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THE FISHERIES BIOLOGICAL STATION AT FAIRPORT, IOWA

By R. E. COKER

*Assistant in Charge of Scientific Inquiry
U. S. Bureau of Fisheries*

CONTENTS

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THE NEW BIOLOGICAL LABORATORY BUILDING, COMPLETED IN 1920.

THE FISHERIES BIOLOGICAL STATION AT FAIRPORT, IOWA.

By R. E. COKER, *Assistant in Charge of Scientific Inquiry,*
U. S. Bureau of Fisheries.

HISTORY AND FUNCTIONS.

The Fairport station was established by act of Congress in 1908. Its construction was begun in 1909, and with temporary equipment it began operations in June, 1910. The old laboratory, a frame structure of approximately the same dimensions as the present fireproof building, was constructed in 1912 and 1913. At the formal dedication of the building on August 4, 1914, unusual public interest was manifested by the attendance of 5,000 persons and by the congratulatory addresses delivered by men of prominence in public life and by scientific men of established repute. This building was unfortunately destroyed by fire on December 20, 1917. The office furniture and files and such scientific records as were retained in the office in original or duplicate form were saved; but records embodying results of tedious investigations were lost, together with the scientific equipment. A chief loss was the library, which, though not large, included a rare collection of separate papers and monographs, particularly such as related to fresh-water mussels of America and Europe.

Fortunately, the station comprised a great deal more than the laboratory building. The ponds and water system remained intact. The personnel of the station adapted itself readily to the changed conditions, and the important scientific and administrative work of the station was promptly resumed in the cramped quarters afforded by the old "temporary laboratory," a small one-story building just below the railroad, which had served a similar purpose in the first years of the station's history. For nearly three years valuable scientific work was carried on in these poor quarters, both by the permanent scientific staff and by a limited number of specialists in temporary association with the Bureau—men and women to whom personal convenience or comfort was secondary to the achievement of the objects to which the station was dedicated.

An appropriation of \$80,000 was promptly made by Congress for the erection of a new and fireproof building. This, supplemented by two small additional appropriations, made it possible to build and partially to equip the present admirable building of brick, stone, and concrete. Experience gained during the occupancy of the old building, the resourcefulness and skill of the architect,¹ and the good spirit manifested by the constructing company, all combined to make the new building superior in available space, convenience, and serviceability, and an exceptional value in proportion to cost.

¹ Prof. James M. White, professor of architecture and supervising architect of the University of Illinois.

After unavoidable delays arising from the conditions of national emergency, the new laboratory was completed and occupied in August, 1920. Again there was a demand upon the Bureau for the observance of exercises of dedication, and these were set for October 7, in connection with a Conference Regarding the Application of Science to the Utilization and Preservation of the Resources of our Interior Waters (October 7 and 8). The occasion was made impressive, helpful, and inspiring through the whole-hearted cooperation of representatives of the Government, business men, and scientists from the leading American universities. Recognition of the national significance of this biological station for investigation of problems of fresh waters was attested by the presence of delegates from 22 universities and colleges and from two independent scientific organizations, representing 14 States, from California on the west to Massachusetts on the east, from Oklahoma and Florida on the south to Wisconsin and Michigan on the north.

The station serves as a base of operations for a large part of the scientific work of the Bureau of Fisheries in the Mississippi Basin. A primary activity is the propagation of pearly fresh-water mussels; but not less significant are its functions in experimental fish culture, in investigations of various fresh-water fishery problems, and in promoting both a fuller utilization of aquatic products and a broader interest in the protection of aquatic resources, in order that the future, as well as the present, may be properly served.

Through field parties the activities of the station have been extended into most of the States of the Mississippi Basin, and the results of work done go much further than the localities in which operations are conducted. The benefits of service to the mussel industries are felt not only where mussel fishing, or clamming, is practiced, but wherever mussels are manufactured into the finished products of commerce—in New York and Massachusetts, as well as in Wisconsin and Iowa; they are experienced, too, though unconsciously, by all who are consumers or utilizers of buttons. The demonstration at Fairport of the feasibility of propagating the channel catfish in ponds can be made useful for the increase of food supply in other parts of the United States. The propagation and distribution of some hundreds of millions of buffalofish fry in public waters each year is the direct result of experiments originally conducted at the Fairport station. The broader utilization of fishes formerly considered "coarse" or useless is in part the result of practical experiments in smoking fish, conducted during several years at this station. The varied services of the station will be described and illustrated more fully in later pages.

PERSONNEL AND EQUIPMENT.

Every station of the Bureau is regarded as an agency through which as complete a public service is to be rendered as conditions allow, but it is evident that the Fairport station combines in a somewhat unique way the functions of a fisheries biological station and a fish-cultural experiment station. This it does because of the provisions of personnel and equipment authorized by the Congress and because of the conditions of its location and origin.

There is attached to the station a small permanent staff of scientists, fish-culturists, and other employees necessary for continuous

operation and uninterrupted experimental work. During some parts of the year, as may be desirable and practicable, the personnel responsible to this laboratory is much enlarged. The temporary associates or employees, comprising investigators skilled in special lines, scientific assistants, practical fishermen, or others, make it possible not only to increase the effectiveness of the station, but to broaden the territory of its operations.

About 60 acres of land, extending from the banks of the Mississippi, on a two-fifths of a mile front, to the brow of a hill a quarter of a mile back, afford ample space for the distribution of ponds and the suitable location of buildings. The slope of the ground is such as to assure proper drainage and to make it feasible to have a gravity flow of water from the storage reservoirs, located on or beneath the ground at suitable elevations, to the ponds and buildings.

There are in all 36 ponds, 14 of which are small and made of concrete, and 22 of which are dug out of the earth, simulating the conditions of natural ponds and varying in area from one-tenth of an acre to an acre or more. There are two water systems, the natural river water, pumped into a large storage reservoir and flowing thence to the several ponds, and filtered river water which is stored in low and high pressure cisterns and used for domestic and laboratory purposes. There is also a complete underground sewage and drainage system, which conveys the waste water and sewage into the river well below the source of supply.

The buildings comprise a main laboratory building, a small tank house, a boiler and pump house, a boat and seine shed, a storehouse and carpenter shop, a small shell-testing shop, and other necessary living houses and outbuildings. In some of these will be found pumping machinery for the two water-supply systems, machinery for cutting and finishing buttons in testing work, and such shop and field tools as are necessary to make the station as nearly self-contained as practicable.

The principal building, of concrete, stone, and brick, with ground dimensions of approximately 100 by 55 feet, has a fully finished basement besides two full stories and a finished third story over the center and larger portion of the building. The present laboratory accommodations for 16 investigators can be extended by conversion of other rooms into laboratories. A well-lighted library, chemical laboratory, photographic room, museum, tank, and aquarium rooms are features of the building essential to the efficient accomplishment of biological and chemical investigations of fishery problems. To afford necessary accommodations for temporary investigators at certain seasons, there are provided also a kitchen, a dining room, and a number of bed chambers which may be converted into laboratories as required. The building is lighted by electricity.

SERVICE RENDERED.

WHAT IS DONE FOR MUSSEL INDUSTRIES.

The services of the Fairport station to the pearly mussel industries have consisted in the propagation of mussels, the survey of mussel resources, the investigation of mussel problems, and the promotion of the protection of mussels.

FIG. 1.—The biological laboratory, ground floor plan: D, ice box.

FIG. 2.—The biological laboratory, first floor plan: A, tank table; B, chemical hood; C, balance slab.

FIG. 3.—The biological laboratory, second floor plan: A, tank table; E, linen closet.

FIG. 4.—The biological laboratory: E, linen closet.

The survey of resources has resulted in opening new fields, and it helps also to furnish the necessary basis of information for estimate of the perpetuity of the resources, for the adoption of intelligent protective measures, and for guidance in the work of propagation. The special investigations and experimental studies have led to improvements in method of propagation and are pointing the way to further improvements. By investigations in the field and by continued observation of the industries, the Bureau has arrived at a better understanding of the measures necessary for effective conservation of mussels; and, by propaganda, correspondence, publications, and personal conferences, it has been enabled to stimulate more general interest in the subject and to cooperate with State authorities and others in the framing of suitable protective measures.

The enactment and enforcement of such measures must be left to the several States, but a commendable interest has been shown in some States, and a beginning has been made, notably in Wisconsin and Minnesota.

Mussel propagation is carried on by field parties engaged at various places on important rivers. Fishes are seined from the rivers or from overflow waters, are infected with the glochidia (the larval forms of mussels) and then liberated again in the public waters.

The methods of propagation are based upon a peculiar feature of the normal course of development of fresh-water mussels. The very young fresh-water mussels, with rare exception, when first liberated from the incubation pouches of the parent, must become parasitic upon fish in order to pass through the next stage of their existence. To this end, if the chance offers after liberation, the young mussels, or glochidia as they are called in this stage, attach themselves to the gills, fins, or scales of a fish. The mussels of economic importance attach themselves almost exclusively to the gills. In attaching, or biting on the fish, a very slight wound seems to be caused, which begins at once to heal over; but, in the process of mending, the glochidium is overgrown and thus inclosed within the tissues of the fish. The mussel is now actually an internal parasite, in which condition it remains for a period of two weeks, more or less. It is thus conveyed wherever the fish goes, until, when the proper stage of development is reached, it frees itself from the host and falls to the bottom; if, through favorable fortune, it finds suitable lodgment, it continues its growth to form an adult mussel.

The glochidia are so small that the infection, if not excessive, has no apparent injurious effect upon the fish that serves as host. Investigations by the station have shown that mussels do not attach to fish indiscriminately, but that for each species of mussel there is a limited number of species of fish which may serve as hosts.

The task of propagation is to bring together suitable fish and the glochidia of mussels. Careful studies of natural and artificial infections show that a moderate-sized fish may successfully carry in parasitism from 1,000 to 2,000 of the microscopic glochidia, but that under the chance operation of nature few of the glochidia find lodgment upon the proper fish or upon any fish.

During the fiscal year 1920, in round numbers, 183 million glochidia were liberated in parasitic condition. A considerable proportion of these glochidia undoubtedly fall upon unfavorable ground

FIG. 1.—PONDS FOR EXPERIMENT WORK.

Earth-walled ponds of various sizes and forms present natural conditions such as may be reproduced on the farm. Small concrete-lined ponds serve the needs of special experiments. Both fish and mussels are reared here.

FIG. 2.—TROUGHS FOR REARING MUSSELS.

In troughs supplied with naturally clarified water flowing from near the surface of one of the ponds, the best conditions have been found for rearing several species of fresh-water mussels. As is the fortune of experimental work, success has been variable, but a single trough may produce in one season more than 2,000 young mussels one-fourth to one-half inch in length.

FIG. 1.—PONDS FOR FISH-CULTURAL EXPERIMENT WORK.

Part of the equipment used for fish-cultural experiment work. In these ponds we learn how to rear buffalofish and catfish, and how to make ponds more productive of black bass, bream, and other esteemed game fishes. Mussel culture, too, is practised in these ponds.

FIG. 2.—A SIMPLE FISHPOND.

This pond, a quarter of an acre in extent, simulates the natural conditions of a farm pond receiving minimum attention. Being stocked with generally esteemed fishes, it is intended to answer the question: What will a small pond yield without special attention?

or fail from other causes to reach maturity. However, it is the large number which can be infected on fish and liberated at small expense that justifies a confidence in the accomplishment of commensurate benefits. The average cost per 1,000 glochidia artificially infected on fish in the fiscal year 1920 was less than 6 cents, inclusive of overhead expenses.

Some of the streams in which this work has been carried on are the Mississippi River, at various points, the Ohio and Cumberland Rivers, the Wabash River in Indiana, and the White and Black Rivers of Arkansas.

In connection with the propagation of mussels, many fishes are rescued from land-locked ponds and restored to the rivers. In this way, during the fiscal year 1920, 36,442 adult and 871,553 fingerling fish were preserved from probable death by suffocation with the drying up of the temporary ponds, and this benefit was accomplished practically without expense additional to that necessarily incurred for the propagation of mussels.¹

WHAT IS DONE FOR FISH CULTURE.

The services of agricultural and experimental stations to the farmer are so well understood that large appropriations are annually made by the Federal Government and by every State in order that there may be conducted the various sorts of investigations and experiments that are necessary to assist the farmer in producing larger and better crops with the greatest degree of economy. It is likewise important that studies and experiments be carried on to increase the productiveness of streams and lakes and ponds. The grower of fishes is even more dependent than the land farmer upon guidance from governmental experiments. A wheat grower or a cattle raiser has some chance to try out various methods and ascertain the effects by watching the growth of his crops or of his stock. The fish farmer, on the other hand, may try different methods, but he can not see how they work. Furthermore, nearly all of our water areas are under public and not private ownership and control, and only the public is justified in expenditures for experimental work.

Nearly all that we know of fish culture in America has been learned in connection with practical fish-cultural stations, where, since the establishment of the United States Fish Commission 50 years ago, many experiments have been carried out. The accumulated experience of keen and observant fish-culturists is of inestimable value; yet it should be pointed out that the function of a fish-cultural station is to produce as large as possible an output of fry or fingerling fish to be distributed in various waters where others must assume the responsibility for bringing the fish to maturity. It is not the purpose of such stations to work out by tedious experimentation and careful studies the conditions necessary to make individual ponds as productive as possible for market fish. As yet no other station of the Federal Government than Fairport has been designed to serve this function.

¹ During the first half of the fiscal year 1921, through the cooperation of the National Association of Button Manufacturers, more than 5 million fishes taken in the Bureau's rescue work along the Upper Mississippi River have been infected with mussels and liberated.

A few years ago no catfish except the small bullheads had been successfully propagated, although attempts to breed them in ponds had repeatedly been made. Having at Fairport the facilities and the personnel for continuous fish-cultural experiments, the channel cat, or common spotted catfish, the most favored of the tribe, was chosen as one of the fishes for experiment. Success was not attained in the first two or three years, but finally the right thing was done, and the propagation of the fish was found to be practicable. The methods may be and should be improved, but the results obtained can now be made useful for the promotion of fish culture and increase of food supply.

All attempts at artificial propagation of the buffalofish yielded most discouraging results until this station by properly conducted experiment demonstrated its entire feasibility and thus made a particularly valuable contribution to fish culture. The buffalofish are large species of commercial fish, in good esteem, formerly abundant in the principal rivers of the Mississippi Basin, but of late years diminishing in numbers. The hatching of the eggs of buffalofish by artificial means with the subsequent liberation of the fry or fingerling is now shown to be practicable, and it has been put into practice on a large scale through the fish-cultural stations of the Bureau. There are in progress at Fairport further experiments to determine if this fish may be successfully grown in properly controlled ponds.

Other experiments at this station relate to the growing of game fishes in ponds. Incidental to the experiment work, a considerable number of fish of several species are propagated each year and planted in the Mississippi River.

The task of fish culture is only begun when the fry or fingerling fish are produced and placed in ponds. The success of the pond depends upon the rate of growth of the fish and the proportion of the original stock which survives. The poultry raiser does not overrate his accomplishment when several thousand young chickens are transferred from brooders to yards. His success or failure is measured when the chickens are ready for market, by their number, weight, and quality. If fishes are to be grown successfully in ponds, it is necessary to know upon what they feed and how this food is maintained in the pond, and what other conditions are favorable or unfavorable to the survival and growth of the fish.

Let us again find a partial analogy in the rearing of farm animals. Is the farmer concerned only with his cattle, or does he in the selection, the preparation, and the conduct of his farm, give thought to the growing of pasture plants and hay grain foods? Can he ignore the parasites which cause disease or weakness among his animals; Would he not be stupid to overlook the insects or plant rusts that may sweep his pastures or crop fields bare? Evidently the stock farm is a good deal more than an abiding place for large and useful animals; it is a complex association of cattle, plants, insects, birds, worms, soil bacteria, and what else, not to mention such inanimate things as soil chemicals, water, and air. The fish pond or the fish stream is just as much a complex—more of one, it must be thought, because, though the air on the land farm is ever-present in unlimited quantities, the air in the water farm is limited and variable. Suffocation of the cow in the pasture is never feared, but partial or complete suffocation of fish is a frequent reality. Furthermore, the movements of fish are often

governed by distribution of air or waste gases in the water, and the quantity of animal life in the pond is limited by the supply of dissolved gases.

Since the air supply of fish, without which they can not live, varies both seasonably and irregularly, the investigators must study the conditions of occurrence and distribution of gases in ponds and streams that we may learn what is favorable and what is unfavorable to the best conditions of gas content and thus to productivity of useful animals.

Since the air and the chemicals of water and soil are brought to the fish through the intermediation of small plants, small floating animals, creeping insects, and other things, these must all be carefully considered in their relation to fish culture. The relations are complex and the investigators must concentrate attention in different studies upon particular animals or plants. Some of the investigations so far pursued at Fairport relate to the food of the fishes at various stages of development, the kinds of plants that are most suitable and necessary in fish ponds, the relations of certain insect larvæ as food or as enemies of fish, and the occurrence of parasites that weaken the growing fishes and cause them to die or become an easier prey to enemies.

OTHER SERVICES TO FISHERIES.

A good deal of valuable work which is not directly related to mussels or to fish culture is done at and from the Fairport station. A few typical forms of service may be cited.

The construction of the dam across the Mississippi River, about 100 miles below Fairport, at Keokuk, Iowa, gave opportunity for a comprehensive investigation of the effects of water-power developments upon the fisheries of large rivers, and considerable information has been gained as the result of observations continued over a period of several years at Keokuk and at various points both above and below.

Chemical studies pursued in the laboratory have been directed toward ascertaining the food qualities of some aquatic products and possible methods of improving them.

Studies of the diseases of fishes, the causes and remedies, have been pursued. It has been learned that the slight injuries incidental to the handling of fish in warm weather, particularly in rescuing fishes from overflow waters, often lead to bacterial infections which cause serious mortalities. Means of prophylaxis are being devised which may be simple of application and effective in materially increasing the effectiveness of rescue operations in warm weather.

Somewhat apart from the ordinary lines of activity of the station, but corresponding to an evident need existing along the Mississippi River, there were conducted during a period of years some simple but immediately practical experiments in smoking the common fishes of the Mississippi River which had no particular value in the fresh state and which brought so little return to the fishermen that they were often allowed to go to waste. Some of these were occasionally smoked, but in many cases the smoking was so carelessly or ignorantly done that the product was inferior in taste and in keeping quality. Others were thrown away or sold for nearly nothing. The

result of the experiments at Fairport was to enable the Bureau in a period of food emergency to issue a printed circular describing in detail the construction of a simple portable smokehouse, the methods of operation for different fishes, and the qualities of taste imparted to the fish by several sorts of fuel. This was followed almost immediately by sending out demonstration parties along principal rivers and even along the seacoast, proving by actual test, both to fishermen and to housekeepers, that "coarse" or "useless" fishes could be made palatable to the consumer and profitable to the fishermen. This was a simple and practical thing to do, but it required some years of experimental work, as opportunity offered, to try out various fishes by varied methods and to learn some things that were entirely unexpected.

The Fairport station, then, as a special agency of the Bureau of Fisheries, adapts its services within reasonable limits to the varying needs arising within its sphere of action. It endeavors to bring about a broader and better understanding of our inland waters as national resources—that they may be viewed not only as channels of surface-water drainage, as avenues of transportation, or as convenient and economical sewers, but as fields for the continuous production of necessities of food and raiment. It has set before it the task of discovering by scientific study and by practical experiment the conditions of preservation and increase of the useful life of inland waters.

Its work should tend to disclose what degree of protection is necessary and what methods are feasible, what conditions of biological, chemical, and physical environment are favorable for increased production of fish and other aquatic animals, and what measures may be taken to improve the environments in ponds, lakes, and streams.

The objective, let us say, is the prevention of the continued depletion of our aquatic resources, and the bringing of all interior waters to a condition of greatest fruitfulness. The way may be long and beset with obstacles, and success can be attained but gradually and by means of persistent effort and painstaking study. As we have indicated, some small milestones of progress have been passed, but it must be evident to all that the main task is for the future and that it is big enough and sufficiently complex and offers a degree of promise not only to justify the best efforts of the station, but to enlist the cooperation of all those having opportunity and interest to render public service through attention to the resources of interior waters.

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