REPORT ON THE MAY, 1968, SURVEY OF CHOCCOLOCCO CREEK AND TRIBUTARIES: BIOLOGY OF FISHES AND WATER QUALITY

By: Dr. Royal D. Suttkus,
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DSW 105109

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INTRODUCTION

The present report includes a series of samples taken on Choccolocco Creek and its tributaries on two separate trips. The first and principal survey extended from May 15-19, 1968; the second group of samples was taken May 24-25, 1968.

Although very high water conditions prevailed for the first trip, we were able to obtain respectable representative fish samples at most of the stations employed. For some of the stations we probably got more fishes than would have been caught during low water if number of specimens were the only criterion used, since the stream had risen up over the edge of its banks at these localities. Admittedly, some fishes will move into the rising water as a stream overflows its banks while others ordinarily will not. Species composition of the fishes in our catches was undoubtedly affected to some extent by the rising nature of the creek water. For the second trip, the water receded somewhat and fish collecting was facilitated.

The primary objective of our survey was to determine the status of the prevailing fishes and water quality in Choccolocco Creek. Tributaries were included also since this gives us a better total picture for the drainage.

Two general types of data were collected: 1. physico-chemical data, and 2. data relevant to fish populations. A five-day survey of the type we performed allows us to run enough water quality samples to be able to develop a general appreciation of the ability of the stream to support fishes. Unfortunately, the important water quality analyses an aquatic biologist runs reflect the conditions prevailing at the particular moment in time when the samples were removed from the stream. They actually tell us little, if anything, about the conditions of the stream in the past. That is why we ordinarily sample a river or stream at

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least 5 to 6 times a year in order to determine operative seasonal changes and periodic changes in water quality. Secondly, the species composition of the fish population present at a given station at a given time and the relative numbers of each species taken reflect present conditions and, to some degree at least, indicates conditions that prevailed in the immediate past. Stations were chosen above the sites of water pollution, in clean water upstream; in the areas presently being polluted; and at a considerable distance below the sites of pollution. In this way we can develop a general idea as to what effect the various pollutants that have entered Choccolocco Creek from time to time have had on the fish populations present there.

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I. The Determinations Used for Water Quality

A. Water Temperature

For our purposes, it is sufficient to take water temperature using a common hand-thermometer with an accuracy of a degree or so. In most instances, we will be interested only in samples taken five feet below the surface. If temperatures of the water close to the bottom are required, in the future, we will simply bring up water samples using the metal sampler employed in our work.

B. Hydrogen-ion Concentration or pH

All determinations of pH will be made using a Hellige Comparator Kit. This type of kit facilitates pH determination under field conditions.

C. Dissolved Oxygen

In most instances we collect water samples five feet below the surface. The following procedure is used to make the dissolved oxygen determination:

1. Collect the water sample in a standard bottle.
2. Add two milliliters of $MnSO_4$ and two milliliters of alkaline-iodide reagent.
3. Mix the water in the bottle by shaking by hand.
4. Add two milliliters of concentrated sulfuric acid.
5. Mix again.
6. Remove 203 milliliters for titration.
7. Titrate with 0.025 (1/40) normal thiosulfate to a pale straw color.
8. Add two milliliters of starch-indicator solution.

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9. Continue the titration to the first disappearance of the blue color.

10. The result is expressed as milligrams per liter of dissolved oxygen by simply noting how many milliliters of thiosulfate were used in the titration.

D. Total Acidity (actually free carbon dioxide)

By collecting only one bottle (250-300 ml) of water, one can run both total acidity and total alkalinity due to the smaller amounts of water needed. The water sample is collected as before. Follow these directions:

Total Acidity

1. Measure out 100 milliliters of the water sample.

2. Add three drops of phenolphthalein indicator to the sample.

3. Titrate over white with one-fiftieth (1/50) normal sodium hydroxide to the appearance of a faint pink color. The pink color must persist for a period of at least thirty seconds.

4. Calculate total acidity expressed as milligrams per liter of calcium carbonate as follows:

   Total Acidity as mg/l $CaCO_3$ equals the milliliters of N/50 NaOH used times 1000 over the milliliters of water sample employed.

   Example: 3.5 ml of NaOH were used to get to the end-point--then assuming that a 100 ml sample of water was used, one would have 35.0 mg/l total acidity expressed as calcium carbonate.

E. Total Alkalinity (expressed as mg/l calcium carbonate)

The directions for the determination of total alkalinity, which in this instance is bicarbonate alkalinity expressed in terms of calcium carbonate, are also simple:

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1. Use a 100 milliliter water sample.
2. Add two drops of methyl orange indicator.
3. Titrate over white with a one-fiftieth (1/50) normal solution of sulfuric acid to the appearance of an orange color.
4. The milliliters of acid used in the titration times a factor of ten for a 100 milliliter water sample will give the mg/l of total alkalinity expressed as calcium carbonate.

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II. Interpretation of Water Quality Results

A. Temperature

It is well known that simple physical and chemical criteria for the suitability of waters for fishes cannot be prescribed for general application, because of the large number and the complex interaction of factors which, taken together, can determine or influence the quality of water (Doudoroff, 1957). For example, a dissolved oxygen concentration that is inadequate and fatal for some fish at ordinarily favorable temperatures may be tolerated by the same fish indefinitely at extremely low temperatures.

The resistance of fishes to high temperatures under laboratory conditions varies markedly with their thermal history. The highest temperatures to which different species can be gradually acclimated (median values) have been found to be about 41 C for the goldfish (Carrasius auratus), 37.5 C for the bullhead (Ictalurus nebulosus), 31 C for the sucker (Catostomus commersoni), and 25.3 C for the brook trout (Salvelinus fontinalis) (Doudoroff, 1957: 406-407).

Mortality of fishes in nature may occur due to the rate of temperature change per unit time as opposed to an upper temperature limit tolerance. Mortality occurs if the temperature changes faster than the fish can acclimatize to the change. Such mortality would be increased if the fishes were under an additional stress such as low dissolved oxygen content, for example.

Bailey (1955) studied a mass mortality of fishes in a Michigan lake which was attributed to high temperature. The mortality was assumed to be due to temperature in excess of the lethal limit, rather than to rate of temperature change. The water temperature in the lake was 38 C (100.4 F).

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In the geographic area in which we are working, low temperatures are not emphasized since our determinations are being made during the warmer part of the year. We are always on the lookout for temperatures in excess of 95 F with regard to direct effect on fishes, and high water temperatures in general, considering the role temperature plays in dissolved oxygen relationships. Cold water has a greater capacity for holding dissolved oxygen than does warmer water. Also we look for rapid changes in temperature within a given body of water in terms of effects of rate of temperature change per unit time.

B. Hydrogen-ion Concentration (pH)

Determinations of pH are principally valuable as a means of detecting certain kinds of pollution, for example mine-waste drainage, some textile operations, and oil refinery effluents. One usually looks for a possible source of pollution or some other unusual explanation if the pH values for a body of water are outside the range of 6.5 to 8.5. It is known that most species of fishes tolerate both wide ranges and rapid changes of acidity and alkalinity as expressed on the pH scale (Lagler, 1956). If we get a value outside the range of 6.5 to 8.5, we then make a detailed study of the surrounding area and attempt an explanation, unless it is already known (limestone pit used by Monsanto to raise pH).

C. Dissolved Oxygen

Biologists would like to find 5.0 mg/l of dissolved oxygen in waters that support fish populations. There are many explanations for the lower values that are often found in nature. At the bottom of a lake, the dissolved oxygen may become depleted during the summer months, particularly if the lake is very shallow, realizing that depletion occurs in deeper lakes

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also in other regions. In streams that are polluted with organic materials one often finds values that approach or actually reach zero. Values below 3.0 mg/l may cause direct mortality of fishes due to suffocation, depending upon the species concerned. During visits to sites of organic polution, one has an opportunity to see oxygen depletion first-hand as well as the biological effects of this condition. Oxygen values must be interpreted in light of other information such as the time period over which minimal values extend, the water temperature that obtains in the environment, and other environmental stresses.

D. Total Acidity

The designation "total acidity" as used here simply means the amount of free carbon dioxide. A determination of the amount of free carbon dioxide in a stream is important since it is perhaps one of the best single criteria of environmental suitability of water for fishes that can be employed. High concentrations of free carbon dioxide are known, in themselves, to be toxic and/or lethal to fishes. In addition, high concentrations of free carbon dioxide are usually accompanied by low dissolved oxygen values. It is generally agreed that free carbon dioxide in excess of 20.0 mg/l may be regarded as harmful to fishes (Lagler, 1956), although lower values may be equally harmful in waters of low dissolved oxygen content, meaning less than 3.0 to 5.0 mg/l of dissolved oxygen. One of us has worked on streams which exhibited total acidity values as high as 750 mg/l (Gunning, 1963). One stream was typical, in the region studied, of rivers and connecting tributaries which were heavily polluted by coal-mine wastes. Massive fish mortalities were characteristic in this stream, and others like it.

One should be on guard if values approximating 15.0-20.0 mg/l total acidity are obtained, and attempt to find the cause of these high values.

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E. Total Alkalinity

Total alkalinity in a body of water depends on the geology of the region. For example, streams cutting through soluble limestone would be expected to exhibit high alkalinity values. In midwestern United States, for example, water bodies may have as much as 350 mg/l total alkalinity expressed as calcium carbonate, although the great majority of values will fall between 45 and 200 mg/l (Ellis, Westfall, and Ellis, 1946). This range of values would ordinarily have little direct effect on fishes.

It is known, however, that total alkalinity relationships may significantly affect the well-being of fishes indirectly through their influence on plankton growth. Waters with low alkalinity values are generally biologically less productive than those with high values. A significant increase in standing crop of fishes per acre has been observed with increasing carbonate content of trout lakes (Lagler, 1956, quoting Carlander), warm-water lakes, and reservoirs. This knowledge has led to attempts to classify waters on the basis of total alkalinity. Such results often demonstrate regional individuality and should be interpreted for localized as opposed to general treatment.

Brooks and Deevey (1963) have classified New England lakes on the basis of bicarbonate alkalinity as follows:

10 mg/l------extremely soft
10-28 mg/l---soft
28-84 mg/l---medium hard
over 84 mg/l-hard

We often find it helpful to compare our stream analyses in this manner.

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III. Water Quality Analyses for Choccolocco Creek and its Tributaries

Ten water quality stations were set up (Table 1) for the initial survey of Choccolocco Creek and its tributaries. These stations are spaced in such manner that any significant changes in water quality should be detectable.

Our goal as consulting biologists is to assess the ability of Choccolocco Creek to continuously support aquatic life, particularly in the area affected by pollution.

The usual procedure is to report on water quality by discussing the individual determinations or analyses in turn (Tables 2-3). Beginning with water temperature, the range for the Choccolocco proper was 67-69°F for those water samples taken five feet below the surface; a single determination of 73°F at station 2 is explainable on the basis that this sample was taken from the shore since flood waters over the road approaching the creek prevented our taking the sample from the bridge (Table 2); all of these statements refer to those samples taken on May 16. The water temperature range on May 18 was 68-71°F on the Choccolocco proper (Table 3). All of these water temperatures are normal for this time of year and one could safely say that water temperature is not a limiting factor for the time period we were on the stream.

Considering all of the water samples taken on the two different days, the pH range was 6.0-6.6 for the Choccolocco proper (Tables 2 and 3). These values are well within the normal range for fishes (since the usual 6.5 to 8.5 range has to be interpreted loosely) and do not indicate problems of any kind as far as the animals are concerned. The only alkaline reading obtained was for a tributary; Dry Creek water had a pH of 7.2 on May 18, 1968 (Table 3). There is

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Table 1. Listing of Water Quality Stations for Choccolocco Creek, Alabama.

Station Number	Station Location
1	Highway 78 bridge above Anniston.
2	Boiling Springs above Anniston Sewage Treatment Plant.
3	Bridge immediately below (downstream from) Anniston Sewage Treatment Plant.
4	Highway 21 bridge.
5	Bridge crossing on Calhoun County Highway 109.
6	Highway 93 bridge crossing.
7	Highway 77 crossing (U.S. Highway 231)
8	Stemley Bridge, Alabama Highway 34, Coosa River.
9	Dry Creek at Highway 78 crossing below Coldwater Spring.
10	Snow Creek at Highway 78 bridge.

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nothing unusual about a pH of 7.2 under any circumstances as far as fishes are concerned.

Dissolved oxygen values for the Choccolocco proper ranged from 6.1 to 6.9 mg/l on May 16 discounting the 4.3 reading for station 2 which was taken from the bank, as stated previously, as opposed to the normal five-foot level (Table 2). On May 18 the dissolved oxygen range for Choccolocco Creek was 6.5-7.4 mg/l (Table 3). The highest dissolved oxygen value recorded during the survey was taken at station 9 (Dry Creek) on May 18, and amounted to 8.0 mg/l (Table 3). These values are within the expected range for this time of the year and are quite adequate for the fishes of Choccolocco Creek and its tributaries.

All of the free carbon dioxide (total acidity as it is called by some workers) determinations yielded values well within the so-called "normal range" for fishes expept Station 10, Snow Creek, for May 18, 1968. When we get a value of 15.0 to 20.0 mg/l free carbon dioxide, we always look around for other limiting factors and attempt an explanation. In this instance we knew the source of Snow Creek water and were aided by this fact. Fishes are often affected in a deleterious manner by free carbon dioxide values of this magnitude. We did not expect to find fishes when Snow Creek was sampled and our assumption turned out to be correct--the area was worked thoroughly without finding a single specimen. In some instances fishes will swim upstream into tributaries during high water and hence penetrate waters that would ordinarily not be suited for fishes with different conditions obtaining. In spite of the high water conditions prevailing in Snow Creek, however, fishes were not found. Note that the free carbon dioxide value for Snow Creek is at least double the values recorded for the other water quality stations (Tables 2 and 3).

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Table 2. Water quality analyses for Choccolocco Creek, Alabama---May 16, 1968.

STATION NUMBER	ANALYSIS Water Temperature °F	pH	Dissolved Oxygen mg/l	Free CO_2 mg/l	Total Alkalinity mg/l $CaCO_3$
1	67	6.2	6.9	7.0	9.0
2	73*	6.2	4.3	8.0	16.0
3	67	6.0	6.6	6.0	9.0
4	67	6.0	6.5	7.0	8.0
5	68	6.1	6.4	7.0	9.0
6	68	6.1	6.3	7.0	12.0
7	69	6.2	6.1	6.0	14.0
8	73	6.9	6.1	5.0	47.0

* Water samples are ordinarily brought up by sampler from the five-foot depth level, however the water was over the road when this sample was taken. Hence, this single sample was taken from the bank in shallow water.

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Table 3 . Water quality analyses for Choccolocco Creek, Alabama and tributaries---May 18, 1968.

STATION NUMBER	ANALYSIS Water Temperature °F	pH	Dissolved Oxygen mg/l	Free CO_2 mg/l	Total Alkalinity mg/l $CaCO_3$
1	68	6.6	7.4	4.0	12.0
2	68	6.6	7.2	4.0	12.0
3	69	6.6	6.9	4.0	14.0
4	71	6.6	6.9	6.0	16.0
5	70	6.4	6.5	5.0	16.0
6	70	6.6	6.6	5.0	18.0
9	66	7.2	8.0	4.0	51.0
10	72	6.6	6.4	16.0	38.0

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Although high concentrations of carbon dioxide are known to be toxic and/or lethal to fishes, all of the factors involved in this toxicity or mortality are not presently known.

Total alkalinity values for the Choccolocco proper ranged from 8.0 to 19.0 mg/l for the two days determinations (Tables 2 and 3). Higher values were recorded for the Coosa River, Dry Creek and Snow Creek (Tables 2 and 3); all of the values recorded are within the usual range found in fresh waters. In order that one can see how Choccolocco Creek compares with several rivers throughout the United States, we include the following data with regard to total alkalinity:

Location:	Bicarbonate alkalinity mg/l
Platte River, Nebraska	165-186
Cimmaron River, Kansas	308
Arkansas River, Oklahoma	216
Missouri River	178-203
Mississippi River tributaries, Iowa	90-216
Average for 8 streams in the Middle Atlantic States	30
Pearl River, Louisiana	12-25
Alabama River	32-48
Red River, Louisiana	120-140

In terms of basic productivity, or the materials available for plankton growth, the water of Choccolocco Creek in general is not very productive. It is generally comparable to the Pearl River of Louisiana in this regard.

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IV. FISHES

A. Fish Sampling

Collections were obtained with a ten-foot seine (nylon) six feet in depth and 3/16 inch ace mesh.

Some of the samples were taken at night because we know that night fish collections (from large streams in particular) are more productive in terms of species and numbers of individuals. This is an established fact based on many years of experience and on many series of tests in different rivers. Catches are greater at night primarily for three reasons: (1) fishes come into the shallows to feed; (2) they do not see the net as readily at night; with regard to the latter point, we do not have lights in use during the actual seining, but only while removing fishes from the net, and (3) nocturnal fishes come out of their day habitat.

We realize from past experience that our collecting gear is inadequate for sampling the depths of the creek in the lower part and that we do not obtain adults of some species and any specimens of a few other species which we presume are in the creek. We firmly believe that we do sample a sufficient amount of the total representation of species in the river and that we will have a firm basis for evaluation of any changes that might be initiated by the future outfall of the various types of pollutants that may come into Choccolocco Creek or its tributaries.

Specimens were placed in 10% formalin immediately after capture. After a hardening period of two or three days the formalin was removed by washing and soaking in tap water for a few days. The specimens were then sorted to species and put in separate jars in 40% isopropyl alcohol.

No specimens are discarded. All specimens are catalogued and permanently housed in the Tulane University Collections and are available for future reference in any work done for Monsanto Company.

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B. Fish Collections for Choccolocco Creek Proper.

All of the fish collecting station locations are listed in Table 4. The nine stations on Choccolocco Creek yielded a total of 37 species of fishes (Table 5). Those stations yielding the largest number of fish species were Station 1 (20 species), Station 9 (17 species) and Station 3 (16 species) (Table 5). The stations yielding the least number of fish species were Station 5 (3 species), Station 2 (8 species) and Stations 4 and 6 (9 species at both stations).

A total of 1439 specimens were taken in the nine collections made on Choccolocco Creek. Station 7 yielded 415 specimens, Station 1 yielded 270 specimens, Station 9 yielded 220 specimens, and Station 8 yielded 164 specimens (Table 6). Only six fishes were taken in the collection at Station 5 (Table 6).

C. Fish Collections for the Tributaries to Choccolocco Creek.

The locations of the tributary fish stations are given in Table 4 also. The number of specimens and fish species taken at each tributary station were as follows (Table 7):

Tributary Station	Number of Specimens	Number of Species
1	134	12
2	102	12
3	120	4
4	139	10
5	38	7
6	137	19

Hence, a total of 670 fishes was taken in the tributaries (Table 7) for six stations as opposed to 1439 fishes for nine main-stream stations. The tributary stations thus averaged 112 fishes per station while the main stream (Choccolocco Creek) stations averaged 160 fishes per station.

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Table 4. Listing of stations where fish collections were made.

Station Number	Location
Main Stream	
1	Three miles NE of White Plains.
2	One mile E of White Plains.
3	One mile S of White Plains.
4	Highway 78 crossing.
5	Highway 21 crossing.
6	Highway 109 crossing.
7	Highway 95 crossing.
8	Highway 93 crossing.
9	Highway 77 crossing.
Tributaries	
1	Shoal Creek 6.8 miles NW of Edwardsville.
2	Shoal Creek 5.5 miles W of Edwardsville.
3	Tributary to Chinch Creek 2 miles E of White Plains.
4	Coldwater Spring Creek just below the spring.
5	Dry Creek at Highway 78 crossing.
6	Chehaw-haw Creek at Highway 95 crossing.

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Table 5. Fishes collected from Choccolocco Creek at nine stations in Cleburne, Calhoun and Talladega counties, Alabama, during May 1968.

Species	Common Name	Stations								
		1	2	3	4	5	6	7	8	9
Ichthyomyzon gagei	Southern brook lamprey	x								
Dorosoma cepedianum	Gizzard shad									x
Dorosoma petenense	Threadfin shad									x
Hypentelium etowanum	Alabama hogsucker	x		x						
Moxostoma duquesnei	Black redhorse	x								
Moxostoma erythrurum	Golden redhorse				x					
Campostoma anomalum	Stoneroller	x	x				x	x	x	
Carassius auratus	Goldfish						x		x	x
Cyprinus carpio	Carp									x
Notemigonus crysoleucas	Golden shiner					x	x	x	x	x
Notropis asperifrons	Burrhead shiner	x		x						
Notropis caeruleus	Blue shiner	x	x	x						
Notropis callistius	Alabama shiner	x		x						
Notropis chrosomus	Rainbow shiner	x	x					x	x	
Notropis chrysocephalus	Common shiner			x						
Notropis lirus	Mountain shiner	x	x	x	x		x	x	x	
Notropis stilbius	Silverstripe shiner							x	x	x
Notropis trichroistius	Tricolor shiner	x	x	x						
Notropis venustus	Blacktail shiner	x		x	x		x	x	x	x
Notropis volucellus	Mimic shiner	x	x	x	x			x	x	
Notropis xaenocephalus	Coosa shiner	x	x	x				x		
Pimephales vigilax	Bullhead minnow									x
Semotilus atromaculatus	Creek chub	x						x	x	
Fundulus stellifer	Southern studfish	x								
Gambusia affinis	Mosquitofish				x	x	x	x	x	x
Chaenobryttus gulosus	Warmouth			x					x	x
Lepomis cyanellus	Green sunfish				x		x	x	x	x
Lepomis humilis	Orangespotted sunfish									x
Lepomis macrochirus	Bluegill	x		x	x		x	x	x	x

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Table 5. (continued)

Lepomis megalotis	Longear sunfish	x		x			x			x
Micropterus coosae	Redeye bass			x	x					
Micropterus punctulatus	Spotted bass									x
Micropterus salmoides	Largemouth bass			x				x	x	x
Pomoxis nigromaculatus	Black crappie				x	x		x		x
Etheostoma stigmaeum	Speckled darter	x		x						
Percina nigrofasciata	Blackbanded darter	x	x							
Cottus carolinae	Banded sculpin	x								
	Number of Species	20	8	16	9	3	9	11	11	17
	Number of Families	7	2	4	4	3	3	3	3	4

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Table 6. Number of fishes collected from Choccolocco Creek at nine stations in Cleburne, Calhoun and Talladega counties, Alabama, during May 1968.

Family and Species	Stations								
	1	2	3	4	5	6	7	8	9
Petromyzontidae-Lampreys									
Ichthyomyzon gagei	1								
Clupeidae-Herrings									
Dorosoma cepedianum									6
Dorosoma petenense									3
Catostomidae-Suckers									
Hypentelium etowanum	4		4						
Moxostoma duquesnei	1								
Moxostoma erythrurum				1					
Cyprinidae-Minnows									
Campostoma anomalum	18	3				1	4	19	
Carassius auratus						1		2	1
Cyprinus carpio									4
Notemigonus crysoleucas					2	40	5	2	8
Notropis asperifrons	4		3						
Notropis caeruleus	28	1	2						
Notropis callistius	4		3						
Notropis chrosomus	17	10					1	1	
Notropis chrysocephalus			1						
Notropis lirus	24	23	69	1		2	201	25	
Notropis stilbius							23	30	3
Notropis trichroistius	144	26	20						
Notropis venustus	3		12	6		4	35	1	109
Notropis volucellus	2	4	5	3			98	51	
Notropis xaenocephalus	7	1	1				1		
Pimephales vigilax									5
Semotilus atromaculatus	1						2	1	
Cyprinodontidae-Topminnows									
Fundulus stellifer	6								

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Table 6. (continued)

Poeciliidae-Livebearers										
Gambusia affinis				3	3	38	35	21	6	
Centrarchidae-Sunfishes										
Chaenobryttus gulosus			7					1	4	
Lepomis cyanellus				14		7	1	15	6	
Lepomis humilis									6	
Lepomis macrochirus	2		1	9		3	5	9	11	
Lepomis megalotis	1		6			1			38	
Micropterus coosae			1	1						
Micropterus punctulatus									1	
Micropterus salmoides			2				2	6	5	
Pomoxis nigromaculatus				1	1		2		4	
Peroidae-Darters										
Etheostoma stigmaeum	1		2							
Percina nigrofasciata	1	1								
Cottidae-Sculpins										
Cottus carolinae	1									
TOTALS	270	69	139	39	6	97	415	184	220	- 1439

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Table 7. Number of fishes collected from tributaries to Choccolocco Creek in Cleburne, Calhoun and Talladega counties, Alabama, during May 1968.

Family and Species	Common Name	Stations					
		1	2	3	4	5	6
Esocidae-Pikes							
Esox niger	Chain pickerel	2			4	1	
Catostomidae-Suckers							
Hypentelium etowanum	Alabama hogsucker	1			3	2	3
Cyprinidae-Minnows							
Campostoma anomalum	Stoneroller	1	7	1	2		4
Notropis asperifrons	Burrhead shiner	3	10				1
Notropis callistius	Alabama shiner	8	10				9
Notropis chrosomus	Rainbow shiner		1	3		12	2
Notropis stilbius	Silverstripe shiner						4
Notropis trichroistius	Tricolor shiner	54	50	79			35
Notropis venustus	Blacktail shiner						14
Notropis xaenocephalus	Coosa shiner	54	13	37			1
Semotilus atromaculatus	Creek chub		2				
Cyprinodontidae-Topminnows							
Fundulus olivaceus	Blackspotted topminnow						3
Poeciliidae-Livebearers							
Gambusia affinis	Mosquitofish				12	9	13
Centrarchidae-Sunfishes							
Ambloplites rupestris	Rockbass		2				
Chaenobryttus gulosus	Warmouth				1		
Lepomis cyanellus	Green sunfish				7	6	1
Lepomis macrochirus	Bluegill	4			23	4	6
Lepomis megalotis	Longear sunfish	3	1				1
Lepomis microlophus	Redear sunfish				1		
Micropterus coosae	Redeye bass	1					1
Micropterus salmoides	Largemouth bass	1			5	4	
Peroidae-Darters							
Etheostoma coosae	Coosa darter		3				

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Table 7. (continued)

Etheostoma jordani	Greenbreast darter		1					
Etheostoma stigmaeum	Speckled darter						9	
Percina nigrofasciata	Blackbanded darter						10	
Percina palmaris	Bronze darter						3	
Cottidae-Sculpins								
Cottus sp. nov.					81			
Cottus carolinae	Banded sculpin	2	2				17	
	TOTALS	134	102	120	139	38	137	- 670

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V. Discussion

On our first survey trip to Choccolocco Creek we were concerned with various aspects of water quality and fish populations. It is important to realize that fish populations are the endpoint of biological production in Choccolocco Creek and because of this fact we have concentrated our efforts on fishes. Physico-chemical results should be studied in conjunction with the work on fishes in order to have a clear understanding of events occurring in the river. Ultimately we want to know whether any changes in the physico-chemical characteristics of Choccolocco Creek are causative factors affecting the relative abundance of fishes, or some stage of the life history, as opposed to random variations that occur under natural conditions and have no real biological significance as far as Monsanto Company is directly concerned. When physico-chemical characteristics are changed due to the addition of effluents, we are generally able to predict what the result may be in terms of population structure.

One fact is clear from our survey, and this is the most important conclusion we can draw: the segment of stream immediately below the Anniston Sewage Treatment Plant, as judged by the species composition and number of fishes taken in our samples (Tables 5 and 6; Fish Stations 5 and 6 on Choccolocco Creek); has been adversely affected by pollutants in the past. It is not possible for us to say whether the fishes have been affected adversely by sewage wastes (which can lower dissolved oxygen and cause fish kills due to suffocation) or by parathion wastes or some other effluent (emanating from Monsanto Company) which is extremely toxic to fishes and can cause extensive fish kills when other water quality characteristics are normal. There are, of course, other pollutants entering Choccolocco Creek at other points and these would have to be evaluated separately.

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The present survey was, in our estimation, quite valuable in that it established a framework or plan for future work. We would not, based on past experience, expect a single trip to provide all of the answers for such a complex problem.

Judging by the results obtained during the first survey, we would only have to consider slight station adjustments for future work undertaken. We now know the general species composition of Choccolocco Creek from the headwaters, middle portion and lower part of the stream, however we would expect to add fishes to our species list on each successive trip. In addition, we need to learn more about the stream and fishes at each station during low water conditions. We are now in a good position to be able to interpret any fish kills which may occur on Choccolocco Creek in the future. We would like to study the next kill, if and when one occurs, and suggest the following procedure: (1) notify us of the kill, (2) preserve as many dead and/or dying fishes as Monsanto Company personnel can obtain. Use 10% formalin (1 part straight formalin per 9 parts water), and (3) label all fish collections as to date, locality, etc., for our future use. This procedure would aid us in determining the cause of the fish kill.

We recommend future approval of a five-day trip in the fall under low-water conditions. The objectives for this trip would be: 1. to donduct a thorough examination of the stream, including bottom types, depth, bank conformation, and the physical relationships with regard to current, 2. re-examination of water quality, 3. search for visible signs (deposits, etc.) of the various pollutants entering the stream, 4. determine seasonal aspects, species composition, and relative abundance of fishes, and 5. taking points 1-4 into consideration, we would have a firm basis for adjusting collecting sites within the general areas selected initially.

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VI. Literature Cited

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