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Baldwin Feeding Station

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REPORT ON THE USE OF DRY FEEDS AT BALDWIN, MICHIGAN, DURING SUMMER OF 1936

by

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The fish at the Baldwin Feeding Station were sent there on about the 15th of May. On July 8, some 53 days later, about three-quarters of all the fish at the station were changed from a meat diet they had been receiving to a diet consisting of meat and dry meals. The remaining one-quarter were continued on the meat diet. Following are some data concerning the composition and costs of the diets used subsequent to July 8.

Meat Diet

7.4	lbs.	sheep liver	@	8.5	cents	per lb.	=	62.90 cents
11.1	"	hog melts	@	3.5	"	" "	=	38.85 "
6.86	"	Balto	@	6.0	"	" "	=	41.16 "
25.36	lbs.	(wt. per pail)						$1.4291

Pond of rainbow fingerlings received 1½ pails full per day, which equals 38 pounds @ 5.63 cents per pound, which cost $2.14.

Meal Diet

125	lbs.	hog melts	@	3.5	cents	per lb.	=	$4.375
41	"	Balto	@	6.0	"	" "	=	2.46
125	"	meals	@	4.47	"	" "	=	5.588
100	"	water						
391	lbs.							$12.423

Ponds of rainbow fingerlings received 1 pail full per day, which equals 28 pounds @ 3.18 cents per pound, which cost $0.89.

The discussion which follows is concerned chiefly with three ponds full of rainbow fingerlings, as data and weights were obtained only for these fish.

After the diets had been selected and the employees at the Baldwin Station had been shown how to prepare the feed, the question of how much of this diet to feed arose. Since it is impossible to state definitely how much to feed any pond of fish, the attendants were instructed to feed the same amount (weight) as they had been feeding previously, but to watch the fish and increase the amount of feed regularly so that the fish would get all they could eat. The meat-fed fish were to be fed three times a day, but the meal-fed fish only twice--this in view of the fact that the meals digest more slowly than meat. Both groups, as already stated, were to get the same weight of food to begin with.

At a superintendents meeting in Lansing on August 7, Mr. Fortney reported that the meal-fed fish at Baldwin were doing very poorly. On August 11 the situation was investigated. Three ponds of rainbow fingerlings were studied particularly, of which one was a pond which had been continued on a meat diet, while the other two had been on the meal diet since July 8. Ten pounds of fish from each pond were weighed and counted. It was found that the meat-fed fish (pond 12) ran 44 to the pound, whereas the two ponds of meal-fed fish ran only 82 to the pound (pond 11) and 100 to the pound (pond 10). Thus the meat-fed fish were more than twice as large (heavy) as the meal-fed. These results being contrary to experiences elsewhere with similar meal diets, the attendants were questioned as to amounts fed, methods of feeding, number of fish, etc. Their method of feeding was observed and on this point more will be said later. The data obtained are given in the following table, except that the last column contains theoretical figures which will be explained below.

Feeding Data for 3 Ponds of Fingerlings. July 8 - Aug. 11

Pond No.	No. of Fish	Lbs. of Food Daily	Units of Food Daily Per Fish[1]	Ave. Wt. of Fish Aug. 11. Actual	Ave. Wt. of Fish Aug. 11. Expected
12	25,000	38	1.52	1/44 lb.	.....
11	30,000	28	.93	1/82 lb.	1/72 lb.[2]
10	35,000	28	.80	1/100 lb.	1/95 lb.[3]

[1] Pounds of food fed daily ÷ number of thousand fish.

[2] This figure obtained from proportion 152:93::1/44:x.

[3] This figure obtained from proportion 93:80::1/82:x.

- Number of Fish. Pond 12 being shorter than pond 11, and 11 shorter than 10, the three ponds were given different numbers of fish when planted on May 15.

Pounds of Food Fed Daily. The fish in pond 12 received $\frac{1}{2}$ of a pail full of meat at each of their three daily feedings. Those in ponds 11 and 10 each received $\frac{1}{2}$ of a pail full of feed at each of their two daily feedings. The figures listed are from actual weighings of sample pail-fulls of each feed previous to the addition of any water (that is, the water which is stirred into the mixture just previous to feeding).

Units of Food per Fish Daily. By dividing the pounds of food fed by the number of fish in the pond, we obtain the amount fed per fish. To avoid long decimals this figure is given in "units" rather than in ounces.

Average Weight of Single Fish. Actual. Ten pounds of fish from each pond were weighed, a random sample being taken in each case from near the foot of the pond. The fish ran 44 to the pound, 82 to the pound, and 100 to the pound.

Average Weight of Single Fish. Expected. Let us assume that ponds 12 and 11 were on the same diet. Such an assumption is not too far from the facts in view of the results obtained by Lenel (1933) who got almost an identical growth on a pure meat diet and a diet very similar to the one used here. The only difference in the treatment of the two ponds then would be the difference shown in column 4.

Since, within certain limits, the size of fish will vary in proportion to the amount of food they receive, we can state a proportion involving the elements as follows: Units of food per fish pond 12 is to the units of food per fish pond 11 as size of fish in pond 12 is to size of fish in pond 11. Let us take the last element in this proportion as the unknown, and we get the following proportion:

152:93::1/44:X

Solving this proportion we get X = 1/72. This means that, merely on the basis of the difference in the amount of food fed, if the fish in pond 12 reached a weight of 1/44 pound we would expect those in pond 11 to have reached a size of 1/72 pound, or to run 72 to the pound. Actually they ran 82 to the pound. Thus they were smaller than expected, but not as much smaller as the comparison between 44 to the pound and 82 to the pound would indicate.

It should be pointed out that the above proportion could not be absolutely correct because of a number of factors. To mention only two, the ratio of 152 to 93 represents only the ratio in which they were fed for 34 days, whereas the ratio 1/44 to X represents <u>total</u> growth including the growth for the period previous to the use of the meal feeds. A truer proportion could be obtained if we had a figure for the growth during the 34 days the meals were used, but we do not have this figure for the fish were not weighed when the diets were started. In the second place, the two groups were fed different diets, and the proportion would be strictly true only for fish on the same diet.

The fact that the fish in pond 11 ran only 82 to the pound, whereas they could have been expected to run less than 72 to the pound, can perhaps be explained by some of the following points:

(1) The fish in pond 11 may have been somewhat smaller than those in pond 12 when the meal diets were started on July 8. They must certainly have been smaller if insufficient allowance in feeding had been made for the fact that there were more fish in pond 11 than in 12 previous to July 8, as insufficient allowance was made subsequent to that date.

(2) The meal feed may not have been scattered well enough for the fish and so fallen to the bottom of the ponds in rather large lumps which later disintegrated and were carried away by the current. Such lumps might settle among the algae on the bottom of the ponds and so be lost to the fish. It is a fact that more care must be used in handling meal feeds than pure meat because the latter breaks up more easily and can therefore be fed more rapidly. As regards the question of the proper method of feeding. Mr. Basford was observed feeding the fish and he appeared to be doing it correctly. This most certainly could not be said for the attendant feeding the yearling brown trout, for in this case the feed was being thrown to the fish in large masses which settled down beneath the algae and became unavailable to the fish.

A comparison of the size of the fish and the amounts of food fed should give a closer approximation between expected and actual results in the case of ponds 11 and 10 than in the case of ponds 12 and 11 because ponds 11 and 10 were on the same meal diet. In this case we get the following proportion:

$$93:80::1/82:X$$

Solving this proportion we get $X = 1/95$. This means that on the basis of the difference in the amount of food fed the two groups, if those in pond 11 reached a size of 82 to the pound those in pond 10 would be expected to reach a size of 95 to the pound. Actually they were a little smaller than this (100 to the pound) but the agreement is quite close.

In view of the fact that the size attained by the fish on the meal diets agrees fairly well with what might have been expected on the basis of the amounts fed, it seems fair to conclude that the disappointing showing made by the meals was due to the fact that the fish were underfed.

This conclusion is supported by the fact that this same meal has worked very well both in experiments and in large-scale use in the hatcheries of New York State.

Also by the fact that the fish in question were seen to eat the food very readily and apparently cleaned up all they could obtain, yet they were thin and emaciated.

Miscellaneous Remarks About the Meal Diets at Baldwin

(1) Mr. Fortney reported that the meals encouraged the growth of algae and weeds in the ponds. In this regard it should be stated that even for the meat ponds the algae situation this year was the worst ever experienced at Baldwin, due to the high temperatures, low water, and numerous clear, sunny days. If the meal ponds were worse than the meat ponds it may have been, as suggested by Mr. Basford, because the meal-fed fish were smaller and therefore did not tear up the algae quite so much. It is, of course, possible that the waste meals fertilized the ponds and promoted the growth of vegetation.

(2) On August 11 when the fish were weighed some losses were occurring among the brown trout fingerlings. These losses were lightest in the one meat pond, almost as light in one of the meal ponds, and heavier in the rest of the meat ponds. There were no losses among any of the other species of fish, meat- or meal-fed.

Thus it appears that the meals were responsible for the higher mortality in the brown trout fingerlings. At no time, however, did the mortality become serious.

(3) While there was no mortality among the yearling brown trout, yet the meal-fed ponds contained a number of fungused individuals, whereas the meat-fed pond seemed entirely free from this condition. It must be pointed out, however, that the ponds containing the yearlings were in a series and that the meat-fed pond was the first one in the series. During a summer as hot and dry as the past one, it could be expected that the lower ponds of a series would not do so well as the upper, regardless of diet. At the White River Station, for instance, practically all the fish in the lower ponds of a series were killed by high temperatures this summer, whereas the losses were not nearly so great in the upper ponds. All these fish were on the same meat diet.

It is the opinion of the writer that the poor showing made by the meal diets at the Baldwin Feeding Station this year cannot be considered conclusive evidence of the low value of these meals for fish food. We have some 70 years' experience behind the feeding of ground meat. An experienced fish culturist can tell almost at a glance whether fish are feeding properly, are being under- or over-fed, are making satisfactory gains for the amount consumed, etc. But meal feeds are so different physically from meat, and our experience with them is so short, that some disheartening reverses in their use are to be expected. We should not be discouraged by the Baldwin results in the light of the fact that an ever increasing number of fish culturists are meeting with success in the feeding of meals. When we can duplicate the conditions under which these feeds have been successful elsewhere, there is no reason why they should not be successful in Michigan.

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