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DEVELOPMENT OF MARKETS FOR UNDERUTILIZED LAKE ERIE FISH--PROGRESS REPORT

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BACKGROUND

An investigation of new markets for the underutilized fish populations of Lake Erie was undertaken August 1, 1955, by the Fish and Wildlife Service's Branch of Commercial Fisheries at the specific request of the Lake Erie Fish Management Committee. Funds for the project were provided by the Saltonstall-Kennedy Act of 1954. Headquarters for this study was established near Cleveland, Ohio. Lake Erie was chosen as the site of the pilot market development program in the Midwest because of the tremendous numbers of rough fish in this Lake, particularly in the Western basin. The Service's role has been largely that of endeavoring to develop and cement contacts between producing and buying groups.



Fig. 1 - Concentration of dead gizzard shad washed ashore at West Basin, Lake Erie.

POTENTIAL ROUGH FISH PRODUCTION

A preliminary survey of the Lake Erie area indicated that there are very large populations of rough fish that play only a secondary role in the commercial catch because of economic selectivity. These consist of gizzard shad (sawbellies), goldfish, sheepshead, carp, burbot, and white bass.

Knowledge of the potential availability of the various species of rough fish in Lake Erie is practically nil and it was difficult to determine the potential quantity that could be produced by Lake Erie fishermen. We have had to rely almost completely on the educated guesses of fishermen. Recently, the Ohio Commercial Fishermen's Association distributed questionnaires among its members asking that they indicate the quantity of each species of rough fish they felt they could produce incidental to their marketable fish during each month of the fishing season. Although all questionnaires have not as yet been returned and processed, a preliminary estimate of the potential rough fish production was obtained, using available figures (table 1). Since these are estimates from only part of the fishermen, they

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do not represent the true potential of rough fish from Lake Erie. This is particularly true for a species such as gizzard shad.

Table 1 - Potential Rough Fish Production by Members of the Ohio Commercial Fishermen's^{1/} Association

Month	Sheepshead	Burbot	Carp	Gizzard Shad	Total
(Thousands of Pounds)					
March	130.0	11.2	310.9	185.6	637.7
April	2,708.0	42.0	940.4	594.0	4,284.4
May	5,712.4	139.2	506.4	1,419.2	7,777.2
June	4,948.2	76.0	640.3	1,724.8	7,389.3
July	761.4	4.4	255.0	1,044.8	2,065.6
August	285.2	4.8	305.4	450.8	1,046.2
September	371.2	9.4	106.8	449.6	937.0
October	277.2	15.2	184.5	507.2	984.1
November	237.2	35.2	141.9	161.6	575.9
December	44.5	18.0	6.4	82.8	151.7
Total	15,475.3	355.4	3,398.0	6,620.4	25,849.1
Actual Landings, 1955	1,575.5	89.3	2,406.9	0	4,071.7

^{1/} These are estimates from only part of the fishermen. The actual potential is considerably greater.

PROBLEMS IN UTILIZING ROUGH FISH

Let us assume that the fishermen can produce about 25 million pounds of rough fish, as indicated. Even though we had a ready market for all of these fish, there would still be a number of problems to be overcome before we could utilize these fish. Chief among these is the lack of adequate freezer space in the Lake Erie area. Last fall, J. W. Slavin, Refrigeration Engineer, and David Miyauchi, Fishery Products Technologist, from the Service's Fishery Technological Section made a survey of cold storage and freezing facilities along Lake Erie from Cleveland to Toledo, Ohio. Their report pointed up the inadequacy of freezing and cold-storage facilities throughout this area.

Another problem is the high cost of trained labor in the Lake Erie area, which would make it uneconomical for most producers to handle quantities of rough fish that are normally expected to bring a low price. If, however, rough fish could be moved with a minimum of handling, most producers would be willing to handle these fish.

Still another problem, undoubtedly the most important to the fishermen, is the relatively low price paid for rough fish by processors of food for animals. Initially, most fishermen indicated they could catch no fish for less than five cents a pound. Most fishermen now feel they can catch for about two cents a pound, and some feel they can produce for even less. If the problems of refrigeration, handling, and transport can be solved, a price agreement between fisherman and buyer could be more readily attained.

Many possible markets for Lake Erie rough fish have been explored. Among these are: human food industry, fur farm industry, pet food industry, fish meal industry, and fish hatchery foods.

FOR HUMAN CONSUMPTION

Naturally, the first market to be considered for Lake Erie rough fish would be that of human food. At the present time, a limited market is available for carp, sheepshead, and burbot for human consumption. Our investigations show, however, that it is doubtful that any increase in this area can be expected. The human food market for rough species has declined in the past few years. This past year the

prices for rough species have been particularly low. Lake Erie fishermen are finding it uneconomical to transport species such as carp to Chicago to compete with the fish produced locally and more cheaply. Some rough fish are being sold live in Southern markets for stocking purposes, but it is doubtful that this business will grow sufficiently to be of any appreciable benefit to Lake Erie fishermen.

Gizzard shad, capable of production in tremendous quantities, have never been used as human food, and it is doubtful that they ever will be.

FOR ANIMAL FEEDING

One of the best potential markets for Lake Erie rough fish is the fur farm industry. There are some 5,000 mink ranches in the United States and the National Board of Fur Farm Organizations estimates that these ranchers can use some 250 million pounds of fish a year. Over two thirds of these fur farms are within easy reach of Lake Erie fishermen.

The fur farmers are interested in purchasing greater quantities of fish, since prices for horse meat, the hitherto standard protein ration, are constantly rising. About four years ago, the price of horse meat was about $7\frac{1}{2}$ cents a pound as compared to about 12 cents a pound today. On the Pacific Coast, many ranchers are feeding as high as 90 percent fish at the present time, with success. Many Midwestern ranchers feed as high as 50 percent fish and it is anticipated that they will soon be feeding as high as 65 percent fish. A few years ago it was a rarity to see more than 15- to 20-percent fish in mink diets in the Midwest.

The mink industry is a growing industry. Reportedly, some 70 percent of all furs used in the United States are mink. Pelt production has risen about 15 percent yearly for the past several years. The average pelt price has increased 10 to 20 percent in recent years.

Since the mink industry seemed the greatest potential market for rough fish, our initial market development activities have been directed, for the most part, to this market.

FISH FOR PET FOOD PACKERS

Use of fish in the pet food industry has increased tremendously during the past decade. In 1947, this industry packed about 43.7 million pounds of fish-based pet foods, valued at almost \$4 million to the packer. In 1955 the pack of fish-based pet food totaled 256 million pounds, valued at \$27.5 million. Part of this increase has been due to an expansion of the pet food industry, whereas, part has been due to the shortage of horse meat, with fish now being used as an effective substitute, especially in food for cats. Indications are that this industry will continue to expand during the next decade. Several pet food manufacturers have already started on long-range expansion of plant facilities in fish-producing centers.

Shortage of products normally used in processed dog food, such as horse meat, is forcing these canners to look for a substitute. Fish may well be the logical re-



Fig. 2 - Removing and hauling away gizzard shad dead from natural causes at West Basin, Lake Erie. Gives some idea of the potential fishery for this species if some use was found for it.

placement. The Department of Agriculture reports that about 50 percent of all processed dog foods are certified, which requires that the products be fit for human consumption, be nutritious, and contain no inedible materials. Recent conferences between the Departments of Agriculture and Interior and pet food manufacturers have encouraged a compromise and clarification in the interpretation of present dog food ingredients. If this compromise can be reached, the dog food industry could within the existing inspection service use considerably more fish in the future, thus creating an additional market for rough species.

FOR FISH MEAL

The fish meal industry was initially considered another excellent market for rough fish. Investigation showed, however, that a fish meal and oil operation was not economical in the Great Lakes area at the present time due to seasonal factors and the fact that production is dispersed over a wide area. The present price paid for this type of fish meal (about \$140 a ton) precludes payment of more than about one cent a pound for the raw fish. Lake fish are low in oil content, and an operation in this area would be strictly for fish meal.

Plans and specifications for a fish reduction plant, mounted on a trailer bed and capable of being moved from place to place, have been designed for the Service by Renneberg and Sons, of Baltimore, Md. Although this unit was limited as to hourly capacity for a large-scale commercial operation, it was anticipated that it would serve some use in connection with state rough fish removal programs. Many states now find it necessary to pay considerable money to catch these fish and to haul them away for disposal. Possibly the fish could be made into fish meal and the money derived from its sale would defray removal costs. Several Midwestern States have developed their own rough fish marketing programs, and most of the rough fish is being either sold for human or animal food uses. A good example is that of the State of Wisconsin. Commercial fishing took about 3.6 million pounds of rough fish (sheepshead) out of Lake Winnebago last year. All of it found a ready market, primarily as mink feed. Wisconsin Conservation officials hope to more than double the take from Winnebago in 1956.

Other states are not so readily finding such markets and may well investigate the application of the portable reduction plant to their programs.

OTHER USES

Other possible markets for rough fish are Federal and state fish hatcheries and rearing stations, and the many trout and pondfish dealers throughout the United States. Although these outlets represent a potential market for millions of pounds of fish annually, many problems still require solutions before any substantial program can be assured. Further investigation of this market will be deferred until a later date.

WORK ON SUITABILITY OF ROUGH FISH FOR ANIMAL FOOD

Considerable work has already been done by the Fish and Wildlife Service's Technological Section, the University of Wisconsin, individual mink ranchers, and pet food manufacturers on the suitability of Lake Erie rough fish as animal food.

The Service has been working on the proximate composition of sheepshead from Lake Erie as early as 1951. Since that time a regular sampling of the principal species has been made to determine if seasonal and area differences occur in the principal constituents. Analyses were made of the edible portion and the trimmings. More recently, whole raw rough fish from Lake Erie were analyzed to determine the proximate composition and the thiaminase content (table 2).

Lake Erie rough fish run considerably higher in fat content than the marine fish, which many mink ranchers consider an asset. Thiaminase, an enzyme capable of thiamine destruction, is an important consideration particularly in fish to be used for feeding mink. If a small proportion of fish containing an appreciable amount of this enzyme is mixed with another lot of fish not containing the enzyme, the vitamin thiamine present in the mixed lot may be destroyed. Thiamine in the

Table 2 - Proximate Composition and Thiaminase Assay of Fresh-Water Rough Fish From Lake Erie

Species	Date Caught	Dry Matter	Protein	Fat	Ash	Thiaminase
Sheepshead ^{1/} . . .	Oct. 1951	24.2	18.4	6.0	1.1	<u>4/</u>
2/ . . .	June 1952	24.6	17.2	6.9	1.1	<u>4/</u>
<u>1/</u> . . .	Aug. 1954	24.5	17.5	6.0	1.0	<u>4/</u>
3/ . . .	Sept. 1955	28.3	16.3	8.0	4.2	<u>4/</u>
<u>3/</u> . . .	Nov. 1955	28.3	16.3	8.0	4.2	None
Gizzard Shad ^{3/} . .	Nov. 1955	37.0	16.2	17.6	3.0	Present
Burbot ^{3/}	Nov. 1955	22.8	13.9	5.2	2.4	Present
Carp ^{3/}	Nov. 1955	32.7	16.5	10.6	5.0	Present
Goldfish ^{3/}	Sept. 1955	32.7	16.5	10.6	5.0	<u>4/</u>
<u>3/</u>	Nov. 1955	32.7	16.5	10.6	5.0	Present

1/ Edible portion and trimmings. | 3/ Whole raw fish.
 2/ Edible portion only. | 4/ Not analyzed for thiaminase.

Note: Analyses made by Service Technological Laboratory, College Park, Md.

diet is necessary to the proper growth and development of mink. Lack of thiamine causes chastic paralysis in mink. Thiaminase may also destroy the thiamine in other constituents in the diet. Cooking the fish prior to feeding the animals will destroy this enzyme. Raw fish containing thiaminase may be fed to mink if special precautions are taken to feed the raw fish apart from the other diet ingredients. Some mink ranchers feed raw fish known to have a high thiaminase content, such as carp, on alternate days, with no detrimental effect.

The Service plans considerable work on fresh-water fishes this year. Samples of rough fish will be collected throughout the year to ascertain seasonal and area variation in the proximate composition of these fish. The results are being made available to the animal food industries and fur farmers to facilitate the development of a properly balanced nutritive diet.

Fur animal nutritional research has been conducted by Dr. Leoschke of the University of Wisconsin. Experiments recently completed showed that sheepshead was an excellent feed for mink. It was thiaminase-free and could be fed in either the raw or cooked state. Dr. Leoschke is at present interested in doing similar nutritional research, using gizzard shad. He believes this species shows a great deal of promise as mink feed.

Individual mink ranchers also have conducted fish-feeding experiments. Most of this work is being done by the larger mink ranchers. Many lake species have been tried. Extensive use of sheepshead on mink ranches in the Midwest resulted from just such experiments. Last year some of the mink ranchers fed sheepshead, exclusively, with promising results. Some ranchers are now planning to try burbot and gizzard shad along with cooked smelt and carp. Some ranchers have suffered losses because of lack of good basic information on various species of fish. Most favor nutritional research by some central agency where controlled experiments can demonstrate that most suitable application of fish to mink diets.

Pet food concerns have tested practically every species of "trash" fish on both coasts and in the Gulf area and are now testing fresh-water rough fish. Some of

the larger concerns have this analytical work done by their own staffs, while other have commercial testing laboratories run the tests for them. Smelt is already being used by some of the cat food canners in the Midwest. Other species, such as carp, burbot, and gizzard shad will be tested in the near future.

PROBLEMS IN DEVELOPING ROUGH FISH MARKETS

Initial progress in developing markets for Lake Erie rough fish has been extremely encouraging. Emphasis has been primarily on markets in the fur farm and pet food industries as outlets for Lake Erie rough fish.

Many mink ranchers have not resorted to Lake Erie as a source of supply because of lack of information as to the potential of this lake and the limited availability of facilities, such as freezers, in the area. After some initial survey work, it is evident that tremendous supplies of rough fish are available in Lake Erie, particularly in the Sandusky Bay area where haul-seine catches average 75 percent rough fish and, at certain times of the year, go as high as 90 percent.

One of the leading mink ranchers in the world became interested in fish from the Lake Erie area shortly after the Service program was initiated. This rancher surveyed the area completely in cooperation with the Service's market development staff, the Ohio Division of Wildlife, and commercial fishermen. Supply proved no problem, but it was obvious that rough fish removal would be drastically limited by lack of adequate freezing and cold-storage space in the area. Unless some on-the-spot facilities were available, trucking costs to distant freezers would make an operation in this area economically difficult. The groups explored the possibility of establishing large freezers at Sandusky, in the heart of the rough fish area. This seemed promising but costly. Through affiliates on the Pacific Coast, the groups learned of a brine-tank holding method which had proved successful in holding fish in the chilled state for more than a month. A 10,000-pound-capacity tank was assembled on a mink ranch and experiments conducted. The tanks are lined with refrigeration coils which are designed to drop the temperature of the brine solution (3 parts/million) to 28° F. One of the recently-developed antibiotic type products was added to the chilled brine solution to determine the suitability of this procedure for the preservation of fish as a source of mink food. If the tests prove entirely satisfactory, it is anticipated that the company involved will apply this technique on a larger scale in Lake Erie to insure continuing sources of a fishfood product.

Others have looked into the problem of lack of freezer space. A Chicago concern, long active in the vitamin field, recently developed a process which is similar to the meat drum-pack process. In it the rough fish are ground and cooked in vats. After thorough cooking, and the inclusion of a special preservative, it is packed in metal containers with a capacity of 100 pounds each. This product will keep for extended periods in nonrefrigerated storage without spoilage. The cans may be opened and closed repeatedly without any effect on the product. A cannery in the Sandusky area has been found satisfactory for the operation, and a test run using carp has already been conducted successfully. It was anticipated that this plant would be in operation this year, probably during the heavy rough fish production in May and June.

A number of mink feed brokers also plan to truck sheephead to freezers in Midwestern States. These concerns have already made contacts with Ohio fish producers, and some contracts have been signed for substantial quantities of this year's rough fish production. However, lack of adequate freezer space on Ohio mink ranches precluded extensive storage of Lake Erie fish during the periods when these fish are most plentiful. If adequate holding facilities, such as brine tanks, are made available in the Sandusky area, use of lake fish by Ohio ranchers is expected to increase tremendously.

Considerable effort by the Service's market development staff also was directed to the pet food industry. Although some of the small cat food canneries do use quantities of lake fish, primarily smelt, in their operations, larger concerns are using practically no fresh-water fish in their product. A number of the large pet food concerns have been contacted. Most expressed interest in Lake Erie rough fish and indicated they would investigate the feasibility of using these fish in their operations. One of the leading pet food concerns in the country has for some time planned expansion of its pet food operations. Although it can expand somewhat in its present areas of operation, it would prefer to set up cannery operations in the Midwest. This concern has requested our cooperation in obtaining monthly samples of each of the Lake Erie rough species throughout this coming fishing season. These fish will be thoroughly tested by its research staff, test packs will be made, and feeding trials held. An initial shipment of sheepshead, gizzard shad, burbot, carp, and goldfish has already been sent to this concern for testing. If Lake Erie rough fish can be used, this segment of the industry plans expansion of plant facilities in the Midwest and will use a great deal of rough fish.

Indications are that almost all sheepshead produced in the Lake Erie area will find ready markets in the fur farm industry, once adequate handling facilities are established along Lake Erie's shore. In addition, markets for other species of rough fish, such as carp, goldfish, burbot, and gizzard shad should be forthcoming. Fuller utilization will undoubtedly result if present tests being conducted by pet food canners indicate that Lake Erie rough fish can be used as cat and dog food.

RECOMMENDATIONS FOR DEVELOPING ROUGH FISH MARKETS

We should look at 1956 as a year of experimentation. We hope to see 1957 as a year of utilization. We can look on Lake Erie as the proving grounds for future market development work in the Midwest.

To further facilitate the development of markets for Lake Erie fish, the following program of research is recommended:

1. A thorough study of availability of each species of rough fish by area throughout the fishing season. Concise estimates of potential should be obtained from fishermen and by direct observation.
2. Species composition of rough fish catches by area throughout the fishing season should be obtained through interviews with fishermen and direct observations and sampling.
3. Proximate composition and thiaminase assays of all rough fish species should be determined, by area, at prescribed intervals throughout the fishing season.
4. Fur animal nutritional studies, using lake species, should be conducted, if possible. These would have to extend through several generations to be effective.
5. Statistical information should be collected, which would indicate the amount of rough fish marketed, and its value.
6. Establishment of a sound biological program to measure the effect of rough fish removal on other species.
7. And last, but not least, a continuing survey of all potential markets for rough fish.

It is readily obvious that the success of any market development program in the Lake Erie area requires the cooperation of market development people, technologists, biologists, and fishermen.

