Tagging Herring With Coded-wire Microtags

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ABSTRACT—A coded-wire microtag system can be used to tag Pacific herring, Clupea harengus pallasi. *Adult herring were tagged in the geniohyoideus muscle and held for 13 months. Of the 136 fish tagged, 81 percent survived: 98 percent of the survivors retained tags. During shipboard experiments, an average of 10 fish were tagged per minute.*

Introduction

An efficient method of marking large numbers of herring, *Clupea harengus*, has application in separating stocks, describing seasonal migration, and estimating abundance of populations. Herring have been marked with a variety of external and internal tags. External tags of plastic or metal have been attached to fins, opercula, or muscle; internal tags of magnetized metal (Dahlgren, 1936) or radioactive metal (Wilimovsky, 1963) have been placed in body cavities.

Coded-wire microtags, used to mark young salmon, can also be used to mark herring if the appropriate technique is followed. The tag—a 6-bit, binary-coded wire of stainless steel—is small (0.254 mm diameter, 1.07 mm long) yet allows coding for 262,144 number combinations. The microtag does not internally damage the fish or alter its external appearance.

Equipment and Methods

I used the coded-wire microtag system manufactured by Northwest Marine Technology (NMT)[1]. The equipment includes a tag injector, a quality-control unit that magnetizes the tag and detects untagged fish, a portable tag detector, and an AC-DC power supply[2].

When the tag injector is triggered, a hollow needle penetrates the fish; tagging wire is fed through the needle and cut; and the needle retracts leaving the wire tag implanted. The placement of an adjustable aluminum base controls the distance the needle penetrates the fish. For tagging Pacific herring, *Clupea harengus pallasi*, the distance between the aluminum base and the tip of the needle is 1.5 mm (Fig. 1). The needle extends an additional 4.5 mm from the aluminum base when the injector is triggered (Fig. 2). The distance the tag projects through the needle is controlled by an adjustment on the tag injector. For tagging Pacific herring, the tag is implanted 2.0 mm from the head-mold base (Fig. 3).

For the tag location, I chose the geniohyoideus muscle, located on the lower jaw between the dentary bones and immediately below the tongue (Fig. 4). The

[1]Mention of trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

[2]Northwest Marine Technology. 1978. Binary coded marine identification system. Northwest Marine Technology, Shaw Island, WA 98286, 8 p.

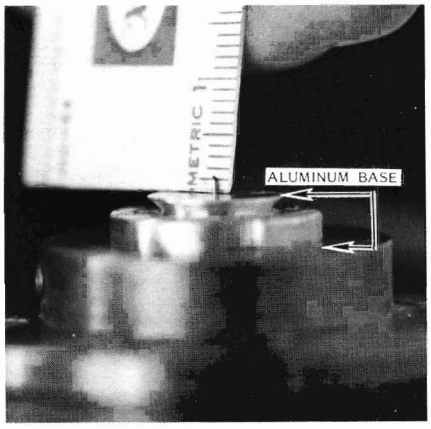

Figure 1.—Positioning of aluminum base to set needle length.

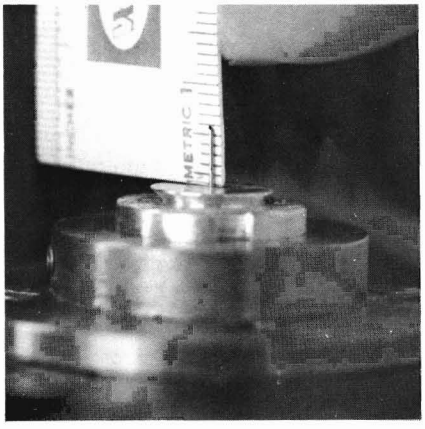

Figure 2.—Distance needle extended when machine is triggered.

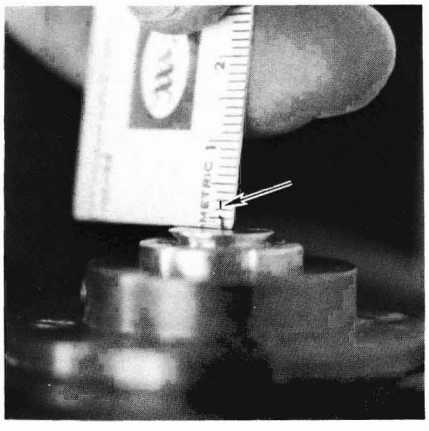

Figure 3.—Depth the tag is planted.

strong tissue of the geniohyoideus muscle prevents tag dislodgement yet is penetrable by the tagging needle. Tag placement is rapid and accurate, and the tag can be easily seen and removed from the clear geniohyoideus muscle.

To tag Pacific herring, the operator holds the fish ventral side up with the snout just below the tagging needle and pointing toward the aluminum base. While lifting the fish, the operator pushes the operculum slightly outward with the thumb. This motion allows the tagging needle to rest on the symphysis of the left and right dentary bones (Fig. 5). The fish is then tilted upward, and the operator triggers the injector with a foot switch.

The size of the fish determines the angle it is tilted. Large, adult Pacific herring (19-24 cm fork length) are tilted approximately 60° relative to the aluminum base (Fig. 6). At this angle, the tag is implanted directly behind the symphysis in the anterior geniohyoideus (Fig. 7). Juvenile and young-adult Pacific herring (11-18 cm fork length), which have a narrower muscle than adult fish, are tilted approximately 10° relative to the aluminum base (Fig. 8) to prevent the needle and tag from penetrating both sides of the muscle. At the 10° angle, the tag is implanted in the posterior geniohyoideus muscle (Fig. 9).

The implanted tags are magnetized as the fish pass through the plastic tubes of the quality control unit. Fish with magnetized tags are then detected by a tag detector that senses changes in a magnetic field. The fish must move past the detector, or the detector past the fish, at a minimum rate of 15-30 cm/second for changes in the magnetic field to be detected.

Retention of Tags

To determine tag retention and mortality from tagging, I tagged 136 adult Pacific herring on 5 November 1976 and held them in a circular tank 1.8 m high

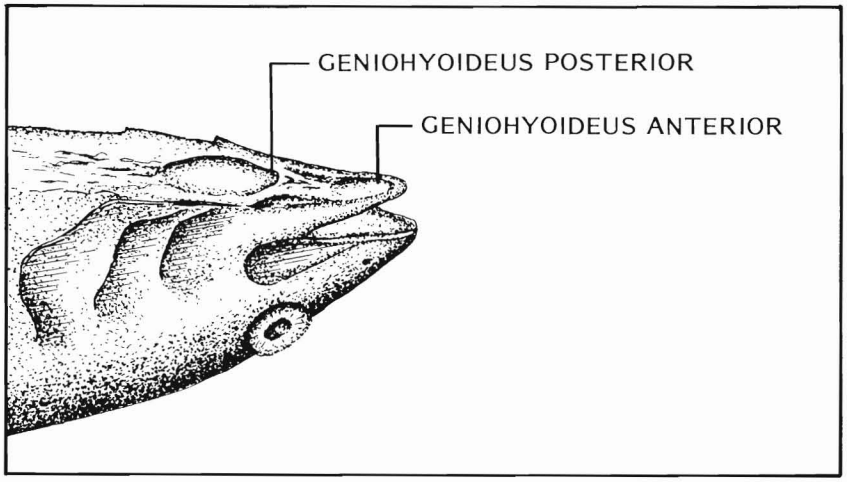

Figure 4.—Location of geniohyoideus muscle of Pacific herring.

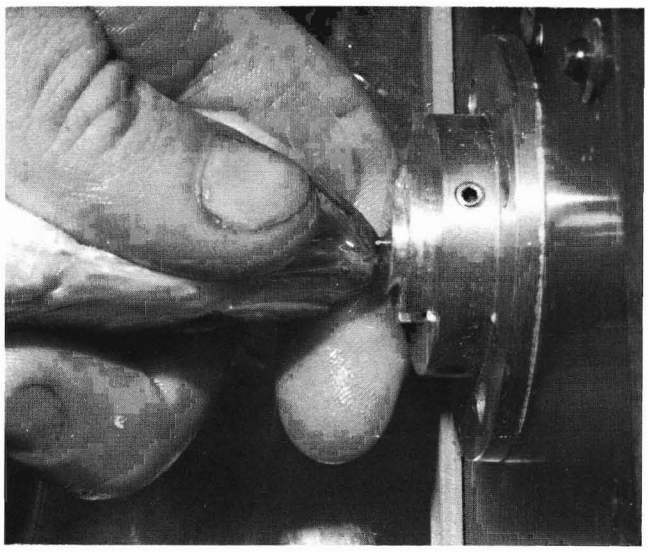

Figure 5.—Positioning of Pacific herring for tagging before tag injector is triggered.

Figure 6.—Position of large Pacific herring (19-24 cm fork length) when tag injector is triggered.

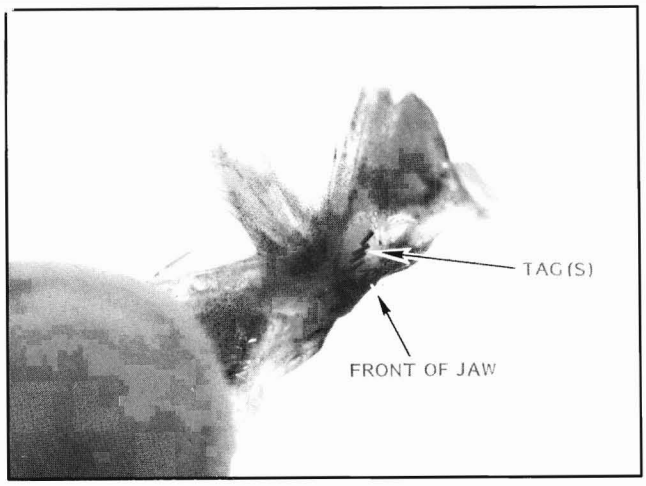

Figure 7.—Location of several tags in the geniohyoideus muscle of large Pacific herring (19-24 cm fork length). Note precision of tag placement.

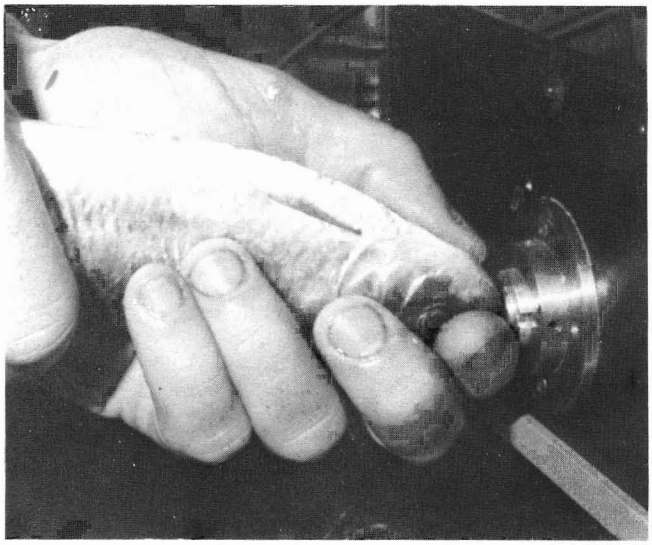

Figure 8.—Position of small Pacific herring (11-18 cm fork length) when tag injector is triggered.

with 34,000 l of circulating seawater. Each week, dead fish were counted and checked for tags. At the end of the study, 5 December 1977, all surviving fish were checked for tags.

At the end of the study, 88 Pacific herring were alive, of which 86 (98 percent) contained tags. Of the original 136 tagged fish, 28 disappeared and could not be accounted for; 20 of the remaining 108 fish (19 percent) died between November 1976 and April 1977.

I checked 14 of the 20 dead fish and all 14 fish had tags. The dead fish had no infection where the tags were implanted, and I attributed their deaths to bacterial infection at scale-loss sites. Scale loss was heavy because the fish were repeatedly handled during their capture and transfer to the holding tank.

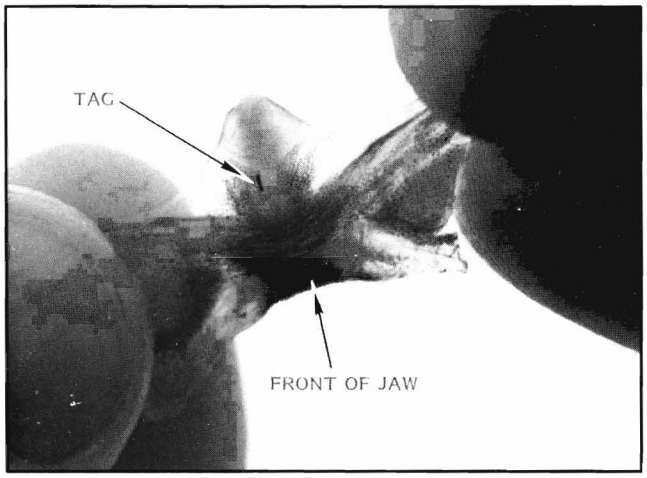

Figure 9.—Location of tag in the geniohyoideus muscle of small Pacific herring (11-18 cm fork length).

Field Tagging Study

Live Pacific herring were tagged aboard ship to develop tagging procedures and determine the rate of tagging under field conditions. On 16 November 1977, juvenile Pacific herring were captured with a midwater trawl in Fritz Cove, 13 km northwest of Juneau in southeastern Alaska, and placed into a holding tank aboard ship. The fish were not anesthetized because low water temperature (5°C) minimized their activity. Fish were removed from the holding tank and placed in a bucket half-filled with seawater. The tagging operator then removed the fish from the bucket for tagging. Tagging speed was averaged from two 5-minute and two 10-minute tagging periods. Two operators tagged an average of 10.6 and 10.0 fish per minute.

Tag Recovery

During experiments at sea, coded-wire microtags have been successfully detected in catches of Atlantic herring,

Clupea harengus harengus (Corten, 1980). These experiments were designed to determine the reliability and screening capacity of the detection equipment when it is used aboard vessels at sea. Nineteen microwire-tagged Atlantic herring were mixed with several hundred kilograms of unmarked Atlantic herring and fed into a NMT detector tube. All tagged fish were detected by the system, and no false alarms were registered. In a second test, one tagged Atlantic herring was placed among 100 kg of Atlantic herring, which were then placed in six baskets. The baskets were quickly emptied into the detector tube. The tagged fish was detected (with no false alarms) during each of the several times the test was run. An average of 200 kg of fresh fish were screened per minute; 140 kg of fish with rigor mortis were screened per minute. Corten (1980) concluded that "the detection of magnetic coded wire tags in herring is very well possible" and "it is unlikely major problems will arise concerning the reliability of the detection system." Furthermore, he believed "the maximum throughput of fish with the present detector tube is already approaching the processing capacity of many commercial freezer trawlers."

Thus, it appears that the coded-wire microtag system can be used to tag herring quickly and effectively with low tagging mortality and good tag retention (present study), and that tagged herring can be recovered from large catches (Corten, 1980).

Literature Cited

Corten, A. 1980. Experiments on the detection of magnetic wire tags in herring catches at sea. Int. Counc. Explor. Sea, Pelagic Fish Committee, C.M. 1980/H:36, 5 p.

Dahlgren, E. H. 1936. Further developments in the tagging of the Pacific herring, *Clupea pallasii*. J. Cons. Cons. Int. Explor. Mer 11(2):229-247.

Wilimovsky, N. J. 1963. A radioactive internal tag for herring. Int. Comm. Northwest Atl. Fish. Spec. Publ. 4:359-361.