Translocation of Adult Pacific Lamprey within the Wenatchee Subbasin, 2015-2016 Broodstock

[Cover Photo: April Hull releasing an adult lamprey into Wenatchee River above Tumwater Dam (river km 50.4) on March 17, 2016]

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Abstract

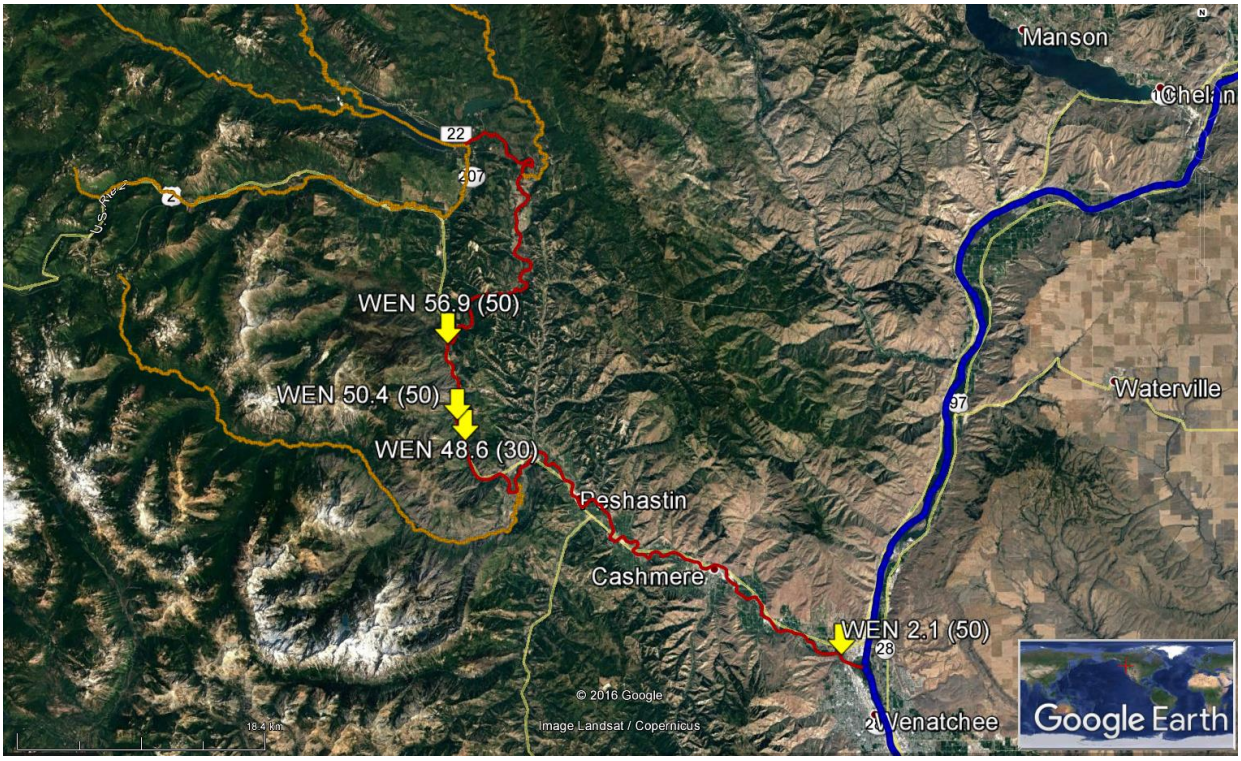
This report is composed of two parts: 1) summary of all 2015-2016 broodstock adult Pacific Lamprey releases during the spring 2016 migration season within the Wenatchee Subbasin and 2) analysis of migration data from those adults that were PIT tagged (all adults were PIT tagged). From the 2015-2016 broodstock (adults collected in summer 2015 that primarily mature in 2016), a total of 210 adult Pacific Lamprey were released in the lower to upper reaches of the Wenatchee River. Initially, 180 adults were released at four sites on March 17, 2016: 1) 0.7 km upstream of North Wenatchee Avenue (Highway 285) bridge at river km 2.1 (n=50), 2) 1.0 km downstream of Tumwater Dam at river km 48.6 (n=30), 3) 0.8 km upstream from Tumwater Dam in Jolanda Lake at river km 50.4 (n=50), and 4) just downstream of US Route 2 Highway bridge crossing at river km 56.9 (n=50). Subsequently, 30 adults were released on May 3, 2016, within three sections of the Tumwater Dam fish ladder at river km 49.6: 1) Weir 2 Pool (n=10), 2) Weir 9 Pool (n=10), and 3) Weir 18 Pool (n=10). Female ratio was estimated to be 42.9%, PIT tag ratio was 100.0%, and genetic tag ratio was 95.7%. This is the first year that adult Pacific Lamprey were translocated into the Wenatchee Subbasin. Larval or adult lamprey have not been documented upstream of Tumwater Dam on the Wenatchee River since the early 1990s. Translocation was implemented in 2016 out of concern for the species extinction observed upstream of Tumwater Dam and also to enhance the larval pheromone signal from Upper Wenatchee River to improve adult lamprey attraction.

From the PITAGIS regional data base (http://www.ptagis.org/), using Query Builder2 Reports, the interrogation data of PIT tagged lamprey were summarized. Out of 210 PIT tagged lamprey, 31 lamprey (14.8%) were detected in at least one PIT array site within the Columbia Basin. The highlights from the 2015-2016 broodstock Pacific Lamprey translocation monitoring in the Wenatchee Subbasin are the following:

- None of the 30 lamprey released immediately downstream of Tumwater Dam were detected within the Tumwater fish ladder arrays.
- Two lamprey (20.0%) from both Weir Pool 2 and Weir Pool 9 were detected moving upstream to the lower array (Weir Pool 13/14) within the Tumwater Dam fish ladder.
- No lamprey were detected at the upper array (Weir Pool 17/18) despite the release of 30 PIT tagged lamprey.
- Two lamprey (4.0%) were detected moving upstream from the upper release at river km 56.9) – one was detected in the White River (river km 10.9) past Lake Wenatchee and another was detected in the Chiwawa River (river km 11.5) in June/July period.
- Upstream migration was observed primarily in April and June through early July, with episodic movements in August and September.
- Downstream migration was observed primarily in May- July, and early August, potentially indicating the timing of post-spawn drifting.

Part I: Release Summary

From the 2015-2016 broodstock (adults collected in summer 2015, most of which mature in spring/summer 2016), a total of 210 adult Pacific Lamprey were released in the lower to mid reaches of the Wenatchee River between March 17, 2016, and May 3, 2016 (Map 1 and Table 1). Overall female ratio was estimated to be 42.9%, PIT tag ratio was 100.0%, and genetic tag ratio was 95.7%. All lamprey were originally captured from Bonneville Dam (13.5%), The Dalles Dam (29.3%), or John Day Dam (57.2%) in the Lower Columbia River during the summer of 2015. Total length averaged 631 mm (min. 512 mm and max. 729 mm) and weight averaged 430.7 g (min. 280.9 g and max. 700.0 g) during the PIT tagging operations in summer 2015 through spring 2016.



Map 1. Overall aerial map of 2015-2016 broodstock Pacific Lamprey translocation release sites in the Wenatchee River. "WEN" stands for Wenatchee, the number next to the stream name is the river km, and the number in parenthesis is the total number of lamprey released. The red line represents mainstem Wenatchee River, the orange lines represent its tributaries (Icicle, Chiwawa, and Nason creeks from downstream to upstream), and the blue line represents the Columbia River.

Table 1. Summary of 2015-2016 broodstock Pacific Lamprey translocation release in the Wenatchee Subbasin. "F" stands for female, "M" stands for male, and "UN" stands for unknown sex. "(?)" denotes slightly lower certainty with the sex ID. Female Ratio (Est. 1) is based solely on "# F" and "# M", whereas "Female Ratio (Est. 2)" includes "# F (?)" and "# M (?)" in the estimation.

Stream	River km	Date	Time	Water Temp (C°)	# Total	# F	# M	# F (?)	# M (?)	# UN	# with Pit Tags	# with Genetic Tags	Female Ratio (Est. 1)	Female Ratio (Est. 2)	Pit Tag Ratio	Genetic Tag Ratio
Wenatchee	2.1	3/17/2016	14:00	5.9	50	8	24	7	9	2	50	48	25.0%	31.3%	100.0%	96.0%
Wenatchee	48.6	3/17/2016	13:00	4.0	30	9	9	7	3	2	30	29	50.0%	57.1%	100.0%	96.7%
Wenatchee	49.6	5/3/2016	15:46	9.0	30	11	18	1	0	1	30	30	37.9%	40.0%	100.0%	100.0%
Wenatchee	50.4	3/17/2016	11:00	3.7	50	15	17	4	11	3	50	47	46.9%	40.4%	100.0%	94.0%
Wenatchee	56.9	3/17/2016	12:00	3.9	50	10	20	15	5	0	50	47	33.3%	50.0%	100.0%	94.0%
Total	**-**	**-**	**-**	**-**	**210**	**53**	**88**	**34**	**28**	**69**	**210**	**201**	**37.6%**	**42.9%**	**100.0%**	**95.7%**

Lower Wenatchee Release (River KM 2.1)

A total of 50 lamprey were released at river km 2.1 in Lower Wenatchee River 0.7 km upstream of North Wenatchee Avenue (Highway 285) bridge on March 17, 2016 (Map 2). The estimated female ratio was 31.3%, PIT tag ratio was 100.0%, and genetic tag ratio was 96.0%. Water temperature was 5.9°C during the release. Typically, we target approximately 10-12°C for early release, so we were able to release the lamprey plenty early prior to the main spring migration season.

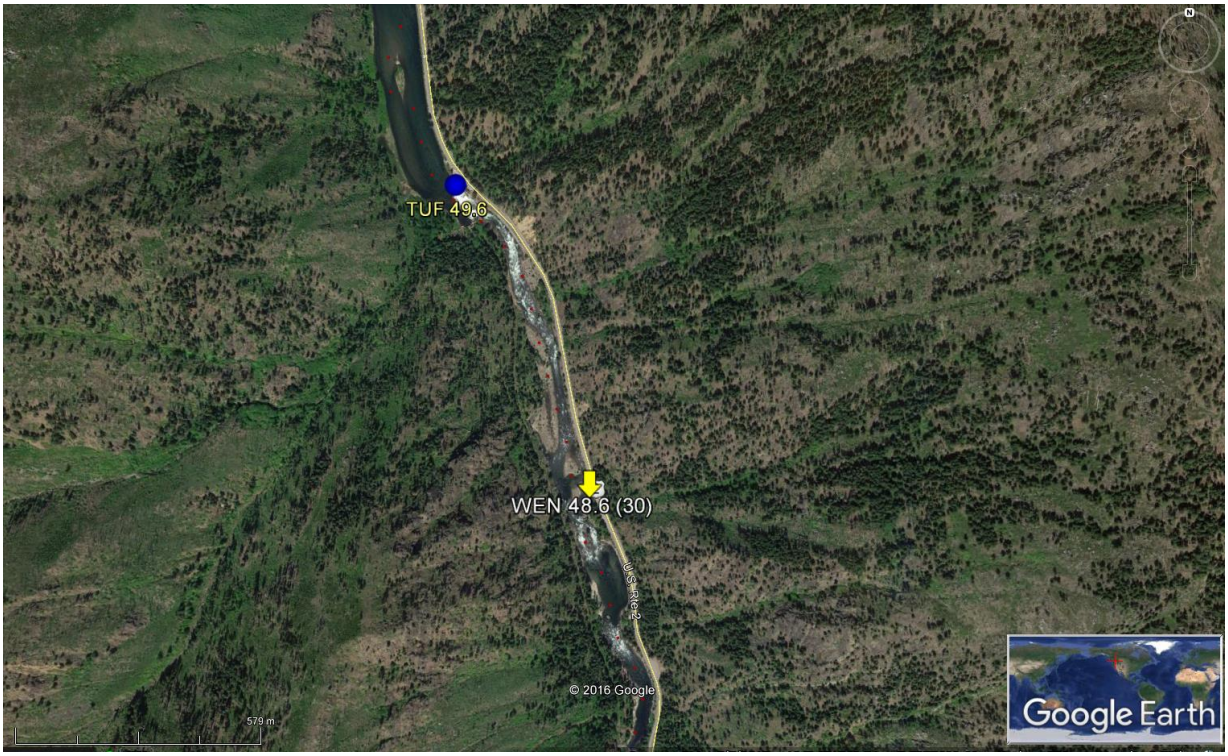
The primary goal was two-fold: 1) to release them in the lower reach of the mainstem to allow them to determine their preferred spawning reaches; and 2) to get an understanding of the detection efficiency of the instream PIT array located at river km 2.7 (LWE).

Map 2. Aerial map of 2015-2016 broodstock Pacific Lamprey translocation lower release site at Wenatchee river km 2.1. The number next to the stream name is the river km and the number in parenthesis is the total number of lamprey released. Shown with the blue circle is the PIT tag array location (LWE). Also, 0.1 km points along the Wenatchee River are displayed as red dots.

Mid Wenatchee Release #1 (River KM 48.6)

A total of 30 lamprey were released at river km 48.6 downstream of Tumwater Dam by 1.0 km, on March 17, 2016 (Map 3). The estimated female ratio was 57.1%, PIT tag ratio was 100.0%, and genetic tag ratio was 96.7%. Water temperature was 4.0ºC. Typically, we target approximately 10-12ºC for early release, so we were able to release the lamprey plenty early prior to the main spring migration season.

The primary goal was to understand what portion of the adults would be able to enter the entrance to Tumwater fish ladder and pass through the PIT array within ladder (TUF). No lamprey have been detected in Wenatchee River upstream of Tumwater Dam for over two decades despite intensive monitoring efforts conducting larval lamprey electrofishing surveys by Yakama Nation Fisheries and USFWS.



Map 3. Aerial map of 2015-2016 broodstock Pacific Lamprey translocation mid release site at Wenatchee river km 48.6. The number next to the stream name is the stream km and the number in parenthesis is the total number of lamprey released. Shown with the blue circle are the PIT tag array location (TUF). Also, 0.1 km points along the Wenatchee River are displayed as red dots.

Mid Wenatchee Release #2 (River KM 49.6)

A total of 30 lamprey were released at river km 49.6 within the Tumwater Dam on May 3, 2016 (Map 4). The estimated female ratio was 40.0%, PIT tag ratio was 100.0%, and genetic tag ratio was 100.0%. Water temperature was 9.0ºC. Typically, we target approximately 10-12ºC for early

release, so despite the late release, temperature-wise we were still within the desired range (and adults with >20 mm interdorsal distance, indicating lack of sexual maturation, were purposefully selected to avoid the inclusion of energy deficient mature lamprey in this group).

The primary goal was to understand the ability of Pacific Lamprey to pass various parts of the Tumwater fish ladder. There are two arrays within the fish ladder: 1) one between Weir Pool 13 and 14, and 2) one between Weir Pool 17 and 18. Ten lamprey were placed in Weir Pool 2 to assess whether they can move upstream to either of the two arrays upstream. Ten lamprey were placed in Weir Pool 9 to assess whether more lamprey can access the two arrays upstream from the middle of the fish ladder compared to the lower fish ladder. Finally, 10 lamprey were placed in Weir Pool 17 to assess whether lamprey would be detected moving upstream to the upper array and potentially past the counting station or downstream to the lower array. No lamprey have been detected in Wenatchee River upstream of Tumwater Dam for over two decades despite intensive monitoring efforts conducting larval lamprey electrofishing surveys by Yakama Nation Fisheries and USFWS.

Map 4. Aerial map of 2015-2016 broodstock Pacific Lamprey translocation mid release site at Wenatchee river km 49.6. The number next to the stream name is the stream km and the number in parenthesis is the total number of lamprey released. Shown with the blue circle are the PIT tag array locations (TUF).

Upper Wenatchee Release #1 (River KM 50.4)

A total of 50 lamprey were released at river km 50.4 in the middle reach of the Wenatchee River just upstream of Tumwater Dam on March 17, 2016 (Map 5). The estimated female ratio was 40.4%, PIT tag ratio was 100.0%, and genetic tag ratio was 94.0%. Water temperature was 3.7ºC. Typically, we target approximately 10-12ºC for early release, so we were able to release the lamprey plenty early prior to the main spring migration season.

The primary goal was to understand where Pacific Lamprey will distribute themselves within the Upper Wenatchee River or any of the tributary streams, taking advantage of the existing instream PIT array sites in Upper Wenatchee as well as Chiwawa, Nason, White, and Little Wenatchee watersheds. No lamprey have been detected in Wenatchee River upstream of Tumwater Dam for over two decades despite intensive monitoring efforts with larval lamprey electrofishing surveys by Yakama Nation Fisheries and USFWS.

Map 5. Aerial map of 2015-2016 broodstock Pacific Lamprey translocation upper release site at Wenatchee river km 50.4. The number next to the stream name is the stream km and the number in parenthesis is the total number of lamprey released. Shown with the blue circle are the PIT tag array locations (TUF and WEN). PIT array at WEN (river km 50.4), however, was not in operation during the release. Also, 0.1 km points along the Wenatchee River are displayed as red dots.

Upper Wenatchee Release #2 (River KM 56.9)

A total of 50 lamprey were released at river km 56.9 in the middle reach of the Wenatchee River just downstream of US Route 2 Highway bridge crossing on March 17, 2016 (Map 6). The estimated female ratio was 33.3%, PIT tag ratio was 100.0%, and genetic tag ratio was 94.0%. Water temperature was 3.7°C. Typically, we target approximately 10-12°C for early release, so we were able to release the lamprey plenty early prior to the main spring migration season.

The primary goal was to understand where Pacific Lamprey would migrate to on their own within the Upper Wenatchee River or any of the tributary streams, taking advantage of the existing instream PIT array sites in Upper Wenatchee as well as Chiwawa, Nason, White, and Little Wenatchee watersheds. No lamprey have been detected in Wenatchee River upstream of Tumwater Dam for over two decades despite intensive monitoring efforts with larval lamprey electrofishing surveys by Yakama Nation Fisheries and USFWS.

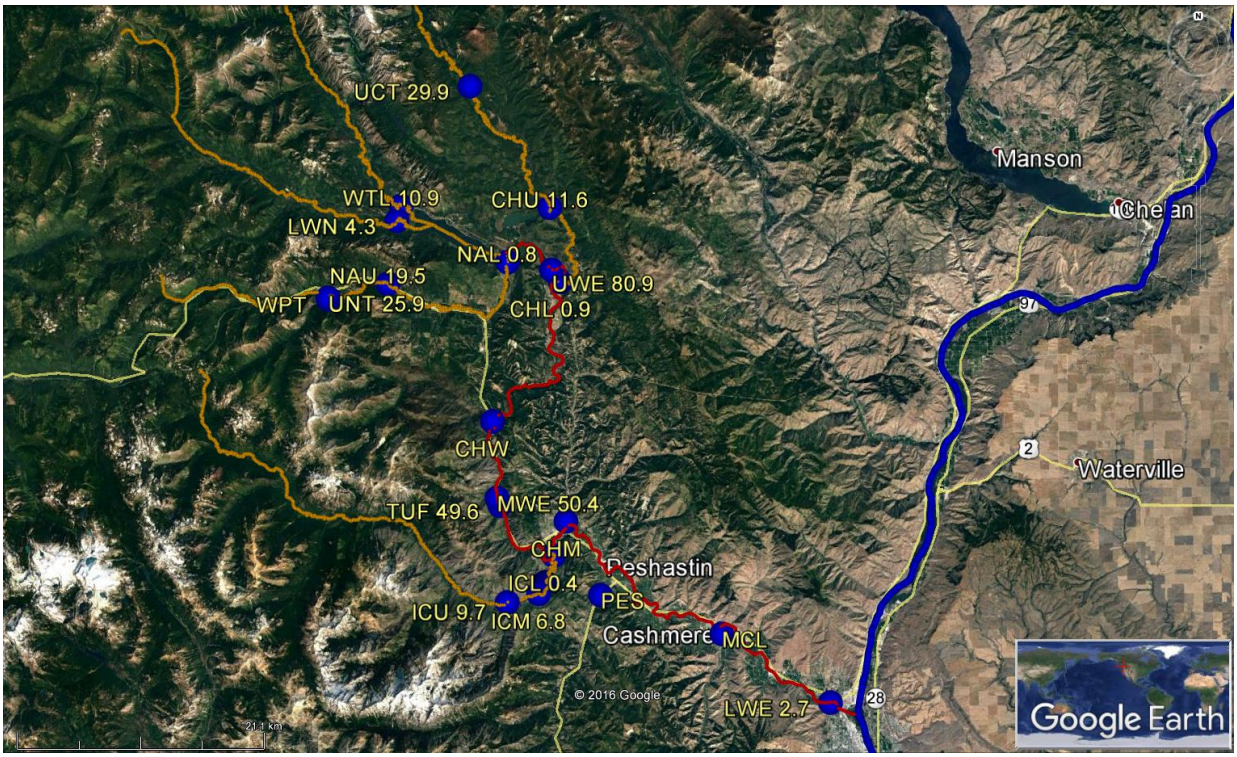
Map 6. Aerial map of 2015-2016 broodstock Pacific Lamprey translocation upper release site at Wenatchee river km 56.9. The number next to the stream name is the stream km and the number in parenthesis is the total number of lamprey released. Shown with the blue circle is the PIT tag array location (CHW). Also, 0.1 km points along the Wenatchee River are displayed as red dots.

Part II: Pit Tag Detection and Analysis

From the PITAGIS regional data base (http://www.ptagis.org/), using Query Builder2 Reports, the interrogation data of individual PIT tagged lamprey is summarized. A total of 31 lamprey (14.8%) out of 210 total PIT tagged lamprey released were detected in at least one PIT array site.

There are a total of four instream PIT array sites located on the mainstem Wenatchee River (river km 2.7, 49.6, 50.4, and 80.9), four sites on Icicle Creek (river km 0.4, 4.8, 6.8, and 9.7), three sites on Chiwawa Creek (river km 0.9, 11.6, 29.9), three sites on Nason Creek (river km 0.8, 19.5, and 25.9), and one site each on Mission, Preshastin, Chumstick, Chiwaukum, Little Wenatchee (river km 4.3), and White (river km 10.9) rivers/streams (Map 7). The PIT array site just above Tumwater Dam at river km 50.4 (MWE) was not in operation during this study. Most sites have a pair of arrays, consisting of lower (downstream) and an upper (upstream) array.

At the flow monitoring station at Monitor, WA (river km 10.5), Wenatchee River water level was between 3,000-4,000 cfs during the first release event on March 17, 2016, and was >12,000 cfs during the second release event on May 3, 2016 (Figure 1). The last detection was on September 26, 2016, corresponding to the lowest level of water flow period.



Map 7. Overall aerial map of PIT tag arrays within the Wenatchee Subbasin (blue circles). The three letter abbreviation and its associated river km is labeled in yellow font. The red line represents mainstem Yakima River, the orange lines represent its tributaries, and the blue line represents the Columbia River.

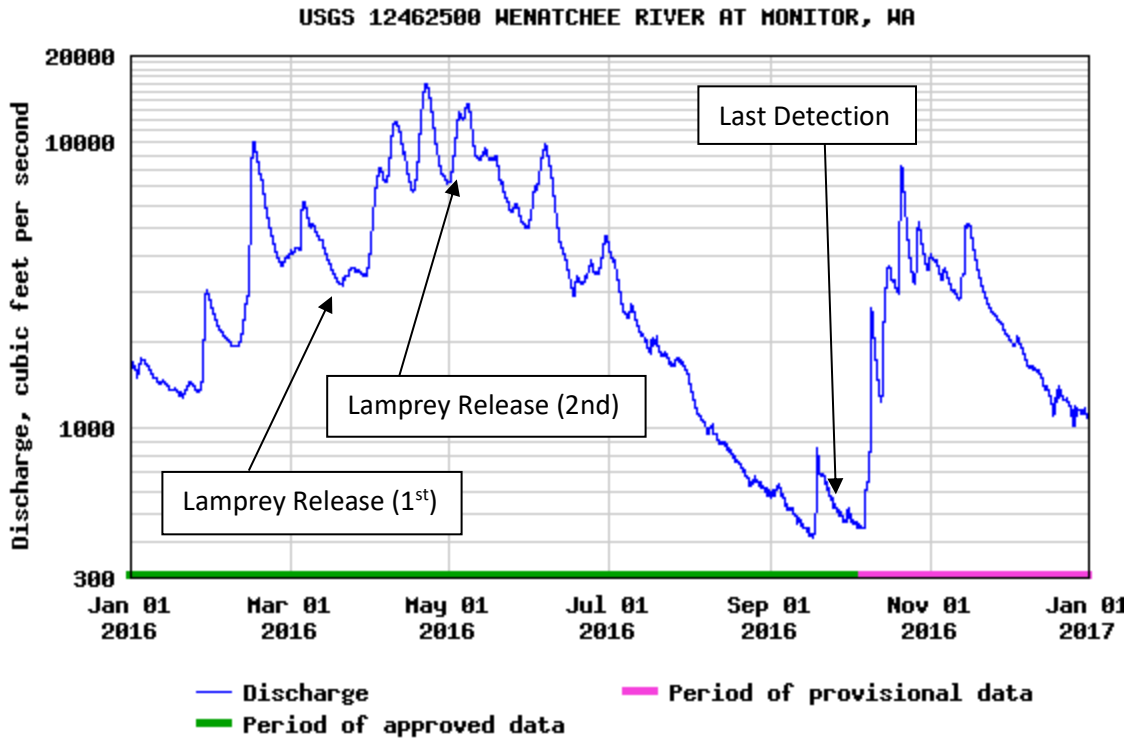


Figure 1. Discharge (cubic feet per second) data of the Wenatchee River at Monitor, WA (river km 10.5) between January 1, 2016, and December 31, 2016 (US Geological Survey National Water Information System: Web Interface).

Lower Wenatchee Release (River KM 2.1)

Of the 50 PIT tagged lamprey released in lower Wenatchee River at river km 2.1 on March 17, 2016, 14 lamprey (28.0%) were detected at least once at one of the PIT array sites in the Columbia Basin. All 14 of these detections were from the LWE site (river km 2.7), which is upstream of the original release site, and none were detected at a site downstream of the original release location.

The first detection was on April 12, 2016 and the last detection was on July 28, 2016 (four detections in April, five detections in June, and five detections in July). Typically, the majority of released lamprey migrate upstream within the first few days after release, but none were detected for over 25 days. It is possible that some of the lamprey may have passed the array undetected within the first few days. The lack of detection does not seem to correspond to high flow as the flow was much lower in mid-March compared to June (during which many detections were made). According to the PITAGIS site metadata website (http://www.ptagis.org/sites/interrogation-site-metadata?IntSiteCode=LWE), LWE arrays were all functioning normally between January 26, 2016, and August 13, 2016. At least one of the detection in July was in the downstream direction and it is unclear whether any of the other detections later in the season (e.g. June - July) were in the upstream or downstream direction because they were detected at only one of the two arrays.

Of those detected at the LWE site, the detection rate from the lower array was < 35.7% whereas that from the upper array was < 85.7%. Therefore, at least some (>9%) are passing through without being detected (based on [1-0.857]*[1-0.357]=0.092) and possibly much more (especially if lamprey are able to pass through areas where they would not be detected by either of the two arrays). None of the 14 lamprey detected at the LWE site were detected at any other PIT array sites later. Because none were detected further upstream, it is not feasible to make any estimates for correcting the detection efficiency.

Mid Wenatchee Release #1 (River KM 48.6)

Of the 30 PIT tagged lamprey released just downstream of Tumwater Dam at river km 48.6 on March 17, 2016, only one lamprey (3.3%) was detected at least once at one of the PIT array sites in the Columbia Basin. The one lamprey was detected at Rocky Reach Dam Fishway (RRF) at Columbia river km 755.5, indicating that it migrated 48.6 km downstream to the mouth of Wenatchee River and moved 8.6 km upstream to reach the dam. It was first detected on August 2, 2016, at Lower Weir and was last detected on August 21, 2016, at the fish counting station (indicating that it likely passed the dam). Based on this migration past July (end of spawning season), this lamprey will likely overwinter twice to spawn the following spring/summer. None of the lamprey were detected within Tumwater Dam. If we assume passage rate from Weir Pool 2 to the lower array (Weir Pool 13/14) is 20.0% (see below), the fish ladder entrance rate is estimated to be at least < 16.1% (based on 1÷31÷0.200).

Mid Wenatchee Release #2 (River KM 49.6)

Of the 30 PIT tagged lamprey released within the Tumwater Dam at river km 49.6 on May 3, 2016, 13 lamprey (43.3%) were detected at least once at one of the PIT array sites in the Columbia Basin.

Of those 10 lamprey released at Weir Pool 2, three (30.0%) were detected at least once at one of the PIT array sites in the Columbia Basin. Two of these (20.0%) were detected at the lower array (Weir Pool 13/14) within the fish ladder, indicating upstream movement. Both of these two were detected on June 7, 2016 (at 0:23 and 6:41) and both of them were detected till the following evening on June 8, 2016 (at 0:07 and 2:32, respectfully). This showcased that at least some of the lamprey within the ladder can pass at least 11 weir pools successfully; however, none were detected at the upper array (Weir Pool 17/18). Another lamprey (10.0%) was detected at Rocky Reach Dam Fishway at Columbia river km 755.5, indicating that it migrated 49.6 km downstream to the mouth of Wenatchee River and moved 8.6 km upstream to reach the dam. It was detected on July 3, 2016, at Lower Weir and was last detected 8 minutes later at the fish counting station (indicating that it likely passed the dam). Based on this migration past mid summer (end of spawning season), it is likely this lamprey will overwinter twice to spawn the following

spring/summer (all lamprey in this release group had an interdorsal distance >20 mm, so many of them may overwinter twice).

Of those released at Weir Pool 9, two (20.0%) were detected at least once at one of the PIT array sites in the Columbia Basin. Both of these lamprey were detected at the lower array (Weir Pool 13/14) within the Tumwater fish ladder, indicating upstream movement. One was detected on June 6, 2016, for 1.1 days and another was detected on September 27, 2016, for 1.0 day (the latter will likely overwinter another year). This indicated that at least some lamprey can move through at least four weir pools successfully; however, none were detected at the upper array (Weir Pool 17/18).

Of those released at Weir Pool 17, eight (80.0%) were detected at least once at one of the PIT array sites in the Columbia Basin. All of these lamprey were detected at the lower array (Weir Pool 13/14) within the Tumwater fish ladder, indicating downstream movement. Seven of these eight lamprey were all detected between 1.7 min and 4.7 hours after the release, indicating that many of the released lamprey did not stay put within the fish ladder (especially the upper portion of the ladder was quite turbulent with very little resting areas for lamprey). Another lamprey was detected 34 days later on June 6, 2016, indicating it held between the Weir Pools 14-17 during this entire period. None were detected at the upper array (Weir Pool 17/18). Results from this pilot release within the fish ladder (Figure 7) indicate that the fish ladder entrance and upper fish ladder may be especially problematic for Pacific Lamprey passage during the spring migration season. The fate of the two undetected lamprey are unknown, but may have moved downstream from the release location without being detected.

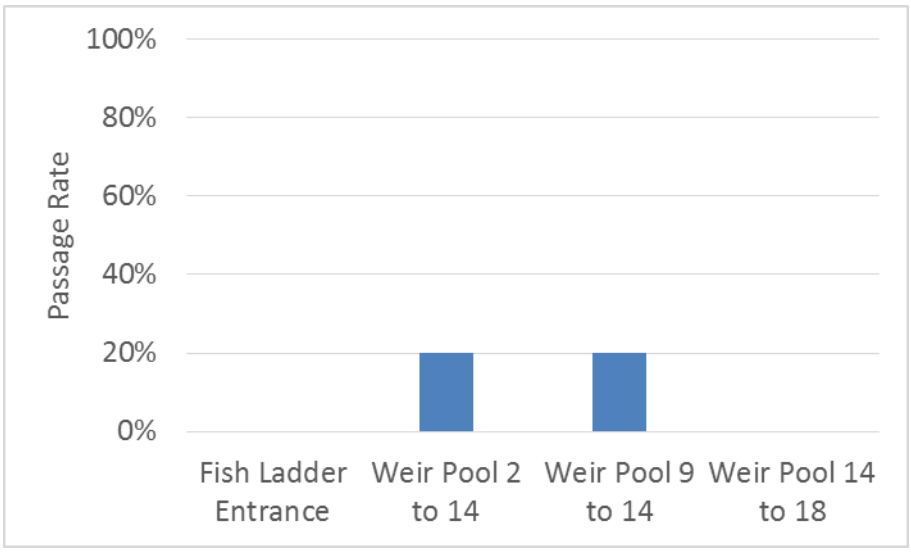


Figure 2. Estimated passage rates at Tumwater Dam based on the four separate releases: 1) 1.0 km downstream of Tumwater Dam, 2) Weir Pool 2, 3) Weir Pool 9, and 4) Weir Pool 17.

Upper Wenatchee Release #1 (River KM 50.4)

Of the 50 PIT tagged lamprey released in the upper reach of the Wenatchee River at river km 50.4 on March 17, 2016, only one lamprey (2.0%) were detected at least once at one of the PIT array sites in the Columbia Basin. This lamprey was detected downstream at Tumwater Dam fish ladder lower array (Weir Pool 13/14) between June 6, 2016 and June 8, 2016, for a 24-hour period. Because there was no detection at the upper array (Weir Pool 17/18), it is possible that this lamprey could have moved downstream past the dam (over the dam structure) initially and moved into the fish ladder to the lower array site consequently.

Upper Wenatchee Release #2 (River KM 56.9)

Of the 50 PIT tagged lamprey released in the upper reach of the Wenatchee River at river km 56.9 on March 17, 2016, two lamprey (4.0%) were detected at least once at one of the PIT array sites in the Columbia Basin. One lamprey was detected 40.6 km upstream in White River at the WTL site (river km 10.9) on June 7, 2016; however, there was no detection from the UWE site (Wenatchee river km 80.9) which it passed through to enter White River. This showed that Pacific Lamprey will migrate through a lake system (Lake Wenatchee) during their spawning migration in the Upper Columbia Basin. The other lamprey was detected 32.4 km upstream in Chiwawa River at the CHU site (river km 11.5) on July 30, 2016 (likely a lamprey that will spawn the following year based on migration timing).

Summary

The highlights from the 2015-2016 broodstock Pacific Lamprey translocation monitoring are the following (Table 2 and Figure 3):

- Detection efficiency of some of the arrays are likely quite low for adult Pacific Lamprey, such as the LWE site (Wenatchee river km 2.7).
- None of the 30 lamprey released immediately downstream of Tumwater Dam were detected within the Tumwater fish ladder arrays. Based on within ladder passage rates, we estimate the fish ladder entrance rate to be at least <16.1%.
- Two lamprey (20.0%) from Weir Pool 2 were detected moving upstream to the lower array (Weir Pool 13/14) within the Tumwater Dam fish ladder.
- Two lamprey (20.0%) from Weir Pool 9 were detected moving upstream to the lower array (Weir Pool 13/14) within the Tumwater Dam fish ladder.
- No lamprey were detected at the upper array (Weir Pool 17/18) despite the release of 30 PIT tagged lamprey.

- None of the lamprey released in the Jolanda Lake (river km 50.4) were detected at an array site upstream of the release location.
- Two lamprey (4.0%) were detected moving upstream from the upper release at river km 56.9) – one was detected in White River (river km 10.9) past Lake Wenatchee and another was detected in Chiwawa River (river km 11.5) in June/July period.
- None of the lamprey were detected moving into Icicle, Nason, or any other tributaries with PIT array stations (Mission, Peshastin, Chumstick, Chwaukum, or Little Wenatchee).
- Two lamprey (1.0%) moved down to the Columbia River and migrated upstream to Rocky Reach Dam fish ladder (both appeared to pass successfully).
- Upstream migration was observed primarily in April and June through early July, with episodic movements in August and September (Figure 4). It will be interesting to assess the combination of fall and spring movements from the fall release in 2016.
- Downstream migration was observed primarily in May, June, July, and early August, potentially indicating the post-spawn drifting (Figure 5).
- Pre-spawning migration during the spring appears to be influenced considerably by the discharge; the peaks in discharge appear to coincide with small peaks in movements (both upstream and downstream) (Figure 6).
- The fastest upstream traveling lamprey detected was only 0.49 km/day (the lamprey detected at White River), indicating that many lamprey simply held in locations between the PIT arrays.

Table 2. Summary of 2015-2016 broodstock Pacific Lamprey translocation detection sites from the Wenatchee Subbasin releases.

Stream	River KM	Site ID	# of Lamprey Detected	% Detected
Wenatchee	2.7	LWE	14	6.7%
Wenatchee	49.6	TUF	13	6.2%
Chiwawa	11.5	CHU	1	0.5%
White	10.9	WTL	1	0.5%
Columbia	755.5	RRF	2	1.0%

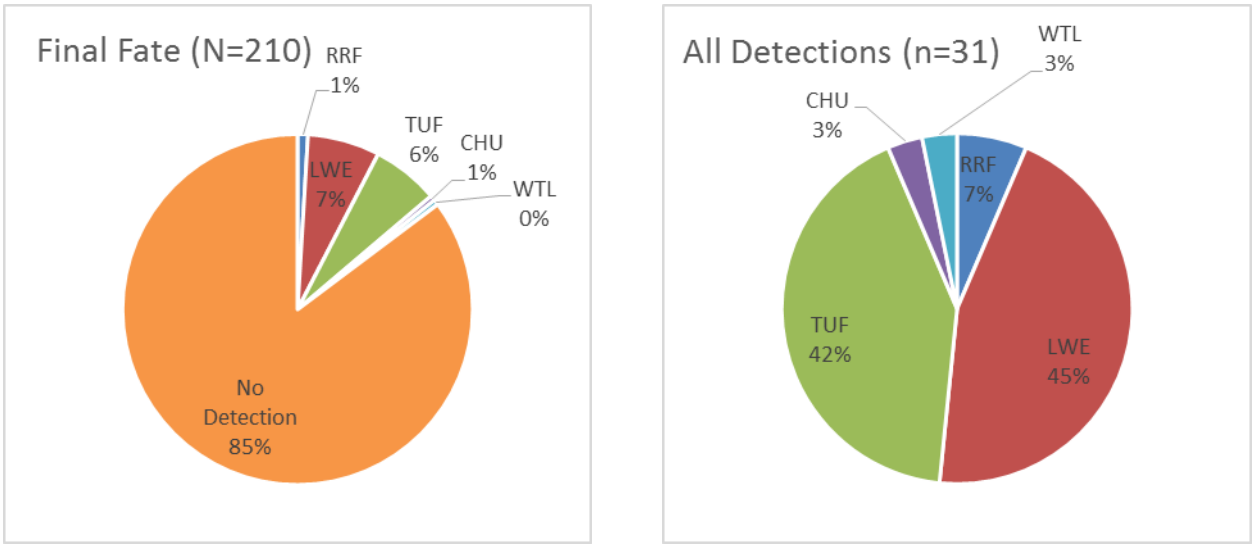


Figure 3. The final fate of the 210 Pacific Lamprey from the Spring 2016 release in the Wenatchee Subbasin based on PIT tag detection data (last detection site) (left pie chart) and a detailed view of all the detections from the 31 lamprey (right pie chart).

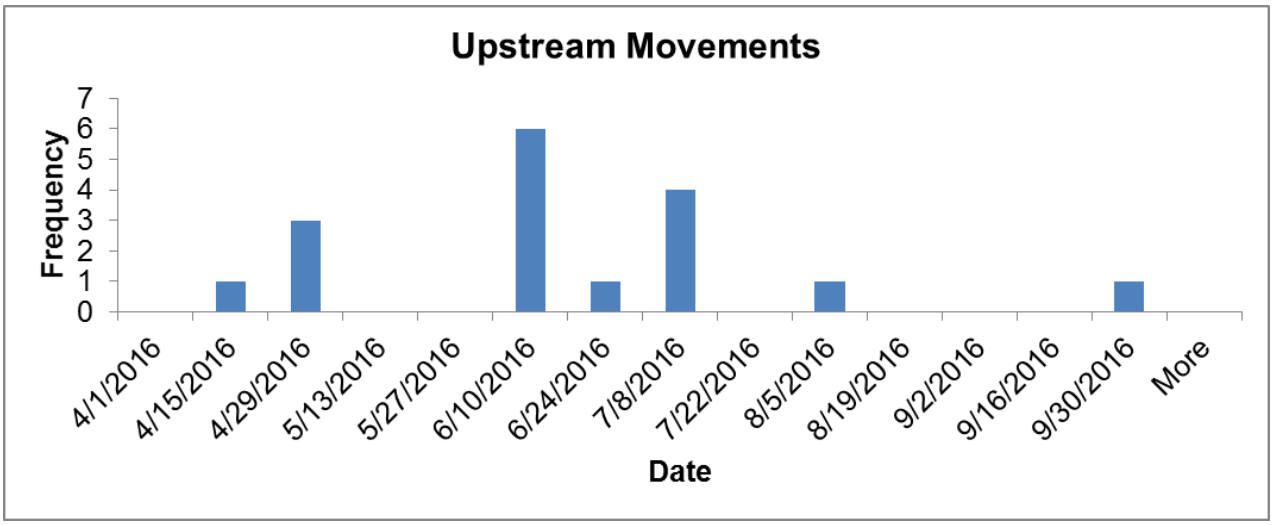


Figure 4. Frequency of upstream movement displayed by Pacific Lamprey from the Spring 2016 release in the Wenatchee Subbasin based on PIT tag detection data.

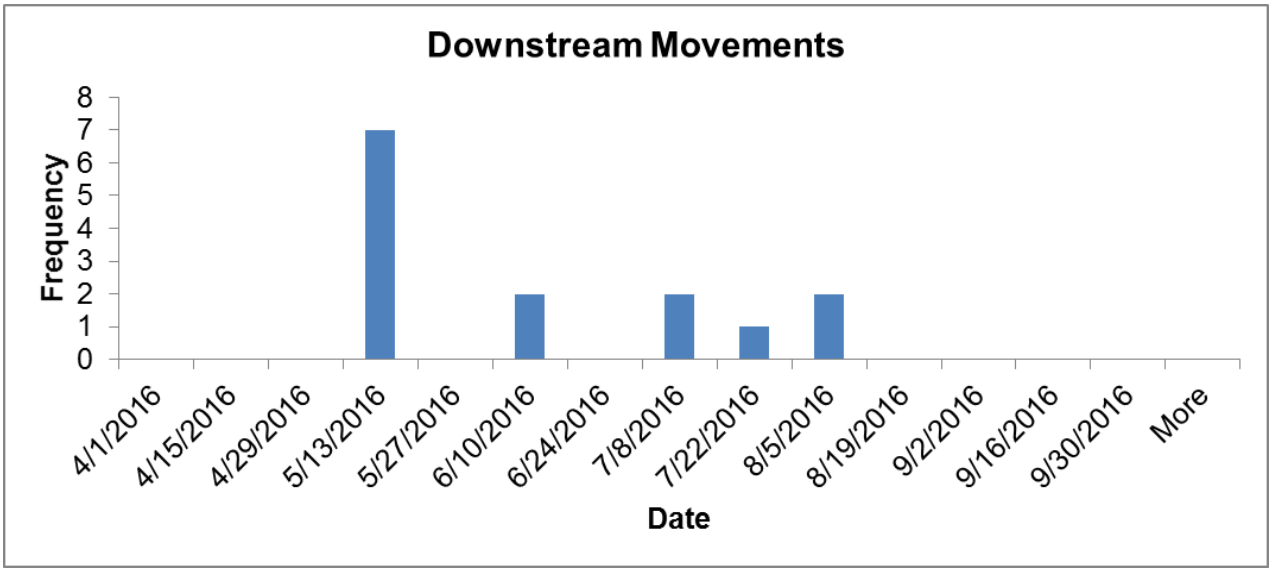


Figure 5. Frequency of downstream movement displayed by Pacific Lamprey from the Spring 2016 release in the Wenatchee Subbasin based on PIT tag detection data.

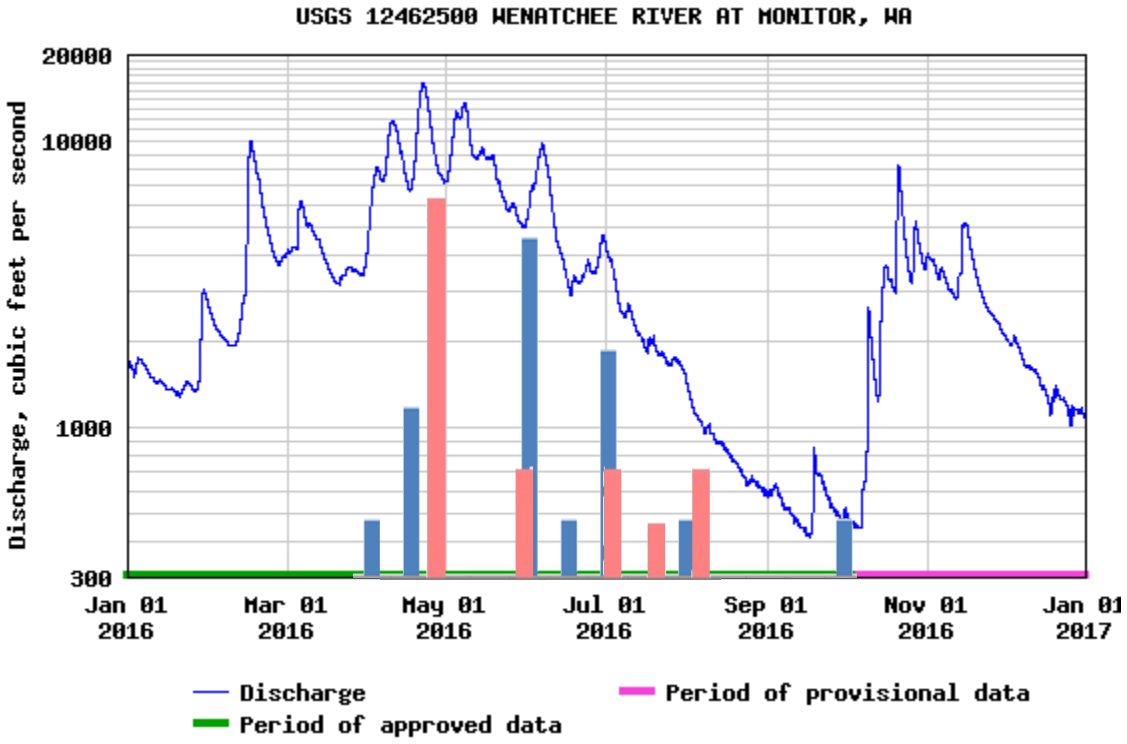


Figure 6. Frequency of upstream (blue bars) and downstream (red bars) movement by Pacific Lamprey from Spring 2016 release in the Wenatchee Subbasin, displayed together with the discharge data from Figure 1.

Appendix: PIT Tag Information

#	Full PIT Tag ID	Release Date	Release River	Release River KM	Release Latitude	Release Longitude
1	384.1B7977125F	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
2	3DA.1A19B3245D	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
3	3DA.1A19B30CCB	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
4	3DA.1A19B309F3	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
5	384.1B79770C8B	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
6	3DA.1A19B33829	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
7	3DA.1A19B330C1	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
8	3DA.1A19B30670	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
9	384.1B797701DF	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
10	3DA.1A19B31194	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
11	384.1B79733B31	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
12	3DA.1A19B3037E	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
13	3DA.1A19B30C0F	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
14	3DA.1A19B2F904	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
15	3D9.1C2C53F2B0	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
16	3DA.1A19B30A39	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
17	3DA.1A19B33652	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
18	3DA.1A19B30783	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
19	384.1B79770542	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
20	3DA.1A19B33BD2	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
21	3DA.1A19B3354F	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
22	3DA.1A19B30979	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
23	384.1B79770A9C	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
24	3DA.1A19B3146A	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
25	3DA.1A19B334F2	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
26	3DA.1A19B31465	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
27	3DA.1A19B332CF	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
28	3DA.1A19B328C2	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
29	3DA.1A19B33390	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
30	384.1B79736068	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
31	3DA.1A19B32E0B	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
32	384.1B79735BDA	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
33	384.1B7977021B	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
34	3DA.1A19B33C19	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
35	384.1B79770C7C	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
36	3D6.001569BE5C	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
37	3DA.1A19B2FFB4	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
38	384.1B79770D50	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
39	384.1B79734092	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
40	3DA.1A19B3103D	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
41	3DA.1A19B3276D	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
42	3DA.1A19B30F15	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
43	3DA.1A19B3027F	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
44	3DA.1A19B2FF9C	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
45	3DA.1A19B33946	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
46	3DA.1A19B33523	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
47	3DA.1A19B33435	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
48	3DA.1A19B335C1	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
49	384.1B79770D73	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
50	3DA.1A19B30142	3/17/2016	Wenatchee	2.1	47.463073	-120.343364
51	3DA.1A19B31A30	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
52	3DA.1A19B3231E	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
53	3D9.1C2C3B8AFB	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
54	3DA.1A19B3333A	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
55	3DA.1A19B33522	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
56	3DA.1A19B33B4E	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
57	3DA.1A19B32D5B	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
58	384.1B797709CD	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
59	3DA.1A19B305AA	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
60	3DA.1A19B31E8C	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
61	384.1B7976DC91	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
62	3DA.1A19B31CFB	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
63	3DA.1A19B305E1	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
64	3DA.1A19B31032	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
65	3DA.1A19B33BAF	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
66	3DA.1A19B2F877	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
67	3DA.1A19B2F7E6	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
68	3DA.1A19B31D16	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
69	384.1B79770E3A	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
70	3D9.1C2C43E013	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
71	3DA.1A19B320C3	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
72	3DA.1A19B336B5	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
73	3DA.1A19B30F10	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
74	384.1B797713CB	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
75	3DA.1A19B2F983	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
76	3DA.1A19B30282	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
77	3DA.1A19B30A18	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
78	3DA.1A19B30FD8	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
79	384.1B79770235	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
80	3DA.1A19B33C8C	3/17/2016	Wenatchee	48.6	47.608897	-120.718035
81	3DA.1A19B31D1C	5/3/2016	Wenatchee	49.6	47.617074	-120.723091
82	3DA.1A19B318A8	5/3/2016	Wenatchee	49.6	47.617074	-120.723091
83	3DA.1A19B319BC	5/3/2016	Wenatchee	49.6	47.617074	-120.723091
84	3DA.1A19B327D8	5/3/2016	Wenatchee	49.6	47.617074	-120.723091
85	3DA.1A19B32D76	5/3/2016	Wenatchee	49.6	47.617074	-120.723091
86	3DA.1A19B31879	5/3/2016	Wenatchee	49.6	47.617074	-120.723091
87	3DA.1A19B31E83	5/3/2016	Wenatchee	49.6	47.617074	-120.723091
88	3DA.1A19B31D06	5/3/2016	Wenatchee	49.6	47.617074	-120.723091
89	3DA.1A19B33B46	5/3/2016	Wenatchee	49.6	47.617074	-120.723091
90	3DA.1A19B32607	5/3/2016	Wenatchee	49.6	47.617074	-120.723091
91	3DA.1A19B323AF	5/3/2016	Wenatchee	49.6	47.616854	-120.722751
92	3DA.1A19B33C57	5/3/2016	Wenatchee	49.6	47.616854	-120.722751
93	3DA.1A19B31D61	5/3/2016	Wenatchee	49.6	47.616854	-120.722751
94	3DA.1A19B33C43	5/3/2016	Wenatchee	49.6	47.616854	-120.722751
95	3DA.1A19B33987	5/3/2016	Wenatchee	49.6	47.616854	-120.722751
96	3DA.1A19B31D03	5/3/2016	Wenatchee	49.6	47.616854	-120.722751
97	3DA.1A19B33D11	5/3/2016	Wenatchee	49.6	47.616854	-120.722751
98	3DA.1A19B31CBA	5/3/2016	Wenatchee	49.6	47.616854	-120.722751
99	3DA.1A19B31C4B	5/3/2016	Wenatchee	49.6	47.616854	-120.722751
100	3DA.1A19B33CED	5/3/2016	Wenatchee	49.6	47.616854	-120.722751
101	3DA.1A19B33D02	5/3/2016	Wenatchee	49.6	47.616946	-120.722934
102	384.1B79769580	5/3/2016	Wenatchee	49.6	47.616946	-120.722934
103	3DA.1A19B32BBF	5/3/2016	Wenatchee	49.6	47.616946	-120.722934
104	3DA.1A19B33A1F	5/3/2016	Wenatchee	49.6	47.616946	-120.722934
105	3DA.1A19B32984	5/3/2016	Wenatchee	49.6	47.616946	-120.722934
106	3DA.1A19B325F1	5/3/2016	Wenatchee	49.6	47.616946	-120.722934
107	3DA.1A19B31F96	5/3/2016	Wenatchee	49.6	47.616946	-120.722934
108	3DA.1A19B32321	5/3/2016	Wenatchee	49.6	47.616946	-120.722934
109	3DA.1A19B33A7F	5/3/2016	Wenatchee	49.6	47.616946	-120.722934
110	3DA.1A19B30F92	5/3/2016	Wenatchee	49.6	47.616946	-120.722934
111	3DA.1A19B33378	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
112	3DA.1A19B30231	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
113	384.1B79770C6B	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
114	384.1B7977221B	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
115	3DA.1A19B322B6	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
116	384.1B797706FC	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
117	3D9.1C2C52EBF4	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
118	384.1B79771862	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
119	3DA.1A19B322F6	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
120	3DA.1A19B313F7	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
121	384.1B79770EF5	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
122	384.1B79771E55	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
123	3DA.1A19B33722	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
124	384.1B797360A3	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
125	3DA.1A19B3051F	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
126	3DA.1A19B33724	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
127	384.1B797334F7	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
128	3DA.1A19B3353A	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
129	3DA.1A19B301F7	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
130	384.1B79770286	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
131	3D9.239F892721	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
132	3DA.1A19B30061	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
133	3DA.1A19B31060	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
134	3DA.1A19B2F798	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
135	384.1B797707D3	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
136	3DA.1A19B33AD8	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
137	3DA.1A19B336B2	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
138	384.1B79770D81	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
139	3D9.1C2C539910	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
140	3DA.1A19B30579	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
141	3DA.1A19B310EF	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
142	3DA.1A19B33780	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
143	3DA.1A19B3107C	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
144	3DA.1A19B334CA	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
145	3DA.1A19B3375E	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
146	3D9.239F892077	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
147	3DA.1A19B302CF	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
148	3DA.1A19B31C21	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
149	3DA.1A19B30251	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
150	3DA.1A19B3013E	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
151	3DA.1A19B31367	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
152	3DA.1A19B30679	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
153	3DA.1A19B307C0	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
154	3DA.1A19B310D8	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
155	3DA.1A19B336B9	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
156	384.1B79771B1E	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
157	3DA.1A19B33675	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
158	3DA.1A19B2FFD2	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
159	3DA.1A19B31254	3/17/2016	Wenatchee	50.4	47.622867	-120.725768
160	3D9.1C2CA4065F	3/17/2016	Wenatchee	50.4	47.622867	-120.725768

#	Full PIT Tag ID	Release Date	Release River	Release River KM	Release Latitude	Release Longitude
161	384.1B797708EF	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
162	3DA.1A19B3007A	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
163	384.1B79735AF6	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
164	3DA.1A19B338B3	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
165	384.1B79770914	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
166	3DA.1A19B31A68	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
167	3DA.1A19B3254D	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
168	3DA.1A19B3382F	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
169	3DA.1A19B336B3	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
170	3DA.1A19B31449	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
171	3DA.1A19B33773	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
172	384.1B797708C0	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
173	3DA.1A19B30630	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
174	3DA.1A19B30B8D	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
175	3DA.1A19B33245	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
176	3DA.1A19B323ED	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
177	3DA.1A19B33782	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
178	3DA.1A19B2FF5F	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
179	3DA.1A19B30FA1	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
180	3DA.1A19B31E3A	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
181	3DA.1A19B3395A	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
182	384.1B797715A7	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
183	3DA.1A19B31D14	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
184	3DA.1A19B31EF9	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
185	384.1B79771393	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
186	3DA.1A19B30680	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
187	3DA.1A19B2FB0E	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
188	384.1B7977094B	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
189	3DA.1A19B30A8D	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
190	3DA.1A19B319B6	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
191	3DA.1A19B300D4	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
192	3DA.1A19B33AAF	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
193	3DA.1A19B332A5	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
194	3DA.1A19B3100C	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
195	3DA.1A19B335A8	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
196	3DA.1A19B32EC7	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
197	3DA.1A19B33CCC	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
198	3DA.1A19B33AE1	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
199	3DA.1A19B30457	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
200	3DA.1A19B30755	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
201	3DA.1A19B33953	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
202	3DA.1A19B33BED	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
203	3DA.1A19B311FA	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
204	3DA.1A19B31B92	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
205	3DA.1A19B31238	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
206	3DA.1A19B337EA	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
207	3DA.1A19B30133	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
208	3DA.1A19B31171	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
209	3DA.1A19B2F7FA	3/17/2016	Wenatchee	56.9	47.673996	-120.735192
210	3DA.1A19B300CF	3/17/2016	Wenatchee	56.9	47.673996	-120.735192