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ACKNOWLEDGMENTS

The original data of this study were collected while I was employed by the City of Tulsa, Oklahoma, as a Fishery Biologist. I am indebted to the City of Tulsa, Oklahoma, and the Oklahoma Game and Fish Department in providing financial aid throughout the two years of study needed for the completion of academic requirements.

I wish to express my appreciation to Dr. Carl D. Riggs for his encouragement and guidance throughout this study; to the late Dr. A. O. Weese for aid and assistance in statistical treatments; to Mr. Robert M. Jenkins for making available the facilities of the Oklahoma Fishery Research Laboratory and for aid in laboratory methods and computations; to Mr. Gordon E. Hall for his invaluable aid in the identification of fishes; to the staffs and fellow graduate students of the Department of Zoology, University of Oklahoma, and the Oklahoma Fishery Research Laboratory for their suggestions and encouragement; to Messrs. W. F. McMurray, A. B. Jewell, and J. W. Costilow, for making it possible for me to continue this study while in the employ of the City of Tulsa, Oklahoma; to Mr. E. W. Henson, my assistant, and all other city employees who aided in this endeavor; and to my wife, Marion, whose continual encouragement aided in the completion of this work.

Further, I am indebted to Drs. George A. Moore and A. P. Blair for the use of their field notes on fish collections in Spavinaw Creek before impoundment of Upper Spavinaw Lake.

PRELIMINARY EXPERIMENTS ON WINTER FEEDING SMALL FATHEAD MINNOWS

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The fathead (*Pimephales promelas*) is a very popular bait minnow, especially among crappie fishermen, and, therefore, has been raised extensively by commercial minnow producers during the last 10 years. Fatheads weighing four pounds or more per thousand are preferred as bait for bass; however, minnows weighing 2.5 to 3.0 pounds per thousand are acceptable for use as bait for crappie. Fatheads smaller than these sizes are not generally salable.

The fathead lays eggs periodically from early spring until the water temperature drops below 60 to 65° F. in the fall. As a result a large proportion of the total number of minnows produced is too small for sale when the rearing ponds are drained. In experiments conducted at Auburn, Alabama, over the past 10 years, 20 to 40 percent of all fatheads produced in fertilized rearing ponds that were stocked in January had not reached a useable size by the end of the year. Even in experiments where supplemental feeds were added to ponds during the fall and winter before draining, approximately 15 percent of the minnows failed to reach a salable size within one year.

Fathead minnows are in demand principally during the period of February to May. Consequently, the bulk of the crop must be raised to a suitable size for late winter and early spring sales. Therefore, it appeared necessary to drain the ponds during late fall or in the winter, store or sell those of desirable size,

and restock those too small for sale in growing ponds. These small fish must be restocked at such a rate per acre that they may be raised to a suitable size in a few months. This growth must be produced during the winter months, as fatheads will reproduce again in March or April.

Results of experiments on different rates of stocking and methods of feeding for raising small fatheads to salable sizes during the winter months are given in this paper.

In the first experiments, small fatheads were stocked in ponds during the winter at rates of 100,000 and 120,000 per acre (Table I). They were fed at a very heavy rate so that they would reach a useable size as quickly as possible. The feeds used were soybean cake and a 1:1 mixture of soybean meal and cottonseed meal. Feeding was done six days a week, and was stopped several days before the ponds were drained. In addition, each pond received three applications of fertilizer equivalent to 200 pounds of 8-8-4 per acre per application.

Results from these tests show that small fatheads, averaging 0.5 to 1.9 pounds per thousand, grew rapidly during cold weather on each of the feeds. In the pond that received the soybean meal-cottonseed meal mixture, 86 per cent of the minnows survived. The average weight per thousand fish increased from 0.53 to 5.0 pounds in 87 days.

The survival in the ponds that received soybean cake varied from 64 to 83 percent. The fatheads grew quite rapidly in each pond and averaged 4.5 to 5.0 pounds per thousand when the ponds were drained. The fatheads stocked on March 10 at the rate of 120,000 per acre (average weight 1.4 pounds per thousand) and fed 60 pounds soybean cake daily more than trebled their average weight in 39 days. The average daily gain per acre for the three ponds was 5.05, 4.70, and 5.40 pounds, with the highest gains being made in the ponds that received the highest rates of feeding.

TABLE I

RESULTS OF FEEDING FATHEADS SOYBEAN MEAL–COTTONSEED MEAL MIXTURE AND SOYBEAN CAKE

Items Per Acre	*Soybean Meal–Cottonseed Meal*	*Soybean Cake*	*Soybean Cake*	*Soybean Cake*
Number Fatheads Stocked	100,000	100,000	120,000	120,000
Size Stocked—Pounds Per 1,000 Fish	0.53	1.03	1.94	1.41
Date Stocked	Jan. 11	Feb. 19	Feb. 19	Mar. 10
Number Days in Test	87	49	47	39
Number Days Fed	48 *	44	40	29
Pounds Fed Per Day 6 Days a Week	30	40	40	60
Rate Fed at Start **	56	39	17	35
Rate Fed at End	6.9	11.4	8.8	16.0
Date Drained	Apr. 8	Apr. 9	Apr. 7	Apr. 17
Percent Survival	87	79	83	64
Size Produced—Pounds Per 1,000 Fish	5.02	4.46	4.54	4.98
Total Pounds Feed Used	1,440	1,760	1,600	1,740
Total Pounds Gained	381.6	247.6	220.8	213.0
Average Gain Per Day—Pounds	4.39	5.05	4.70	5.46
Conversion Factor †	3.77	7.11	7.24	8.17
Cost of Feed and Fertilizer Per 1,000 Fish Produced	0.80	1.04	0.76	1.06
Value of Fatheads Above Feed and Fertilizer Costs ‡	$623.28	$546.84	$721.54	$533.26

* Feeding stopped March 5.
** Expressed as percentage of total weight of fatheads.
† Discounting natural food in ponds.
‡ Fish averaging 2.5 to 3.9 pounds per 1,000—$6.00.
4 to 8 pounds per 1,000—$8.00.

Spawning activity was observed in each pond when water temperatures reached about 60° F. and small numbers of recently hatched fry were present when the last pond was drained on April 17. Adult fatheads die soon after spawning and

this may have accounted for the higher mortality that occurred in the pond drained latest in the spring.

The expenses for feed and fertilizer and the value of the fatheads above these costs are given in Table I. The gross income less expenses for feed and fertilizer varied from $533.26 to $721.54 per acre, and depended mainly upon survival and amount of feed used.

Because of the extremely rapid growth obtained with fatheads in the first feeding tests, it was believed that higher numbers could be stocked and still get satisfactory growth.

Two ponds were stocked February 19 at rates of 248,000 and 276,000 small fatheads per acre, weighing 0.45 pound per thousand. The fish in each pond were fed 16 pounds per acre three times a week for two weeks and 60 pounds per acre three times a week for three additional weeks. Peanut meal was used for three feeding periods and fish meal the fourth feeding period. In a five-week period these fatheads failed to increase in size.

Upon draining these ponds, the fatheads were restocked at rates of 100,000 per acre, weighing 0.5 pound per thousand, and fed 60 pounds per day four times a week, using peanut meal and fish meal as described above. At this lower rate of stocking, there was a four-fold increase in weight in one month. Mortality averaged 10 per cent. It appeared, however, that the heavy rates of feeding used here were wasteful and that lower rates would have given satisfactory growth at less expense. In addition, daily feeding would appear more desirable than feeding only three to four times a week.

Therefore, it seemed desirable to set up experiments with other feeds and light rates of feeding. Five ponds were stocked October 14 at the rates of 120,000 small fatheads per acre, weighing 0.8 pound per thousand; one pond was stocked the same day with 136,000 fatheads per acre, weighing 0.7 pound per thousand. They were fed fish meal one day a week and peanut meal six days a week including a double ration on Saturday (Table II). The fish in three ponds were fed at the rate of two pounds per acre daily (2 percent of their initial body weight) and three ponds were fed double that amount. The rates were doubled after two months and the tests were continued four months at the increased rate of feeding. No fertilizers were used. The average survival in the three ponds that received the lower rate of feeding was 87 percent, while only 47 percent survived where the higher rate of feeding was used. The overall average for the six ponds was 67 percent.

TABLE II

RESULTS OF FEEDING FATHEADS PEANUT MEAL AND FISH MEAL

	Pond Numbers					
Items Per Acre	*1*	*2*	*3*	*4*	*5*	*6*
Number Fatheads Stocked	120,000	120,000	120,000	120,000	120,000	136,000
Avg. Size Stocked—Lbs. Per 1,000 Fish	0.8	0.8	0.8	0.8	0.8	0.7
Date Stocked	Oct. 14	Oct. 14	Oct. 14	Oct. 14	Oct. 14	Oct. 14
Number Days in Test	187	174	174	174	152	152
Pounds Fed and Days Fed	2–59	2– 59	2–59	4– 59	4–59	4–59
	4–89	4–113	4–89	8–112	8–89	8–89
	12–33	. . .	. . .	. . .	. . .	. . .
Daily Rate Fed at Start *	2.0	2.0	2.0	4.0	4.0	4.0
Daily Rate Fed at End	2.3	1.0	1.3	1.6	2.6	3.2
Date Drained	Apr. 19	Apr. 6	Apr. 6	Apr. 6	Mar. 15	Mar. 15
Percent Survival	100	91	69	83	36	23
Avg. Size Produced, Lbs. Per 1,000 Fish	4.08	3.64	3.68	5.08	6.98	8.07
Total Pounds Feed Used	870	570	474	1,140	948	948
Total Pounds Gained	417.6	303.2	209.2	412.0	208.0	166.4
Average Gain Per Day	2.23	1.74	1.20	2.37	1.37	1.10
Conversion Factor †	2.08	1.88	2.27	2.77	4.56	5.70
Cost of Feed Per 1,000 Fish Produced	0.34	0.25	0.27	0.54	1.03	1.42
Value of Fatheads Above Feed and Fertilizer Costs ‡	$923.59	$631.43	$475.65	$748.05	$303.82	$201.42

* Expressed as percentage of total weight of fatheads.
† Discounting natural food in ponds.
‡ Fish averaging 2.5 to 3.9 pounds per 1,000—$6.00.
4 to 8 pounds per 1,000—$8.00.

The weight of feed required to produce one pound of gain at the lower rate of feeding varied from 1.88 to 2.27. The average for the three ponds was 2.08. The conversion factors at the higher rate of feeding varied from 2.77 to 5.70 and averaged 4.34. In general, there was a direct relationship between rate of feeding and conversion factors. The most efficient gains were made in ponds that had highest survival of fatheads. Also, the gross incomes per acre above feed costs were greatest in those ponds with the highest survival. The range was $201.42 to $923.59.

Five ponds were stocked with small fatheads on December 10 at the rate of 112,000 per acre, weighing 1.2 pounds per thousand (Table III). They were fed Auburn No. 1 fish feed, which contains 35 percent soybean oil meal, 35 percent peanut oil meal, 15 percent fish meal, and 15 percent distillers dried solubles. The fish in one pond were fed 1 percent of their body weight daily, those in two ponds were fed 2 percent, and those in the other two ponds were fed 4 percent.

Two other ponds were stocked November 27 with 80,000 to 190,000 small fatheads per acre, weighing 1.67 and 1.47 pounds per thousand, respectively (Table III). They were fed Auburn No. 1 fish feed at the rate of 3 percent of their body weight per day. The fish in all seven ponds were fed six days a week including a double ration on Saturday. No fertilizer was used.

Average survival was 78, 83, 89, and 83 percent for the four groups of ponds where the fish were fed Auburn No. 1 fish feed at the rates of 1, 2, 3, and 4 percent initial body weight daily. The overall average (84 percent) was much higher where this mixed feed was used than where the peanut meal plus fish meal was used.

The average amount of Auburn No. 1 fish feed required to produce a pound of fatheads varied from 2.5 pounds at the 1 percent level to 3.5 at the 4 percent level. In general, the more efficient gains were made at the lower rates of feeding.

Gross income per acre above feed costs was $507.44 at the 1 percent level of feeding, and averaged $638.38, $672.61, and $689.18 at the 2, 3, and 4 percent levels, respectively.

TABLE III

RESULTS OF FEEDING FATHEADS AUBURN NUMBER 1 FISH FEED

	Pond Numbers						
Items Per Acre	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Number Fatheads Stocked	112,000	112,000	112,000	80,000	190,000	112,000	112,000
Size Stocked—Pounds Per 1,000 Fish	1.2	1.2	1.2	1.67	1.47	1.2	1.2
Dates Stocked	Dec. 10	Dec. 10	Dec. 10	Nov. 27	Nov. 27	Dec. 10	Dec. 10
Number Days in Test	124	101	132	65	78	124	124
Pounds Fed and Days Fed.	1.4–28	1.4–28	1.4–28	4–45	8–55	1.4–28	1.4–28
	2.0–67	4 –67	4 –67	. . .	. . .	8 –67	8 –67
	6.0–28	. . . .	8 –36	. . .	. . .	16 –29	16 –29
Daily Rate Fed at Start *	1.0	2.0	2.0	3.0	3.0	4.0	4.0
Daily Rate Fed at End	2.1	1.5	1.9	1.3	1.9	4.1	3.4
Date Drained	Apr. 13	Mar. 15	Apr. 21	Jan. 31	Feb. 13	Apr. 13	Apr. 13
Percent Survival	78	78	87	98	80	75	90
Size Produced—Pounds Per 1,000 Fish	3.23	3.10	4.42	2.55	2.81	4.69	4.69
Total Pounds Feed Used	340	306	594	180	440	1,038	1,038
Total Pounds Gained	148.0	132.4	297.6	66.0	144.4	259.2	339.6
Average Gain Per Day	1.19	1.31	2.25	1.02	1.85	2.09	2.74
Conversion Factor †	2.30	2.31	2.00	2.73	3.05	4.00	3.06
Cost of Feed Per 1,000 Fish Produced	0.19	0.17	0.31	0.11	0.14	0.61	0.51
Value of Fatheads Above Feed and Fertilizer Costs ‡	$507.44	$523.38	$753.39	$460.49	$884.74	$620.43	$757.93

* Expressed as percentage of total weight of fatheads.
† Discounting natural food in ponds.
‡ Fish averaging 2.5 to 3.9 pounds per 1,000—$6.00.
4 to 8 pounds per 1,000—$8.00.

Question: Did you have trouble with disease?
Answer: Yes, we have been troubled with several diseases and parasites.

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

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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