the average Kentucky stream. It is therefore recommended that this technique no longer be considered as a potential management tool for improving stream populations prior to watershed and/or stream rehabilitation and improvement. There is reason to believe that population manipulation might not be needed if environmental conditions were near optimum in the average Kentucky stream. This remains to be demonstrated, however.

ACKNOWLEDGMENTS

The author wishes to express his appreciation to Mr. Minor E. Clark and to practically every employee of the Fisheries Division, who at one time or another, aided the progress of this project. Special thanks are due William A. Tompkins, who directed and coordinated all phases of this investigation from its inception, and to Bernard T. Carter, who later assumed these responsibilities. The able and willing assistance given by Luther Ray Renaker, former field assistant, and Billy Sayle, present field assistant, is gratefully acknowledged. Miss Lucille Stewart cheerfully labored with not only the present report, but with many other interim reports and secretarial work connected with this project the past several years.

Question: Was a barrier considered?
Answer: Yes, but was rejected because of cost.

Question: Was fishing pressure heavy?
Answer: No. It was considered medium on Floyd's Fork.

Question: Was a creel census used to check results?
Answer: No.

Question: Would not the low game fish population be responsible for poor fishing interest?
Answer: That is a good point but one stream had Kentucky bass available in favorable numbers.

Question: How large are the streams?
Answer: This is covered in the paper.

INTRODUCTION AND SUCCESS OF WHITE BASS (Roccus chrysops) IN NORTH CAROLINA WATERS

By BUFORD L. TATUM
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North Carolina is divided into three well-defined physiographic regions: the mountains, piedmont, and coastal plains. In the piedmont, which is the region of highest population, the major fishing waters are main stream hydro-electric reservoirs that are heavily silted and subject to frequent water level fluctuations. Before the introduction of white bass, *Roccus chrysops* (Rafinesque), the fishing in these waters was good in early spring and late fall, but during other seasons of the year the fishing was poor.

It was apparent in these reservoirs that little could be done to improve the physical habitat. In some cases, however, certain over populations of fish or unbalanced fish populations could be changed or corrected. Naturally, the sportsmen desired better fishing and it was decided that the introduction of white bass, a predator species, and one which is tolerant of fluctuating water levels, might produce better fishing. Introductions of white bass were made in both major chains of reservoirs in the piedmont, with notable successes and failures.

The purpose of this paper is to outline the introductions of the white bass and point out some of the apparent reasons for their success and failure.

DESCRIPTION OF WATERS

Yadkin River Basin

The upper part of the Yadkin River Basin (Figure 1) lines in the mountain region, which consists of rugged foothills and mountain reaches. The tributaries

of the Yadkin River do not penetrate deeply into this region, but have their sources on the slopes or crests of the Blue Ridge Mountains, which make up the eastern wall of the Appalachian system.

The central and larger portion of the basin lies in the piedmont plateau region, which divides the basin both geographically and industrially. This region is characterized by rolling hills, which rise higher above the plain toward the western limit of the area.

The coastal plain region covers only a small area of the basin in North Carolina. This portion is quite undulating with hills rising to elevations ranging from 400 to 500 feet above sea level.

The slope of that portion of the river below Spencer, North Carolina, to the State Line is more precipitous, and hydroelectric development on this lower portion within the state is practically complete (Figure 1). This portion, which is 85 miles in length, has five reservoirs. They are: High Rock, Badin, Falls, Tillery, and Blewett Falls. All of these reservoirs are over twenty years old. Table I gives the surface area and the year in which each dam was completed.

The principal tributaries of the main stream above the state line are: Rocky River, the largest, South Yadkin River and Uwharrie River, in that order. Approximately 62 percent of the area of the Yadkin River Basin consists of forest land.

The reservoirs of the Yadkin Chain are all mainstream, typical warm water reservoirs. The most common species of fish present are: largemouth bass,* sunfish, white crappie, white perch, white catfish, suckers, and carp (Table II). The only major difference in the fish populations is the absence of gizzard shad, *Dorosoma cepedianum* (LeSueur), in the upper three reservoirs, High Rock, Badin, and Falls.

Only two of the five reservoirs, High Rock and Badin, are subject to extreme water level fluctuations. The three remaining reservoirs fluctuate from one to three feet. All the reservoirs are rather turbid several months of the year, especially after heavy rains or extended wet periods. The upper reservoir, High Rock, is usually less turbid and clears more rapidly than do the downstream reservoirs. The downstream reservoirs remain turbid longer because they are smaller and receive their inflow of water at a point several feet below the surface of the upstream reservoir. This water from below the surface is usually more turbid than the surface water and clears less rapidly.

Catawba River Basin

The Catawba River, known as the Wateree River in South Carolina, rises on the eastern slope of the Blue Ridge Mountains near Swannanoa Gap (Figure 2). It first flows eastward and then southward into South Carolina, where it unites with Congaree to form the Santee River. The Catawba's course in North Carolina is 180 miles long; the headwaters are nearly 2,700 feet above sea level, thus dropping an average of 12 feet per mile. The upper part of the river is enclosed between parallel mountain ranges which are heavily timbered; the lower part is in a fertile and heavily populated valley 15 to 20 miles wide. The only tributary of importance is South Fork, which flows from the northwest and enters Catawba Lake near the South Carolina state line. The drainage basin of the Catawba River in North Carolina is approximately 3,000 square miles. The major soil type in the basin is red clay.

There are six hydroelectric reservoirs on the Catawba River, completely or partially within North Carolina. They are Lake James, the upper most lake near Marion, North Carolina; Rhodhiss Lake, Hickory Lake, Lookout Shoals Lake, Mountain Island Lake, and Catawba Lake. Table I gives surface area and the year in which each dam was completed. All the reservoirs in this chain are over 20 years old and are subject to extreme fluctuations in water level. The reservoirs downstream, from Lake James have considerable turbidity during heavy rains and extended wet periods. Clearing usually begins a few days after a rain. The Catawba Chain is not as turbid as the Yadkin Chain because of the more protected watershed of the former. Lake James is relatively clear most of the year. Almost 90 percent of its watershed is in forest land.

* Names of fishes are the same as those given in the American Fisheries Society Special Publication No. 1. A list of common and scientific names of the better known fish of the United States and Canada (1948).

The reservoirs on the Catawba vary more in habitat than do those of the Yadkin Chain. The upper reservoir, Lake James, is a typical mountain reservoir containing largemouth bass, smallmouth bass, walleye, sunfish, white crappie, white catfish, suckers and rarp (Table II). The downstream reservoirs are typical warm-water habitats with many of the same species present, with the exception of smallmouth bass and walleye. Gizzard shad are abundant in all the reservoirs. White perch are not present in the Catawba Chain, although they are very abundant in the Yadkin River Chain.

Tar River Basin

The Tar River is a typical coastal stream which rises in North Carolina near the Virginia State line and flows in a general southeast direction into a long arm of Pamlico Sound known as Pamlico River (Figure 3). The river is approximately 175 miles long and drains an area of nearly 3,000 square miles. The bed of the river is composed of sand gravel, clay, mud, or rock, and the banks in the upper part of its course are comparatively high. At Rocky Mount, a dam extends across the river which constitutes an impassable barrier to fish.

The Tar River is entered by the common migratory fishes of this area of the Atlantic Coast region. They are: striped bass, white perch, hickory shad, gizzard shad, American shad, alewives, and various suckers. The major non-migratory species of importance are catfish, pickerel, largemouth bass, white crappie, and sunfish.

Little Tennessee River Basin

Fontana Lake is a Tennessee Valley Authority impoundment on the Little Tennessee River in Graham and Swain Counties, North Carolina (Figure 4). It is a mountain reservoir and the fish population is somewhat different than that of most piedmont reservoirs. The species present are similar to those present in Lakes James, *i. e.*, largemouth bass, smallmouth bass, walleye, crappie, sunfish, white catfish, and suckers. Gizzard shad are present in great numbers.

INTRODUCTION OF WHITE BASS, 1952 TO 1954

In the early spring of 1952 adult white bass from Tennessee and Alabama were stocked in Mountain Island and Catawba Lakes in the Catawba River Chain, and Tillery Lake on the Yadkin River Chain. The year of stocking and number of fish stocked is given in Table I. The white bass stocked in North Carolina were sexually mature and in good physical condition.

The three original introductions were successful and these reservoirs were used as "nurseries" for brood stock for further introductions into other suitable waters.

In 1954 brood stock from these reservoirs were used to stock Lookout Shoals Lake in the Catawba Chain; High Rock, Badin, Falls, and Blewett Falls in the Yadkin Chain; and the Tar River, a coastal stream. The white bass in Fontana Lake were probably introduced in 1954 or 1955. They were present for the first time in the 1956 rotenone samples.

Only two of the 1954 introductions were definitely successful. They were Lookout Shoals in the Catawba Chain and Blewett Falls in the Yadkin Chain.

The success of the Tar River introduction, near Rocky Mount, is not known because population or reproduction checks have not been made. Reports of catching white bass have not been received from local fishermen, so it is assumed that the first introduction was unsuccessful. Rotenone samples, netting studies, fishermen checks, and fishermen reports have failed to indicate white bass in High Rock, Badin, and Falls Lakes. It is fairly certain that the introductions into these waters were unsuccessful.

In only two Yadkin River reservoirs was success observed: Tillery, the first lake to be stocked, and the downstream reservoir, Blewett Falls. That white bass would be successful in the lower two reservoirs and unsuccessful in the three upper reservoirs was a little surprising.

All the reservoirs are within 85 miles of each other. Thus, no major physiographic changes are evident from the proximity of the reservoirs. White bass have been successfully introduced at higher elevations, farther north, in more turbid lakes, in less turbid lakes, in deep lakes, in shallow lakes, in fluctuating, and in stable reservoirs. The water from the upper reservoirs goes directly

into the one below and so on down the chain. Each reservoir, with the exception of Falls Lake, has adequate white bass spawning areas. The only apparent difference in the reservoirs in the Yadkin Chain is the presence of gizzard shad in Tillery and Blewett Falls Lakes. The unsuccessful reservoirs, High Rock, Badin, and Falls Lakes do not have gizzard shad present.

INTRODUCTION OF WHITE BASS IN 1957

In 1957 white bass were again stocked in High Rock and Badin Lakes in an effort to establish the species (Table I). An experimental stocking was made in Lake Fisher, one of two water supply reservoirs for the city of Concord, North Carolina.

New introductions were made in the Cape Fear, Northeast Cape Fear and Neuse Rivers, all coastal rivers. A second introduction was made in the Tar River. During this latter introduction the river was stocked in two places, near Rocky Mount (the approximate mid-point of the river) and near Greenville (the lower portion of the river). The South Fork of Catawba, a piedmont stream, was also stocked because of a dam that blocked the upstream passage of the fish.

DISCUSSION

The white bass was selected for stocking in the warm water Piedmont reservoirs of North Carolina for several reasons. The species is able to reproduce successfully despite fluctuating water levels and since it is a piscivorous species it was felt that it would serve as an additional check on over abundant species such as gizzard shad, white perch and white crappie. In addition, the white bass appears to provide excellent sport during the summer months when reservoir fishing for bass and walleye is in a slump.

Fontana Reservoir might be considered an "accidental" stocking. The white bass were apparently stocked by fishermen who had fished elsewhere for this fish. A high population of gizzard shad and other favorable conditions helped make the introduction a success and the white bass have added to the sport fishery in Fontana.

It is considered significant that, in all cases where gizzard shad were present, the introduction of white bass was successful and likewise no success was obtained in reservoirs lacking the shad (Table II). No other single factor or combination of factors appears to present itself to account for the success or lack of success of the white bass in these waters. It is also apparent, from the North Carolina introductions that the white bass cannot successfully utilize the white perch and white crappie.

TABLE I

WHITE BASS INTRODUCTIONS IN NORTH CAROLINA

Body of Water	*Year Dam Completed*	*Length or Surface Acres*	*Year Introduced*	*No. of Fish Stocked*	*Shad Present or Absent*	*Success*
		Yadkin River Reservoirs				
High Rock	1927	15,180	1954	112	Absent	Unsuccessful
High Rock	....	....	1957	94	Absent	Unsuccessful
Badin	1917	5,973	1954	44	Absent	Unsuccessful
Badin	....	....	1957	60	Absent	Unsuccessful
Falls	....	203	1954	47	Absent	Unsuccessful
Tillery	1928	5,000	1952	103	Present	Successful
Blewett Falls	1911	2,500	1954	48	Present	Successful
		Catawba River Reservoirs				
James	1919	6.500	None	None	Present	Not Stocked
Rhodhiss	1924	3,515	"	"	Present	Not Stocked
Oxford	1928	4,110	"	"	Present	Not Stocked
Lookout Shoals	1915	1,270	1954	42	Present	Successful
Mountain Island	1923	3,235	1952	98	Present	Successful
Catawba	1925	12,455	1952	23	Present	Successful

TABLE I—*Continued*

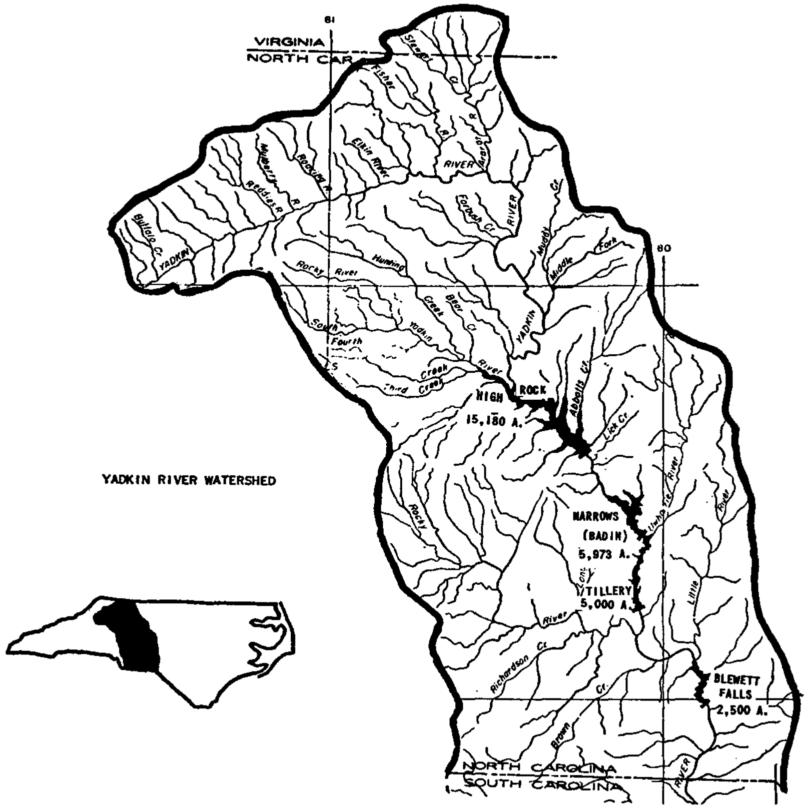
WHITE BASS INTRODUCTIONS IN NORTH CAROLINA

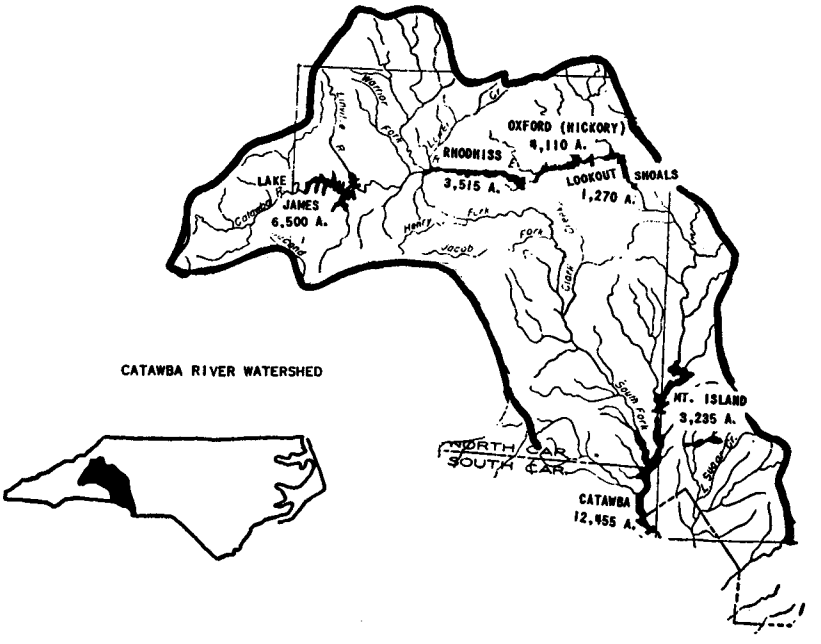
Body of Water	*Year Dam Completed*	*Length or Surface Acres*	*Year Introduced*	*No. of Fish Stocked*	*Shad Present or Absent*	*Success*
			Tennessee River Reservoir			
Fontana	1944	10,670	1954 or 1955	Unknown	Present	Successful
			Coastal Rivers			
Tar	....	175 Miles	1954	30	Present	Unsuccessful
Tar	....	....	1957	121	Present	.....
Cape Fear	....	....	1957	118	Present	.....
Northeast Cape Fear	....	....	1957	24	Present	.....
Neuse	....	....	1957	160	Present	.....
			Piedmont Lake and River			
Fisher Lake	1947	277	1957	56	Absent	.....
South Fork River	....	....	1957	12	Absent	.....

TABLE II

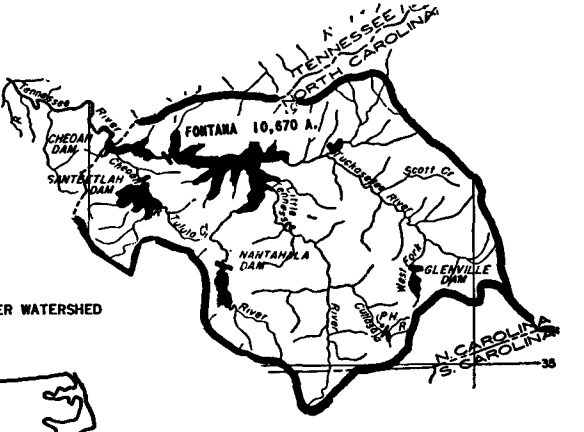
RESULTS OF COMBINED ROTENONE (Samples, 1956)

	Yadkin River Basin					*Little Tenn. River Basin*
Species	*High Rock % Total Wt.*	*Badin % Total Wt.*	*Falls % Total Wt.*	*Tillery % Total Wt.*	*Blewett Falls, % Total Wt.*	*Fontana % Total Wt.*
Catfish	28.1	25.3	9.0	5.3	24.4	17.4
White Perch	19.1	30.9	83.4	2.1	0.4	0
Crappie	15.5	3.4	2.5	4.6	1.8	1.6
Carp	14.6	0.8	0.5	2.2	2.5	5.7
Sunfish	8.6	21.9	1.7	15.9	8.2	4.8
Largemouth Bass	6.1	4.0	0.2	5.3	3.4	16.1
Golden Shiner	5.8	0.1	Present	Present	0.8	0
Yellow Perch	2.0	2.0	2.7	1.1	1.0	0
Chub Sucker	Present	Present	Present	Present	Present	0
Red Horse Sucker	Present	Present	Present	26.4	4.6	15.2
Quillback Pickerel	Present	Present	Present	Present	1.3	0
Chain Pickerel	Present	Present	Present	1.6	0.1	0
Gar	Present	0.2	Present	0.2	Present	0
Gizzard Shad	0	0	0	35.3	51.4	32.3
Buffalo	0	11.4	Present	0	Present	0
White Bass	0	0	0	Present	Present	Present
Smallmouth Bass	0	0	0	0	0	7.9
Walleye	0	0	0	0	0	0.8

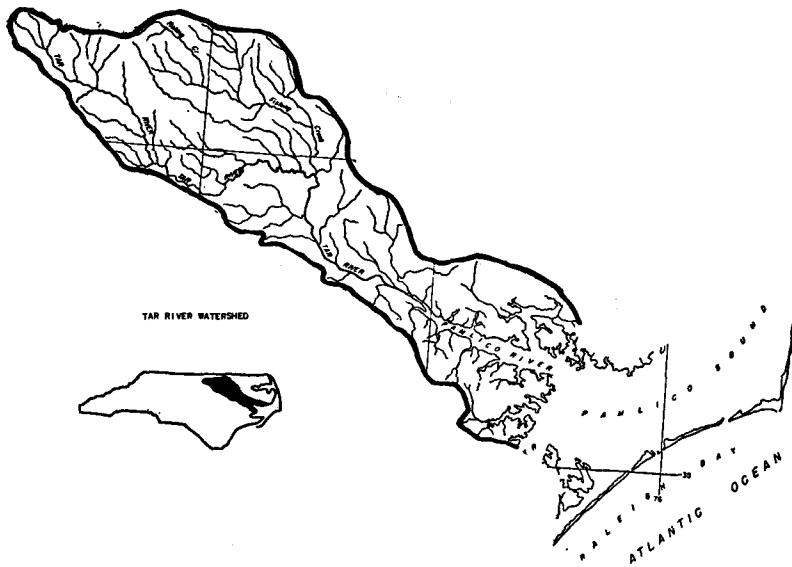

81
VIRGINIA
NORTH CAR
80
Fisher
Elkin River
RIVER
Buffalo C.
YADKIN
Rocky River
Hunting
Creek
South
Fourth
Third Creek
YADKIN
River
HIGH
ROCK
15,180 A.
Abbotts Cr.
Lick Cr.
NARROWS
(BADIN)
5,973 A.
TILLERY
5,000 A.
Rocky
River
Richardson Cr.
Brown
Cr.
Little
River
BLEWETT
FALLS
2,500 A.
RIVER
NORTH CAROLINA
SOUTH CAROLINA
YADKIN RIVER WATERSHED



CATAWBA RIVER WATERSHED



LITTLE TENNESSEE RIVER WATERSHED



Question: Did you find a rapid growth rate among High Rock young of the year?

Answer: Yes, they were 5½-6 inches long.

Question: Are gizzard shad necessary for the success of white bass?

Answer: Yes, it appeared that way.

Question: Do you have a large population of small crappie and a good number of walleye in these reservoirs?

Answer: No.

Question: Were precautions taken to insure that both sexes were present?

Answer: Yes, and the fish are easily sexed.

Question: Did the black bass fishermen object to the introduction?

Answer: Generally, no. Only a few objected.

LAW ENFORCEMENT SESSION

"HOW TO CREATE BETTER WORKING RELATIONSHIPS BETWEEN CONSERVATION OFFICERS AND THE COURTS"

By WEBB MIDYETTE

Chief, Law Enforcement Division, Commission of Game and Inland Fisheries

Richmond, Virginia

Every court of law demands one thing from every peace officer and that is dignity. This dignity has come about through long years of tradition and will always be uppermost in the minds of jurists throughout the land. To violate this dignity is to violate the ethics of the courts, and thereafter the law enforcement officer will fight a losing battle in the courts of law.

In the term "dignity" I do not mean any false mannerism or special type of behavior, but rather a firmness, impartialness and neatness affirming that dignity.