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Abundance and distribution of steelhead (Oncorhynchus mykiss) in Toppenish Creek

2013

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Tim Resseguie, Yakama Confederated Tribes, Toppenish, WA, 98948

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1. Executive Summary

a. Fish Population Status Monitoring (RM&E)

The Yakama Reservation Watersheds Project (1996-035-01) (YRWP) originated as several BPA funded projects, the earliest of which began in Satus Creek in 1996. YRWP now participates in restoration and monitoring for fish populations in Satus, Toppenish, and Ahtanum creeks, the three lower steelhead producing tributaries of the Yakima River. All three of these watersheds are located on the Yakama Reservation. In March 1999, the Middle Columbia River Steelhead Distinct Population Segment was listed as threatened under the Endangered Species Act (ESA). Under this listing, four populations (Satus, Toppenish, Naches, and Upper Yakima) are recognized by NOAA's National Marine Fisheries Service for recovery purposes in the Yakima Basin and comprise the Yakima MPG (Major Population Group) (Yakima Fish and Wildlife Recovery Board 2009).

Steelhead redds (n= 78) increased in 2013 compared with 2012 when redd survey conditions were affected by flooding (Figure 3). Distribution of redds was similar to previous years (Figure 4). The estimated number of steelhead smolt outmigrants decreased in 2013 (Figure 6).

2. Introduction

Fish Population Status Monitoring (RM&E)

In 2009, Toppenish Creek was identified as the watershed in the Yakima basin where "fish in/fish out" population monitoring should be prioritized. We strengthened our Toppenish Creek screw trapping program beginning in the 2010-2011 season to meet the objective of accurately quantifying "fish out" or the number of steelhead juveniles migrating out of the Toppenish creek spawning grounds with a data standard (CV, coefficient of variation < 30%) adhering to recommendations in Crawford and Rumsey (2009). Better equipment and more manpower obtained with additional BPA funding (1996-035-01 BIOP M&E Toppenish Creek) were required to meet this objective. We attempted to use census redd counts and develop expansions to obtain the adult abundance or “fish in” estimates.

Monitoring the steelhead population in Toppenish Creek has proved to be difficult in many years. Adult steelhead are counted as they migrate up the Yakima River at Prosser Dam in the town of Prosser. These counts using mostly video footage collected at the fish ladders (as well as a Denil fish ladder and trap used for biological sampling) are believed to produce a fairly accurate adult migrant count for the Yakima MPG. Another counting facility (Roza) is located on the Yakima River farther upstream above the Naches River and provides a direct count of adult steelhead migrating upstream of the boundary delineating the Upper Yakima Population. No counting facilities are present for the Naches, Toppenish, or Satus Creek populations. Instead, spawner surveys provide an index of adult escapement on these Yakima River tributaries. Redd count surveys have been performed in Toppenish Creek since 1997. The accuracy of these counts varies from year to year and is dependent on snowpack and stream conditions during the spawning season. The poor accessibility of the upper section of the watershed and spring flooding have been the greatest obstacles to completing a spawner survey that captures the entire spawning season.

Study Area

Toppenish Creek is located in south central Washington and the entire watershed is situated within the boundary of the Yakama Reservation. Toppenish Creek is also a major tributary of the Yakima River with nearly as large a watershed area (622 mi^2) as Satus Creek. The headwaters of Toppenish Creek are located on Lost Horse Plateau at a maximum elevation of 5200 feet. Simcoe Creek, the main tributary of Toppenish Creek, joins at RM river mile 32 (about the halfway point). The forks of Simcoe Creek and its main tributaries Agency and Wahtum Creeks also arise from Lost Horse Plateau, but at a slightly lower elevation. Toppenish Creek enters the Yakima River about 7 miles south east of the town of Toppenish, Washington at RM river mile 80 at an elevation of 650 feet. Along its approximately 70-mile length, stream morphology and watershed topography changes substantially. Through nearly the upper third of its length, Toppenish Creek flows through a remote forested canyon. Most of the upper Toppenish Creek watershed is tribal trust land managed for timber production and cultural resources. The middle third of Toppenish Creek is dominated by an alluvial fan. This area is managed for multiple uses including livestock grazing and some agriculture. Irrigation withdrawals begin in this region of the watershed, at the head of the alluvial fan. The lower portion of Toppenish Creek is heavily influenced by agriculture with a variety of crops grown (e.g. corn, wheat, hops, mint, and grapes). Flows and water quality are altered drastically by irrigation withdrawals, spills and return flows in the lower portion of Toppenish Creek. Much of the land adjacent to the lower third of the creek is devoted to waterfowl production and hunting. The USFWS Toppenish Creek Wildlife Refuge, Yakama Nation wildlife areas, and a number of private duck clubs provide a substantial amount of off-channel wetland habitat (managed to attract waterfowl) on the lower 30 miles of Toppenish Creek.

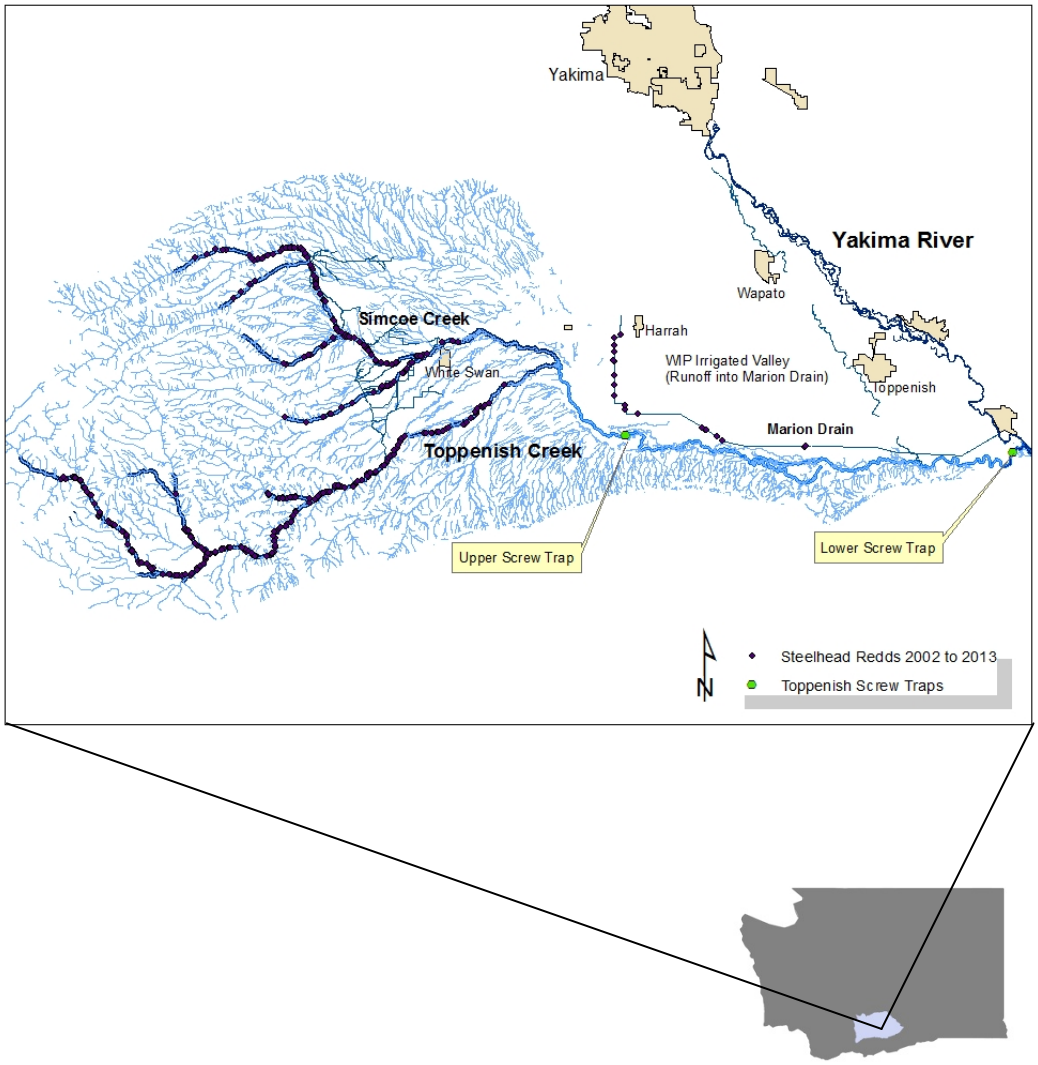

Figure 1. Map of Study sites on Toppenish Creek

The hydrograph of Toppenish Creek is similar to other streams on the east slopes of the Cascade Range (Figure 2). Peak flows typically occur in early to mid-spring resulting from snowmelt, although rain-on-snow events during winter can cause substantial floods—sometimes the peak flow for the season. Flows decrease rapidly during late spring and early summer as the snowpack is depleted. Flows (and closely-related water temperature) are probably the limiting factor for steelhead production in portions of the Toppenish and Simcoe watersheds. Irrigation spills and return flows in the lower portions of Toppenish Creek are substantially greater than natural flow and are believed to be detrimental to salmonids because of their temperature, suspended solids, and the potential homing issues raised by flows originating from outside the Toppenish Creek watershed.

Marion Drain and its tributary Harrah Drain carry irrigation drainage from the agricultural area north of Toppenish Creek eastward to the Yakima River. During the irrigation season, most of their flow is mixed with Toppenish Creek flow and diverted south of the creek to the Satus Area of the Wapato Irrigation Project. Steelhead can access Marion and Harrah

drains via the Yakima River outlet or Toppenish Creek. Redds are counted in both drains every year, but survival of steelhead eggs and parr may be low enough to consider Marion and Harrah drain a population sink.

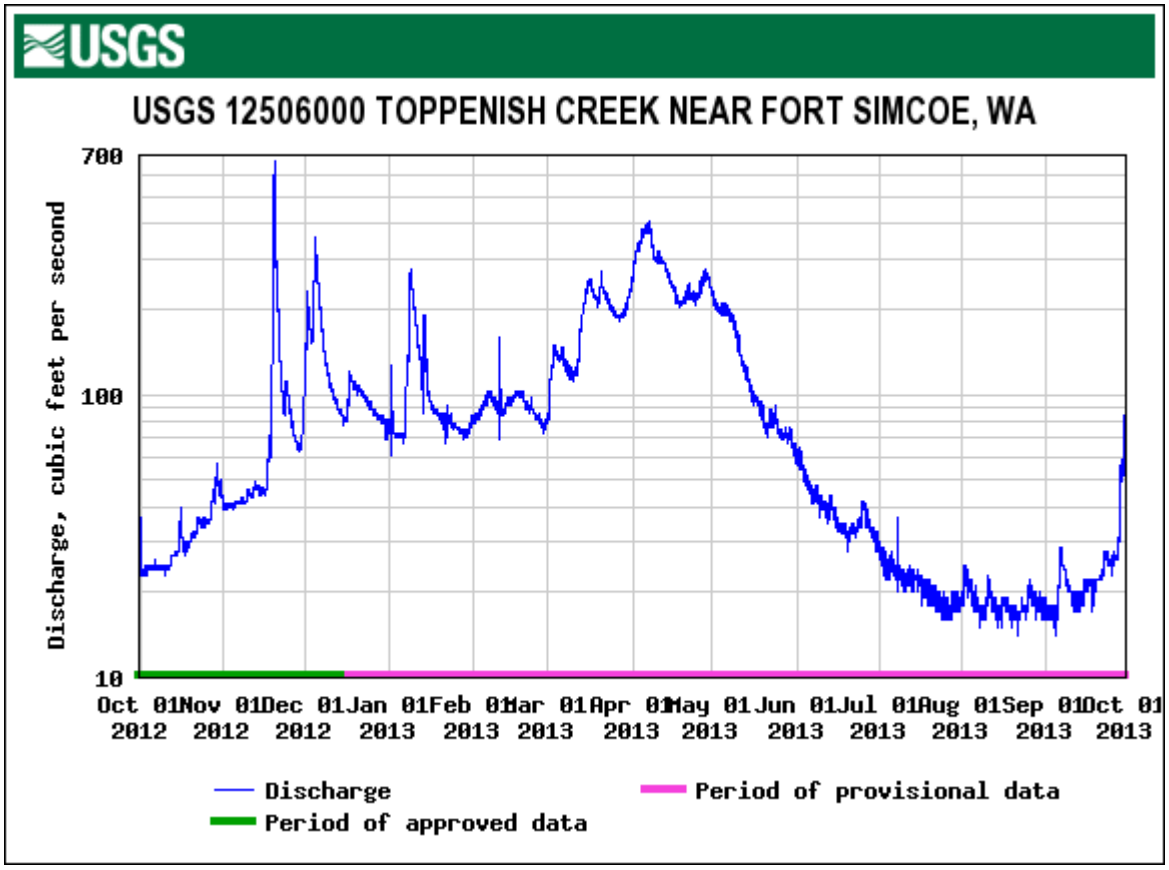

Figure 2. Hydrograph for the Toppenish Creek watershed at the USGS gage (12506000) at River Mile 44 for water year 2013 (These discharge data are preliminary)

3. Methods: Protocols, Study Designs, and Study Area

Adult abundance and distribution

Protocol Title: YRWP Adult steelhead abundance (1996-035-01) v1.0

Protocol Link: http://www.monitoringmethods.org/Protocol/Details/110

Protocol Summary: Steelhead redd counts are used as an index of adult spawner abundance on the tributary spawning grounds in Lower Yakima River tributaries (Satus, Toppenish and Ahtanum Creeks) .

Steelhead Census Redd Counts

Redd counts are often utilized to estimate or index spawning escapement for adult salmonids (Gallagher et. al. 2007, 2010a, 2010b; Susac and Jacobs 1999). In each lower Yakima River tributary (Satus, Toppenish, and Ahtanum), we attempted to perform a census survey on all recognized spawning habitat in each tributary. The Yakama Nation Fisheries Program have tried various survey methods (ground, raft and aerial) in some areas outside of these recognized spawning reaches but have not documented any redds. The procedure for conducting steelhead redd counts has not changed significantly during past 25 years that the Yakama Nation has performed them. For each of three passes, two surveyors typically cover each 2 to 6-mile survey reach, walking downstream. In some smaller streams only one surveyor conducts the survey. Surveyors wear polarized glasses to aid in spotting redds, and generally begin after the sun breaks over the horizon. Each identified redd is marked with a GPS with an accuracy of +/- 30 feet. Redds are marked with fluorescent flagging to prevent counting redds identified on previous passes. Each redd is measured and its location in relation to the stream bank and thawlweg are recorded. The presence or absence of direct cover is also noted on data sheets. It is unlikely that resident rainbow trout redds (or redds from other redd building species) are mistaken for anadromous steelhead redds because of the small size of all resident *O. mykiss* observed in these watersheds during redd counts and snorkel surveys. The number of live steelhead adults and carcasses are also recorded. When possible, the sex of live steelhead and carcasses is noted. Surveyors are careful not to disturb spawning fish or possible staging pools when conducting spawner surveys.

Juvenile steelhead outmigrant abundance

Protocol Title: YRWP Juvenile steelhead outmigration (1996-035-01) v1.0

Protocol Link: http://www.monitoringmethods.org/Protocol/Details/111

Protocol Summary: Rotary screw traps are used on Satus, Toppenish, and Ahtanum to estimate juvenile steelhead outmigrant abundance, timing, and downstream survival.

Steelhead outmigrants are partitioned into migratory years (MY) that begin on July 1st and end on June 30th of the following year (e.g. MY12 began on July 1, 2011 and ended on June 30, 2012) because little or no migration occurs during the summer months.

Upper Toppenish Screw Trap

The upper Toppenish screw trap was deployed at the beginning of the outmigration season in late autumn and fished for the entire steelhead outmigration season ending in June. We have deployed and operated the 5-foot-diameter screw trap (designed and constructed by EG Solutions) located at river mile 26.5 below the Unit 2 diversion each year since 1999. This location was chosen because of its favorable site characteristics (stream morphology facilitating good trap efficiency and groundwater recharge that keeps this small section of stream from freezing in most years allowing us to operate through the winter months) and position several miles below all recognized spawning and rearing habitat that begins upstream at about river mile 35.5 below Shaker Church Road on the mainstem Toppenish Creek, and above RM 5.5 on Simcoe Creek. Mill Creek, which was identified as a minor spawning population in the Yakima Steelhead Recovery Plan, is located about 4.5 miles upstream from this site. No viable tributaries enter Toppenish Creek below the Mill Creek confluence and much of the runoff from the north is captured by Marion Drain, which parallels Toppenish Creek for 19 miles beginning at the trap site. Aerial, watercraft, and limited foot surveys below our trap site indicate that habitat and successful spawning activity in the reach below the upper Toppenish screw trap site is unlikely.

Lower Toppenish Screw Trap

We deployed a second screw trap on Toppenish Creek starting in 2010 to evaluate out-migration timing, growth and survival of steelhead smolts in the lower part of Toppenish Creek. This portion of Toppenish Creek is situated on the historical Yakima River floodplain, which has been modified extensively for agricultural purposes and transportation over the last 150 years. There is a complex irrigation system of canals and drains (WIP, Wapato Irrigation Project) that significantly influences flow, temperature, and other hydrologic characteristics of the lower Toppenish watershed. Another prominent feature of this part of the watershed are numerous controlled wetlands that were developed for producing, attracting and providing refuge to waterfowl species (and other migratory birds). It isn't clear what role these wetlands play to migrating adult and juvenile steelhead. We hope to ascertain the impact of these wetlands through several ongoing studies including this PIT-tagging study for juveniles and also the radio tracking study for adults. Like the upper trap, the lower trap and its target organisms were protected by lifting the cone during periods of high flows and debris loading.

4. Results

a. Fish Population Status Monitoring (RM&E)

Adult steelhead abundance

For the 2013 spawning season lasting from March 2013 through June 2013 a total of 78 steelhead redds were identified in the Toppenish Creek watershed. Unlike the 2012 season when major flooding during the peak spawning season prevented us from completing surveys, in 2013 we completed all three planned passes of the watershed.

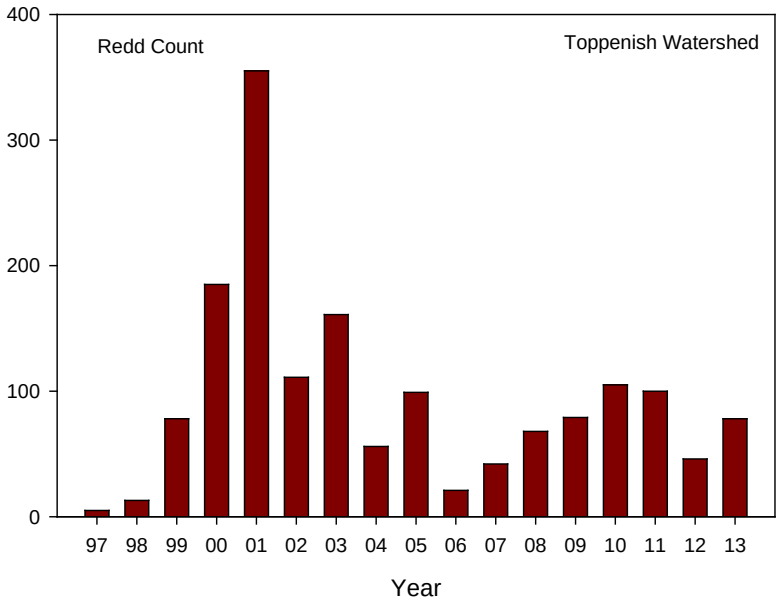

Figure 3. Number of steelhead redds per year in the Toppenish Creek watershed since 1997

This, in part, explains the increase in steelhead redds between 2013 and 2012 despite a reduction in adult steelhead counted at Prosser Dam between 2012 (n=6359) and 2013 (n=4787).

The spatial distribution of redds in the Toppenish watershed was typical compared with recent years. Thirty-one percent of these were found in the Simcoe Creek watershed the largest tributary and the remaining 69 percent were found in the mainstem and smaller tributaries such as the North Fork Toppenish Creek and Willy Dick Creek.

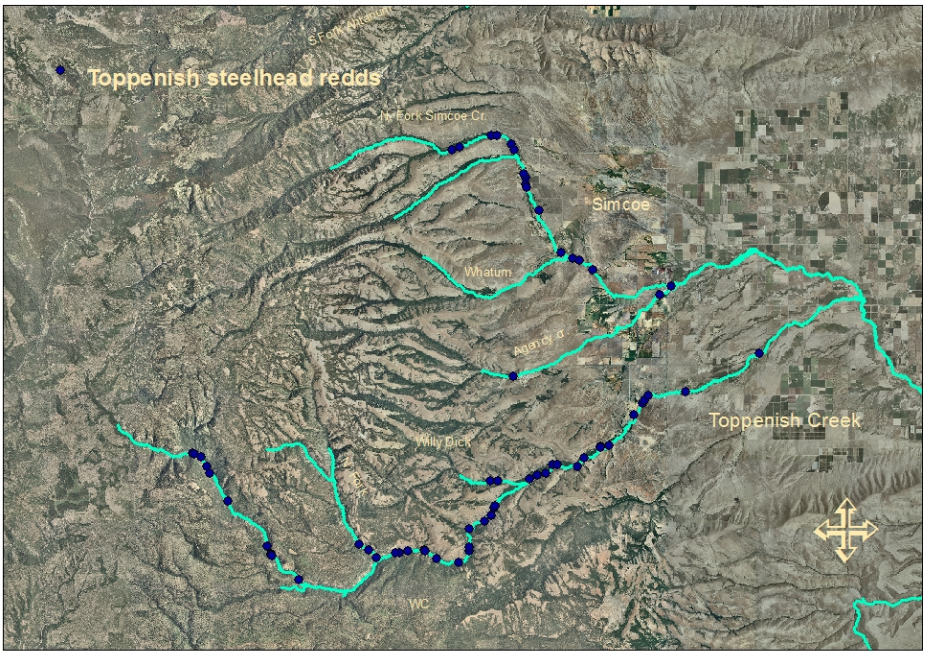

Figure 4. The Location of steelhead redds in the Toppenish Creek watershed in 2013.

Juvenile Steelhead Outmigrant Abundance

Upper Toppenish Creek Screw Trap

We operated a rotary screw trap on Toppenish creek from September 2012 through June 2013, a period which encompasses most of the outmigration period. We captured a total of 1142 steelhead parr/smolts and PIT tagged 992. The daily catch of steelhead juveniles peaked in late November (Figure 5) as typically observed. Most of the PIT tagged steelhead juveniles were released several hundred meters above the screw trap as part of a mark recapture study. An estimate of 21300 (SE 3586) juvenile outmigrants was obtained for the 2013 season using this method. This is the lowest number of juveniles leaving the watershed in nine years of calculating outmigration estimates (Figure 6). We expected the number of juveniles migrating out of the watershed to be lower due to a substantial flood that destroyed many of the redds in March and April 2012.

The size of outmigrants was larger in 2013 than previous years. The mean length for all measured outmigrants was just over 132 mm (fork length). Mean length ranged from 103 mm to 125 mm during previous years. A higher percentage of age 2 or older outmigrants , which should be more capable of tolerating high flood flows, were possibly represented in the 2013 screw trap catch.

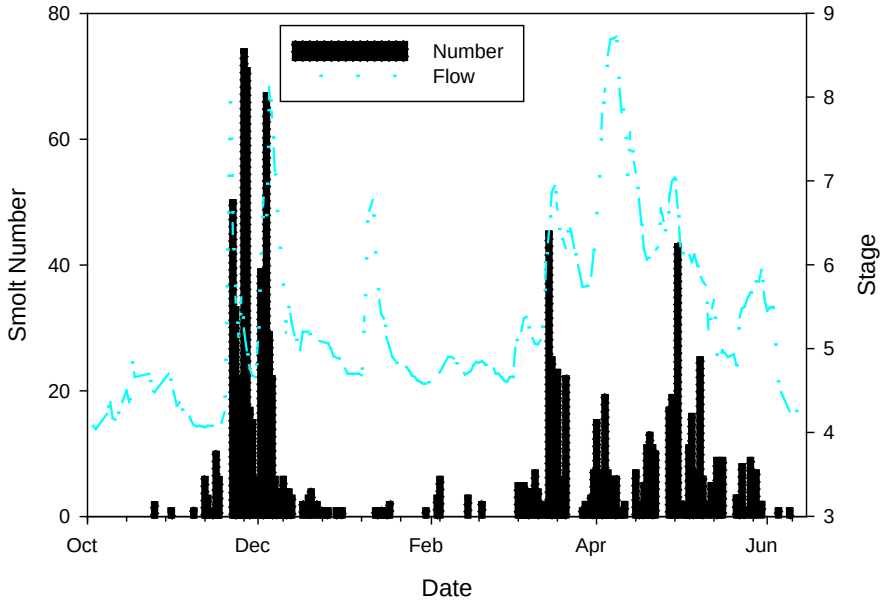

Figure 5. Steelhead juvenile outmigration timing. Daily catch at the Toppenish Creek trap compared with stream stage for the 2013 season.

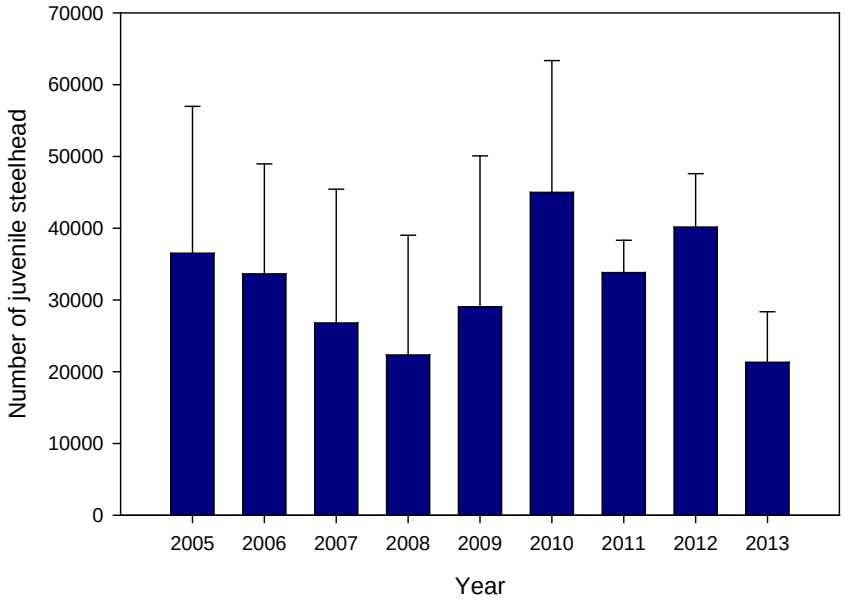

Figure 6. Estimated number of steelhead juvenile outmigrating from spawning and rearing habitat on Toppenish Creek. Error bars represent 95% CI

Lower Toppenish Creek Screw Trap

We operated a second rotary screw trap near the mouth of Toppenish Creek at a location that has been in use since 2011. This trap was deployed in mid November 2012 and retrieved in June 2013. We captured 36 steelhead juveniles,

364 chinook juveniles and 1 coho juvenile. Unlike the screw trap located upstream at river mile 30 on Toppenish Creek where outmigration typically peaks in late fall or early winter, ninety-two percent of steelhead outmigrants moved through the trap zone and were captured in April and May. This pattern indicates that significant overwintering in the lower reaches of Toppenish Creek between the traps. Growth by steelhead juveniles was also documented during the three years of operation for the Lower Toppenish screw trap. During the last 3 years, of the four steelhead juveniles that were captured and PIT tagged at the upper screw trap and subsequently recaptured at the lower screw trap exhibited an average increase in length of 19% as they reared in lower Toppenish Creek between the traps.

5. Synthesis of Findings: Discussion/Conclusions

a. Fish Population Status Monitoring (RM&E)

Lessons Learned

We will continue to use our screw trapping method to estimate steelhead juvenile outmigrant abundance in Toppenish Creek. Despite the highest water year in 15 years on Toppenish creek, the screw trapping season progressed reasonably well for the Toppenish Trap and we obtained an estimate of outmigrant abundance with a coefficient of variation

Although we successfully completed steelhead spawning surveys in 2013, the use of redd counts to determine steelhead adult spawner abundance in Toppenish Creek is questionable particularly during high water years like 2012.

Alternative methods to using PIT tagged adult steelhead and instream antenna arrays to determine spawner abundance and fish per redd will continue to be developed in future years.

However, we intend to continue redd count surveys because they provide useful information on spawning distribution and they provide an opportunity for reconnaissance of critical steelhead spawning and rearing habitat.

Adaptive management

Information on adult steelhead abundance and juvenile outmigrant abundance is valuable in evaluating restoration efforts, managing natural resources (fish, water, etc.) and in determining if recovery goals for this species are being met.

References

Bjorkstedt (2005 and 2009) Darrochs (1961) Petersen Estimator (Darr v 2.02 R code) available at http://swfsc.noaa.gov/textblock.aspx?Division=FED&id=3346 .

Carlson, S. R., L. G. Coggins, C.O. Swanton. 1998. A simple stratified design for smolt mark-recapture estimation for salmon smolt abundance. Alaska Fishery Research Bulletin 5(2): 88-102.

Gallagher, S.P., P.K. Hahn, and D.H. Johnson. 2007. Redd Counts. Pages 197-231 in D.H.Johnson, B.M. Shrier, J. A. Knutzen, X Augerot, T.A. O'Neil, and T. N. Pearsons. 2007. Salmonid field protocols handbook: techniques for assessing status and trends in salmon and trout populations. American Fisheries Society, Bethesda Maryland.

Hubble, J. D. 1992. A study of summer steelhead, Oncorhynchus mykiss, in several intermittent tributaries of the Satus Creek Basin. M.S. Thesis, Central Washington University, Ellensburg WA. 86 pp.

Johnson D.H., B.M. Shrier, J.S. O'Neil, J.A. Knutzen, X Augerot, T.A. O'Neil, T.N. Pearsons. 2007. Salmonid field protocols handbook: techniques for assessing status and trends in salmon and trout populations. American Fisheries Society, Bethesda, Maryland.

Junk, W.J., P.B. Bayley, and R.E. Sparks. 1989. The Flood Pulse Concept in River Floodplain Systems. p. 110-127. In D. P. Dodge [ed.] Proceedings of the International Large River Symposium. Can. Spec. Publ. Fish. Aquat. Sci. 106 pp.

McClure, Michelle, Tom Cooney. 2005. Updated population delineation in the interior Columbia Basin, NOAA Fisheries Memorandum, http://www.nwfsc.noaa.gov/trt/updated_population_delineation.pdf. 16 pp.

Northwest Power Planning Council. 2000. Columbia River Basin Fish and Wildlife Program. 56pp.

Rawding, Dan and P. Cochran. 2007. Wind River Winter and Summer Steelhead Adult and Smolt Population Estimates from Trapping Data, 2006. Project No. 199801900 Contract No. 19617 For The Bonneville Power Administration Portland, Oregon

Schuett-Hames, D, A. Pleus, L. Bullchild and S. Hall, eds, 1994. Timber-Fish-Wildlife Ambient Monitoring Program Manual. TFW-AM9-94-001. Northwest Indian Fisheries Commission, Olympia, Washington.

Susac, G. L., S. E. Jacobs. 1999. Evaluation of spawning ground surveys for indexing the abundance of winter steelhead in Oregon coastal basins. Oregon Department of Fish and Wildlife Federal Aid in Sport Fish Restoration Program: F-145-R-08.

Stanford, J. A. and J.V. Ward. 1992. Management of aquatic resources in large catchments: recognizing interactions between ecosystem connectivity and environmental disturbance, In. Naiman, R.J. (Ed.), Watershed Management. Springer-Verlag, New York. Pp 91-123.

Terraqua, Inc. 2009. A Field Manual of Scientific Protocols for Downstream Migrant Trapping within the Upper Columbia Monitoring Strategy. BPA, ISEMP. (.pdf)

Terraqua, Inc. 2009. A Field Manual of Scientific Protocols for Steelhead Redd Surveys within the Upper Columbia Monitoring Strategy. BPA, ISEMP. (.pdf)

Thedinga, J.F. 1994. Determination of salmonid smolt yield with rotary screw traps in the Situk River, Alaska, to predict the effects of glacial flooding. North American Journal of Fisheries Management 14: 837-851.

Volkhardt, G.C., S.L. Johnson, B.A. Miller, T.E. Nichelson, and D.E. Seiler. 2007. Rotary Screw Traps and Inclined Plane Traps. Pages 235-266 in D.H. Johnson, B.M. Shrier, J. A. Knutzen, X Augerot, T.A. O'Neil, and T. N. Pearsons. 2007. Salmonid field protocols handbook: techniques for assessing status and trends in salmon and trout populations. American Fisheries Society, Bethesda Maryland.

Yakima Subbasin Fish and Wildlife Planning Board. 2004. Yakima Subbasin Plan. 557pp. + appendices. http://www.nwcouncil.org/fw/subbasinplanning/yakima/plan/.

Yakima Subbasin Fish and Wildlife Planning Board. 2004. Yakima Subbasin Plan Supplement. 47pp. http://www.nwcouncil.org/fw/subbasinplanning/yakima/plan/Supplement.pdf.

Yakima Subbasin Fish and Wildlife Recovery Board. 2009. Draft 2009 Yakima Steelhead Recovery Plan. 288pp. http://www.ybfwrb.org/RecoveryPlan/YakimaSteelheadPlan.pdf

Appendix A: Use of Data & Products

Steelhead redd count, juvenile outmigrant abundance, and juvenile outmigrant survival data for Toppenish Creek are located at:

http://ykfp.org/docsindex.htm

Appendix B: Detailed Results

Table. B-1 Number of steelhead redds in the Toppenish Creek watershed in 2013.

	Upper Toppenish Creek watershed (River Miles at Confluence in Parentheses)		Distance miles	Number of Redds
Toppenish	O Connor Cr (65.7)	"East Bank" (61.1)	4.6	9
	"East Bank" (61.1)	NF confluence (55.4)	5.7	5
	North Fork (55.4)	Washout (50.9)	4.5	8
	Washout (50.9)	Willy Dick Cr (48.5)	2.5	11
	Willy Dick Cr (48.5)	Olney Lateral (44.2)	4.3	9
	Olney Lateral (44.2)	Pom Pom Rd. (38.9)	5.3	6
	Pom Pom Rd. (38.9)	Shaker Church Rd. (35.9)	3	1
Total			**29.9**	**52**
N. Fork Toppenish	NF Falls (4)	NF confluence (0)	**4**	**3**
Willy Dick	old logging site (4)	Confluence (0)	**4**	**2**
	Simcoe Creek Watershed			
Simcoe	NF at 2nd crossing (6.5)	Diamond Dick Cr (3.4)	3.1	0
	NF at Diamond Dick Cr (3.4)	NF/SF confluence (0)	3.4	6
	SF 6 mi above confluence (6.2)	SF 3 mi above confluence (3)	3.2	0
	SF 3 mi above confluence (3)	NF/SF confluence (0)	3	0
	NF/SF confluence (18.9)	Simcoe Creek Rd. (15.3)	3.6	7
	Simcoe Creek Rd. (15.3)	Wesley Rd. (10.1)	5.2	6
	Wesley Rd. (10.1)	N. White Swan Rd. (8.1)	2.0	1
	N. White Swan Rd. (8.1)	Stephenson Rd. (5.9)	2.2	0

Total			**25.7**	**22**
Agency	Falls (8.9)	Lateral Canal (4.4)	4.5	1
	Lateral Canal (4.4)	Confluence (0)	4.4	1
Total			**8.9**	**2**
Wahtum	Yesmowit Rd. (3.6)	Confluence (0)	**3.6**	**0**
Total			76.1	**78**

Table B-2. Steelhead juvenile catch and mark-recapture data stratified weekly for the upper Toppenish creek screw trap for the MY 2013 season. Recaptures for each week are adjusted using PIT tag codes to exclude fish tagged in previous seasons and to assign fish to appropriate release group (e.g. fish in the trap recapture week *i* +1 column were recaptured the week following the week they were released above the trap).

Statistical Week (*i*.)	Dates	Number Captured (week *i*)	Number Released Upstream (week *i*)	Number Recaptured (week *i*)	Number Recaptured Week (week *i*+1)
Week 1	10/22-10/28	2	2		
Week 2	10/29-11/4	1	1		
Week 3	11/5-11/11	1			
Week 4	11/12-11/18	26	25	3	
Week 5	11/19-11/25	116	94	8	4
Week 6	11/26-12/2	222	205	13	2
Week 7	12/3-12/9	166	114	10	
Week 8	12/10-12/16	17	16	1	
Week 9	12/17-12/22	11	11		
Week 10	12/24-12/30	3	2		
Week 11	12/31-1/6	1	1		
Week 12	1/7-1/13	2	2		

Week 13	1/14-1/20	5	4		
Week 14	1/21-1/27	0	0		
Week 15	1/28-2/3	4	4	1	
Week 16	2/4-2/10	6	6		
Week 17	2/11-2/17	3	3		
Week 18	2/18-2/24	2	2	1	
Week 19	2/25-3/3	0	0		
Week 20	3/4-3/10	28	26		1
Week 21	3/11-3/17	94	92	3	1
Week 22	3/18-3/24	54	32		
Week 23	3/25-3/31	13	5		
Week 24	4/1-4/7	61	25	1	
Week 25	4/8-4/14	10	10		
Week 26	4/15-4/21	50	49	2	
Week 27	4/22-4/28	46	45	1	
Week 28	4/29-5/5	82	80	4	1
Week 29	5/6-5/12	50	48	3	
Week 30	5/13-5/19	33	25	1	
Week 31	5/20-5/26	24	24	1	
Week 32	5/27-6/2	15	15		
Week 33	6/3-6/9	2	1		
Total	**10/22-6/9**	**1150**	**969**	**53**	**9**

*number captured during this week includes some dates when the trap was not operated and numbers were interpolated using an average of the catch 3 days before and after the period of inoperability.

Appendix C: List of Metrics and Indicators

Category	Subcategory	Subcategory Focus 1	Subcategory Focus 2	Specific Metric Title
Fish	Abundance of Fish	Fish Life Stage: Adult - Spawner	Fish Origin: Natural	Steelhead redd count (an index of adult spawner abundance)
Fish	Abundance of Fish	Fish Life Stage: Juvenile - Migrant	Fish Origin: Natural	Estimate of juvenile abundance
Fish	Abundance of Fish	Fish Life Stage: Juvenile - Migrant	Fish Origin: Natural	Outmigrant estimate for juvenile steelhead