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ABUNDANCE AND DISTRIBUTION OF ADULT AND JUVENILE STEELHEAD (ONCORHYNCHUS MYKISS) IN TOPPENISH CREEK

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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). 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).

We attempted to obtain precise estimates of adult steelhead spawner abundance and juvenile outmigrant abundance. Census redd counts were performed along all 76 miles of documented steelhead spawning habitat. In addition, one aerial survey using a helicopter was completed on the lower (unwadeable, 36 mile long) section of Toppenish Creek. 42 Redds were found during surveys. Two rotary screw traps were deployed on Toppenish Creek to estimate steelhead juvenile out-migration from Toppenish Creek spawning habitat and to evaluate survival to the mouth and downstream through the series of detection facilities on the Yakima and mainstem Columbia. An estimated 40,152 (SE 3790; CV=9.4%) steelhead juveniles migrated off the spawning and rearing grounds and past the rotary screw trap located at river mile 26.5 on Toppenish Creek. At the second screw trap located at the mouth of Toppenish Creek, we captured 14 juvenile steelhead.

2. Introduction

a. Fish Population Status Monitoring (RM&E)

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 cameras 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 (Major Population Group). Another counting facility (Roza) is located on the Yakima River upstream of the Naches River and provides a direct count of adult steelhead migrating upstream of the boundary delineating the Upper Yakima Population. No such population specific counting facilities are present for the Naches, Toppenish, or Satus Creek populations. Instead, redd count 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.

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. Precise estimates of juvenile steelhead abundance and adult spawner abundance are the primary objectives of this study. It is anticipated that this project will span multiple generations allowing us to quantify freshwater productivity.

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

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 a major tributary of the Yakima River comprising 10% of the total Yakima River watershed at an area of 622 mi^2. 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 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 river mile 80 at an elevation of 650 feet. Along its approximately 70-mile length, stream morphology and watershed topography changes substantially. Through most of the upper third of its length, Toppenish Creek flows through a remote forested canyon. Most of the upper Toppenish 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. 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.

The hydrograph of Toppenish Creek is similar to other streams on the east slopes of the Cascade Range. 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 stream flow are not believed to be beneficial to salmonids because of their temperature, suspended solids, and the potential homing issues raised by flows originating from outside the Toppenish watershed.

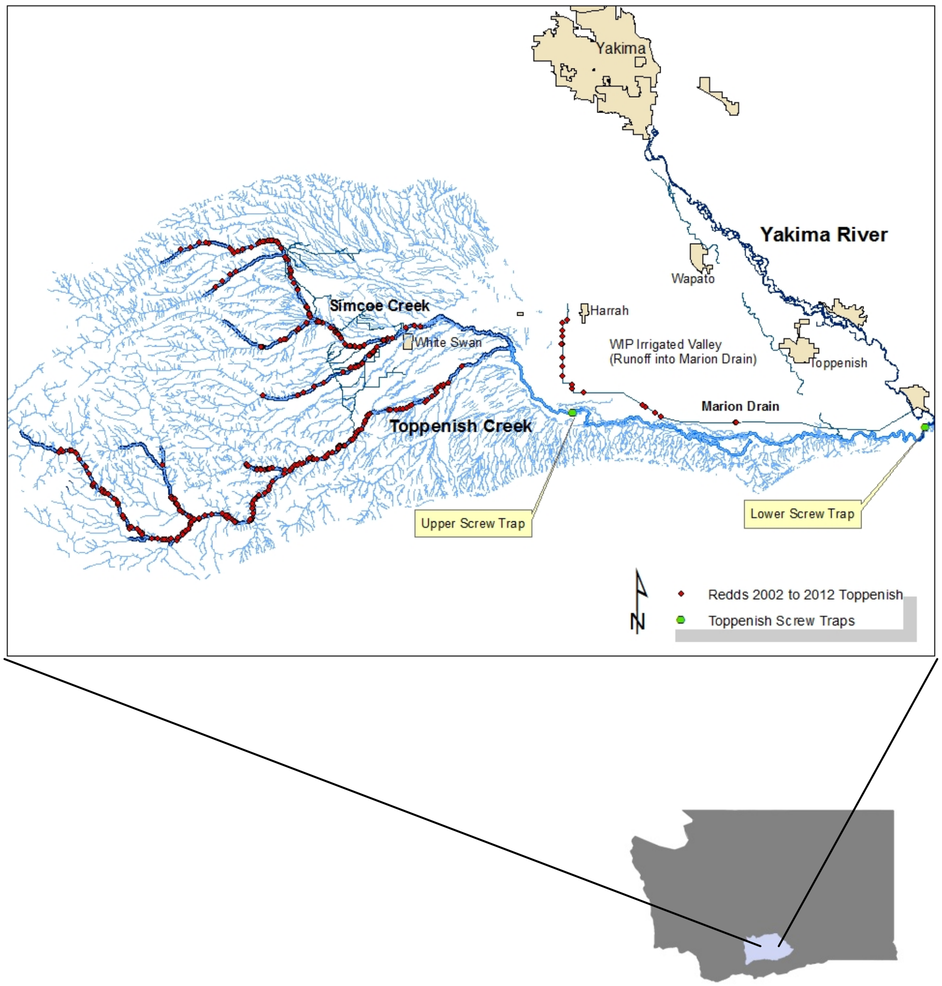

Figure 1 Map of the study area including screw trap location, steelhead distribution, and steelhead redd GPS locations,

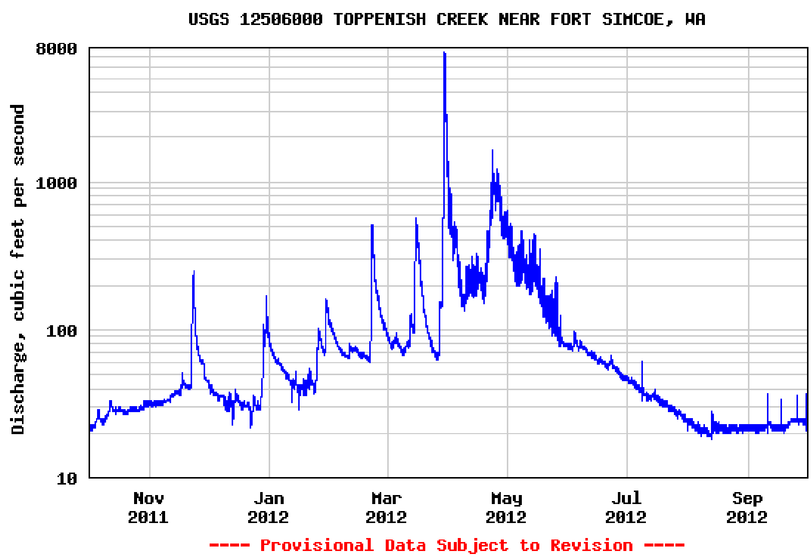

Figure 2 Hydrograph for Toppenish Creek at the USGS gage 12506000 at River Mile 44 for water year 2012 (these discharge data are preliminary).

Marion Drain and its tributary Harrah Drain carry irrigation runoff from the irrigated agricultural area north of Toppenish Creek eastward to the Yakima River. During the irrigation season, most of the 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 may be low enough to consider Marion and Harrah drain a population sink.

Fish species that are known to reside in the Toppenish Creek watershed include: steelhead/rainbow trout (*Oncorhynchus mykiss*), coho Salmon (*O. kisutch*), chinook salmon (*O. tshawytscha*), westslope cutthroat trout (*O. clarki*), redside shiners (*Richardsonius balteatus*), speckled (*Rhinichthyus osculus*) and longnose dace (*R. cataractae*), chiselmouth (*Achrocheilus alutaceus*), northern pikeminnow (*Ptychocheilus oregonensis*), suckers (*Catostomus* spp.), sculpin (*Cottus* spp.), goldfish (*Carassius auratus*), carp (*Cyprinus carpio*), bluegill (*Lepomis macrochirus*), pumpkinseed (*L. gibbosus*), largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), yellow perch (*Perca flavescens*), lamprey (*Entosphenus* spp.), black bulhead (*Ictalurus nebulosis*), and threespine stickleback (*Gasterosteus aculeatus*).

Methods

<u>Juvenile Out-migration</u>

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 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.

Trapping and tagging Procedures

We have often been unable to obtain reliable estimates due to high flows that commonly occur in winter and spring. The heavy debris loads associated with these high-flow events have the potential to clog the screw trap cone and impinge and kill out-migrating juvenile fish. During normal to high flow years between 1999 and 2009, we were forced to temporarily halt operation of the trap to avoid trap mortality numerous times throughout the season. This affected our study and estimates negatively because studies to obtain outmigration estimates require or at least benefit from continuous operation. In 2010, we found that we could operate the trap during high water events and minimize trapping mortality through multiple visits to the traps during a 24 hour period and in some cases camping out at the trap and cleaning it periodically throughout the night. Our study and out-migrant estimates have improved since we have combined continuous fishing with rigorous maintenance. The trap was operated continuously in all but the highest flows. During the entire period of operation the trap was checked daily in the mornings including holidays and weekends, even during low and moderate flow.

Our screw trapping protocol was similar at all four of the screw traps that we operate (upper Toppenish, lower Toppenish, Ahtanum, and Satus) in the lower Yakima River basin tributaries. Each trap was visited at least once a day usually between 6:30 AM and 11:00 AM. Fish were netted out of the live box, identified and target fish were held in 5-gallon buckets. Aeration using battery operated pumps was applied if needed (i.e. more than 20 to 30 smolts depending on size were captured). All juvenile steelhead were anesthetized in MS-222 before being handled. They were then enumerated, measured (mm), and weighed (g). Scales were collected on up to 300 individuals per season and location (up to 10 per day). We also collected fin clips from 100 individuals from Toppenish Creek. These samples were sent to CRITFC for DNA analysis to be used in several ongoing studies. On several occasions when large catches occurred (n> 300) only a random sub-sample (first 100) were measured. We inserted PIT tags into a subsample (first 100 of the day) of captured steelhead smolts over 80 mm in length. PIT tagged fish were released several hundred meters upstream from the trap to estimate trap efficiency (i.e. mark-recapture). The upstream release site alternated between the right and left banks of the stream. Efficiency releases were made 4 times per week (Monday-Thursday) and release numbers and recaptures for the week were pooled. Day and night releases were compared for several efficiency release groups. We set a target of 4000 steelhead juveniles to PIT tag and attempted to space our tagging effort throughout the season so the total out-migration was represented appropriately. Due to variable seasonal catches, there is no clear formula to achieve this and the target number tagged per day had to be adjusted several times during the season; however, we still ended the season short of our target of PIT tagged fish.

Scales were collected from 100 Toppenish Creek steelhead smolts of varying sizes to use in conjunction with PIT tag data to assess survival by year class. After handling we released steelhead juveniles, along with all recaptures and undersized fish 100 meters downstream below a check dam structure. Physical data (water temperature, air temperature, and percent cloud cover) were recorded. The trap rotation rate (seconds per revolution) was recorded to evaluate operating efficiency.

Juvenile out-migration estimate

Studies using capture-recapture methods have been used to obtain fairly precise estimates of smolt production of anadromous salmonid species including steelhead (Thedinga 1994, Calson et. al. 1998, Rawding and Cochran 2007). Several variations of the capture-recapture model are used throughout the Columbia basin. We utilized a Petersen’s stratified capture-recapture model to estimate juvenile steelhead outmigrant abundance.

The assumptions of this model are:

1) The population is closed;
2) All fish have an equal probability of capture in the first period;
3) Marking does not affect catchability;
4) The fish do not lose their marks; and
5) All recovered marks are reported (Volkhardt et al. 2007)

Due to changes in factors shown to affect trap efficiency (i.e. stream flow, temperature, increasing smolt size) that occur as the out-migration season progresses, we stratified our estimate temporally by week. Darr 2.02 software for R utilizing Darroch's (1961) maximum likelihood estimator for stratified data was used to obtain an estimate and its associated variance (Bjorkstedt 2005 and 2009). A one-trap study design was used. Since at least 5 recaptures are typically necessary to converge, Darr 2.02 incorporates an algorithm that automatically pools adjacent strata as needed. We enabled this algorithm because many strata outside the peak migration period had fewer than five recaptures. During periods of high flow when operation of the trap was not possible and trapping was suspended, we interpolated daily catch numbers by calculating the mean of the three days before and the three days after the missed period.

<u>Adult abundance and distribution</u>

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 attempt to perform a census survey on all recognized spawning habitat in each tributary. The Yakama Nation Fisheries Program has attempted 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.

Redd Count Expansion

Several methods were considered to convert our redd counts to estimates of adult spawner abundance. We attempted to quantify redd life and surveyor accuracy. Although, not incorporated into an estimate of adult abundance, these studies provide some insight into spawn timing and the accuracy of redd counts as tool to index adult spawner abundance.

To translate our census count into an estimate of steelhead abundance we utilized the method outlined in Gallagher et al. (2007). The cumulative redd count was multiplied by the standard 2.5 fish per redd used for Washington streams for an estimate of spawning escapement. Other expansion coefficients were also considered (Poxon et al 2011).

4. Results

a. Fish Population Status Monitoring (RM&E)

Juvenile Out-migration

The upper Toppenish Creek trap was deployed during the first week of September, 2011 and remained in until early June, 2012. Juvenile *O. mykiss* were captured throughout this period, but catch rates were low at the beginning and end of the season indicating that little of the outmigration season was missed. Above-normal precipitation and snowpack in 2012 resulted in several runoff events that were beyond those seen in previous years of screw trap operation. As a result, the trap was removed on three occasions for short periods of several hours to several days due to movement of large debris jams and the possibility of stranding operators at the screw trap site. However, during most of the frequent high water events during 2012, we managed to keep the trap operating. During periods of high flow and high catches, staff would stay onsite at the upper Toppenish screw trap in a small travel trailer, check the trap every two hours throughout the night and clean any debris from the cone or live-box. In 2012, YRWP personnel had to stay on-site overnight at the upper Toppenish trap for a total of 4 to 5 weeks mostly between the end of December and mid-April. This practice improved trap efficiency and reduced mortality. Overall (average) trap efficiency for the 2012 outmigration season was 13.7% and juvenile *O.mykiss* mortality for the season was 1.35%. Despite this success, the frequency and magnitude of flood events during the season resulted in lower average efficiency and a higher mortality rate for the MY (migratory year) 2012 season compared with the MY 2011 season.

The first juvenile steelhead of the season was captured on October 27th, 2011--nearly 2 months after the screw trap was first deployed. Little movement by steelhead smolts was shown to occur during the month of June during prior screw trapping seasons. This indicates that little outmigration occurs during the warmer periods of the year. It also may suggest that few residents are present in this reach of Toppenish Creek.

In MY 2012, the peak in screw trap catch occurred at the end of November--earlier than normal. Migratory behavior appeared to be triggered by a minor spike in discharge (Figure 3). 27.5 % of the MY 2012 juveniles were captured before December 1st, when typically only a few juveniles were captured during this period in previous years.

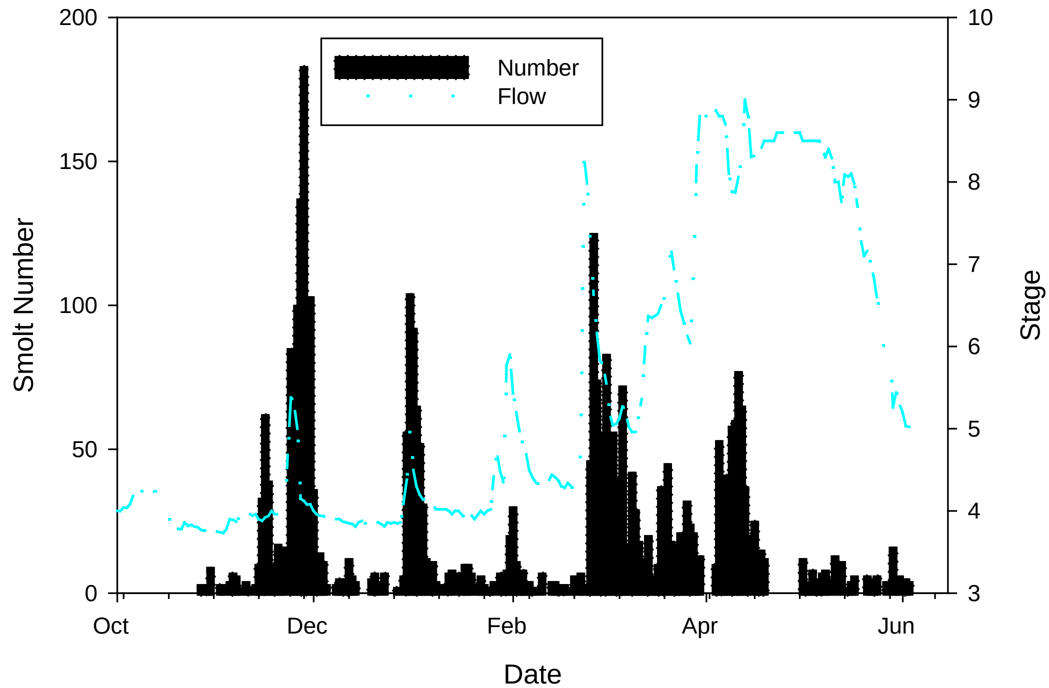

Figure 3. Number of steelhead juveniles captured per day (daily catch) compared with stream stage (staff gage reading) at the Upper Toppenish Creek screw trap in 2012.

During MY 2011, monthly catches decreased later in the season with less than 7% of the annual catch occurring during the spring period (March-June). However, at the nearest PIT tag detection site on the Yakima River at Prosser dam (RM 48), migrants typically are detected from the end of April through May. In MY 2012, we observed a different pattern. More spring migration was apparent at the screw trap with 41% of the catch occurring from March through June, in contrast with the typical year in which the majority of steelhead juveniles appear to pass the trap from November through January. Surprisingly, the 2012 out-migration pattern most closely resembled that of 2005, but 2005 was one of the drier years on record.

The total catch for the 2012 season was 3471 steelhead and of these, 2393 were PIT tagged. Catches and numbers tagged decreased from MY 2011 due to higher spring flows that decreased the efficiency of the trap.

Our primary goal in operating the screw trap is to estimate of the number of steelhead juveniles migrating out of the spawning and rearing habitat of upper Toppenish Creek and into the over-wintering habitat on lower Toppenish Creek and the Yakima River (outmigration estimate). In 2012, our estimate of total outmigrating juveniles was 40,152 (SE=3790; CV=9.4%). The trap operation had to be halted for several short periods due to above-normal peak flows that washed out the access road to the trap. Catches were interpolated during these high flow dates from catches three dates before and after trapping was halted. For the purpose of monitoring trends in juvenile out-migration, using the estimate of all juveniles captured at the trap is probably prudent assuming that no substantial differences in age composition or migratory behavior exist between years.

Although these estimates do not differentiate between residents and anadromous steelhead smolts, we have concluded that the number of residents moving through the portion of Toppenish creek where the trap site is located is small and possibly discountable. That assumption is based on documentation of very few recaptured *O.mykiss* that were not previously released upstream as part of an efficiency test and recaptured within a few days. With a more robust resident population we would expect periodic recaptures of residents that were PIT-tagged earlier in the season or in prior years. These non-efficiency recaptures are more commonplace in watersheds where resident populations are present at the trapping location. Another indicator of resident *O.mykiss* absence is the rarity of individuals larger than 200 mm in the catch. Such larger individuals are however, sometimes seen further upstream during summer snorkel surveys. High summer temperatures may prevent the resident population from establishing themselves lower in the watershed where the traps are located. In our similar screw trap on Ahtanum Creek, we frequently catch *O. mykiss* larger than 200 mm, despite the slower rotation rate of the trap cone. This suggests that trap avoidance by larger fish is not the reason for their absence in the Toppenish Creek catch. Large *O.mykiss* are also rare in the Satus Creek screw trap catch.

Lower Toppenish Screw Trap

In 2012, we operated a second screw trap at a new location near the mouth. Fourteen juvenile steelhead were captured at this site indicating that the trap location and site stream morphology was not ideal. However, we could not locate a better site near the mouth of Toppenish Creek. Like our other sites on the Yakima River floodplain, morphology and low gradient make screw trapping a challenge. It is impossible to obtain estimates of outmigration with such a low sample size. Timing is also unclear for the same reason; however, outmigration through this location appears to occur throughout the season (December through June). Most PIT-tagged juveniles appear at the first detection facility at Prosser Dam from late April through mid-May.

We recaptured two steelhead juveniles tagged at the upper screw trap site and both appeared to exhibit overwinter growth. This is consistent with a previous trapping study conducted on lower Toppenish Creek at the USFWS Toppenish Refuge where over winter growth of PIT tagged juveniles was also observed (Jezerek and Petersen 2005). In addition to steelhead juveniles, we captured 1106 chinook smolts--mostly smaller specimens that were likely fall chinook--but also some larger possible spring chinook juveniles earlier in the season. Three coho juveniles were captured during the spring period as well.

We hope to increase the efficiency of this trap in future years by using weir panels to direct more flow and fish into the screw trap. The trap data supplement detections at an instream PIT tag antenna operating at the same location since December, 2011. We hope to continue operation of the screw trap through 2013 to test efficiency of these antennas in detecting outmigrating smolts and to recapture juveniles tagged upstream to collect information on winter growth. If the antenna continues to operate at a high-enough efficiency allowing us to calculate survival rate through the lower reach, we may relocate the lower screw trap to Marion Drain to obtain an out-migrant estimate for that part of the Toppenish Creek watershed.

Adult Abundance

In 2012, only 46 redds were identified in the Toppenish Creek watershed. This is substantially fewer than expected and certainly reflects the poor surveying conditions discussed above, rather than low spawning escapement in the Toppenish Creek *w*atershed. This is the lowest number of redds documented since 2006.

Of the Toppenish Creek sub-watersheds, the planned three passes could only be completed in the Simcoe Creek watershed. Fourteen redds were identified in the Simcoe Creek watershed. High flows are typically less of a barrier to completing spawning surveys in Simcoe Creek.

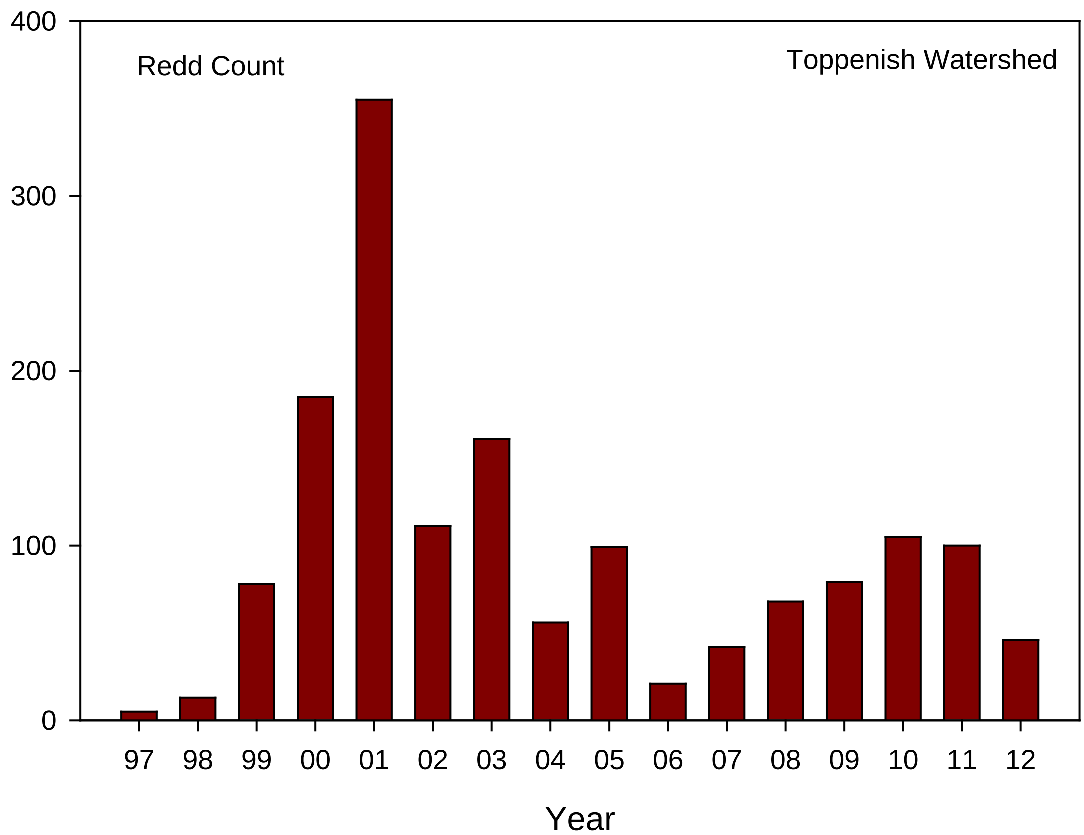

Figure 3. Number of steelhead redds per year in the Toppenish Creek watershed for the period from 1997 to 2012.

In the mainstem of Toppenish Creek, only one pass could be completed after the flows subsided in late May. Surveys of two reaches comprising the center of steelhead spawning in the mainstem were completed on March 27^{th}, 2012. Rain and rising waters on March 28^{th} prevented us from finishing the survey of the mainstem as planned. Heavier rain (4 to 7 inches) over the following days in the region produced a flood not seen in the watershed since the late 1990's (Ladd 2012a, b). At elevations above 4000 feet, substantial snow pack was added during this event. Preliminary discharge readings at the Toppenish Creek gage at river mile 44 peaked at over 7000 cfs, and this site does not include discharge from Simcoe Creek which enters at river mile 32.7. As discharge from the precipitation subsided in mid-April, warmer temperatures triggered snowmelt in the higher elevations of the Toppenish Creek watershed where snow pack was 152% of normal on April 1, 2012^{st} (Ladd 2012a). These events created conditions where wading surveys were impossible between March 28^{th} and May 20^{th}—most of the steelhead spawning season. These conditions resulted in a redd count totaling only 18 for the mainstem Toppenish Creek. Most of these (N=10) were documented in the uppermost reach where water temperature is cooler and spawning appeared to occur after most of the scouring flows receded. No redds were identified below the Willy Dick Creek confluence (river mile 48.5) where spawning habitat is typically productive. In addition, fewer redds than normal were identified in the North Fork Toppenish Creek.

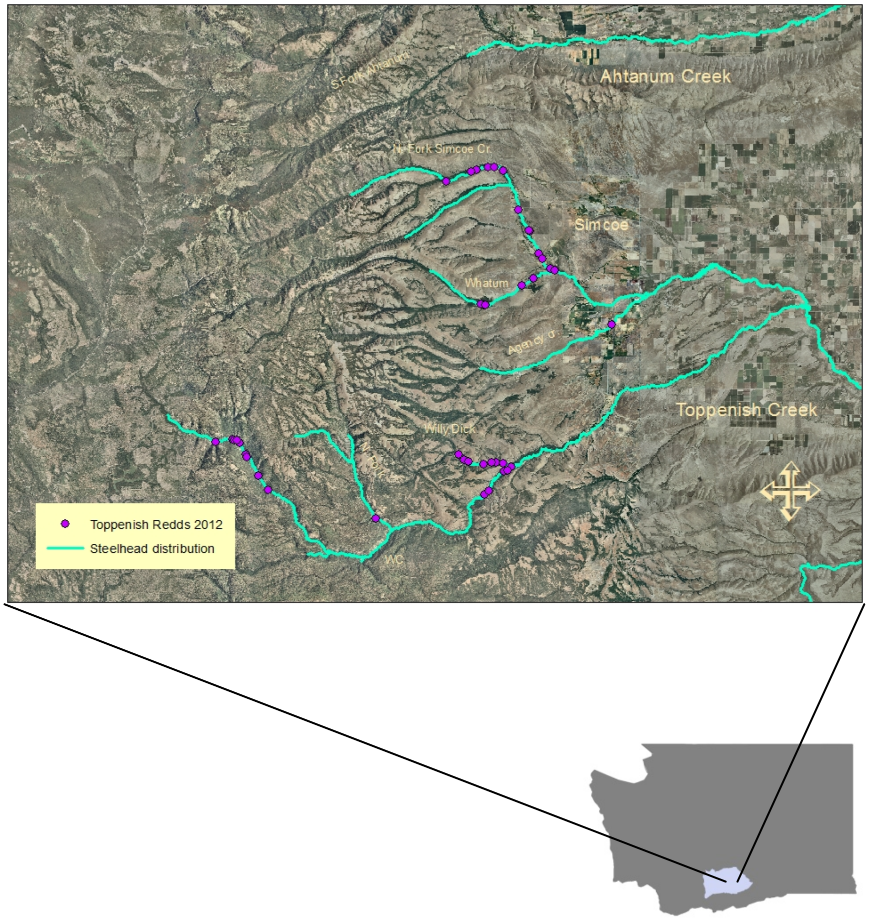

Figure 4. GPS locations of steelhead redds identified in the Toppenish Creek watershed in 2012

Efforts to determine redd life through weekly surveys of selected reaches and efforts to determine surveyor efficiency were abandoned in 2012 due to the large flood events that occurred on March 30, 2012. High water persisted throughout the peak steelhead spawning season in April preventing repeat wading surveys. After flows dropped in May, very few redds were identified so repeat surveys were not attempted during that period either.

Irrigation Drains

Seven redds were identified during a survey of Marion and Harrah drains on March 5th, 2012. A survey of the South Satus drain that empties into the Yakima River several hundred meters downstream from Satus Creek did not reveal any redds or adult steelhead despite the presence of riffles that could be used for spawning by steelhead.

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

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 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.

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7. 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

8. Appendix B: Detailed Results

Table B1. Monthly steelhead catch statistics for the rotary screw trap in upper Toppenish Creek (RM 26.5) for the 2012 season.

Stat	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Overall
Monthly Catch	12	944	281	364	439	765	540	119	7	3471
% of total	0.3%	27.2%	8.1%	10.5%	12.6%	22.0%	15.6%	3.4%	0.2%	100.0%
Max Fork Length	183	246	270	343	198	195	190	190	164	343
Min Fork Length	104	68	72	65	50	60	57	71	104	12
Mean Fork Length	131.71	120.59	117.91	116.19	111.24	111.55	100.57	121.08	131.71	113.66
Max Weight	42	145.3	169.89	197.31	73.13	75.11	66	62.2	42	197.31
Min Weight	11.1	3	1.2	1.3	1.7	2.32	1.8	2	11.1	1.2
Mean Weight	24.17	19.42	18.66	16.14	15.55	16.92	13.55	22.12	24.17	17.29
Mean Cond.Factor	0.998	0.975	0.991	0.942	0.984	1.048	1.103	1.067	0.998	1.299
Number tagged	7.0	585.0	145.0	305.0	386.0	502.0	376.0	75.0	7.0	2393.0
% monthly catch tagged	58.33%	61.97%	51.60%	83.79%	87.93%	65.62%	69.63%	63.03%	100.00%	
%of total	0.20%	24.45%	6.06%	12.75%	16.13%	20.98%	15.71%	3.13%	0.29%	68.94%

Table B2. Monthly steelhead catch statistics for the rotary screw trap in lower Toppenish Creek (RM 1) for the 2012 season.										
Stat	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Overall
Monthly Catch	0	0	1	1	4	4	3	1	0	14
% of total	0.0%	0.0%	7.1%	7.1%	28.6%	28.6%	21.4%	7.1%	0.0%	100.0%
Max Fork Length		.	200	110	154	164	180		.	200
Min Fork Length		.	200	110	97	80	80		.	80
Mean Fork Length		.	200.00	110.00	125.25	130.75	145.67		.	136.23
Max Weight		.	73.13	13.9	154	44.5	56.7		.	73.13
Min Weight		.	73.13	13.9	97	19.3	4.9		.	4.9
Mean Weight		.	73.13	13.90	125.25	33.47	37.17		.	31.68
Mean Cond.Factor		.	0.914	1.044	0.928	1.009	0.943		.	0.967
Number tagged		.	1.0	1.0	4.0	1.0	3.0		.	10.0
% monthly catch tagged		.	100.00%	104.43%	100.00%	25.00%	100.00%		.	
%of total		.	10.00%	10.44%	40.00%	10.00%	30.00%		.	71.43%

Table B3.	Number of steelhead redds in the Toppenish Creek watershed in 2012.			
	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	**10**
	"East Bank" (61.1)	NF confluence (55.4)	5.7	**2**
	North Fork (55.4)	Washout (50.9)	4.5	**0**
	Washout (50.9)	Willy Dick Cr (48.5)	2.5	**5**
	Willy Dick Cr (48.5)	Olney Lateral (44.2)	4.3	**0**
	Olney Lateral (44.2)	Pom Pom Rd. (38.9)	5.3	**0**
	Pom Pom Rd. (38.9)	Shaker Church Rd.	3	**0**

		(35.9)		
Total			**29.9**	**18**
N. Fork Toppenish	NF Falls (4)	NF confluence (0)	**4**	**1**
Willy Dick	old logging site (4)	Confluence (0)	**4**	**8**
	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	**4**
	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	**6**
	Simcoe Creek Rd. (15.3)	Wesley Rd. (10.1)	5.2	**2**
	Wesley Rd. (10.1)	N. White Swan Rd. (8.1)	2.0	**0**
	N. White Swan Rd. (8.1)	Stephenson Rd. (5.9)	2.2	**0**
Total			**25.7**	**14**
Agency	Falls (8.9)	Lateral Canal (4.4)	4.5	**0**
	Lateral Canal (4.4)	Confluence (0)	4.4	**1**
Total			**8.9**	**1**
Wahtum	Yesmowit Rd. (3.6)	Confluence (0)	**3.6**	**5**
Total			**76.1**	**46**

Table B4. Steelhead juvenile catch and mark-recapture data stratified weekly for the upper Toppenish creek screw trap for the MY 2012 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	10/24-10/30	12	0	0	
Week 2	10/31-11/06	13	0	0	
Week 3	11/07-11/13	12	0	0	
Week 4	11/14-11/20	167	124	17	2
Week 5	11/21-11/27	373	112	14	7
Week 6	11/28-12/04	446	291	64	1
Week 7	12/05-12/11	12	9	1	
Week 8	12/12-12/18	19	19	4	1
Week 9	12/19-12/25	19	19	1	
Week 10	12/26-01/01	255	143	7	36
Week 11+	01/02-01/08	176	156	52	
Week 12	01/09-01/15	21	7	0	
Week 13	01/16-01-22	31	23	3	
Week 14	01/23-01/29	19	5	0	
Week 15	01/30-02/05	78	65	9	
Week 16	02/06-02/12	11	3	2	
Week 17	02/13-02/19	11	11	3	
Week 18	02/20-02/26	184	162	5	14
Week 19	02/27-03/04	388	308	19	
Week 20	03/05-03/11	217	159	13	1
Week 21	03/12-03/18	88	36	3	
Week 22	03/19-03/25	158	103	8	
Week 23*	03/26-04/01	143	66	1	
Week 24*	04/02-04/08	224	106	2	1

Week 25	04/09-04/15	311	225	11	
Week 26	04/16-04/22	53	44	1	
Week 27*	04/23-04/29	21	0	0	
Week 28	04/30-05/06	33	15	1	
Week 29	05/07-05/13	39	16	1	
Week 30	05/14-05/20	9	8	0	
Week 31	05/21-05/27	19	15	0	
Week 32	05/28-06/03	29	19	2	
Total	**10/24-06/03**	**3591**	**2269**	**244**	**63**

*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.

+ One individual in week 11 was recaptured 6 weeks after it was released upstream of the trap.

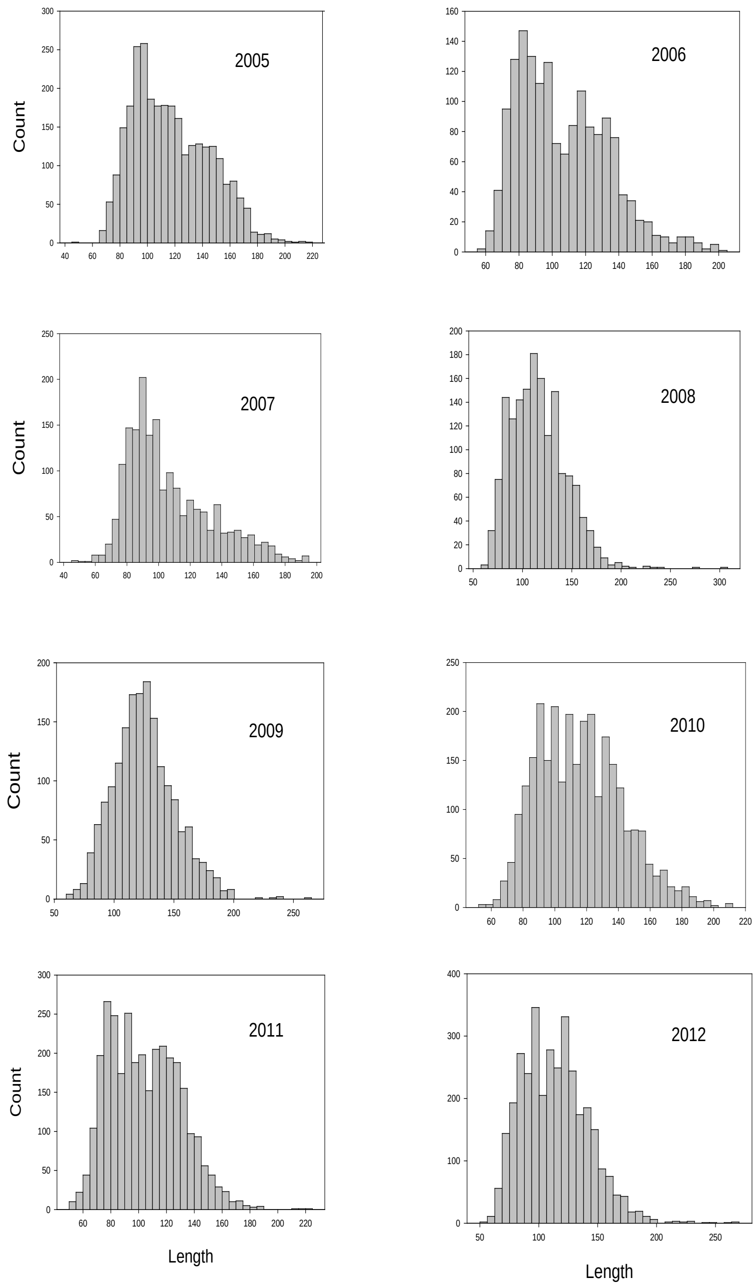

Figure B5. Length-frequency distribution for measured juvenile steelhead (*O.mykiss*) captured in the upper Toppenish Creek screw trap between October and June for years 2005 to 2012.

9. Appendix C: List of Metrics and Indicators

Number of steelhead redds

Juvenile outmigrant abundance