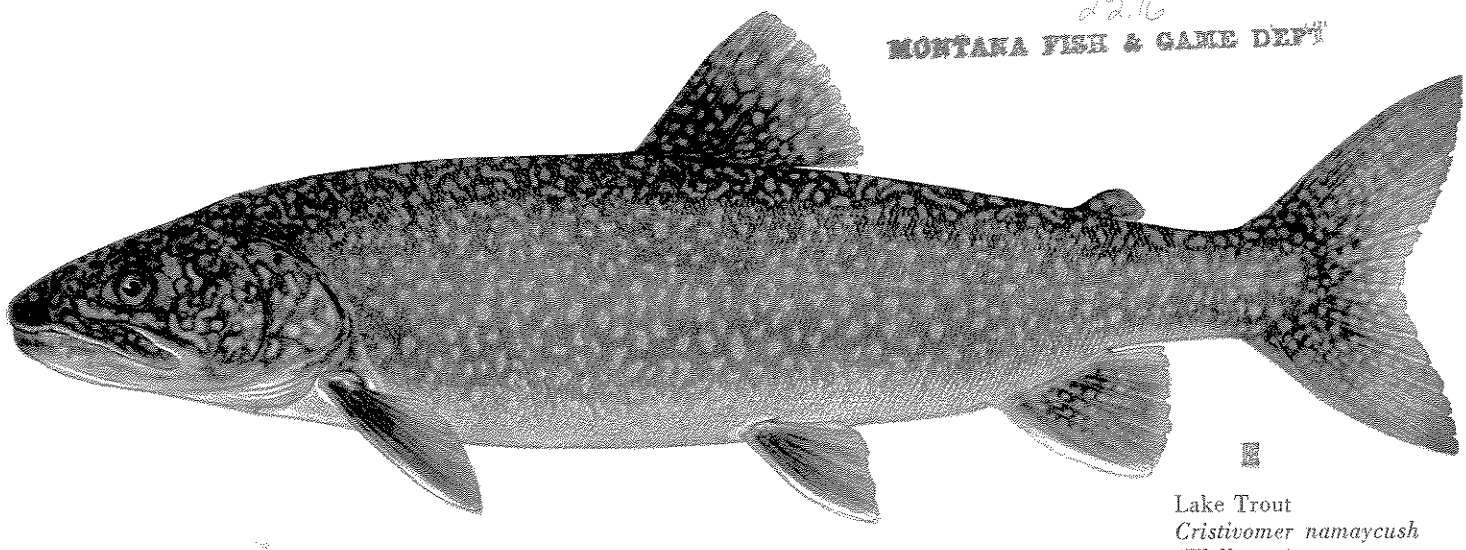


Lake Trout
Cristivomer namaycush
(Walbaum)

Cayuga-

A Lake Trout Laboratory

by Dwight A. Webster, *Department of Conservation, Cornell University*

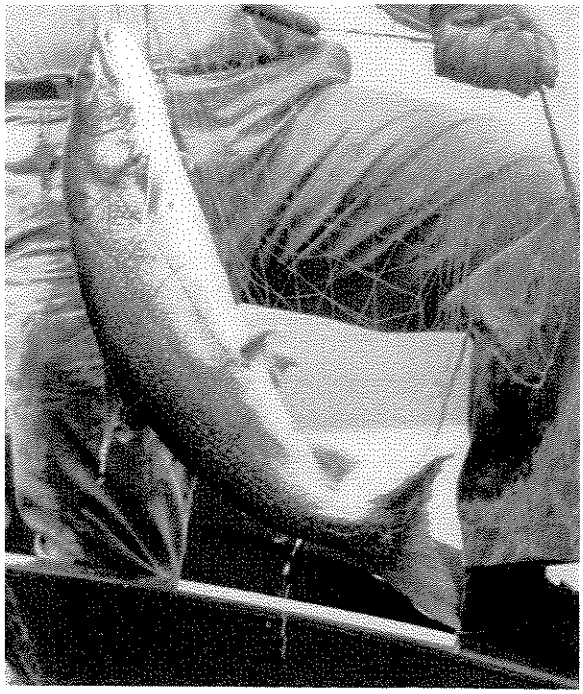
OF all the Finger Lakes, Cayuga appears to have enjoyed the poorest reputation as a lake trout producer through the past half century. The late George C. Embody, Professor of Fish Culture at Cornell, noted in 1922 that "Lake trout are sometimes taken in Cayuga Lake . . . They should . . . occur in large numbers in the deeper parts of the lake where the waters are cold and clear unless some undetermined factor is working to their detriment." And shortly thereafter (1927), when Cayuga Lake was included in the Biological Survey of the Conservation Department, E. H. Eaton wrote: "We have been unable to find any condition of the water which would explain the scarcity of trout in Cayuga Lake and believe it should be attributed not to the condition of the water but to the enemies of the fish, to illegal fishing and to mistakes in planting." (The latter reference was to releasing the trout from shore in the Summer, when water temperatures were high.)

The status of the lake trout population in Cayuga Lake received cursory attention from a former Cornell graduate student, Dr. H. John Rayner, about a decade later. "During 1939 and 1940 it is doubtful if more than fifty fish were taken by anglers. The large size of the fish taken (10 to 27 pounds) is possibly indicative of a small population. Gill nets set on a once famous spawning ground produced three fish in 1939 and none in 1940, even 'though the sets were made every five days from the last of August to the middle of December."

The documentation is thus adequate to substantiate the view that Cayuga's waters have, in fact, not supported an appreciable stock of lake trout for many years. However, in the early 1940's, there were reports from the regular though limited numbers of lake trout fishermen that the fishing had improved, and that many of the fish were of small size. Then the appearance of lake trout in experimental gill nets set in Cayuga Lake in the Fall of 1944 was convincing proof that there had been a marked increase in the lake trout population. The word had gotten around sufficiently by 1946 to stimulate considerable fishing, and a phenomenally high catch of lake trout resulted.

What could have been the cause of this sudden happy state of affairs? It was a subject which invited investigation, with proximity to Cornell University and interest in training students being additional motivating factors. Accordingly, following discussions with Dr. W. C. Senning and O. R. Kingsbury of the Conservation Department in 1946, a long-term research program was set up. One of the subjects which appeared worth exploring was a recent change in the lake trout stocking policy. This involved the initiation of yearling trout plantings in late Winter or early Spring, in addition to the usual late Summer fingerlings. The first substantial stocking of yearlings (6,000) was made in 1939, and annual plantings of that order were subsequently made. This time of year was more favorable, as air and water temperatures were cold. But of course the possibility also existed that the increased fish population was the result of greater success of natural spawning. Rayner had previously suggested the possibility ". . . that the lake trout are being destroyed as eggs or young fish in Cayuga Lake . . . In the Fall and Winter when a strong wind is blowing, the mud which is stirred up by the currents may be seen as a yellow area streaming from the points in the direction of the wind-driven currents. Such mud settling on the lake trout eggs may have a deleterious effect."

The program of study evolved consisted of marking (by fin clipping) all the hatchery yearlings, and also a known fraction of the fingerling lake trout planted in Cayuga Lake. From 1946 through 1954, a total of 64,600 yearlings



Lake trout in gill net. Fish ramming it become entangled in fine thread of mesh

Cornell University fishery crew, Paul Neth, Scotty Little and Bill Lyon (left to right), at work processing lake trout taken from nets. Data on length, weight, number of lamprey wounds, fin clips and scale samples are taken. If trout is vigorous . . .

and 730,000 fingerlings were planted; since 1950 the annual stocking has been stabilized at 8,000 yearlings and 80,000 fingerlings (half of which are marked). The New York State fish hatcheries at Bath and Caledonia have reared the lake trout from eggs obtained from wild Seneca Lake fish. Fingerlings were scattered over deep water using large private power boats or in recent years, the Game Protector's patrol craft. During distribution the fish were carried in tanks supplied with oxygen to keep them in as good condition as possible. And yearling lake trout have been released from shore at Taughannock Point.

As in many studies of this sort, getting started by planting marked fish was the easiest part of the project. *Adequate follow-up* is the time-consuming part, although by no means the least interesting—as the accompanying pictures may suggest. In the Cayuga work it was decided to use gill nets of varying mesh sizes to sample the lake trout population. This decision was based on the fact that lake trout are very susceptible to capture by gill nets, and that a census of the fishermen's catch to check for marked fish would be impracticable to attempt with the resources available. Furthermore, since lake trout are frequently not kept until lengths of 20 or more inches are attained, this would necessitate a time lapse of 4 or 5 years before the results of any one planting could even begin to be evaluated.

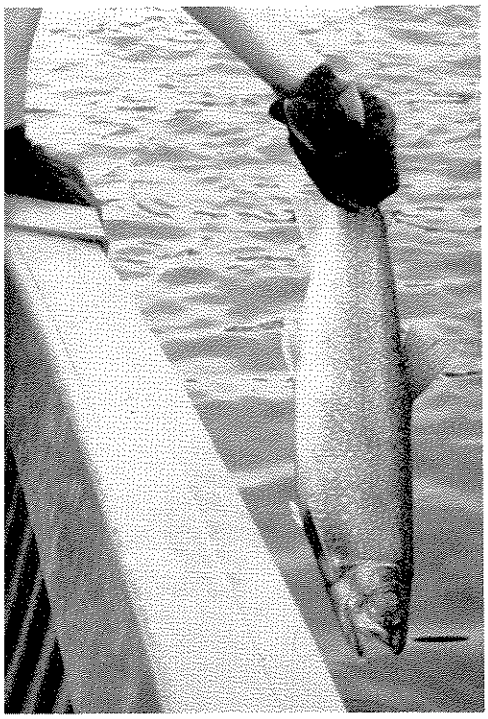
But many questions arose in attempting to set up a sampling program. How long should the nets be? Where in the lake should they be set? How deep? How often? Investigational work is frequently very expensive, and it is important to determine in advance the kind and amount of information that will provide evidence bearing on the problem to be studied. Even with the best of planning the vagaries of biological sampling often produce unexpected shortcomings in the final data.

The study on Cayuga lake trout did not arise full blown overnight. Answers had to be provided to some of the above questions. Furthermore, it was desirable to incorporate certain features into the sampling which would be useful in measuring the abundance of the lake trout population and also of its main food item, the alewife or sawbelly. Thus, the summers of 1949 and 1950 were given over to exploration and preliminary study.

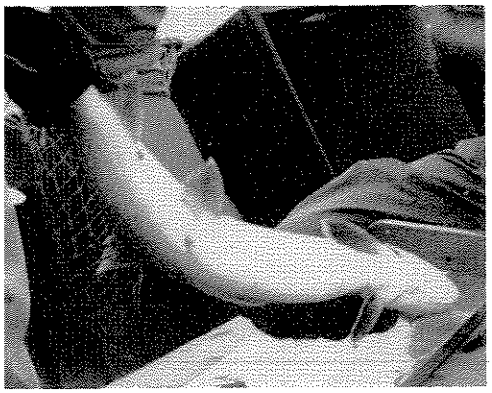
Fishermen's reports indicated that there was a Summer concentration of the larger lake trout in the vicinity of King Ferry. The preliminary and subsequent sampling definitely confirmed this; about five times as many trout of 22 inches or over were taken in this area as elsewhere in the lake in July and August. A major proportion of Cayuga Lake exceeds 300 feet in depth, but it was found that the net catch of lake trout dropped off at depths over 150 feet. Thus, netting in the depths would be unprofitable and could be eliminated. (Note that this does not mean that lake trout may not be found in the middle of the lake; there is no doubt that they do occur there, but well off the bottom, feeding on the sawbelly schools that range the open waters of the lake.) Baby lake trout below two years of age were poorly sampled by the nets, but trout of two years (9-10 inches) and older were well represented. Young lake trout of about 20 inches or less were generally distributed about the entire lake, excluding the shallow warm water at the north and south ends.

These and other salient features resulting from this probing were incorporated into a final sampling design. Cayuga Lake was divided into five areas: The Summer concentration area, the planting area in the vicinity of Taughannock Point, the central basin of the lake, and the deeper water adjacent to the shoals at the north and south ends. It appeared that fishing a total of 25,000 feet of gill net during the Summer months could be handled with convenience and yet yield an adequate enough sample (the number of lake trout taken in this quantity of net has varied from 200-300 each year). The sample unit consisted of a gang of 5 nets, each 100 feet long and varying in ½-inch steps from 1½-to- 3½-inch mesh size (stretched

. . . tag is placed on lower jaw. On side of specimen note open wound left by lamprey eel (below the gloved hand)



Back in Cayuga. To keep in good condition, trout are held on boat in tanks of cold water pumped up from the depths



A fin-clipped lake trout. Missing left belly fin shows no tendency to grow back in this specimen. Frequently it may grow back into a deformed fin or into a spike

measure). Five of these gangs were fished at one time and each of the five areas we've enumerated was sampled once in July, with a repeat in August. The nets were fished at right angles to the shoreline, starting in 30 feet of water in July and going to 50 feet in August (to allow for deeper offshore distribution as the water warmed up); nets were set in late afternoon or evening and lifted the following morning. The field procedure is detailed in the accompanying photographs taken by Fred Mohn of the *Ithaca Journal.*

The results of the sampling through 1954 have shown some consistent and clear-cut results bearing on the subject of fingerling *vs.* yearling survival. In the seven-year classes ("hatches") sampled, yearlings outnumbered fingerlings by an average of about 4 to 1. It can be anticipated that the fingerlings should show a lower representation because they have been subjected to natural mortality in the lake for an additional 6 or 8 months. In fact the mortality of the fingerlings during this period can be estimated at 75 per cent, including losses contingent upon stocking procedure.

The question of whether it is advantageous to stock yearlings evidently becomes one of economics, hatchery management and problems of planting. For any given weight of lake trout produced in the hatchery, there would be about 4 times as many fingerlings as yearlings in the sizes currently stocked. Obviously, then, yearlings must show at least a four-fold superiority in recoveries—that is, show four times the survival, to equal the numerical advantage of fingerlings. By coincidence the actual figure observed was about 4. The conclusion follows that from a production viewpoint, yearlings offer little advantage over fingerlings if it can be assumed that the cost of rearing a pound of each is the same.

There may be other considerations, however. For example, if hatchery lake trout are in short supply, it is more efficient to hold them for planting as yearlings. From the standpoint of hatchery management, it may be that the most efficient use of space can be achieved by stocking the bulk of the fish as fingerlings, but carrying enough through as yearlings to complete the stocking policy. And from the standpoint of ease in planting, the use of yearlings has advantages; they are planted in the early Spring when surface waters are cold, and the fish are released under more favorable circumstances.

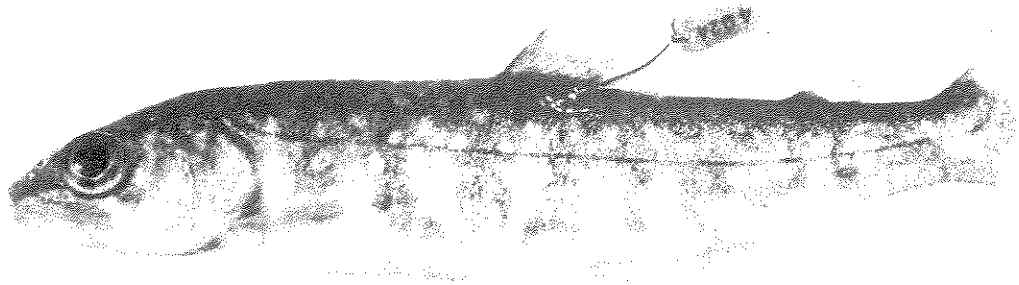
This reintroduces the question relating to the origin of the lake trout population which appeared in the 1940's. On the basis of present information it is reasonable to conclude that the initiation of the yearling plantings in the 1930's was responsible. But as marked fingerlings were also well represented in the gill net samples, it seems strange that the fingerling plantings of past decades did not make a better showing. There are abundant reports, however, current as well as old, that fingerling lake trout have not always entered the water in the best possible condition or location—which well may account for this situation.

These contentions are greatly strengthened by the fact that during the years that marked fish have been planted, the lake trout population in Cayuga Lake can be shown to be largely of hatchery origin. The data backing up this statement are derived in the following way: Since only half of the fingerlings stocked each year are marked, the unmarked lake trout of any given age can be the result of (1) natural production or (2) the unmarked fingerlings stocked. When the proportion between marked and unmarked fingerlings is known, the number of unmarked lake trout also of hatchery origin can be estimated. As an actual example, through 1954 there have been 64 recoveries of the marked fingerlings planted in 1950 and 60 recoveries of the yearlings. At the same time 75 unmarked trout of the same year class showed up in the sample. Since equal numbers of marked and unmarked trout were stocked, it is fair to assume that 64 of the 75 unmarked trout were also hatchery origin. The difference presumably represents natural spawning—or possibly sampling variation. We must therefore conclude that some condition or conditions adversely affect natural production of lake trout in Cayuga Lake prior to the fingerling stage. As suggested by Rayner, the suitability of spawning grounds might be a logical place to start looking for the answer.

Naturally one is interested in the application which the information forthcoming from the Cayuga studies may have to other bodies of water. This was one of the major reasons for a more generalized study on other New York waters, described, in part, in C. W. Greene's article in this issue. While the lack of adequate natural spawning in Cayuga Lake may be exceptional, the conclusion is unavoidable that under favorable circumstances the survival of hatchery lake trout is comparatively good. This is a welcome circumstance from the standpoint of management, but it also means that there are very real potential dangers from overstocking. The reasoning that "if some is good, more is better" does not necessarily hold when it comes to stocking.

At left, close-up of tag used on lake trout in these studies, also in general use by New York State Conservation Department. Anglers catching tagged fish in Cayuga Lake should report this to Cornell University or elsewhere to Conservation Department, Albany. Important: Send in tag (or at least number) with particulars on date of capture, location, and length and weight of specimen. Information derived from tag returns is important in directing future fish management plans.

Below, new type of tag developed in Sweden, used to tag 2,000 yearling lake trout in Cayuga Lake in 1958. As fish grows, only the green plastic pennant may remain visible. Anglers should start looking for these tags in 1960-61 when this group of trout will reach 15 inches.



Most of the lake trout stocked in Cayuga Lake marked by removal of one or two fins before fish leave hatchery. Sometimes fin tends to grow back, as shown in this series of young trout taken a year or two after stocking. In most cases, deformities in ventral fins make mark easily recognizable. Specimen on left exhibits no re-growth. Front paired fins (pectorals) and small back fin (adipose) also used, but do not commonly grow back.