Yakima/Klickitat Fisheries Project

Klickitat Only Monitoring and Evaluation

Annual Report
2002 - 2003

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YAKIMA/KLICKITAT FISHERIES PROJECT
KLICKITAT ONLY

Monitoring and Evaluation
Annual Report 2002

April 1, 2002—April 30, 2003

Project No. 199506335

Contract #5934

The Confederated Tribes and Bands of
The Yakama Nation

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YAKIMA/KLICKITAT FISHERIES PROJECT
KLICKITAT ONLY

Monitoring and Evaluation 2002 Annual Report

Preface

The monitoring and evaluation activities described in this report were determined by consensus of the scientists from the Yakama Nation (YN). Klickitat Subbasin Monitoring and Evaluation (M&E) activities have been subjected to scientific and technical review by members of YKFP's Science/Technical Advisory Committee (STAC) as part of the YKFP's overall M&E proposal. Yakama Nation YKFP project biologists have transformed the conceptual design into the tasks described.

This report summarizes progress and results for the following major categories of YN-managed tasks under this contract:

1. **Monitoring and Evaluation**: Accurately characterize baseline available habitat and salmonid populations pre-habitat restoration and pre-supplementation.
2. **EDT Modeling**: Identify and evaluate habitat and artificial production enhancement options.
3. **Genetics**: Characterize the genetic profile of wild steelhead in the Klickitat Basin.
4. **Ecological Interactions**: Determine the presence of pathogens in wild and naturally produced salmonids in the Klickitat Basin and develop supplementation strategies using this information.

1. Monitoring & Evaluation

Overall Objective: Develop methods to assess existing natural production, as well as methods to statistically detect an increase in natural production.

Task 1.a Klickitat juvenile salmonid population surveys

Objective: To determine the spatial distribution/relative abundance of salmonids throughout the Klickitat Basin.

Rationale: Winter habitat utilization is of particular interest in the Klickitat watershed due to the relatively cold temperatures and potential of anchor ice occurring within higher elevation segments of the mainstem and tributaries.

Planned Methods:

Conduct summer and winter snorkel and electro-fishing surveys in three <u>mainstem</u> reaches:

- McCormick Meadows to Castile Falls
- Castile Falls to the WDFW Klickitat Salmon Hatchery (summer only)
- WDFW Klickitat Salmon Hatchery to Lyle Falls.

Snorkel surveys will be direct fish counts; electro-fishing surveys will use catch per unit effort to estimate relative abundance.

Conduct summer and winter electro-fishing surveys in selected reaches of the key <u>tributaries</u> to the Klickitat River. Use depletion estimates to determine absolute abundance.

We will begin by identifying river segments containing potential over-winter habitat, then evaluate our ability to enumerate by species in those segments. In the event all aspects progress as hoped, systematic and comprehensive surveys of the chosen segments will commence. Clear water will be essential for success.

Results:

<u>Mainstem</u>

Winter snorkel surveys were conducted in two locations during this contract period. We employed four snorkelers equipped with drysuits; each was assigned a lane to maximize coverage.

On March 4, 2003, approximately 375 linear feet were surveyed below Castile Falls and upstream of the Signal Peak Bridge, approximately river mile [RM] 62. The segment included two pool-to-riffle sequences but contained very little large woody debris (LWD). Water clarity was good with visibility exceeding 10 feet; water temperature was 36.5 degrees F. We identified two whitefish in the segment; no other fish were observed.

The second segment was snorkeled on the following day, March 5, 2003. This segment is located ~0.8 miles above the Castile Falls Bridge. Total length was approximately 175 linear feet and included significant LWD throughout the pool/riffle sequence. Visibility was approximately 6 feet and water temperature was 37.2 degrees F. We identified a single *O. mykiss* (2 – 4 inches in length); no other fish were observed.

A planned survey in the lower river was postponed due to turbidity/poor visibility.

Snorkel surveys in the mainstem Klickitat are problematic. Swift current makes upstream movement nearly impossible, except along shallow shorelines. The current also makes snorkeling downstream difficult. Excessive speed does not provide adequate time for complete coverage of assigned snorkeling lanes.

We believe the segment from Leidl Campground to the Little Klickitat confluence will offer some gradient relief and, due to habitat complexity, may provide suitable over-winter habitat. We plan to snorkel this reach in conjunction with steelhead spawner surveys. The initial pass will be used to identify segments containing fish in significant numbers and, if successful, we will return to delineate segments of interest and make counts.

<u>Tributaries</u>

Electro-fishing surveys were completed in Trout, Bear and Summit Creeks (all left bank tributaries between Klickitat river mile [RM] 37 and 43). We employed a depletion methodology (3-pass removal) on six separate 100-meter segments within each of the three streams.

These sites were selected to gain a further understanding of resident rainbow trout (*O. mykiss*) populations in areas where future steelhead acclimation sites may be suitable. Table 1 presents the finds from the tributary population estimates in 2002.

Less comprehensive "spot" electro-fishing surveys were accomplished in Swale, Bowman, White, Brush, Teepee, Surveyors, Trappers, Fish Lake, McCreedy, and Piscoe creeks; and in the Little Klickitat, Diamond Fork and the upper mainstem Klickitat rivers. These were preliminary surveys designed to provide information with respect to planning future abundance and distribution surveys.

Table 1. Resident Rainbow Trout Population Estimates for Trout, Bear and Summit Creeks

Stream	Location	Density (Fish/m^2)	95% Conf. Range (Fish/m^2)
Bear Creek	lower	0.07	0.07 – 0.09
Bear Creek	lower	0.06	0.06 – 0.08
Bear Creek	mid	0.12	0.11 – 0.17
Bear Creek	mid	0.16	0.15 – 0.22
Bear Creek	upper	0.18	0.18 – 0.21
Bear Creek	upper	0.25	0.24 – 0.30
Summit Creek	mid	0.18	0.15 – 0.28
Summit Creek	lower	0.19	0.18 – 0.22
Summit Creek	mid	0.10	0.09 – 0.11
Summit Creek	lower	0.10	0.10 – 0.11
Summit Creek	upper	0.14	0.12 – 0.20
Summit Creek	upper	0.13	0.12 – 0.19
Trout Creek	lower	0.17	0.17- 0.25
Trout Creek	lower	0.24	0.24 – 0.25
Trout Creek	mid	0.05	0.05 – 0.05
Trout Creek	mid	0.12	0.12 – 0.16
Trout Creek	upper	0.04	0.04 – 0.04
Trout Creek	upper	0.07	0.07 – 0.08

Task 1.b Klickitat mobile juvenile monitoring sites

Objective: To determine the feasibility of using rotary traps to monitor long-term juvenile salmonid out-migrants in the upper and lower Klickitat River.

Planned Methods:

- Fish rotary traps located at the WDFW Klickitat Hatchery and near RM 6 in the mainstem river on a year-round basis. A rotary trap located above Castile Falls will be fished seasonally between May and November.
- Conduct calibration studies at each trap to determine the feasibility of establishing a fish-entrainment-to-river-discharge relationship, as well as the feasibility to operate the traps on a year-round basis. Calibration efforts will use logistic regression to describe discharge/entrainment relationships.

Protocols require obtaining environmental and trap data along with bio-data on 20 to 30 of each salmonid species represented. The excess and non-salmonid fish are tallied by species. Bio-data consists of fork lengths, weights and smoltification stage. Environmental and trap data include weather conditions, water temperature and clarity, trap revolution speed, and debris load.

Results: Three rotary screw-traps were used during the 2002 fiscal year. A five-foot trap located upstream of Castile Falls at RM 67 was fished from late April through early November and was removed before the first significant snowfall; the area is inaccessible during winter. The five-foot trap located at the Klickitat Hatchery (RM 42) was fished the entire year. The eight-foot rotary screw-trap was relocated from RM 6 to RM 2.5.

Flow/entrainment studies have not been successful to date. We believe the problems are related to river morphology and flow velocities. The ideal screw trap location maximizes the volume of water sampled. This normally requires a constricted or narrowed channel with a well-defined thalweg and increased water velocities. Suitable morphology is prerequisite to establishing a consistent flow/entrainment relationship. We believe the new location for the eight-foot Lyle Falls trap will prove successful and intend to relocate the hatchery and upper traps once suitable sites have been identified and evaluated. Identifying and testing accessible sites will be an ongoing objective. The catch of each trap is summarized on a monthly basis and presented in Appendix A.

Traps are discussed individually in the following narrative.

Upper Trap

The upper trap was operated continuously from April 30, 2002 through October 31, 2002. The trap caught predominantly rainbow/steelhead (*O. mykiss*) and spring chinook (*O. tshawytscha*) fry/parr along with an occasional brook trout (*S. fontinalis*). The chinook fry/parr observed resulted from a hatchery "thinning" release done in May 2002, or were progeny of hatchery adults that were transported and released above Castile Falls.

Hatchery Trap

The hatchery trap was operated continuously for the entire 12-month period with the exception of a few winter days with sub-freezing temperatures and during high flow events that mobilized large amounts of debris. This trap catches predominantly rainbow/steelhead (*O. mykiss*), spring chinook (*O. tshawytscha*) and coho (*O. kisutch*) with an occasional brook trout (*S. fontinalis*). Non-target species frequently caught in the trap include dace (*Rhinichthys spp.*), suckers (*Catostomus spp.*), ammocoetes (larvae of lamprey, *Lampetra spp.*), whitefish (*Prosopium spp.*) and sculpin (*Cottus spp.*).

Since very little fall chinook spawning occurs above the hatchery, we generally consider the chinook captured by the trap to be spring chinook. Distinguishing between spring and fall chinook juveniles is problematic at best. Timing of emergence, and therefore size, is an indicator but alone is not sufficient for this determination. Therefore we do not attempt to distinguish between the two, except when known hatchery releases have occurred and the fish are marked accordingly. We are able to estimate a probability based on the number of spring chinook redds upstream of the hatchery compared to those of fall chinook. As an example, our spring chinook redd counts above the hatchery for 2001 and 2002 were 121 and 389 respectively; the fall chinook redd counts were zero and

3, respectively. Barring any upstream movement of progeny, we would not expect any fall chinook in the trap from the 2001 brood year, while up to 1% of the catch from the 2002 brood year could be fall chinook. Since this is entirely theoretical, we have not attempted to make any such estimate within Appendix A.

Lyle Falls Trap

The Lyle Falls trap is the only eight-foot trap used on the Klickitat. Because of its location, this trap samples all anadromous species that use the Klickitat watershed. Non-target species frequently caught in the trap include ammocoetes (larvae of lamprey, *Lampetra spp.*), dace (*Rhinichthys spp.*), redside shiners (*R. balteatus*) sculpin (*Cottus spp.*), suckers (*Catostomus spp.*), and whitefish (*Prosopium spp.*)

The trap has the potential to provide exceedingly valuable information regarding outmigration magnitude. It was removed for repairs in late 2001 and on August 7, 2002, was re-deployed from RM 6to RM 2.5, which is at the upstream entrance to Lyle Falls. The new site offers a narrowed channel and increased flow velocities. At this site we are able to sample a larger percentage of river discharge and believe there is improved potential for establishing a consistent flow/entrainment relationship.

Many adjustments have been necessary and problems encountered, but most problems have been solved. The most significant problem has been cable failures on two separate occasions. The failures were caused by fraying of the cable via constant back-and-forth movement over time. Our solution consisted of reducing the length of lead cable and removing the pulleys that provided additional adjustability. We also replaced the 3/8" 7x19 standard cables with 3/8" 6x36 aircraft cable because it provides added flexibility.

Because of the many adjustments, cable failures, and a period of unusually high flows, we were unable to begin entrainment studies until April, 2003 (actually FY2003). These initial investigations used hatchery coho releases and have been successful, although significantly more work is needed. Based on our sampling to date of 1,819 marked fish, we have recaptured 5.26%. The individual tests have provided recapture rates of 4.95% (849 samples) and 5.39% (970 samples) with flows ranging from 1,950 to 2,400 cubic feet/second.

Task 1.c Spawning ground surveys (redd counts)

Objectives:

- To enumerate the temporal and spatial distribution of redd deposition in the Klickitat basin for spring chinook, fall chinook, coho and steelhead.
- To collect biological information from carcasses.

Planned Methods:

- Conduct regular foot and/or boat surveys within the established geographic range for each species.
- Individually mark redds during each survey.
- Sample carcasses to determine egg retention, sex, and body length; to collect scale

samples; and to check for possible experimental marks.

Results: A summary of spawning ground survey results by species is presented in Appendix B.

Steelhead

Steelhead spawner surveys for 2002 were concluded at the start of the annual reporting period and commenced for 2003 at the conclusion of the period. Surveys were conducted in a number of tributaries not normally included, with interesting results. The total steelhead redd count for the entire Klickitat watershed was 261 (2002). This represents the highest redd count observed in the Klickitat watershed to date. The previous high of 199 was documented in 2000 (a year of unusually high counts throughout the Columbia System). The seemingly high count for 2002 is most likely a result of extended coverage and effort. Spawner surveys were conducted from January 17 to July 2, 2002, a span of nearly 6 months.

Of the 261 redds, 86 (33%) were found in the lower 50 river miles of the mainstem; the remaining 175 (67%) were in tributaries. The White Creek drainage (RM 39.6), including Brush and Teepee creeks, accounted for 107 (41%) of the total, while Dead Canyon added another 27 (10%). These two tributaries alone account for over 50% of the entire redd count for the Klickitat system. Other significant tributaries and redd counts included Wheeler (11), Summit (7), Canyon (5) and Dillacort (5) creeks (see Appendix B for spawner survey results in tabular form).

Our coverage was not entirely complete. A number of the tributaries were subject to partial surveys, due to time constraints and manpower limitations. Additionally, private landownership and trespass issues limited our coverage in the Little Klickitat drainage. The Little Klickitat is the largest tributary and is thought to be significant in terms of steelhead spawning. Additional effort is needed to identify ownership and secure access permission.

High spring flows, turbidity, and vastness limit the effectiveness of the mainstem surveys. We believe there is an unavoidable bias toward undercounting in the mainstem.

Spring Chinook

Spring chinook surveys were conducted between August 19 and October 2, 2002. Klickitat spring chinook are mainstem spawners. The large majority of redds were found between Castile Falls and the WDFW hatchery. This 22-mile segment contained 100% of the 146 redds identified below Castile Falls.

Excess adults returning to the hatchery were transported above Castile Falls to spawn naturally and hopefully seed the habitat. The fish transported included 275 females, 165 adult males and 170 jacks, for a total of 610 fish. These fish accounted for 243 redds, or 62%, of the combined spring chinook redd count for 2002.

Fall Chinook

Fall chinook spawner surveys were conducted between October 21 and December 10, 2002. Fall chinook also are mainstem spawners; generally they utilize the lower river. The highest redd densities were found in the 20 miles from Summit Creek downstream to Wahkiacus. This segment contained 988 or 81% of the total count of 1,225, and a redd density of 49.2 per mile. Fall chinook were found spawning from the old USGS gage above Parrot's Crossing down nearly to Lyle Falls, a total of 48.6 river miles; the average redd density was 25.2 per mile.

Coho

Coho spawner surveys were conducted from October 21 through February 24, 2002. Coho spawning occurs in the lower reaches of most lower river tributaries as well as the mainstem below Parrot's Crossing (RM 49.4). Most spawning occurs between the WDFW hatchery and Soda Springs. This 19-mile segment contained 288 (70%) of the total redd count of 410.

Task 1.d Scale analysis

Objective: To determine age and stock composition of juvenile and adult salmonid stocks in the Klickitat basin.

Planned Methods:

- Use scale analysis to estimate the proportion of hatchery and wild smolts in the estimated smolt outmigration for unmarked fall chinook.
- Estimates of the proportion of hatchery and wild adults carcasses collected will be applied to estimate adult returns by age

Results: Scale samples were obtained from juvenile rainbow/steelhead (*O. mykiss*) caught in screw-traps and from adult chinook (*O. tshawytscha*) and coho (*O. kisutch*) carcasses. The samples have been processed and ages determined. Appendix C presents the age breakdown with accompanying fork length ranges and basic statistics.

Rainbow/Steelhead

The juvenile rainbow/steelhead samples ranged from 0+ to 3+ in age, with the majority being 1+ (56.9%) and 2+ (34.3%). Most 0+ age fish remain in tributaries and preferred habitats; therefore it is not surprising to find so few in our screw trap sample. The oldest fish in this category were 3+ and comprised 1.8% of the sample; these fish generally were out-migrating steelhead smolts. Notably, significant overlap in fork length ranges occurs between age groups 1+ to 3+.

Chinook

Scale samples were obtained from adult chinook carcasses during spawner surveys. The samples consisted of 56% female and 44% male. Some variation between sexes was found: males ranged from 2-year-old jacks to 5-year-olds, and females from 3- to 5-year-olds. Seventy-nine percent of the females were 4-year-olds, another 11 percent were 5 years old, and 10% were 3-year-olds. Males also were predominantly 4 years old (53%), but 3- and 5-year-olds were better represented, at 29% and 18% respectively.

Coho

Scale samples were obtained from adult coho carcasses during spawner surveys. The samples consisted of 42% female and 58% male. All fish were 3-year-olds, and males and females were very similar in fork length.

Task 1.e Klickitat Hatchery Trainee

Rationale: To provide continuity as the existing WDFW facility at Glenwood Washington is transferred from traditional hatchery operation to a YKFP supplementation facility.

Planned Methods: Trainee will transfer from the Cle Elum Supplementation & Research Facility. Employee will learn the facility's operations and capabilities for integration into the YKFP. Employee will advise the Klickitat M&E biologist on facility capabilities, to guide future efforts to obtain information from experimental releases of supplementation and production stocks.

Results: The YKFP Fish Culturist IV was on station at the Klickitat Hatchery during the entire reporting period. He participated in all phases of Klickitat Hatchery operation: adult spawning, incubation, rearing and release of Klickitat spring chinook; and incubation, rearing and release of coho and fall chinook. The Culturist IV gained experience in rearing techniques for steelhead juveniles, which were temporarily reared at the facility. Steelhead supplementation will be an important component of the YKFP activities in the Klickitat Basin. The Culturist IV learned the capabilities and limitations of the existing water supply to the hatchery and is providing input to proposed facility changes needed to support YKFP supplementation at the facility.

Task 1.f Habitat monitoring flights and ground truthing

Objective: To measure a number of environmental variables by analyzing data extracted from periodic aerial videos.

Rationale: Aerial video monitoring is a very effective tool to document habitats in privately held timber lands in the upper Little Klickitat Basin, as well as a cost effective techniques to capture a snap shot in time of existing conditions.

Planned Methods: Aerial video surveys of the Klickitat subbasin will be conducted and analyzed. The habitat conditions (e.g., LWD, pool/riffle ratio, side channel abundance, substrate composition, etc.) shown in the videos will be checked by "ground truthing"—dispatching crews of technicians to specific areas to verify that conditions are in fact as they appear on video.

Results: Habitat monitoring flights and ground-truthing were postponed pending selection of a qualified EDT modeler (see Section 2). Extensive planning and specific timing are crucial elements to successful implementation of this task. In our efforts to extract the greatest potential benefit from aerial photography, we deemed it prudent to postpone until such a time as we were fully equipped and all necessary planning had been accomplished.

On February 26 and 27, 2003 the entire Klickitat basin was flown using a fixed-wing aircraft. Video footage was taken to document later winter habitat conditions. River discharge during the flight was approximately 2,700 cfs (USGS gage at Pitt, WA), two weeks after the first significant freshet of the season. This footage will be used along with the two previous flights (i.e., fall-low flow, and spring-emergence) to document quantity and quality of the various EDT life stage habitat types present. Additionally, aerial video documentation will be used in conjunction with the newly developed Timber, Fish and Wildlife (TFW) Ambient Monitoring habitat database to clearly delineate reaches, sub-reaches, and channel confinement; and to give the viewer/modeler a clear sense of disturbance and channel recovery compared with previous aerial videos.

Task 1.g Sediment impacts on habitat

Objective: To monitor stream sediment loads associated with anthropogenic factors (e.g., logging, agriculture and road building.

Rationale: Excessive sediment loads can play a critical role in egg-to-fry survival, and can depress survival and productivity of many other life stages of salmonids. Information will be used to site future supplementation and production acclimation sites to ensure that return adults homing to the immediate river reach will have the highest likelihood to increase natural production

Planned Methods: Representative gravel samples will be collected from throughout the basin. Each sample will be analyzed to estimate the percentage of fines or small particles present. The TFW program guidelines on sediments will then be used to specify the impacts that estimated sedimentation levels have had on salmonid egg-to-smolt survival. These impacts would be incorporated in analyses of impacts of “extrinsic” factors on natural production.

Results: Data from sediment monitoring is presented in Appendix D. To develop long-term trend data, additional years of data must be collected from sites on the 2002 list. Prior to the final development of the 2002 list, investigations were made at the various sites identified to determine their feasibility for sampling access.

Some general observations can be made from the existing data. It appears that the 1995-96 floods and above-average flows from 1996-98 may have increased the fine sediment in the entire basin through local bank erosion and mass wasting processes. Delivery to the stream systems may have been accelerated due to human activities. The Klickitat River at Cow Camp (RM 78) strongly displays this effect, with an intense increase in fines through 2000 and a trend downward in 2001 and 2002. Additionally, it is apparent that there is fine sediment migration within Klickitat Meadows (Diamond Fork Creek). It is evident that from the top of Klickitat Meadows to the bottom the overall percentage of sediment decreases from the top of the meadows with time.

Task 1.h Klickitat fish passage obstruction inventory assessment

Objectives:

- To locate and describe existing salmonid fish migration barriers in the Klickitat basin.
- To better describe both existing and future anadromous distribution for EDT modeling purposes.

Rationale: Fish passage barriers occur in numerous forms from man-made structures such as dams and road culverts to natural barriers including waterfalls, bedrock chutes, cascades, debris jams, or even beaver dams. The most significant barriers within the Klickitat watershed are culverts, dams, waterfalls, bedrock chutes, and cascades. Fish passage barrier assessment work is critical to delineating the extent of anadromy within the Klickitat watershed and therefore necessary as a monitoring and evaluation function within the YKFP.

Planned Method:

- Gather existing data that has been collected in past years by YN Fisheries staff and other agencies (e.g., Dept. of Transportation, WDFW).
- Conduct field surveys using WDFW's *Fish Passage Barrier Assessment and Prioritization Protocol* to locate and assess both natural and artificial passage problems not identified through existing reports, etc. Barrier survey included this year will look at both natural and artificial barriers with an eye toward defining boundaries to anadromy.
- Classify all barriers as "passable" or "impassable" along with any conditions under which the classifications apply.

The WDFW *Fish Passage Barrier Assessment and Prioritization Manual* identifies two levels of evaluation. Level A determines if the culvert is a barrier or non-barrier. If a Level A evaluation is inconclusive, a Level B analysis is required. Level B analysis requires collecting physical data sufficient for hydraulic modeling.

Results: FY2002 efforts concentrated on identifying and documenting additional artificial and/or natural barriers and adding them to our database. Most work to date has concentrated on locating and classifying culverts, although waterfalls, bedrock chutes and cascades are also being identified and mapped for inclusion.

To date we have identified 61 culverts at 48 locations within the watershed (Appendix E includes a list of sites). Level A evaluation has been attempted on all sites, although errors and quality control issues indicate that at least 24 of these sites will need to be revisited.

Waterfalls also have been documented on a number of tributaries used by steelhead. Most of these waterfalls have been photographically documented but will require additional work. We plan to evaluate individual falls by taking physical measurements and documenting GPS locations for inclusion in the developing database and GIS.

Appendix E includes our current list of culvert sites identified to date along with a table noting waterfalls of interest and their classification, if applied.

Task 1.i Klickitat water quality inventory

Objective: Record water quality measurements on selected tributaries and within selected habitat survey reaches on a seasonal basis.

Rationale: The relationship of water temperature to dissolved oxygen (DO) is a critical factor within the Klickitat watershed. Many of the significant steelhead spawning and rearing tributaries are subject to excessive warming or even dewatering during the summer. There is an inverse relationship between water temperature and DO; as water temperature increases DO decreases. According to research published by the U.S. Army Corps of Engineers (USACE), the upper lethal temperature boundary for steelhead/rainbow is 75^{o}F (23.9^{o}C). Additionally, due to increased metabolic rates, growth ceases in all cold water species at temperatures exceeding 68^{o}F (20 ^{o}C) (Bell, 1990).

Methodology: Water quality measuring devices were deployed to measure and record the following parameters- temperature, dissolved oxygen, conductivity, total dissolved solids, and turbidity. Mean daily water temperatures will be monitored on an annual basis for several key tributaries and mainstem sites using Hobo thermographs.

Results: Water quality sampling was conducted at 11 locations on 7 tributaries during FY2002. The tributaries sampled included Summit, Cougar, Cunningham, Soda Springs, Teepee, White and the Big Muddy creeks. Sampled parameters include temperature, dissolved oxygen, turbidity, conductivity (similar to total dissolved solids), and pH. Additionally, thermographs were placed at 5 locations on the mainstem between RM 6 and RM 80. Thermographs (Hobos) are also used at 24 locations in 18 tributaries.

We identified two potentially problematic parameters: temperature and turbidity. The temperature problem is more prevalent in the lower basin, from White Creek down-stream. Temperature and reduced DO, along with dewatering, are responsible for losses of juvenile steelhead. We have observed stranding and subsequent desiccation in a number of tributaries. Considerable losses occur annually in White, Tepee, Brush, Dead Canyon, Swale, and Dillacort creeks as a result of dewatering and/or warming of refugia pools.

Glacially derived fine sediment from the eastern face of Mt. Adams is delivered to the Klickitat by Big and Little Muddy Creeks in mid-summer. More troublesome, however, is the sediment delivered from farmlands and forest roads during spring run-off while steelhead eggs are incubating within the gravels. Fine sediment can suffocate the eggs.

The temperature and other water quality data are summarized in Appendix F.

Reference:

Bell, M. 1990. Fisheries Handbook of Engineering Requirements and Biological Criteria. Fish Passage Development and Evaluation Program, U.S. Army Corps of Engineers, North Pacific Division, Portland, Oregon.

Task 1.j Klickitat habitat inventories

Objective: The near-term objective is to collect baseline data on existing habitat conditions, fish populations, and passage conditions throughout the basin.

Rationale: This information will be used to refine the Ecosystem Diagnosis and Treatment (EDT) model, which will guide decisions about future habitat restoration and hatchery supplementation projects as well as mainstem and tributary passage improvements.

Planned Methods: The habitat inventories will be conducted using the TFW methodology (modules: Stream Segment Identification, Reference Point Survey, Habitat Unit Survey, Large Woody Debris Survey and Ambient Salmonid Spawning Gravel Composition). Data gathered will be included in the database currently under development and will be used for comparative purposes and trend analysis. In the event changes are noted over time, we will be able to document the changes and identify potential causes and solutions.

Results: Habitat inventories based on the TFW Ambient Monitoring Protocol were conducted on 1,000-meter segments in White, Trout, Summit and Bear creeks. In addition to the protocols noted under "Methods," we added nutrient analysis based on macro-invertebrate and periphyton abundance in Trout, Summit and Bear creeks. This baseline information will added to the database (in development) and used to monitor and potentially react to negative changes as they become apparent.

2. EDT Modeling

Overall Objective: Identify preferred enhancement options with respect to habitat and artificial propagation using the EDT model, applicable TFW protocols, and/or other scientific methods where appropriate.

Task 2.a Klickitat habitat and production assessment

Objective: To estimate potential benefits from habitat restoration and artificial production scenarios using the EDT model.

Rationale: The EDT model is being developed to be the primary focus for the Klickitat Subbasin Plan, and a component of the habitat section of the Klickitat Subbasin Master Plan.

Planned Methods:

- Apply the EDT model on habitat improvement strategies and artificial propagation/supplementation options for chinook, coho and steelhead.
- Incorporate existing data into relational database (ACCESS) and identify additional data needs to refine and bolster output.
- Generate EDT model runs to illustrate and guide management actions to maximize potential fishery benefits regarding habitat, passage and artificial production options.

Results: The EDT modeler position funded under this contract was filled on December 9, 2002 (roughly 8 months into the contract period). The following is a list of that person's accomplishments toward meeting the objective from December 9, 2002 – March 31, 2003.

- Familiarization on the theoretical basis of the EDT model
- Compilation of existing scientific data in Klickitat basin for level 2 data inputs
- Finalized appropriate reach segments and reach breaks for model based on physical geomorphic characteristics
- Analyzed existing USGS stream gauging information for subbasins and created annual flow patterns for several level 2 attributes
- Populated channel morphometry dimensions for several subbasins in model
- Conducted several field surveys for data acquisition and basin-wide familiarization

Future objectives and timelines:

November 1, 2003

Completion of data acquisition and populating of patient attributes

December 15, 2003

Completion of data inputs for template conditions and design

Spring 2004

Completion of consumer output reports depicting restoration and preservation potential reach by reach, and construction of scenario generator that will analyze the following:

- Possible benefits of habitat restoration modeled through scenario generator
- Benefits of supplementation spatially modeled through out the basin

3. Genetics

Overall Objective: Develop methods of detecting within-stock genetic variability and between-stock genetic variability.

Task 3.a DNA data collection and analysis

Objective: Make a full baseline-level screening (approx 60 loci) of the hatchery and wild steelhead and spring chinook collected. Additional DNA analysis will probably be a nine-locus screening of the broodstock used for supplementation to serve as a baseline from which to monitor changes.

Rationale: The DNA data will augment the allozyme baseline data of Klickitat spring chinook to serve as baseline from which to distinguish population(s) for broodstock collection purposes.

Planned Methods: Tissue samples from steelhead and spring chinook (approximately 300 of each species) will be analyzed according to standard DNA protocol. Samples will be collected from screw-traps and spawning areas in the mainstem Klickitat River. These data will also be compared to the electrophoritic data set collected by WDFW. It is becoming evident that DNA data will totally supplant allozyme work in time.

Results: DNA samples were obtained from spring chinook and rainbow/steelhead during FY2002. The chinook samples were obtained from post-spawning adult carcasses and hatchery adults. The steelhead samples were a mixture of juveniles captured in screw traps along with a few from adult carcasses found during spawner surveys. In addition, we collected 100 hatchery samples from fish bound for the Klickitat. Our thanks are extended to Shawn Narum, Geneticist with CRITFC based at the University of Idaho's Hagerman facility. Mr. Narum supplied the information presented here. Preliminary finding for the steelhead evaluation are presented in Appendix G.

<u>Spring Chinook</u>

We had hoped to obtain 300 samples but were unsuccessful; CRITFC has agreed to accept additional samples until the stated 300 have been collected. They have genotyped all of the hatchery fish, but poor quality DNA from the wild chinook carcasses hampered their efforts. Only 15 wild individuals could be genotyped. They were, however, able to analyze the data from 7 micro-satellite loci for hatchery and wild sample groups and found no significant genetic differences at any of the loci. CRITFC would like to compare genetic diversity between wild and hatchery chinook, but due to the low sample size of wild fish, the comparison would not be reliable. CRITFC has agreed to analyze another 200 samples at no additional cost and we intend to deliver those samples.

<u>Steelhead</u>

Though the final results have not been received as of this writing, we have been informed of the following: Analysis to date comparing the Klickitat steelhead population to those of the Yakima, Walla Walla, Umatilla, and Snake watersheds indicates the Klickitat population is dissimilar. The Klickitat population contains significant genetic difference from the four others which are genetically very similar.

A total of 100 DNA samples were collected from Skamania Hatchery steelhead smolts for comparison to Klickitat wild stocks. WDFW annually out-plants 120,000 Skamania smolts in the Klickitat River. Analysis was performed to determine the amount of transgression between the two stocks. Results are presented in Appendix G.

4. Ecological Interactions

Task 4.a Pathogen sampling

Rationale: This work will help determine if supplementation increases the incidence of pathogens.

Objective: Establish a baseline data set describing existing levels of pathogens in wild resident trout and naturally produced chinook and coho.

Planned Method: Yakama Nation field crews will collect approximately 50 resident rainbow trout, 50 brook trout, 50 chinook and 50 coho smolts and pre-smolts throughout the Klickitat Basin. They will examine the fish for pathogens, using standard protocols at the USFWS Fish Health Laboratory, to identify fish pathogens present in the Klickitat Basin. USFWS will conduct analysis at no cost, per federal Wild Fish Study procedures and guidelines.

Results: Pathogen sampling was conducted in October of 2002. Mainstem Klickitat samples were taken from the upper and hatchery screw trap catches; tributary samples were gathered via electro-fishing. Sampled tributaries included Bear, Brush, Fish Lake Stream, Little Klickitat, McCreedy, Piscoe, Summit, Surveyors, Swale, Tepee, Trout and White creeks. Mr. Kenneth Lujan, a microbiologist with the USFWS Lower Columbia River Fish Health Center, accompanied us during sampling and provided preservatives and containers for all samples.

RS (*Renibacterium salmoninarum*), the disease agent for Bacterial Kidney Disease (BKD), was found in most samples; most other tests were negative. Because sample sizes were generally small, additional sampling is planned for FY2003. A table with all positive results is presented in Appendix H along with an explanatory statement written by Mr. Lujan. We extend our gratitude to Mr. Lujan and the Lower Columbia River Fish Health Center for their assistance and expertise.

5. Appendices

Appendix A. Screw Trap Results

Upper Trap - FY2002

Catch by Month

Month	Rainbow/ Steelhead	Spring Chinook	Brook Trout	Monthly Totals
January	n/a	n/a	n/a	n/a
February	n/a	n/a	n/a	n/a
March	n/a	n/a	n/a	n/a
April	n/a	n/a	n/a	n/a
May	6	510	0	516
June*	10	10	0	20
July	62	117	2	181
August	20	100	2	122
September	19	11	1	31
October	8	7	11	26
November**	0	0	0	0
December	n/a	n/a	n/a	n/a
Totals	125	755	16	896

* needed repairs limited operation & catch

** trap was removed in early November

Hatchery Screw Trap - FY2002

Catch by Month

Month	Chinook	Chinook Fry	Coho	Coho Fry	O. Mykiss	Monthly Totals
April	86	530	2	153	18	789
May	2498	547	50	659	19	3773
June	405	167	2	250	17	841
July	26	170	0	44	56	296
August	9	41	21	3	15	89
September	0	81	68	0	9	158
October	0	58	23	0	2	83
November	0	28	68	0	0	96
December	13	29	79	0	3	124
January	9	17	34	0	9	69
February	28	11	10	0	6	55
March	226	12	14	45	13	310
April	159	15	11	31	24	240
Totals	3459	1706	382	1185	191	6923

Lyle Falls Screw Trap - FY2002

Catch by Month

Month	Chinook	Coho	O. Mykiss	Monthly Totals
April	n/a	n/a	n/a	n/a
May	n/a	n/a	n/a	n/a
June	n/a	n/a	n/a	n/a
July	n/a	n/a	n/a	n/a
August	1314	0	7	1321
September	339	9	3	351
October	n/a	n/a	n/a	n/a
November	2	4	1	7
December	15	18	2	35
January	42	111	5	158
February	n/a	n/a	n/a	n/a
March	28	42	6	76
April	73	40216	275	40564
Totals	1813	40400	299	42512

Appendix B. Spawning ground surveys (redd counts)

Steelhead

KLICKITAT WATERSHED - STEELHEAD SPAWNING SURVEY RESULTS, 2002							
RIVER	REACH	MILES*	# OF PASSES	REACH TOTALS	REDDS /MILE*	LIVE OBS.	DEAD OBS.
Klickitat							
MAIN STEM	Huckleberry Cr. - McCormick Mdws.	2.0	1	0	0.0	0	0
	McCormick Mdws - Cattle guard	5.1	1	0	0.0	0	0
	Cattle guard - Castile Falls	12.9	0	n/s			
	Castile Falls #10 - Castile Falls #1	0.8	0	n/s			
	Castile Falls - Signal Peak Br.	3.3	0	n/s			
	Signal Peak Br. - Big Muddy Cr.	6.9	0	n/s			
	Big Muddy Cr. - old USGS gage	3.3	0	n/s			
	Old USGS gage - WDFW Hatchery	8.2	1	2	0.2	3	0
	WDF Hatchery - Summit Cr.	5.5	3	5	0.9	15	0
	Summit Cr. - Leidl Br.	5.6	3	9	1.6	7	0
	Leidl Br. - Stinson Flat	2.5	3	14	5.6	12	0
	Stinson Flat - Soda Springs	5.0	3	24	4.8	14	0
	Soda Springs - Twin br.	6.4	3	18	2.8	29	1
	Twin Br. - Field Office	1.5	3	2	1.3	7	0
	Field office - Pitt	6.5	3	11	1.7	14	0
	Pitt - Turkey Farm	5.0	4	1	0.2	1	2
	Turkey Farm - Lyle Falls	2.0	2	0	0.0	1	0
	MAINSTEM TOTAL	55.3		86	1.6	103	3

KLICKITAT WATERSHED - STEELHEAD SPAWNING SURVEY RESULTS, 2002[1]							
RIVER	REACH	MILES*	# OF PASSES	REACH TOTALS	REDDS /MILE*	LIVE OBS.	DEAD OBS.
Tributaries							
Trib of trib							
DIAMOND FORK			0	n/s			
McCREEDY CR.			0	n/s			
PISCOE CR.		7.6	1	0	0.0	0	0
SURVEYORS CR.		1.7	2	2	1.2	0	0
BIG MUDDY	End of rd. to falls	1.4	1	0	0.0	0	0
TROUT CR.		4.0	3	0	0.0	0	0
Bear Cr.		1.0	1	0	0.0	0	0
OUTLET CR.		0.3	1	0	0.0	0	0
WHITE CR.	Upper rd. xing - IXL Rd.	2.8	1	8	2.9	0	0
	IXL Rd. - 191 Rd. Xing	3.1	1	8	2.6	0	0
	191 Rd. xing - Cedar Valley Rd.	2.4	1	10	4.2	5	0
	Cedar Valley Rd. - Brush Cr.	4.6	1	9	2.0	1	1
	Brush Cr. - washed out xing	1.8	1	13	7.2	0	1
	Washed out xing. - Schafer Cr.	1.2	1	7	5.8	0	1
	Schafer Cr. - mouth	1.9	3	16	8.4	7	1
West Fork Cr.	Lower LB trib. - mouth	1.9	1	0	0.0	0	0
Teepee Cr.	RB Trib - IXL Rd.	2.2	1	6	2.7	0	0
	IXL Rd.- Teepee Cr. Rd.	2.5	1	6	2.4	0	0
	Teepee Cr. Rd. - mouth	3.4	1	6	1.8	0	0
Brush Cr.	Xing 3.8 mi above Coyote Springs Rd.	3.8	1	0	0.0	0	0
	Coyote Springs Rd. - Cedar Valley Rd.	2.0	1	8	4.0	0	0
	Cedar Valley Rd. - Blue Creek	2.6	1	6	2.3	0	0
	Blue Creek - mouth	2.2	1	4	1.8	0	0

[1] n/s = not surveyed; *mileages from GIS arcs (feet/5280)

RIVER/TRIB.	REACH	MILES*	# OF PASSES	REACH TOTALS	REDDS /MILE*	LIVE OBS.	DEAD OBS.
SUMMIT CR.	Falls - rt. bank spring inflow	1.0	2	6	6.0	3	0
	Rt. bank spring inflow - watering hole	0.2	2	1	5.0	0	0
	Watering hole - mouth	0.1	0	n/s			
DEAD CANYON CR.		3.5	3	27	7.7	10	1
BEEKS CANYON		0.5	2	1	2.0	2	0
LITTLE KLICKITAT	Bowman Cr. - mouth	1.2	0	n/s			
Bowman Cr.	Falls - mouth	1.0	0	n/s			
Canyon Cr.	Right bank trib #3 - left bank trib #1	1.0	1	1	1.0	0	0
	Left bank trib #1 - Weeping Wall	1.0	1	4	4.0	0	3
	Weeping Wall - mouth	1.0	1	4	4.0	0	2
Mill Cr.			0	n/s			
East Prong		1.0	0	n/s			
West Prong		1.0	0	n/s			
SWALE CR.	Above railroad trestle	1.1	3	0	0.0		0
	Trestle to mouth	1.1	3	2	1.8	9	0
SNYDER CR.	Upper falls - Lower falls	0.7	1	0	0.0		0
	Lower falls - flume	1.5	1	0	0.0		0
	Flume - mouth	0.4	1	0	0.0	0	0
LOGGING CAMP CR		1.0	2	4	4.0	0	3
WHEELER CR.		2.0	3	11	5.5	10	0
DILLACORT CR.	Falls - mouth	1.5	3	5	3.3	0	1
SILVA CR.	Bottom	0.1	2	0			0
CANYON CR.	Bottom 1/4 mile	0.3	1	0			0
	Tributary Totals	**72.3**		**175**	**2.4**	**47**	**14**
	COMBINED TOTAL	**127.6**		**261**	**2.0**	**150**	**17**
	Tributary Contribution			**67%**		**31%**	**82%**
	Mainstem Contribution			**33%**		**69%**	**18%**

Spring Chinook

KLICKITAT WATERSHED - SPRING CHINOOK SPAWNING SURVEY RESULTS, 2002							
RIVER	REACH	MILES*	# OF PASSES	REACH TOTALS	REDDS /MILE*	LIVE OBS.	MORTS OBS.
Klickitat							
MAIN STEM	**Above Castile Falls**						
	Huckleberry Cr. - McCormick Mdws.	3.4	1	11	3.3	1	4
	McCormick Mdws - Cow Camp	8.0	3	146	18.3	93	83
	Cow Camp - McCreedy Cr.	7.1	4	82	11.5	27	20
	McCreedy Cr. - Castile Falls	6.0	3	4	0.7	0	2
	Subtotal	24.4		243	10.0	121	109
	Below Castile Falls						
	Castile Falls #11 - Castile Falls #1	0.6	1	0	0.0	7	1
	Castile Falls #1 - Signal Peak Br.	3.3	3	50	15.2	39	16
	Signal Peak Br. - old USGS gage	10.5	3	80	7.6	76	26
	Old USGS gage - WDFW Hatchery	8.2	1	16	2.0	3	5
	WDF Hatchery - Summit Cr.	5.5	1	0	0.0	0	0
	Summit Cr. - Leidl Br.	5.6	1	0	0.0	0	1
	Subtotal	33.7		146	4.3	125	49
	MAINSTEM TOTALS	**58.1**		**389**	**6.7**	**246**	**158**
	Above Castile Falls contribution			**62%**		**49%**	**69%**
	Below Castile Falls contribution			**38%**		**51%**	**31%**

n/s = not surveyed

*mileages derived from GIS arc lengths (feet/5280)

****Note 7/23/2002 -** Excess hatchery returns were transported above Castile Falls and released to spawn naturally. Included in the transport effort were 275 females, 165 adult males and 170 jacks, for a total of 610 fish. Their contribution to the overall redd count was significant, approximately 62%.

Fall Chinook

KLICKITAT WATERSHED - FALL CHINOOK SPAWNING SURVEY RESULTS, 20(							
RIVER	REACH	MILES*	# OF PASSES	REACH TOTALS	REDDS /MILE*	LIVE OBS.	MORTS OBS.
Klickitat							
MAIN STEM	Castile Falls #11 - Castile Falls #1	0.6	0	n/s			
	Castile Falls #1 - Signal Peak Br.	3.3	0	n/s			
	Signal Peak Br. - old USGS gage	10.5	0	n/s			
	Old USGS gage - WDFW Hatchery	8.2	1	3	0.4	0	0
	WDF Hatchery - Summit Cr.	5.4	2	75	13.9	372	35
	Summit Cr. - Leidl Br.	5.2	3	258	49.6	360	204
	Leidl Br. - Stinson Flats	2.9	3	97	33.4	182	157
	Stinson Flat - Soda Springs	4.5	3	160	35.6	189	190
	Soda Springs - Twin Bridges	6.3	2	420	66.7	287	277
	Twin Bridges - Klick Field Office	1.2	2	53	44.2	90	45
	Klick Field Office - Town of Klickitat	3.6	2	83	23.1	32	91
	Klickitat Town - Pitt Bridge	3.4	2	27	7.9	119	46
	Pitt Bridge - Turkey Farm CG	5.4	2	38	7.0	16	70
	Turkey Farm CG - Lyle Falls trap	2.5	2	11	4.4	8	18
	Below Lyle Falls	0.5	0	n/s			
	MAINSTEM TOTALS	**48.6**		**1225**	**25.2**	**1655**	**1133**

n/s = not surveyed
*mileages derived from GIS arc lengths (feet/5280)

Coho

KLICKITAT WATERSHED - COHO SPAWNING SURVEY RESULTS, 2002							
RIVER	REACH	MILES*	# OF PASSES	REACH TOTALS	REDDS /MILE*	LIVE OBS.	DEAD OBS.
Klickitat							
MAIN STEM	Castile Falls #10 - Castile Falls #1	0.8	0	n/s			
	Castile Falls - Signal Peak Br.	3.3	0	n/s			
	Signal Peak Br. - Big Muddy Cr.	6.9	0	n/s			
	Big Muddy Cr. - old USGS gage	3.3	0	n/s			
	Old USGS gage - WDFW Hatchery	8.2	3	22	2.7	188	5
	WDF Hatchery - Summit Cr.	5.5	4	108	19.6	496	49
	Summit Cr. - Leidl Br.	5.6	4	66	11.8	259	81
	Leidl Br. - Stinson Flat	2.5	4	48	19.2	147	72
	Stinson Flat - Soda Springs	5.0	3	66	13.2	93	24
	Soda Springs - Twin Br.	6.4	3	43	6.7	79	45
	Twin Br. - Field Office	1.5	3	20	13.3	24	9
	Field office - Klickitat Town	3.1	3	14	4.5	42	14
	Klickitat Town - Pitt Bridge	3.4	3	13	3.8	91	13
	Pitt - Turkey Farm	5	3	10	2.0	26	15
	Turkey Farm - Lyle Falls	2	3	0	0.0	3	3
	MAINSTEM TOTAL	48.2		410	8.5	1448	330
TRIBUTARIES							
Trib of trib							
WHITE CREEK	Washed out xing. - Schafer Cr.	1.2	0	n/s			
	Schafer Cr. - confluence	1.9	1	1	0.5	0	3
SUMMIT CREEK	Falls - rt. bank spring inflow	1.3	1	0	0.0	26	7
DEAD CANYON CR		3.5	2	30	8.6	26	7
BEEKS CANYON		0.5	1	3	6.0	1	4
LITTLE KLICKITAT	Bowman Cr. - confluence	1.2	0	n/s			
Bowman Cr.	Falls - confluence	1.0	0	n/s			
Canyon Cr.	Right bank trib #3 - left bank trib #1	1.0	0	n/s			
	Left bank trib #1 - Weeping Wall	1.0	0	n/s			
	Weeping Wall - confluence	1.0	0	n/s			
Mill Cr.			0	n/s			
East Prong		1.0	0	n/s			
West Prong		1.0	0	n/s			
SWALE CREEK	Above railroad trestle	1.1	2	4	3.6	3	0
	Trestle - confluence	1.1	2	10	9.1	5	4
SNYDER CREEK	Upper falls - Lower falls	0.7	0	n/s			
	Lower falls - Flume	1.5	1	0	0.0	0	0
	Flume - confluence	0.4	1	0	0.0	0	0
LOGGING CAMP CR		1.0	2	1	1.0	0	1
WHEELER CREEK		2.0	2	10	5.0	0	0
DILLACORTE CR	Falls - confluence	1.5	1	0	0.0	0	0
SILVA CREEK	Bottom	0.1	0	n/s			
CANYON CREEK	Bottom 1/4 mile	0.2	1	11	44.0	252	28
	Tributary Totals	19.0		70	1.1	313	54
	COMBINED TOTAL	**67.2**		**480**		**1761**	**384**
	Tributary Contribution			**15%**		**18%**	**14%**
	Mainstem Contribution			**85%**		**82%**	**86%**

n/s = not surveyed
*mileages from GIS arcs (feet/5280)

Appendix C. Scale analysis

2002 Rainbow/Steelhead (*O.mykiss*) scale based age data

Age	Number in Sample	Average Fork Length	Median Fork Length	Maximum Fork Length	Minimum Fork Length	Percent of Total
0+	47	84.5	85	102	70	7.0%
1+	382	122.5	115	221	71	56.9%
2+	230	180.3	179.5	287	100	34.3%
3+	12	205.8	192.5	278	158	1.8%
Totals	671					100.0%

Note: Fork lengths measured to the nearest millimeter

2002 Chinook (*O.tshawytscha)* scale based age data

Age	sex	Number in Sample	Average Fork Length	Median Fork Length	Maximum Fork Length	Minimum Fork Length	Percent of Sex	Percent of Total
2	Female	0					0.0%	0.0%
3	Female	25	77.9	78	88	56	10.0%	5.6%
4	Female	197	84.3	84.5	97	65	79.1%	44.3%
5	Female	27	92.7	93	108	79	10.8%	6.1%
Females		249					100.0%	56.0%
2	Male	1	64	64	64	64	0.5%	0.2%
3	Male	56	72.9	72.8	91	50	28.6%	12.6%
4	Male	103	70.7	72	84	54	52.6%	23.1%
5	Male	36	101.6	103.8	118	73.5	18.4%	8.1%
Males		196					100%	44.0%
Totals		445						100.0%

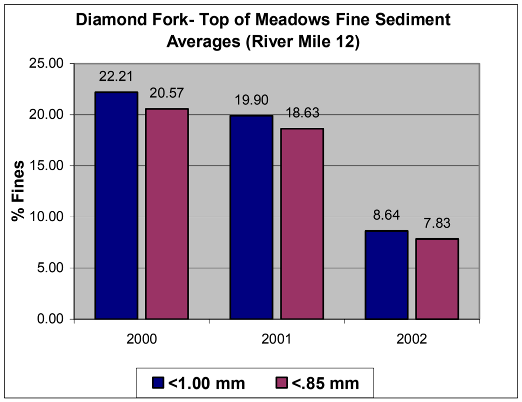
Note: Fork lengths in centimeters

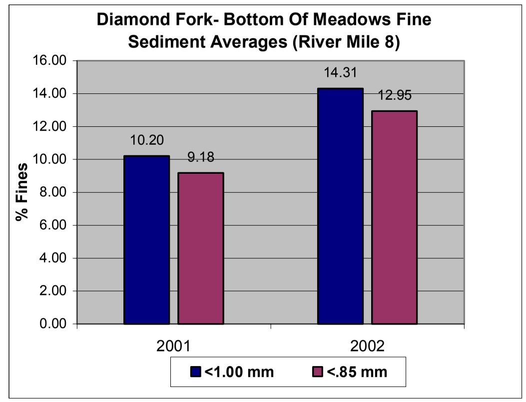
2002 Coho (*O.kisutch*) scale based age data

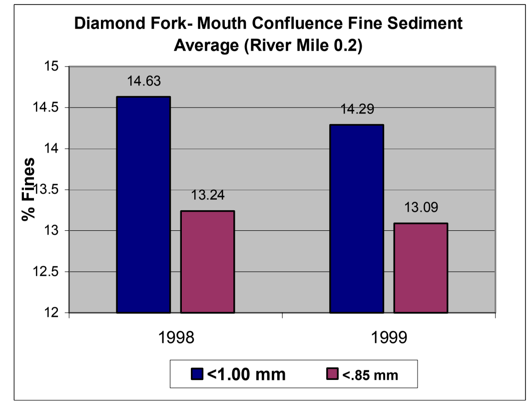
Age	sex	Number in Sample	Average Fork Length	Median Fork Length	Maximum Fork Length	Minimum Fork Length	Percent of Total
3	Female	76	59.3	60	69	44	42%
3	Male	105	55.7	57	68	41	58%
Total		181					100%

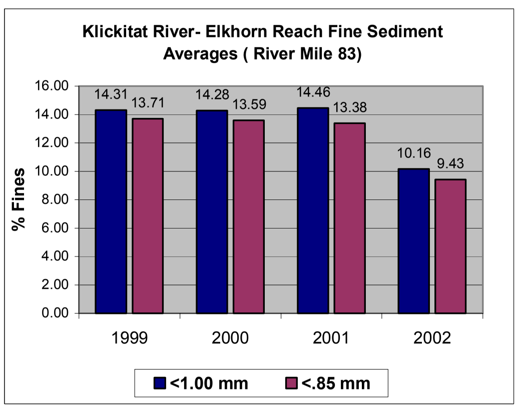
Note: Fork lengths in centimeters

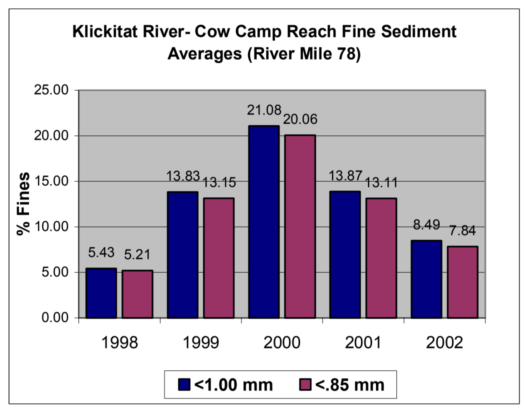
Appendix D. Sediment data

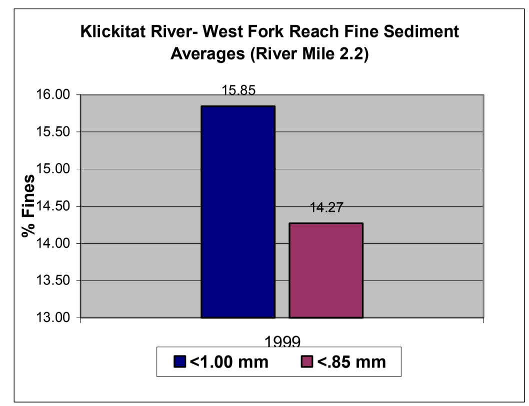


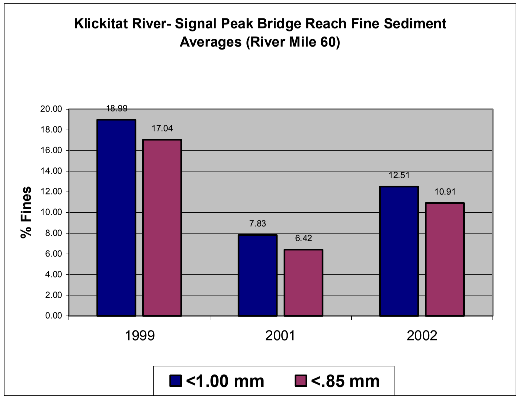


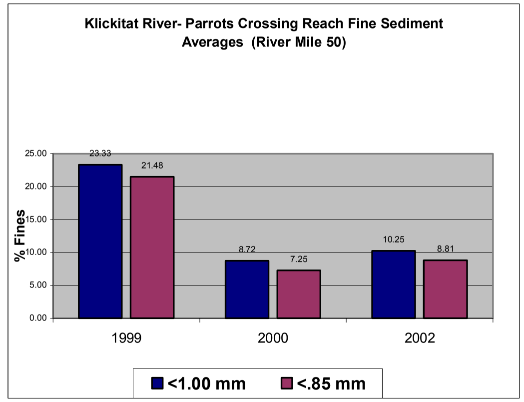


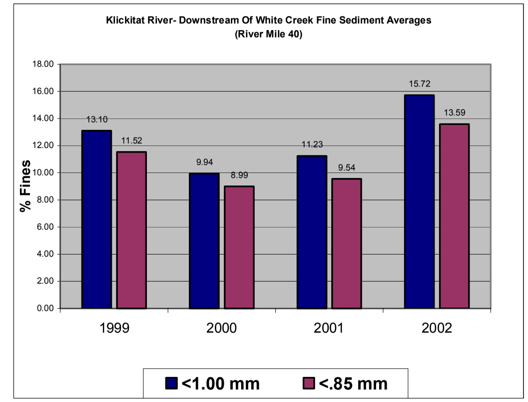


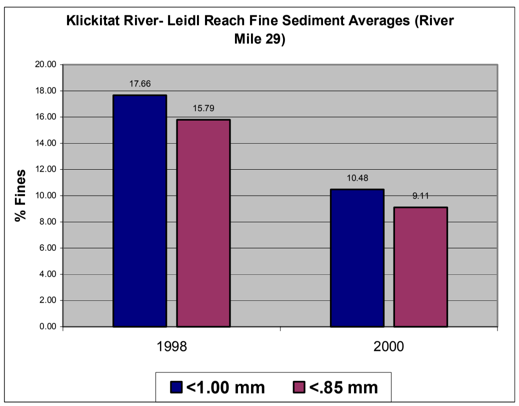


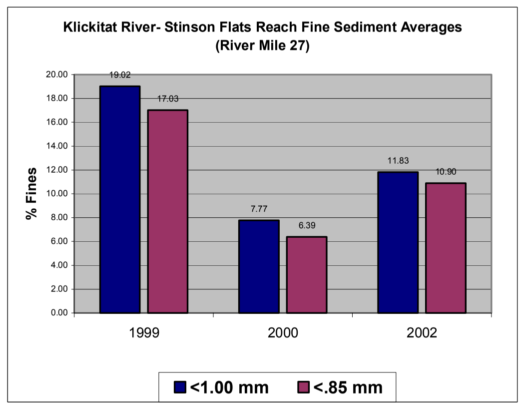


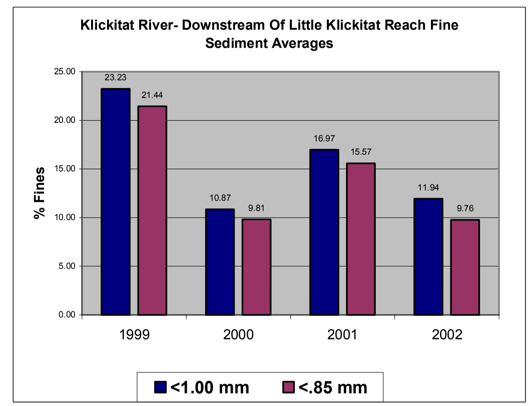

Klickitat River- Signal Peak Bridge Reach Fine Sediment Averages (River Mile 60)
% Fines
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
18.99
17.04
7.83
6.42
12.51
10.91
1999
2001
2002
<1.00 mm
<.85 mm

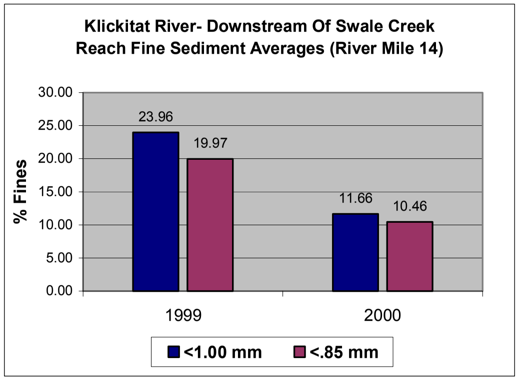

Klickitat River- Parrots Crossing Reach Fine Sediment Averages (River Mile 50)
% Fines
25.00
20.00
15.00
10.00
5.00
0.00
23.33
21.48
8.72
7.25
10.25
8.81
1999
2000
2002
<1.00 mm
<.85 mm

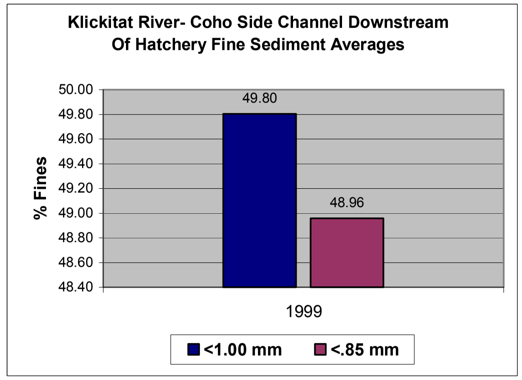

Klickitat River- Downstream Of White Creek Fine Sediment Averages (River Mile 40)
% Fines
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
13.10
11.52
9.94
8.99
11.23
9.54
15.72
13.59
1999
2000
2001
2002
<1.00 mm
<.85 mm

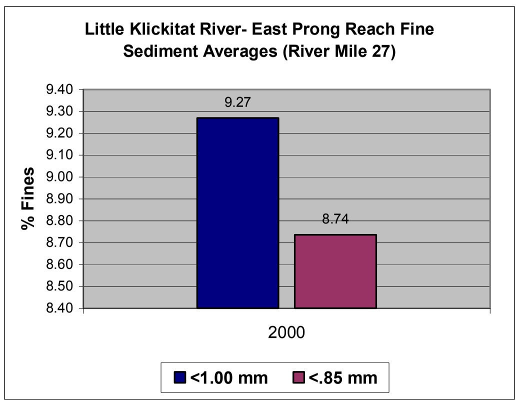

Klickitat River- Leidl Reach Fine Sediment Averages (River Mile 29)
% Fines
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
17.66
15.79
10.48
9.11
1998
2000
<1.00 mm
<.85 mm

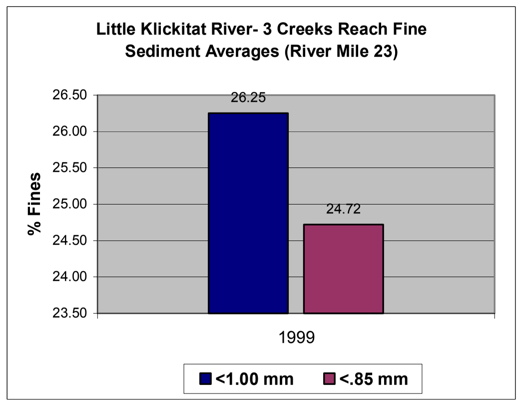

Klickitat River- Stinson Flats Reach Fine Sediment Averages (River Mile 27)
% Fines
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
19.02
17.03
7.77
6.39
11.83
10.90
1999
2000
2002
<1.00 mm
<.85 mm

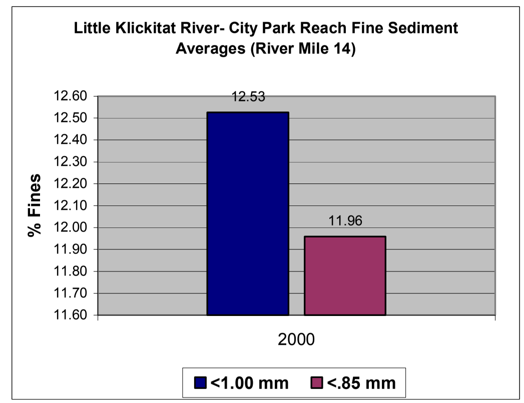

Klickitat River- Downstream Of Little Klickitat Reach Fine Sediment Averages
% Fines
25.00
20.00
15.00
10.00
5.00
0.00
23.23
21.44
10.87
9.81
16.97
15.57
11.94
9.76
1999
2000
2001
2002
<1.00 mm
<.85 mm

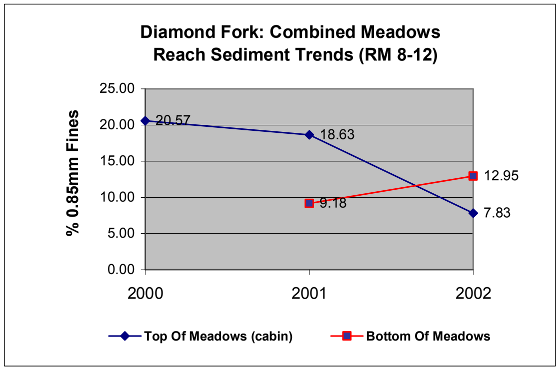

Klickitat River- Downstream Of Swale Creek Reach Fine Sediment Averages (River Mile 14)
% Fines
30.00
25.00
20.00
15.00
10.00
5.00
0.00
23.96
19.97
11.66
10.46
1999
2000
<1.00 mm
<.85 mm

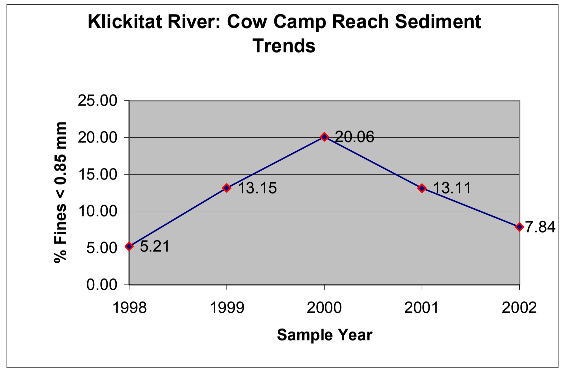

Klickitat River- Coho Side Channel Downstream Of Hatchery Fine Sediment Averages
% Fines
50.00
49.80
49.60
49.40
49.20
49.00
48.80
48.60
48.40
49.80
48.96
1999
<1.00 mm
<.85 mm

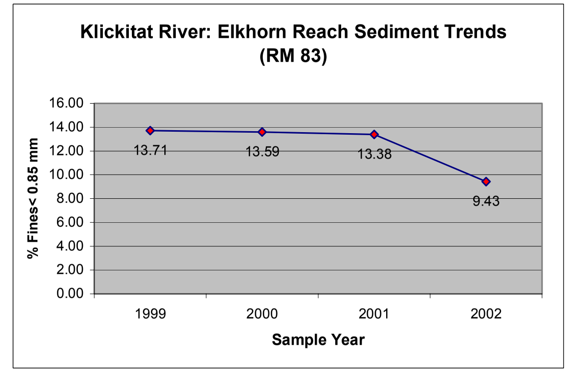

Little Klickitat River- East Prong Reach Fine Sediment Averages (River Mile 27)
% Fines
9.40
9.30
9.20
9.10
9.00
8.90
8.80
8.70
8.60
8.50
8.40
9.27
8.74
2000
<1.00 mm
<.85 mm

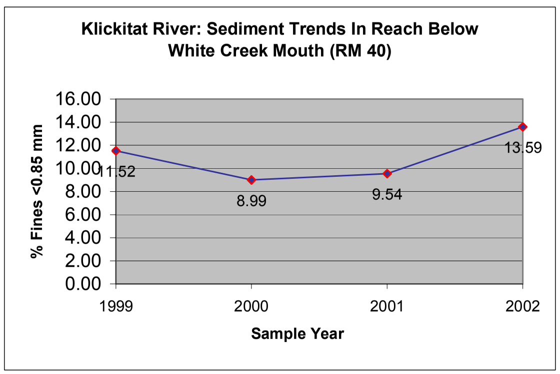

Little Klickitat River- 3 Creeks Reach Fine Sediment Averages (River Mile 23)
% Fines
26.50
26.00
25.50
25.00
24.50
24.00
23.50
26.25
24.72
1999
<1.00 mm
<.85 mm

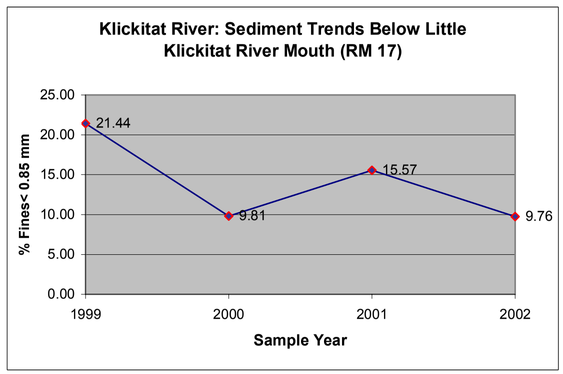

Little Klickitat River- City Park Reach Fine Sediment Averages (River Mile 14)
% Fines
12.60
12.50
12.40
12.30
12.20
12.10
12.00
11.90
11.80
11.70
11.60
12.53
11.96
2000
<1.00 mm
<.85 mm


Diamond Fork: Combined Meadows Reach Sediment Trends (RM 8-12)
% 0.85mm Fines
25.00
20.00
15.00
10.00
5.00
0.00
2000
2001
2002
20.57
18.63
9.18
12.95
7.83
Top Of Meadows (cabin)
Bottom Of Meadows


Klickitat River: Cow Camp Reach Sediment Trends
% Fines < 0.85 mm
25.00
20.00
15.00
10.00
5.00
0.00
1998
1999
2000
2001
2002
Sample Year
5.21
13.15
20.06
13.11
7.84


Klickitat River: Elkhorn Reach Sediment Trends (RM 83)
% Fines< 0.85 mm
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
1999
2000
2001
2002
Sample Year
13.71
13.59
13.38
9.43


Klickitat River: Sediment Trends In Reach Below White Creek Mouth (RM 40)
% Fines <0.85 mm
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
1999
2000
2001
2002
Sample Year
11.52
8.99
9.54
13.59


Klickitat River: Sediment Trends Below Little Klickitat River Mouth (RM 17)
% Fines< 0.85 mm
25.00
20.00
15.00
10.00
5.00
0.00
1999
2000
2001
2002
Sample Year
21.44
9.81
15.57
9.76

Appendix E. WDFW Fish Passage Barrier Assessment

WDFW Fish Passage Barrier Assessment and Prioritization Protocol

LEVEL A CULVERT INVENTORY

Site ID	Stream	Num frm mouth	Tributary to	Barrier (Y/N)	Level B Done
1110001	Surveyors	2	Klickitat	N	Y
1110001	Surveyors	2	Klickitat	N	Y
1110002	Surveyors	1	Klickitat	N	Y
1110002	Surveyors	1	Klickitat	N	Y
1110003	Trout	2	Klickitat	Y	N
1110004	Trout	1	Klickitat	Y	N
1110004	Trout	1	Klickitat	Y	N
1110005	Bear	1	Trout	Y	N
1110006	Bear	2	Trout		N
1110007	White	2	Klickitat	Y	N
1110007	White	2	Klickitat	N	Y
1110007	White	2	Klickitat		N
1110008	W. Fk. White	1	White	Y	N
1110008	W. Fk. White	1	White	Y	N
1110009	E. Fk. McCreedy	1	McCreedy	Y	
1110009	E. Fk. McCreedy	1	McCreedy	Y	
1110010	E. Fk. McCreedy	2	McCreedy	Y	
1110011	Middle Fk. McCreedy	1	E. Fk. McCreedy	Y	
1110012	Middle Fk. McCreedy	2	E. Fk. McCreedy	Y	
1110013	McCreedy	2	Klickitat	Y	
1110014	W. Fk. McCreedy	1	McCreedy	Y	
1110015	McCreedy	1	Klickitat	Y	
1110016	Piscoe	1	Klickitat	Y	N
1110016	Piscoe	1	Klickitat	Y	N
1110017	Surveyors	3	Klickitat	Y	N
1110018	Summit	2	Klickitat	Y	N
1110019	Kinney	5	Summit	Y	N
1110020	Summit	1	Klickitat	N	Y
1110021	Kinney	4	Summit	Y	N
1110022	Kinney	3	Summit	Y	N
1110023	Summit	2	Klickitat	Y	N
1110023	Summit	2	Klickitat	Y	N
1110024	Summit	1	Klickitat	Y	N
1110025	White	2	Klickitat	Y	N
1110025	White	2	Klickitat	Y	N
1110026	Teepee	3	White	Y	N
1110026	Teepee	3	White	Y	N
1110027	Teepee	2	White	Y	N
1110027	Teepee	2	White		n/a
1110028	Teepee trib	1	Teepee	Y	N
1110028	Teepee trib	1	Teepee	Y	N
1110029	Joe Cr	2	Trout		Y
1110030	Joe Cr	1	Trout	Y	N
1110031	Joe Cr	3	Trout	Y	N
1110032	Cedar	1	Summit	N	
1110033	NF Cedar	2	Summit	N	
1110034	SF Cedar	3	Summit	Y	
1110035	Crawford	1	Little Muddy	Y	
1110036	Crawford	1	Crawford	Y	
1110037	Pearl	2	Klickitat	Y	
1110038	Teo	1	Klickitat	Y	
1110039	Pearl	1	Klickitat	Y	
1110040	Piscoe	5	Klickitat	Y	
1110041	Piscoe	3	Klickitat	Y	
1110042	Piscoe	4	Klickitat	Y	
1110043	Piscoe	8	Klickitat	Y	
1110044	Piscoe	7	Klickitat	Y	
1110045	Piscoe	6	Klickitat	Y	
1110046	Twin Br. Swamp Cr.	2	Klickitat	Y	
1110047	Twin Br. Swamp Cr.	1	Klickitat	N	
1110048	Piscoe	2	Klickitat	Y	

Note: Records with identical site ID's indicate multiple culverts exist at the site

Klickitat Drainage Waterfalls

Fish Passage Barrier Assessment

General location	Description
Little Klickitat Falls	
Castile Falls	
Lyle Falls	passable
Outlet Falls	impassable
West Fork Falls	
Dead Canyon Falls #5	35 - 40' high; impassable
Dead Canyon Falls #4	probably impassable
Dead Canyon Falls #1	
Dead Canyon Falls #3	
Dead Canyon Falls #2	
Bowman Falls #2	impassable
Bowman Falls #1	
Blockhouse Falls #1	impassable
Canyon Falls #1	
Swale Falls #1	
Snyder Falls #3	probably impassable
Snyder Falls #2	
Snyder Falls #1	
Dillacort Falls #1	passable
Dillacort Falls #2	passable
Dillacort Falls #3	probably passable
Dillacort Falls #4	probably impassable
Trout Falls	
Surveyors Falls	passable

Appendix F. Klickitat Water Quality Inventory

The following chart presents a synopsis of the thermograph data gathered during 2002. The “Longest Duration” columns represent the longest period where temperatures remained at or above the noted temperature. These are considered critical levels. In each case there were other times when temperatures exceeded the critical level, but the duration was shorter. Other parameters are self-explanatory. There are gaps in the data. Thermographs must be removed for downloading and then replaced. Due to manpower limitations and program priorities, the replacement may not have occurred in a timely fashion. Most upper watershed sites are inaccessible during winter.

Klickitat Watershed Temperatures - 2002

Water	Location	MAX temp	Longest Duration > 20°C	Longest Duration > 23.9°C	MIN temp	Average of Data	Time Span of Data Collection
Bear Cr.	Mouth	14.8	0	0	-0.1	6.9	1/1 - 10/13
Bowman Cr.	Mouth	20.9	4 hrs. (7/12&13)	0	-0.1	8.9	1/18 - 11/13
Butte Meadow Cr.*	Road x-ing	14.8	0	0	-0.06	4.4	1/1 - 4/8, 7/23 - 10/13
Clearwater Cr.		9.8	0	0	0.7	5	1/1 - 4/25, 5/23 - 8/18, 8/20 - 11/13
Diamond Fork*	Low Mdw	19	0	0	-0.06	5.5	1/1 - 4/8, 7/23 - 10/13
Diamond Fork*	Up Mdw	15.2	0	0	-0.1	0.9	1/1 - 4/8, 7/23 - 7/25
Diamond Fork*	Mouth	17.4	0	0	-0.1	7.7	5/22 - 11/13
Dillacort Cr.*	Bridge	20.9	13 hrs. (7/13)	0	1.6	9.4	1/17 - 7/15
Fish Lake Str.	Road x-ing	14.4	0	0	-0.1	5.3	1/1 - 11/13
Klickitat	Castile Bridge	17.4	0	0	-0.6	6.8	1/1 - 11/18
Klickitat	Cow Camp	17.4	0	0	-0.1	5.7	1/1 - 4/25, 5/23 - 8/19
Klickitat	Hatchery	17.1	0	0	-0.6	8.2	1/1 - 1/3, 4/19 - 7/15, 8/17 - 11/13
Klickitat	Field Office	18.2	0	0	1.1	8	1/1 - 1/3, 1/17 - 7/15, 8/20 - 11/13
Little Klickitat	Resort*	20.5	24 hrs. (8/28 - 29)	0	-0.1	5.6	1/1 - 1/3, 1/18 - 4/17, 8/19 - 11/13
Little Klickitat	Mouth	25.6	44 hrs. (7/12-14)	7 hrs. (7/13)	-0.1	9.8	1/1 - 1/3, 1/18 - 11/13
Little Klickitat	Olsen Road	29.1	30 hrs. (7/12 - 14)	13 hrs. (7/12 - 13)	-0.1	9.8	1/1 - 1/3, 1/18 - 4/17, 4/20 - 7/17, 8/25 - 11/20
Logging Camp Cr.*	RR x-ing	11.7	0	0	3.3	7.5	3/15 - 5/12
Outlet Cr.	Road x-ing	22.8	8 hrs. (8/22)	0	-3.8**	9.3	1/1 - 1/3, 1/18 - 7/15, 8/20 - 11/17
Piscoe Cr.	Mouth	16.3	0	0	-0.1	6.1	1/1 - 4/25, 5/23 - 8/18, 8/21 - 11/18
Snyder Cr.*	Old Mill Site	15.6	0	0	4.9	9.7	5/31 - 7/12
Snyder Cr.*	Mouth	26.3	12 hrs. (6/26)	5 hrs. (6/26)	1.6	9.6	1/1 - 1/3, 1/18 - 4/17, 4/20 - 6/30, 8/17 - 11/13
Summit Cr.	Mouth	21.3	4 hrs. (7/13)	0	-0.6	7	1/1 - 1/3, 1/18 - 4/17, 4/19 - 7/15, 8/19 - 11/13
Surveyors Cr.*	Road x-ing	15.6	0	0	-0.6	5.4	1/1 - 1/16, 1/18 - 4/17, 6/1 - 7/12, 8/20 - 11/17
Swale Cr.	Harms Rd.	24.8	90 hrs. (7/10 - 14)	6 hrs. (7/11)	0.2	10.9	1/1 - 1/3, 1/18 - 4/17, 4/20 - 7/15, 8/17 - 11/13
Swale Cr.	Mouth	24.8	39 hrs. (7/12 - 14)	6 hrs. (7/13)	1.6	11.1	1/1 - 1/3, 1/19 - 3/28, 4/20 - 7/17, 8/17 - 11/13
West Fork	Road x-ing	12.9	0	0	-0.6	5.5	1/1 - 4/25, 5/23 - 11/13
Trapper Cr.	Road x-ing	9.4	0	0	0.2	4.6	1/1 - 4/25, 5/23 - 8/18, 8/20 - 11/13
White Cr.*	Mouth	23.6	4 hrs. (7/25)	0	0.2	8.3	1/1 - 1/3, 1/18 - 4/17, 7/25 - 10/13

Hobo accuracy = + or - 1.3°F
* Limited data set, does not include the mid-July HOT period
** Thermograph may have been frozen in ice or out of water

Water quality samples were obtained and analyzed for pH, conductivity, turbidity, dissolved oxygen and temperature. The following table presents the acquired data. Of particular interest is the turbidity for Big Muddy Cr. on July 29, 2002. This value is very high but is significantly diluted once it enters the mainstem Klickitat River.

Klickitat Drainage Water Quality - 2002

Steam	Location	Date	Time	pH	Cond (mS/cm)	Turb (NTU)	DO (mg/L)	Temp (deg C)
Summit Cr.	Mouth	2/1/2002	2:31pm	7.57	0.049	0.2	10.69	3.9
Summit Cr.	Mouth	7/29/2002	11:35am	6.85	0.057	0	10.85	15.1
Summit Cr.	Off summit Cr. Rd.	4/9/2002	10:03am	8.27	0.041	1.55	11.24	5.3
Summit Cr.	Off summit Cr. Rd.	6/12/2002	11:14	7.12	0.037	0.2	10.61	8.4
Summit Cr.	Off summit Cr. Rd.	7/29/2002	11:15am	9.91	0.049	0	9.04	11.5
Summit Cr.	Mouth	4/9/2002	10:35am	7.74	0.046	1.34	11.29	6.5
Summit Cr.	Mouth	6/12/2002	11:40am	6.85	0.045	0.4	11.35	11.3
Cougar Cr.	At guard station	4/9/2002	11:40am	7.99	0.022	0.51	11.31	4
Cougar Cr.	At guard station	7/29/2002	12:50pm	6.19	0.03	12	10.63	10.5
Cougar Cr.	At waterhole	4/9/2002	12:01pm	7.79	0.022	0.84	12.41	3.8
Cougar Cr.	At waterhole	6/12/2002	1:08pm	7.48	0.013	9.3	10.82	7.9
Cougar Cr.	At waterhole	7/29/2002	1:00pm	6.39	0.03	12.7	7.92	10.9
Cunningham Cr.	At waterhole	4/9/2002	12:42pm	7.59	0.032	0.41	11.22	4.1
Cunningham Cr.	At waterhole	6/12/2002	1:45pm	7.22	0.034	0	12.21	10.7
Cunningham Cr.	At waterhole	7/29/2002	1:41pm	6	0.037	0	11.52	10.8
Cunningham Cr.	At camp site	4/9/2002	12:51pm	7.61	0.032	0.18	11.85	4
Cunningham Cr.	At camp site	7/29/2002	2:20pm	6.37	0.036	0	10.73	11.5
Soda springs Cr.	At waterhole	4/9/2002	1:09pm	7.6	0.41	0.31	11.57	4.3
Teepee Cr.	Above IXL rd.	6/12/2002	9:41am	7.51	0.04	0.1	9.08	9
White Cr.	At Bridge	6/12/2002	10:37am	7.84	0.043	0.12	8.79	11.3
Big Muddy Cr.	At Klick river rd.	6/12/2002	1:27pm	6.87	0.04	0.1	10.35	10.4
Big Muddy Cr.	At Klick river rd.	7/29/2002	1:20pm	6.58	0.038	63.3	8.13	10.9

Appendix G. Preliminary Summary of Klickitat Steelhead Genetic Relation to Skamania Hatchery Steelhead

Shawn Narum, Columbia River Inter-Tribal Fish Commission
3059-F National Fish Hatchery Rd.
Hagerman, ID 83332
nars@critfc.org
208-837-9096

In order to increase steelhead production and harvest in the Klickitat River, smolts from Skamania hatchery have been stocked for decades. The goal of this study was to genotype a representative group of *Oncorhynchus mykiss* samples from the Klickitat River and Skamania Hatchery and calculate genetic differences between the two groups.

METHODS

Fin clips were taken from 91 *O. mykiss* individuals from the Klickitat River and 94 individuals from Skamania Steelhead Hatchery. Samples from the Klickitat River were taken with a smolt trap during outmigration and displayed the chrome body and blue tipped fins typical of steelhead smolts rather than resident rainbow trout coloration. Further, all smolts with adipose clips collected from the Klickitat River were sorted out of the sample in order to have a representative sample of wild Klickitat steelhead. DNA was extracted from all samples, and eight microsatellite loci (OMM1007-GenBank AF346669, OMM1019-GenBank AF346678, OMM1020-GenBank AF346679, OMM1036-GenBank AF346686, OMM1046-GenBank AF346693, OMM1050-GenBank AF346694, *Ots*1-Banks et al. 1999, and *Ocl*1-Spindle unpub. data) were amplified and genotyped for each sample at each locus.

Data from each group were analyzed for genetic diversity (heterozygosity, average alleles per locus, and total number of alleles), genetic divergence based on allele frequencies (Fst; Nei 1987), and assignment testing of individuals to each group (GeneClass; Cornuet et al. 1999).

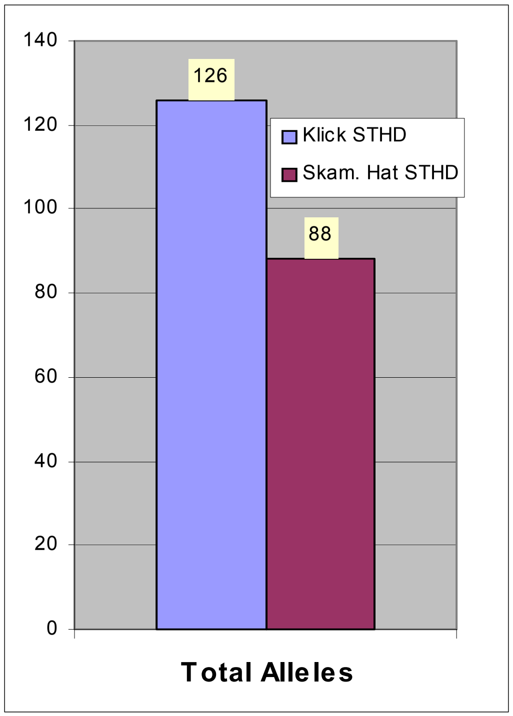
RESULTS

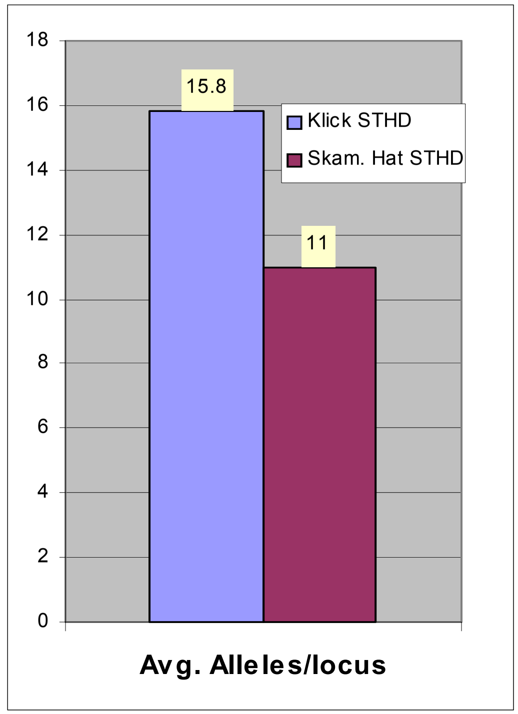
All measures of genetic diversity were significantly higher in the Klickitat group than the Skamania group (Fig. 1). In fact, 38 alleles were detected in the Klickitat group that were not present in the Skamania group, while only 7 alleles were found solely in the Skamania group (Fig. 2). While many of these were rare alleles (detected at low frequencies), nearly equal sample sizes between groups would suggest that this result is not solely a result of sampling error.

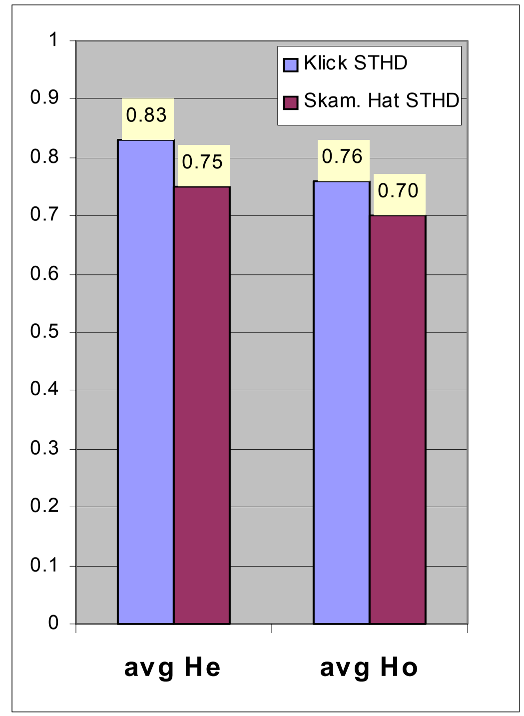
Differences in allele frequencies (particularly at OMM1019 and *Ots*1) led to a significant ($p < 0.0001$) overall Fst value between groups equal to 0.05. This result suggests that gene flow is restricted between the two groups.

An assignment test was performed using GeneClass software that incorporated the genotypes of each individual and placed them in categories based on similar genotypes. The test indicated strong differences in genotypes between the Klickitat and Skamania groups (Fig. 3). Of the 91 Klickitat individuals, only 11 assigned to the Skamania group and only two of those 11 assigned strongly to the Skamania group. The other nine, as well as four other Klickitat individuals, fell into the zone of non-significant assignment (Fig. 3) and may represent hybrid individuals.

Figure 1. Genetic diversity (total alleles, average alleles/locus, and heterozygosity) of Klickitat steelhead (Klick STHD) and Skamania Hatchery Steelhead (Skam. Hat. STHD).







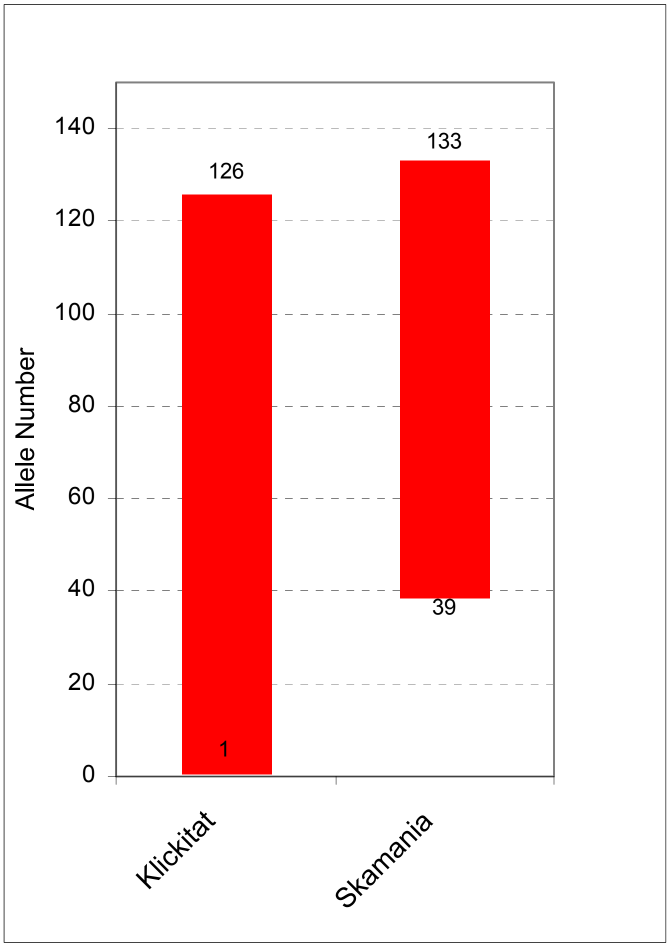
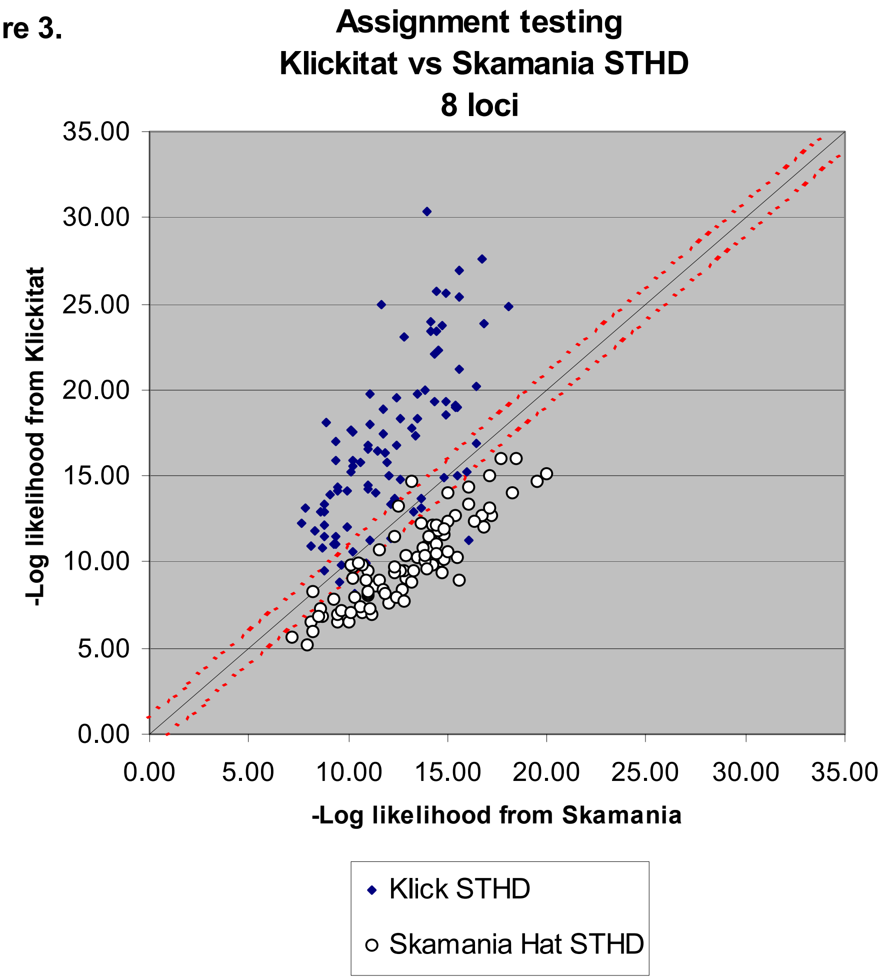


Figure 2. Allele overlap between Skamania and Klickitat Steelhead.

Figure 3.



DISCUSSION

Higher genetic diversity and high number of private alleles (alleles found in one group but not the other) in the Klickitat group indicate that the natural population in the Klickitat River are much more genetically diverse than steelhead from Skamania Hatchery. However, the alleles present in the Skamania group appear to be largely a subset of alleles in the Klickitat group. The high level of genetic difference (Fst = 0.05) between the Klickitat and Skamania groups indicates that little gene flow is occurring between sample groups, or likely only one-way gene flow from Skamania Hatchery into the Klickitat. While it is possible samples from the Klickitat may be influenced by resident rainbow trout, interbreeding between *O. mykiss* life history types is likely (Zimmerman and Reeves 2000).

It appears that development of a local broodstock of steelhead from the Klickitat would be in the best interest to maintain genetic diversity of *O. mykiss* in the Klickitat River. Hybridization of Skamania origin steelhead with natural/wild Klickitat steelhead appears to be at a level (15 to 20 percent) that could reduce overall diversity of steelhead stocks in the Klickitat River (Allendorf et al. 1980).

These are preliminary findings, and further study is ongoing to determine steelhead stock structure within the Klickitat, as well as to determine if progeny of Skamania origin steelhead are present in other sections of the Klickitat River.

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Appendix H. Pathogen Sampling

Pathogens Found in Klickitat Salmonids - 2002

LOCATION	DATE	SPECIES	SAMPLE SIZE	POSITIVE TEST	COMMENT
Bear Creek	10/10/02	*O. mykiss*	19	RS	+6/9 pools detected by ELISA, confirmed by PCR +3/3
					Gyrodactylus on the skin (low)
Brush Creek	10/9/02	*O. mykiss*	19	RS	+2/2 pools detected by ELISA, confirmed by PCR +2/2
Fish Lake Stream	10/10/02	*S. fontinalis*	8	RS	+2/5 pools detected by ELISA, confirmed by PCR +2/2
Fish Lake Stream	10/10/02	*O. mykiss*	1		All test results were negative
Klick. Hatchery Trap	10/10/02	*O. kisutch*	1		All test results were negative
Klick. Hatchery Trap	10/10/02	*O. tshawytscha*	7	RS	+1/3 pools detected by ELISA, confirmed by PCR +1/1
Klick. Hatchery Trap	10/16/02	*O. tshawytscha*	2	RS (suspect)	detected by ELISA, not confirmed by PCR
Little Klickitat River	10/9/02	*O. kisutch*	33	RS (suspect)	+2/18 pools detected by ELISA, not confirmed by PCR 0/2
Little Klickitat River	10/9/02	*O. mykiss*	2	RS (suspect)	+1/1 pool detected by ELISA, not confirmed by PCR 0/1
McCreedy Creek	10/16/02	*S. fontinalis*	6	RS (suspect)	+4/4 detected by ELISA, not confirmed by PCR 0/3
McCreedy Creek	10/16/02	*O. mykiss*	11	RS	+9/10 pools detected by ELISA, confirmed by PCR +2/3
					Epistylis on the skin (low), Spores found in heads, not *M. cerebralis*
Piscoe Creek	10/16/02	*S. fontinalis*	7	RS (suspect)	+4/4 detected by ELISA, not confirmed by PCR 0/3
Piscoe Creek	10/16/02	*O. mykiss*	20	RS (suspect)	+7/9 detected by ELISA, not confirmed by PCR 0/3
Summit Creek	10/9/02	*O. kisutch*	23	RS	+3/5 pools detected by ELISA, confirmed by PCR +2/3
Summit Creek	10/9/02	*O. mykiss*	11	RS (suspect)	+1/4 detected by ELISA, not confirmed by PCR 0/1
Surveyors Creek	10/10/02	*S. fontinalis*	4	RS	+1/1 pools detected by ELISA, confirmed by PCR +1/1
Swale Creek	10/9/02	*O. kisutch*	25	RS	+6/8 pools detected by ELISA, confirmed by PCR +3/3
					ELISA and virus pooled
					Neascus (Black spot) on the skin (moderate levels)
Swale Creek	10/9/02	*O. mykiss*	6	RS	+2/2 pools detected by ELISA, confirmed by PCR +1/2
					ELISA and virus pooled in 3 fish pools.
					Hookworms in the hind-gut (moderate levels)
Tepee Creek	10/9/02	*O. mykiss*	20	RS (suspect)	+2/2 pools detected by ELISA, not confirmed by PCR 0/2
Trout Creek	10/10/02	*O. mykiss*	20	RS	+8/8 pools detected by ELISA, confirmed by PCR +1/3
					Epistylis on the skin (moderate)
Upper Klickitat Trap	10/10/02	*O. mykiss*	1	RS	+1/1 pools detected by ELISA, confirmed by PCR +1/1
					Dorsal fungus, possible injury
Upper Klickitat Trap	10/16/02	*O. tshawytscha*	1	RS	detected by ELISA, confirmed by PCR, **Gross Kidney lesion**
White Creek	10/9/02	*O. mykiss*	22	RS	+5/5 pools detected by ELISA, confirmed by PCR +1/3
					Epistylis on gill (low)

Explanatory statement is from Mr. Kenneth Lujan, the Microbiologist who performed the laboratory analysis.

Klickitat River sampling 2002

In October 2002, the Lower Columbia River Fish Health Center, with the cooperation of the Fisheries Resource Management of the Confederated Tribes and Bands of the Yakama Nation, examined 360 fish from 17 sites. The fish examined included brook trout, rainbow trout, coho salmon, steelhead, and spring chinook salmon. They were examined using the protocols from the Laboratory Procedures Manual for the National Wild Fish Health Survey. Overall, the fish appeared to be in good health. Only one fish showed signs of an active bacterial infection. A spring chinook salmon smolt from the upper Klickitat River trap had a swollen, grossly infected kidney. It was positive for *Renibacterium salmoninarum*, bacterial kidney disease (BKD. *Renibacterium salmoninarum* (Rs) is a gram positive, fastidious, slow growing bacillus. It is nonmotile, nonacid-fast and does not produce spores. BKD has been detected in both free ranging and cultured salmonids. All species of salmonids are susceptible to BKD in varying degrees. Pacific salmon are the least resistant, whereas rainbow trout are the most resistant (Lesee 1995). The disease can be transmitted both horizontally, possibly by ingestion of feces from infected fish, and vertically, through infected gametes. Some investigators propose that all fish are carriers of Rs and the disease occurs only when the conditions are favorable to the bacterium. Therefore, like most diseases of fish, stress plays a key role in the severity of the disease (Lesee 1995).

The enzyme-linked immunosorbent assay (ELISA) is a highly sensitive and complex protocol that requires careful preparation of assay reagents and strict adherence to protocol. It was selected as the most sensitive screening method for Rs antigen in both salmonid and non-salmonid fish species tested for the survey. As a confirmation method, subsets of samples containing the highest optical densities values (ODs) from each ELISA assay were tested for the presence of Rs DNA by the Polymerase Chain Reaction procedure (PCR). Eleven of 17 sites had optical densities of Rs antigen detected by ELISA and tested positive for Rs DNA by PCR. In addition, Rs was found in all six species. Six of 17 sites had optical densities of Rs antigen detected by ELISA but tested negative for Rs DNA by the PCR technique.

There were a couple of parasites detected during the examination. Coho salmon from Swale Creek and the Little Klickitat River had moderate levels of *Neascus* (Black Spot Disease) on the skin. *Neascus* may cause mortality, especially when infections are heavy and water temperatures decline. Black spot disease exhibit numerous black raised nodules (1-2 mm in diameter) in the skin, fins, and gills (Lesee 1995).

Steelhead from White Creek had moderate levels of *Epistylis* on the gills. *Epistylis* is a very common parasite in fishes and can sometimes contribute to mortality due to partial smothering of the gills.

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