Yakima Tributary Access & Habitat Program

Annual Biological Monitoring Report 2007

Prepared by WDFW

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For

Yakima Tributary Access & Habitat Program

SCW Resource Conservation & Development Council

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Introduction
The Yakima Basin in Central Washington is home to approximately 500,000 acres of irrigated agriculture lands and numerous municipalities, with a population nearing 400,000. The 214 mile Yakima River and its 6,155 square mile watershed provide habitat for resident and anadromous fish species, including Chinook and coho salmon, as well as federally listed as threatened, Middle Columbia River Steelhead and Columbia River Bull Trout. In an effort to enable private landowners to actively participate in salmon, steelhead and bull trout recovery, the Yakima Tributary Access & Habitat Program (YTAHP) was formed to provide fish passage at man-made barriers, screen irrigation diversions and improve in-stream and riparian habitat conditions. Juvenile salmonid habitat is limited in the mainstem Yakima River due to flow regulation and little floodplain habitat. By providing passage into tributary streams, juvenile salmonids will gain valuable rearing habitat.

Bonneville Power Administration (BPA) through the Northwest Power and Conservation Council's Fish and Wildlife Program currently provides the base funding for YTAHP. The investment of public funds into these habitat enhancement projects warrants an evaluation of their effectiveness at achieving their objectives. Future BPA funding is contingent upon monitoring and evaluating these and future projects to determine their effectiveness in providing fish passage to upstream habitat and preventing entrainment within artificial irrigation waterways.

YTAHP recognizes that habitat above and around project sites may not be recolonized immediately by species that previously were denied access to upper reaches of streams, however it is hypothesized that species richness and salmonid abundance will increase (over one or more generations) above man-made barriers once passage is corrected. A monitoring approach that will enable detection of large-scale changes in species richness and abundance within individual project sites on a short-term basis as well as a broad, long-term, watershed scale has been proposed. It is difficult to extrapolate findings from one watershed to adjacent watersheds; however, given limited monitoring resources within the YTAHP statement of work, we have developed a manageable monitoring plan that provides specific information on the biological benefits of our projects. It is generally assumed that removal of fish passage barriers and implementation of correctly designed fish passage structures leads to reestablished access for salmonids. Roni et al. (2002) supports this assumption by prioritizing restoration efforts into five general categories: (1) habitat reconnection, (2) road improvement, (3) riparian restoration, (4) instream habitat restoration, and (5) nutrient enrichment. The highest category includes removing passage barriers and screening diversions as a means of re-connecting habitat.

Although restoring watershed processes is generally the preferred approach to attain watershed health and function; restoring "process" (i.e. channel migration; re-connection of off-channel habitat) often involves a different temporal scale than site-specific projects, such as those most often implemented by the YTAHP. Site specific remedies are warranted when considering near-term benefits to threatened species (i.e. steelhead and bull trout).

In addition, fish passage was listed as a limiting factor throughout the Yakima Basin in the Salmon Recovery Plan, Steelhead Recovery Plan (update will be submitted to NMFS in

August 2008), and the Yakima Subbasin Summary. YTAHP projects are contributing to the overall watershed recovery by enabling fish access to valuable tributary habitat, reducing risks of entrainment, and enhancing instream rearing conditions.

Two species of fish in the Yakima Basin are listed under the Endangered Species Act as threatened. The following describes potential effects on these fish from monitoring activities and what will be done to minimize any negative outcomes. WDFW personnel are the project leaders for monitoring efforts. They have the appropriate NMFS and USFWS sampling authorizations to conduct scientific research in waters containing species listed under the ESA. Protocol will be strictly adhered to and every effort will be made to prevent harm to any species.

Steelhead

Federally threatened Middle Columbia River Steelhead (*Oncorhynchus mykiss*) are present within the Yakima River Basin. Based on low steelhead counts at Prosser and Roza Dams (Table 1), historical redd counts (available at www.ykfp.org), and gene flow data from Pearsons et al. (2003); it is not likely that the anadromous form of *O. mykiss* encountered within the Yakima Basin exceeds 4% of all *O. mykiss*. Previous electrofishing surveys within YTAHP selected tributaries (WDFW unpublished data, YTAHP 2007) indicate that the majority of *O. mykiss* encountered are less than 250 mm fork length. McMichael et al. (1998) determined that injury rates associated with electrofishing to *O. mykiss* less than 250 mm fork length in Yakima Basin tributaries was only 5% when using a multiple pass sampling approach similar to the proposed methods as described below. Cumulative electrofishing mortality rates were calculated to be only 10% of injured fish (McMichael et al. 1998). Based on the low probability of encountering *O. mykiss* of the anadromous life history form, and low incidences of injury, the risks associated with the proposed methods will have discountable effects on Middle Columbia River Steelhead. These risks were accepted by NMFS, and a 4(d) take authorization was granted to WDFW under the YTAHP program to conduct these monitoring efforts.

Bull Trout

Bull trout (*Salvelinus confluentus*) occurred historically throughout most of the Yakima River Subbasin. Today, however, they are fragmented into relatively isolated stocks and federally listed as threatened. Although bull trout were probably never as abundant as other salmonids in the Yakima River basin due in part to their requirements for cold, clear water, they were certainly more abundant and more widely distributed than they are today (WDFW 1998). Within the Middle Columbia River Unit, the United States Fish and Wildlife Service (USFWS) recognizes 13 subpopulations (USFWS 2002). WDFW conducts spawning surveys annually to monitor these subpopulations. Adult bull trout in the Yakima Basin often begin migrating into their spawning streams in July-August and hold until spawning in September-November. Their eggs incubate until emergence in April-June, depending on stream temperature. The majority of bull trout spawning occurs above 3000 feet in elevation within the Yakima Basin (WDFW 1998). Most of YTAHP's sampling efforts are in lower

Table 1. Annual steelhead counts in the Yakima River from 1995 to present. Dam counts include the time period from July of the previous year to June of the stated year. All data is available on www.ykfp.org and www.cbr.washington.edu/dart/.

Year	Prosser Dam	Roza Dam
1995	925	23
1996	504	92
1997	1106	22
1998	1113	51
1999	1070	14
2000	1611	14
2001	3089	140
2002	4525	238
2003	2235	134
2004	2665	213
2005	3451	227
2006	2005	123
2007	1537	60
2008	3115	164

elevation reaches of tributaries during the time adult bull trout are spawning in the headwaters. Spawning bull trout locations are fairly well documented, and they will be avoided during any instream sampling. For these reasons, we believe there is little chance of encountering any threatened bull trout in our monitoring efforts and any impacts would be discountable. YTAHP's monitoring efforts are not likely to encounter bull trout, but we have ESA coverage under a Section 6 agreement between WDFW and USFWS if any are encountered.

Methods

The monitoring efforts described provide meaningful baseline information to assess the biological benefits of fish passage, screening, and habitat enhancement projects. The YTAHP Monitoring Team is a small, volunteer subset of the Core Team. There are however, no dedicated personnel to conduct the surveys. Staff completed the surveys in addition to their full time positions and with the assistance of in-kind match from other agencies and interested parties. In the future, personnel outside of the YTAHP Core Team may not be available to participate in monitoring efforts. Monitoring efforts and protocol will be adjusted based on best available science, projects planned, funding levels, and available personnel.

Tiered Approach

The YTAHP monitoring team has completed two years of monitoring consisting of a two-tiered approach to assess fish species richness and abundance as biological indicators in passage improvement and artificial waterway screening projects. The first level of monitoring focuses on specific project sites at least one year before implementation and annually for at least two years after project completion. For each sampling location, a 50-meter stream section was isolated with block nets on the upstream and downstream sides of man-made barriers; and when possible, a 50-meter section within the irrigation waterway downstream from the point of diversion was sampled. Sites are monitored before implementation and after project completion when possible.

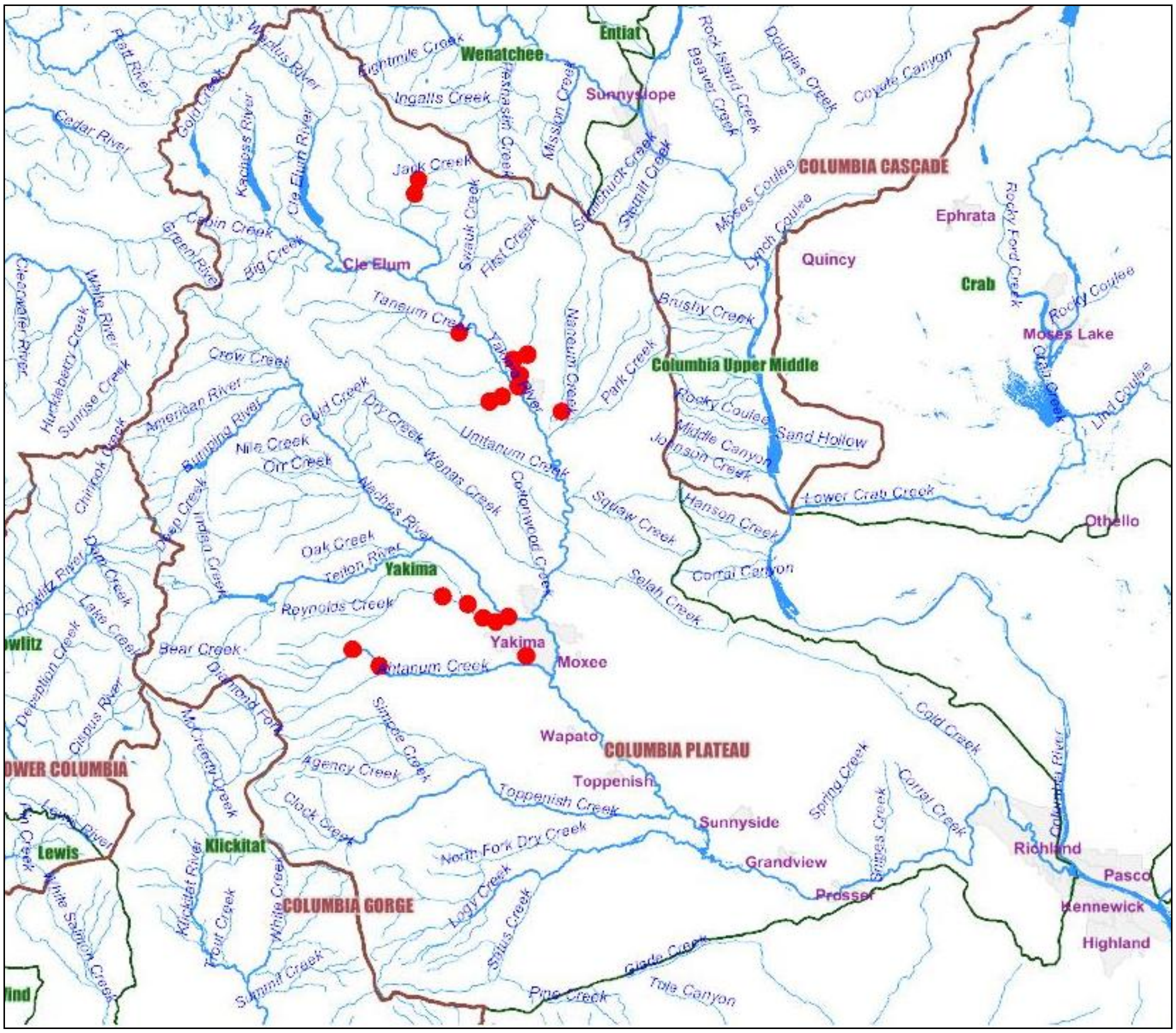

Figure 1. The red dots indicate the electrofishing sites sampled in 2007.

The second level of monitoring is extended watershed-based surveys in systems with high potential for increased salmonid use during all life stages. The Cowiche Watershed in Yakima County and Reecer/Currier Watershed in Kittitas County were selected for more long term monitoring on a watershed scale throughout YTAHP's project area. Sample locations were sites where a man-made fish passage barrier currently exists or where YTAHP corrected one, or where another habitat enhancement project is located and site access is permitted. These watersheds will be monitored for at least five years as described with the electrofishing protocol and redd surveys conducted as possible.

Sample Locations
The number of YTAHP projects implemented renders it impossible to monitor trends in fish populations at each project site; individual projects have been selected (Figure 1 and Table 2) based on accessibility, timing, and overall scope of the project. Table 2 describes the locations of the sites that were monitored during 2007.

Table 2. Sites sampled in 2007 by the YTAHP monitoring team. Monitoring type indicates if the creek was selected for watershed based monitoring or project specific monitoring. The column labeled S-T-R represents Section, Township, and Range.

Creek	Site Name	River Mile	Monitoring Type	S-T-R	Pre or Post Implementation
Wide Hollow	Fines Diversion	1.3	Project	6-12-19	Pre
NF Ahtanum	Shaw Knox	3.25	Project	7-12-16	Pre
NF Ahtanum	Gauge Station	4.53	Project	2-12-15	Pre
Cowiche	Mouth	0.0	Watershed	10-13-18	Pre
Cowiche	Ingham Bridge	0.27	Watershed	10-13-18	Control*
Cowiche	Garretson	0.88	Watershed	9-13-18	Post
SF Cowiche	Schneider	6.5	Watershed	2-13-17	Pre
SF Cowiche	Snow Mtn. Ranch	4.2	Watershed	31-14-17	Post
Coleman	Nisbet/Burris	1.03	Project	20-17-19	Pre
Manastash	Barnes	1.4	Project	4-17-18	Pre
Manastash	Menastash Div.	5.0	Project	14-17-17	Pre
Reecer	Durand	0.07	Watershed	3-17-18	Pre
Reecer	Dolarway	0.9	Watershed	34-18-18	Control*
Reecer	Dry Creek Road Div.	2.97	Watershed	28-18-18	Pre
Currier	Deneen #2	0.81	Watershed	18-18-18	Pre
Taneum	Bruton	1.42	Project	5-18-17	Pre
Indian	NF Teanaway Rd Culvert	0.22	Project	20-21-16	Pre
Jack	NF Teanaway Rd Culvert	0.66	Project	8-21-16	Pre

**denotes a site without a YTAHP project directly related to it, but within a priority watershed*

Electrofishing Methods
Backpack electrofishing was used as the primary means of gathering fish abundance data in selected tributaries. The electrofishing guidelines established by NMFS (2000) were strictly adhered to. Experienced crews of four to six individuals sampled in the late summer and fall when flows were low enough that creeks could be sampled efficiently and when volunteer crews were available. All sites were examined prior to the initiation of electrofishing to ensure that large, migratory salmonids or their redds were not present within the area.

Figure 2. Members of the YTAHP monitoring team electrofishing downstream of the Bruton diversion in Taneum Creek in 2007.

A 50-meter section was blocked off and was sampled (Figure 2) on the upstream and downstream sides of man-made barriers or habitat improvement project sites. When possible, a 50-meter section within the irrigation ditch downstream from the point of diversion was also sampled. The multiple-pass, removal/depletion method as described by Zippen (1958) was used to estimate fish abundance. A minimum of two electrofishing passes were conducted such that the number of salmonids captured on the last pass was no greater than half of the number of salmonids captured on the previous pass. Due to time and personnel constraints, no more than three passes were conducted even if the 50% depletion was not achieved. Additionally, if no native salmonids were captured during the first pass, a second pass was not completed.

Fish were held in large coolers and fresh water was added periodically to ensure cool temperatures and adequate levels of dissolved oxygen such that fish remained in good condition. To aid in the safe and efficient handling of fish, they were lightly sedated then measured to fork length (mm). Once species and lengths were recorded, they were immediately placed in a recovery cooler and not released until they were fully recovered. Salmonids were processed first so they could be released into the flowing water as quickly as possible after recovery.

The biases associated with electrofishing in general and using the removal depletion method for estimating abundance are well documented. However, given the limited resources available, this method provides reliable, reproducible information that can be used to track long-term trends in salmonid populations and abundance in habitat where access has been reestablished through barrier removal projects.

Species Abundance & Richness Trend Monitoring
The monitoring protocol described will provide consistent and reliable trend data related to specific biological response indicators through time. Sample locations will remain relatively constant throughout the monitoring period. Based on changing channel conditions and project priorities, some changes to sampling sites have occurred. Data will be analyzed to detect differences in species richness and abundance through time, after barriers have been corrected such that they are in compliance with state and federal fish passage criteria, and after habitat enhancement projects. In addition, where screens have been installed, irrigation ditches may be sampled when possible and we expect that we will see a decrease in the number of fish (specifically salmonids) in the artificial irrigation waterways.

Spawning Surveys
Redd surveys were conducted in November and December in the Cowiche and Reecer Creek Watersheds where suitable and accessible habitat occurred for coho salmon spawning. Two individuals walked a stream section from the mouth, upstream and looked for redds, carcasses, and live spawners. All redds were marked with a GPS location and flagged in the field. Carcasses were examined for clipped fins and their sex was determined when possible (Figure 3). Spawning surveys were coordinated with other agencies that already conduct similar surveys to avoid redundant efforts. In order to have comparable data, YTAHP adopted the methods of the agency that conducts the most redd counts for the specific species (YN – coho) in the Yakima Basin. The YTAHP has been successful in sharing information amongst agencies to eliminate redundant surveys, and increase the area of coverage.

Figure 3. Coho carcass discovered in lower Cowiche Creek during a redd survey in December. This carcass had been preyed upon, contributing marine derived nutrients to the ecosystem.

Data Analysis
We implemented a removal-depletion sampling protocol to obtain abundance estimates for salmonids. In most cases, the number of salmonids captured in the second pass was less than or equal to half of the number collected in the first pass; therefore only two passes were necessary to estimate the number of salmonids within the reach according to Zippen (1958) and the following equation:

$$N = \frac{(U_1)^2}{(U_1 - U_2)}$$

where:
N = Estimated population size
U_1 = Total number of salmonids captured on first pass
U_2 = Total number of salmonids captured on the second pass.

The standard error was calculated as follows:

$$SE(N) = \sqrt{\frac{(U_1)^2 \times (U_2)^2 \times (U_1 + U_2)}{(U_1 - U_2)^4}}$$

There were four sites where three passes were necessary to achieve 50% depletion (Downstream Bruton, Upstream Bruton, Downstream Snow Mountain Ranch, and Downstream Shaw Knox). For these sites, the following equations were used to estimate the population size:

$$T = U_1 + U_2 + U_3$$

where:
T = total number of fish collected on all passes
U_i = total number of fish collected on specific pass (our maximum was three)

The ratio (R) was determined as follows:

$$R = \frac{(1-1)U_1 + (2-1)U_2 + (3-1)U_3}{T}$$

The proportion of fish captured (Q) during all removals is determined using the calculated R value and graphs published in Zippen (1958). The population (N) can then be estimated using the following equation:

$$N = \frac{T}{Q}$$

The standard error is calculated as follows:

$$SE(N) = \sqrt{\frac{N(N-T)T}{T^2 - N(N-T)\frac{(kp)^2}{(1-p)}}}$$

where:

k = total number of passes/removals
p = estimated probability of capture based on R and figures in Zippen (1958).

Regardless of the number of passes, the 95% confidence interval for the population estimate was calculated as follows:

$$95\% CI = N \pm (1.96 \times SE_N) .$$

The total number captured per hour was calculated as follows:

$$\#Captured/hr = \frac{T}{\sum(t_1 + t_2 + t_3)}$$

where:

t_i = time in hours sampled per pass (convert seconds to hours).

Results and Discussion
Salmonid Abundance~Electrofishing Surveys
Population estimates for salmonids (salmon, steelhead, trout, and whitefish) were calculated for each site (Table 3) when possible. Steelhead could be present in the Yakima Basin at any time and it is impossible to visually differentiate between juvenile steelhead and resident rainbow trout. For the purposes of this report, rainbow trout will be used to describe the presence of any *O. mykiss*. One focus of this report is on differences in species composition and abundance above and below barriers (Figure 4).

<u>Wide Hollow Creek</u>
The Fines diversion has a manmade dam that prevents fish passage for most species at most flows, and has an unscreened and uncontrolled ditch associated with it. The ditch conveys water from Wide Hollow Creek year round, beyond irrigation season, because it lacks a headgate and metering system. YTAHP is in the planning phases to provide fish passage, install a screen and meter this diversion in FY 08. The YTAHP monitoring team sampled upstream and downstream of the dam and 50 meters in the ditch in 2006 and 2007, prior to project implementation. Wide Hollow Creek receives canal spill during the irrigation months and consequently, the flows remain relatively high throughout the summer months. An effort

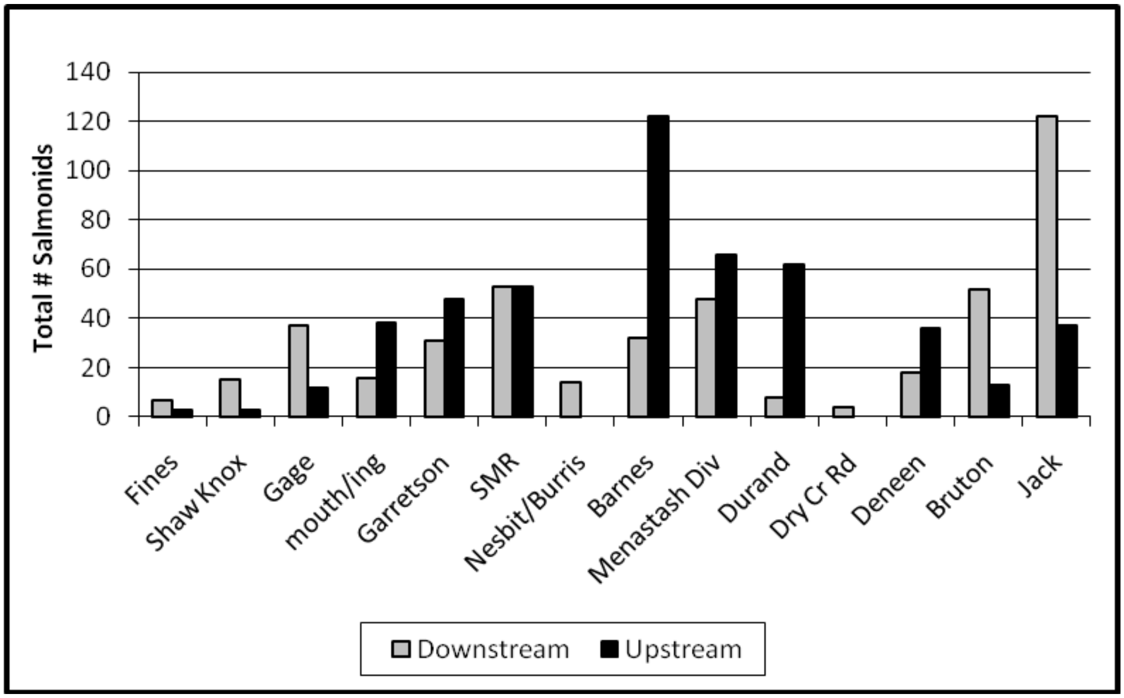

Figure 4. This graph illustrates the number of salmonids captured on the upstream and downstream sides of projects in 2007.

was made to sample this site in August, but flows were too high to sample safely or effectively. We were able to collect some data in August (noted as "test" in Tables 3 and 4), but the official effort, following standard protocol, occurred in early November, after the irrigation season was complete and canal spills into the creek ceased.

The 2007 survey occurred about one week later than the 2006 survey. Prior to electrofishing, we identified two freshly excavated brown trout (*Salmo trutta*) redds downstream of the Fines barrier. To avoid these sensitive areas, the sampling area was shortened from 50 meters to 42.4 meters. Seven brown trout of various age classes were captured in this reach. WDFW used to stock brown trout in Wide Hollow Creek and it was not known that they were naturally reproducing and self-sustaining until the 2007 YTAHP survey. Brown trout were the only salmonids captured downstream of the dam, so only a single pass was completed. A population estimate was not calculated because they are a non-native salmonid, and not a target species for YTAHP's efforts.

We also sampled the Fines ditch/canal in August and November from the connection with Wide Hollow Creek, for 50 meters downstream. The ditch was sampled in one pass for a presence/absence determination without blocknets. Coho salmon and rainbow trout were captured in the Fines ditch in August and November of 2007, similar to the 2006 sample (Figure 5). Coho salmon are known to spawn in lower Wide Hollow Creek, but it is also possible that the juvenile coho in the ditch may have swam up the ditch toward Wide Hollow

Creek from adjacent Ahtanum Creek, at the downstream end of the Fines ditch. Most salmonids were captured in a large pool near the point of diversion in Wide Hollow Creek during all sampling periods.

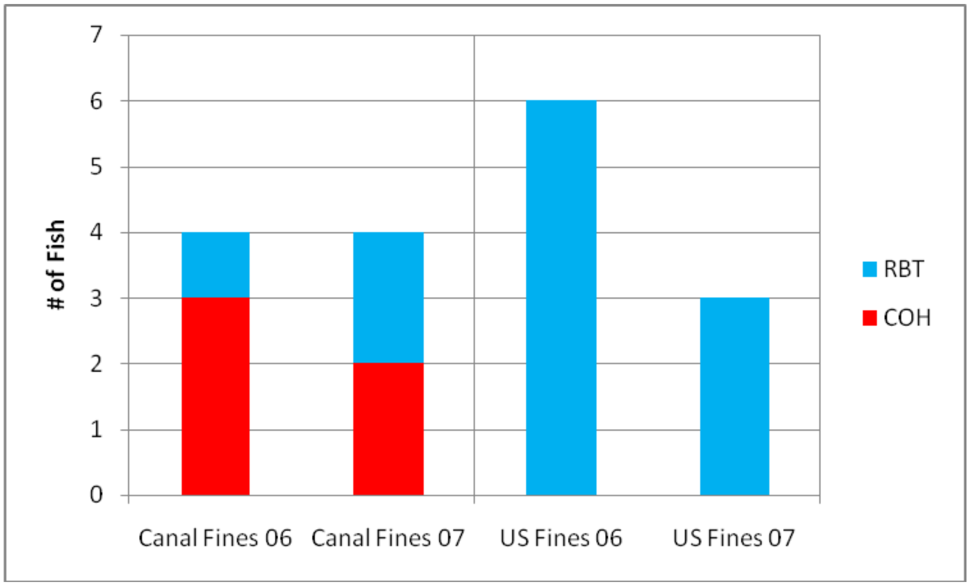

Figure 5. This figure compares the numbers and types of salmonids captured in 2006 compared with 2007 in Wide Hollow Creek when (at least) two passes were completed.

Three rainbow trout were captured upstream of the barrier and a population estimate was calculated (Table 3) based on two passes. The total number of rainbow trout and the estimated population size were less in 2007 than in 2006 (Figure 5). This is most likely due to sampling variation and normal fish movements because there have been no significant habitat changes or known events that would have likely affected salmonid population densities between the years.

Native cyprinids dominated the species composition around the Fines diversion in Wide Hollow Creek (Table 4). This site will continue to be monitored annually for at least two years post-implementation if resources allow.

North Fork Ahtanum Creek

The Shaw Knox project was completed in 2006 and it effectively screened a previously unscreened barrier and it created off channel rearing habitat through wetland enhancement. Prior to implementation in 2006, a mountain whitefish was captured in the unscreened and uncontrolled irrigation ditch. This year, we sampled the site in August, after irrigation was complete. No water was in the ditch because the headgate YTAHP installed was closed, effectively keeping all flow in the creek and out of the ditch. This was the first year in its operating history that a fish screen protected fish from entrainment in the ditch. Rainbow trout were the only salmonid species captured on the upstream and downstream sides of the point of diversion (no barrier at this site). We also sampled the inlet and outlet

Table 3. This table indicates the estimated population size (N) and the 95 % confidence interval (CI), the standard error (SE), and Salmonid Catch Per Unit Effort (CPUE) in hours for each site. The total number of salmonids captured during all passes is given as well as the salmonid catch rate for each site; all passes combined.

Creek	Site	# Salmonids Captured	N ± 95 % CI	SE	Salmonid CPUE
Wide Hollow	Downstream Fines	7			14.14
	Downstream Fines test	0			0
	Fines ditch	4			11.66
	Fines ditch test	2			5.49
	Upstream Fines	3	4 ± 6.8	3.46	3.82
NF Ahtanum	Downstream Shaw Knox	15	15 ± 0.8	0.41	11.73
	Upstream Shaw Knox	3	4 ±6.8	3.46	3.80
	Shaw Knox off channel	0			0
	Downstream Gauge	37	48 ±21.2	10.80	34.75
	Upstream Gauge	12	12 ±0.7	0.38	15.19
Cowiche	Mouth	16	20 ±12.0	6.11	22.57
	Ingham	38	66 ±65.1	33.23	34.69
	Downstream Garretson	31	40 ±18.9	9.66	30.77
	Upstream Garretson	48	84 ±74.8	38.17	72.45
	Llamas	66	81 ±21.7	11.06	64.20
	Downstream Schneider	50	59 ±14.4	7.36	52.93
	Upstream Schneider	94	112 ±21.5	10.96	101.56
	Downstream SMR	53	56 ±4.0	2.05	43.90
	Upstream SMR	53	65 ±19.2	9.77	59.61
Coleman	Downstream Nisbet/Burris	14	20 ±20.6	10.52	14.97
	Upstream Nisbet/Burris	0			0
Manastash	Downstream Barnes	32	36 ±8.3	4.24	30.71
	Upstream Barnes	122	138 ±17.0	8.66	104.17
	Downstream Menastash. Diversion	48	56 ±12.8	6.51	51.52
	Upstream Menastash Diversion	66	88±31.9	16.25	57.63
Reecer	Downstream Durand	8	13 ±20.8	10.61	10.61
	Downstream Durand test	5			14.57
	Upstream Durand	62	89 ±41.9	21.39	67.53
	Dolarway	7			22.09
	Downstream Dry Creek Road	4	-0.5* ±2.9	1.50	4.72
	Upstream Dry Creek Road	0			0
Currier	Downstream Deneen	18	21 ±8.5	4.31	17.56
	Upstream Deneen	36	53 ±35.2	17.94	50.08
Taneum	Downstream Bruton	52	58 ±6.5	3.30	32.29
	Upstream Bruton	13	17 ±3.5	1.77	12.50
Indian	Downstream Indian	23			
	Upstream Indian	13			
Jack	Downstream Jack	122	124 ±4.1	2.09	222.94
	Upstream Jack	37	38 ±2.6	1.34	52.61

*More salmonids were captured on the second pass but habitat conditions and personnel prevented us from completing a third pass. The result was a negative number for the estimated population size.

channels to the pond. These channels had very little flow at this time of year, and only one sculpin was captured in the inlet, just off the main channel. We were not able to sample the pond due to its large size and depth, but given the low flow in the inlet and outlet channels, it is likely that the pond will be most beneficial to salmonids as refuge during high flow conditions in the main channel, when the inlet and outlet channels remain watered up and in full connection to the main channel. Stranding in the pond may occur during the low flow summer months, but water temperatures remain relatively cool, below lethal temperatures for most salmonids; in late August the temperatures in the inlet and outlet were less than 20^{o} C. The Shaw Knox project was sampled in 2006, prior to setting YTAHP protocol for monitoring, so the results from 2007 are not directly comparable (Figure 6). However, rainbow trout were the only salmonids captured during both surveys, and they were in relatively low abundance both years given the habitat available. More rainbow trout were captured in 2007, using the standard protocol and more experienced crew; the downstream reach had a higher abundance of trout than the upstream reach (Figure 6).

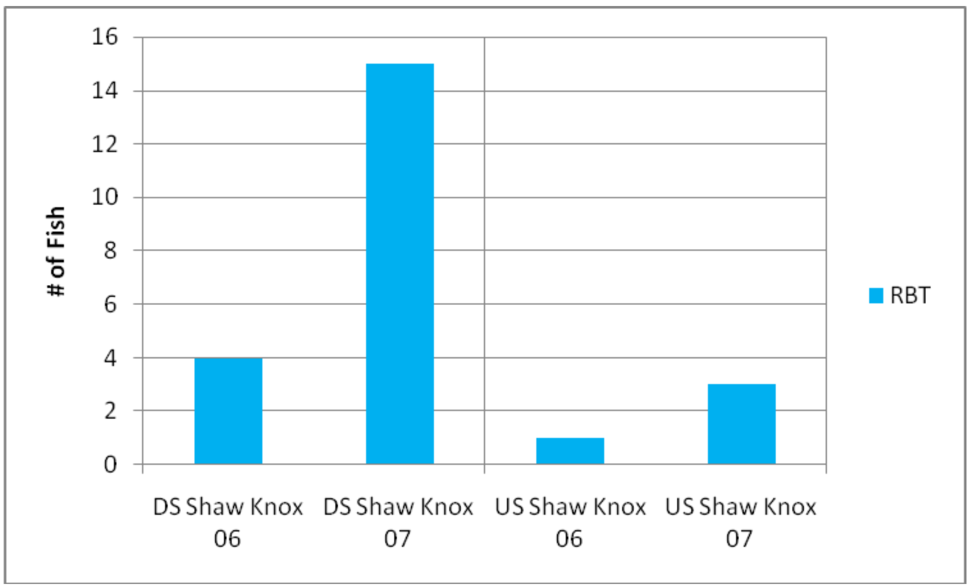

Figure 6. This figure compares the numbers of rainbow trout captured in 2006 compared with 2007 in North Fork Ahtanum Creek at the Shaw Knox site.

Baseline fish population data was collected at a stream flow gauging station that is a partial fish passage barrier, near the confluence of Nasty Creek with North Fork Ahtanum Creek. Planning efforts are currently underway to improve passage and maintain flow-monitoring capabilities at this site for implementation in FY 09. Rainbow trout were captured on both sides of the barrier; several of the trout captured were young of the year, especially downstream of the barrier, indicating that natural production likely occurs near this site. Sculpin and longnose dace were also captured in the downstream site; however no dace and noticeably fewer sculpin and rainbow trout were captured on the upstream side of the barrier (Table 4).

Table 4. Total number of fish sampled during all passes for each site. BL=brook lamprey, MWF=mountain whitefish, WSC=Westslope cutthroat trout, RBT=*O. mykiss*, COH=coho, SPC=spring Chinook, FCH=fall Chinook, BRN=brown trout, EBT=Eastern brook trout, CHM=chiselmouth, NPM=northern pikeminnow, LND=longnose dace, SPD=speckled dace, RSS=redside shiner, BLS=bridgelip sucker, LSS=largescale sucker, SUK=sucker species, COT=sculpin species, TSS=threespine stickleback, LMB=largemouth bass, and YP=yellow perch.

Site	BL	MWF	WSC	RBT	COH	SPC	FCH	BRN	EBT	CHM	NPM	LND	SPD	RSS	BLS	LSS	SUK	COT	TSS	LMB	YP	TOTAL
Wide Hollow																						
Downstream Fines								7		1	5		193	66	3							**275**
Fines Ditch				2	2								211	8								**223**
Upstream Fines				3							1		310	26	3							**343**
Downstream Fines test													49	15								**64**
Fines Ditch test				1	1								9	12	4							**27**
North Fork Ahtanum																						
Downstream Shaw Knox				15								52	10					40				**117**
Upstream Shaw Knox				3								15	2					45				**65**
Off channel inlet and outlet																		1				**1**
Downstream Gauge				37								63						343				**443**
Upstream Gauge				12														59				**71**

Table 4 (cont.).

Site	BL	MWF	WSC	RBT	COH	SPC	FCH	BRN	EBT	CHM	NPM	LND	SPD	RSS	BLS	LSS	SUK	COT	TSS	LMB	YP	TOTAL
Cowiche																						
Mouth	1			12		4					13	3	61	21	8	1	25	20				**169**
Ingham	2			35	1	2						8	165	15	10		5	75				**318**
Downstream Garretson				27	4								162	20	3	1		36				**253**
Upstream Garretson				48						8			103	70	6	1	4	12				**252**
Llamas				66							1		211	202	22		1	4				**507**
Downstream Schneider				46	4								20	17				55				**142**
Upstream Schneider				94									910	56	22			34				**1116**
Downstream SMR				43	10								40	2	1			45				**141**
Upstream SMR				40	12		1						11	2				16				**82**
Coleman																						
Downstream Nisbet	1	1				13					2		51	32	1			11	3			**115**
Upstream Burris	1												25	7	2			50	11			**96**
Manastash																						
Downstream Barnes				31		1						1	21					151				**205**
Upstream Barnes		2		82	8	30							29					270				**421**
Downstream Menastash Diversion			1	45					2									76				**124**
Upstream Menastash Diversion				65					1									82				**148**

Table 4 (cont.).

Site	BL	MWF	WSC	RBT	COH	SPC	FCH	BRN	EBT	CHM	NPM	LND	SPD	RSS	BLS	LSS	SUK	COT	TSS	LMB	YP	TOTAL
Reecer																						
Downstream Durand				1		7					1		2	5	3	2		36	1		2	**60**
Upstream Durand				62									16		1	3	1	2	12	1		**98**
Downstream Durand test				3		2					1		3	2				16			1	**28**
Upstream Dolarway				4	3														16			**23**
Downstream Dry Creek Road				3		1							145	16	3		1		16			**185**
Upstream Dry Creek Rd													33				2		107			**142**
Currier																						
Downstream Deneen #2	1			18									125	58			26		7			**235**
Upstream Deneen #2				36									98						2			**136**
Taneum																						
Downstream Bruton	1			23		29						12	41	1				71				**178**
Upstream Bruton				12		1							15		1			63				**92**
Indian																						
Downstream Indian				23														1				**24**
Upstream Indian				13																		**13**

Table 4 (cont.).

Site	BL	MWF	WSC	RBT	COH	SPC	FCH	BRN	EBT	CHM	NPM	LND	SPD	RSS	BLS	LSS	SUK	COT	TSS	LMB	YP	TOTAL
Jack																						
Downstream Jack				51					71									19				**141**
Upstream Jack				26					11									90				**127**
TOTAL	**7**	**3**	**1**	**982**	**45**	**90**	**1**	**7**	**85**	**9**	**24**	**154**	**3071**	**653**	**93**	**8**	**65**	**1723**	**175**	**1**	**3**	**7200**

Downstream of the gauge station barrier, the rainbow trout captured were almost all under 100 mm in fork length (mm FL) while upstream, there were fewer trout captured, but almost 60% were greater than 100 mm FL (Figure 7). The upstream habitat was more complex and the biologists on site expected to find higher salmonid densities and increased species diversity in the upstream reach. The trend was consistent and obvious while in the field that distribution and abundance of fish declined on the upstream side of the barrier. The gauge station is a barrier to small fish; if they fell below the structure, they were not able to move back upstream. This site will continue to be monitored through time to track fish populations and detect any changes after project implementation if resources are available.

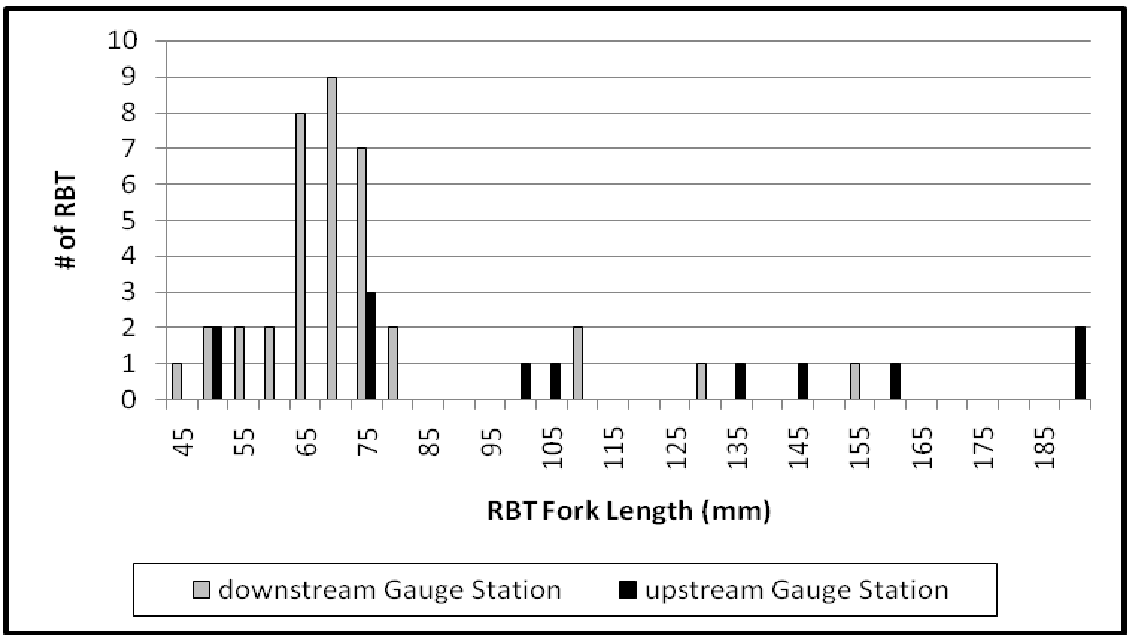

Figure 7. This graph shows the size distribution of rainbow trout above and below the North Fork Ahtanum Gauge Station in 2007.

<u>Cowiche Creek</u>

Three barrier removal project sites were sampled in 2007 on the upstream and downstream sides of each. Additionally, we collected baseline data for two future habitat enhancement project sites; we sampled downstream and within the Schneider project areas and one site within the Llamas project area. The lower Lust site was sampled in 2006, but was replaced with other locations in 2007 because there will likely be no significant habitat enhancement or passage project necessary at the lower Lust site. The sites in Cowiche Creek will be monitored and evaluated at a watershed scale for at least five years, as long as YTAHP resources allow.

In Cowiche Creek, the mouth is a short, wide section of stream, up to the city diversion dam and Alaska steep-pass. This is a partial barrier, with a large, deep pool that is difficult to sample efficiently. The 14-meter section at the mouth had high species diversity, and all were

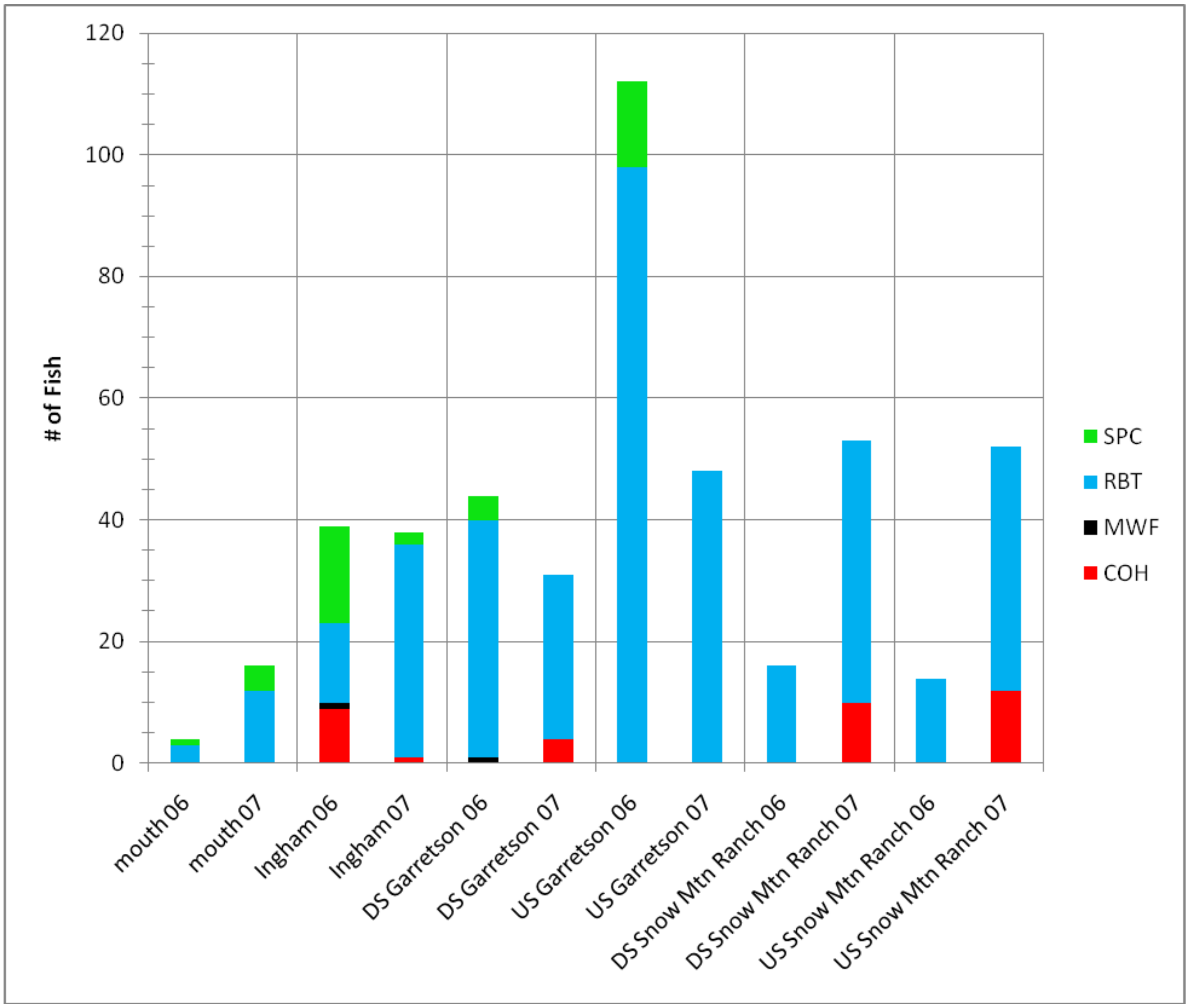

Figure 8. This figure compares the numbers and types of salmonids captured in 2006 compared with 2007 in Cowiche Creek when (at least) two passes were completed.

native fish including rainbow trout and juvenile spring Chinook (Table 4). In 2007, the salmonid population estimate at the mouth was nearly four times larger than the 2006 estimate, and the salmonid catch per unit effort (CPUE) was twice what it was in 2006 (Table 3 and Figure 8). The total fish density increased from 19 total fish captured in 2006 to a total of 169 fish captured in 2007, all passes combined. The steep-pass has not been removed, and the habitat conditions were nearly identical both years. A more experienced crew sampled the mouth in 2007, during the same week sampling occurred in 2006. It is likely that the differences in fish populations can be attributed to sampling variance and more experienced personnel in 2007.

The Ingham Bridge serves as the upstream sample site for the mouth of Cowiche Creek; one 50-meter section was sampled at this site. In 2006, the Ingham site was the only area along Cowiche Creek where juvenile coho salmon were observed in addition to rainbow trout, spring Chinook salmon and mountain whitefish. Salmonids captured in 2007 consisted of rainbow trout, naturally produced coho salmon, and spring Chinook salmon (Figure 8). The numbers of juvenile salmon decreased in 2007, but rainbow trout densities increased relative to 2006. We had difficulty sampling this site in 2007 due to repetitive gear malfunction. The backpack electrofishing unit continuously cut out during each pass, enabling fish to easily move throughout the sampling reach without being captured. Because of the problems we experienced with our gear, we only completed two passes even though we did not achieve 50% salmonid depletion on the second pass, therefore, the resulting population estimate had wide spread confidence intervals (Table 3). Time and personnel limitations did not allow a second sample date at this site.

Increased beaver activity changed the channel characteristics around the Garretson diversion in 2007. There were two dams downstream of the lower site and two large dams within the upstream site that inundated the sample area and shortened the upstream site from 50 meters to 13.5 meters due to the depth and width of the pools. Naturally produced coho salmon and rainbow trout were captured downstream of the corrected barrier at Garretson (Figure 8). In 2006, coho salmon were not captured this far upstream; the Ingham site was the most upstream they were found. The high number of 2006 spawners in Cowiche Creek likely explains the increase in naturally produced coho captured in 2007. Downstream Garretson is the most upstream site in the Cowiche watershed where naturally produced anadromous fish were captured (steelhead may be the exception) in 2007. Rainbow trout were the only salmonid captured in the short section upstream of the previous barrier that could safely be sampled. Two passes were completed in this short section, but 50% depletion was not achieved due to the width of the site and added complexity of the beaver dam as the upstream "barrier". The woody debris in the channel provided unlimited cover for fishes, thereby reducing our efficiency of depleting the salmonids, resulting in large confidence intervals around the population estimate (Table 3).

One 50-meter section was surveyed at the Llamas site, just downstream of the Cowiche canyon and upstream of the Garretson diversion. This property is likely to be acquired by the Cowiche Canyon Conservancy (CCC) for habitat restoration. CCC is working with YTAHP to remove the current dike and enhance the instream and riparian habitat once the property is acquired. The YTAHP Monitoring Team collected baseline data in 2007, and will continue to monitor this site after habitat restoration activities have been implemented. Rainbow trout were the only salmonid captured at the Llamas site along with numerous native cyprinids and suckers; few sculpin were captured in this reach (Table 4). Many of the rainbow trout captured were age 1, fewer age 2, and a single age 3-4 based on length frequencies (Figure 9) and data from Wydoski and Whitney (2003). The presence of multiple age classes indicates natural salmonid reproduction is occurring in lower Cowiche Creek.

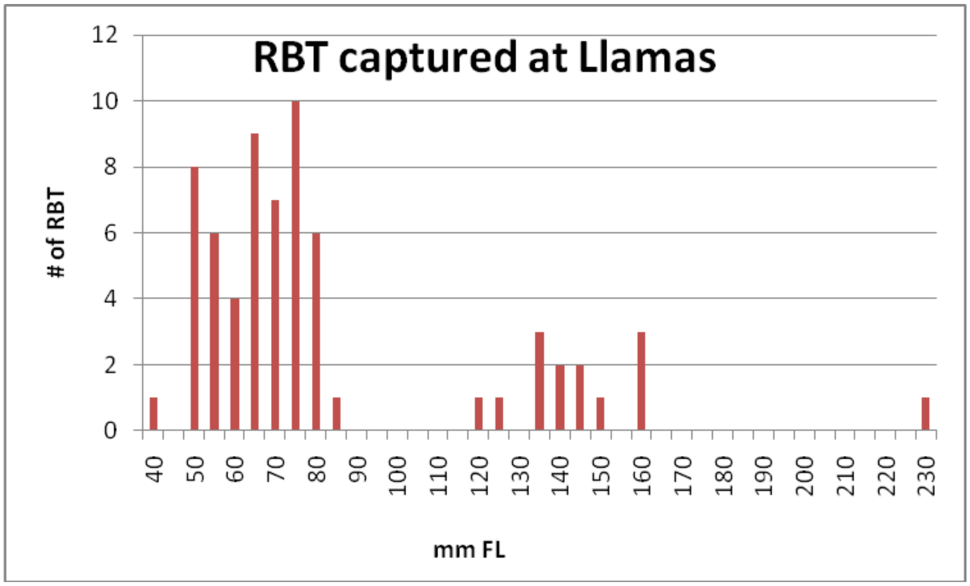

Figure 9. This figure illustrates the three distinct age classes of RBT captured at the Llamas site on Cowiche Creek.

The lower Lust site was not sampled in 2007 because there is not likely to be any major instream projects at that location. Just downstream from the lower Lust site, a replacement site was sampled; the Schneider habitat improvement project. In the fall of 2007, YTAHP completed the Schneider project to help stabilize the banks and provide instream complexity for fish habitat. Two sites were sampled in early September, prior to implementation of the project; one downstream of the treatment reach and another within the treatment area. In the downstream site, we captured juvenile coho salmon that were likely PIT tagged (planted fish from the YN coho reintroduction program), but the detector was malfunctioning, so tags were not confirmed. Also at this site, we captured numerous rainbow trout along with native cyprinids and sculpins (Table 4). Upstream, within the treatment reach, we captured 94 rainbow trout; all but five of these fish were young of the year, less than 100 mm FL. The reach is likely spring fed, with cool water attracting high numbers of rearing salmonids in the margins of a riffle. The large wood structures that were installed along the banks to increase habitat complexity should help increase the rearing density in this valuable reach of Cowiche Creek by increasing pool habitat and instream cover. This sampling site also had the highest density of speckled dace of any sampled in the two years of YTAHP monitoring, with just under 1000 speckled dace captured in a 50-meter reach (Table 4), and many more observed. These sites will continue to be monitored for at least two years as resources allow.

The upstream and downstream sites at Snow Mountain Ranch (SMR) were the same stream reaches in 2006 and 2007, on the upstream and downstream sides of a previous barrier. The instream habitat complexity and channel course were not significantly different between years, but in 2007, the substrate was much less silty than in 2006. Reasons for the change in substrate are not known, but rainbow trout densities above and below the previous barrier were almost the same in 2007 (Table 3), and increased at both sites relative to 2006 (Figure 8). The Yakama Nation planted approximately 3000 juvenile coho salmon just upstream of our sample reaches earlier in the summer, before our electrofishing surveys. We captured 22

PIT tagged coho between the two sites, 12 upstream and 10 downstream, indicating the stocked fish redistributed themselves throughout the reach. We also captured a fall Chinook salmon that was almost in smolt condition. Local school children released 100 fall Chinook salmon from their Salmon in the Classroom tank in late May, upstream of our project areas. Densities of all fish captured were nearly the same on both sides of the previous barrier (Table 4), but speckled dace and sculpin were captured in higher densities on the upstream side in 2006. These are the types of trends the YTAHP monitoring team anticipates tracking for barrier removal projects, however no baseline sampling occurred at Snow Mountain Ranch prior to barrier removal for comparison to these data. The combination of a more experienced crew in 2007 and less silty substrate probably explains the increased density in nearly all species from 2006 to 2007.

The higher salmonid population estimates and greater CPUE in 2007 relative to 2006 for all sites upstream of Garretson, reflect the additional coho salmon that were planted by the Yakama Nation earlier in the summer (Figure 8). However, when only rainbow trout are compared at the Snow Mountain Ranch site, a total of 83 were captured in 2007 versus 30 in 2006. This trend of increased rainbow trout holds true for each site in the Cowiche except the two sites surrounding the Garretson diversion (Figure 8) where the habitat conditions were different between years. In general, more experienced crews were sampling in 2007 and that may be the largest single reason for the noticeable increases in naturally produced salmonid populations.

The spring Chinook salmon distribution and abundance was notably different between 2006 and 2007 (Figure 8). In 2006, we captured spring Chinook at the mouth, Ingham, and on both sides of Garretson. Densities of Chinook and rainbow trout were similar at the mouth and Ingham sites, and rainbow trout increased around the Garretson diversion. However, in 2007, Chinook were captured in low abundance at the mouth and Ingham sites only (Table 4), with none captured further upstream. In both sites, rainbow trout densities were much higher than Chinook densities and higher than rainbow trout densities in 2006 (Figure 8). Naturally produced coho salmon were captured on the downstream side of the Garretson diversion in 2007 and none were captured that far upstream in 2006. Coho and Chinook salmon densities decreased at the Ingham site, but rainbow trout densities increased in 2007 relative to 2006. Gear malfunctions during sampling at the Ingham site make it difficult to draw conclusions from the data.

In 2006, there were fewer Chinook salmon redds in the Naches River system, and coho redds increased (YN unpublished data). The Cowiche Watershed will continue to be monitored to evaluate fish use of the newly accessible habitat. The Yakama Nation continues their coho salmon reintroduction program and YTAHP will work closely with YN staff to evaluate how coho salmon repopulate Cowiche Creek. YTAHP Monitoring Team will watch for possible competition for rearing habitat between juvenile Chinook, coho, and rainbow trout that may affect their distributions.

Coleman Creek

Coleman Creek's natural watercourse has been altered due to historical agricultural practices in the Kittitas Valley. It is now a tributary to Naneum Creek and eventually Wilson Creek, but historically was a direct tributary to the Yakima River. The upper watershed provides some potential for steelhead spawning until a natural barrier falls at river mile 17.5, and there is one historical record of a bull trout observation in the upper watershed. Most immediately, YTAHP's efforts will provide juvenile salmonids access to the valuable rearing habitat closer to the Yakima River. In 2004, YTAHP replaced a perched culvert that was a fish passage barrier with a bridge at river mile 0.6. Snorkel surveys before and after project implementation revealed that juvenile spring Chinook salmon took advantage of the newly accessible habitat and moved upstream (Pat Monk memo to KCCD, 2005) almost immediately after implementation. The 2007 electrofishing survey took place downstream of the next passage barrier at river mile 1.03 (Nisbet) where we captured 13 spring Chinook salmon. This reach would have been inaccessible to rearing juvenile fish had it not been for YTAHP project implementation in 2004, removing the barrier downstream. We also sampled above the next barrier at river mile 1.6 (Burris) and found no salmonids (Figure 4). Funding has been secured to remove each of these barriers. Planning and design efforts are currently underway with project implementation planned for FY 09, effectively providing fish passage into more than 2 miles of lower Coleman Creek.

Manastash Creek

Kittitas County Conservation District (KCCD) is working closely with landowners and irrigators in Manastash Creek to provide fish passage and screening under a different BPA funded program, similar to YTAHP. Because of the similarity to YTAHP projects and that KCCD is a primary player in both programs; the YTAHP Monitoring Team sampled two sites in Manastash Creek in 2007 using the standard protocol. We collected baseline data above and below the Barnes and Menastash diversions (4 sites). In most years, there is a 3 mile reach of Manastash Creek that dries up between a diversion at river mile 4.8 and the Westside Canal operational spill, just upstream of the Barnes Diversion, between June and November, depending on the year and irrigation needs.

At the time of sampling (October 22-23), the dam boards preventing passage had already been removed from the structure at the Barnes diversion, so there was no fish barrier. One spring Chinook was captured downstream of Barnes along with 31 rainbow trout. Upstream of the barrier, we captured the highest number of salmonids for any sight in 2007 (Table 3 and Figure 4). Naturally produced coho and Chinook salmon were found at this site as well as numerous rainbow trout and two mountain whitefish, demonstrating the importance of Manastash Creek for juvenile salmonid rearing. The rainbow trout size distribution ranged from 80 to 403 mm FL, although most were less than 150 mm FL (Figure 10). This variation in size classes is an indicator that natural production for rainbow trout occurs and is successful in Manastash Creek, despite the numerous challenges that currently exist.

Further upstream, below and above the Menastash diversion, no (known) anadromous salmon were captured. Resident salmonids such as rainbow trout, brook trout, and one westslope cutthroat trout were captured. Sculpins were the only non-salmonid species captured (or observed) on either side of the Menastash Diversion. The Menastash diversion (and our sampling location) is just upstream of the location where the creek typically dries up during the irrigation season. This, in association with the diversion dams, likely factors into the lack of species diversity at this site (Table 4).

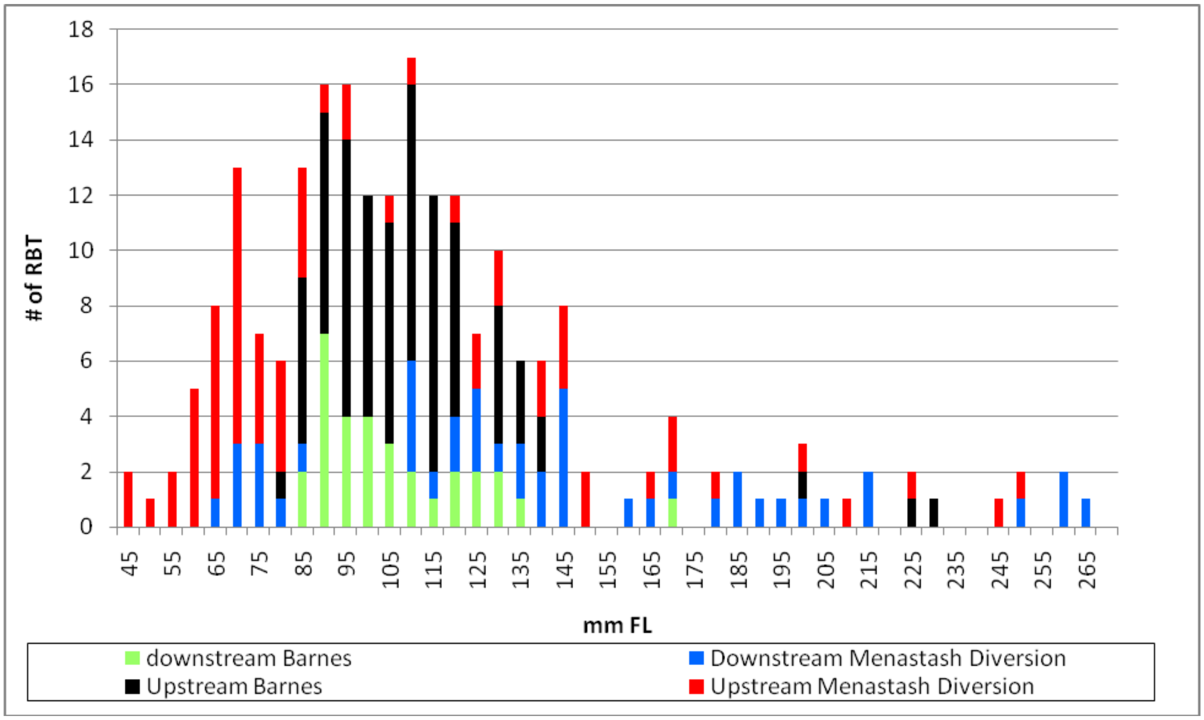

Figure 10. Length frequency distribution of RBT sampled in Manastash Creek. The 403 mm RBT captured upstream of Barnes Diversion is not included on this graph.

In late 2007, a Memorandum of Agreement and an Implementation Plan were signed by several irrigators, natural resource managers, BPA, and environmental interest groups to consolidate diversions, complete fish passage projects, and improve irrigation efficiencies. YTAHP's monitoring efforts will provide some general baseline data at two of the identified project sites, scheduled for FY 08 implementation and monitoring will continue as resources allow to evaluate post implementation fish distributions and abundance data.

Reecer and Currier Creeks

The Reecer/Currier Watershed has the potential to support some salmonid spawning and provide valuable juvenile rearing habitat off of the mainstem Yakima River. Collaborative efforts are underway to remove the two most downstream barriers, properly screen the diversions, and reconnect part of Reecer Creek to its floodplain. Upstream in Currier Creek, three passage barriers were corrected in late 2007, with three more barriers slated for removal in 2008. Additionally, YTAHP core team members are working with a landowner to install large wood habitat features in the stream and enhance the riparian buffer for over a mile of

Reecer Creek. Because of these efforts to enhance the habitat in the Reecer Creek watershed and provide good fish passage conditions, the Yakama Nation and Yakima Klickitat Fisheries Program (YKFP) planted 3000 juvenile coho salmon into Reecer and Currier Creeks in the summer of 2007. These coho will hopefully return as adults to spawn and begin recolonization of anadromous fish into Reecer Creek. The YTAHP monitoring team continues to coordinate with the Yakama Nation and YKFP to monitor and evaluate salmonid populations in lower Reecer and Currier Creeks.

Reecer and Currier Creeks proved difficult to sample effectively once again in 2007. High flows during irrigation season due to canal spills, irrigation delivery, and relatively high natural flows in the fall after irrigation season make efficient sampling a challenge. Additionally, reed canary grass is the dominant vegetation in several reaches, providing instream cover to fishes and preventing efficient capture. Nonetheless, Reecer Creek electrofishing sites occurred near the mouth at the Durand diversion/barrier slated for correction in FY 09, upstream of the next barrier at Dolarway, and at the Dry Creek Road crossing with a seasonal irrigation barrier. Currier Creek was sampled at one project location, Deneen #2, an abandoned diversion structure slated for removal early in 2008.

Initially, we tried to sample downstream of Durand dam in mid-September. The discharge at this time, due to the irrigation spill and delivery, was too high to sample safely or efficiently, and is indicated by “test” in Tables 3 and 4. We returned in mid-October and conducted our surveys according to the standard protocol. Durand dam is about 75 meters upstream from the confluence with the Yakima River and is a complete barrier to juvenile salmonid migration, except during high flows, when this portion of lower Reecer Creek is actually backwatered by the mainstem Yakima River and the dam is submerged. Juvenile spring Chinook salmon and rainbow trout were both captured downstream of the dam, and the overall species diversity was high, likely due to the close proximity to the mainstem Yakima River (Table 4). The section sampled upstream of Durand dam did not have any juvenile salmon, however the abundance of rainbow trout was much greater than the downstream reach (Figure 4); the same was true for 2006 (Figure 11). The banks in this section are heavily armored (the Interstate 90 overpass was included in this reach) and has little instream complexity. Due to aquatic macrophytes, sampling efficiency of small fish was not high upstream of Durand, so the data do not accurately reflect the high densities of three-spine stickleback and other prey fish available for salmonid forage. Two nonnative species were captured around the Durand Diversion; yellow perch (*Perca flavenscens*) were captured downstream of Durand and one largemouth bass (*Micropterus salmoides*) was captured upstream of Durand.

We surveyed a site just upstream of Dolarway Road bridge (river mile 1), but the flows were too concentrated at this site to effectively set block nets and capture efficiencies were not good. We did sample a 50-meter reach (single pass) and recovered PIT tagged coho salmon and some rainbow trout. The Yakima Nation released approximately 150 PIT tagged coho salmon between Dolarway Road and Interstate 90 earlier in the summer, as well as 150 PIT tagged coho further upstream in Currier Creek. The Dolarway site was selected because the City of Ellensburg plans to replace this bridge by 2010 with a longer spanning structure, and YTAHP is in the planning phases of returning part of Reecer Creek to its natural floodplain just downstream of the Dolarway Bridge and upstream of Interstate 90. Significant changes in habitat, aquatic species use, species composition and densities are anticipated upon completion of these habitat enhancement projects. Monitoring will continue at this site as flow conditions and personnel constraints allow.

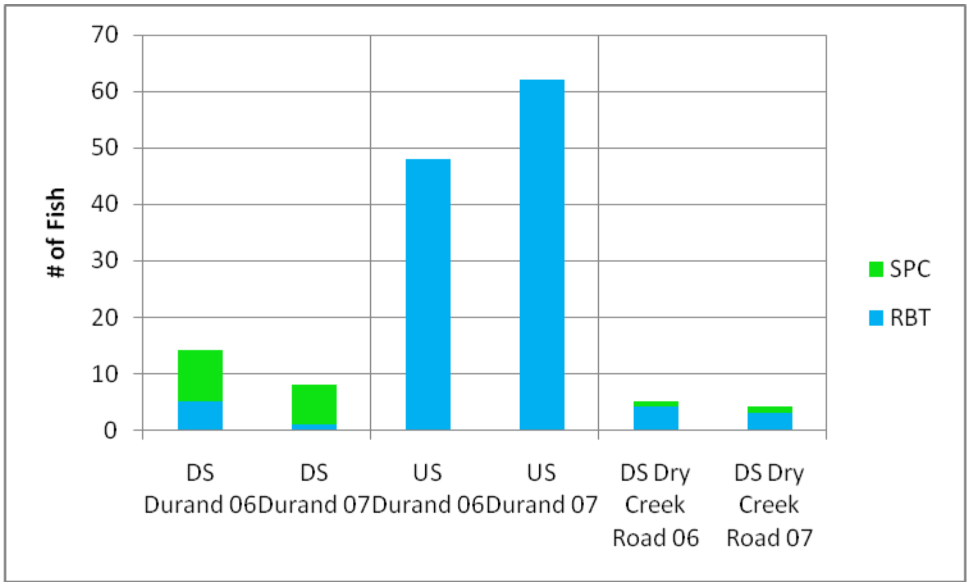

Figure 11. This figure compares the numbers and types of salmonids captured in 2006 compared with 2007 in Reecer Creek when (at least) two passes were completed.

The seasonal barrier at the Dry Creek Road crossing was still in place at the time sampling occurred (October 16). This reach of the creek has been channelized and was choked with reed canary grass, so it was difficult to effectively deplete the population. Despite these habitat conditions, salmonids captured included one juvenile spring Chinook salmon downstream of the Dry Creek Road diversion as well as three rainbow trout. The salmonid population estimate for this site actually calculated to a negative number (Table 3) because only one salmonid was captured on the first pass and three on the second. Due to personnel constraints, only two passes were completed, so an accurate population estimate could not be calculated. No salmonids were captured upstream of the Dry Creek Road diversion in 2007 (Figure 4). It is likely that the Chinook salmon may have entered Reecer Creek via a canal, however a single Chinook was captured at this same site in 2006 as well (Figure 11), and natural production above the downstream barriers is possible because high flow events submerge the barriers. This site was sampled in 2006 and remains an important site because planning efforts are underway to restore this entire reach of Reecer Creek, including rerouting the stream, removing barriers, and revegetating with native plants. Any baseline data will be useful for comparison after these restoration efforts have been implemented.

On Currier Creek, a tributary to Reecer Creek, a landowner is working with YTAHP to remove five abandoned diversion structures within one stream mile and revegetate the area with native plants. Baseline data were collected at one of the diversions that formed a partial barrier at low flow conditions in Currier Creek, Deneen #2. Rainbow trout were the only salmonids captured at this site, on either side of the structure, and similarly to other Reecer and Currier Creek sites, rainbow trout densities were relatively high (Table 3). Trout densities were higher on the upstream side of the barrier (Figure 4), but redside shiners and suckers were only captured on the downstream side and densities of speckled dace and three-spine stickleback were lower on the upstream side as well (Table 4). Smaller, less athletic, native fish may not be able to migrate around the diversion structure as effectively as salmonids. The site will be monitored after structure removal for at least two years.

The only site in Reecer Creek where sculpin were captured in 2007 was downstream of Durand dam, near the mouth (Table 4). In 2006, sculpin were captured downstream of Durand and a single sculpin was captured on the downstream side of the Dry Creek Road Diversion. There could be a variety of reasons for the low abundance of sculpins, including low primary productivity or lack of available forage, but YTAHP's monitoring efforts are insufficient to determine the possible causes for the low densities and distribution of sculpin species in the system beyond physical barriers. As passage barriers are removed from this system, it may be important to track the distribution of sculpin as well as salmonids.

The coho redds that YTAHP observed in December 2006 were the first documented in Reecer Creek to our knowledge. The adults were able to pass the Durand dam and spawned just upstream in a channelized portion of the creek (adjacent to the proposed floodplain restoration project). The same stream reach was surveyed in November 2007, but no redds or carcasses were encountered. During the survey, a population of freshwater floaters (mussels) was encountered. This was reported to the WDFW fish program's non-game species biologists and professors at Central Washington University. The distribution of floaters in the Yakima Basin is not well known, but this was the first documented occurrence either entity was aware of in an Upper Yakima tributary stream. In general, freshwater mussels are an indicator of good water quality conditions in Reecer Creek.

Taneum Creek

Much of Taneum Creek's upper watershed is surrounded by public lands that are managed for fish and wildlife habitat. Karp et al. (2005) identified Taneum Creek as an important tributary for upper Yakima River steelhead and found that approximately 7% of the Upper Yakima River steelhead spawn in Taneum Creek. Additionally, the watershed has been identified as a potential bull trout recovery area due to the habitat quality and protection in the upper watershed. YTAHP is in the planning phases to provide passage at two irrigation diversion dams in lower Taneum Creek. Both have fish ladders at their dam sites, but they are not in compliance with NMFS or WDFW fish passage criteria and create barriers to juvenile fish at almost all flows and for adult salmonids part of the time. YTAHP is working in cooperation with other entities to restore ecological connectivity for all species at all flows.

YTAHP sampled on the upstream and downstream sides of the Bruton diversion dam at river mile 1.6. Large wood and boulder structures had been installed in the downstream reach, so there was channel complexity and good rearing habitat for salmonids. Additionally, KRD canal began releasing water from their canal into Taneum Creek to help maintain instream flow through lower Taneum Creek. We found numerous rainbow trout and spring Chinook salmon in the downstream site, but the salmonid density upstream of the barrier decreased by 75%; with only one spring Chinook salmon and half as many rainbow trout captured as the downstream reach (Figure 4). The difference in the number of (known) anadromous fish upstream of the dam in combination with almost 50% fewer total fish (salmonids, sculpin, minnows…) captured in the upper site (Table 4), clearly indicates that this fishway is a barrier to juvenile salmonids and small native fish. The baseline data collected from YTAHP's efforts will be important to help monitor the biological responses to the fish passage projects and other instream habitat enhancement projects that are planned for the Taneum Creek Watershed. In 2008, the YTAHP Monitoring Team plans to add the project site upstream of the Bruton Dam to the monitoring schedule.

Indian and Jack Creeks

Jack and Indian Creeks are adjacent left bank tributaries to the North Fork Teanaway River. Both have undersized culverts (6' diameter) that create fish passage barriers where North Fork Teanaway Road crosses them. YTAHP will replace each culvert with a larger structure (Jack Creek will have a 22' wide box culvert and Indian Creek will have a 17' wide elliptical culvert) that will provide fish passage at all flows. Jack Creek is the larger of the two tributaries and has been identified as critical bull trout habitat. Additionally, both steelhead and bull trout have been documented in Jack Creek. Less is known about the fish distribution in Indian Creek.

Jack Creek was sampled according to the standard protocol above and below the barrier culvert. Eastern brook trout outnumbered rainbow trout below the culvert, but both were in relatively high densities with multiple age classes present (Table 4). Upstream of the barrier, rainbow trout outnumbered brook trout, but both had lower densities than the downstream site (Tables 3 and 4). Sculpin were the only other species captured, and the densities of sculpin were higher on the upstream side of the barrier than the downstream side. The large plunge pool just below the perched culvert was not electrofished but a snorkel survey by William Meyer (WDFW personal communication 2007) in 2006 found brook trout and rainbow trout occupying this pool; no other species were documented. Approximately 20 meters downstream from the downstream sample site, Jack Creek flowed subsurface for approximately 600 meters before regaining surface flows to reconnect to the North Fork Teanaway River. This stretch of dry streambed may have increased fish density in our downstream sample area as fish searched for refuge.

Indian Creek was only spot checked by electrofishing above and below the culvert barrier, standard protocol was not used. Rainbow trout were captured on both sides of the barrier, all were small, young of the year age class, with the exception of four rainbow trout over 100 mm FL that were captured in the plunge pool directly below the culvert. Indian Creek has a year round connection with the North Fork Teanaway River, but is a smaller tributary than Jack Creek. Our spot sampling methods in Indian Creek were not comprehensive, but we expected to find brook trout densities in Indian Creek similar to those observed in Jack Creek, but no brook trout were captured in Indian Creek. If resources allow, YTAHP will complete a full survey in Indian Creek in 2008 to have more comparable data into the future.

General

The focus of YTAHP monitoring efforts has been on salmonids and their use of newly accessible habitat. However, overall species composition is also recorded for each site and provided in Table 4. Similarly to 2006, overall species diversity decreased as we moved upstream in each watershed (Figure 12). This is likely a result of numerous partial and full fish passage barriers preventing natural migrations from the mainstem Yakima River (or Naches River) into tributary habitat. This may be a useful indicator of the biological benefits of passage improvement projects through time if we see an increase in biodiversity upstream of previous passage barriers. By monitoring the trends in salmonid abundance and distribution as well as overall species diversity through time and maintaining consistent sampling locations, we will be able to detect differences in abundance above the previous barriers. If populations increase in abundance and diversity upstream of previous barriers, one could conclude that the recolonization is a result of the barrier removal projects and the other projects that enhance rearing conditions.

YTAHP's monitoring efforts were well coordinated with other programs and agencies working in the basin. The Yakama Nation, through YKFP, scatter planted several hundred PIT tagged juvenile coho salmon throughout the basin in 2007. Some of the streams and sites selected to plant these fish were, in part, due to YTAHP's efforts to remove barriers and screen irrigation diversions; making the creeks safe for juvenile fish. The Yakama Nation loaned our crew a PIT tag detector to help monitor the distribution of their newly stocked fish as we were sampling in the creeks. This was a collaborative effort as we captured 29 tagged fish in two watersheds in addition to numerous naturally produced fish in other watersheds.

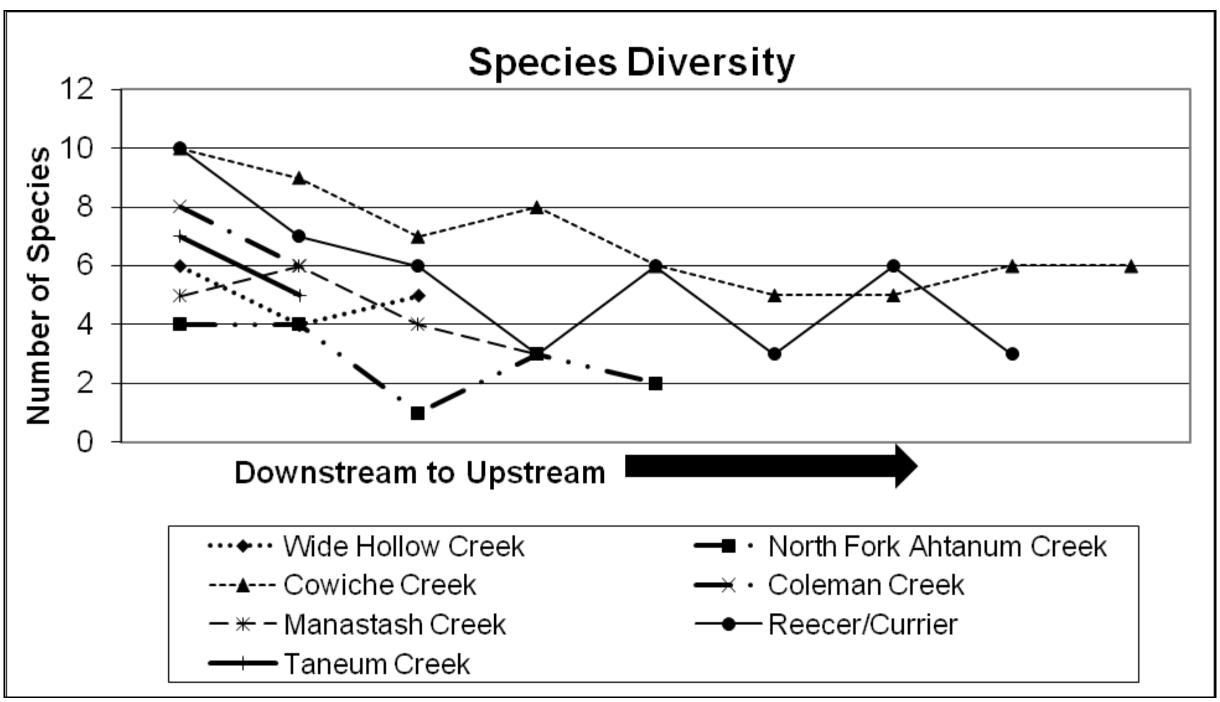

Figure 12. This graph illustrates the general trend of decreasing species diversity as we moved upstream in each watershed.

YTAHP recognizes that habitat above and around project sites may not be recolonized immediately by species that previously were denied access to upper reaches of streams. This monitoring approach enables detection of large-scale changes in species richness and abundance within individual project sites on a short-term basis as well as a broad, watershed scale for an extended time period. It is difficult to extrapolate findings from one watershed to adjacent watersheds; however, given limited monitoring resources within the YTAHP statement of work, we have come up with a manageable monitoring plan that provides specific information on the biological benefits of our projects and other related salmon enhancement efforts in the Yakima Basin.

Spawning Surveys
Limited redd surveys were conducted in the late fall for coho salmon in Cowiche and Reecer Creeks. Cowiche Creek was walked from the mouth upstream about 2.5 miles, to the base of the canyon in late November. The lowest mile was walked again in mid-December to capture the late run of coho in the Yakima Basin. Additionally, we surveyed upstream from river mile 3 to river mile 4.5 in South Fork Cowiche Creek, near the location where the Yakama Nation released adult coho salmon. In total, 9 redds were discovered and 3 carcasses. Seven redds were discovered in the lower reach, that included one new redd on the mid-December pass. Two redds were observed in the South Fork Cowiche Creek pass, but it is likely there were more redds upstream of the area surveyed. Staff from the Yakama Nation walked further upstream after we found these two redds, but due to increases in flow, no new redds were observed. Due to time, weather, high flows, turbid conditions, and personnel constraints, additional surveys could not be complete.

Reecer Creek was surveyed from the Interstate 90 overpass, upstream for approximately one half mile to Dolarway Road, and another one half mile reach of Currier Creek from the confluence, upstream was also surveyed, but no redds, carcasses, or adult fish were observed. A late survey was not completed in the Reecer/Currier Watershed due to time, weather, and personnel constraints.

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