

Original: Fish Division
cc: Mr. Ruhl
Mr. Shetter

INSTITUTE FOR FISHERIES RESEARCH
UNIVERSITY MUSEUMS
UNIVERSITY OF MICHIGAN
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WINTER TROUT STREAM STUDIES

The undersigned Institute investigators undertook field studies between the dates of February 18-26, 1936, with the following objectives: (1) to make observations on surface and anchor ice formation in certain lower peninsula trout streams; (2) to accumulate data on wintering habits of trout; (3) to form estimates regarding duck concentration on trout waters; and (4) to make the routine stream-bottom samples and obtain a series of trout for stomach analysis and scale-reading studies.

The present report is to deal with the first two items, i.e., ice formation and wintering habits of trout. On this trip a large series of Mergansers was secured, and additional specimens are still being referred to the Institute by Departmental field workers. It has been considered advisable, therefore, to defer treatment of this problem until the influx of material has ceased, when a comprehensive report will be prepared to include stomach analyses of all specimens, as well as notes on duck concentration.

General Ice Conditions, With Special Reference to the North Branch of the Au Sable River near Lovells, Crawford County:

The following series of temperatures was taken while the Institute workers were stationed at Lovells:

<u>Date</u>	<u>Air Temperature</u>			<u>Water Temperature</u>			<u>Remarks</u>
	<u>7 a.m.</u>	<u>12 m.</u>	<u>7 p.m.</u>	<u>7 a.m.</u>	<u>12 m.</u>	<u>7 p.m.</u>	
Feb. 21	-15°F.	+19°F.	+19°F.	+33°F.	+34°F.	+33°F.	Very little anchor ice in early morning.
Feb. 22	-22	+19	+13	+32	+33	+33	Anchor ice present in early morning, 31°F.
Feb. 23	+ 4	+36	+33				No anchor ice, rained during night.
Feb. 24	+35	+45	+39	+35	+35	+35	Warm SW wind, sky clear.
Feb. 25	+30	+38		+33	+34		Strong W wind, sky clear.

An attempt was made to determine the depth of the frost-line in the ground adjacent to the stream. In front of the general store at Lovells, 10 feet back from the stream-edge, the ground was not frozen. 21 feet from the stream the ground was frozen to a depth of 5 inches, under 18 inches of snow.

Due to the unbroken period of zero and sub-zero temperatures which prevailed for about a month previous to our visit to the North Branch, a considerable amount of surface ice was found to have formed over the river. There was some open water in almost all sections of the river observed, the open channel varying from 6-20 feet in width. Surface ice formation was most extensive in quiet water, over the deeper portions and in the shelter of stream improvement devices. Where the current was accelerated by such devices, no ice was found. The depth of the surface ice varied from paper-thin outer edges to average maximum thicknesses of 4-6 inches. Apparently, the ice thickness had been increased by accumulations of snow amalgamated with surface ice.

Compared with last year's winter conditions, very little anchor ice formed on the North Branch, despite the extended period of bitter cold. Last year it was found that extensive anchor ice formation had taken place, and, during the early spring break-up, had wedged against masses of surface ice behind improvement barriers, subjecting them to great strain. No instances of this sort of condition were found in 1936,-- during the thaw, surface ice would drift down stream in large but relatively thin masses which, upon striking a barrier, would fragment readily and pass through the restricted channel without damaging the barrier.

Two possible explanations for the sparing formation of anchor ice during the past winter are: (1) the heavy snows which have kept the ground deeply covered since early winter, and which have doubtless aided in keeping the ground relatively warm; and (2) the fact that the river was extensively covered with surface ice before the temperature fell much below 0°F. Barnes, of McGill University, has published observations indicating that anchor ice will not form beneath surface ice. If this is true, it is a possible explanation for this winter's anchor ice conditions.

Some anchor ice was encountered on the West Branch of the Sturgeon River, north of Vanderbilt, near the old U. S. 27 bridge. Where observed, it had formed over sand and very fine gravel bottom, and was never over $1\frac{1}{2}$ inches thick. Almost as soon as it was touched by the rays of the sun it left the bottom and floated to the top. In consistency it was very soft and mushy. There was a small amount of sand, fine gravel, and vegetable debris embedded in it, but no instances of extensive delamination of the stream bottom were seen. On the West Branch of the Sturgeon, the surface ice was more narrowly restricted to the areas immediately adjacent to the banks than it was on the North Branch of the AuSable.

On February 19, about 3 miles of the Pigeon River downstream from the Vanderbilt Bridge were examined. No anchor ice was seen, but the formation of surface ice was considerably greater than on the North Branch. Stretches of open water were sparse and often widely separated, and in places the ice attained a thickness of at least 12 inches.

Winter Occurrence of Trout:

While at Lovells, one day, and parts of two others, were devoted to seining and to hook-and-line fishing. The latter method proved unproductive. The areas seined were the sections of stream near the Akron Club and Anderson's Ranch, sections which had yielded a large number of trout when seined by us in early January. In the present case, however, seining at these localities gave us no returns. We were able, nevertheless, to obtain a few trout by combing the mud and submerged aquatic vegetation with our hands. A 10 $\frac{1}{8}$ -inch Brown Trout was found practically buried in mud at the edge of the stream under the surface ice. In the same locality several small Brook

Trout were seen, and a large number of Black-sided Dace collected.

Seining in front of the store at Lovells gave us our best results. Here we took about 20 small Brook Trout, among them two bearing tags. Both of these had been tagged near Anderson's Ranch, about two miles upstream, one in June and one in August of 1935. Other fish taken here included many Muddlers, small Black-nosed Dace, Sucker fry, and Chubs. The habitat here is similar to that in the vicinity of the Akron Club.

Our findings suggest two possibilities. It seems likely that at least a certain percentage of trout may "hibernate" by burrowing into the muck beds which support growths of aquatic vegetation. On the other hand, the two tag recoveries at Lovells lends strength to the idea that brook trout tend, in winter, to move down stream into deeper waters, returning later in the spring, when the water temperature rises.

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David S. Shetter
J. W. Leonard
By: J. W. Leonard and
David S. Shetter