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AN INTERIM REPORT ON THE USE OF HORMONES TO OVULATE STRIPED BASS (*Roccus saxatilis*)

BY

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ABSTRACT

A total of 429 female striped bass were treated with hormones during the spring spawning seasons of 1962 and 1963. Of this number, 118 (26.6%) were induced to ovulate while held captive. One hundred of the ovulated fish were treated with chorionic gonadotropin while used alone or in combination with other preparations. Eighteen of the ovulated fish were treated with follicle stimulating hormone while used alone or in combination with preparations other than chorionic gonadotropin.

Fry production amounted to 2.6 million in 1962 and 13.8 million in 1963. All of the fry were stocked in the major reservoirs of South Carolina except the Santee-Cooper Reservoir.

INTRODUCTION

Within the past decade several southeastern states, including South Carolina, have attempted to establish a population of striped bass in large impoundments. This activity was prompted by the spectacular success that striped bass had in establishing themselves in the Santee-Cooper Reservoir in South Carolina (Stevens 1957). This population not only serves as an excellent food and game fish but also effectively controls gizzard shad (*Dorosoma cepedianum*) through predation.

Despite repeated stocking of adult and sub-adult striped bass in the other large reservoirs of South Carolina, no population has developed. It has been tentatively concluded that the reservoirs of South Carolina, other than Santee-Cooper, do not provide the spawning requirement which is essential for egg survival. This spawning requirement dictates that unless the freely spawned striped bass eggs remain suspended in a current until hatching, they will settle to the bottom and suffocate. A reservoir, therefore, must have many uninterrupted miles of stream above it for hatching purposes or at least the equivalent in terms of current within the reservoir or perhaps sandy or rocky areas where partially developed eggs and larvae may settle and escape suffocation.

As a substitute for natural spawning, a striped bass hatchery was constructed in 1961 at Moncks Corner below Pinopolis Dam. The hatchery is based on a jar type culture and was a failure in 1961 because ripe females could not be found. (Stevens and Fuller, 1962). At least two other attempts to artificially propogate striped bass have failed for the same reason. (Raney, 1952.)

In 1962 and 1963, hormones were used to artificially ovulate striped bass and this report is concerned with the results of this experiment.

The use of sex hormones and sex steriods in spawning fish is exceptionally well documented in *The Physiology of the Pituitary Gland of Fishes* by Grace E. Pickford and James W. Atz and in many other excellent references including those by Sneed and Clemens (1959), Sneed and Dupree (1961) and Clemens and Sneed (1962).

During the months of April and May of 1962 and 1963, 439 female striped bass were captured in the sanctuary below Pinopolis Dam by hook, bow net, gill net and electric seine. The fish ranged in size between 7.1 and 33.0 pounds and averaged approximately 17.0 pounds. All, except ten controls, were treated with hormones or sex steriods at the time of capture and placed in a temporary holding pond for observation.

There was remarkable consistency between years in the percent of females successfully induced to ovulate (Table 1). Approximately 30 percent of these treated both years spawned either in the hatchery or in the pond or were found dead but ripe. Of course, those fish which spawn within the pond or die while ripe were lost to the experiment as far as fry production is concerned. This loss is the direct result of inadequacies in the holding pond which made direct observation impossible. In subsequent years, permanent ponds will be constructed containing viewing windows, lights and clear water and it is anticipated that the time of ovulation will be, to a large degree, discernable by direct observation of the fish. This should reduce the necessity of employing inefficient and harmful method of periodical physical examination now being used and should decrease handling mortality and increase fry production.

An increase in hatchery-spawned fish from 14.4 percent in 1962 to 19.8 percent in 1963 reflects the experience gained in 1962 concerning the latent period between injection and ovulation. This experience enables us to better predict the time of ovulation and to guard against premature pond-spawning by frequent inspections of the females in the terminal hours.

The rather large percent of negative examples is a reflection of our inability to judge the natural degree of ripeness of the females which we chose for treatment and to mortality associated with capture and treatment.

During the current year, females were selected with much greater

Table 1. The Outcome of 429 Female Striped Bass used during the Spawning Season of 1962 and 1963.

	1962		1963	
	Number	Percent	Number	Percent
Spawned in Hatchery	24	14.4	54	19.8
Spawned in Pond	15	9.0	16	5.9
Found Dead but Ripe	5	3.0	4	1.5
Negative	118	70.6	193	71.0
Control	5	3.0	5	1.8
Total	167	100.0	272	100.0

care than in 1962 and yet the results did not improve. Our method of selection is based upon the feel and appearance of the abdomen and the genital opening. Both methods are far from being fool-proof and in many cases the best prospects failed while the most unlikely spawned. This is in great contrast to the experience of Clemens and Sneed (1962) in which they were able to judge with a high degree of accuracy whether a fish was eligible for artificial maturation. At least one factor confuses the issue with striped bass and that is the great variation in the size of the ovaries. In 114 females which had been on hormones from five to forty hours, typical ovaries ranged between 8.1 percent and 24.5 percent of the total body weight while atypical ovaries ranged between 5.3 percent and 9.3 percent of the total body weight. A female with ovaries representing 20-25 percent of her total weight can easily be selected as a likely prospect. One with ovaries representing only 10 percent of the total body weight might be rejected and yet actually be a good prospect.

In order to find a better method of selecting females for treatment, small samples of ova were taken by inserting a small glass catheter into the ovaries via the genital pore. Unfortunately, the method was used only in the closing days of the 1963 season and too little experience was gained to adequately evaluate the technique at this writing. It is hoped that criteria can be established through examination of the ova prior to treatment which will enable us to reject ineligible females. There are indications also, that periodic samples of ova may illustrate the maturation of the ova and this, in turn, would allow a more precise evaluation of the effectiveness of the several hormones now employed.

Mortality due to the stress of capture, handling, treatment and captivity is a serious limiting factor. Death due to the stress of treatment could be greatly reduced by better selection. A nearly ripe female can usually be spawned with little trouble and, if she happens to spawn within the pond, can subsequently be released in an apparently healthy and vigorous condition. Females which are not nearly ripe or which are refractory to treatment, invariably die.

Since the majority of the striped bass captured in the tailrace canal do not mature below 8-10 pounds and since the average female used in the last two years has averaged about 17 pounds, we are faced with all the difficulties inherent in capturing, transporting and handling large fish. In addition, striped bass are excitable, subject to shock and prone to struggle until their last breath. For these reasons, it has been found that the least lethal method of capturing large females is by the use of an electric seine. While the seine occasionally causes vertebral fracture, it has the advantage of quickly subduing the fish. Also, the fish usually remain in a state of shock long enough for transporting to the holding pond and subsequent treatment with hormones.

Females above 25 pounds are especially susceptible to injury or shock from capture and handling. Last year several died as a result of the over-inflation of the air bladder as though they had been brought up from great depths.

There appears to be certain individuals which simply will not tolerate captivity and there are undoubtedly others which succumb to the cumulative traumata of capture, handling, treatment and captivity. There are also examples of tolerant individuals including a female who sustained a shattered vertebra as a result of shocking but who subsequently was ovulated with hormones although she could barely remain submerged.

Many of these problems can undoubtedly be solved or the effects mitigated through additional experience and experimentation.

Hormones:

During the two-year period, 429 female striped bass were treated with several different hormones and 118 (26.6%) were induced to ovulate. Chorionic gonadotropin (CG) was used alone or in combination with other preparations in all but 18 of the successful instances (Table 2).

Several brands of both human and non-human chorionic ganadotropin were used in 1963. Similar results were obtained from each brand

Table 2. An Analysis of the Effectiveness of the Several Hormones used in an Attempt to Induce 429 Female Striped Bass to Ovulate during April and May of 1962 and 1963.

1962

	CG		FSH		CG FSH		CG PLH		CG TSH		CG Testosterone		PLH		Estrogen	
Spawned in Hatchery	19		1		3		0		1		0		0		0	
Spawned in Pond	11		0		2		0		2		0		0		0	
Dead but Ripe	1		0		2		1		0		1		0		0	
Total Ovulated	31	36.0%	1	16.7%	7	28.0%	1	20.0%	3	16.7%	1	16.7%	0		0	
Negative	55	64.0%	5	83.3%	18	72.0%	4	80.0%	15	83.3%	5	83.3%	2	100.0%	14	100.0%
Total Treated	86	100.0%	6	100.0%	25	100.0%	5	100.0%	18	100.0%	6	100.0%	2	100.0%	14	100.0%

1963

	CG		FSH		CG FSH		CG PLH		FSH PLH		CG FSH PLH		FSH PLH TSH		CG FSH PLH TSH		Fish Pituitary Gland	
Spawned in Hatchery	35		9		3		3		2		1		0		1		0	
Spawned in Pond	10		5		0		0		0		0		1		0		0	
Dead but Ripe	3		0		1		0		0		0		0		0		0	
Total Ovulated	48	27.5%	14	27.5%	4	44.5%	3	75.0%	2	22.2%	1	100.0%	1	100.0%	1	100.0%	0	
Negative	127	72.5%	37	72.5%	5	55.5%	1	25.0%	7	77.8%	0		0		0		16	
Total Treated	175	100.0%	51	100.0%	9	100.0%	4	100.0%	9	100.0%	1	100.0%	1	100.0%	1	100.0%	16	100.0%

1962 and 1963

	CG		FSH		CG FSH		CG PLH	
Spawned in Hatchery	54		10		6		3	
Spawned in Pond	21		5		2		0	
Dead but Ripe	4		0		3		1	
Total Ovulated	79	30.4%	15	26.3%	11	32.3%	4	20.0%
Negative	181	69.6%	42	73.7%	23	67.7%	5	80.0%
Total Treated	261	100.0%	57	100.0%	34	100.0%	9	100.0%

Grand Total (1962 & 1963)

Ovulated	118	27.5%
Negative	311	72.5%
Total Treated	429	100.0%

even though there was a substantial variation in price. We currently recommend a veterinarian grade manufactured by Biolab, Norborne, Mississippi, because it is both cheap and effective.

Preparations other than CG have been tried in an attempt to decrease both the incidence of abortion and the mortality of egg-bound females. These other preparations are follicle stimulating hormone (FSH), pituitary lutenizing hormone (PLH), thyroid stimulating hormone (TSH), estrogen preparations, testosterone and fish pituitary glands (Table 2).

Follicle Stimulating Hormone (FSH):

The preparation used in this study was produced by the Veterinary Department of the Armour Pharmaceutical Company, Kankakee, Illinois. In 1963, FSH was equal to CG in effectiveness in that both preparations induced ovulation in 27.5 percent of the cases.

FSH reacts more slowly than CG and usually requires two separate treatments to achieve ovulation. Average latency for nine hatchery-spawned fish on FSH was 47 hours as compared to 39 hours for 35 hatchery-spawned females on CG.

Treatments involving the use of FSH and CG in combination produced no significant improvement over either used alone. Two staggered sub-liminal doses of CG may be the equivalent of the same treatment with FSH. It is not clear yet whether FSH or any other preparation is superior to CG in reducing abortion or mortality among egg-bound fish.

FSH and CG have been used successfully in combination with TSH, PLH and testosterone but more experience is needed to demonstrate any complimentary value of the latter preparations.

In 1962 several estrogen preparations were used and in 1963 dried striped bass pituitary materials were tried. Negative results were obtained in both cases. Clemens and Sneed (1962) had excellent success in ovulating several species of fish, other than striped bass, using either homoplastic or heteroplastic injections of pituitary glands. The failure of the striped bass to respond to pituitary glands is puzzling but, for the present, the failure will be relegated to a long list of similar unsolved problems.

Once again, it is hoped that the periodic inspection of the ova will serve as a better means of evaluating the several preparations used in the study.

Dose Levels:

In order to decrease handling mortality, the fish were not weighed prior to treatment. Instead, the weights were estimated and a dose approximating 300 I. U. per pound was given. After death, the fish were weighed and the precise dose was tabulated. Average dose levels for both years have been approximately 350 I. U. per pound although 200 to 250 I. U. per pound seems to be sufficient. Massive or excessive dose levels produce no advantage and may be harmful. Russian workers found egg mortality to be twice as high when over-doses were used. (Pickford and Atz, p. 259).

Retreatment with CG is occasionally necessary to ovulate striped bass. A second dose ls given when a female is obviously nearly ripe but sickening and, at this time, it is important to quickly induce ovulation before she dies or becomes moribund. Ovulation usually occurs 6-12 hours after treatment.

FSH is given in doses roughly approximating 25 mg. per 10 pounds of body weight. Retreatment is typically needed with FSH and the second dose is usually one-half the original.

Injections are made either interperitoneally or intramuscularly although less trauma results with intramuscular injections.

Latent Period:

The latent period between treatment and spawning varies with the natural ripeness of the female; the water temperature; and whether FSH or CG is used.

About 48 hours is required when the water temperature is around 60°F. while 36 hours or less is required for water temperatures near

70°F. A nearly ripe female may reduce the latent period by 10 hours and, as mentioned before, FSH usually requires about eight hours longer than CG. These figures are only guidelines, however, because the shortest latent period recorded to date occurred in 24 hours at 65°F. water temperature with the use of FSH.

Egg Mortality:

Although about 70 percent of the treated females die without ovulating, many millions of striped bass could be produced from the remaining 30 percent which do ovulate successfully if subsequent egg mortality were slight. Unfortunately, egg mortality has been great and is, by far, the greatest limiting factor to fry production.

Tables 3 and 4 list the fish which have been successfully ovulated in the two-year period and includes information concerning latency, water temperature, fry produced, hormones used and a comment, where applicable, which attempts to explain the source of mortality.

Three sources of egg mortality have been recognized to date as follows:

1. Over-ripeness
2. Abortion
3. Faulty hatchery techniques

Over-ripeness:

In captivity, a female striped bass does not necessarily release her eggs immediately after ovulation although there is much presumptive evidence that spawning closely follows ovulation in nature (Stevens and Fuller, 1962). Perhaps the absence of external stimuli such as the presence of males, adequate current and the traumata associated with captivity and treatment causes the delay of spawning in certain females in the holding pond.

Table 3. A List of 24 Hatchery-Spawned Striped Bass Ovulated with Hormones in 1962.

Latency Hours	Water Temp. °F.	Fry X 1000	Drugs	Comments
26	70	540	CG	50% mortality?
33	70	0	CG	Abortion?
33	70	0	CG	Abortion? — 75% didn't harden
34	74	0	CG	10% ovulated
34	66	222	CG	
34	64	204	CG	40% unhardened or infertile
34	64	240	CG	
35	72	0	CG	Moribund — eggs infertile and unhardened
35	70	0	CG	Abortion? — 10% hardened
35	66	161	CG	
35	66	162	CG	1/3 ovulated — moribund when cut
36	64	30	CG	50% infertile
37	69	0	CG	Moribund — 100% unhardened
39	66	0	CG	Abortion?
40	69	0	CG	Over-ripe
40	70	0	CG	50% spawned — many eggs did not hardened
40	60	460	CG + TSH	
41	66	30	CG	
48	60	50	CG	Over-ripe and partially spawned
48	61	1	CG + FSH	
49	60	120	CG	
57	68	120	CG + FSH	Much hatchery mortality
61	60	300	FSH	
97	61	0	CG + FSH	Eggs did not water harden
		2,640,000		

It was hypothesized in 1962 and confirmed in 1963 that ova retention is deleterious and results in partial or complete mortality of the ova during incubation. Russian workers found that the eggs of sturgeon which remain within the ovary five to six hours after ovulation are 67-100 percent unfertilizable (Pickford and Atz, 1957, pp. 259-260).

Over-ripe striped bass can be identified by the fact that they are usually partially spawned out as well as by the extreme fluid condition of the ova. A fish in this condition loses ova when lifted from the water or from any violent movement.

The incidence of over-ripeness varies directly with water temperature and is, in our opinion, due to hypoxia within the ovary. Once the ova are separated from the bloodstream of the parent by ovulation,

Table 4. A List of 54 Hatchery-Spawned Striped Bass Ovulated with Hormones in 1963.

Latency Hours	Water Temp. °F.	Fry X 1000	Hormones	Comments
24	65	500	FSH + PLH	11 lb. fish — possible hatchery O_2 mortality
25	66	1,000	FSH	12.4 lb. fish — slight mortality
28	65	1,150	CG	22 lb. fish — slight mortality
29	67	1,120	CG	80% ovulated
30	66	750	CG + FSH	20 lb. fish — mortality slight
31	67	1,368	CG	25% infertile
31	65	270	CG + PLH	Possible sub-oxygenation in hatchery
31	69	540	CG	25% infertile — 25% atypical development
31	69	50	CG	Mostly spawned — over-ripe — 50% did not harden — 14% infertile
32	66	0	CG	Over-ripe 60% infertile
32	67	125	CG	Over-ripe and partially spawned — 30% unhardened
33	66	150	CG	Center ovulation only — 30% mortality of ovulated eggs
34	67	1	CG	Cut too soon
34	66	160	CG	50 to 70% spawned
34	63	0	CG	Over-ripe
34	66	0	CG + FSH	Moribund — 50% ovulated — few eggs water hardened
35	66	20	CG	5% hardened — over-ripe or abortion
35	66	150	CG	25% infertile — many mutations
35	64	0	CG	Small ovaries or partially spawned
36	63	0	CG	?
36	63	0	CG	2/3 spawned — over-ripe — 10% water hardened and 10% fertilized
36	63	400	CG	40% mortality within 18 hours
36	63	405	CG	Over-ripe — partially spawned 30% infertile
36	66	700	FSH/PLH	18 lb. fish — 5% infertile
37	67	225	CG	Excellent hatch — 10 lb. fish with small ovaries
37	66	420	CG	50% ovulated — 14 lb fish with large ovaries
37	62	0	CG/PLH	
39	59	700	CG	
40	69	0	CG	Over-ripe — 50% spawned
41	60	504	CG	
41	67	700	FSH	
42	60	63	CG	10.8 lb. fish — 10% hatch
44	65	355	CG + PLH + FSH	
45	63	300	CG	30% dead in 6 hours
45	66	0	CG	100% hardened atypical division and possible abortion

Table 4 (Continued)

Latency Hours	Water Temp. °F.	Fry X 1000	Hormones	Comments
46	60	100	CG	Partially spawned — over-ripe
47	63	175	CG	Partially spawned and hatchery mortality
47	63	0	CG	Over-ripe and 90% infertile
47	63	0	CG	Partially ovulated and moribund when cut
47	66	70	FSH	Probably over-ripe
47	66	0	FSH	Moribund when cut — ova with atypical color
48	66	0	FSH	Moribund when cut — ova with atypical color
48	63	243	FSH	60% mortality within 9 hours
48	65	250	CG + PLH + TSH	90% mortality?
50	66	300	PLH	Many were inadvertently flushed from jars
51	60	0	FSH	Fertilization doubtful
51	61	0	CG	Over-ripe
51	63	0	CG	Moribund — used doubtful male
51	63	0	CG	Moribund — eggs dead in ovary
52	66	0	CG	?
58	65	540	CG	60% died within 18 hours
58	66	0	CG + PLH	5% hardened — over-ripe
70	66	0	FSH	Abortion?
94	63	0	CG + FSH	Eggs dead within ovary
		13,804,000		

they have no direct source of oxygen. Diffusion of oxygen from the walls of the ovary, if any, is insufficient and hypoxia results. The deleterious effects of hypoxia within striped bass ovaries occur much sooner than the five to six hours reported for sturgeon. Critical periods for striped bass are more in the magnitude of 30-60 minutes in water between 65-70°F. Cooler water tends to delay the effects of over-ripeness.

In order to avoid over-ripeness, frequent physical checks are made during the terminal hours of latency. These inspections include the pressuring of the abdomen to encourage a show of ovulated eggs from the genital pore and, in some cases, fingering within the ovary to determine ovulation. Neither method is fool-proof because of center-ovulation, *i.e.*, the ova nearest the lumen of the ovary are ovulated first. Many apparently ripe females have been sacrificed only to find a few center-ovulated eggs.

The trick is to cut the female at just the right time thus avoiding both over-ripeness and premature sacrifice.

Capture and handling of the fish during the terminal hours of treatment results in a high incidence of mortality. Failure to do so, results in over-ripeness or spawning within the pond.

It is hoped that this dilemna can be resolved by the renovation of the holding ponds which will allow direct observation of the fish. These renovations include viewing windows, lights and clear water; and will permit observation both day and night. We believe that the fish will indicate ovulation by their actions. In 1963, two females were observed swimming rapidly at the surface in close proximity to each other. A check of this section of the pond revealed that two females had recently spawned in the pond. No males were present at the time, but it is felt that the action of the males will prove to be valuable in indicating that ovulation is near. In 1964, the actions of males and females will be closely observed in the hope of recognizing certain reactions by both sexes to approaching ripeness. We feel that the recognition of ripeness through the direct observation of the actions of the fish is essential to fry production in terms of several hundred millions per year.

The problem of selecting eligible females for treatment and of timing the sacrifice of females in order to avoid over- or under-ripe eggs in sturgeon are solved by Russian investigators by observation of the eggs through an incision made in the body wall of the fish (Pickford and Atz, 1957, p. 255). Striped bass almost certainly would not tolerate such a technique and it is felt that internal catheter-sampling of the ova will accomplish the same objectives.

Abortion:

The hormone-induced release of immature striped bass eggs is assumed but its role is, as yet, unclear. We are unable, at this point, to separate the symptoms of abortion from those of over-ripeness as the cause of egg mortality in a given fish. Unhatchable eggs are those which will not accept fertilization or will not water harden; and those which display atypical division or development during incubation even though they had originally accepted sperm and water in a normal manner.

Faulty Hatchery Techniques:

Water temperatures within the hatchery typically vary as much as 10°F. between midnight and midday. It is believed that a variation of this magnitude is a possible source of egg mortality. This problem will be solved in future years by the installation of a water temperature control device.

Much needs to be learned concerning the optimum number of eggs per jar. Sub-oxygenation results from crowding and hatchery capacity declines when too few eggs are placed in each jar. The number of eggs per jar dictates the maximum amount of water which can be circulated through the jar because if too much water is added the eggs will flush out of the jars. The amount of water entering the jar frequently decreases due to the clogging of the petcock with clay particles and volume also varies slightly with the temperature. Both of these problems will be eliminated by the use of well water and by water temperature control.

Eisler (1957) reported on the lethal effects of fluorescent light upon salmon eggs and larvae. In 1963 all fluorescent lighting was removed from the hatchery as a safety measure, although no experiment has been conducted to determine any effects that such lighting might have on striped bass eggs and larvae.

Fry Production:

Fecundity studies on striped bass as reported by Raney (1952) indicate that a 15-17-pound striped bass is capable of producing one and one-half million eggs. Based on this figure about 81 million eggs entered the hatchery in 1963. Fry production amounted to 13,804,000 and represents a survival of about 17 percent. In 1962 an estimated 36 million eggs entered the hatchery, and 2,640,000 fry were produced representing only about seven percent survival. While progress has been made, survival will have to be greatly increased in order to achieve fry production of several hundred million per year. There is good evidence also that the above-mentioned fecundity figures do not apply to the Cooper River striped bass. As mentioned earlier, typical ovaries vary from about 10 to 25 percent of the total weight and such a large variation will tend to weaken any index based on average yields.

In 1964, much more attention will be directed toward fecundity studies in order to better measure mortality and fry production. Mortality has been estimated by comparing the number of dead eggs to the number of live eggs at a given age during incubation. This method has several faults including the fact that dead eggs are buoyant and continuously flush out of the jars. Mortality also continues throughout the incubation period and cannot be properly measured at a given point in time. We hope to measure the ova at the time of fertilization and the fry at the time of hatching and, in this manner, measure both mortality and survival.

Upon hatching, the hatching jars are placed adjacent to an aquarium in order that the fry can swim over into these aquaria for a continued short period of development. In 1963, the aquaria mal-functioned due to faulty drain pipe guards. As a result, fry were frequently shipped out at a relatively immature stage of development. The fry were shipped in sealed plastic bags containing water and pure oxygen. No provision was made to insulate the bags and, as a result, the water temperature varied with air temperature in transit.

The combination of early shipment and change in water temperature resulted in some transit mortality. Most shipments arrived in good condition, however, and the fry were swimming vigorously when released.

In order to measure survival, two half-acre hatchery ponds at the Newberry Hatchery were stocked four different times with a total of 510,000 fry. One of the stockings was successful and produced 3,577 fingerling striped bass which averaged 2.4 inches in total length 52 days after stocking. The original stock was estimated at 300,000 fry and survival rate was 1.2 percent.

Table 5 presents the stocking information for the 1963 hatchery operation.

Table 5. Stocking Information, 1963 Hatchery Operation

LOCATION	NUMBER OF FRY	NUMBER OF STOCKINGS
Lake Murray	10,786,000	11
Lake Greenwood	993,000	2
Wateree Reservoir	540,000	1
Newberry Hatchery Pond	510,000	4
Clark Hill Reservoir	420,000	1
Hartwell Reservoir	330,000	1
Catawba Reservoir	225,000	1
	13,804,000	

One fingerling striped bass was recovered on August 22 in Lake Murray. Fertilized striped bass eggs were taken in the Saluda River above Lake Murray this spring and the fingerling could have resulted from natural spawning.

We feel that a stocking of 100 million healthy fry will approximate natural reproduction and would ultimately result in significant numbers of catchable striped bass. Even a small catchable population of striped bass will have significance to local fishermen. Occasional catches of striped bass in the upper reservoirs of South Carolina typically make the newspapers and striped bass, in this situation, tend to assume a degree of prestige similar to that enjoyed by muskellunge in northern waters.

Miscellaneous Observations:

The majority of striped bass in Cooper River have spawned, in the past two years, between April 1 and May 15. By the second week of May many of the females are spent when captured, but those which have not yet spawned are naturally nearly ripe and respond well to induced ovulation.

In 1963, 53 percent of those treated between May 6 and May 13 were successfully ovulated. During April, however, results have varied tremendously from day to day each year and in 1963 the incidence of success ranged between 7.7 percent and 100.0 percent.

This great variation leads to the assumption that females tend to segregate themselves into groups according to ripeness. If we happen to capture members of a nearly ripe group, our success in inducing ovulation is excellent. An example of this occurred on April 23 when 14 of 18 females were induced to ovulate. These fish were so nearly ripe that eleven spawned in the pond within 30 hours or less after treatment with either CG or FSH. Two days before, only two out of sixteen females were ovulated and two days afterward only two out of seventeen females were ovulated. Similar instances occurred throughout April. It would, needless to say, be highly desirable to find methods of locating nearly ripe groups of females.

Other Drugs:

About half of the treated females die after having advanced almost to the point of ovulation. In 1963, eleven such females advanced to the point of center-ovulation before succumbing. We believe this class of female could be ovulated successfully if they could be kept alive for a few more hours. In another attempt to accomplish this, several other preparations have been used and while none have proven to be a panacea, several have an apparent value. It is difficult, however, to clearly demonstrate the value of these preparations because of the many sources of mortality which influence the death of adult fish. For example, a female which is not nearly ripe or which is injured in capture will most likely die regardless of any drug therapy.

Penicillin:

Clemens and Sneed (1962) used penicillin to minimize inflamation which results from needling and recommended its use as a precautionary measure. In 1963 crystalline penicillin was used in 53 striped bass and 16 (30.2%) successfully spawned.

Decadron:

Decadron is a trademark of Merck and Company, Inc. for dexamethasone which is a synthetic adrenocortical steriod used for anti-inflamatory therapy. Decadron has been used both years in a total of 73 female striped bass and 32 (43.8%) successfully spawned.

Emivan:

Emivan is a brand of ethamivan which is manufactured by the U. S. Vitamin and Pharmaceutical Corporation and is a respiratory stimulant and arousing agent. It was used in a total of 40 female striped bass and 12 (30.0%) spawned successfully. Emivan is available in both tablet and injectable form and definitely increases the rate of respiration of striped bass.

Renese:

Renese is a brand of polythiazide and is manufactured by Pfizer Laboratories. It is described as an orally effective diuretic, saluretic and antihypertensive agent. Chorionic gonadotropin acts as an antidiuretic and, as such, may be a source of sickness in treated fish. Renese was used in four striped bass during the last few days of the 1963 season and three (75.0%) spawned successfully.

Vistaril:

Vistaril is manufactured by Pfizer Laboratories, and is described as hydroxyzine pamoate and is a tranquilizer. Vistaril was used in five females during the last few days of the 1963 season and four (80.0%) spawned successfully.

Cortril:

Cortril is a brand of hydrocortizone manufactured by Pfizer Laboratories and was used in the same females as Vistaril. Four out of five spawned successfully.

These and other preparations will be tried in the future in an attempt to mitigate the stresses involved in capturing, handling, captivity and artificial maturation of striped bass.

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FLORIDA PHOSPHATE PITS FOR MANAGED PUBLIC FISHING AREAS [1]

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ABSTRACT

Several mined-out and flooded phosphate pits near a large population center in peninsular Florida have been acquired and put under management by the Florida Game and Fresh Water Fish Commission for public sport-fishing purposes. Costs of making these abandoned phosphate areas accessible to the public are discussed; fishing pressure and sportfishing success on renovated ponds are reported and compared; and the relationships of size and shape of the ponds to success in fishery management are noted.

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