DEVELOPMENT OF A TAGGING PROTOCOL

FOR OUTMIGRANT

JUVENILE LAMPREY, *LAMPETRA TRIDENTATA*

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Introduction

Pacific lamprey populations are experiencing a precipitous decline in abundance throughout the Pacific Northwest of the U.S.A. While the decline of lamprey is widespread, it is of great concern in the Columbia River system (Close *et al*., 1995).

Recovery is dependent on identification of sources of mortality. While very little is known about their migratory biology, successful outmigration relies on safe passage through dams. Therefore, paramount to recovery is developing a way of monitoring fish during migration; hence the need for an appropriate tagging and detection system.

We have been exploring the use of radio telemetry and PIT tags to monitor juvenile lamprey outmigration. Development of an effective tagging system is dependent on obtaining a tag of appropriate physical characteristics that has the necessary transmitting and/or sensing parameters, allows for normal behavior, and provides an adequate "recapture" system.

Methods/Results

Radio- tags

Due to the small size of juvenile lamprey and restrictions in available tag size, radio-tags (12.5 mm X 5 mm X 2.5 mm, 0.43 g.) were mounted externally, approximately mid body, and laterally on the fish. The tag is attached with suture (Ethicon 5.0 non-absorbable), at two anchor points, from the attachment loop at the battery end of the tag in addition to a suture loop around the base of the tag where the antenna exits the transmitter. Forty-five animals were tagged in this manner, in which approximately 25% of the tags were removed (by the lamprey) by the third day post-tagging. All of the tags were detached by day 15 (Fig. 1).

PIT tags are small enough for internal implantation (8 mm X 2 mm X 2 mm) in juvenile lamprey. In an initial experiment, 45 juvenile lamprey (each group) were either implanted with PIT tags using a single scalpel-incision, given an incision only (sham) or left intact (control). Approximately 25% of both the PIT-tagged and sham animals died by day 6 post-tagging; there was no mortality over this period in the control group (Fig. 2).

In a second experiment, 36 animals (each group) were either PIT-tagged using the single incision method described above, but with the use of a dissecting microscope to avoid damaging the digestive tract and given oxygen-enriched recovery, or left intact. The results of this experiment reduced mortality by 10% over the same period (Fig. 2).

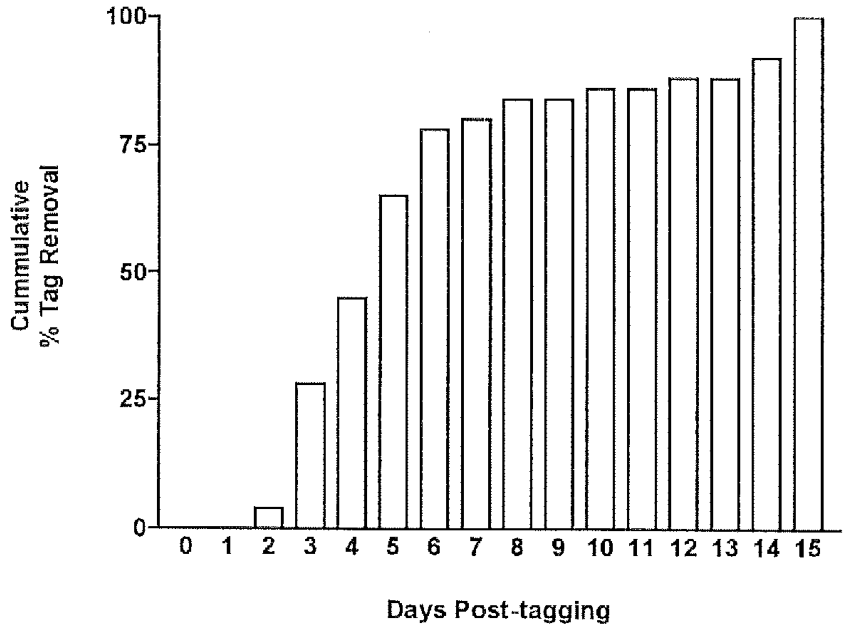

Figure 1. Cumulative percentage of radio-tags removed by juvenile lamprey. Lamprey were externally tagged with radio-tag dummies that were the same weight, shape and density as real tags. Tags were attached by suture mid-body and lateral on the fish. All of the tags were removed by day 15 post-tagging.

PIT-tags

Regression analysis of the length and weight data from the previous two experiments indicates that 99% of the mortality in both trials was those animals smaller than 150 mm in length. In a third experiment, 35 animals (each group) were selected for relatively large size (150 mm total length) and either PIT-tagged by the method in the second experiment or left intact. Results suggest that nearly 100% survival can be obtained by PIT-tagging animals with total lengths greater than 150 mm. (Fig 2).

Swimming Behavior

In separate experiments, radio-tagged and PIT-tagged juvenile lamprey were subjected to flows similar to what they may encounter in and around Columbia River hydroelectric projects. For the radio-tag experiment 6 animals were tagged as described previously and along with 6 untagged, fish were placed into one of three chambers (2 tagged and 2 control fish per chamber) of a swim tube. Animals were allowed to attach or "hold fast" to the side of the tube, at which time, flows were gradually (within 1 minute) increased to 2.5 ft./sec. Animals were then monitored by video for a twenty-four hour period and time of detachment from the tube was recorded. By 12 hours, 100% of the radio-tagged animals were detached. Untagged fish remained attached by 24 hours post-treatment. Eight PIT-tagged and eight untagged fish were subjected to the same conditions as described above. By 24 hours post-treatment, all animals (tagged and untagged) remained attached to the swim tube.

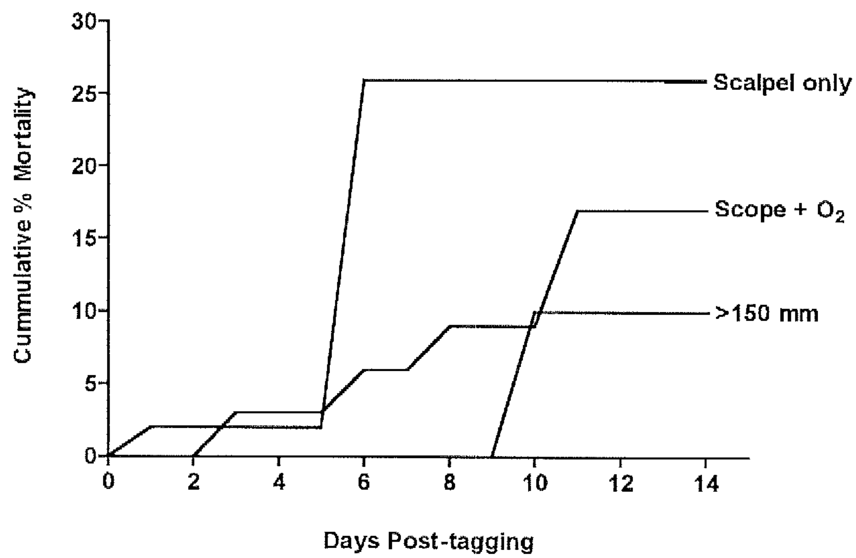

Figure 2. Cumulative percent mortality for three PIT tagging procedures. Animals were PIT-tagged using a scalpel incision only, using a scalpel incision under a dissecting microscope and provided and oxygen enriched recovery, or selected for size greater than 150 mm and tagged using the scope + O_2 method. Fourteen days post-tagging, the size biased group had fewer mortalities.

Discussion

We have determined that the maximal size for an implantable telemetry tag for juvenile pacific lamprey is the size of a miniature PIT tag. Mortality associated with implantation can be significantly reduced by improved surgical techniques and the use of animals greater than 150 mm in total length. External application of the smallest radio-tag currently available may be able to provide some information about migratory behavior through hydroelectric projects on the Columbia River, however, results from these experiments clearly showed that the external attachment of these radio-tags alters behavior as compared to PIT-tagged or untagged fish. Reductions in the size of radio-tags would be of great benefit.

Acknowledgements

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References

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