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TROUT TAGGING EXPERIMENT OF 1932-1933 AT THE HARRIETTA HATCHERY

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Experiments to test the available types of fish tags were undertaken at the Harrietta hatchery in October 1932. The tagging was done October 21-24 by the writer, assisted by Gerald McCrimmon. The fish tagged were brook trout. The tags used were the 1 1/4 inch celluloid body-cavity or belly tag, the small-size (No. 3) clip-type tag, and the special fingerling tag of the clip-type.

The purposes in view were: (1) To determine the most desirable methods of tagging trout (2) and to determine, so far as possible, the relative advantages of the three types of tags.

Mr. A. J. Walcott, superintendent of the hatchery, turned over two ponds each approximately 75 by 18 feet, with concrete sides, for the purposes of the experiment, and otherwise cooperated finely. The fish used were raised at Harrietta and were large fingerlings, young of the year, mostly four to seven inches long. The lot included a few breeding males and at least three adult females, but most of the fish were immature.

The 853 fish after being tagged were placed in the upper one of the two ponds. The 619 fish which were not tagged were placed in the lower pond. The sizes of these control fish were approximately the same as those of the tagged individuals. The purpose in keeping a check lot was to have some standard of normal mortality to use in interpretation of mortality in the tagged lot.

Mr. Walcott saved dead fish from the tagged lot during the period from October 24 to May 18. Each of the specimens, picked up dead, was labelled with

with the date and preserved in formaldehyde solution. The fish were cleared from each of the ponds by the writer on May 18, when the check lot was counted. The tagged lot was carefully looked over to determine the effects of the tagging.

Of the 619 brook trout left in the check pond, 464 individuals were found in the May examination, a survival of 75%. Of the 853 brook trout which had been tagged, 337 individuals were found in the May check-over, a survival of 40%.

The experiment was divided into the following sections:

A. Gill-cover experiment. Special fingerling tag.

Experiment A-1; 100 fish used. Special fingerling tag on left gill cover. Size of fish 4 3/8 to 6 inches. Found dead with tags, 14 (Nov. 19-Jan. 8). Recoveries with tags 4. (4% of total tagged). One of these tags was loose and was removed during handling. The tags had worn holes in all instances. The four fish were 5 1/2 to 5 7/8 inches long when tagged and were 7 1/4 to 8 1/2 inches when re-examined May 18-19.

Experiment A-2; 93 fish used. Tagged as in Exp. A-1, except that fish were selected for small size, being 3 1/2 to 5 inches long. Found dead with tags, 24 (Nov. 12 to Jan. 31). Recoveries with tags, none. (May 18-19).

Experiment A-4; 100 fish used. Tagged as in Exp. A-1, except that fish were selected for large size, being 5 to 7 1/2 inches long. Found dead, with tags, 18 (Nov. 12 to Jan. 21). Recoveries with tags, none. (May 18-19).

B. Gill-cover experiment. Regulation small-size No. 3 fish tag.

Experiment B; 150 fish used. Size of fish 5 to 7 3/4 inches. Dead with tags, 50 (Nov. 10 to Jan. 28). Recoveries with tags, none (May 18-19).

Summary of gill-cover experiments

	Number of Fish	Percentage of total experimented on
Alive with tag in May (A-1).....	4	1 %
Dead, with tag.....	106	23 %

	Number of Fish	Percentage of total experi- mented on
Dead, with scar on gill-cover.....	49	11 %
Alive, May, with scar on gill-cover.....	185	41 %
Alive, May, with scar on gill-cover so healed as to be uncertain*.....	55	12 %
Dead, with uncertain scar*.....	<u>13</u>	<u>3 %</u>
Total accounted for.....	412	91 %
Missing.....	40	9 %
Total.....	452	100 %

Discussion of Gill-Cover Tagging Experiments (A and B)

The experiment demonstrated, conclusively, that both sizes of tag, when attached to the gill covers, usually are lost within six months. The four tags which remained in place until the May check of the experiment had caused large holes in the gill covers and presumably would have dropped off within a few months, or less. A number of the trout picked up dead as early as November had already lost tags. Mr. A. B. Cook wrote in a letter of November 14 that he had picked up six of the No. 3 tags at the bottom of the pond. Some of the fish had succeeded in tearing the tags loose. In many other instances, the loss can be interpreted to results of a continual irritation of the bone which develops a sore with some mucus. The hole in the bone gradually enlarges until the tag falls out. Larger trout, with tougher bone, might be expected to carry a tag longer than the ones used in the experiment, but irritation of the bone might be expected whenever bone is pierced by the metal. It is probable that the decomposition of the opercle, leading to the loss of the tags, involved bacterial action, and that the action was accelerated in the hatchery pond because of crowding and contagion. Much evidence is available, however, to indicate that fish in natural waters lose their gill-cover tags through the wearing away of the bone. Many trout had healed

the gill-cover scars so completely, that the identification of individuals as ones used in the gill-cover experiments was doubtful (see ones listed with * above). Most of these fish, however, were undoubtedly a part of this experiment. The number of gill-cover tagged fish still living May 18-19 was 244, a survival of 54 per cent. This is 21 per cent less than that of the check pool (see also discussion of mortality factors).

Jaw tagging experiment. Special fingerling tag

Experiment A-3; 97 fish used. The lower jaw-bone was ringed by the tag, which surrounded but did not pierce the bone. The tag thus hung downward, from the jaw. The fish used were 4 3/8 to 6 inches long. Fifty trials of the tag as usually clamped were made, and on 47 fish the tag was spread with pliers after clamping, so as to give the jaw-bone more room for growth.

Summary:	Number of Fish	Percentage of total experimented on
Alive with tag, May.18-19,.....	46	47 %
Alive, with tag lost and jaw broken, May 18-19.	9	9 %
Dead with tag (Nov. 15 to March 22).....	36	37 %
Dead, with tag lost and jaw broken (Jan., Feb.)	2	2 %
Total accounted for.....	93	96 %
Missing.....	4	4 %
Total... ..	97	100 %

Discussion: This represents, apparently, the first trial of this method of tagging. The method appears to be highly promising. The fish had fed, in spite of the tag which surrounded the lower jaw-bone of one side. The tag, in this position, does not interfere with closure of the mouth, although the fish bites down on the thin band of metal. Individuals measured May 18-19 had grown as much as two inches, since October 21-24, an overwinter growth which seemed about the same as that of the control fish (which were not measured). Where the tags had not been spread, irritation

of the jawbone was always noted. When the fish had grown, the jaw was pinched and, in extreme cases, had given away, leaving the fish with a broken jaw. Spreading of the tag appears highly desirable. Most of the lot which had had the tags opened out to give more space showed practically no irritation of the jaw. Although only 16 of the ones with tags spread were found in the May check-over, as against thirty of the ones with normally clinched tags, this apparent higher survival rate is perhaps not significant on the small number of fish used (about 50 of each). In all, 57 percent of the fish tagged had survived. This is 18 percent less than the standard given by the untagged lot.

Experiment A-5: 103 fish used, 4 1/4 to 7 inches long. The special fingerling tag was clinched through one side of the jawbone, near its base. A hole was pierced through the bone so as to allow the tag to be passed through without coming up around the bone. The tag hung downward and toward the tail of the fish. The bone of the jaw offers a firm attachment, much firmer than that of the gill-cover.

Summary:	Number of Fish	Percentage of total experi- mented on
Alive with tag, May 18-19.....	0	0 %
Dead with tag (Nov. 7 to Dec. 27).....	25	24 %
Alive, with tag lost and scar healed, May 18-19	38	37 %
Dead, with tag lost (Nov. 12 to Apr. 22).....	<u>24</u>	<u>23 %</u>
Total accounted for.....	87	84 %
Missing.....	16	16 %
Total.....	103	100 %

Discussion: This represents, apparently, another new way to attach tags. The contrast with experiment A-3 is very illuminating. In the present experiment, where the jaw-bone is pierced, the tags did not remain in place. Apparently, no matter how firm the bone, piercing of a bony structure causes an irritation and consequent loosening of tag.

Body-cavity ("belly") tagging experiment

Red celluloid tags 1 1/2" x 1/4", stamped with numbers in special celluloid marking ink were used. The tags were supplied by courtesy of R. S. Nesbit, of the U. S. Bureau of Fisheries, who has originated their use.

Experiment C-1; 26 fish used, 6 to 7 5/8 inches long. A transverse cut on the belly, between ventral fins and anus was made with a sharp knife point. The cut was made small and the tag was forced into the body cavity and pushed forward, along the belly wall. The cut bled rather badly and tended to gape open. Dead with tags 21 (Nov. 6-Nov. 17). Missing 5. No recoveries on May 18-19.

Experiment C-2; 25 fish used, of sizes similar to those in C-1. The cut was made longitudinally, on the belly. Bleeding was scarcely evident and the cut closed more naturally than in the preceding experiment. Dead with tags, 21 (Nov. 8-Nov. 15). Missing 4. No recoveries on May 18-19.

Experiment C-3; Fifty fish used, of lengths 6 to 8 1/8 inches. The cut was made on the side, low down but about one-half inch from the mid line of the belly, between ventral fins and anus. The cut was made diagonally, following the myotome direction, so as to cut between muscles so far as possible, rather than across them. Dead, with tags 41 (Nov. 7 to March 13). Missing 9. No recoveries on May 18-19.

Experiment C-4. One hundred fish used. The experiment was like #C-3 except that smaller fish were selected (4 to 6 inches). Dead with tags, 85 (Nov. 7 to Nov. 25). Missing 15. No recoveries on May 18-19.

Discussion of body-cavity tagging experiment. The trout seemed to have no immediate discomfort from this tag, and swam away readily. No deaths seem to have occurred within the first week after the experiment. Subsequent mortality was sudden, and rapidly reached a peak around November 11, when 35 fish died. Examination of the preserved specimens indicated that many of the wounds had been well along toward healing when death occurred. The preserved fish showed abundant evidence of furunculosis. In many instances the characteristic tissue degeneration was localized

about the point of insertion of the tag. No precautions were taken to prevent internal infections, neither the point of operation, the knife used, or the tags were sterilized. Such precautions might have prevented infection. The evident outbreak of furunculosis among the tagged fish makes the body-cavity experiment of doubtful significance as a test of this method. Mr. Nesbit reports good success in experiments carried on by him and by the Vermont Department of Conservation, with this type of tag. An experiment tried by the writer during October 1932 at the Northville hatchery, where nine trout were used in a trial of this tagging method, gave encouraging results, five of the fish (one brook trout and the others rainbows) were found to have become entirely healed in an April re-examination. Mr. Nesbit just tells us of getting a report from Connecticut, of 2000 returns in the first month from 13000 legal-sized trout tagged with the belly tags.

About all that it is safe to conclude from our experiments with belly tags is that the necessary operation is likely to cause loss of the fish, if these are kept crowded in water containing a concentration of disease germs.

Mortality factors

The percentages of losses which can be attributed to the several types of tags have not been decisively determined, by the present experiments. The outbreak of furunculosis was a serious upset to the experiment, particularly because all of the tagged trout were confined in one pond. The fish with slits into their body-cavity provided good material for the disease to work on and the outbreak probably took a number of fish, with this and other types of tags, which would have survived had they not been in the midst of fish with the disease. The check pond, of untagged fish received the overflow water from this pond, and the loss here was fairly high (25 percent). The cuts made for insertion of the body cavity tags, and also the irritation caused by clip-type tags, are certainly to be considered as points of entrance for infection.

The majority of the brook trout used in the Harrietta experiment are

parasitized by gill-lice (Salmincola edwardsii). This^{is} a factor which may lessen the resistance of these fish to tagging injuries. However, trout of the sizes used do not usually have so large a number of the parasites as do the older fish. Certainly, the number carried by the younger trout does not seem to affect growth very materially.

Considering only the fish tagged with clip-type tags, the survival of fish in the tagged lot was 52% (337 alive May 18-19, with or without tags, out of 652 tagged). This is 23% less than the survival percent in the check pond. The best of the experiments, the jaw experiment (A-3) gave a survival percent of 57 (46 recovered with tags, and 9 alive with broken jaw). This is 18% less than the figure set by the untagged fish.

Evidently the fish with clip-type tags suffered heavier losses than the untagged fish, by the differences in percentages shown above. The conclusion, that 18 to 23 percent less survived, due to the tagging seems tenable, but it should be pointed out that the disease outbreak, among which the tagged fish had to live, is a complicating factor. The epidemic among the fish tagged with body-cavity tags may have raised the losses in fish tagged with the other types of tags by contagion.

We have no reason to suppose that the losses of the tagged fish in this experiment were due to any lack of care. Such losses might well be expected in any of the older hatcheries, nearly all of which are more or less infested with fish disease organisms.

Recommendations for further experimentation in trout tagging

The experiments reported here have proven, at least to the satisfaction of the writer, that neither type of clip tag can be expected to give a high percentage of returns over a six-month period when put on the gill covers of trout less than eight inches long. Tagging through the bone of the jaw is unsatisfactory.

The method explained under discussion of experiment A-3, involving use of

the special fingerling tag ringed around one side of the lower jaw appears to be, by far, the best method yet demonstrated for attaching these tags. Further experiments using this method, particularly where the tag is spread to permit growth of the jawbone, are recommended. The extent to which wild trout may be handicapped, in getting natural food, by reason of a tag so placed needs study. The relative mortality caused by this method of tagging to fish of various sizes should be investigated. In the meanwhile, tagging operations with external tags carried on by the Department of Conservation, or by individuals, should make use of the principle of ringing the lower jaw, as explained in this experiment, rather than to continue the gill-cover method.

It does not follow that results of the tagging experiments to date are without value or interest, because even a small percentage of returns give some valuable evidence.

The body-cavity method should not be condemned, on the basis of the experiments here reported. Further trial of this method is in order. It is suggested that care be taken, in at least one lot of fish, to sterilize the area to be cut, the cutting instrument, and the celluloid tag.

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