# RESULTS OF STRIPED BASS (Roccus saxatilis) INTRODUCTIONS INTO FRESHWATER IMPOUNDMENTS

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## INTRODUCTION

The recent interest in introductions of the striped bass, *Roccus saxatilis* (Walbaum) into Southern impoundments is undoubtedly due to the remarkable growth of a striped bass sport fishery in Lakes Moultrie and Marion. These artificial impoundments were created on the Santee-Cooper Rivers in South Carolina adjoining the normal estuarine or brackish water habitat of the species. The lakes were formed when the Santee River flow was diverted into the Cooper River system by construction of a dam across Santee River, a 7.5-mile diversion canal leading into Cooper River, and a second dam across Cooper River. This second dam (Pinopolis Dam) created Lakes Moultrie and Marion, and a surging stream, very attractive to striped bass, in the tidewater area below.

The Santee River contained striped bass at the time of impoundment, or adult fish were passing through the locks when the writer first visited this area about fifteen years ago. A few large "rocks" were caught in the new impoundments, particularly Pinopolis Pool (Lake Moultrie) shortly after these reservoirs were filled.

Scruggs and Fuller (1954) presented evidence to show that striped bass spawned successfully in the Congaree and Wateree Rivers and the Diversion canal (freshwater) above the Santee-Cooper dams and that a large population of the species was present throughout the year, whereas the concentration in the Tailrace Canal below Pinopolis Dam seemed to migrate on a seasonal basis.

Suspecting that striped bass moved through the lock of Pinopolis Dam, they fished a trammel net in the lock 12 times between April, 1954, and August, 1954, but they caught only five striped bass. However, they tagged 545 adult striped bass in the Tailrace below Pinopolis dam from which they received nine returns. Of these, two (22%) were captured above the dam in Lake Moultrie. They recognized that some recruitment of fish from Cooper River to the reservoir population was taking place. This fact has been further substantiated by more recent observations under South Carolina's D J Project F-1-R, of which Robert Stevens is now the Project Leader. A total of 606 striped bass were tagged by project personnel. In spite of infrequent operation of the navigation lock in Pinopolis dam, 14.3% of striped bass recoveries of marked fish are from above the dam. The occurrence of Glut Herring, Alewife, Mullet, Needlefish, Menhaden, and American Shad in the Santee-Cooper reservoirs noted by Stevens indicates at least some connection of the fish populations of these reservoirs with salt or brackish waters. Subsequent studies will undoubtedly show how important this connection may be. In spite of decreased lock operation, and increasing fishing pressure, the sport fishery for striped bass in these reservoirs continues to grow.

Raney and Woolcott (1954) on the basis of total soft ray counts as a racial character index concluded that within the Santee-Cooper River System, there seemed to be an indication of two different populations. They tentatively concluded that the South Carolina stock of striped bass is an endemic race which in turn is differentiated into an upstream form which may not go to sea and a downstream form which at least goes down to brackish water. They were certain that little interchange occurred between the South Carolina stock and that of Albemarle Sound, N. C. and the St. Johns River, Florida.

Rounsefel and Everhart (1953) place the striped bass in the category of estuarine fishes which are quite tolerant of changes in salinity and temperature, living typically in estuaries where the water may vary from fairly salt to nearly fresh. They point out that the white perch (*Morone americana*) is another estuarine species, living close to shore in the estuaries and spawning in fresh or slightly brackish water. This species has been "landlocked" in a few locations.

Rathjen and Miller recently studied the striped bass in the Hudson River, New Rork State. They found the principal spawning area to be between Ionia Island and Dunning Point. These points are 24.1 miles and 35.6 miles above Yonkers. Ninety percent of the eggs they collected were taken in this 11½ mile area where the salinity was 1,000 parts per million, or less. According to Raney and Woolcott (1954), there are two races of striped bass in the Hudson River.

Raney, Tresselt, *et al.* (1952) in studying the spawning areas of striped bass in the Chesapeake Bay area found that most of the spawning activity occurred in tributary streams within the first 25 miles of freshwater.

Before evaluating the success of introducing striped bass into impoundments, some note should be made of the age at which males and females mature. Merriman (1941) observed that only 25% of females are mature as they are becoming four years of age, 75% are mature as they reach five years, and 95% at six years. On the other hand, a large percentage of males are mature at two years, and close to 100% are mature as they become three years of age.

Another important consideration in regard to reproduction is the fact that the eggs of the species are semibuoyant. Spawning activity occurs near the water surface in usually fairly fast and turbulent waters in rivers. The eggs are transported in these waters for two or three days until they hatch. Hatching occurs in 70-74 hours at 58-60 degrees F., and in less time at higher temperatures, but during this period they must be kept in suspension.

## RESULTS OF INTRODUCTIONS

In January, 1955, South Carolina introduced 297 adult striped bass ranging in weight from 2-23 pounds (average weight 9.6 pounds) in Lake Greenwood, a reservoir on the Saluda River. In spite of intensive seining efforts during 1956 and 1957, no young of the species have been collected, and it has been concluded that the introduction was unsuccessful.

These adults were collected below the Pinopolis Dam on the Cooper River and were not obtained from the population which has done so remarkably well in Lakes Moultrie and Marion.

In November, 1956, South Carolina stocked 207 young-of-the-year striped bass from Lake Marion into Lake Murray, and they followed this with the stocking of 36 additional fish 8 to 12 inches in length on April 30, 1957, taken from the Congaree River near Columbia. It will be several years before these stockings can be evaluated.

In the late summer of 1952, and spring of 1953, on Kent Island, Queen Anne County, Maryland, near Graysonville, Mr. H. A. Kimball introduced both adult and fingerling striped bass into a 4-acre gravel pit pond that had already been stocked with largemouth bass and bluegills. Edwin Barry of the Maryland Division of Game and Inland Fisheries, considered this release of 4- to 8 inch striped bass an outstanding success. These fish, as well as the largemouth bass, were fed large quantities of brackish water minnows. Mr. Kimball estimates that he now has about 50 four- to six-pound striped bass, which with the bass, are pets in his pond. He obtained poor survival in stocking large fish in this pond. According to Kimball, the fish he reared to four pound plus size spawned last year, but this has not been verified by Maryland biologists to date.

Maryland stocked 12 adult fish of a total weight of 123 pounds in Conowingo Reservoir in Cecil County, on May 20, 1955, but there is no record to date of successful spawning. This planting of adult fish was followed by the stocking of larger numbers of smaller fish in 1956.

Deep Creek Lake, Maryland, has been stocked since October, 1956, with a total of 829 striped bass weighing a total of 465 pounds. It will be three years or more before the results of these plants can be evaluated.

J. H. Cornell, of North Carolina, reports that they tried the introduction of striped bass fry into two "cleaned" farm ponds, one with an area of one acre and the second with an area of seven acres. In both cases fair tributary streams entered the ponds. In both cases fry developed into adults, but there was no evidence of successful reproduction.

North Carolina stocked one million fry per year for three successive years in Mattamuskeet Lake. In subsequent years, a very few of the original stock were caught, but there was no evidence of successful reproduction.

Hickory Reservoir and Lookout Shoals Reservoir on the Upper Catawba River in North Carolina were stocked two successive years with one million fry each, but there has been no evidence of survival in these waters. Adults obtained from commercial netters at the mouth of the Roanoke River were next stocked in both of these reservoirs. In addition, some North Carolina sportsmen secured adults from the Santee River below Lake Marion, South Carolina, and stocked them in these waters. This introduction prior to the 1956 spawning season, as well as those preceding it, have apparently been unsuccessful, for no evidence of reproduction has been found to date.

In a letter received from J. H. Cornell on June 7, 1957, he stated, "In consideration of the idea that suitable spawning habitat may be some unknown water quality factor in addition to the apparent physical requirements, we decided to try Kerr Reservoir. This is located on the Roanoke River some miles above the most important North Carolina spawning grounds of the species. For three successive years, ending in 1955, one million fry were stocked each year in Kerr Reservoir . . ." "In the summer of 1956 we had reports of several young-of-the-year striped bass being caught. One of these reports was verified by our biologists. Since there was no stocking in 1956, any young would necessarily have been offspring of the original introduction."

On July 16, 1957, John E. King, Oklahoma Game and Fish Department, in replying to a letter inquiring about the success of introducing striped bass in that state, noted that in 1955 between 4,000 and 4,500 striped bass from the State of California were liberated in Oklahoma. Two thousand were placed in Lake Murray in Carter County in Southern Oklahoma, and another 2,000 were liberated in Great Salt Plains Reservoir in Alfalfa County in North central Oklahoma. To date, two fairly reliable catches have been reported from Lake Murray, but no returns have been reported from the Great Salt Plains. In this lake of 10,000 to 13,000 acres, the salinity fluctuates from about 1,000 p.p.m. to as much as 16,000 p.p.m. If these were young-of-the-year fish when stocked, sufficient time has not yet elapsed for females to have reached maturity.

In 1929 the California Department of Fish and Game transplanted striped bass from the San Joaquin River to the Salton Sea. This is a 340 square mile body of salt water created in the southern California desert by a two-year diversion of the Colorado River which began in 1905. None of the striped bass were recovered. In 1930, more were brought from San Francisco Bay, but this planting was also a failure according to John O'Reilly (1957).

New Jersey has spent considerable time investigating any possibility that striped bass spawned in fresh water in New Jersey, according to Roland F. Smith, Senior Fisheries Biologist for the New Jersey Department of Conservation and Economic Development. In a recent letter, he stated, "We feel quite certain that there is no reproduction of striped bass in our lakes or ponds but there is limited spawning in some of our coastal rivers."

He described New Jersey's efforts in stocking the species in freshwater impoundments as follows: "In 1951 we stocked several small farm fish ponds with striped bass and a three-hundred acre reservoir. They did not survive in the farm ponds but limited survival was indicated in the reservoir and we have had several reports of striped bass being caught the next few years. None of the other ponds we stocked have indicated any survival nor has it been possible to check these waters thoroughly to find out whether or not any survival has taken place. We do have one large impoundment in south Jersey near the city of Millville on the Maurice River called Union Lake where fishermen have caught striped bass below the dam and tossed them into the impoundment. Every now and then a striper is taken from this impoundment. In October of 1952, a Mrs. Beebee caught a striper from this impoundment that was 40 inches long; 21 inch girth, and weighed 23.5 pounds. Its age was 11 to 12 years. I might add that white perch do very well in this lake but many intensive checks for striper reproduction have proved fruitless. . . ." "the State stocked young striped bass quite extensively throughout impoundments in the southern part of the State during the mid-thirties, but as far as we can determine few, if any, of these were ever caught. We are still continuing to stock striped bass in the hope of establishing a landlocked population."

There is evidence that some of the failures in stocking this species to date may be due to the difficulty in handling a physically sensitive species. Stevens

in South Carolina is of the opinion that adults are intolerant of handling from gill nets, and they seem to suffer from shock. Dr. William M. McLane, formerly of the Florida Game and Fresh Water Fish Commission, found striped bass in north Florida very difficult to handle. Mortality immediately after tagging was heavy. On the other hand, Merriman (1941) recorded that in 1879 and 1881, a number of yearling striped bass (435) were seined in New Jersey, taken in tanks by train across the continent and planted in San Francisco Bay, California. This planting resulted in a commercial fishery for which in 1899 the net catch alone was 1,234,000 pounds.

## DISCUSSION AND CONCLUSIONS

A great fishery for striped bass (*Roccus saxatilis*) developed in the strictly fresh waters of Lakes Moultrie and Marion in South Carolina when Santee River was dammed and the main flow diverted into the Cooper River. This may have been due partly to the creation of better natural spawning areas for the species. The species has semi-buoyant eggs which hatch in 70-74 hours at 58-60 degrees F., but during this period they must be kept in suspension. The construction of Pinopolis Dam with its huge water releases into Cooper River, a somewhat smaller stream, may have provided the necessary turbulence to keep the eggs in suspension for a favorable period. Adult striped bass soon congregated at Pinopolis Dam, and South Carolina's tagging data and observations on other normally marine species showed that there was some recruitment, apparently through the locks, to the reservoirs above. The importance of this is unknown but it could furnish a spawning population, and however small, should not be ignored.

Like the white perch, another estuarine species, the Santee-Cooper race apparently adapted itself to freshwater conditions above the dam where they may have spawned successfully in lotic situations.

Attempts at introductions into other freshwater impoundments have been unsuccessful for the most part. The criterion for success is the production of mature fish which ultimately produces enough young fish to perpetuate a breeding stock. Only one instance of this has been produced to date. This occurred in Kerr Reservoir (North Carolina-Virginia), a relatively short distance above one of the famous spawning grounds of the species. Even here the evidence is meager at the moment since only one young fish produced in this reservoir has been positively identified by North Carolina biologists.

Many recent introductions have occurred so recently that they can not be evaluated.

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