Question: Has copper sulfate at a rate of 1 p.p.m. been used to control columnaris?

Answer: Yes, but not tested extensively. Did not give successful control where is was used.

Question: What was the lowest water temperature at which feeding was carried on?

Answer: In the low forties or high thirties.

Question: Was the amount fed varied according to temperature?

Answer: No, it was not.

THE STRIPED BASS OF THE SANTEE-COOPER RESERVOIR

By ROBERT E. STEVENS

South Carolina Wildlife Resources Department

ABSTRACT

The continued spawning success of striped bass, *Roccus saxatilis,* within the reservoir during the past three years, in spite of greatly reduced lock operations, is evidence which heavily supports the resident hypothesis.

Striped bass feed heavily upon mayfly nymphs during the spring months, but take clupeoid fish almost entirely for the remainder of the year.

The results of a three-year creel census ending August 31, 1957, shows that the number of striped bass caught and the percent of the total catch which striped bass represents has approximately doubled for the past two years. The average catch per trip has increased from 1.7 fish to 3.0 fish since 1955. Other data demonstrate a decided change in preference to striped bass fishing from other species by fishermen.

An intensive gill net effort between June 5, 1956 and August 6, 1957 took 5,730.4 pounds of fish. Of this total, 60.1 percent was striped bass. The efficiency of the nets in taking striped bass indicates a very large population of this species within the reservoir.

Age and growth were calculated for 322 striped bass. The calculated average total lengths at the end of the first seven years are as follows: I-8.5, II-15.7, III-19.8, IV-22.9, V-25.8, VI-28.5, and VII-30.2. The average first year growth is approximately double that reported from New England and the Chesapeake Bay.

Striped bass from the reservoir and tributary streams have been introduced in six impoundments in three states. Adult fish were used in two instances but no reproduction has been found.

INTRODUCTION

On November 12, 1941, the water of the Santee River was impounded and diverted to form the Santee-Cooper Reservoir. The reservoir contains 160,000 acres of water when full, and is composed of Lake Marion which is 100,000 acres, and Lake Moultrie which is 60,000 acres. The lakes are joined by a canal which serves to divert the water of the Santee River down the Cooper River where it meets the ocean (Figure 1). The primary purpose of the reservoir is electrical power which is generated at Pinopolis Dam on Lake Moultrie. Also, at Pinopolis Dam is a navigation lock which is 180 feet long, 60 feet wide and has a lift of 75 feet.

Historically, a seasonal run of striped bass, *Roccus saxatilis,* occurred in both the Santee and Cooper Rivers. Soon after the impoundment, isolated catches of striped bass within the reservoir were reported. By 1950, however, striped bass were appearing in schools and fishermen were experimenting with various baits and techniques for taking them.

PREVIOUS INVESTIGATIONS

In February of 1954, Mr. George Scruggs assumed the duties of project leader for a study which was primarily concerned with the striped bass within

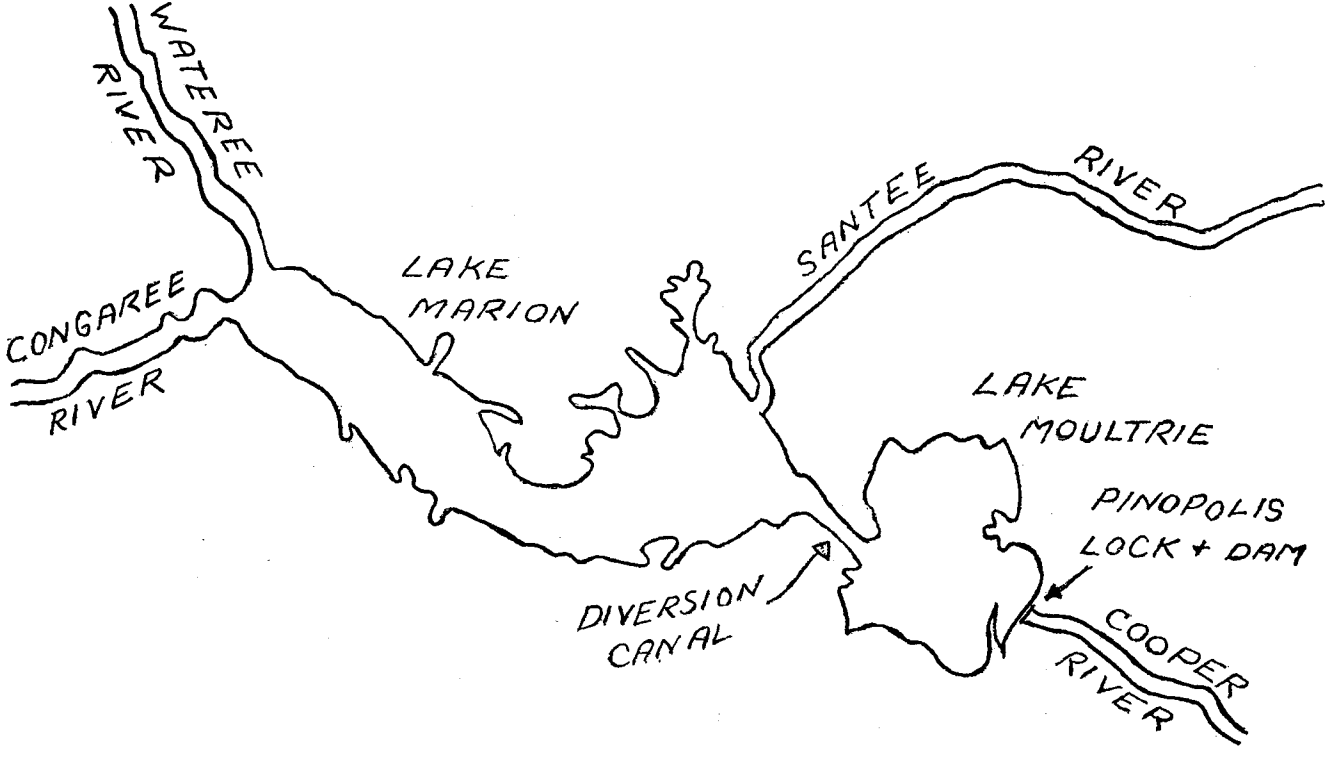

Figure 1 Map of the Santee-Cooper Reservoir System

the reservoir. Scruggs remained on the project until September of 1956 and the results of his efforts were published by Scruggs and Fuller (1954) and Scruggs (1955).

Scruggs was interested in measuring the size of the striped bass population and in determining whether the population was resident or migratory. He approached the first question by establishing a partial creel census on both lakes. He found at the end of the first creel census year that the catch of striped bass equalled 6.7 percent of the total catch. Scruggs approached the second problem through a trammel net study, a tagging study and a spawning study.

Between April 21, 1954 and April 20, 1955, Scruggs fished a trammel net within the navigation lock 29 times. The net was fished while the lock was being operated in a typical manner and it caught 2,569 fish including 14 species. The net took one striped bass moving into the reservoir and three moving out.

Between March 25 and December 16, 1954, 606 striped bass were caught, tagged and released in the tailrace canal. There has been 42 returns as of this writing, 36 (85.7%) of which were taken in the Cooper River or tailrace canal and 6 (14.7%) of which were taken in Lake Moultrie after having moved through the lock.

Between February 16 and June 1, 1955, Scruggs examined the gonads of 243 female and 165 male striped bass. He stated that approximately 98 percent of all males were mature by March 31, and that more than 88 percent of the females over 24 inches had maturing, mature or spent ovaries.

Finally, Scruggs collected striped bass eggs with a small mesh net both within the reservoir and tributary streams. With these facts, Scruggs (1955) concluded that most of the striped bass within the reservoir were landlocked and able to complete a full life cycle without returning to salt water.

CURRENT INVESTIGATIONS

Any consideration of the question of a resident vs. a migratory population will necessarily be preoccupied by the operations of the lock, since this is the only access point to the reservoir from salt water (Fig. 1). Furthermore, the operation of the lock should be considered in terms of two distinct periods of time. The first period between September 20, 1944 and July 31, 1954 when 4,429 operations occurred, and the second period between August 1, 1954 and September 30, 1957 when the lock was operated only 207 times (Table I). The operations in the former period include approximately 1,785 operations for the purpose of encouraging fish to enter the reservoir. This practice was aban-

TABLE I

A LOG OF OPERATIONS OF THE NAVIGATION LOCK IN PINOPOLIS DAM BETWEEN SEPTEMBER 20, 1944 AND SEPTEMBER 30, 1957

Year	*Navigation*	*Trammel Net*	*Fishway*	*Start*	*End*
1944	5	0	0	....	.....
1945	19	0	81	3/ 1	5/ 1
1946	32	0	87	1/ 1	5/15
1947	88	0	129	3/ 1	5/16
1948	1,267	0	162	2/ 2	5/ 2
1949	1,030	0	108	9/ 3	10/17
1950	47	0	201	3/14	6/ 5
1951	24	0	120	4/19	6/21
1952	24	0	96	3/ 1	5/10
1953	67	0	315	2/10	7/31
1954	68	21	486	1/ 6	7/31
1955	65	8	0	....	.....
1956	53	0	0	....	.....
1957	33	0	0	....	.....
TOTAL	2,822	29	1,785	....	.....
GRAND TOTAL	....	..	4,636	....	.....

Operations between August 31, 1954 and September 30, 1957—207 (4.5%)

doned on July 31, 1954 and operations since that have been limited to a relatively small and sporodic amount of navigation. During this second period, two very successful spawning seasons have occurred and the population of striped bass has expanded in an almost eruptive manner.

The reduced number of lock operations in the past three years makes it physically impossible for a large number of striped bass to move into or from the reservoir. Spawning has continued unabated during this period and the magnitude of the annual production indicates a very large spawning population. I do not believe the annual increment of striped bass to the population could be accomplished by a few large adults which may go to sea each year or which were exposed to salt water only during their formative years.

From March 15, 1956 until this writing, the project has continued to be primarily concerned with the striped bass as a resident. The data collected during this period will be presented in the following order: a foot habits study, a creel census study, a gill net study, an age-growth study and a section on the stocking of South Carolina striped bass.

FOOD HABITS

Between October 1, 1956 and September 30, 1957, 1573 striped bass stomachs were examined. The identification and measurement of the contents was done in the field when possible. The contents were separated as to species and number and measured by volumetric displacement. Any stomach not entirely empty was classified as full. Of the 1,573 stomachs examined, 1,093 (69.5%) were full.

The results of the study can be summarized, I believe, by three statements:

1. Clupeoid fish support the striped bass population except in the spring of the year.
2. In April, May and June, mayfly nymphs become the dominant food item.
3. Game fish and other rough fish are taken in insignificant numbers.

The clupeoid fish which were found to have been eaten by striped bass were gizzard shad, threadfin shad, alewife and glut herring. This group of fish varied by month between 60.3 percent and 100.00 percent in frequency of occurrence except in April, May and June (Table III). Gizzard shad and threadfin shad were easily identified by the presence of the gizzard which usually resisted digestion longer than other tissues. When digestion had obliterated the external characters and shad were less than 5.0 inches in length, no attempt was made to differentiate between the two shad.

TABLE II

A LIST OF FOOD ITEMS ANALYZED BY FREQUENCE OF OCCURRENCE IN NUMBERS AND INCLUDING AVERAGE VOLUME PER STOMACH AND PERCENT OF FULL STOMACHS BY MONTH

Food Items	*10/56*	*11/56*	*12/56*	*1/57*	*2/57*	*3/57*	*4/57*	*5/57*	*6/57*	*7/57*	*8/57*	*9/57*
Shad*	36	71	36	6	70	33	1	4	4	9	63	26
Gizzard Shad	14	13	3	3	3	4	6	1	2	..	..	1
Threadfin Shad	4	5	2	..	5	1	1	3	2	7	1	1
Herring	1	1	3	4	17	11	14	15	6	4	5	3
Unidentified Clupeoid	1	2	1	2	26	21	9	16	3	5	3	1
Needlefish	..	..	3	..	1	..	..	..	..	..	..	..
Carp	1	..	..	..	..	..	..	..	..	..	..	..
Catfish	..	..	..	..	1	..	..	1	..	..	..	..
Crappie	1	..	..	1	..	..	..	..	..	..	..	..
Redear Sunfish	..	..	..	..	..	1	..	..	..	..	..	..
Yellow Perch	1	..	..	..	2	..	..	1	..	..	..	..
Unidentified Fish	1	..	..	..	5	2	1	..	4	..	8	4
Freshwater Shrimp	..	..	..	..	..	..	..	1	..	..	..	..
Mayfly Nymphs	..	..	..	..	22	38	135	284	113	3	9	1
Adult Mayflies	..	..	..	..	..	..	..	..	2	1	3	..
Dragonfly Larvae	..	..	..	..	..	..	1	2	..	..	..	..
Diptera Pupae	..	..	..	..	..	5	5	..	..	..	..	..
Stick	..	..	..	..	..	..	..	..	..	..	2	1
TOTAL	60	92	48	16	152	116	173	328	136	29	94	38
TOTAL FULL STOMACHS	48	90	42	10	107	85	149	293	121	23	89	36
PERCENT FULL STOMACHS	46.6	51.1	40.7	52.6	62.6	59.0	92.0	89.9	86.4	51.1	70.7	52.9
AVERAGE CC PER STOMACH	24.6	15.1	9.3	61.6	5.2	5.6	6.8	10.0	6.2	3.7	6.5	8.3

* Includes undifferentiated gizzard shad and threadfin shad.

TABLE III

A LIST OF FOOD ITEMS ANALYSED BY FREQUENCY OF OCCURRENCE IN PERCENT

Food Items	*10/56*	*11/56*	*12/56*	*1/57*	*2/57*	*3/57*	*4/57*	*5/57*	*6/57*	*7/57*	*8/57*	*9/57*
Shad*	60.0	77.2	75.0	37.5	46.0	28.4	0.6	1.2	2.9	31.0	67.0	68.4
Gizzard Shad	23.3	14.1	6.2	18.8	2.0	3.4	3.5	0.3	1.5	. .	. .	2.6
Threadfin Shad	6.5	5.4	4.3	. . .	3.3	0.9	0.6	0.9	1.5	24.1	1.1	2.6
Herring	1.7	1.1	6.2	25.0	11.2	9.5	8.0	4.6	4.4	13.8	5.3	8.0
Unidentified Clupeoid	1.7	2.2	2.1	12.4	17.0	18.1	5.2	4.9	2.2	17.2	3.2	2.6
Needlefish	. .	. .	6.2	. .	0.7	. .	. .	. .	. .	. .	. .	. .
Carp	1.7	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
Catfish	. .	. .	. .	. .	0.7	. .	. .	0.3	. .	. .	. .	. .
Crappie	1.7	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
Redear Sunfish	. .	. .	. .	6.3	. .	0.9	. .	. .	. .	. .	. .	. .
Yellow Perch	1.7	. .	. .	. .	1.4	. .	. .	0.3	. .	. .	. .	. .
Unidentified Fish	1.7	. .	. .	. .	3.3	1.8	0.6	. .	2.9	. .	8.5	10.6
Freshwater Shrimp	. .	. .	. .	. .	. .	. .	. .	0.3	. .	. .	. .	. .
Mayfly Nymphs	. .	. .	. .	. .	14.4	32.7	78.0	86.6	83.1	10.4	9.6	2.6
Adult Mayflies	. .	. .	. .	. .	. .	. .	. .	. .	1.5	3.5	3.2	. .
Dragonfly Larvae	. .	. .	. .	. .	. .	. .	0.6	0.6	. .	. .	. .	. .
Diptera Pupae	. .	. .	. .	. .	. .	4.3	2.9	. .	. .	. .	. .	. .
Stick	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	2.1	2.6
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100

* Includes undifferentiated gizzard shad and threadfin shad.

TABLE IV

FOOD HABIT DATA

	Number	*Percent*
Fish Examined	1,575	...
Full Stomachs	1,093	69.5
Empty Stomachs	482	30.5
Fish Taken by Gill Nets	1,499	95.2
Fish Taken by Fishermen	76	4.8
Largest Fish Examined	30.1	...
Smallest Fish Examined	8.5	...
Average Length of All Fish	16.2	...
Approximate Number of Food Items	20,669	...
Total Volume	10,403 cc	...
Average Volume Per Stomach	9.5 cc	...

TABLE V

A LIST OF SPECIES FOUND IN STRIPED BASS STOMACHS

Common Name	*Scientific Name*
Gizzard Shad	*Dorosoma cepedianum*
Threadfin Shad	*Signalosa pectenensis*
Alewife	*Pomolobus pseudoharengus*
Glut Herring	*Pomolobus aestivalis*
Needlefish	*Stongylura marina*
Carp	*Cyprinus carpio*
Catfish	*Ictalurus catus*
Black Crappie	*Pomoxis nigro-maculatus*
Redear Sunfish	*Lepomis microlophus*
Yellow Perch	*Perca flavescens*
Freshwater Shrimp	*Palaemonetes sp.*
Mayfly	*Hexagenia bilineata* (Say)
Dragonfly	*Gomphus scudderi* (Selys)

Mayfly nymphs occurred from February through September, but the volume per stomach was significant only in April, May and June (Table II). During this period, 89.7 percent of all stomachs were full and of all full stomachs, 94.5 percent contained mayfly nymphs. The switch from shad to mayflies can undoubtedly be explained by the fact that shad of suitable size are naturally scarce in the spring while mayfly nymphs are vulnerable and therefore available.

Mayfly nymphs were taken by all sizes of striped bass examined, and the occurrence of excess fat around the intestines of most of the fish during this period indicated the high quality of this food. The maximum volume of nymphs in one stomach was 42.0 cubic centimeters.

Game fish were represented by only two crappie, four yellow perch and one redear sunfish, while the rough fish taken include only four needlefish, one carp and two catfish. It should be noted, however, that no striped bass under 8.5 inches in length was examined. Any predation by striped bass on game fish or rough fish on the postlarval or fingerling level would not have been detected by this study.

The largest striped bass examined was 30.1 inches in length. The largest food item was a 15.1 inch gizzard shad which was found lodged in the throat of a strangling striped bass which was 29.7 inches in total length.

CREEL CENSUS

August 31, 1957 marked the end of the third consecutive year of a partial creel census of the reservoir. The census was accomplished by three checkers on Lake Moultrie and by two checkers on Lake Marion.

The census measures a small but unknown percent of the fishing effort. The only information which indicates the size of the sample is an aerial count of fishermen made between 1:00 a. m. and 12:45 p. m., on November 19, 1956. The ground census for that day was 11.0 percent of the aerial count. The aerial

count missed those fishermen which left the lake before the flight or entered upon the lake after the flight, but it does give at least an indication of the coverage of the census.

Except for a short time during the first year, the census has been maintained in the same location by the same people. The number of days checked each year and number of fishermen checked each day for the three-year period are very close. It is for these reasons, that I believe the relative information and the trends that are apparent in the data are accurate.

Table VI demonstrates the tremendous increase in the sports fishery for striped bass during the three-year period. The catch for the current year is more than four times that of 1955, while the number of successful fishermen didn't quite triple itself. These facts are reflected in an increase in average catch per trip from 1.7 fish in 1955 to 3.0 gsh for the current year.

TABLE VI

CREEL CENSUS DATA

	1954–55	*1955–56*	*1956–57*
Number of Striped Bass Caught	6,451	13.098	28,272
Percent of Total Catch	6.7	13.1	23.4
Number of Successful Fishermen	3,864	6,408	9,288
Successful Fishermen	21.7	30.0	47.1
Average Catch Per Man Per Trip	1.7	2.0	3.0

One other important development is the great rise in the percent of the total successful fishermen represented by striped bass fishermen. This category was about equal to the successful bream and largemouth bass fishermen in 1955; was second only to crappie fishermen the next year; and represents 47.1 percent of all successful fishermen in the current year. This is in spite of the fact that the average catch of other game fish has improved each year as well.

The trends measured by the creel census over the three-year period demonstrate, I believe, the following:

1. An expanding population of striped bass.
2. An increasing effort in terms of more fishermen and better fishing techniques.
3. A change in preference to striped bass from other game fish by fishermen.

GILL NET STUDY

In order to obtain striped bass in quantity for the food habits study and to learn something of the composition of the fish life within the reservoir, gill nets were set intensively for a fourteen-month period between June 5, 1956 and August 6, 1957.

Gill nets were set on 39 different dates within this period for a total catch of 5,730.4 pounds which included 60.9 percent game fish and 39.1 percent non-game fish (Table VII). Striped bass accounted for 98.8 percent of all game fish while the rough fish total was made up primarily of gizzard shad, catfish and longnose gar.

The sets were typically made in the open water of Lake Moultrie which exceeded 20 feet in depth. This was true because sets made in coves, shoal areas, or in Lake Marion produced a great decrease in the catch of striped bass.

The stretched mess sizes of the nets were 2", 2½", 3", 3½", 4½" and 5½". The nets were 150 feet long and varied in depth between 6 and 18 feet. Each set consisted, usually, of three nets set at the surface during the night. The average catch per set was 146.9 pounds, but varied between 15.1 pounds and 502.8 pounds. The largest catch of striped bass was taken on May 22, 1957 when two nets caught 148 striped bass weighing 326.3 pounds. This catch was made offshore in Lake Moultrie in water which was 40 feet deep.

The most efficient net by a considerable margin was the 3½" net. This net averaged 33.6 pounds of striped bass per set as compared with 14.5 pounds per set for the 3" net, and 11.3 pounds per set for the 2½" net. The maximum catch for the 3½" net was 116 striped bass weighing 236.6 pounds taken in a

TABLE VII

GILL NET ANALYSIS—JUNE 5, 1956 THROUGH AUGUST 6, 1957

	Reservoir	*Lake Moultrie*	*Lake Marion*
Total Catch	5,730.4	5,049.4	681.0
Gamefish	3,486.7 (60.9%)	3,384.0 (67.0%)	102.7 (15.1%)
Non-Game Fish	2,243.7 (39.1%)	1,665.4 (33.0%)	578.3 (84.9%)
Number of Sets	39	36	3
Number of Nets	119	110	9
Average Catch Per Set	146.9	140.3	227.0
Average Catch Per Net	48.2	45.9	75.7
Total Hours Set	561	514	47
Average Hours Set	14.4	14.3	15.7
Average Depth	28.0	27.8	30.0
Pounds of Striped Bass	3,445.9 (98.8%)	3,346.5 (98.9%)	99.4 (96.8%)
Pounds Other Game Fish	40.8 (1.2%)	37.5 (1.1%)	3.3 (3.2%)
Lbs. of Striped Bass Per Net	29.0	30.4	11.0
Lbs. of Striped Bass Per Hour	6.1	6.5	2.1
No. of Striped Bass Per Net	13.5	14.3	4.2
Avg. Weight of Striped Bass	2.2	2.1	2.6
Avg. Length of Striped Bass	15.8	. . .	. . .
Lbs. Non-Game Fish Per Net	18.9	15.1	64.3
Lbs. Non-Game Fish Per Hour	4.0	3.2	12.3

12-hour period. The average size of 773 striped bass taken by this net during the study was 15.7 inches.

The average catch per set for all nets was 13.5 striped bass weighing 29.0 pounds. The total catch of striped bass was 1,609 fish of which 70.4 percent were between 12 and 18 inches in length. I interpret from these data that the 1954 and 1955 year classes were very strong.

AGE AND GROWTH

The scale method was employed to age 322 striped bass taken in 1956 and 1957. The image of the scales was projected on an Eberbach projector and the direct proportion method using the body scale relationship was used to calculate the growth of the fish.

The average calculated length at the end of the first seven years arae as follows: I-8.5, II-15.7, III-19.8, IV-22.9, V-25.8, VI-28.5 and VII-30.2 inches (Table VIII). Scruggs (1955) analyzed 412 striped bass scales with very similar results except for the first two years of growth. He found striped bass to average 7.1 inches at one year, and 14.9 inches at two years of age. The greatest increment of growth occurred in the first year for the current study but in the second of the study by Scruggs.

TABLE VIII

AVERAGE CALCULATED LENGTHS AND ANNUAL LENGTH INCREMENTS IN INCHES OF STRIPED BASS FROM THE SANTEE-COOPER RESERVOIR

Age Group	*No. of Fish*	*Avg. Total Length*	*Calculated Total Length at End of Year of Life*						
			1	*2*	*3*	*4*	*5*	*6*	*7*
0	26	8.99	. . .	. . .	. . .	. . .	. . .	. . .	. . .
I	94	12.97	8.30	. . .	. . .	. . .	. . .	. . .	. . .
II	84	18.15	8.08	15.62	. . .	. . .	. . .	. . .	. . .
III	49	21.39	9.34	15.88	19.91	. . .	. . .	. . .	. . .
IV	34	23.29	7.85	15.24	18.75	21.54	. . .	. . .	. . .
V	19	26.85	8.45	15.09	19.15	22.25	24.75	. . .	. . .
VI	8	29.80	8.29	16.61	20.61	23.41	26.11	28.45	. . .
VII	8	31.23	9.10	15.85	20.93	24.09	26.41	28.54	30.24
GRAND AVG. AND TOTAL	322	. . .	8.49	15.72	19.79	22.94	25.83	28.50	30.24
INCREMENTS OF GROWTH	. . .	. . .	8.49	7.31	3.98	3.15	2.89	2.67	1.74

Raney (1952) reviewed the existing literature on age and growth of the striped bass on both coasts. He states that Merriman (1941:25) found that striped bass from New England and Long Island to be about 11 to 12 cm. (4.5 in.) long at the end of their first year. Vladykov and Wallace (1952) were of the opinion that striped bass in the Cheasapeake Bay reach an average length of 110 mm. (About 4 in.) at the end of the first year of life.

Striped bass having one annulus in the Santee-Cooper Reservoir vary greatly in length. The 94 fish in this group ranged between 2.9 inches and 13.8 inches in total length at capture. I believe this to be a reflection of the long spawning season. Scruggs (1955) took striped bass eggs in the Cooper River as early as March 16, and in the Congaree River as late as June 2. Striped bass which were spawned during the first part of the season are probably large enough to utilize mayflies in April, May and June. If so, these fish would be large enough to take the shad hatch and to remain large enough to feed upon yearling shad throughout the year. Striped bass spawned at the end of the season very probably would miss both the mayfly hatch and the shad hatch, and would remain relatively small until the following season.

The annulus appears to form around February in all size groups. Striped bass take food in every month as was demonstrated by the food habit study. Digestion undoubtedly is slow in the cold months of January and February, but I believe striped bass grow to a great or lesser degree all year.

STRIPED BASS INTRODUCTIONS

Table IX lists the location and other information incidental to the movement of South Carolina striped bass to other freshwater impoundments. Adult fish were stocked in only two instances.

In January of 1954, 293 striped bass averaging 9.6 pounds were stocked in Lake Greenwood in the piedmont of South Carolina. Since that time, three spawning seasons have passed but no reproduction has been found despite the intensive use of gill nets and minnow seines.

In February of 1956, 104 adult striped bass were stocked in Lake Hickory in North Carolina. Two spawning seasons have passed but no reproduction has been reported.

It should be noted that these introductions were not with reservoir fish. Raney and Woolcott (1954) on the basis of character counts concluded the South Carolina stock of striped bass to be an endemic race which in turn might include an upstream race which doesn't go to sea and a downstream race which at least goes to brackish water. The results of the several other introductions with reservoir striped bass will not be known for several years because immature fish were used (Table IX).

The experience gained by capturing striped bass of all sizes for transfer serve to establish the fact that this species is sensitive to handling. It appears almost intolerant to gill nets and small fish seem to be very vulnerable to fungus infection.

The example which set the precedent for successful transplantation of striped bass, however, was reported by Raney (1952). In 1879 and 1881, 435 yearling striped bass were seined in New Jersey and moved by train to the San Francisco Bay. The success of this introduction is well known. Pelgen (1955, a) estimated that the value of the striped bass sport fishing in California in 1953 was $18,000,000. This was more than his estimated value of the sport fishing for salmon and steelhead combined for the same year.

CONCLUSIONS

I believe the striped bass in the Santee-Cooper Reservoir to be landlocked, resident, very successful, a positive influence upon the ecology of the total fish population, and from the standpoint of a perpetuating phenomenon, to be worth millions of dollars and countless hours of pleasure to the people of South Carolina.

ACKNOWLEDGMENTS

I am indebted to J. C. Fuller of the South Carolina Wildlife Resources Department for his advice throughout the study and suggestions concerning the manuscript. I wish to also thank Eugene Surber for his identification of the

TABLE IX

STOCKING DATA

Location of Capture	*Date of Capture*	*Number*	*Size*	*Location of Release*	*Number*	*Comments*
Cooper River	1/10– 1/14/55	297	9.6 Lbs.	Lake Greenwood	293	Arrived in Good Condition
Santee River	2/56	104	Adult	Lake Hickory, N. C.	104	Arrived in Good Condition
Lake Marion	11/ 5–11/13/56	2,345	Fingerling	Arkansas (?)	250	2,095 Died from Fungus Infection
Lake Marion	10/17–12/ 6/56	207	Fingerling	Lake Greenwood	180	Arrived in Good Condition
Lake Moultrie	3/12– 3/26/57	58	Sub-Adult	Boyds Mill, S. C.	30	28 Died from Effects of Gill Nets
Congaree River	3/30/57	36	8"–12"	Lake Murray	36	Arrived in Good Condition
Lake Moultrie	3/20– 4/ 5/57	183	Sub-Adult	Lake Ouachita, Ark.	19	164 Died from Effects of Gill Nets
Cooper River	4/6/57	67	Sub-Adult	Lake Ouachita, Ark. and Narrows Lake, Ark.	63	Arrived in Good Condition
Lake Marion	8/26–10/ 1/57	3,325	Fingerling	Lake Greenwood	3,223	102 Died in Transit

bottom organisms. The assistance of the late Roland Morris, Oscar M. Dennis and Edward Wrenn in the field work was invaluable. The secretarial help of Mabel Thomas is gratefully acknowledged.

LITERATURE CITED

Merriman, Daniel. 1941. Studies on the Striped Bass (*Roccus saxatilis*) of the Atlantic Coast. Fish. Bull. U. S. Fish and Wildlife Service No. 50:1-77.

Pelgen, David E. 1955. Economic Value of Striped Bass, Salmon and Steelhead Sport Fishing in California. California Fish and Game, Vol. 41, Number 1, pp. 5-17.

Raney, E. C. 1952. The Life History of the Striped Bass (*Roccus saxatilis*) (Walbaum). Bull. Bingham Oceangr. coll., 14(1):5-97.

———— and William S. Woolcott. 1954. Racial Status of the Striped Bass (*Roccus saxatilis*), (Walbaum), in the Southeastern United States. Eighth Annual Conference of the Southeastern Assn. of Game and Fish Commissioners, New Orleans, Nov. 1-3, 1954.

Scruggs, G. D., Jr. and J. C. Fuller, Jr. 1954. Indications of a Freshwater Population of Striped Bass, *Roccus saxatilis* (Walbaum) in Santee-Cooper Reservoirs. Proceedings of the Southeastern Assn. of Game and Fish Commissioners, New Orleans, La., Nov. 1-3, 1954, pp. 64-68.

————. 1955. Reproduction of Resident Striped Bass in Santee-Cooper Reservoir, South Carolina. Trans. Am. Fish. Soc. Vol. 85, (1955) pp. 144-159.

Vladykov, V. D. and D. H. Wallace. 1952. Studies of Striped Bass, *Roccus saxatilis* (Walbaum) with Special Reference to the Cheasapeake Bay Region during 1936-1938. Bull. Bingham oceangr. Coll., 14(1):132-177.

THE STATUS OF STRIPED BASS (Roccus saxatilis) (Walbaum) IN NORTH CAROLINA WATERS

By ARTHUR W. DICKSON

Fisheries Investigator, North Carolina Wildlife Resources Commission

Unlike the striped bass of most of the northern Atlantic coast, the fish of the North Carolina waters seem to maintain a separate and distinct population which tend to remain in more or less inland waters. According to Raney (private correspondence) there are no morphological characteristics which would indicate a separate race of fish. All of the tagging studies carried out thus far indicate that there is very little migration of fish into and out of the brackish water sounds and rivers into the Atlantic. Observations show that the largest concentrations of striped bass are located in the Albemarle Sound area in the northeast portion of the state. Fish in these waters normally spend the summer months in the open water of the larger sounds and move into the estuarine rivers and streams during the late fall. Wintering usually takes place in the deeper holes in the rivers.

Both commercial and sports fishermen take advantage of this wintering concentration. Netters take large numbers of fish during the fall months when the fish are moving into the rivers. The fish are very susceptible to angling when they are concentrated in the rivers. There seem to be selected areas where the fish prefer to winter. Experienced fishermen know where these holes are located and annually remove large numbers of fish from the same areas. Trolling spoons and similar lures usually produce the best catches. Low temperatures seem to have little effect on the catchability of the fish with catches being recorded throughout the winter months.

In the spring the striped bass move out of the rivers into the sounds. In the Albemarle Sound area, most of the fish move toward the Roanoke River which flows into the western section of the sound. Some ten rivers empty into the sound but the Roanoke is the only one that carries a perceptible current. It is most probable that this current provides an attraction for the fish that are preparing to spawn. After ascending the river for a distance of about 135 miles