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Upper Columbia Spring Chinook and Steelhead Acclimation Project 2009-2014 Summary Report

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1.0 Background

The Upper Columbia Salmon and Steelhead Acclimation Project (UCSCSA; Project) is designed to provide additional acclimation opportunities for existing spring Chinook and steelhead hatchery mitigation programs in the Wenatchee and Methow basins. The Project uses natural ponds for short term acclimation to improve the efficacy of supplementation programs. Acclimation can improve the efficacy of supplementation programs by returning hatchery fish to available habitat where they may successfully spawn rather than returning to the location of the hatchery which often sees high densities of hatchery returns and reduced habitat quality.

The Tribal Restoration Plan (TRP) Wy-Kan-Ush-Mi Wa-Kish Wit (CRITFC 2014) is designed to 'put fish back in the rivers'. The TRP emphasizes strategies that rely on natural production and healthy river systems to restore anadromous fish production. For hatchery production programs this means releasing young salmon into areas where they can return as adults and help rebuild naturally spawning populations. The UCSCSA project helps support the goals of the TRP.

Acclimation can support effective supplementation programs through more than one mechanism: returning adult spawners to suitable habitat and through improved homing fidelity. Habitat where hatchery fish spawn has been shown to affect the reproductive success of the spawning hatchery fish (Williamson et al 2010), to such an extent that Williamson et al (2010) suggested that acclimating and releasing spring Chinook farther upstream in the Chiwawa River could result in a higher reproductive success. Similarly, within the Wenatchee Basin, hatchery spring Chinook which spawn in areas of high quality habitat (Little Wenatchee and White Rivers) and low spawner densities are have equal reproductive success as natural origin spawners (Ford et al. 2013).

1.1 Project History

The Project receives funding under the Columbia River Basin Fish Accords (MOA). The project began in 2009 with the first releases in 2010. Much of the efforts under this project to date have been focused on identifying and permitting acclimation sites, developing acclimation plans and working with hatchery program operators and managers to reprogram some production to UCSCSA acclimation sites.

Many of the early and current acclimated releases as part of this Project were intended to address questions identified by the local resource managers, such as: 1) How do hatchery smolts perform in natural ponds? 2) Is it possible to co-mingle more than one species? 3) Can the distribution of adult returns be affected by short term acclimation? 4) Does short term acclimation improve homing fidelity? And, 5) what is the appropriate number of fish to release from natural ponds based on the habitat capacity for adults?

This report documents the numbers, locations, and species of acclimated releases from 2010 through 2014 and juvenile survival metrics where available. This report also provides data to

address questions 1 and 2 above. Data collection is underway to answer question 3 and an approved study plan is in place to evaluate 4 and 5 (Appendix A).

2.0 Methods

2.1 Source of Project Fish

Juvenile salmon and steelhead were obtained through existing hatchery mitigation programs. Steelhead acclimated in the Wenatchee Basin were part of Chelan County Public Utility District (PUD) hatchery mitigation. These steelhead are reared at Eastbank Fish Hatchery on the Columbia River and are currently over-winter acclimated at the Chiwawa Acclimation Ponds prior to direct truck planting into Nason Creek and other locations. Unanimous approval by the Rock Island and Rocky Reach Habitat Compensation Plan Hatchery Committees (HCP HC) was required for Project implementation. The Rock Island and Rocky Reach HCP HCs are comprised of representatives from Chelan County PUD, Washington Department of Fish and Wildlife (WDFW), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), Colville Confederated Tribes (CCT) and Yakama Nation (YN).

Spring Chinook in the Methow Basin used in the Project were obtained from two sources, Winthrop National Fish Hatchery and Methow Fish Hatchery. Spring Chinook obtained from Methow Fish Hatchery required the approval of the Wells Dam HCP Hatchery Committee (Douglas County PUD, USFWS, NMFS, WDFW, CCT, and YN) and the approval of the Priest Rapids Salmon and Steelhead Settlement Agreement Coordinating Committee Hatchery Sub-Committee (PRCC HSC; Grant County PUD, USFWS, NMFS, WDFW, CCT, and YN).

2.2 Fish Transportation Procedures

At all acclimation sites pre-smolts are transported from their rearing facility in March or as soon as the acclimation site is ice free. Fish transport procedures include crowding and loading into distribution trucks via a fish pump. Water is tempered to within 3°C of the receiving waters prior to release into the ponds. Loading densities may range from 0.3 to 0.5 pounds of fish per gallon of water consistent with Integrated Hatchery Operations Team (IHOT) standards (IHOT 1995). In most cases the rearing facility provides transportation to the acclimation pond.

2.3 Fish Condition, Growth, and Health Monitoring

A pre-transfer fish health examination is conducted by the appropriate fish health staff associated with the rearing facility. Once in the pond, fish are monitored daily by YN staff for signs of disease symptoms (lethargic behavior, skin coloration, visible lesions, caudal fungus, etc.) through observation of feeding behavior and monitoring of daily mortality trends. Additionally staff collected data from a random sample of approximately 100 fish from each pond on a weekly basis. Weekly sampling included a general assessment of fish condition, visual assessment of smoltification, fish length and weight so that growth rates and condition factors could be documented.

2.4 Release

Smolts are released as close as possible to size targets, 15-18 fpp for spring Chinook and 6 fpp for steelhead. Acclimated smolts are volitionally released from the acclimation sites in late April to early May depending upon the species and acclimation site. Release typically begins when >90% of the acclimated group display visual signs of smoltification (identified by transitional and/or smolt stage), target fpp is met and releasing into favorable river conditions (high water events). All releases are truly volition, fish are not 'pushed' out of the pond.

2.5 Juvenile Survival Metrics

Beginning in 2011, each group of acclimated smolts were marked with 7000-10,000 PIT tags. When possible a similar number of PIT tags were applied to an on-station reference group. The PIT tags were used to measure in-pond survival, release-to-McNary Dam survival and tagging-to-McNary Dam survival. Tagging typically occurred in the winter prior to acclimation and release. Because tagging occurred before transfer, the tagging-to-McNary survival metric is inclusive of in-pond survival and downstream migratory survival. Since protection from predation in natural ponds is limited, we expect a slightly reduced in-pond survival metric when compared to an on-station release. Theoretically release to McNary -survival could be greater for acclimated release than non-acclimated releases, therefore a potentially higher in-pond mortality rate could be ameliorated at later live stages. We view the tagging-to-McNary metric the best overall gauge of juvenile survive and most appropriate for comparison between the acclimated releases and reference releases (on-station or direct plants).

Migratory survival metrics (tagging-to-McNary and release-to-McNary) are measured through PIT tag detection. Survival estimates for both tagging and release use Cormak-Jolly-Seber estimates with associated standard errors for both survival and detection probabilities (Columbia River DART).

2.6 Adult Survival and Homing Fidelity

At the time of this writing, the adult return data remains incomplete. Analysis of smolt-to-adult survival rates (SARs) and spawner distribution/homing fidelity will be provided in future reports.

2.7 Acclimation Sites and Species

Wenatchee Basin

Steelhead at Rohlfings Pond

Rohlfing's Pond is located on an unnamed seasonal creek which connects to the lower end of Mahar Creek before reaching Nason Creek at RK 20.3. The seasonal creek flows directly into the man-made earthen pond providing approximately 2 cfs of water during the spring months. Additionally there is a ground water supply consisting of an 8" well which was dug in 2003 and is estimated to produce 130 gpm. The existing pond was expanded in 2004 and again in 2009. The pond now measures approximately 90' long by 50' wide with an average depth of 6 ft. A

barrier net at the pond outlet is installed during the acclimation period to prevent premature downstream migration.

Steelhead were acclimated in Rohlfing's pond alongside coho salmon in 2010, 2011, and 2012.

Methow Basin

Spring Chinook in Spring Creek

Spring Chinook were acclimated in spring Creek alongside coho salmon during 2010-2013. Spring Creek is a waterway associated with the Winthrop National Fish Hatchery (WNFH) outfall. Spring Creek acclimation was not intended to result in improved homing fidelity or spawner distribution due to its close association with WNFH, rather Spring Creek provided the opportunity to look at growth and survival of spring Chinook when acclimated with coho salmon in a natural setting. For this location, detailed in-pond and on station growth is presented. The data collected in Spring Creek proved to be a necessary first step in the development of future acclimation proposals.

Spring Chinook in Wolf Creek Pond

Wolf Creek pond is located off of Wolf Creek which joins the Methow River at near RK 85.0. During 2010 and 2011 Methow Fish Hatchery (MFH) spring Chinook were acclimated in Wolf Creek Pond. Wolf Creek is located a half kilometer upstream of Methow FH. Due to the proximity of the Wolf Creek site to Methow MFH, Wolf Creek was not suited to address our goal of acclimating fish farther upstream in available habitat, rather Wolf Creek pond provided an opportunity to test the concept of acclimation, comparing survival rates to on-station releases. The data collected at Wolf Creek pond allowed this Project to pursue opportunities to acclimate additional fish as part of the MFH program.

Spring Chinook in Mid-Valley Pond (Heath Pond)

Mid-Valley pond is located at RK 88 on the Methow River. Mid-Valley pond is part of a series of large springs which originate in the Methow valley floor. The ponds were originally constructed to impound water for irrigation purposes. Habitat restoration efforts have since provided fish passage into and past the ponds. Acclimation occurs in the most downstream pond within the complex. A temporary seine net is used to contain fish within the pond while still allowing passage by other fish into the spring system.

3.0 Results and Discussion

3.1 Wenatchee Basin

Rohlfing's Pond

During 2010, 2011, and 2012, Rohlfing's Pond was used to acclimate juvenile steelhead (Chelan County PUD mitigation) which were reared at Eastbank Fish Hatchery and the Chiwawa Acclimation site. In the absence of this acclimation opportunity, CCPUD mitigation steelhead would have been trucked from the Chiwawa Acclimation Facility and directly planted into Nason Creek.

The first year of the program, 10,364 steelhead were acclimated in Rohlfing's Pond. Of the fish acclimated in Rohlfing's Pond in 2010, only 566 contained PIT tags. The fish transferred to Rohlfing's Pond were randomly selected from the overall mitigation program so did not contain any other unique marks.

During 2011 and 2012 the number of steelhead acclimated in Rohlfing's pond increased to 20,706 and 18,254 respectively. In 2011 the Project began PIT tagging steelhead so that juvenile and adult survival rates, and homing fidelity could be assessed. Numbers of PIT tagged fish can be found in Table 1.

During all years (2010-2012) steelhead were acclimated alongside coho salmon, however due to the large size difference in 2010 and 2011, the steelhead were segregated from the coho salmon with a seine net. In 2012 due to their small size, steelhead were co-mingled with coho salmon.

In all years steelhead were transported to the pond the third week of March and remained in the pond until the start of a volitional release in early May (Table 1).

Numbers of steelhead acclimated, transfer dates, release dates, size at transfer, and size at release can be found in Table 1.

Table 1. Acclimation Details for Rohlfing's Pond.

Release Year	Acclimation Site	Program	# Acclimated	Transfer Date	Release Date (volitional start)	Size at Transfer (FPP)	Size at Release (FPP)	PIT Tags
2010	Rohlfing's Pond	CPUD Steelhead	10,364	3/25/10	5/7/10	9.0	7.4	566
2011	Rohlfing's Pond	CPUD Steelhead	20,706	3/22/11	5/2/11	9.7	8.2	9856
2012	Rohlfing's Pond	CPUD Steelhead	18,254	3/20/15	5/15/12	27.9	19.7	9789

Figure 1 below shows juvenile survival rates for steelhead acclimated at Rohlfing's pond. Due to the low number of PIT tags in the pond in 2010, most juvenile survival metrics could not be calculated.

During 2011 and 2012, all juvenile survival metrics were calculated for the Rohlfing's Pond acclimated steelhead (note: survival to John Day Dam was used instead of survival to McNary Dam due to too few detections at McNary Dam). All juvenile survival rates were based on PIT tag detections at the pond outlet and downstream. In-pond survival for steelhead acclimated at Rohlfing's Pond was typically high (2010: 92.7%, 2011: 88.9%, 2012: 93.8%; Figure 1).

CCPUD Wenatchee River steelhead truck planted in Nason Creek were used as a reference group (Figure 1). Only release-to-John Day survival could be calculated for the reference group. When the reference steelhead were trucked from the hatchery facility to release locations, the tagging files were edited to reflect only those PIT tags loaded in the trucks. Because of the edits made to the tagging files a PIT tag based in-pond survival rate and a tagging-to-John Day survival rate could not be calculated (Figure 1).

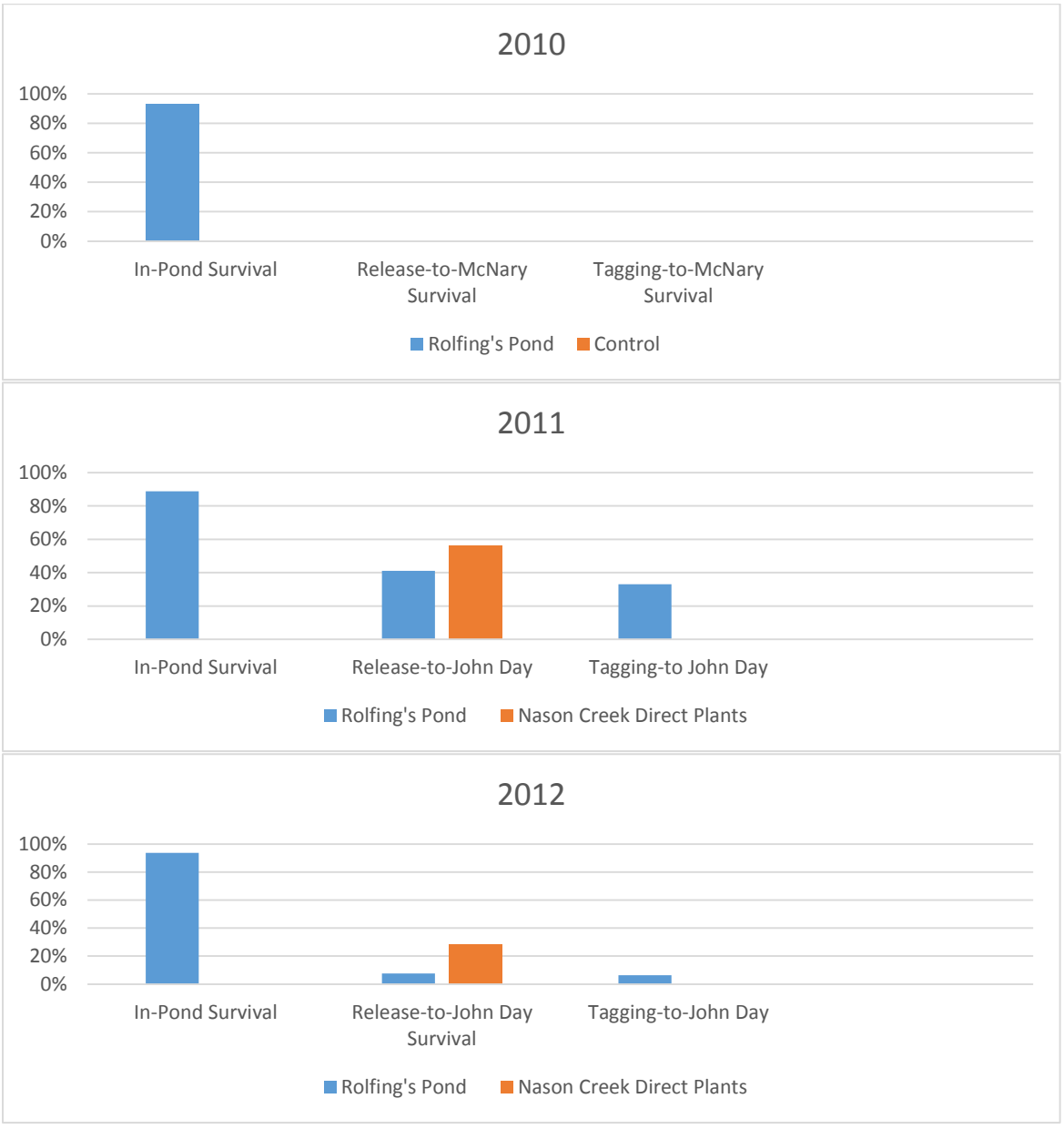


Figure 1. Juvenile survival metrics for Rohlfing's Pond, 2010-2012. Nason Creek direct plants are shown for reference. Note: 2010-no migratory survival rates due to lack of PIT tags; 2011& 2012 Release-to-John-Day was used as a downstream migratory survival index due to lack of detections at McNary Dam, no in-pond or tagging-to-John Day survival metrics available for reference groups because the tagging files were edited to represent only release detections.

In both 2011 and 2012 survival rates from release-to-John Day Dam were lower than the truck planted steelhead. We are unsure the reason in 2011, however the extremely small size of the steelhead acclimated in 2012 likely contributed to the reduced migratory survival and higher rates of residualism.

The main purpose of acclimating steelhead at Rohlfing's Pond is to increase homing fidelity to Nason Creek above what one would expect from direct planted fish with no acclimation. At the time of this writing the adult return data is not yet complete. A comparison of homing fidelity from the 2011 and 2012 releases will be provided in future reports. Due to the lack of a unique tag and the low number of PIT tags, adult data from the 2010 is limited.

3.2 Methow Basin

Spring Creek

Spring Creek has been used to acclimate coho salmon as part of the Mid-Columbia Coho reintroduction project. The purpose of acclimating spring Chinook in spring Creek (which is part of WNFH) was to directly compare growth and survival of Chinook co-acclimated with coho salmon (in Spring Creek) to those reared on-station. Any measurable detrimental effects of multi-species acclimation should be apparent in either reduced juvenile survival rates, reduced growth rates, or both. These data will be used to inform future decisions about how to make the best use of limited acclimation space for more than one species. Spring Chinook Acclimation details can be found in Table 2.

Table 2. Spring Creek acclimation details, 2010-2013.

Release Year	Acclimation Site	Program	# Acclimated	Transfer Date	Release Date (volitional start)	Size at Transfer (FPP)	Size at Release (FPP)
2010	Spring Creek	WNFH Spring Chinook	49,890	3/23/10	4/19/10	17.5	15.0
2011	Spring Creek	WNFH Spring Chinook	38,633	3/10/11	4/10/11	19.6	16.5
2012	Spring Creek	WNFH Spring Chinook	51,550	3/6/12	4/26/12	22.7	17.9
2013	Spring Creek	WNFH Spring Chinook	46,498	4/19/13	4/19/15	24.2	18.8

Comparing growth of spring Chinook co-acclimated with coho salmon, to Chinook reared on-station at Winthrop NFH was an important part of the evaluation to determine the feasibility of acclimating multiple species together. In 2010 and 2011 the spring Chinook transferred to Spring Creek were nearly identical in size to the fish remaining on station. Chinook were acclimated in Spring Creek grew at the same rate as those on-station. Final release sizes of both groups were also the same, 15.0 fpp in 2010 and 16 fpp in 2011 (Figures 2 and 3).

During 2012 and 2013 the fish we received in the acclimation pond were smaller than those remaining on-station, complicating the growth evaluation (Figures 4 and 5). In 2012, the fish transferred to the acclimation pond measured 23.7 fish per pound (fpp) and obtain a final size at release of 17.7 fpp for a total change of 6.0 fpp during the acclimation period. During this same time, the on-station release grew from 19.1 fpp to 15.2 fpp (a change of 3.9 fpp). Even though WNFH was able to release the on-station group at a slightly larger size, the Spring Creek acclimated group grew more. We observed the opposite trend in 2013. Again the fish transferred to Spring Creek were smaller than those that remained on-station but the growth we measured during acclimation (change in size of 5.4 fpp; Figure 5) was less than observed in the on-station group (change in size of 7.9 fpp; Figure 5).

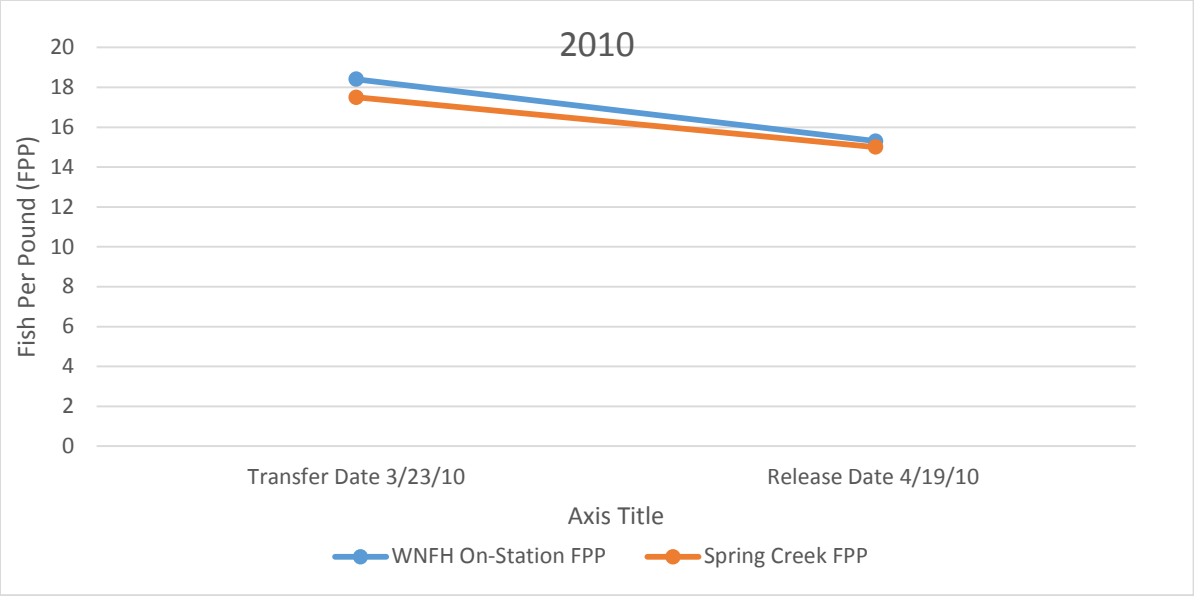


Figure 2. Size (fish per pound) of spring Chinook in Spring Creek and WNFH at the time of transfer and at release, 2010.

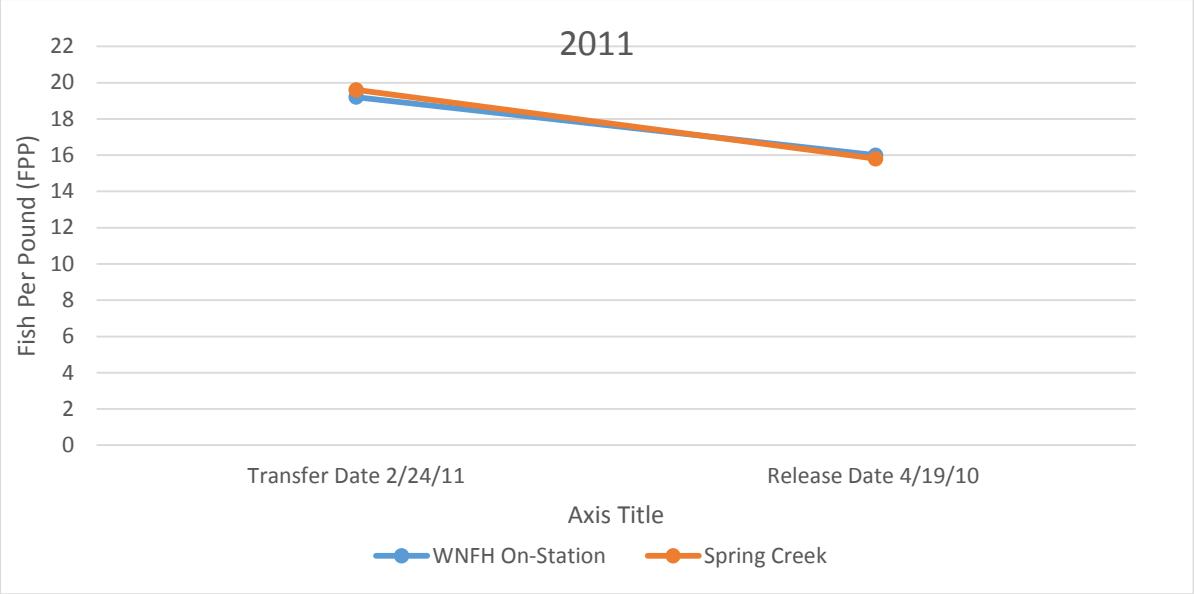


Figure 3. Size (fish per pound) of spring Chinook in Spring Creek and WNFH at the time of transfer and at release, 2011.

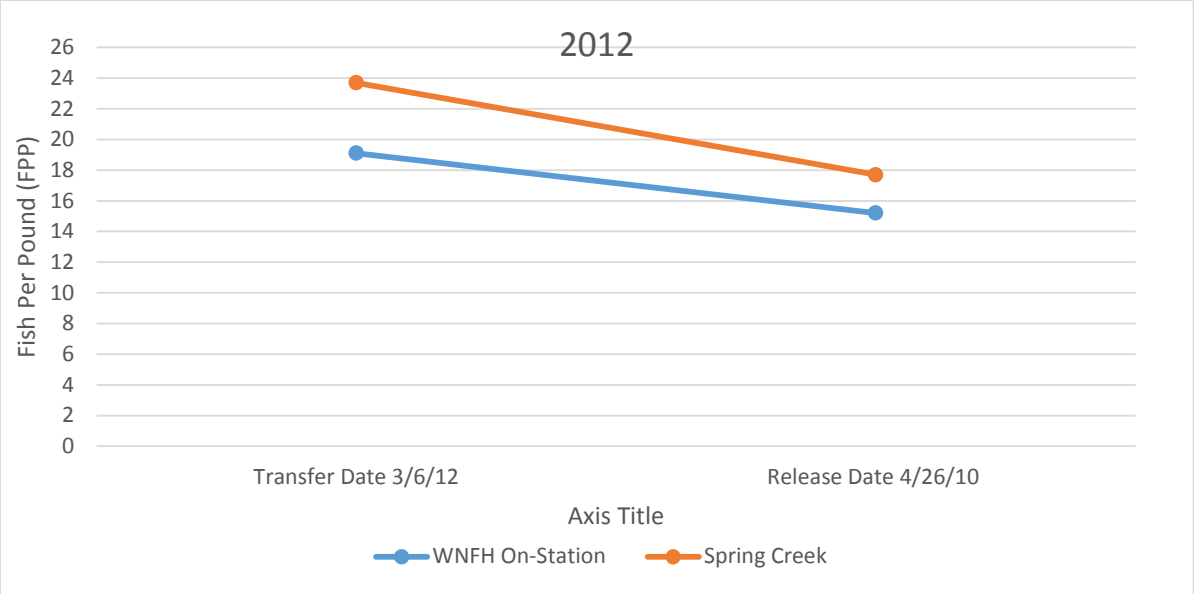


Figure 4. Size (fish per pound) of spring Chinook in Spring Creek and WNFH at the time of transfer and at release, 2012.

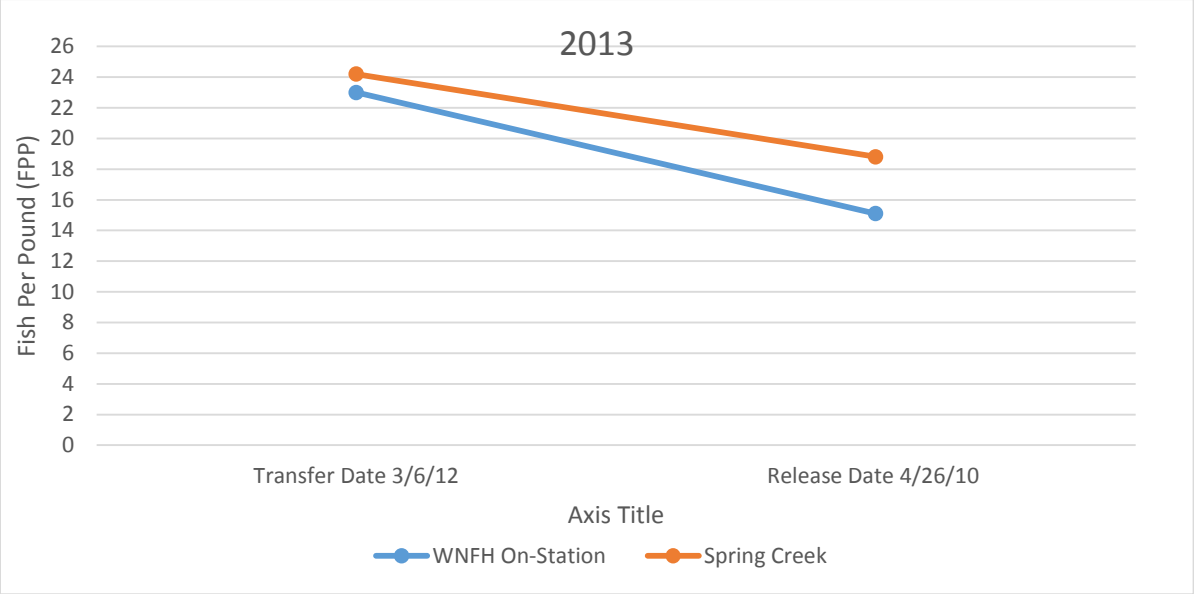


Figure 5. Size (fish per pound) of spring Chinook in Spring Creek and WNFH at the time of transfer and at release, 2013.

In addition to in-pond growth, a comparison of juvenile survival metrics were calculated and compared between the Spring Creek acclimated Spring Chinook and the on-station releases (Figure 6).

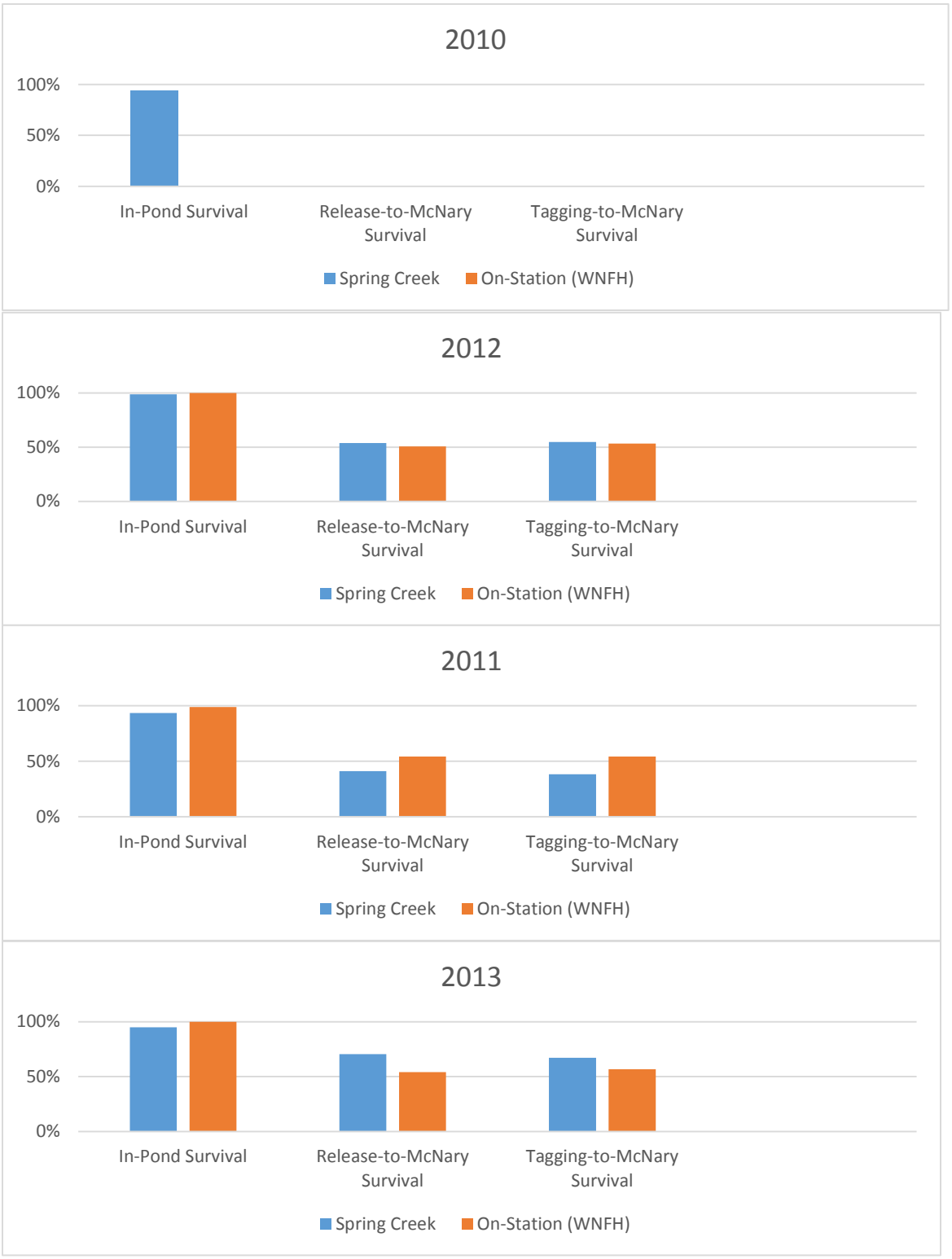


Figure 6. Juvenile survival rates for spring Chinook acclimated at Spring Creek. Survival rates for the Winthrop NFH on-station release is provided for reference, 2010-2013 (note: no PIT tags in 2010).

In-pond survival for spring Chinook in Spring Creek was slightly lower than the on-station releases. Because natural acclimation sites have limited protection from predation, a slightly lower in-pond survival is not uncommon (Figure 6; reference data not available for 2010). Release-to-McNary and tagging-to-McNary survivals were higher for the on-station releases release in 2011 but were higher for the acclimated releases in 2012 and 2013.

Although growth rates of Chinook in the Spring Creek acclimation site were slightly lower than those of the on-station release, a difference in downstream juvenile survival rates was not observed. We believe that the data collected at the Spring Creek site was sufficient to indicate that spring Chinook could be co-acclimated with coho salmon without negative results. Acclimation of Chinook at the Spring Creek site was discontinued after 2013.

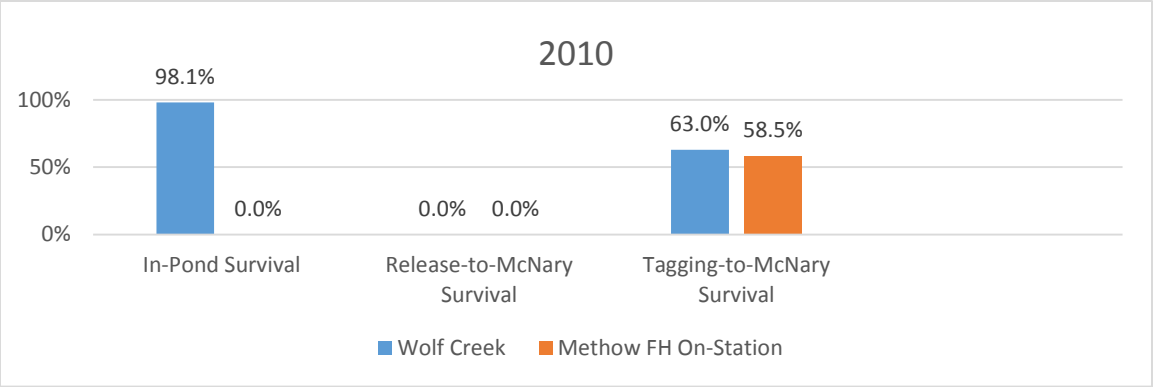
Wolf Creek Pond

We acclimated spring Chinook (GCPUD mitigation from Methow FH) in Wolf Creek Pond during 2010 and 2011. During the first year of operation we acclimated 25,591 smolts, increasing the number to 59,890 in 2011 (Table 3)

Table 3. Acclimation details for Wolf Creek Pond, 2010 and 2011.

Release Year	Acclimation Site	Program	# Acclimated	Transfer Date	Release Date (volitional start)	Size at Transfer (FPP)	Size at Release (FPP)
2010	Wolf Creek	GCPUD Spring Chinook	25,591	3/26/10	4/18/10	18.0	14.4
2011	Wolf Creek	GCPUD Spring Chinook	59,980	3/31/11	4/19/11	18.2	17.4

In-pond survival rates at Wolf Creek were similar to the Methow Fish Hatchery on-station releases. There was no consistent difference in tagging-to-McNary survival between acclimated and on-station releases (Figure 7). Overall acclimation and release from Wolf Creek pond was successful. While the close proximity of Wolf Creek to the Methow FH did not meet YNs goals of encouraging natural origin spawners to migrate farther upstream to areas with lower hatchery



fish spawner densities and available habitat, the data from the Wolf Creek releases provided the HCP Hatchery Committee with the information needed to approve additional releases farther upstream.

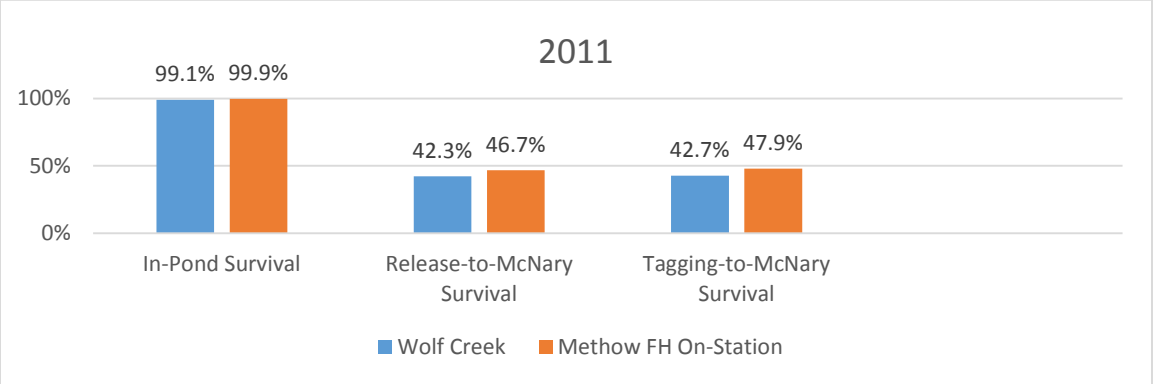


Figure 7. Juvenile survival metrics for Wolf Creek Pond spring Chinook, 2010 & 2011. Survival rates for Methow FH spring Chinook are provided for reference. Note: No outlet detections systems were in-place in 2010 for calculating in-pond survival and Release-to-McNary survival. 2010 Wolf Creek in-pond survival was calculated based on visual estimates of predation and recovered mortalities rather than PIT tags.

Mid-Valley Pond

In 2010, the Wolf Creek release (Methow FH) was moved approximately 3 KM upstream to the Mid-Valley pond. We continued to acclimate over 50,000 spring Chinook from Methow FH in 2012 and 2013. Due the HCP mitigation recalculation, the overall Methow FH spring Chinook production decreased significantly from 550,000 to 134,000 smolts in 2014. Due to the overall reduction in program size, the HCP HC approved a reduced number of smolts for acclimation at Mid-Valley Pond in 2014 (Table 4).

Table 4. Acclimation details for Mid-Valley Pond, 2012-2014.

Release Year	Acclimation Site	Program	# Acclimated	Transfer Date	Release Date (volitional start)	Size at Transfer (FPP)	Size at Release (FPP)
2012	Mid-Valley Pond	GCPUD Spring Chinook	51,151	3/27/12	4/23/12	20.0	16.6
2013	Mid-Valley Pond	GCPUD Spring Chinook	55,519	3/19/13	4/12/13	19.5	15.1
2014	Mid-Valley Pond	GCPUD Spring Chinook	22,039	3/19/14	4/21/14	20.0	15.1

As is expected in natural ponds, the in-pond survival at Mid-Valley pond was slightly lower than the on-station releases. Mid-Valley pond is a large open pond, and in our experience these larger ponds can be subject to increasing numbers of avian predators. In each year of operation the in-pond survival declined. In 2014 the in-pond survival reached a low value of 70.9%. We believe that this low survival was exacerbated by the reduction in the number of fish in the pond. Our predator observations indicated that the number of predators observed in 2013 and 2014 was similar. With similar numbers of predators in the pond in both years, we assume the total number of losses to predators was also similar between years but with only half the number of fish in the pond the proportion of fish lost to predation increased.

In-part, due to the reduced in-pond survival and in-part due to the location of the pond and new ponds farther upstream becoming available, the releases at Mid-Valley pond were discontinued in 2015. Future acclimated releases of Methow FH spring Chinook will occur at the newly developed Goat Wall pond. Goat Wall pond meets the long term goals of the Yakama Nation and provides a better evaluation of how acclimation can affect spawner distribution (Appendix A).

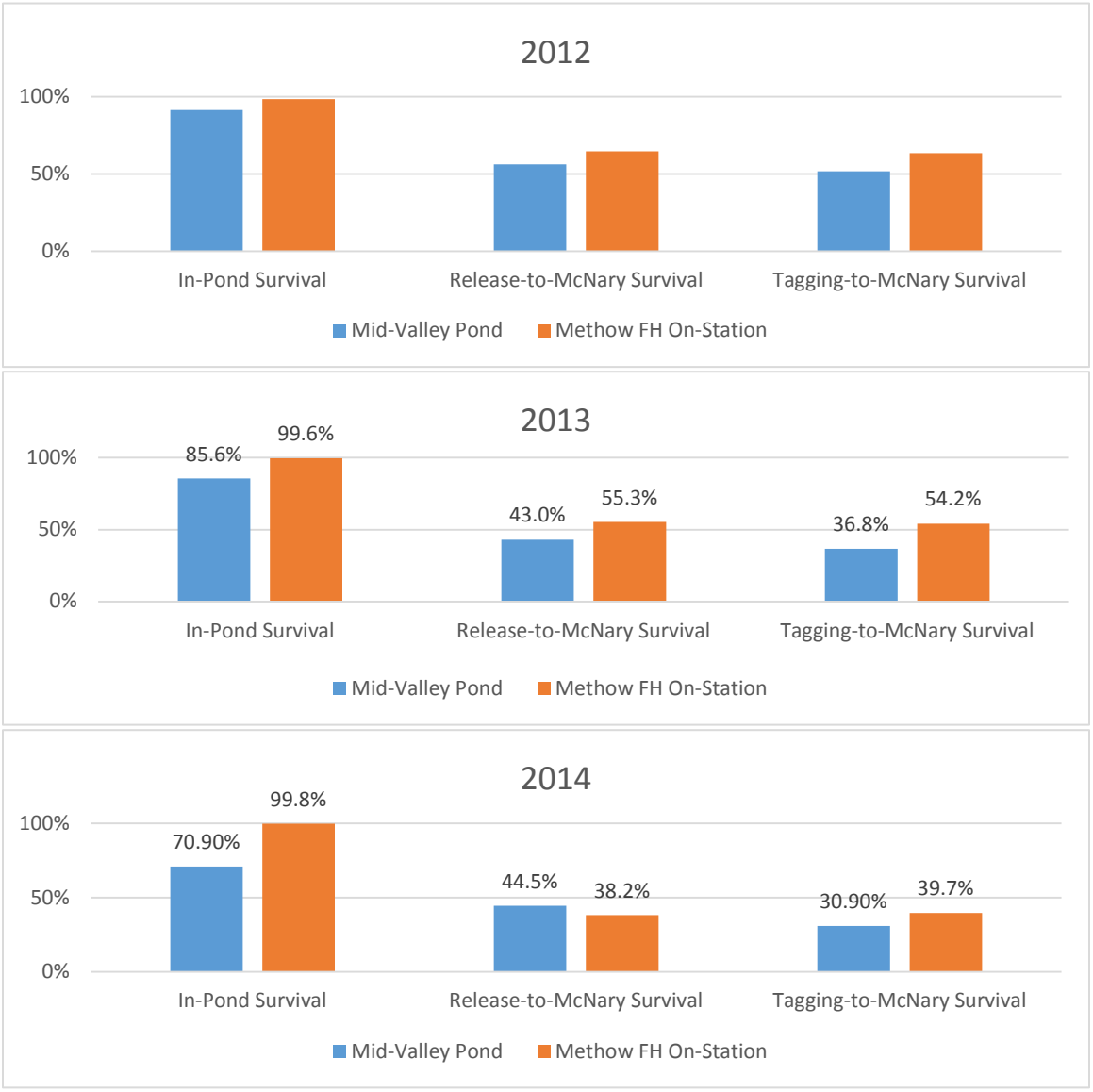


Figure 8. Juvenile survival metrics for Mid-Valley Pond acclimated spring Chinook 2012-2014. Survival rates for Methow FH spring Chinook are provided for reference

4.0 Conclusions

The first four years of project implementation (2010-2014) focused on identifying potential acclimation sites, and testing the concept of both multi-species acclimation and single species acclimation. During this time period we demonstrated that multi-species acclimation is a viable option, increasing acclimation opportunities for more than one species. We also demonstrated that natural acclimation sites can provide juvenile survival rates similar to that of on-station releases. The data collected during the last four years has provided the agencies which oversee the implementation of existing hatchery programs (USFWS, CCPUD, DCPUD, GCPUD, WDFW, YN, CCT, and NMFS) the necessary information to approve the transfer of mitigation fish to UCSCSA project ponds. We believe these first four years were successful and are continuing to identify, develop and permit ponds in key habitat areas to achieve YN's goals of returning fish to habitats where they belong.

5.0 Acknowledgements

We are thankful to the many people involved in the Upper Columbia Spring Chinook and Steelhead Acclimation Project. Bonneville Power Administration funded the project; Roy Beaty administered the funding and contracting. Tom Scribner, project manager, provided program oversight and direction. Tim Jeffries and Rick Alford provided oversight and management of the daily operation of the acclimation ponds, data collection, and data management. We would also like to thank WDFW, USFWS, Chelan County PUD, Douglas County PUD, Grant County PUD, the HCP Hatchery Committees, and the PRCC Hatchery Sub-Committee for their willingness to use mitigation program hatchery fish in this Project.

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Appendix A

Upper Methow Spring Chinook Acclimation Plan

Upper Methow Spring Chinook Acclimation Proposal

Upper Columbia Spring Chinook and Steelhead Acclimation Project (BPA Project #200900100)

4 March 2015

Prepared by Keely Murdoch, Yakama Nation Fisheries Resource Management

1.0 Background

1.1 YN's Expanded Acclimation Project

YN's Upper Columbia Spring Chinook and Steelhead Acclimation Project (BPA Project #2009-00-001) is based on the premise that acclimating salmon and steelhead in a manner that mimics natural systems can increase the effectiveness of integrated (conservation) hatchery programs by enhancing homing of adult fish to target reaches and can be used to improve the Viable Salmonid Population (VSP) status of ESA listed spring Chinook and steelhead.

The Columbia River Basin Fish Accords (MOA) recognize that hatchery actions can provide important benefits to ESA listed species. This Project seeks to improve the efficacy of current supplementation programs by providing additional short-term acclimation sites to enhance homing of adult salmon to identified reaches, which may contribute to improved productivity and survival.

The concept of acclimating salmon smolts in 'natural' ponds has been thoroughly tested over the last decade as part of YN's coho restoration project in the Wenatchee and Methow Rivers. The coho restoration project has demonstrated both high survival rates (juvenile and adults) as well as adult returns with SARs comparable or higher than established supplementation programs in the Upper Columbia (YN 2010). The success of YN's coho restoration project in the Wenatchee and Methow basins has also demonstrated that short-term acclimation will attract fish back to the areas where they were released rather than the hatchery facility where they were raised, effectively changing the spawner distribution (Kamphaus et al., 2013)

Beginning in 2014, as a result of the HCP No-Net-Impact (NNI) recalculation, spring Chinook smolt release numbers from most conservation hatchery programs in the Methow and Wenatchee basins were significantly reduced. Because of this reduction, we believe it is crucially important that each program be operated in a manner that maximizes efficacy of the supplementation effort by acclimating and releasing smolts in locations where they will return to high quality spawning and rearing habitat.

1.2 Methow Spring Chinook

Spring Chinook that are released from the Methow FH and WNFH have a spawning distribution significantly different than that of natural origin fish (Figure 1; Murdoch et al., 2011).

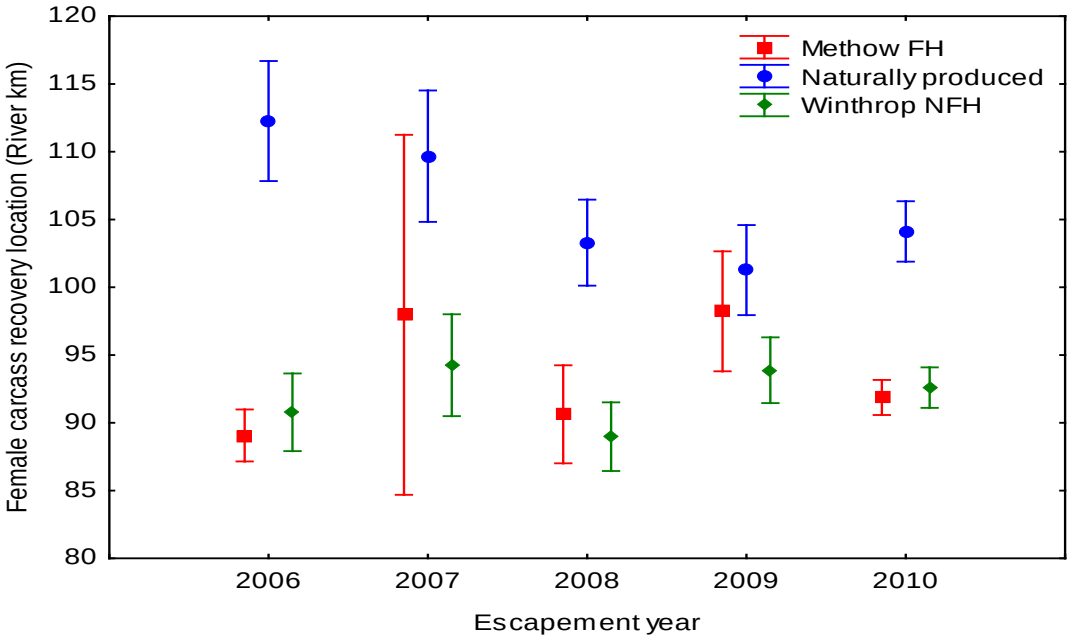


Figure 1. Mean spawner distribution based on female carcass recovery of hatchery and natural origin spring Chinook in the Methow River (Murdoch et al., 2011).

Similarly, the most recent data (2006-2013) indicates the average spawn distribution for Hatchery Origin fish released from the Methow Fish Hatchery is rkm 92 compared to rkm 104 for natural origin fish (Snow et al., 2014).

The difference in proportional spawner distribution (2005-2013) within each origin by upper, middle, and lower reaches for spring Chinook in the Methow River is further illustrated in Figure 2. Figure 2. does not depict spawner composition by reach, rather the proportional distribution of hatchery and natural origin spawners respectively. Figure 2 clearly illustrates that proportionately greater hatchery fish spawn in the lowermost reaches while proportionately greater natural origin fish spawn in the upper most reaches.

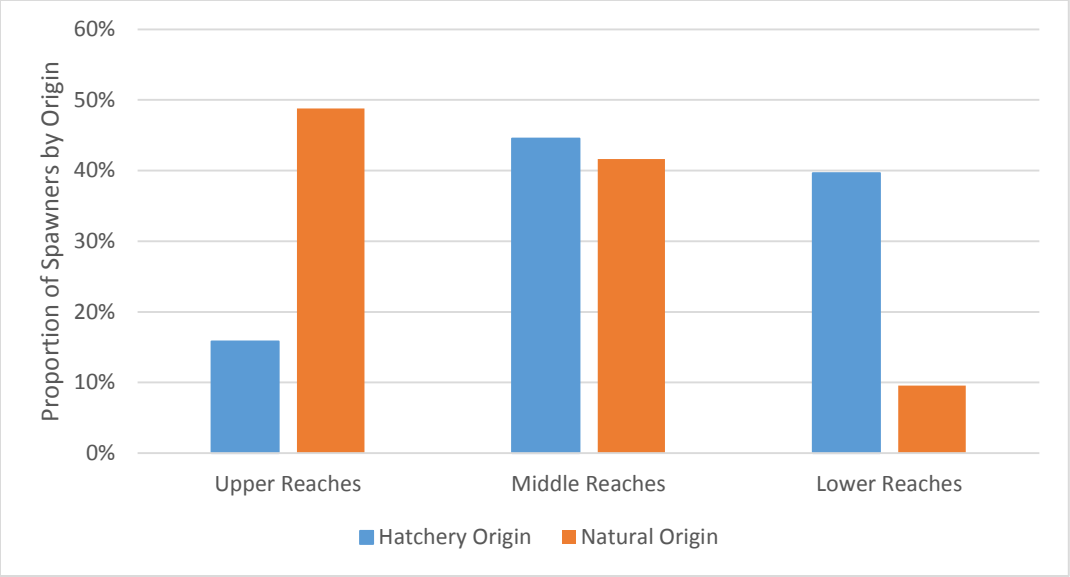
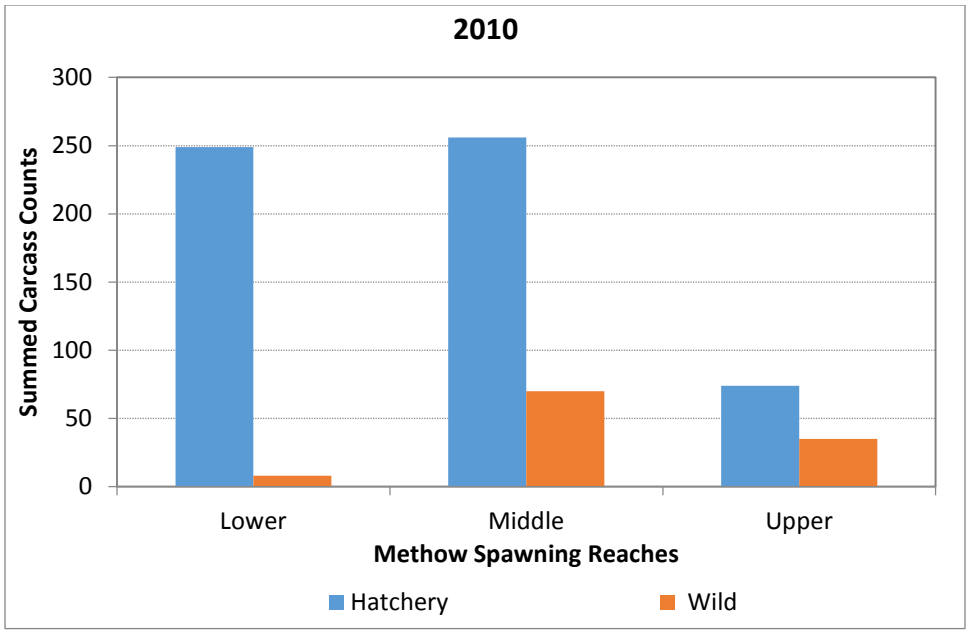


Figure 2. Spawning distribution of hatchery and natural origin spring Chinook in the Methow River as measured by female carcass recovery location (Upper Reaches = M11-M15 including the Lost River and Early Winters Creek, Middle Reaches = M8-M10 including Hancock Springs, Lower Reaches = M4-M7 including the hatchery outfalls and Wolf Creek; Data extracted 2005-2013 annual reports).

The skewed spawning distribution along with high densities of hatchery fish could be a contributing factor to the low productivity observed in the Methow River. We believe that the difference in spawner distribution can be directly attributed to hatchery spring Chinook imprinting and homing to Winthrop NFH (Rkm 81) and Methow FH (Rkm 85) from which the fish are reared and released. Figure 3 shows the numeric representation of hatchery and wild carcasses in each survey reach of the Methow River. Hatchery fish outnumber wild fish in each spawning reach. Moving forward in 2015 and beyond, densities of hatchery origin fish on the spawning grounds should be reduced through a significant reduction in release numbers and may be reduced by adult management; however without some method to attract adult returns to the uppermost reaches we do not expect the spawner distribution to change. Therefore, additional spawners may be desired in reaches that are underutilized by spawners.


2010
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Summed Carcass Counts
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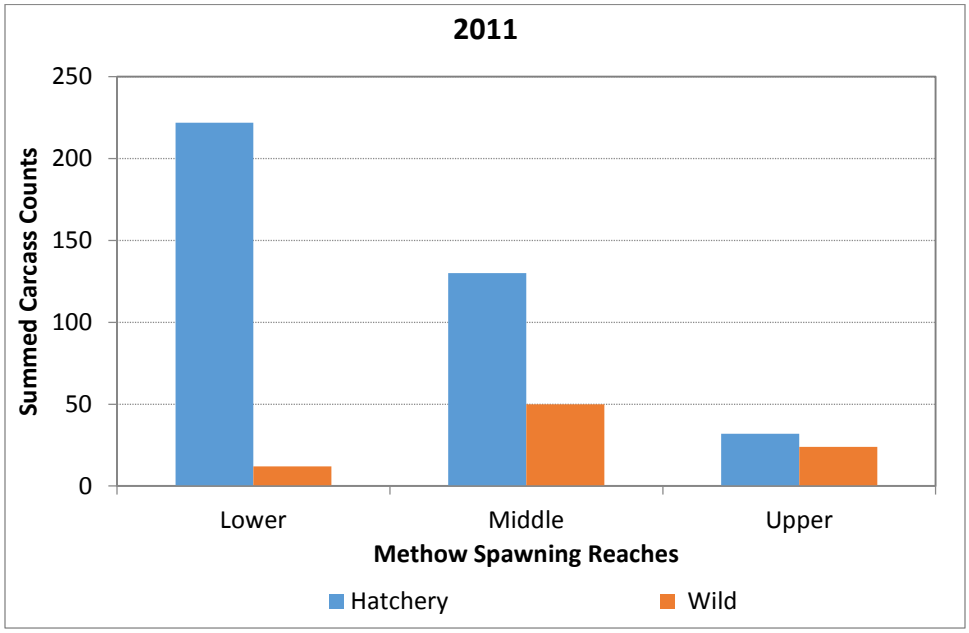
Methow Spawning Reaches
Hatchery
Wild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Methow Spawning Reaches
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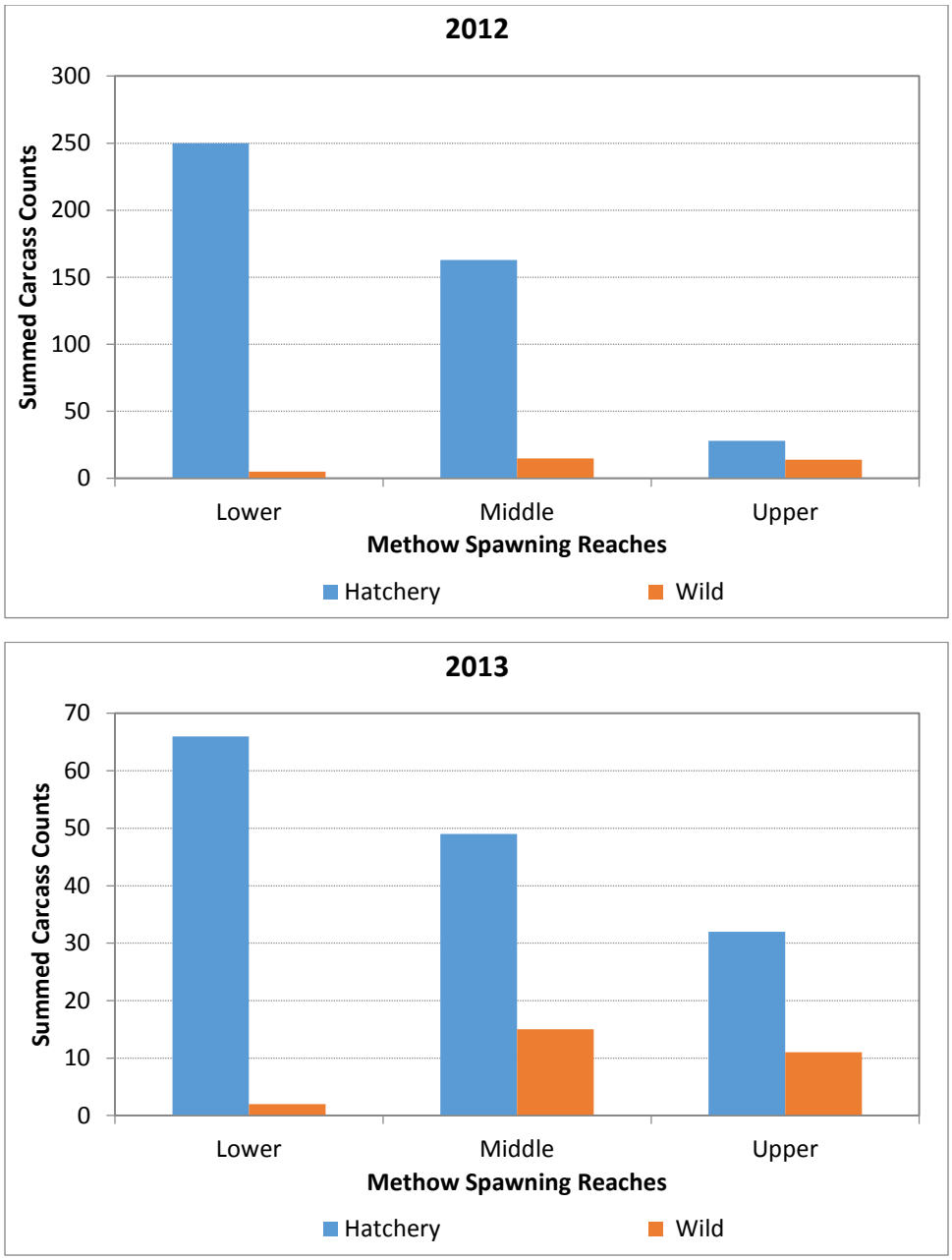

Figure 3. Number of hatchery and wild origin carcasses in Methow River survey reaches in 2010-2013. Reaches are different sizes and contain varying amounts of spawning habitat. (Upper Reaches = M11-M15 including the Lost River and Early Winters Creek, Middle Reaches = M8-M10 including Hancock Springs, Lower Reaches = M4-M7 including the hatchery outfalls and Wolf Creek)

The fundamental assumption behind supplementation is that hatchery fish returning to the spawning grounds are 'reproductively similar' to naturally produced fish; inherent in the supplementation strategy is that conservation hatchery fish released from acclimation ponds and naturally produced fish are intended to spawn together and in similar locations. If supplemented fish are not fully integrated into the naturally produced spawning population, the goals of supplementation may not be achieved (Hays et al., 2007). For this reason,

Objective 5 within the Monitoring and Evaluation plan for PUD Hatchery Programs (Hillman et al., 2013) is focused on evaluating if hatchery and natural origin fish have similar run timing, spawn timing, and spawning distribution, or are meeting management expectations.

Despite reductions in release numbers of spring Chinook and steelhead from CCPUD, DCPUD, and GCPUD supplementation programs (in 2014), we have no reason to expect a change in the distribution of hatchery origin spawners, only the number of spawners on the spawning grounds. We believe that the future spawning distribution of hatchery fish will not change unless changes under the forthcoming release reductions, but that incorporating a remote acclimation release strategy will enhance homing of hatchery fish to desired reaches.

2.0 Goals and Objectives

The long-term measure of success would be realizing similar spawning distributions of conservation hatchery origin spring Chinook and natural origin returns, as assessed by Objective 5 in the Monitoring and Evaluation Plan for PUD Hatchery Programs (Hillman et al., 2013).

However a release of 25,000 acclimated spring Chinook may be insufficient to shift the overall spawner distribution of hatchery fish in the Methow basin since most (81%) of the Methow FH conservation program smolts will be released directly from the hatchery.

Rather, we view this as a research proposal to answer critical uncertainties surrounding acclimation, and homing fidelity under the new management paradigm, which will operate under pHOS/PNI targets and is expected to incorporate removal of hatchery fish through adult management practices.

With this proposal we will address the following short term objectives:

1) To determine if conservation hatchery fish spawner distribution can be altered through short –term spring acclimation in the Upper Methow basin.

Success for objective 1 will be a measureable change in spawning location for acclimated hatchery fish compared to hatchery fish released from Methow FH (See Data Analysis for details).

2) To determine what proportion of acclimated hatchery fish home back to Methow FH and are collected during adult management activities

There is no success or failure metric for Objective 2. Rather hatchery return rate data will be used to develop any future acclimation plans (beyond this proposal) and will be used to determine appropriate release numbers of spring Chinook in the upper Methow such that we do not exceed PNI/PHOS targets through an in ability to attract fish back to the hatchery (See Adaptive Management for details).

3) To compare project performance indicators (tagging-Rocky Reach/McNary survival, SARs) between acclimated and non-acclimated releases.

We consider success for Objective 3 to be either no change or an increase in survival rates for acclimated releases compared to non-acclimated releases (See Data Analysis and Adaptive Management for details).

3.0 Project Proposal

To encourage hatchery origin spring Chinook adults to distribute (and spawn) farther upstream than fish released from Methow Fish Hatchery the YN proposes to acclimate 25,000 Chinook pre-smolts from Methow Fish Hatchery at YN's Goat Wall acclimation site (Figure 4) beginning in spring 2016 and extended for five years.

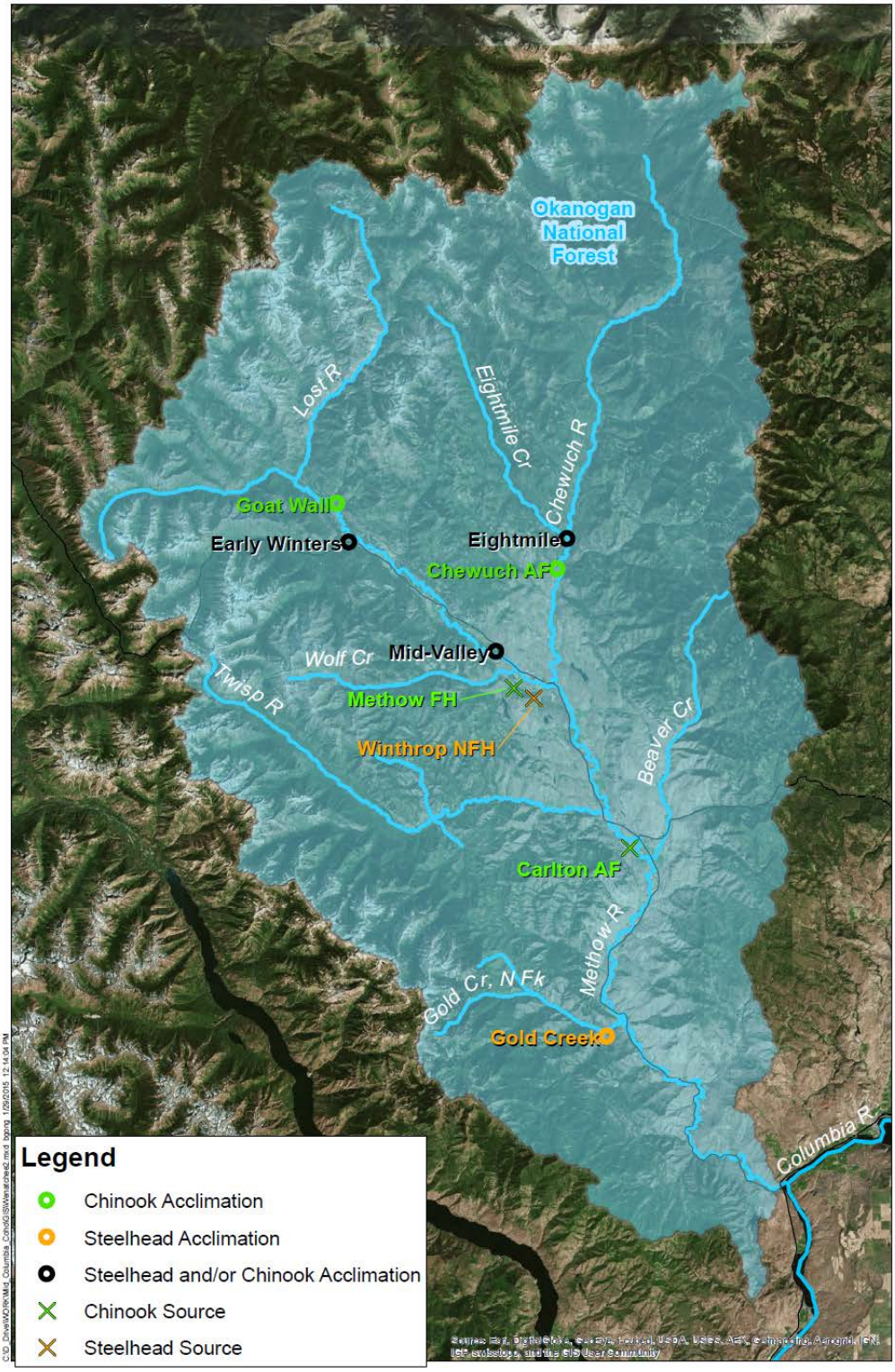

Figure 4. Locations of the Goat Wall Acclimation site relative to Methow Fish Hatchery, Winthrop NFH and other potential acclimations sites in the Methow Basin.

3.1 Upper Methow Release Numbers

Appropriate release numbers in the Upper Methow should be driven by spawner carrying capacity, estimated wild fish abundance, and available habitat. Reach based estimates of carrying capacity do not exist in the Methow basin, but could be estimated from basin-wide carrying capacity estimates. Mackey (2014), estimated the Methow Basin spawner Capacity (Ksp) to be either 2,962 spawners (Ricker S-R model 1992-2006) or 2,173 (Ricker S-R model 95th quantile; 1992-2006). Other estimates have ranged from a high of 4,077 (Fisher) to a low value of 782 (Mullen et al., 1992).

Recovery Criteria for spring Chinook in the Methow Basin requires a minimum abundance of 2,000 natural origin spawners (12-year geo-mean) for delisting. Using the delisting criteria as a minimum escapement target and the current distribution of NOR spawners in the Methow River, we can estimate a minimum number of spawners which may be appropriate for the Upper Methow River (Table 1; as defined as reaches M11-M15, including the Lost River and early Winters Creek). The mean NOR spawner abundance in the upper Methow River (reaches M11-M15, including the Lost River and Early Winters Creek) for years 2005-2013 has been 89 (Table 1). A minimum target number of hatchery origin spawners in the upper Methow River could then be 405 (minimum abundance goal based on delisting criteria– average NOR abundance; 837-185 =652) which is far greater than the expected return from this acclimated release, leading us to believe that spawner capacity exists in the reaches near the proposed acclimation site.

Table 1. Mean number of NOR spawners in Upper Methow River and minimum additional spawners required to reach abundance target.

Reaches	Mean number NOR spawners (2005-2013)	Current Proportion of NOR spawners (2005-2013)	Estimated Minimum Spawner Abundance Needed	Additional Spawners Required for Minimum Abundance
Upper Methow Reaches (M11-15, Lost River, Early Winters)	89	20.2%	405	316
Middle Methow Reaches (M8-10, Hancock Springs)	96	21.8%	436	340
Lower Methow Reaches (M4-M7, Wolf Creek, Hatchery Outfalls)	17	3.9%	79	62
Combined Methow River Reaches	203	45.9%	919	716
Chewuch River	164	36.6%	731	567
Twisp River	76	17.4%	349	273
Combined Methow Basin	**441**	**100%**	**2000**	**1559**

While suitable spawning space exists, this project will be implemented in such a manner as to increase the spawning escapement in the upper Methow River while working within the permit required sliding scale of pHOS or PNI. In a typical year, a release of 25,000 smolts from Goat Wall pond would yield 88 adult returns (Table 2) back to the basin (with no adult removal); with adult removal this number could be markedly reduced.

Table 2. Anticipated number of returning spring Chinook adults from a release size of 25,000 at the Goat Wall Site. Acclimation Pond based on minimum, mean, and maximum SARs observed at Methow FH for brood years 2000-2007 (Snow et al. 2014).

Target Number of Smolts	Anticipated Number of Adults Returned		
	Maximum SAR	Mean SAR	Minimum SAR
Upper Methow: Goat Wall Pond (25,000)	203 (0.81%)	88(0.35%)	28 (0.11%)

3.2 Goat Wall Acclimation Site

The Goat Wall acclimation site is accessed through privately owned property and consists of a watered slough located downstream from the Lost River. Water to the pond is supplied through a diversion on Gate Creek and through natural groundwater seepage (Cold Creek). A temporary seine net system would be used to contain hatchery spring Chinook during the acclimation period. The Lost River Rd provides access to the site and is plowed during the winter. The site measures 0.08 acres (30' x 110') and is approximately 9500 cu ft. We have observed the cfs ranging from 3.85 cfs (in May 2011) up to 11.6 cfs (July 2014). Regular flow monitoring is scheduled to occur during the spring of 2015. The site has a capacity to hold up to 30,000 fish at 16 fish per pound at densities less than 0.06 lbs/cu ft/in

3.2.1 Fish Transportation Procedures

Spring Chinook pre-smolts would be transported in March (preferably by WDFW tanker truck) from Methow FH to the Goat Wall location. Current fish-transport procedures include crowding and loading into distribution trucks via a fish pump. Water will be tempered as appropriate. Fish are tempered to within 3°C of the receiving water prior to release. Loading densities may range from 0.3 to 0.5 pounds of fish per gallon of water consistent with IHOT standards.

3.2.2 Fish Condition, Growth, and Health Monitoring

A pre-transfer fish health examination will be conducted by WDFW fish health specialists. Once in the acclimation site, fish will be monitored daily by staff for signs of disease symptoms (lethargic behavior, skin coloration, visible lesions, caudal fungus, etc.) through visual observations, feeding behavior and monitoring of daily mortality trends. Additionally, staff will collect data from a random sample of approximately 100 fish on a weekly basis. Weekly sampling will include a general assessment of fish condition, stage of smoltification, fish length and fish weight so that growth rates and condition factors maybe be assessed. A fish health specialist will be contacted if any disease symptoms are noted. If required, YN staff under the direction of the fish health specialist will provide treatment for disease.

3.2.3Release

Spring Chinook would be released as close as possible to the agreed upon size target (15 fpp). Targets are subject to change at the discretion of the HCP and PRCC Hatchery Committees. Spring Chinook will be volitionally released from the acclimation site by removing the barrier

net mid-to-late April. Release typically begins when > 90% of the acclimated group is displaying visual signs of smoltification (identified by transitional and/or smolt stage), target fpp is met and releasing into favorable river conditions (high water events). The release will truly be volitional; no fish will be pushed out of the pond. Our experience with spring Chinook in natural ponds indicates that they leave the pond within 7-10 days of removing the barrier net.

4.0 Adult Return Rates and Adult Management

Historic adult return rates from the Methow Fish Hatchery can be found in Table 2 below.

Table 3. Brood year, number of smolts released, adult returns, and SAR (%) from the Methow Fish Hatchery (data source: Snow et al. 2012).

Brood Year	Smolt Released	Adult Returns	SAR (%)
1996	202,947	500	0.246
1997	332.,484	821	0.247
1998	435,670	2300	0.528
1999	180,775	145	0.080
2000	266,392	852	0.320
2001	130,787	508	0.388
2002	181,235	599	0.331
2003	48,831	57	0.117
2004	65,146	316	0.485
2005	156,633	328	0.209
2006	211,717	1,714	0.810
2007	119,407	515	0.431
Mean	**194,335**	**721**	**0.349**

Based on the mean SARs (%) from previous releases, we would expect an average of 88 adults to return to the Methow River from a release of 25,000 smolts (Table 3).

The historic SARs for hatchery fish (Table 3) along with historic estimates of natural origin spawners in the Methow River can be used to provide a retrospective analysis of what we may be able to expect for PNI and pHOS metrics given the release of 25,000 in the Upper Methow River and assuming no adult removal. This retrospective analysis provides insight into what PNI values could be in the future (Table 4). Based on this analysis, it is clear that even in the absence of adult management, numbers of fish proposed for acclimation in the upper Methow River alone will not result in exceedance of the sliding scale of allowable pHOS presented in the DRAFT Methow Spring Chinook Section 10 Permit (NMFS, In Prep). However, it is unrealistic to expect that fish released as part of this project would be the only fish on the spawning grounds. Similarly, it is also unrealistic to expect that spring Chinook released from this project would not be attracted back to the Methow FH and would not be removed in adult management activities.

Table 4. Forecast of adult returns and PNI using a retrospective analysis of SARs and NOR spawning escapement. This analysis assumes ALL returning hatchery fish spawn in the Methow River and are NOT removed during adult management activities.

Return Year	NORS		Hatchery SAR[a]	Hypothetical Hatchery Return	Hypothetical Proportion of Run		Target Basin-wide PHOS[b]	PNI (pNOB = 1)	PNI (pNOB = 0.75)
	Basin Total	Methow			Hatchery	Natural			
2000	950	611	0.0032	80	0.12	0.91	0.2	0.89	0.87
2001	1832	594	0.0039	98	0.14	0.89	0.1	0.88	0.84
2002	345	86	0.0033	83	0.49	0.39	0.4	0.67	0.60
2003	58	8	0.0012	30	0.79	0.29	Anything	0.56	0.48
2004	488	199	0.0043	123	0.38	0.71	0.4	0.72	0.66
2005	527	221	0.0021	53	0.19	0.69	0.3	0.84	0.80
2006	328	128	0.0033	30	0.39	0.61	0.4	0.72	0.66
2007	266	152	0.0012	30	0.16	0.84	Anything	0.86	0.82
2008	298	172	0.0049	123	0.42	0.59	Anything	0.72	0.64
2009	564	261	0.0021	53	0.17	0.83	0.3	0.86	0.82
2010	601	290	0.0081	203	0.41	0.59	0.3	0.71	0.65
2011	961	432	0.0043	108	0.20	0.85	Anything	0.83	0.79
Mean	**602**	**262**	**0.0035**	**89**	**0.32**	**0.68**		**0.77**	**0.69**

a. For the purposes of this exercise hatchery SARs were matched with return year NORs based on a 4-year age class return

b. Green shading represents pHOS values with those allowed in the Draft Methow Spring Chinook BiOp. Red shading represents pHOS values exceeding those allowed in the Draft Methow Spring Chinook BiOp.

Data from spring Chinook reared at the Methow FH and short term acclimated in the Chewuch Acclimation Pond (AP) indicate that on average 43% will 'stray' back to the Methow River (Murdoch et al., 2011), presumably due to attraction back to the Methow FH where they were reared. In some years this figure has been as low as 0% for BY 1994 (which generated only 2 hatchery returns so straying could not really be evaluated) and as high as 88% for BY 2001. Table 5 presents the same data as Table 4 but assumes that 43% of the spring Chinook acclimated at the Goat Wall pond will be attracted back to the Methow FH and removed from the spawning population during adult management activities.

Based on the analysis presented in Table 5, we expect an acclimated release of 25,000 spring Chinook smolts from Goat Wall to result in an increase of spring Chinook spawners using habitat areas in the upper Methow while making anticipated pHOS and/or PNI targets achievable.

Table 5. Forecast of adult returns and PNI using a retrospective analysis of SARs and NOR spawning escapement. This analysis assumes 57% of returning hatchery fish spawn in the Methow River and 43% are removed during adult management activities.

Return Year	NORs		Hatchery SAR[a]	Hypothetical Hatchery Return	% HORs removed at MFH	Hypothetical HORS to spawn	Hypothetical Proportion of Run		Target Basin-wide PHOS[b]	PNI (pNOB = 1)	PNI (pNOB = 0.75)
	Basin Total	Methow					Hatchery	Natural			
2000	950	611	0.0025	80	43%	45.6	0.07	0.91	0.2	0.94	0.92
2001	1832	594	0.0028	97.5	43%	55.6	0.09	0.89	0.1	0.92	0.90
2002	345	86	0.0053	82.5	43%	47.0	0.35	0.39	0.4	0.74	0.68
2003	58	8	0.0008	30	43%	17.1	0.68	0.29	Anything	0.59	0.52
2004	488	199	0.0032	122.5	43%	69.8	0.26	0.71	0.4	0.79	0.74
2005	527	221	0.0039	52.5	43%	29.9	0.12	0.69	0.3	0.89	0.86
2006	328	128	0.0033	82.5	43%	47.0	0.27	0.61	0.4	0.79	0.74
2007	266	152	0.0012	30	43%	17.1	0.10	0.84	Anything	0.91	0.88
2008	298	172	0.0049	122.5	43%	69.8	0.29	0.59	Anything	0.78	0.72
2009	564	261	0.0021	52.5	43%	29.9	0.10	0.83	0.3	0.91	0.88
2010	601	290	0.0081	202.5	43%	115.4	0.28	0.59	0.3	0.78	0.72
2011	961	432	0.0032	107.5	43%	61.3	0.12	0.85	Anything	0.89	0.86
Mean	**602**	**262**	**0.0035**	**88**		**50**	**0.23**	**0.68**		**0.83**	**0.79**

a. For the purposes of this exercise hatchery SARs were matched with return year NORs based on a 4-year age class return

b.Green shading represents pHOS values with those allowed in the Draft Methow Spring Chinook BiOp. Red shading represents pHOS values exceeding those allowed in the Draft Methow Spring Chinook BiOp.

5.0 Sources of Uncertainty

Like most field research, uncertainties and unforeseen events may limit our ability to address the three objectives described above.

1) Because we are only proposing to acclimate and release 25,000 smolts, low return rates (below average) may result in an insufficient number of returning adults from which to fully address the three objectives and answer critical uncertainties.
2) There is some variability in performance of fish acclimated in natural ponds. We generally believe that natural ponds result in benefits to acclimated fish, including more natural coloration, exposure to natural food sources, and predator avoidance skills. However in the history of our use of natural ponds for acclimation, we have come to realize that fish perform better in some ponds than other ponds. On rare occasions this has caused us to recommend discontinuing use of a pond. Goat Wall is a new acclimation pond, and we have not acclimated fish at this location previously. However, smaller, protected acclimation sites (like Goat Wall) seem to work better than large open sites.
3) Adult Management (removal of hatchery adults from the spawning population) is a new strategy in the Methow River. It is unknown at what rates managers will be able to extract fish from the population. It is possible that over extraction of the acclimated fish could occur in which case we may not be able to address the three objectives outlined above. Similarly it is possible that an insufficient number of hatchery fish will be extracted, allowing the hatchery program to exceed pHOS/PNI goals. Additionally, if hatchery fish are not collected/removed evenly from throughout the run there is a possibility that some segments of the spawning population may be differently affected than other.

6.0 Monitoring and Evaluation

Being able to address near term objectives described in Section 2.0 is key to being able to adaptively manage this acclimation project. The following describes the monitoring and evaluation approach for this project.

Objective 1: To determine if spawner distribution can be expanded through short-term spring acclimation in the Upper Methow Basin.

To accomplish Objective 1, all spring Chinook acclimated and released from Goat Wall will be marked with a unique CWT. Methods for collecting spawner location data based on carcass recovery and analytical details can be found in the Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update (Hillman et al., 2013). All spawning ground, carcass recovery data and CWT extraction and reading will be completed by WDFW during implementation of the Douglas and Grant PUDs regular M&E activities (Objective 5 in Hillman et al., 2013).

Hypothesis:

- H_0: The distribution of hatchery origin redds from acclimated releases (Goat Wall Acclimation Site) = The distribution of hatcher origin redds from non-acclimated *releases (Methow Fish Hatchery)*

Measured Variables:

- Location (GPS coordinates) of female salmon carcasses observed on spawning grounds (Hillman et al, 2013)

Derived Variables:

- Location of female salmon carcasses at the historic reach scale and at the 0.1 km scale

Data Analysis:

- Graphic analysis and Yates' Chi-square analysis by reach.

We will consider Objective 1 successfully achieved if acclimated carcass recoveries are distributed in statistically greater numbers/proportions in the 'upper' reaches than would have occurred if acclimation was not implemented.

Objective 2: To determine what proportion of acclimated spring Chinook home back to Methow Fish Hatchery and are collected during adult management or broodstock collection activities.

As described above, all spring Chinook acclimated at Goat Wall will be marked with a unique CWT tag. CWT recovery necessary to meet objective 2 will occur at Methow FH by WDFW during spawning and adult management activities as normal to meet reporting and M&E objectives described in Hillman et al 2013, and by USFWS at WNFH. Alternatively detection of PIT tagged fish from both treatments (acclimated and non-acclimated) at the hatchery and at Wells Dam can be used to address Objective 2.

Hypothesis:

No hypothesis are being tested under Objective 2

Measured Variables:

- Count of CWT recovered by code at Methow FH
- Counts of CWT recovered by code at WNFH
- Counts of CWT recovered by code on the spawning grounds

Derived Variables:

- Estimates of fish return by code to Methow Fish Hatchery
- Estimates of fish return by code to Winthrop NFH
- Estimates of fish return by code to spawning grounds in the Methow Basin

Data Analysis:

CWT Analysis: The number of CWT fish from the acclimated release group recovered at the hatchery will be expanded based upon the in-hatchery sample rate and pre-release tag retention rate. The estimated proportion back to Methow Fish Hatchery will then be calculated based upon all in-basin tag recoveries for the acclimated release.

PIT Tag Analysis: The proportion of PIT tagged returns to Methow FH for the acclimated and non-acclimated release can be estimated by dividing the number of PIT tag detections/recovery at the hatchery by PIT tag detections over Wells.

There are no success or failure criteria for Objective 2. Hatchery return rate data for both acclimated and non-acclimated releases will be used to develop future acclimation proposals and make recommendations. Proportions of acclimated releases returning to the rearing facility will be used to recommend appropriate release numbers for spring Chinook in the upper Methow such that we do not exceed PNI/PHOS targets should the resource managers decide to continue acclimation beyond this 5-year plan.

Objective 3: To monitor project performance indicators and where appropriate, compare performance indicators to an on-station reference group.

Fish Condition and Growth

To monitor fish growth, condition and stage of smoltification a random sample of approximately 100 fish will be sampled weekly (for a total combined sample of 600-800 fish). Weekly sampling will include a general assessment of fish condition, visual assessment of smoltification, fish length and fish weight so that growth rates and condition factors may be assessed.

Success will be considered meeting size targets assuming fish are transferred to the pond at the appropriate size. There are no success criterial for the fish condition (k-factor). Fish condition (k-factor) will be used to retrospectively understand any observed differences in survival rates.

Release Monitoring and In-Pond Survival

Up to 7,000 spring Chinook within the site will be PIT tagged by YN. YN will design and install a PIT tag detection system at the sloughs' outlet to determine out-migration timing as well as produce an estimate of in-pond survival (following the volitional release and downstream migration). Additionally, daily predator observations will be recorded so that YN can respond in real-time to increased predation.

There is no success criteria for this metric, data from release monitoring will be used to identify predation rates at the pond and make changes if necessary (see Tagging-to McNary Survival and Tagging to Rocky Reach Survival for metrics from which we plan to measure juvenile survival success)

Tagging-to-McNary Dam and Tagging-to-Rocky Reach Survival

Equal groups of approximately 7,000 PIT tags will be applied to both the acclimated hatchery fish and the on-station release. Tagging will occur during the winter prior to acclimation and release. Because tagging occurs prior to transfer, the Tagging-to-Rocky Reach/McNary survival metric is inclusive of in-pond survival, and downstream migratory survival. Theoretically, Release-to-Rocky Reach/McNary Survival could be greater for acclimated releases than non-acclimated releases, therefore a potentially higher in-pond mortality rate could be ameliorated and later life stages. Therefore comparing Tagging-to-Rocky Reach/McNary survival rates for both on station and acclimated releases is a better comparison of overall juvenile survival than a Release-to-Rocky Reach/McNary metric.

Tagging-to- McNary Dam survival will be measured with PIT tags. Survival estimates for both tagging and release will use Cormack-Jolly-Seber estimates with associated standard errors for both survival and detection probabilities (Columbia River DART). These survival rates will be compared to like metrics from the Methow FH on-station release.

Hypothesis

- H_0: Tagging-to-Rocky Reach/McNary survival for acclimated fish = Tagging-to-Rocky Reach/McNary survival for Methow FH on station releases.

Measured Variables:

- Unique PIT tags at tagging
- Unique PIT tag detections at Rocky Reach/McNary Dam
- Unique PIT tag detections at John Day or Bonneville Dam

Derived Variables:

- Cormak-Jolly Seber estimates and standard error for both survival and detection probabilities using Columbia River DART

Data Analysis:

- Paired T-test by year for acclimated and on station releases

We will consider this metric successful if the tagging-to-Rocky Reach/McNary survival rates are equal to or greater than the on station releases.

Smolt-to-Adult survival

Smolt-to-Adult Return (SAR) rates will be calculated using the unique CWT for each acclimated release. SARs are typically reported in the PUD annual M&E report. SARs for the acclimated release can be compared to the on-station release by brood year.

Hypothesis

- H_0: Smolt-to-Adult survival rates for acclimated fish >= Smolt-to-adult survival rates for Methow FH on station releases.

Measured Variables:

- Numbers of CWTs recovered at the hatchery, spawning grounds, and in fisheries

Derived Variables:

- Estimated return to the basin with and without harvest.

Data Analysis:

- SARs for acclimated and non-acclimated release can be compared with a paired T-test by year.

We will consider this metric successful if the SARs for acclimated hatchery returns are equal to or greater than the on station releases.

7.0 Project Timeframe

Release would occur in 2016-2020. In-pond and in-hatchery assessment would also occur in those years. Field assessment of adult return rates and spawning distribution would occur in 2017-2023. Data collected from the spawning grounds and from the hatchery will occur during regular M&E activities described in Hillman et al. 2013.

The five year timeframe is designed to achieve the near-term objective described above, which address critical uncertainties. Pending results, the HCP HC and PRCC HSC may consider future opportunities to expand acclimation of Methow FH spring Chinook production. in 2019 based upon available information while the adult return data is collected through 2023.

8.0 Alternate Site: Early Winters Pond

As mentioned in 'Section 5.0 Sources of Uncertainty', the Goat Wall site is a new site that has not yet been used for acclimation. If it appears that in-pond survival at Goat Wall is lower than desired, or if for any other reason the site does not work well (such as difficult fish containment or changes in land owner agreement) we are also developing an alternate site. Early Winters Pond is also a potential site for future expansion of this project should the data generated in this 5-year plan warrant expansion and Early Winters Pond is officially accepted/incorporated into the Mid-Columbia Coho Program and/or as part of the Upper Columbia Salmon and Steelhead Acclimation Project. Early Winters Pond would be a constructed pond that is being evaluated as part of Mid-Columbia Coho BA Addendum, and the Upper Columbia Salmon and Steelhead Acclimation Project (in Prep). Site detail and development/construction plans for Early Winters Pond can be found in Appendix B.

6.0 Adaptive Management

Information collected through this project may be used by YN in the development of future proposals and can also be used by the resource managers to make decisions about spawner distribution, desired escapement levels, and hatchery release locations. Management decisions that may result from this data are within the purview of the resource managers and therefore will not be included in this research proposal. Similarly, decisions pertaining to hatchery operations are within the purview of the HCP Hatchery Committees and the PRCC Hatchery Sub Committees and therefore are not included within this proposal.

7.0 Literature Cited.

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