch rates were a product of the entrainment of reservoir fish and enhanced sampling efficiency in the shallow, clear water below the dam. Entrainment and other factors result in a highly productive tailwater sport fishery.

Catch rates in the tailwaters were similar for both sampling seasons (spring and summer). In typical riverine (non-tailrace) areas, catch rates were highest in the summer due to better sampling efficiency at low water levels. Near shore spawning aggregations of several species produced higher

growth evaluations, diversity, richness, evenness, rarefaction curves, cluster analysis, and the IBI. All of these techniques, when integrated and compared where possible with similar analyses conducted on other rivers, document a measurable degree of degradation within the Oconee River fish community resulting from the impoundment of Lake Sinclair. It has not proven possible in most cases to correlate specific characteristics of the fish community with individual facets of project operation. It is also difficult to assess the relative magnitude of the degradation in the absence of pre-impoundment data on fish community characteristics, or a comparable control stream.

13). **Anadromous Species**. One objective of the present study was to document the abundance and distribution of anadromous species downstream of Sinclair Dam. Although no striped bass or Atlantic sturgeon were collected, significant numbers of adult American shad were found immediately below Sinclair Dam and successful reproduction was verified by young-of-the-year collected from the middle and lower portions of the study area.

14). **Fish Species Introductions**. Flathead catfish were collected from the Oconee River from just below Georgia Hwy. 22 at Milledgeville to the downstream limits of the study area. Predation by this introduced piscivore has virtually eliminated both snail and flat bullheads from the Oconee River below Milledgeville and may have permanently altered fish community composition. Electrofishing catch rates of grass carp on the Oconee River were higher than typically occur on Georgia rivers and 67 percent of those collected were diploid, or fertile.

15). **A "Rediscovered Species"**. Five adult redhorse (*Moxostoma* sp.) collected during both the summer and spring samples were initially believed to be an undescribed species, but are now thought to represent a remnant population of a species originally described by the naturalist Edward Cope in 1870. Cope's original scientific name, *Ptychostomus robustus* (*Ptychostomus* is a generic synonym of *Moxostoma*), will be resurrected and applied to the species as *Moxostoma robustum* (Cope), with an original common name - the robust redhorse. The scientific name *Moxostoma robustum* is presently misapplied to the smallfin redhorse, which will be redescribed and placed in the

jumprock genus (*Scartomyzon*).

At present, the Oconee River between Ga. Hwy. 22 and Dublin, Georgia contains the only known viable population of this species. Other remnant populations may exist, undiscovered or undocumented, in river systems within the known historic range from the Altamaha River in Georgia to the Pee Dee River in North Carolina.

RECOMMENDATIONS

1. Use this report to facilitate negotiations between Georgia Power Company, the Georgia Department of Natural Resources, and the Federal Energy Regulatory Commission (FERC) over future flows below the Sinclair Hydroelectric Project. These negotiations are mandated by the FERC hydropower relicensing process.

2. Utilize this report as a baseline from which to judge future impacts to the fish community resulting from negotiated changes to the existing flow regime below Sinclair Dam.

3. Conduct creel and recreational use surveys at three to five year intervals to monitor changes in fish communities or the sport fishery.

4. Begin efforts to restore the declining robust redhorse population in the Oconee River, primarily through habitat enhancement based on optimization of flows. Establish refugial populations in suitable sites outside the Oconee River.

5. Build one additional boat ramp on the Oconee River between the existing ramps at Ga. Hwy. 57 and Hardwick.

6. Actively promote the river fishery, with special emphasis on angling opportunities in the immediate tailwaters and on the neglected flathead catfish resource.

7. Encourage final taxonomic descriptions of the two undescribed carpsucker species found in the Oconee River and in several other south Atlantic slope drainages.

8. Encourage measures to protect swamp and bottomland hardwood plant communities

bordering the Oconee River between Sinclair Dam and Dublin from forest management practices harmful to aquatic habitat.

9. Make this report available to agencies responsible for managing the natural resources of the Oconee River Basin.

ACKNOWLEDGEMENTS

I would like express my appreciation to Wayne Clark for the dedication and expertise he demonstrated throughout this study. I would also like to thank Beverly Loggins and Gladys Hughes for accomplishing the difficult task of typing this manuscript.

LITERATURE CITED

- Adams, S. M. and C. T. Hackney. 1992. Ecological processes of southeastern United States aquatic ecosystems. Pages 3-17 in C. T. Hackney, S. M. Adams, and W. H. Martin, eds. Biodiversity of the southeastern United States. John Wiley and Sons, Inc. New York, NY.
- Ambrose, J. 1987. Bottomland forest habitat regions of Georgia. Ga. Dept. of Nat. Res., Game and Fish Div., Natural Heritage Invent., Report. 12pp.
- Anderson, K. B. 1972. Report to Federal Power Commission on the fish and wildlife aspects of the relicensing of the Potter Valley hydroelectric project (F. P. C. Project No. 77), Lake and Mendocino Counties, California. California Dept. Fish and Game. 59 pp.
- Anderson, R. O. 1980. Proportional stock density (PSD) and relative weight (W_r): interpretive indices for fish populations and communities. Pages 27-33 in S. Gloss and B. Shupp, eds. Practical fisheries management: more with less in the 1980's, Workshop proceedings, New York chapter, American Fisheries Society, Ithaca, NY.
- Armitage, P. D. 1977. Invertebrate drift in the regulated River Tees, and an unregulated tributary Maize Beck, below Cow Green Dam. *Freshwater Biol.* 7:167-183.
- Ashley, K. W. and B. Buff. 1986. Determination of current food habits of flathead catfish in the Cape Fear River. N.C. Wildl. Resour. Comm., Div. of Boating and Inland Fish., Final Rept. 19pp.
- Baxter, R. M. 1977. Environmental effects of dams and impoundments. *Annu. Rev. Ecol. Syst.* 8:255-283.