



FISH PASSAGE CENTER

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MEMORANDUM

TO: Joe Skalicky, USFWS

FROM: Michele DeHart

DATE: November 14, 2014

RE: Review of PIT-tag data for juvenile lamprey in the Columbia River Basin

In response to your request, we have reviewed all available data for PIT-tagged lamprey in the Columbia River Basin. Specifically, you asked us to summarize available data for the juvenile life-stage. Below is a general overview of our findings from this review, including some recommendations that could increase the utility of PIT-tag data, particularly for juvenile lamprey.

- To date a total of 14,053 lamprey have been PIT-tagged and released into the Columbia River Basin, of which 3,647 (26%) were determined to have been tagged and released as juveniles.
- Approximately 81% of the PIT-tagged juvenile lamprey that we identified were tagged and released at a dam for specific studies on passage conditions. Many of these fish were collected from downstream projects and transported upstream to the release site for these studies. Therefore, any downstream detections of these fish would not be useful in assessing passage timing, travel times, diel passage, survival, etc., because they do not represent the run-at-large. Marking and handling effects have been documented in salmonids and steelhead from similar marking, transport, and release activities.
- The only group of PIT-tagged juvenile lamprey that were useful to assess timing patterns, travel times, etc., were 690 PIT-tagged Pacific macropthalmia that were tagged and released into the Umatilla River in 2012 and 2013.
 - Of these, only 25 were detected at John Day Dam and none were detected at Bonneville Dam.

- With only 25 downstream detections, assessing passage timing, travel times, diel passage patterns, etc., is limited and estimating survival is not possible.
- Based on our review of the available PIT-tag data for juvenile lamprey we offer the following recommendations which could improve the potential to develop travel time, timing, and survival data for juvenile lamprey:
 - It would be useful if researchers PIT-tagging lamprey could clearly identify adults from juveniles. For example, researchers from the Confederated Tribe of the Umatilla Indian Reservation used a two-letter code in the Conditional Comments field to identify that the lamprey they marked in 2012 and 2013 were macrophthalmia (i.e., juveniles).
 - Increased marking of juvenile lamprey is needed in order to better inform passage timing, travel times, diel passage, and survival.

To date, 14,053 total lamprey have been PIT-tagged and released into the Columbia River Basin. However, this release total includes individuals that were tagged and released as juveniles or adults. Currently, all PIT-tagged lamprey are recorded in PTAGIS with the Species Code of “A”. This means that there is currently no simple way of determining whether an individual was PIT-tagged and released as an adult or as a juvenile. However, it is possible to use other information from the tag file to determine juveniles from adults. To determine how many of the 14,053 total PIT-tagged lamprey may have been tagged and released as juveniles, we relied on three different pieces of information.

1. We used Capture Method. Specifically, we assumed that all PIT-tagged lamprey with a Capture Method of LADDER were tagged and released as adults, as intentionally capturing juvenile lamprey in an adult fish ladder for PIT-tagging purposes would be extremely difficult. Of the 14,053 PIT-tagged lamprey, approximately 6,894 (49%) had a Capture Method of LADDER.
2. We used Session Message to inform life-stage at tagging. All individuals whose Session Message contained the word “adult” were assumed to have been tagged and released as adults.
3. We used length at tagging to determine the life-stage at tagging. It is worth noting that length at tagging is a voluntary field for PIT-tagged fish which means that not all PIT-tagged lamprey had a length. For example, approximately 8% of the total PIT-tagged lamprey were missing length data all together. This means that using length at tagging to determine life-stage at tagging likely eliminated some juveniles from the data set. To determine an appropriate length “cut point,” we relied on condition monitoring data from John Day, McNary, and Bonneville dams, as part of the Smolt Monitoring Program (SMP). As part of the condition monitoring program, Pacific lamprey macrophthalmia that are collected by the SMP are measured to the nearest mm TL (total length). In all, 25,307 Pacific lamprey macrophthalmia have been examined for condition at these three projects over the past four years. The maximum length of these fish is 455 mm TL. However, this is likely an erroneous length, as the next highest length was 228 mm TL. Based on these data, we used 250 mm TL as the “cut point” for determining juvenile lamprey.

After using the criteria discussed above, we estimate that approximately 3,647 (26%) of the 14,503 PIT-tagged lamprey were tagged and released as juveniles. Of the 3,647 lamprey that were tagged as juveniles, 2,941 (81%) were tagged and released at Lower Granite Dam in 2013 and 2014, McNary Dam in 2005, or the Sullivan Hydroelectric Plant at Willamette Falls in 2004 as part of studies to assess passage conditions at these sites. Many of the lamprey juveniles that were used in these studies were collected at a downstream dam and transported to the study site for PIT-tagging and release. Therefore, downstream detections of these individuals are not useful for informing juvenile passage metrics, as they do not represent the run-at-large because of the additional handling and transportation. Of the remaining 706 PIT-tagged juveniles that were not tagged for these passage condition studies, one was tagged and released into the Methow River in 2011, one was tagged and released into Lolo Creek on the Clearwater River in 2014, 14 were tagged and released into Newsome Creek on the Clearwater River in 2014, and 690 were tagged and released into the Umatilla River in 2012 and 2013. The tagging on the Umatilla River was conducted by researchers from the Confederated Tribes of the Umatilla Indian Reservation (CTUIR).

Based on these data, it appears that the 690 PIT-tagged juveniles from the Umatilla River marking in 2012 and 2013 are likely the only juvenile lamprey that may be useful in assessing patterns in timing, travel times, etc. All 690 of these PIT-tagged juveniles had a Conditional Comment (i.e., Flag Code) of MP, which stands for Macrophthalmia Pacific (Aaron Jackson, CTUIR, personal communication), which verifies that these were juveniles. The average length and weight at tagging for these PIT-tagged Pacific macrophthalmia were 147.7 mm TL (95% CI: 146.8–148.7 mm TL) and 4.9 grams (95% CI: 4.8–5.0 grams). In comparison to our juvenile lamprey “cut point,” the maximum length at tagging for these PIT-tagged macrophthalmia was 197 mm TL.

All of the Umatilla River macrophthalmia were tagged and released over the span of about three months, from December 7, 2012, to March 19, 2013. Figure 1 is provided below to illustrate the daily proportions of PIT-tags that were released into the Umatilla River over this period. Of the 690 macrophthalmia that were PIT-tagged for this project, only 25 were detected at a downstream project. All 25 of the downstream PIT-tag detections were at John Day Dam and occurred between March 28 and July 21, 2013. To date, one of the 690 PIT-tagged Pacific macrophthalmia released into the Umatilla River in 2012 and 2013 have been detected at an adult detection site in the Columbia River Basin.

With only 25 downstream detections, estimates of passage timing, travel time, and diel passage patterns are limited. Furthermore, estimation of juvenile survival is not possible. Although limited, we used the 25 PIT-tagged macrophthalmia that were detected at JDA to assess passage timing, travel time (release to John Day), and diel passage patterns. Figure 2 is provided to illustrate the passage timing of these 25 detected fish.

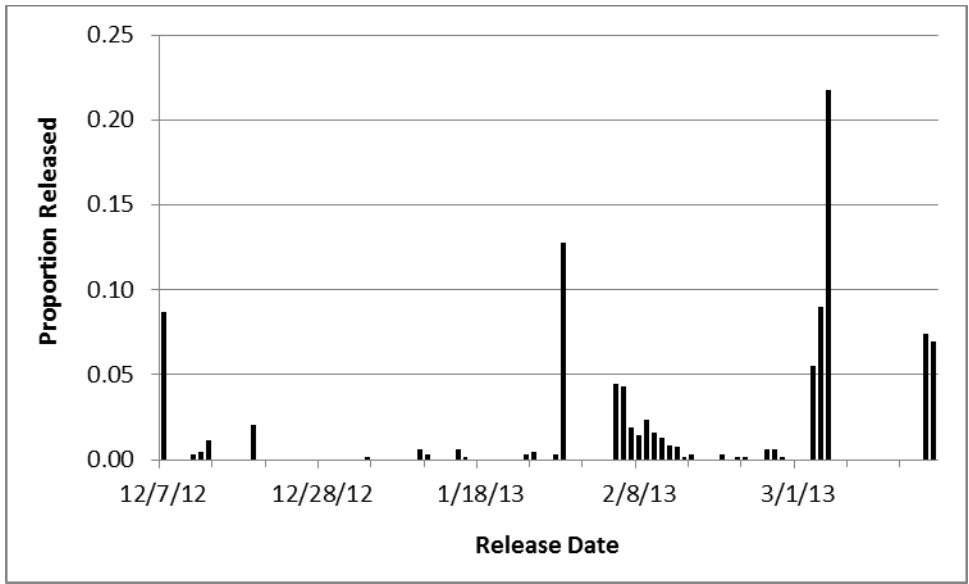


Figure 1. Daily tagging (expressed as a proportion) of PIT-tagged juvenile lamprey from the Umatilla River in 2012 and 2013.

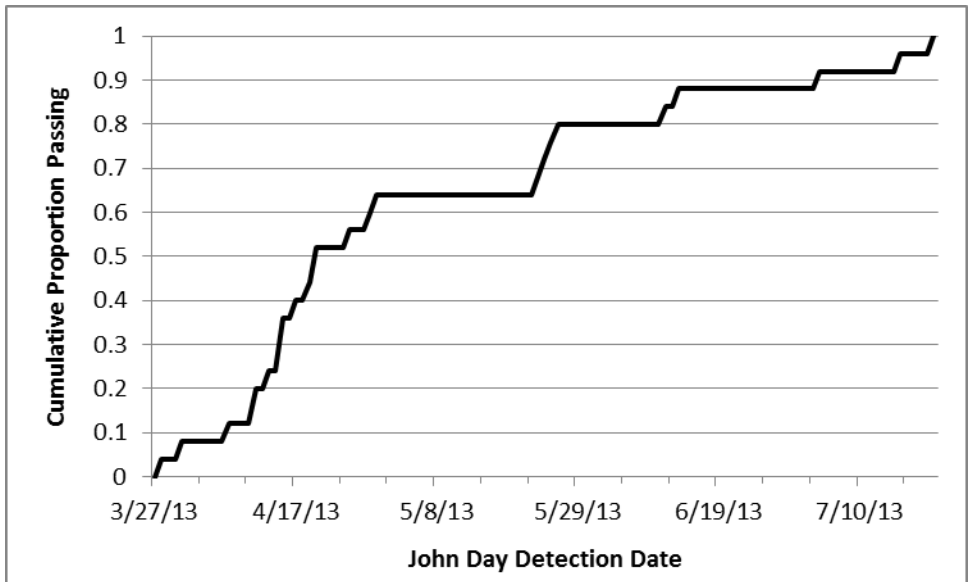


Figure 2. Cumulative proportion of PIT-tagged Pacific macrophthmia released from the Umatilla River and detected at John Day Dam.

Table 1 presents the minimum, median, and maximum travel times from release in the Umatilla River to John Day Dam for the 25 PIT-tagged Pacific macrophthmia that were detected at John Day Dam in 2013. Also provided are estimates of the 95% confidence limits around the estimated median travel time. Finally, Figure 3 is a histogram of the passage time (i.e., hour) of the 25 PIT-tagged Pacific macrophthmia that were detected at John Day Dam in 2013. From these limited data, it appears that Pacific macrophthmia pass the project at night, from approximately 20:00 to 04:00 (Figure 3).

Table 1. Estimated travel times from release to John Day Dam of Umatilla River Pacific macrophthalmia tagged and released from December 2012 to March 2013.

Travel Time (Days)			95% Confidence Limits	
Minimum	Median	Maximum	Lower	Upper
13.8	68.1	173.4	39.7	85.6

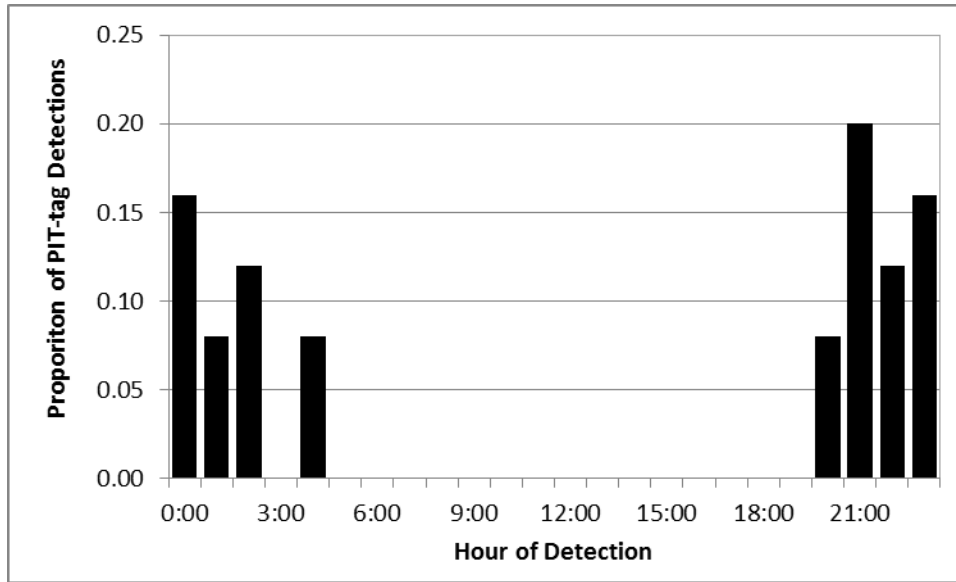


Figure 3. Hourly PIT-tag detections (expressed as a proportion) for Pacific macrophthalmia tagged and released into the Umatilla River and detected at John Day Dam in 2013.

Conclusions

Based on our review of the available PIT-tag data for lamprey it appears that current PIT-tagging levels are not sufficient to effectively assess passage timing, travel times, diel passage distributions, survival, etc., for juvenile lamprey in the Columbia River Basin. In addition, we would recommend that researchers PIT-tagging lamprey clearly identify individuals that were tagged as adults versus those tagged as juveniles. Although length at tagging can be used to distinguish adults from juveniles, it would be beneficial if the researcher conducting the tagging made that distinction. For example, researchers from CTUIR used a two-letter code in the Conditional Comments field to identify that the lamprey they marked in 2012 and 2013 were macrophthalmia (i.e., juveniles).