

FRESH WATER MUSSELS AS A FISH FOOD.

By D. LYDELL,
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During the time when the price of liver, etc., was almost prohibitive for feeding fish, we began the search for a substitute. We found tons of fresh-water clam meats going to waste along our rivers in Michigan, so conceived the idea of using them for fish food. Some of the fresh meat was taken to our hatcheries and ground up and the adult fish seemed to take it very readily, but it was impossible to get the fresh meat fine enough for our fry and fingerlings.

Fresh clam meats do not keep for any length of time, and the season for collecting them covers only a few months in the summer, so we attempted to devise a way to preserve the meats for feeding throughout the year. Drying seems to be the only method. At first we dried a few of them in the sun, which is a very successful way, providing you do not have cloudy or rainy weather, in which case the clams will sour very shortly and be unfit for feeding. Several experiments and methods were tried, but the most practical and economical drier and one that can be moved to any point along the stream where the clams are collected, is a box-like arrangement 3 or 4 feet square, and 5 or 6 feet in height, fitted with trays made of quarter inch galvanized wire. These are filled with clams and set directly one above the other. An old-fashioned box stove is put in the bottom and fired with wood or coal, or refuse picked up along the stream. In this way the clams are dried in nice condition in about 20 hours. These clams, when thoroughly dried and stored away, will keep indefinitely. I have some here on exhibition that were dried in 1916. By placing them in warm water, they will return to their natural size in about 15 hours.

The next problem was to get the clams fine enough for our small fish and grinding seemed to be the only method. After some experiments we found they could be ground up into a nice meal. This meal when put into hot water swells up very quickly, and a very little of it makes a large amount of food, and it is fine enough to feed to the smallest fry.

Other experiments were then tried in regard to feeding the meal to our adult fish. This we accomplished by making a thick mush, similar to a corn-meal mush, simply by stirring the meal into boiling water slowly until the mush was as thick as it could possibly be stirred. This was set away to cool and then run through a grinding machine or a press, with holes in it the size of the food required. The food came through the press or grinder in wormlike masses. We found our adult fish would take this a great deal more readily than they did the ground up clams.

REDUCING THE DEATH RATE AMONG OUR STOCK FISH.

During the summer of 1918 and 1919, clam meal was the only food used to feed all of our fish at the Mill Creek Station, and the death rate has been reduced to a minimum. Not enough fish died in 1919 to justify us in keeping a record of them. Prior to 1918 the death rate among our stock fish, such as bass, blue-gills and perch, was always about 25%. From the Drayton Plains Hatchery, in Michigan, comes the following report:

"I have lost less than 20% of my blue-gill breeders this season, where every season before we have lost 75% and I firmly believe that it is all due to clam meal diet. We have fed it almost clear to both the large and small fish, and they have certainly done well on it.
J. L. BRASS, Overseer."

At Mill Creek Station this season 89,000 blue-gills and 57,000 perch were raised to the fingerling stage. The last of these were distributed on October 4th, when they ranged from 1½ to 5 inches in length. At first they were fed five times a day, but later only one feeding was given each day.

CLAM MEAL AS A NATURAL FISH-FOOD PRODUCER.

During the season of 1918, when our ponds were drawn down and being cleaned, I scattered about 25 pounds of clam meal around the shores of one pond. Several days after the ponds were re-filled with water, I noticed large quantities of crustacea, which seemed to be more abundant in this particular pond. Whether this was due to the clam meal, of course, we do not know.

During the season of 1919, this experiment was carried further, part of our ponds were treated and the others were not. The

result seemed amazing, as though there was twice as much natural food in the ponds treated as in those not treated. Whether this natural food supply is increased, or simply fed by this meal, is a matter, I think, for science to decide.

These are only some facts that have been discovered and jotted down to get information and provoke a discussion. Several tons of this food has been sold by Comstock Park Fish Food Company, and possibly some of the men that have been using it are present at this meeting. If so, I would appreciate hearing what success they have had, how the meal has been prepared for use, etc.

The Wistar Institute of Anatomy and Biology, of Philadelphia, Pa., seems to be having great success in feeding it to their colony of white rats. They claim that their death rate has not only been reduced, but that their litters have been increased.

Discussion.

MR. GEO. H. GRAHAM, of Massachusetts: I would like to ask Mr. Lydell if he ever fed this meal to trout or salmon.

MR. LYDELL: I have not had occasion to feed it to brook trout. We fed it exclusively to chinook salmon one season until they were about six inches in length. They did better than on liver and there were only thirteen deaths among 600 fish in one small pond.

A MEMBER: What is the difference between the cost of liver and this preparation?

MR. LYDELL: I cannot say exactly, but this meal costs about ten cents a pound and we feed less than one-third as much of it as we would of the liver. Besides we can rear the fish better on it.

MR. GRAHAM: To what other fish can it be fed?

MR. LYDELL: We have fed this food exclusively for two years to yellow perch and large- and small-mouth black bass.

The mussels are shipped to us from the button factories. After they are dried they are stored in that condition. When we want them for food we put them in the dryer and then run them through the grinder, which is connected with a gasoline engine.

MR. GRAHAM: Is there any limit to the amount we can get?

MR. LYDELL: I should judge that we could have secured forty or fifty tons within thirty miles of Grand Rapids.

MR. GRAHAM: What is the name of the company and are they now selling the meal?

MR. LYDELL: The Comstock Park Fish Food Company is preparing now to handle the meal in a commercial way. (Mr. Lydell then exhibited samples of the dried mussels and various grades of the meal intended for use with fish of different sizes.)

MR. G. C. LEACH, of the U. S. Bureau of Fisheries. I believe the clam meal is a very good fish food. I have ordered fine clam meal and the whole clams with the intention of having five or six of our superintendents try them out in the way Mr. Lydell has described. We have used it in Washington, under ideal conditions, with good success, feeding nothing else but clam meal, mixed with water into a thick mush. We fed salmon, brook, rainbow and steel-head trout, whitefish and perch.

When the meal was dropped on the water some fish were quite wily, but later, when it had settled to the bottom, they sucked it up. At the stations where bass and other such fishes had been fed on beef heart they did not take readily to the dried clam, but I believe that they could have been trained to take it. We have not had a full report from the stations that have used the meal, so I cannot say as to the results, but in Washington we found it satisfactory. What results did you have, Mr. Seagle?

MR. GEO. A. SEAGLE, Wytheville, Va.: After feeding the young trout on beef heart and liver they did not take to the clam meal readily, but I believe that if we feed them on the meal first and nothing else they will take it readily enough.

MR. JOHN P. WOODS, St. Louis, Mo.: I wish to give the benefit of some experience I had during the years 1914 to 1918. When seining our ponds in the summer time we took large numbers of crayfish. These were run through a grinder with stale bread and substituted for other fish food. When this could be had there was a great demand for the crayfish substitute.

A MEMBER: The grinder we use is the same as for grinding beef hearts. By using the fine plates and mixing with corn meal or low grade flour or shorts we get any desired length or thickness we desire. But I think that probably the greatest success with the clam meal, as Mr. Lydell suggests, is as food for *Daphnia*, by scattering it around the edges of the pond where it serves as food for the small organisms.

MR. LEACH: We use crayfish a good deal at the Ocean Station, grinding it and mixing with low grade flour or shorts. It makes a very nice food.

PROF. E. E. PRINCE, Commissioner of Fisheries of Canada: I believe the fish get rather tired of heart or liver when fed continuously, though it appears, as Mr. Seagle says, that they don't take readily to new food when offered. But experiments in fishing show, in the east at any rate, that fish can be caught more readily by a change of food. For instance, if the fishermen have been using soft-shell clams and then change to mussels they will do better. In one locality I know sea-anemones were used as a change and the boats using them caught more fish than the other boats, as though the novelty attracted the fish.

But there is one thing about Mr. Lydell's clam meal which I think noteworthy. It is a diet that embodies a variety of foods. The mussels contain liver, muscle tissue, connective tissue, etc., and I think such a mixed diet has much to do with the success of this food and the healthy character and growth of the fish.

MR. N. R. BULLER, of Pennsylvania: I would like to inquire in this connection whether the increase of Daphnia in ponds in which this meal is scattered is not simply because the meal acts as a fertilizer. My impression is that the Daphnia feed on algae. In other words doesn't this meal simply furnish ammonia and ammonium nitrate which could be as easily and more cheaply furnished by commercial fertilizers? Doesn't it act only as a fertilizer?

MR. LYDELL: That may be true. It is up to some one better versed in science than I am and I only know the results we obtained. In regard to the trouble experienced in feeding the clams to bass, I may say that if the whole clam is scalded and ground, you do not get the worm-like masses. The feet of the mussels are very hard and do not soften readily. By being pulverized in the dry condition and then soaked, that part is prepared so the fish will eat and relish it. An eighth of a teaspoonful of this finest meal put in a cup of hot water will make as fine a bouillon as you ever drank.

MR. KILLIAN, of Maryland: There is a preparation being manufactured from oysters at Hampton, Va., and sold under medical recommendation as human food. It is the very same proposition.