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RESULTS OF STREAM AND LAKE IMPROVEMENT IN MICHIGAN

By Dr. Albert S. Hazzard

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Stream and lake improvement were twin children of the depression, conceived by an able fisheries scientist who could not be faithful to purely academic interests but who ever and anon consorts with the practical side of fisheries work to the benefit of the angler. These twins were the direct result of stream and lake surveys in various scattered areas of the state. The germ of the idea was found in each group of waters studied. No two were alike and some were much better than others. Some reasons for these superiorities were immediately evident to the scientist: bottom types more productive of fish food, pools affording more adequate shelter or superior spawning conditions. We suspect the parent of these children received some stimulation from reading European literature on stream improvement (several books appeared in England a few years before conception); in fact we are certain the developing embryos were "marked" by indulgence in such literature.

At all events the twins were born here in Michigan sometime during the year 1930. As is often the case with twins, one—stream improvement—was much more vigorous than the other and became the favored child. The parents, like many of us, tried to give the children long, dignified names—in this case "environmental improvements"—but few people would use them preferring the easier (and to them more understandable) terms used in the title of this paper.

Our scientist did his best to start the children in life but the offspring were poorly received. No one—least of all the parent—had the money to develop them properly. The state Conservation Department, while acknowledging some interest and responsibility for their support, was in dire straits for funds but helped all it could. Several wealthy fishing clubs adopted one or the other of the infants for a time but could not keep them indefinitely, and then came their fairy godmother in the form of the CCC and after considerable persuasion (and a little pressure, perhaps) the children were adopted but with the Conservation Department still acting as guardian. At first they were given little attention but as they grew and became noticed by the sportsmen their popularity with their foster parents increased until today stream and lake improvement are recognized as legitimate and worthwhile projects for all state and National Forest ECW camps in the vicinity of fishing

waters, not only in Michigan but in almost every state in the union. The children have come of age!

As evidence, witness the following report of the work as supplied by Mr. George Young, Jr., Administrative Assistant in charge of ECW in Michigan, covering this work from April, 1933 to September, 1936: lake and pond development (another change of name for our progeny)—34,238 acres, stream development—3,819.4 miles, stream and lake bank protection—43,931 square yards including treatment of 436½ acres of gullies.

As further evidence, consider the report of Mr. R. R. Hill, Assistant Regional Forester, U. S. Forest Service, covering stream and lake improvement in the National Forests of Michigan from 1934 to 1936 inclusive: 284.7 miles of stream improved, 38 lakes improved by 1958 structures, experimental plantings of aquatic vegetation to the extent of 5,914 pounds.

So much for the development of the infants. What of the actual results of stream and lake improvement? The Institute for Fisheries Research was charged by the Conservation Department with the responsibility of watching the progress of the twins to keep them developing along proper lines and to actually find out how much good they were accomplishing. Clarence M. Tarzwell was selected to check on and test out stream improvement; R. W. Eschmeyer was to be the guardian of lake improvement.

The following facts are from recent reports by Dr. Tarzwell[1, 2] completed before leaving the Institute for other fields. Experimental sections of 18 streams developed and checked since 1930 show that:

1. The type of stream determines the kind of improvement. Log deflectors only can be used in soft bottomed (other than coarse gravel, rock or boulder) streams; log or boulder deflectors are efficient in most of the harder bottomed types; dams are practicable only where the bottom is firm and even in such streams some filling will occur during floods so that eventually the permanent pool will be below. Simple log dams with end cribs and board facings have proven most successful.

2. The amount of ice forming in a stream limits the types of structures which can be used and the manner of installation. Cover devices must be submerged below winter levels and all structures should be kept low.

3. Tree covers, slanting log covers, submerged bank covers, boom

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[1]**Tarzwell, Clarence M. Lake and Stream Improvement in Michigan. Proc. N. Am. Wildlife Conf., 1936, pp. 429-434.**

[2]**Tarzwell, Clarence M. Experimental Evidence as to the Value of Trout Stream Improvement in Michigan. Trans. Am. Fish. Soc. (1936), 1937. (In press.)**

covers, underpass deflectors and various styles of log or boulder wing deflectors are most useful in Michigan streams. During the fall of 1936 the author observed spawning brown trout were attracted to gravel near boom covers on the Boardman River. Any disturbance caused them to dart beneath these covers—proof that they found these shelters of value.

4. Oak and tamarack are most suitable for stakes.

5. Sound dead or fire-killed timber is best for log structures. Pine logs or "deadheads" make the most durable deflectors; white cedar, the best covers.

Of the great variety and number (2,235) of experimental structures installed, the loss during a five year period ranged from none to 30%. Anchored stumps and raft covers made up the bulk of the loss due to heavy ice action. Certain structures proved to be much more efficient than others in bettering trout environment.

In addition to providing shelter, deflectors exposed gravel areas which trout were observed to be using for spawning and which are also much more productive of fish food than the original bottom of shifting sand. The sand was deposited in the lee of deflectors, became mixed with silt and soon supported beds of water plants rich in fish food.

Numerous counts of bottom food organisms taken with the quantitative sampler before and after improvement showed that the structures installed increased the food supply from 4 to 9 times that of the original bottom.

Counts of fish population as described by Greeley[1] were made before and after improvement in two sections of one stream. They showed an increase in the number and average size of the trout. Creel census on this stream also demonstrated an increased yield following improvement. However, more evidence of this type is necessary to show definitely the value of various structures in promoting the fish yield.

The undersized twin, lake improvement, meanwhile continued to grow but less rapidly because the reasons for better fishing in one lake of a group were not so readily apparent and the remedy not so obvious. Results of the work are harder to check and properly evaluate. In fact, the Institute maintains stoutly that a rather detailed survey is essential to intelligent lake improvement.

Nevertheless, brush shelters of various shapes, sizes and compactness have been tried out; several types of gravel spawning beds have been used; slab, tile and other structures have been in-

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stalled for minnow spawning; and plantings of several kinds of vegetation were made in different types of lakes. In other lakes superphosphate was introduced to enrich the basic food supply.

Results of experimental lake improvement may be summarized as follows:

1. Plantings of aquatic vegetation have not proven very successful. It is our present opinion that such plantings do not result in successful weed beds (except in newly formed lakes) unless the existing environmental conditions for plant life (improper bottom soil, severe wave action, acidity, etc.) are first improved.

2. Plantings of forage minnows have proven successful in a number of lakes lacking this food for game fish. Golden shiners (*Notemigonus crysoleucas*) seem best suited to the larger, weedy "pike" lakes. The blunt-nosed minnow (*Hyborhynchus notatus*), the fathead (*Pimephales promelas*) and the northern dace (*Chrosomus eos*) are well adapted to smaller lakes where forage minnows for bass, perch, etc., are needed.[1]

3. Slabs or flat objects at least six inches wide and placed on sandy bottom in from 6 to 18 inches of water are preferred by spawning blunt-nosed or fathead minnows. Evidence of the use of such structures when installed is available for a number of lakes.

4. Gravel piles (about one bushel each) placed in lakes deficient in such bottom are used by bass and bluegills for nest building. Best results were obtained in water from 2 to 3 feet in depth and the piles must be placed not closer than 8 or 10 feet. On soft bottom, boxes to hold the gravel must be used. Logs or small brush shelters in deeper water and close to spawning beds add to their attractiveness to the nesting fish.

5. Brush shelters have been proven to attract fish. Large, loosely built structures attract the larger game fish; small, compact shelters were favored by young game and forage fish. Since the shelters are not equally attractive to all species (perch rarely use them), they can be used to favor certain species which need encouragement. Crayfish and insects were also attracted to shelters in considerable numbers.

While enough experimental work has not been done, especially in the field of lake improvement, to demonstrate the value and practicability of many methods which have been suggested, the youngsters show definite promise that if they are given the proper encouragement and direction they will be a credit to their parents and will be of great assistance in building up and maintaining better fishing.

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[1]**Cooper, Gerald P. Importance of Forage Fishes. Proceedings N. Am. Wildlife Conf., 1936, pp. 305-311.**

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