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PRELIMINARY FECUNDITY STUDIES OF THE HYBRID (STRIPED BASS X WHITE BASS) IN TWO SOUTH CAROLINA RESERVOIRS *

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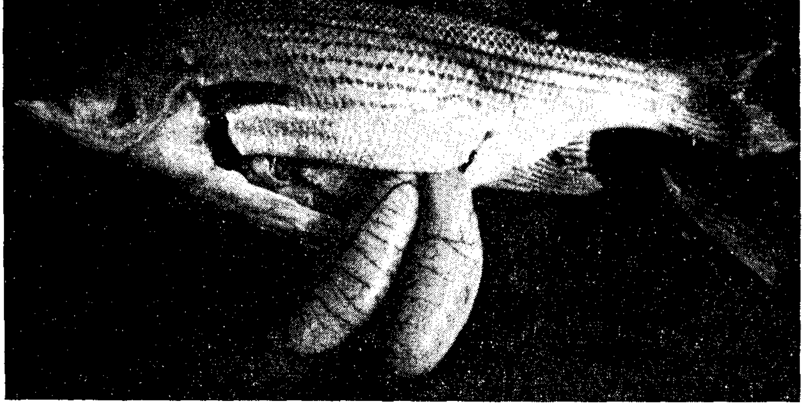

ABSTRACT

The ovaries of 28 mature female hybrids, striped bass *Morone saxatilis* (Walbaum) X white bass *Morone chrysops* (Rafinesque) from Lakes Hartwell and Clark Hill were utilized in determining fecundity in this oviparous species.

These data were collected from all year classes present that were sexually mature, which included year classes I, II, and III. No females of year class O were captured during these studies.

Many hybrid males one year of age were caught at the spawning grounds and specimens as small as 269 mm in total length appeared to be sexually mature.

Female hybrids as small as 409 mm in total length and some weighing as little as 917 grams were found to be sexually mature. Mean ova production although increasing in direct proportion to age, total length and body weight remained rather constant as to average number of eggs per pound of body weight.

Total ova production ranged from a minimum of 185,000 in a 2.9 pound two year old fish to a maximum of 1,152,000 in a 6.3 pound four

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year old specimen. Mean number of eggs per pound of body weight from all 28 hybrids was 160,000.

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 stocking of hybrids in South Carolina.

As with any new species, certain basic research must be conducted regarding the life history of the hybrid. Such data, as fecundity, were therefore deemed desirable in evaluating the degree of success the hybrid might attain in establishing a self-sustaining fishery by natural reproduction.

Objectives of this study were to obtain as much information as possible concerning the number of eggs produced and some observations regarding the care or nurture afforded the eggs, and to determine the age and size at which female hybrids reach sexual maturity.

In addition, the success and feasibility of hybrid stocking much be evaluated not only from an economic standpoint, but as to the effects this new species will have on the existing fish population. Fecundity data will be useful regarding the potential of the hybrid concerning reproductive capacity helping, therefore, to determine if such hybrid stocking is feasible and should be initiated in other reservoirs of the state.

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 deep (170 feet), clear, oligotrophic lake with 962 miles of shoreline 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 shoreline and an area of 70,000 surface acres.

MATERIALS AND METHODS

Specimens were collected for fecundity studies by gill netting and an electro-fishing unit. The total length of each fish was taken, as well as the weight to the nearest gram. Ovaries were removed and preserved in 10% formalin for computation at a later date. Scales were taken in the manner prescribed by Lagler (1952) and read on an Eberbach scale projector in order to ascertain the age of each fish.

The number of eggs from 28 fully mature hybrids were estimated by the volumetric method of water displacement. The counting of three one milliliter samples had been envisioned until the small size of the eggs was discovered. These ranged from just over 2,000 to 8,800 per milliliter.

Three ovary samples were taken—posterior, anterior and central—which, with proportionate quantities of ovarian tissue, amounted to one milliliter. The eggs were then counted under 10X magnification. Total volume of each ovary was then obtained and the total number of eggs per fish calculated by direct proportion equation.

Determination of sexual maturity in the hybrid was by visual inspection and specimens were designated to be sexually mature if the gonads had visibly deferentiated into mature ovaries or testes.

RESULTS AND DISCUSSION

Hybrid males appeared to be mature at one year of age and many were in evidence at the spawning areas. Specimens as small as 269 mm in total length were mature and either running ripe or could have milt expressed manually.

Table I depicts hybrid fecundity data from both lakes combined as is, in fact, all data presented. With both large reservoirs being on the same river system having similar drainage areas, population makeup, food supply and geographical location, it was considered that fecundity of the hybrid would be substantially the same. Also, by the utilization of both lakes, a larger more statistically valid sample was available.

TABLE I. Hybrid Fecundity Data—Lakes Hartwell and Clark Hill, March - April, 1971

Age in Years	Number of Fish	Mean length (mm) and range	Mean weight (g) and range	Mean egg production and range (X1000)	Eggs per lb. (454 g) of body weight (X1000)
2	12	458 (409-495)	1341 (917-1603)	467 (185-621)	159
3	10	516 (475-546)	1897 (1437-2216)	670 (353-941	161
4	6	583 (556-605)	2807 (2463-3087)	998 (897-1152)	164

Although the data contained in the tables were of necessity taken from mature, but more or less green ovaries, valuable information relating to size at sexual maturity, mean egg production, and ova per pound of body weight was obtained.

No year-class O female hybrids were collected during the spawning season, and it is assumed that females one year old had not reached sexual maturity. The smallest two year old female was 409 mm in length and weighed 1,020 grams. She was mature and contained an estimated 345,958 eggs. The lightest specimen weighed 917 grams and was 432 mm long, containing some 264,000 eggs.

It appears from analyzing these data that, although the mean ova production increases in true proportion to size and age, the mean ova production per pound of body weight remains fairly constant.

Averages by weight groups (Table II) are provided in case of the desire for future estimation of production of an individual hybrid by weighing the captured specimen. This would be a more readily attainable mode of field estimation than would aging the fish.

TABLE II. True and Calculated Mean Total Egg Production X1000 by Weight Groups from Lakes Hartwell and Clark Hill, March - April, 1971

	2.0–2.9		3.0–3.9		4.0–4.9		5.0–5.9		6.0–6.9
True	363		574		693		1084		954
Calculated		483		634		772		998	

True and Calculated Mean Egg Production per Pound (454g) of Body Weight X1000 by Weight Groups from Lakes Hartwell and Clark Hill, March - April, 1971

	2.0–2.9		3.0–3.9		4.0–4.9		5.0–5.9		6.0–6.9
True	148		170		159		197		147
Calculated		161		165		167		163	

Figue I is a graph which depicts both the total mean egg production (true and calculated) and production per pound of body weight by

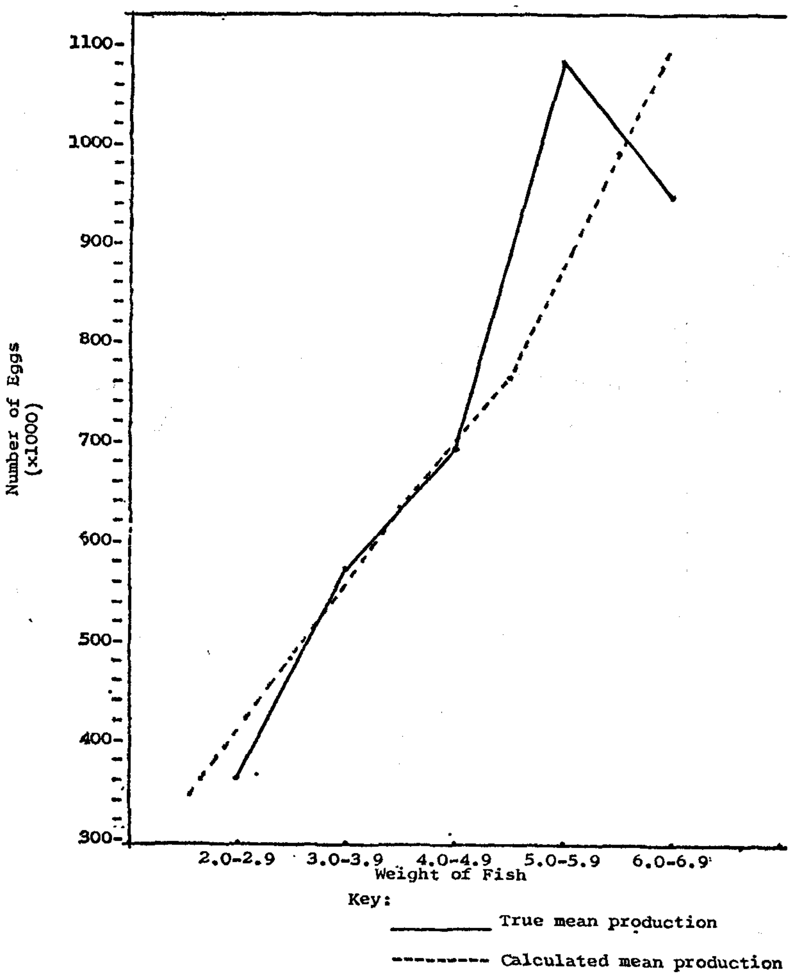

FIGURE I. Ova Production Graph by Weight Groups from Lakes Hartwell and Clark Hill, March - April, 1971

Part A. True and calculated mean total egg production

weight groups regardless of age. Part A shows the true and calculated mean total egg production for specimens in the five weight groups present. The true and calculated averages are fairly consistent until the 5.0-5.9 pound and 6.0-6.9 pound groups are reached. Here, the calculated mean appears more realistic. This is due to only two fish in the 5.0-5.9 pound group being available and only four from the 6.0-6.9 pound group. The other size groups had from six to eight specimens and should present a more statistically valid and acceptable mean.

Part B shows the true and calculated mean egg production per pound of body weight for the same weight groups. Again, the calculated mean is rather consistent and in alignment with the true mean until the two 5.0-5.9 pound fish are encountered, at which time the calculated mean seems a more realistic figure.

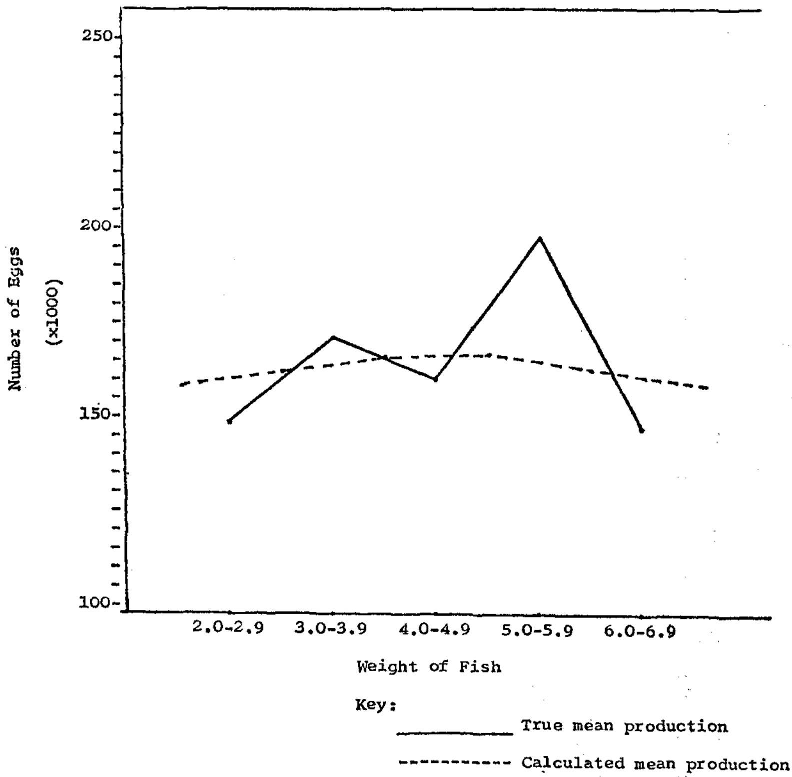

FIGURE I. Ova Production Graph by Weight Groups from Lakes Hartwell and Clark Hill, March - April, 1971

Part B. True and calculated mean egg production per pound (454 g) of body weight.

Such a small number of specimens in the 5.0-5.9 pound group is judged insufficient to base a true production prediction upon as is, in fact, the total of only 28 fish. This is, in part, the reason no prediction of future production or projected fecundity was made. Although for fish from 2.0-7.0 pounds, the use of the number of 160,000 eggs produced per pound of body weight appears supportable.

Even so, this number (160,000) varies somewhat according to the weight of the average individual as shown in Part B, Figure I. It does, however, provide a usable average.

The contradiction between the 160,000 figure and the 159-164,000 figures of eggs per pound of body weight, as shown in Table I, comes about from the use of the total weight and production of all 28 specimens, regardless of age, for the overall mean figure as opposed to the grouping by age unmindful of size and weight in the table.

The bar graph in Figure II depicts the following means within each weight group: weight, length, total egg production, and eggs per pound of body weight. This is a simple pictorial effort depicting the true mean production as the fish increases in size. Observations indicate that the hybrids do make a spawning run at about the same time as the white and striped bass. This run seems to last about four to five weeks and this year in Clark Hill Reservoir was from the last of March through the end of April. Hybrids were caught in the spawning areas (shoals

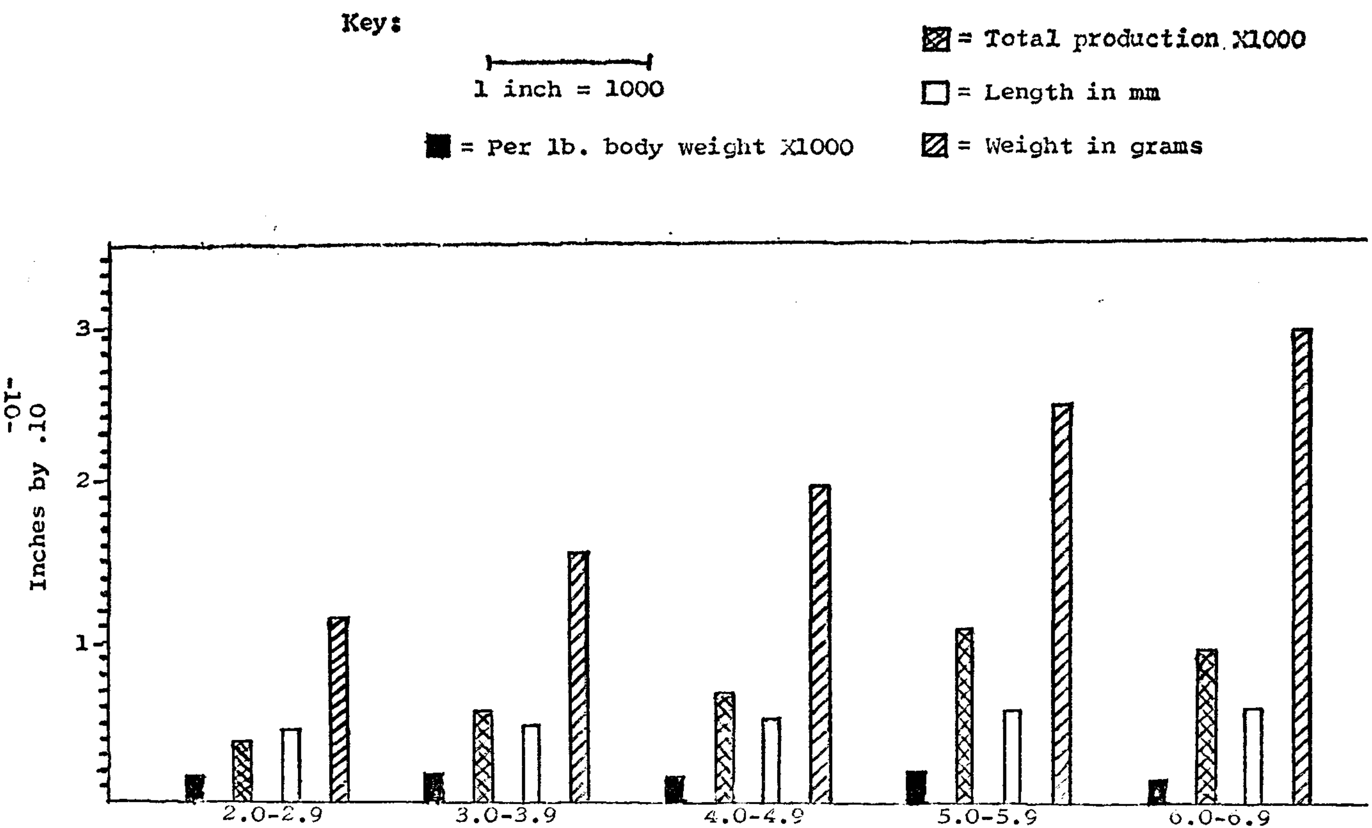

FIGURE II. Bar Graph Depicting Hybrid Fecundity from Lakes Hartwell and Clark Hill, March - April, 1971. Showing Within Each Weight Group: Mean Weight, Length, Total Egg Production, and Eggs Per Pound of Body Weight.

and shallow rocky areas as far upstream as possible in Clark Hill) when the surface water temperature ranged from 54° to 60°F.

On April 19 at the height of the spawning run, an apparent spawning act of the hybrid was observed. This was in the same area with white bass and was in clear, rocky bottom shoal water from one to three feet deep. The surface water temperature was 59°F and one large hybrid (presumed to be a female) was observed closely attented by five or six smaller fish nudging at her sides. They swam in a group and would occasionally violently break the surface and splash in much the same manner as striped bass. Since it was impossible to accurately identify all the smaller fish (presumably males) around the female hybrid, some could have been white bass. No eggs were observed. Therefore, notes concerning their adhesiveness were not taken at that time.

Several years ago, however, personnel at this Department's striped bass hatchery at Moncks Corner, Bayless (1971) did artificially induce a two year old hybrid to spawn successfully and indicated that, while all eggs were cohesive in the ovary, when spawned into water, some were adhesive as with the white bass and some floated like the striped bass.

CONCLUSIONS

Although these findings give indications of age and size at maturity as well as ova production, no concrete evidence of successful natural reproduction by the hybrid has been found.

Many questions, therefore, remain to be answered concerning fecundity of the hybrid, some of which are: Does, is, or will the hybrid spawn in the wild? Is this spawning successful? Will the progeny breed true? Will they backcross in a natural habitat with fish or their parent species?

Future management plans include further investigation of these subjects.

ACKNOWLEDGMENTS

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EFFECTS OF INCREASED WATER HARDNESS, SOURCE OF FRY AND AGE AT STOCKING ON SURVIVAL OF STRIPED BASS FLY IN EARTHEN PONDS

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ABSTRACT

Research on the extensive culture of striped bass, *Morone saxatilis* (Walbaum), was conducted in ponds at Auburn University Fisheries Research Unit in the spring of 1971. Investigations were conducted to determine the effect of water hardness, source of fry and immediate versus delayed stocking on the survival of striped bass fry.

Twelve 0.10-acre earthen ponds were used. Six ponds were treated with calcium sulfate to raise the hardness to 150 ppm. The hardness of the remaining ponds was approximately 20 ppm. Striped bass fry from two sources (Cooper River, South Carolina, and Savannah River,