Yakama Nation Ceded Lands Larval Lamprey Synthesis Report, 2017

(Cover Photo: A larval lamprey survey site on the Klickitat River at RKM 1.9, where a large density of larval lampreys was observed in September, 2017)

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Tyler Beals and Ralph Lampman

Confederated Tribes and Bands of the Yakama Nation
Yakama Nation Fisheries Resource Management Program, Pacific Lamprey Project
P.O. Box 151, Toppenish, Washington 98948, USA

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ABSTRACT

In 2017, larval lamprey habitat surveys were performed by the Yakama Nation Pacific Lamprey Project in the Klickitat, Yakima, and Wenatchee subbasins. All larval lamprey survey data collected in 2017 were synthesized in relation to rearing densities of larval lampreys and electrofishing gear capture efficiency. Young of year (YOY) lampreys were separated from larger, older lampreys (non-YOY lampreys), and all lampreys were combined by species (Western Brook Lamprey and Pacific Lamprey). By combining all lamprey density data, our objective was to assess the average and upper threshold values of numerical density ($\#/m^2$) and biomass density (g/m^2) for larval lampreys in natural rearing habitat. The goal of the following report is to 1) explore trends in rearing densities of larval lampreys (in terms of number and biomass) and 2) analyze electrofishing capture efficiency of four different size classes of lampreys, using all available 2017 electrofishing data.

For YOY lampreys (all species combined), we found the average estimated numerical density to be 44.3 $\#/m^2$ from 20 surveyed sites where YOY lampreys were present. The maximum estimated density of YOY lampreys was 245.0 $\#/m^2$ and the minimum was 4.0 $\#/m^2$. The majority of sites (80%) had YOY densities at, or less than 70 $\#/m^2$, with the mode density at 10-20 $\#/m^2$ (30% of surveyed sites). It is likely that seasonality plays a strong role in the YOY densities that we observed, with the highest densities likely occurring immediately after lampreys hatched in late spring and early summer, while the lower densities likely occurred during the summer and fall months, when the YOY lampreys start to spread and move throughout the available habitat. We did not measure and weigh all YOY lampreys, therefore a biomass density is not estimated.

For non-YOY lampreys (all species combined), the average estimated numerical density was 17.1 $\#/m^2$ from 40 surveyed sites where non-YOY lampreys were present. The maximum estimated numerical density was 128.1 $\#/m^2$, while the minimum was 0.2 $\#/m^2$. In total, 90% of surveyed sites had a numerical density at, or less than 30 $\#/m^2$, with the mode density at 5-10 $\#/m^2$. For biomass density, the average density was 12.6 g/m^2. The maximum estimated biomass density was 55.8 g/m^2, while the minimum was 0.1 g/m^2. In total, 97% of surveyed sites had a biomass density at, or less than 30 g/m^2, with the mode density at 10-15 g/m^2.

Overall, larval lamprey electrofishing capture efficiency (percentage) decreased as lampreys decreased in size. Lamprey capture efficiency was best for large larvae (90 mm or greater). In total, 90% of sites with large lampreys present (35 sites total) had a capture percentage greater than 70%. The mode capture percentage rate was at 80-90% (35% of total); 30% of sites also had a capture percentage of 100%. For medium sized lampreys (>49 and <90 mm), the majority (60%) of sites (34 sites total) had a capture percentage between 70-90%, and only 7% of sites had a capture percentage of 100%. For small sized lamprey (>30 and <50 mm), 73% of sites with small lampreys present (30 sites total) had a capture percentage between 30% and 70%. The mode capture percentage rate was at 50-60% (23% of total). No sites had 100% capture percentage for small larvae. For YOY lampreys (30 mm or less), the mode capture percentage rate was at 40-50% (23% of all 21 sites), although capture percentages varied widely, from 4% of sites with no YOY captured (0%), to 10% of surveyed sites with 100% YOY lampreys captured.

INTRODUCTION

In 2017, larval lamprey habitat surveys were performed by the Yakama Nation Pacific Lamprey Project in the Klickitat, Yakima, and Wenatchee subbasins. All larval lamprey survey data collected in 2017 was synthesized together, in terms of rearing densities of larval lampreys, as well as electrofishing capture efficiency. Young of year (YOY) lampreys were separated from larger, older lampreys (non-YOY lampreys), and non-YOY lampreys were combined by species (Western Brook Lamprey and Pacific Lamprey). By combining all lamprey density data (in terms of numbers and biomass), we can start to analyze the upper threshold, and averages, of numerical density (#/m^2) and biomass density (g/m^2) of rearing larval lampreys in the wild. The goal of the following report is to 1) explore trends in rearing densities of larval lampreys (in terms of number and biomass) by looking at all collected density data, and 2) analyze electrofishing capture efficiency of four different size classes of lampreys using all available 2017 electrofishing data.

METHODS

Field Survey

In 2017, larval lamprey electrofishing surveys were conducted in the Klickitat, Yakima and Wenatchee subbasins. Surveys were focused on Type I (preferred) and Type II (acceptable) larval lamprey 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 coarser substrates (gravel/cobble/boulder/bedrock). Type II habitat is coarse shifting sand or other fine substrate mixed with coarse substrate.

At each electrofished site a 50 m reach was measured out which encompassed the most accessible and abundant Type I larval lamprey habitat. The total area (m^2) of Type I habitat was estimated within the 50 m reach. In addition Type II (acceptable) larval lamprey habitat was estimated within the 50 m reach. Electrofishing surveys targeted representative areas of Type I habitat, and in general, covered a minimum area of 5 m^2 of Type I habitat. Throughout the course of the survey, young of year (YOY) larvae were kept separate from larger (non-YOY) lampreys. Larvae were considered YOY when their length was less than or equal to (≤) 25 mm between June and August, and this threshold was increased to ≤ 30 mm during the months of September and October.

Electrofishing surveys were conducted with an AbP-2 Backpack Electrofisher (ETS Electrofishing Systems Inc., Madison, WI), specially designed for the sampling of larval lampreys. Surveys targeted available (wetted) larval habitat using standard survey methods (slow tickle pulse of 3 pulses/sec and fast stunning pulse of 30 pulses/sec, 25% duty cycle, 3:1 burst pulse train, and 125 volts). Another person, equipped with a fine-mesh hand net was also present to help capture any electrofished larvae. Electrofishing time (seconds) and area (m^2) covered (of each habitat type) was recorded. For YOY larvae, we recorded the total area where YOY larvae were observed during the course of the survey. Captured lampreys were separated by habitat type, tallied by life stage, age class (YOY lampreys versus larger, non-YOY lampreys), For non-YOY lampreys, 15 representative lengths were taken (+/- 1 mm). Four of these lampreys were measured to the nearest 0.01 gram (length and weight was taken on the largest, smallest and two medium sized larvae relative to the site). The combined weight of all captured lampreys was also measured (nearest 0.01 g). Missed larvae were counted and tallied by size class (small <50 mm, medium 50-90 mm, and large > 90 mm).

Data Analysis

Type I and Type II Habitat Availability

The available Type I and Type II habitat in 50 m survey sites were averaged together for each subbasin, as well as individual watersheds. Only sites where larval lampreys were found were used in this calculation. Sites where no larval lampreys were found, were not included in this calculation. Surveyed watersheds where no larval lampreys were found are excluded from the presented graphs.

Numerical Density Analysis and 50 m Reach Estimated Number of Lampreys

Captured and missed larvae were tallied together to determine the total number of observed lampreys from electrofishing for each habitat type. If the number of captured lampreys was less than half of the observed total, the number of captured lampreys was doubled, and used as the final observed total. If the number of captured lampreys was equal to or more than half, the recorded observed number was used as the final observed total.

In many cases, survey visibility was less than ideal, and many lampreys went unseen. To account for unseen lamprey, the total number of lampreys observed (final observed total) was adjusted (increased) based on a 1-5 visibility scale. A separate adjustment value was given for non-YOY larvae, and YOY larvae (in an attempt to account for the small size of YOY larvae). For non-YOY (larger) larvae, the following 1-5 visibility scale was used: (1) poor (60%), (2) fair (70%), (3) good (80%), (4) very good (90%) and (5) excellent (100%). For YOY (smaller) larvae, a more generous visibility adjustment scale was used: (1) poor (10%), (2) fair (20%), (3) good (30%), (4) very good (40%) and (5) excellent (50%).

For each survey, and each age class, the total number of observed lampreys was increased (by the percentage listed above) based on the survey's visibility rank. The adjusted observed value is referred to as the "Sampled Estimated Number". Estimated survey densities of non-YOY lampreys ($\#/m^2$) were calculated using the estimated sample number, and the total survey area. However, for YOY larvae, survey densities were calculated from the estimated sample number, and the survey area where YOY lamprey were observed during the survey. Within each 50 m reach, the number of non-YOY lampreys (excluding YOY lampreys) within Type I habitat was estimated. The survey density was extrapolated over the estimated area within the 50 m reach, to arrive at the total number of lampreys within Type I habitat at each site.

For numerical densities (#/m^2), we compiled numerical density data from all surveys (across all three subbasins). We summarize this data in two histograms; 1) YOY lampreys, and 2) non-YOY lampreys. Please see "Supplemental Data Analysis" at the end of this report, for graphs that compare numerical densities of all non-YOY lampreys between subbasins, and further by watersheds.

Biomass Density Analysis and 50 m Reach Estimated Lamprey Biomass

The average weight of the captured non-YOY lamprey (total weight g/# weighed) was calculated for each site. In the event, that not all of the captured lampreys were weighed together, the average capture weight was multiplied by the total number of captured lampreys. In the event that no lampreys were weighed, an average condition factor (acquired from all surveyed sites) was applied to the average length of larvae captured, and used to estimate the average weight, and resulting total weight, of the captured lampreys. The final estimated biomass density (g/m^2) was then calculated from the estimated total biomass and total survey area of Type I habitat.

Further, the electrofishing density (by mass) was calculated separately for captured and missed lampreys. The biomass densities for captured and missed lampreys was summed together to get the total biomass density for the survey of Type I habitat. The estimated final biomass density was then extrapolated over the respective area of Type I habitat, to arrive at a total biomass (g) for Type I habitat within the 50 m site.

For biomass densities (g/m^2), we compiled numerical density data from all surveys (across all three subbasins). We summarize this data in two histograms; 1) YOY lampreys, and 2) non-YOY lampreys. Please see "Supplemental Data Analysis" at the end of this report, for graphs that compare biomass densities of all non-YOY lampreys between subbasins, and further by watersheds.

Electrofishing Capture Efficiency by Larval Lamprey Size Classes

Electrofishing capture efficiency by larval lamprey size class was assessed by comparing the frequency of missed lampreys to captured lampreys within four separate size classes; YOY (≤ 30 mm), 2) Small (> 30 mm and < 50 mm), 2) Medium (≥ 50 mm and < 90 mm), and 3) Large (≥ 90 mm). During our electrofishing surveys at each site, we recorded the number of missed lampreys within each of the four size classes. To calculate the number of each size class that were captured, we calculated the ratio of each size class from the measured 15 lampreys (which are representative of what we captured), and extrapolated that ratio over the total number of captured lampreys. The ratio of captured to missed lampreys (by size class) was then calculated**.** A minimum of two lampreys of within a size class needed to be present, in order to be included in this analysis. A histogram of the frequency of these ratio is shown in this report.

RESULTS

A summary of our synthesized data from 2017 larval lamprey electrofishing surveys is summarized below in the following two parts: 1) “Part I – Overall Lamprey Density Data From All Surveyed Sites” and 2) “Electrofishing Capture Efficiency by Size Class”.

Part I – Overall Lamprey Density Data From All Surveyed Sites

YOY Lampreys Numerical Density (#/m^2) Summary

The average estimated numerical density of YOY lampreys was 44.3 #/m^2 at 20 surveyed sites where YOY lampreys were present (Fig. 1). The maximum estimated density of YOY lampreys was 245.0 #/m^2 and the minimum was 4.0 #/m^2. In total, 80% of the surveyed sites had YOY densities at, or less than 70 #/m^2, with the most common YOY density 10-20 #/m^2 (30% of surveyed sites). Only 20% of the surveyed sites had YOY densities at, or greater than 90 #/m^2.

Non-YOY Lampreys Numerical (#/m^2) and Biomass Density (g/m^2) Summary

The average estimated numerical density of non-YOY lampreys was 17.1 #/m^2 at 40 surveyed sites where non-YOY lampreys were present. The maximum estimated numerical density was 128.1 #/m^2, while the minimum was 0.2 #/m^2 (Fig. 2). In total, 90% of surveyed sites had a numerical density at, or less than 30 #/m^2, with the most common estimated density 5-10 #/m^2 (10 #/m^2 category in the displayed histogram). Only 10% of surveyed sites had non-YOY densities at, or greater than 35 #/m^2.

The average estimated biomass density of non-YOY lampreys was 12.6 g/m^2 at 40 surveyed sites where non-YOY lampreys were present. The maximum estimated biomass density was 55.8 g/m^2, while the minimum was 0.1 g/m^2 (Fig. 3). In total, 97% of surveyed sites had a biomass density at, or less than 30 g/m^2, with the most common estimated density 10-15 g/m^2 (15 g/m^2 category in the displayed histogram). Only 3% of surveyed sites had an estimated biomass density at, or greater than 55 g/m^2.

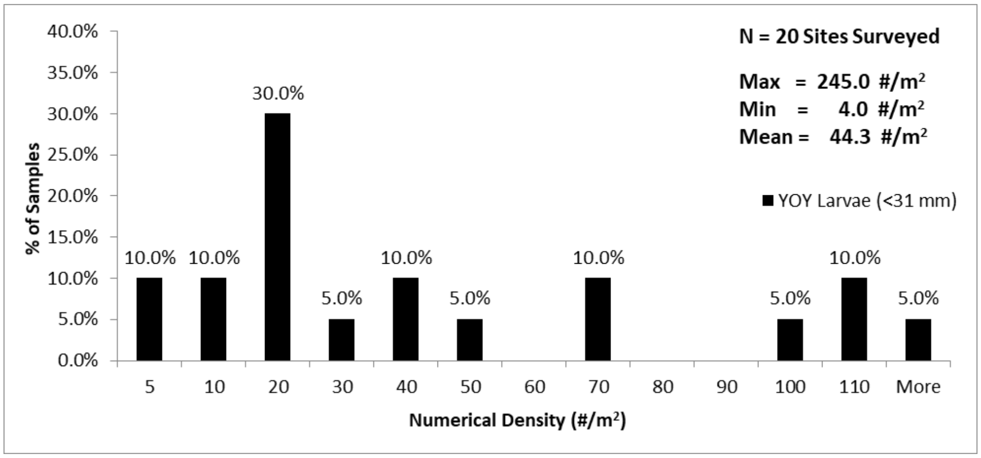

Figure 1. Estimated numerical density (#/m^2) of YOY lampreys at all sites where YOY lampreys were present in the Klickitat, Yakima and Wenatchee subbasins.

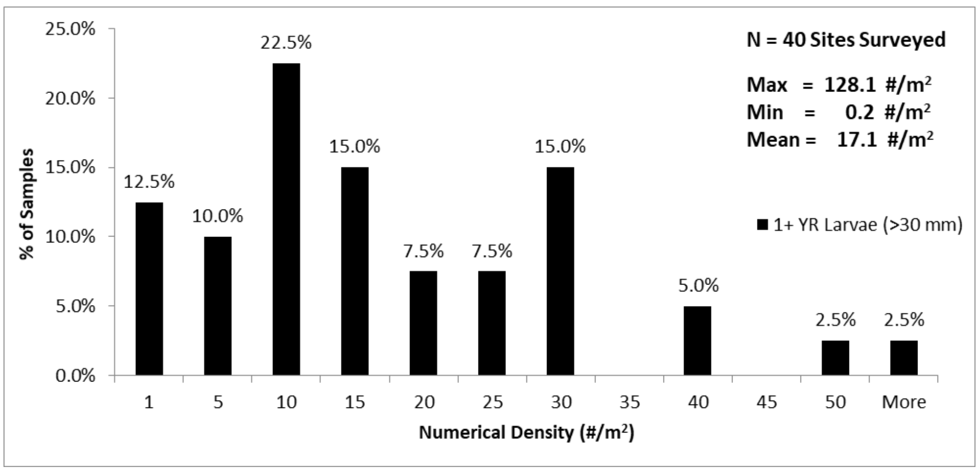

Figure 2. Estimated numerical density (#/m^2) of non-YOY lampreys at all Type I survey sites where non-YOY lampreys were present in the Klickitat, Yakima and Wenatchee subbasins.

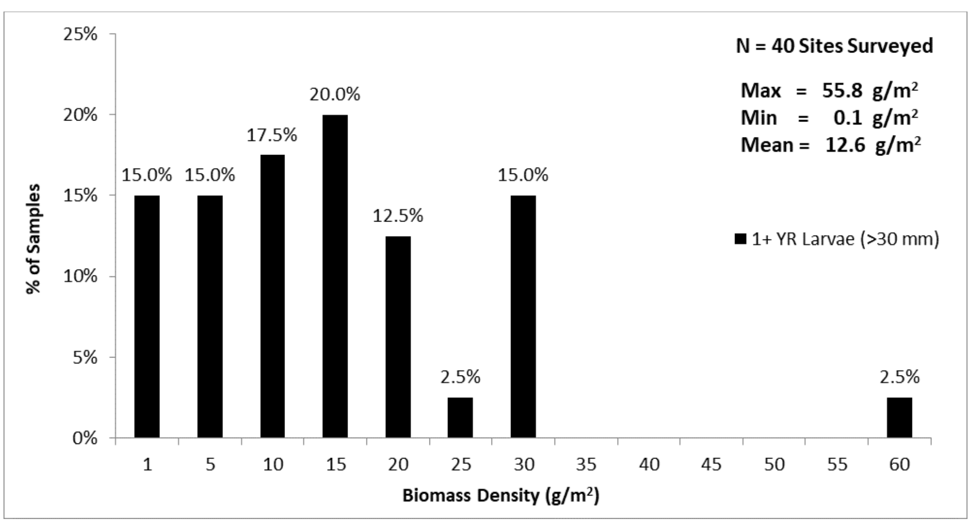

Figure 3. Estimated biomass density (g/m2) of non-YOY lampreys at all Type I survey sites where non-YOY lampreys were present in the Klickitat, Yakima and Wenatchee subbasins.

Part II – Electrofishing Capture Efficiency by Lamprey Size Class

Overall, lamprey capture efficiency (percentage) decreased as lampreys decreased in size (Fig. 4). Lamprey capture efficiency was best for large larvae (>90 mm). In total, 90% of sites with large lampreys present (35 sites total) had a capture percentage greater than 70%, with the highest percent of sites (35%) with a capture percentage of 80-90%, and 30% of sites with a capture percentage of 100% (Fig. 4). For medium sized lampreys (>49<90 mm), the majority (60%) of sites (34 sites total) had a capture percentage between 70-90%, and only 7% of sites had a capture percentage of 100%. For small sized lamprey (>30<50 mm), 73% of sites with small lampreys present (30 sites total) had a capture percentage between 30% and 70%, with the highest percent of sites (23%) with a capture percentage of 50-60%. No sites had 100% capture percentage for small larvae. For YOY lampreys (<31 mm), the most common capture percentage (at 23% of 21 sites) was 40-50%, although capture percentages varied widely, from 4% of sites with no YOY captured (0%), to 10% of surveyed sites with 100% YOY lampreys captured.

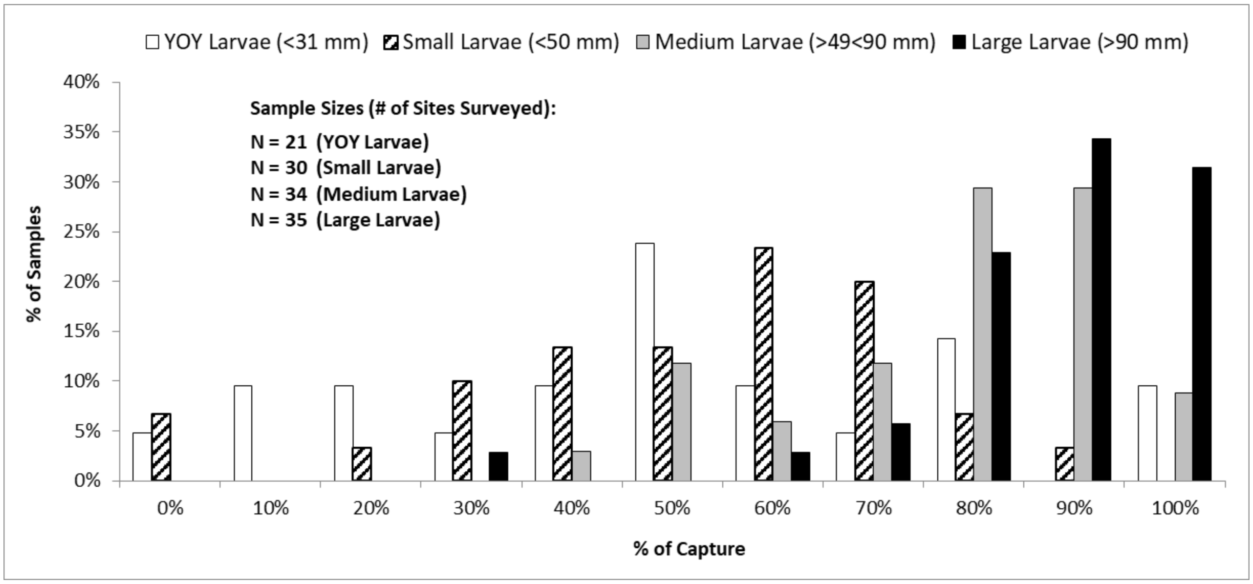

Figure 4. Electrofishing capture efficiency of larval lampreys by size classes (YOY, Small, Medium and Large) from electrofishing sites that contained the specified size classes in the Klickitat, Yakima and Wenatchee subbasins. For each size class, "N" equals the number of sites surveyed where at least two lampreys from the respective size class were present.

DISCUSSION

In 2017, larval lamprey habitat surveys were performed by the Yakama Nation Pacific Lamprey Project in the Klickitat, Yakima, and Wenatchee subbasins. All larval lamprey survey data collected in 2017 was synthesized together, in terms of rearing densities of larval lampreys, as well as electrofishing capture efficiency. Young of year (YOY) lampreys were separated from larger, older lampreys (non-YOY lampreys), and non-YOY lampreys were combined by species (Western Brook Lamprey and Pacific Lamprey). By combining all lamprey density data (in terms of numbers and biomass), we can start to analyze the upper threshold, and averages, of numerical density (#/m^2) and biomass density (g/m^2) of rearing larval lampreys in the wild. The goal of the following report is to 1) explore trends in rearing densities of larval lampreys (in terms of number and biomass) by looking at all collected density data, and 2) analyze electrofishing capture efficiency of four different size classes of lampreys using all available 2017 electrofishing data.

For YOY lampreys (all species combined), we found the average estimated numerical density to be 44.3 #/m^2 from 20 surveyed sites where YOY lampreys were present. The maximum estimated density of YOY lampreys was 245.0 #/m^2 and the minimum was 4.0 #/m^2. The majority of sites (80%) had YOY densities at, or less than 70 #/m^2, with the most common YOY density 10-20 #/m^2 (30% of surveyed sites). It is likely that seasonality plays a strong role in the YOY densities that we observed, with the highest densities likely occurring immediately after lampreys hatched in late spring and early summer, while the lower densities likely occurred during the summer and fall months, when the YOY lampreys start to spread throughout the available habitats. We did not measure and weigh all YOY lampreys, therefore a biomass density is not provided.

For non-YOY lampreys (all species combined), we found the average estimated numerical density was 17.1 #/m^2 at 40 surveyed sites where non-YOY lampreys were present. The maximum estimated numerical density was 128.1 #/m^2, while the minimum was 0.2 #/m^2. In total, 90% of surveyed sites had a numerical density at, or less than 30 #/m^2, with the most common estimated density 5-10 #/m^2. For biomass density, we found the average density to be 12.6 g/m^2 at the same 40 surveyed sites. The maximum estimated biomass density was 55.8 g/m^2, while the minimum was 0.1 g/m^2. In total, 97% of surveyed sites had a biomass density at, or less than 30 g/m^2, with the most common estimated density 10-15 g/m^2.

Overall, larval lamprey electrofishing capture efficiency (percentage) decreased as lampreys decreased in size. Lamprey capture efficiency was best for large larvae (>90 mm). In total, 90% of sites with large lampreys present (35 sites total) had a capture percentage greater than 70%, with the highest percent of sites (35%) with a capture percentage of 80-90%, and 30% of sites with a capture percentage of 100%. For medium sized lampreys (>49<90 mm), the majority (60%) of sites (34 sites total) had a capture percentage between 70-90%, and only 7% of sites had a capture percentage of 100%. For small sized lamprey (>30<50 mm), 73% of sites with small lampreys present (30 sites total) had a capture percentage between 30% and 70%, with the highest percent of sites (23%) with a capture percentage of 50-60%. No sites had 100% capture percentage for small larvae. For YOY lampreys (<31 mm), the most common capture percentage (at 23% of 21 sites) was 40-50%, although capture percentages varied widely, from 4% of sites with no YOY captured (0%), to 10% of surveyed sites with 100% YOY lampreys captured.

Supplemental Data Analysis

Klickitat, Yakima and Wenatchee Subbasins

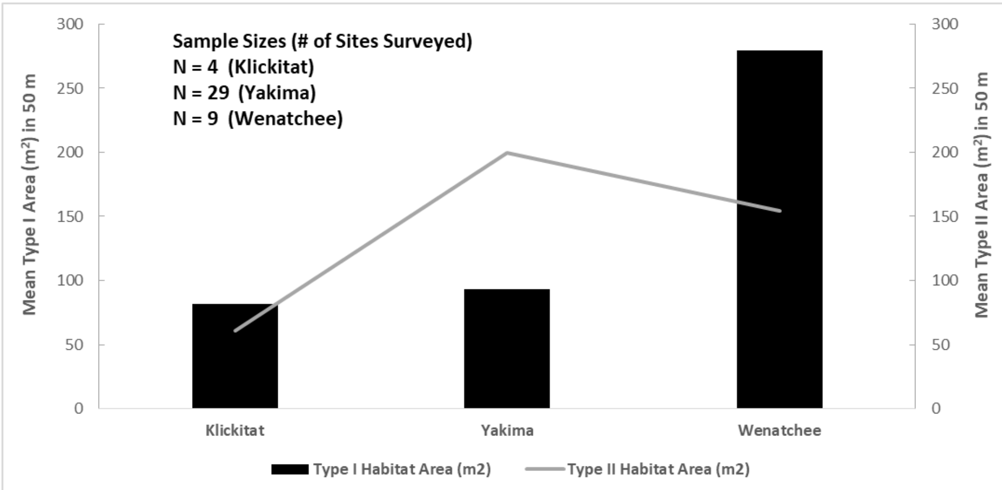

Figure S1. Mean habitat availability from all 50 m survey sites in the Klickitat, Yakima and Wenatchee subbasins from electrofishing surveys in 2017. Displayed are the mean Type I (bar graph) and Type II (line graph) habitat area within the 50 m reach survey sites. Only sites with lampreys present (all age classes and species) were used in this analysis (surveyed sites with no lampreys were excluded). Western Brook Lamprey have not been confirmed in the Wenatchee Subbasin, but are present in the other two.

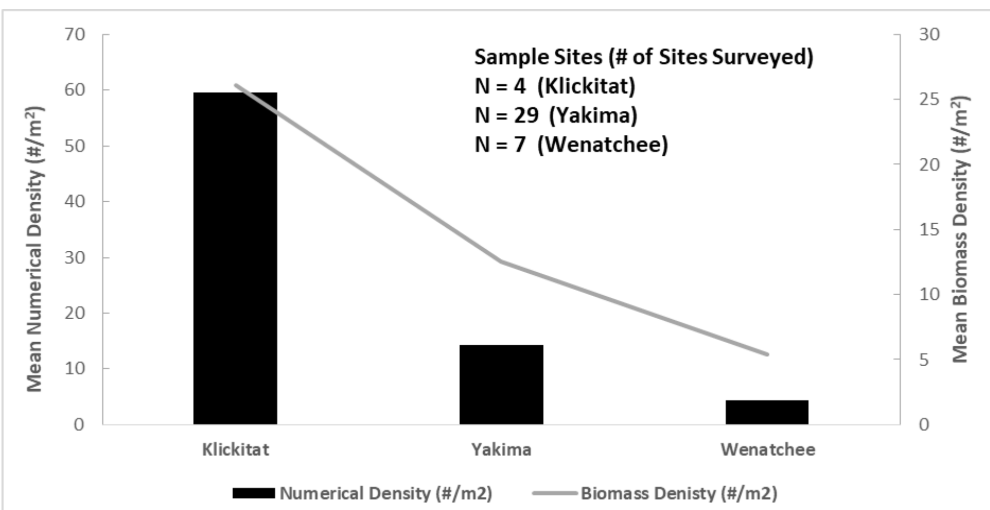

Figure S2. Mean numerical density (#/m^2) and biomass density (g/m^2) of non-YOY lampreys from all Type I habitat survey sites (when lampreys were present) in the Klickitat, Yakima and Wenatchee subbasins from electrofishing surveys in 2017. Displayed are the mean of numerical density (bar graph) and biomass density (line graph). The displayed graph is combined data for Pacific Lamprey, Western Brook Lamprey and unknown species lampreys (lampreys of unidentifiable length, <50 mm, but larger than YOY lampreys). Western Brook Lamprey have not been confirmed in the Wenatchee Subbasin, but are present in the other two.

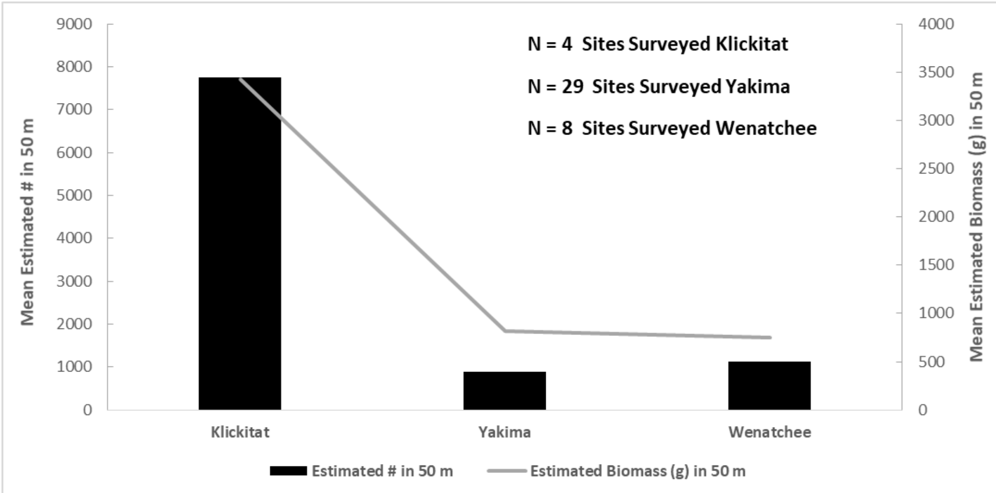

Figure S3. Mean estimated number and estimated biomass of non-YOY lampreys from in 50 m reach sites in Type I habitat (when lampreys were present) in the Klickitat, Yakima and Wenatchee subbasins from electrofishing surveys in 2017. Displayed are the mean estimated number (bar graph) and mean estimated biomass (line graph) within the 50 m reach survey sites. The displayed graph is combined data for Pacific Lamprey, Western Brook Lamprey and unknown species lampreys (lampreys of unidentifiable length, <50 mm, but larger than YOY lampreys). Western Brook Lamprey have not been confirmed in the Wenatchee Subbasin, but are present in the other two.

Klickitat Subbasin Watersheds

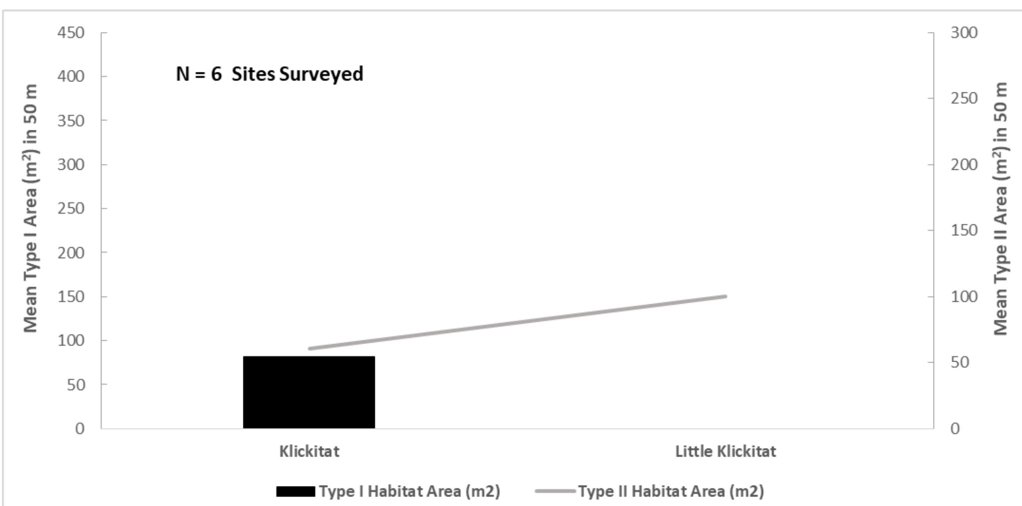

Figure S4. Mean habitat availability from all 50 m survey sites where larval lampreys were found in the Klickitat Subbasin from electrofishing surveys in 2017. Individual watersheds are shown. "Klickitat" is the mainstem Klickitat River. Displayed are the mean of Type I (bar graph) and Type II (line graph) habitat area within the 50 m reach survey sites. Only sites with lampreys present (all age classes and species) were used in this analysis (surveyed sites with no lampreys were excluded). Both Western Brook Lamprey and Pacific Lamprey reside in the Klickitat Subbaisn.

Yakima Subbasin Watersheds

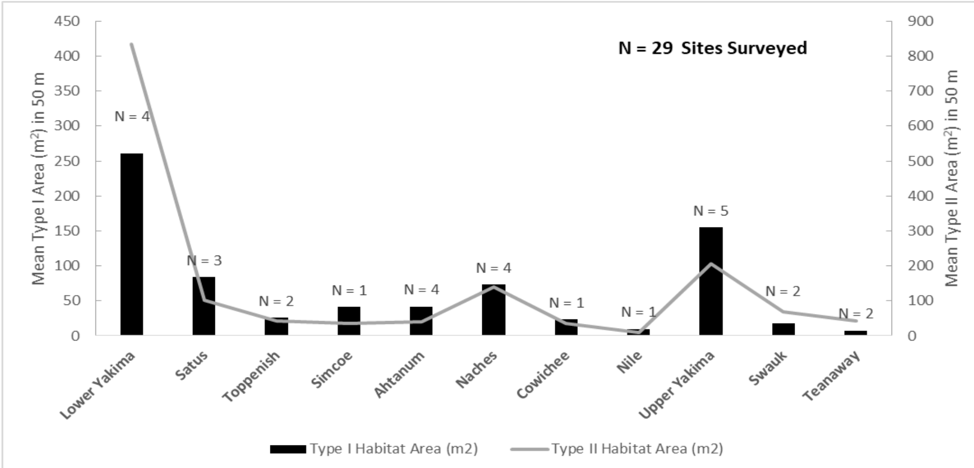

Figure S5. Mean habitat availability from all 50 m survey sites where larval lampreys were found in the Yakima Subbasin from electrofishing surveys in 2017. Displayed are the mean of Type I (bar graph) and Type II (line graph) habitat area within the 50 m reach survey sites. Individual watersheds are shown, ordered downstream (left) to upstream (right). "Lower Yakima" is the lower Yakima River mainstem downstream of Naches confluence (RKM 191.9). "Upper Yakima" is the mainstem Yakima River upstream of the Naches River confluence (RKM 191.9). Only sites with lampreys present (all age classes and species) were used in this analysis (surveyed sites with no lampreys were excluded). Both Pacific Lamprey and Western Brook Lamprey reside in the Yakima Subbasin.

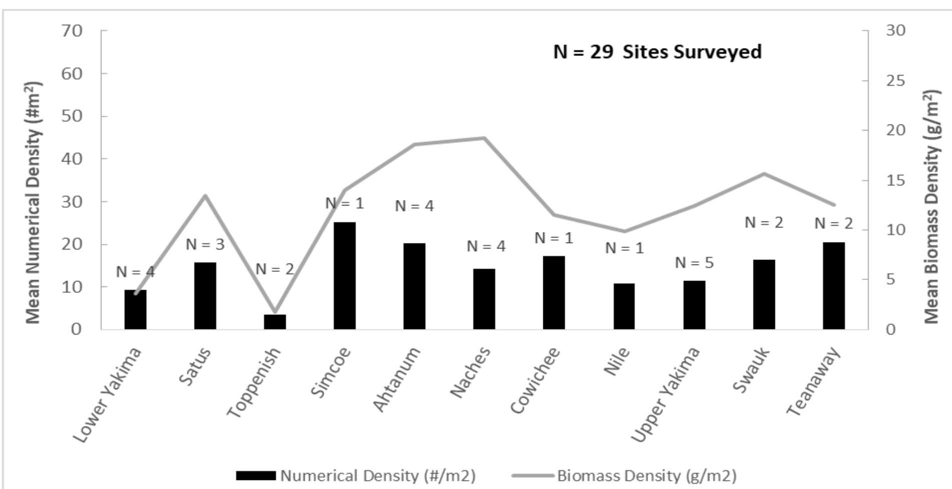

Figure S6. Mean numerical density (#/m^2) and biomass density (g/m^2) of non-YOY lampreys from all Type I habitat survey sites (where lampreys were present) in the Yakima Subbasin from electrofishing surveys in 2017. Displayed are the mean numerical density (bar graph) and biomass density (line graph) within the 50 m reach survey sites. Individual watersheds are shown, ordered downstream (left) to upstream (right). "Lower Yakima" is the lower Yakima River mainstem downstream of Naches confluence (RKM 191.9). "Upper Yakima" is the mainstem Yakima River upstream of the Naches River confluence (RKM 191.9). The displayed graph is combined data for Pacific Lamprey, Western Brook Lamprey and unknown species lampreys (lampreys of unidentifiable length, <50 mm, but larger than YOY lampreys).

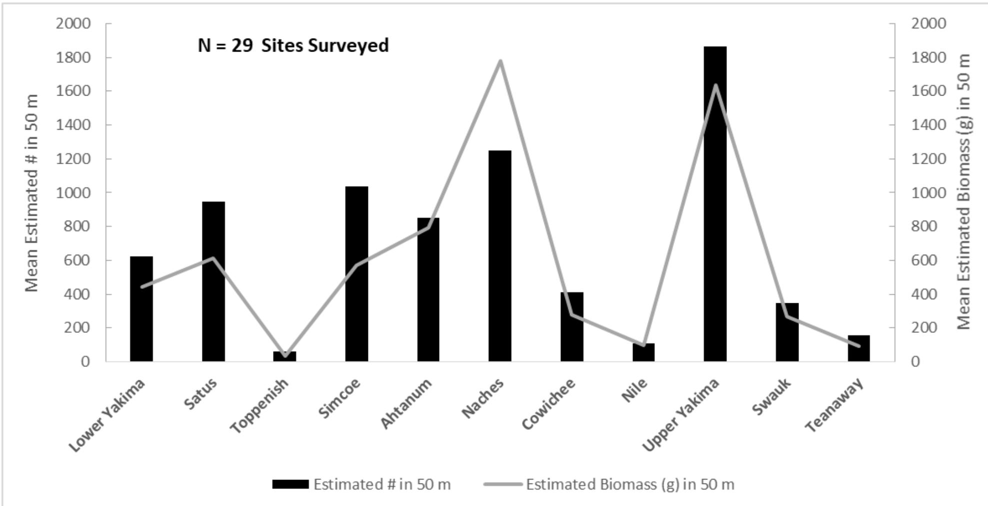

Figure S7. Mean estimated number and estimated biomass of non-YOY lampreys in 50 m reach sites in Type I habitat (where larval lampreys were present) in the Yakima Subbasin from electrofishing surveys in 2017. Displayed are the mean estimated number (bar graph) and mean estimated biomass (line graph) within the 50 m reach survey sites. Individual watersheds are shown, ordered downstream (left) to upstream (right). "Lower Yakima" is the lower Yakima River mainstem downstream of Naches confluence (RKM 191.9). "Upper Yakima" is the mainstem Yakima River upstream of the Naches River confluence (RKM 191.9). The displayed graph is combined data for Pacific Lamprey, Western Brook Lamprey and unknown species lampreys (lampreys of unidentifiable length, <50 mm, but larger than YOY lampreys).

Wenatchee Subbasin Watersheds

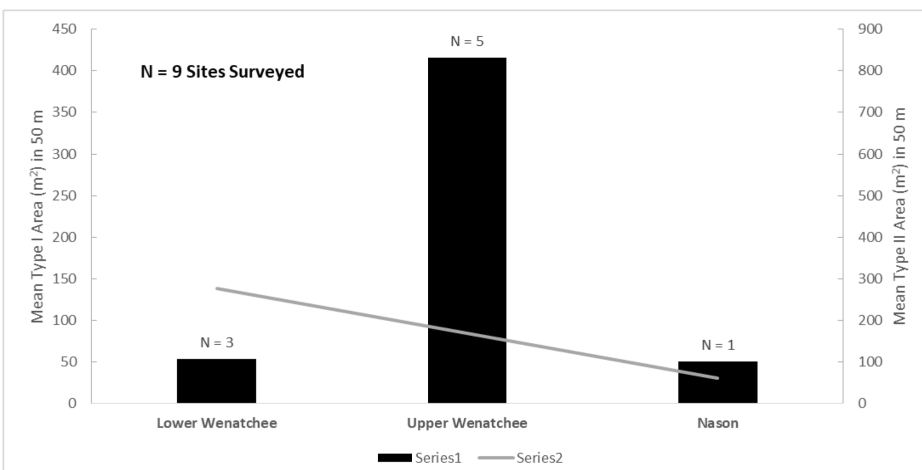

Figure 4S8. Mean habitat availability from all 50 m survey sites (where lampreys were present) in the Wenatchee Subbasins from electrofishing surveys in 2017. Displayed are the mean Type I (bar graph) and Type II (line graph) habitat area within the 50 m reach survey sites. "Lower Wenatchee" is the lower Wenatchee River mainstem downstream of Tumwater Dam (RKM 49.6). "Upper Wenatchee" is the mainstem Wenatchee River upstream of Tumwater Dam (RKM 49.6). Only sites with lampreys present (all age classes and species) were used in this analysis (surveyed sites with no lampreys were excluded). Only Pacific Lamprey have been confirmed in the Wenatchee Subbasin.

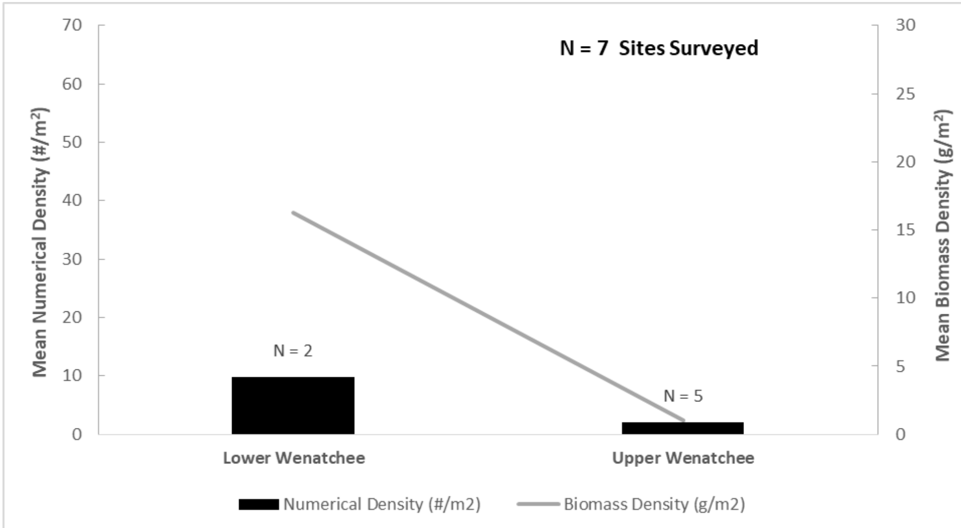

Figure S9. Mean numerical density (#/m^2) and biomass density (g/m^2) of non-YOY lampreys from all Type I habitat survey sites (where lampreys were present) in the Wenatchee Subbasin from electrofishing surveys in 2017. Displayed are the mean numerical density (bar graph) and biomass density (line graph) within the 50 m reach survey sites. "Lower Wenatchee" is the lower Wenatchee River mainstem downstream of Tumwater Dam (RKM 49.6). "Upper Wenatchee" is the mainstem Wenatchee River upstream of Tumwater Dam (RKM 49.6). The displayed graph is for Pacific Lamprey and unknown species lampreys (lampreys of unidentifiable length, <50 mm, but larger than YOY lampreys). Western Brook Lamprey have not been confirmed in the Wenatchee Subbasin).

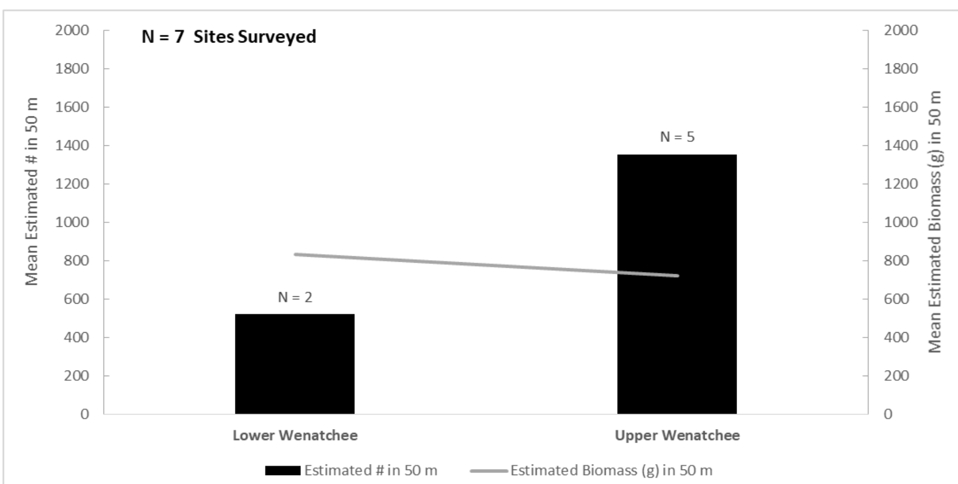

Figure S10. Mean estimated number and estimated biomass of non-YOY lampreys in the 50 m reach survey sites in Type I habitat (where lampreys were present) in the Wenatchee Subbasin from electrofishing surveys in 2017. Displayed are the mean estimated number (bar graph) and mean estimated biomass (line graph) within the 50 m reach survey sites. "Lower Wenatchee" is the lower Wenatchee River mainstem downstream of Tumwater Dam (RKM 49.6). "Upper Wenatchee" is the mainstem Wenatchee River upstream of Tumwater Dam (RKM 49.6). The displayed graph is for Pacific Lamprey and unknown species lampreys (lampreys of unidentifiable length, <50 mm, but larger than YOY lampreys). Western Brook Lamprey have not been confirmed in the Wenatchee Subbasin.