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PRELIMINARY STUDIES OF CERTAIN ASPECTS OF THE LIFE HISTORY OF THE HYBRID (STRIPED BASS X WHITE BASS) IN TWO SOUTH CAROLINA RESERVOIRS

by

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ABSTRACT

From 1967 through the spring of 1970 Lakes Hartwell and Clark Hill on the upper Savannah River between Georgia and South Carolina have been stocked with the striped bass *Roccus saxatilis* (Walbaum) X white bass, *Roccus chrysops* (RaFinesque) hybrids. A total of 30,000 fingerlings and 26,120,000 fry have thus far been introduced.

Approximately 130 hybrids were captured during a one year period (1969-70) of which 87 were examined for age, growth rate, food habits and meristic characters.

The average total lengths for three year classes were 12.6, 17.2 and 20.2 inches respectively and maximum weights were 3.7 pounds and 5.9 pounds for year class one and two respectively. These lengths and weights compare favorably with findings in Tennessee, Bishop (1967) and, as in Tennessee, were greater than reported in Virginia (1969) - (Howard Kerby, personal communication).

Stomach contents of specimens examined indicated a definite preference for threadfin shad. Meristic characters as described by Bayless (1967) held up in all cases and, of the 130 hybrids observed, all but one exhibited the chain-like broken line effect.

Spawning migration is apparent in the spring when the water temperature reaches 50°F. This is just prior to white bass migration with females apparently running earlier than males.

INTRODUCTION

The desire for a large game fish that might provide a fishery and act as a biological control for gizzard shad *Dorosoma cepedianum* (LeSueur) in our large reservoirs prompted the stockings of hybrid fry and fingerlings in South Carolina. This was instigated by the rather poor survival rate of striped bass fry. It was hoped that the hybrid fry might prove more hardy and have a better chance of survival and such has been the case.

This information obtained from investigations supported in part by Dingell-Johnson funds made available through the South Carolina Wildlife Resources Department and the Bureau of Sport Fisheries and Wildlife, Project No. F-15.

Even though, as in other species, the rate of fry survival is much less than fingerling survival, the fry stocked in Clark Hill in 1967 have established a significant fishery. Other fry stockings in both lakes appear to be thriving as well.

Hybrids up to 5.9 pounds have been taken by the author and unconfirmed fishermen reports indicate fish of over 6.0 pounds are being caught in both lakes. Using the premise that enough of a specific species are being caught by fishermen to warrant their being sought after as an individual species and not incidentally taken while seeking other fishes as a criterion for the establishment of a fishery, my observations indicate such a fishery has been established in these lakes.

Life history studies, survival, fishery establishment and other observations of the hybrid have not heretofore been reported in South Carolina and are contained herein. These data were taken incidental to other currently conducted studies and were compiled from a total of 87 fish taken over a period of one year.

Indications of food habits, age-growth, spawning behavior, survival and the continued validity of previously described meristic characters in the adult fish are included.

DESCRIPTION OF STUDY AREA

Hartwell Reservoir is located on the Savannah River between Georgia and South Carolina and extends in two main branches up the Tugaloo and Seneca Rivers. The dam is situated about 305 miles above the mouth of the Savannah River. It is a deep (170 feet), clear, oligotrophic lake with 962 miles of shore line and covers 55,950 acres. The multi-purpose dam was completed in 1963 for flood control, hydro-electric power, recreation and the regulation of river flow in the interest of navigation below Augusta, Georgia.

Clark Hill Dam, located 67 miles downstream from Hartwell Dam, is another multi-purpose structure completed in 1954. This is also a deep (150 feet) lake with 1200 miles of shore line and an area of 70,000 surface acres.

MATERIALS AND METHODS

Fish were collected from gill nets of various mesh sizes in conjunction with and incidental to other studies such as survival and depth distribution.

Scales were taken in the manner prescribed by Lagler (1952) and stored in regular scale envelopes with pertinent data recorded on same. Total length to the nearest one-tenth inch as well as weight to the nearest one-tenth pound were taken. Scales were read on an Eberback scale projector and length at annulus calculated assuming a straight line relation between scale length and total length.

Stomach contents were examined, identified and recorded in the field.

RESULTS AND DISCUSSION

The South Carolina Wildlife Resources Department has stocked, since 1967, some 17,660,000 hybrid fry and 5,000 fingerlings in Clark Hill Reservoir. At the end of two years, fish weighing up to 3.5 pounds were taken and at the end of three years, up to 5.8 pounds.

Lake Hartwell received 25,000 fingerlings and 500,000 fry in 1967 and 8,460,000 fry through the spring of 1970. Hybrids up to 5.9 pounds have been taken in this lake.

Meristic Characters:

Some confusion has arisen concerning identification of the hybrid among area fishermen. As striped bass are rarely taken in these lakes, the most common confusion is caused by the white bass. Within the past year a rash of apparent (to the fishermen) world record white bass have been caught in each of the lakes - all of which were large hybrids of the 1967 year class. Publicity and more exposure of the hybrid, to the public, should shortly alleviate this problem. Recently the South Carolina Wildlife Resources Department registered a five pound fourteen ounce hybrid as a state record for this species, thereby giving recognition as a game fish.

The chain-like or broken line effect, although not a sure means of identification, is usually present either on one or both sides of the fish. It is the one most easily made by the average fisherman and has been present on all except one adult fish examined. This includes some fifty fish that were released uninjured besides the ones taken for this study.

The description of meristic characters made for juvenile fish Bayless (1967) are more positive means of identification and have held up in all cases involving adult fish. The characters most reliable and often used are the scale count above the lateral line and the length ratio of the second anal spine to the head.

Spawning Behavior:

While no studies of spawning behavior as such were made, observations made during the work on walleye *Stizostedion vitreum* (Mitchill) indicate that hybrids do make a spawning run. This seemingly is earlier than the white bass and migration is apparent when the water temperature reaches 50° F. They do school according to sex, and the fish taken earliest in these lakes have been mostly mature females. These fish were taken the latter part of February through March, and the males may have moved up into the spawning grounds earlier. The males do stay in the spawning area later, and when the surface water temperature reached 54°-56° F only males were taken on the spawning grounds.

Food Habits:

Food habit data were collected year round, and by far the most important forage was Clupeidae with threadfin shad *Dorosoma petenense* (Gunther) utilized much more than gizzard shad. Of the 87 hybrids examined for stomach contents, 37 specimens (42.5 per cent) contained food. Of the 37 stomachs containing food, 30 specimens (81 percent) contained Clupeidae. Eighty-six percent of all food items were Clupeidae with some stomachs containing as many as 24 one and two inch threadfin shad. See Tables II and III.

It is interesting to note that in Clark Hill yellow perch *Perca flavescens* (Mitchill) were eaten in late winter and early spring at the beginning of the spawning run. This is probably due to their availability and lack of other forage at that season. Also one 5.5 pound female taken during the spring of 1970 in Lake Hartwell had eaten, besides two threadfin shad, one largemouth bass *Micropterus salmoides* (Lacepede) eight inches long. This, with the other food items listed, would indicate their versatility concerning food habits although showing a definite preference for threadfin shad. At present, due to the size of hybrids in these lakes, few gizzard shad larger than four inches are consumed but with continued growth, this food preference may extend to include more and larger individuals of this species.

Another item of interest is that of 27 male hybrids taken during and immediately after the spawning run in Lake Hartwell only four (14.8 percent) contained food items, while three out of five (60 percent) of the females had been actively feeding during this time.

TABLE I
FRY STOCKING - HYBRIDS

<u>Year</u>	<u>Hartwell</u>	<u>Clark Hill</u>
1967	500,000	3,260,000
1968	500,000	2,910,000
1969	2,360,000	6,970,000
1970	5,100,000	4,520,000
Total	8,460,000	17,660,000

FINGERLING STOCKING - HYBRIDS

<u>Year</u>	<u>Hartwell</u>	<u>Clark Hill</u>
1967	25,000	—
1968	—	5,000
Total	25,000	5,000

TABLE II
 FOOD HABITS: PERCENT EACH ITEM REPRESENTS OF TOTAL
 FOOD ITEMS FOUND IN 37 HYBRID STOMACHS

<u>Food Item</u>	<u>Percent</u>
Threadfin shad	84.4
Gizzard shad	2.5
Yellow perch	2.5
Unidentified fish	7.2
Insects	3.0
Largemouth bass	0.2
<i>Lepomis sp.</i>	0.2
Total	100.0

TABLE III
 FOOD HABITS — FREQUENCY OF OCCURRENCE: FOOD ITEMS
 FOUND IN 37 HYBRID STOMACHS

<u>Food Item</u>	<u>Frequency</u>	<u>Percent</u>
Threadfin shad	23	62.1
Gizzard shad	7	18.9
Yellow perch	4	10.8
Unidentified fish	10	27.0
Insects	2	5.4
Largemouth bass	1	2.7
<i>Lepomis sp.</i>	1	2.7

These data were collected from fish ranging in length from 16.7 to 21.6 inches weighing from 2.4 to 5.9 pounds and are inclusive of both lakes. With both lakes being on the same river system and containing like forage species, food habits should be basically the same. Also, combined, they represent a year round study where individually they would not, considering the paucity of specimens caught containing food.

Age-Growth:

Scales of 33 fish from Clark Hill were read of which none were from year class 0, 17 from year class I and 16 were from year class II, the oldest in the lake. Table IV depicts the average calculated lengths at each annulus as well as the average annual increment of growth and the average length of each year class at capture.

At the first annulus, fish of year class I had an average calculated length of 9.9 inches with a range of from 3.6 inches to 14.6 inches. Year class II fish ranged from 14.8 inches to 19.0 inches for an average calculated length of 17.8 inches. The grand average annual increment of growth was 9.9 inches during the first year and 7.9 during the second year in Clark Hill Reservoir.

The age-growth history of 54 hybrids from Lake Hartwell is depicted in Table V. One 0 year class fish 12.6 inches in length was captured in March which in this area is about the time annuli are formed. Although seemingly large considering the average of 6.9 inches, it is well within the range of 3.6 inches to 14.9 inches at annulus I development for year class I fish. Year class II fish ranged in length from 11.8 to 18.8 inches for an average of 16.1 inches in Lake Hartwell.

The grand average annual increment of growth, although less for the first year in Lake Hartwell exceeds Clark Hill during the second year and the average length of three year old (year class II) fish at time of capture is within one-tenth inch of each other. The average total length of year class I fish in Lake Hartwell is 14.6 inches at time of capture which is some three inches less than 17.6 inches average for Clark Hill. This, however, may be biased due to the fact of only three of these fish being taken in Lake Hartwell as compared to 17 from Clark Hill.

The age-growth history of all 87 hybrids combining both lakes is shown in Table VI. The average annual increment of growth is very good with fish at three years of age averaging 20.2 inches and weighing up to 5.9 pounds.

Fish of year class I in Clark Hill had a faster growth rate than in Lake Hartwell, but as noted in the tables, this difference was nullified during the following growing season.

The following, Table VII, is a simple comparison of the length and weight ranges of known age hybrids between the two lakes. Fish from 12 to 35 months of age were used which includes all year classes present in these lakes.

Hybrids in these two lakes, although somewhat smaller at the earlier ages than reported in Tennessee, Bishop (1967), became comparable later. The weight range of 40 hybrids from Cherokee Lake, Tennessee, 23 months old was (2.5-4.8 lbs.) and 26 hybrids 27 months old was (2.8-5.2 lbs.). This is comparable to the 20 hybrids 23 months old and 25 hybrids 30 months of age taken in these lakes and both are larger than those taken in Virginia. The weight range of 99 Rappahannock River hybrids (Howard Kerby, personal communication) 18 to 22 months old was (0.40-1.35 lbs.) and eight fish 30 to 31 months old weighed (2.15-3.41 lbs.). The paucity of 23 month old specimens in Lake Hartwell may account for the difference between it and Clark Hill. The older specimens, however, tend to equate.

Conclusions:

Present indications are that the hybrid will be a very desirable addition to our South Carolina reservoirs. With continued growth, it should soon be able

to fulfill its intended purpose of providing a large game fish and act as a biological control for gizzard shad. In fact, the gizzard shad by its very presence may be able to provide us with a bonus pelagic fishery through the hybrid.

No information concerning natural reproduction or fecundity is available presently for these two lakes but such studies are included in future management plans.

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TABLE IV
AGE-GROWTH HISTORY OF 33 HYBRIDS FROM CLARK HILL
RESERVOIR - EXPRESSED AS AVERAGE CALCULATED
LENGTHS (INCHES) ATTAINED BY EACH YEAR CLASS

Year	Average calculated lengths at each annulus						Average Total Length at Capture
	Class	0 C.L.	No.	1 C.L.	No.	2 C.L.	
1969	0	0					
1968	I	9.9	33				17.6
1967	II				17.8	16	20.3
		Range (3.6-14.6) (14.8-19.0)					(15.6-21.0)
Grand average annual incre- ment of growth			9.9		7.9		
Total number of fish			33		16		

TABLE V
AGE-GROWTH HISTORY OF 54 HYBRIDS FROM LAKE
HARTWELL - EXPRESSED AS AVERAGE CALCULATED
LENGTHS (INCHES) ATTAINED BY YEAR CLASS

Year	Average calculated lengths at each annulus				Average Total Length at Capture
	Class	0 C.L. No.	1 C.L. No.	2 C.L. No.	
1969	0		12.6 1*		12.6
1968	I		6.9 53		14.6
1967	II		16.1 50	20.2	
		Range	(3.6-14.9)	(11.8-18.8)	(12.6-21.7)
Grand average annual increment growth					
			6.9	9.2	
Total number of fish					
			54	50	

*Only one 0 year class found, appears large but was taken in March at time of annulus formation and is within the range for year class I fish.

TABLE VI
AGE-GROWTH HISTORY OF 87 HYBRIDS FROM TWO SOUTH
CAROLINA LAKES—EXPRESSED AS AVERAGE CALCULATED
LENGTHS (INCHES) ATTAINED BY EACH YEAR CLASS

Year	Average calculated lengths at each annulus				Average Total Length at Capture
	Class	0 C.L. No.	1 C.L. No.	2 C.L. No.	
1969	0		12.6 1*		12.6
1968	I		8.1 86		17.2
1967	II			16.5 66	20.2
		Range	(3.6-14.9)	(11.8-19.0)	(12.6-21.7)
Grand average annual increment of growth					
			8.1	8.4	
Total number of fish					
			87	66	

*Only one 0 year class found, appears large but was taken in March at time of annulus formation and is within the range for year class I fish.

TABLE VII
 LENGTH AND WEIGHT RANGES OF KNOWN AGE HYBIRDS
 IN LAKES HARTWELL AND CLARK HILL

HARTWELL

Age	No. fish	Total Length Range	Weight Range
12 months	1	12.6-	1.0-
23 months	3	13.6-15.9	1.4-2.1
30 months	20	18.0-21.6	3.1-5.7
35 months	30	18.7-21.7	3.1-5.9

CLARK HILL

Age	No. Fish	Total Length Range	Weight Range
23 months	17	15.6-19.1	2.0-3.7
30 months	5	19.7-21.0	3.6-5.0
35 months	11	19.3-21.0	4.1-5.9

**TOLERANCE OF STRIPED BASS,
 MORONE SAXATILIS (WALBAUM), LARVAE
 AND FINGERLINGS TO NINE CHEMICALS USED
 IN POND CULTURE¹**

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ABSTRACT

Bioassays were conducted on nine chemicals using one week old larvae and one month old fingerling striped bass, *Morone saxatilis* (Walbaum), as the test species. The chemicals tested were potassium permanganate, potassium dichromate, copper sulfate, Dylox, ethyl and methyl parathion, Karmex, butyl ester of 2, 4-D and HTH. Tests were conducted at 70° Fahrenheit in glass containers using reconstituted water as the diluent. The fingerlings were much more tolerant to Karmex, potassium dichromate, potassium permanganate and butyl ester of 2, 4-D than were the larvae. A higher concentration of ethyl parathion, methyl parathion, HTH, copper sulfate or Dylox was required to kill the larvae than the fingerlings.

INTRODUCTION

A successful striped bass, *Morone saxatilis* (Walbaum), program in Louisiana is dependent upon rearing adequate numbers of fingerlings for stocking.

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