CONFEDERATED TRIBES AND BANDS OF THE YAKAMA NATION

Yakama Nation Pacific Lamprey *Entosphenus tridentatus* Restoration Project

Annual Progress Report

Project No. 2008-470-00

Contract No. 52042

Performance Period

March 1, 2010 – February 29, 2011

Prepared for:

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Bonneville Power Administration

Environment, Fish and Wildlife

P.O. Box 3621

Portland, OR 97208

Prepared by:

Yakama Nation Pacific Lamprey Project

Yakama Nation Fisheries Resource Management Program

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EXECUTIVE SUMMARY

In accordance with Bonneville Power Administration Contract # 2008-470-00 and the Confederated Tribes and Bands of the Yakama Nation (YN) has prepared this Annual Progress Report for the Yakama Nation Pacific Lamprey Project. This report outlines the activities undertaken by the Yakama Nation Pacific Lamprey Project (YNPLP) from March 1, 2010 through February 28, 2011.

Over the past three years, the YNPLP has grown considerably. During this past year (2010) we have initiated the first Pacific lamprey surveys within the Yakima River subbasin, which was our primary focus throughout field season. Presence / absence surveys for juvenile Pacific lamprey were performed with an emphasis in the upper portions of the Basin as well as surveys in various irrigation canals. These latter surveys were completed in close coordination with the Bureau of Reclamation (BOR). Additionally, the YNPLP initiated a pilot radio telemetry study being implemented by the US Fish and Wildlife Service (USFWS). This evaluation, in coordination with the US Army Corps of Engineers (USACE) and the BOR, is designed to evaluate potential passage issues for returning adult lamprey over irrigation diversion dams within the mainstem of the Yakima River.

The goal of the Yakama Nation is to restore natural production of Pacific lamprey to a level that will provide robust species abundance, significant ecologic contributions and meaningful harvests throughout the Yakama Nations Ceded Lands and Usual and Accustomed areas (see Figure 1). To accomplish this goal the YNPLP is focusing all activities towards five general objectives, including: (1) establishing baseline information for the presence and absence of Pacific lamprey, (2) understanding primary limiting factors affecting abundance of local populations, (3) development of subbasin "Action Plans" that identify key activities that can be implemented in each subbasin to promote Pacific lamprey recovery in that area, (4) initiate research and development into both juvenile and adult supplementation practices to potentially re-introduce Pacific lamprey back into areas where

local populations have been extirpated - or at least functionally extirpated and (5) establish long-term status and trend monitoring.

This Progress Report focuses on field work accomplished in the Yakima Subbasin in 2010. During this time we were able to cover a relatively wide geographic area, completing approximately 50 individual surveys. It is well recognized that additional surveys in the following years will be required to begin formulating a more comprehensive picture of the current lamprey status within this subbasin. Pacific lamprey juveniles were found at river kilometer 144 (mainstem Yakima River) and in locations above this point, but in very low numbers. Western brook *Lampetra richardsoni* presence was prevalent throughout the upper Yakima River basin, and there was no clear evidence of River lamprey *Lampetra ayersi* presence during this field season. No estimates associated with density or relative abundance of any of these three species are available at this time.

INTRODUCTION

The Pacific lamprey (*Estophenus tridentatus*) has always been important to Native Americans throughout the Pacific Northwest. Since time immemorial, the Fourteen Bands (Palouse, Pisquose, Yakama, Wenatchapam, Klinquit, Oche Chotes, Kow way saye ee, Sk'in-pah, Kah-miltpah, Klickitat, Wish ham , See ap Cat, Li ay was and Shyiks) who make up the Yakama Nation, have shared a commonality taking care of lampreys as a medicine, food source, and cultural icon. These fish are native to the Columbia River basin, spawning hundred of kilometers inland within the states of Washington, Oregon, and Idaho (Kan 1975; Hammond 1979; Vella et al. 1999). Over the past three decades the tribes of the Columbia River Basin have noticed drastic declines from the previous era. These trends are now well known and documented within most current literature about Pacific lamprey throughout their range.

Since initiation of the YNPLP (2008) we have understood the development of this Project to occur in roughly three distinct phases, each requiring approximate three years.

- Phase 1 has been simply the establishment of the Project, initiating preliminary surveys throughout several subbasins, establish general protocol and to begin wide ranging coordination - both regionally and locally. For the most part, these efforts have been successful, particularly with respect to the experience and basic knowledge we have gained in this short time. We are developing much needed cost-share partnerships, have initiated field surveys over large geographic areas, have produced a Preliminary Draft Action Plan for the Yakima Subbasin (still under local review) and have engaged other agencies and publics at both regional and local levels.

- Phase 2 will focus the survey experience towards establishment of long-term "index-sites" from which we can monitor status and trend. These sites will include the following subbasins, White Salmon, Klickitat, Yakima, Wenatchee, Entiat, and Methow, at a minimum. From our many deliberations about the current state of Pacific lamprey populations, current funding levels and other considerations, we have also concluded that aggressive initiation of supplementation research and management activities will likely be central for meaningful lamprey recovery within the foreseeable future. Also, we will continue development of Action Plans for key subbasins within the Yakama Nation Ceded Lands (Figure 1, below) in close coordination with the Bureau of Reclamation. And, we are fully committed to continuing our work with the USACE and the Mid-Columbia Public Utility Districts towards Columbia River mainstem passage issues, supporting the USFWS with their progress towards

the Conservation Initiative, continued coordination with the CRITFC and member tribes, specifically in the implementation of the Tribal Pacific Lamprey Recovery Plan and in the many other forums that we have been engaged.

- Phase 3 will focus on implementation of the knowledge we have gained from Phase 1 and 2. Specifically (but not limited to) we anticipate (1) passage and entrainment issues within the Yakima Basin will begin to be addressed, (2) supplementation research and related management activities will be well defined, developed and initiated in a manner to measure the biological performance of re-introduced local populations, (3) habitat restoration activates oriented primarily towards salmonid recovery will have lamprey habitat needs incorporated, (4) initiate programmatic actions that will reduce toxic chemical levels within juvenile lamprey tissues, (5) fully engage a regional, if not international effort to better understand the ecology of Pacific lamprey within the marine environment, and (6) continued coordination as described in Phase 2.

From the 2010 field season, Our general findings to date indicate Pacific lamprey are at very low numbers throughout the Yakima River, although Western Brook lamprey range from very low numbers in some areas to relative abundants in local areas. Adult counts at Roza Dam (approximately 15 miles above Yakima, WA.) continue to indicate no Pacific lamprey entering the upper Yakima basin. Adult counts at Prosser Dam fish counting station continue to indicate very fewadult lamprey pass this location each year. Only in the years 2002, 2003 and 2004 were significant counts noted (22, 87, 65 respectively) whereas in all following years, very few if any were counted (Figure 2, below).

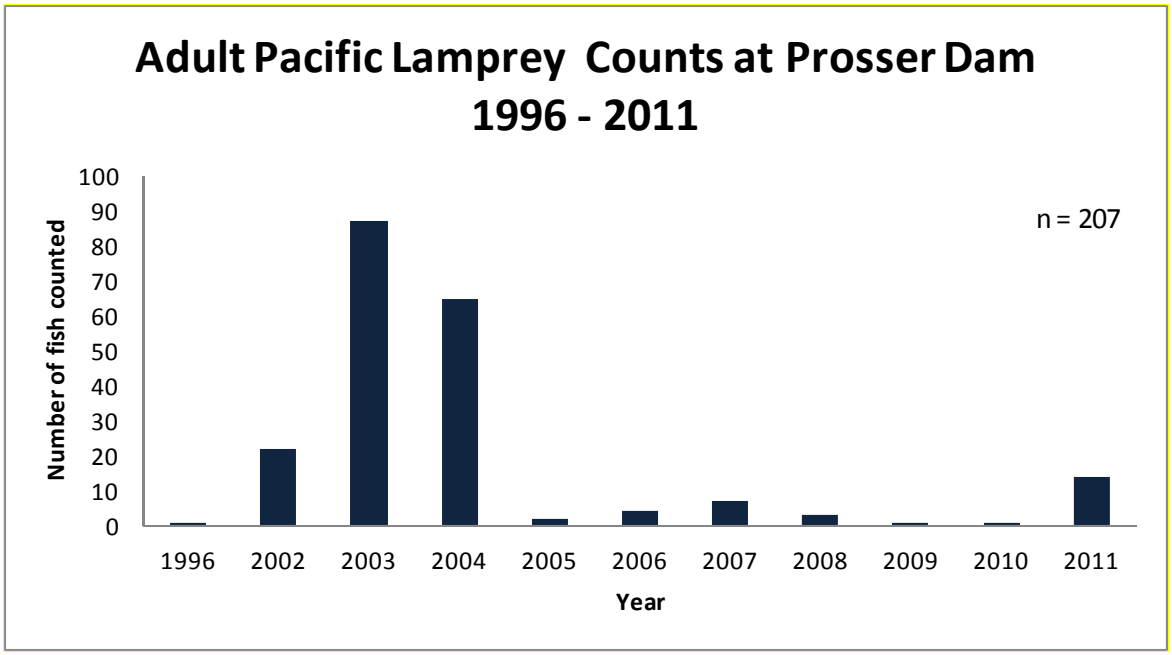

Figure 1. Adult Pacific lamprey counts at the Prosser Fish Counting Station, Lower Yakima River, Prosser, WA.

Prior to 1996 adult lamprey were not counted at Prosser. From 1997 zero adults were observed up to 2002, but only day counts were monitored. Pacific lamprey may have passed Prosser Dam during the night time hours. Assuming approximately 7-years between egg through larval metamorphosis and out-migration (juvenile life stage) from the Yakima River, most juveniles from the 2002-2004 brood years, which were relatively large year classes, will have left the Yakima Subbasin. Our recent electro-shocking findings are consistent with this notion. It is our initial conclusion is that Pacific lamprey are functionally extirpated (i.e. they contribute little or no ecological value to the basin and essentially no abundance to the population as a whole) in the Yakima River - if not literally extirpated.

We also speculate, based upon discussions and findings within recent literature that pheromones produced by both juveniles and adults play a significant role in "homing" of

adult lamprey to spawning locations. If this is true, there is little "incentive "(pheromone production) left within the Yakima River. Also, given the current low population that migrates up to, and could be available to the Yakima River, it is difficult to imagine a significant change in the current status over the next ten or more years. From this context it is logical to conclude that a re-introduction effort of either adults (through translocation) or juveniles (through artificial propagation) are management options that should be developed and probably undertaken. We are aware that these efforts will not be successful without also addressing many other local and regional limiting factors simultaneously.

We would like to acknowledge that because of the BPA funds, resulting from the 2008 Fish Accords, the YNPLP has had the important opportunity to cost-share with the USACE, USFWS and the North Wasco Mitigation Fund to evaluate adult passage issues at Yakima River irrigation diversions. Without BPA funding, these cost-share contributionswould not be available.

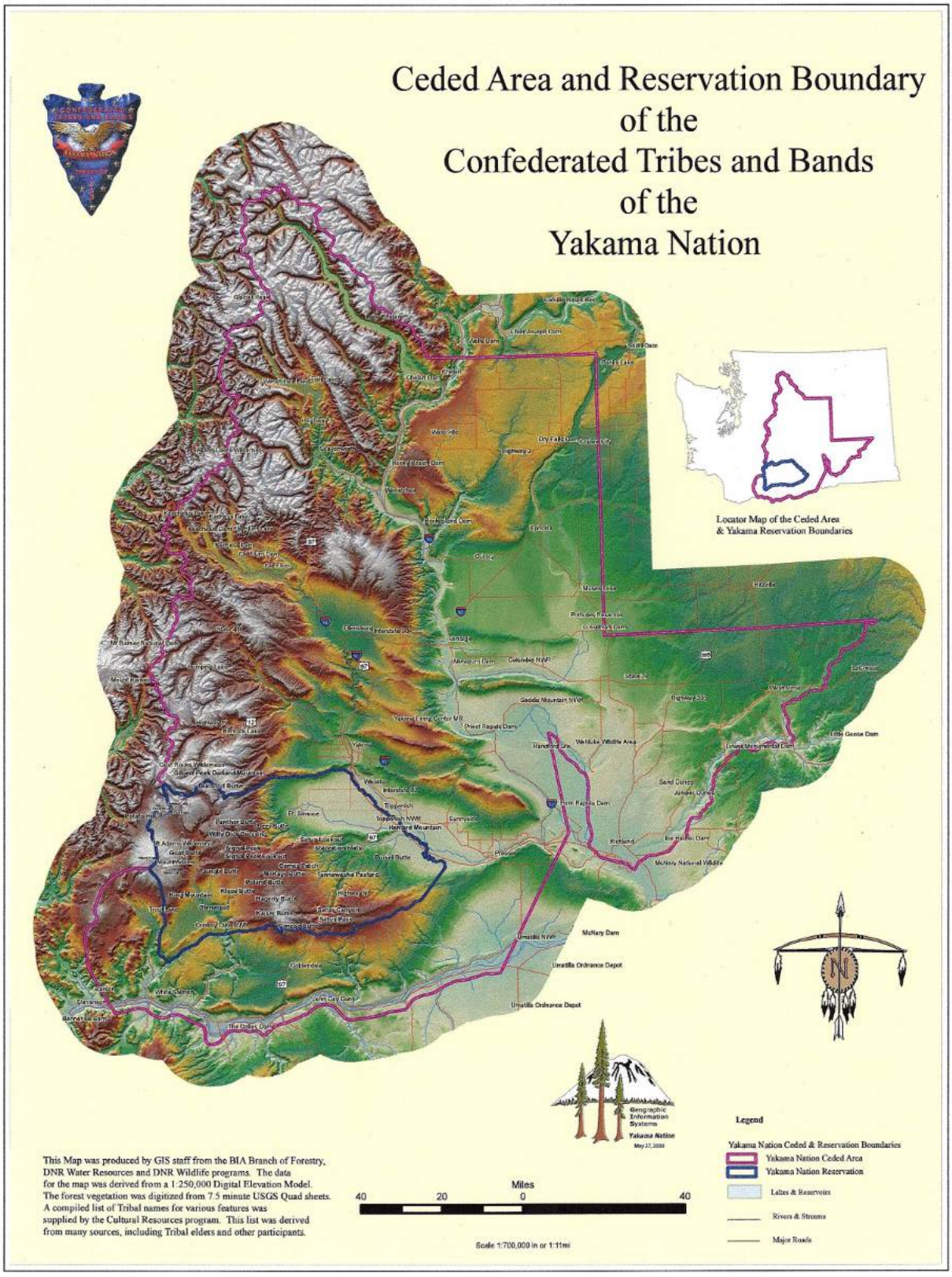

Figure 2. Ceded Area and Reservation Boundary of the Yakama Nation

STUDY AREA

The Yakama subbasin is one of the major tributaries of the Columbia River basin, with its confluence 335 miles from the ocean. The Yakima River flows 214 miles and is located in central Washington. The watershed contains an area of approximately 6,155 square miles with nearly 2,000 miles of perennial rivers and streams from the crest of the Cascade Mountain to the Columbia River 325 kilometers from the Pacific Ocean. Its large size contributes not only to sheer volume of available lamprey habitat but the wide variety of geologic, topographic, and ecological conditions producing a wide range of habitat types. These habitats are suitable for a variety of species and provide habitat diversity that supports multiple life stages of lamprey species. Specifically, Pacific Lamprey larvae, ammocoetes, macropthalmia and adults have different optimal habitat types necessary to carry out essential life functions including migration, feeding, rearing, and spawning.

The major tributaries of the Yakima River include Keechelus, Kachess, and Cle Elum, Teanaway rivers in the northern part of the subbasin, and the Naches and Tieton rivers in the west. The Ahtahum, Toppenish and Satus creeks join the Yakima in the lower parts. There are five major reservoirs located in this subbasin, and form the storage components of the federal Yakima Projects managed by the Bureau of Reclamation, including: Keechelus Lake, Kachess Lake, Cle Elum Lake, Rimrock Reservoir and Bumping Lake. The north fork of the Tieton River connects Clear Lake with Rimrock Lake. These important features are illustrated below in Figure 3.

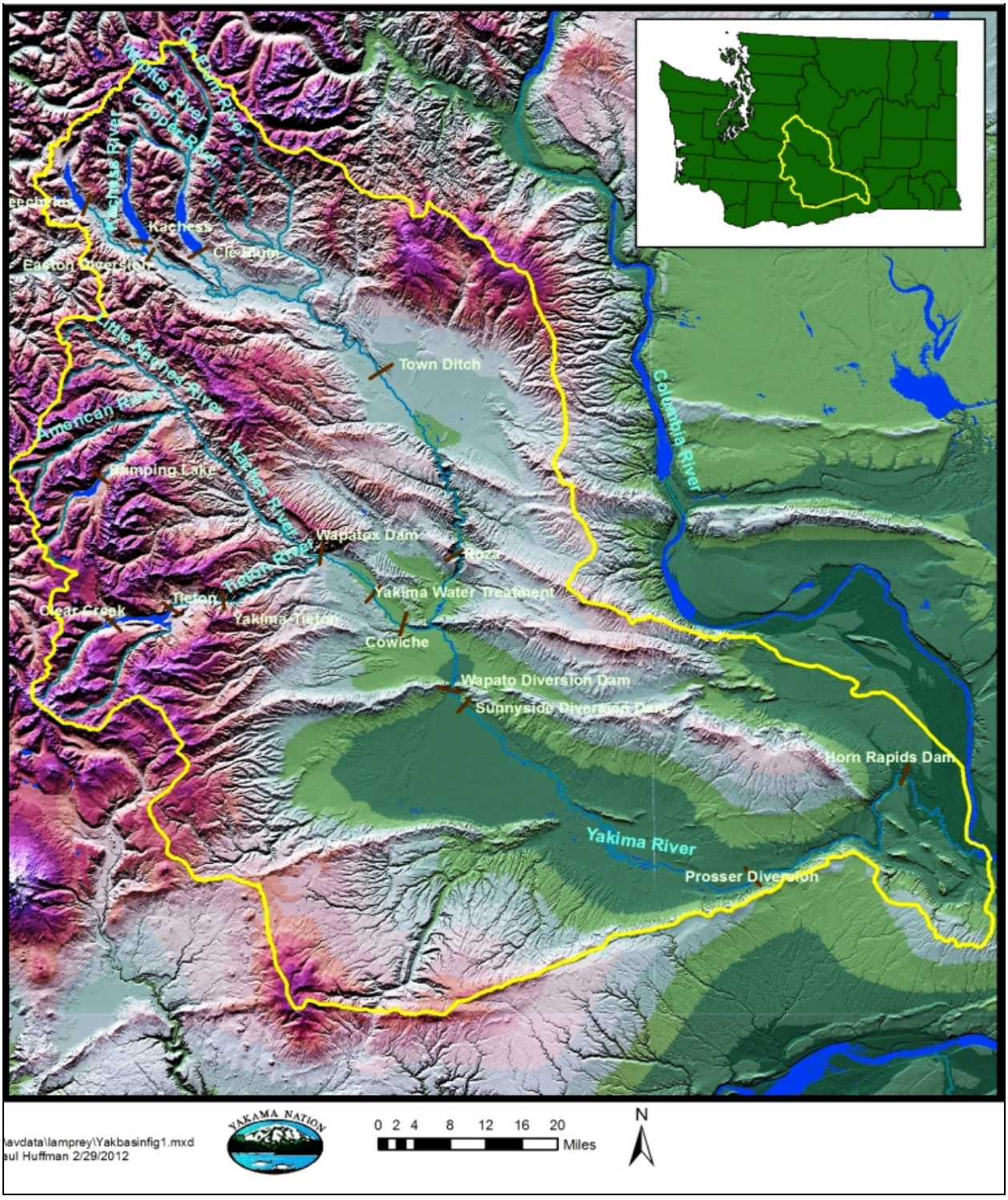

Figure 3. The Yakima River Basin and major irrigation facilities.

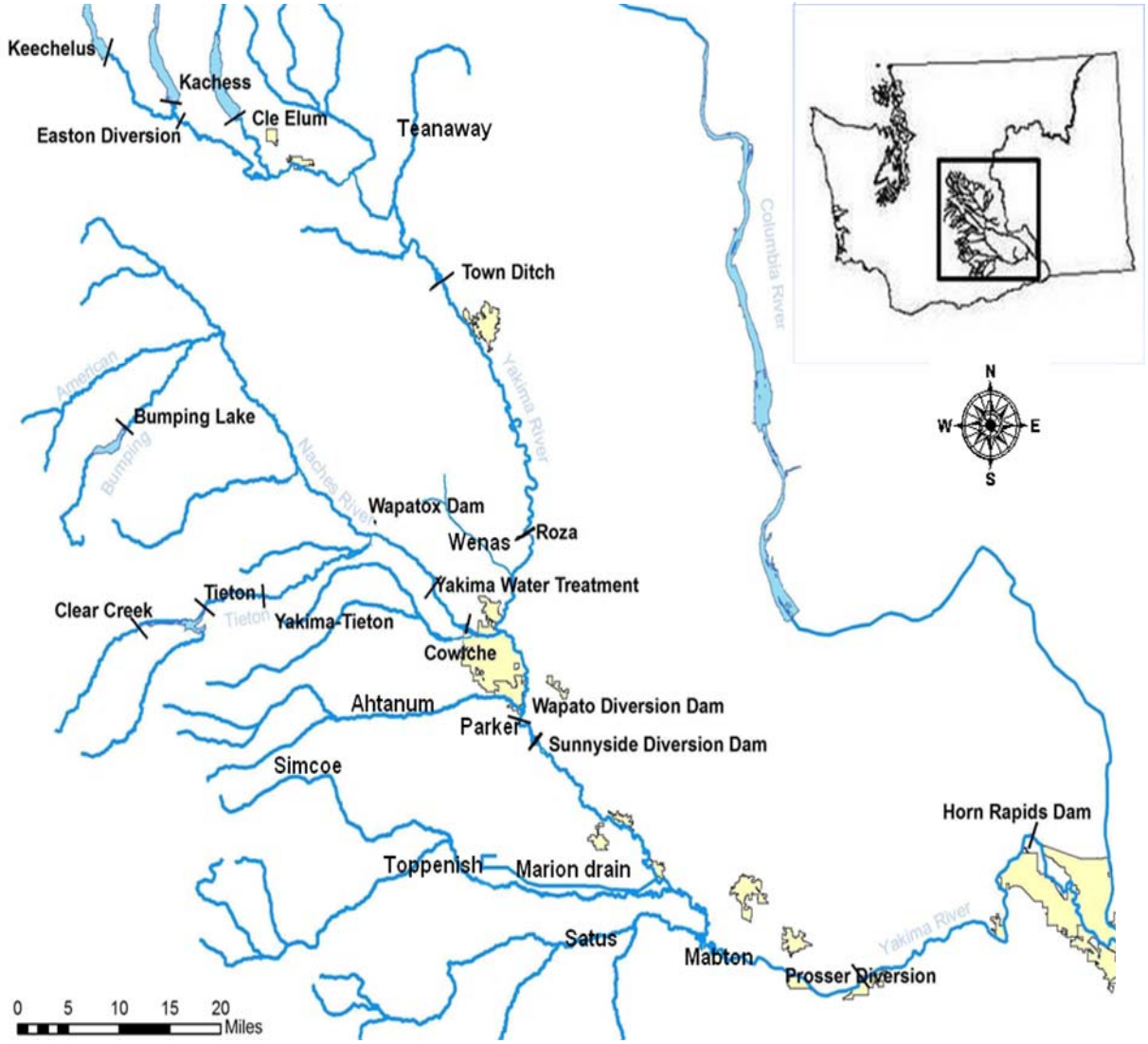

Figure 4. Schematic diagram of the Yakima River and major tributaries and irrigation facilities.

Tributary descriptions

For convenience, we have dissected the Yakima River Basin into five separate Analysis Units (AUs), each having distinct geo-physical and/or hydrologic properties. These AUs are briefly outlined below. Primary activities in 2010 occurred in the Lower Yakima and Satus Creek, although other areas were surveyed as well.

Upper Yakima – includes the Yakima River and tributaries above the confluence of the Naches and Yakima Rivers. Pacific lamprey are believed to be extirpated - or essentially extirpated from this area. No adults have been counted at the Roza Dam fish counting window. Plentiful habitat exists in this Analysis Unit, both spawning and rearing although river flow management may be a potential limiting factor. Recent WDFW surveys have also shown areas where lamprey are present, but these are all believed to be Western Brook. Naches– includes the Naches, Tieton, Bumping and American rivers, as well as their tributaries. Pacific lamprey are believed to currently occupy this Analysis Unit, but in very low numbers. Due to the periodic flashy flows, (primarily from the Tieton) and generally higher gradients and elevations, useable habitats, especially rearing are limited. The lower Naches River remains largely unconfined and braided and has the potential to provide good spawning and rearing habitats, although restoration actions would likely be needed to enhance the quality and quantity of these habitat-types.

Middle Yakima–includes the Yakima River and tributaries between Granger and the Yakima River/Naches River confluence. This Analysis Unit is designated due to its long, continuous and sinuous channel morphology that lends itself to prime rearing habitats and moderate river temperatures.

Lower Yakima– includes the mainstem Yakima River and tributaries (excluding Toppenish and Satus Creeks) between its confluence with the Columbia River and the community of Granger. This

Analysis Unit is designated due to the likelihood that water temperatures exceed tolerance of juvenile lamprey and offer little opportunity to contribute to overall basin productivity. Winter rearing is available although no lamprey were found throughout most of this AU during the 2010 presence/absence surveys.

Toppenish-Satus– includes Toppenish and Satus creeks and their tributaries. Each of these streams exist primarily on the Yakama Nation reservation, are relatively small and are locally degraded in places. However, with continuing restoration efforts (primarily salmonid), several stream reaches offer good opportunities for future high productivity and research.

METHODS

Methods 2010

Habitat Designation: Habitat characteristics that help describe juvenile lamprey habitat are defined as: Type I – suitable and preferred substrate of fines, soft organic sediment, particulate fine silt, sand, and clays mixtures. Type I habitats are often found in backwater areas or along the margins of larger pools. Type II – similar habitat but with larger contribution of gravels and smaller cobble. Type III – generally unsuitable juvenile habitat with a preponderance of hard substrates such as bedrock, hard clays, cobble or course gravels (Fodale 1999).

In 2010, the general focus for surveys was in the lower portion of the Yakima basin. A systematic survey was attempted where sample sites were generally randomly selected and equally spaced. Site locations were pre-determined using National Agriculture Imagery Photos at 1:24,000-scale aerial maps and GIS software. Sampling sites began from the confluence with the Columbia, spaced every four-river kilometer (RK) up to river kilometer 204. At each site a search by foot was done to find the first preferred larval habitat in Type I or II habitats (Hansen et al. 2003). The only exceptions to these criteria are when we could not get our sampling equipment through unsafe areas or not accessible from the road.

Sites with Type I or Type II habitats were surveyed. Once lamprey were found a 7.5-m^2 plot was delineated and "depletion pass protocols" were performed (consecutive samples collected at sites; e.g., Pajos and Weise 1994; Beamish Lowartz 1996; Harvey and Cowx 2003; Torgeson and Close 2004; Stone and Brandt 2005). The use of a backpack model Abp-2 electrofishing unit (Engineering Technical Services, University of Wisconsin, Madison, Wisconsin), in wade able (<0.1 meter in depth) waters. The electro fishing unit delivered 3 pulses per second (125 volts DC) at 25% duty cycle, with a 3:1 burst pulse train (three pulses on, one pulse off) to remove larvae. If larvae were present with the first 90 second depletion pass, two more passes were completed. Observation of presence was noted then stun pulsation slowed the larval enough for capture. If the larvae got away it was counted and marked undefined. Following collection, larvae were placed into a 1 liter bath of anaesthetize MS-222 at 50 mg/L (tricane methanesulfonate). Larvae were identified using Goodman & Lampman 2008 caudel ridge / pigmentation key with a 20X Nikon Field Microscope. Individual weights were taken using OHAUS Portable scale for each fish to the nearest 1/10 gram. Then placed into a recovery bucket, then returned to the river safely. The time spent at each site differed depending on presence and abundance of larval lamprey.

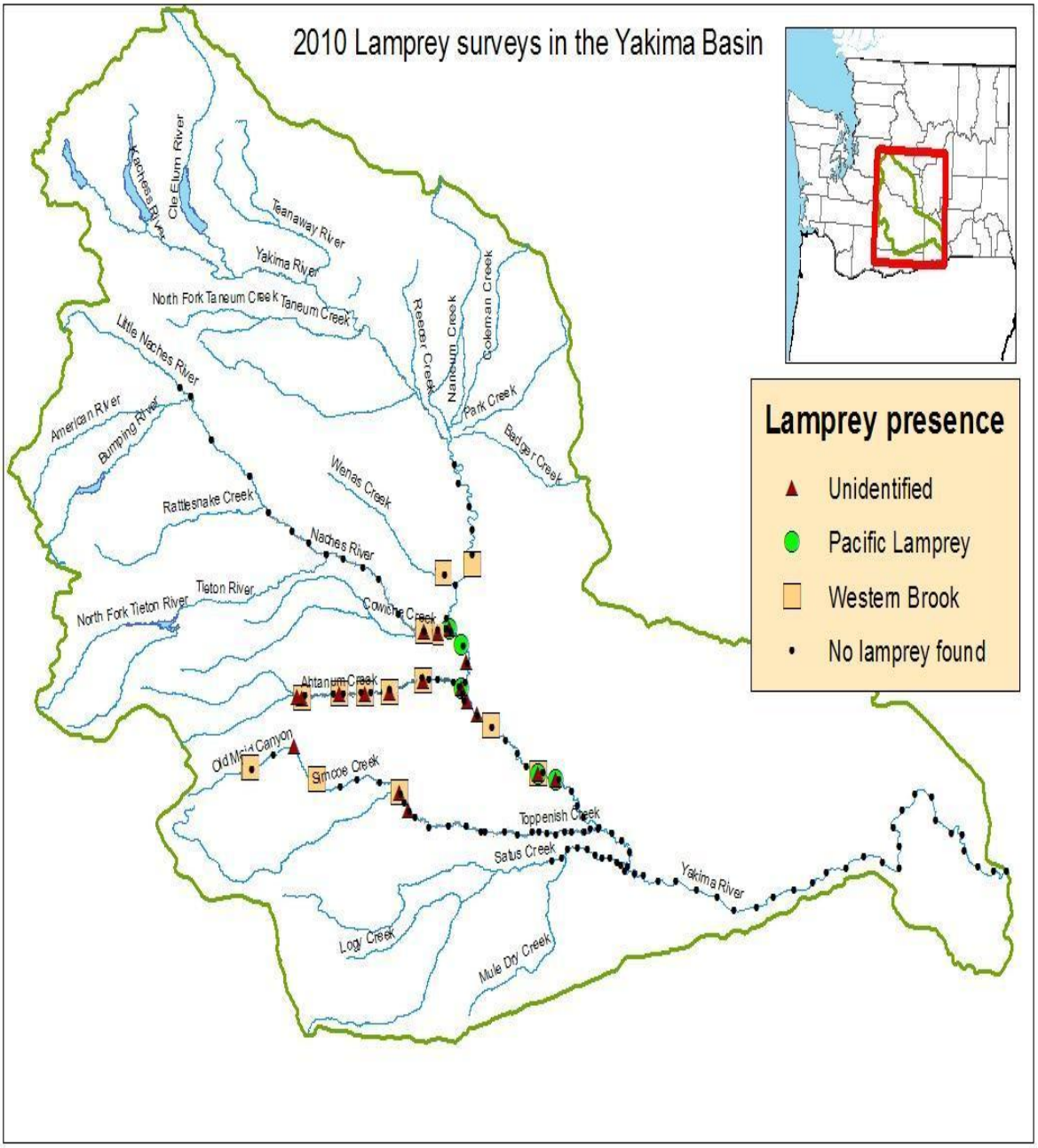

Figure 5. Juvenile Pacific lamprey survey points for 2010 field season.

RESULTS

Results from 2010 Surveys

In 2010, a total of 106 sites weresample beginning in June through December 2010. Figure 7 (below) illustrates where lamprey were found during this field season.

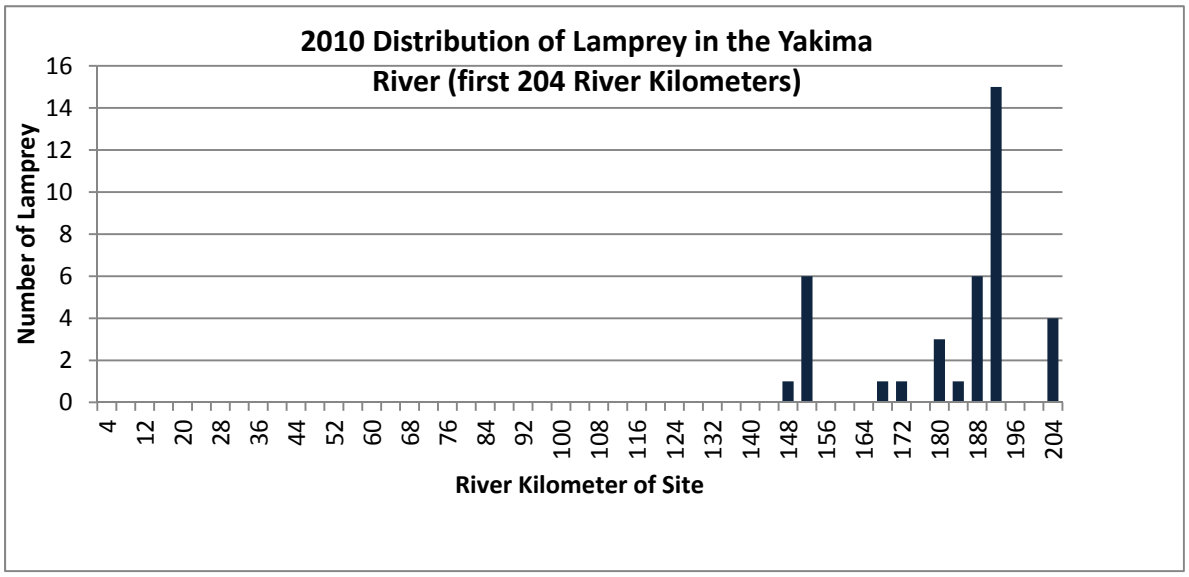

Figure 7 Distribution of larval lamprey in the Yakima River from 2010 surveys

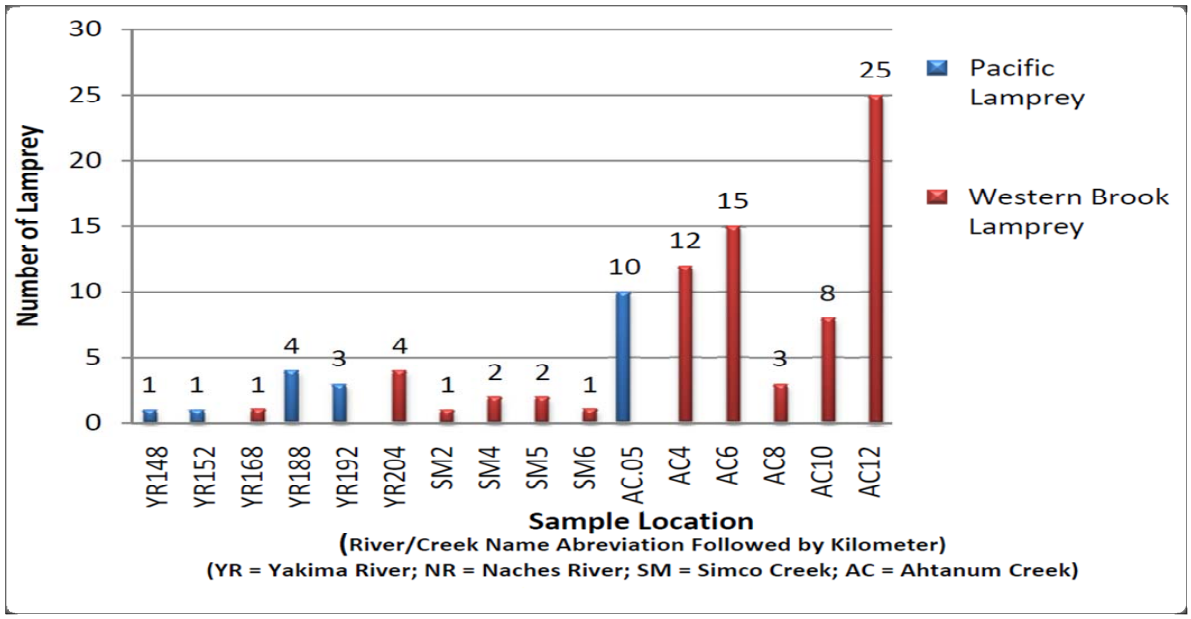

Figure 8. YN 2010 lamprey survey results, summarized by sampling locations.

In Toppenish / Simco creeks 21 sites were sampled; in Ahtanum Creek, 12 sites were sampled and in the Nachese River 14 sites were sampled. Tables 1, 2 and 3 (below) illustrate these findings. In Satus Creek, 12 sites were sampled but no lamprey were found in 2010.

Table 1 Summary of data collected from juvenile lamprey surveys in the Toppenish/Simco Creek.

Sample	Pacific lamprey	Western brook	Undefined YOY
Minimum Length (mm)	0	57	0
Average Length (mm)	0	77	0
Maximum Length (mm)	0	103	0
Minimum Weight (g)	0	0.35	0
Average Weight (g)	0	1.05	0
Maximum Weight (g)	0	1.83	0
Number Captured (n)	0	6	4

Table 2 Summary of data collected from juvenile lamprey surveys in the Ahtanum Creek.

Sample	Pacific lamprey	Western brook	Undefined YOY
Minimum Length (mm)	48	0.23	0
Average Length (mm)	55	82	0
Maximum Length (mm)	67	185	0
Minimum Weight (g)	0.28	0.23	0
Average Weight (g)	0.4	0.95	0
Maximum Weight (g)	0.64	3.64	0
Number Captured (n)	10	63	29

Table 3 Summary of data collected from juvenile lamprey surveys in the Naches River.

Sample	Pacific lamprey	Western brook	Undefined YOY
Minimum Length (mm)	0	0	0
Average Length (mm)	0	0	0
Maximum Length (mm)	0	0	0
Minimum Weight (g)	0	0	0
Average Weight (g)	0	0	0
Maximum Weight (g)	0	0	0
Number Captured (n)	0	0	204

DISCUSSION

As can be seen from Figures 5 , the Yakama Nation Pacific Lamprey Project (YNPLP) has "touched" a considerable amount of the lower Yakima River basin during the 2010 field surveys. . Our primary objective this year was simply to begin identifying areas (streams or reaches) where we *believe* Pacific lamprey are present and where we *believe* they are absent. We have not yet attempted to "quantify" either relative or absolute abundance at any spatial scale.

It is important to bear in mind these surveys are considered preliminary in nature. For example, we have little idea of the densities of juveniles anywhere within the basin, but density appears to be low throughout most of the basin. If this is true, it is likely that a particular survey may indicate no Pacific lamprey are present, when they actually could be. For this reason, we are not yet at a place to draw conclusions. However, drawing from our existing information, it is reasonable to speculate that:

- juvenile Pacific lamprey populations within the Yakima River are at very low abundance,
- the majority of Pacific lamprey juveniles to date are found within the "Wapato Reach" - or mid-section Yakima River (Granger to City of Yakima) with small local populations in a couple key tributaries of this Reach Cowichie and Ahtanum creeks),
- lower Yakima River appears to have juvenile populations that are so low, they are functionally, if not literally extirpated from these areas, and
- Western brook juveniles may be found at considerably higher abundance that Pacific lamprey.

These observations are supported by adult counts at both Prosser and at Roza Dam fish counting stations. At Prosser, very few adults have been counted since 2003. With counts numbering less than 10 adults passing Prosser, it seems entirely possible that spawning males and females may not be able to find each other, providing no contribution to the next generation. At the Roza fish counting station, no adults have been reported since operation began several years ago.

During 2010, the YNPLP worked closely with the BOR to initiate surveys in various irrigation canals within the Yakima basin. Results of these surveys are noted above in Tables 4, 5, 6, and 7. Indeed many juvenile lamprey were found behind fish screens (3/32 mesh - within compliance of salmonid criteria). It is not at all understood how these lamprey are getting through, or possibly, over these screens. Interestingly, multiple length classes are found. Work specific to thse surveys is summarized in Appendix A. This work will continue, in close coordination with BOR and other private irrigation districts over the next few years.

Over the next couple years, the YNPLP will work closely with the USFWS and other tribes towards the continueddevelopment of survey techniques that, hopefully, will provide statistical confidence in determination of "absence" and relative abundance within a given area. We believe this method will be similar to those recently employed, but will provide greater consistency amoungst various surveyers and intensity (greater survey area and greater survey time). It is conceivable that this same method will be very consistent with the collection of information needed to establish confidence in long-term status and trend, as well as gaining reasonable estimates of relative abundance, if not "absolute" abundance (at very local scales).

CONCLUSION

The completion of the 2010 field season provided the Yakama Nation Pacific Lamprey Project a first, overall glimpse of the state of Pacific lamprey within the Yakima River basin. In short, we be-

lieve it is reasonable to speculate, if not conclude that Pacific lamprey are essentially extirpated from this subbasin. We will continue surveys over the years to come, providing better information about this local population.

If this speculation / preliminary conclusion is valid, the obvious question is: "How do we go about recovery of Pacific lamprey in the Yakima River basin?" Indeed, the first step is to identify, as best we can the primary limiting factors affecting this species destined for or residing in the basin.

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APPENDIX A

Confederated Tribes and Bands of the Yakama Nation

Department of Natural Resources, Fisheries Resources Management Program

Yakama Nation Pacific Lamprey Restoration Project

Assessment of lamprey presence in irrigation diversions and canals in the Yakima Basin

Prepared for:

Bureau of Reclamation

Annual Update Preliminary Report

Prepared by:

Patrick Luke, Fisheries Biologist

Yakama Nation Fisheries Resource Management Program

4 Bickleton Hwy., / P. O. Box 314 Goldendale Washington 98620, USA

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Introduction

Historically, Pacific lamprey were found throughout much of the Columbia River Basin (Kan 1975; Hammond 1979; Vella et. al.1999). Populations have drastically decreased over the last 50 plus years due to a variety of factors, including but not limited to dam passage, habitat degradation, and potential entrainment of juveniles into irrigation diversion canals and ditches.

There are two species of lamprey in the Yakima subbasin. Pacific lamprey (*Entosphenus tridentatus)* is anadromous, their life cycle includes time in both the freshwater and the ocean environments. The second is the Western brook *Lampetra richardsoni*, a resident lamprey whose life cycle never leaves freshwaters. Unfortunately, resource managers know less about these species than most other fishes, both native and non-native within the basin. To the Yakama people Pacific lamprey have a long history of legends, of cultural importance as a staple, and for medicinal purposes.

Within the last few years, observations from regional biologists have indicated that tributary irrigation dams may create passage barriers for returning adults moving into headwater spawning areas and may also entrain juveniles into irrigation ditches as they migrate downstream. As a result, the Bureau of Reclamation (BOR) and the Yakama Nation (YN) are working together to evaluate potential issues associated with lamprey movement past irrigation diversions in the Yakima River Basin. For the purposes of this report, we focus primarily on potential issues associated with juvenile entrainment into diversion ditches and past existing fish screens.

Existing fish screens were design to keep salmonids and other larger fish from entering the irrigation canal systems. However, it is becoming increasingly evident that lamprey are getting behind some of these screens. Currently, there is no empirical information to indicate the magnitude of this potential issue. Studies by the YN within the Yakima River Basin over the past two years (2010 and 2011) were designed to be exploratory in nature, intended to simply identify, in a qualitative context, if lamprey were present in various canals. Much of this "presence / absence" information has been established and future surveys will be designed to address these issues in a more quantitative manner.

In 2010, the YN performed preliminary surveys in front and behind diversion screens at the Prosser/Chandler, Sunnyside, Wapato/NewRez, Selah/Moxee, and Roza irrigation diversions. The results indicated that larval lamprey were present behind some screens, which justified additional surveys to be conducted in the 2011 field season. These surveys were coordinated with YN and BOR staff during the dewatering events at each of the canals. The intent of these initial surveys is to obtain baseline information addressing two basic questions:

1. are juvenile lampreys found behind diversion screens, and if so,
2. which canals contain the greatest number of lamprey?

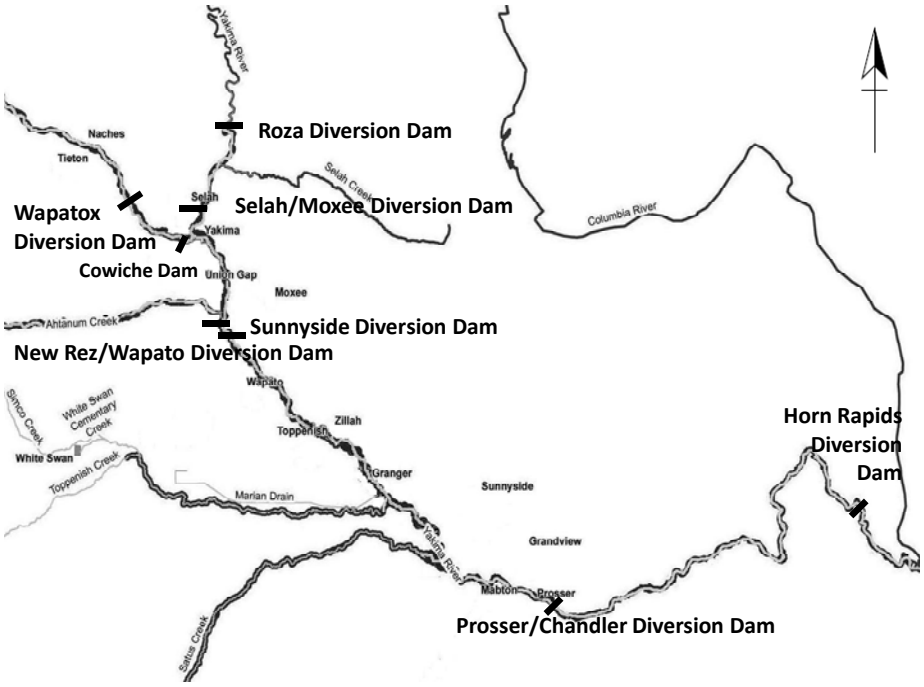
Over the next two or three years, the YN will continue to survey all major canal systems in the Yakima River Basin. These surveys will help determine relative abundance of lamprey in various canals, indicate size classes found, distribution throughout certain canals, and species composition.

Purpose and Scope

The purpose of these surveys is to determine the extent that juvenile lampreys are found behind the fish screens within various irrigation canals. Upon verifying presence, we are interested in 1) estimating how many lamprey are entering the canals each year, 2) understanding how lamprey distributed in the canals and 3) what age groups are present. Over the next few years, additional surveys will be performed to estimate the number of juvenile lamprey getting behind these screens and determining how they are getting behind these screens.

Study Area

Figure 1 displays the study area and major irrigation diversion dams in the lower Yakima River Basin.



Description of Sample Sites

Yakima River

- Horn Rapids (Wanawish) diversion is in Benton County at river mile 18 from the Columbia River.
- Prosser/Chandler diversion is in Benton County at river mile 47 from the Columbia River at Prosser, Washington. Chandler canal entrance is on the left bank of Prosser dam.
- Sunnyside Dam and diversion is location in Yakima County at river mile 103 on the left bank and the canal runs 60 miles eastward to Prosser.
- Wapato-Parker/New Rez diversion is located in Yakima County at river mile 104 upstream of Sunnyside diversion and is on the right bank approximately 1.4 miles southwest, and north-west of Parker.
- Selah/Moxee diversion is located in Yakima County, and the water is diverted from the mainstem Yakima near the township of Selah.
- Roza dam and diversion is located in the Yakima County at river mile 127.8 on the right bank about 10 miles north of Yakima.

Naches River

- Cowiche Creek diversion is located in Yakima County approximately 3.4 miles west-southwest of Yakima, and 6 miles west of Cowiche.
- Wapatox diversion is located in Yakima County about 7.4 miles upstream from the Yakima River and 0.5 miles below Tieton River near the township of Naches.

Methods and Materials

Surveys took place from late October to mid November for the 2010 season after coordinating with Bureau of Reclamation staff on planned dewatering periods. Roza, Selah/Moxee, Wapato, Sunnyside, Cowiche and Horn Rapids were sampled.

Initial locations of sampling sites were determined using Google earth software. Actual sample locations were modified based on "on the ground" conditions. Sampling at sites began from the down stream side working upstream insuring water would not be clouded during sampling. Type I habitats[1] were the preferred sampling locations. The only exceptions to these criteria were when we could not get sampling gear into some inaccessible areas (through steep inclines, large basalt boulders or fissures, and/or concrete gorges).

At each sample site, a 7.5-m2 plot was measured, and a backpack model Abp-2 specialized lamprey electrofishing unit (Engineering Technical Services, University of Wisconsin, Madison, Wisconsin) was used to determine if lamprey larvae were present. The electrofishing unit delivered 3 pulses per second (125 volts DC) at 25% duty cycle, with a 3:1 burst pulse train (three pulses on, one pulse off) to remove larvae. Surveys were done in water <0.1 meter in depth. If any lamprey were found during the first 90 second pass, we continued with two more 90 second samples consecutively. If more fish were found, electrofishing continued across the entire canal to initiate a fish salvage effort. Following collection random subsamples of larvae were anaesthetized in MS-222 at 50 mg/L (tricane methanesulfonate). Larvae were identifying using the caudal ridge / pigmentation assessment (Goodman et al. 2008) with a 20X Nikon Field Microscope. Our sampling effort concentrated on the capture of each fish observed, then placed into buckets, then into aerated coolers to be transported back into the mainstem of the Yakima River.

[1] Type I habitats are those containing significant portions of mud/sand mixture with detritus materials preferred for rearing juvenile lamprey.

Results

Field surveys observed juvenile lamprey above and below fish screens in various canals. A total of 526 lamprey were caught in front of the screens from various diversions and 1901 lamprey were caught behind the screens. Table 1 summarizes these results.

TABLE 1. - Number of lamprey caught at eight diversions during the 2010 field seasons (N=2,427).

Diversion	Front of Screens	Behind Screens
YAKIMA RIVER		
Horn Rapids	0	0
Prosser/Chandler	0	0
Sunnyside	0	1292
Wapato/New Rez.	325	358
Selah/Moxee	0	0
Roza	0	24
NACHES RIVER		
Cowiche	201	227

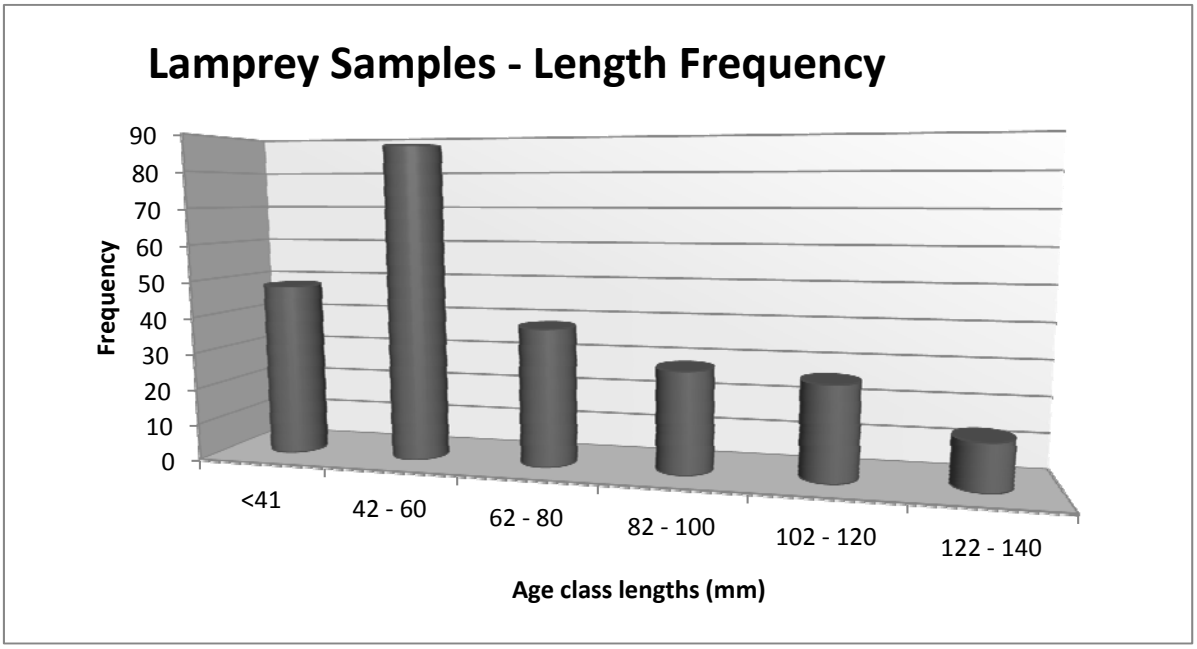
In 2010, most samples were taken near each of the fish screens within the various diversions.

Discussion

These initial surveys are the first completed during the annual dewatering of the these canals. These surveys are preliminary but indicate that lamprey are getting behind certain screens, although it is not yet clear how they are getting past the screens. Lamprey of various size classes are found in front and behind these screens, suggesting some lamprey actually survive the dewatering period and live in portions of the canal throughout the full year. Alternatively the screen system appears to allow multiple age classes to pass below, into the canal.

For example, in 2010, 240 length and weights measurements were taken from juveniles from the Wapato/NewRez sites. Figure 4 (below) illustrates the length classes that were found. This information clearly shows several age classes ranging from fish less than 40 mm (likely young of the year) to transforming individuals greater than 100 mm. The entire subsample of 240 individuals were identified as Western brook lamprey. There were no Pacific lamprey positively identified during the entire sampling time.

Figure 4 - Length Frequencies of juveniles lamprey found at diversion at Wapato/NewRez 2010.



One of the key problems is the difficulty to confidently determine species in the field. Determination between Pacific and Western brook lamprey at smaller size classes (approximately <50 mm or smaller) is extremely difficult. Genetic samples could be obtained to make this determination. Regardless of species, it is obvious that juvenile lamprey are getting behind diversion screens, warranting concern that entrainment of lamprey into these conveyance canals could be an issue in recovering Pacific lamprey populations in the Yakima River Basin. Our sampling approach was appropriate for establishing preliminary baseline data at this time. In future years additional studies will be conducted to (1) determine a better estimate of relative abundance and (2) the manner in which lamprey are entering into these canals.

Recommendations

1) Surveys should continue in future years to determine presence and relative abundance of juvenile lamprey and specific age classes found within all major canal systems in the Yakima River Basin. Given the substantial number of canals within the Yakima Basin and the overall extent of these systems, this will require greater efforts to obtain this important information in a timely manner.

2) Methods should be developed to determine how juvenile lamprey are entering into the canal system with a focus on identifying if, or how different age classes are moving past theses screens. It appears likely that lamprey are also overwintering in some of the canal systems. It is recommended that future surveys look at areas within the canals that contain water throughout the winter to evaluate this potential.

References

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