

February 23, 1935

JAW-TAGGING: A NEW METHOD OF MARKING FISHES*

By David S. Shetter

INTRODUCTION

The movements of wild animals, both mass and individual, have ever fascinated the biologist. Often in the study of the natural history of these creatures it is desirable and important to know the nature and extent of their natural migrations. To accomplish this end, individuals must be marked so that they will be readily recognized by the investigator when reencountered. Birds have been marked for many years with the familiar leg band. Fish have been marked for even a longer time, although marking experiments on them are not quite so well known.

In general, fish-tagging investigations are conducted to obtain data pertaining to one or more of the following points: (1) Migration habits, (2) growth rate, (3) population density estimates, and (4) survival ratios. All of these are of value in life history and distributional studies of fishes. The failure of these studies to provide the desired data in past investigations has no doubt frequently been due to the nature of the tag used and the technique employed in fastening it to the fish. Previous investigators have constantly devised new types of tags and attempted to improve the method of attachment. The purpose of this paper is the description of an improved method for fish tagging.

THE DEVELOPMENTS OF METHODS FOR MARKING FISH; EARLIER TAGGING EXPERIMENTS

Attempts at fish marking date back to a time earlier than Isaac Walton¹, for in "The Compleat Angler", published in 1653, Walton mentioned having heard that fish

* A contribution from the Institute for Fisheries Research.

¹ Pearson, J. C. 1934. Marking Fish - Louisiana Conservation Review, April, 1934.

were marked by tying ribbons around their tails. In 1852, another Englishman, Alexander Russel¹, recorded that 500 young salmon were marked with silver wire. Three of these salmon were later recovered, one from the stomach of a cod.

The first systematic attempts at fish marking must be credited to Charles G. Atkins (1872). Atkins' experiments with marking salmon (Salmo salar) included branding of the sides, fin-clipping, and attaching metallic tags.

Other notable early workers on tagging methods were Archer¹ and Fulton¹ of Scotland, and Petersen¹ of Denmark. From the experiments of Fulton and Petersen was developed the first of the three types of tags now generally used. This is the "button" or "disc" type, wherein two vulcanized rubber or celluloid discs, one lying on each side of the body, are connected by silver wire passing through the flesh. A serial number and the address to which the tag and attendant information are to be forwarded are printed on the disks. The points of application for this type of tag are: (1) the caudal peduncle, (2) the fleshy region under the dorsal fin, and (3) either gill cover. This method of tagging has had a wide and successful use in investigations on the flat-fishes (Pleuronectidae) in European waters.

A second type of mark, known as the "metal strap-tag" or "clip tag" was devised by the late C. H. Gilbert¹ of Stanford University. This marker is a metal clip patterned after those used to ear-mark hogs, sheep and cattle. The tag is provided with a simple locking device operated by a special pair of pliers, and is applied to the caudal peduncle, the dorsal fin, or to the operculum.

A third type of tag, and the one most recently developed, is the so-called "belly" tag originated by Nesbit (1933). This marker consists of a thin celluloid strip with the number and return address printed thereon. The strip is inserted into the eselon of the fish through a small incision in the side.

I will now mention some of the more outstanding workers and the results of some of their experiments. The extensive tagging experiments of Gilbert (1924), Rich (1926),

¹ Pearson, J. C. 1934. Marking Fish - Louisiana Conservation Review, April, 1934.

Snyder (1924) and Scofield (1920)² on the Pacific salmon (*Anchoa mitchellii* ^{*Encorhynchus*} spp.) initiated as early as 1919, have provided important biological data on this fish. While their recovery percentage has usually not been high, the fish recovered have revealed many pertinent facts that probably would not have been obtainable in any other manner.

Schroeder (1930) published the results of an extensive tagging experiment on the cod (*Gadus* spp.). His data on the movements in the Atlantic off the southern New England coast provided important facts bearing on practical fisheries problems. Between 1923 and 1929 Schroeder tagged 24,739 cod with the strap tag, attaching it to the caudal peduncle. In all, 834 tagged fish were recovered,--a percentage of 3.3. From this six-year study Schroeder determined first, cod are most abundant on Nantucket Shoals in the spring and fall, and second, most of the Nantucket Shoals stock migrates southward toward the Carolinas in the fall, and reverses this migration in the spring. The average summer cod population of Nantucket Shoals ^{he} was finally able to estimate from percentage of recovery in relation to total catch. Tagging data also served as a valuable supplement to age and growth studies based on scale readings.

A variation of the belly tag method has been used on the herring of the Pacific Coast (Rounsefell and Dahlgren, 1933), where numbered metal strips ^{were inserted} in the abdominal cavity, and later recovered from the cleanings by a powerful electro-magnet. This represents the best method yet devised for the recovery of this type of tag.

One of the best recent experiments on tagging is that of Tøning (1934), who in 1931 marked 227 plaice on the northeastern coast of Iceland with the disk type tag on the gill cover. Within one and one-half years he obtained a twenty-six percent recovery. From these returns he was able to learn: (a) plaice approaching maturity tend to migrate away from the cold east coast; (b) 300 miles is approximately the longest individual migration; (c) the annual growth is about 3 cm. for individuals from 30 to 50 cm. long; and (d) the plaice migrate both north and south around the island.

The earliest known tagging experiments in Michigan waters were initiated by the

² Titles in bibliography represent earlier papers.

Michigan Department of Conservation in 1927 under the direction of the late Dr. Jan Metzelaar. Since 1930 these experiments have been carried on the Institute for Fisheries Research of the University of Michigan. In the five years following 1927, 20,288 fish including ten different species, were marked with the clip type tag on the caudal peduncle, dorsal fin or gill cover. The recoveries totalled 551 fish—a percentage of 2.71. For tag numbers of these fish together with the attendant data, the Conservation Department was dependent on information from the sport fishermen. Of the ten species marked, only four species yielded sufficient returns to attempt statistical analyses. These were the rainbow trout, the brook trout, the brown trout, and the yellow pike perch.

that: the

The returns indicated (a) migratory range of the rainbow trout (S. gairdneri irideus) is much wider than either that of the brook (S. f. fontinalis) or brown trout (S. fario), and (b) the yellow pike-perch (Stizostedion vitreum), with the exception of a few long distance migrants, shuffle or disperse at random throughout the confines of the Inland Water System (Crooked, Burt, Mullet lakes, and connecting waters).

Mention should be made at this point of a successful tagging experiment conducted by Charles W. Creaser and John Delavan in 1932 and 1933 on great northern pike (Esox lucius) in the Pine River in the region of Alma, Michigan. The pike were marked with the largest size strap tag attached to the operculum. From three hundred and eighty-four great northern pike tagged during the spawning runs of the springs of 1932 and 1933, forty-eight (48), or 12.5 percent were later recovered. The most important result of this experiment was the indication that the sport fishing above the dams at Alma was probably bettered by rescue work undertaken by the local sportsmen's organization. The data of the investigation also showed that with the exception of occasional wanderers, the great northern pike of the Pine River does not undertake any extensive migrations. It was determined also that the tags would not remain attached to the gill covers of the pike much longer than two months.

THE JAW TAG METHOD OF MARKING FISH

In all the earlier tagging work undertaken for the Conservation Department by the

Institute for Fisheries Research, the fish were marked by attaching the tags to the caudal peduncle, the gill cover, or occasionally to the dorsal fin. Later experiments on marking technique indicated rather strongly that these locations for tag placement are not suitable, at least for the marking of soft-rayed fishes, and particularly if long-time experiments are to be conducted. Not only does the strap tag tend to irritate any flesh or bone pierced and thus wear an aperture and drop out, but there is also reason to believe that tagging in the above manner may bring about a certain number of fatalities.

In 1932 and 1933 Dr. John R. Greeley, then a staff member of the Institute for Fisheries Research, conducted experimental taggings on fingerling brook trout under ideal recovery conditions at the state hatchery, at Harrietta, Michigan. One experiment demonstrated that almost all strap tags attached to the dorsal fin or on the caudal peduncle were lost within a six-month period, while 98% of the tags attached to the gill cover were lost over the same period of time. These results agree in general with the work done by Creaser and Delavan (see p.).

Concurrently with the above investigations, an experiment was conducted to test the feasibility of rining the lower jaw with the clip type of tag. Forty-seven percent of the fingerlings so marked retained their tags over a 6 month period. In order to test the applicability of the jaw tag method to larger fish, Dr. Greeley and the writer tagged 65 rainbow trout in the fall of 1933 at the ^{Federal} Northville Hatchery, Northville, Michigan. The size range of these fish was from 8-12 inches total length. When these fish were examined one year later (November 1, 1934), thirty-two individuals were found to have held their tags; all were in good condition. Since hatchery conditions made it impossible at the time of examination to inspect the entire stock of trout in the ponds it is possible than more than 32 trout retained their tags. It may then be concluded that at least 50% of the marked trout had kept their tags over a period of one year. It was observed that where the smallest clip tag was used on these larger rainbow that the jaw bone did not have sufficient room in which to grow, and as a consequence 66% of the fish tagged with the small tag forced them loose and dropped them. In general,

³ Schroeder (1930) states that he tagged ood on the jaw in 1927, but did not give any details, nor did he use the method extensively.

the results of the experiment seemed to point out that if a tag of the proper size is applied to the jaw, it may be carried by the trout for relatively long periods of time.

In view of these past experiments with trout, I have adopted the jaw-tag method for use in all my tagging work on soft-rayed fishes. The clip tag is the type used, and its application to the fish is a relatively simple operation. A small slit is made with a scalpel under and inside the maxillary bone. The short end of the tag is then inserted through the aperture and clasped through the lock-hole on the opposite end of the tag. This projecting short piece is pinched down firmly with jeweller's pliers, locking the tag. To allow for jaw growth, the resulting elongate oval is spread to an approximately circular shape by pressure exerted from both ends by means of pliers. I have developed another type of tag and pliers similar to the hog nose ring and its pliers, which I feel would make possible a simpler and speedier operation, but as yet we have not been able to have them manufactured.

The jaw-tag method of marking fish^w is in use at present in an investigation of movements and growth of the brook and brown trout on the North Branch of the Au Sable River. Between July 25 and September 27, 1954, 1061 brook trout, and 36 brown trout were marked by the jaw-tag method. Of the 1097 trout so marked, 490 brook trout, or 46% and 7 brown trout, or 19% were recovered. Of the 1061 brook trout tagged, 27% were recaptured and remeasured from one to five times. These repeated recoveries within a 5-month period seem to have provided rather accurate knowledge of their migrations and growth rates. The comparatively high percentage of returns I attribute to two factors: (1) a better location of the tag on the fish, and (2) repeated seining in and around points where fish were tagged—a more efficient and dependable method of obtaining recoveries than that offered by fishermen's returns. The publication of results on migrations and growth rates will be deferred pending the addition of next summer's data.

It is the hope of the Institute for Fisheries Research that we will be able to continue this interesting study, and attempt to develop the general tagging method to a point where it will be a valuable aid to the Conservation Department in the scientific attack on its many fisheries problems.

SUMMARY AND CONCLUSIONS

1. The development of the technique of fish tagging, and the types of fish tags were discussed. Certain earlier tagging experiments were described briefly.
2. Data were presented to show the inadequacy of the methods previously employed for the tagging of soft rayed fishes.
3. The jaw tag method was described. Evidence was presented to show that the jaw tag method gives more reliable results than those formerly used for marking soft rayed fishes.