



Distribution and Occupancy of Pacific Lamprey in Six Major Columbia River Subbasins within the Yakama Nation Ceded Lands: Summary from 2009-2015 Surveys



Cover Photo: Larval lamprey (~ 40 mm) found in a scoop of sandy sediment from a 2015 survey in Lower Wenatchee River (river km 8.8).

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ABSTRACT

Between 2009 and 2015, surveys for larval lamprey were conducted in six major Columbia River subbasins within the Yakama Nation Ceded Lands (Table G1-1 and Table G1-2); White Salmon Subbasin (17 sites surveyed from 2012-2015), Klickitat Subbasin (75 sites surveyed from 2009-2015), Yakima Subbasin (369 sites surveyed from 2009-2015), Wenatchee Subbasin (34 sites surveyed from 2012-2015), Entiat Subbasin (14 sites surveyed from 2012-2014), and Methow Subbasin (31 sites surveyed from 2013-2015). Pacific Lamprey were found in each subbasin. The known Pacific Lamprey distribution within each subbasin, including tributaries, was determined using all past Yakama Nation survey data, as well as collaborative distribution information shared by the USFWS, WDFW, and other local partners (including John Crandall - Methow Salmon Recovery Foundation).

The total reach length for Pacific Lamprey distribution was highest in the Yakima Subbasin with 212.0 river km of known distribution (121.8 and 90.2 river km in the mainstem and tributary streams, respectively), followed by the Methow (129.4 river km), Klickitat (71.5 river km), Wenatchee (47.8 river km), Entiat (45.2 river km), and White Salmon (6.4 river km) subbasins. Pacific Lamprey occupancy (% of occupied sites with Pacific Lamprey) within the known Pacific Lamprey distribution was generally high in the Upper Columbia tributaries (upstream of the Yakima Subbasin) where Western Brook Lamprey are known to be absent and only Pacific Lamprey reside (75.0-88.9%). Occupancy was highest in the Entiat Subbasin (88.9%). Although no lamprey were found in any of the Upper Wenatchee watersheds, occupancy in the Lower Wenatchee River (up to Tumwater Dam) was high (87.5%).

In the Lower and Mid Columbia subbasins (Yakima Subbasin and downstream), Pacific Lamprey and Western Brook Lamprey are both present. Pacific Lamprey occupancy was highest in the Klickitat Subbasin (80.0-100.0%), potentially due to its higher abundance stemming from proximity to the ocean and the limited number of hydroelectric dams that fish have to pass through in order to reach the Subbasin. Pacific Lamprey occupancy was low in the White Salmon Subbasin (25.0%), potentially due to the limited distribution range Pacific Lamprey currently occupy (the habitat above the old Condit Dam site became available only since 2011). Pacific Lamprey occupancy was also low in the Yakima Subbasin (16.7-50%). Local Pacific Lamprey population in the Yakima Subbasin has become functionally extinct in recent years (annual counts of only 0-87 adults at Prosser Dam in Lower Yakima River since 1996), which likely explains why Pacific Lamprey occupancy has been low in this Subbasin. However, occupancy within the Lower Yakima watershed has been increasing steadily between 2011 and 2015 (0%, 12.1%, 25.0%, 36.4%, and 84.6%, respectively), suggesting that translocation may be increasing the abundance of Pacific Lamprey.

Furthermore, when looking at overall lamprey occupancy within the known Pacific Lamprey distribution, the occupancy percentage increases substantially in both the White Salmon and Yakima subbasins (50.0% and 43.5-91.3%, respectfully). In these subbasins where both Western Brook Lamprey and Pacific Lamprey are present, larger larvae need to be captured for identification, and more lamprey need to be identified to confirm the presence of Pacific Lamprey. Therefore, the hurdle of documenting occupancy is much higher. However, smaller specimen that cannot be identified to species based on visible features can still be collected, preserved, and identified to species via genetic analysis.

INTRODUCTION

Since 2009, the Yakama Nation Pacific Lamprey Project (YNPLP) has conducted larval lamprey electrofishing surveys to document the distribution and relative abundance of Pacific Lamprey (*Entosphenus tridentatus*) within six major Mid and Upper Columbia subbasins: the White Salmon, Klickitat, Yakima, Wenatchee, Entiat, and Methow subbasins.

In the White Salmon Subbasin, Western Brook Lamprey (*Lampetra richardsoni*), a (predominantly) resident lamprey species, is also present in the subbasin in relatively high abundance. Pacific Lamprey were absent upstream of Condit Dam (river km 5.9) prior to the dam's removal in 2011. Recently, in 2015, USFWS detected Pacific Lamprey upstream of the Condit Dam removal site.

In the Klickitat Subbasin, Western Brook Lamprey (*Lampetra richardsoni*), a (predominantly) resident lamprey species, is also present in the subbasin in relatively high abundance. Now with up to seven years of past survey data in the Klickitat Subbasin, the YNPLP has enough information to share related to the occupancy and distribution ranges of lamprey species. The primary monitoring objective in the Klickitat Subbasin is to monitor the distribution and status/trend of wild Pacific Lamprey (and if present, Western Brook Lamprey). In this report, we have summarized key information related to the distribution and occupancy of Pacific Lamprey within the Klickitat Subbasin using survey data collected between 2009 and 2015.

In the Yakima Subbasin, Western Brook Lamprey (*Lampetra richardsoni*), a (predominantly) resident lamprey species, is also present in the subbasin in relatively high abundance. Since 2012, adult Pacific Lamprey have been translocated (collected from Lower Columbia River dams and held at Prosser Fish Hatchery) into three major lower Yakima River tributaries (Satus Creek, Toppenish Creek, and Ahtanum Creek) to supplement the declining wild population. Additionally, in March of 2015 adult Pacific Lamprey were translocated upstream of Roza Dam to restore their historical distribution upstream of the dam. Future supplementation efforts will include the release of artificially propagated larvae at strategic locations within the Yakima Subbasin.

In the Wenatchee Subbasin, Pacific Lamprey is the only lamprey species known to be present. Tumwater Dam (located at river km 49.6) is a known passage barrier for Pacific Lamprey, though historically lamprey were present in the area upstream of the dam. In 2016, the YNPLP translocated adult Pacific Lamprey (initially collected from Lower Columbia River dams and held at Prosser Fish Hatchery) into the mainstem Wenatchee River (both upstream and downstream of Tumwater Dam). Translocation efforts were put in place to understand adult usage of spawning habitat throughout the subbasin, adult passage over Tumwater Dam, and to restore lamprey populations upstream of the dam.

In the Entiat Subbasin, Pacific Lamprey is the only lamprey species known to present. Box Canyon (located at river km 50.4) is a known natural passage barrier for Pacific Lamprey. Now with up to three years of past survey data in the Entiat Subbasin, the YNPLP has enough information to share related to the occupancy and distribution ranges of Pacific Lamprey. The primary monitoring objective is to monitor the distribution and status/ trend of wild Pacific Lamprey. In this report, we have summarized key information related to the distribution and occupancy of Pacific Lamprey within the Entiat Subbasin using survey data collected between 2012 and 2014.

In the Methow Subbasin, Pacific Lamprey is the only lamprey species known to present. In recent years, Pacific Lamprey numbers have been declining rapidly in the Methow Subbasin, likely due to the large number of hydroelectric dams lamprey have to pass through to reach the Subbasin (only 0-35 lamprey counted at Wells Dam from 2006-2015). John Crandall (Methow Salmon Recovery Foundation, previously Wild Salmon Conservancy) has been leading electrofishing surveys for Pacific Lamprey (*Entosphenus tridentatus*) in the Methow Subbasin since 2011, with the Yakama Nation's participation beginning in 2013. Starting in 2015, adult Pacific Lamprey were translocated into the mainstem Methow River (initially collected from Lower Columbia River dams and held at Prosser Fish Hatchery) to supplement the declining wild population.

METHODS

Rivers and streams with the potential to hold Pacific Lamprey were surveyed extensively within six major Mid and Upper Columbia subbasins between 2009 and 2015: the White Salmon, Klickitat, Yakima, Wenatchee, Entiat, and Methow subbasins. Larval lamprey were surveyed during the summer/fall low flow season between mid-June and mid-October. Surveys were focused on Type I (preferred) and/or Type II (acceptable) habitat to provide optimal opportunity to capture the largest number of larval lamprey. Type I habitat primarily consists of fine sand, silt and/or clay and is absent of coarse substrate (gravel/cobble/boulder). Type II habitat is coarse shifting sand or other fine substrate mixed with coarse substrate. Type III (unsuitable) habitat consists of no fine sediments and was not surveyed. Type I and II habitat is generally found in backwater areas, side channels, or along the margins of larger pools.

Survey sites were chosen based on aerial images from Google Earth and GIS software and site visits. Sites that had higher chances of being a Type I habitat [such as slow water, shallow channel margin with dark tints (usually indicating fine sediment), backwater eddies, confluence of side channels, behind island bars, and tail end of deposition bars, etc.] were given priority. We determined that targeting the preferred habitat more effectually will provide us with a better framework for evaluating presence/absence, distribution, and relative abundance. Further, due to restricted survey time, the ease of access to a survey site (bridges, road access, landowners who lived right on the river or a short hike) was a critical issue and strongly considered when choosing sites. By prioritizing accessibility, more ground could be covered throughout the expansive six subbasins. Chosen habitat sites were ultimately spatially distributed throughout individual watersheds.

After larval habitat sites were identified, the sites were visited on the ground and the site was initially scouted for larval habitat availability. If larval habitat was present, larval lamprey surveys were performed with an AbP-2 backpack electrofisher designed for the sampling of larval lampreys (ETS Electrofishing Inc., Madison, Wisconsin) at a rate of >60 seconds per meter. The electrofishing setting was at 3 pulses per second (125 V direct current) at 25% duty cycle with a 3:1 burst pulse train (three pulses on, one pulse off) to entice larval lamprey to leave the fine sediment. Once larval lamprey were observed, we used a pulse of 30 pulses/sec at 25% duty cycle to stun and effectively capture the fish. If no lamprey was found, a second pass at up to 200 V (other settings the same) was conducted to substantiate presence/absence. At all survey sites, a minimum of 5 m² of larval habitat was sampled at each site.

Captured lampreys were identified to species, if fish length was >50 mm (Western Brook Lamprey or Pacific Lamprey). Pacific Lamprey distribution is the upper and lower extent where Pacific Lamprey was found between 2009 and 2015. Pacific Lamprey occupancy is the percent of surveyed sites with Pacific Lamprey present and lamprey occupancy is the percent of surveyed sites with any lamprey species present within the known Pacific Lamprey distribution range.

RESULTS

White Salmon Subbasin

Between 2012 and 2015, a total of 17 sites were surveyed in the White Salmon Subbasin. Pacific Lamprey distribution and site occupancy (from all YNPLP survey data between 2012 and 2015) within the mainstem White Salmon River and tributary watersheds is summarized below.

Mainstem White Salmon River

- A total of 14 larval lamprey surveys were conducted between 2012 and 2015 (Table 1 and Table 2).
 - 2012 – 2 sites were surveyed; river km 3.0-45.8
 - 2013 – 5 sites were surveyed; river km 0.8-41.5
 - 2014 – 3 sites were surveyed; river km 0.8-13.0
 - 2015 – 4 sites were surveyed; river km 0.8-13.1
- Pacific Lamprey distribution
 - The lowermost distribution is at river km 0.8 (surveyed in 2014), located 0.1 km upstream of the Lewis and Clark Hwy Bridge.
 - The uppermost distribution is at river km 7.2 (surveyed in 2015 by USFWS), located approximately 1.25 river km upstream of the old Condit Dam site.
- Pacific Lamprey presence
 - Pacific Lamprey were present at 1 of the 4 sites (25%) in the 6.4 river km of known Pacific Lamprey distribution in the White Salmon River.
- Survey effort outside the known Pacific Lamprey distribution
 - No sites were surveyed downstream of the known Pacific Lamprey distribution.
 - A total of 10 sites were surveyed upstream of the known Pacific Lamprey distribution (river km 8.3-41.5).

Trout Lake Creek – White Salmon River Tributary

- A total of three larval lamprey surveys were conducted in 2012 and 2015 (Table 1 and Table 2).
 - 2012 – 1 site was surveyed; river km 10.7
 - 2013 – 1 site was surveyed; river km 4.5
 - 2015 – 1 site was surveyed; river km 4.2
- Pacific Lamprey distribution
 - No Pacific Lamprey are currently known to reside in Trout Lake Creek. However, Western Brook Lamprey were found at relatively high densities at river km 4.2 and 4.5.
- Survey effort outside of the known distribution
 - No Pacific Lamprey are currently known to reside in Trout Lake Creek

Table 1. Pacific Lamprey distribution and site occupancy at all surveyed sites between 2012 and 2015 in the White Salmon Subbasin.

Watershed	Stream Name	Year	# of Survey Sites	River km of	River km of	Total River km with PA Lamprey	# of Sites Downstream of PA Lamprey Distribution	# of Sites Upstream of PA Lamprey Distribution	# of Sites within PA Lamprey Distribution	# of Sites Occupied (PA Lamprey) within PA Lamprey Distribution	% PA Lamprey Occupancy within PA Lamprey Distribution	
				Lower-most Site with PA Lamprey	Upper-most Site with PA Lamprey							
White Salmon	White Salmon	2012	2				0	2	0	0	-	
		2013	5	0.8	7.2	6.4	0	4	1	0	0.0%	
		2014	3				0	2	1	1	100.0%	
		2015	4				0	2	2	0	0.0%	
	Trout Lake	2012	1									
		2013	1	-	-	-	-	-	-	-	-	-
		2014	0									
		2015	1									

Table 2. Lamprey distribution and site occupancy (Western Brook Lamprey and Pacific Lamprey) at all surveyed sites between 2012 and 2015 in the White Salmon Subbasin.

Watershed	Stream Name	Year	# of Survey Sites	River km of	River km of	Total River km with Lamprey	# of Sites within PA Lamprey Distribution	# of Sites Occupied (All Lamprey) within PA Lamprey Distribution	% Lamprey Occupancy within PA Lamprey Distribution	# of Sites within Lamprey Distribution	# of Sites Occupied (All Lamprey) within Lamprey Distribution	% Lamprey Occupancy within Lamprey Distribution	
				Lower-most Site with Lamprey	Upper-most Site with Lamprey								
White Salmon	White Salmon	2012	2				0	0	-	1	0	0.0%	
		2013	5	0.8	41.5	40.7	1	0	0.0%	5	3	60.0%	
		2014	3				1	1	100.0%	3	3	100.0%	
		2015	4				2	1	50.0%	4	2	50.0%	
	Trout Lake	2012	1										
		2013	1	4.2	4.5	0.3	-	-	-	1	1	100.0%	
		2014	0										
		2015	1							1	1	100.0%	

Klickitat Subbasin

A total of 85 sites were surveyed in the Klickitat Subbasin between 2009 and 2015. Pacific Lamprey distribution and site occupancy (from all YNPLP survey data between 2009 and 2015) within the Klickitat River mainstem and tributary watersheds is summarized below.

Mainstem Klickitat River

- A total of 57 larval lamprey surveys were conducted between 2009 and 2015 (Table 1 and Table 2).
 - 2009 – 30 sites were surveyed; river km 1.9-85.0
 - 2010 – 1 sites was surveyed; river km 28.5
 - 2013 – 12 sites were surveyed; 0.0-118.3
 - 2014 – 5 sites were surveyed; 0.0-52.4
 - 2015 – 9 sites were surveyed; 0.0-99.7
- Pacific Lamprey distribution
 - The lowermost distribution is at river km 0.0 (surveyed in 2015), located on the downstream side of the train tracks at the mouth (river left).
 - The uppermost distribution is at river km 69.3 (surveyed in 2013), downstream side of the dam at the Klickitat Fish Hatchery.
- Pacific Lamprey presence
 - Pacific Lamprey were present at 43 of the 47 sites (91.5%) in the 69.3 river km of known Pacific Lamprey distribution in the Klickitat River.
- Survey effort outside the known Pacific Lamprey distribution
 - No sites were surveyed downstream of the known Pacific Lamprey distribution.
 - A total of 10 sites were surveyed upstream of the known Pacific Lamprey distribution (river km 69.4-118.3).

Little Klickitat River – Klickitat River Tributary

- A total of 18 larval lamprey surveys were conducted in 2009 and 2013 (Table 1 and Table 2).
 - 2009 –16 sites were surveyed; river km 0.6-42.8
 - 2013 – 2 sites were surveyed; 27.3-29.8
- Pacific Lamprey distribution
 - The lowermost distribution is at river km 0.6, located 0.1 km upstream of the Hwy 142 Bridge.
 - The uppermost distribution is at river km 2.8, located 2.3 km upstream of the Hwy 142 Bridge.

- Pacific Lamprey presence
 - Pacific Lamprey were present at 2 of the 2 sites (100%) in the 2.2 river km of known Pacific Lamprey distribution in the Little Klickitat River.
- Survey effort outside of the known Pacific Lamprey distribution
 - No sites were surveyed downstream of the known Pacific Lamprey distribution.
 - A total of 16 sites were surveyed upstream of the known Pacific Lamprey distribution (river km 4.0-42.8).

Table 3. Pacific Lamprey distribution and site occupancy at all surveyed sites from 2009 to 2015 in the KI Subbasin.

Subbasin	Stream Name	Year	# of Survey Sites	River km of Lower-most Site with PA Lamprey	River km of Upper-most Site with PA Lamprey	Total River km with PA Lamprey	# of Sites Downstream of PA Lamprey Distribution	# of Sites Upstream of PA Lamprey Distribution	# of Sites within PA Lamprey Distribution	# of Sites Occupied (PA Lamprey) within PA Lamprey Distribution	% PA Lamprey Occupancy within PA Lamprey Distribution
Klickitat	Klickitat	2009	30				0	3	27	25	92.6%
		2010	0				-	-	-	-	-
		2011	1				0	0	1	1	100.0%
		2012	0	0.0	69.3	69.3	-	-	-	-	-
		2013	12				0	4	8	8	100.0%
		2014	5				0	0	5	4	80.0%
		2015	9				0	3	6	5	83.3%
		2009	16				0	14.0	2	2	100.0%
		2010	0				-	-	-	-	-
		2011	0				-	-	-	-	-
Little Klickitat	Little Klickitat	2012	0	0.6	2.8	2.2	-	-	-	-	-
		2013	2				0	2	0	-	-
		2014	0				-	-	-	-	-
		2015	0				0	0	0	-	-

Table 4. Lamprey distribution and site occupancy (Western Brook Lamprey and Pacific Lamprey) at all surveyed sites between 2009 and 2015 in the Klickitat Subbasin.

Subbasin	Stream Name	Year	# of Survey Sites	River km of Lower-most Site with Lamprey	River km of Upper-most Site with Lamprey	Total River km with Lamprey	# of Sites within PA Lamprey Distribution	# of Sites Occupied (All Lamprey) within PA Lamprey Distribution	% Lamprey Occupancy within PA Lamprey Distribution	# of Sites within Lamprey Distribution	# of Sites Occupied (All Lamprey) within Lamprey Distribution	% Lamprey Occupancy within Lamprey Distribution
Klickitat	Klickitat	2009	30				27	26	96.3%	29	27	93.1%
		2010	0				-	-	-	-	-	-
		2011	1				1	1	100.0%	1	1	-
		2012	0	0.0	82.7	82.7	-	-	-	-	-	-
		2013	12				8	8	100.0%	9	9	100.0%
		2014	5				5	5	100.0%	5	5	100.0%
		2015	9				6	5	83.3%	8	7	87.5%
		2009	16				2	2	100.0%	13	5	38.5%
		2010	0				-	-	-	-	-	-
		2011	0				-	-	-	-	-	-
Little Klickitat	Little Klickitat	2012	0	0.6	29.8	29.2	-	-	-	-	-	-
		2013	2				0	0	-	2	2	100.0%
		2014	0				-	-	-	-	-	-
		2015	0				0	-	-	-	-	-

Yakima Subbasin

Between 2009 and 2015, a total of 369 sites were surveyed for larval lamprey in the Yakima Subbasin. Pacific Lamprey distribution and site occupancy (from all YNPLP survey data between 2009 and 2015) within the Yakima River mainstem and tributary watersheds is summarized below.

Mainstem Yakima River

Lower Yakima River (river km 0.0-191.8); downstream of the Naches River confluence

- A total of 101 larval lamprey surveys were conducted between 2010 and 2015 (Table 1 and Table 2).
 - 2010 – 50 sites were surveyed; river km 2.7-191.8
 - 2011 – 9 sites were surveyed; river km 73.5-171.1
 - 2012 – 22 sites were surveyed; river km 88.9-191.8
 - 2013 – 10 sites were surveyed; river km 73.5-191.8
 - 2014 – 4 sites were surveyed; river km 6.5-191.8
 - 2015 – 6 sites were surveyed; river km 8.2-191.8
- Pacific Lamprey distribution
 - The lowermost distribution is at river km 73.5 (initially detected in 2011), located under the I-82 Bridge in Prosser, WA.
 - The uppermost distribution is at river km 191.8 (initially detected in 2010), slightly (75 m) downstream of the Naches River confluence.
- Pacific Lamprey occupancy
 - Pacific Lamprey were present at 13 of the 78 sites (16.7%) in the 118.3 river km of known Pacific Lamprey distribution in the lower Yakima River.
- Survey effort outside the known Pacific Lamprey distribution
 - Known Pacific Lamprey distribution goes all the way to the upper most extent of the Lower Yakima River (river km 191.8).
 - A total of 23 sites were surveyed downstream of the known distribution (from river km 2.7-71.0).

Upper Yakima River (river km 191.8-345.7); from the Naches River confluence, upstream

- A total of 94 larval lamprey surveys were conducted between 2010 and 2015 (Table 1 and Table 2).
 - 2010 – 5 sites were surveyed; river km 195.3-302.1
 - 2011 – 41 sites were surveyed; river km 195.5-345.7
 - 2012 – 9 sites were surveyed; river km 193.3-300.9
 - 2013 – 13 sites were surveyed; river km 215.0-300.9
 - 2014 – 14 sites were surveyed; river km 210.5-301.2

- 2015 – 12 sites were surveyed; river km 244.0-301.4
- Pacific Lamprey distribution
 - The only site upstream of the Naches River confluence that Pacific Lamprey have been found is at river km 195.3 (initially detected in 2010), located 0.8 km upstream of the I-82 Bridge in Selah, WA. Adult Pacific Lamprey were released into the upper Yakima River (above Roza Dam) in March of 2015 with the goal of restoring historical distribution to this area.
- Pacific Lamprey occupancy
 - Pacific Lamprey were present at 1 of the 2 sites (50%) at river km 195.3. There is a total of 3.5 river km of Pacific Lamprey range in the upper Yakima River between river km 191.8 and 195.3.
- Survey effort outside the known Pacific Lamprey distribution
 - Known Pacific Lamprey distribution goes all the way to the lower most extent of the Upper Yakima River (river km 191.8). A total of 92 sites were surveyed upstream of the known distribution (river km 195.5-345.7).

Satus Creek – Lower Yakima River Tributary

- A total of 36 larval lamprey surveys were conducted between 2010 and 2015 (Table 1 and Table 2).
 - 2010 – 4 sites were surveyed; river km 0.5-42.5
 - 2011 – 8 sites were surveyed; river km 5.1-56.8
 - 2012 – 10 sites were surveyed; river km 0.1-38.5
 - 2013 – 4 sites were surveyed; river km 12.9-41.2
 - 2014 – 6 sites were surveyed; river km 2.9-41.2
 - 2015 – 4 sites were surveyed; river km 12.9-41.2
- Pacific Lamprey distribution
 - The lowermost distribution is at river km 12.9 (initially detected in 2012), located at the Plank Road Bridge near Toppenish, WA.
 - The uppermost distribution is at river km 41.2 (initially detected in 2015), located under the Hwy 97 Bridge crossing.
- Pacific Lamprey occupancy
 - Pacific Lamprey were present at 7 of the 23 sites (30.4%) surveyed within the 28.3 river km of known Pacific Lamprey distribution.
- Survey effort outside the known Pacific Lamprey distribution
 - A total of 9 sites were surveyed downstream of the known distribution (river km 0.1-10.1)
 - A total of 3 sites were surveyed upstream of the known distribution (river km 42.5-56.8).

Toppenish Creek – Lower Yakima River Tributary

- A total of 27 larval lamprey surveys were conducted between 2010 and 2015 (no surveys conducted in 2011; Table 1 and Table 2).
 - 2010 – 10 sites were surveyed; river km 0.2-59.8
 - 2012 – 5 sites were surveyed; river km 4.5-59.9
 - 2013 – 3 sites were surveyed; river km 31.4-73.2
 - 2014 – 5 sites were surveyed; river km 11.6-73.2
 - 2015 – 4 sites were surveyed; river km 1.7-73.2
- Pacific Lamprey distribution
 - The only site where Pacific Lamprey have been found is at river km 44.6 (initially detected in 2015), located 0.1 km downstream of the Unit 2 Feeder diversion dam.
- Pacific Lamprey occupancy
 - Pacific Lamprey were only present at 1 of the 2 sites (50.0%) surveyed at river km 44.6 (the only site where Pacific Lamprey occupancy was confirmed).
- Survey effort outside the known Pacific Lamprey distribution
 - A total of 13 sites were surveyed downstream of the known distribution (river km 0.2-44.3)
 - A total of 13 sites were surveyed upstream of the known distribution (river km 56.9-73.2).

Simcoe Creek – Toppenish Creek Tributary

- A total of 12 larval lamprey surveys were conducted between 2009 and 2015 (no surveys conducted in 2011; Table 1 and Table 2).
 - 2009 – 1 site was surveyed; river km 30.6
 - 2010 – 5 sites were surveyed; river km 0.1-28.7
 - 2012 – 2 sites were surveyed; 9.0-15.3
 - 2013 – 1 site was surveyed; river km 9.0
 - 2014 – 2 sites were surveyed; river km 9.0-12.6
 - 2015 – 1 site was surveyed; river km 9.0
- Pacific Lamprey distribution
 - No Pacific Lamprey have been detected in Simcoe Creek. However, adult PIT tag detections indicate that more than half of the lamprey released in upper Toppenish Creek migrate to Simcoe Creek. Western Brook Lamprey have been found within 30.5 river km of Simcoe Creek (river km 0.1-30.6).
- Survey effort outside the known Pacific Lamprey distribution
 - A total of 12 sites were surveyed and no Pacific Lamprey were found. However, out of the sites surveyed, Western Brook Lamprey (as well as unidentifiable lamprey <50 mm) were found at 10 of the 12 sites (83.3%).

Ahtanum Creek – Lower Yakima River Tributary

- A total of 27 larval lamprey surveys were conducted between 2010 and 2015 (Table 1 and Table 2).
 - 2010 – 10 sites were surveyed; river km 0.9-38.5
 - 2011 – 1 site was surveyed; river km 1.7
 - 2012 – 5 sites were surveyed; 1.7-7.7
 - 2013 – 3 sites were surveyed; 4.1-32.1
 - 2014 – 4 sites were surveyed; 4.3-31.9
 - 2015 – 4 sites were surveyed; 4.3-31.9
- Pacific Lamprey distribution
 - The lowermost distribution is at river km 0.9 (initially detected in 2010), located 0.4 river km downstream of the Hwy 97 bridge near the mouth.
 - The uppermost distribution is at river km 31.9 (initially detected in 2015), located 75 m upstream of Bachelor-Hatton Diversion.
- Pacific Lamprey occupancy
 - Pacific Lamprey were present at 6 of the 23 sites (26.1%) within the 31.0 river km of known Pacific Lamprey distribution.
- Survey effort outside the known Pacific Lamprey distribution
 - No sites were surveyed downstream of the known distribution.
 - A total of 4 sites were surveyed upstream of the known distribution (river km 32.1-38.5).

Naches River – Upper Yakima River Tributary

- A total of 38 larval lamprey surveys were conducted between 2010 and 2015 (Table 1 and Table 2).
 - 2010 – 10 sites were surveyed; river km 4.4-48.4
 - 2011 – 1 site was surveyed; river km 14.0
 - 2012 – 7 sites were surveyed; 13.2-63.3
 - 2013 – 5 sites were surveyed; 14.1-51.2
 - 2014 – 7 sites were surveyed; 1.7-72.8
 - 2015 – 8 sites were surveyed; 1.7-72.1
- Pacific Lamprey distribution
 - The lowermost distribution is at river km 1.7 (initially detected in 2015), located at the Greenway Trail access site at the 16th Ave Exit off of Hwy I-82, Yakima, WA.
 - The uppermost distribution is at river km 29.0 (initially detected in 2015), 30 m upstream of the inlet to Wapatox Diversion.
- Pacific Lamprey occupancy

- Pacific Lamprey were present at 4 of the 22 sites (18.2%) within the 27.3 river km of known Pacific Lamprey distribution.
- Survey effort outside the known Pacific Lamprey distribution
 - No sites were surveyed downstream of the known distribution.
 - A total of 16 sites were surveyed upstream of the known distribution (river km 36.0-72.8).

Wenas Creek – Upper Yakima River Tributary

- A total of 17 larval lamprey surveys were conducted between 2011 and 2015 (no surveys conducted in 2013; Table 1 and Table 2).
 - 2011 – 3 sites were surveyed; river km 13.9-25.2
 - 2012 – 5 sites were surveyed; 0.5-13.9
 - 2014 – 3 sites were surveyed; river km 0.0-1.2
 - 2015 – 6 sites were surveyed; river km 0.1-2.2
- Pacific Lamprey distribution
 - No Pacific Lamprey is currently known to reside in Wenas Creek. However, Western Brook Lamprey have been found within 19.2 river km of Wenas Creek (river km 0.0-19.2). Wenas Creek is designated as a future outplanting site for propagated Pacific Lamprey larvae.
- Survey effort outside the known Pacific Lamprey distribution
 - A total of 17 sites were surveyed and no Pacific Lamprey were found. However, out of the sites surveyed, Western Brook Lamprey (as well as unidentifiable lamprey <50 mm) were found at 10 of the 16 sites (62.5%) within the known lamprey distribution.

Taneum Creek – Upper Yakima River Tributary

- A total of 5 larval lamprey surveys were conducted in 2011 and 2012 (Table 1 and Table 2).
 - 2011 – 4 sites were surveyed; river km 10.4-10.5
 - 2012 – 1 site was surveyed; river km 2.7
- Pacific Lamprey distribution
 - No Pacific Lamprey is currently known to reside in Taneum Creek. Also, at 5 out of the 5 survey sites, no lamprey were observed. Adult Pacific Lamprey were released into the upper Yakima River watershed (upstream of Roza Dam, river km 210.5) in March of 2015 with the goal of restoring historical distribution to this area.

Swauk Creek – Upper Yakima River Tributary

- A total of 9 larval lamprey surveys were conducted between 2009 and 2015 (no surveys conducted in 2011; Table 1 and Table 2).
 - 2011 – 8 sites were surveyed; river km 0.2-10.8
 - 2012 – 1 site was surveyed; river km 11.7
- Pacific Lamprey distribution
 - No Pacific Lamprey is currently known to reside in Swauk Creek. However, Western Brook Lamprey have been found within 11.5 river km of known lamprey distribution in Simcoe Creek (river km 0.2-11.7). Adult Pacific Lamprey were released into the upper Yakima River watershed (upstream of Roza Dam, river km 210.5) in March of 2015 with the goal of restoring historical distribution to this area, and some of the PIT tagged adults were detected moving into Swauk Creek.
- Survey effort outside the known Pacific Lamprey distribution
 - A total of 9 sites were surveyed and no Pacific Lamprey have been found. However, out of the sites surveyed, Western Brook Lamprey (as well as unidentifiable lamprey <50 mm) were found at 6 of the 9 sites (66.7%).

Teanaway River – Upper Yakima River Tributary

- A total of 3 larval lamprey surveys were conducted in 2011 (Table 1 and Table 2).
 - 2011 – 3 sites were surveyed; river km 0.2-7.1
- Pacific Lamprey distribution
 - No Pacific Lamprey is currently known to reside in the Teanaway River. However, Western Brook Lamprey have been found within 1.0 river km of known lamprey distribution in the Teanaway River (river km 0.2-1.2). Adult Pacific Lamprey were released into the upper Yakima River watershed (upstream of Roza Dam, river km 210.5) in March of 2015 with the goal of restoring historical distribution to this area, and many of the PIT tagged adults were detected moving into Teanaway River.
- Survey effort outside the known Pacific Lamprey distribution
 - A total of 3 sites were surveyed and no Pacific Lamprey was found. However, out of the sites surveyed, Western Brook Lamprey (as well as unidentifiable lamprey <50 mm) were found at 2 of the 2 surveyed sites (100%) within the known lamprey distribution.

Table 5. Pacific Lamprey distribution and site occupancy at all surveyed sites from 2009 to 2015 in the Yakima Subbasin.

Subbasin	Stream Name	Year	# of Survey Sites	River km of Lower-most Site with PA Lamprey	River km of Upper-most Site with PA Lamprey	Total River km with PA Lamprey	# of Sites Downstream of PA Lamprey Distribution	# of Sites Upstream of PA Lamprey Distribution	# of Sites within PA Lamprey Distribution	# of Sites Occupied (PA Lamprey) within PA Lamprey Distribution	% PA Lamprey Occupancy within PA Lamprey Distribution	
Lower Yakima	Yakima	2009	0				-	-	-	-	-	
		2010	50				21	0	29	3	10.3%	
		2011	9				0	0	9	0	0.0%	
		2012	22	73.5	191.8	118.3	0	0	22	3	13.6%	
		2013	10				0	0	10	2	20.0%	
		2014	4				1	0	3	1	33.3%	
	2015	6				1	0	5	4	80.0%		
	Satus	2009	0				-	-	-	-	-	-
		2010	4				1	1	2	0	0.0%	
		2011	8				1	2	5	0	0.0%	
		2012	10	12.9	41.3	28.4	4	0	6	1	16.7%	
		2013	4				0	0	4	1	25.0%	
		2014	6				2	0	4	2	50.0%	
	2015	4				1	0	3	3	100.0%		
	Toppenish	2009	0				-	-	-	-	-	-
		2010	10				6	3	1	0	50.0%	
		2011	0				-	-	-	-	-	-
		2012	5	44.6	44.6	0.0	2	3	0	0	-	-
		2013	3				1	2	0	0	-	-
		2014	5				3	2	0	0	-	-
2015	4				1	2	1	1	100.0%			
Simcoe	2009	1				-	-	-	-	-	-	
	2010	5				-	-	-	-	-	-	
	2011	0				-	-	-	-	-	-	
	2012	2	-	-	-	-	-	-	-	-	-	
	2013	1				-	-	-	-	-	-	
	2014	2				-	-	-	-	-	-	
2015	1				-	-	-	-	-	-		
Ahtanum	2009	0				-	-	-	-	-	-	
	2010	10				0	3	7	1	14.3%		
	2011	1				0	0	1	0	0.0%		
	2012	5	0.9	31.9	31.0	0	0	5	0	0.0%		
	2013	3				0	1	2	1	50.0%		
	2014	4				0	0	4	1	25.0%		
2015	4				0	0	4	3	75.0%			
Naches	2009	0				-	-	-	-	-	-	
	2010	10				0	3	7	0	0.0%		
	2011	1				0	0	1	-	-	-	
	2012	7	1.7	29.0	27.3	0	6	1	0	0.0%		
	2013	5				0	2	3	0	0.0%		
	2014	7				0	3	4	1	25.0%		
2015	8				0	2	6	3	50.0%			
Yakima	2009	0				-	-	-	-	-	-	
	2010	5				-	4	1	1	100.0%		
	2011	41				0	41	0	-	-	-	
	2012	9	191.8	195.3	3.5	0	8	1	0	0.0%		
	2013	13				0	13	0	-	-	-	
	2014	14				0	14	0	0	-	-	
2015	12				0	12	0	-	-	-		
Wenas	2009	0				-	-	-	-	-	-	
	2010	0				-	-	-	-	-	-	
	2011	3				-	-	-	-	-	-	
	2012	5	-	-	-	-	-	-	-	-	-	
	2013	0				-	-	-	-	-	-	
	2014	3				-	-	-	-	-	-	
2015	6				-	-	-	-	-	-		
Swauk	2009	0				-	-	-	-	-	-	
	2010	0				-	-	-	-	-	-	
	2011	8				-	-	-	-	-	-	
	2012	1	-	-	-	-	-	-	-	-	-	
	2013	0				-	-	-	-	-	-	
	2014	0				-	-	-	-	-	-	
2015	0				-	-	-	-	-	-		
Taneum	2009	0				-	-	-	-	-	-	
	2010	0				-	-	-	-	-	-	
	2011	4				-	-	-	-	-	-	
	2012	1	-	-	-	-	-	-	-	-	-	
	2013	0				-	-	-	-	-	-	
	2014	0				-	-	-	-	-	-	
2015	0				-	-	-	-	-	-		
Teanaway	2009	0				-	-	-	-	-	-	
	2010	0				-	-	-	-	-	-	
	2011	3				-	-	-	-	-	-	
	2012	0	-	-	-	-	-	-	-	-	-	
	2013	0				-	-	-	-	-	-	
	2014	0				-	-	-	-	-	-	
2015	0				-	-	-	-	-	-		

Table 6. Lamprey distribution and site occupancy (Western Brook Lamprey and Pacific Lamprey) at all surveyed sites between 2009 and 2015 in the Yakima Subbasin.

Subbasin	Stream Name	Year	# of Survey Sites	River km of Lower-most Site with Lamprey	River km of Upper-most Site with Lamprey	Total River km with Lamprey	# of Sites within PA Lamprey Distribution	# of Sites Occupied (All Lamprey) within PA Lamprey Distribution	% Lamprey Occupancy within PA Lamprey Distribution	# of Sites within Lamprey Distribution	# of Sites Occupied (All Lamprey) within Lamprey Distribution	% Lamprey Occupancy within Lamprey Distribution	
Lower Yakima	Yakima	2009	0				-	-	-	-	-	-	
		2010	50				29	8	27.6%	29	8	27.6%	
		2011	9				9	4	44.4%	9	4	44.4%	
		2012	22	73.5	191.8	118.3	22	11	50.0%	22	11	50.0%	
		2013	10				10	7	70.0%	10	7	70.0%	
		2014	4				3	3	100.0%	3	3	100.0%	
	2015	6				5	4	80.0%	5	4	80.0%		
	Satus	2009	0				-	-	-	-	-	-	-
		2010	4				2	0	0.0%	2	0	0.0%	
		2011	8				5	0	0.0%	6	0	0.0%	
		2012	10	2.9	41.3	38.4	6	1	16.7%	9	3	33.3%	
		2013	4				4	3	75.0%	4	3	75.0%	
		2014	6				4	3	75.0%	6	4	66.7%	
	2015	4				3	3	100.0%	4	4	100.0%		
	Toppenish	2009	0				-	-	-	-	-	-	-
2010		10				0	0	-	4	1	25.0%		
2011		0				-	-	-	-	-	-	-	
2012		5	43.3	73.2	29.9	0	0	-	3	3	100.0%		
2013		3				0	0	-	2	2	100.0%		
2014		5				0	0	-	3	3	100.0%		
2015	4				1	1	100.0%	3	3	100.0%			
Simcoe	2009	1				-	-	-	1	1	100.0%		
	2010	5				-	-	-	5	3	60.0%		
	2011	0				-	-	-	-	-	-	-	
	2012	2	0.1	30.6	30.5	-	-	-	2	2	100.0%		
	2013	1				-	-	-	1	1	100.0%		
	2014	2				-	-	-	2	2	100.0%		
2015	1				-	-	-	1	1	100.0%			
Ahtanum	2009	0				-	-	-	-	-	-	-	
	2010	10				7	7	100.0%	10	9	90.0%		
	2011	1				1	1	100.0%	1	1	100.0%		
	2012	5	0.9	38.5	37.6	5	4	80.0%	5	4	80.0%		
	2013	3				2	2	100.0%	3	3	100.0%		
	2014	4				4	3	75.0%	4	3	75.0%		
2015	4				4	4	100.0%	4	4	100.0%			
Naches	2009	0				-	-	-	-	-	-	-	
	2010	10				7	1	0.0%	10	1	10.0%		
	2011	1				1	-	-	1	0	0.0%		
	2012	7	1.6	72.3	70.7	1	1	100.0%	7	4	57.1%		
	2013	5				3	2	66.7%	5	4	80.0%		
	2014	7				4	3	75.0%	6	5	83.3%		
2015	8				6	3	50.0%	8	5	62.5%			
Upper Yakima	Yakima	2009	0				-	-	-	-	-	-	
		2010	5				1	1	100.0%	4	1	25.0%	
		2011	41				0	-	-	39	22	56.4%	
		2012	9	195.3	328.1	132.8	1	0	0.0%	8	7	87.5%	
		2013	13				0	-	-	13	11	84.6%	
		2014	14				0	0	-	14	6	42.9%	
	2015	12				0	-	-	12	5	41.7%		
	Wenas	2009	0				-	-	-	-	-	-	-
		2010	0				-	-	-	-	-	-	-
		2011	3				-	-	-	2	2	100.0%	
		2012	5	0.0	19.2	19.2	-	-	-	5	3	60.0%	
		2013	0				-	-	-	-	-	-	-
		2014	3				-	-	-	3	3	100.0%	
	2015	6				-	-	-	6	4	66.7%		
	Swauk	2009	0				-	-	-	-	-	-	-
2010		0				-	-	-	-	-	-	-	
2011		8				-	-	-	8	5	62.5%		
2012		1	0.2	11.7	11.5	-	-	-	1	1	100.0%		
2013		0				-	-	-	-	-	-	-	
2014		0				-	-	-	-	-	-	-	
2015	0				-	-	-	-	-	-	-		
Taneum	2009	0				-	-	-	-	-	-	-	
	2010	0				-	-	-	-	-	-	-	
	2011	4				-	-	-	-	-	-	-	
	2012	1	-	-	-	-	-	-	-	-	-	-	
	2013	0				-	-	-	-	-	-	-	
	2014	0				-	-	-	-	-	-	-	
2015	0				-	-	-	-	-	-	-		
Teanaway	2009	0				-	-	-	-	-	-	-	
	2010	0				-	-	-	-	-	-	-	
	2011	3				-	-	-	2	2	100.0%		
	2012	0	0.2	1.2	1.0	-	-	-	-	-	-	-	
	2013	0				-	-	-	-	-	-	-	
	2014	0				-	-	-	-	-	-	-	
2015	0				-	-	-	-	-	-	-		

Wenatchee Subbasin

A total of 36 sites were surveyed for larval lamprey between 2012 and 2015 in the Wenatchee Subbasin. Pacific Lamprey distribution and site occupancy within the mainstem Wenatchee River and tributary watersheds are summarized below.

Mainstem Wenatchee River

Lower Wenatchee River (river km 0.0-49.6); downstream of Tumwater Dam

- A total of 9 larval lamprey surveys were conducted in 2012 and 2015 (Table 1).
 - 2012 – 6 sites were surveyed; river km 1.0-46.0
 - 2015 – 3 sites were surveyed, river km 8.8-27.8
- Pacific Lamprey distribution
 - The lower most distribution is at river km 1.0 (surveyed in 2012), located 0.30 km downstream of the Highway 285 Bridge.
 - The upper most distribution is at river km 48.8 (surveyed in 2015 by USFWS), located 0.83 river km downstream of Tumwater Dam.
- Pacific Lamprey presence
 - Pacific Lamprey were present at 7 of the 8 surveyed sites (87.5%) within the 47.8 river km of known Pacific Lamprey distribution within the lower Wenatchee River.
- Survey effort outside the known Pacific Lamprey distribution
 - No sites were surveyed downstream of the current distribution.
 - No sites were surveyed upstream of the current distribution between river km 48.8 and 49.6.

Upper Wenatchee River; upstream of Tumwater Dam (river km 49.6-84.0)

- A total of 10 larval lamprey surveys were conducted in 2012 and 2015 (Table 1).
 - 2012 – 7 sites were surveyed; river km 50.1-84.0
 - 2015 – 3 sites were surveyed, river km 50.4-74.6
- Pacific Lamprey distribution
 - No Pacific Lamprey is currently known to reside upstream of Tumwater Dam (collaborative survey efforts between Yakama Nation and USFWS).
- Pacific Lamprey Presence
 - No Pacific Lamprey were found at all 10 surveyed sites upstream of Tumwater Dam.

Icicle Creek – Lower Wenatchee River Tributary

- A total of 9 larval lamprey surveys were conducted in 2012 and 2015 (Table 1).
 - 2012 – 3 sites were surveyed; river km 2.5-5.3

Entiat Subbasin

A total of 15 sites were surveyed for larval lamprey between 2012 and 2014 in the Entiat Subbasin. Pacific Lamprey distribution and site occupancy within the mainstem Entiat River and is summarized below.

Entiat River (river km 0.0-53.0)

- A total of 15 larval lamprey surveys were conducted in 2012 and 2014 (Table 1).
 - 2012 – 5 sites were surveyed; river km 0.6-31.0
 - 2014 – 10 sites were surveyed; river km 1.5-53.0
- Pacific Lamprey distribution
 - The lower most distribution (surveyed in 2014) is at river km 1.2, located 0.8 km upstream of the Highway 97 Bridge.
 - The upper most distribution (surveyed by USFWS in 2013) is at river km 46.4, located approximately 4 km downstream of Box Canyon (Silver Falls).
- Pacific Lamprey Presence
 - Pacific Lamprey were present in 8 of the 9 surveyed sites (88.9%) within the 45.4 river km of known distribution.
- Survey effort outside of the known Pacific Lamprey distribution
 - A total of 2 sites were surveyed downstream of the known distribution (from river km 0.6-1.1)
 - A total of 3 sites were surveyed upstream of the known distribution (from river km 46.6-53.0).

Table 8. Pacific Lamprey distribution and site occupancy for all surveyed sites between 2012 and 2014 in Entiat Subbasin.

Subbasin	Stream Name	Year	# of Survey Sites	River km of	River km of	Total River km with PA Lamprey	# of Sites	# of Sites	# of Sites	# of Sites	% PA Lamprey Occupancy within PA Lamprey Distribution
				Lower-most Site with PA Lamprey	Upper-most Site with PA Lamprey		Downstream of PA Lamprey Distribution	Upstream of PA Lamprey Distribution	within PA Lamprey Distribution	Occupied (PA Lamprey) within PA Lamprey Distribution	
Entiat	Entiat	2012	5	1.2	46.4	45.2	2	0	3	3	100.0%
		2013	0	-	-	-	-	-	-	-	-
		2014	9	1.2	46.4	45.2	0	3	6	5	83.3%

Methow Subbasin

A total of 30 sites were surveyed between 2013 and 2015 in the Methow Subbasin. Pacific Lamprey distribution and site occupancy (from all survey data collected between 2013 and 2015) within the Methow River mainstem and tributary watersheds is summarized below.

Mainstem Methow River

Lower Methow River (0.0-84.0); downstream of the Chewuch River confluence

- A total of 11 larval lamprey surveys were conducted in 2013, 2014 and 2015 (Table 1).
 - 2013 – 5 sites were surveyed; river km 25.6-74.7
 - 2014 – 3 sites were surveyed; river km 25.6-74.7
 - 2015 – 3 sites were surveyed; river km 25.6-74.7
- Pacific Lamprey distribution
 - The lower most distribution of Pacific Lamprey (surveyed by John Crandall between 2009 and 2012) is at river km 2.9, located approximately 2.3 river km upstream of the Hwy 97 Bridge.
 - The upper most distribution of Pacific Lamprey (surveyed by John Crandall between 2009 and 2012) is at river km 81.4, located approximately 3.6 river km downstream of the Chewuch River confluence.
- Pacific Lamprey presence
 - Pacific Lamprey were present in 7 of the 10 surveyed sites (70.0 %) within the 78.5 river km of known distribution.
- Survey effort outside of the Pacific Lamprey distribution
 - One site (river km 1.7) was surveyed downstream of the known Pacific Lamprey distribution.
 - No sites were surveyed between river km 81.4 (upper distribution) and 84.0 (Chewuch River confluence).

Upper Methow River; upstream from the Chewuch River confluence (river km 84.0)

- A total of 4 larval lamprey surveys were conducted in 2013 (Table 1).
 - 2013 – 4 sites were surveyed; river km 90.3-117.4
- Pacific Lamprey distribution
 - No Pacific Lamprey are currently known to reside in the upper Methow River (collaborative efforts between Yakama Nation, WDFW, and John Crandall).
- Pacific Lamprey Presence
 - No Pacific Lamprey were found at the 4 survey sites (from river km 90.3-117.4).

Twisp River – Lower Methow River Tributary

- A total of 1 larval lamprey survey was conducted in 2013 (Table 1).
 - 2013 – 1 survey site; river km 16.5
- Pacific Lamprey distribution
 - No Pacific Lamprey are known to reside in the Twisp River (collaborative efforts from Yakama Nation, WDFW, and John Crandall).
- Pacific Lamprey presence
 - No Pacific Lamprey were found at the single survey site (river km 16.5).

Chewuch River – Upper Methow River Tributary

- A total of 14 larval lamprey surveys were conducted in 2013, 2014 and 2015 (Table 1).
 - 2013 – 5 sites were surveyed; river km 0.8-52.3
 - 2014 – 4 sites was surveyed; river km 0.8-28.6
 - 2015 – 5 sites were surveyed; river km 0.8-49.5
- Pacific Lamprey distribution
 - The lower most distribution is at river km 0.8 (surveyed in 2014), located 0.2 km upstream of the Highway 20 Bridge in Winthrop, WA.
 - The upper most distribution (surveyed by John Crandall between 2009 and 2012) is at river km 51.7, and is located 3.0 km downstream of the footbridge by the end of the road. In 2012, the uppermost distribution was at river km 28.6, and in 2015, this shifted downstream to river km 23.9., showing the rapid recession of the upper distribution over this short span of time.
- Pacific Lamprey presence
 - Pacific Lamprey were present in 11 out of 14 surveyed sites (78.6%) within the 50.9 river km of known distribution.
- Survey effort outside of the Pacific Lamprey distribution
 - No sites were surveyed downstream of the known distribution.
 - One site (river km 52.3) was surveyed upstream of the known distribution.

Table 9. Pacific Lamprey distribution and site occupancy at all surveyed sites from 2013 to 2015 in the Methow Subbasin.

Subbasin	Stream Name	Year	# of Survey Sites	River km of Lower-most Site with PA Lamprey	River km of Upper-most Site with PA Lamprey	Total River km with PA Lamprey	# of Sites Downstream of PA Lamprey Distribution	# of Sites Upstream of PA Lamprey Distribution	# of Sites within PA Lamprey Distribution	# of Sites Occupied (PA Lamprey) within PA Lamprey Distribution	% PA Lamprey Occupancy within PA Lamprey Distribution
Lower Methow	Methow	2013	5				1	0	4	3	75.0%
		2014	3	2.9	81.4	78.5	0	0	3	2	66.7%
		2015	3				0	0	3	2	66.7%
	Twisp	2013	1								
		2014	0	-	-	-	-	-	-	-	-
		2015	0								
Upper Methow	Methow	2013	4								
		2014	0	-	-	-	-	-	-	-	-
		2015	0								
	Chewuch	2013	6				0	1	5	4	80.0%
		2014	4	0.8	51.7	50.9	0	0	4	4	100.0%
		2015	5				0	0	5	3	60.0%

DISCUSSION

Within the White Salmon Subbasin, a total of 17 sites were surveyed between 2012 and 2015. The known distribution of Pacific Lamprey in the mainstem White Salmon River is river km 0.8-7.2 (river km 0.8 is located 0.1 km upstream of the Lewis and Clark Hwy Bridge). The total reach length for Pacific Lamprey distribution is 6.4 river km. Pacific Lamprey were absent upstream of Condit Dam (river km 5.9) prior to the dam's removal in 2011. Recent surveys by USFWS in 2015 have shown Pacific Lamprey recolonization up to 1.3 river km upstream of the removal site (river km 7.2). Pacific Lamprey occupancy (% of occupied sites with Pacific Lamprey) within the known Pacific Lamprey distribution was low (25.0%), potentially due to the limited distribution range Pacific Lamprey currently occupy. Overall lamprey occupancy within the known Pacific Lamprey distribution increases substantially to 50.0%. In these Subbasins where both Western Brook Lamprey and Pacific Lamprey are present, larger larvae need to be captured for identification, and more lamprey need to be identified to confirm the presence of Pacific Lamprey.

Within the Klickitat Subbasin, a total of 85 sites were surveyed between 2009 and 2015. The known Pacific Lamprey distribution in the mainstem Klickitat River is river km 0.0 to 69.3 (not extending upstream of the dam at the Klickitat Fish Hatchery at river km 69.4). The distribution of Pacific Lamprey also extends into the Little Klickitat River (river km 0.6-2.8). The total reach length for Pacific Lamprey distribution in the Klickitat Subbasin was 71.5 river km of known distribution (69.3 and 2.2 river km in the Klickitat River and Little Klickitat River, respectfully). Pacific Lamprey occupancy (% of occupied sites with Pacific Lamprey) within the known Pacific Lamprey distribution was high (91.5-100%). The notably high occupancy is potentially due to the relatively high abundance of Pacific Lamprey stemming from close proximity to the ocean and the limited number of hydroelectric dams that fish have to pass through in order to reach the Subbasin. Since both Pacific Lamprey and Western Brook Lamprey are present in the Klickitat Subbasin, larger larvae need to be captured for identification, and more lampreys need to be identified to confirm the presence of Pacific Lamprey. Smaller specimens that cannot be identified to species based on visible features can still be collected, preserved, and identified to species via genetic analysis.

Within the Yakima Subbasin, a total of 369 sites were surveyed between 2009 and 2015. The known distribution of Pacific Lamprey in the mainstem Yakima River is river km 73.5 to 195.3. Roza Dam (river km 210.5) is a known passage barrier to Pacific Lamprey passage. The total reach length of Pacific Lamprey distribution within the Yakima Subbasin was 208.4 river km (121.8 and 86.6 river km in the mainstem and tributary streams, respectfully). Pacific Lamprey occupancy (% of surveyed sites with Pacific Lamprey within the known distribution range) was low in the Yakima Subbasin (16.7-50%). Local Pacific Lamprey population segments in the Yakima Subbasin has been functionally extinct in recent years (annual counts of only 0-87 adults

at Prosser Dam in Lower Yakima River since 1996), which likely explains why Pacific Lamprey occupancy has been low in this Subbasin. However, occupancy within the Lower Yakima watershed has been increasing steadily between 2011 and 2015 (0%, 12.1%, 25.0%, 36.4%, and 84.6%, respectfully), suggesting that translocation is likely increasing the abundance of Pacific Lamprey.

Within the Wenatchee Subbasin, a total of 36 sites were surveyed for larval lamprey between 2012 and 2015 throughout the Wenatchee Subbasin. The known Pacific Lamprey distribution was determined from all past Yakama Nation survey data, and collaborative distribution information shared by the USFWS. Tumwater Dam (river km 49.6) is a known passage barrier to Pacific Lamprey. Pacific Lamprey is currently absent upstream of the dam where they have been historically present. Downstream of Tumwater Dam, the known distribution of Pacific Lamprey in the mainstem is river km 1.0-48.8; 47.8 river km of known distribution. Despite its location downstream of Tumwater Dam, no lamprey have been found in Icicle Creek. Although no lamprey were found in any of the Upper Wenatchee watersheds, Pacific Lamprey occupancy (% of occupied sites with Pacific Lamprey) in the Lower Wenatchee River (downstream of Tumwater Dam) was high (87.5%). Because Western Brook Lamprey is known to be absent in the Wenatchee Subbasin, even if no larval lamprey were large enough to confirm species, it was assumed that the small larvae (< 50 mm) were also Pacific Lamprey.

Within the Entiat Subbasin, a total of 15 sites were surveyed between 2012 and 2014. The known Pacific Lamprey distribution within each subbasin, including tributaries, was determined using all past Yakama Nation survey data, as well as collaborative distribution information shared by the USFWS. The known distribution of Pacific Lamprey in the mainstem Entiat River is river km 1.9-46.4. Occupancy was relatively high in the Entiat Subbasin (88.9%), which may be due to the lack of passage barriers and large-scale irrigation diversions within the subbasin. Larval lamprey habitat is well distributed within the current known distribution of Pacific Lamprey.

Within the Methow Subbasin, a total of 30 sites were surveyed between 2013 and 2015. The known Pacific Lamprey distribution is river km 25.6-81.4. Pacific Lamprey distribution in the Methow Subbasin covers a total of 129.4 river km (78.5 river in the Methow River and 50.9 in the Chewuch River). Pacific Lamprey occupancy (% of occupied sites with Pacific Lamprey) within the Methow Subbasin ranged from 60% to 100%. Pacific Lamprey occupancy was highest in the Chewuch River (60-100%), followed by the mainstem Methow River (66.7-75%). No lamprey are known to reside in the Twisp River (based on WDFW screw trap monitoring and surveys by the Yakama Nation and partners), possibly due to the limited larval lamprey habitat within Twisp River and the limited number of adults that enter the Methow Subbasin.