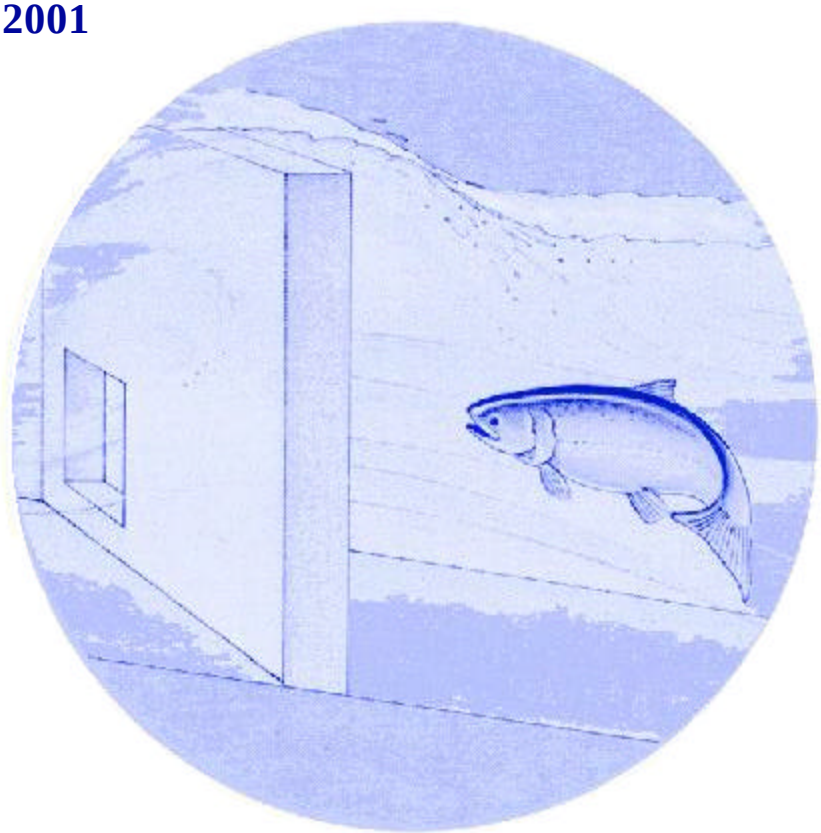
Yakima/Klickitat Fisheries Project

Monitoring and Evaluation

Annual Report
2001



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MONITORING AND EVALUATION

PROJECT NUMBER 1995-063-25
Contract Number 00005881

THE CONFEDERATED TRIBES AND BANDS OF THE YAKAMA NATION

YAKIMA/KLICKITAT FISHERIES PROJECT

ANNUAL REPORT 2001

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YAKIMA/KLICKITAT FISHERIES PROJECT

MONITORING AND EVALUATION PROJECT REPORT

Preface

The monitoring and evaluation objectives and tasks have been developed through a joint process between the co-managers, Yakama Nation (YN, Lead Agency) and Washington Department of Fish and Wildlife (WDFW). The Science/Technical Advisory Committee (STAC), which consists of core members from the co-managers, employs the services of a work committee of scientists, the Monitoring Implementation Planning Team (MIPT) to develop the Monitoring and Evaluation (M&E) Plan.

The process employed by STAC to verify these designated activities and the timing of their implementation involved the utilization of the following principles:

1. YKFP monitoring should evaluate the success (or lack of it) of project supplementation efforts and its impacts, including juvenile post release survival, natural production and reproductive success, ecological interactions, and genetics;
2. YKFP monitoring should be comprehensive: and,
3. YKFP monitoring should be done in such a way that results are of use to salmon production efforts throughout and Columbia basin and the region.

Utilizing these principles, STAC and MIPT developed this M&E action plan in three phases. The first phase was primarily conceptual. STAC and MIPT defined critical issues and problems and identified associated response variables. The second phase was quantitative, which determined the scale and size of an effective monitoring effort. A critical element of the quantitative phase was an assessment of the precision with which response variables can be measured, the probability of detecting real impacts and the sample sizes required for a given level of statistical precision and power. The third phase is logistical. The feasibility of monitoring measures was evaluated as to practicality and cost. The Policy Group has determined that the M&E activities covered by this agreement are necessary, effective and cost-efficient.

Background

Previously, the M&E program consisted of a number of biologically related sub-tasks that were funded under different projects and associated contracts. This year, the plan grouped related M&E tasks into general categories under an overall umbrella proposal. It is structured under this format:

1. Monitoring and evaluation: to include marking, adult and juvenile enumeration, data management, biometrical support and other related tasks.
2. Tech Pool: funds the participation of the YKFP tribal technicians for the operation and labor associated with numerous monitoring and evaluation tasks.
3. Modeling: includes the Ecosystem Diagnosis and Treatment model development, calibration and operation to evaluate the watersheds for future salmonid enhancement project prioritization and to guide habitat restoration.
4. Video monitoring: to enumerate the adult returns to the watershed.
5. Klickitat: to fund all of the tasks associated with the Klickitat portion of the YKFP.
6. Fall Chinook: to fund the fall chinook programs that have become a part of the YKFP.
7. Coho: tasks designed to evaluate the feasibility of reintroduction of coho salmon into the Yakima basin.

This report will only reference the respective tasks that WDFW are contracting for, since they are responsible for reporting on them. It is anticipated that this revised method will facilitate better coordination and administration of the M&E aspect of the YKFP. This report will follow the format of the contract utilizing Attachments when necessary and a reference catalogue.

Special acknowledgement and recognition is owed to all of the dedicated YKFP personnel who are working on various tasks. The referenced accomplishments and achievements are a direct result of their dedication and desire to seek positive results for the betterment of the resource. The readers of this report are requested to pay special attention to the Personnel Acknowledgements. Also, these achievements are attainable because of the efficient and essential administrative support received from all of the office and administrative support personnel for the YKFP. This team approach is proving to be beneficial in achieving the goals and objectives of the YKFP, as referenced in this report.

1. NATURAL PRODUCTION

Overall Objective: Develop methods of detecting indices of increasing natural production, as well as methods of detecting a realized increase in natural production, with specified statistical power.

Task 1.a Modeling

Rationale: To design complementary supplementation/habitat enhancement programs for targeted stocks with computer models incorporating empirical estimates of life-stage-specific survival and habitat quality & quantity.

Methods: To diagnose the fundamental environmental factors limiting natural production, and to estimate the relative improvements in production that would result from a combination of habitat enhancement and supplementation using the "Ecosystem Diagnosis and Treatment" (EDT) model. A brief description of the EDT model can be found on the Mobrand Biometrics Incorporated (MBI) website at www.mbi.com.

Progress:

Yakima

The revised, Level 2 EDT model was run for spring chinook throughout the basin, and the stage was set for running the revised model for Yakima summer steelhead, coho and fall chinook. The "preservation value" was estimated for each reach in the spring chinook analysis (the degree to which current production is dependent upon the reach), as was the "restoration potential" (the degree to which basin-wide production would increase if the reach were fully restored to historical conditions) (see Table 1).

Spring chinook predictions from the new EDT model were roughly validated in two ways: by comparing observed and EDT-predicted adult and smolt production over time. Validation of adult predictions entailed comparing the observed adult recruits by brood year with the recruits predicted by the EDT model. This comparison was done separately for each stock of spring chinook (American, Naches and Upper Yakima). The congruence was quite good between observations and predictions for all three stocks (see Figures 1-3). Indeed, for the upper Yakima population, the residual sum of squares for the EDT fit was slightly less than the residual sum of squares for a Beverton-Hold-based prediction, where the Beverton-Holt function was fit to observed data by non-linear regression (Solver).

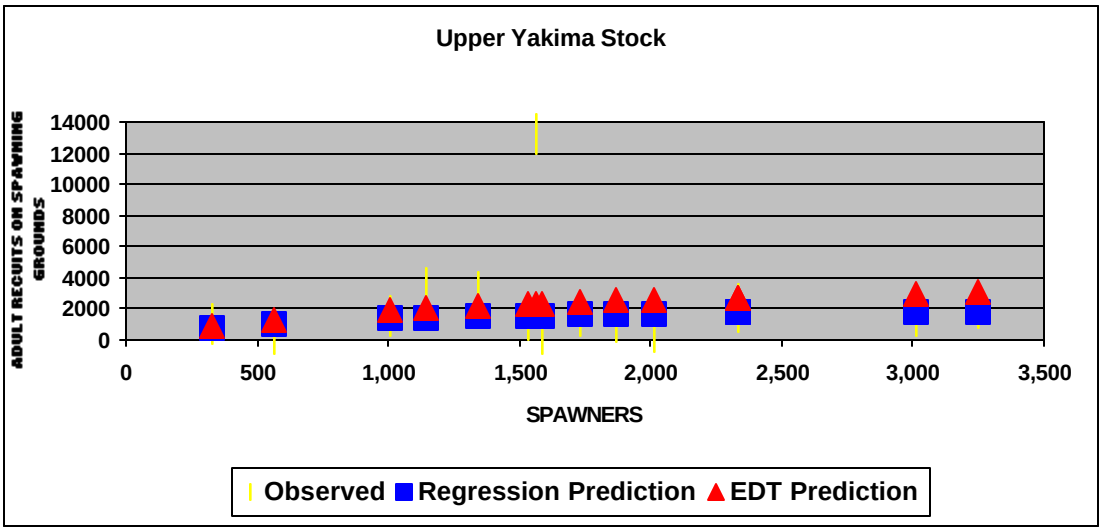
It should be noted that a non-linear fit of the Beverton-Holt production function to observed recruitment data for the Naches and American stocks was not possible: Solver did not converge to an absolute minimum on the negative log-likelihood surface. If Solver was constrained to a productivity value equal to that predicted by EDT, a solution was found. However, even here, the residual sum of squares was less for the EDT prediction than for the constrained Solver Beverton-Holt fit.

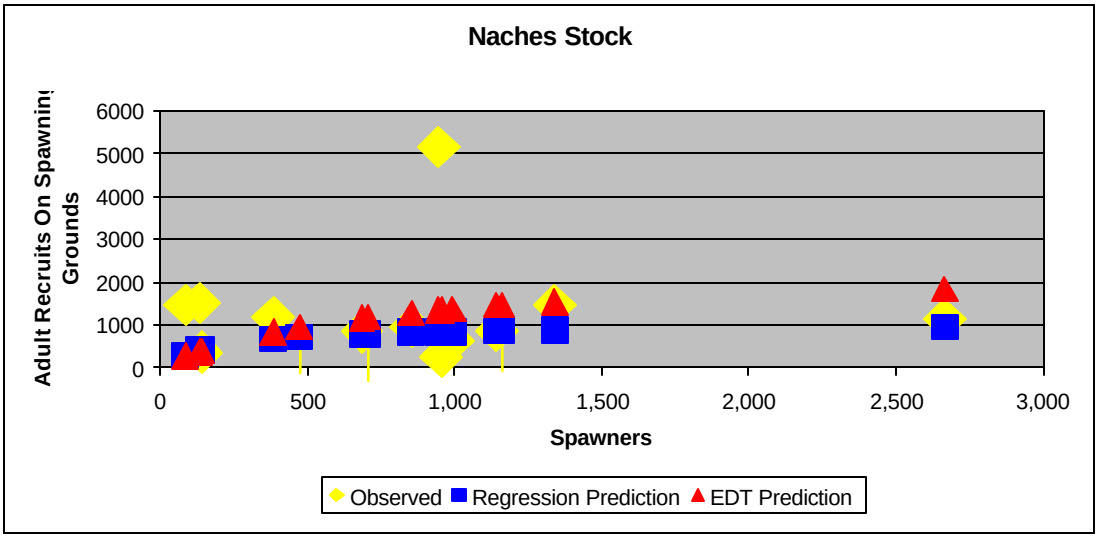
Smolt data was used to validate EDT predictions in the following manner. The EDT model generates Beverton-Holt parameters (productivity and capacity) for the number of smolts produced as a function of the number of spawners, and it does so for each of the spring Chinook populations. If the model is predicting production with reasonable accuracy, then the sum of the smolts predicted for all three stocks (American, Naches and Upper Yakima) should approximate the total number of smolts observed at Chandler. This sort of comparison was in fact made (see Figure 4). Specifically, the EDT-based smolt production functions were used to predict stock-specific smolt production from observed spawning escapements. Because all Yakima spring chinook smolts are yearlings, escapements in year i were used to predict smolt production in year i + 1. These EDT predictions were then compared to estimated Chandler totals for smolt years 1983 – 2001 (brood years 1981 – 1999). Again, the correspondence between observed and estimated Chandler smolt production was reasonably good. In general, predicted smolt production was less than observed in years of higher than average runoff, but closely approximated observations during normal or drought years. Such a pattern is to be expected because the mainstem and ocean survival rates incorporated in the model were based on the early 1990's, years of average to below-average flows and ocean survival conditions. It is perhaps significant that for smolts as well as for adults, the residual sum of squares for the non-linear Solver Beverton-Holt fit was greater than the residual sum of squares for the EDT predictions. This was so even when a log-normal environmental correlate (mean year-class flow at Parker) was added to the non-linear fit to try to account for some of the density-independent impacts on smolt production.

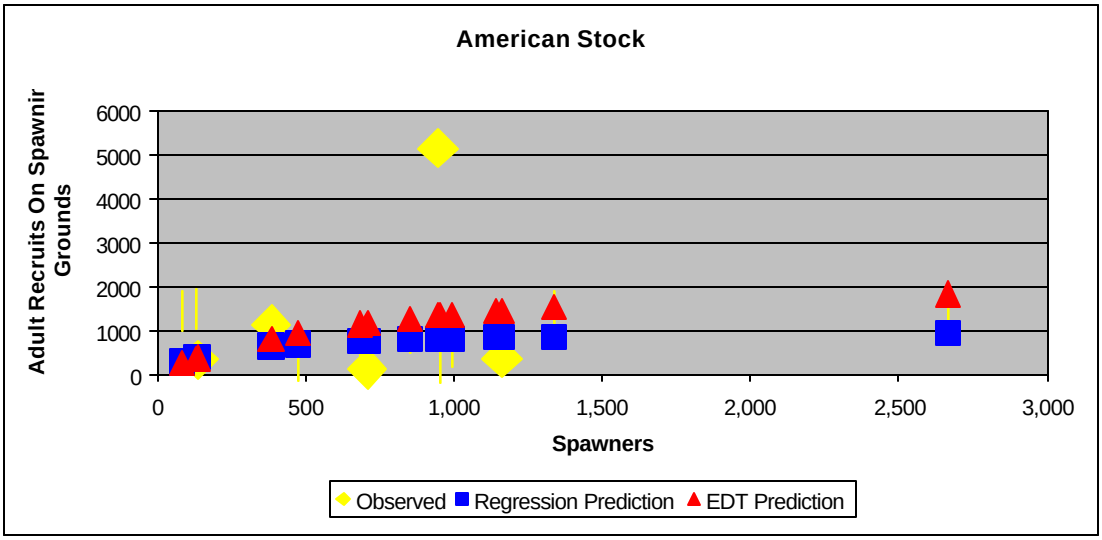
The future of EDT modeling in the Yakima Subbasin can be summarized as follows. Baseline and Diagnostic runs are complete for Yakima spring chinook, and final graphics are being generated and submitted to YN biologists. Baseline and diagnostic runs on coho, steelhead and fall chinook have begun, and are expected to be completed in several weeks. A completion report summarizing the diagnosis and a limited number of diagnosis-based enhancement scenarios will be completed by mid-July.

Table 1. Yakima Basin spring chinook restoration splice analysis.

Alternative	%Change in Productivity	Productivity Rank	%Change in Abundance	Abundance Rank
Columbia above Estuary	70.76%	1	141.28%	1
Yakima Ahtanum to Naches	52.22%	2	68.41%	3
Yakima Wilson to Manastash	51.17%	3	47.34%	6
Teanaway drainage below forks	50.65%	4	55.41%	4
Yakima Manastash to Taneum	49.35%	5	53.70%	5
Yakima Teanaway to Cle Elum	49.35%	5	45.57%	7
Yakima Cle Elum to Easton Dam	41.25%	7	29.31%	10
Yakima Naches to Roza Dam	40.47%	8	70.63%	2
Yakima Taneum to Teanaway	25.59%	9	16.54%	15
Yakima Easton Dam to Keechelus Dam	24.54%	10	18.45%	14
Yakima Roza Dam to Wilson Cr	22.19%	11	34.32%	8
Cle Elum R below Cle Elum Dam	21.15%	12	15.33%	16
Columbia Estuary	18.54%	13	32.49%	9
Yakima above storage dams	15.67%	14	23.79%	11
Teanaway drainage above forks	10.70%	15	20.45%	13
Taneum Drainage	9.40%	16	9.09%	20
Manastash drainage	7.57%	17	9.68%	19
Yakima Prosser to Satus	6.53%	18	11.62%	18
Big Cr Drainage	5.48%	19	7.00%	21
Yakima Horn Dam to Benton	3.13%	20	5.25%	24
Swauk Drainage	2.35%	21	4.25%	25
Yakima Sunnyside Dam to Ahtanum Cr	1.83%	22	13.36%	17
Yakima delta to Horn Dam	0.78%	23	1.91%	26
Yakima Powerplant to Prosser Dam	0.78%	23	1.57%	27
Wilson Drainage	0.26%	25	5.40%	23
Yakima Benton to Powerplant	0.26%	25	0.80%	28
Offshore Marine	0.00%	27	0.00%	30
Yakima delta	0.00%	27	0.16%	29
Yakima Satus to Toppenish	0.00%	27	5.86%	22
Yakima Toppenish to Sunnyside Dam	0.00%	27	23.37%	12
Coastal Zone	0.00%	27	0.00%	30







Figures 1-3. Comparison of observed, EDT predicted and regression predicted values.

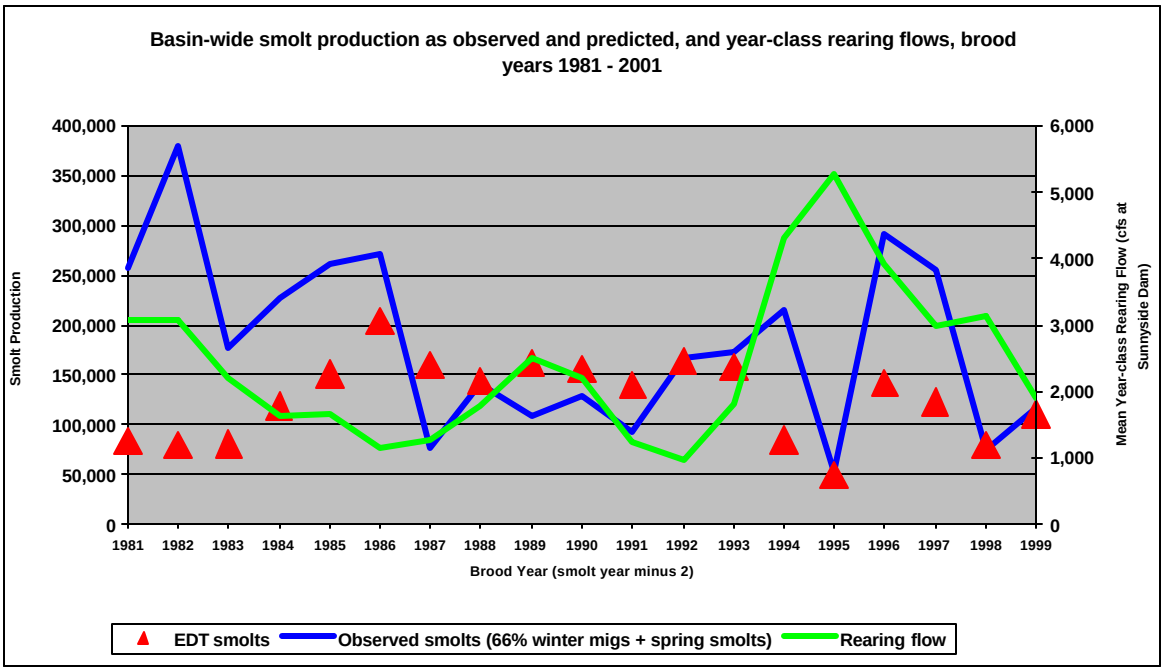


Figure 4. Comparison of EDT predicted annual Yakima Basin spring chinook smolt abundance compared to observe values at CJMF, 1981-2001.

Klickitat

During the last quarter initial work was begun to input the Level 2 data, and to determine additional reaches/obstructions that needed to be added or split in the model's hydrography reaches layer. It's anticipated that by spring of 2003 the diagnosis (preservation and restoration) output will be completed for spring chinook.

Personnel Acknowledgements: Bruce Watson and Joel Hubble, YN biologists, are handling this task for Yakima Basin stocks, while Bill Sharp, also a YN biologist, is handling the Klickitat stocks.

Task 1.b Yakima River Fall Chinook Fry Survival Study

Rationale: To determine the optimal locations within the lower Yakima basin where fall chinook production is feasible, and to guide location of future acclimation/release sites.

Methods: The feasibility of beach seining for juvenile fall chinook was initiated in 2001, with the long-term objective of initiating a PIT tag study to evaluate smolt-smolt survival between different reaches of the Yakima River.

In 2001 beach seine sites were established at Toppenish, Granger and Benton City.

Progress: Growth profiles of naturally rearing fall chinook juveniles in the lower Yakima River were successfully monitored via beach seining approximately 2-3 times per month. Juvenile fall chinook passage at the CJMF was used as an index of passage in order to direct the field sampling efforts. Beach seining areas were located in 9 sections of the Yakima River, at Van Giesen Street Bridge (Rm 8.4), West Richland (Rm 9), Horn Rapids Dam (Rm 18), Benton City (Rm 29.8), below Granger (Rm 69-83), above Granger (Rm 83-90), Toppenish (Rm 90), Union Gap (Rm106.9-116, and Sundown Ranch (Rm 123.5). Seining was conducted using a 60 ft beach seine. Areas were seined until 100 fork lengths of juvenile fall chinook salmon were gathered. Any additional fish were enumerated, identified to species and released back into the river.

The data set indicates a large spatial distribution of spawning fall chinook throughout the middle and lower Yakima River. Juvenile fall chinook, were found rearing from Rm 106 at Union Gap down to the mouth of the Yakima River. With the exception of Union Gap in May, the rearing juveniles showed faster growth down river, possibly due to the warmer water (Figure 5). The larger fork lengths at Union Gap may be attributed to early adult spawners.

The size of juvenile fall chinook salmon in the Yakima River was consistently larger down river. In April mean fork lengths from Benton City down river were 1.4 to 6.9 mm larger compared to sites above Benton City. Mean fork lengths in May from Benton City down river were 3 to 15 mm larger than measured at sites above Benton City (Table 2).

In addition to determining growth profiles and parr distribution, this field activity is designed to examine the feasibility of PIT tagging 1,000 wild rearing juvenile fall chinook by beach seining. We have interest in comparing the relative survival and outmigration timing between wild fall chinook smolts that rear and initiate smolt outmigration in the upper river (above Granger) versus those in the lower river (down river from Benton City), as well as, how these two geographical areas compare to the hatchery reared fall chinook.

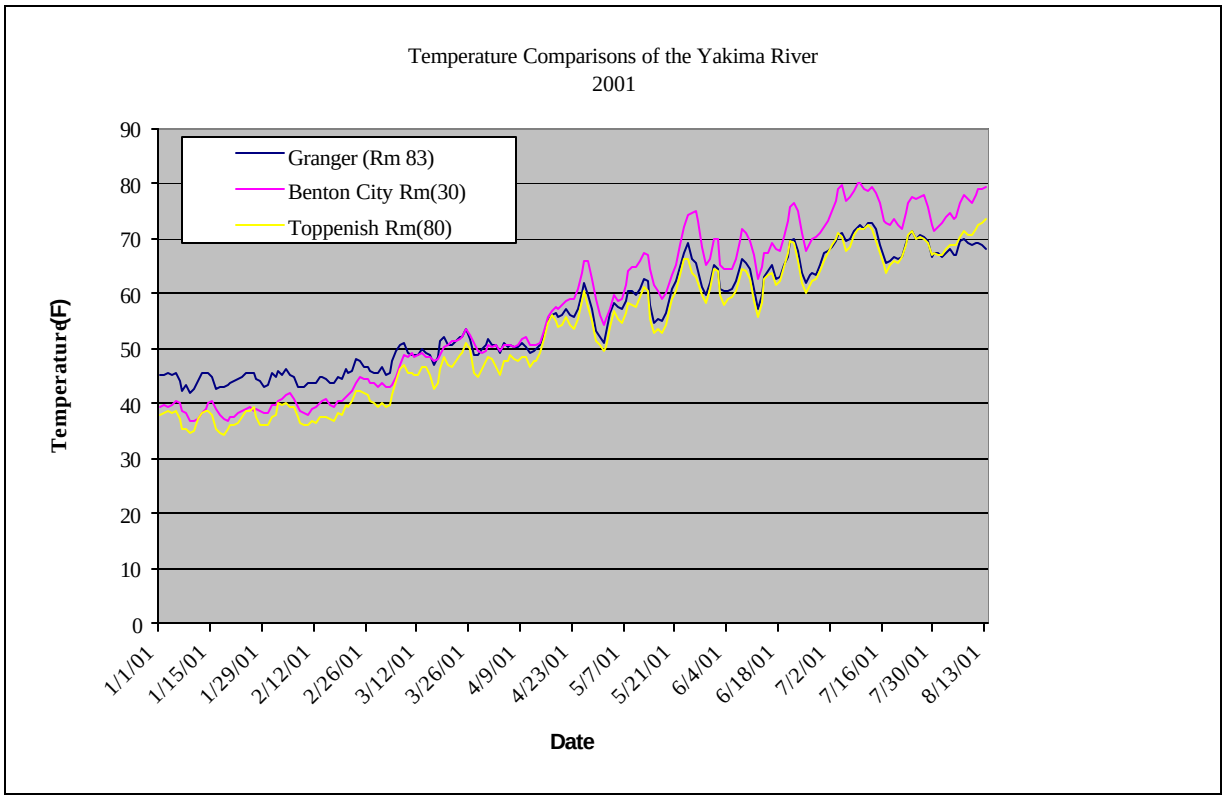


Figure 5. Temperature comparisons of the Yakima River.

Table 2. Growth profiles of naturally rearing juvenile fall chinook salmon.

		Total Counts		Average FL		Max FL		Min FL	
	RM	April	May	April	May	April	May	April	May
Sundown	123.5								
Union Gap	106.9-116		130		66		89		34
Toppenish	90	6	97	37.7	46	41	73	36	37
Above Granger	83-90	134	785	42.2	55	82	90	33	34
Below Granger	69-83	239	505	43.2	56	87	86	35	36
Benton City	29.8	221	191	44.6	58	72	77	32	41
Horn Rapids	18		101		61		77		48
West Richland	9	100		44.6		64		37	
Van Giesen	8.4								

The logistics of capturing enough naturally rearing juvenile fall chinook to PIT tag depends on spring freshets (river stage), the proportion of available fish at each site meeting the minimum PIT tagging criteria size, and spawner escapement (parr density). The size threshold for PIT tagging juvenile fall

chinook is 60 mm. At this size, they are approaching smoltification and are beginning to leave the Yakima River. This data suggests however, there are some juvenile fall chinook large enough to PIT tag in the lower river before the hatchery releases occur in mid to late May.

Juvenile coho were the only salmonid species encountered above Union Gap, and were found throughout the entire beach seining locations. Spring chinook smolts were found in small numbers in nearly all the locations down river from Union Gap. Adult piscivorous fish species such as largemouth bass, smallmouth bass and northern pikeminnow, were encountered in the lower sections of the river. Average size fork lengths were consistent with the time of year seining was taking place (Table 3). Coho averaged 65 mm and were sub- yearlings, while spring chinook and rainbow trout/steelhead were smolt outmigrants.

Table 3. Other species encountered beach seining.

Species	Total Count	Average Fork length (mm)
Coho Salmon (*Oncorhynchus kisutch)*	249	65
Spring Chinook Salmon *(Oncorhynchus tshawytscha)*	21	132
Smallmouth Bass *(Micropterus dolomieui)*	10	340
Largemouth Bass *(Micropterus salmoides)*	1	367
Northern Pikeminnow *(Ptychocheilus oregonensis)*	6	400
Rainbow Trout/Steelhead *(Oncorhynchus mykiss)*	2	155

Personnel Acknowledgements: Jim Dunnigan is the project biologist for this task. Technicians Linda Lamebull, Joe Jay Pinkham, Jerald Reed, Jason Allen, and Wilda Watlamet conducted all field activities.

Task 1.c Yakima River Coho Life History Study

Rationale: To gain knowledge about the freshwater life history and survival of juvenile coho.

No activities were scheduled for FY 2001.

Task 1.d Klickitat Juvenile Salmonid Population Surveys

Beginning in FY 2001 all Klickitat Basin monitoring and evaluation activities are under the auspices of a specific BPA funded contract (Project No. 1995-063-35). Progress on this activity is reported in the annual report entitled Yakima/Klickitat Fisheries Project, Klickitat Only.

Task 1.e Yakima River Juvenile Spring Chinook Microhabitat Utilization

This task is assigned to WDFW and they will report on its status in their annual progress report to BPA.

Task 1.f Yakima River Juvenile Spring Chinook Marking

Rationale: Estimate hatchery spring chinook smolt-to-smolt survival at CJMF and Columbia River projects, and smolt-to-adult survival at Bonneville (PIT tags) and Roza (PIT and CWT) dams.

Method: To estimate smolt-to-smolt survival by rearing treatment (OCT/SNT), acclimation location and raceway, we PIT tagged and adipose clipped the minimum number to determine statistically meaningful differences detected at CJMF and lower Columbia River projects. The remaining fish will be adipose fin clipped and tagged with multiple body placement coded wire tags unique for rearing treatment, acclimation location, and raceway. Returning adults that are adipose clipped at Roza Dam Broodstock Collection Facility (RDBCF) will be interrogated using a hand-held CWT detector to determine the presence/absence of body tags. We will recover CWT during spawning ground surveys. We will use ANOVA to determine significant differences between groups for both smolt-to-smolt and smolt-to-adult survival.

Progress: Tagging began at the Cle Elum hatchery on October 15, 2001 and was completed on December 14, 2001. The marking consisted of all the fish being adipose clipped, with 2,225 fish (total = 18 raceways x 2,225 = 40,050) from each raceway being CWT tagged in the snout and then PIT tagged. The remainder of the fish (761,989) in each raceway had a CWT placed in their body (i.e. left/right cheek, anterior/posterior dorsal fin, caudal fin and adipose fin) and a colored elastomer dye placed into the adipose eyelid. The three colors of elastomer dye in the adipose eyelid corresponded to the three

acclimation sites (red = Clark Flat, green = Jack Creek and orange = Easton). Fish with the elastomer dye in the left eyelid corresponded to the OCT treatment and the right eyelid to the SNT treatment. The six different CWT body tags corresponded to the rearing raceway (numbers 1-6, 7-12 and 13-18) at the Cle Elum Hatchery.

Further quality control analysis pertaining to juvenile-to-adult PIT loss can be found in the following WDFW report:

Knudsen, C., M. Johnston, J. Rau, and S. Schroder. 2002. Juvenile-to-Adult PIT Tag Loss In Yakima River Hatchery Spring Chinook. YKFP Progress Report 2001.

Personnel Acknowledgements (for 1.f, 1.g, 1.p): The Biologists assigned to these tasks include: Bruce Watson, Mark Johnston, and John McConnaughey. The Technicians assigned are: Joe Hoptowit, Joe Jay Pinkham III, Leroy Senator, Gerry Lewis, Seymour Billy, Wayne Smartlowit, Tammy Swan, Morales Ganuelas, Arnold Barney, Ray Decoutea, Linda Lamebull, Shelia Decouteau, Steve Salinas, Pharmond Johnson, Jimmy Joe Olney and Jamie Bill.

Task 1.g Roza Juvenile Wild / Hatchery Spring Chinook Smolt PIT Tagging

Rationale: To capture and PIT tag wild and hatchery spring chinook to estimate, 1) wild and hatchery smolt-to-smolt survival to CJMF and the lower Columbia River projects, and 2) to estimate differential smolt-adult survival between winter versus a spring migrant fish.

Methods: The Roza Dam juvenile fish bypass trap was used to capture wild and hatchery spring chinook pre-smolts. The trap was operated from December 19, 2001 and ended on April 26, 2002. The trap was fished five days per week, 24 hours per day. Fish were removed from the trap each morning and PIT tagged on site and released the following day after recovery.

Progress: A total of 9,987 (8,717 wild and 1,270 hatchery) juvenile spring chinook were PIT tagged from fish collected at the Roza juvenile fish bypass trap.

Task 1.h Yakima River Wild/Hatchery Salmonid Survival and Enumeration (Chandler Juvenile Monitoring Facility; CJMF)

Rationale: As referenced in the YKFP Monitoring Plan (Busack et al. 1997), CJMF is a vital aspect of the overall M&E for YKFP. The baseline data collected at CJMF includes: stock composition of smolts, outmigration timing, egg-to-smolt and/or smolt-to-smolt survival rates, hatchery-v-wild and hatchery optimum conventional treatment (OCT) reared fish-v-hatchery semi-natural treatment (SNT) reared fish survival rates (spring chinook). Monitoring of these parameters is essential to determine whether post-supplementation changes are consistent with increased natural production. This data can be gathered for all anadromous salmonids within the basin.

In addition, the ongoing fish entrainment study is used to refine smolt, both present and historic, as adjustments are made to the CJMF fish entrainment to river discharge logistical relationship.

The facility also collects steelhead kelts for the kelt reconditioning project, and conducts trap and haul operations when conditions in the lower Yakima are not favorable to smolt survival.

Methods: The CJMF is operated on an annual basis, with smolt enumeration efforts conducted from late winter through early summer corresponding with salmonid smolt outmigrations. The 2001 water year operations began on December 19, 2000 continuing until July 11, 2001. A sub-sample of salmonid outmigrants is bio-sampled on a daily basis and all PIT tagged fish interrogated.

Replicate releases of PIT tagged smolts were made in order to estimate the fish entrainment and canal survival rates in relation to river conditions. The entrainment rate estimates were used in concert with a suite of independent environmental variables to generate a multi-variate smolt passage relationship used to develop current, future and passage estimates with confidence intervals.

Hand held CWT detectors were used to scan for body-tags on hatchery spring chinook smolts. This is a monitoring and evaluation protocol is built in as a backup in the event that the corresponding PIT tagged fish from each treatment group (OCT/SNT) failed to be accurately detected by the PIT detectors stationed at the CJMF. Fortunately, there was good correspondence between the detection rates between the two mark groups.

Progress: The 2001 smolt passage estimates as follows: wild spring chinook– 96,734; OCT spring chinook– 235,316; SNT spring chinook– 216,433; wild fall chinook– 1,677,537; Marion Drain hatchery fall chinook– 15,938; wild coho– 40,605; hatchery coho– 442,249; and wild steelhead– 28,428. These estimates are provisional and subject to change as better entrainment estimates are developed. The 2001 fall chinook estimate in particular will likely be adjusted downward.

In 2001 approximately 154,347 smolts were hauled by truck from CJMF to the Columbia River, due to excessive water temperatures in the lower Yakima River.

Personnel Acknowledgements: Biologist Mark Johnston and Fisheries Technician Leroy Senator are, respectively, the project supervisor and on-site supervisor of CJMF operations. Biologist John McConnaughey is responsible for the analysis of data collected at the facility. Other Technicians that assisted are Sy Billy, Joe Hoptowit, Jerry Evans, Morales Ganuelas, Tammy Swan and a varying number of seasonal temporary Fisheries Technicians.

Task 1.i Yakima River Fall Chinook Optimal Rearing Treatment

Rationale: To determine optimal release timing to increase overall smolt and smolt-to-adult survival, and to investigate the general life history of wild Yakima River fall chinook.

Method: Approximately 325,000 fall chinook smolts were produced from fish spawned during the fall of 2000. These smolts were divided into two equal groups. One group was reared using conventional methods using ambient river temperature incubation and rearing profiles. The other group was incubated and reared using warmer well water to accelerate emergence and rearing and ultimately smoltification. Both groups of fish were spawned, incubated and reared at the Prosser Hatchery. Fish from both groups were 100% marked using ventral fin clips (pelvic fins), and approximately 2,000 fish from each group were PIT tagged to evaluate survival and migration timing to the lower Columbia River. Approximately 1,000 PIT tagged Marion Drain hatchery fall chinook juveniles were released to estimate survival from Marion Drain Hatchery to CJMF and McNary Dam. We monitored water temperature and the juvenile wild fall chinook growth profile within the mainstem Yakima River in the spring of 2001 to help determine whether or not temperature may be limiting fall chinook production above Prosser Dam.

Progress: Yakama Nation collected a total of 51 fall chinook broodstock between Prosser Dam Denil ladder and from fish taken from Chandler canal at Prosser. This resulted in 143,077 smolts that were split into two groups of approximately 82,985 accelerated incubation and rearing, and 60,092 incubated and reared on ambient river water (conventional group). All fish were ventral clipped, either left or right, to distinguish treatment groups as returning adults at Prosser Dam (video monitoring) and from carcasses recovered by WDFW during their fall chinook redd surveys conducted downstream of Prosser Dam. A total of 1,000 PIT tagged fish were marked from each of the two treatment groups (non-accelerated and accelerated) in order to estimate smolt-smolt survival to the lower Columbia River. There was no significant difference in the smolt-at-CJMF to smolt-at-McNary Dam survival-index between the accelerated (0.39) and conventional (0.27) groups.

The survival indice for the Marion Drain conventional group was 0.30 and was not significantly different to either of the two Prosser released groups.

Task 1.j Yakima River Coho Optimal Stock, Temporal, and Geographic Study

Rationale: To determine the optimal location, date, and stock of release to maximize the feasibility of coho re-introduction into the Yakima Basin, and to determine the spawning distribution of returning adults.

Method: A nested factorial experimental design was intended to be used to test for survival differences between out of basin hatchery and Prosser Hatchery stocks; release location (upper Yakima and Naches subbasins); and release date (May 7 and May 31). Each release date had two replicates per sub-basin). Within each replicate 2,500 coho smolts were PIT tagged (1,250 out of basin stock and Prosser Hatchery stock were intended to be PIT tagged) to evaluate survival to CJMF and lower Columbia projects. In addition to PIT tags to monitor juvenile survival, a portion of the smolts were CWT'ed in order to assess the survival of returning adult to Prosser Dam. Beginning with the 1997 broodyear 100% of the locally produced, and out of basin smolts have been CWT in order to monitor smolt-adult survival, and relative wild contribution of both smolt and adult coho production. The 2000 returning adults was the first year where wild and hatchery smolt-adult return rates could be compared. In order to determine the relative abundance of hatchery coho smolt residuals, we conducted surveys in the upper Yakima and Naches rivers to enumerate coho that did not migrate during the spring. Since 1999 about 98 spawners have been radio tagged at Prosser Dam to evaluate spawning

distribution. In 2000 105 fish were tagged and 75 fish were successfully tracked until spawning.

Progress: Success of the Yakima/Klickitat Fisheries Program's (YKFP) efforts to re-introduce coho to the Yakima River is reliant upon the use of hatchery fish to develop naturalized spawning populations. The first milestone that must be achieved is the return of sufficient numbers of adults to either spawn naturally or to be spawned in a hatchery. Optimizing the date and location of release of hatchery coho may be a promising method of increasing returns of coho salmon. A literature review tends to indicate that survival increases with a later release date, and even though not definitive, previous results in the Yakima basin also suggest that later releases may out perform early releases in terms of juvenile survival (YN 1997). The optimal release date or location(s) for juvenile coho in the Yakima basin are not known at this time. Adult coho returns to the Yakima River have increased in recent years; however, the spawning distribution of returning adults is not well described. Until recently, the project has relied entirely upon the transfer of lower Columbia River hatchery coho to produce adult coho returns in the Yakima basin. If viable self-sustaining populations of coho are to be re-established in the Yakima River, parent stocks must possess sufficient genetic variability to allow phenotypic plasticity to respond to differing selective pressures between environments of the lower Columbia River and the Yakima River. We are optimistic that the project will observe positive trends in coho survival in the Yakima basin as the program develops a localized broodstock.

- We estimated that wild smolt-to-adult survival rate for 31,070 natural origin coho smolts (counted at CJMF) in 2000 was 4.9%, which was 2.4 times greater than that observed for hatchery smolts.

- We estimated that hatchery smolt-to-adult survival rate for 167,910 hatchery coho smolts (counted at CJMF) released in the Naches and upper Yakima rivers in 2000 was 2.0%.

- The 2001 adult coho run was comprised of 30.8% (1,530 fish) naturally produced fish and 69.2% hatchery fish. This was the first year where this distinction could be made due the 100% CWT'ing of smolts beginning with the 2000 release.

- Smolt-smolt survival (CJMF to McNary Dam) was higher for the Yakima stock (mean= 18.6%) than for the Willard stock (mean= 6.6%) in 2001. Reasons for this are not readily understood at this time.

- There was no significant difference in smolt-smolt survival (CJMF to McNary Dam) between the early and late release groups for either basin. The lack of a differential survival difference between the two groups is most likely due to the extremely poor outmigration conditions, which persisted the entire smolt outmigration period in 2001.

- A total of 105 coho spawners were radio tagged at Prosser Dam in the fall of 2001, of which 75 were subsequently successfully tracked. The spawner distribution throughout the Yakima basin was as follows: Prosser Dam (rm 47.1)-Granger (rm 83.0)- 6.7%, Granger-Sunnyside Dam reach (rm 103.8)- 37.1%, Sunnyside Dam-Naches River (rm 116.3)- 5.7%, mid-Yakima River tributaries- 4.8%, lower Naches River- 3.8%, Naches River above Cowiche Dam (rm 2.7)- 13.3%, Naches River confluence to above Roza Dam (rm 127.9)- 9.5%.

- Since 1999 all smolts have been released in the Naches and the upper Yakima rivers, and in 1998 a portion of the smolts were released from Lost Creek in the upper Naches River. Despite this, the majority of spawning appears to occur in the Yakima River downstream to the Naches River confluence. It's believed that three factors are contributing to this, 1) lack of stamina primarily by females to reach their areas of release located further upstream, 2) straying and delay due to false attraction from irrigation return flow and 3) from natural production occurring in the Yakima River above Granger. Nevertheless, the percentage of spawners returning to the Naches River has steadily increased from 8.2% in 1999 to 26.7% in 2001. Correspondingly the percentage of fish spawning in the Granger to Sunnyside Dam reach has decreased from 61.6% in 1999 to 37.1% in 2001.

- Residual coho smolt survey sites on the upper Yakima River (Easton reach) were from the Easton acclimation site (Rkm 325.4) to the confluence of Cle Elum River (Rkm 294.6). The Naches River (Lost Cr. reach) surveys were done from the Lost Creek acclimation site (Rkm 61.8) to the confluence with Rock Creek (Rkm 53.9). In 2001 residual coho were generally absent from all snorkel surveys. Two residual coho were seen in the Lost Cr. reach, which equated to 0.25 fish per river

kilometer. No residuals were observed in the upper Yakima River reach. Sub-yearling coho were observed in low numbers (upper Yakima- 55 fish or 1.8 fish per km; Naches- 33 fish or 4.2 fish per km) an indication of natural production. Results in 2001 are consistent with those the past two years, where relatively low densities of residuals and sub-yearlings were observed in both subbasins.

Personnel Acknowledgements: They are the same as for Task 1.i with the following additions. PIT tagging occurred at Prosser Hatchery with assistance from Biologist Mark Johnston and Fisheries Technicians Leroy Senator, Tammy Swan, Sy Billy, Joe Hoptowit, and Gerry Lewis.

Task 1.k Yakima Spring Chinook Juvenile Behavior

Rationale: This study is part of an effort to evaluate the rearing of Spring Chinook salmon (*Oncorhynchus tshawytscha*), at the Cle Elum Supplementation and Research Facility. Yearling Spring Chinook smolts, *Oncorhynchus tshawytscha*, from two hatchery treatment groups, conventional and semi natural rearing treatments, were compared to wild smolts in an experiment designed to assess differences in cover utilization, and survival to a predation threat.

A two-year experiment was conducted, and the results are presented in a paper entitled "Comparisons of Hatchery and Wild Spring Chinook *Oncorhynchus tshawytscha* Smolts in Cover Utilization and Avoidance of Predation by Northern Pikeminnows, *Ptychocheilus oregonensis*".

Methods: Groups of five smolts from each of the three treatment groups, (Wild, OCT & SNT), were placed sequentially into an aquarium. Cover and a predation threat were present in the aquarium. Typically, upon introduction, smolts will dive for cover and remain hidden for several minutes before emerging to explore or school with other smolts. Observers recorded the amount of time smolts spent in cover and made qualitative assessments of the smolt's cover utilization. Northern Pikeminnows, *Ptcocheilus oregonensis*, were then allowed to feed on the smolts until approximately one-half were consumed. Surviving smolts were then counted and measured by treatment group.

Progress: The experiment to assess differences in cover utilization was replicated 12 times with 180 smolts total. The predator avoidance experiment was replicated 18 times with 261 smolts total. The hatchery smolts spent less time in cover than did the wild, and this difference was significant for the SNT

treatment at p=0.023. We saw a significant size dependant predation for hatchery fish, where the smaller fish were consumed at over twice the rate as were the largest. No such size dependant mortality was seen in the wild fish, however. Overall, the hatchery and wild fish suffered similar predation rates. However, wild fish were smaller on average. When we compared the predation rates on just the smaller fish (<130mm), we found the OCT fish had a 32% lower survival rate than did the wild, and this difference was significant at p=0.033. Small SNT fish had a nominally 10% lower survival rate than wild, but the difference failed to reach significance.

Personnel Acknowledgements: John McConnaughey, (YKFP Research Center) and Dr. Terry DeVietti, (CWU Psychology Dept).

Task 1.l Yakima Spring Chinook Juvenile Morphometric/Coloration

Refer to WDFW report:

Schroder, S., C. Knudsen, B. Watson, T. Pearsons, and J. Rau. 2002. Comparing the reproductive success of Yakima River hatchery and wild spring chinook. YKFP 2001 Annual Report.

Task 1.m Yakima Spring Chinook Smolt Physiology

This task is assigned to NMFS and they will report on its status.

Task l.n Klickitat Feasibility Study of Mobile Juvenile Sites

Beginning in FY 2001 all Klickitat Basin monitoring and evaluation activities are under the auspices of a specific BPA funded contract (Project No. 1995-063-35). Progress on this activity is reported in the annual report entitled Yakima/Klickitat Fisheries Project, Klickitat Only.

Task 1.o Adult Salmonid Enumeration at Prosser Dam

Rationale: To estimate the total number of adult salmonids returning to the Yakima Basin by species (spring and fall chinook, coho and steelhead), including the estimated return of externally marked fish (i.e., adipose clipped fish). In addition, biotic and abiotic data is recorded for each fish run.

Methods: Monitoring was accomplished through use of time-lapse video recorders (VHS) and a video camera located at each of the three fishways. The

videotapes were played back and various types of information/data were recorded for each fish that migrated past, and data was entered into the YKFP database.

Progress:

Spring Chinook (2001 run)

An estimated 21,474 spring chinook were counted past Prosser Dam. The total adult count was 19,763 (92%) fish, while the jack count was 1,709 (8%) fish. Of the adult count, 7,803 were identified as hatchery origin. Returning hatchery adults this year comprised 3 and 4 year olds (brood years 1997 and 1998). The ratio of wild jacks to hatchery jacks was 36.4% to 63.6%, respectively.

The 25%, 50% and 75% dates of cumulative passage were May 1, May 7 and May 16, respectively.

The estimated mean fork length for adults (wild and hatchery) and jacks (wild and hatchery) was 65.4 cm and 45.0 cm, respectively. The estimated video fork length for adults was 7.2 cm smaller than that measured "hands-on" at Roza in the broodstock collection. The difference between jacks was less than one centimeter. This suggests that video based fork lengths measured at Prosser underestimate the true fork length. It's believed this is a result of a "mismatch" in the applied multiplier value (video length x multiplier value = true length) relative to the horizontal passage trajectory of the fish as it passes by the viewing window. This bias in underestimating the actual fork length is being examined for the 2001 spring and fall runs.

Fall Run (coho and fall chinook)

Coho (2001)

The estimated coho run was 5,046 fish. It should be mentioned that an undetermined number of fish "dropped out" below Prosser Dam and are not reflected in this count. Some fish were harvested while others were falsely attracted into tributaries such as Spring Creek. Adults comprised 98.7% and jacks 1.3% of the run. A total of 1,786 adipose clipped fish were counted, 1752 were adults and 34 were jacks. Of the estimated run, 43.8% were processed at the Denil.

The 25%, 50% and 75% dates of cumulative passage were October 7, October 19 and October 26, respectively.

The estimated mean adult and jack fork length was 55.8 cm and 36.7 cm, respectively, which is smaller than measured fish collected for broodstock. This indicates a size bias (underestimate) of the true fork length for fish measured from the videotapes. This same bias has been observed in past years for all salmonid species at Prosser Dam.

Fall Chinook (2001 run)
Estimated fall chinook passage at Prosser Dam was 4,311 fish. Adults comprised 84.7% of the run, and jacks 15.3%. Of the total number of fish, 533 were adipose clipped, 437 fish were adults and 96 fish were jacks. The median passage date was October 22, while the 25% and 75% dates of cumulative passage were September 26 and November 22, respectively. Of the total fish estimate, 11.1% were counted at the Denil.

The mean adult and jack fork length was 66 cm and 47 cm, respectively.

Steelhead (2000-01 run)
The estimated steelhead run was 3,089 fish. Of the total, 57 adipose clipped fish, which were all out-of-basin strays since no hatchery returns were expected to the Yakima River. The median passage date was December 27th, 2000, while the 25% and 75% cumulative dates of passage were October 16, 2000 and February 12, 2001 respectively.

The mean fork length was 58.6 cm, and fish ranged in size from 32.1 cm to 85.2 cm.

Personnel Acknowledgements: Biologists, Melinda Davis and Joel Hubble, and Fisheries Technicians Winna Switzler and Florence Wallahee.

Task 1.p Adult Salmonid Enumeration and Broodstock Collection at Roza/Cowiche Dams: (Radio Telemetry, please see 1.j)

Rationale: To estimate the total number of adult salmonids returning to the upper Yakima Basin for spring and fall chinook, coho and steelhead) at Roza Dam, and for coho only into the Naches Basin at Cowiche Dam. This includes the count of externally marked fish (i.e., adipose clipped). In addition, biotic and abiotic data is recorded for each fish run.

Methods: Monitoring was accomplished through use of time-lapse video recorders (VHS) and a video camera located at each fishway. The videotapes were played back and various types of information/data are recorded for each

fish that passes. Spring chinook passing Roza Dam are virtually entirely enumerated through the Cle Elum Supplementation and Research Facility broodstock activity.

Progress: Roza Dam

Steelhead

A total of 135 steelhead were counted past Roza Dam for the 2000-01 run. As shown in figure 6, most steelhead migrated past Roza Dam in late March and April of 2001.

Spring Chinook

At Roza Dam 12,516 (90% adults and 10% jacks) spring chinook were counted at the adult facility between April 23 and September 10, 2001. The adult return was comprised of natural- (45%) and CESRF-origin (55%) fish. The jack return was comprised of natural- (25%) and CESRF-origin (75%) fish. Figure 7 shows passage and wild brood collection timing at Roza in 2001.

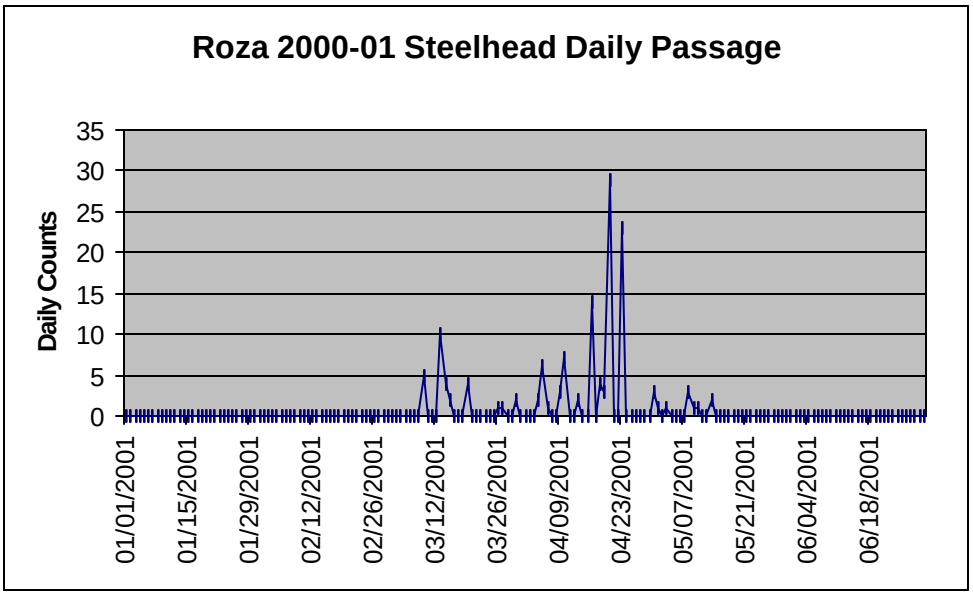


Figure 6. Daily steelhead passage at Roza Dam, 2000-01.

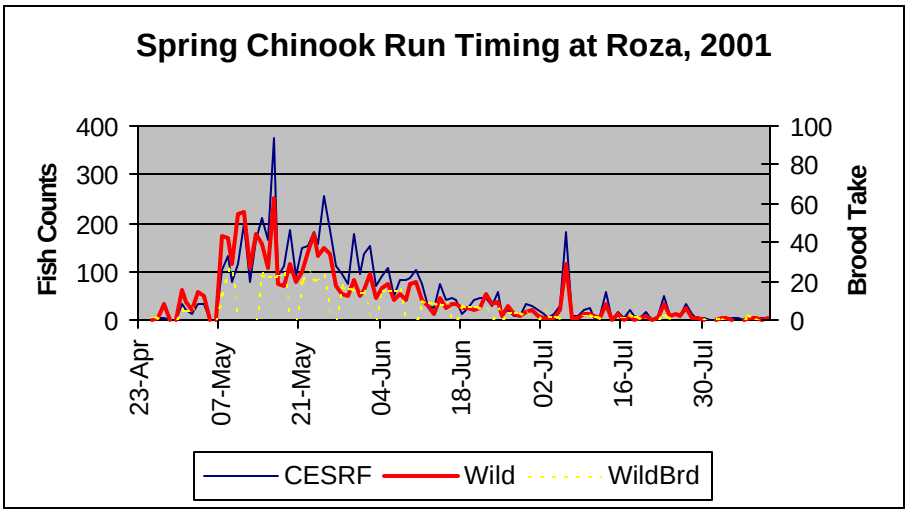


Figure 7. Daily spring chinook passage for CESRF-origin, wild and wild broodstock collected at Roza Dam, 2001.

Coho

The estimated coho run was 729 fish. Of the total, 71 (10.8%) fish were adipose clipped. Coho were monitored from October 4th through December 31st, 2000, with 50% of the passage occurring by November 8th, 2000.

Cowiche Dam (coho)

Coho spawners were monitored at the dam from October 9th, through December 31st, 2001.

A total of 309 coho were counted passing the fishway. Because of the camera configuration at this facility no adult and jack breakdown is possible. The number of fish passing Cowiche Dam represented 6% of the Prosser count. The majority of fish (53%) migrated past the dam between mid-to-late October. The last fish was counted on November 14th.

Personnel Acknowledgements: Biologists, Melinda Davis and Joel Hubble, and Fisheries Technicians Winna Switzler and Florence Wallahee.

Task 1.q Spawning Ground Surveys (Redd Counts, Yakima & Klickitat Basins)

Rationale: To enumerate the temporal-spatial distribution of spring chinook, fall chinook, steelhead and coho redd deposition in the Klickitat and Yakima basins. To collect biological information from spawned out carcasses.

Methods: Regular foot and/or boat surveys were conducted within the established geographic range for each species (this is increasing for coho as acclimation sites are located upriver and as the run increases in size). Redds were individually marked during each survey and carcasses are sampled to collect-egg retention, scale sample, sex, body length and to check for possible experimental marks.

Progress: A summary of the spawning ground surveys by species are as follows:

Steelhead: Steelhead surveys in Satus and Toppenish basins and Ahtanum Creek began in mid-March and end in late April. Total redd counts by subbasin were as follows: Satus basin- 172, Toppenish basin- 354, and Ahtanum Creek- 8. For all three basins a total of 534 redds were counted.

Spring Chinook: Redd counts began in late July in the American River and ended in early October in the upper Yakima River. Total counts for the American, Bumping, Little Naches, Naches, and Rattlesnake rivers were, respectively, 392, 257, 107, 394, and 42 redds. Redds counts in the upper Yakima, Teanaway and the Cle Elum rivers were, 2,932, 21 and 386, respectively. The entire Yakima basin had a total of 4,531 redds (Naches- 1,192 redds, upper Yakima- 3,339).

Fall Chinook: Marion Drain fall chinook surveys were conducted three times in 2001. A total of 34 redds were counted. The number of redds located for each survey was as follows: October 31 – 15 redds, November 10- 15 redds, and November 24- 4 redds.

Coho: Surveys began in early November and ended in late December in the Yakima River basin. A total of 151 redds were located in the Yakima Basin. Surveys were concentrated where radio telemetry fish were located to maximize survey effort. Due to untimely winter freshets, river conditions prevented accurate enumeration of coho redds. Nearly all the redds were located before the first winter freshet. The redd distribution was as follows:

Yakima R.- 27 redds. Most redds were located between the Zillah Bridge and Roza Dam. Two redds were located in the upper Yakima Canyon.

Naches R.- 124 redds. Most redds were located from the confluence to below the Tieton River confluence.

Ahtanum Cr.- 37 redds.

Cowiche Cr.- 10 redds.

Buckskin Cr.- 29 redds.

Teanaway R.- 0 redds.

Beginning in FY 2001 all Klickitat Basin monitoring and evaluation activities are under the auspices of a specific BPA funded contract (Project No. 1995-063-35). Progress on this activity is reported in the annual report entitled Yakima/Klickitat Fisheries Project, Klickitat Only.

Task 1.r Yakima Spring Chinook Spawning Behavior Observations

This task is assigned to WDFW and they will report on its status in their annual progress report to BPA.

Task 1.s Yakima Spring Chinook Residuals/Precocials Studies

Refer to WDFW report:

Schroder, S., C. Knudsen, B. Watson, T. Pearsons, and J. Rau. 2002. Comparing the reproductive success of Yakima River hatchery and wild spring chinook. YKFP 2001 Annual Report.

Task 1.t Yakima River Relative Hatchery/Wild Spring Chinook and Coho Reproductive Success

Refer to WDFW report:

Schroder, S., C. Knudsen, B. Watson, T. Pearsons, and J. Rau. 2002. Comparing the reproductive success of Yakima River hatchery and wild spring chinook. YKFP 2001 Annual Report.

No activities for coho reproductive success experiments were scheduled for the 2001 field season.

Task 1.u Yakima Spring Chinook Gamete Quality Monitoring

Refer to WDFW report:

Knudsen, C., S. Schroder, J. Rau, M. Johnston,C. Strom, and M. Hammlin. 2002. Monitoring Phenotypic and Demographic Traits of upper Yakima River Hatchery and Wild Spring Chinook: Gametic and Juvenile Traits. YKFP Annual Report 2001.

Task 1.v Scale Analysis

Rationale: To determine age and stock composition of juvenile and adult salmonid stocks in the Yakima and Klickitat basins.

Methods: Scale analysis was used to accomplish this task.

Scale analysis was used to determine the proportion of hatchery vs. wild coho smolts and adult in the Yakima Basin. Juvenile coho scales were randomly collected from smolts that entered the CJMF. Adult coho scales were taken from broodstock captured at Prosser Dam, right fishway, and Denil ladder.

Progress: Scale samples were collected and subsequent analysis performed for several YKFP related tasks. Sample locations and species sampled are listed as follows:

Chandler Juvenile Monitoring Facility- random samples collected from spring and fall chinook, coho and steelhead smolts.
Roza Adult Broodstock and Monitoring Facility- samples from all spring chinook broodstock and returning hatchery adults for DNA analysis.
Prosser Dam (Denil ladder)- samples from all coho broodstock and fall chinook
Yakima spawner surveys- samples from spring chinook carcasses in the Naches and upper Yakima subbasins.
Klickitat basin- samples collected from juvenile salmonids captured in the rotary traps; and samples from fall chinook and coho collected during the spawning ground surveys.

Personnel Acknowledgement: Fisheries Technician Tammy Swan is the scale reader for the Yakama Nation and John Sneva is the scale reader for Washington Department of Fish and Wildlife.

Task 1.w Fish Health Monitoring

Since the subcontract for Fish Health services with U.S. Fish and Wildlife Service is referenced in the "Management, Data, and Habitat" contract, this report was done and submitted in the report for the Management Contract. It covered the services for Spring Chinook, Fall Chinook and Coho. Please see that Report for status.

Task l.x Habitat Monitoring Flights and Ground Truthing

No activities scheduled for FY 2001.

Task 1.y Out-of-Basin Environmental Monitoring

Rationale: To obtain and utilize information from outside sources, regarding environmental and harvest-related impacts on all anadromous salmonids occurring outside the Yakima and Klickitat subbasins.

Methods: The method entails communicating (telephone, E-mail and occasional face-to-face meetings) with various state and federal agencies, other research programs, hatcheries, and university researchers and collecting information regarding out of basin environmental and harvest-related impacts on anadromous stocks.

Progress:

No activity occurred in FY 2001.

Task 1.z Trophic Enhancement Research

This task is assigned to WDFW and they will report on its status in their annual progress report to BPA.

Task 1.A Sediment Impacts On Habitat

Rationale: To monitor stream sediment loads associated with the operation of dams and other anthropogenic factors (e.g. logging, agriculture and road

building), which can increase sediment loads in stream utilized by all salmonids in the Klickitat and Yakima subbasins.

Methods: Representative gravel samples were collected from the upper Yakima River (upstream of the Cle Elum River), Little Naches basin, and the South Fork of the Tieton River in the fall of 2001. Each sample was analyzed to estimate the percentage of fine or small particles present (<0.85 mm). The Washington State TFW program guidelines on sediments were used to specify the impacts estimated sedimentation levels have had on salmonid egg-to-smolt survival. These impacts will be incorporated in analyses of impacts of "extrinsic" factors on natural production.

Progress:

Upper Yakima

Sixty samples were collected; with the control reach located above Lake Easton (Stampede Pass) and the treatment reaches extending from Easton to the Cle Elum River confluence. Mean percent fines (<0.85 mm) by sample reach ranged from 8.8% (in the control reach) up to 18.9% (Cle Elum River).

Naches

In the Little Naches basin 120 samples were collected from the mainstem and several of the tributaries. In addition, 12 samples were collected from the South Fork of the Tieton River. The mean percent fines (<0.85 mm) in the Little Naches River was 14.5%; North Fork- 15.5%; South Fork- 16.8%; Bear Creek- 14.6% and Pyramid Creek- 14.9; and in the Tieton South Fork- 12.9%.

Personnel Acknowledgements for Tasks 1.A, 1.B, 1.C, & 1.D: Lead Biologist is Mark Johnston assisted by the following Technicians, Ray Decoutea, Jamie Bill, Elroy Shavehead.

Task 1.B Klickitat Fish Passage Obstruction Inventory Assessment

Beginning in FY 2001 all Klickitat Basin monitoring and evaluation activities are under the auspices of a specific BPA funded contract (Project No. 1995-063-35). Progress on this activity is reported in the annual report entitled Yakima/Klickitat Fisheries Project, Klickitat Only.

Task l.C Klickitat Water Quality Inventory

Beginning in FY 2001 all Klickitat Basin monitoring and evaluation activities are under the auspices of a specific BPA funded contract (Project No. 1995-063-35). Progress on this activity is reported in the annual report entitled Yakima/Klickitat Fisheries Project, Klickitat Only.

Task l.D Klickitat Habitat Production Assessment

Beginning in FY 2001 all Klickitat Basin monitoring and evaluation activities are under the auspices of a specific BPA funded contract (Project No. 1995-063-35). Progress on this activity is reported in the annual report entitled Yakima/Klickitat Fisheries Project, Klickitat Only.

Task 1.E Predator Avoidance Training

Rationale: Hatchery fish have been shown to be more susceptible to predation than wild counterparts and it has been suggested that hatchery fish lack skills required to avoid predators (Wiley et al. 1993; Olla et al. 1994; Maynard et al. 1995).

Method: Predator avoidance training will consist of introducing a hungry common merganser into a cage submerged in a raceway three times per week for three weeks prior to release. The predator will be allowed to feed for 30 minutes. The design will consist SNT fish randomly divided into control and treatment PIT tagged groups. Survival both groups will be estimated at CJMF and McNary and John Day dams.

Progress: In 1999 we built an enclosure for the birds at the Cle Elum hatchery and acquired six mergansers (of which three have since died) to be used in spring 2000 as referenced in the Method.

Task 1.F Data Management:

Aside from the funds being allocated from Monitoring and Evaluation, the status of Data was reported in the "Management, Data, and Habitat" report. The administration of the Data Management element is handled under the Management contract of the YKFP, thus, it has been included in that report. Please see that report for current status.

Task 1.G Biometrical Support:

Aside from the funds being allocated from Monitoring and Evaluation, the status of the Biometrical Support was reported in the "Management, Data, and Habitat" report. The administration of the Biometrical sub-contract is administrated under the Management contract. Please see that report for the current status.

Task 1.H MIPT Operations

This is referenced but was not implemented as a separate task. Was implemented with participation realized through other existing tasks.

2. HARVEST

Overall Objective: Develop methods for detecting increases in harvest of YKFP target stocks.

Task 2.a Out-of-Basin Harvest Monitoring

Rationale: To develop a database to track the contribution of target stocks to out-of-basin fisheries.

Method: Coordinate with agencies responsible for harvest management (WDFW, ODFW, USFWS, CRITFIC, etc.) to estimate the harvest of target stocks.

Progress: Standard run reconstruction techniques were employed to derive reasonable estimates of harvest from the Columbia River mouth to the Yakima River mouth for spring chinook (Table 4). Data from databases maintained by the *United States versus Oregon* Technical Advisory Committee (TAC) were used to obtain harvest rate estimates for the aggregate Yakima River spring chinook population and to estimate passage losses from Bonneville through McNary reservoirs. These data, combined with the Prosser Dam counts and estimated harvest below Prosser, were used to derive a Columbia River mouth run size estimate and Columbia River mainstem harvest estimate for Yakima spring chinook. Work on similar databases for other species in the Yakima River and for all species in the Klickitat will continue as time allows.

Estimates of harvest of Cle Elum Supplementation and Research Facility (CESRF) spring chinook by treatment (OCT/SNT) type for out-of-basin fisheries were made using Roza Dam sampling proportions. For in-basin fisheries, these estimates were made using in-basin harvest sampling data. An analysis of harvest data by acclimation site and pond can be made using available PIT tag detection data maintained in the regional PTAGIS database. Beginning with the 2002 adult spring migration, adult PIT tag detection facilities at all ladders at McNary and Bonneville Dams are operational. These facilities are expected to achieve nearly 100% efficiency in adult PIT tag detection. In addition, all returning CESRF spring chinook are mark-sampled at Roza Dam and any PIT detections there are submitted to PTAGIS. Interested scientists can derive the stock composition (OCT/SNT by acclimation site) of the estimated CESRF portion of the catch of Yakima River spring chinook by querying PTAGIS to obtain adult PIT detection data from Bonneville, McNary, and/or Roza Dams.

Additionally, two other databases are available to retrieve data to complement the data that are derived using run reconstruction. The Regional Mark Information System (RMIS) can be queried regularly for any CWT recoveries of YKFP releases in ocean or Columbia River mainstem fisheries. In addition, the commercial fish ticket database maintained by Washington and Oregon can be queried for recoveries of Klickitat River fall chinook and coho in non-Indian and Treaty Indian fall season commercial fisheries in the Columbia River.

Table 4. Yakima River Spring Chinook Run Reconstruction, 1982-Present.

Year	Columbia River Mth. Run Size	ColRMth to BON Harvest	Passage Loss BON to YakRMth	BON to McNary Harvest	Yakima River Mth. Run Size	Harvest of Yakima R. fish from Col. River Mouth to Yakima R. Mouth					Harvest of Yakima R. fish from Yakima R. Mouth to Escapement				
						Total	Wild	CESRF	OCT	SNT	Total	Wild	CESRF	OCT	SNT
1982	3,836	67	1,661	286	1,822	353	353	0	0	0	434	434	0		
1983	2,442	124	770	107	1,441	231	231	0	0	0	84	84	0		
1984	4,380	161	1,247	313	2,658	474	474	0	0	0	289	289	0		
1985	5,306	203	352	191	4,560	394	394	0	0	0	865	865	0		
1986	12,968	274	2,456	799	9,439	1,073	1,073	0	0	0	1,340	1,340	0		
1987	6,028	96	1,088	402	4,443	498	498	0	0	0	517	517	0		
1988	6,026	416	930	434	4,246	850	850	0	0	0	444	444	0		
1989	8,307	213	2,510	670	4,914	883	883	0	0	0	747	747	0		
1990	6,293	337	1,145	438	4,372	775	775	0	0	0	663	663	0		
1991	4,445	189	1,063	287	2,906	476	476	0	0	0	32	32	0		
1992	5,611	96	557	358	4,599	455	455	0	0	0	345	345	0		
1993	4,293	36	61	279	3,917	315	315	0	0	0	129	129	0		
1994	1,626	70	167	87	1,302	157	157	0	0	0	25	25	0		
1995	1,089	0	356	66	666	66	66	0	0	0	79	79	0		
1996	6,058	4	2,546	328	3,179	332	332	0	0	0	475	475	0		
1997	5,136	2	1,768	373	2,993	375	375	0	0	0	575	575	0		
1998	2,861	3	793	163	1,903	166	166	0	0	0	188	188	0		
1999	4,147	3	1,152	210	2,781	214	214	0	0	0	604	604	0		
2000	26,295	50	5,340	1,657	19,249	1,706	1,641	66	35	31	2,458	2,405	53	31	22
2001	30,544	1,022	1,446	4,002	24,075	5,024	2,703	2,321	1,228	1,093	4,630	2,806	1,825	940	885

Task 2.b Yakima and Klickitat Subbasin Harvest Monitoring

Rationale: To develop a database to track the contribution of target stocks to in-basin fisheries.

Method: The two co-managers, Yakama Nation and WDFW, are responsible for monitoring their respective fisheries in both the Klickitat and Yakima rivers. Each agency employs fish monitors dedicated to creel surveys and/or fisher interviews at the most utilized fishing locations and/or boat ramps. From these surveys, standard techniques are employed to expand fishery sample data for total effort and open areas and times to derive total harvest estimates. Fish are interrogated for various marks. This information is used along with other adult contribution data (i.e. broodstock, dam counts, spawner ground surveys) to determine overall project success.

Progress: Total estimates of Yakima and Klickitat River in-basin harvest for both tribal and sport fisheries are reported annually (since at least the early-to-mid 1980s) and are available through the YKFP, the *United States versus Oregon* TAC, the WDFW, and/or the U.S. Bureau of Indian Affairs.

Klickitat
The Treaty Indian harvest estimate for Klickitat River fisheries in 2001 was:

Spring Chinook Adults - 264
Spring/Summer Chinook Adults - 76
Spring/Summer Jacks - 44
Fall Chinook Adults - 1,231
Fall Chinook Jacks - 47
Steelhead - 582
Coho – 4,771

Yakima
Both non-Indian and Treaty Indian spring chinook fisheries occurred in the Yakima River in 2001. For tribal fisheries, the sites monitored were those of traditional and historic fishing sites. These included, but were not limited to, Wapato, Parker, Prosser and Horn Rapids dams. Approximately 2,510 adult and 96 jack spring chinook were harvested in Treaty Indian fisheries from the mouth of the Yakima River to Union Gap. Washington State sport fisheries occurred from the Granger Bridge to below Roza Dam. The sport harvest was estimated at 1,908 adult and 116 jack spring chinook. Estimates of the

composition (wild and CESRF by treatment type) of the in-basin spring chinook harvest based on in-river harvest sampling are given in Table 1.

Fisheries also occurred in the Yakima River during the fall for fall chinook and coho. There was little effort and no harvest observed in the tribal fall season fisheries. The state sport fishery in the lower Yakima River harvested an estimated 1,000 fall chinook and about 50 coho.

Personnel Acknowledgements: Biologist Mark Johnston and Fisheries Technicians Steve Blodgett and Arnold Barney.

3. GENETICS

Overall Objective: Develop methods of detecting significant PAPS genetic changes in extinction risk, within-stock genetic variability, between-stock variability and domestication selection.

Progress: All Tasks within this Section are assigned to WDFW and are reported in written progress reports submitted to BPA.

4. ECOLOGICAL INTERACTIONS

Overall Objective: To develop monitoring methods to determine if supplementation and enhancement efforts keep ecological interactions on non-target taxa of concern within prescribed limits and to determine if ecological interactions limit supplementation or enhancement success.

Task 4.a Avian Predation Index

Progress: Implemented and funded by WDFW in cooperation with U of W.

Task 4.b Fish Predation Index (Yakama Nation Portion Only)

Rationale: Develop an index of the mortality rate of upper Yakima spring chinook attributable to non-salmonid piscivorous fish in the lower Yakima. This index will be used to estimate the contribution of in-basin predation to fluctuations in hatchery and wild smolt-to-adult survival rate.

Methods: The densities of all major piscivorous fish species were censured during the smolt outmigration in representative reaches of the lower Yakima, and predator-specific smolt consumption data was gathered in the same reaches. From this data, reach-specific Predation Indices (PI) were calculated. The Yakama Nation is responsible for three reaches above Prosser Dam (northern pikeminnow target species). WDFW is responsible for reaches below Prosser Dam where smallmouth bass and channel catfish are the primary target species. WDFW is responsible for the annual report with assistance from the Yakama Nation project biologist.

Progress: The Yakama Nation sampled a total of 917 northern pikeminnow (> 200 mm fork length) during the 2001 field season. Northern pikeminnow abundance estimates by site and month were as follows:

Toppenish site (rm 90.5-95.3)- April: 610 (0-1,249); May: 425 (85-764)*; June: 1,304 (212-2,396)*; Granger (RM 83): April: 2,595 (109-5,081)*; May: 1,394 (523-2,265)*; June: 1,642 (610-2,674)* and Sunnyside Dam (RM 103): 1,003 (503-1,502); May: 4,290 (2,108-6,471); June: 3,061 (717-5,404)*. The asterisk (*) denotes sites where the population estimate was invalid because it didn't meet specific mark and/or recapture criteria.

At the time of this writing the analysis to estimate total yearling salmonid consumption by northern pikeminnow from Prosser Dam to Roza Dam wasn't complete. This information will be reported in the first quarter report for FY 2002.

Personnel Acknowledgments: Jim Dunnigan was the lead biologist for this project, and project technicians were Linda Lamebull, Jerald Reed, and Jason Allen.

Task 4.c Yakima River Coho Life History Study

No activities were planned in FY 2001.

Task 4.d Indirect Predation.

Rationale: The release of hatchery salmonids may enhance or decrease the survival of randomly commingled wild salmonid smolts by altering the functional or numerical response of predators. For example, predators may increase consumption of wild fish by switching prey preferences from invertebrates to fish, or may be attracted to areas where hatchery fish are

released. Conversely, large numbers of hatchery fish may confuse or satiate predators, resulting in enhanced survival of wild fish.

Methods: Survival from Prosser Dam to McNary Dam was estimated for separate releases of PIT-tagged spring chinook made in 2001 (coho and fall chinook releases were not analyzed because McNary detection rates had not yet been developed at the time of the analysis). All releases were "self-selected": made up of tagged fish released at various points above Prosser Dam and detected at the main PIT-tag detector at the Chandler trap over a one- to two-day period. Fish detected at the secondary Chandler detector were excluded from analysis because the detector is located at the exit of the live-box, and fish detected at this point might have incurred stresses or injuries attributable solely to handling.

Survival was estimated from the main detector at Chandler trap at Prosser Dam to McNary Dam on the Columbia River. The method of estimating survival consisted of dividing daily McNary tag detections by the estimated McNary detection rate for the appropriate time period. McNary detection rates were estimated by Dr. Doug Neeley, and were based on the ratio of joint John Day\McNary detections to John-Day-only detections on a given day:

Detection rate (day i) = (number joint detections McNary and John Day)/(number detections at John Day).

Dr. Neeley developed statistical techniques to determine appropriate intervals over the outmigration season during which it is most reasonable to use a mean detection rate as the interval-specific estimate.

Multiple logistic regression was used to detect a survival impact attributable to a number of factors acting both just below Prosser Dam and in the McNary forebay. The variables that were examined were: flow (below Prosser and in McNary forebay); water temperature (Prosser and McNary); and smolt density (daily passage estimate at Prosser and Smolt Passage Index at McNary). Unlike analyses in earlier years, turbidity could not be included in this analysis because the turbidity detector at Prosser Dam malfunctioned. Similarly, the mean size of smolts in the self-selected releases could not be used because none of the fish used in these releases were subsampled.

This procedure assumes a number of factors affect smolt survival and that if there is a real Indirect Predation effect on survival, *it should be statistically apparent after the effects of the other factors have been accounted for.* Accordingly, a statistical test

of developed by Dr. Doug Neeley, a YN biometrical consultant, was developed which determines the significance of one of two independently significant independent variables when both are acting simultaneously. *The only factors considered to exert a real effect on survival were those whose impact remained significant after the affect of other (independent significant) factors had been accounted for (by Dr. Neeley's analysis).*

Again, the 2001 analysis included only spring chinook and only "unhandled" spring chinook– those detected only at the main PIT-tag detector at Chandler. In 2002, all main-detector-only fish seen over the years 1999-2002 will be included in a major composite analysis. This analysis will lump coho and spring chinook as "yearling smolts", and fall chinook smolts seen over the targeted years as "sub-yearlings". It is hoped that the larger sample size will increase the power with which significant impacts attributable to various independent variables can be detected.

Progress: Unlike analyses performed in 1999 and 2000, *none* of the independent variables – flow, temperature or smolt density – was significantly correlated with survival when analyzed independently. In previous years, Prosser and McNary flow were almost always significantly and positively correlated with survival, Prosser temperature was almost always significantly negatively correlated, and Prosser smolt density was usually significantly correlated, although the nature of the correlation differed by year (high- or low-flow years) and smolt age/size (smolt density was almost always significantly and positively correlated with subyearling survival).

A significant difference between the 2001 analysis and all previous analyses was that only unhandled self-selected fish were used in 2001. Previous analyses included both fish released at Chandler (non-self-selected fish) as well as a considerable number of fish that had been diverted into the live-box, anaesthetized and handled. The large, multi-year analysis to be performed in 2002 will be structured similar to the 2001 outmigrant analysis: only unhandled, self –selected fish will be used. Thus, a definitive answer as to the existence of an Indirect Predation effect must be deferred until this larger, more carefully controlled analysis can be completed.

Personnel Acknowledgements: Bruce Watson, YN Biologist, is collaborating with Dr. Todd Pearsons and Kenneth Ham, WDFW Biologist on this task.

Task 4.e Yakima River Spring Chinook Competition/Prey Index

This task is assigned to WDFW and they will report on its status in their annual progress report to BPA.

Task 4.f Upper Yakima Spring Chinook NTTOC Monitoring

This task is assigned to WDFW and they will report on its status in their annual progress report to BPA.

Task 4.g Pathogen Sampling

This task is assigned to WDFW and they will report on its status in their annual progress report to BPA.

5. CONCLUSION

This concludes the report for this time period for the M&E Contract. We request any constructive recommendations on how this report can be improved upon. On behalf of the Yakama Nation's YKFP personnel, we respectively hope that this report meets or exceeds the requirements.