

FURTHER EXPERIMENTS ON FEEDS FOR FATHEAD MINNOWS

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ABSTRACT

Fathead minnows averaging 1.74 pounds per thousand were stocked into ponds January 21 at rates of 100,000 per acre, and fed 6 days a week until the ponds were drained April 1. The feeds were 3 forms of Auburn No. 2 fish feed, namely, dry mix, crumbles, $\frac{3}{8}$ -inch diameter pellets, and a commercial trout pellet. The ingredients of the Auburn No. 2 fish feed were:

35 Percent Soybean Oil Meal	(44 percent protein)
35 Percent Ground Peanut Cake	(53 percent protein)
15 Percent Fish Meal	(60 percent protein)
15 Percent Distillers Dried Solubles	(24 percent protein)

The composition of the Auburn No. 2 fish feed was 46 percent protein, 26 percent carbohydrate, and 5 percent fat. The analysis of the trout ration was 43 percent protein, 20 percent nitrogen-free extract, 3.25 percent fat, and 4 percent fiber.

The initial daily feeding rate was 3 percent of the body weight of the fish for the period January 22 to March 2. Twice the initial weight of feed was used from March 3 until March 31. No fertilizers were used during these experiments.

The gains in weights of fish from all ponds fed the Auburn No. 2 feeds were significantly greater than the average gain in weight of fish fed the commercial trout ration. There were no significant differences in gains among the fish fed the 3 forms of Auburn No. 2 feed, nor in survival among the 4 treatments.

Preliminary experiments on winter feeding small fathead minnows with Auburn No. 1 fish feed were reported in a previous paper.* The feed was composed of 35 percent soybean oil meal, 35 percent peanut oil meal, 15 percent fish meal, and 15 percent distillers dried solubles. The protein content was 42 percent. All ingredients were mixed thoroughly and fed in a dry form, referred to as a dry mix.

In 1957-1958, a different formulation was designated as Auburn No. 2 fish feed. This differed from Auburn No. 1 only in the substitution of ground peanut cake for peanut meal to reduce fiber content. The composition of the Auburn No. 2 feed was 46 percent protein, 26 percent carbohydrate, and 5 percent fat. The ingredients used in preparing this feed were as follows:

35 Percent Soybean Oil Meal	(44 percent protein)
35 Percent Ground Peanut Cake	(53 percent protein)
15 Percent Fish Meal	(60 percent protein)
15 Percent Distillers Dried Solubles	(24 percent protein)

Experiments were conducted comparing 3 forms of Auburn No. 2 fish feed as dry mix, crumbles, and pellets $\frac{3}{8}$ -inch in diameter and approximately 1 inch long. The crumbles were made by grinding the pellets into irregular shaped particles, largest dimensions of which were 0.1 to 0.2 inch. The cost per pound was 5.5 cents for the dry mix, and 6 cents for the crumbles and pellets.

Included in the tests was a commercial trout feed having a guaranteed analysis of 43 percent protein, 20 percent nitrogen-free extract, 3.25 percent fat, and 4 percent fiber. It also included numerous vitamins, mineral supplements, and antibiotics. It was in the form of hard round pellets about 0.05 inch in diameter. The cost per pound was 17 cents.

Fathead minnows weighting 1.74 pounds per thousand fish were stocked into each of twelve 0.25-acre ponds on January 21, 1958, at the rate of 100,000 per

* Prather, E. E. Preliminary experiments on winter feeding small fathead minnows. Proc. Southeast. Assoc. Game & Fish Comm., 1957:249-253.

acre. No fertilizers were used during these experiments. The fish were fed once daily except Sundays. There were three replications for each of the four feeds used. The initial daily feeding rate was 3 percent of the body weight of the fish for the period January 22 to March 2. Twice the initial weight of feed was used from March 3 until March 31. No feed was used on several days when ice covered the ponds. All ponds received the same weights of feed during the test period. They were drained on April 1, and the fish were counted and weighed (Table I).

TABLE I
EFFECT OF FEEDS ON FATHEAD PRODUCTION
*Numbers * and Weights of Fatheads Recovered Per Acre on Draining
When Fed the Following Rations*

<i>Dry Mix</i>	<i>Crumbles</i>	<i>Pellets</i>	<i>Trout Ration</i>
<i>Number Pounds</i>	<i>Number Pounds</i>	<i>Number Pounds</i>	<i>Number Pounds</i>
95,184 — 316.0	97,556 — 351.2	101,406 — 369.8	102,561 — 292.3
92,143 — 301.0	81,743 — 309.6	98,520 — 297.2	86,453 — 260.8
93,638 — 298.1	92,908 — 300.4	96,659 — 360.4	91,295 — 271.6

* Calculated by counting random samples of approximately 20 percent of the total number of fish in each pond; all fish were weighed.

The results of these feeding tests are summarized in Table II. The data demonstrate no significant differences in survival beyond normal variation. However, survival was highest where the fish were fed Auburn No. 2 pellets, and lowest where crumbles were used.

TABLE II
AVERAGE RESULTS * OF FEEDING FATHEADS THREE FORMS OF AUBURN No. 2
FISH FEED AND TROUT RATION

<i>Item</i>	<i>Dry Mix</i>	<i>Crumbles</i>	<i>Pellets</i>	<i>Trout Ration</i>
Percent Survival	93.6	90.7	98.8	93.4
Pounds Fish Recovered Per Acre...	305.0	320.4	342.5	274.9
Pounds Gained Per Acre.....	131.0	146.4	168.5	100.9
Average Weight, Pounds Per				
1,000 Fish	3.37	3.64	3.64	2.94
Pounds Feed Used	380.0	380.0	380.0	380.0
Conversion Factors †	2.98	2.59	2.26	3.77
Cost of Feed Per Pound of Fish				
Produced	\$0.16	\$0.15	\$0.13	\$0.64

* Average of three ponds per feed.

† With no correction for natural feed.

The highest gains were made by fish that were fed Auburn No. 2 pellets, and slightly better gains were made on crumbles than on dry mix. However, there were no significant differences in these gains. The poorest gains were made by the fish that received the trout ration. When these data were treated statistically,† there was a significant difference at $P = 0.05$ between the treatments as shown below:

	<i>D. F.</i>	<i>S. S.</i>	<i>M. S.</i>	<i>F</i>
Reps.	2	3,284.8	1,642.4	4.94
Treat.	3	7,250.9	2,417.0	7.27*
Error	6	1,995.3	332.6	...

Upon further analysis, it was found that the gains in weights of fish from all ponds fed the Auburn No. 2 feeds were significantly ($P = .01$) greater than the average gain in weight of fish fed the commercial trout ration as indicated:

	<i>D. F.</i>	<i>S. S.</i>	<i>M. S.</i>	<i>F</i>
Auburn No. 2	2	2,124.3	1,062.2	3.19
Auburn No. 2 vs. Trout	1	5,126.8	5,126.8	15.41†
Error	6	...	332.6	...

† The author is indebted to Dr. J. M. Lawrence for aid in statistical analysis of the data presented in this paper.

The reasons for the poor results obtained with the trout ration are not fully understood. However, it contained small amounts of antibiotic feed supplements, and there is some evidence that antibiotics fed to fish over a long period may reduce rate of growth.

Although there were no significant differences in the gains among the fish fed the three forms of Auburn No. 2 fish feed, there were indications that particle size influenced production. Apparently, the fish were able to find and consume a larger percentage of the feed when the size of the particle was increased. It was observed that the fatheads consumed a considerable amount of the dry mix just after it hit the water and before the particles sank to the pond bottom. The crumbles and pellets sank more rapidly than the dry mix, and it appeared that the fatheads did not eat these forms until after they had softened on the pond bottom.

A SUMMARY OF METHODS USED DURING FLORIDA'S GIZZARD SHAD CONTROL EXPERIMENTS

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ABSTRACT

Determination of a desirable concentration of 5 percent emulsified rotenone in a given lake to control gizzard shad was accomplished by an observational technique. The concentration employed varied from 0.06 p.p.m. to 0.14 p.p.m. The time of year considered best suited for treatment was during the fall. Methods used to apply the toxicant were varied but appeared about equal of results except while using spray planes. The most favorable results occurred when good distribution was secured by using six to twelve hours for application, numerous surface units and dilute mixtures. As many as 4,600 acre feet were treated by one efficiently equipped boat. A table is presented which was used as a basis for calculations of concentrations. At least three successive treatments one year apart were needed for the most effective control of shad. Conclusions regarding stocking were not drawn.

INTRODUCTION

Control of undesirable forage fish populations have been attempted in Florida waters for several years. Selective poison techniques with five percent rotenone have been demonstrated to efficiently destroy large poundages of gizzard shad. These methods as used in Florida are described in this paper.

DETERMINATION OF DESIRABLE CONCENTRATIONS

The determination of a desirable concentration of 5 percent emulsified rotenone required for gizzard shad control in Florida was not predictable since it appeared to be dependent upon several variables. Such variables were the amount of active ingredient in the material to be applied, water temperature, amount of organic material present, nature of the lake bottom and others. An observational technique, based largely upon experience, was found to be a satisfactory method of making the determination. During treatments of small lakes general activity of gizzard shad over the entire lake surface as the concentration approached 0.10 p.p.m. was used as an index. If the shad were more active in some areas than others, as the desired concentration was approached, those areas were avoided during the subsequent application so that activity of shad on the entire lake tended to be uniform. When the surface was "working" with small and some medium sized shad it was believed the kill of shad would be satisfactory. At low temperatures a general activity was difficult to detect. The concentrations required were found to vary from 0.06 p.p.m. to 0.14 p.p.m.