

11.—LOCH LEVEN TROUT INTRODUCED IN THE UNITED STATES.**By CHARLES W. SMILEY.**

The first importation of Loch Leven trout eggs to the U. S. Fish Commission, and, so far as I am informed, to the United States, was made through the courtesy of Sir J. Ramsay Gibson Maitland, Bart., the proprietor of the Howietoun fishery, Stirling, Scotland. This trout has succeeded finely in streams in the south of England, though lacking the superb flavor of those bred in Loch Leven.

On November 12, 1884, a lot of Loch Leven trout eggs was taken at the Howietoun hatchery from fish which were hatched in 1876. These were packed under the direction of Mr. Guy in six cases, as follows: Each box contained six trays, and each tray three layers. Each layer contained 950 eggs, making a total of 102,000. On top of each box was a tray for ice and containing moss or sawdust. In unpacking, the moss in the trays which had been felted by machinery is rolled back (not lifted), and if this is done carefully no eggs adhere to the moss. The muslin on which the eggs lie is then lifted out by two persons holding the four corners tight. It was not intended that the eggs should be repacked at New York. If the eggs had remained in the hatchery and hatched normally they would mature in seventy-two days or about the 22d of January, but with the cold packing it was believed that the hatching would be retarded until the first week in February.

The six cases were sent to Liverpool by way of Glasgow, the latter place being only one hour distant from Howietoun. At Liverpool Messrs. Henderson Brothers took charge of the cases and consigned them, freight free, per steamship *Furnessia*, of the Anchor line. On January 1, 1885, the *Furnessia* arrived in New York Harbor, but the custom-house being closed in consequence of its being New-year's Day nothing could be done to remove the eggs until January 2. Mr. Fred Mather had already effected an arrangement with the New York custom-house, with the aid of Mr. George Hilliar, for the prompt delivery of the eggs in order that he might promptly transfer them from the ice-room of the *Furnessia* to the Cold Spring Harbor hatchery. The eggs reached the hatchery at 8 o'clock that evening, January 2, where they remained over Sunday. On opening, the eggs were found to be in excellent condition, there being but a small number dead and but few indented. The method of packing was found to be most admirable, and the boxes, 3 by 2 by 2 feet, were of the most substantial nature. Each contained a 3-inch air space between the box and lining. The lining had been charred. There was no trace of fungus in the lot.

The trays were about 8 inches square and 5 inches deep. This arrangement economizes space and expense as well. The boxes were used by Mr. Mather a few days later for forwarding whitefish eggs to Ger-

many and Switzerland. On Monday, January 5, Mr. Mather sent 10,000 eggs to General R. U. Sherman, of the New York State commission, and the remainder to the Northville station. None were retained at the Long Island hatchery, because they had been supposed to be a trout requiring the deep waters of lakes, a belief which was afterward found to be incorrect, as it was learned that the fish had been introduced into the streams of England. Mr. Clark telegraphed their safe arrival at Northville on January 7, and made the following distribution :

1885.

Jan. 29. To E. B. Hodge, Plymouth, N. H., for Sunapee Lake.....	5,000
Feb. 3. To A. W. Aldrich, Anamosa, Iowa	20,000
Feb. 3. To R. O. Sweeny, Saint Paul, Minn	20,000
Feb. 4. To Charles G. Atkins, for lakes in Maine.....	10,000

The remainder were retained by Mr. Clark to be hatched at Northville. Between April 10 and April 23 he distributed them as follows:

To Michigan fish commission	10,000
To L. S. Hill, Grand Rapids, Mich.....	5,000
To G. H. Dalrymple, Grand Rapids, Mich.....	1,500
To Crooked Lake, Northern Michigan.....	20,000
Retained to be reared at the hatchery.....	7,000

The 10,000 eggs assigned to General R. U. Sherman were forwarded to the Bisby Club hatchery, situated at the first Bisby Lake in the Adirondacks, town of Wilmurt, Herkimer County, New York. General Sherman is president of the Bisby Club. Under date of January 24, 1885, Mr. Henry Studor, the keeper of the Bisby Club House, wrote: "The Loch Leven trout eggs which came from Scotland are a splendid lot. I do not think that I have picked out fifty bad ones. In the course of ten days they will begin to hatch. The young fish can be plainly seen in the shell." General Sherman writes that the eggs hatched successfully, producing vigorous fry, which were planted in the Second Sylvan Pond, a sheet of 30 acres, with pure spring water and well supplied with insect and minute crustacean food. It also contains brook trout and dace, but no other fish.

The eggs sent to Mr. E. B. Hodge arrived in good condition, hatched well (loss only 118), and about 3,400 fry were planted June 1 in Sunapee Lake, Sullivan County, New Hampshire. Concerning them he wrote, March 18, 1887:

"This is one of our largest lakes and has an elevation of about 1,200 feet above sea level. It is a natural trout lake. It is 9 miles in length and from $\frac{1}{2}$ to 3 miles wide. I do not know of their having been seen since, and from so small a plant in a lake of this size it is hardly time to expect their appearance. We shall make a plant this year in this lake of 20,000 Loch Leven trout fry."

The 20,000 eggs sent to the Anamosa hatchery arrived in splendid order, only four being dead. They hatched well, and on April 3 the fry were taken to Spirit Lake, Iowa, to be put into West Okoboji Lake, one

of the chain of lakes in Dickinson County, with very clear and very deep water. It is about 6 miles long and 2 miles wide, and is considered the only suitable lake in the State for these trout. Mr. A. A. Mosher, who deposited the fish, says that nothing has yet been heard from them, the long mosses and aquatic plants, which rise from 2 to 10 feet from the bottom of the lake, making an excellent hiding-place for them.

The 10,000 eggs sent to Mr. Atkins went, by some mistake, to Grand Lake Stream, and were reshipped to Bucksport, Me. On arrival there it was found that they were partly frozen, which caused a loss of 1,575 eggs. The total loss was about 3,000. Those that hatched were planted in Branch Pond or its tributaries, within the city of Ellsworth, on May 4, 1885. Branch Pond is a tributary of Union River, in Hancock County, Maine. Up to February, 1887, nothing had been seen of the fish. In the spring of 1886 Mr. Atkins angled for them without success.

The 10,000 sent to the Michigan fish commission were planted in two small lakes in Clare County, Michigan, the headwaters of the Tobacco River.

The 5,000 eggs sent to Mr. L. S. Hill were hatched and planted in streams and lakes tributary to Ball's Lake, Bulton's Lake, and Buck Creek, a few miles out of Grand Rapids, Mich., and some were placed in a small body of water since turned into a trout pond. All seemed to be doing well in the fall of 1886, and in the spring of 1887 many were seen in the trout pond.

In March, 1887, Mr. Clark reported that of the 7,000 fry retained at the Northville hatchery about 2,500 remained in good condition and were doing well, no perceptible losses having occurred since four or five months after hatching.

Either no report has been given or nothing definite is known of those sent to Messrs. Sweeny and Dalrymple, and to Crooked Lake, in Northern Michigan, where the plant was made by the Flint and Pere Marquette Railroad.

Concerning the hatching of these eggs Mr. Maitland wrote: These eggs differ from the *fontinalis* in requiring a much larger supply of water, and it is absolutely necessary that they in no case be laid down so as to lie one above another. The water over them should not be more than half an inch, with a supply of 2 gallons per minute. A test experiment of this was made and has been repeated with the same results for seven successive years. They asphyxiated in 6 inches of water, temperature at 45° F.; date, one week before hatching; size of trough, 7 feet by 20 inches. Under the same circumstances, *fontinalis* eggs would hatch perfectly.

In Loch Leven, says Mr. John D. Quackenbos, writing from that lake on June 24, 1886, these trout are found upon the shoals all summer, and afford rare sport to the angler. As fighters they far surpass the *Salvelinus fontinalis*, and no fish can surpass them in delicacy of flavor.

They also attain an extraordinary size, the largest specimen on record weighing nearly 18 pounds; but the average size of fish ordinarily taken with a fly is from 1 to 1½ pounds.

The Loch Leven trout (*Salmo levenensis*) is closely allied to and by some has been claimed to be identical with the European or brown trout (*Salmo fario*), but this view is not shared by Dr. Francis Day and Sir Gibson Maitland, who classify the *Salmonidæ* as follows:

Sub-genus A.

Deciduous vomerine teeth—Salmones.

- a. About eleven rows of scales in an oblique line from adipose dorsal fin to the lateral line.
1. *Salmo salar* The salmon.
 - b. Fourteen or more rows of scales in an oblique line from adipose dorsal fin to the lateral line.
 2. *Salmo trutta* The sea trout.

VARIETIES.

- (a) *Salmo albus*, under which Day includes *S. crix* or *S. brachypoma*; in other words, bull trout.
- (b) *Salmo cambricus*, commonly called the sewen.

- 2 A. *Salmo levenensis* The Loch Leven trout.
- 2 B. *Salmo fario* The common trout.

VARIETIES.

- (a) *Salmo orcadensis* The Loch Stennis trout.
- (b) *Salmo ferox* The ferox.
- (c) *Salmo cornubiensis* The Cornwall trout.
- (d) *Salmo nigripinnis* The black-finned trout.
- (e) *Salmo estuarius* The Galway sea trout.
- (f) *Salmo stomachicus* The gillaroo.
- (g) *Swaedale trout*.
- (h) *Ciassapwill trout*.

Sub-genus B.

Vomerine teeth restricted to near the head of that bone—Salvelini.

3. *Salmo alpinus* The alpine char.

VARIETIES.

- (a) *Salmo perisi* The Welsh char.
- (b) *Salmo willughbii* The Windermere char.
- (c) *Salmo killinensis* The Loch Killin char.
- (d) *Salmo grayii* The Lough Melvin char.
- (e) *Salmo colii* The Lough Eske char.

4. *Salmo fontinalis* The American char.

All British char are varieties of 3, *S. alpinus*. The American brook trout ranks as *S. fontinalis*.

The following facts are furnished by Sir Gibson Maitland:

“Loch Leven is a lake of between three and four thousand acres, fully one-half of which averages a depth of 12 feet. The lower end and cen-

ter of the lake vary from 40 to 80 feet in depth. The summer temperature is between 50 and 60 degrees Fahrenheit; the winter, probably not below 40 degrees; the deeper parts, probably above 46 degrees.

"Until the beginning of the present century there was free access to the sea, and probably a few centuries ago the Loch Leven trout was thoroughly migratory. About fifty years ago the loch was reduced to its present size, 1,000 acres being drained, the surface lowered 6 feet, and sluices constructed at the outlet for the accommodation of mills on the River Leven below. The *S. levenensis* is found in the River Forth, in Loch Lomond, and other lakes of the west coast of Scotland, and also those of the northwest of England. It crosses readily with *S. trutta* (sea trout) and *S. fario* (common trout); the offspring are fertile. It hybridizes with *S. salar*. The offspring of *S. levenensis* (female) and *S. salar* (male) have hitherto been sterile. Those I have are now in their fourth year. The offspring of *S. salar* (female) and *S. levenensis* (male) which I have are as yet too young to determine sterility, but this cross is much easier made and the ova more prolific than in the former.

"The Loch Leven trout still retains many characteristics of a sea-going salmonoid, such as the parr marks, the silvery smolt livery, the forked-tail grilse stage, with its small proportion of spawners, diminutive eggs (40,000 to a gallon), and tender, delicate embryos; and its mature state, with a square tail, strongly developed hook on the under jaw of the males, large eggs (27,000 to a gallon), producing strong, well-formed, vigorous embryos. The practical difference between *S. levenensis* and *S. fario* is that the former has a much larger number of cæcal appendages and a stronger stomach, enabling it to crush the *Limnia pereger*, on which it largely feeds."

At a meeting of the Linnean Society of London, in January, 1887, Dr. Francis Day read a paper on the Loch Leven trout, in which he said: "These fish are known by their numerous cæcal appendages, and up to their fourth or fifth year they are of a silvery gray, with black but no red spots. Subsequently they become of a golden purple, with numerous black and red spots. Undergrown ones take on the color of the brown trout [common English brook trout, *Salmo fario*?]. Remove these fish to a new locality, and they assume the form and color of the indigenous trout. In 1883 a salmon parr and a Loch Leven trout were crossed, and the young have assumed the red adipose dorsal fin, and the white-edged margins to the dorsal and ventral, also the orange edges to both sides of the caudal—all colors which are found in the brook trout, but not in the salmon or Loch Leven trout. The maxilla in this form not extending to behind the eye, the absence of a knob on the lower jaw in old breeding males, and the difference in the fins from those of *Salmo fario*, were shown to have been erroneous statements."

WASHINGTON, D. C., May 5, 1887.