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OOSTANAULA CREEK A STUDY OF THE ABATEMENT OF STREAM POLLUTION MCMINN COUNTY, TENNESSEE

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INTRODUCTION

Oostanaula Creek is a tributary of Hiwassee River which for many years has received virtually all of the raw sewage from the City of Athens (population about 10,000) not otherwise handled in private septic tanks. No less than 27 separate outfalls were counted in one survey. Late in 1960 the city began construction of a new disposal plant designed to intercept and collect this sewage and give it at least primary treatment. The plant was completed and placed in operation on December 20, 1961.

When plans for the renovation of this sewage system were announced, significant changes in the fish population of Oostanaula Creek were anticipated. To establish a basis for an evaluation of these changes, a preliminary survey was conducted in June, 1961, with subsequent annual re-surveys planned to determine the nature, extent and chronology of change. It is believed that this study represents the first reported attempt to evaluate conditions existing both prior to and following pollution abatement.

This paper presents the results of the preliminary survey compared with those of the first annual re-survey.

METHODS AND PROCEDURE

Collections were made June 5 and 6, 1961, and May 20-22, 1963, at six stations below Athens and at two (control) stations above the city, as follows:

Station Number	Creek-Miles Above Mouth	Creek-Miles Below Athens
1	4.0	27.6
2	5.8	25.8
3	13.9	17.7
4	18.6	13.0
5	27.9	3.7
6	30.8	0.8
C-1	.75 miles above Athens	
C-2	3.2 miles above Athens	

Cresol was used as the collecting agent, in conjunction with a block seine and dip-nets. With the block seine in place at the lower end of the station, cresol was introduced at the upper end at full strength. At each

station, the quantity to be used was applied in two or three approximately equal amounts at three to five minute intervals in order to intercept fish attempting to escape by swimming upstream into fresh water.

Two men held the block seine in place while two others with dip-nets followed the cresol down, picking up drifting fish and those found lodged on the bottom.

When no more drifting fish were found—usually fifteen to thirty minutes after application of the cresol—the block seine was raised carefully so that the fish were retained in the bag. The catch was then assembled in a tub and sorted as to species and length classes. Scale samples were taken in 1961 from representative individuals of each species and size group. The minnows were counted and the length range was determined for each station, but no scale samples were taken from this group. Weights were omitted since the turbidity of the water precluded any certainty of 100 percent recovery in the deeper sections. However, it is believed that no species present in the sample area was overlooked. Collection data are shown in Table 1.

The water temperature was 67°-68° F. at mid-afternoon throughout both surveys.

In order that the results of the 1963 re-survey might be comparable to those of the 1961 survey, the same methods and procedures were used and the study areas or stations were identical.

STATION DESCRIPTIONS

Station 1

Located at and below the Calhoun-Delano highway bridge, at creek-mile 4.0. Collections made June 5, 1961, and May 20, 1963. Length: 450 feet. Bottom: Sand to fine gravel, fairly smooth, short riffle at upper end. Cresol used, 5 gallons.

Station 2

At and below steel bridge at old mill, creek-mile 5.8. Collections made June 5, 1961, and May 20, 1963. Length: 450 feet. Bottom: Sand to fine gravel, fairly smooth, riffle at upper end. Cresol used, 5 gallons.

Station 3

Located just to rear of Eastanaulee Baptist Church at

Table 1.
Fish collected in Oostanaula Creek, May 20, 21, 22, 1963 (1961 collections in parentheses).

Species	Station	Station	Station	Station	Station	Station	Station	Station	TOTALS	
	One	Two	Three	Four	Five	Six	C-1	C-2	1963	1961
Largemouth bass	1 (1)	— (—)	— (—)	— (—)	— (—)	— (—)	1 (1)	— (—)	2	(2)
Rock bass	10 (—)	8 (3)	17 (8)	2 (1)	— (—)	— (—)	1 (1)	3 (—)	41	(13)
Bluegill	— (—)	1 (—)	6 (18)	9 (7)	16 (33)	13 (13)	5 (—)	18 (2)	68	(73)
Redhorse	5 (1)	1 (—)	13 (31)	3 (3)	— (—)	— (—)	— (—)	— (—)	22	(35)
Hogsucker	5 (2)	13 (3)	13 (1)	— (—)	— (—)	— (—)	2 (5)	4 (4)	37	(15)
White sucker	— (—)	— (—)	4 (4)	6 (8)	5 (60)	— (2)	13 (7)	7 (3)	35	(84)
Spotted sucker	— (—)	— (—)	1 (—)	— (—)	— (—)	— (—)	— (—)	— (—)	1	(0)
Gizzard shad	— (—)	— (1)	— (—)	— (—)	— (—)	— (1)	— (—)	— (—)	0	(2)
Yellow bullhead	— (—)	1 (—)	1 (2)	— (—)	— (—)	— (—)	— (—)	— (—)	2	(2)
Minnows	182 (88)	233 (201)	148 (93)	82 (33)	230 (81)	141 (11)	287 (141)	186 (90)	1,489	(738)

DISCUSSION

Original Survey June 5 and 6, 1961

creek-mile 13.9. Collections made June 5, 1961, and May 20, 1963. Length: 750 feet. Bottom: Sand to mud, smooth, relatively deep most of length. Cresol used, 10 gallons.

Station 4

Located at wooden bridge one-half mile north of South Liberty Church at creek-mile 18.6. Collections made June 6, 1961, and May 21, 1963. Length: 450 feet. Bottom: Sandy, relatively deep. Cresol used, 5 gallons.

Station 5

Located at bridge one mile southeast of Cedar Springs Church at creek-mile 27.9. Collections made June 6, 1961, and May 21, 1963. Length: 600 feet. Bottom: Sandy, rock ledge with deep hole midway. Filamentous algae in evidence. Cresol used, 5 gallons.

Station 6

Located in tailwater of a very old mill dam, back of abandoned house approximately one-quarter mile south southwest of new sewage treatment plant, at creek-mile 30.8. Collections made June 6, 1961, and May 21, 1963. Length: 450 feet. Bottom: Sandy; deep hole just below remains of old dam; driftwood jam midway; lower end, ledge rock. (Jam had been removed in 1963.) Cresol used, 5 gallons.

Station C-1 (Control)

In Mayfield Dairy Farm pasture, near large dairy barn, .75 miles above Athens. Collections made June 6, 1961, and May 22, 1963. Length: 450 feet. Bottom: Two rocky riffles, two small pools. Cresol used, 3 gallons.

Station C-2

Above Mt. Harmony Church at bridge on Niota-Englewood highway, 3.2 miles above Athens. Collections made June 6, 1961, and May 22, 1963. Length: 600 feet. Bottom: Sand, fine gravel, channelized, relatively shallow. Cresol used, 2 gallons.

Oostanaula is a relatively small, cool creek with an average width, below Athens, of approximately 15 feet. Depths infrequently exceed two feet, although a few small pools may be six or more feet deep. The normal flow is fairly swift in spite of its tortuous course. Fall is approximately seven feet per mile from Athens to its confluence with the Hiwassee arm of Chickamauga Reservoir. At the latter point, an old mill dam, of masonry construction and originally about 20 feet high, prevents free up-stream migration from the reservoir. A few fish probably do get over this obstruction during the spring or summer floods, when the reservoir is at maximum level and the fall is less than two feet. This may account for the two gizzard shad in our 1961 collection.

Local residents mentioned catches of several species, notably carp, flathead and channel catfish, and small-mouth bass, but none of these was found during our study.

Probably as a result of rapid run-off, the creek below the city limits of Athens, was remarkably free of the blanket of sludge usually found in waters fouled by raw sewage. The only algal growth noted was at Station 5, where a filamentous green algae was in evidence along the banks.

The most objectionable observed misuse of the stream was for trash rather than for garbage or sewage. Within the city limits and downstream to Station 6, large numbers of tin cans, glass jars, etc., were seen in the stream bed, along the banks, and lodged against driftwood jams. Residents as far downstream as Station 4 told of similar deposits there, particularly following heavy rains.

Growth was somewhat slower than might be expected in a warmer stream. Age determination of fish was extremely difficult. Regenerated scales outnumbered readable ones. Annuli were seldom distinct except in the bluegills. Spawning marks and false annuli were quite common and many scales showed evidence of

resorption and erosion. Only the rock bass had a high incidence of current annulus formation.

First Annual Re-Survey May 20-22, 1963

No obvious physical change was apparent except at Station 6 and upstream to the upper city limits, where there was a marked reduction in the amount of trash in and along the stream. In 1961 an old bridge, demolished by time and flood, had formed the key to a large accumulation of glass jars, tin cans, etc., at Station 6. This barrier has been removed and the creek is relatively free of litter, even inside the city limits.

At Station 5, the filamentous green algae mentioned in the 1961 report is still present but not in sufficient quantities to constitute a nuisance.

The 1963 collection showed little change in the species composition of the fish population. The most notable difference was in the numbers of fish taken. In some species this amounted to a four, five, or six-fold increase. The 1963 work was completed approximately three weeks earlier and the creek (at Station 3) was about one foot higher and noticeably more turbid than in 1961, but these factors are not believed to be responsible for the difference.

Only one species was found in 1963 which did not appear in the 1961 collection. A single specimen of the spotted sucker was picked up at Station 3. This species is not common in East Tennessee and the presence of this specimen in Oostanaula Creek is unusual. Conversely, gizzard shad did not appear in the 1963 collection, although single specimens were picked up at two widely separated stations in 1961. Largemouth bass were found in the same numbers and at the same stations as in 1961—single individuals at Stations 1 and C-1. However, in 1961 the larger fish (12 inches total length) was found at Station 1 and the smaller (7 inches total length) at Station C-1, while in 1963 the sizes were reversed—the smaller fish (3 inches total length) was found at Station 1 and the larger (12 inches total length) at Station C-1. It is unlikely that this species reproduces extensively in Oostanaula Creek, because of low water temperatures and high summer turbidity.

Yellow bullheads were found in the same numbers and in the same general part of the creek—two at Station 3 in 1961, one at Station 2 and one at Station 3 in 1963.

Recovery of rock bass indicated a large increase since 1961—three-fold below the city and four-fold at the control stations. However, in the latter area the numbers were small for both years. The range of this species apparently had been extended both up and down stream, the latter more markedly.

Bluegills showed a relatively large increase in the control area, but had decreased somewhat in the stream below Athens. Similarly, white suckers were found to be more abundant upstream, less so downstream; but hogsuckers showed an increase downstream, a decrease

upstream. Redhorse, probably migratory in the lower reaches of Oostanaula, were less abundant in 1963. It should be noted that in the 1961 collection of both white suckers and redhorse, a great majority was recovered from a single (although not the same) downstream station and could have represented spawning or migratory concentrations.

The most remarkable change noted in 1963 was the increase in the minnows at the first three stations below the new disposal plant. This is the area most likely to be directly affected by sewage treatment. For the creek as a whole, the 1963 minnow collection was almost exactly double that of 1961, but at Station 6, just below the plant, the increase was from 11 to 141; at Station 5, from 81 to 230; at Station 4, from 33 to 82. No effort was made to identify minnows as to species but no obvious change in species representation was noted.

Scale samples taken in 1961 proved difficult, if not impossible, to read. The prevalence of regenerated scales, indistinct and false annuli, spawning marks, resorption and erosion made precise age determination at least unreliable. For this reason age and growth studies were omitted in the 1963 study.

The following tables describe the fish collections for the years 1961 and 1963.

DESCRIPTION OF FISH COLLECTIONS BY STATIONS
(Total length to nearest inch)

Station 1

Species	1963		1961	
	Length	Number	Length	Number
Largemouth bass	3	1	12	1
Rock bass	2	3		
	3	1		
	5	1		
	7	1		
	8	2		
	9	2		
Totals		10		
Redhorse	3	2		
	8	1		
	15	1	15	1
	16	1		
Totals		5		1
Hogsucker	3	2		
	5	2	8	1
	12	1	13	1
Totals		5		2
Minnows (Range)	2-10	182	2-6	88

Station 2

Species	1963		1961	
	Length	Number	Length	Number
Rock bass	2	6		
	3	1	3	1
	9	1	9	2
	Totals		8	3
Bluegill	3	1		
Yellow bullhead	11	1		
Redhorse	16	1		
Hogsucker	3	3	2	1
	4	7	3	1
	8	1	7	1
	10	1		
	12	1		
Totals		13	3	
Minnows (Range)	2-9	233	1-5	201

Station 3

Species	1963		1961	
	Length	Number	Length	Number
Rock bass	1	1	4	1
	2	3	6	1
	5	1	7	2
	7	4	8	2
	8	5	9	1
	9	3	10	1
Totals		17	8	
Bluegill	3	2	2	9
	5	1	3	9
	6	1		
	7	2		
Totals		6	18	
Yellow bullhead	9	1	10	1
			11	1
Totals		1	2	
Redhorse	3	2	4	1
	5	1	5	11
	9	5	6	4
	10	2	7	4
	12	2	9	3
			10	5
		11	1	
		12	2	
Totals		12	31	
Hogsucker	3	10	2	1
	4	2		
	7	1		
Totals		13	1	

White sucker	5	1	6	1
	6	1	9	1
	7	1	12	1
	11	1	13	1
Totals		4	4	
Spotted sucker	5	1		
Minnows (Range)	2-8	148	2-5	93

Station 4

Species	1963		1961	
	Length	Number	Length	Number
Rock bass	6	2	8	1
Bluegill	2	6	1	1
	3	2	2	2
	5	1	3	2
Totals		9	5	
Redhorse	4	3	7	3
Hogsucker	3	1		
White sucker	6	2	4	2
	7	1	5	2
	10	2	6	3
	12	1	11	1
Totals		6	8	
Minnows (Range)	2-6	82	2-6	33

Station 5

Species	1963		1961	
	Length	Number	Length	Number
Bluegill	3	2	2	11
	4	10	3	16
	5	4	4	5
		5	1	
Totals		16	33	
White sucker	5	2	3	3
	7	2	4	7
	13	1	5	10
			6	28
			7	8
			10	1
			12	1
			13	1
		14	1	
Totals		5	60	
Minnows (Range)	2-7	230	2-6	81

Station 6

Species	1963		1961	
	Length	Number	Length	Number
Bluegill	3	3	2	13
	4	3	3	6
	5	2		
	6	2		
	7	2		
	8	1		
Totals		13		19
White sucker	7	2	6	1
	8	2	7	1
	14	1		
Totals		5		2
Minnows (Range)	2-7	146	2-3	11

Station C-1 (Control)

Species	1963		1961	
	Length	Number	Length	Number
Largemouth bass	12	1	7	1
Rock bass	5	1	6	1
Bluegill	3	1		
	4	2		
	6	2		
Totals		5		
Hogsucker	4	1	3	1
	6	1	5	2
			7	2
Totals		2		5
White sucker	4	1		
	5	5	5	7
	6	3		
	7	1		
	8	1		
	10	1		
14	1			
Totals		13		7
Minnows (Range)	1-6	287	1-6	141

Station C-2 (Control)

Species	1963		1961	
	Length	Number	Length	Number
Rock bass	2	1		
	3	1		
	4	1		
Totals		3		

Bluegill	2	5		
	3	5	3	1
	4	6		
	5	2	6	1
	Totals		18	
Hogsucker	3	1	4	2
	8	1	6	1
	9	1	9	1
	10	1		
Totals		4		4
White sucker	4	2		
	5	1		
	6	1	7	2
	8	1		
	9	1	10	2
	12	1		
Totals		7		4
Minnows (Range)	1-6	186	1-6	90

CONCLUSION

After only a year and a half, it is still too early to speculate on the ultimate effects of the sewage treatment plant on Oostanaula Creek. It appears, however, that the environment has been improved for at least one important sport fish species, the rock bass, and for several species of minnows which are quite important as forage for sport fish. The City of Athens seems to be doing an outstanding job in reducing the load of raw domestic and industrial pollution formerly dumped into the stream. Although the amount of litter and trash is appreciably less than in 1961, there is still room for improvement in this respect.

The most serious pollution of Oostanaula Creek now appears to be the heavy silt load it carries, particularly in the lower reaches. This also constitutes an impediment to the successful taking of sport fish. In the observation of the author, transparency has seldom been as much as six inches, even in periods of low flow. If this silt pollution could be reduced by modification of agricultural and animal husbandry practices, road-bank stabilization, or other soil conservation measures, the introduction of smallmouth bass and redbreast sunfish could be recommended.

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