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DOC NO. 88428

Public Utility District No. 1 of Douglas County

1151 Valley Mall Parkway • East Wenatchee, Washington 98802-4497 • 509/884-7191 • FAX 509/884-0553

April 19, 2005

Ms. Magalie Salas, Secretary
Federal Energy Regulatory Commission
888 1st Street N.E.
Washington, D. C. 20426

Subject: Wells Hydroelectric Project - FERC No. 2149 WA
Annual Report - Fish Settlement Agreement

Dear Ms. Salas:

In accordance with paragraph E of the order approving the Settlement Agreement issued January 24, 1991, Public Utility District No.1 of Douglas County submits the enclosed annual report of activities related to this Settlement Agreement. A copy of the January 24, 1991 order is enclosed for your reference.

As directed by the order, the annual report addresses activities during the previous year. This annual report covers activities performed in 2004.

On June 21, 2004, the Federal Energy Regulatory Commission approved the Anadromous Fish Agreement and Habitat Conservation Plan (HCP) for the operation of the Wells Project. The HCP will cover all anadromous fish issues that were part of the Wells Settlement Agreement. The F.E.R.C. on rehearing of the June 21, 2004 Order, dismissed the Settlement Agreement on November 23, 2004 allowing the HCP to supersede the Wells Settlement Agreement. This is the final annual report under the Settlement Agreement and will cover the period from January 1 through June 20, 2004. The planning, studies and coordination required in the Settlement Agreement forum were carried over into the HCP. Issues that continue after June 21, 2004 will be covered in the annual report of the Wells HCP.

Very truly yours,

Robert W. Clubb

Robert W. Clubb, Ph.D.
Chief of Environmental & Regulatory Services

c: (with report, but not appendices)

Ms. Carmen Andonaegui	Mr. James Hastreiter
Mr. Ron Boyce	Mr. Robert Heinith
Mr. Brian Cates	Mr. Garfield Jeffers
Mr. Tom Dresser	Mr. Jerry Marco
Mr. Mark Eames	Mr. Jon Miyashiro
Mr. Mike Erho	Mr. Mark Quehrn
Mr. Cary Feldmann	Mr. Steve Saugee
Mr. William Frymire	Mr. Shaun Seaman
Mr. Ritchie Graves	Mr. Nolin Shishido
Mr. Harry Hall	Mr. Tim Weaver

54 FERC ¶ 61,056

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Martin L. Allday, Chairman;
Charles A. Trabandt, Elizabeth Anne Moler,
Jerry J. Langdon and Branko Terzic.

Public Utility District No. 1 of Douglas County, Washington	))	Project No. 2149-002 Docket No. E-9569-002

ORDER APPROVING SETTLEMENT AGREEMENT

(Issued January 24, 1991)

This is the most recent of a series of settlement agreements that have emerged from our consolidated proceeding on anadromous fish issues on the mid-Columbia River in Washington State. Before us today is a comprehensive, uncontested, long-term settlement of such issues arising out of the operation of Wells Project No. 2149, located in Douglas and Okanogan Counties, Washington. We will approve the settlement, with clarifications and conditions that are consistent with our approval of related recent settlements.

BACKGROUND

In 1979, the Commission consolidated and set for hearing in Docket No. E-9569 a set of related petitions seeking modification of the operation of five licensed projects on the mid-Columbia River to protect and enhance salmon and steelhead trout. 1/ The petitions were filed by various state and federal fishery agencies and Indian tribes, and sought to protect anadromous fish migration downstream through project facilities. Wells Project No. 2149 was one of the five projects. The proceeding has generated a series of interim and long-term settlements. Most recently, the Commission approved long-term settlements resolving the Vernita Bar Phase (Priest Rapids Dam) of the proceeding, 2/ and issues involving Rock Island Project No. 943-002 (Chelan County). 3/ We also have had occasion to approve a settlement of fishery issues in Project No. 2149-017, a related proceeding

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1/ 6 FERC ¶ 61,210 (1979).

2/ 45 FERC ¶ 61,401 (1988).

3/ 46 FERC ¶ 61,033 (1989).

involving the raising of the surface elevation of the reservoir. 4/

On October 30, 1990, the parties in the above-captioned proceeding filed an offer of settlement with the presiding administrative law judge. On November 19, 1990, the Commission's trial staff filed comments in support of the settlement. On December 4, 1990, the presiding administrative law judge certified the settlement and the staff's comments to the Commission for decision.

The parties to the settlement are Public Utility District No. 1 of Douglas County, Washington (the PUD); Puget Sound Power & Light Company, Pacific Power and Light Company, the Washington Water Power Company, and Portland General Electric Company (collectively, the Power Purchasers); and the Washington Department of Fisheries, the Washington Department of Wildlife, the Oregon Department of Fish and Wildlife, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the Confederated Tribes and Bands of the Yakima Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Colville Reservation (collectively, the Joint Fishery Parties).

As summarized by the trial staff in its comments, the settlement agreement provides for the following.

The agreement has a term from its execution date to the expiration of the license (2012) plus any annual licenses. During that time, the agreement is intended to satisfy the PUD's obligations under Article 41 of the license. The agreement is not subject to modification prior to March 1, 2004. There are procedures (discussed, in part, below) for the resolution of disputes.

The PUD has agreed to provide juvenile and adult fish passage and a hatchery program. The juvenile fish passage system will be a program of controlled spills using five bypass baffles. The agreement specifies criteria for the operation, timing, and performance of the bypass system. The adult passage system will use the existing fish ladder. Criteria are established for water depth over the weirs, entrance gate settings, and jet and trashrack operations.

The PUD's hatchery program is designed to mitigate fish passage losses at the Wells Project. The physical structures include adult collection sites, a central hatchery facility and acclimation facilities. The amount of compensation is to be

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4/ 30 FERC ¶ 61,285 (1985).

determined by a formula using a five-year running average of adult runs by species. In 1991, the PUD will produce spring chinook yearlings, sockeye juveniles, and steelhead smolts. The production will then be evaluated and, based on those results, the PUD will either increase sockeye production or eliminate sockeye production and add production of summer chinook juveniles.

At completion of a project juvenile mortality/survival study, adjustment will be made to production levels, except for steelhead, to reflect the differences between the mortality rate developed in the study and the mortality rate assumed in developing the original production amounts. Adjustments will also be made to compensate for any unavoidable and unmitigated adult losses.

Once the five-year rolling average estimate of the juvenile run size reaches 110 percent of the estimated juvenile production used to establish the original production, the Joint Fisheries Parties can request a compensation increase in juvenile run size, except for steelhead.

The settlement also provides for continued studies and evaluations of the program. Studies will also be conducted on the potential unutilized habitat and on establishing sockeye in new habitat. The studies will be conducted under the direction of the Wells Project Coordinating Committee, which will be composed of one technical representative of each signatory to the agreement.

The Joint Fisheries Parties agree with the PUD that the Wells Project portion of the proceeding in Docket No. E-9569 should be terminated. These parties also agree to support the PUD when it requests relicensing of the project. The Joint Fisheries Parties further are of the view that the PUD's performance of its responsibilities under the agreement satisfies the PUD's fish protection and compensation obligations under the Federal Power Act and all other applicable laws and regulations.

In their offer of settlement, the parties indicate that it represents the culmination of two years of intensive negotiation, and that it "is intended to resolve, at least until March 1, 2004, the anadromous fish issues" pending in the proceeding.

The trial staff, in its comments supporting the settlement, requests that the Commission "make clear that the Commission's authority to require changes in structures and operations, should the need arise, is preserved" during the period when the settlement is not subject to modification. The trial staff also suggests adding certain reporting requirements to enable the

Commission to monitor compliance with the settlement. The trial staff does not propose modification of any of the substantive terms of the settlement, and no party opposes the settlement.

DISCUSSION

As we noted in approving an earlier settlement in this proceeding, 5/ the issues have been thoroughly ventilated and debated, and the settlement agreement is the result of a concerted effort to resolve these important matters in a way that is acceptable to all of the participants. We commend the participants for their efforts. We believe the settlement agreement is in the public interest, and we will adopt it. The agreement balances the continued operation of the project with an effective, long-term program for protection, mitigation, and enhancement of the fishery resources affected by the project.

We will clarify the dispute resolution provisions of the settlement agreement in the same manner as we did in our above-cited 1988 and 1989 orders approving related settlements. 6/ Section I.D. of the settlement agreement provides that, if the Wells Project Coordinating Committee cannot resolve a dispute among the signatories and if the amount in controversy is less than $325,000, then any party may request the Commission to refer the dispute to (1) the presiding judge in the mid-Columbia Proceeding, Docket No. E-9569, (2) the Commission's Chief Administrative Law Judge, or (3) the Division of Project Compliance and Administration, Office of Hydropower Licensing, "in the order listed," for expedited review. For the reasons stated in our prior orders, the Commission will in most cases refer such disputes to the Division of Project Compliance and Administration, and will use its best efforts to resolve such disputes within the time frames set forth in the agreement. In appropriate circumstances, such as when there are material facts in dispute, we may refer a matter to an administrative law judge. In either event, the initial staff decision will be subject to *de novo* review by the Commission. And, as we emphasized in our 1989 order, any resolution by the Coordinating Committee, or a third party, pursuant to Section I.D. that contemplates a change in the license or in the operation of the project thereunder shall result in the filing of an appropriate application therefor by the licensee as soon as practicable after the dispute is resolved.

5/ *See* 45 FERC at p. 62,259.

6/ *See* 45 FERC at pp. 62,259-60 and 46 FERC at p. 61,197.

As we noted in our prior orders with respect to the settlements approved therein, 7/ approval of the settlement agreement does not affect the Commission's authority, as reserved in the license, to require, after notice and opportunity for hearing, alterations to project facilities or operations that may be warranted by changed circumstances. We intend that any such reserved authority would be exercised only after full consideration of the benefit sought to be achieved thereby, balanced against the possibility that as a consequence the settlement could be voided, thereby eliminating the benefits obtained thereunder. If any party voids the agreement, the licensee shall, within 30 days, so inform the Commission in writing.

Finally, we will adopt the reporting provisions proposed by the trial staff in its comments.

<u>The Commission orders</u>:

(A) The settlement agreement filed in this proceeding on December 4, 1990, is approved and made a part of the license for Wells Project No. 2149.

(B) The Wells Project No. 2149 portion of the proceeding in Docket No. E-9569 is terminated.

(C) The Commission's approval of the settlement agreement shall not constitute approval of, or precedent regarding, any principle or issue in these or any other proceedings.

(D)(1) Whenever a violation of the settlement agreement occurs, the licensee shall, within 30 days of the occurrence, file with the Commission, and send a copy to the Regional Office, a report containing an explanation of the circumstances surrounding the violation and the licensee's plan to avoid any repetition thereof.

(2) Whenever a dispute arises under Section I.D. of the settlement agreement that is resolved without referral to the Commission, the licensee shall, within 30 days, file with the Commission, and send a copy to the Regional Office, a report containing an explanation of the dispute and the nature of the resolution.

7/ <u>See</u> 45 FERC at p. 62,260 and 46 FERC at p. 61,198.

(E) The licensee: (a) shall notify the Commission and the Commission's Portland Regional Office of all meetings of the Coordinating Committee; (b) shall file functional design drawings, including all information required by 18 C.F.R. § 380.3, at least 90 days prior to construction of any facilities under the agreement; (c) shall file for approval all changes in monitoring, evaluation, study and production plans, not specified in the agreement; and (d) shall file an annual report. The annual report shall be filed on April 30 of each year and shall include:

(1) A description of plans developed during the previous year for any studies, evaluations, monitoring programs, production programs, system operations, or fish passage efforts;

(2) The results of all studies, evaluations and monitoring of the previous year;

(3) An outline of all actions taken towards fulfillment of the terms of the agreement;

(4) An explanation of the reasons for exercising specific alternatives stipulated in the agreement;

(5) A chronology of compliance for the previous year, outlining schedule changes, the reasons for the changes, and documentation that the Joint Agencies were consulted prior to implementation of the changes;

(6) A schedule of activities for the next year; and,

(7) Summaries or meeting minutes from each of the meetings of the Coordinating Committee for the previous year.

(F) This order is final unless a request for rehearing is filed within 30 days from the date of its issuance, as provided in Section 313(a) of the Federal Power Act. The filing of a request for rehearing does not operate as a stay of the effective date of this order or of any other date specified in this order, except as specifically ordered by the Commission. The licensee's failure to file a request for rehearing shall constitute acceptance of the order.

By the Commission.

(S E A L)

Lois D. Cashell
Lois D. Cashell,
Secretary.

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

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Report to

the Federal Energy Regulatory Commission
of Activities under the Long-Term Settlement Agreement
between Fisheries Agencies and Tribes
and Public Utility District No. 1
of Douglas County
for the 2004 Calendar Year

Wells Hydroelectric Project

F.E.R.C. Project No. 2149

Public Utility District No. 1
of Douglas County, Washington
1151 Valley Mall Parkway
East Wenatchee, WA 98802-4497

April 2005

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Foreword

On January 24, 1991, the Federal Energy Regulatory Commission approved the Wells Settlement Agreement to resolve anadromous fish issues for the Wells Hydroelectric Project on the Columbia River in Washington State. The Agreement was a product of negotiations with state and federal fisheries agencies and tribes on the operations of the Wells Project (No. 2149). The F.E.R.C. directed that Douglas PUD, as the licensee for the Wells Project, has certain reporting responsibilities. This document is intended to fulfill portion (E)(d) of Order requiring the licensee to file an annual report of Settlement Agreement activities by April 30th of the following year.

On June 21, 2004 the F.E.R.C. approved the Wells Anadromous Fish Agreement and Habitat Conservation Plan (Wells HCP). . The Wells HCP is now the agreement covering all of the anadromous fish issues at the Wells Project. On November 23, 2004, the F.E.R.C., on rehearing of the June 21, 2004 Order, explicitly dismissed the Wells Settlement Agreement and replace the Settlement Agreement with the Wells HCP. This is the fifteenth (and final) annual report under the Settlement Agreement. The time period covered by this annual report includes January 1 to June 20, 2004. Effective June 21, 2004, the planning, studies and coordination issues once covered by the Settlement Agreement coordinating committee were officially transferred to the Wells HCP coordinating committee. Issues that continue after June 21, 2004 will be covered in the annual reports of the Wells HCP.

Report to
the Federal Energy Regulatory Commission
of Activities under the Long-Term Settlement Agreement
between Fisheries Agencies and Tribes
and Public Utility District No. 1
of Douglas County
for the 2004 Calendar Year

(1) Development of Studies, Plans and Evaluations

The Public Utility District No. 1 of Douglas County (District) worked closely with fisheries agencies and tribes to carry out various studies and obligations specified in the Settlement Agreement. These included various monitoring studies and operation plans.

1.1 Annual Bypass System Operations Plan for 2004

The Settlement Agreement calls for the District to provide an Annual Bypass System Operational Plan to members of the Wells Coordinating Committee (WCC) by December each year. The District submitted a draft plan for 2004 that was identical to the approved plan in 2003 (04-1[1]). The Joint Fisheries Parties, through the negotiations of the Habitat Conservation Plan set a series of fixed dates. The fixed start date (April 12) was selected based upon an analysis of historical data to insure protection for at least 95 percent of the spring migrants. The end date of August 26 was selected to provide protection for 95 percent of the summer migrants. The WCC approved the Annual Bypass System Operation Plan (04-2). There was no need for Bypass Representatives in 2004 because of the fixed operation dates (Appendix A).

1.2 Habitat Conservation Plan

The Joint Fisheries Parties discussed the transition between the operations of the Settlement Agreement Coordinating Committee and the HCP Coordinating Committee.. Chelan and Douglas PUDs submitted license amendment applications in November 2003 (04-1). The signature parties to the Wells HCP by December 2004 were the National Marine Fisheries Service, U.S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, Colville Confederated Tribes, the Power Purchasers for the Wells Project and Douglas PUD). The technical merits of the three HCPs were explained to the public, FERC Commissioners and staff on February 11. The signing parties asked FERC to approve the HCP by March 1, 2004, to delete the Settlement Agreement from the Wells Project license and to insert, in its place, the Wells HCP (04-1). At the end of March, the F.E.R.C. was waiting for the US Fish and Wildlife

[1] 04-1 Referrers to minutes from the first meeting of the Wells Coordinating Committee in 2004.

Service to issue a Biological Opinion and Incidental Take Statement on bull trout (04-2). The processing delayed FERC approval of the HCPs from March 2004 to June 2004. (04-2).

1.3 2004 Broodstock Protocol

The Washington Department of Fish and Wildlife (WDFW) presented a draft Broodstock protocol document for review on April 15 (Appendix B). The Protocol gave a forecast of the various populations of salmon and steelhead in the mid-Columbia area. Broodstock collection figures reflected the proposed HCP production requirements. For Douglas PUD, obligations would be reduced to reflect the 96.2% survival rate at Wells, thus requiring less broodstock.

Bob Clubb of Douglas PUD requested Kristine Petersen of NOAA Fisheries to give an update on the status of Section 10 Permit 1196, issued to the WDFW and to Douglas and Chelan PUD's (04-3). NOAA Fisheries had not reissued the permit because WDFW would not agree to a new provision requiring that a certain percentage of wild brood to be part of the collection numbers (04-3). WDFW wanted flexibility to use a larger percentage of hatchery brood when wild broodstock were hard to obtain. The lack of Section 10 coverage at the start of May had the potential to jeopardize the collection of spring Chinook broodstock (04-3). The Permit was issued with the understanding the ratio of wild and hatchery fish will be resolved at a latter date.

Shane Bickford of Douglas PUD raised the issue that once the HCP was approved, the obligation for spring Chinook would move from 450,000 to 286,000 smolts (04-3). If the HCP were approved after eggs were collected, then Douglas PUD would be expected to raise the extra eggs out to release. Douglas PUD's spring Chinook obligation under the HCP (Section 8.4.3) will be further reduced to 61,071 smolts starting with the 2004 brood There was mention that discussions were underway with Grant PUD to pick up "available rearing capacity" once Douglas PUD obligation was further reduced. This would help maintain the full capacity of 550,000 smolts at the Methow Hatchery (04-3). NOAA Fisheries had approved the Grant PUD Biological Opinion, for Priest Rapids Dam, which cleared the way for Grant to pay Douglas PUD to raise 201,000 spring Chinook at the Methow Hatchery.

1.4 Tributary Trap sub-Committee

Representatives of the Joint Fisheries Parties (JFP) from both the Wells Settlement Agreement and Wells HCP forums met to discuss ways to improve trap efficiency for brood collection in tributaries (04-1). The District had developed a plan for a new trapping facility on the Chewuch River. The JFP provided input on the issues of hydraulic scour, location of live box and weir protection in high flow events (04-1). Concerns would be incorporated into the design (04-2).

Permit applications had been submitted and approval was pending for modification to the broodstock trap on the Twisp River (04-1). Permits were issued too late for construction in the winter and spring of 2004. 2004 brood stock collection plans were moved back following the news that a new trap would not be available on the Twisp River system until early 2005 (04-2).

1.5 Fish – Water Management Tool for Sockeye

In 2002, the Wells Coordinating Committee (WCC) provided conditioned approval for Douglas PUD and Canadian Fisheries Parties in the Okanagan Basin to develop a Fish & Water Management Tool (FWMT) designed to improve rearing conditions for sockeye salmon as a mitigative instrument for the Wells Project. The model uses real time physical data (river flow and temperatures) and biological data (location of redds and stage of egg development) to predict how water releases from Lake Okanagan may impact sockeye and kokanee populations. A presentation by the Canadian fisheries parties to the WCC was completed at the 2004 June (04-2) Coordinating Committee meeting. Following this presentation and FERC approval of the Wells HCP, the flow management tool was ultimately approved by the Wells HCP Coordinating Committee and Wells HCP Hatchery Committee as the preferred mitigation package for sockeye losses at the Wells Project. Details regarding approval of the flow management program are contained within the HCP Coordinating Committee Annual Report.

1.6 Twisp Pond Screen Improvements

The District proposed improvements to the screens at the Twisp River Acclimation Ponds. The original design provided adequate screening under all but severe freshet conditions. During severe freshets the screens were not able to self clean. The proposed change would move the screen from a flat surface to a submerged slanted surface. Features such as sweeping flows across the screens and an air-burst system to lift and move debris were proposed. The design work was developed in collaboration with engineers from the NOAA Fisheries and the Washington Department of Fish and Wildlife. After the approval of the HCP, all permitting was received and construction initiated.

(2) Results of Studies, Evaluations and Monitoring Efforts

2.1 Operation of the Juvenile Bypass

The Bypass was operated in accordance with HCP parameters. The spring bypass started on April 12 at 0000 hours and ran through June 13 at 2400 hours. Spring operations covered 63 days with a flow of 1.1 million-acre feet (MAF), or 8.1% of the total discharge. During spring bypass, there were 3 hours (0.2% of the hours) of forced spill. Summer bypass started on June 14 at 0000 hours and ran until August 26 at 2400 hours, for a total of 74 days. There was 1.1 MAF or 6.9% of the total discharge dedicated to summer bypass. During summer bypass, there was no forced spill (Appendix C).

2.2 Fish - Water Management Tool for Sockeye

Bryan Symonds (Ministry of Water, Air and Land Protection) presented the history of how water is regulated through the Okanogan drainage. The system is complicated to operate. Damage can occur to property from flooding and/or to fish eggs in the gravel from desiccation or scour.

Water managers have needed information on weather forecasts and stage of development of incubating sockeye and kokanee eggs to effectively manage the sockeye/kokanee resource.

Kim Hyatt (Department of Fisheries and Oceans) pointed out competing interests in the development of the FWMT between kokanee and sockeye resources (04-4). The intention of the FWMT is to present water management decisions in a more "fish friendly" fashion, while avoiding increases to losses in property damage. Early investigations of a possible FWMT suggested that a 10 – 15 percent gain in sockeye production may be possible. The computer program was built from a group of sub-models with input from local experts in fish and water management. After members were satisfied with the operation, a 25 year retrospective analysis was performed. The FWMT requires annual input on 1) migration and spawning timing, 2) spawner distribution, 3) spawning area (controlled by flow), 4) total egg deposition. The model has a series of "rules" that show amounts of water and status of the fish, from returning spawners to emerging fry. There is also a component to help relieve the late summer high temperature low oxygen squeeze.

Clint Alexander (ESSA) said the FWMT uses real time information to develop forecasts to understand how low, and high water conditions may impact a variety of resources (04-4).

Kim Hyatt said that a retrospective analysis for 25 years was run with the FWMT and apprentice water managers. The result of this analysis was compared to actual water decisions over those years to the operations made using the tool. The FWMT provided an average improvement to sockeye production of 55 percent. The greatest benefit came in years with high water flows (04-4). Hyatt mentioned that while there is still one additional year of model development, the Canadian Parties were very pleased with the results to date. Ritchie Graves expressed that the FWMT was consistent with the interests of NOAA Fisheries, by improving conditions for natural production (04-4).

2.3 Sockeye Sampling at Wells Dam

The Columbia River Inter Tribal Fisheries Commission (CRITFC) requested access to the Wells trapping facilities to conduct research on adult sockeye salmon. CRITFC samples sockeye in the lower Columbia River at Bonneville to gather information on stock strength and characteristics of the two major sockeye runs (Wenatchee and Okanogan). Sampling scales from adult sockeye to help verify early freshwater growth patterns are generally done at Wells Dam for Okanogan destine fish and at Tumwater Dam for Lake Wenatchee fish. The WCC approved the requests for access to the Wells Dam (04-3).

2.4 Dissolved Gas Monitoring

The volume of discharge in the Columbia River, April through August of 2004, was 84.3 percent of the twenty year average at Wells Dam. Monitoring of total dissolved gas showed a range of the 12-hour daily high values from 102 – 113 percent in the forebay and from 102 - 113 percent in the tailrace. There were three hours of forced spill that occurred do to reservoir elevation control in 2004. These events did little to change tailwater TDG.

2.5 Spring Chinook Salmon Hatchery

The Methow Spring Chinook Supplementation Hatchery released 493,547 yearling fish in 2004. The releases were made up of 58,074 fish into the Twisp River, 181,235 into the Methow River and 254,238 into the Chewuch River. Total pounds of spring chinook released for this brood year was close to 33,000 pounds. All of these fish were marked with coded wire tags. In addition, 20,000 yearlings were marked with PIT tags, half of the fish from anadromous parents and half from captive brood parents.

The 2003 brood year production in June 2004 was comprised of at total of 320,323 fish for the Methow Composite, Chewuch and Twisp populations. These fish will be released in the spring of 2005 from acclimation ponds.

The 2004 broodstock were collected at the Methow Hatchery outfall, Fog Horn Dam trap, Chewuch Dam trap, Fulton Dam trap and Twisp trap. The Twisp trap was modified by moving the live box out from the bank. Trapping on the Chewuch was conducted at the Fulton Dam plus a new location at, Chewuch Dam. The majority of the brood collection occurred after the F.E.R.C. accepted the Wells HCP. Further details of broodstock collection can be found in the Annual report of the Wells HCP.

Evaluation reports of the facilities were completed on the 2000 and 2001 broodyear production (Appendix D and E). An evaluation report on natural production in 2000 and 2002 for the Methow drainage was completed in 2004 (Appendix F). This investigation is being conducted in part to increase the understanding of potential impacts from hatchery operations on natural production.

2.6 Bulltrout Telemetry Study

Forty bull trout were collected from the fishways at Wells, Rocky Reach and Rock Island dams and surgically fitted with radio transmitters in 2002. Monitoring for these fish was initiated in 2002 and continued through 2004. Monitors were placed around the fishways at four of the mid-Columbia dams (Wanapum, Rock Island, Rocky Reach and Wells dams), the forebay and tailrace of those dams and along the tributaries that fed this portion of the Columbia River. In addition, aerial flights and boat surveys were made monthly to help track bull trout. The final report from monitoring activities conducted during 2002 and 2003 was published in 2004. Fish tagged in 2002 had a mean ladder passage time at Wells Dam ranged from 5.04 to 7.7 hours (right to left ladders) and from the Wells forebay to the mouth of the Methow River was 5.8 days (Appendix G)

2.7 Wells Dam Adult PIT-tag Interrogation System Counts

The District placed a PIT-tag interrogation system in the both Wells Dam fish ladders in 2002 to fulfill a conservation recommendation of the 2000 Wells Biological Opinion. The newly installed system was evaluated with 189 PIT-tagged adult sockeye salmon plus 1,315 additional PIT-tagged salmon and steelhead. Detection for all species was estimated to be 100 percent (Appendix H).

During the 2004 migration, the adult PIT-tag detection system at Wells Dam detected 139 spring chinook, 916 summer/fall chinook, 1133 steelhead, 3 coho and 14 sockeye.

(3) Outline of Action Taken Toward Fulfillment of the Settlement Agreement

3.1 Methow Spring Chinook Facility

The Settlement Agreement calls for a hatchery based compensation program for spring chinook composed of multiple adult collection sites; a central hatchery facility for incubation, early rearing, and adult holding; and three acclimation facilities for final rearing (Agreement IV). During 2004, hatchery personnel reared and released progeny from adults that returned in 2002 and reared progeny from adults that returned in 2003. They also collected broodstock and incubated eggs from 2004 broodyear returning adults.

The Settlement Agreement calls for an evaluation of the hatchery program impact on the donor populations. Several aspects of the hatchery facility as well as the effects of the hatchery on natural production within in the Methow Basin were evaluated during 2004 including the completion of spring chinook and steelhead spawning ground surveys, smolt outmigrant trapping and evaluation. (Appendix F).

3.2 Contract for Professional Services in Implementing the Settlement Agreement

During 2004, the District contracted with Mike Erho to serve as Studies Coordinator for the Wells Coordinating Committee. Mr. Erho also serves as coordinator for the Mid-Columbia Coordinating Committee and Rock Island Coordinating Committee. The District also contracted with Dr. Skalski to provide statistical evaluation of methods and studies.

3.3 Juvenile and Adult Fish Passage Operations at Wells Dam

During 2004, the juvenile bypass system operated as per conditions outlined in the Settlement Agreement (II, C, D and F). The Coordinating Committee recommended bypass operations based upon information collected during previous years of hydroacoustics and fyke net samples at Wells. The two adult ladders operated per criteria agreed to by the fisheries agencies and tribes.

3.4 Steelhead Production at Wells Hatchery

The Settlement Agreement specified that the District fund additional steelhead compensation of 30,000 pounds at 6 fish per pound after 1991 (IV.3.a), bringing the total obligation to 80,000 pounds. Records from the Wells Hatchery show that 355,935 steelhead or 59,322 pounds were liberated in 2004.

Reports on 2000 and 2001 broodyear steelhead production at the Wells hatchery were prepared in 2004. These reports are found in the Appendix I and J. A report on steelhead spawning in the Methow River was prepared and released this year (Appendix K).

In addition to conducting evaluations of the adequacy of the hatchery facilities, Douglas PUD also provided funding to evaluate the effect of hatchery steelhead on the Methow Basin population of steelhead. This assessment included escapement monitoring and smolt outmigration monitoring. (Appendix F and K).

3.5 Other Actions Toward Fulfillment of the Settlement Agreement

The District funded evaluations and studies that are part of the District's responsibility in the Settlement Agreement. These were described in Sections 2 and 3.

(4) Explanation of Alternatives Chosen

No operational or mitigation alternatives were selected during the 2004 time period.

(5) Chronology of Compliance for 2004

Items (3) and (4) above contain chronology of compliance in 2004. Documentation that the Joint Fisheries Parties were consulted prior to implementation of changes is provided in the minutes of the Wells Coordinating Committee. These records are included as Appendix L.

(6) Schedule of Activities for 2005

Section six of this report is dedicated to the activities of the upcoming year. Since the F.E.R.C. dismissed the Settlement Agreement on November 23, 2004, this is the final report under the Wells Settlement Agreement.. In the future, refer to the Annual report of the Wells HCP.

(7) Minutes of Meetings

7.1 Minutes of the Wells Coordinating Committee for 2004

The Wells Project was removed from the mid-Columbia proceedings on January 24, 1991 as the Settlement Agreement between the fisheries agencies and tribes was approved by F.E.R.C. Minutes from the meetings of the WCC for 2004 are attached as Appendix L.

Table of Appendices

Appendix N

The Long-Term Settlement Agreement for the Wells Hydroelectric Project

Appendix O

F.E.R.C. Order dismissing the Wells Settlement Agreement

<u>ANNUAL BYPASS OPERATION PLAN</u>
<u>YEAR 2004</u>

APPENDIX A

WELLS HYDROELECTRIC PROJECT
JUVENILE BYPASS SYSTEM OPERATIONS PLAN
for the 2004 Bypass Season

The Wells Long Term Settlement Agreement (II.F.1) specifies that Douglas PUD will submit an Annual Operations Plan for the bypass to the Wells Coordinating Committee prior to the spring migration. This plan will be reviewed and approved by the Committee by March 1. This plan will also be available for the Habitat Conservation Plan Coordinating Committee for bypass operations in 2004 .

The Bypass System

The PUD will install five bypass barriers in spill gates of the Wells Project. The bypass will operate per criteria in the Settlement Agreement (II.C, E). [HCP 4.3.1]

Operation Criteria

The operation criteria includes operation of the bypass in partnership with adjacent turbine units, the amount of water required for bypass operation and criteria for full bypass system operation.

Bypass Operations Timing Criteria

The bypass will be in place from two weeks before predicted start of the migration until two weeks after the migration is complete.

Projected Hatchery Releases above Wells Dam

Estimated hatchery releases for 2004 above Wells Dam are as follows:

Facility	Species	No. in thousands	Dates
Winthrop (USFWS)	Spr. Chinook	580	4/15
Methow (WDFW)	Spr. Chinook	490	4/15
OTID Elisford (CCT)	Spr. Chinook	100	4/15
Omak Creek (CCT)	Spr. Chinook	50	4/15
Carlton (WDFW)	Sum. Chinook	310	4/15
Similkameen (WDFW)	Sum. Chinook	250	4/15
Bonapart Pond (CCT)	Sum. Chinook	70	4/15
Wells (WDFW)	Sum. Steelhead	385	4/20
Winthrop (USFWS)	Sum. Steelhead	115	5/01
Omak Creek (CCT)	Sum. Steelhead	9	5/01
Winthrop (USFWS)	Coho	220	4/25

Starting Dates and Ending Dates

The HCP provides for planng dates for the start and completion of bypass operation of April 10 through August 15. Previously, fyke netting and hydroacoustics provided the Wells Bypass Team information on the start of the juvenile migration as it reached Wells Dam. Starting in 2003, the bypass was initiated based upon set dates of April 12 through August 26 at the recomondation of the HCP Coordinating Committee. These fixed dates were established from 21 years of hydroacoustic and 14 years of species composition information collected on juvenile run patterns at Wells Dam. The bypass operation is divided into a spring and summer period. The end of the spring period was set at June 13 at 2400 hours. The summer bypass stared on June 14 at 0000 hours.

For 2004, based upon the historical run records, the dates of April 12 through 26 are again proposed.

The HCP coordinating committee will decide the start and end of bypass operation.

(01/09/04)

2004 UPPER COLUMBIA RIVER SALMON AND STEELHEAD ESCAPEMENT AND BROODSTOCK FORECASTS

APPENDIX B

STATE OF WASHINGTON
DEPARTMENT OF FISH AND WILDLIFE
Mid-Columbia Field Office
3515 Chelan Hwy 97-A Wenatchee, WA 98801 (509) 664-3148 FAX (509) 662-6606

15 April 2004

To: Joint Fishery Parties / Mid-Columbia Coordinating Committee

From: Laura Praye and Andrew Murdoch

Subject: **2004 UPPER COLUMBIA RIVER SALMON AND STEELHEAD ESCAPEMENT AND BROODSTOCK FORECASTS**

The draft adult broodstock collection protocol for year 2004 is keyed on target numbers at various collection sites operated by the Washington Department of Fish and Wildlife (WDFW) that provide broodstock for Mid-Columbia Public Utility District (PUD) mitigation program facilities. Hatchery programs or facilities operated by other agencies or tribes are not addressed in the document with the exception of the Methow Basin spring chinook production and supplementation programs, and the Northwest Power Planning Council (NWPPC) Coho Reintroduction Program. This adult broodstock collection protocol is to be considered an interim and dynamic hatchery broodstock collection plan, which may be altered following Joint Fishery Party (JFP) discussions. As such, there may be significant in-season changes in broodstock numbers, locations, or collection times, brought about through continuing co-manager consultation and in-season monitoring of the anadromous fish runs to the Columbia River above Priest Rapids Dam.

The year 2004 outlook for ESA-listed upper Columbia River spring chinook is slightly greater than the 2003 return. The Technical Advisory Committee (TAC) forecast for upper Columbia spring chinook is 110% of last years return at the mouth of the Columbia River. Upper Columbia summer chinook returns are expected to be approximately 83% of the 2003 return, while sockeye are expected to 104% of the 2003 return to the mouth of the Columbia River. The A-run steelhead component, which includes upper Columbia stocks, is forecast to be 101% of the 2003 run to Bonneville Dam (Table 1).

The spring chinook collection protocols will target specific populations of fish in the Methow Basin through broodstock collections in tributary locations rather than collections at Wells Dam. Broodstock collection protocols for Wenatchee River spring and summer chinook, Methow/Okanogan summer chinook, Wells stock steelhead and Wenatchee stock steelhead will target an increased proportion of wild origin fish for inclusion in the broodstock. With each upper Columbia River stock, if the run size is limited, then the wild component objective within the broodstock collection will be adjusted in order to meet program.

Table 1. Columbia River Mouth Fish Forecasts

			2003 Forecast	2003 Return	2004 Forecast
Spring chinook	Willamette		109,800	126,600	109,400
	Sandy		4,800	6,400	5,200
	Cowlitz		4,900	13,400	15,900
	Kalama		3,600	5,100	6,000
	Lewis		3,100	4,200	5,400
	Upriver		145,400	209,100	360,700
	Wind		14,300	21,500	12,700
	Drano Lake		6,500	10,600	8,400
	Klickitat		3,700	3,900	3,500
	Yakima		6,400	4,900	19,200
	Snake River	Total	72,500	107,100	167,000
	Upper Columbia	**Total**	13,200	25,600	28,200
	Upper Columbia	Wild	1,300	2,600	3,400
Summer chinook	Upriver		87,600	116,900	102,800
	Snake River	Total	19,300	33,800	33,700
	Upper Columbia	Total	68,300	83,100	69,100
Spring/Summer	Snake River	Total	91,800	140,900	200,700
	Snake River	Wild	32,700	62,300	46,200
Fall chinook [1]	LRH - Lower River	Hatch.	115,900	155,000	77,100
	LRW - Lower River	Wild	24,600	26,000	24,100
	BPH - Bonneville Pool	Hatch.	96,900	180,600	138,000
	URB - Upriver Bright		280,400	373,200	292,200
	MCB - Mid Col. Bright	Hatch.	104,800	150,300	90,400
	BUB - Bonn. Upr. Br.	Hatch.	61,900	82,700	40,000
	PUB - Pool Upr. Br.	Hatch.	42,900	67,500	50,400
	LRB - L. River Brights	Wild	1,800	NA	NA
	SAB - Select Area Br.	Hatch.	6,200	NA	NA
	Total		*630,600*	*885,000*	*621,800*
	Snake River	Wild	NA	NA	NA
Coho [1]	Early stock	Hatch.	440,000	645,700	316,600
	Late stock	Hatch.	377,900	248,000	274,700
	Total		*817,900*	*893,700*	*588,300*
Sockeye	Wenatchee		11,000	7,100	27,500
	Okanogan		11,000	32,300	53,000
	Snake River	Wild	80	28	154
	Total Upriver		*22,080*	*39,428*	*80,654*
Steelhead (big/little index) (at Bonneville)	Upriver Skamania Index	Hatch.	12,100	12,400	12,800
		Wild	4,500	1,800	6,500
		Total	*16,600*	*14,200*	*18,300*
	Upriver A-run Index	Hatch.	209,000	238,100	224,200
		Wild	70,600	66,400	82,400
		Total	*279,600*	*304,500*	*306,600*
	Upriver B-run Index	Hatch.	53,200	32,000	50,500
		Wild	11,500	6,500	12,700
		Total	*64,700*	*38,500*	*63,200*
	Upriver combined	Hatch.	274,300	282,500	287,500
		Wild	86,600	74,700	100,600
		Total	*360,900*	*357,200*	*388,100*

[1] *Represents ocean abundance estimate.*

Chelan County PUD Programs

Wenatchee Spring Chinook

The production level for spring chinook in the Wenatchee Basin will remain at 672,000 until 2013 under the Rock Island Habitat Conservation Plan (HCP). The HCP also authorizes the Hatchery Committee to make modifications to the initial production level. Although under the HCP the 7% No Net Impact (NNI) for spring chinook would be 298,853 smolts, the WDFW proposes resizing the Chiwawa Program to 336,000 smolts, beginning in 2005 contingent upon the start of Grant Co. PUD mitigation for Wenatchee spring chinook salmon in Nason and White rivers.

An estimated 1,182 spring chinook are expected to return to the Chiwawa River in 2004. With the projected run size of 776 wild fish to the Chiwawa River we would expect to have 60% wild origin in the broodstock (i.e., 29% of the wild return).

To partially address the straying of Chiwawa River hatchery origin fish, trapping at Tumwater Dam will be the focus of the hatchery origin portion of the broodstock collection. Infusion of wild origin fish collected at the Chiwawa Weir is also an important element to the success of recovery of the Wenatchee River spring chinook ESU. A more flexible trapping schedule at Chiwawa Weir and the use of Tumwater Dam to collect the hatchery fish will be critical changes to enhance our ability to collect fish authorized under the new 1196 Permit.

The White River spring chinook has been determined to be a genetically unique stock and shall be managed as a separate stock. If collection of spring chinook at Tumwater Dam is implemented, collection will be limited to hatchery origin only, thereby eliminating the potential to incorporate wild White River adults into the Chiwawa River hatchery supplementation program.

Progeny from the Nason Creek captive broodstock program may be reared at the Aquaseed facility in Rochester. The progeny may be reared to pre-smolt stage at Aquaseed, then acclimated and released into Nason Creek.

Wenatchee Summer Chinook

An estimated 9,000 wild summer chinook are expected to return to the Wenatchee Basin in 2004. Based on this escapement level there is a moderate probability of meeting 100% wild origin fish in the broodstock. Broodstock collection should begin two weeks earlier than current protocol to ensure the collection goal is achieved.

Methow/Okanogan Summer Chinook

The anticipated wild fish return to Methow and Okanogan basin is 16,000 fish. The Methow/Okanogan program should have a high probability of meeting 100% wild origin fish in their broodstock. Broodstock collection will occur per current protocol.

Wenatchee Sockeye

An estimated 27,500 (14,500 using smolt production estimate) sockeye are expected to return to Lake Wenatchee in 2004. Broodstock would be collected per protocol with a very high probability of meeting the broodstock goal of 100% wild origin fish.

Wenatchee Steelhead

An estimated 3,500 steelhead are forecasted to return to the Wenatchee basin in 2004. These levels are similar to returns in 2003 and would reflect a wild contribution of nearly 800 fish. Based on this escapement level there is a moderate probability of meeting 50% wild composition in the broodstock. Broodstock collection will be adjusted accordingly to include the use of Tumwater Dam to collect wild fish.

Douglas County PUD Programs

Methow Spring Chinook

Consistent with the BAMP (1998), Biological Opinion for ESA Section 10 Permit 1196, Permit 1196, and the NWPPC Methow River Subbasin Summary, WDFW proposes to collect spring chinook broodstock in a manner that reduces the Carson lineage within the supplementation production and consistent with the development of local tributary attributes. The collection protocol outlines tributary trapping on the Methow, Chewuch, and Twisp rivers and trapping at both the Winthrop NFH and Methow Fish Hatchery (FH).

In conjunction with the tributary trapping activities, Twisp River captive broodstock gametes (2004 brood) provided from adults held at the AquaSeed facility in Rochester, WA may be incorporated into the adult supplementation program. If the captive brood progeny in combination with the projected smolt production from the adult broodstock collection exceeds 513,000 smolts, the broodstock collection will be reduced accordingly. Further, should the Wells HCP be approved prior to the collection of eggs for the 2004 brood, then the protocol will target the collection of sufficient eggs to produce 349,000 smolts.

The 2004 forecast for ESA-listed Methow River spring chinook was calculated using data regarding natural production and hatchery survival from the Wenatchee River Basin (Table 2). These data were not available in a timely manner for the Methow River. In 2004, the estimated escapement to the Methow Basin is expected to be considerably higher than observed in 2003. The Methow and Chewuch River should experience a 200% increase. The Twisp River may increase as much as 1500% (Table 3).

Table 2. Data used in run forecast calculations.

Year	1999	2000	2001
Fecundity	4200	4200	4200
Egg to smolt	0.1	0.1	0.1
Smolt to adult-Wild	0.015	0.015	0.015

Smolt to adult-Hatchery	0.01	0.01	0.01

Table 3. Estimated number of hatchery and wild spring chinook returning to the Methow River in 2004.

	Brood Year			Adults Produced			2003 Adult Returns	2004 Adult Returns	Est. Escapement	Broodstock Goal Total H/W		Trap eff. Required
	1999	2000	2001	1999	2000	2001						
Twisp												
# redds	10	99	371	63	624	1,402	75	445	1,167	110	36	9.43%
Hatchery smolts	67,408	75,704	57,471	674	757	575		722			74	
% Ad-clipped	100	0	0									
Chewuch												
# redds	6	32	1,105	38	202	4,177	520	262	1,560	110	36	7.05%
Hatchery smolts	0	199,938	261,284	0	1,999	2,613		1,298			74	
% Ad-clipped	n/a	0	0									
Upper Methow												
# redds	16	299	2,353	101	1,443	8,894	831	1,183	2,279	110	36	4.83%
Hatchery smolts	180,775	66,454	130,887	1,808	665	1,309		1,095			74	
% Ad-clipped	100	0	0									
WNFH	377,696	172,718	461,678	3,777	1,727	4,617		2,552	2,552			
% Ad-clipped	100	0	0									

The preliminary spring chinook run forecast to Wells Dam (7,558) exceeds the minimum escapement of 964 fish identified in ESA Section 10 Permit 1196, where adult fish may be trapped at Wells Dam. The projected return to the Methow Basin is expected to be approximately 75% hatchery origin, 64% of which are expected to return to or near the Winthrop NFH and the Methow Fish Hatchery. Of the hatchery fish returning to the Methow FH, greater than 65% are expected to be 2000 Methow Composite stock, that have 17-19% Winthrop-Carson ancestry. The remaining age-5 and age-3 Methow Composite stock have 44%-51% and 23-33% Winthrop-Carson ancestry, respectively. Wild origin fish returns to the Methow Basin are expected to be 1,890 fish. The age structure of the wild origin returns in 2004 will be skewed towards age-3 (23%) and age-4 (73%) fish based on redd counts in 2001 and 2000. Age-5 fish would only comprise 4% of the wild returns versus the historical mean of 36%. This is a result of limited adult returns to the Methow basin in 1999 and poor in river smolt survival during the 2001 out migration.

Parental crosses for the mainstem Methow River will consist of wild origin and 1999, 2000, and 2001 MetComp, with minimal 1999 MetComp x 1999 MetComp hatchery origin crosses. The fish for the mainstem program will be collected primarily at the Methow FH. The remaining Methow FH production (up to the program objective of 550,000 smolts) will be contingent upon successful collection of wild origin chinook and age-3, age-4, and age-5 hatchery chinook at the Methow FH outfall, Foghorn Dam, Fulton Dam, Twisp River, plus the Twisp captive brood. The production designated for the Chewuch River will include 1999, 2000, and 2001 MetComp and wild origin parental outcrosses. The management of the Twisp stock remains stock specific and will be supported by the captive brood component currently at AquaSeed and any Twisp River wild and Twisp River hatchery origin fish that are collected in 2004 from any of the five collection locations (Twisp Weir, Winthrop NFH, Methow FH, Foghorn Dam, and Fulton Dam).

The WDFW will attempt to reduce the overall Carson ancestry influence within the Methow spring chinook broodstock by minimizing the number of crosses that contain high Carson ancestry (>50%). This will be the last year of returning adults from the high Carson ancestry 1999 brood. Continued retention of age-5 hatchery chinook (51.5% Carson) will be contingent upon collection of age-3 and age-4 hatchery fish, wild origin fish, cryopreserved milt at the Methow FH and available male component from the Twisp Captive Brood program (i.e. males not required for the captive brood program). This is also the last year adults (age-5) will be available from the Twisp River captive broodstock program. The estimated number of eggs from the captive broodstock program would not likely exceed 5,000.

In an effort to reduce the overall Carson ancestry in the 2004 brood and to improve smolt production levels, 2000 and 2001 MetComp males and wild males may be utilized twice as primary spawners. Additionally, Twisp anadromous and Twisp captive brood males may also be utilized twice as primary spawners.

The new tributary traps and improvements to existing traps planned for this spring will not be completed in the time for the 2004 trapping period due to permit delays. Tributary trapping efficiency would be similar to those experienced in previous years and Methow FH would likely collect the bulk of the fish. Additionally, WDFW personnel will seine the pool directly below Foghorn Dam twice a week in an effort to force fish into the trap. If seining fails to provide broodstock, angling may also be used to collect broodstock.

Wells Summer Chinook

Wells Fish Hatchery is anticipating 5,800 hatchery origin adults to return in 2004. Infusing 10% wild origin genes into the broodstock (126 fish) from the west ladder will minimize the risk of inbreeding depression, genetic drift, and domestication selection. Broodstock collection will occur per current protocol.

Wells Steelhead

An estimated 11,000 steelhead are expected to return to Wells Dam in 2004. A 10% wild origin component (10-year average) would result in 1,100 wild origin steelhead expected to return. Consistent with broodstock collection in 2003, a 33% wild origin component will provide opportunities to increase the HxW and WxW parental crosses for the 2005 brood year. A 33% wild origin component within the broodstock (128 fish) would result in approximately 12% extraction of the wild origin component arriving at Wells Dam.

Distribution List:

Mike Erho, for distribution to Mid-Columbia Coordinating Committee

Kris Petersen, NMFS

WDFW:

Bruce Sanford	Joe Foster	Rod Woodin	Ross Fuller
Craig Busack	Bill Tweit	Jon Anderson	Heather Bartlett
Cindy LeFleur	Rick Stilwater	Bob Jateff	
Art Viola	Bob Rogers	Charlie Snow	
Andrew Murdoch	John Easterbrooks	Chuck Johnson	

SUMMARY OF BYPASS OPERATIONS AT WELLS DAM, 2004

APPENDIX C

Commissioners:
MICHAEL DONEEN
T. JAMES DAVIS
LYNN M. HEMINGER

Chief Executive Officer/Manager:
WILLIAM C. DOBBINS

Public Utility District No.1 of Douglas County

1151 Valley Mall Parkway • East Wenatchee, Washington 98802-4497 • 509/884-7191 • FAX 509/884-0553

Memorandum

TO: Wells HCP Coordinating Committee

FROM: Shane Bickford, Douglas PUD

DATE: September 16, 2004

SUBJECT: Summary of 2004 Bypass Operations at Wells Dam

The 2004 spring outmigration at Wells Dam consisted of natural stream-type fish spawned during brood year 2002 and 2003. Escapement of stream-type fish included a spring chinook natural escapement of 6,626 adults (Wells Count minus hatchery broodstock), a sockeye escapement of 10,768 adults (Wells Count) and a relatively large steelhead escapements of 18,528 in 2001 and 9,478 in 2002 (Wells Counts).

Hatchery releases above Wells Dam included yearling spring chinook releases from the Chewuch, Twisp and Methow Acclimation Ponds, from the Winthrop National Fish Hatchery and from the Colville's Okanogan spring chinook reintroduction program. Coho were released from the Winthrop National Fish Hatchery and summer chinook yearlings were released from the Carlton, Similkameen and Bonapart Acclimation Ponds. Hatchery summer steelhead were released throughout the Methow and Okanogan rivers. Hatchery steelhead released above Wells Dam originate from the Wells, Winthrop and Omak steelhead programs.

The summer outmigration that passed Wells Dam consisted entirely of naturally produced ocean-type summer/fall chinook spawned during brood year 2003. Natural escapement of summer / fall chinook in 2003 was the second largest return since dam counts began at Wells Dam with a combined total of 54,644 fish counted at Wells Dam.

The initiation and termination of the Wells bypass in 2004 was guided by the Wells HCP Coordinating Committee. Operation of the bypass system was strictly guided by the Bypass Operating Plan contained within Section 4.3 of the Wells HCP Agreement. The initiation and termination dates for the bypass system in 2004 were based upon 21 years of hydroacoustic and 14 years of species composition information collected on hatchery and wild juvenile run patterns at Wells Dam. Based upon an analysis of the run-timing information at Wells Dam, the HCP Coordinating Committee agreed to initiate the Wells bypass system on April 12th. The analysis indicated that on average initiating the bypass system on April 12th would provide a non-turbine passage alternative for 95.5% of the spring migration. Similarly, shutting down the bypass system on August 26th, on average would provide bypass operation for 95% of the summer migration. The bypass system operated continuously during the transition period between the spring and summer juvenile fish migrations. For accounting purposes, the end to the 2004 spring bypass season was June 13th at 2400 hours and the beginning of the summer bypass season was June 14th at 0000 hours.

Flows at Wells Dam during the 2004 juvenile plan species migration (April – August) were at 86 percent of the twenty-year average. Operationally, all five bypass bays were available and were utilized at one time or another during the 2004 outmigration. Operation of the bypass system throughout the 2004 season was guided by the bypass operating criteria contained within Section 4.3 of the Wells HCP.

The spring bypass season started on April 12th at 0000 hours and run continuously through June 13th at 2400 hours. The spring bypass operated for a total of 63 days and utilized a total discharge of 1.1 MAF, or 8.1% of total project discharge. During the spring bypass operation, there was forced spill during 3 hours or 0.2% of the season.

Summer bypass started on June 14th at 0000 hours and ran until August 26th at 2400 hours, for a total of 74 days. There was 1.1 MAF or 6.9% of the total discharge dedicated to summer bypass. During the summer bypass operating period, there was no forced spill. The highest hourly discharge at the project occurred on June 29th at 1900 hours with 217 kcfs flowing through the project.

METHOW HATCHERY 2000 BROOD SPRING CHINOOK PRODUCTION

APPENDIX D

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
Fish Program: Science Division
Supplementation Research Team
Methow Field Office
20268 Highway 20, Suite 7, Twisp WA 98856 (509) 997-0066

October 1, 2004

To: Rick Klinge

From: Michael Humling

Subject: Methow Hatchery 2000 Brood Spring Chinook Salmon Production

This document summarizes the hatchery and evaluation activities relating to the trapping, spawning, rearing, and release of the 2000 brood spring chinook at Methow Hatchery.

Broodstock Collection

The 2000 brood spring chinook collection protocols specified collection of 640 fish from Wells Dam to satisfy requirements for both the Winthrop National Fish Hatchery (WNFH) and Methow State Fish Hatchery (MSFH) programs. Pre-season forecasts estimated that the composition of the 2000 brood return was approximately 46% Carson ancestry origin. Consistent with the objective of phasing-out Carson ancestry in the Methow River, additional fish were collected at both hatcheries to ensure that sufficient broodstock of non-Carson origin would be available to meet production requirements.

A total of 417 spring chinook were collected at Wells Dam between 7 May and 1 July (65% of the Wells Dam goal of 640). Of these, 83 (20%) were determined to be out-of-basin strays based on scale and mark analyses and were subsequently released below the dam. The remaining fish from the Wells collection ($N = 334$) were sent to MSFH, comprising 104.4% of the program goal of 320 fish. An additional 162 spring chinook were collected at MSFH between 10 May and 1 July. Of these fish, five died in the trap and one was identified by an opercle punch as an out of basin stray and released below Wells Dam. The remaining 156 fish were transferred to WNFH for spawning. Pre-spawn mortality of MSFH broodstock was 3.6% ($N = 12$; Table 1). All adult chinook at MSFH were inoculated with erythromycin prior to spawning to minimize vertical transmission of Bacterial Kidney Disease (BKD).

Broodstock Spawning and Composition

Gametes were transferred between the hatchery facilities on individual spawn days as specified in verbal agreements concerning the rearing locations of individual stocks. Methow Hatchery transferred gametes from 185 Carson origin chinook (104 female; 81 male) to WNFH, and received gametes from 195 Methow Composite (89 female; 106 male) and 33 Twisp fish (20 female; 13 male).

On the last day of spawning at MSFH, 54 surplus male and 4 out-of-basin stray females were killed for coded wire tag (CWT) extraction. Gametes from these fish were not utilized. However, fertilized gametes from six females (three Methow Composite; three Twisp) were sent to WNFH because they were crossed with males that were later determined to be of Carson or unknown hatchery origin. Additionally, CWT codes from six Twisp females were transposed incorrectly during spawning, identifying the fish as Methow Composite stock. The eggs were fertilized with Methow Composite milt and were transferred to the Methow Composite program. A total of 296 spring chinook salmon were incorporated into the Methow Composite ($N = 230$) and Twisp ($N = 66$) programs (Table 2).

Table 1. The 2000 brood adult spring chinook broodstock management at Methow Hatchery.

Week ending	Mortality		Hatchery spawned		Wild spawned		Total
	Female	Male	Female	Male	Female	Male	
6/09/00	2	1					3
6/16/00	1	2					3
6/23/00		1					1
6/30/00		1					1
7/14/00	2						2
7/21/00	1						1
8/11/00	1		18	12	1	0	32
8/18/00			27	15	0	0	42
8/25/00			48	38	1	2	89
9/01/00			52	35	1	2	90
9/08/00			34	24	0	1	59
9/15/00			1	55	0	0	56
Total	7	5	180	125	3	5	379

Table 2. Spawning and egg distribution at MSFH for 2000 brood spring chinook.

Stock	Spawned			Egg collection	Eyed egg transfer[a]	Egg loss	Eggs retained
	Female	Male	Total				
Methow Composite	131	99	230	515,757	229,806	18,292	267,659
Twisp	41	25	66	161,069	0	4,671	156,398
Total	172	124	296	743,900	229,806	22,963	424,057

[a] *To Winthrop National Fish Hatchery.*

Virology sampling was conducted on 60 female spring chinook and no pathogens were detected. Results from ELISA sampling of kidney and spleen tissue taken from all females indicated that all wild females ($N = 3$) and 97.8% of the hatchery females ($N = 176$) had below-low (<0.100) and low (0.100 – 0.199) optical density values. The male: female ratio of the 2000 broodstock spawned at MSFH was 1.02:1. Mean fecundity of age-four hatchery females was 3,739 eggs ($N = 176$, SD = 668) and age-five wild females was 5,292 eggs ($N = 3$, SD = 997). Based on scale and CWT information, 3.0% ($N = 9$) of the 2000 broodstock were natural origin fish (Table 3). Length information by age and stock is displayed in Table 4. Statistical comparisons of length information between hatchery and wild fish were not made due to the small number of wild fish recovered.

Table 3. Stock composition and origin of adults used for 2000 brood at MSFH.

Total age	Stock	Origin	Program	Broodstock collection	
				N	%
5	Unknown	Wild	Met. Comp.	2	0.7
4	Chewuch	Hatchery	Met. Comp.	27	9.1
4	Methow	Hatchery	Met. Comp.	157	53.0
4	Twisp	Hatchery	Met. Comp.	7	2.4
3	Chewuch	Hatchery	Met. Comp.	21	7.1
3	Methow	Hatchery	Met. Comp.	16	5.4
5	Unknown	Wild	Twisp	5	1.7
4	Twisp	Hatchery	Twisp	59	19.9
3	Unknown	Wild	Twisp	2	0.7
Total				296	100.0

Table 4. Mean fork length (cm) by stock of 2000 brood Methow Hatchery spring chinook.

Origin	Stock	Mean fork length (*N*, SD)		
		Age 3	Age 4	Age 5
			Male	
Hatchery	Chewuch	49.2 (42, 4.3)	67.0 (11, 9.4)	- -
	Methow	52.0 (32, 3.9)	74.0 (70, 5.6)	91.0 (1, 0)
	Twisp	51.5 (2, 0.7)	70.4 (23, 11.3)	- -
Wild	Overall	45.0 (1, 0)	- -	98.0 (2, 1.4)
			Female	
Hatchery	Chewuch	- -	73.4 (18, 3.5)	- -
	Methow	- -	74.0 (109, 3.6)	- -
	Twisp	- -	75.1 (44, 3.4)	- -
Wild	Overall	- -		91.0 (3, 1.0)

Juvenile Rearing

The 2000 brood egg collection totaled 267,659 Methow Composite and 156,398 Twisp eggs (after transfers and loss). Ponding of fry into start tanks began in December 2000 and continued through January 2001.

The Twisp captive brood showed development of BKD in February 2001 (808 FPP) with associated high mortalities (up to 0.35%/d). The fish received three 28-day erythromycin treatments for BKD in March, April and June 2001. An additional 14-day treatment of erythromycin was administered during November 2001. Twisp anadromous progeny were administered two 28-day erythromycin treatments, beginning in March and June 2001. Additional 14-day treatments were given in November 2001 and beginning in January 2002. All erythromycin treatments were prophylactic. Twisp anadromous progeny experienced no major health problems during rearing. Methow Composite progeny received three prophylactic 28-day erythromycin treatments during rearing. These were administered in June 2001, March 2001 and February 2002. Methow Composite releases experienced no major health problems during rearing.

Twisp anadromous and captive stocks were differentiated by CWT code. Methow Composite fish were given a single CWT code, regardless of release location (Table 5).

Table 5. Coded wire tagging and external marking of 2000 brood spring chinook.

Stock	# Tagged	Fish/lb	CWT code	External mark	% Tagged
Twisp	156,789	- -	630182	None	99.1
Twisp Captives	1,380	120	630994	None	93.2
Methow Comp.	267,236	- -	630776	None	95.8

Juvenile Release

The Twisp Acclimation Pond received 104,688 fish on 25-26 March 2002. Releases were scheduled to begin on 15 April 2002. On 14 April, debris carried by rising water blocked the water intake causing the acclimation pond water level to drop. An estimated 79,688 spring chinook smolts died from the resulting decrease in volume and flow. Alarm systems failed to alert WDFW personnel and the problem wasn't discovered until hatchery staff arrived later in the morning. The estimated 25,000 fish still alive in the pond were highly stressed and immediately released. Surviving smolts released from the pond received a maximum of 20 days of acclimation time prior to release. Direct plants were made to the Twisp River on 23 April consisting of 49,717 anadromous progeny and 987 captive brood progeny. These groups were not combined with the acclimated population due the higher presence of BKD and related fish health concerns.

An estimated 150,000 Methow Composite fish were transferred to the Chewuch Pond between 25 and 27 March 2002. On 6 April, an additional 50,000 Methow Composite fish were transferred to the Chewuch Acclimation Pond. A volitional release of the Methow Composite fish (N = 199,938) began on 16 April. Because groups were transferred to the acclimation pond at different times, Chewuch-release fish received between 10 and 25 days of acclimation time. Approximately 75% of the fish (N = 149,994) released from the pond were acclimated for 25 d. The estimated 50,000 (25%) additional fish transferred on 6 April received 13 d of acclimation time.

Approximately 55,090 Methow Composite and 11,364 high-ELISA Methow Composite fish remained at MSFH. Two separate on-site volitional releases began on 16 April and 19 April for the Methow Composites and Methow Composite high-ELISA fish, respectively.

Organosomatic index samples (OSI; $N = 20$) were taken from all stocks prior to release. Normality indices were 98.5% for the Twisp Acclimation Pond fish, 100% for direct release Twisp fish and 100% for the Methow Composite group (not including high-ELISA group). A normality index greater than 90% is indicative of a healthy population. Evidence of sexual precocity was found in one male fish (5%) examined in the Twisp direct plant group, two male fish (10%) in the Twisp Acclimation Pond sample and two males (10%) from the Chewuch Pond Methow Composite sample. Length and weight sampling was conducted on all groups prior to release (Table 6).

Table 6. Length and weight sampling of 2000 brood spring chinook at release.

Release site	Stock	Fork length (mm)	SD	CV %	N	Kf	Wt (g)	Fish /lb	Normality index
Twisp Pond[a]	Twisp	129.7	7.5	6.0	20	1.25	27.7	16.4	98.5%
Twisp River	Twisp	133.4	6.8	5.1	133	1.15	27.2	16.7	100%
Twisp River	Twisp Capt.	142.4	8.2	5.8	29	1.24	35.8	12.7	- -
Chewuch Pond	MetComp	131.3	6.8	5.1	118	1.18	26.7	17.0	100%
MSFH	MetComp	131.3	6.8	5.1	118	1.18	26.7	17.0	100%
MSFH	MetComp Hi-ELISA	138.5	7.2	5.2	65	1.23	32.7	13.9	- -

[a] Measurements from OSI analysis due to mortality event.

Carson Influence

Carson influence for each group was determined by analyzing Carson and unknown contribution during spawning events at the hatcheries. Summary of Carson and unknown influence by release group is presented in Table 7. Twisp stock had no Carson influence, Methow Composite stock had 19.1% Carson or unknown ancestry, regardless of release location.

Table 7. Carson influence of 2000 brood spring chinook salmon released from MSFH.

Stock	CWT	Total released	% Carson influence[a]
Twisp	630182	74,717	0.0
Twisp Captive	630994	987	0.0
Met. Comp. (Chewuch rel.)	630776	199,938	19.1
Met. Comp. (Methow rel.)	630776	66,454	19.1
Total		342,096	

[a] Campton, D. 2001. Number and origin of adult spring chinook salmon used to produce release progeny for the Methow State Salmon Hatchery. USFWS Memo (Rev. 4/24/01).

2000 Brood Spring Chinook Summary

With the exception of mortality associated with the Twisp Pond event, survival in both anadromous stocks was above set standards throughout rearing at Methow Hatchery (Table 8). Captive brood progeny showed significantly ($P < 0.05$) higher mortality rates than progeny of both Methow Composite and Twisp anadromous stocks. The lower survival rate is attributed to the high-ELISA parentage (96 brood) of the Twisp captive progeny and associated losses due to BKD infection throughout rearing.

Production goal for 2000 brood spring chinook at MSFH was 15 FPP. Average size at release of Twisp captive progeny and Hi-ELISA Methow Composite progeny was above production goals. Average size at release of Twisp anadromous progeny, and Methow Composite (Chewuch and Methow-releases) fish was below production goals. A total of 342,096 spring chinook salmon were released from MSFH facilities. These consisted of 74,717 Twisp anadromous progeny, 987 Twisp Captive progeny, 199,928 Chewuch-release Methow Composite fish and 66,454 Methow-release Methow Composite fish.

Table 8. Survival standards and release numbers for 2000 brood spring chinook.

Release/standard	Pre-spawn	Egg to fry	Fry to smolt	Released	CWT	
	90%	90%	90%		Code	%
Twisp Pond	95.1%	96.0%	47.0%	25,000	630182	99.1
Twisp River	95.1%	96.0%	95.5%	49,717	630182	99.1
Twisp River Capt.	- -	- -	56.8%	987	630994	93.2
Twisp program total				75,704		
Methow Comp. (Chewuch)	96.0%	94.1%	99.0%	199,938	630776	95.8
Methow Comp. (MSFH)	96.0%	94.1%	99.0%	55,090	630776	95.8
Methow Comp. (Hi-ELISA)	96.0%	94.1%	98.0%	11,364	630776	95.8
Methow Composite program total				266,392		

cc: Heather Bartlett, Shane Bickford, David Carie, Brian Cates, Mike Erho, Bill Hopley, Bob Jateff, Chuck Johnson, Methow Hatchery, Andrew Murdoch, Chris Pasley, Todd Pearsons, Kurt Perry, Kris Petersen, Bob Rogers, Tom Scribner, Charlie Snow, Rick Stilwater, Kirk Truscott

METHOW HATCHERY 2001 BROOD SPRING CHINOOK PRODUCTION

APPENDIX E

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Fish Program: Science Division
Supplementation Research Team
Methow Field Office
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October 1, 2004

To: Rick Klinge

From: Michael Humling

Subject: Methow Hatchery 2001 Brood Spring Chinook Salmon Production

Enclosed is a summary of the hatchery and evaluation activities relating to the trapping, spawning, rearing and release of the 2001 brood spring chinook at Methow Hatchery.

Broodstock Collection

Methow State Fish Hatchery (MSFH) personnel collected 897 fish from three separate trapping sites between 14 May and 23 July. Spring chinook collected at the MSFH outfall were utilized for both the Winthrop National Fish Hatchery program (WNFH; N = 400), and MSFH program (N = 376; Table 1). Broodstock collection achieved 89.6% of the combined target collection goal of 1,000 fish for both programs. After transfers, MSFH retained a total of 497 fish for broodstock (Table 2). Pre-spawn mortalities totaled 2.4% of the fish held at MSFH (N =12). The male to female ratio of the MSFH broodstock was 1.7:1.0.

Broodstock Spawning and Composition

Coded-wire tags were read prior to spawning to determine origin and to facilitate genetic crossing at the hatchery. Of those fish collected at the Twisp River weir, hatchery and wild fish comprised 29.2% (N = 14) and 70.8% (N = 34), respectively. The Chewuch trap collection consisted of 37.0% (N = 27) wild adults and 63.0% (N = 46) hatchery adults. All of the 776 fish collected at the MSFH outfall trap were hatchery-origin chinook (Table 3).

Fish were spawned at both hatcheries between 8 August and 20 September. Gametes from two Twisp females and five Chewuch females were transferred from WNFH to MSFH. Gametes from 16 female and 15 male Twisp captive brood chinook were transferred from Aquaseed Corporation to MSFH. Virology sampling conducted on all females spawned at MSFH found that 16.8% (N = 36) had high ELISA values (OD $\geq$ 0.450). High ELISA values were found in 11.3% (N = 15) of ESA listed females (Twisp, Chewuch, Methow, and Methow Composite) and 25.9% (N = 21) of non-ESA listed females (Winthrop and unknown hatchery-origin; Table 4).

Table 1. 2001 MSFH spring chinook broodstock collection summary by trapping location.

Week ending	Chewuch Ad-pres	Chewuch Ad-clip	Twisp Ad-pres	Twisp Ad-clip	MSFH – retained Ad-pres	MSFH – retained Ad-clip	MSFH – to WNFH Ad-pres	MSFH – to WNFH Ad-clip	Total
18-May	2	2	0	0	0	0	0	19	23
25-May	12	5	6	2	0	0	3	196	224
01-Jun	7	13	1	0	0	0	2	33	56
08-Jun	4	5	7	7	0	0	0	0	23
15-Jun	1	2	9	2	0	0	0	0	14
22-Jun	2	0	5	1	1	45	1	146	201
29-Jun	0	0	4	1	0	80	0	0	85
06-Jul	1	4	3	0	3	200	0	0	211
13-Jul	2	7	0	0	1	46	0	0	56
20-Jul	1	0	0	0	0	0	0	0	1
23-Jul	0	3	0	0	0	0	0	0	3
Total	32	41	35	13	5	371	6	394	897

Table 2. Broodstock collection and mortality of 2001 brood spring chinook at MSFH.

Location	Total trapped Ad-present	Total trapped Ad-clip	Transferred to WHFH	Retained at MSFH	Pre-spawn mortality Hatchery	Pre-spawn mortality Wild
Twisp	35	13	- -	48	1	2
Chewuch	32	41	- -	73	3	0
MSFH	11	765	400	376	6	0
Total	78	819	400	497	10	2

Table 3. Stock composition and origin of 2001 broodstock by collection location.

Stock	Twisp trap *N*	Twisp trap %	Chewuch trap *N*	Chewuch trap %	MSFH outfall *N*	MSFH outfall %	Total *N*	Total %
Twisp	13	27.1	- -	- -	4	0.5	17	1.9
Chewuch	- -	- -	26	35.6	13	1.7	39	4.3
Methow	- -	- -	2	2.7	319	41.1	321	35.8
Met. Comp.	- -	- -	3	4.1	132	17.0	135	15.1
Winthrop	- -	- -	6	8.2	251	32.3	257	28.7
Unk. hatchery	1	2.1	9	12.3	57	7.3	67	7.5
Wild	34	70.8	27	37.0	- -	- -	61	6.8
Total	48		73		776		897	

Table 4. ELISA results for 2001 brood females at MSFH.

Stock	Below low (<0.100)		Low (0.100-0.199)		Moderate (0.200-0.449)		High (≥ 0.450)	
	N	%	*N*	%	*N*	%	*N*	%
Twisp	14	93.3	0	0.0	0	0.0	1	6.7
Twisp captive	5	31.3	6	37.5	4	25.0	1	6.3
Chewuch	23	85.2	2	7.4	0	0.0	2	7.4
Methow	51	73.9	8	11.6	2	2.9	8	11.6
Winthrop	39	54.2	12	16.7	3	4.2	18	25.0
Unk. hatchery	5	55.6	1	11.1	0	0.0	3	33.3
ESA-listed	93	73.2	16	12.6	6	4.7	12	9.4
Non-listed	44	54.3	13	16.0	3	3.7	21	25.9
All hatchery*	115	66.1	23	13.2	5	2.9	31	17.8
All wild	17	94.4	0	0.0	0	0.0	1	5.6
All females	137	65.9	29	13.9	9	4.3	33	15.9

*Does not include Twisp captive brood females

Fecundities of wild and hatchery females were compared within stocks using T-tests. No significant difference ($P > 0.05$) was detected between fecundities of age four Chewuch females. Age four Twisp wild females had significantly ($P < 0.05$) higher fecundities than age four Twisp hatchery females. No significant differences were detected between fecundities of age four Chewuch, Twisp (anadromous only), Methow or Winthrop hatchery females ($P > 0.05$). Fecundities of age five females were not compared due to small sample sizes (Table 5).

Table 5. Mean fecundity values by stock, origin and age for MSFH 2001 broodyear.

Stock	Age-4			Age-5		
	Fecundity	SD	*N*	Fecundity	SD	*N*
Chewuch	4,078	679	22	- -	- -	- -
Chewuch wild	3,753	706	10	- -	- -	- -
Methow	3,893	790	68	- -	- -	- -
Twisp captive	990	282	13	1,570	451	3
Twisp	3,922	579	7	4,941	- -	1
Twisp wild	4,720	558	7	4,469	- -	1
Winthrop	3,868	951	79	6,829	- -	1

Mean fork lengths (cm) were compared using T-tests to detect differences between hatchery and wild fish. No significant difference ($P > 0.05$) was found between wild and hatchery age three males (all stocks). Age four hatchery male spring chinook had significantly greater mean fork lengths ($P < 0.05$) than wild male age four spring chinook (Table 6).

Table 6. Length-at-age information for 2001 Methow Basin spring chinook broodstock.

Origin	Sex	Stock	Mean fork length (cm) (*N*, SD)		
			Age-3	Age-4	Age-5
Hatchery	Male	Overall	54.1 (104, 4.3)	79.6 (146, 5.2)	91.5 (2, 3.5)
		Chewuch	- -	79.0 (12, 6.2)	- -
		Methow	- -	79.7 (68, 5.0)	- -
		Met. Comp.	53.8 (96, 4.2)	- -	- -
		Twisp	63.0 (2, 2.8)	79.4 (5, 4.9)	- -
		Winthrop	56.0 (4, 1.8)	80.8 (47, 4.0)	91.5 (2, 3.5)
Hatchery	Female	Overall	65.0 (1, 0)	76.4 (162, 3.6)	91.7 (3, 6.7)
		Chewuch	- -	77.4 (17, 4.4)	- -
		Methow	- -	76.8 (68, 3.7)	- -
		Met. Comp.	65.0 (1, 0)	- -	- -
		Twisp	- -	77.6 (5, 1.5)	92.5 (2, 9.2)
		Winthrop	- -	75.8 (71, 3.1)	90.0 (1, 0)
Wild	Male	Overall	52.3 (3, 1.5)	75.6 (38, 5.0)	- -
		Chewuch	52.0 (1, 0)	76.0 (16, 5.7)	- -
		Twisp	52.5 (2, 2.1)	75.3 (22, 4.5)	- -
Wild	Female	Overall	- -	76.8 (17, 3.8)	88.0 (1, 0)
		Chewuch	- -	74.8 (10, 3.7)	- -
		Twisp	- -	79.6 (7, 1.5)	88.0 (1, 0)

The eggtake at MSFH consisted of 441,479 ESA-listed gametes and an additional 315,335 non-listed Winthrop/Carson and unknown stock gametes. Unfertilized gamete transfers to MSFH consisted of 17,238 Twisp captive eggs from Aquaseed, 7,799 Twisp anadromous eggs, and 18,765 Chewuch stock eggs from WNFH collections. Total ESA-listed unfertilized egg total at MSFH after transfers was 485,281 (Table 7). Gamete crosses were all single pair mating.

Egg mortality at MSFH was 5.4% ($N = 43{,}059$), leaving a total of 752,188 fertilized eggs on station among all stocks. Fertilized egg transfers were completed in October. All fertilized eggs found to have direct Carson or unknown hatchery parentage ($N = 303{,}370$) were either transferred to WNFH ($N = 174{,}221$) or were planted as eyed eggs in the Methow River ($N = 129{,}149$). Eyed-egg plants were made in Methow River side channels and beaver pond outlets from rkm 82 (Gold Creek) to rkm 85 (Wolf Creek).

WNFH transferred 30,506 low-ELISA Methow Composite eyed eggs to MSFH. Methow Hatchery retained a total of 479,324 ESA-listed fertilized eggs from the 2001 anadromous and captive brood spawning.

Table 7. Spawning and eggtake totals for 2001 brood spring chinook.

Spawn location	Stock	Females spawned		Males spawned		Surplus fish[a]	Total egg take
		Wild	Hatchery	Wild	Hatchery		
MSFH	Twisp	8	8	9	7	--	62,927
MSFH	Chewuch	10	17	18	8	10	104,662
MSFH	Methow	--	69	14	13	--	273,890[b]
MSFH	ESA total	--	--	--	--	--	441,479
MSFH	Winthrop	--	81	1	73	139	315,335[b]
MSFH	Total	18	175	42	101	149	756,814
Aquaseed	Twisp Capt.	--	16	--	7	8	17,238
WNFH	Twisp	--	2	--	--	--	7,799[c]
WNFH	Chewuch	--	5	--	--	--	18,765[c]
Program Grand Total		18	117	41	35	18	485,281

[a] Surplus fish consisted of 138 hatchery-origin males, one non-viable hatchery female, and ten wild Chewuch stock males. All wild Chewuch males and 26 hatchery males were transferred to WNFH for use in their program.

[b] Reflects WNFH-parentage Methow Composite eggs planted or transferred to WNFH.

[c] WNFH egg transfers to MSFH.

Juvenile Rearing

After egg transfers and mortality MSFH had on station approximately 289,006 Methow Composite eggs (spawned from fish released from MSFH), 118,033 Methow Composites (spawned from fish released from Chewuch Pond), 64,418 Twisp eggs (spawned from anadromous parents), and 7,867 Twisp eggs (spawned from females of captive broodstock). No major fish health incidents occurred during the rearing of 2001 brood spring chinook at MSFH, with the exception of the Twisp Captive group, which experienced elevated losses associated with bacterial kidney disease (BKD). All stocks within the hatchery experienced BKD, Costia, and minor fungal infections during rearing. Treatments for these infections consisted of erythromycin for BKD, and 1:6000 formalin to water drips for the Costia and fungus.

CWT marking occurred between mid-June and early July for all populations (Table 8). PIT tags were implanted in 17,500 Methow Composite fish (MSFH-release) and 17,498 Methow Composite fish (Chewuch-release) as part of a mainstem Columbia River transportation study funded by the US Army Corps of Engineers.

Table 8. Coded wire tagging and external marking of 2001 brood spring chinook.

Stock	Release site	CWT	# Tagged	Fish/lb.	External mark	% Tagged
Twisp	Twisp Pd.	631478	53,564	90	None	97.7
Twisp captive	Twisp Pd	631068	6,411	50-80	None	97.2
Methow Comp.	Chew. Pd.	631440	98,648	100	None	98.6
Met. Comp. high	Lake Cr.	631494	17,964	80	None	91.7
Methow Comp.	Chew. Pd.	631384	151,393	100	None	98.6
Methow Comp.	MSFH	630976	50,569	90	None	99.4
Methow Comp.	MSFH	631477	44,623	90	None	97.5
Methow Comp.	MSFH	631179	36,990	80	None	88.7

Juvenile Release

Twisp Program juveniles (N = 57,645) were transferred to the acclimation facility on 25 March. The combined population (captive and anadromous) was sampled prior to release from the acclimation pond. The normality index for these fish was 90.0%, based on an Organosomatic Index (OSI) sub-sample of 20 fish. Values above 90% indicate a healthy population. Mean fork length at release of the Twisp population was 120.4 mm (N = 100; SD = 9.98). Mean weight was 17.0 g (N = 20; SD = 3.4; Table 9). No precocial fish were noted (N = 20). Release of this population began on 21 April and ended on 22 April (Table 10). Twisp released fish received a minimum of 27 days of acclimation.

Fish were transferred to the Chewuch Acclimation Pond (N = 96,581) on 25 March. Additional Methow Composite fish in Pond 13 (N =148,001) were transferred to the Chewuch Acclimation Pond on 26 March. At release fish had a mean fork length of 133.8 mm and mean weight of 30.2 g (N = 111; SD = 6.67). The normality index (N = 20) for the population was 90.5% and no precocial fish were found (N = 20; Table 9).

Volitional release at the Chewuch pond occurred between 21 and 25 April. Acclimation time of the Chewuch fish ranged from 27 days for the first group (39.5%) to 26 days for the second group (60.5%). High-ELISA Chewuch fish (N = 17,241) were reared and released separately from other groups to prevent the horizontal transmission of BKD. These fish were direct planted into Lake Creek, a tributary of the Chewuch River (rkm 37) on 23 April (Table 10).

OSI analysis of Methow Composite fish (N = 20) released from MSFH provided a normality index of 94.0%. The mean fork length of the six subgroups ranged from 125 to 134 mm. The mean weight of fish released from MSFH was 26.7 g (N = 20; SD = 6.3; Table 9). No precocial fish were noted during sampling. A volitional release from MSFH of Methow Composite stock (N = 130,887) occurred between 21 and 25 April (Table 10).

Table 9. Summary of 2001 MSFH spring chinook pre-release sampling.

Release Location	Fork length (mm)	SD	CV%	*N*	K_f	Wt (g)	Fish/ lb.	Normality index (%)
Twisp Pond	122.5	9.95	8.12	114	1.17	21.6	21.0	90.0
MSFH Pd. 1	129.0	7.36	5.70	102	1.24	26.7	17.0	94.0
MSFH Pd. 2	132.2	5.87	4.44	111	1.23	28.4	16.0	94.0
MSFH Pd. 3	131.9	6.49	4.92	113	1.24	28.4	16.0	94.0
MSFH Pd. 4	133.9	8.30	6.20	101	1.18	28.4	16.0	94.0
MSFH Pd. 14	128.5	6.46	5.02	105	1.26	26.7	17.0	94.0
MSFH Pd. 16	125.0	7.90	6.32	108	1.11	21.6	21.0	94.0
Chewuch Pd.	133.8	6.67	4.98	111	1.26	30.2	15.0	90.5
Lake Cr.[a]	105.6	23.05	21.83	106	1.83	21.6	21.0	- -

[a] High-ELISA Chewuch-release group

Table 10. Release numbers and tagcodes for 2001 brood spring chinook.

Stock	Release Location	Start/end	CWT	Mark	Number
Twisp anad.	Twisp Acc. Pd.	4/21-4/22	631478	CWT	51,496
Twisp captive	Twisp Acc. Pd.	4/21-4/22	631068	CWT	5,975
Methow Comp.	MSFH Ponds 1, 2	4/21-4/25	630976	CWT[a]	50,272
Methow Comp.	MSFH Ponds 3, 4	4/21-4/25	631477	CWT[b]	44,383
Methow Comp.	MSFH Pds. 14, 16	4/21-4/25	631179	CWT	36,232
Methow Comp.	Chewuch Acc. Pd.	4/21-4/25	631384	CWT[c]	147,737
Methow Comp.	Chewuch Acc. Pd.	4/21-4/25	631440	CWT	96,306
Met. Comp. high	Lake Cr. (direct)	4/23	631494	CWT	17,241
Total listed release					449,642

[a]Included 8,750 PIT-tagged fish
[b]Included 8,750 PIT-tagged fish
[c]Included 17,498 PIT-tagged fish

Carson influence

Carson influence for each group was determined by analyzing the parental crosses and the respective pedigrees of each broodyear. No Carson influence was noted in the 2001 Twisp anadromous or captive stocks. The 2001 brood Methow Composite release from MSFH had a 33.2% Carson or unknown ancestry and the 2001 brood Methow Composite released from Chewuch Pond a had 3.6% Carson or unknown ancestry.

2001 Brood Spring Chinook Summary

The pre-spawn survival of all spring chinook held at MSFH was 97.6%. Adult survival within all stocks exceeded the 90% standard. Twisp anadromous progeny exceeded set standards from adult collection to the fry stage. Prespawn survival was 93.8% and egg to fry survival was 91.1%. The Twisp anadromous stock had a lower fry to smolt survival (79.9%) than the 90% survival standard. This was primarily due to BKD-associated loss through rearing. Twisp captive progeny survival was below the set standard for the egg to smolt stage. Captive progeny egg to fry and fry to smolt survivals were 45.6% and 76.0%, respectively. High mortality among captive progeny was also associated primarily with BKD outbreaks.

Methow Composite stocks exceeded set standards throughout all rearing phases for both Chewuch and Methow River release groups. Prespawn survival among Chewuch-release fish was 95.9%. Egg to fry and fry to smolt survivals were 95.6% and 96.2%, respectively. Prespawn survival among Methow-release fish was 98.4%. Egg to fry and fry to smolt survivals were 96.3% and 96.4%, respectively. The total smolt release (*N* = 449,642) achieved 81.6% of the program goal of 550,000 fish (Table 11).

Table 11. Survival standards and release numbers for 2001 brood spring chinook.

Stock/standard	Pre-spawn	Egg to fry	Fry to smolt
	90%	90%	90%
Twisp anadromous	93.8	91.1	79.9
Twisp captive	- -	45.6	76.0
Met Comp. (Chewuch)	95.9	95.6	96.2
Met Comp. (MSFH)	98.4	96.3	96.4

cc: Heather Bartlett, Shane Bickford, David Carie, Brian Cates, Mike Erho, Brett Galyean, Bill Hopley, Bob Jateff, Chuck Johnson, Methow Hatchery, Andrew Murdoch, Chris Pasley, Todd Pearsons, Kurt Perry, Kris Petersen, Bob Rogers, Tom Scribner, Charlie Snow, Rick Stilwater, Kirk Truscott

METHOW BASIN SPRING CHINOOK NATURAL PRODUCTION STUDY REPORTS FOR 2000 AND 2002

APPENDIX F

Methow Basin Spring Chinook Natural Production Study Report For 2000

Prepared by

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Prepared for

Public Utility District No. 1 of Douglas County

East Wenatchee, WA

May 2004

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ABSTRACT

The estimated 2000 spring chinook run to Wells Dam was 2,587 (82% adults and 18% jacks). Of these 1,436 were taken for broodstock (89% adults and 11% jacks). The estimated spawner escapement was 1151 fish.

A total of 368 spring chinook redds were located in the Methow Basin in 2000. The number of redds by major subbasin were as follows: Methow– 234 (64%), Lost– 2 (.06%), Early Winters- 0 (0%), Chewuch– 32 (9%) and Twisp– 99 (27%). The number of redds (71%) downstream of the Methow index (below Weeman Bridge) reach was the highest recorded since complete surveys were initiated in 1987.

The fish per redd ratio was 3.1 (1151 natural escapement/368 total redds).

A summary of the distribution of carcasses recovered in the Methow Basin is presented in Table 3. A total of 178 carcasses were recovered, of these 22 (12%) were of natural origin while the remaining 158 (78%) carcasses were of hatchery origin.

During the juvenile outmigrant monitoring period (October 5 – December 7) an estimated 1,414 spring chinook outmigrants passed the Halderman's Hole monitoring site. The 25%, 50% and 75% dates of cumulative passage for spring chinook were, respectively, October 15, October 27 and November 8. The mean spring chinook fork length was 102 mm (S.D. = 11.6). A total of 60 O. mykiss fish were captured during the monitoring period. Steelhead/ rainbow trout ranged in fork length from 72 to 301 mm, and had a mean fork length of 151 mm (S.D. = 49.6).

Future management considerations based on results of the 2000 spawner survey are as follows:

1. Future consideration needs to be made of relocating the Methow acclimation site further upstream nearer the traditional spawning reaches.
2. Indirectly related to the first issue, is the need to include in years when possible, a higher proportion of natural fish in the broodstock collection.
3. Given the low redd counts in the Lost River in recent years consideration should be given by technical and management makers to determining supplementation objectives for this population.

INTRODUCTION

The Methow Basin Spring Chinook Salmon Supplementation Plan (MBSCSP) is a compensation program directed towards the enhancement of the wild spring chinook (*O. tshawytscha*) stocks in the Methow Basin. The MBSCSP is the result of the Wells Settlement Agreement between the fishery agencies, tribes, Douglas PUD and the power purchasers of the Wells Project. The goal of this agreement is to compensate for unavoidable losses of juvenile anadromous fishes at Wells Dam. The stated purpose of the MBSCSP "...is to increase natural propagation of salmon in the Methow, Chewuch, and Twisp rivers in a manner that minimizes or eliminates ecological and genetic risks to the natural population.", through a monitored hatchery supplementation plan. The settlement agreement requires that the MBSCSP be operated according to procedures outlined by the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program (NPPC, 1987). A specific outcome is that the MBSCSP "be capable of collecting, rearing, and releasing three potentially discrete stocks of salmon" (Methow, Chewuch and Twisp), which is part of the Phase I compensation requirements under the settlement agreement. Spring chinook spawner surveys in the Methow Basin are a monitoring and evaluation task, which is a component of the MBSCSP. Under Objective 2, Task 2.9 (Natural Production section) of the MBSCSP spawner surveys are conducted to evaluate various attributes (i.e., spawning behavior and geographic distribution) between natural and hatchery spawners. The entire monitoring and evaluation plan is presented in Appendix D of the MBSCSP document, which will provide the reader context for where spawner surveys mesh with other tasks of the evaluation program. Basin wide spring chinook spawning ground surveys have been conducted since 1987. In 1996 and 1998 no spawner surveys were conducted since nearly all spring chinook were collected at Wells Dam for broodstock.

STUDY AREA

The Methow River Basin is located in north-central Washington on the eastern slope of the Cascade Mountains (Figure 1). The Methow River and its tributaries lie in Okanogan County and drain an area of nearly 1,800 square miles. The headwaters of the Methow Basin are located near the Cascade Crest at a maximum elevation of 8,500 feet and drops to 781 feet where it joins the Columbia River (RM 524) at Pateros, WA. The upper portions of the Methow basin is mountainous, and dominated by sub-alpine and alpine forest at the upper elevations. Moving eastward from the Cascade Crest in association with a decrease in elevation the forests are dominated by ponderosa pine and steppe-brush in the lower most portion of the basin. Annual

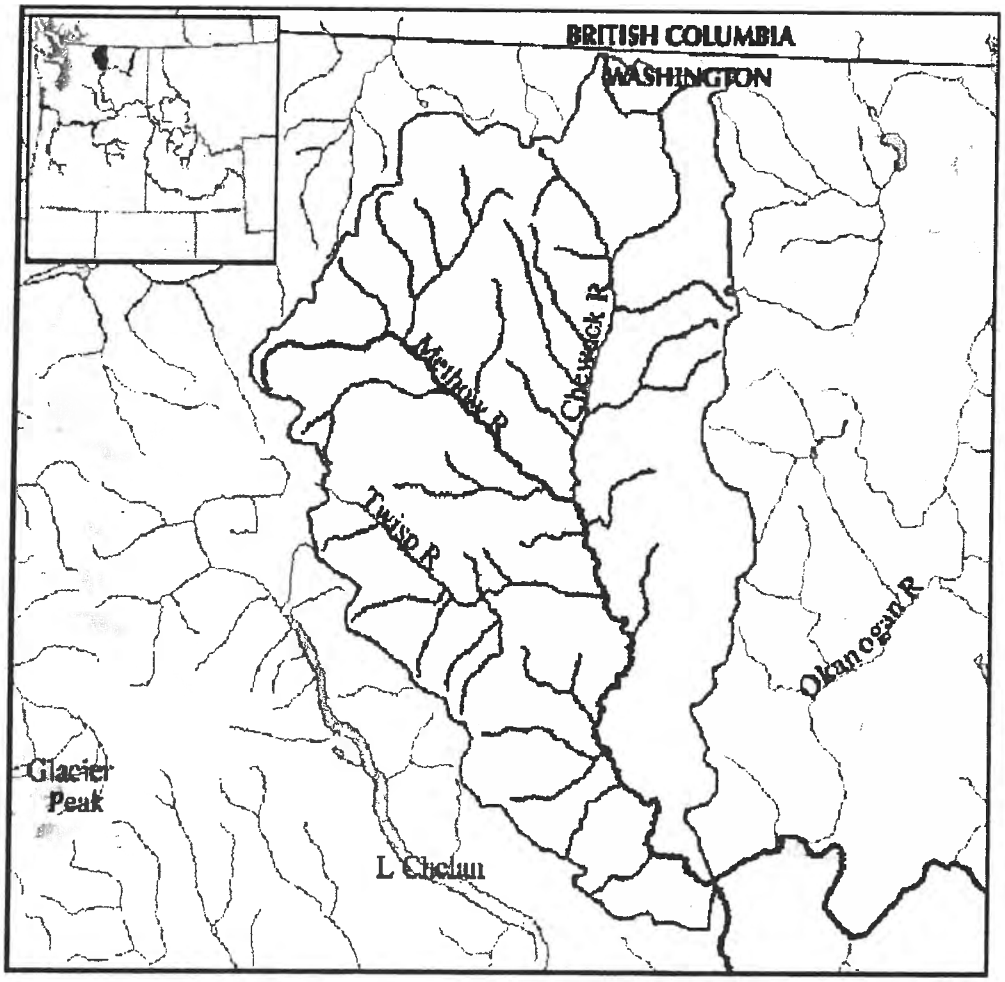

Figure 1. Map of the Methow Basin.

precipitation ranges from 80 inches at the Cascade Crest to 10 inches where the river enters the Columbia River (Richardson 1976). The majority of precipitation occurs from October through March, primarily in the form of snow. The summer months are dry with precipitation occurring in the form of brief thunderstorms. Stream flows in the Methow Basin are driven by the annual snow pack cycle of accumulation during the winter and the spring snowmelt. Generally peak river discharge occurs from mid May to mid June, with base flows occurring from late September through March, with a slight increase in the fall prior to snowfall due to fall rains.

The Methow Basin is characterized as rural with human developed concentrated in the towns of Mazama, Winthrop, Twisp and Methow. Individual homes are scattered throughout the lowlands and upland areas of the basin usually associated with acreage.

The lower Methow valley is a fertile agricultural area that experiences heavy irrigation demands. Water quality in the lower Methow Basin nonetheless remains high, with an AA rating from the Washington Department of Ecology. Spring chinook spawning in the Methow River extends from about Trout Creek (river mile 78) to about two miles downstream of the Chewuch River confluence (river mile 48).

The Chewuch River joins the Methow River at RM 50, at an elevation of 1,745 feet. These two rivers join in the city of Winthrop. The Chewuch basin covers 530 square miles and drains in a southern direction into the Methow River. The upper portion of the Chewuch River is located in the Pasayten Wilderness (above RM 32.4) and is heavily forested. Spring chinook spawn downstream from river mile 31.5, which is also used extensively for recreation and residential development.

The Twisp basin encompasses about 250 square miles of watershed and enters the Methow River at near RM 40. The elevation descends from 8,500 ft to 1,600 ft and drains in a southeast direction. The headwater and upslope areas lay within the Lake Chelan-Sawtooth Wilderness. Spring chinook spawning has extended upstream to South Creek (RM ~28).

METHODS AND MATERIALS

Spawning Escapement

Estimated spawner escapement was derived by subtracting the Wells Dam, WNFH and MFH broodstock collections from the Wells Dam fish count. It was assumed that no pre-spawning mortality occurred. It's likely that the estimated spawner escapement represents an over estimate. The first reason for this conclusion was the antidotal evidence by WDFW of some fall back of ENFH fish. Secondly, was the high number (153 fish) of summer chinook reported by the Fish Passage Center on June 29th, which is the first official day for summer chinook enumeration at Wells Dam. This strongly suggests that spring chinook counts a week before June 29th were comprised of summer chinook, resulting in an over estimate of the spring chinook run at Wells Dam. Because of the inability to accurately estimate the numbers of fish associated with these two factors, it's difficult to accurately derive a revised spawner escapement number

Spawning Surveys

Surveys were primarily conducted in the Methow, Lost, Chewuch and Twisp rivers, and in Early Winters Creek. The historical index reaches were normally surveyed weekly, while those reaches where nominal spawning occurs were normally surveyed bi-weekly. All spawning reaches where redds normally are located were surveyed at least once during or after the historic peak spawning period. The historic index reaches are the following:

- Methow: Weeman bridge to Mazama bridge (6.2 river miles)
- Lost: Lost River bridge to the Eureka Creek (4.2 river miles)
- Early Winters: Highway 20 bridge to Cedar Cr. (1.9 river miles)
- Chewuch: Falls Creek Campground to Camp Four bridge (6.8 river miles)

- Twisp: Buttermilk Creek bridge to the Mystery Creek bridge (10.1 river miles)

Regular surveys began August 1 and continued through September 28, with additional spot-checks conducted afterward. Appendix Tables 1, 2, 3 and 4 present the complete week-by-week survey schedule and redd counts.

Raft or canoe surveys were conducted in the Methow River downstream from Lost River when flows were of sufficient depth, after which they were conducted on foot. All remaining rivers and tributaries were conducted on foot. To ensure survey consistency the same survey crew was normally assigned to the same spawning reach. However, for quality control purposes, a different crew occasionally surveyed another crew's survey reach. To avoid recounting or missing a previously counted redd, each redd was marked with surveyor's tape on the riverbank adjacent to the redd. Written on each posted tape were the consecutive redd number and survey date. A global positioning system unit (GPS) was also used to locate many of the redds, usually to an accuracy of 15 feet.

All live chinook were counted during each survey. Carcasses were recovered and checked for sex, tags, fin clips, and spawning success. Scales and DNA samples were collected when possible from each carcass, and fork length and post eye-to-hypural plate length was recorded. Heads from all adipose clipped carcasses were recovered and stored for later dissection and recording of the coded-wire-tag code. In addition, the river reach was recorded for each coded-wire-tagged carcass to evaluate the stock distribution of hatchery fish.

Juvenile Outmigration

An eight foot diameter rotary screw trap (EG Solutions, Corvallis, OR) was used to monitor juvenile spring chinook and steelhead/rainbow trout (*O. mykiss*) migration at RM 38.5 ("Halderman's Hole") on the Methow River from October 11 to December 7.

Three trap efficiency test releases of spring chinook were made during the course of the monitoring period. Unfortunately, only 25 fish were released in total, of which 17 fish were subsequently recaptured for a combined trap efficiency of 68 percent. However, because of the small sample size, daily spring chinook counts were expanded based upon the direct river flow entrainment method. This method assumes that fish entrainment is directly proportional to the percent stream discharge into the trap. This assumption is probably not completely accurate given the 68% fish entrainment value. Therefore, the daily passage estimates should be view more as a daily passage index. Daily spring chinook counts were divided by the daily rotary trap entrainment rate to estimate the number of daily outmigrants.

Flow approaching the trap was approximated using the combined daily flow data from the USGS Twisp River and Methow at Winthrop gauging stations. The flow (cfs) through the trap was calculated by multiplying the water velocity immediately in front of the cone by the exposed surface area (25 ft^2) of the cone opening. A linear regression was used to estimate mean daily discharge through the trap based upon the mean daily river discharge (Equation 1). The daily rotary trap entrainment rate was defined as the ratio of mean daily discharge (cfs) through the trap divided by the estimated mean daily river discharge (cfs) (Equation 2). River discharge during the period of trap operation ranged from 207 to 337 CFS (mean=268 CFS); while estimated discharge through the rotary trap ranged from 98 to 125 CFS (mean=112 CFS). The daily rotary trap entrainment rate ranged from 38% to 44% during the period of trap operation.

$$\text{Estimated mean daily discharge through the trap} = 0.27 * \text{Mean Daily River Discharge} + 37 \quad \text{(Equation 1)}$$

$$\text{Daily Rotary Trap Entrainment Rate} = \frac{\text{Estimated Mean Daily Discharge Through The Trap}}{\text{Mean Daily River Discharge}} \quad \text{(Equation 2)}$$

Estimated daily passage was calculated as follows:

$N(i)=n(i)/p(i);$

where $N(i)$ is the estimated daily passage, $n(i)$ is the daily catch, and $p(i)$ is the predicted daily rotary trap entrainment rate.

The cumulative estimated daily passage up to day j was calculated as follows:

$$\text{summation } [AN(j)_{=1 \text{ to } j} N(i)];$$

where $\text{summation } [AN(j)]$ is the cumulative estimated daily passage.

For purposes of data analysis, the sampling day ended when the trap was moved out of the flow in the morning, and a new sampling day began after the trap was redeployed to resume fishing. Therefore, fish collected from the livebox during the afternoon were pooled with fish collected through the night and up to the following morning check. Trap checks were normally performed at 0830, but additional checks were performed when debris load or fish abundance was elevated. For safety reasons, the trap was pulled to the bank with an electric winch when possible, then returned to the fishing position when the livebox was clean. Once the fish were removed from the livebox, they were anesthetized with MS-222, identified to genus or species, measured (fork length) to the nearest millimeter. After the fish were sampled they were allowed to recover in a bucket for a short period of time prior to release.

Periods when the trap was not fished (including repair times) were recorded. A linear regression was used to interpolate data for these periods. The linear regression was based on the daily fish counts for a 2-4 day period preceding and following the non-fished period.

RESULTS AND DISCUSSION

Spring Chinook Run Size

A summary of the Methow Basin spring chinook run size and spawner escapement for years 1967-2000 is presented in Table 1 and Figure 2. The estimated 2000 spring chinook run size to Wells Dam was 2,587 (2,130 or 82% adults; 457 or 18% jacks).

Broodstock Collection

A total of 1,436 fish (1,283 (89%) adults and 153 (11%) jacks) were taken for broodstock (Table 1). The broodstock collection was derived as follows: 338 spring chinook (296 adults, 42 jacks) were collected at Wells Dam and transferred to Methow Fish Hatchery (MFH); 156 chinook (133 adults, 23 jacks) volunteered to the MFH; and 942 chinook (854 adults, 88 jacks) volunteered to the WNFH.

The stock composition for each of the three broodstock collections is presented in Table 2. The Wells Dam collection was of natural origin- 2%, Methow Fish Hatchery (MFH) (all three subbasins)- 41%, WNFH- 44%, ENFH- 5%, Leavenworth National Fish Hatchery (LNFH)- 2%, Idaho origin- 1% and unknown- 17%. The MFH collection was comprised of MFH (all three subbasins)- 68%, Winthrop National Fish Hatchery (WNFH)- 23%, and unknown- 9%. The WNFH collection was comprised of MFH (all three subbasins)- 15%, WNFH- 75%, ENFH- 3%, and unknown- 6%.

Estimated Spawner Escapement

A total of 2587 fish were counted at Wells Dam minus 1436 fish taken for broodstock leaving a calculated natural escapement to the Methow Basin of 1151 fish. This most likely is an over estimate because of antidotal evidence of fall back and the inclusion of summer chinook in the final spring chinook run estimate at Wells Dam, both of which numbers are incalculable with any precision.

Fish Per Redd Ratio

A total of 368 redds were counted for the entire Methow Basin and based on an estimated spawner escapement of 1151 fish this equates to 3.1 fish per redd.

Spawning Ground Surveys

A summary of past year's spring chinook redd counts by subbasin are presented in Appendix Table 5. The basin wide redd distribution for year 2000 is shown in Figure 3. There was 368 total redds counted in 2000. This compares to an annual mean of 40 redds for the period 1995-99, and an annual mean of 395 redds since complete surveys were initiated in 1987. No pre-spawner mortality

Table 1. Summary of spring chinook adults passing Wells Dam, number of broodstock collected at Winthrop National Fish Hatchery and Methow Valley Spring Chinook Hatchery, and estimate of natural spawners in the Methow Basin, 1967-2000.

Year	Wells Dam Counts Adults	Jacks	Total	Composition of Jacks	Hatchery Broodstock WNFH	Hatchery Broodstock MFH	Natural Escapement (est.)
1967	541	616	1,157	53%	0	–	1,157
1968	4,086	845	4,931	17%	0	–	4,931
1969	3,048	551	3,599	15%	0	–	3,599
1970	2,092	578	2,670	22%	0	–	2,670
1971	2,535	633	3,168	20%	0	–	3,168
1972	3,368	248	3,616	7%	0	–	3,616
1973	2,505	507	3,012	17%	0	–	3,012
1974	3,199	221	3,420	6%	0	–	3,420
1975	2,096	129	2,225	6%	0	–	2,225
1976	1,510	1,249	2,759	45%	0	–	2,759
1977	3,976	235	4,211	6%	0	–	4,211
1978	3,532	83	3,615	2%	38	–	3,577
1979	971	132	1,103	12%	102	–	1,001
1980	941	241	1,182	20%	155	–	1,027
1971-1980 (avg)			2,831				2,801
1981	1,367	98	1,465	7%	399	–	1,066
1982	2,270	131	4,252	3%	601	–	3,651
1983	2,726	143	2,869	5%	755	–	2,114
1984	3,066	214	3,280	7%	510	–	2,770
1985	5,151	116	5,267	2%	1201	–	4,066
1986	2,896	65	2,961	2%	836	–	2,125
1987	2,272	74	2,346	3%	594	–	1,752
1988	2,844	96	2,940	3%	1327	–	1,613
1989	1,633	87	1,720	5%	195	–	1,525
1990	927	12	939	1%	121	–	818
1981-1990 (avg)			2,804			–	2,150
1991	682	100	782	13%	92	–	690
1992	1,596	27	1,623	2%	271	60	1,232
1993	2,422	22	2,444	1%	646	252	1,546
1994	243	15	258	6%	29	34	195
1995	72	41	113	36%	0	14	99
1996	388	73	461	16%	146	315	0
1997	972	32	1,004	3%	220	323	461
1998	416	14	430	3%	409	10	11
1999	360	289	649	45%	0	377	272
2000	2,130	457	2,587	18%	1,098	338	1,151/a
1991-2000 (avg)			1,035				501

/a If the ENFH fish fallback issue is taken into account the revised escapement value is 826 fish.

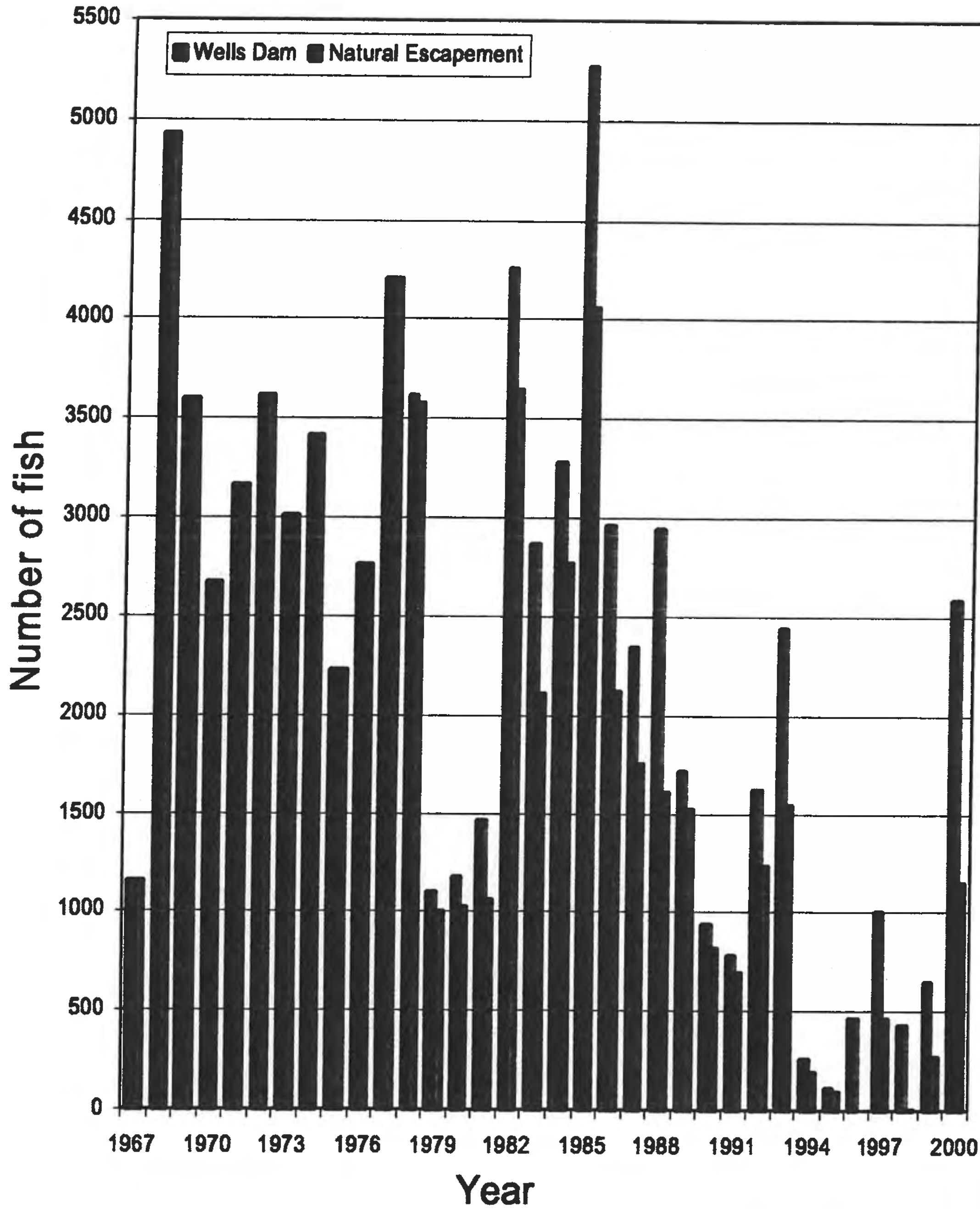

Figure 2. Estimated run size and natural escapement in the Methow Basin, 1967-2000.

Table 2. The number of 2000 brood spring chinook adults based on origin from Wells Dam, MFH and WNFH collection sites.

Stock	Wells Dam		Methow Outfall		WNFH	
	Adults	Percent	Adults	Percent	Adults	Percent
Methow Composit	96	29%	84	61%	124	14%
Twisp River	39	12%	9	7%	22	2%
Wild	7	2%	0	0%	0	0%
Carson (WNFH)	146	44%	32	23%	695	75%
ENFH	17 /a	5%	0	0%	32 /b	3%
LNFH	5	2%	0	0%	1	0%
Idaho	4	1%	0	0%	0	0%
Unknown	17	5%	12	9%	55	6%
Total	**331**	**100%**	**137**	**100%**	**929**	**100%**

/a 100% adipose clipped fish.

/b This number includes 28 adipose present fish with hatchery scale patterns.

was observed in any of the subbasins.

Methow

A total of 234 spring chinook redds were found in the Methow River, which comprised 63.6% of the basin total (Appendix Table 1). This includes two redds in Wolf Creek, five in the MFH outfall, 14 in the WNFH outfall (Spring Creek), and one in Foghorn ditch.

Presented in Table 3 is the number and percent of redds located above, within and below each index reach by subbasin. There were 23 (9.8%) redds located within the index reach (Mazama Bridge to Weeman Bridge). However, we estimate that all but one of these redds were lost during the fall and winter, when the river dewatered. The percentage of redds located above and below the index reach was 0.9% (2 redds) and 89.3% (209 redds), respectively.

The number of redds downstream of the Methow index reach was the highest recorded since complete surveys were initiated in 1987. The reach from Weeman Bridge to "Along-Highway 20" had the highest number of redds- 120, while the Foghorn-Chewuch confluence reach had the second most redds- 47, with most of these being deposited in the tail-out of the pool immediately downstream of Foghorn Dam. Seventy-one percent of the redds were deposited in these two reaches (51% in Weeman Bridge-"Along-Highway 20" and 20% in Foghorn-Chewuch confluence (Appendix Table 2).

September 11 was the peak week (44%) of spawning in the Methow River, while spawning extended from the week of August 28 through September 29.

The atypically high percentage (71%) of fish that spawned below the index reach appears to be the result of the run being composed of 85% in-basin hatchery origin fish (pers comm. Bob Jataff, WDFW, 2000). This is the most skewed run with respect to the wild to hatchery composition since the program was initiated. Foghorn Dam, which is situated just upstream of both hatcheries, was not determined to be an impediment to migrating adults, and thus not a factor contributing to the observed spawning distribution in the Methow. Most likely, the observed Methow spawning distribution is a consequence of returning hatchery adults not distributing to river reaches that are geographically distant from their initial acclimation site. Another factor is the availability of good spawning habitat in close proximity to both hatcheries. For example, ample spawning habitat exists near the Big Valley Ranch (RM 54.5) both in the mainstem and adjacent side channels, which is located within the Weeman Bridge-"Along-Highway 20" reach, where 51% of the redds in the Methow River were located. There were also redds located immediately below Foghorn Dam in close proximity to one another where adequate spawning habitat exists.

Lost River

Two redds were located near the confluence of the Lost and Methow rivers (Appendix Table 2). These were outside the index reach (Eureka Creek to Lost River Bridge). The Lost River accounted for 0.5% of the Methow Basin total redd count, which is well below the annual mean of 6.3% and the maximum of 11% recorded in 1989. Both redds were counted during the week of September 4.

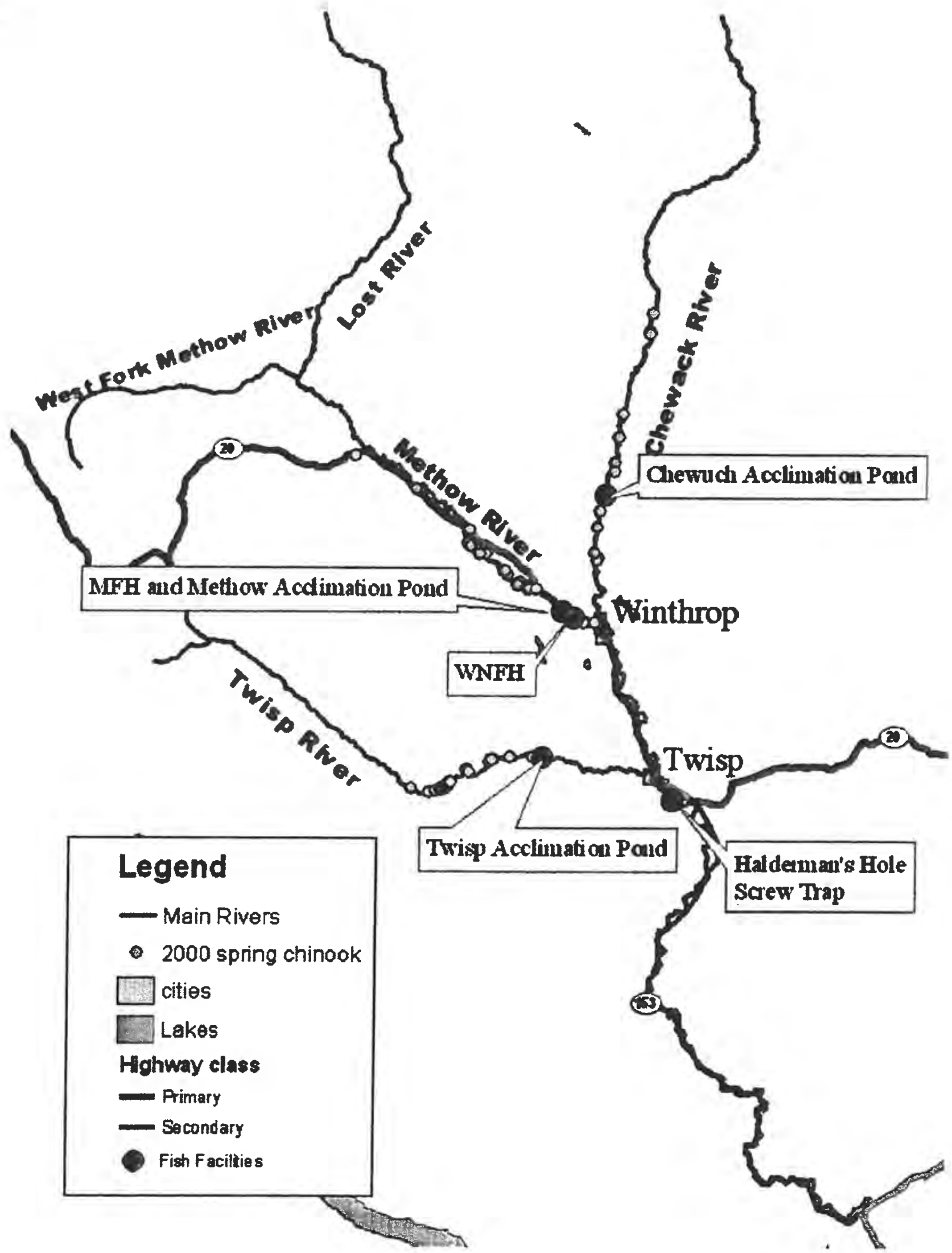

Figure 3. Spring Chinook spawning distribution and location of key sites in the Methow Basin.

Table 3. The number and percent of redds located above, within and below the index reaches in the Methow, Chewuch and Twisp basins, 1987-2000.

Year	Methow # of redds	% of redds	# of redds	% of redds	# of redds	% of redds	Total # of redds
1987	32	12.5%	75	29.3%	149	58.2%	256
1988	52	19.8%	82	31.3%	128	48.9%	262
1989	9	8.2%	60	54.5%	41	37.3%	110
1990	26	13.4%	80	41.2%	88	45.4%	194
1991	18	24.3%	31	41.9%	25	33.8%	74
1992	45	13.4%	90	26.8%	201	59.8%	336
1993	59	20.3%	92	31.7%	139	47.9%	290
1994	15	23.4%	8	12.5%	41	64.1%	64
1995	0	0.0%	7	77.8%	2	22.2%	9
1996 /	0	0.0%	0	0.0%	0	0.0%	0
1997	25	41.7%	4	6.7%	31	51.7%	60
1998 /	0	0.0%	0	0.0%	0	0.0%	0
1999	3	17.6%	2	11.8%	12	70.6%	17
2000	2	0.9%	23	9.8%	209	89.3%	234
Average	**26**	**17.8%**	**50**	**34.1%**	**97**	**57.2%**	

Year	Chewuch # of redds	% of redds	# of redds	% of redds	# of redds	% of redds	Total # of redds
1987	38	19.9%	77	40.3%	76	39.8%	191
1988	51	25.2%	55	27.2%	96	47.5%	202
1989	22	13.8%	44	27.5%	94	58.8%	160
1990	34	21.5%	61	38.6%	63	39.9%	158
1991	17	18.7%	30	33.0%	44	48.4%	91
1992	38	20.5%	77	41.6%	70	37.8%	185
1993	23	27.7%	35	42.2%	25	30.1%	83
1994	5	18.5%	11	40.7%	11	40.7%	27
1995	2	100.0%	0	0.0%	0	0.0%	2
1996 /	0	0.0%	0	0.0%	0	0.0%	0
1997	2	3.6%	27	49.1%	26	47.3%	55
1998 /	0	0.0%	0	0.0%	0	0.0%	0
1999	0	0.0%	0	0.0%	6	100.0%	6
2000	1	3.1%	11	34.4%	20	62.5%	32
Average	**21**	**24.8%**	**39**	**34.1%**	**48**	**50.3%**	

Year	Twisp # of redds	% of redds	# of redds	% of redds	# of redds	% of redds	Total # of redds
1987	44	26.8%	79	48.2%	41	25.0%	164
1988	45	22.6%	111	55.8%	43	21.6%	199
1989	28	15.6%	100	55.9%	51	28.5%	179
1990	12	10.7%	77	68.8%	23	20.5%	112
1991	12	17.4%	40	58.0%	17	24.6%	69
1992	12	8.5%	73	51.8%	56	39.7%	141
1993	40	20.8%	108	56.3%	44	22.9%	192
1994	13	40.6%	13	40.6%	6	18.8%	32
1995	0	0.0%	2	50.0%	2	50.0%	4
1996 /	0	0.0%	0	0.0%	0	0.0%	0
1997	1	3.1%	12	37.5%	19	59.4%	32
1998 /	0	0.0%	0	0.0%	0	0.0%	0
1999	9	90.0%	1	10.0%	0	0.0%	10
2000	2	2.0%	63	63.6%	34	34.3%	99
Average	**20**	**23.5%**	**62**	**54.2%**	**31**	**31.4%**	

/a All fish were collected at Wells Dam for broodstock.

No carcasses were found in the Lost, but two were found nearby in the Methow (Lost River Confluence-Gate Creek reach). Both were females; the first age four from WNFH, while the other was age five and wild.

Chewuch River

A total of 32 redds were deposited in the Chewuch River (Appendix Table 3), which comprised 8.7% of the Methow basin total. Eleven redds were located in the index reach (Camp-Four Bridge to Falls Creek Campground). This is comparable to the annual mean of 34.1% of the redds being located in the index reach (Table 3). One redd was located above and 20 redds below the index reach, respectively.

The peak spawn week (72%) in the Chewuch River occurred September 4, and spawning extended from the week of August 28 through September 26.

Twisp River

A total of 99 redds were located in the Twisp River (Appendix Table 4); with the majority of spawning occurred upstream of the Twisp acclimation pond (RM 5). Eighty-nine percent of the spawning occurred upstream to Little Bridge Creek. Sixty-three were redds deposited within the index reach (Mystery bridge to Buttermilk bridge), which is somewhat higher than the annual mean of 54.2% redds located within the index reach (Table 3). Two redds were located above the index reach, and 34 were located below the index reach. No dewatering of redds occurred in the Popular Flats reach this year.

Peak spawning (37%) in the Twisp River occurred the week of August 28, and spawning extended from the week of August 14 through September 18.

Other Tributaries

One redd was found near the diversion on Early Winters Creek. Surveys at the end of the season found no spring chinook redds in Lake, Twenty-Mile and Boulder creeks (Chewuch drainage), Gold Creek (Methow drainage), or Little Bridge Creek (Twisp drainage).

Carcass Distribution And Length Distribution

A total of 176 carcasses were recovered in the entire Methow Basin, of these 32 (18%) were of natural origin and 156 (82%) were of hatchery origin. Wild origin fish were determined either through scale reading or the presence of an adipose fin. It should be noted that subsequent to the field season it was learned that some adipose present hatchery fish existed in the 2000 run. Because readable scales were not always available for each wild carcass, it's therefore possible that some carcasses were miss identified as wild when in fact they are hatchery.

A summary of CWT recoveries by hatchery release groups within specific reaches of the Methow, Chewuch and Twisp subbasins is presented in Figure 4.

Summary By Subbasin

Chewuch

Within the Chewuch 12 carcasses were recovered, of these, seven were of natural origin and five hatchery origin. Four CWTs were recovered from carcasses collected in the Chewuch with one CWT from each of the following releases:

Chewuch 97 (63/06/14)	1 fish
Methow 96 (63/01/30)	1 fish
Winthrop 96 (05/44/53)	1 fish
Enitiat 96 (05/37/07)	1 fish

One hatchery fish (adipose clipped) was recovered with no CWT present.

Methow

Within the Methow River 116 carcasses were recovered. The natural to hatchery origin composition was 17 and 99 fish, respectively. The composition of the 79 CWT recoveries was as follows:

Methow 96 (63/01/30)	43 fish
Methow 96 (63/63/15)	1 fish
Methow 97 (63/06/13)	2 fish
Chewuch 97 (63/06/14)	3 fish
Twisp 96 (63/61/14)	4 fish
Winthrop 96 (05/36/31)	6 fish
Winthrop 96 (05/38/56)	10 fish
Winthrop 96 (05/44/53)	8 fish
Winthrop 96 (05/46/11)	2 fish

Three CWTs were subsequently lost during dissection and six hatchery carcasses were without CWTs after being scanned. It's assumed the remaining 11 hatchery carcasses had a CWT present, but were not recovered (the field notes did not state a reason for these tags not being recovered).

Twisp

A total of 48 carcasses were recovered in the Twisp River, of these eight were of natural origin and 40 of hatchery origin. A total of 35 CWTs were recovered and no tag was present or recovered from the remaining five hatchery carcasses.

The composition of CWT recoveries was as follows:

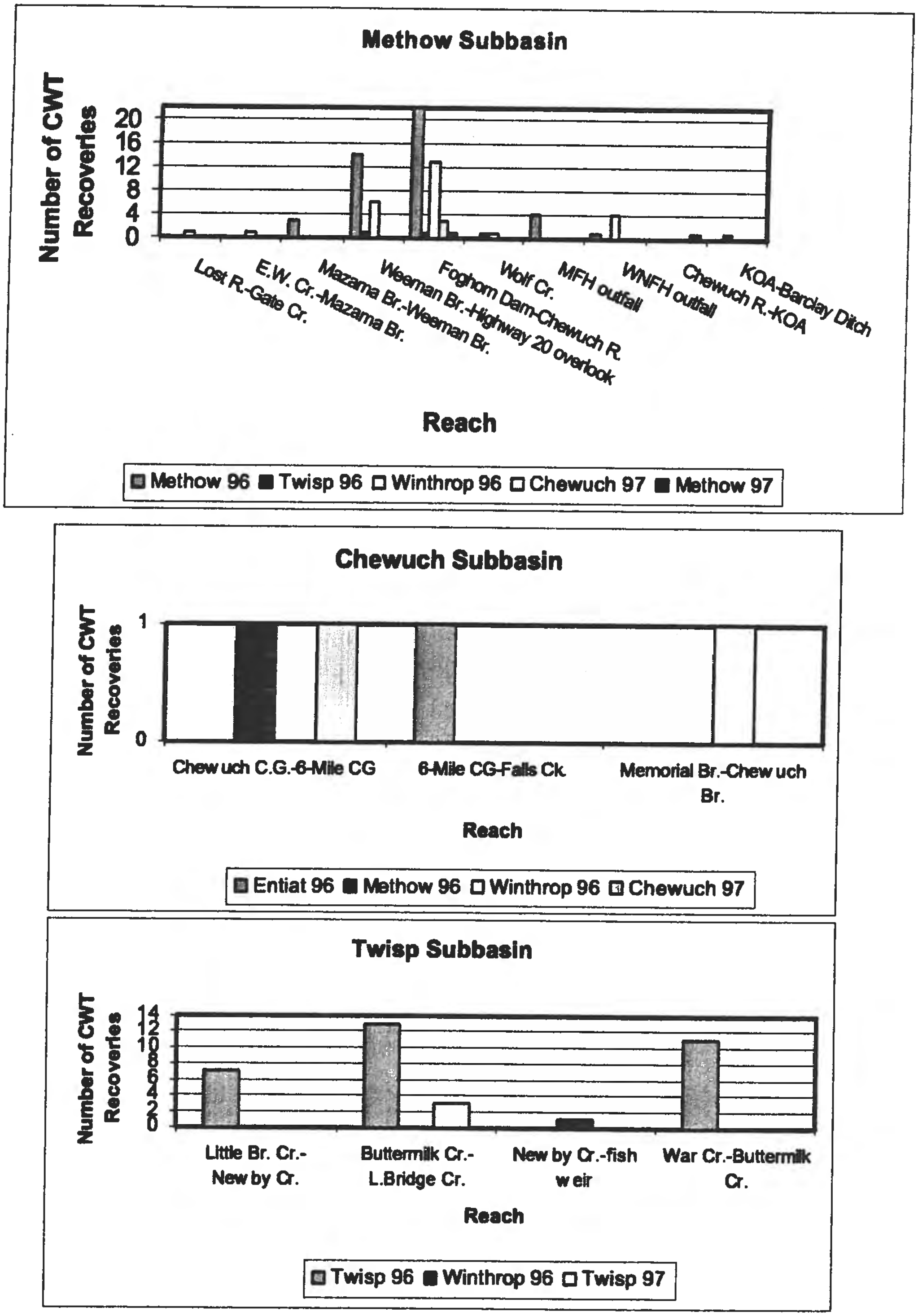

Figure 4. Summary of coded-wire-tag recoveries by release group within the Methow, Chewuch and Twisp subbasins in 2000.

Twisp 96 (63/61/14)	26 fish
Twisp 96 (63/63/16)	5 fish
Twisp 97 (63/04/34)	3 fish
Winthrop 96 (05/36/31)	1 fish

Distribution By Release Group

The distribution of carcass recoveries by hatchery release group in the Methow, Chewuch and Twisp subbasins in presented in Figure 5. A total of 45 Methow-96 CWTs were successfully read from carcasses, of which 44 were recovered in the Methow River and one from the Chewuch River.

A total of 35 Twisp-96 CWTs were successfully read from recovered carcasses. Of these, 31 were recovered within the Twisp River and the other four were recovered in the Methow River.

A total of 28 Winthrop-96 carcasses were recovered and their CWT successfully read. Twenty-six of them were located in the Methow River and one each in the Chewuch and Twisp rivers.

Of the four Chewuch CWTs recovered and read, one was located in the Chewuch River while the remaining three were found in the Methow River. One Entiat-96 CWT located in the Chewuch River successfully recovered and read.

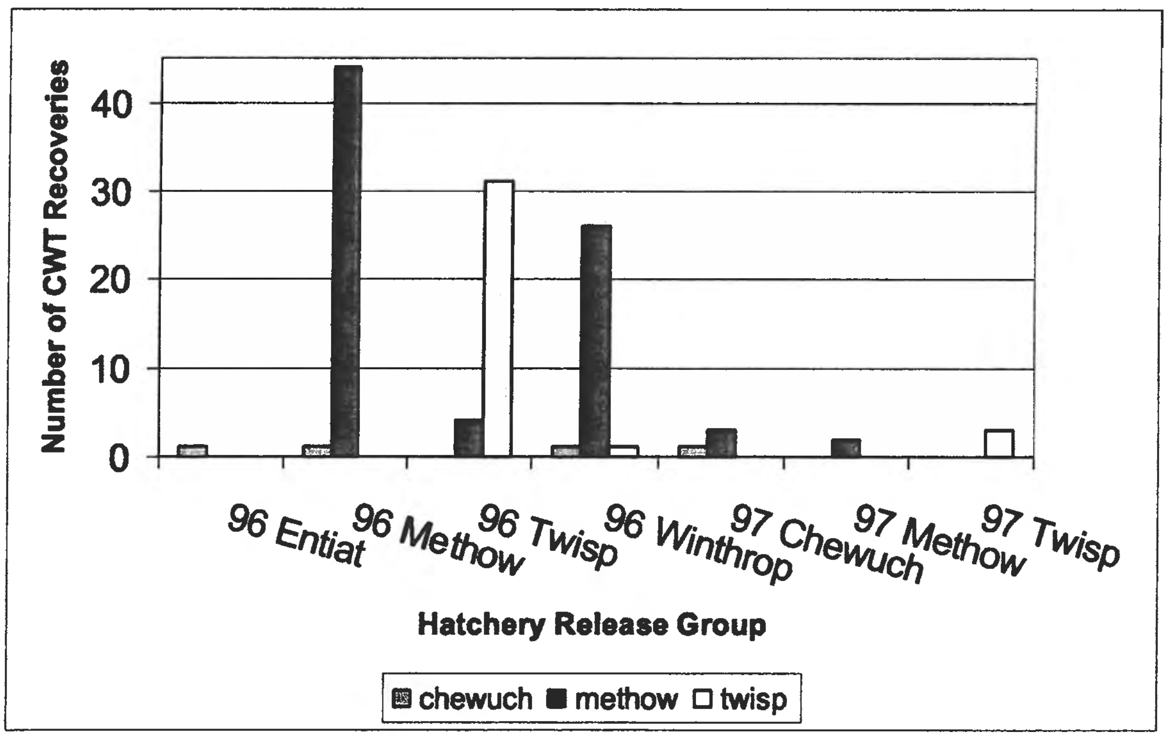

Figure 5. Summary of coded-wire-tag recoveries by release group throughout the Methow Basin in 2000.

Two Methow-97 CWTs were successfully recovered and read from carcasses in the Methow River, and three Twisp-97 CWTs were similarly recovered in the Twisp River.

Carcass Length Distribution

Figures 6-8 depict the fork length frequency of carcasses (not stock specific) recovered from the three subbasins. In the Methow the mean fork length of adults was 72 cm, and ranged from 52 cm to 104 cm. The mean fork length of adults in the Chewuch was 79 cm, with fish ranging from 56 cm to 93 cm. The mean fork length of adults in the Twisp was 72 cm, with a range of 53 cm to 84 cm.

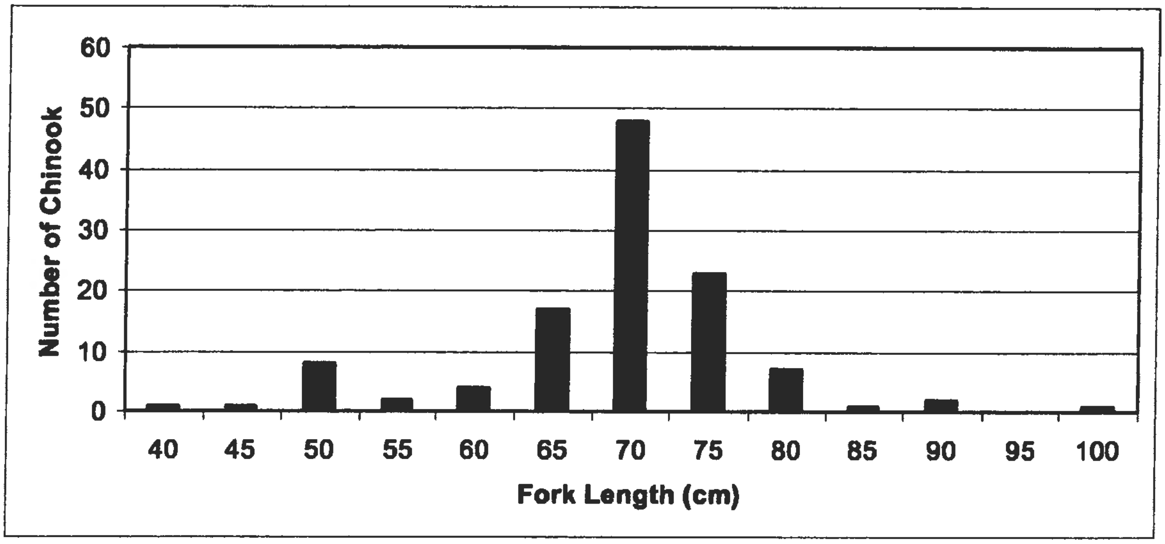

Figure 6. Fork length frequency of spring chinook carcasses collected from the Methow River in 2000.

Age Composition

A summary of the spring chinook age composition based on scales collected from carcasses in the Methow, Chewuch and Twisp subbasins is presented in Table 4.

A total of 123 hatchery and 15 wild origin scale samples were successfully read, while 21 hatchery and 17 wild samples were not read either due to a missing sample, the scale was unreadable or was regenerated. Within the hatchery group 100% of the fish were age-4 across all three subbasins. Wild fish age composition in the Methow River was 33% (N=3) age-3 (jacks), 33% (N= 3) age-4 and 33% (N=3) age-5. For the Chewuch (N= 4)and Twisp (N= 2) rivers the wild age composition consisted only of age-5 adults.

Steelhead/rainbow trout ranged in fork length from 72 to 301 mm (Figure 10), and had a mean fork length of 151 mm (S.D. = 49.6). The wide distribution in length indicates the presence of

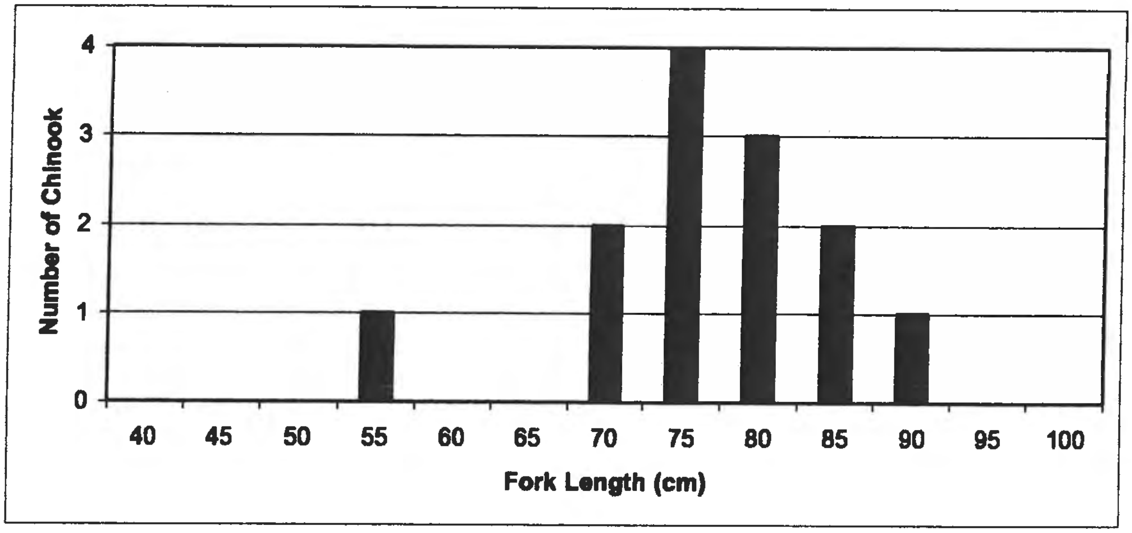

Figure 7. Fork length frequency of spring chinook carcasses collected from the Chewuch River in 2000.

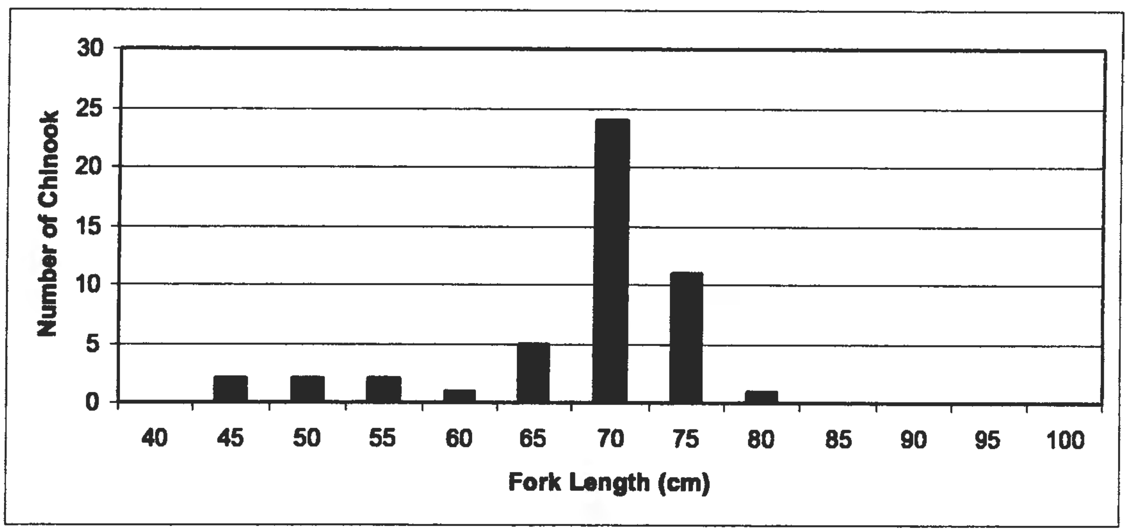

Figure 8. Fork length frequency of spring chinook carcasses collected from the Twisp River in 2000.

Table 4. Summary of spring chinook age composition based on readable scales collected from carcasses in the Methow Basin, 2000.

River	Hatchery			Wild			
	Age-3	Age-4	NA \a	Age-3	Age-4	Age-5	NA \a
Methow	5	76	18	3	3	3	8
Chewuch	1	3	1	0	0	4	3
Twisp	3	35	2	0	1	1	6

\a NA = scale samples either missing, unreadable or regenerated.

Juvenile Outmigration

Spring Chinook

Estimated daily wild spring chinook outmigrants are summarized in Appendix Table 7. During the monitoring period (October 5 – December 12) an estimated 1,414 spring chinook outmigrants passed the Halderman's Hole monitoring site. This estimate is based upon the direct percent river flow entrained by the rotary trap. The estimate is noticeably lower- 829 fish, if based upon the percent of spring chinook entrained into the trap from the three efficiency test releases (mean equaled 68%). The 25%, 50% and 75% dates of cumulative passage for spring chinook were, respectively, October 15, October 27 and November 8. There were three peak periods of outmigration, which occurred October 12 and 25 and November 21. In all cases there was no apparent association with either river flow or water temperature. River flow remained essentially constant throughout the monitoring period. Stream flow ranged from 207 cfs to 337 cfs, with a mean flow of 268 cfs and a standard deviation of 30.7. To be expected, water temperature declined throughout the monitoring period. In October the water temperature was 7° C or greater and ranged between 7 to 11° C; while water temperatures in November remained above freezing, ranging between 1 to 8° C. During the first week in December temperatures ranged between 3 to 5° C.

The mean wild spring chinook fork length was 102 mm (S.D. = 11.6) and ranged from 70 to 141 mm (Figure 9). With the exception of a few fish, all are considered to be of age-0.

Steelhead

A total of 60 wild *O. mykiss* fish were captured during the monitoring period. Since no efficiency test releases were made for *O. mykiss* only the absolute number of fish captured is reported. The numbers of outmigrating fish increased from October (25%) to November (53%), and into December, where 22% (13) of the fish were collected during the first week, after which monitoring ceased.

several year classes.

Other Species

Non-target fish species captured in the rotary trap are presented in Appendix Table 8. Mountian Whitefish (*Prosopium coulteri*) was the most common fish (104) collected, followed by dace (*Rhinichthys spp*)- 16, sculpins (*Cottus spp*)- 8, summer chinook (*O. tshawytscha*)- 5, 1 lamprey- 4, suckers (*Catostomus spp*)- 3, redside shiner (*Richardsonius balteatus*)-2, bulltrout (*Salvelinus Malma*)- 2, cutthroat trout (*O. Clarki*)- 2 and sockeye (*O. nerka*)-1.

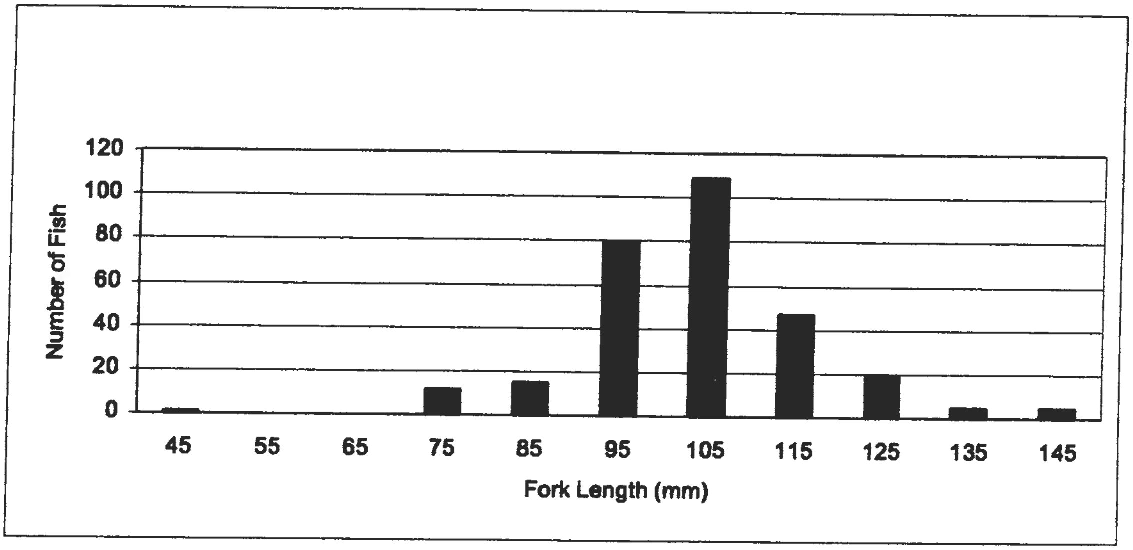

Figure 9. Fork length frequency of juvenile chinook captured in the rotary trap, fall 2000.

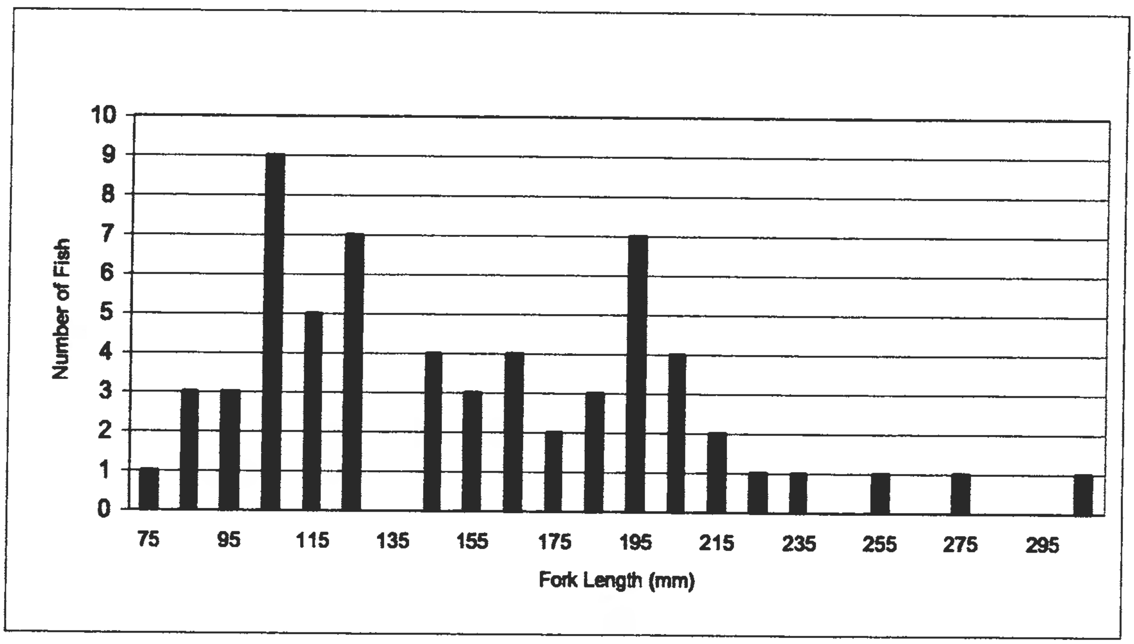

Figure 10. Fork length frequency of juvenile *O. mykiss* captured in the rotary trap, fall 2000.

Conclusions

Management Considerations

The uniqueness of the 2000 return being dominantly comprised of hatchery origin fish has raised two issues that will require future decision-making on both the technical and management levels. First, it's quite apparent, at least in the Methow River that the spawning distribution in 2000 shifted downstream, with the majority of fish spawning downstream to Weeman Bridge. Twenty percent of the redds were located between Foghorn Dam and the Chewuch River confluence. This may suggest that the supplementation objective of getting hatchery spawners to distribute throughout the Methow River in portion to the historic spawning distribution is not succeeding in the Methow. As previously stated in this document, it appears this is a function of both suitable spawning habitat near the two hatcheries and the acclimation and release of hatchery smolts from the MFH and WNFH. This phenomenon was not observed in either the Twisp or Chewuch rivers. It's believed that the lack of both quantity and quality of spawning habitat in the vicinity of each respective acclimation site force fish to migrate upstream into the index reaches, where most of the spawning historically occurs and where the most suitable spawning habitat exists. Future consideration needs to be made of relocating the Methow acclimation site further upstream nearer the traditional spawning reaches. Additionally, this needs to be considered for fish cultured at the WNFH.

Secondly, and indirectly related to the first issue, is the need to include in years when possible, a higher proportion of natural fish in the broodstock collection. The issue at hand is whether the MBSCSP is unwontedly moving incrementally towards a "concrete-to-concrete" type hatchery program especially in the Methow. For the Methow population the manner in which broodstock is collected needs to be revisited. Clearly, few if any natural spawners ever volunteer into the WNFH or the MFH broodstock holding ponds, thus the issue of tributary and/or Wells Dam broodstock collection needs to be further discussed. It's acknowledged that low run sizes in recent years have forced the Program to deviate somewhat from its original objectives.

Thirdly, given the low redd counts in the Lost River in recent years consideration should be given by technical and management makers to determining supplementation objectives for this population.

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Richardson, Don. 1976. Natural monthly streamflow in the Methow Basin. Water Resources Analysis and Information Section, Office Report No. 46. Washington Dept. of Ecology, Olympia, WA. 7p.

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APPENDICES

Appendix Table 1. Methow subbasin survey schedule and redd counts, 2000.

River Section	Section number	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9*	Total
		7/31	8/7	8/14	8/21	8/28	9/4	9/11	9/18	9/25	
Trout Cr. - Ballard cmp. gr.	--										0
Ballard cmp. gr. - Lost R.	1	0		0	0			0	0		0
Lost R. - Gate Cr.	2				0	0	0	0	0		0
Gate Cr. - Early Winters Cr.	3	0			0		0		0		0
Early Winters Cr. - Mazama Br.	4	0	0		0		2	0	0		2
Mazama Br. - Rd. barrier	**5**	0	0	0	0	0	4	1	0	0	5
Rd. barrier - Weeman Br.	**6**	0	0	0	0	6	5	0	5	2	18
Weeman Br. - Along Highway 20	7		0	0		16	31	69	4	0	120
Along Highway 20 - Wolf Cr.	8		0	0		0	3	0	0	0	3
Wolf Cr. - Foghorn Dam	9		0	0		0	6	3	5		14
Foghorn Dam - Chewuch Confluence	10		0	0		5	12	30	0		47
Chewuch Conf. - KOA Campground	11					0				3	3
											0
Wolf Creek						2			0		2
Methow Hatchery outfall						4		0		1	5
Spring Creek (Winthrop H. outfall)							7		1	6	14
Foghorn Ditch										1	1
		0	0	0	0	33	70	103	15	13	234

* Includes data from weeks after 9/25

Appendix Table 2. Lost River and Early Winters Creek survey schedules and redd counts, 2000.

River Section	Section number	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Total
		7/31	8/7	8/14	8/21	8/28	9/4	9/11	9/18	9/25	
Lost River											
Sunset Cr. - Eureka Cr.	1		0								0
Eureka Cr. - Lost R. Rd. Br.	2		0	0		0	0		0		0
Lost R. Rd. Br. - confluence	3	0	0	0	0	0	2	0			2
Early Winters Creek											0
											0
Klipchuch cmp. gr. - Early Winters Br.	1				0			0			0
Early Winters Br. - Highway 20 Br.	2		0		0			0			0
Highway 20 Br. - diversion dam	3		0			1			0		1
Diversion dam - Highway 20 Br.	4		0			0			0		0
Highway 20 Br. - confluence	5					0			0		0
		0	0	0	0	1	2	0	0	0	3

Appendix Table 3. Chewuch subbasin survey schedule and redd counts, 2000.

River Section	Section number	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9 *	
		7/31	8/7	8/14	8/21	8/28	9/4	9/11	9/18	9/25	Total
falls - 30 mi. Br.	1				0						0
30 mi. Br. - road-side cmp.	2		0		0		0		0		0
Rd. side cmp. - Andrews Cr.	3		0		0		0	0	0		0
Andrews Cr. - Lake Cr.	4		0		0		0	0	0		0
Lake Cr. - Buck Cr.	5				0		0	0	0		0
Buck Cr. - camp 4	6	0	0	0	0	0	0	0	0	1	1
camp 4 - road-side cmp.	7		0	0	0	0	1	0	1	0	2
road-side cmp. - Chewuch cmp. gr.	8	0	0	0	0	0	2	0	1	0	3
Chewuch cmp. gr. - mile 6 cmp.	9	0	0	0	0	0	4	0	0		4
mile 6 cmp. - Falls Cr. cmp. gr.	10	0	0	0	0	0	1	0	0	1	2
Falls Cr. cmp. gr. - 8 mile ranch	11	0			0	0	3	0	0	1	4
8 mile ranch - Memorial Br.	12	0	0		0	0	7		0		7
Memorial Br. - Chewuch Br.	13	0	0		0	0	0		0	1	1
Chewuch Br. - halfway pt.	14	0		0		1	1		0	1	3
halfway pt. - confluence	15			0		0	4		0	1	5
		0	0	0	0	1	23	0	2	6	32

* Includes data from weeks after 9/25

Appendix Table 4. Twisp subbasin survey schedule and redd counts, 2000.

River Section	Section number	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Total
		7/31	8/7	8/14	8/21	8/28	9/4	9/11	9/18	9/25	
Rd. end cmp. gr. - up 2 mi.	1		0	0							0
Rd. end cmp. gr. - South Cr. Br.	2		0	0			2		0		2
South Cr. Br. - Popular Flats cmp. gr.	3	0	0	0			0		0		0
Popular Flats cmp. gr. - Mystery Br.	4	0		0			0		0		0
Mystery Br. - War Cr. Br.	5	0	0	0	5	10	0		0	0	15
War Cr. Br. - cabin	6	0	0	1	7	17	0		5	0	30
cabin - Buttermilk Br.	7	0	0	0	8	6			4	0	18
Buttermilk Br. - green Br.	8		0	1	0		1	0	3	0	5
green Br. - Little Br. Cr.	9			0	0		15	0	3	0	18
Little Cr. Br. - Newby Cr. Br.	10			0	0	1		0	3		4
Newby Cr. Br. - fish weir	11			0	0	3			1		4
fish weir - wooden Br.	12			0					2		2
wooden Br. - Poorman's Br.	13		0						1		1
Poorman's Br. - Twisp R. Br.	14		0						0		0
Twisp R. Br. - confluence	15		0	0				0	0		0
		0	0	2	20	37	18	0	22	0	99

Appendix Table 5. Summary of Methow Basin Spring Chinook Redd Counts, 1987-2000.

River	Survey Reach	1987	1988	1989	1990	1991	1992
		Number of redds and corresponding percentages.					
Lost River							
Index Reach	Eureka Ck-Lost R. Bridge	52	53	53	31	16	71
		92.9%	100.0%	93.0%	93.9%	100.0%	97.3%
Below Index Reach	Lost R. Br-Confluence	4	0	4	2	0	2
		7.1%	0.0%	7.0%	6.1%	0.0%	2.7%
	Annual Lost Total	56	53	57	33	16	73
	Annual Percent of Methow Basin	8.2%	7.2%	11.0%	6.6%	6.4%	9.9%
Early Winters Cr.							
	Klipchuck C.G.-Hwy Bridge	6	8	5	0	0	2
		42.9%	47.1%	45.5%	0.0%	0.0%	66.7%
	Highway Br.-Confluence	8	9	6	1	0	1
		57.1%	52.9%	54.5%	100.0%	0.0%	33.3%
	Annual Early Winters Total	14	17	11	1	0	3
	Annual Percent of Methow Basin	2.1%	2.3%	2.1%	0.2%	0.0%	0.4%
Methow River							
Above Index Reach	Lost R. Conf.-Mazama Bridge	32	52	9	26	18	45
		12.5%	19.8%	8.2%	13.4%	24.3%	13.4%
	Number of Redds Above The Index Reach	32	52	9	26	18	45
	Percent of Redds Above The Index Reach	12.5%	19.8%	8.2%	13.4%	24.3%	13.4%
Index Reach	Mazama Br.-Weeman Bridge	75	82	60	80	31	90
		29.3%	31.3%	54.5%	41.2%	41.9%	26.8%
Below Index Reach	Weeman Br.-Winthrop Bridge	131	121	37	74	21	173
		51.2%	46.2%	33.6%	38.1%	28.4%	51.5%
	Winthrop Bridge-Twisp Bridge	16	7	2	7	3	21
		6.3%	2.7%	1.8%	3.6%	4.1%	6.3%
	Twisp Bridge-Carlton Bridge	2		2	7	1	7
		0.8%	0.0%	1.8%	3.6%	1.4%	2.1%
	Number of Redds Below The Index Reach	149	128	41	88	25	201
	Percent of Redds Below The Index Reach	58.2%	48.9%	37.3%	45.4%	33.8%	59.8%
	Annual Methow Total	256	262	110	194	74	336
	Annual Percent of Methow Basin	37.6%	35.7%	21.3%	39.0%	29.6%	45.5%

Appendix Table 5 Cont'. Summary of Methow Basin Spring Chinook Redd Counts, 1987-2000.

River		Survey Reach	Number of redds and corresponding percentages. 1987	1988	1989	1990	1991	1992
Chewuch River								
	Above Index Reach	30 Mile Bridge-Andrews Creek	17	25	1	16	6	12
			8.9%	12.4%	0.6%	10.1%	6.6%	6.5%
		Andrews Creek-Lake Creek	0	0	0	0	0	0
			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Lake Creek-Camp 4 Bridge	21	26	21	18	11	26
			11.0%	12.9%	13.1%	11.4%	12.1%	14.1%
		Number of Redds Above The Index Reach	**38**	**51**	**22**	**34**	**17**	**38**
		Percent of Redds Above The Index Reach	**19.9%**	**25.2%**	**13.8%**	**21.5%**	**18.7%**	**20.5%**
	Index Reach	Camp-4 Bridge-Falls Creek Campground	77	56	44	61	30	77
			40.3%	27.2%	27.5%	38.6%	33.0%	41.6%
	Below Index Reach	Falls Creek Campground-Chewuch Bridge	54	63	52	42	16	61
			28.3%	31.2%	32.5%	26.6%	17.6%	33.0%
		Chewuch Bridge-Confluence	22	33	42	21	28	9
			11.5%	16.3%	26.3%	13.3%	30.8%	4.9%
		Number of Redds Below The Index Reach	**76**	**96**	**94**	**63**	**44**	**70**
		Percent of Redds Below The Index Reach	**39.8%**	**47.5%**	**58.8%**	**39.9%**	**48.4%**	**37.8%**
		Annual Chewuch Total	191	202	160	158	91	185
		Annual Percent of Methow Basin	28.0%	27.6%	30.9%	31.7%	36.4%	25.1%
Twisp River								
	Above Index Reach	Upstream-South Creek	5	3	0	0	0	0
			3.0%	1.5%	0.0%	0.0%	0.0%	0.0%
		South Creek-Mystery Bridge	39	42	28	12	12	12
			23.8%	21.1%	15.6%	10.7%	17.4%	8.5%
		Number of Redds Above The Index Reach	**44**	**45**	**28**	**12**	**12**	**12**
		Percent of Redds Above The Index Reach	**26.8%**	**22.6%**	**15.6%**	**10.7%**	**17.4%**	**8.5%**
	Index Reach	Mystery Bridge-Buttermilk Bridge	79	111	100	77	40	73
			48.2%	55.8%	55.9%	68.8%	58.0%	51.8%
	Below Index Reach	Buttermilk Bridge-Little Bridge \a	29	27	41	19	17	16
			17.7%	13.6%	22.9%	17.0%	24.6%	11.3%
		Little Bridge-Confluence \b	12	16	10	4	0	40
			7.3%	8.0%	5.6%	3.6%	0.0%	28.4%
		Number of Redds Below The Index Reach	**41**	**43**	**51**	**23**	**17**	**56**
		Percent of Redds Below The Index Reach	**25.0%**	**21.6%**	**28.5%**	**20.5%**	**24.6%**	**39.7%**
		Annual Twisp Total	164	199	179	112	69	141
		Annual Percent of Methow Basin	24.1%	27.1%	34.6%	22.5%	27.6%	19.1%
Annual Basin Total			681	733	517	498	250	738

\a in 1987 survey ended at Newby Cr.

\b in 1987 survey started at Newby Cr.

\c in 1996 & 1998 all fish were collected at Wells Dam for broodstock.

Appendix Table 5 Cont'. Summary of Methow Basin Spring Chinook Redd Counts, 1987-2000.

River	Number of redds and corresponding percentages.						
	1994	1995	1996 /c	1997	1998 /c	1999	2000
Lost River							
Index Reach	6	0	na	7	na	0	0
	100.0%	0.0%	na	0.0%	na	0.0%	0.0%
Below Index Reach	0	0	na	0	na	3	2
	0.0%	0.0%	na	0.0%	na	100.0%	100.0%
	6	0	na	7	na	3	2
	4.5%	0.0%	na	4.7%	na	8.3%	0.5%
Early Winters Cr.							
	4	0	na	0	na	0	0
	100.0%	0.0%	na	0.0%	na	0.0%	0.0%
	0	0	na	0	na	0	1
	0.0%	0.0%	na	0.0%	na	0.0%	100.0%
	4	0	na	0	na	0	1
	3.0%	0.0%	na	0.0%	na	0.0%	0.3%
Methow River							
Above Index Reach	15	0	na	25	na	3	2
	23.4%	0.0%	na	44.6%	na	17.6%	0.9%
	15	0	na	25	na	3	2
	23.4%	0.0%	na	44.6%	na	17.6%	0.9%
Index Reach	8	7	na	4	na	2	23
	12.5%	77.8%	na	7.1%	na	11.8%	9.8%
Below Index Reach	39	2	na	27	na	11	206
	60.9%	22.2%	na	48.2%	na	64.7%	88.0%
	2	0	na	0	na	1	3
	3.1%	0.0%	na	0.0%	na	5.9%	1.3%
	0	0	na	0	na	0	0
	0.0%	0.0%	na	0.0%	na	0.0%	0.0%
	41	2	na	31	na	12	209
	64.1%	22.2%	na	48.2%	na	70.6%	89.3%
	64	9	na	56	na	17	234
	48.1%	60.0%	na	37.3%	na	47.2%	63.6%

Appendix Table 5 Cont'. Summary of Methow Basin Spring Chinook Redd Counts, 1987-20(

River	1994	1995	1996 /c	1997	1998 /c	1999	2000
	Number of redds and corresponding percentages.						
Chewuch River							
Above Index Reach	2	0	na	0	na	0	0
	7.4%	0.0%	na	0.0%	na	0.0%	0.0%
	0	0	na	0	na	0	0
	0.0%	0.0%	na	0.0%	na	0.0%	0.0%
	3	2	na	2	na	0	1
	11.1%	100.0%	na	3.6%	na	0.0%	3.1%
	5	2	na	2	na	0	1
	18.5%	100.0%	na	3.6%	na	0.0%	3.1%
Index Reach	11	0	na	27	na	0	11
	40.7%	0.0%	na	49.1%	na	0.0%	34.4%
Below Index Reach	1	0	na	22	na	5	12
	3.7%	0.0%	na	40.0%	na	83.3%	37.5%
	10	0	na	4	na	1	8
	37.0%	0.0%	na	7.3%	na	16.7%	25.0%
	11	0	na	26	na	6	20
	40.7%	0.0%	na	47.3%	na	100.0%	62.5%
	27	2	na	55	na	6	32
	20.3%	13.3%	na	36.7%	na	16.7%	8.7%
Twisp River							
Above Index Reach	0	0	na	1	na	0	2
	0.0%	0.0%	na	3.1%	na	0.0%	2.0%
	13	0	na	0	na	9	0
	40.6%	0.0%	na	0.0%	na	90.0%	0.0%
	13	0	na	1	na	9	2
	40.6%	0.0%	na	3.1%	na	90.0%	2.0%
Index Reach	13	2	na	12	na	1	63
	40.6%	50.0%	na	37.5%	na	10.0%	63.6%
Below Index Reach	6	0	na	12	na	0	23
	18.8%	0.0%	na	37.5%	na	0.0%	23.2%
	0	2	na	7	na	0	11
	0.0%	50.0%	na	21.9%	na	0.0%	11.1%
	6	2	na	19	na	0	34
	18.8%	50.0%	na	59.4%	na	0.0%	34.3%
	32	4	na	32	na	10	99
	24.1%	26.7%	na	21.3%	na	27.8%	26.9%
Annual Basin Total	133	15	na	150	na	36	368

\a in 1987 survey ended at Newby Cr.

\b in 1987 survey started at Newby Cr.

\c in 1996 & 1998 all fish were collected at Wells Dam for broodstock.

Appendix Table 6. Estimated daily spring chinook outmigrants for the rotary trap, Fall 2000.

Date	Hours trap fished per day	Chinook daily absolute fish count /a	Mean daily discharge (CFS)	Percent discharge into trap	Spring chinook extrapolation based on percent flow entrained	Temperature (Centigrade)	Spring chinook extrapolation based on mark-recapture efficiency
10/5/2000	14:00	12	301	40%	30	10	18
10/6/2000	0:00	13	298	40%	32	9	18
10/7/2000	0:00	13	301	40%	33	10	19
10/8/2000	0:00	14	297	40%	34	10	20
10/9/2000	0:00	14	297	40%	36	10	21
10/10/2000	0:00	15	297	40%	37	10	22
10/11/2000	0:00	15	291	40%	39	12	23
10/12/2000	0:25	16	288	40%	40	11	24
10/13/2000	22:55	11	284	40%	27	11	16
10/14/2000	9:30	10	282	40%	25	10	15
10/15/2000	0:00	9	278	41%	22	8	13
10/16/2000	0:00	8	279	41%	20	9	12
10/17/2000	1:15	7	284	40%	17	11	10
10/18/2000	23:10	3	284	40%	7	11	4
10/19/2000	6:50	1	284	40%	2	8	1
10/20/2000	8:30	2	288	40%	5	8	3
10/21/2000	23:45	3	297	40%	8	8	4
10/22/2000	0:00	11	294	40%	28	8	17
10/23/2000	0:00	20	290	40%	49	8	29
10/24/2000	0:40	28	290	40%	70	8	41
10/25/2000	23:45	30	284	40%	74	8	44
10/26/2000	0:00	17	284	40%	42	8	25
10/27/2000	23:45	18	284	40%	45	8	26
10/28/2000	0:00	18	312	39%	45	8	26
10/29/2000	0:00	17	337	38%	45	8	25
10/30/2000	0:00	17	310	39%	43	9	25
10/31/2000	0:00	16	298	40%	41	8	24
11/1/2000	0:00	16	294	40%	40	9	23
11/2/2000	0:00	15	285	40%	38	7	23
11/3/2000	21:20	15	284	40%	37	7	22
11/4/2000	16:20	3	293	40%	8	8	4
11/5/2000	0:00	4	293	40%	9	7	5
11/6/2000	0:00	4	284	40%	11	7	6
11/7/2000	23:50	5	277	41%	12	6	7
11/8/2000	23:15	4	293	40%	10	5	6
11/9/2000	23:25	5	295	40%	13	6	7
11/10/2000	0:05	2	283	40%	5	6	3
11/11/2000	22:15	3	268	41%	7	4	4
11/12/2000	22:30	1	260	42%	2	4	1
11/13/2000	22:30	1	264	41%	2	4	1
11/14/2000	22:20	7	257	42%	17	-	10
11/15/2000	20:45	8	237	43%	19	-	12
11/16/2000	14:51	3	251	42%	7	4	4
11/17/2000	23:07	4	244	43%	9	4	6
11/18/2000	22:10	3	231	43%	7	4	4
11/19/2000	7:35	10	230	44%	24	4	15
11/20/2000	0:00	18	246	42%	42	5	26
11/21/2000	17:15	25	234	43%	58	3	37
11/22/2000	23:20	11	220	44%	25	1	16
11/23/2000	0:10	5	236	43%	12	4	7
11/24/2000	0:00	0	228	44%	16	3	0
11/25/2000	0:30	1	229	44%	2	3	1
11/26/2000	22:20	5	232	43%	12	3	7
11/27/2000	0:25	5	227	44%	11	3	7
11/28/2000	23:20	1	209	45%	2	1	1
11/29/2000	1:15	3	245	43%	7	3	4
11/30/2000	23:14	6	239	43%	14	5	9
12/1/2000	23:20	4	233	43%	9	5	6
12/2/2000	21:25	2	232	43%	5	5	3
12/3/2000	23:55	0	227	44%	0	5	0
12/4/2000	23:45	2	207	45%	4	3	3
12/5/2000	17:10	4	229	44%	9	4	6
12/6/2000	22:00	3	226	44%	7	4	4
12/7/2000	21:30	3	222	44%	7	3	4
Fish totals		569			1,414		829

a/ Red highlighted numbers denote days where the daily fish count was interpolated due to the trap being operated less than 24 hours per day.

Appendix Table 7. Daily absolute counts of non-chinook species captured for the rotary trap, Fall 2000.

Date	Steelhead (<130 mm)	Steelhead (>=130 mm)	Mountain Whitefish	Dace	Bulltrout	Sculpin	Suckers	Sockeye	Cutthroat	Redside Shiner	Lamprey
10/5/2001	1	2	4	3	0	0	0	0	0	0	0
10/6/2001	0	0	0	0	0	0	0	0	0	0	0
10/7/2001	0	0	0	0	0	0	0	0	0	0	0
10/8/2001	0	0	0	0	0	0	0	0	0	0	0
10/9/2001	0	0	0	0	0	0	0	0	0	0	0
10/10/2001	0	0	0	0	0	0	0	0	0	0	0
10/11/2001	0	0	0	0	0	0	0	0	0	0	0
10/12/2001	1	1	0	2	1	0	0	0	0	0	0
10/13/2001	0	2	2	2	0	0	0	0	0	0	0
10/14/2001	0	0	0	0	0	0	0	0	0	0	0
10/15/2001	0	0	0	0	0	0	0	0	0	0	0
10/16/2001	0	0	0	0	0	0	0	0	0	0	0
10/17/2001	2	2	17	0	0	1	0	1	0	0	0
10/18/2001	2	1	3	0	0	0	0	0	0	0	0
10/19/2001	0	0	0	0	0	0	0	0	0	0	0
10/20/2001	0	0	0	0	0	0	0	0	0	0	0
10/21/2001	0	1	0	0	0	0	0	0	0	0	0
10/22/2001	0	0	0	0	0	0	0	0	0	0	0
10/23/2001	0	0	0	0	0	0	0	0	0	0	0
10/24/2001	3	2	7	0	0	0	0	0	0	0	0
10/25/2001	3	3	3	2	0	0	1	0	0	0	0
10/26/2001	2	5	1	0	0	0	1	0	1	1	0
10/27/2001	1	1	6	0	0	0	0	0	0	0	0
10/28/2001	0	0	0	0	0	0	0	0	0	0	0
10/29/2001	0	0	0	0	0	0	0	0	0	0	0
10/30/2001	0	0	0	0	0	0	0	0	0	0	0
10/31/2001	0	0	0	0	0	0	0	0	0	0	0
11/1/2001	0	0	0	0	0	0	0	0	0	0	0
11/2/2001	0	0	0	0	0	0	0	0	0	0	0
11/3/2001	0	3	6	0	0	0	0	0	0	0	0
11/4/2001	1	0	0	0	0	0	0	0	0	0	0
11/5/2001	0	0	0	0	0	0	0	0	0	0	0
11/6/2001	0	0	0	0	0	0	0	0	0	0	0
11/7/2001	0	0	3	1	0	0	1	0	0	0	0
11/8/2001	0	0	1	0	0	0	0	0	0	0	0
11/9/2001	0	0	0	0	0	0	0	0	0	0	0
11/10/2001	0	0	1	1	0	0	0	0	0	0	0
11/11/2001	0	0	6	0	0	0	0	0	0	0	0
11/12/2001	1	0	3	0	0	0	0	0	0	0	0
11/13/2001	0	1	0	0	0	0	0	0	0	1	0
11/14/2001	0	0	0	0	0	0	0	0	0	0	0
11/15/2001	1	1	0	1	0	0	0	0	0	0	0
11/16/2001	0	1	0	0	0	0	0	0	0	0	0
11/17/2001	0	0	0	0	0	1	0	0	0	0	0
11/18/2001	0	0	1	1	0	0	0	0	0	0	0
11/19/2001	0	0	0	0	0	0	0	0	0	0	0
11/20/2001	0	0	0	0	0	0	0	0	0	0	0
11/21/2001	1	2	3	0	0	0	0	0	0	0	1
11/22/2001	1	0	2	0	0	0	0	0	0	0	0
11/23/2001	5	2	3	0	0	0	0	0	0	0	0
11/24/2001	0	0	0	0	0	0	0	0	0	0	0
11/25/2001	0	1	6	1	0	0	0	0	0	0	0
11/26/2001	1	0	6	0	0	0	0	0	0	0	0
11/27/2001	0	0	1	1	0	0	0	0	0	0	1
11/28/2001	0	1	1	0	0	0	0	0	0	0	0
11/29/2001	0	0	4	0	0	0	0	0	0	0	0
11/30/2001	0	0	1	0	0	2	0	0	0	0	1
12/1/2001	0	0	0	0	1	0	0	0	0	0	0
12/2/2001	2	0	0	0	0	0	0	0	0	0	0
12/3/2001	0	0	0	1	0	1	0	0	0	0	0
12/4/2001	0	0	0	0	0	2	0	0	0	0	0
12/5/2001	0	0	0	0	0	1	0	0	0	0	1
12/6/2001	0	1	13	0	0	0	0	0	0	0	0
12/7/2001	0	0	0	0	0	0	0	0	1	0	0
Totals	28	33	104	16	2	8	3	1	2	2	4

Methow Basin Spring Chinook Natural Production Study Report For 2002

Prepared by

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Fisheries Resource Management Program
Yakama Nation

Prepared for

Public Utility District No. 1 of Douglas County

East Wenatchee, WA

May 2004

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ABSTRACT

The estimated 2002 spring chinook run size to Wells Dam was 7,633 (7,592 adults; 41 jacks) and the estimated spawner escapement was 6,637 fish.

There were 1,192 redds deposited in the Methow Basin in 2002 with subbasin redds counts as follows: Methow River- 721, Lost River- 54, Early Winters Creek- 6, Chewuch River- 301, Twisp River- 109 redds and Wolf Creek– 1 redd.

Subbasin redd counts within, above and below the index reach were as follows:

Methow:	above index- 6.2% (45 redds); index- 7.6% (55 redds); below- 86.1% (621 redds).
Chewuch:	above index– 4.3% (13 redds); index– 17.9% (54 redds); below– 77.7% (234 redds).
Twisp:	above index– 5.6% (6 redds); index– 80.4 (86 redds); below– 15.9% (17 redds).
Lost:	above index– 0.0% (0 redds); index– 74.1 (54 redds); below– 25.9% (14 redds).

The mean carcass fork length by subbasin and age class were the following:

Methow:	total: 78.1 cm (N= 499)	age-4: 76.5 cm (N= 425)	age-5: 88.5 cm (N= 64)
Chewuch:	total: 78.5 cm (N= 199)	age-4: 76.9 cm (N= 170)	age-5: 87.7 cm (N= 29)
Twisp:	total: 80.9 cm (N= 29)	age-4: 76.7 cm (N= 15)	age-5: 87.6 cm (N= 14)
Lost:	total: 78.7 cm (N= 15)	age-4: 76.1 cm (N= 13)	age-5: 95.5 cm (N= 2)

The age composition for returning adults on the spawning grounds was comprised of 86% 4-year olds and 14% 5-year olds. The age composition by subbasin was the following:

Methow:	age-4: 87.5% (N= 457)	age-5: 12.5% (N= 65)
Chewuch:	age-4: 85.7% (N= 174)	age-5: 14.3% (N= 29)
Twisp:	age-4: 53.3% (N= 16)	age-5: 46.7% (N= 13)
Lost:	age-4: 86.7% (N= 13)	age-5: 13.3% (N= 2)

A total of 914 carcasses were recovered in the Methow Basin (Methow– 634, Chewuch– 224, Twisp- 34, Lost- 17, Wolf Creek– 4 and Early Winters Creek– 1). Of the 914 carcasses recovered 695 coded-wire-tags were successfully dissected and read (Methow- 497, Chewuch– 174, Twisp– 8, Lost– 14, Early Winters– 1 and Wolf– 1). A summary of CWT recoveries by subbasin is presented in Tables 3a and 3b.

The Chewuch juvenile trap located on the Chewuch River (rm 0.1) was operated intermittently for the period of March 26 through May 3, and was not fished from April 15-30 to both allow for passage of the hatchery smolts and the need to redeploy the trap when the river discharge increased. An estimated 7,868 spring chinook smolts passed the trap during the period the trap was operated (March 26 - April 14 and May 1 - 3). The mean spring chinook fork length was 96 mm and ranged in size from 70 to 197 mm.

INTRODUCTION

The Methow Basin Spring Chinook Salmon Supplementation Plan (MBSCSP) (1995) is a compensation program directed towards the enhancement of the wild spring chinook (*O. tshawytscha*) stocks in the Methow Basin. The MBSCSP is the result of the Wells Settlement Agreement between the fishery agencies, tribes, Douglas PUD and the power purchasers of the Wells Project. The goal of this agreement is to protect, mitigate and compensate for unavoidable losses of juvenile anadromous fishes at Wells Dam. The stated purpose of the MBSCSP *"...is to increase natural propagation of salmon in the Methow, Chewuch, and Twisp rivers in a manner that minimizes or eliminates ecological and genetic risks to the natural population."*, through a monitored hatchery supplementation plan. The MBSCSP as part of the settlement agreement complies with the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program (NPPC, 1987). A specific outcome is that the MBSCSP "*be capable of collecting, rearing, and releasing three potentially discrete stocks of salmon*" (Methow, Chewuch and Twisp), which is part of the Phase I compensation requirements under the settlement agreement.

Tasks reported on in the 2002 Methow Basin Spring Chinook Natural Production Study annual report address specific tasks under Objective 2 of the MBSCSP, which states *"Determine that actions taken under the MBSCSP conserve the genetic integrity and long-term fitness of naturally spawning populations of spring chinook salmon in the Methow Basin"*. Spawning ground surveys addressed elements of Task 2.4 ("*Collect baseline stock profile data on Chewuch, Methow and Twisp populations of spring chinook salmon.*"), Task 2.9 ("*Determine if hatchery salmon are similar to natural salmon in spawning characteristics.*"), and Task 2.10 ("*Compare survival rates among various life stages for spring chinook salmon in a natural river environment. Quantify freshwater survival rates, parr production, and rearing densities of a selected population of spring chinook.*"). Juvenile outmigrant monitoring was aimed at addressing Task 2.11 ("*Characterize and quantify natural spring chinook salmon juvenile outmigration from a natural environment*"). Objective 1 (*Determine if Methow FH is capable of meeting the Phase 1 production requirements of the Agreement.*") and Objective 3 (*Determine if salmon released from Methow FH interact adversely with natural production in the Methow River Basin.*") relate primarily to aspects of the hatchery and fish culturing and are being evaluated by WDFW.

STUDY AREA

The Methow River Basin is located in north-central Washington on the eastern slope of the Cascade Mountains (Figure 1). The Methow River and its tributaries lie in Okanogan County and drain an area of nearly 1,800 square miles. The headwaters of the Methow Basin are located near the Cascade Crest at a maximum elevation of 8,500 feet and drops to 781 feet where it joins the Columbia River (RM 524) at Pateros, WA. The upper portions of the Methow basin is mountainous, and dominated by sub-alpine and alpine forest at the upper elevations. Moving eastward from the Cascade Crest in association with a decrease in elevation the forests are dominated by ponderosa pine and steppe-brush in the lower most portion of the basin. Annual precipitation ranges from 80 inches at the Cascade Crest to 10 inches where the river enters the Columbia River (Richardson 1976). The majority of precipitation occurs from October through March, primarily in the form of snow. The summer months are dry with precipitation occurring in the form of brief thunderstorms. Stream flows in the Methow Basin are driven by the annual snow pack cycle of accumulation during the winter and the spring snowmelt. Generally peak river discharge occurs from mid May to mid June, with base flows occurring from late September through March, with a slight increase in the fall prior to snowfall due to fall rains.

The Methow Basin is characterized as rural with human developed concentrated in the towns of Mazama, Winthrop, Twisp and Methow. Individual homes are scattered throughout the lowlands and upland areas of the basin usually associated with acreage.

The lower Methow valley is a fertile agricultural area that experiences heavy irrigation demands. Water quality in the lower Methow Basin nonetheless remains high, with an AA rating from the Washington Department of Ecology. Spring chinook spawning in the Methow River extends from about Trout Creek (river mile 78) to about two miles downstream of the Chewuch River confluence (river mile 48).

The Chewuch River joins the Methow River at RM 50, at an elevation of 1,745 feet. These two rivers join in the city of Winthrop. The Chewuch basin covers 530 square miles and drains in a southern direction into the Methow River. The upper portion of the Chewuch River is located in the Pasayten Wilderness (above RM 32.4) and is heavily forested. Spring chinook spawn downstream from river mile 31.5, which is also used extensively for recreation and residential development.

The Twisp basin encompasses about 250 square miles of watershed and enters the Methow River at near RM 40. The elevation descends from 8,500 ft to 1,600 ft and drains in a southeast direction. The headwater and upslope areas lay within the Lake Chelan-Sawtooth Wilderness. Spring chinook spawning has extended upstream to South Creek (RM ~28).

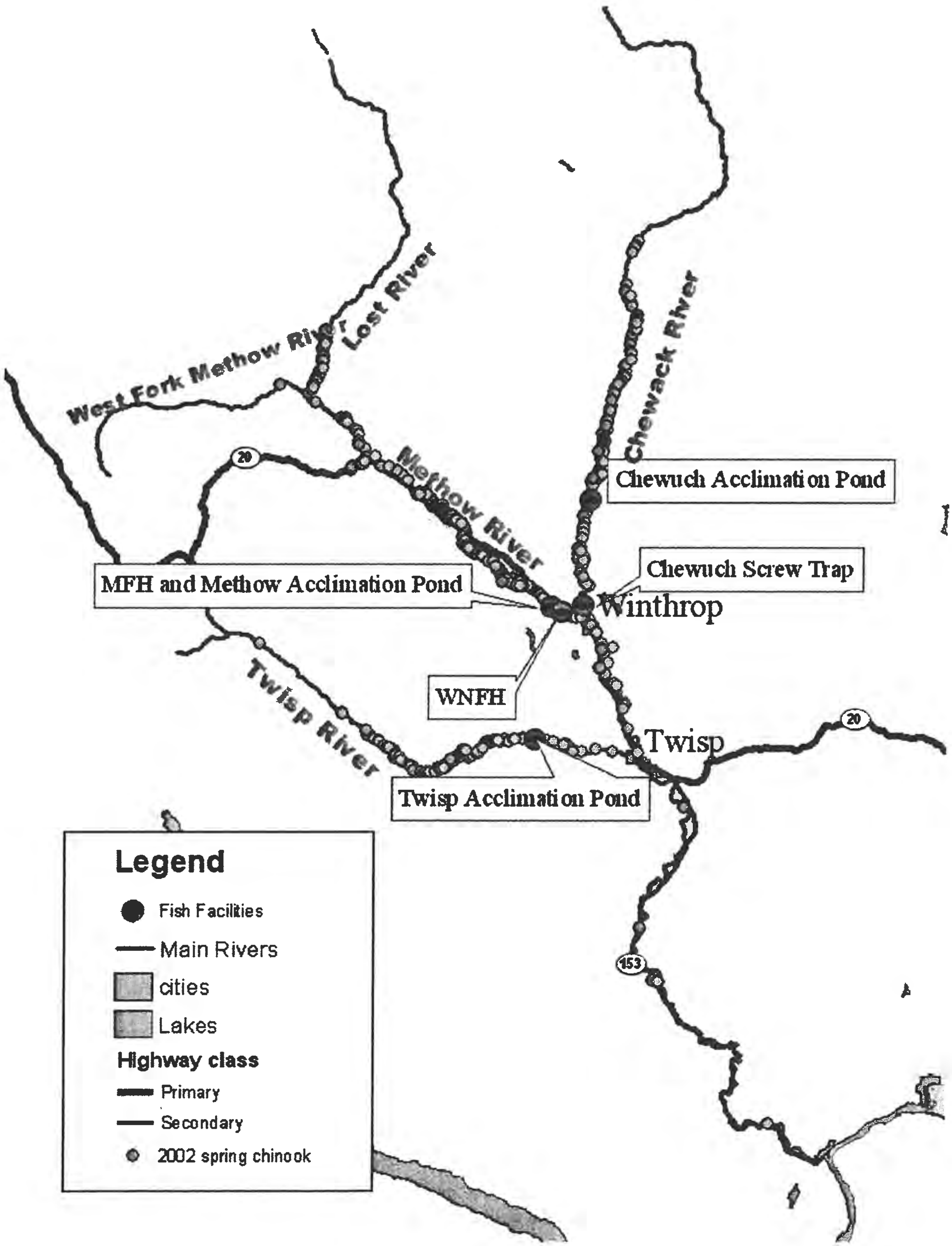


Figure 1. Spring Chinook spawning distribution and location of key sites in the Methow Basin.

METHODS AND MATERIALS

Spawning Surveys

Redd Surveys

Surveys were primarily conducted in the Methow, Lost, Chewuch and Twisp rivers, and in Early Winters Creek. The historical index reaches were normally surveyed weekly, while those reaches where nominal spawning occurs were normally surveyed bi-weekly. All spawning reaches where redds normally are located were surveyed at least once during or after the historic peak spawning period. The historic index reaches are the following:

- Methow: Weeman bridge to Mazama bridge (6.2 river miles)
- Lost: Lost River bridge to the Eureka Creek (4.2 river miles)
- Early Winters: Highway 20 bridge to Cedar Cr. (1.9 river miles)
- Chewuch: Falls Creek Campground to Camp Four bridge (6.8 river miles)
- Twisp: Buttermilk Creek bridge to the Mystery Creek bridge (10.1 river miles)

Regular surveys began August 1 and continued through September 28, with additional spot-checks conducted afterward. Appendix tables 1, 2 and 3 present the complete week-by-week survey schedule and redd counts.

Surveys were conducted in the upper Methow, Lost, Chewuch and Twisp rivers, and in Early Winters Creek. Raft or canoe surveys were conducted in the Methow River downstream from Mazama Bridge, according to river flows. To ensure survey consistency, the same survey crew was normally assigned to the same spawning reach. However, for quality control purposes a different crew occasionally surveyed another crew's survey reach. To avoid recounting or missing a previously counted redd, each redd was marked with surveyor's tape on the riverbank adjacent to the redd. Written on each posted tape were the consecutive redd number and survey date. A global positioning system unit (GPS) was also used to locate many of the redds, usually to an accuracy of 15 feet.

All live chinook were counted during each survey. Carcasses were recovered and checked for sex, tags, fin clips, and spawning success. Scales and DNA samples were collected when possible from each carcass, and fork length and post eye-to-hypural plate length was recorded.

Juvenile Outmigration

The Chewuch River (RM 0.1) five-foot diameter rotary trap (EG Solutions, Corvallis, OR) was operated in the Chewuch River between March 26, 2002 through May 3, 2002 to monitor the spring chinook smolt outmigration. The trap was not fished from April 15 through April 30 to allow for the passage of the spring chinook hatchery smolt releases from the Methow Fish Hatchery, Chewuch acclimation pond located at RM 7.8. During this same time period an increase in river discharge required pulling the trap initially for heavy debris and then to redeploy the trap at more suitable location within the existing site. Smolt trapping ceased May 3 due to the low spring chinook smolt daily counts when trapping resumed on May 1.

The daily mean river discharge was measured based on the discharge data provided by USGS at the Chewuch River at Winthrop gauge station located at Winthrop, WA on the Chewuch River (station #12448000).

Juvenile spring chinook catch efficiency for the Chewuch River rotary trap was calculated by releasing previously captured smolts; that were marked with an upper or lower caudal fin clip, 610 m upstream of the trap. Eleven releases were successfully conducted in April 2002 and release sizes ranged from 18 to 69 fish depending on the availability of fish each day. Each catch efficiency test release was completed within a 24 hour period, indicating that all the marked fish moved past the trap site the first evening after the fish were released. Fish for these efficiency tests were released at twilight and were held during the day in a separate live box located on the trap. Estimated trap efficiency was defined as the decimal fraction of marked fish recovered for each specific test release. The estimated trap efficiency for each test was plotted against river discharge to determine trap capture efficiency to river discharge. Since there was not a good linear regression fit of trap efficiency to discharge (r^2= 0.0025) the seasonal mean fish entrainment rate of 8.0% was used to expand daily spring chinook fish counts.

Trap checks were normally performed in the morning. Fish were netted from the live box and anesthetized using MS-222 at a dosage of approximately 40 ppm. Data recorded from fish sampled included species identification, fork length, weights (subsampled), maturity (fry, parr or smolt) and any external marks. Fish were also scanned for the presence of a coded wire tag to indicate their origin (hatchery or natural). Fish that were not used for efficiency releases were allowed to recover during the day in a separate live box and were released later that evening downstream of the trap.

RESULTS

Spawning Ground Surveys

Spring Chinook Run Size

A summary of the Methow Basin spring chinook run size and spawner escapement for years 1967-2002 is presented in Table 1 and Figure 2. The estimated 2002 spring chinook run size to Wells Dam was 7,633 (7,592 adults; 41 jacks).

Total broodstock collected by the Methow Fish Hatchery (MFH) was 996 fish (Table 1). As in 2001 no broodstock collection occurred in 2002 at Winthrop National Fish Hatchery. This was done to maximize the collection of Methow Composite type broodstock and to minimize the collection of WNFH Carson type broodstock. The estimated spawner escaped derived by subtracting the Wells Dam count from fish taken for broodstock was 6,637 (Table 1).

There was a total of 1192 redds deposited in the Methow Basin in 2002. Subbasin redds counts were the following- Methow River- 721, Wolf Creek– 1, Lost River- 54, Early Winters Creek- 6, Chewuch River- 301 and the Twisp River- 109 redds. There were 84 dewatered redds found in the upper Methow River (Lost River to near Boulder Creek) and in the Twisp River two dewatered redds were found in the Popular Flats reach. Both reaches experience naturally induced dewatering except for above normal water years.

The estimated average number of fish per redd was atypically high at 5.6. Since 1987 the average fish per redd has been 3.3 with a range of 1.6 (1990; 498 redds and 818 spawners) to 8.5 (1999; 32 redds and 272 spawners). The other year with an atypical high fish per redd value, besides 1999 and 2002 occurred in 1995 (6.6 fish per redd). However, unlike in 2002 which had a high spawner escapement in both 1995 and 1999 spawner escapement was less than 300 fish.

Methow

The 721 redds located in the Methow River comprised 60.5% of the basin total (Appendix Table 1). This included 43 redds located in the MFH outfall and 26 redds located in the WNFH outfall (Spring Creek).

An estimated 84 redds became naturally dewatered within the Methow River, most of which were located from the Lost River confluence (river mile 73.0) to approximately river mile 60.8 (near McKinney Mountain diversion). This represented 11.6% of the total number of redds deposited in the Methow River.

There were 55 (7.6%) redds located within the index reach (Mazama Bridge to Weeman Bridge). The percentage of redds located above and below the index reach was 6.2% (45 redds) and 86.1% (621 redds), respectively (Figure 3). For the third consecutive year, the percent of redds located below the index reach (downstream of Weeman Bridge) exceeded 80%. In 2002 86.1% (N= 622) of the redds were located downstream of the index reach, which compares to the 1987-95 average of 41.7%. For each of these three return years (2000, 2001 and 2002) a portion of each run was comprised of fish produced from broodyear's 1996 and 1998 in which 100% of the run was spawned in the hatchery. The 2000 return was comprised of age 4 spawners from BY1996; the 2001 return was comprised of age 3 adults from BY1998 and age 5 adults from BY1996; while the 2002 spawners were comprised of age 4 adults from BY1998. Since all of these fish were released from either the MHF or the WNFH homing back to suitable spawning reaches below Weeman Bridge nearer to the hatcheries is not unexpected.

Table 1. Summary of spring chinook adults passing Wells Dam, number of broodstock collected at Winthrop National Fish Hatchery and Methow Fish Hatchery, and estimate of natural spawners in the Methow Basin, 1967-2002.

Year	Wells Dam Counts				Hatchery	Hatchery	Natural
	Adults	Jacks	Total	Composition of Jacks	Broodstock WNFH	Broodstock MFH	Escapement (est.)
1967	541	616	1,157	53%	0	--	1,157
1968	4,086	845	4,931	17%	0	--	4,931
1969	3,048	551	3,599	15%	0	--	3,599
1970	2,092	578	2,670	22%	0	--	2,670
1971	2,535	633	3,168	20%	0	--	3,168
1972	3,368	248	3,616	7%	0	--	3,616
1973	2,505	507	3,012	17%	0	--	3,012
1974	3,199	221	3,420	6%	0	--	3,420
1975	2,096	129	2,225	6%	0	--	2,225
1976	1,510	1,249	2,759	45%	0	--	2,759
1977	3,976	235	4,211	6%	0	--	4,211
1978	3,532	83	3,615	2%	38	--	3,577
1979	971	132	1,103	12%	102	--	1,001
1980	941	241	1,182	20%	155	--	1,027
1967-1980 (avg.)			**2,905**				**2,884**
1981	1,367	98	1,465	7%	399	--	1,066
1982	2,270	131	4,252	3%	601	--	3,651
1983	2,726	143	2,869	5%	755	--	2,114
1984	3,066	214	3,280	7%	510	--	2,770
1985	5,151	116	5,267	2%	1201	--	4,066
1986	2,896	65	2,961	2%	836	--	2,125
1987	2,272	74	2,346	3%	594	--	1,752
1988	2,844	96	2,940	3%	1327	--	1,613
1989	1,633	87	1,720	5%	195	--	1,525
1990	927	12	939	1%	121	--	818
1981-1990 (avg.)			**2,804**			**--**	**2,150**
1991	682	100	782	13%	92	--	690
1992	1,596	27	1,623	2%	271	60	1,232
1993	2,422	22	2,444	1%	646	252	1,546
1994	243	15	258	6%	29	34	195
1995	72	41	113	36%	0	14	99
1996	388	73	461	16%	146	315	0
1997	972	32	1,004	3%	220	323	461
1998	416	14	430	3%	409	10	11
1999	360	289	649	45%	0	377	272
2000	2,130	457	2,587	18%	1,098	338	1,019
1991-2000 (avg.)			**1,035**				**553**
2001	9,989	882	10,871	0.8%	0	874	9,997
2002	7,592	41	7,633	0.5%	0	996	6,637
2001-2002 (avg.)			**9,395**				**8,017**

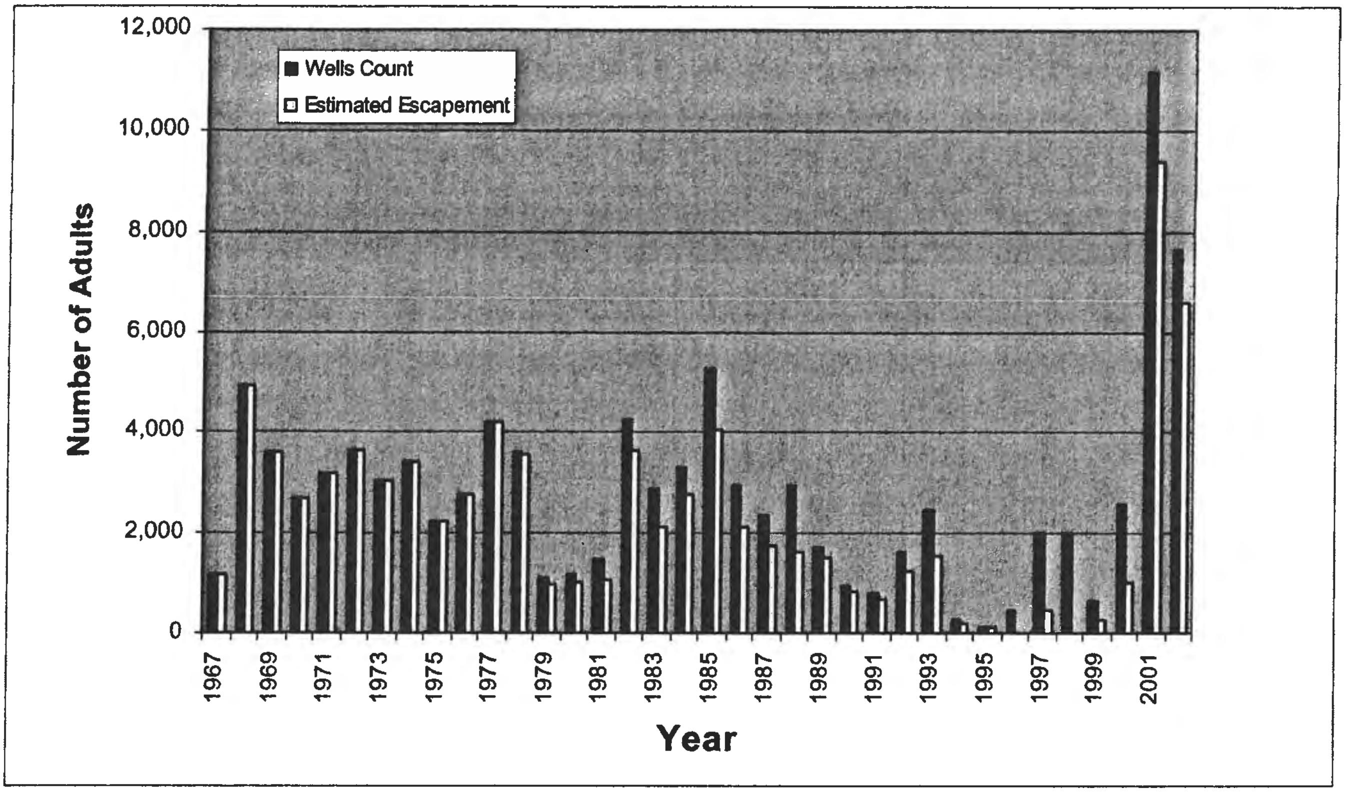


Figure 2. Summary of the annual adult spring chinook count at Wells Dam and the estimated spawner escapement to the Methow Basin, 2002.

The mean carcass fork length was 78.1 cm for all fish sampled (N = 499) in the Methow River (Figure 4). The mean fork length for 4 year-old and 5 year-old spawners was 76.5 cm (N = 425) and 88.5 cm (N = 64) respectively. For both age classes wild fish were somewhat larger than the hatchery fish (age-4: hatchery = 76.4 cm, wild = 81.7 cm; age-5: hatchery = 87.3 cm, wild = 95.1 cm).

Spawning commenced on August 7 and the last redds were located on September 25. The majority (78%) of spawning in the Methow River occurred between August 19 through September 5 (spawn weeks 4-6), while the median spawn date was about August 27 (Figure 5).

Lost River and Early Winters Creek

There were 54 redds located in the Lost River. The majority (40 redd and 74.1%) of the redds were deposited in the index reach (Eureka Creek to Lost River Bridge), while the remaining 14 (25.9%) redds located between the Lost River Bridge and the confluence. The Lost River accounted for 4.5% of the Methow Basin total redd count (Appendix Table 2). Six redds were deposited in Early Winters Creek, which accounted for 0.5% of the Methow Basin's total.

The mean fork length from carcasses recovered in the Lost River was 78.7 cm (N = 15) (Figure 4). The mean fork length of age-4 fish was 76.1 cm (N = 13) and 95.5 cm (N = 2) for age-5 fish.

Spawning occurred the earliest in the Lost River where 35 (62%) of the 54 redds were located on the August 21 survey. No further redds were found after the September 10 survey, where two redds were located (Figure 5).

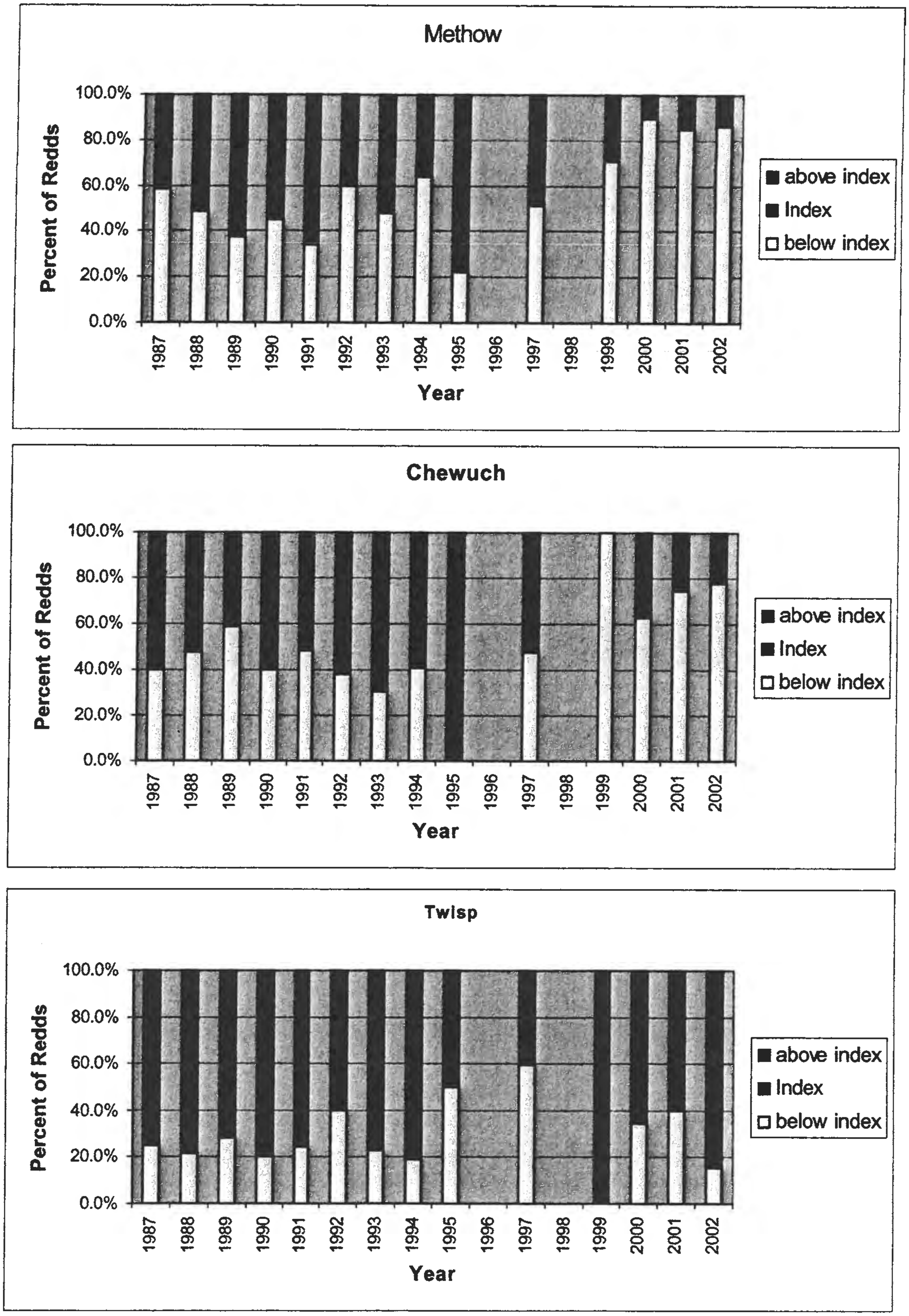
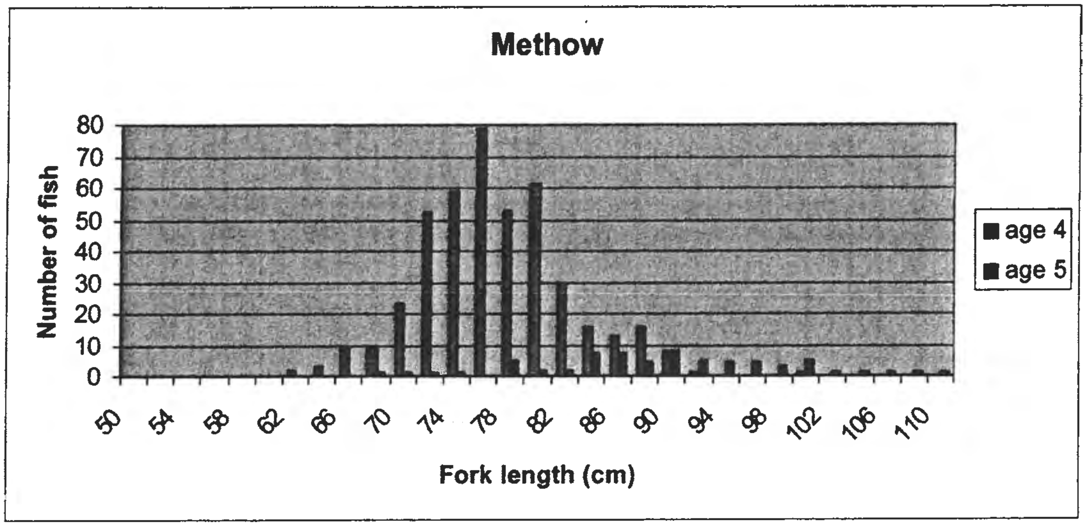
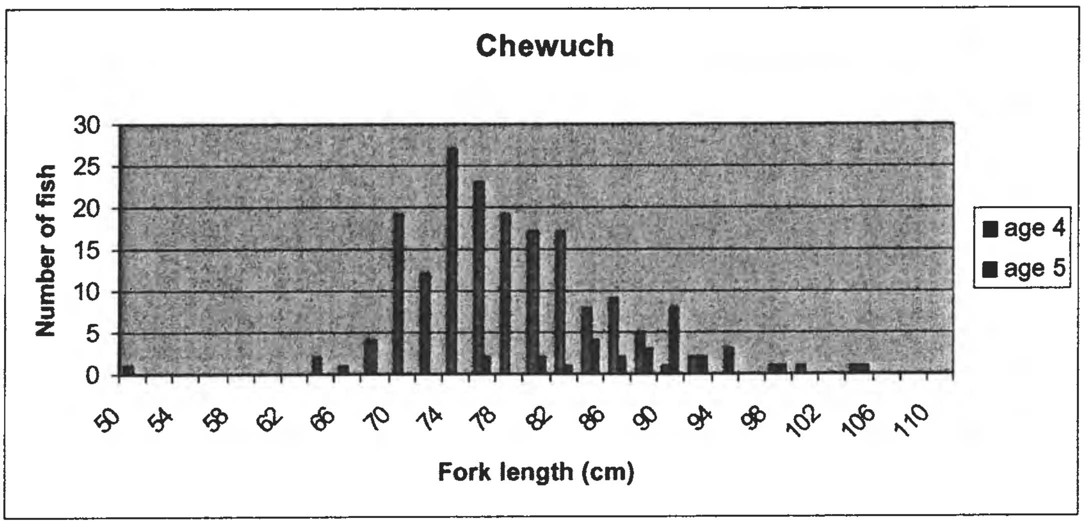


Figure 3. Summary of spring chinook redd counts within, above and below the Index reach for the Methow, Chewuch and Twisp rivers for 1987-2002.





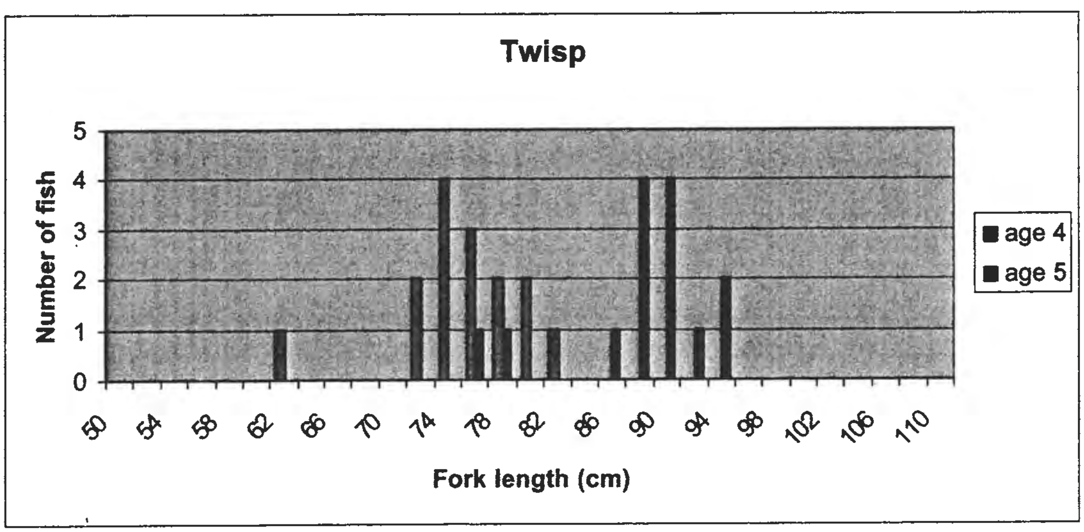


Figure 4. Fork length (cm) distribution of age-4 and age-5 adult spring chinook spawners for the Methow, Chewuch and Twisp rivers, 2002.

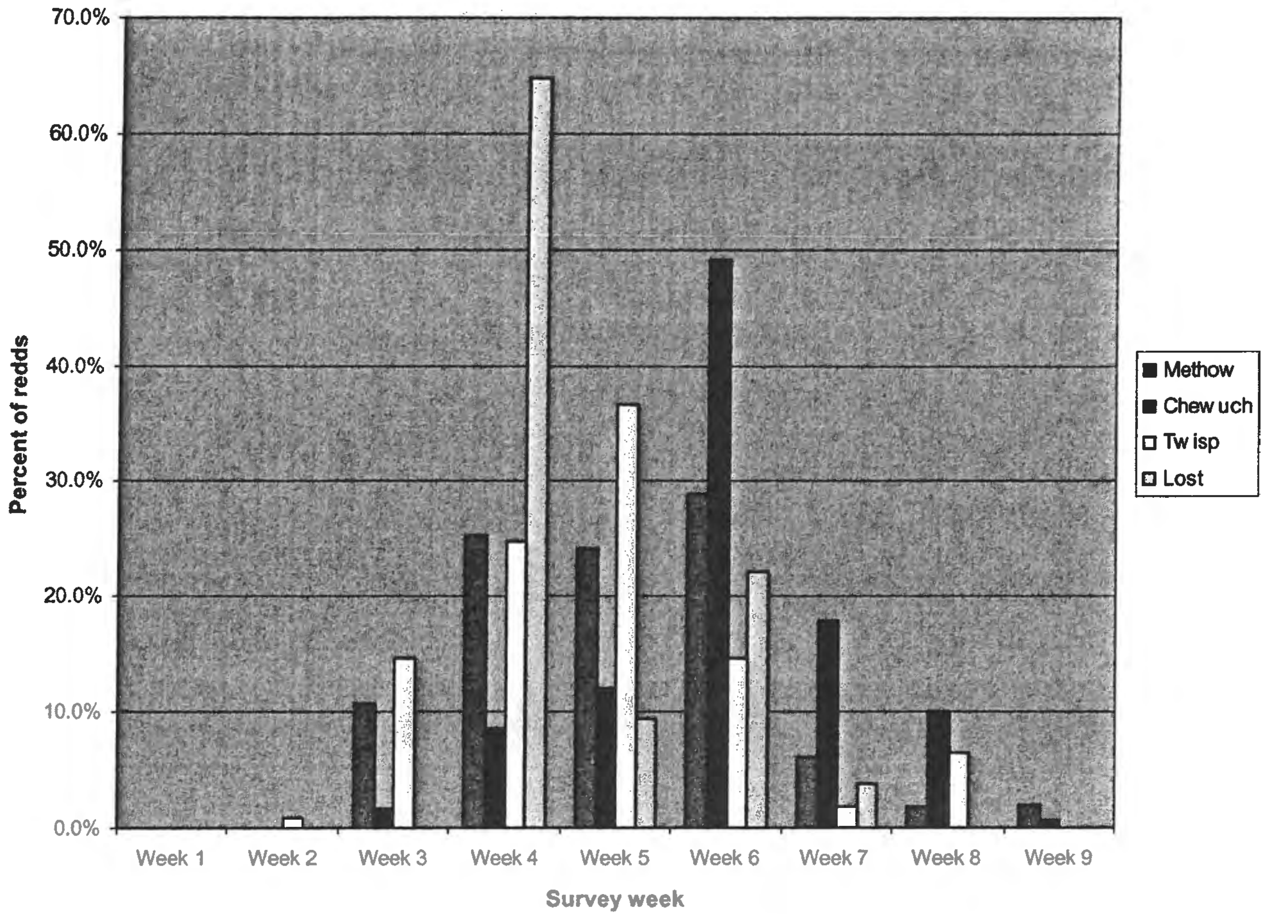


Figure 5. Summary of spring chinook spawn timing for the Methow, Chewuch and Twisp rivers, 2002 (week 1 = 7/28-8/3 and week 9 = 9/22-28).

Chewuch River

A total of 301 redds were deposited in the Chewuch River, which comprised 25.3% of the Methow Basin redd total. The index reach (Camp Four Bridge to Falls Creek Campground) had 54 (17.9%) redds. While there were 13 (4.3%) redds above and 234 (77.7%) redds below the index reach (Figure 3). Similar to the Methow River the percent of redds located in the lower Chewuch below the index reach has steadily increased for the past three years (2000-02) and has averaged 79% of the Chewuch River redd count. For comparison the average percent of redds located below the index reach for the years 1987-94 was 43%.

The mean carcass fork length was 78.5 cm for all fish sampled (N = 199) in the Chewuch River (Figure 4). The mean fork length between age-4's and age-5's was 76.9 cm (N = 170) and 87.7 cm (N = 29), respectively. As in the other subbasins the wild fish on average were larger than the hatchery fish for each age class (age-4: hatchery = 76.5 cm, wild = 84.0 cm; age-5: hatchery = 83.5 cm, wild = 90.2 cm).

The first and last redds were located on August 14 and September 24 respectively. The majority (79%) of spawning occurred between August 25 through September 14 (spawn weeks 5-7). The median spawn date occurred approximately September 7 (Figure 5).

Twisp River

The Twisp River had 109 redds, which accounted for 9.1% of the Methow Basin's total. Within the index reach (Mystery Bridge to Buttermilk Bridge) 86 (80.4%) redds were found (Figure 3). Redds located above and below the index reach, respectively, were 6 (5.6%) and 17 (15.9%). Two dewatered redds were located in the Poplar Flats Campground area, which naturally dewaters a short distance (<0.25 rivermile). Campground area, which naturally dewaters a short distance (<0.25 rivermile). Unlike the Methow and Chewuch rivers, the redd distribution within and below the index reach has remain fairly consistent in recent years to that observed prior to 1995. This observation is likely the result of less hatchery influence (in general lower hatchery smolt release numbers relative to wild production), and equally important the lack of quality spawning habitat downstream of the acclimation pond in comparison to the mainstem Methow River.

The Twisp River redd count comprised 9.1% of the total Methow Basin redd count, which is the second consecutive year the Twisp River has had the lowest redd contribution amongst the three major subbasins. As was the case in 2001 this is a consequence of lower numbers of hatchery smolts being released from the Twisp acclimation pond relative to the Methow and Chewuch subbasins.

The mean carcass fork length in the Twisp River was 80.9 cm (N = 29) (Figure 4). The mean fork length for 4 year-old and 5 year-old spawners was 76.7 cm (N = 15) and 87.6 cm (N = 14) respectively. As observed in the other subbasins the wild fish were larger than the hatchery fish within each respective age class (age-4: hatchery = 72.3 cm, wild = 76.2 cm; age-5: hatchery = 78.0 cm, wild = 88.3 cm).

Spawning began about August 7 and continued through September 16. The majority (62%) of spawning took place from August 19 through August 26 (spawn weeks 4 and 5), while the median spawn date was around August 24 (Figure 5).

Other Tributaries

No redds were found in Gold Creek in 2002, while one redd and four carcasses (3 females, 1 male) were found in Wolf Creek.

Age Composition

Basin wide the age composition for returning adults on the spawning grounds (Table 2) was comprised 86% of 4-year olds (BY1999) and 14% of 5-year olds (BY1998). As is typical, most of the hatchery spawners were age- 4, and comprised from 87.5% in the Twisp River to 93.8% in the Chewuch. Wild spawners were comprised of at least 50% age-5 spawners in all subbasins. The approximate 50:50 split in the Twisp River between age 4 and age 5 spawners is a consequence of the low percent of hatchery fish (dominated by age-4 spawners) relative to the wild fish (dominated by age-5 spawners). Returning spawners to the Chewuch and Methow subbasins were the dominated by hatchery fish thus the overall age compositions to these two subbasins were comprised largely of 4 year old spawners.

Carcass Distribution and Coded Wire Tag Recoveries

Basin wide a total of 914 carcasses were recovered. The number of carcasses was as follows: Methow– 634, Chewuch– 224, Twisp- 34, Lost- 17, Wolf Creek– 4 and Early Winters Creek– 1.

A summary of the coded wire tag (CWT) codes successfully recovered from spring chinook carcasses for each subbasin is presented in Tables 3a and 3b. For the entire Methow Basin 694 coded-wire-tags were successfully dissected and read. The majority of tags were recovered in the Methow (496 CWTs). The Chewuch, Twisp and Lost rivers had CWT recoveries of 174, 8 and 14 respectively. While one coded wire tag each was found in Early Winters and Wolf creeks.

Table 2. Age composition summary of spawners collected off the spawning grounds by subbasin, 2002.

Subbasin	Hatchery		Wild		Total	
	Age 4	Age 5	Age 4	Age 5	Age 4	Age 5
Methow	89.0% (447)	11.0% (55)	50.0% (10)	50.0% (10)	87.5% (457)	12.5% (65)
Lost	92.9% (13)	7.1% (1)	0.0% (0)	100.0% (1)	86.7% (13)	13.3% (2)
Chewuch	93.8% (166)	6.2% (11)	30.8% (8)	69.2% (18)	85.7% (174)	14.3% (29)
Twisp	87.5% (7)	12.5% (1)	40.9% (9)	59.1% (13)	53.3% (16)	46.7% (13)

Methow

Of smolts released from the Methow subbasin (either from the WNFH or the MFH) 209 carcasses with successfully read CWTs were subsequently recovered within the Methow River. The three highest CWT groups recovered in the Methow River were Winthrop BY98– 113 (54.1%), Methow Composite WNFH BY98– 44 (21.5%) and Methow Composite MFH BY98– 28 (13.4%). These three release groups accounted for 89.0% of all CWTs recovered in the Methow River from smolts released from either the WNFH or the MFH (Figure 6). Most (63 tags or 30.1%) of the CWTs recovered in the Methow River were between Fog Horn Dam and the Chewuch River confluence. The two next reaches with the most CWT recoveries in the Methow River were in the outfall areas of the WNFH and the MFH (37 CWTs or 17.7%) and between the Barkley ditch and the East Methow Valley Irrigation Diversion (28 CWTs or 13.4%). These three reaches accounted for 61.2% of all Methow River origin CWT'ed carcasses (Figure 6).

One coded wire tag from a Spring Creek Hatchery released fall chinook (BY1998) was found in the Methow River.

The distribution of Methow released smolts and their subsequent CWT carcass recoveries across all subbasins is presented in Figure 7. Most (209 or 88.9%) spawners were recovered in the Methow River, followed by 17 (7.2%) in the Chewuch River, 4 (1.7%) in the Twisp River and 5 (2.1%) in the Lost River.

Chewuch

Carcasses recovered in the Chewuch River derived from Chewuch smolt releases totaled 157. The majority (149 or 94.9%) were from the Methow Composite Chewuch BY98 release group, followed by the Chewuch BY97 with 8 (5.1%) CWT'ed carcasses. The reach from Eight-Mile Creek to Memorial Bridge had the most (57 or 36.3%) number of recovered CWT'ed carcasses. This was followed by river reach Falls Creek Campground to Eight-Mile Creek (31 or 19.7%) and river reach halfway point to the confluence (21 or 13.4%). These three reaches account for 69.4% of the CWT'ed carcass recoveries originating from Chewuch smolt releases (Figure 8).

The distribution of carcasses derived from Chewuch River smolt releases were most prominent (279 or 62.4%) in the Methow River, which was 1.8 times more than the number (157 or 35.1%) located in the Chewuch River. The remaining distribution of Chewuch derived carcasses in the other subbasins was as follows– Twisp: 1 (0.2%), Lost: 9 (2.0%), and one CWT (0.2%) each in Early Winters and Wolf creeks (Figure 9).

Table 3a. Summary of spring chinook carcass coded wire tag recoveries in the Methow and Chewuch subbasins from the 2002 spawner surveys[1].

Recovery Location		Coded-Wire-Tag Release Group								
River	Section No.	97 Chewuch	97 Met. Comp. WNFH	97 Met. Comp. Methow	97 Winthrop	98 Met. Comp. Chewuch	98 Met. Comp. WNFH	98 Twisp	98 Winthrop	Totals
Methow	1									
	2	0	0	0	1	5	1	0	2	**9**
	3	0	0	3	0	2	0	0	1	**6**
	4	0	0	0	0	4	0	0	1	**5**
	5	0	0	1	0	8	0	1	3	**13**
	6	0	1	3	0	27	1	1	2	**35**
	7	0	0	2	2	47	8	1	12	**72**
	8	0	0	0	1	6	0	0	1	**8**
	9	0	0	3	2	15	1	0	7	**28**
	10	2	1	11	6	89	13	3	32	**157**
	11	2	0	1	2	29	6	0	13	**53**
	12	0	0	4	2	28	8	1	14	**57**
	MFH outfall	0	0	0	3	10	0	0	8	**22**
	WNFH outfall	0	1	0	2	5	6	1	17	**31**
	Sub-basin Total	**4**	**3**	**28**	**21**	**275**	**44**	**8**	**113**	**496**
Chewuch	1	0	0	0	0	0	0	0	0	**0**
	2	0	0	0	0	0	0	0	0	**0**
	3	0	0	0	0	0	0	0	0	**0**
	4	0	0	0	0	0	0	0	0	**0**
	5	0	0	0	0	0	0	0	0	**0**
	6	0	0	0	0	5	0	0	1	**7**
	7	0	0	0	0	2	0	0	0	**2**
	8	0	0	0	0	5	0	0	0	**5**
	9	0	0	0	0	9	0	0	0	**9**
	10	1	0	0	1	10	1	0	4	**17**
	11	5	0	0	0	26	2	0	0	**33**
	12	0	0	0	1	57	0	0	4	**62**
	13	0	0	0	0	1	0	0	0	**1**
	14	1	0	0	0	13	1	0	1	**16**
	15	1	0	0	0	21	0	0	1	**23**
	Sub-basin Total	**8**	**0**	**0**	**2**	**149**	**4**	**0**	**11**	**174**

[1] This excludes the one Spring Creek Hatchery fall chinook CWT (BY1998) recovered in the Methow River.

Table 3b. Summary of Spring Chinook Carcass Coded Wire Tag Recoveries in the Twisp, Lost Early Winters and Wolf Subbasins From the 2002 Spawner Surveys.

Recovery Location		Coded-Wire-Tag Release Group								
River	Section No.	97 Chewuch	97 Met. Comp. WNFH	97 Met. Comp. Methow	97 Winthrop	98 Met. Comp. WNFH	98 Met. Comp. Chewuch	98 Twisp	98 Winthrop	Totals
Twisp	1	0	0	0	0	0	0	0	0	**0**
	2	0	0	0	0	0	0	0	0	**0**
	3	0	0	0	0	0	0	0	0	**0**
	4	0	0	0	0	0	0	0	0	**0**
	5	0	0	0	0	0	0	1	0	**1**
	6	0	0	0	0	0	0	0	0	**0**
	7	0	0	0	0	2	1	2	0	**5**
	8	0	0	0	0	0	0	0	0	**0**
	9	0	0	0	0	0	0	0	0	**0**
	10	0	0	0	0	0	0	0	0	**0**
	11	0	0	0	0	0	0	0	0	**0**
	12	0	0	0	0	0	0	0	2	**2**
	13	0	0	0	0	0	0	0	0	**0**
	14	0	0	0	0	0	0	0	0	**0**
	15	0	0	0	0	0	0	0	0	**0**
	Subbasin Total	**0**	**0**	**0**	**0**	**2**	**1**	**3**	**2**	**8**
Lost	2	0	0	0	0	0	4	0	1	**5**
	3	0	0	1	0	0	5	0	3	**9**
	Subbasin Total	**0**	**0**	**1**	**0**	**0**	**9**	**0**	**4**	**14**
Early Winters	1	0		0	0	0	1	0	0	**1**
	Subbasin Total	**0**		**0**	**0**	**0**	**1**	**0**	**0**	**1**
Wolf	1	0		0	0	0	1	0	0	**1**
	Subbasin Total	**0**		**0**	**0**	**0**	**1**	**0**	**0**	**1**

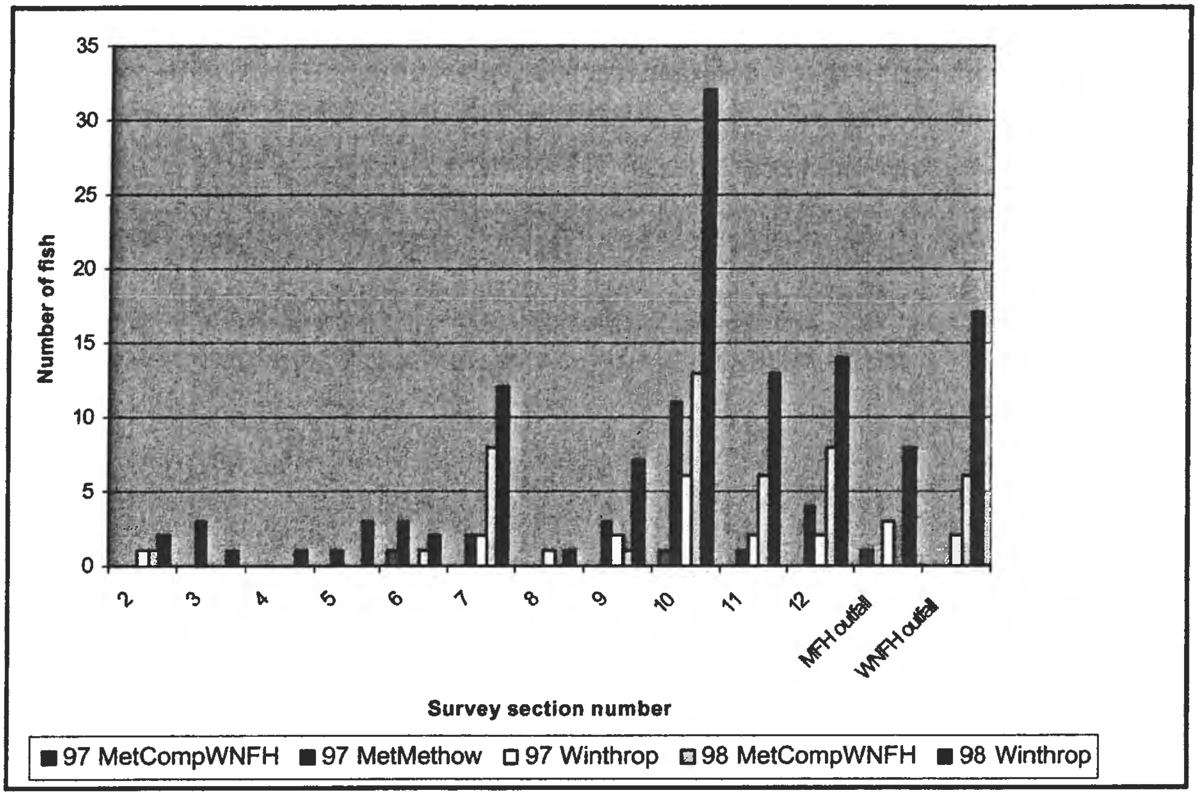


Figure 6. Distribution of coded wire tagged spring chinook carcass recoveries within the Methow River that originated from smolt releases in the Methow River, 2002.

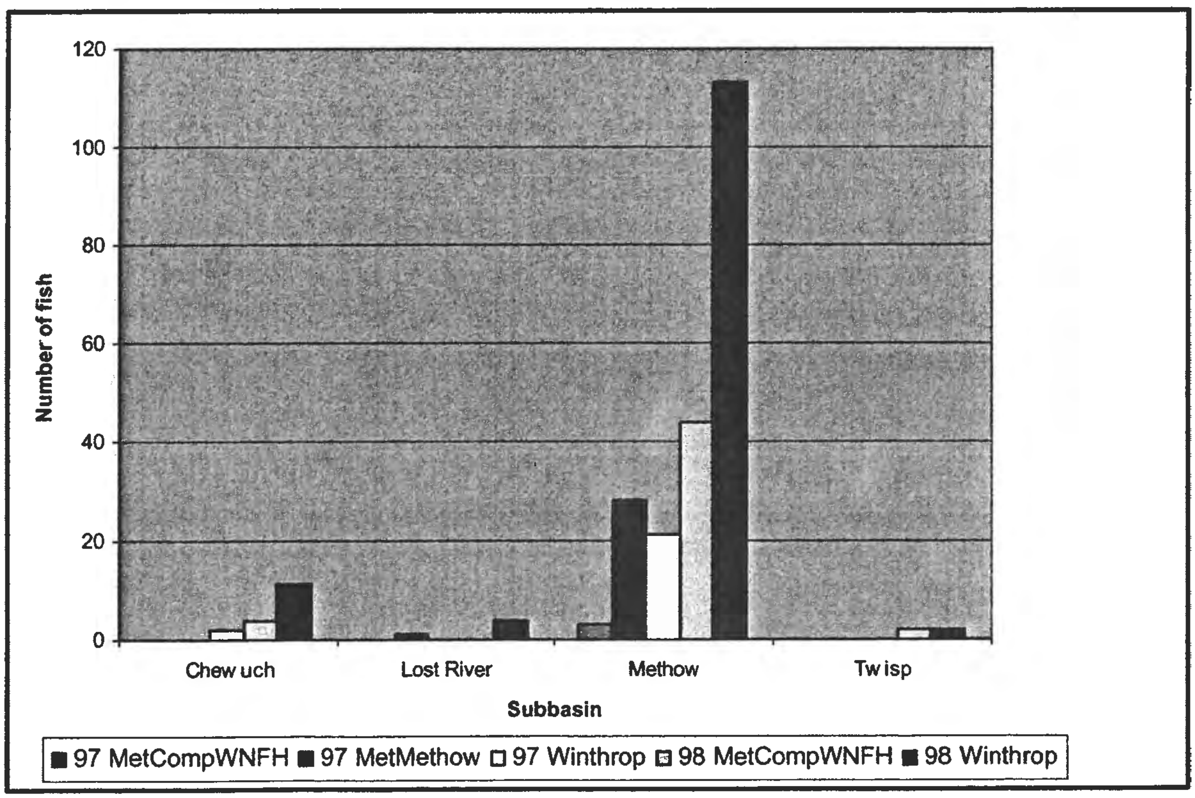


Figure 7. Distribution of coded wire tagged spring chinook carcass recoveries across all subbasins that originated from smolt releases in the Methow River, 2002.

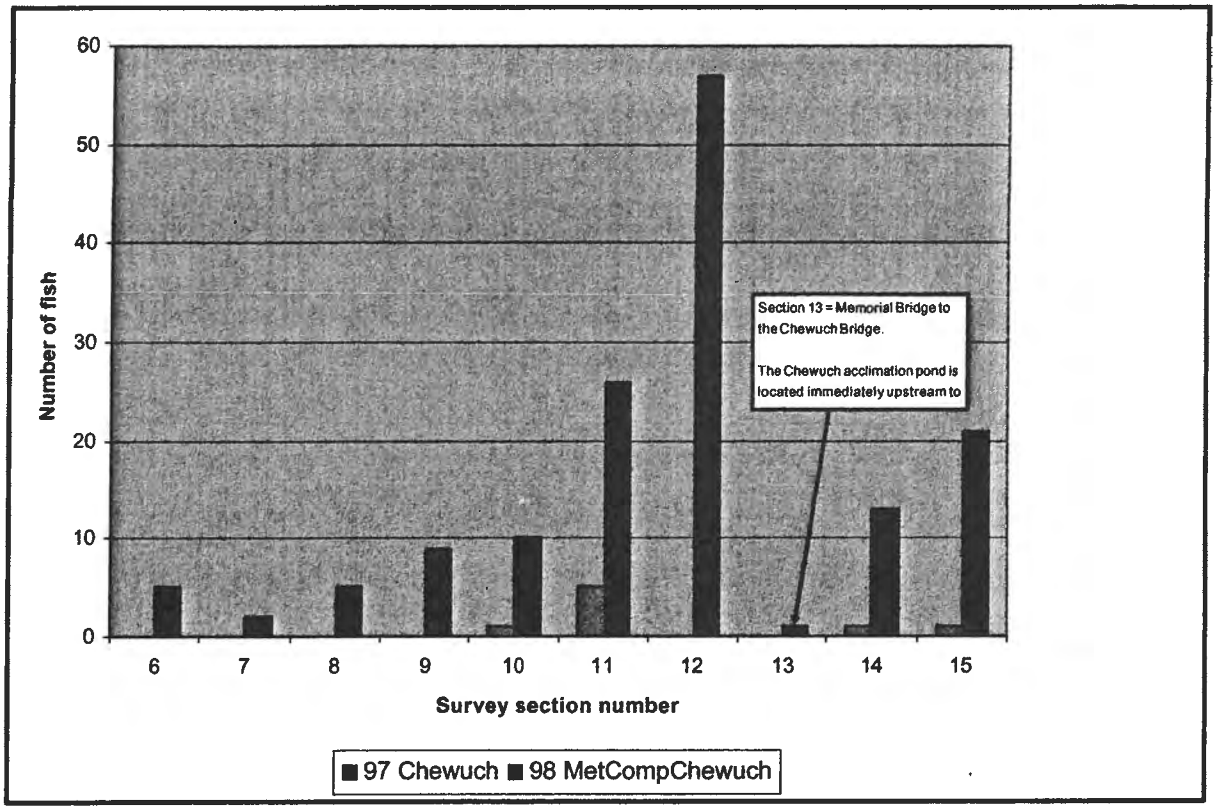


Figure 8. Distribution of coded wire tagged spring chinook carcass recoveries within the Chewuch River that originated from smolt releases in the Chewuch River, 2002.

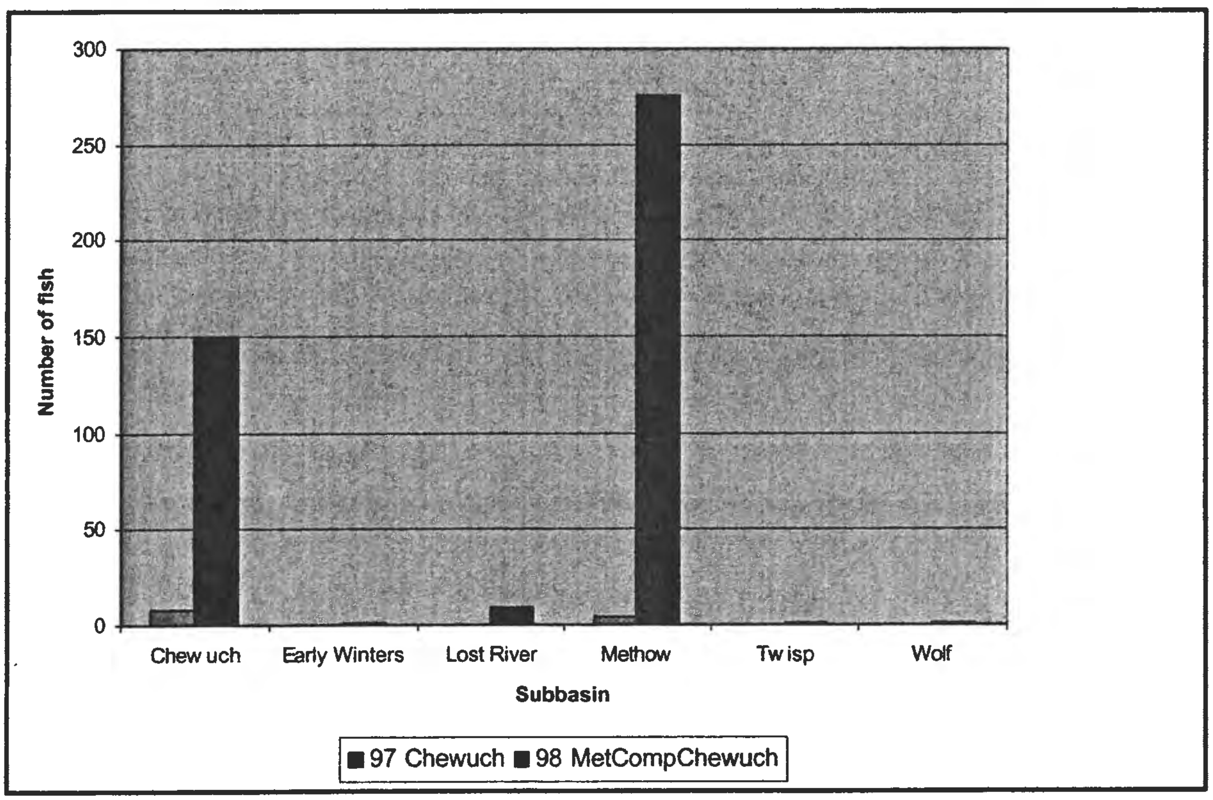


Figure 9. Distribution of coded wire tagged spring chinook carcass recoveries across all subbasins that originated from smolt releases in the Chewuch River, 2002.

Twisp

There was a total of three CWT carcasses originating from Twisp BY98 smolt release recovered in the Twisp River (Figure 10). Two of these were recovered between Mystery Creek Bridge to the War Creek Bridge and the other between Buttermilk Creek Bridge and the cabin (rm 12.1). An additional eight CWT'ed carcasses originating from the Twisp River acclimation release were recovered in the Methow River. (Figure 11).

Lost

A total of 14 CWT'ed carcasses were successfully identified in the Lost River. The majority (9 or 64.3%) were from the Methow Composite Chewuch BY98 smolt release (Figure 12). This was followed by four CWT'ed carcasses from the Winthrop BY98 smolt release and one from the Methow Composite Methow BY97 smolt release.

Wolf and Early Winters Creeks

In both Wolf and Early Winters creeks a single CWT'ed carcass both originating from the Chewuch River Methow Composite release (BY98) were recovered.

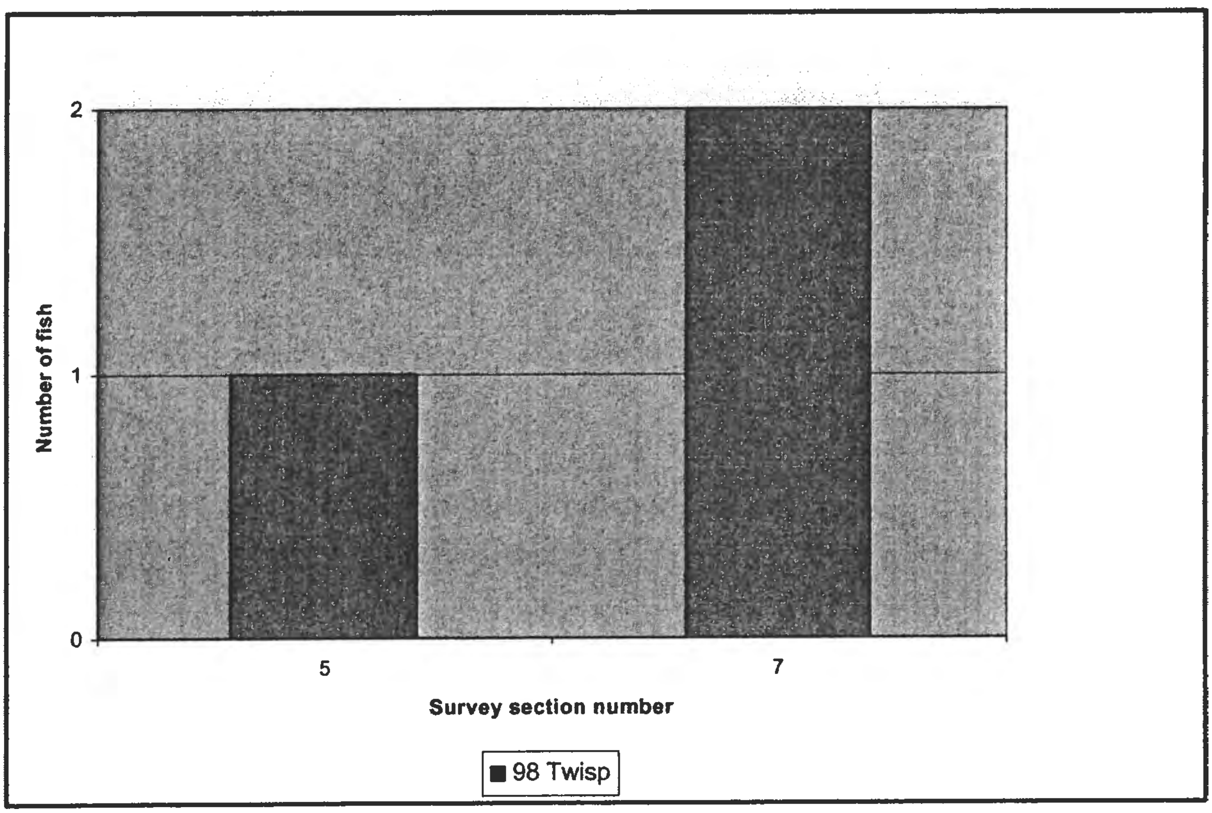


Figure 10. Distribution of coded wire tagged spring chinook carcass recoveries within the Twisp River that originated from smolt releases in the Twisp River, 2002.

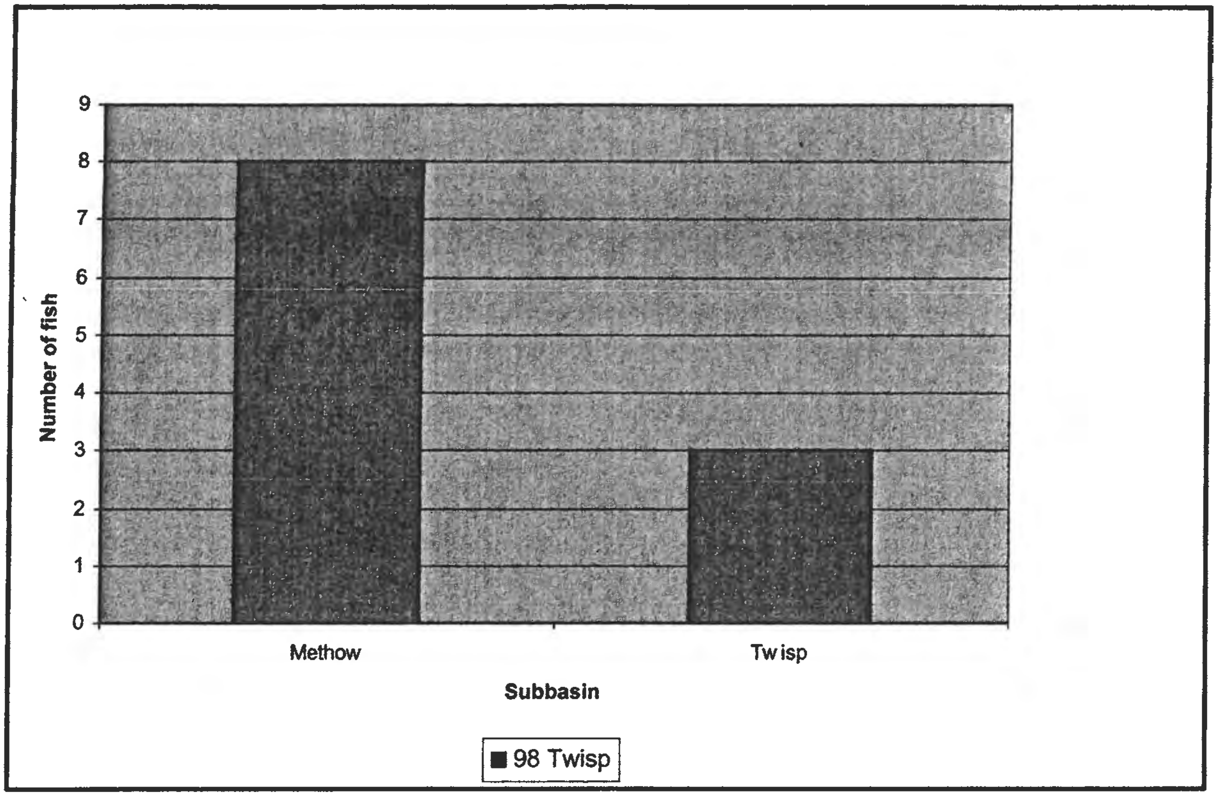


Figure 11. Distribution of coded wire tagged spring chinook carcass recoveries across all subbasins that originated from smolt releases in the Twisp River, 2002.

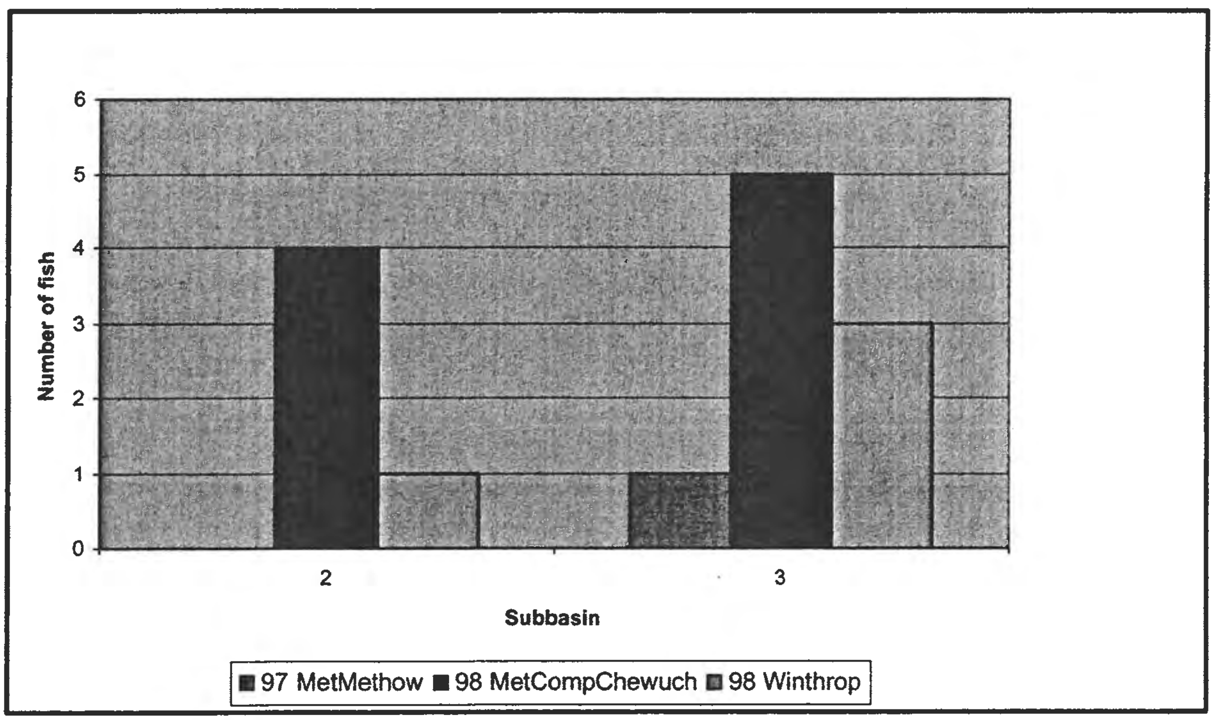


Figure 12. Distribution of coded wire tagged spring chinook carcass recoveries located in the Lost River from smolt releases that originated from the Methow and Chewuch rivers, 2002.

Juvenile Outmigration

A total of 633 spring chinook and 56 steelhead smolts were captured in the trap during its period of operation from March 26 through May 3, 2002 (Table 4). In addition a total of 990 young-of-the-year spring chinook were captured throughout the monitoring period. A complete estimate of spring chinook smolt outmigration was not possible due to the trap not fishing to allow for the passage of hatchery spring chinook smolt outmigrants and an increase in river discharge that required relocation of the trap. These two events occurred from April 15 - 30. For the period of March 26 through April 14 an estimated 7,868 spring chinook smolts passed the Chewuch trap located near the confluence of the Chewuch River.

The mean spring chinook fork length was 96 mm (N = 539) with a standard deviation of 8.6. Spring chinook ranged in size from 70 to 197 mm (Figure 13). The three fish equal to or greater than 145 mm suggest a smolt greater than age-1+. The mean fork length for steelhead/rainbow trout was 114 mm (N = 58) and the standard deviation was 35.5 (Figure 14). Fish ranged in fork length from 60 to 188 mm, which suggests a broad range in age classes and fish under 100 mm are likely steelhead or rainbow trout parr.

A summary of Chewuch trap efficiency test releases conducted in April 2002 are presented in Table 5. Eleven trap efficiency tests were successfully completed using wild spring chinook smolts during the month of April. River discharge ranged from approximately 78 to 168 cfs (based on measured discharge at the USGS gauge station #12448000 located at the Highway 20 bridge crossing in Winthrop, WA). The April 4 efficiency test was excluded from the final data set because it was significantly higher (30.7%) than the calculated efficiencies for the other ten test releases. The reason for this outlier value was not determined. There was no significant correlation ($r^2 = 0.0025$) between trap efficiency and river discharge. This most likely is related to the relatively narrow range (90 cfs) range in river discharge experienced during the period when wild smolts were available, coupled with the small number (an mean of 40 fish/release) of fish available per test release. Excluding the April 4 efficiency test, the overall mean trap efficiency was 8.0%, which was applied to expand the daily spring chinook catch totals since there was no flow specific correlation to trap entrainment efficiency.

Table 4. Summary of spring chinook and steelhead smolt counts at the Chewuch rotary trap located at RM 0.1 on the Chewuch River, 2002.

Date	Spring Chinook Daily Catch	Spring Chinook Estimated Passage	Steelhead Daily Catch	Discharge
3/26/02	1	13	1	62
3/27/02	16	200	2	63
3/28/02	7	88	0	63
3/29/02	19	238	1	6
3/30/02	27	338	1	67
3/31/02	32	400	1	72
4/1/02	38	475	2	79
4/2/02	69	863	0	77
4/3/02	68	850	2	78
4/4/02	52	650	3	81
4/5/02	27	338	2	87
4/6/02	33	413	1	95
4/7/03	44	550	1	105
4/8/02	67	838	7	111
4/9/02	25	313	4	115
4/10/02	37	463	5	118
4/11/02	25	313	2	128
4/12/02	18	225	5	141
4/13/02	14	175	2	168
4/14/02	10	125	3	265
4/15/02	not fished		not fished	304
4/16/02	not fished		not fished	281
4/17/02	not fished		not fished	261
4/18/02	not fished		not fished	244
4/19/02	not fished		not fished	235
4/20/02	not fished		not fished	239
4/21/02	not fished		not fished	249

Table 4 Cont.' Summary of spring chinook and steelhead smolt counts at the Chewuch rotary trap located at RM 0.1 on the Chewuch River, 2002.

Date	Spring Chinook Daily Catch	Spring Chinook Estimated Passage	Steelhead Daily Catch	Discharge
4/22/02	not fished		not fished	271
4/23/02	not fished		not fished	279
4/24/02	not fished		not fished	267
4/25/02	not fished		not fished	266
4/26/02	not fished		not fished	264
4/27/02	not fished		not fished	260
4/28/02	not fished		not fished	255
4/29/02	not fished		not fished	273
4/30/02	not fished		not fished	336
5/1/02	3	38		448
5/2/02	0	0		575
5/3/02	1	13		626
Totals	633	7919	56	

Notes– Daily catches highlighted in red denote counts were interpolated using linear regression based on the daily counts three days before and after the period of non-fishing (March 30 through April 1). Days highlighted in blue for spring chinook estimated daily passage denote days where the mean daily discharge exceeded the river discharge that trap calibration catch efficiency tests were conducted.

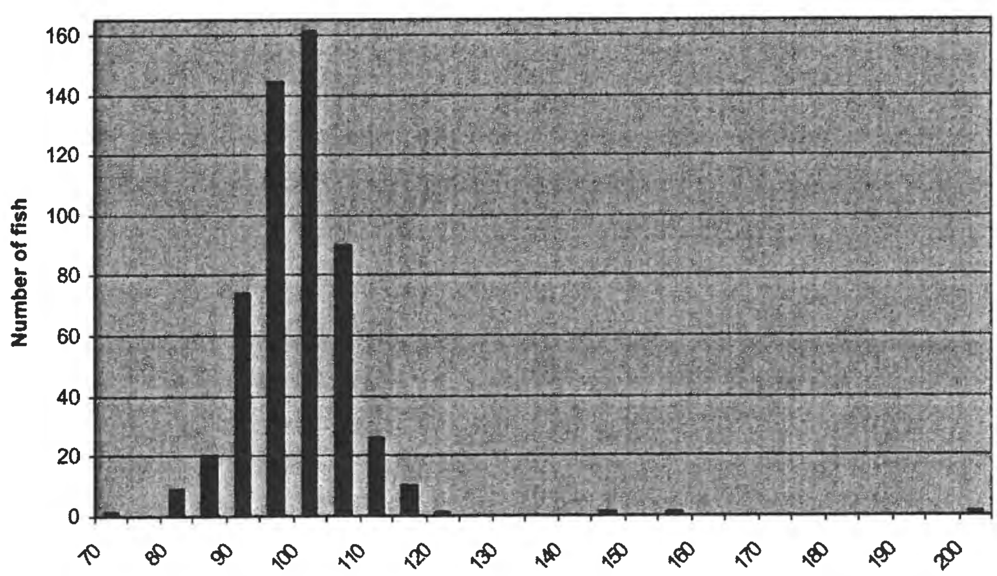


Figure 13. Spring chinook smolt fork length frequency from fish captured at the Chewuch River (RM 0.1) rotary trap on the Chewuch River, spring 2002.

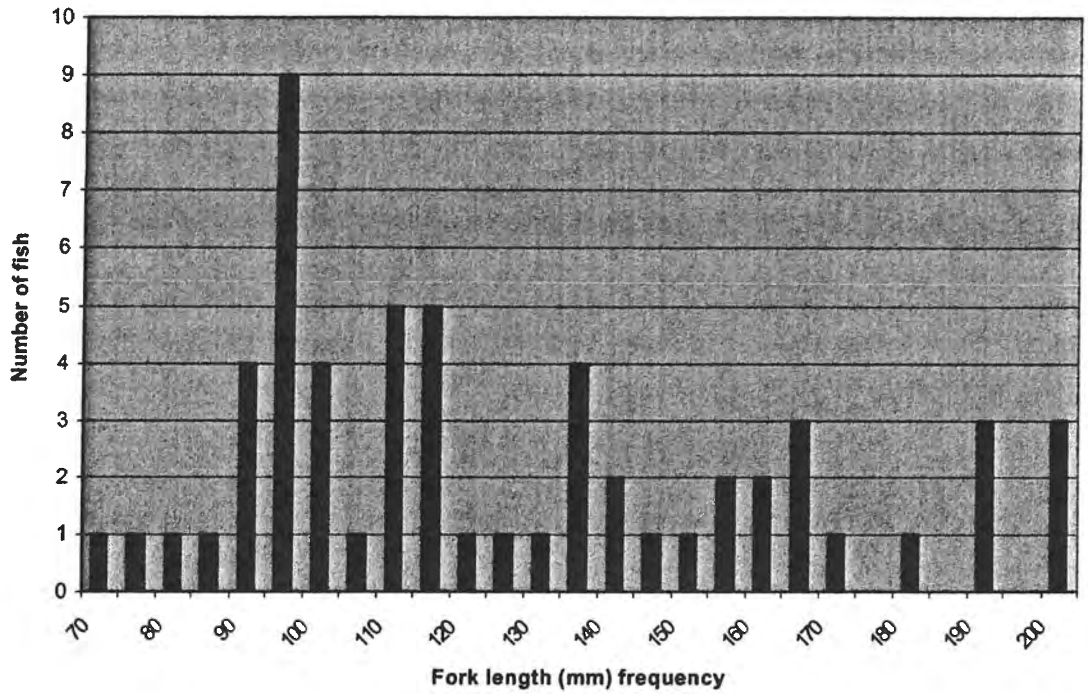


Figure 14. Steelhead/rainbow trout fork length frequency from fish captured at the Chewuch River (RM 0.1) rotary trap on the Chewuch River, spring 2002.

Table 5. Summary of trap efficiency test releases for the Chewuch River (RM 0.1) rotary trap on the Chewuch River, April 2002.

Release Date	Marked Fish Released	Marked Fish Recaptured	Trap Efficiency	Mean Daily Discharge
April 4	69	5	7.2%	78
April 3	68	6	8.8%	81
April 4	52	16	30.7%	87
April 5	26	3	11.5%	95
April 6	33	3	9.1%	105
April 7	44	2	4.5%	111
April 8	67	3	4.5%	115
April 9	25	3	12.0%	118
April 10	37	1	2.7%	128
April 11	25	2	8.0%	141
April 12	18	2	11.1%	168
Mean Efficiency (excluding the April 4 release)			8.0%	

CONCLUSIONS

Key Findings

1. Since 2000 the percent of redds below the Methow River spawner index reach (Mazama Bridge to Weeman Bridge) has exceeded 80%, which is an increase from the 1987-95 average of 41.7%.
2. Similar to the Methow, the percent of redds deposited in the Chewuch River has increased below the index reach (Camp 4 - Falls Creek campground) since 2000. The average for 2000 - 2002 is 79%, compared to 43% for the years 1987-94.
3. The spawning distribution in the Twisp River has remained fairly consistent since 1987.
4. The homing fidelity of Methow acclimated smolts was good with 88.9% (N= 209) of the returning adults spawning in the Methow River in 2002.
5. The homing fidelity of Chewuch acclimated smolts was fair with 62.4% (N= 279) of the returning adults spawning in the Methow River and 35.1% (N= 157) in the Chewuch in 2002. Of the Chewuch derived adults that spawned in the Methow, 59.1% spawned downstream to Foghorn Dam.
6. The homing fidelity of the Twisp acclimated smolts was poor with 27.3% (N= 3) of the returning adults spawning in the Twisp River and 72.7% (N= 8) in the Methow in 2002..
7. The highest CWT group recovered in the Lost River in 2002 was the Methow Composite Chewuch BY98 accounting for nine (64.3%) of the fourteen CWTs recovered.
8. It appears that the Lost River is being re-colonized by hatchery derived spawners in 2001 and 2002. Redd counts ranged from zero to seven annually from 1994 - 2000, and increased to 72 redds in 2001 and 54 redds in 2002. Seventeen carcasses were recovered in the Lost River in 2002, of which, 16 (94%) were of hatchery origin. In 2001 of the six carcasses recovered, five were of natural origin.

Management Considerations

1. Consideration should be given to the pros and cons of re-locating and/or adding an additional Methow spring chinook acclimation site further upstream of the MFH. Clearly, there is a benefit of reducing the number of redds located in the dewatered section of the upper Methow River. Additionally, there exists plenty of high quality spawning and rearing habitat downstream of the Weeman Bridge. At this time there is minimal overlap both spatially and temporally between spring and summer chinook spawners. Given the present spawning distribution represents a significant shift from what was observed historically, a open discussion by the fish managers should ensue as to any potential negative effects in the areas of ecological interactions and long-term fitness.
2. The shift in redd distribution observed since 2000 in the Chewuch should be viewed with some concern primarily because of the limited and of poorer quality spawning habitat that exists in the lower Chewuch River. Additionally, rearing habitat is generally of lower quality in the lower Chewuch River relative to further upstream.
3. Of the three acclimated smolt releases, the Chewuch release resulted in a significant number of spawners in 2002 straying primarily into the Methow River, and also into the Lost River. The CWT recovery rate in the Methow River was 43.9% in 2001 and 62.4% in 2002 for spawners that originated as Chewuch acclimated smolts. Reasons for this are not understood at this time, especially given that the acclimation protocols are similar for all three acclimation sites. A discussion amongst the fish managers and fish culturists is warranted to determine possible causes and corresponding solutions.

4. Though the stray rate of Twisp River derived hatchery spawners was high (72.7% N= 8) based on CWT recoveries in 2002, this should not necessarily be cause for alarm. The sample size of Twisp origin carcasses was low in 2002 at eleven CWTs recovered. This is not a large enough sample size to pass judgment on. In the two previous years (2001 and 2000) the homing fidelity of Twisp origin hatchery spawners has been high. In 2000 and 2001 the percent of CWTs in the Twisp relative to the Methow Basin was 89.5% (N= 34) and 80.6% (N= 25), respectively.
5. Historically the Lost River spring chinook population has been managed or treated as distinct population. From 1994 - 2000 a total of 18 redds were deposited in the Lost River, followed by an increase of 72 and 54 redds in 2001 and 2002, respectively. It appears that hatchery spawners are largely responsible for this increase in redd counts, opposed to naturally produced spawners. In 2002 94% (N= 16) of the carcasses were of hatchery origin, and of these, 64.3% (N= 9) were from the Methow Composite Chewuch BY98 smolt release group and the other five were from WNFH or MFH on-station acclimated smolt releases. In 2001 five of the six carcasses recovered were of natural origin, however, the parent brood years of 1996 (5-yr olds) and 1997 (4-yr olds) had a total of seven redds for these two years in the Lost River. Even if assumed that all seven redds were the result of Lost River spawners, the 72 redds observed in 2001 were largely the consequence of spawners produced outside of the Lost River. Further, it's likely these spawners were largely of hatchery origin given the size of the 2001 return (10,871 fish past Wells) relative to the parent brood years of 1996 and 1997 where the Methow Basin redd counts were assumed to be zero in 1996 (all adults were collected at Wells Dam this year) and 150 in 1997. Thus the majority of fish that returned to spawn in 2001 were most likely derived from acclimated smolts produced by the two hatcheries. For the future, fish managers need to consider from a biological/genetic and management perspective how best to manage the Lost River spring chinook population.

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Richardson, Don. 1976. Natural monthly streamflow in the Methow Basin. Water Resources Analysis and Information Section, Office Report No. 46. Washington Dept. of Ecology, Olympia, WA. 7p.

Wells Project Coordinating Committee. 1995. Methow Basin Spring Chinook Salmon Supplementation Plan.

APPENDIX TABLES 1-4

Appendix Table 1. Methow basin spring chinook weekly and river section redd counts, 2002.

River Section	Section No.	Week 1 (7/28-8/3)	Week 2 (8/4-10)	Week 3 (8/11-17)	Week 4 (8/18-24)	Week 5 (8/25-31)	Week 6 (9/1-7)	Week 7 (9/8-14)	Week 8 (9/15-21)	Week 9 (9/22-28)	Total
Ballard Camp Ground - Lost R.	1	0	0	0	0	0	0	0	0	0	**0**
Lost R. - Gate Cr.	2	0	0	1	0	0	0	0	3	0	**4**
Gate Cr. - Early Winters Cr.	3	0	0	3	17	3	6	0	0	0	**29**
Early Winters Cr. - Mazama Br.	4	0	0	2	7	3	0	0	0	0	**12**
Mazama Br. - Rd. barrier	5	0	0	0	3	3	8	2	3	0	**19**
Rd. barrier - Weeman Br.	6	0	0	9	7	10	2	8	0	0	**36**
Weeman Br. - along Highway 20	7	0	0	21	81	93	100	11	0	0	**306**
along Highway 20 - Wolf Cr.	8	0	0	0	0	0	1	0	0	0	**1**
Wolf Cr. - Foghorn Dam	9	0	0	1	15	24	19	5	0	14	**78**
Foghorn Dam - Chewuch Confluence	10	0	8	15	32	20	20	15	6	0	**116**
Chewuch Confluence - Barkley Div.	11	0	0	20	0	8	5	2	1	0	**36**
Barkley Div. - Twisp confluence	12	0	0	0	0	9	6	0	0	0	**15**
Methow Hatchery outfall	—	0	0	1	0	0	42	0	0	0	**43**
Spring Creek (Winthrop H. outfall)	—	0	0	3	21	2	0	0	0	0	**26**
Methow River Totals		**0**	**8**	**76**	**183**	**175**	**209**	**43**	**13**	**14**	**721**
Wolf Creek	—	0	0	1	0	0	0	0	0	0	1
Gold Creek	—	0	0	0	0	0	0	0	0	0	0

Appendix Table 2. Chewuch basin spring chinook weekly and river section redd counts, 2002.

River Section	Section No.	Week 1 (7/28-8/3)	Week 2 (8/4-10)	Week 3 (8/11-17)	Week 4 (8/18-24)	Week 5 (8/25-31)	Week 6 (9/1-7)	Week 7 (9/8-14)	Week 8 (9/15-21)	Week 9 (9/22-28)	Total
Falls - 30 Mile Br.	1	0	0	0	0	0	0	0	0	0	**0**
30-Mile Br. - road-side campground	2	0	0	2	0	0	1	0	0	0	**3**
road-side campground - Andrews Cr.	3	0	0	0	0	0	0	0	0	0	**0**
Andrews Cr. - Lake Cr.	4	0	0	0	0	0	0	0	0	0	**0**
Lake Cr. - Buck Cr.	5	0	0	0	0	0	0	0	0	0	**0**
Buck Cr. - Camp 4 Br.	6	0	0	0	4	0	0	6	0	0	**10**
Camp 4 Br. - road-side campground	7	0	0	0	2	8	0	0	0	0	**10**
road-side campground - Chewuch camp-ground	8	0	0	0	4	6	4	3	0	0	**17**
Chewuch campground - Mile-6 campground	9	0	0	1	4	5	0	12	0	0	**22**
Mile-6 campground - Falls Cr. camp-ground	10	0	0	1	1	3	0	0	0	0	**5**
Falls Cr. campground - 8-Mile Ranch	11	0	0	0	0	0	32	0	0	0	**32**
8-Mile Ranch - Memorial Br.	12	0	0	1	11	0	38	33	30	0	**113**
Memorial Br. - Chewuch Br.	13	0	0	0	0	0	0	0	0	2	**2**
Chewuch Br. - halfway Pt.(rm 5)	14	0	0	0	0	4	43	0	0	0	**47**
Halfway Pt. (rm 5) - confluence	15	0	0	0	0	10	30	0	0	0	**40**
Basin Totals		**0**	**0**	**5**	**26**	**36**	**148**	**54**	**30**	**2**	**301**

Appendix Table 3. Twisp basin spring chinook weekly and river section redd counts, 2002.

River Section	Section No.	Week 1 (7/28-8/3)	Week 2 (8/4-10)	Week 3 (8/11-17)	Week 4 (8/18-24)	Week 5 (8/25-31)	Week 6 (9/1-7)	Week 7 (9/8-14)	Week 8 (9/15-21)	Week 9 (9/22-28)	Total
Road end campground - up 2 miles	1	0	0	0	0	0	0	0	0	0	**0**
Road end campground . - South Cr. Br.	2	0	0	0	0	0	0	0	0	0	**0**
South Cr. Br. - Popular Flats camp-ground	3	0	0	0	0	0	0	0	0	0	**0**
Popular Flats campground - Mystery Br.	4	0	0	0	2	0	3	1	0	0	**6**
Mystery Br. - War Cr. Br.	5	0	0	1	9	2	1	1	0	0	**14**
War Cr. Br. - cabin	6	0	0	2	3	0	0	0	0	0	**5**
cabin - Buttermilk Br.	7	0	1	9	12	33	12	0	0	0	**67**
Buttermilk Br. - green Br.	8	0	0	1	0	0	0	0	0	0	**1**
green Br. - Little Br. Cr.	9	0	0	2	1	5	0	0	4	0	**12**
Little Cr. Br. - Newby Cr. Br.	10	0	0	0	0	0	0	0	0	0	**0**
Newby Cr. Br. - fish weir	11	0	0	0	0	0	0	0	0	0	**0**
fish weir - Wooden Br.	12	0	0	0	0	0	0	0	0	0	**0**
Wooden Br. - Poorman's Br.	13	0	0	0	0	0	0	0	0	0	**0**
Poorman's Br. - Twisp R. Br.	14	0	0	0	0	0	0	0	3	0	**3**
Twisp R. Br. - confluence	15	0	0	0	0	0	0	0	0	0	**1**
Basin Totals		**0**	**1**	**16**	**27**	**40**	**16**	**2**	**7**	**0**	**109**

Appendix Table 4. Lost and Early Winters basins spring chinook weekly and river section redd counts, 2002.

River Section	Section No.	Week 1 (7/28-8/3)	Week 2 (8/4-10)	Week 3 (8/11-17)	Week 4 (8/18-24)	Week 5 (8/25-31)	Week 6 (9/1-7)	Week 7 (9/8-14)	Week 8 (9/15-21)	Week 9 (9/22-28)	Total
Lost River										0	
Sunset Cr. - Eureka Cr.	1	0	0	0	0	0	0	0	0	0	**0**
Eureka Cr. - Lost R. Road Br.	2	0	0	0	24	2	12	2	0	0	**40**
Lost R. Road. Br. - confluence	3	0	0	0	11	3	0	0	0	0	**14**
Lost River Totals		**0**	**0**	**0**	**35**	**5**	**12**	**2**	**0**	**0**	**54**
Early Winters Creek											
Klipchuch campground. - Early Winters Br.	1	0	0	0	0	0	0	0	0	0	**0**
Early Winters Br. - Highway 20 Br.	2	0	0	0	0	0	0	0	0	0	**0**
Highway 20 Br. - diversion dam	3	0	0	0	0	0	0	0	0	0	**0**
diversion dam - Highway 20 Br.	4	0	0	0	3	0	3	0	0	0	**6**
Highway 20 Br. - confluence	5	0	0	0	0	0	0	0	0	0	**0**
Early Winters Creek Totals		**0**	**0**	**0**	**3**	**0**	**3**	**0**	**0**	**0**	**6**

MOVEMENT OF BULL TROUT WITHIN THE MID-COLUMBIA RIVER AND TRIBUTARIES 2001-2004

APPENDIX G

MOVEMENT OF BULL TROUT WITHIN THE MID-COLUMBIA RIVER AND TRIBUTARIES, 2001-2004

Final

ROCKY REACH HYDROELECTRIC PROJECT
FERC Project No. 2145

ROCK ISLAND HYDROELECTRIC PROJECT
FERC Project No. 943

WELLS HYDROELECTRIC PROJECT
FERC Project No. 2149

PRIEST RAPIDS HYDROELECTRIC PROJECT
FERC Project No. 2114

NOTED
JUN 18 2004
S.A.B.

May 26, 2004

P.U.D. CHELAN COUNTY POWER

Prepared by:
BioAnalysts, Inc.
Eagle, Idaho

Prepared for:
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Public Utility District No. 1 of Douglas County
East Wenatchee, Washington
&
Public Utility District No. 1 of Grant County
Ephrata, Washington

TABLE OF CONTENTS

SECTION 1: INTRODUCTION

On 10 June 1998, the U.S. Fish and Wildlife Service (Service) listed bull trout (*Salvelinus confluentus*) within the Columbia River basin as threatened under the Endangered Species Act (ESA) (50 CFR 63(111)). Later (1 November 1999), the Service listed bull trout within the coterminous United States as threatened under the ESA (50 CFR 64(210)). The Service identified habitat degradation, fragmentation and alterations associated with dewatering, road construction and maintenance, mining, and grazing; blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment into diversion channels; and introduced non-native species as major factors affecting the distribution and abundance of bull trout. They noted that dams (and natural barriers) have isolated population segments resulting in a loss of genetic exchange among these segments (50 CFR 63(111):31657). The Service believes many populations are now isolated and disjunct.

In a letter to the Federal Energy Regulatory Commission (FERC), the Service requested consultation under Section 7 of the ESA regarding the effects of hydroelectric project operations on bull trout in the Columbia River (letter from M. Miller, USFWS, to M. Robinson, FERC, dated 10 January 2000). The request for consultation was based on observations of bull trout in the study area. In its reply to the Service, the FERC noted that there was virtually no information on bull trout in the mainstem Columbia River.

Because bull trout within the mid-Columbia River[1] area are listed under the ESA (50 CFR 63(111):31651), and they may be affected by the operation of hydro-projects owned and operated by Chelan, Douglas, and Grant PUDs (Mid-Columbia PUDs), the Mid-Columbia PUDs initiated a multi-year evaluation of the status of bull trout in the project area. Currently, little is known about the life-history characteristics (e.g., movements, distribution, habitat use, etc.) of bull trout in the mid-Columbia River. Therefore, in order to assess the operational effects of hydroelectric projects on adult bull trout within the mid-Columbia, a total of 79 adult bull trout were radio-tagged during the 2001-2003 study period and tracked to describe their movements within the mid-Columbia Basin.

The specific objectives of the study were to: (1) describe the movements and migration of adult bull trout in the mid-Columbia system and (2) assess the effects of hydroelectric operations on the movement and migration patterns of adult bull trout in the mid-Columbia River. This report focuses primarily on the last two years of the study, because the first year of work has already been reported (BioAnalysts, Inc. 2002). However, for comparative purposes, the results for all three years of research have been included into one report. For additional information on the first year of this study, please refer to the publication BioAnalysts, Inc. (2002).

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[1] In this document, the mid-Columbia River is defined as the area between the confluence of the Yakima and Columbia rivers and Chief Joseph Dam. NOAA Fisheries refers to this area as the upper-Columbia River.

SECTION 2: PROJECT AREA

The primary geographical area of interest was the mainstem Columbia River from Priest Rapids Dam to Chief Joseph Dam (Figure 1). It is within this area that the effects of Priest Rapids, Wanapum, Rock Island, Rocky Reach, and Wells dams were assessed regarding the movements and migration of adult bull trout. At these dams, fixed-site radio-telemetry systems were installed to monitor the movements of radio-tagged bull trout. The study area also included the four major tributaries to the mid-Columbia River; Wenatchee, Entiat, Methow, and Okanogan systems. Both fixed-site and mobile telemetry surveys monitored the movement of radio-tagged bull trout within each of the major tributary streams.

Columbia River flows in the project area during the period May through October 2001-2003 are shown in Figure 2, Figure 3, Figure 4, Figure 5 and Figure 6. Discharge at the mid-Columbia River projects was a combination of turbine generation and spill generally from the first of May to the end of August. However, minimal spill levels continued at Priest and Wanapum dams until the end of October. Similar spill operations did not occur at Wells, Rocky Reach and Rock Island dams. Migration of bull trout upstream through each of the projects was provided by a fishway ladder system. These ladder systems consist of one or more main entrances located in the tailrace of each project. Some projects (e.g., Priest Rapids, Wanapum, and Rocky Reach dams) also include orifice gates (O.G. gates) that are used to provide additional entrances to the collection channels of the main ladder system. Migration downstream past mid-Columbia River projects likely occurs through powerhouse or spillway passage routes and may also include juvenile bypass collection facilities.

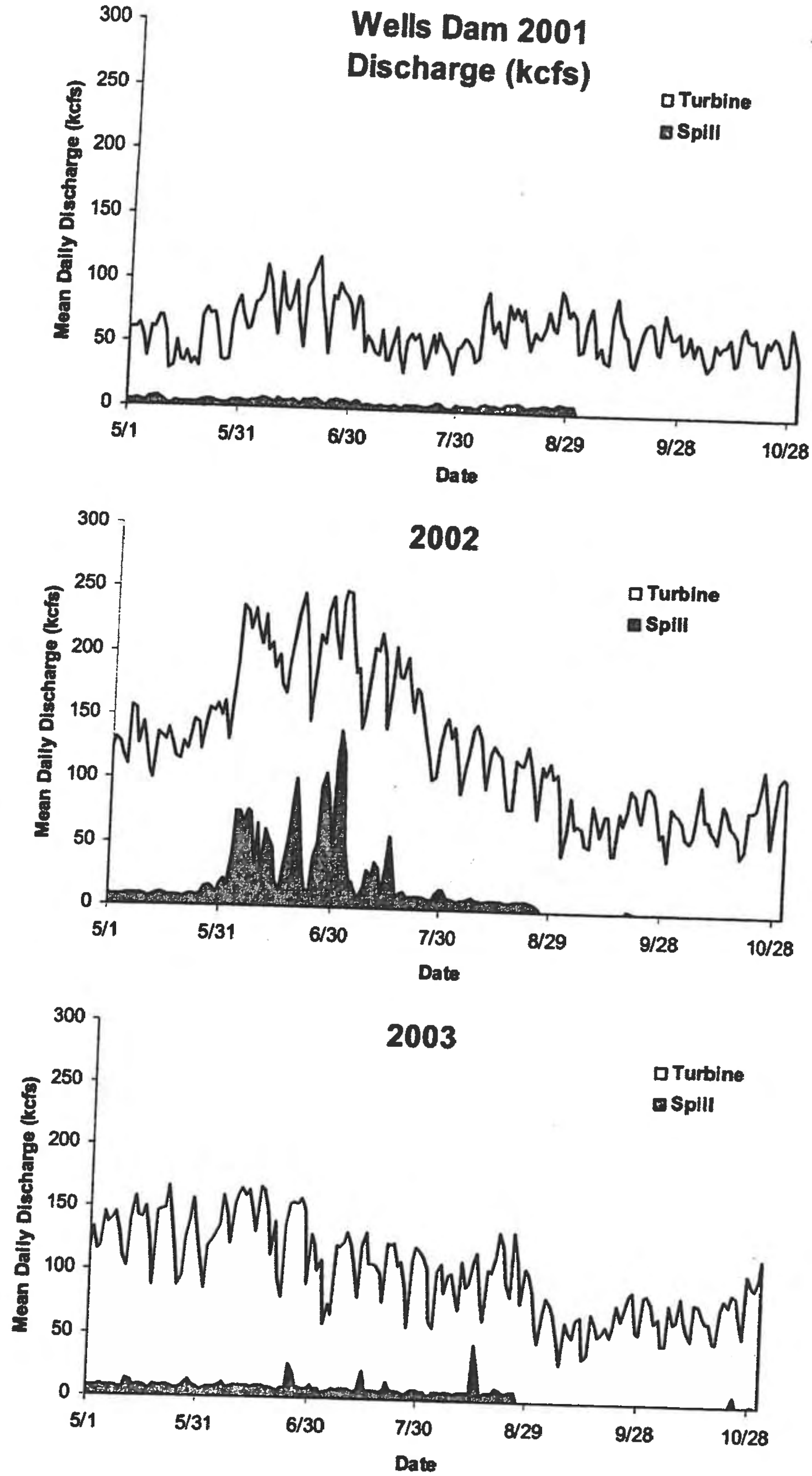

Figure 2: Columbia River flows passing through Wells Dam during the period May through October, 2001-2003.

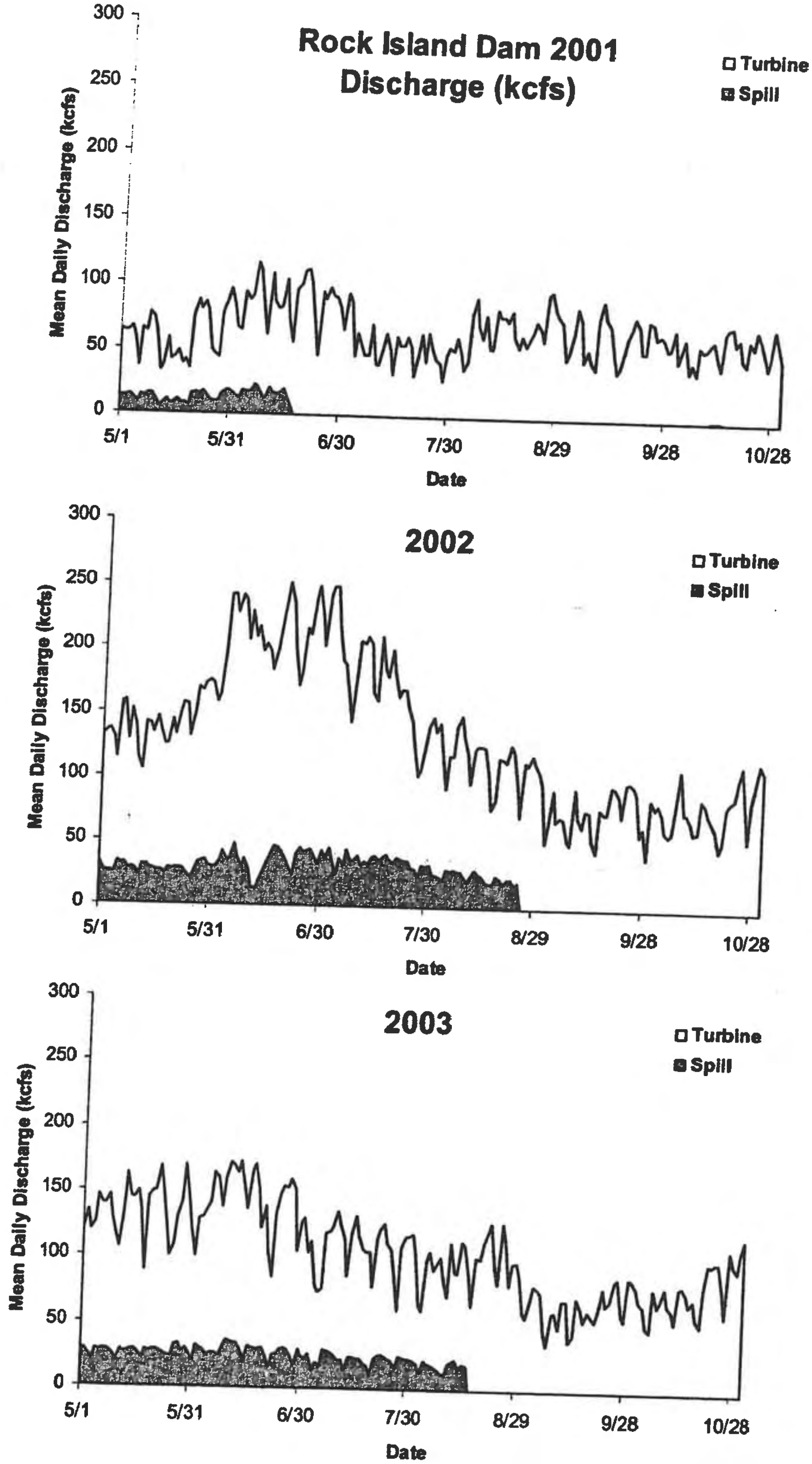

Figure 4: Columbia River flows passing through Rock Island dam during the period May through October, 2001-2003.

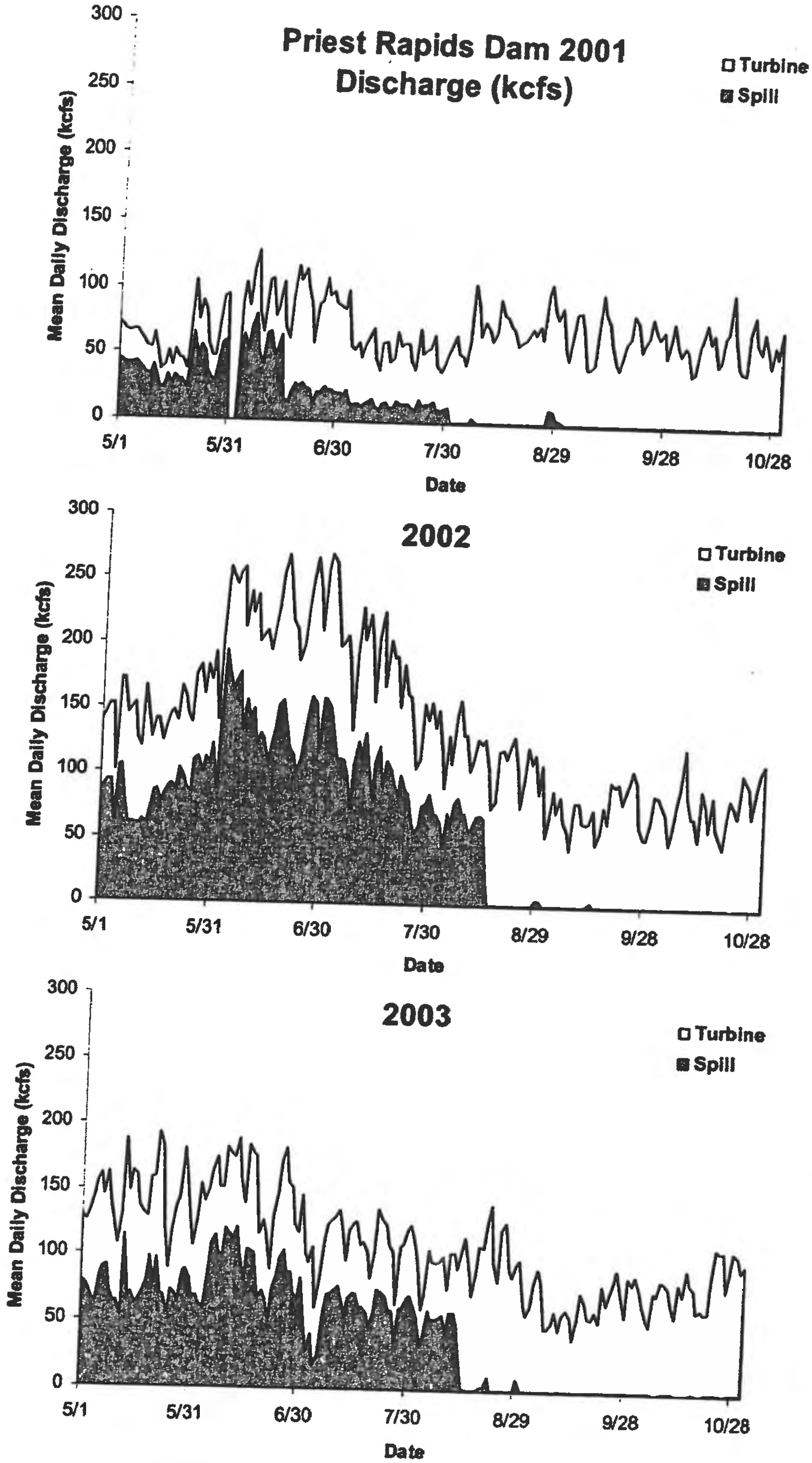

Figure 6: Columbia River flows passing through Priest Rapids dam during the period May through October, 2001-2003.

SECTION 3: METHODS

This study relied on radiotelemetry techniques to monitor the movements and migration patterns of adult bull trout in the mid-Columbia River. Below, is a description of the number of fish tagged in 2002, including the tagging procedures and monitoring systems used in 2002 and 2003. Study methods for the 2001 study period are summarized in BioAnalysts, Inc. (2002). However, it should be noted that all methods and monitoring systems were consistent in all three years of the study.

3.1 Number of Bull Trout Tagged

To assess the movements and migration of adult bull trout, the original proposal was to tag a total of 40 bull trout in the mid-Columbia River in 2002. This number was consistent with tagging efforts in 2001[2] and was based on discussions with the Service. This sample size represented about 20% of all bull trout counted at the dams in previous years. The number of trout to be collected and tagged at each dam was based on the proportion of fish that migrated past those dams in 2000. Because more bull trout pass Rocky Reach Dam than Rock Island or Wells dams, the target was to capture and tag 10 adult bull trout at Rock Island Dam, 20 at Rocky Reach Dam, and 10 at Wells Dam. Bull trout were sampled during mid-May to late-June, which coincides with the period when the most bull trout are observed passing through the three dams (Figure 7, Figure 8 and Figure 9). No attempts were made to tag at Priest or Wanapum dams because very few bull trout are observed moving past those projects.

To avoid a temporal bias in the sampling program, bull trout were collected throughout the spring migration period (20 May to 27 June) at Rocky Reach Dam by establishing weekly tagging targets. These weekly targets were based on the proportion of fish observed at Rocky Reach Dam in 2000 and 2001 (Table 1). That is, bull trout were captured throughout the passage period, but a greater number were collected and tagged during the period of peak passage.

In order to describe passage distribution, the number of bull trout passing Rocky Reach Dam during each week in 2000 and 2001 were compiled. From those data, the proportion of the total run that passed the project during each week was then calculated. The numbers of bull trout captured and tagged at the dam during each week of the 2002 sampling period was estimated from the product of the weekly proportions and total sample size (i.e., 20 fish at Rocky Reach) (Table 1). At most, five fish were to be collected and tagged during a given sampling week (Table 1). Because of the desire to maintain the predetermined tagging schedule, it was decided that if the weekly tagging quotas were not met at the project, the deficit would be carried into the following week.

Diel passage data for adult bull trout at Rocky Reach and Rock Island dams indicated that most bull trout passed the projects between 0800-2300 hours (Figure 10 and Figure 11). Since the upstream release of radio-tagged fish at Rocky Reach Dam required logistical support from Chelan PUD, it was decided to operate the traps between 0800-1700 hours.

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[2] In 2001, only 39 adult bull trout were captured and tagged. Because of the low number of bull trout that passed Rock Island Dam, only seven fish were collected and tagged there. The deficit was partially made up at Rocky Reach Dam, where 22 adult trout were collected and tagged (two more than the target). The goal of 10 bull trout at Wells Dam in 2001 was met.

methanesulfonate (MS-222) at a concentration of 80 mg/L while the fish was contained in the collection vessel (see Surgical Techniques for detailed description of sedation). At Rocky Reach Dam, the collection vessel was moved laterally along an I-beam monorail close to the surgical facility located under the roadway of the ladder. The fish was then transferred by hand to the surgical table for processing. At Rock Island Dam, the surgical facility was located within a trailer about 10 m from the collection area. There, the fish was transferred in a rubber bladder filled with anesthetic water to the surgical facility.

3.2.2 Wells Dam

Bull trout at Wells Dam were trapped at the brood-stock collection facility located within the left bank ladder. The brood-stock collection facility is located at pool 40 about half way up the fish ladder. The trap is operated by placing a barrier fence across the entire width of pool. When the trap is in operation, all fish ascending the left bank ladder are blocked by the barrier fence and forced to ascend the off-ladder trap via a steep-pass denil that leads to an upwell enclosure. Once inside the upwell enclosure, fish move down a sorting chute by jets of water introduced near the top of the sorting chute. As the fish slide down the sorting chute, they are identified and either diverted into the holding tank or allowed to pass upstream of the trap. When a bull trout was observed in the chute, a technician activated a pneumatic gate diverting the fish into a 2,270-liter holding tank. Non-target species and small bull trout (<40 cm fork length) were shunted back to the ladder upstream of the trapping barrier. The fish ladder supplied the holding tank with freshwater at a rate of 114 to 151 L/hr to maintain adequate dissolved oxygen and temperature levels. At the time of tagging, bull trout were netted from the holding vessel and transferred to an anesthetic vessel containing an 80 mg/L solution of MS-222. Once anesthetized, fish were transferred to a mobile surgical station for further processing.

3.3 Tagging Procedures

3.3.1 Description of Radio Tags

Adult bull trout were implanted with digitally-encoded transmitters developed by Lotek Engineering. The transmitter, model MCFT-3A, was 16 mm in diameter, 46 mm long, and weighed 6.2 grams in water and 16.0 grams in air. With a 5.0-second burst rate, the estimated life of the transmitter was 761 days.

Winter (1983) identified a criterion of 2% for the ratio of transmitter to body weight (in air) as being acceptable. For transmitters used in this study, that criterion would allow the tagging of trout equal to or greater than 800 grams. However, more recent information suggests that a radio transmitter that is as much as 5-10% of the fish's body weight will not adversely affect fish behavior (Adams et al. 1998). Using the criterion of 5% would allow the tagging of fish as small as 320 grams, and 10% would allow the tagging of fish as small as 160 grams. Taking a conservative approach, a decision was made to only tag fish with a fork length greater than 40 cm (~650 grams). Based on this strategy, at most, the transmitter would amount to 2.5% of the fish's body weight.

3.3.2 Surgical Techniques

The surgical procedures employed are nearly identical to the methods described in Summerfelt and Smith (1990), with some modifications based on consultation with the Service. Bull trout were anesthetized in a pre-operative solution of MS 222 at a concentration of 80 mg/L. Service biologists swim free of the vessel. The swimming behavior of the fish was observed and any abnormalities were noted.

The transport procedures described above differed slightly for fish tagged and released at Rocky Reach Dam. Because the surgical station was located under a roadway within the fish ladder, it was not possible to carry the holding vessel to the upper deck for transport to the release site. For fish released into the tailrace of Rocky Reach Dam, the vessel was loaded into a boat and transported the vessel to the boat dock located about 50 m upstream from the dam on the right bank. A truck then transported the vessel from the dock to the release site downstream from the dam. For fish released upstream from the project, the vessel was loaded onto a boat and transported directly to the release site. The remaining release procedures were similar to those described above.

At the request of the Service, at each of the three dams half of the fish were released downstream from the dam and the other half were released upstream from the dam. The purpose of this release strategy was to increase the sample size of fish ascending the ladder systems at each of the projects where fish were collected and tagged. For fish released upstream from the dam, they were released as close to the dam as possible, but outside the influence of the forebay hydraulics (i.e., spill and bypass entrainment flows). Figure 15, Figure 16, and Figure 17 show specific release locations.

3.5 Fish Monitoring Systems

3.5.1 Fixed Telemetry

Multiple-telemetry techniques were used to assess the movement of tagged bull trout within the study area. At Priest Rapids, Wanapum, Rock Island, Rocky Reach, and Wells dams, a combination of aerial and underwater antennas were deployed. The primary purpose for these systems was to document the presence of bull trout at each project, specific to either the forebay or tailrace. In addition to these systems, a number of additional telemetry systems were deployed to address specific questions posed by Chelan and Douglas PUDs. At Rock Island, Rocky Reach, and Wells dams, additional systems were installed to identify tagged bull trout that could enter, ascend, and exit specific gates and fish ladders. At these projects, all possible access points to the adult fish ladders and the exits were monitored individually in 2002, allowing the route of passage to be determined as well as the ability to establish the exact time of entrance and exit from the ladder system. In 2003, however, only the tailrace and ladder exits were monitored at Rock Island and Rocky Reach dams, because of a lack of telemetry receivers. At Wells Dam in 2003, all systems were monitored. English et al. (1998, 2001) provided a detailed description of the telemetry systems at each of the dams and within the tributaries.

To assess movement within tributaries, both fixed-telemetry sites and aerial surveys were used within the Wenatchee, Entiat, Methow, and Okanogan rivers (see English et al. 1998, 2001). In the Wenatchee River basin, a single fixed-telemetry site was deployed at the Wenatchee River County Park (R.K. 12.5). In the Entiat River basin, a single system was deployed at R.K. 4.8. In the Methow basin two telemetry sites were established, one at R.K. 2.4 and the other at R.K. 17.5. In the Okanogan basin, a single system was installed at R.K. 9.0. At each of these locations, two 3- or 4-element Yagi antennas were deployed and monitored separately, with one antenna aimed downstream and the other upstream. This allowed us to assess the presence and direction of travel of bull trout at each site.

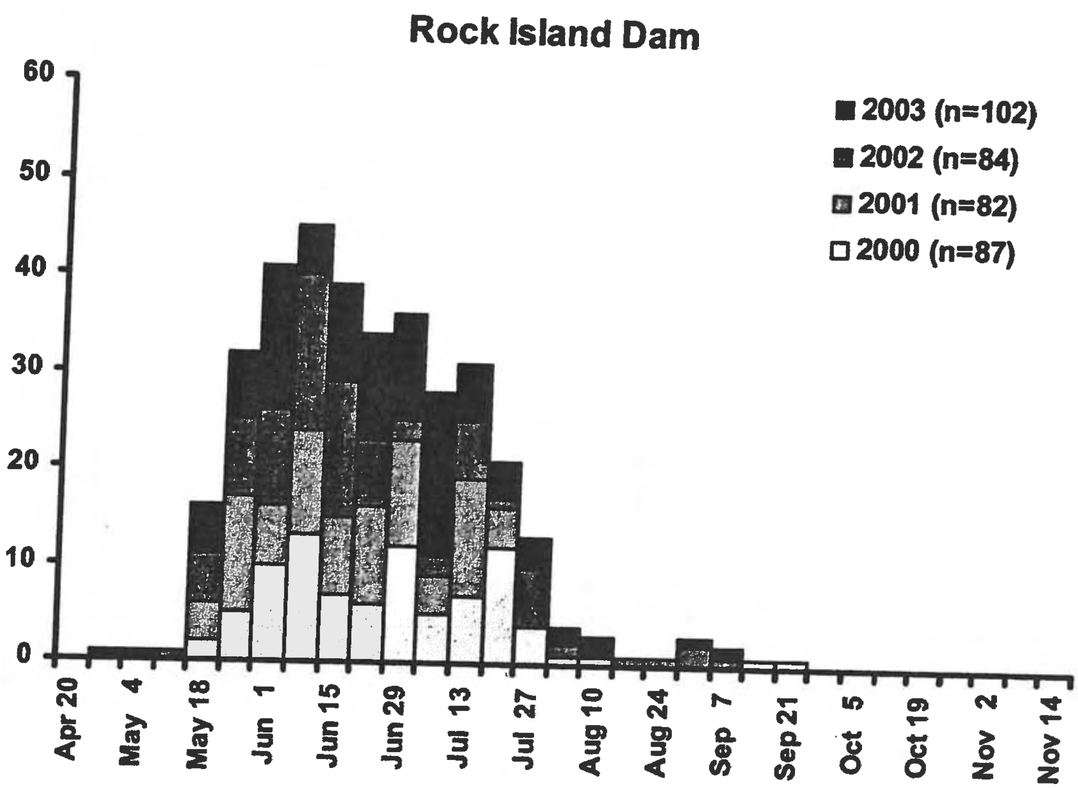

Figure 7: Passage distribution plotted by week for bull trout passing Rock Island Dam from 2000-2003.

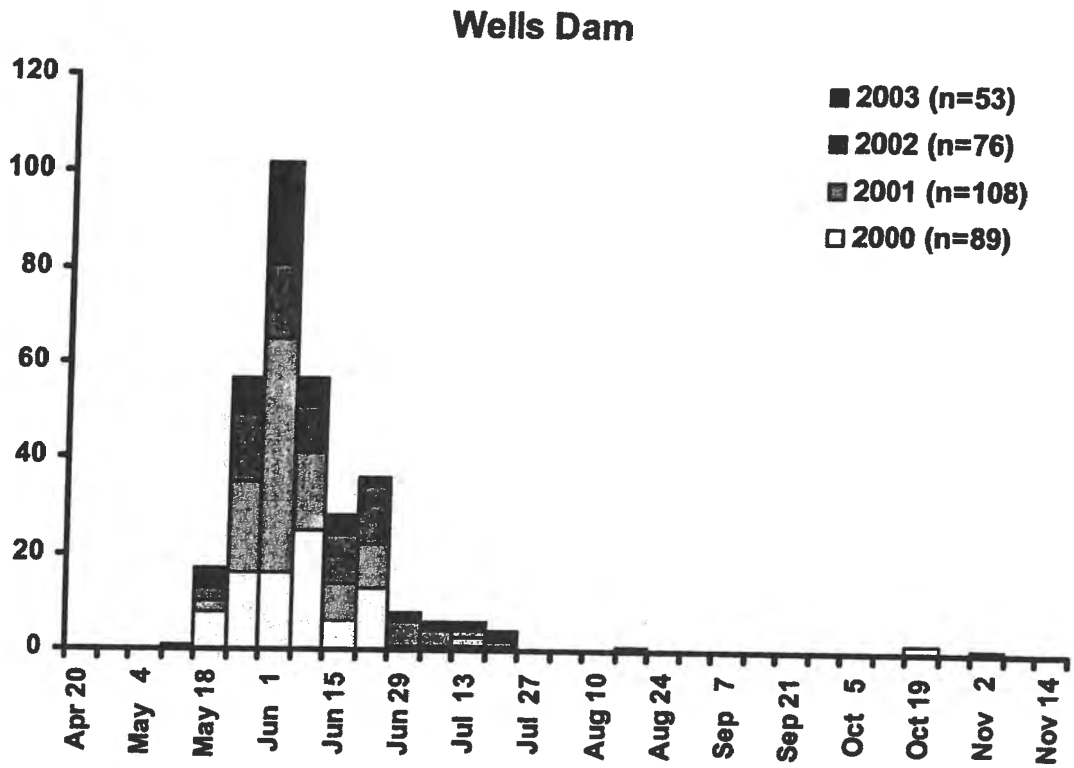

Figure 9: Passage distribution plotted by week for bull trout passing Wells Dam from 2000-2003.

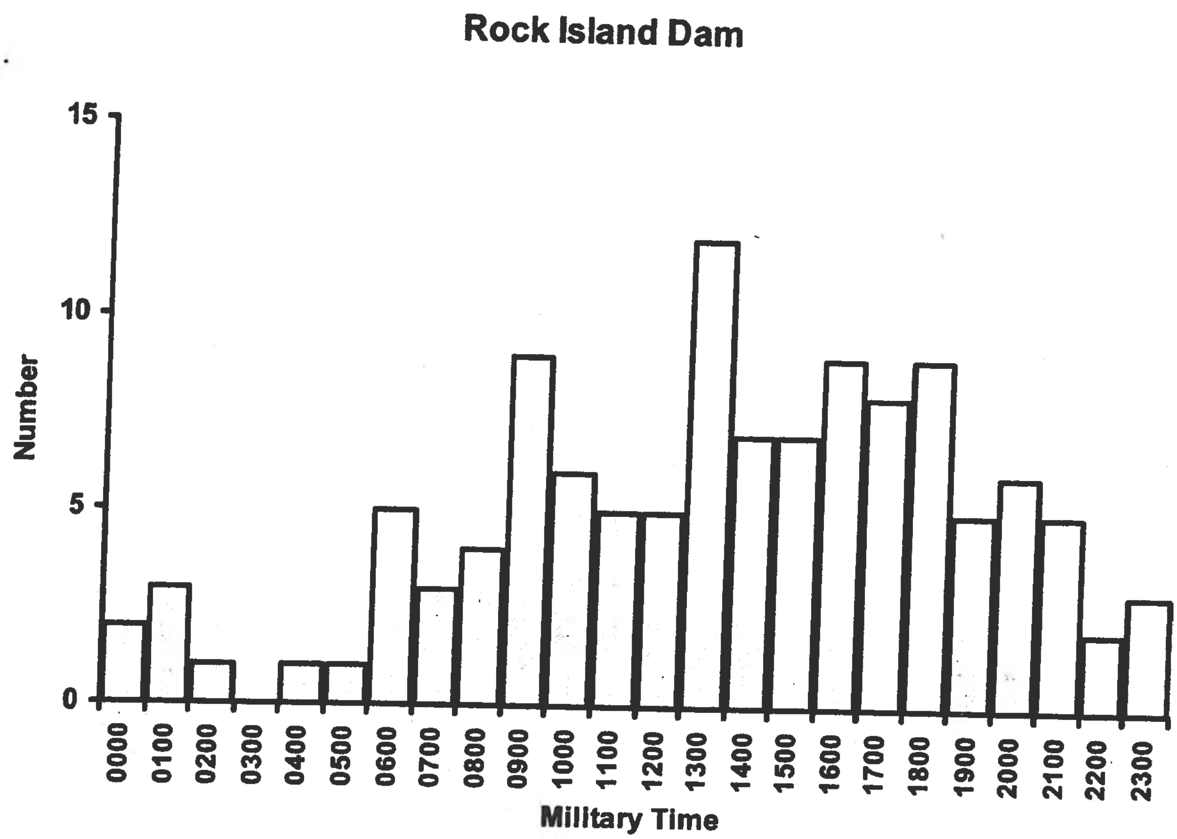

Figure 11: Time of passage for bull trout observed at Rock Island Dam ladders from 15 April to 31 November 2000 and 2001.

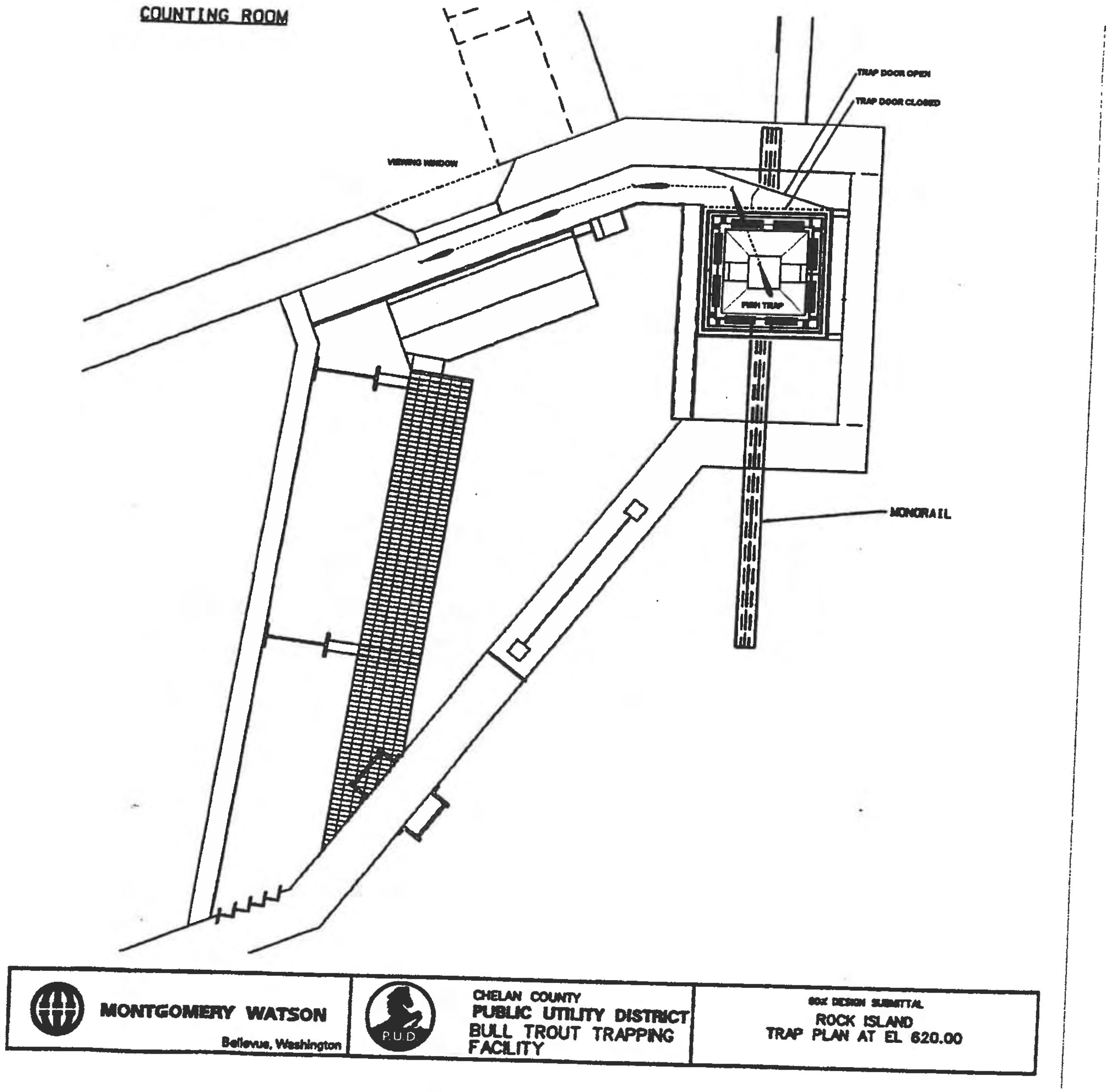

Figure 13: Plan view of Rock Island Dam fish trap showing movement of bull trout past the viewing window and the pneumatic gate open for entry into fish trap.

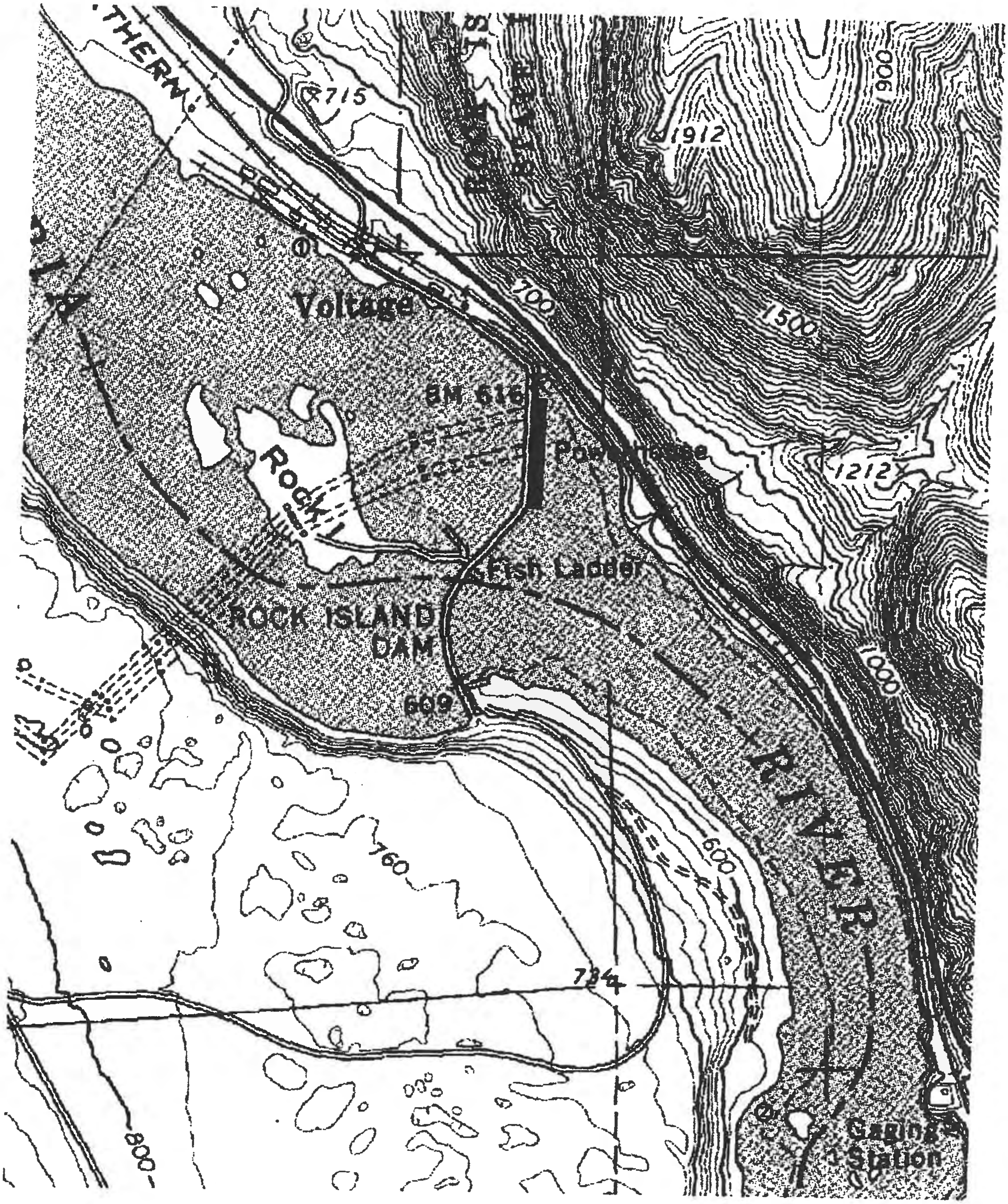

Figure 15: Bull trout release locations upstream (1) and downstream (2) of Rock Island Dam.

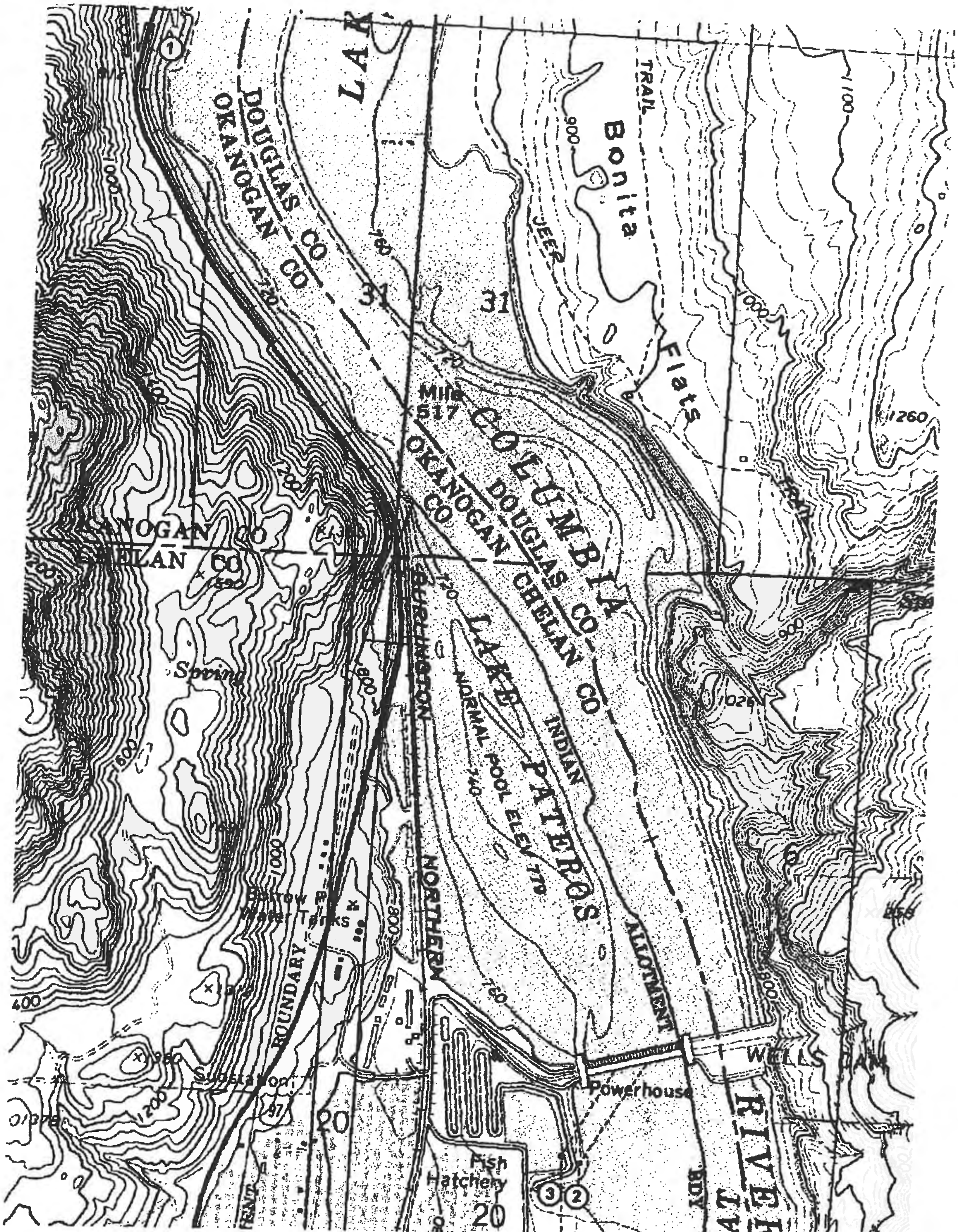

Figure 17: Bull trout release locations upstream (1) and downstream (2) of Wells Dam. Location of hatchery outfall (3) is also identified on the map.

SECTION 4: RESULTS AND DISCUSSION

A total of 79 adult bull trout were radio-tagged at three Columbia River dams during 2001 and 2002, with 39 adult bull trout tagged in 2001 (see results in BioAnalysts, Inc. 2002) and 40 in 2002 (Table 2). In 2002, the goal was to tag 10 fish at both Rock Island and Wells dams and 20 fish at Rocky Reach Dam. At Rock Island Dam in 2002, a total of eight bull trout were captured and tagged, with half released upstream and half downstream from the dam. At Wells Dam, nine adult bull trout were collected and tagged by 12 June, with five released upstream and four downstream from the dam. In an effort to capture and tag a total of 40 adult trout in 2002, the sampling period was extended at Rocky Reach Dam. There, 23 adult bull trout were captured and tagged, with 11 released upstream and 12 downstream from the dam.

The mean size of bull trout captured and tagged in 2002 tended to increase in an upstream direction, with the smallest fish collected at Rock Island Dam and the largest at Wells Dam (Table 2). Bull trout tagged at Rock Island Dam averaged 49.6-cm long (fork length) and weighed 1,325 g. Bull trout at Rocky Reach Dam averaged 55.1-cm long and weighed 1,967 g, while those at Wells averaged 57.3 cm and weighed 2,183 g. In total, the 40 bull trout averaged 54.5-cm long and weighed 1,888 g. Fish size also tended to increase in an upstream direction in 2001, although sizes of fish captured and tagged at Rock Island and Rocky Reach dams were similar (BioAnalysts, Inc. 2002).

The age analysis of fish collected in 2002 varied from the analysis in 2001. In 2002, age was partitioned into two stanzas based on life-history characteristics. For example, an age-5 bull trout could be categorized as a 3/2 fish, which means it spent three years in a cold-water environment (e.g., within a tributary of the mainstem Columbia River) and two years in a relatively warmer-water environment (e.g., the mainstem Columbia River). In 2002, age could be determined for 36 of 40 individuals. Four fish could not be aged because of scale regeneration. Of the 36 fish aged, 12 were 4 years of age (two were classified as 4/0 and ten as 3/1), 19 were 5 years of age (seven were classified as 4/1 and twelve as 3/2), three were 6 years of age (two were classified as 4/2 and one as 3/3), and two were 7 years of age (both were classified as 4/3). Five of the 36 fish had spawned previously on one or more occasion (Table 2). In 2001, only total age was determined for eight bull trout captured at Wells Dam. Of those fish, two were age-5 fish and six were age-6 fish.

For the 40 bull trout captured and tagged at the three collection locations, the mean surgical, recovery, and transport times were 4.7, 11.7, and 11.8 minutes, respectively. The surgical times at the three dams were similar, with the mean times varying by only 0.7 minutes. However, recovery and transport times for the different release sites varied somewhat. The mean recovery time varied between projects by 2.2 minutes, and was likely due to the time necessary to prepare the tagging facility for the next tagging event (this task was completed while the tagged fish recovered). Variability in transport times resulted from road conditions and distance traveled to the various release sites. Nevertheless, the mean overall time from start to finish (surgery, recovery, transport, and release) among tagging locations varied by only 8.3 minutes, with the Rock Island upstream releases requiring only 22.3 minutes and the Rocky Reach downstream releases requiring 30.6 minutes.

Table 2: Description of the 40 adult bull trout tagged in 2002 at Rock Island, Rocky Reach, and Wells dams from 20 May to 27 June 2002. An "s" after the age indicates previous spawning. Water temperatures represent the beginning and end of transport, and at the release site.

Collection		Transmitter		Fish Metrics (cm/g)			Elapsed Time (m)			Water Temp. (°C)			
Date	Time	Chan.	Code	Fork L.	Weight	Age	Surgery	Recovery	Transport	Begin	End	Rel.	Location
						Rock Island Dam							
20-May	1555	14	97	53.0	1,700	3/1(s)	6	11	7	11.0	11.0	12.0	Up
23-May	1321	14	90	49.5	1,250	3/2	6	13	11	12.0	12.0	11.5	Down
04-Jun	0845	14	110	60.0	2,400	4/1	5	8	8	12.5	12.5	13.0	Up
04-Jun	1622	14	105	52.0	1,350	3/1	4	10	10	13.0	13.0	13.0	Down
07-Jun	1019	14	109	50.0	1,400	3/1	5	11	7	12.5	12.5	13.0	Up
07-Jun	1640	14	113	43.0	800	4/1	4	10	11	12.5	12.5	12.5	Down
12-Jun	0928	14	119	42.5	700	R	4	10	7	13.0	13.0	14.0	Up
12-Jun	1256	14	115	46.6	1,000	3/1	5	11	11	13.5	13.5	13.0	Down
			Mean:	**49.6**	**1,325**	—	**5**	**10**	**10**				
			Minimum:	**42.5**	**700**	—	**4**	**8**	**8**				
			Maximum:	**60.0**	**2,400**	—	**6**	**13**	**11**				
						Rocky Reach Dam							
20-May	1445	14	88	65.5	3,200	R	6	14	10	11.0	11.0	11.0	Up
21-May	1737	14	89	63.0	2,950	3/2	6	20	11	11.0	11.0	11.0	Down
23-May	1413	14	92	50.5	1,950	3/2	5	16	11	11.0	11.0	11.0	Up
29-May	0858	14	95	57.0	2,100	3/2	6	13	14	12.0	12.0	12.0	Down
30-May	1057	14	98	57.0	1,950	3/2	4	14	10	12.0	12.0	12.0	Up
30-May	1409	14	104	56.0	2,000	3/2	6	13	12	12.0	12.0	12.0	Down
03-Jun	1310	14	108	62.0	2,350	4/1	5	6	13	12.0	12.0	12.0	Up
03-Jun	1416	14	101	55.3	1,950	R	5	6	13	12.0	12.0	12.0	Down
04-Jun	1212	14	100	52.5	1,700	3/2	4	7	11	12.5	12.5	12.5	Up
04-Jun	1427	14	111	56.5	2,200	R	5	17	13	12.0	125	12.5	Down
06-Jun	1017	14	103	61.4	3,300	4/3(s)	5	11	14	12.0	12.0	12.0	Up
06-Jun	1533	14	106	58.5	2,500	3/2(s)	3	16	14	12.0	12.0	12.0	Down
07-Jun	1413	14	121	48.1	1,350	3/1	5	18	11	12.5	12.5	12.5	Up
10-Jun	1200	14	114	54.0	1,700	3/2	4	14	11	12.0	12.0	12.5	Down
10-Jun	1656	14	116	60.8	2,850	4/1	6	17	11	12.0	12.0	12.0	Up
11-Jun	1406	14	118	46.0	950	3/1	4	11	12	12.5	12.5	13.0	Down
12-Jun	1337	14	122	59.7	2,100	3/2	5	10	13	13.0	13.0	13.0	Up
18-Jun	1040	14	126	60.4	2,300	3/3(s)	6	10	13	13.5	13.5	13.5	Down
21-Jun	1136	14	123	57.5	1,750	3/1	4	11	12	14.0	14.0	14.0	Up
24-Jun	1400	14	124	57.0	1,800	3/2	4	13	11	14.5	15.0	15.0	Up
26-Jun	0824	14	125	46.0	1,000	3/1	4	14	12	15.0	15.0	15.0	Down
27-Jun	1226	14	127	41.5	650	4/0	4	14	14	15.0	15.0	15.0	Down
27-Jun	1755	14	120	40.4	650	4/0	4	12	11	15.0	15.0	15.0	Down
			Mean:	**55.1**	**1,967**	—	**4**	**12**	**12**				
			Minimum:	**40.4**	**650**	—	**4**	**10**	**11**				
			Maximum:	**65.5**	**3,300**	—	**6**	**14**	**14**				
						Wells Dam							
23-May	1530	14	91	69.9	4,250	4/3(s)	5	12	21	10.5	10.5	10.5	Up
28-May	1510	14	93	54.5	1,800	4/2	4	9	13	11.5	11.5	12.5	Down
03-Jun	0915	14	107	60.5	2,300	4/1	4	19	12	13.0	13.0	15.0	Up
03-Jun	1425	14	94	51.0	1,400	3/1	4	4	12	13.0	13.0	15.0	Up
03-Jun	1650	14	96	56.0	1,850	4/2	4	7	11	12.0	12.0	13.0	Down
04-Jun	0912	14	102	63.5	2,900	4/1	4	9	11	13.0	13.0	13.0	Down
04-Jun	1325	14	99	46.5	1,150	3/1	3	6	18	13.0	13.0	16.0	Up
11-Jun	1325	14	112	62.1	2,600	3/2	6	10	11	13.0	13.0	14.0	Down
12-Jun	1535	14	117	52.0	1,400	4/1	4	11	14	14.0	14.0	14.5	Up
			Mean:	**57.3**	**2,183**	—	**4**	**8**	**12**				
			Minimum:	**46.5**	**1,150**	—	**3**	**4**	**11**				
			Maximum:	**69.9**	**4,250**	—	**6**	**11**	**13**				

transmitter was found on shore above the wetted channel. All four fish traveled 98 to 116 km from the release sites at Wells Dam to the Twisp River.

The fifth transmitter was recovered in the upper Entiat River onshore under a boulder. This transmitter was originally implanted into a fish collected at Rocky Reach Dam. This fish traveled 55 km before its transmitter was recovered. The U.S. Fish and Wildlife Service recovered the transmitter and noted that it was in a mink den. The transmitter had identifiable "cut" marks on the antenna resulting from predation or scavenging.

The sixth transmitter recovered in 2002 was implanted in a fish at Rock Island Dam. This fish did not spend any length of time in tributaries, as did other tagged trout. Instead, it moved upstream to Wells Dam, then back downstream to a location downstream from Rock Island Dam. The transmitter was located onshore above the high water mark under debris. This fish traveled about 322 km before its transmitter was recovered.

Transmitter Recovery - 2003:

A total of eight transmitters were recovered in 2003. Three were recovered in the Twisp River, with two originating from Rocky Reach Dam and the third from Wells Dam. One transmitter was recovered downstream of the Poplar Flat Campground, a second near the Scatter Creek Trailhead, and the third near Roads End. Two of the three tags were buried in gravel and the third was on a gravel bar about two feet from the waters edge. No carcasses were recovered with these transmitters.

Two transmitters were recovered in the Mad River (a tributary to the Entiat River), with one fish tagged at Rock Island Dam, the other at Rocky Reach. Both of these transmitters were recovered within 200 meters of each other, and were located about 7 km upstream of the Pine Flat Campground. Both transmitters were found in the water laying on the streambed. No carcasses were found at these sites.

The other three transmitters were recovered in the mainstem Columbia River near the Entiat River confluence. Two of these transmitters were implanted in fish at Rock Island Dam and the other at Rocky Reach. One transmitter was recovered near the east shore about 200 meters upstream of the Entiat River in water about 3.5 m deep. Another was recovered near the west shore at a depth of about 4.5 m, approximately 1.5 km downstream of the Entiat River. The third was recovered about 5 km downstream of the Entiat River near the east shore in 4-m deep water. No carcasses were recovered.

It is likely that five other fish may have died or shed their tags. Two are currently located about 100 m upstream of Box Canyon in the Entiat River, one is in the upper reaches of the Mad River, another is located within the boat restricted zone of Rocky Reach Dam near the east shore, and the fifth was last seen at Priest Rapids Dam. The first four fish have remained in the same location for several months, and the fifth fish has not been detected for some time. Attempts to locate these fish (or their transmitters) have been unsuccessful.

4.2.1 Rock Island Dam

At Rock Island Dam eight adult bull trout were captured and tagged in 2002. All four of the fish released downstream from the project migrated upstream, with one fish passing the project through the left-bank ladder and the other three through the right-bank ladder. In addition, one fish tagged in 2001 (tag 14-7) passed Rock Island Dam through the right-bank ladder. For these five fish, the median tailrace residence time was 5.66 days, ranging from 0.43-16.43 days (Table 3). The median residence time through the right-bank and left-bank fishways was 0.85 days and 0.18 days, respectively. The median elapsed time at the dam for all five fish was 5.90 days and ranged from 1.21-17.35 days (Table 3). During the 2003 migration, two bull trout migrated upstream past Rock Island Dam. As mentioned previously, the ladder entrances were not monitored, and therefore, only overall dam passage times are available. For these two fish, the median passage time was 5.10 days with a range of 4.03 to 6.17 days (Table 4). In 2001, the median elapsed time at the dam was 2.28 days (Table 5). For the three years of passage at Rock Island Dam, no downstream movement of bull trout was observed after the fish exited the ladder systems.

The migration time for bull trout from Rock Island Dam to Rocky Reach Dam or to an upstream tributary was assessed in 2002 for the eight fish tagged and released at Rock Island Dam in 2002, plus one fish tagged in 2001. Of these nine bull trout, seven were detected in the tailrace of Rocky Reach Dam and the other two migrated into the Wenatchee River. The median time between projects was 2.78 days, ranging from 1.14-5.46 days, and the median elapsed time between detection at Rock Island Dam and the Wenatchee River was 5.99 days, ranging from 4.56 to 7.41 days (Table 3). In 2003, the migration time between Rock Island Dam and the upstream locations was assessed for two fish; with one migrating to Rocky Reach Dam and the other entering the Wenatchee River. For these fish, the elapsed time to Rocky Reach Dam and the Wenatchee River was 1.79 and 1.67 days, respectively (Table 4). In 2001, the median travel time between the two dams was 1.33 days, and the median travel time to the Wenatchee River was 1.39 days (Table 5).

Although elapsed times at Rock Island Dam were greater in 2002 and 2003 than in 2001, no evidence was found that indicated that the longer time periods had a negative impact on successful and timely entry into spawning tributaries.

4.2.2 Rocky Reach Dam

To assess the movement and behavior of bull trout at Rocky Reach Dam in 2002, 11 bull trout were tagged and released upstream and 12 downstream from the project for that year. Analysis of residence and passage times at this project also included fish tagged at Rock Island Dam and bull trout tagged in 2001 that passed the project during the 2002 study period. In sum, 21 tagged bull trout passed Rocky Reach Dam in 2002, eight released in Rocky Reach tailrace, one released in Rocky Reach forebay, six from Rock Island Dam, and six fish tagged in 2001. Two of the fish tagged in 2001 ascended the fishway more than once. One ascended the ladder three times; the other ascended the ladder twice. Unfortunately, during the upstream passage of one bull trout (released downstream from Rocky Reach Dam) the ladder exit receiver did not record the exit time. Therefore, a total of 23 passage events[4] were analyzed at Rocky Reach Dam in 2002.

[4] In this analysis, it is assumed that passage events were independent of each other. This may not be statistically valid because two bull trout ascended the ladder system more than once.

the ladder and exited the system on 30 May. On 2 June it was detected at Wells Dam and migrated from there into the Methow River. The second fish (14-101) remained in the Entiat Basin during autumn 2002. It then moved into Rock Island pool, migrated downstream through Rock Island Dam, remained there for some time before moving upstream through the left-bank ladder on 12 June 2003. By 14 June, the fish moved into the Rocky Reach tailrace. It ascended the ladder and exited the system the following day and within 44 minutes the fish entered and passed through turbine unit 1. By 22 June the fish had moved into the Wenatchee River and was stationed near the town of Monitor. This bull trout remained in the Wenatchee system for four months, primarily in Ingalls Creek, a tributary to Peshastin Creek.

The third fish (14-114) exhibited two downstream movement events at Rocky Reach Dam during the 2003 migration. After residing in the Entiat Basin during autumn 2002, the fish moved into Rock Island pool and remained there for the first half of 2003. It then moved to Rocky Reach tailrace (29 May 2003), ascended and exited the ladder on 2 June, and after 27 minutes in the forebay it moved downstream through spillbay 2. By 4 June, the fish re-ascended the ladder and spent 30 minutes in the forebay before moving downstream through spillbay 4. The fish re-ascended and exited the ladder the following day and eventually entered the Entiat River basin where it resided for four months. These observations and those in 2002 indicate that the fish were not significantly harmed during their downstream movements through the dam.

In 2002, migration time was estimated for 30 bull trout from Rocky Reach Dam to either Wells Dam or to an upstream tributary (Entiat River). The 30 fish included eight bull trout released into the tailrace of Rocky Reach Dam, 11 released into the forebay, five tagged at Rock Island Dam, and six from the 2001 study. The median travel time for the 23 bull trout that moved from Rocky Reach to the Entiat River was 11.34 days, range 3.51-26.98 days (Table 3). For the seven fish that traveled to Wells Dam, the median elapsed time between projects was 2.03 days, range 1.09-3.71 days (Table 3). During the 2003 study period, a total of six tagged trout migrated into the Entiat River. For those fish, the median passage time between the dam and the Entiat River was 16.47 days, with a range of 15.18-21.98 days. One other fish migrated upstream to Wells Dam. For that fish, the elapsed time between dams was 1.73 days (Table 4).

Travel times to either the Entiat River or Wells Dam were greater in 2002 and 2003 than in 2001. In 2001, the median travel time between Rocky Reach Dam and the Entiat River was 7.20 days and 1.69 days from Rocky Reach to Wells Dam (Table 5).

4.2.3 Wells Dam

In 2002, nine adult bull trout were tagged and released at Wells Dam to assess movements and migration behavior there. For that year, a total of 11 tagged fish moved through Wells Dam, including five fish from Rocky Reach, the four released into the tailrace of Wells Dam in 2002, and two fish from the 2001 tagging period. One fish re-ascended the ladder twice. Therefore, a total of 12 passage events at Wells Dam were examined, with two bull trout ascending the right-bank ladder and 10 the left ladder. Unfortunately, during the course of the study, the DSP unit monitoring the left-bank ladder entrance malfunctioned, resulting in the detection of only one fish at the left-bank entrance. The absence of detection at this ladder entrance does not affect overall dam passage time (because the left-bank ladder exit monitor worked properly), but precludes estimates of variability of tailrace and ladder residence times.

evidence indicates that these fish were significantly harmed during their downstream passage through the dam. For the 2001 and 2003 migrations, no downstream passage events were observed.

Table 4: Summary of migration time (days) for adult radio-tagged bull trout that traveled between fixed station telemetry sites in 2003. Migration time was only assessed for actively migrating fish.

Location[1]	N	Mean	Median	Minimum	Maximum
Rock Island Dam					
Tailrace (A-B)	---	---	---	---	---
Left Fish Ladder (B-C)	---	---	---	---	---
Right Fish Ladder (B-C)	---	---	---	---	---
Elapsed Time at Dam (A-C)	2	5.10	5.10	4.03	6.17
Dam to Wenatchee River (C-D)	1	1.67	1.67	1.67	1.67
Dam to Rocky Reach Tailrace	1	1.79	1.79	1.79	1.79
Rocky Reach Dam					
Tailrace (A-B)	---	---	---	---	---
Fish Ladder (B-C)	---	---	---	---	---
Elapsed Time at Dam (A-C)	9	5.46	4.68	0.66	16.87
Dam to Entiat River (C-D)	6	17.19	16.47	15.18	21.98
Dam to Wells Tailrace	1	1.73	1.73	1.73	1.73
Wells Dam					
Tailrace (A-B)	1	1.00	1.00	1.00	1.00
Left Fish Ladder (B-C)	1	0.16	0.16	0.16	0.16
Right Fish Ladder (B-C)	---	---	---	---	---
Elapsed Time at Dam (A-C)	1	1.16	1.16	1.16	1.16
Dam to Methow River (C-D)	1	1.09	1.09	1.09	1.09

[1]Locations are defined as:

- A First detection by tailrace system (300 meters downstream).
- B First detection inside either ladder entrance.
- C Last detection at either ladder exit.
- D First detection at tributary site.

4.3 Tributary Selection and Residence

In 2001, all surviving adult bull trout tagged at each dam selected a major tributary for fall or fall-winter residence (Table 6). Major tributaries selected included the Wenatchee, Entiat, and Methow systems. One bull trout entered the Okanogan River (detected at the fixed-telemetry site at R.K. 9.0), but shortly thereafter migrated downstream and entered the Methow River. For many of these fish, it is not possible to establish the date of exodus from the tributary of residence. This is likely due to three factors. First, during the period when these fish may have exited the tributaries, the receivers monitoring those sites were also monitoring frequencies associated with other telemetry studies. As such, due to the extended receiver cycle time associated with this activity, fish may not have been detected as they passed the detection site. Second, for some of these fish, the transmitters may have failed by the time the fish exited the various basins. Finally, mobile survey efforts during the period following potential exodus had been reduced due to tagging efforts. However, based on detections within the mainstem at the various dams, five fish without tributary exit dates were confirmed to have exited the basin of residence (Table 6).

Of the 40 bull trout tagged at the three dams in 2002, 37 of them moved into tributaries for fall or fall-winter residence (Table 7). During 2002, the tributary residence of two fish tagged in 2001 was also documented. Other bull trout tagged in 2001 likely entered tributaries in fall 2002, but their transmitters had failed before it was possible to detect them in tributaries. For these 39 fish, their residence times and locations within tributaries have been summarized (Table 7).

Major tributaries selected by these fish included the Wenatchee, Entiat, and Methow River systems (Figure 18, Figure 19, and Figure 20)[5]. Entrance times of fish within the tributaries were based on the first detection at the fixed-sites within each tributary. All fish that entered tributaries were detected at the fixed sites. However, some fish were not detected at the fixed-sites during their exit from tributary streams. Therefore, aerial and boat surveys, as well as fixed-site telemetry data were used to determine tributary exit times for these fish.

Three fish tagged in 2002 did not enter tributaries. One fish (14-110) is likely dead. The transmitter of this fish was discovered downstream from Rock Island Dam on 22 August 2002. Before its transmitter was discovered, the fish had made brief forays into the Wenatchee and Entiat rivers. Another fish (14-124) remained between the Wenatchee River confluence and Rocky Reach Dam, while the third (14-127) resided between the Wenatchee River and Entiat River confluences.

During the fall of 2003, a total of 14 bull trout entered tributaries (Table 8). All of these fish were tagged in 2002. Of these fish, all but two exited tributaries by 23 November 2003, and all were detected by the fixed-sites as they exited the tributaries. The two fish (14-92 and 14-125) that remained in tributaries were last detected on 3 November 2003 during an aerial survey over the Mad River.

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[5] These figures represent major tributaries selected, not specific locations within the major tributaries. Appendix B provides the locations where fish were detected during aerial surveys.

the Wenatchee River on 16 July, 27 August, and 21 September 2001 (Table 6). The time of egress also varied. As of the end of March 2002, five fish remained in the Wenatchee system, and four did so until their transmitters failed. The fifth fish was detected at Rocky Reach Dam on 22 May 2002. The other three left the system between 2 November and 11 December 2001 (Table 6). Of the three bull trout that left the Wenatchee River, two remained within the Rock Island Pool and did not pass any dams. The other fish moved downstream through Rock Island Dam and later moved back upstream through the dam. It was last detected (1 April) in the forebay of Rock Island Dam.

Bull trout that selected the Wenatchee Basin in 2002 entered and exited the system at different times. Two entered the Wenatchee River by the end of June, three by mid-July, and the last one in early August 2002 (Table 7). The median date of entry was 3 July 2002. The time of tributary egress also varied. Four of the six fish exited the system by the first week of November 2002. The other two exited in mid-December and mid-January, respectively (Table 7). The median date of exodus was 6 November 2002. After leaving the Wenatchee River, four fish resided in the Columbia River between Rock Island Dam and the Wenatchee River confluence, another remained in the Rock Island Pool, and the sixth resided downstream from Rock Island Dam.

For the three fish that resided within the Wenatchee basin in 2003, the date of entry varied by only six days, spanning from 16-22 June. For these fish, the median date of entry was 18 June. The date of tributary egress spanned about five weeks, with the first fish exiting the basin on 17 October. The other two fish exited the Wenatchee basin on 21 and 22 November. For two of these fish, their location of residence after leaving the Wenatchee River was documented during either aerial or boat surveys. One fish migrated downstream of Rock Island Dam, the second is in the Rock Island pool between Rock Island Dam and the Wenatchee River confluence, and the location of the third fish remains unknown.

Tributary selection by bull trout may be influenced by release location. Combining data collected at the three projects during 2001 and 2002 reveals that 28% (11 of 39) of all fish released downstream from projects ended in tributaries downstream from release sites. In contrast, only 3% of the bull trout released upstream from projects ended in tributaries downstream from release sites. This pattern was most apparent at Rocky Reach Dam, where 43% (10 of 23) of the fish released in the tailrace during 2001 and 2002 ended in the Wenatchee River.

4.3.2 Entiat River

For the 2001 period of tributary residence, a total of 15 adult bull trout moved into the Entiat River during the study. Of those, two were tagged at Rock Island Dam (downstream releases), 12 at Rocky Reach (four released downstream and eight upstream), and one at Wells Dam (downstream release; **Table 6**). All fish in the Entiat system resided either in the Mad River (eight fish) or in the mainstem Entiat River (seven fish). Those in the Mad River selected locations upstream from the Pine Flat Campground, while those in the Entiat River resided upstream from the Mad River confluence (BioAnalysts, Inc. 2002).

A total of 21 bull trout entered the Entiat River in 2002. These fish originated from releases at Rock Island (5 fish) and Rocky Reach dams (16 fish) (Table 7; Figure 19). No fish released at Wells Dam ended up in the Entiat Basin (Table 7). All fish in the Entiat system resided in either the Mad River (11 fish) or the mainstem Entiat River (10 fish). Those in the Mad River occupied locations

March 2004). For those fish, the median date of exodus was 21 October, with the first fish leaving the system on 4 October, and the last on 23 November. After exit from that basin, two fish resided within the Rock Island pool, five in Rocky Reach pool, and one downstream from Rock Island Dam.

4.3.3 Methow River

During the 2001 period of tributary residence, a total of 15 tagged adult bull trout moved into the Methow River. Two of those fish were tagged and released at Rock Island Dam (upstream releases), four at Rocky Reach Dam (one downstream release and three upstream releases), and nine at Wells Dam (four downstream releases and five upstream releases; Table 6). All of the fish entered the Methow basin by 11 June. By the end of March 2002, only four tagged bull trout had left the system. Those four had moved out of the system by 16 December 2001. Of the 11 tagged trout that did not leave the system by the end of the 2001 study period (31 March, 2002), eight remained in the Methow basin until their transmitters failed. For the other three, two were last detected in the tailrace of Wells Dam, and one upstream of that project.

During the 2002 study period, 12 adult bull trout entered the Methow River. These fish originated from releases at Rocky Reach and Wells dams (Table 7). Four bull trout were released at Rocky Reach Dam (Figure 19) and eight at Wells Dam (Figure 20). No fish tagged at Rock Island Dam moved into the Methow River (Table 7). Bull trout in the Methow system selected two primary areas, the mainstem Methow River and the Twisp River (Appendix B). Of the 12 fish that resided within the Methow basin, nine were located within the Twisp River upstream of Buttermilk Creek, and three appear to have resided upstream from the town of Winthrop. For the 2003 migration, only a single bull trout entered the Methow basin. That fish was initially tagged at Wells Dam in 2002, and resided in the mainstem Methow River near the Twisp River confluence (Table 8).

All bull trout that entered the Methow River in 2002 did so during the month of June (between 3 and 27 June). For those fish, their fates can be classified into four categories: 1) fish that exited the basin; 2) those that either died or shed their tags; 3) those that have not exited the basin but appear to be alive; and 4) fish whose fates are unknown.

The first category includes only a single fish (14-112). After entering the Methow River, this fish was not located over a 15 month period. During a routine aerial survey on 23 October 2003, it was located about 2 km downstream from the town of Winthrop and near the confluence of Gold Creek on 3 November. The last detection for this fish was 15 November 2003 at the fixed-telemetry site. As aerial surveys were typically terminated near the town of Winthrop, it is likely that this fish resided upstream of this location for an extended period of time. The second category of fish, those that either died or shed their tags, includes a total of seven fish. The transmitters for all seven fish were recovered in the tributary of residence (Table 7: Tributaries selected by adult bull trout tagged at Rock Island, Rocky Reach, and Wells dams and the dates they entered and left those tributaries, 2002.; Appendix A).

The third category, fish that have not exited the basin but appear to be alive, includes two fish. One fish (14-94) was not detected for 17 months after entering the Methow basin. During an aerial survey conducted by the USFWS on 18 December 2003, this fish was located upstream from the town of Winthrop. Another fish (14-116) has resided in both the mainstem Methow River and the Twisp River, and was most recently detected in Buttermilk Creek on 2 October 2003. This fish has

Table 6: Tributaries selected by adult bull trout tagged at Rock Island, Rocky Reach, and Wells dams and the dates they entered and left those tributaries, 2001.

Tagging Information			Tributary Residence			
Release	Code	Date	Entrance	Exit	Subbasin	Location
			Rock Island Dam			
Down	32	21-May-01	04-Jun-01	23-Nov-01	Entiat	Mad River
Down	55	19-Jun-01	28-Jun-01	---	Entiat	Mad River
Down	35	30-May-01	13-Jun-01	---	Wenatchee	Peshastin Creek
Up	48	03-Jul-01	NA	NA	Dead	
Up	4	17-May-01	30-May-01	---	Methow	Twisp River
Up	13	24-May-01	11-Jun-01	---	Methow	Twisp River
Up	36	13-Jun-01	21-Sep-01	02-Nov-01	Wenatchee	Mainstem Wenatchee River
			Rocky Reach Dam			
Down	29[1]	21-May-01	06-Jun-01	---	Entiat	Mad River
Down	18[1]	23-May-01	07-Jun-01	---	Entiat	Mad River
Down	15	25-May-01	06-Jun-01	02-Nov-01	Entiat	Mainstem Entiat River
Down	11	29-May-01	06-Jun-01	02-Nov-01	Entiat	Mainstem Entiat River
Down	54	30-May-01	11-Jun-01	---	Methow	Libby Creek
Down	8	11-Jun-01	30-Jun-01	---	Wenatchee	Chiwawa River
Down	46	18-Jun-01	23-Jun-01	11-Dec-01	Wenatchee	Icicle Creek
Down	5	17-May-01	30-May-01	---	Wenatchee	Mainstem Wenatchee River
Down	9	07-Jun-01	27-Aug-01	16-Nov-01	Wenatchee	Mainstem Wenatchee River
Down	25	25-Jun-01	29-Jun-01	---	Wenatchee	Mainstem Wenatchee River
Down	34[1]	10-Jul-01	16-Jul-01	---	Wenatchee	Mainstem Wenatchee River
Up	45	15-Jun-01	29-Jun-01	---	Entiat	Mad River
Up	47	19-Jun-01	01-Jul-01	---	Entiat	Mad River
Up	3	15-May-01	22-May-01	---	Entiat	Mad River
Up	24	22-May-01	04-Jun-01	---	Entiat	Mad River
Up	6	29-May-01	10-Jun-01	17-Oct-01	Entiat	Mainstem Entiat River
Up	7	04-Jun-01	08-Jun-01	11-Nov-01	Entiat	Mainstem Entiat River
Up	37	06-Jun-01	11-Jun-01	09-Nov-01	Entiat	Mainstem Entiat River
Up	50	13-Jul-01	18-Jul-01	24-Sept-01	Entiat	Mainstem Entiat River
Up	20	21-May-01	30-May-01	16-Dec-01	Methow	Twisp River
Up	12	24-May-01	10-Jun-01	07-Oct-01	Methow	Twisp River
Up	14	25-May-01	02-Jun-01	---	Methow	Twisp River
			Wells Dam			
Down	17	24-May-01	02-Jun-01	10-Aug-01	Entiat	Mainstem Entiat River
Down	22	29-May-01	08-Jun-01	---	Methow	Mainstem Methow River
Down	26	22-May-01	01-Jun-01	16-Dec-01	Methow	Twisp River
Down	19	22-May-01	01-Jun-01	---	Methow	Twisp River
Down	33	22-May-01	08-Jun-01	13-Apr-02	Methow	Twisp River
Up	28	22-May-01	24-May-01	---	Methow	Mainstem Methow River
Up	23[1]	29-May-01	01-Jun-01	---	Methow	Mainstem Methow River
Up	21	22-May-01	24-May-01	02-Nov-01	Methow	Twisp River
Up	31[1]	21-May-01	27-May-01	---	Methow	Buttermilk Creek
Up	16	23-May-01	25-May-01	---	Methow	Buttermilk Creek

[1] Based on detection histories for these fish, it appears that they exited the tributary of residence. However, due to a lack of detections at the fixed telemetry sites on the tributary of residence, a date of exodus can not be established.

Table 8: Tributaries selected by adult bull trout tagged at Rock Island, Rocky Reach, and Wells dams and the dates they entered and left those tributaries, 2003.

Tagging Information			Tributary Residence			
Release	Code	Date	Entrance	Exit	Subbasin	Location
			Rock Island Dam			
Down	113	07-Jun-02	16-Jun-03	21-Nov-03	Wenatchee	Chiwawa River
			Rocky Reach Dam			
Down	101	03-Jun-02	22-Jun-03	17-Oct-03	Wenatchee	Peshastin Creek
Down	104	30-May-02	01-Jun-03	21-Oct-03	Entiat	Mainstem Entiat River
Down	106	06-Jun-02	20-Apr-03	23-Nov-03	Entiat	Mainstem Entiat River
Down	114	10-Jun-02	22-Jun-03	04-Oct-03	Entiat	Mad River
Down	118	11-Jun-02	08-Apr-03	17-Oct-03	Entiat	Mad River
Down	120	27-Jun-02	18-Jun-03	18-Nov-03	Entiat	Mad River
Down	125	26-Jun-02	18-Jun-03	---	Entiat	Mad River
Down	126	18-Jun-02	18-Jun-03	22-Nov-03	Wenatchee	Chiwawa River
Down	127	27-Jun-02	13-Jun-03	17-Oct-03	Entiat	Mad River
Up	92	23-May-02	14-Jun-03	---	Entiat	Mad River
Up	103	06-Jun-02	13-Jun-03	21-Oct-03	Entiat	Mainstem Entiat River
Up	121	07-Jun-02	08-Jun-03	21-Oct-03	Entiat	Mad River
			Wells Dam			
Up	99	04-Jun-02	03-Jun-03	28-Oct-03	Methow	Mainstem Methow River

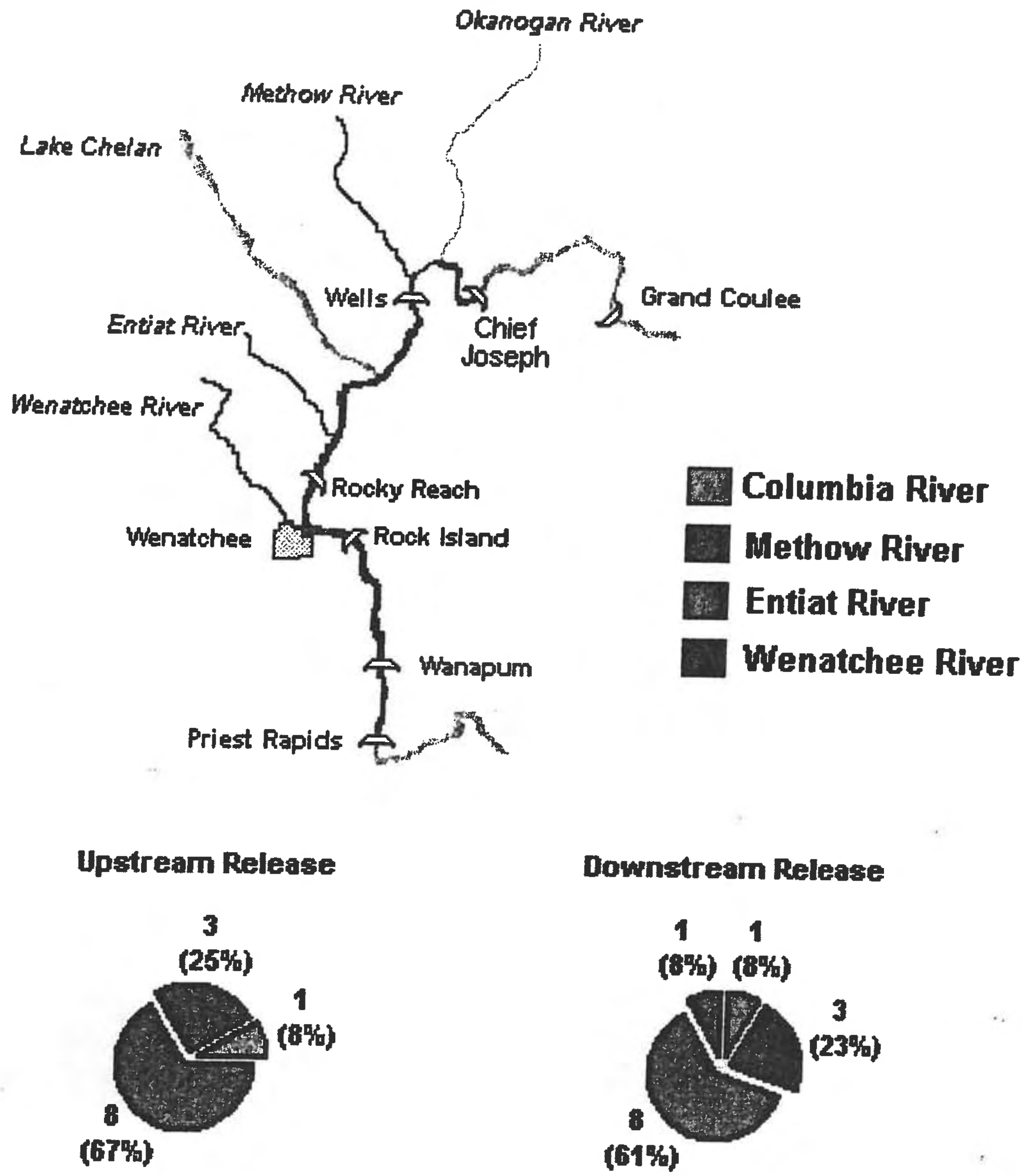

Figure 19: Mid-Columbia River tributaries selected by bull trout after they were released upstream and downstream from Rocky Reach Dam, 2002. Final destination for radio-tagged bull trout within each tributary is noted in Table 7.

4.4 Tributary and Mainstem Temperatures

To investigate the relationship between temperature and movement of bull trout in the mid-Columbia River, it is possible to compare temperatures at the time of entry into tributary streams with that of the Columbia River. For this analysis, the mean daily temperature of the Columbia River relative to the various tributaries at the time bull trout entered the Wenatchee, Entiat and Methow rivers have been compared. Where data were available, minimum, mean and maximum daily temperatures within the lower tributaries have been plotted. For fish entering the Wenatchee and Entiat rivers, tributary temperatures were compared to temperatures measured within the Rocky Reach tailrace. For fish entering the Methow River, tailrace temperatures measured at Wells Dam were used. For some fish, there is a history of tributary entrance on more than one occasion. That is, for some fish tagged in 2001, their transmitters were active long enough to document tributary entrance in both 2001 and 2002. Likewise, many fish tagged in 2002 also entered tributaries in 2003.

Temperature data for the various tributaries is in many cases incomplete. Temperature data collected from the Wenatchee, Methow, and Entiat rivers were all collected in the lower 4-kilometers of each stream. For the lower Wenatchee River, daily minimum, mean and maximum temperatures for 2001, and only mean temperatures for 2002 and 2003 were acquired. For the lower Methow River, only daily mean values were available for 2001 and 2003. No temperature data were available in 2002 for the Methow River. Temperature data for the Entiat River were the most complete with daily minimum, mean and maximum values recorded. However, for all three tributaries, data were only available through the latter part of August. However, to better understand mid-Columbia River temperatures and migration of bull trout, the first and last date of entry into each tributary were used, regardless if temperature data were available in the tributaries.

Seventeen bull trout entered the Wenatchee Basin during the spring and summer of a three year study period. There were no temperature data available in the lower Wenatchee River for three of those fish. Bull trout entered the Wenatchee River in June and July when the mean daily temperatures in the Wenatchee River ranged from 10.5 °C to 17.2 °C. In the Columbia River during that time the mean daily temperatures ranged from 11.2 °C to 19.6 °C (Figure 21).

There were forty-six radio-tagged bull trout that entered the Entiat basin from April to mid-July. Bull trout entered the Entiat River when the mean daily temperatures ranged from 7 .5 °C to 15.8 °C (Figure 22). Mean daily temperatures for the Columbia River during the migration period varied from 5.4 °C to 19.6 °C.

Collectively for the 2001-2003 study period 28 radio-tagged bull trout entered the Methow basin in May and June. However, due to sporadic stream temperature monitoring within the lower Methow River, it is only possible to document stream temperatures for six fish at the time of tributary entrance. Six bull trout entered the Methow River when the mean daily temperatures varied from 9.7 °C to 13.5 °C (Figure 23). For all bull trout that entered the Methow basin, mean daily temperatures for the Columbia River during the three year study period ranged from 10.1 °C to 14.9 °C.

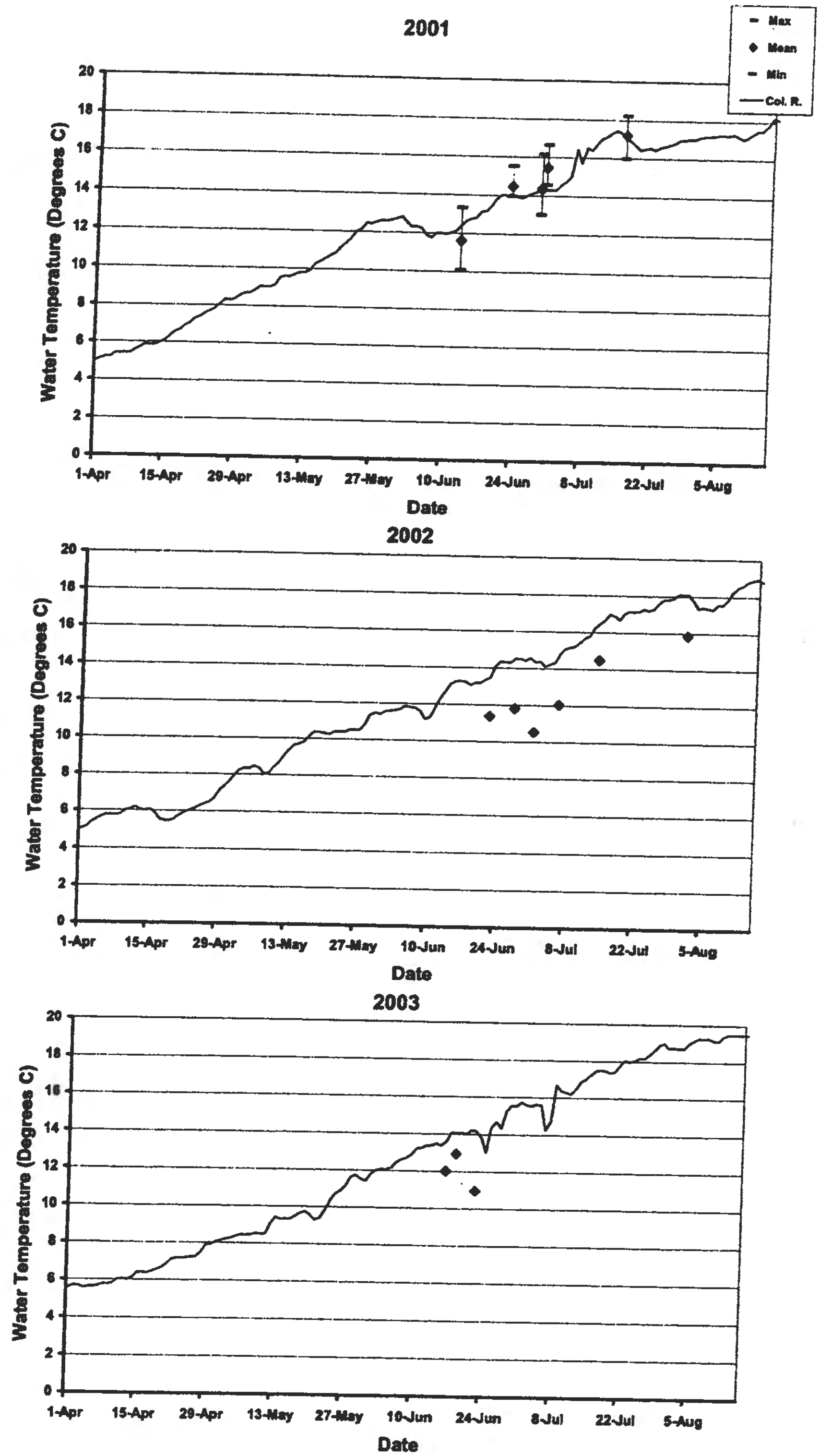

Figure 21: Wenatchee River temperatures at the time of tributary entrance relative to the Columbia River measured downstream of Rocky Reach Dam, 2001-2003. Daily minimum, mean and maximum Wenatchee River temperatures provided where data were available. Each data point represents an individual fish.

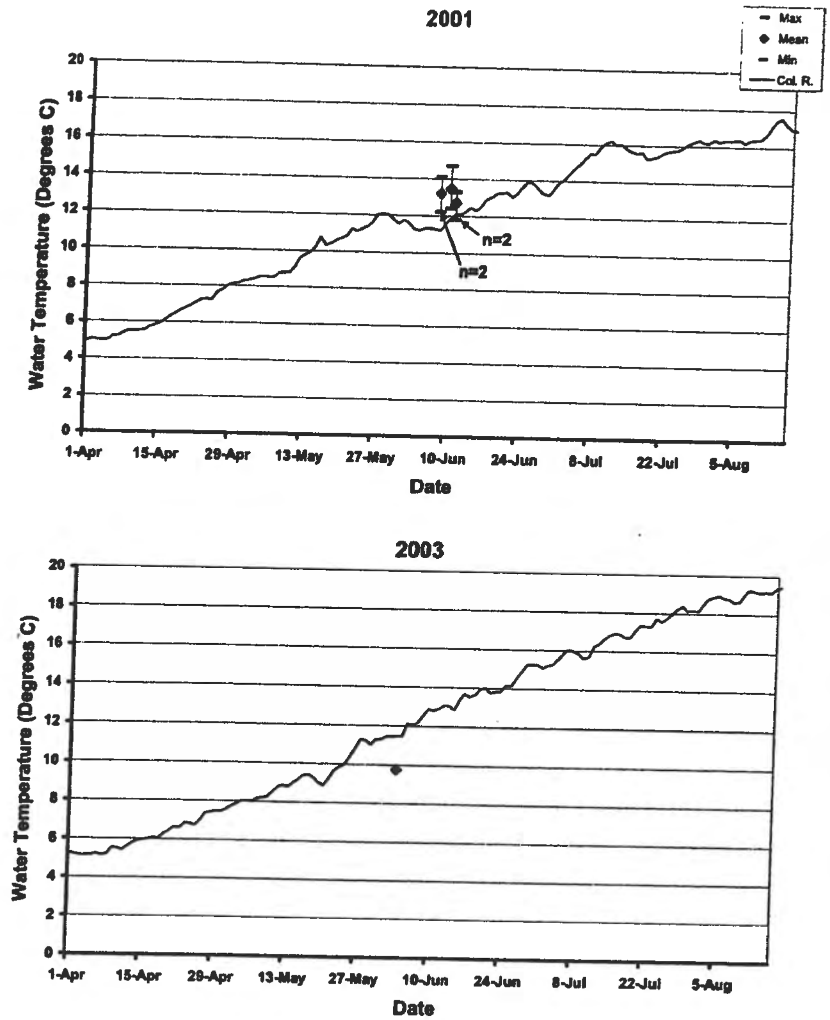

Figure 23: Methow River temperatures at the time of tributary entrance relative to the Columbia River measured downstream of Wells Dam, 2001and 2003. Daily minimum, mean and maximum Methow River temperatures provided where data were available. Each data point represents an individual fish.

of daylight (0500-2100 hours), with an average of 3.6 detections per daylight hour. During periods of darkness, on average 1.9 detections per hour were observed (Figure 24). Similar to observations in 2001, bull trout in 2002 were more likely to use the outfall during daylight hours than at night. Of the 75 detections for the eight tagged bull trout that occurred in the outfall, 56 occurred during daylight, averaging 3.5 detections per daylight hour. During periods of darkness, an average 2.4 detections per hour were observed (n = 19; Figure 25).

There are several possible reasons why adult bull trout frequent the hatchery outflow, including using the area as a temperature refuge, seeking opportunistic feeding opportunities, or simply demonstrating exploratory behavior. With regard to the outflow providing bull trout with a temperature refuge, the hatchery operates June through August primarily on water diverted from the mainstem Columbia River. This water is supplemented with about 4 cfs of well water, which has a fairly constant temperature of 11.1°C. Although the well water may have some moderating effect on water temperature at the hatchery, overall a large difference in temperature between the outfall and the mainstem Columbia River would not be expected. Water temperatures recorded within the mainstem Columbia (recorded at Wells Dam) during the time period when bull trout were detected in the hatchery outfall (3-20 June) ranged between 10.1 and 13.3°C, which are within the thermal optima for adult bull trout (EPA 2001). Therefore, it is doubtful that bull trout used the hatchery outfall as a temperature refuge.

It is possible that the bull trout frequented the outfall in search of prey. Typical operation at the hatchery is to volitionally release yearling chinook smolts between 15 and 30 April, and subyearling chinook smolts in early June. These smolts migrate downstream through the hatchery outfall channel system and then enter the Columbia River. During the 2001 study period, bull trout were observed at the hatchery outfall between 17 May and 27 June. In 2002, detections occurred between 3 June and 20 June. Large numbers of smolts were routinely observed during the period when the bull trout frequented the outflow (Shane Bickford, DPUD, personal communication). Given that bull trout feed opportunistically (Goetz 1989), it is likely that the tagged bull trout were taking advantage of the large concentration of juvenile salmonids within the hatchery outfall system.

Table 10: Number of visits and length of time that eight bull trout were detected within the Wells Hatchery outfall, 2002. The mean, minimum, maximum and total times are in hours and the elapsed time is in days. The elapsed time is defined as the period of time between the first and last detections at this location.

Release Location	Code	Number of Visits	Time Mean	Min	Max	Total	Elapsed
			Rocky Reach Dam				
Up	100	9	0:06:41	0:00:18	0:32:41	1:00:08	4.16
Up	108	5	0:01:15	0:00:19	0:02:15	0:06:14	4.65
Up	116	7	0:03:08	0:00:15	0:16:59	0:21:59	2.87
			Wells Dam				
Down	93	24	0:16:06	0:00:16	1:04:05	6:26:13	15.50
Down	96	17	0:05:19	0:00:16	1:12:57	1:30:24	14.60
Down	102	3	0:01:51	0:01:35	0:02:03	0:05:32	0.08
Down	112	4	0:04:32	0:00:19	0:07:43	0:18:08	4.74
Up	99	6	0:03:47	0:00:22	0:08:45	0:22:40	1.26

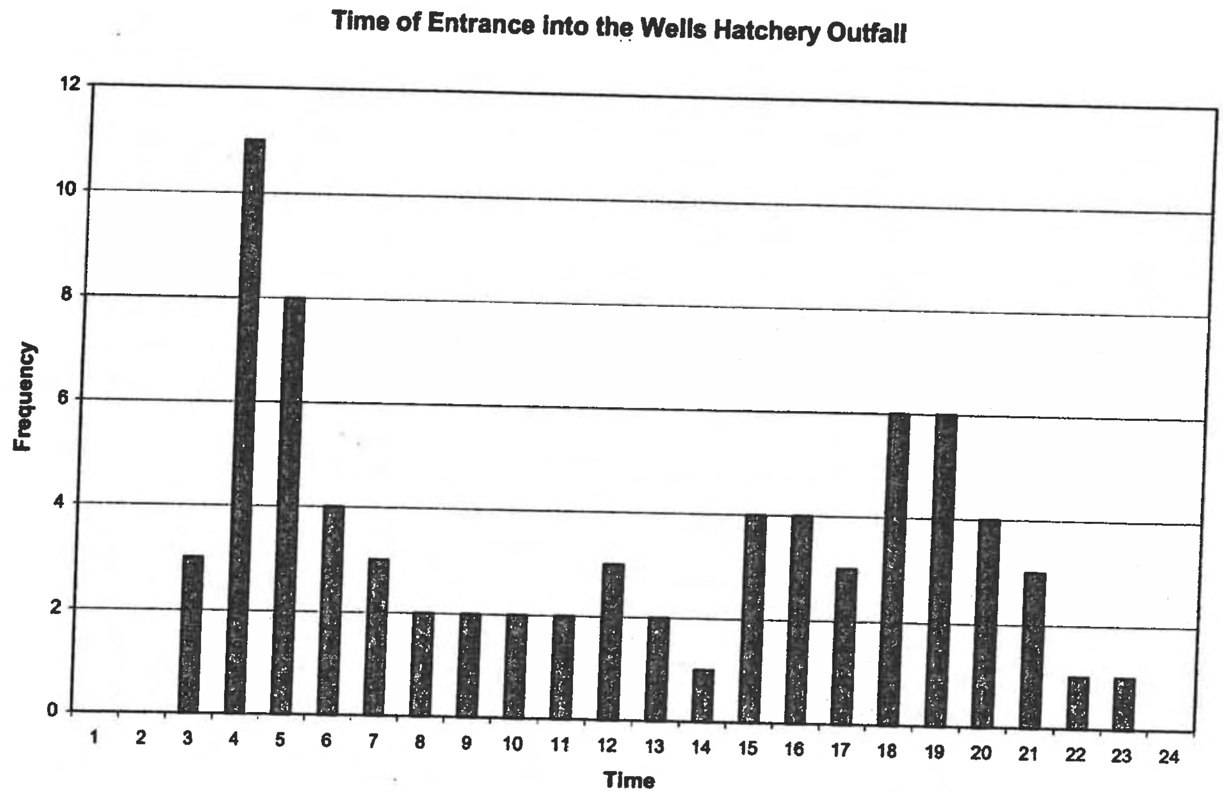

Figure 25: Diel pattern for eight radio-tagged bull trout detected at the Wells Hatchery outfall, 2002. There were 75 visits to the hatchery outfall, but most (56) occurred between 0500-2100 hrs.

trout migrated upstream and entered the Entiat River on 10 June 2001, where it resided until 17 October 2001, much of the time near the Silver Falls Campground. After migrating out of the Entiat River, this trout resided within the Columbia River between Rocky Reach Dam and the Entiat River confluence until it passed Rocky Reach Dam on 14 November 2001. During the period of 14 November 2001 to 17 April 2002, this fish was detected within the Rock Island reservoir and Rocky Reach tailrace by both fixed-telemetry sites and mobile surveys. On 3 June 2002, this fish was detected by the aerial array in the tailrace of Rock Island Dam over a seven hour period (Figure 26). This was the last contact with this fish.

Code 7 Bull Trout – This fish was trapped and tagged at Rocky Reach Dam, released upstream of the project on 4 June 2001, and was 48.5-cm long (FL) and weighed 1,150 g. After release, the fish was detected within the Rocky Reach forebay for about 1 day and then was detected at the Entiat River fixed-site (RK 4.8) on 8 June 2001. The fish migrated upstream and resided within the Entiat River upstream of Preston Creek. On 11 November 2001, this fish was again detected by the fixed-site on the lower Entiat River as the fish exited the tributary. The first detection in the tailrace of Rock Island Dam was on 18 November 2001, at which time it migrated downstream of Rock Island Dam to a point about 11 km upstream of Wanapum Dam. The fish remained within this area for about 2 months (28 February to 25 April 2002) (Figure 26). The fish then began an upstream migration and was last detected at the Rock Island and Rocky Reach ladder exits on 20 May and 25 May, respectively, and re-entered the Entiat River on 11 June where it resided between the Mad River confluence and Preston Creek until it exited the Entiat River on 4 August. This fish was last detected on 10 October 2002 between the Wenatchee River confluence and Rocky Reach Dam.

Code 15 Bull Trout – This trout was collected and tagged at Rocky Reach Dam and released into the tailrace of the project. The fish was released on 25 May 2001 and was 56.1-cm long and weighed 1,950 g. After release, this fish spent about 4 days in the tailrace and ladder system at Rocky Reach Dam. After exiting the ladder, it was detected on 6 June 2001 at the Entiat River fixed-telemetry site. From there it migrated upstream and resided upstream of Preston Creek in the Entiat River. During its migration downstream, it was detected in the lower Entiat River again by the fixed-telemetry site on 2 November 2001. On 10 November 2001, the bull trout was detected at Rocky Reach Dam where it resided in the mainstem Columbia River between Rock Island and Rocky Reach dams until 27 March 2002, when it was first detected in the tailrace of Rock Island Dam. This fish was located during four separate aerial surveys within the Rock Island tailrace and by the fixed-telemetry site at that location until 6 August 2002 (Figure 26). This fish was detected on multiple occasions in the tailrace of Wells Dam during the period of 16 December 2002 to 27 February 2003. Subsequent to detections at that location, this fish was detected in the tailrace of Rocky Reach Dam on 17 March 2003.

Code 36 Bull Trout – This bull trout was collected and tagged at Rock Island Dam on 13 June 2001 and released upstream of the project. It was 59.7-cm long and weighed 1,750 g. After release, this fish migrated upstream to Rocky Reach Dam, where it spent about 3 months within the area between the Wenatchee River confluence and the tailrace of Rocky Reach Dam. On 21 September 2001, this fish was detected within the lower 3 to 4 km of the Wenatchee River, where it remained for about 1.5 months. After exiting the Wenatchee River, it was first detected at Rock Island Dam on 1 December 2001 and later in the Rock Island tailrace during the period of 18-24 December 2001 (Figure 26). After exiting the Rock Island ladder, the fish again resided within the Rock Island in the tailrace of Rock Island Dam. Subsequently, this fish was detected on 26 and 28 May in the forebays of Wanapum and Priest Rapids dams, respectively. These detections were the last contact with this fish. Efforts to locate this fish within the Priest Rapids pool have been unsuccessful, and as such, it is likely that this fish migrated downstream of Priest Rapids Dam. Its fate, whether alive or dead at this point, is unknown.

Code 110 Bull Trout – This bull trout was collected and tagged at Rock Island Dam on 4 June 2002 and is the only fish that may have died downstream from Rock Island Dam (see Section 4.1). The fish was released upstream of the project and was 60.0-cm long and weighed 2,400 g. After release, this fish was detected over a two-day period in the tailrace of Rocky Reach Dam beginning 6 June 2002. Subsequently, this fish migrated downstream and entered the Wenatchee River on 11 June 2002, where it resided between the town of Leavenworth and Tumwater Dam until 10 July. After leaving the Wenatchee River, this trout was detected once again in the tailrace of Rocky Reach Dam beginning 10 July 2002 for a 3-day period. After ascending the fish ladder, the trout was detected in the tailrace of Wells Dam on 14 July 2002 for one day. After migrating downstream, the fish entered the Entiat River on 18 July and remained near the fixed-telemetry site (R.K. 4.8) for two days. On 20 July, this fish was detected in the tailrace of Rocky Reach Dam and on 21 July in the tailrace of Rock Island Dam. The next contact with this fish was between 1 August and 22 August, when its transmitter was recovered (Figure 26).

Code 113 Bull Trout – This trout was captured and tagged at Rock Island Dam and released downstream from the project on 7 June 2002. The fish was 43.0-cm long and weighed 800 g. After release, the fish ascended the left-bank ladder and exited the system on 14 June 2002. Eight days later, this fish was detected at the fixed-telemetry site on the Wenatchee River and subsequently resided within the Wenatchee basin through 6 November 2002, much of that time near the confluence of the Chiwawa River. After leaving the Wenatchee basin, this fish moved downstream, passed Rock Island Dam, and remained near Sunland Bar (downstream from Quilomene Island) during 19 February to 28 March 2003. It then moved to a location about 2 km upstream of Tarpiscan Creek and remained there from 23 May to 3 June 2003 (Figure 26). This fish then migrated upstream, exited the Rock Island right-bank ladder on 14 June 2003, and entered the Wenatchee River on 16 June. It resided within the Wenatchee basin until 21 November, much of the time in Tumwater Canyon and in the Chiwawa River. This fish was last detected on 18 December 2003 in Rock Island reservoir.

Code 118 Bull Trout – This trout was captured and tagged at Rocky Reach Dam and released downstream from the project on 11 June 2002. The fish was 46.0-cm long and weighed 950 g. Twelve days after release, this fish exited Rocky Reach ladder and subsequently entered the Entiat River on 1 July 2002. This trout remained in the mainstem Entiat River downstream from the Mad River confluence until it left the river on 9 October 2002. The fish remained in the Columbia River upstream of Rocky Reach Dam until 8 April 2003, when it re-entered the Entiat River and migrated into the Mad River. After leaving the Entiat basin on 23 October 2003, it was detected in the tailraces of Rocky Reach and Rock Island dams on 5 and 13 November 2003, respectively. This fish has been detected on three occasions over a 3.5 month period downstream of Quilomene Island (Figure 26).

SECTION 5: CONCLUSIONS

Based on the results from the 2001-2004 study, we offer the following conclusions.

1. Seventy-nine adult bull trout were successfully tagged with radio tags in 2001 and 2002. Of those, it appears that 15 may have died or shed their tags. However, there is no evidence that any of these potential deaths were the result of hydroelectric projects.
2. Based on data collected in 2001-2004, operations of hydroelectric facilities on the mid-Columbia River did not negatively affect the survival of adult bull trout. That is, no adult bull trout were killed during upstream or downstream passage through the mid-Columbia dams.
3. Although hydroelectric operations did not appear to affect the survival of adult bull trout, the presence of dams may have slowed migration times. On average, it took bull trout longer to pass dams than it did for them to move through reservoirs (i.e., from project to project). One reason for the possible delays is that bull trout found increased foraging opportunities in the tailraces. Additional work is needed to verify this possibility.
4. The overall dam passage time is considerably greater for fish tagged and released into the tailrace of a given project than it is for fish that migrated upstream after being released at downstream projects. The release location of future studies assessing passage rates at dams should be made upstream of the project or far enough downstream to allow adequate recovery following tagging.
5. At Rocky Reach Dam, the location where tagged fish are released appears to influence tributary selection. Of the tagged fish released downstream from the project in 2001, 55% (6 of 11) moved downstream and entered the Wenatchee River. In 2002, 33% (4 of 12) of the fish released downstream from Rocky Reach Dam entered the Wenatchee River. In contrast, only 3% of the fish released upstream from dams move downstream into tributaries.
6. There were nine downstream passage events observed at Rocky Reach Dam (5 in 2002 and 4 in 2003) and two at Wells Dam (2002). Of those, six occurred within 24 hours after exiting the ladder system(s), and two within 15 hours after the fish were released into the forebay (one at Rocky Reach and one at Wells Dam). These two events may be related to releasing the fish too close to the dam. For three fish, after exhibiting downstream movement behavior, two migrated into tributaries downstream of the given project, and one resided within the mainstem Columbia River. Future studies that include forebay releases should consider releasing fish further upstream from the projects to eliminate the effects of handling on downstream movement.
7. Bull trout entered tributaries shortly after release. They selected the Wenatchee, Entiat, and Methow systems. No bull trout selected the Okanogan system, although one entered the Okanogan River, it quickly left and moved into the Methow system. Most entered tributaries by the end of June and were found in possible spawning streams well before the initiation of spawning. Most tagged trout left tributary streams by late November.

SECTION 6: ACKNOWLEDGMENTS

Chelan, Douglas, and Grant County PUDs funded this study. We thank Scott Kreiter (Chelan PUD), Shane Bickford (Douglas PUD), and Tom Dresser (Grant PUD) for providing valuable assistance in the development and implementation of this study. We especially thank Scott for assuming the role as project coordinator. We thank the Chelan PUD fishway attendants for their assistance in transporting tagged fish and Thad Mosey for his help in securing equipment. Charlie Snow, Washington Department of Fish and Wildlife, coordinated the collection of bull trout at Wells Dam. We appreciate the Douglas PUD operators, who assisted with trapping and tagging activities at Wells Dam, and the Grant PUD fisheries technicians who conducted mobile surveys within Wanapum pool. We thank Karl English, Bryan Nass, and Cezary Sliwinski of LGL Limited for processing telemetry data and LGL field personnel for their assistance in data collection at Priest Rapids, Wanapum, and Wells dams. Finally, we thank Jeff Reeves, Connor Giorgi, and Don Truscott of BioAnalysts for their dedication in trapping and monitoring of bull trout.

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APPENDIX A: SUMMARY OF RECOVERED BULL TROUT TAGS

The purpose of this appendix is to provide a detection history for radio tags recovered from bull trout tagged in spring 2002 at Rock Island, Rocky Reach, and Wells dams. Efforts were made in the fall of 2002 and 2003 to recover those tags from bull trout that were suspected to have perished or shed their tags. The detection histories describe the extent of movement after the bull trout were released, but may not explain the circumstances surrounding the loss of the tagged fish.

All the bull trout were captured, tagged, and released in the spring of 2002 at Rock Island, Rocky Reach, or Wells dams. The bull trout were surgically implanted with radio tags and released either upstream or downstream of their respective projects. Fixed-station telemetry receivers at the projects and in the lower tributary rivers along with monthly aerial surveys provided the detection history for these bull trout. A detailed summary of the methods used to tag, release, and track bull trout can be found in BioAnalysts, Inc. (2002). In addition, the U.S. Fish and Wildlife Service provided information on the location for some of the bull trout while the trout resided in tributaries. Their efforts provided valuable information on the recovery of tags and the condition of the tributary streams.

In this summary, the discussion focuses on 14 of 40 (35%) tagged bull trout. For convenience, the bull trout have been separated by tagging location and each bull trout has been identified by the radio transmitter channel and code (e.g., 14-93) with a brief description of their movement after release. For all of these bull trout the tag was recovered but only one carcass was recovered. A map is provided to show the locations where the tags were recovered.

Wells Dam

Tag 14-93--The upstream movement of this bull trout suggests that it made a migration to a known spawning area in the Twisp River of the Methow Basin. A conservative estimate of this bull trout's migration is roughly 109 km (68 miles) from downstream of Wells Dam to the upper Twisp River and then back downstream within the Twisp River (Table A1).

This bull trout was tagged on 28 May at Wells Dam and was released downstream of the project near the west shoreline. Within hours of the release the bull trout had moved back upstream and was detected in the tailrace of Wells Dam. The bull trout was detected for a period of 14 days in the tailrace until it passed the project on 22 June. Two days later, 24 June, the bull trout was detected in the lower Methow River. By 1 July the bull trout was detected just downstream from McFarland Creek on the Methow River. One month later during an aerial survey on 1 August the fish was detected in the Twisp River upstream from the confluence of South Creek. By 4 September, the fish had moved downstream and was detected near the confluence of Reynolds Creek. The next month on 9 October the bull trout was detected even further downstream near the confluence of Scaffold Camp Creek. Finally on 31 October the tag for this fish was recovered near that location on an island gravel bar above the wetted channel and there was no carcass in the area (Figure A1).

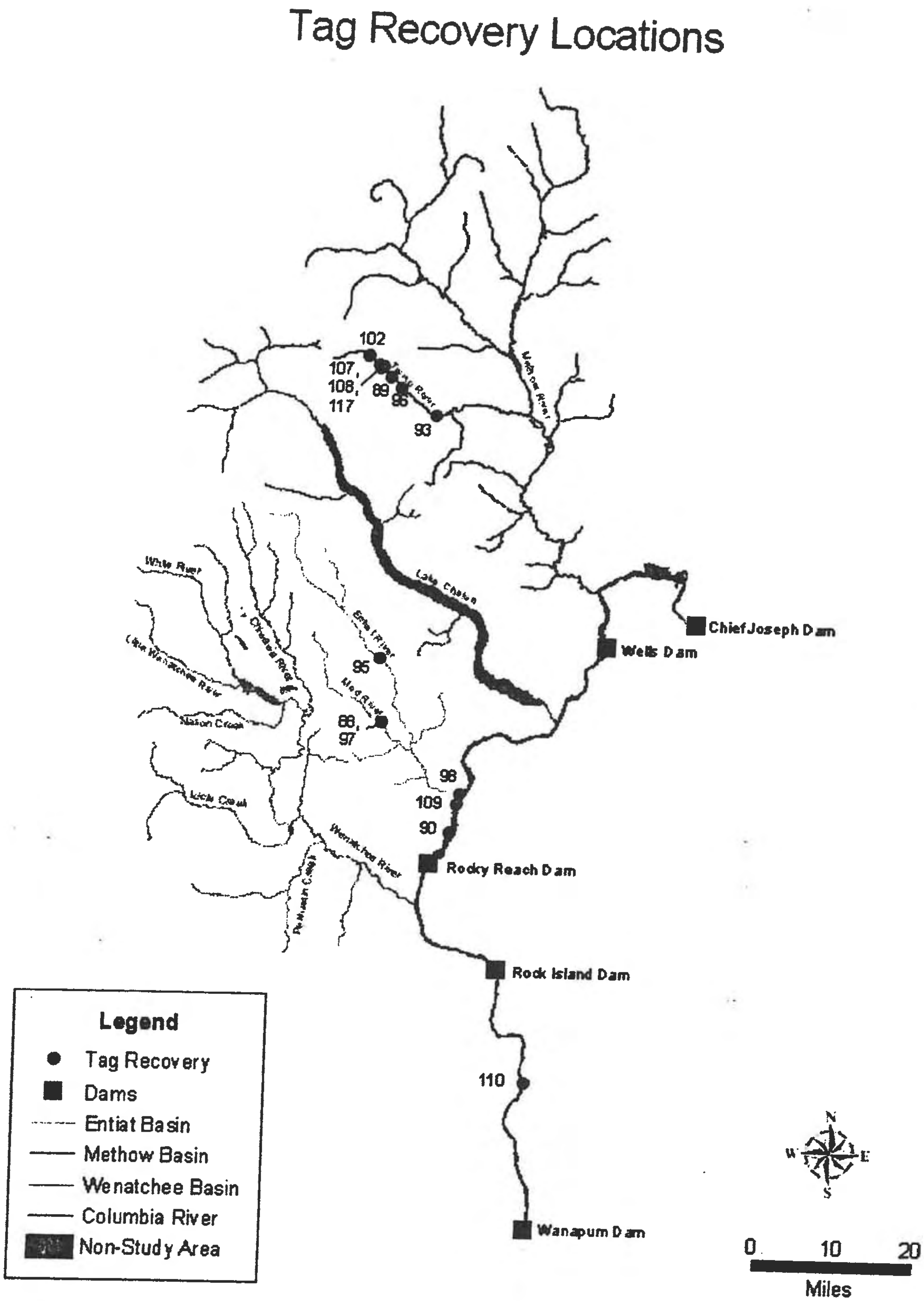


Figure A1: Location and code for radio tags recovered from bull trout tagged at mid-Columbia River projects in spring of 2002.

Tag 14-117--This bull trout migrated to a known spawning area in the Twisp River of the Methow Basin (Figure A1). The bull trout had traveled about 116 km (72 miles) from upstream of Wells Dam to the upper Twisp River (Table A1).

The bull trout was tagged on 6 June at Wells Dam and was released upstream of the project on the west shoreline. The fish then migrated to the Methow River and was detected in the lower river on 21 June. More than a week later on 1 July the fish had ascended the rapids in the lower Methow River and was detected just upstream from French Creek on the Methow River. By 1 August, the bull trout had migrated to the Twisp River and was detected several miles upstream from the confluence of South Creek. U.S. Fish and Wildlife Service personnel observed this fish alive on 25 September in a logjam near a redd. On 9 October the bull trout had moved downstream near the confluence of South Creek. Later, on 22 October the tag but no carcass was recovered in a log jam near that same location (Figure A1).

Rocky Reach Dam

Tag 14-88--This bull trout migrated to a known spawning area in the Mad River of the Entiat Basin. The bull trout migrated approximately 44 km (28 miles) from its release location at Rocky Reach Dam into the Mad River (Table A1).

This bull trout was tagged on 20 May 2002 at Rocky Reach Dam, and was released upstream of the project near the west shoreline. Seventeen days after release, this fish was detected at the fixed-telemetry site on the Entiat River. Upstream movement was documented during a series of aerial surveys; with the fish being detected on 1 July approximately 1.5 km upstream of Pine Flat Campground, on 1 August approximately 1.5 km upstream of Hornet Creek, and on 9 October approximately 1 km downstream from Windy Creek. The fish was detected on four more occasions during the period of December 2002 to March 2003. However, during this period, the transmitter was located at the same location as on 9 October. The transmitter (no carcass) for this fish was recovered on 16 September 2003 at this location in approximately 6 inches of water downstream from a log jam (Figure A1).

Tag 14-089--This bull trout migrated to a known spawning area in the Twisp River of the Methow Basin. A minimum estimate of this bull trout's migration is about 181 km (112 miles) from downstream of Rocky Reach Dam to the upper Twisp River (Table A1).

This bull trout was tagged on 21 May 2002 at Rocky Reach Dam and was released downstream. The next day the bull trout was detected in the tailrace of Rocky Reach Dam. The bull trout passed Rocky Reach Dam 15 days later on 6 June 2002. The next day, 7 June, the fish was detected in the tailrace of Wells Dam. The bull trout passed Wells Dam two days later on 9 June and had moved into the Methow River the same day. On 1 July the bull trout had moved into the Twisp River downstream from the mouth of Buttermilk Creek. Later, on 1 August the fish had moved further upstream in the Twisp River upstream from the confluence of Buttermilk Creek. The fish remained in this area over an extended time until the tag was recovered on 12 September 2003 just downstream of Poplar Flats campground (Figure A1). The tag was buried in on the edge of a pool under cobble and gravel (Figure A1). There were no obvious signs of predation and no carcass was found.

Rock Island Dam

Tag 14-90--This bull trout migrated to a known spawning area in the Entiat River. The bull trout migrated approximately 164 km (102 miles) from its release location to the spawning area, then back to the Columbia River (Table A1).

This fish was released downstream of Rock Island Dam on 23 May 2002 near the west shore. After release, the fish migrated past the dam through the right bank fish ladder, and exited that system on 8 June. The next day this fish was detected in the tailrace of Rocky Reach Dam, and three days later was detected at the ladder exit at that project. On 1 July, this fish was detected at the fixed-telemetry site on the Entiat River. Subsequently, this fish migrated upstream to a location approximately 1 km downstream from Entiat Falls (1 August 2002), then downstream where it was detected on 4 September approximately 3 km upstream of Preston Creek. The next detection of this fish was in the Columbia River on 17 December 2002, where it was located over the course of approximately 10 months on 11 separate occasions. The transmitter (no carcass) of this fish was recovered on 15 September 2003, and was located approximately 8 km downstream of the Entiat River confluence (Figure A1). The transmitter was in approximately 4 meters of water, and was located near the west shore.

Tag 14-97--This bull trout migrated to a known spawning area in the Mad River of the Entiat Basin. The bull trout migrated approximately 81 km (50 miles) from its release location at Rocky Reach Dam into the Mad River (Table A1).

This fish was tagged on 20 May 2002, and was released upstream of Rock Island Dam near the east shore. Six days after release, this fish was detected in the tailrace of Rocky Reach Dam, and four days later it exited the ladder system at that project. On 19 June 2002, this fish was detected at the fixed-telemetry site located at RK 4.8 of the Entiat River. During the next aerial survey (1 July 2002), it was detected in the lower Entiat River approximately 1 km upstream of the Entiat National Fish Hatchery. During the period of September 2002 to September 2003, this fish was located on nine separate occasions, all during routine aerial surveys. The location of this fish for those surveys was the same, which was approximately 1 km downstream of Windy Creek within the Mad River (Figure A1). The transmitter for this fish was recovered at that location on 16 September 2003 without a carcass.

Tag 14-109--This bull trout migrated into the Mad River of the Entiat Basin. This fish migrated about 98 km (61 miles) from its release location upstream from Rock Island Dam to the Mad River and back downstream into the Columbia River where the tag was found (Table A1).

This bull trout was tagged at Rock Island Dam and released upstream from the project on 7 June 2002. Three days later, 10 June, the fish had moved into the tailrace of Rocky Reach Dam and passed the project on 12 June. The bull trout moved upstream and entered the Entiat River on 19 June. The fish was detected again in the Entiat River on 1 July downstream from confluence of Mad River. The bull trout was detected in the Mad River on 4 September and remained there until 17

DISCUSSION

The detection history of most of the bull trout prior to the recovery of the transmitters suggests that they migrated to spawning areas in the Methow and Entiat basins where bull trout are known to spawn (Table A1). The one exception is tag 14-110 that was recovered downstream of Rock Island Dam.

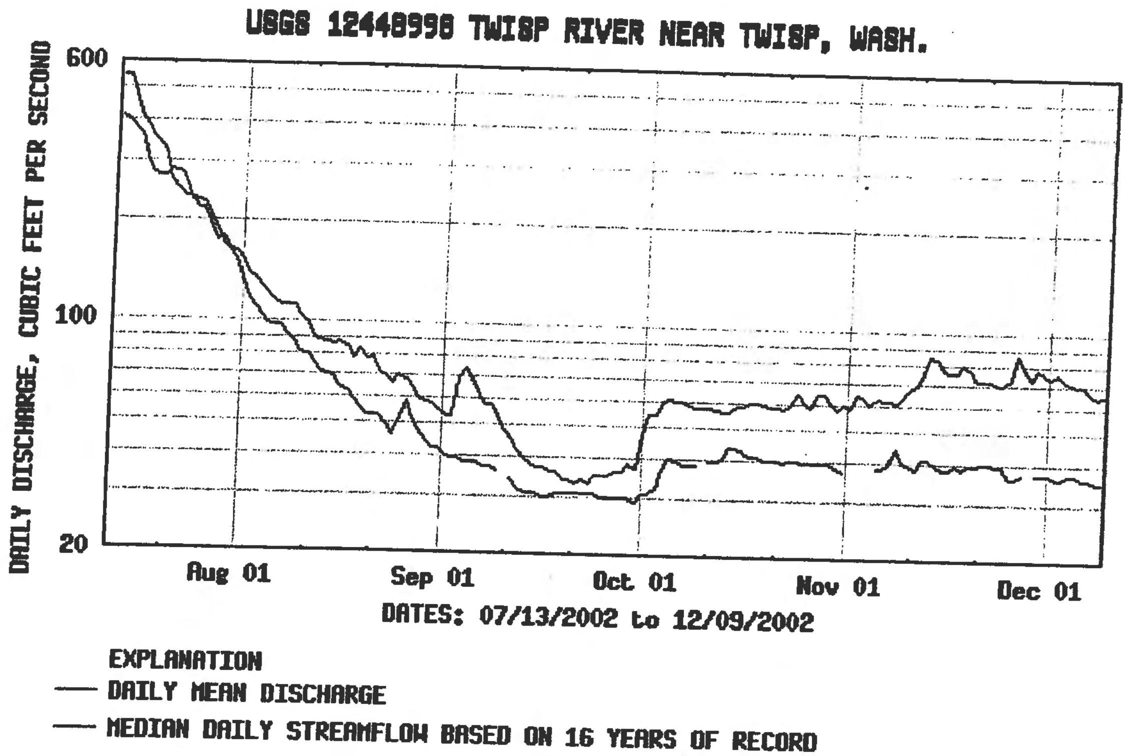
The bull trout reviewed in this summary did not originate from a single tag or release location and were not tagged by a single person, which suggests that these factors did not influence fish survival or tag expulsion. Six of the bull trout were released downstream of mid-Columbia River projects and eight were released upstream. Bull trout released at Wells Dam were detected in the Methow River in June 2002. Those bull trout were later detected in the Twisp River by 1 August 2002. Bull trout released near Rocky Reach Dam entered the Methow and Entiat rivers in June and were detected in the upper Entiat, Mad, and Twisp rivers in July and August. These dates appear to agree with the general migration timing for bull trout (Brown 1994; USFS 2001).

The migration distance for these bull trout from June to September ranged from about 44 km to about 322 km. Assuming that successive detection in different upstream areas means that fish were alive and actively migrating, then most of the fish survived about two months after they were tagged. That length of time between when the fish were tagged to their entry in a tributary stream suggests that the bull trout did not suffer an acute or debilitating injury associated with tagging nor did dam passage have an immediate affect on survival.

In general, observations made on bull trout tagged by the USFWS and BioAnalysts, Inc. revealed that most of the bull trout only had creases or slight wear marks associated with the external antenna (Per. Comm., Mark Nelson, USFWS). The tags in two bull trout may have shifted internally, resulting in the antenna protruding from the body at a right angle. The one bull trout that was recovered (14-107) in the Twisp River did not have any obvious injuries and the incision healed completely.

The location where four tags were recovered suggests that the fish may have been removed from the water (Table A1). Clearly, tags found above the wetted channel in the tributaries during low flow periods of late summer and fall suggest some method of transport. Some researchers have noted that predation, angling/poaching, and shed tags are the suspected causes of tag loss (Elle 1995; Swanberg 1997; Chandler et al. 2001). The U.S. Fish and Wildlife Service suspect that some of their bull trout tagged in 2002 perished (20% of tagged fish). Some of their tags have been recovered onshore away from the river.

Predation may have played an important role in the disappearance of tagged bull trout. One tag (14-95) had cut marks on the antenna portion of the radio tag (Table A1). Here, the observer noted that the tag was recovered on the shore inside a hole under a boulder perhaps only big enough for a mink. Chandler et al. (2001) and Elle (1995) both noted that mink preyed on their bull trout. The bull trout with tag 14-110 made extensive movement both upstream and downstream in the Columbia River. That tag was finally recovered downstream of Rock Island Dam about 10-15 feet from the waters



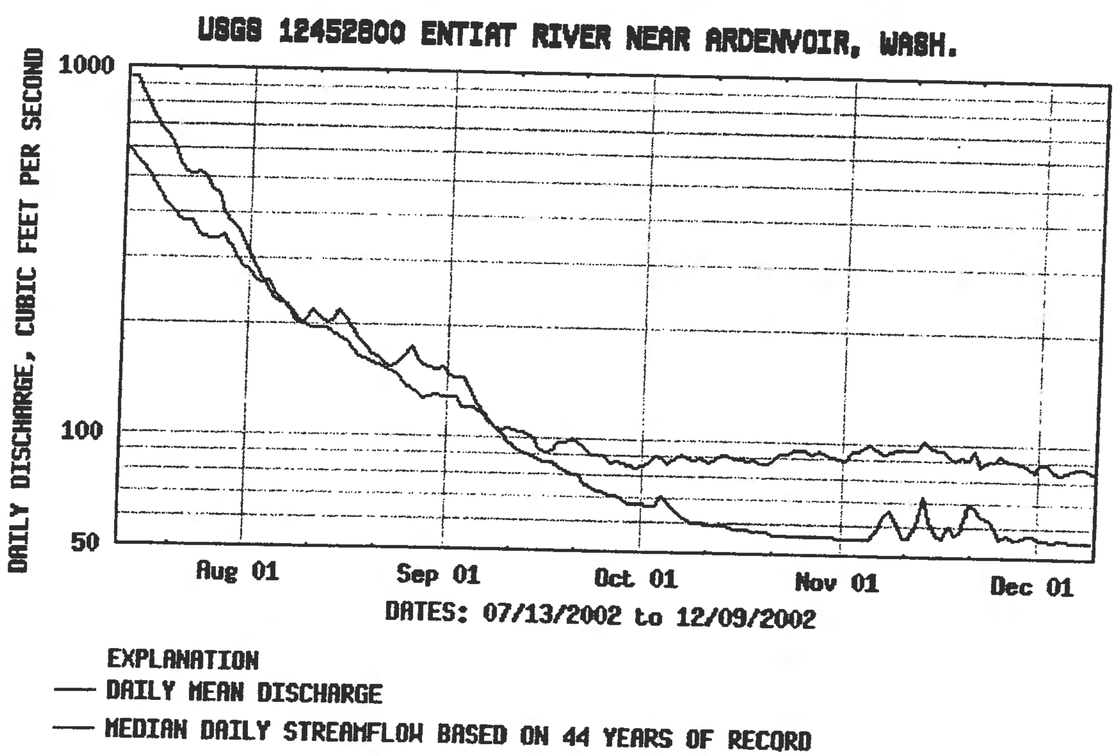


Figure A2: Stream discharge (cfs) in the Twisp and Entiat rivers from August to December, 2002.

WELLS DAM ADULT PIT-TAG INTERROGATION SYSTEM EVALUATION - 2002

APPENDIX H

Wells Dam Adult PIT-tag Interrogation System Evaluation, 2002

BACKGROUND

The Public Utility District of Douglas County (Douglas PUD) owns and operates the Wells Dam on the Mid-Columbia River (Figure 1). Presently, three important species of anadromous Pacific salmon (*Oncorhynchus spp.*) are found in the waters above the projects. They include, by numerical dominance, sockeye (*O. nerka*), chinook (*O. tshawytscha*) and steelhead (*O. mykiss*).

In 1997, NOAA Fisheries listed Upper Columbia River (UCR) steelhead as endangered under the Endangered Species Act (ESA). In 1998, UCR spring-run chinook were similarly listed as endangered under the ESA. The presence of ESA listed stocks at the Wells Project required NOAA Fisheries to conduct a Section 7 consultation on project operations that have the potential to affect the survival and long-term reproductive fitness of listed spring chinook and steelhead.

NOAA Fisheries initiated this Section 7 consultation in 1999 and concluded in 2000 with the preparation of a final Biological Opinion (BO) for the Wells Project (issued on June 18, 2000). Conservation Recommendation 11.3 in the Wells BO recommended that Douglas PUD develop and install an adult PIT-tag interrogation system in the fishways at Wells Dam.

Fortunately, portions of the Wells adult fish ladders were designed without the inclusion of overflow sections and instead each weir in the upper control section of the ladder contained two large submerged orifices. The lack of overflow sections and the presence of mid-weir passage orifices presented the District with a unique opportunity to interrogate 100% of the adult fish migrating through each control weir without having to substantially modify the existing fishway weir structures.

The 2002 Wells PIT interrogation system used a set of precisely wrapped PIT-tag coils surrounded by an internal and external waterproof shield

Study Design

Similar to adult PIT-tag evaluations conducted at Bonneville Dam in 2001 (Lady and Skalski, 2001), the 2002 Wells adult PIT-tag interrogation system evaluation utilized both on-site and run-of-river PIT-tagged adult fish. The following section outlines the statistical methodologies used to estimate detection efficiencies for PIT-tagged adult fish migrating through the fishways at Wells Dam.

Estimating Detection Efficiency

Mark-Recapture Model

All adult salmon and steelhead migrating through the adult fish ladders at Wells Dam were required, by design, to pass through PIT-tag interrogation coils located on control weirs 67 and 68. No overflow sections were present at these two weirs and as such, 100% of the upstream migrating fish are available to be sampled by the interrogation coils. As such, it was reasonably expected that detection probabilities are independent between weirs. The potential influence of fish behavior on the assumptions of independence was minimized by the physical layout of the detection system. The overall probability of detection (P) at a ladder can then be expressed as

$$P = 1 - (1 - p_{67})(1 - p_{68}) \tag{1}$$

where

p_{67} = probability of detection at weir 67,

p_{68} = probability of detection at weir 68.

The detection histories of the adult PIT-tagged salmon at the two weirs can then be used to estimate the probabilities p_{67}, p_{68} and subsequently, the overall detection probability P.

where

n_{11} = number of PIT-tagged adults detected at both weirs 67 and 68,

n_{10} = number of PIT-tagged adults detected at weir 67 but not 68,

n_{01} = number of PIT-tagged adults detected at weir 68 but not 67,

$r = n_{11} + n_{10} + n_{01} = n_1 + n_2 - m$.

Likelihood model (5) was used to calculate the variance of $\hat{P}$ as well as to construct a profile likelihood confidence interval for P. Separate analyses were performed for each of the two fish ladders at Wells Dam. Separate analyses were also be performed for each species and each of the two sockeye mark groups (on-site and run-of-river).

Travel Time Between Weirs

The forth goal of the evaluation was to ensure that the placement of the adult PIT interrogation coils around the adult fish passage orifices did not impede the upstream migration of adult salmon and steelhead. For this evaluation, travel time between weir 67 and 68 was defined as the time from the first detection at the lower weir to the last detection at the upper weir. For adult fish that traversed the ladders multiple times, only the first event was used. First, the PIT-tag interrogation records collected from weirs 67 and 68 were compared and the travel times between coils calculated. Rates of travel were separately reported for both ladders, for each of the four species of fish and for both sockeye study groups (on-site and run-of-river). The results of this evaluation were compared with the average per-weir travel time for adult salmon and steelhead observed in the upper fishways at Wells Dam.

Dam, in such large numbers, was not anticipated during the development of the study plan. The presence of these fish substantially increased the sample size for the PIT-tag system evaluation and subsequently reduced the need to continue tagging sockeye at the left bank ladder trap.

In total, one-hundred-eighty-nine (189) adult sockeye salmon were tagged and released back into the left bank ladder at Wells Dam. Because of the potential for fallback (fish "falling" further downstream after progressing past a detector), the detection history for the left bank was looked at for length of time from being anesthetized, tagged and released to detection at a weir, length of time between detections at consecutive weirs, and the order of detection at weirs.

Of the fish detected at both detection sites, most (98%) were detected at the lower weir within 2.4 hours after being tagged (0.10 days), with only three fish displaying a travel time of greater than 2.4 hours (2.7, 3.0, and 7.4 hours) to reach the first weir. Four fish were detected at the upper weir only (0.156, 0.723, 0.857, and 4.936 days after release), and one fish at the lower weir only (0.669 days after release). None of these fish were detected later at the right bank, and are assumed to have been traveling upstream without falling back. Twenty-four of the on-site tagged fish were detected in the right bank of Wells Dam, with all twenty-four of these fish being detected in the right bank ladder at least 24-hours after release in the left bank ladder.

Table 1: Numbers used in estimation of detection efficiency at Wells Dam.

Total adult fish (sockeye) tagged	189
Total detected at **first** weir, left bank	155
Total detected at **second** weir, left bank	158
Total detected at **both** weirs, left bank	154

downstream weir. These two assumptions were necessary to determine the "10" (detected downstream but not upstream) and the "01" (detected upstream, but not downstream) histories. The first assumption was very likely, as the probability of an adult fish entering an adult ladder at its upstream exit point was very small. The second assumption, while not as strong, was more conservative, and did not appear to affect the estimate of over-all probability of detection.

Table 3: Detection histories used in estimation of detection efficiency for each bank of Wells Dam, in-river adults. "11" indicated detection at both weirs, "10" detection at downstream weir only, "01" detection at upstream weir only. Species-Run-Type codes were PITAGIS designations.

	Left Bank Detection History			Right Bank Detection History		
Species-Run-Type	11	10	01	11	10	01
11H	11	0	0	17	0	0
11U	67	3	10	34	2	1
12H	498	5	44	284	15	6
Pooled Chinook	**576**	**8**	**54**	**335**	**17**	**7**
13H	--	--	--	1	0	0
13U	1	0	0	3	1	0
15H	7	0	0	9	0	0
15U	6	0	0	2	0	0
21U	2	0	0	3	0	0
23H	2	1	0	9	0	0
Pooled Coho	**4**	**1**	**0**	**12**	**0**	**0**
32H	124	3	15	210	8	3
32W	2	2	0	6	0	0
Pooled Steelhead	**126**	**5**	**15**	**216**	**8**	**3**
42U	3	0	0	4	0	0
45U	15	0	0	11	1	0
45W	7	0	0	1	1	0
Pooled Sockeye	**25**	**0**	**0**	**16**	**2**	**0**

Travel Time Between Weirs

Rates of travel between interrogation weirs were determined and were provided to help fisheries managers assess whether the design of the weirs in the adult ladders hampered adult fish passage. Figures 6 and 7 show the distribution of the travel times of adults detected at both downstream and upstream detection sites.

Table 5 lists the summary statistics by species for each bank of adult ladders. The majority of the adult fish (75%) for three species in the left bank and all four species in the right bank were estimated to have traversed through both weirs in less than 4 minutes. Seventy-five percent of the sockeye in the left bank traversed in 11.6 minutes or less. Travel time distributions were skewed by a small number of fish with very large travel times, creating large differences between median and mean travel times. While most instances of protracted travel time between detections were obviously separate travel events (i.e. greater than 2 days), there were a few fish that could not be automatically placed in this category.

Table 5: Summary statistics for the travel times (in minutes).

Left Bank	Chinook	Coho	Steelhead	In-River Sockeye	On-Site Sockeye
Number detected at both weirs	498	4	125	25	154
Minimum	0.150	0.667	0.017	0.333	0.317
1st quarter	0.600	0.917	0.350	1.583	3.050
Median	1.642	1.325	0.983	5.183	6.509
Mean	11.390	1.521	2.496	8.836	24.768
3rd quarter	2.867	1.929	2.050	11.567	17.525
Maximum	1,124.000	2.767	102.233	53.133	589.483

Right Bank	Chinook	Coho	Steelhead	In-River Sockeye
Number detected at both weirs	293	12	212	16
Minimum	0.167	0.167	0.050	0.283
1st quarter	0.517	0.363	0.433	0.571
Median	1.350	0.792	0.892	1.675
Mean	13.249	1.772	2.760	11.395
3rd quarter	3.300	2.279	2.292	3.696
Maximum	1,541.767	9.133	65.350	133.217

SUMMARY

The 2002 PIT-tag interrogation system was installed at Wells Dam to fulfill Conservation Recommendation 11.3 in the 2000 Wells BO. The 2002 system evaluation utilized 189 sockeye PIT-tagged on the east ladder of Wells Dam and was augmented by an unexpected large return of 1,315 unique run-of-river PIT-tagged adult salmon and steelhead. During the 2002 fish migration, the adult PIT-tag interrogation system detected 1,460 run-of-river passage events for run-of-river fish and 176 unique detections of adult sockeye tagged at Wells.

Because of the large samples sizes attained by the study, all four goals of the 2002 evaluation were achieved with a high level of resolution. The detection efficiency for on-site tagged sockeye passing through the left bank ladder was 0.9998 (Table 2) with a 95% confidence interval of (0.9990—1.0000). The overall detection probability for an adult PIT-tagged fish passing over Wells Dam was also correspondingly high (left bank: 0.9959—1.0000; right bank: 0.9990—1.0000). The probability of detection for an adult PIT-tagged chinook, coho, steelhead and sockeye in each fish ladder was also consistently high and ranged from 0.9977 - 1.0000 for chinook, 1.0000 for coho, 0.9899 - 1.0000 for steelhead and 1.0000 for sockeye.

The detection efficiencies for run-of-river fish, on-site tagged sockeye and for all four fish species evaluated (chinook, coho, steelhead and sockeye) were not significantly different from one another or between the ladders examined. In all cases, the detection efficiency estimates exceeded the preseason evaluation objective of 98%.

No evidence of increased fallback at the fish counting stations and no observed accumulations of fish downstream of the adult PIT systems were noted by project personnel or fish counting staff in 2002.

LITERATURE CITES

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English, K. K., C. Sliwinski, B. Nass and J. R. Stevenson. 2001. Assessment of adult steelhead migration through the Mid-Columbia River using radio-telemetry techniques, 1999-2000.

English, K. K., R. F. Alexander and B. Nass. 1998. Assessment of adult sockeye and chinook passage times at Wells Dam and evaluation of fishway gate alterations, 1997.

Lady, J and J. R. Skalski. 2001. Preliminary data analysis report on adult ladder PIT-tag detection efficiency at Bonneville Powerhouse #2. Prepared for; Earl Prentice and Sandra Downing. National Marine Fisheries Service, Northwest Fisheries Science Center. Carter Stein. The Columbia Basin PIT Tag Operations Center.

L. C. Stuehrenberg, G. A. Swan, L. K. Timme, P. A. Ocker, M. B. Eppard, R. N. Iwamoto, B. L. Iverson and B. P. Sandford. 1995. Migrational characteristics of adult spring, summer and fall chinook salmon passing through reservoirs and dams of the Mid-Columbia River.

Figure 2a. Plan View of an adult PIT-tag interrogation coil similar to the one installed on the orifices of fishway weirs 67 and 68 at Wells Dam, 2002.

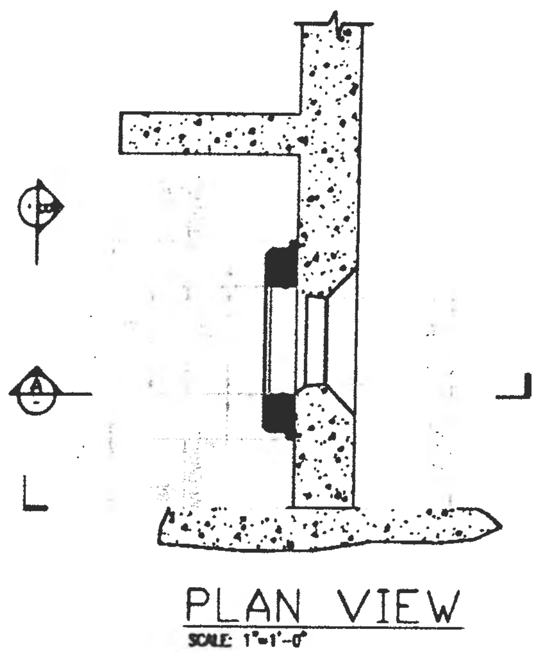


Figure 3. Upstream view of an adult PIT interrogation coil located on weir 67 on the east ladder of Wells Dam, 2002.

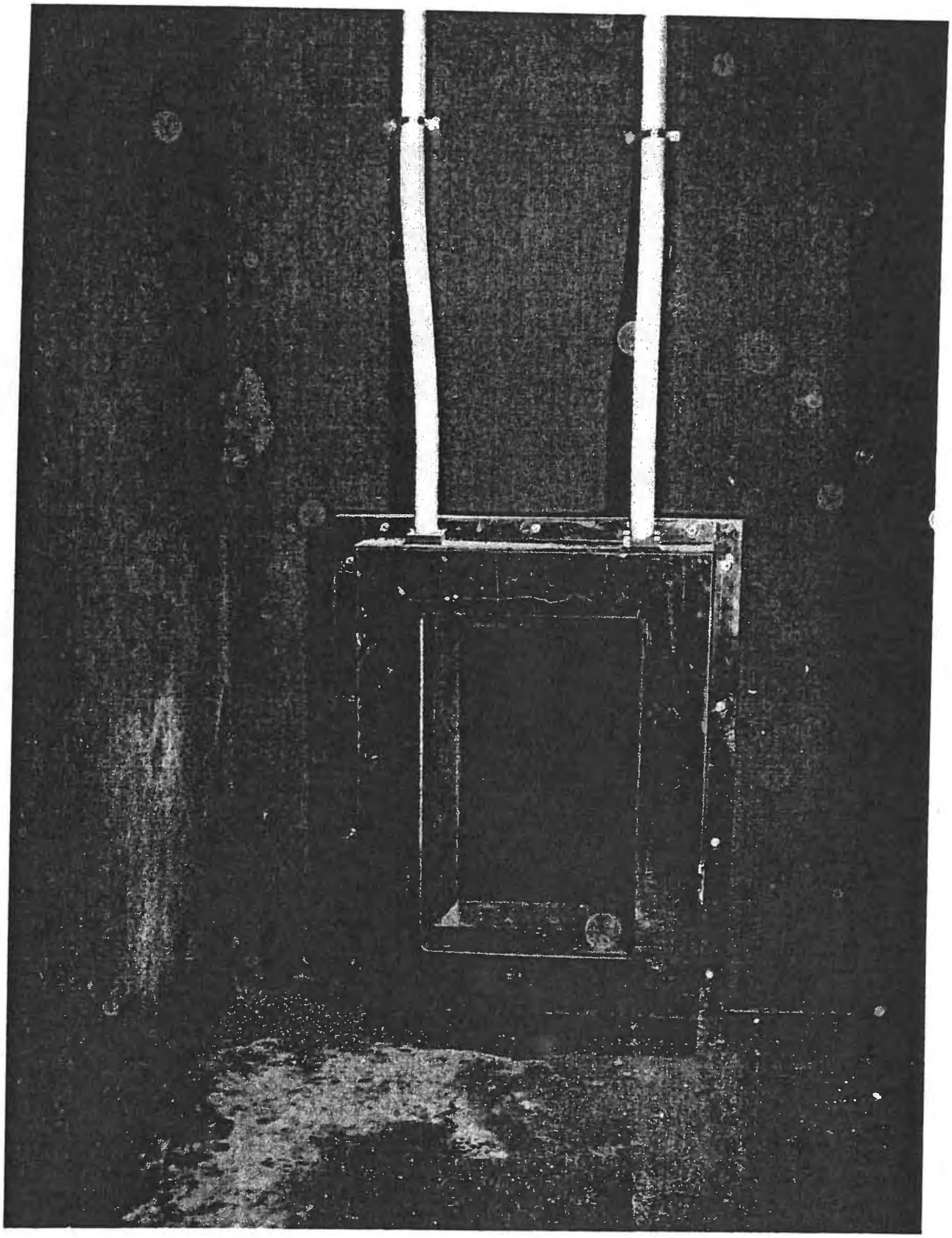


Figure 5. Proposed PIT-tagging technique for adult anadromous salmonids (adapted from: Biomark, Inc. 1999).

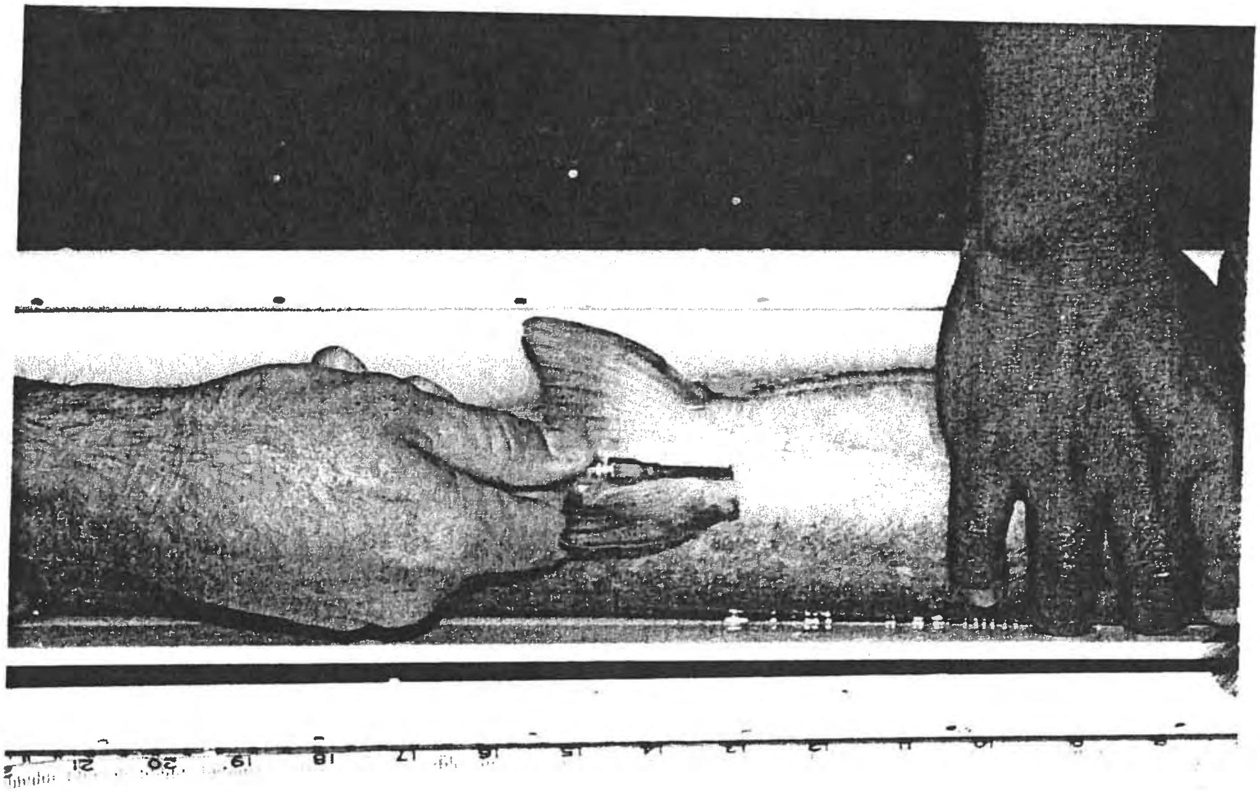
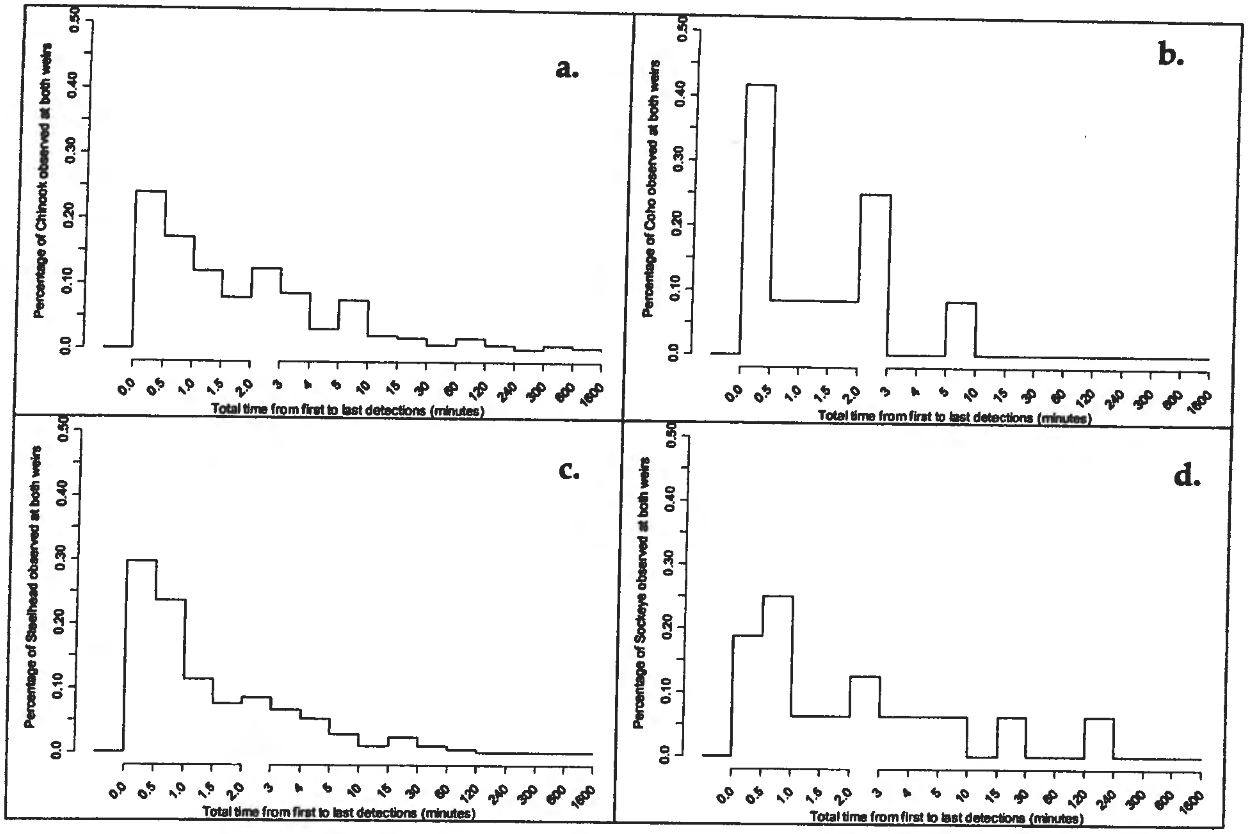


Figure 7. Travel time distributions through the right bank adult ladder at Wells Dam for each species. The x-axis is the total time from first to last detection, the y-axis is the percent of travel times that fall into that travel time range.



APPENDIX A

EXPLORATION OF PIT TAG DATA COLLECTED FROM WELLS DAM ADULT LADDER ANTENNAS IN 2002

PREPARED FOR:
Public Utility District
No. 1 of Douglas County
1151 Valley Mall Parkway
East Wenatchee, Washington 98802

PREPARED BY:
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April 2003

Tables

Table 2 and again in the run-timing curves for each stock. Fish released at or above Wells Dam are of known origin; however, stocks classified as being released below Wells Dam are generally of unknown origin. With the exception of summer chinook from the Turtle Rock facility, other stocks have been collected at the noted projects via gatewell dipping or bypass samples and have been incorporated into a variety of survival projects. There is the potential that these fish were originally released as unmarked juveniles above Wells Dam. Median travel time for spring and summer chinook from Bonneville Dam to McNary Dam was approximately 6 days (d) for all groups (Table 2). Travel time from McNary to Wells Dam for spring chinook released above Wells Dam (14.2 d) was slightly longer than for fish released, collected and tagged at The Dalles Dam (12.0 d). Travel time for summer chinook from McNary to Wells Dam (19.7 d) was approximately 4 to 5 d longer than that of spring chinook salmon. Summer chinook salmon released above Wells Dam exhibited slightly longer travel times from McNary Dam to Wells Dam than summer chinook salmon released at either Rocky Reach or Rock Island dam. Fall chinook from below Wells Dam had a median travel time from Bonneville to McNary Dam of 5 d and approximately 30 d from McNary Dam to Wells Dam (Table 2). Two of the five fall chinook salmon detected at Wells Dam were released from the Priest Rapids Hatchery. Median travel time of coho salmon through both reaches was longer than that of spring and summer chinook (Table 2). The prolonged travel time from Bonneville Dam to McNary Dam, for coho salmon released above Wells Dam, is the result of two of the five fish requiring greater than 27 d to transit the reach. Fallback was not apparent for either one of these fish. Steelhead released above Wells Dam required approximately 11 d to travel from Bonneville Dam to McNary Dam, slightly lower than that for tagged fish from below Wells Dam (km/d). Median travel time of steelhead from McNary Dam to Wells Dam fell within the range calculated for salmon. Travel rates (km/d) for steelhead were similar between the two reaches, unlike those reported for salmon which decreased in the upriver reach (Table 2).

Hatchery spring chinook salmon arrived at McNary Dam in two pulses, with the first pulse occurring in early May and the second pulse in late June and July (Figure 2). The first pulse consisted primarily of fish released above Wells Dam while the second pulse was made up largely of fish released below Wells Dam. The two pulses remained evident in arrival date at Wells Dam with the majority of early arriving fish being of known origin from above Wells Dam (Figure 3). Summer chinook salmon arrived at McNary Dam from mid June through late August with a peak in early July (Figure 4). Passage of PIT-tagged summer chinook at Wells Dam peaked in the third week of July (Figure 5). Summer chinook released above Wells Dam passed primarily in July and August with one fish arriving in October. Passage of fall chinook salmon, from below Wells Dam, occurred in August and September at McNary Dam and in September and October at Wells Dam (Figure 6 and Figure 7).

the number of returning adults from the 2000 migration year, but coho salmon released above Wells Dam were observed at Bonneville Dam in 2001 and 2002. Eighty-five of the coho salmon released in 2000 were detected at the Bonneville Dam in 2001 and 23 of the coho salmon released in 2001 were detected at Bonneville Dam in 2002. Adults detected at Bonneville Dam did not necessarily translate into upriver detections as no adult coho salmon were detected at McNary Dam in 2001 and only 10 were detected at McNary Dam in 2002. Seventeen coho salmon were detected at Wells Dam in 2002. This total consisted of all 10 coho salmon detected at McNary Dam and seven coho salmon not detected at McNary Dam. Twelve (0.15%) of the coho salmon released from Winthrop in 2001 were detected at Wells Dam in 2002 (Table 5). The remaining 5 coho salmon were of unknown origin, and were captured and tagged at The Dalles Dam in 2001.

Steelhead

Steelhead released into the Wells Dam tailrace (23,917 released) and at the mouth of the Methow River (23,857 released) as part of the 2000 yearling summer steelhead survival study made up the majority of PIT tagged steelhead detected at Wells Dam in 2002). Approximately 0.7% of the fish from each release location were detected at Wells Dam in 2002. Twenty juvenile steelhead captured and tagged at Rocky Reach (13:3,947 released) and Rock Island (7:1,195 released) dams in 2000 were observed at Wells Dam in 2002. Three fish tagged and released at Lower Granite Dam in spring 2000 (approx. 90,000 released) and one fish tagged and released in 2001 (approx. 15,700 released) at Lower Granite Dam were detected at Wells Dam in 2002.

Sockeye salmon

In addition to the 176 adult sockeye salmon PIT tagged at Wells Dam in 2002, 43 fish PIT tagged as juveniles at Rock Island, Rocky Reach, and Bonneville dams in 2000 were also detected at Wells Dam in 2002 (Table 7). Approximately 700 juvenile sockeye salmon were released at each site.

Table 1. Composition of adult salmonids detected at Wells Dam from March 21 through November 15, 2002 based on species, run type, and rearing type.

Species	Run	Hatchery	Unknown	Wild	Total
Chinook	Spring	39	99		138
	Summer	650			650
	Fall	1	5		6
	Unknown	17	112	1	130
Coho	Spring		5		5
	Fall	12			12
Steelhead	Summer	355	16	9	380
	Fall		1		1
Sockeye	Summer		7	176	183
	Unknown		27	9	36

Table 3. Release site codes for fish detected at Wells Dam in 2002.

Release Site Code	Release Site
BO2BYP	Bonneville Dam PH2 – release into the facility bypass flume/pipe
BONAFF	Bonneville Dam Adult Facility
DWORNF	Dworshak National Fish Hatchery
COLR	Released into the Columbia River at the mouth of the Methow River
ENTH	Entiat National Fish Hatchery
LEAV	Leavenworth National Fish Hatchery
LGRRBR	Lower Granite Dam – barge transportation from facility
LGRRRR	Lower Granite Dam – return to river at facility
MCNGWL	McNary Dam – release into gatewell
OKANR	Okanagon River
PRDH	Priest Rapids Hatchery
RIS	Rock Island Dam
RRE	Rocky Reach Dam
TDAICE	The Dalles Dam - ice/trash sluiceway
TDASPF	The Dalles Dam – spillway forebay release (within 0.5 km of dam)
TDASPT	The Dalles Dam – spillway tailrace release (within 0.5 km of dam)
TDATRB	The Dalles Dam – release into turbine
UMAR	Umatilla River
WINT	Winthrop National Fish Hatchery
WANPL	Wanapum Dam – pool
WANTAL	Wanapum Dam – tailrace
PRDPL	Priest Rapids Dam – pool
PRDTAL	Priest Rapids Dam - tailrace

Table 6. Hatchery and release site for steelhead detected at Wells Dam from March 21 through November 15, 2002.

	Hatchery	
Release Site	Wells	Unknown
BONAFF		19
LGRRBR		1
LGRRRR		3
RIS		13
RRE		7
WELTAL	172	
COLR	166	

Table 7. Hatchery and release site for sockeye salmon detected at Wells Dam from March 21 through November 15, 2002. Sockeye salmon were captured and tagged as adults in July 2002 and released into the Wells Dam tailrace (WELTAL) to determine detection efficiency of the Adult PIT-Tag interrogation.

	Hatchery
Release Site	Unknown
BO2BYP	7
RIS	8
RRE	28
WELTAL	176 (a)

a: tagged as adults and released into the Wells Dam tailrace; not used in run-timing calculations

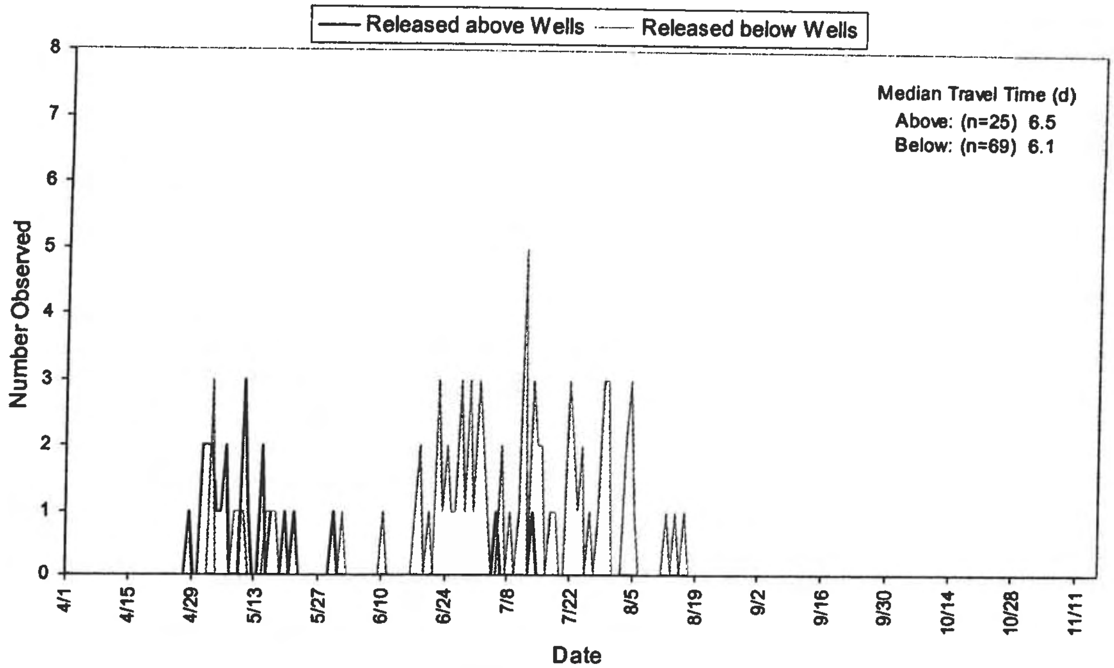
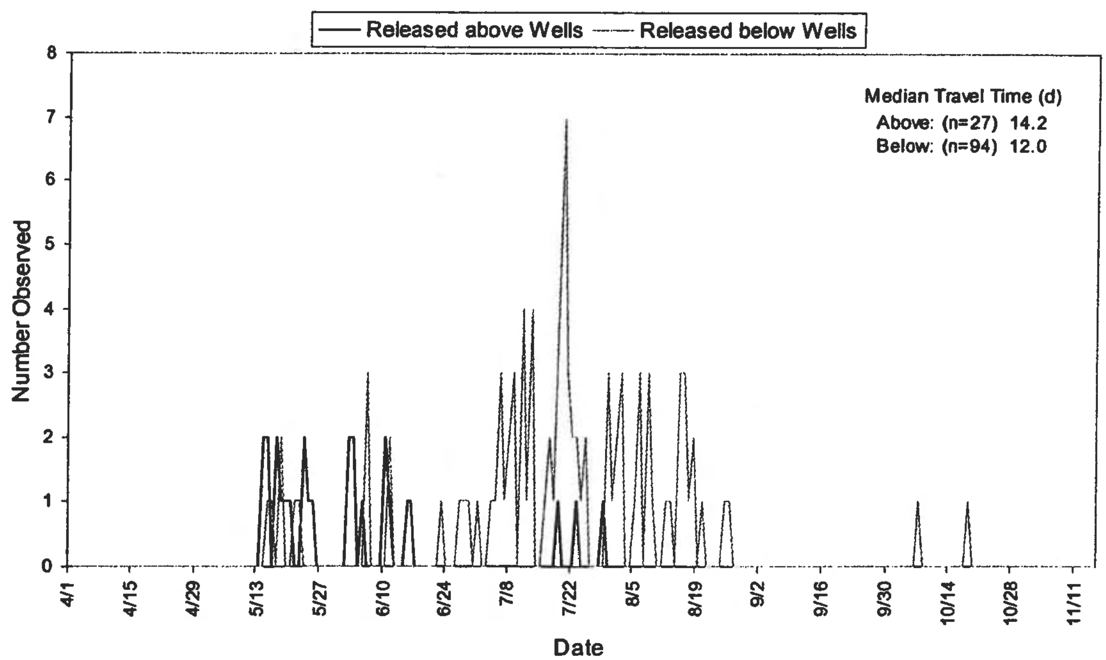


Figure 2. Arrival date at McNary Dam and median travel time (days) from Bonneville Dam to McNary Dam for PIT-tagged spring chinook salmon released above or below Wells Dam and later detected as adults at the Wells Adult PIT detection system. Sample size (n) and median travel time (d) are presented for each group.



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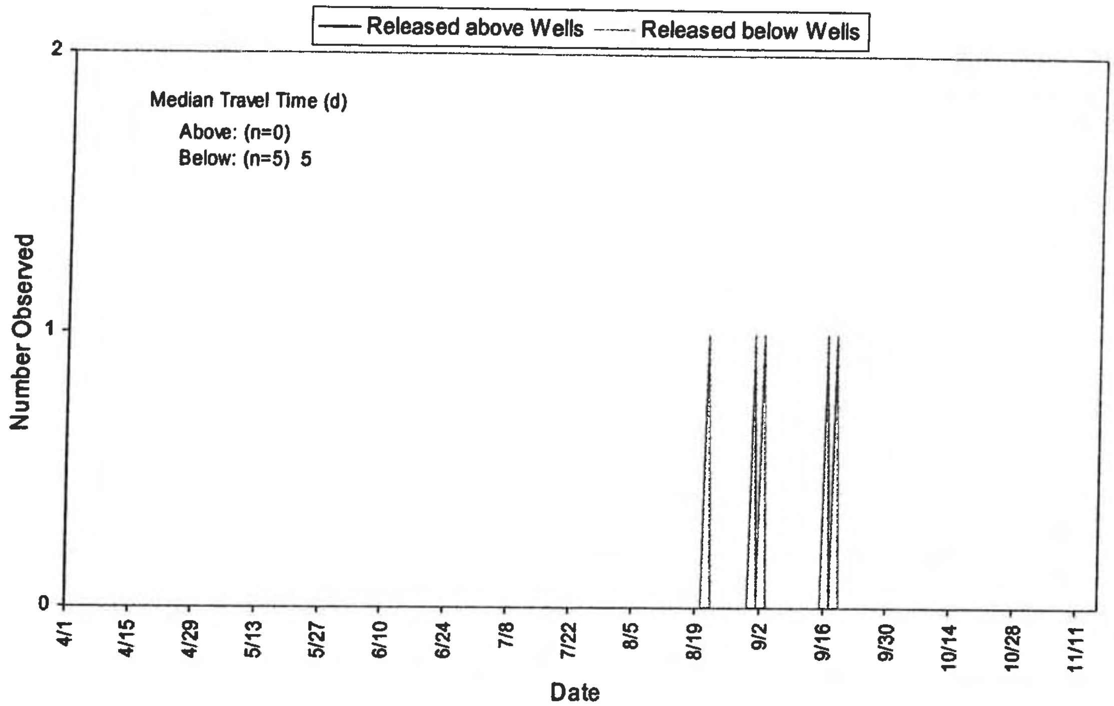
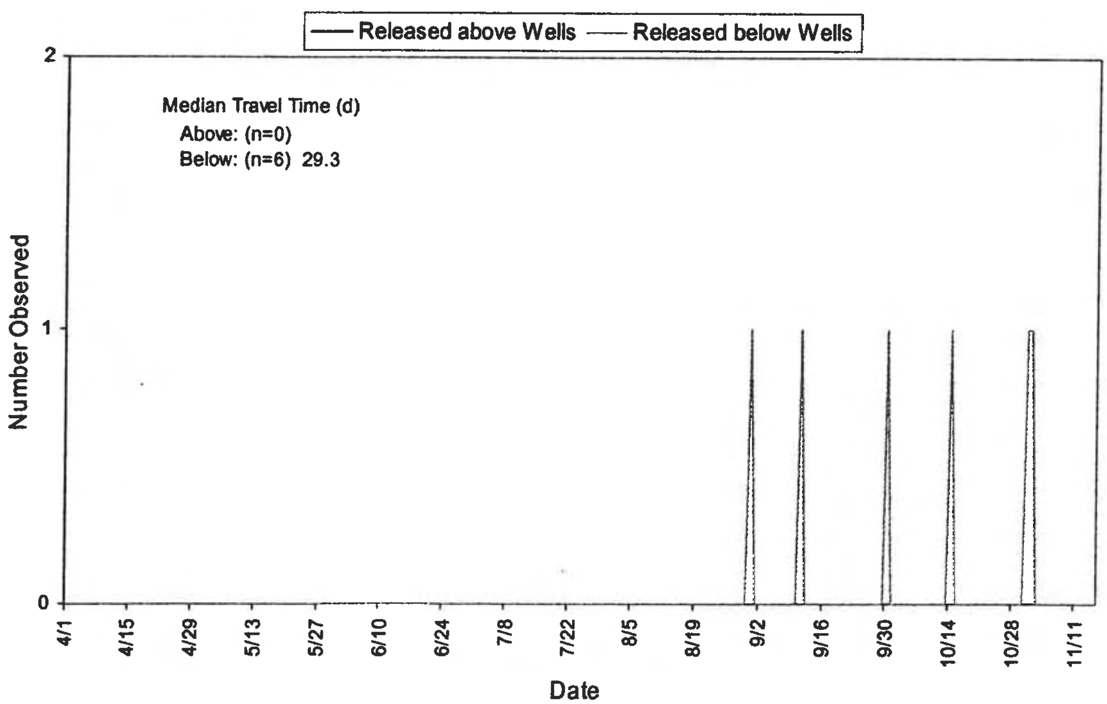


Figure 6. Arrival date at McNary Dam and median travel time (days) from Bonneville Dam to McNary Dam for PIT-tagged fall chinook salmon released below Wells Dam and later detected as adults at the Wells Adult PIT detection system. Sample size (n) and median travel time (d) are presented for each group.



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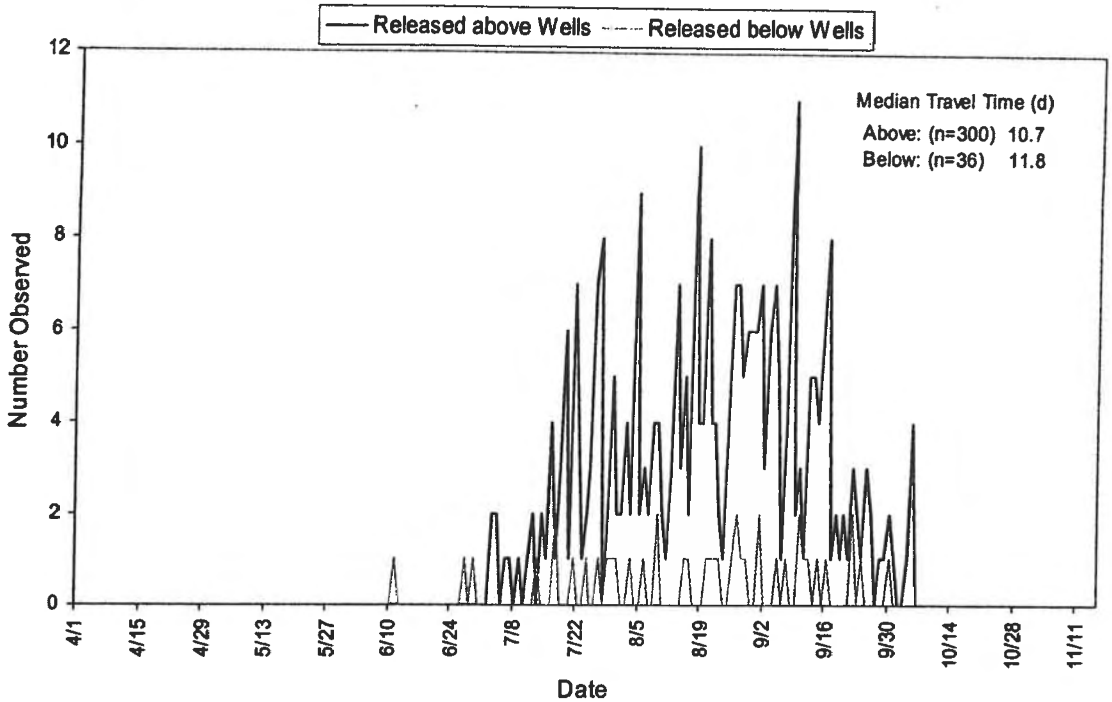

Figure 10. Arrival date at McNary Dam and median travel time (days) from Bonneville Dam to McNary Dam for PIT-tagged steelhead released above or below Wells Dam and later detected as adults at the Wells Adult PIT detection system. Sample size (n) and median travel time (d) are presented for each group.

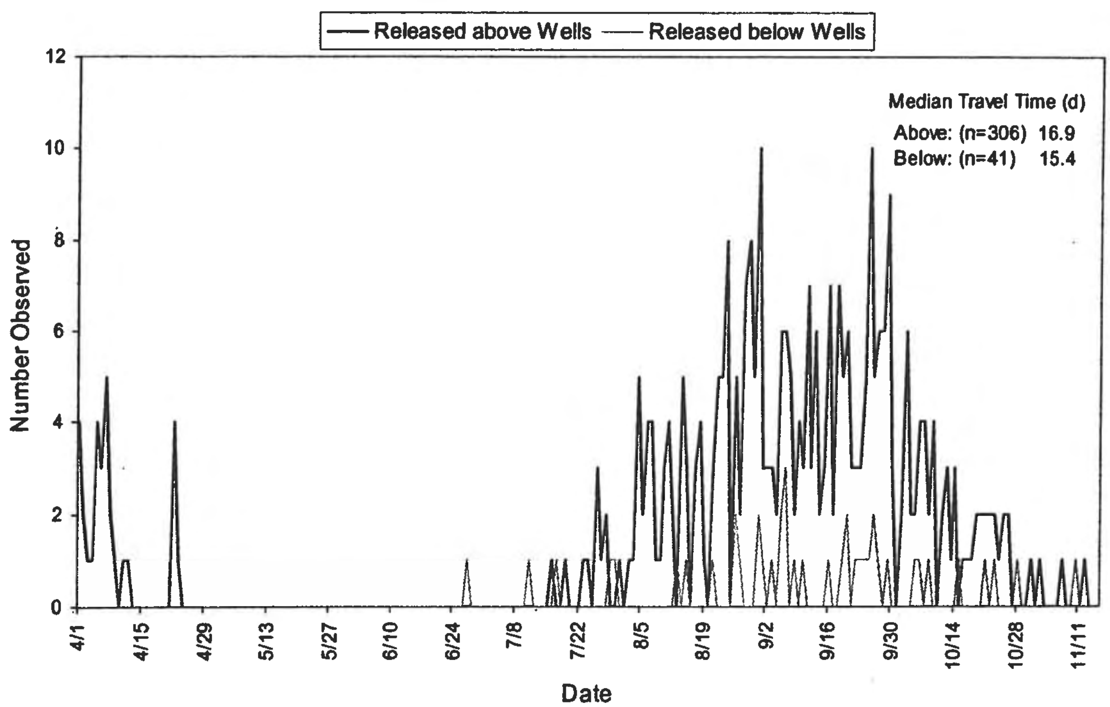

Figure 11. Arrival date at McNary Dam and median travel time (days) from McNary Dam to Wells Dam for PIT-tagged steelhead released above or below Wells Dam and later detected as adults at the Wells Adult PIT detection system. Sample size (n) and median travel time (d) are presented for each group.

ANNUAL PROGRESS REPORT FOR WELLS HATCHERY SUMMER STEELHEAD; 2000 BROOOD YEAR

APPENDIX I

Annual Progress Report For Wells Hatchery Summer Steelhead

2000 Brood Year

Prepared for
Public Utility District No. 1 of Douglas County

By

Charlie Snow

May 2004

Washington Department of Fish and Wildlife
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ABSTRACT

Trapping of upper Columbia River summer steelhead for Wells Hatchery broodstock began on 12 July and finished on 15 November 1999. Wells Hatchery collected 351 steelhead from the west ladder and 41 steelhead from the east ladder of Wells Dam. Wild adults represented 11.2 % of the broodstock collected. Eight female and three male steelhead died prior to spawning (2.8%). The hatchery spawned 158 males with 204 females between 15 December 1999 and 22 March 2000, to produce an estimated 1,148,999 eggs. One additional female and one male were not viable at spawning. On 22 March 2000, the hatchery crew returned 14 male and 3 female steelhead to the Columbia River above Wells Dam. A total of 408,699 eyed eggs were transferred to other facilities, with an estimated 683,613 fertilized eggs retained at the hatchery for Wells programs.

Wells Hatchery released approximately 326,270 H x W smolts in the Methow Basin and an estimated 228,770 H x H smolts in the Okanogan Basin. The 2000 brood releases were 115.6% of the release goal specified in the 1999 broodstock collection protocol. All steelhead releases were accomplished between 16 April and 22 May 2001. Unfertilized egg to fry survival was 83.6% for the Wells program eggs, and fry to smolt survival was 89.2%, and 90.5% for the H x W and H x H juveniles, respectively. Unfertilized egg to smolt survival was 81.2% for the Wells program steelhead.

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ACKNOWLEDGMENTS

This project was funded by the Public Utility District Number One of Douglas County, Washington. Their financial and technical assistance was much appreciated. The assistance of the Wells Hatchery crew, specifically Jerry Moore, Gary Osborne, Ace Trump, Stewart Mitchell, Dennis Schott, and Able Gonzales, was crucial to the data gathering effort necessary for this report. Heather Bartlett assisted with much of the sampling of the adult steelhead covered in this report. I thank John Sneva for providing the scale and age analysis, and Bob Rogers for his assistance with the fish health monitoring. Andrew Murdoch, Mike Tonseth, and Michael Humling provided constructive criticism of earlier drafts of this report.

INTRODUCTION

Hatchery production of summer steelhead in the Columbia River above Priest Rapids Dam was sporadic until the late 1960's, when Chelan and Wells hatcheries began operation. Wells and Chelan hatchery productions are part of the Wells Dam and Rocky Reach Dam mitigation agreements, respectively.

Collection of summer steelhead for hatchery production above Priest Rapids Dam occurred at both Priest Rapids and Wells Dams until 1982 (Mullen et al. 1992). The adult steelhead were held and spawned at Wells Hatchery, and the progeny were released into the upper Columbia River and it's tributaries. Thereafter, Wells Dam became the primary collection site for adult steelhead used for hatchery production above Wells Dam. In August 1997, the National Marine Fisheries Service (NMFS) listed the populations in the Upper Columbia Summer Steelhead Evolutionary Significant Unit, to include all populations upstream from the mouth of the Yakima River, as endangered under provisions of the Endangered Species Act of 1973. Hatchery steelhead were included in the listing and deemed critical to the recovery effort. However, it was noted that a major threat to the genetic integrity of wild fish was attributable to past and present hatchery practices. This report covers all hatchery activities relating to the trapping, spawning, rearing, and release of the 2000 brood Wells summer steelhead.

BROODSTOCK COLLECTION

The adult collection goal for the 2000 brood summer steelhead was 396 fish collected from the run at large, migrating upstream of Wells Dam. Trapping began on 12 July and finished on 15 November 2000. Peak collection occurred during the week of 11 September 1999 (Figure 1). The hatchery retained 392 fish during the collection period (98.9% of goal). An additional 54 hatchery and 6 wild steelhead were examined for marks and released above Wells Dam during the trapping period. Of those fish collected, 37 hatchery and 4 wild steelhead were retained for broodstock from the east ladder of Wells Dam. Forty four of the total fish retained were wild origin fish (11.2%). The adult steelhead were held in well water in a covered pond until spawning. Formalin treatments to control fungus began on 4 December 1999 and continued approximately every other day for 1 h at a ratio of 1:6,000. The last formalin treatment was applied on 18 March 2000.

Scale and otolith samples were used to verify age and origin information from the broodstock. Two hundred twenty five of the 363 readable scales collected from the broodstock were 1-ocean fish (61.9%). An additional 137 steelhead were 2-ocean fish (37.7%), and one 3-ocean fish was identified (0.2%). Hatchery origin steelhead were identified by an adipose fin-clip ($N = 333$). Of the adipose clipped fish, two right-green elastomer, 12 left side blank-wire cheek tag, and 16 right side blank-wire cheek tag marks were observed. One unmarked hatchery origin fish was also identified via scales.

Seventeen wild male and 24 wild female steelhead were identified at spawning (Table 1). Male fish were typically larger than females at the same age, and the difference increased as ocean age increased (Table 2). Fewer than 1% of the hatchery origin fish spent more than one winter in fresh water. Greater than 80% of the wild origin steelhead in the broodstock spent more than one winter in fresh water (Table 3).

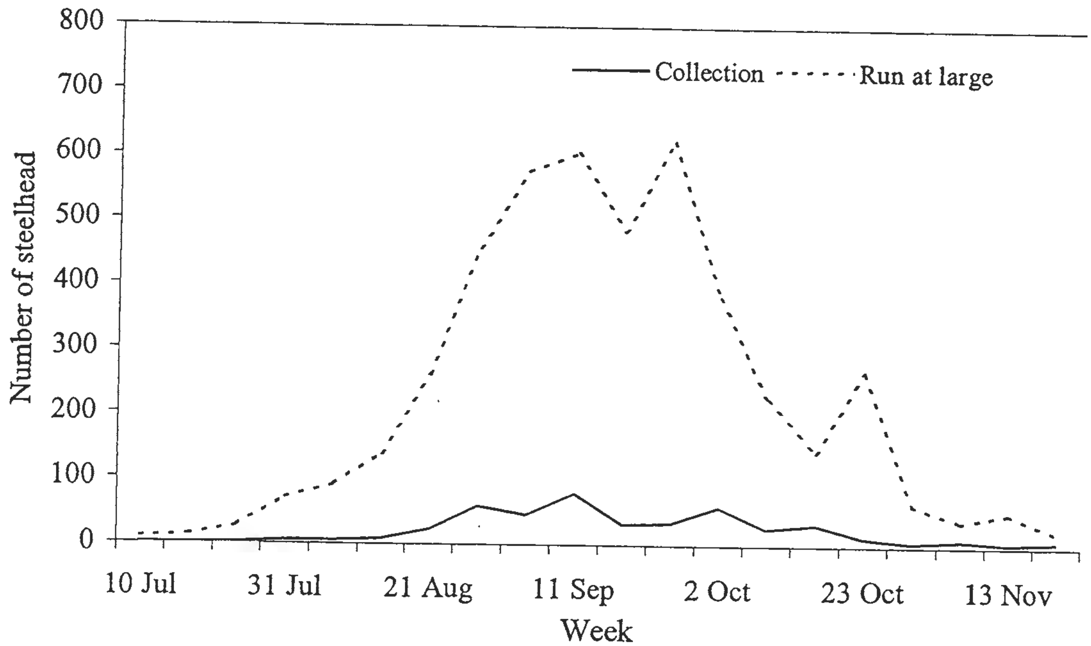

Figure 1. Collection of 2000 brood summer steelhead from Wells Dam.

Table 1. Sex and origin composition of the 2000 brood Wells steelhead broodstock.

Sex	Hatchery	Wild	Total
Male	158 (40.3%)	18 (4.5%)	176 (44.8%)
Female	190 (48.4%)	26 (6.6%)	216 (55.1%)
Total	348 (88.7%)	44 (11.2%)	392 (100%)

Table 2. Mean fork length (cm) by sex, age, and origin of 2000 brood Wells summer steelhead determined by scale analysis.

Origin	Mean fork length (cm) by age and origin								
	1.1	1.2	1.3	2.1	2.2	3.1	3.2	R.1	R.2
					Males				
Hatchery	63.4	77.6		63.0				62.5	81.0
(*N*, SD)	(108, 2.9)	(27, 5.0)		(1, --)				(4, 3.8)	(1, --)
Wild	59.5			63.0	81.3	66.0	60.0		
(*N*, SD)	(2, 2.1)			(9, 3.3)	(3, 0.58)	(2, 0)	(1, --)		
					Females				
Hatchery	61.3	73.8	81					61.5	70.5
(*N*, SD)	(85, 2.4)	(96, 3.5)	(1, --)					(2, 2.1)	(2, 4.9)
Wild	62.0	99.0		62.7	74.5	61.0	75.0		74.5
(*N*, SD)	(1, --)	(1, --)		(11, 2.6)	(7, 3.3)	(1, --)	(1, --)		(2, 2.1)

Table 3. Comparison of fresh water (1.X, 2.X) and salt water (X.1, X.2) ages of Wells Hatchery 1997 through 2000 summer steelhead broodstocks based on scale and otolith analysis.

Origin		Brood year			
		1997	1998	1999	2000
Hatchery	*N*	295	419	356	324
	1.X	99.3%	1	99.4%	99.6%
	2.X or more	0.67%	0.0%	0.56%	0.3%
Wild	*N*	21	11	25	39
	1.X	9.5%	36.3%	12.0%	10.2%
	2.X or more	90.4%	63.6%	88.0%	89.7%
Hatchery	*N*	313	435	372	333
	X.1	76.3%	46.2%	50.8%	61.5%
	X.2 or more	23.6%	53.7%	49.1%	38.4%
Wild	*N*	21	12	27	41
	X.1	52.3%	75.0%	37.0%	63.4%
	X.2 or more	47.6%	25.0%	62.9%	36.5%

SPAWNING

Spawning began at the hatchery on 15 December 1999 and was completed on 22 March 2000 (Table 4). Three male and eight female steelhead died prior to spawning (2.8%). Peak spawning occurred during the month of January 2000 ($N = 150$).

Spawn timing of the 2000 brood hatchery origin steelhead was significantly earlier when compared to wild steelhead within the broodstock ($P < 0.001$). The peak spawn months for hatchery and wild females were January (49%) and March (59%), respectively. A similar spawn timing disparity was observed in the 1999 brood (Snow 2002). Pituitary glands from previously spawned steelhead were emulsified and used as an intramuscular injection to accelerate the maturation of wild fish in order to increase the number of hatchery x wild genetic crosses. Pituitary injections were applied to all wild fish on 2 and 23 February 2000. These injections likely influenced spawn timing comparisons between the hatchery and wild fish (Figure 2).

Wild and hatchery broodstock were held together in a covered pond that provided minimal natural daylight. The fish were held in well water with an average temperature of 11.1°C. Columbia River water averaged 4.6°C between January and April 2000 when spawning occurred at the hatchery. The reduced natural light during the holding period should act to delay maturation, but warmer well water temperatures at the hatchery may have negated any effect.

Wells Hatchery spawned 158 males with 204 females. One female and an additional male steelhead were spawned but did not produce viable gametes. Wild male steelhead were used more than once as primary fertilizers to increase the total number of eggs produced from H x W crosses. The adjusted egg collection was 1,148,999 eggs. Mean (SD) fecundity of the 2000 brood females ($N = 60$) was 5,453 (1,551). The mean fecundity of 2-salt females ($N = 32$; 5,922) was significantly greater ($P < 0.05$) than the mean fecundity of 1-salt females ($N = 28$; 4,917). The male to female spawn ratio was 0.78:1. Spawning was completed on 22 March 2000 and the remaining steelhead (13 male and 1 female hatchery steelhead, and 1 male and 2 female wild steelhead) were returned to the Columbia River above Wells Dam. The female steelhead released did not appear to be maturing rapidly enough to be viable spawners within two weeks of the last spawn date, therefore all remaining steelhead were released.

All lethal spawned steelhead were kidney/spleen sampled for Infectious Hematopoietic and Pancreatic viruses. Ovarian fluid was also collected from 60 females for additional viral monitoring. No viral pathogens were detected in the 2000 brood.

Table 4. Spawning summary of 2000 brood Wells summer steelhead.

Date	Females spawned	Estimated number of eggs[a]		
		H x H	H x W	Total
15-Dec-99	4	21,600		21,600
22-Dec	7	37,800		37,800
29-Dec	7	2,700	10,800	13,500
05-Jan-00	17	91,800		91,800
12-Jan	28	145,800		145,800
19-Jan	21	113,400		113,400
26-Jan	17	37,800	54,000	91,800
02-Feb	17	70,200	16,200	86,400
09-Feb	15		81,000	81,000
16-Feb	19		102,600	102,600
23-Feb	11	54,000	5,400	59,400
01-Mar	17		91,800	91,800
08-Mar	9	43,200	5,400	48,600
15-Mar	8	37,800	5,400	43,200
22-Mar	7	21,600	16,200	37,800
Total	204	677,700	388,800	1,066,500

[a] Actual egg collection is calculated at the eyed stage.

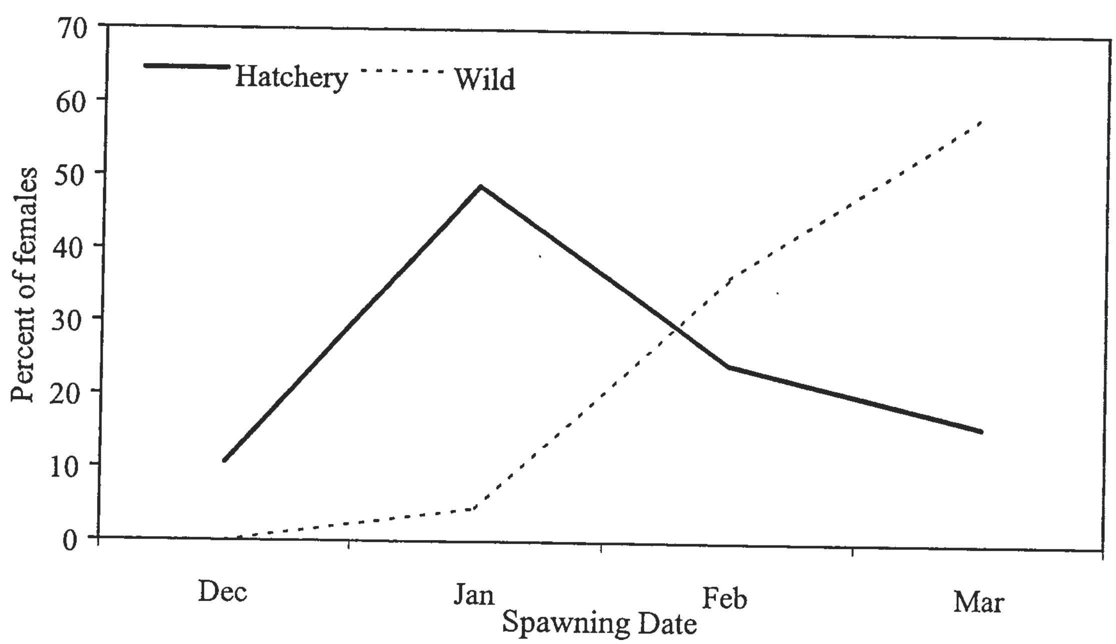

Figure 2. Percent of 2000 brood female steelhead spawned by origin and month.

JUVENILE REARING

Eggs were incubated on well water at a density of one female per tray. After the eggs reached the eyed stage those designated for other programs were transferred. The remaining eyed eggs were incubated at a density of 7,500 eggs per tray. Approximately 293,699 eyed eggs from the earliest H x H spawners were transferred to Lyons Ferry Hatchery between 10 and 20 April 2000. An additional 115,000 eggs from H x H spawners were transferred to the Winthrop National Fish Hatchery between 1 and 8 February 2000. The estimated unfertilized egg to fry survival was 83.6%.

Fry were moved from incubation trays to troughs inside the hatchery after blastopore closure. The juvenile steelhead were transferred to outside rearing ponds when they reached a mean weight of approximately 0.50 g per fish. The H x W and H x H fish were reared in outside raceways prior to tagging for 221 and 99 days, respectively.

The H x W juveniles experienced 22,001 mortalities during rearing at Wells Hatchery (6.1%). The H x H juveniles experienced 25,798 mortalities during rearing at Wells Hatchery (10.2%). Mortalities were primarily attributed to marking activities and juvenile transfers within the hatchery. No major fish health problems were encountered during the rearing of the H x W or H x H juveniles (Table 5).

Table 5. Fish health examinations conducted on the 2000 brood Wells steelhead during rearing at Wells Hatchery.

Date	Diagnosis	Recommendations/observations	
07 Apr 00	Healthy	No recommendation	Small fat deposits started.
11 May 00	Healthy	No recommendation	Gills and fins in good condition.
30 May 00	Healthy	No recommendation	Low level loss to air bladder fungus.
07 Jul 00	Healthy	No recommendation	Gills and fins in very good condition.
07 Aug 00	Healthy	No recommendation	Some dorsal fins nipped.
31 Jan 01	Healthy	No recommendation	Fat levels at 1+ to 2.
28 Feb 01	Healthy	No recommendation	Gills good, fat levels 1 to 1+.
27 Mar 01	OK	Fat levels at 1 to 1+, release as planned.	

Juvenile Marking

The 2000 brood steelhead were differently marked based on their parental origin. Progeny of H x W crosses were freeze-branded with an "F" in position 2 (rotated clockwise 90°) when they were approximately 20 FPP. Progeny of H x H crosses were adipose fin-clipped only. Juvenile steelhead were marked at different times depending on the type of mark they were given, and the size requirements for the mark (Table 6).

Table 6. Juvenile tagging summary of 2000 brood Wells Hatchery steelhead.

Genetic cross	Date(s)	Mark	*N*	Rate (%)	FPP
H x H	8/7 to 8/14/00	Ad-clip	217,725	100	90
H x W	11/7 to 11/27/00	RA-F-2 brand	350,100	92.2	20

Smolt Release

Organosomatic indexing (OSI) was conducted on both populations at Wells Hatchery prior to release (Table 7). The normality indices were 100% for the H x H fish and 90% for the H x W population, indicating that the sampled fish appeared healthy overall (Goede 1993; Goede and Barton 1990).

Table 7. Results of OSI sampling conducted on 2000 brood Wells Hatchery summer steelhead prior to release in 2001.

Program	*N*	Indices: Normality	Indices: Feeding	Male : female ratio	Hematocrit (%)	Leucocrit (%)	Plasma protein
H x H	20	100	100	1.5:1	47.8	1.14	6.93
H x W	20	90	100	0.42:1	48.3	0.68	6.94

In addition to OSI sampling, periodic smolt condition assessment and pre-release length and weight sampling was also preformed. At release, the 2000 brood had a mean fork length of 178.6 mm and 172.9 mm for the H x W and H x H groups, respectively (Table 8). No significant difference in pre-release fork lengths was observed between the two populations ($P > 0.05$). The H x W juvenile releases occurred between 16 April and 22 May 2001. The H x H releases occurred between 16 April and 9 May 2001 (Table 9). Fry to smolt survival for the 2000 brood juveniles was 89.2% and 90.5% for the H x W and H x H fish, respectively.

Table 8. Results of pre-release sampling conducted on the 2000 brood Wells summer steelhead.

Stock	Date	*N*	Fork length (CV)	Weight (SD)	Condition factor	FPP
H x H	4/2/2001	100	172.9 (12.9)	59.8 (21)	1.15	7.5
H x W	4/2/2001	100	178.6 (11.7)	66.8 (22)	1.17	6.7

Table 9. Wells Hatchery 2000 brood steelhead releases.

Stock	Mark	Release		
		N	Location	Date(s)
H x W	RA"F"-2 FBrand	109,950	Twisp River	4/16 to 5/22/01
H x W	RA"F"-2 FBrand	99,490	Chewuch River	4/16 to 5/22/01
H x W	RA"F"-2 FBrand	116,830	Methow River	4/16 to 5/22/01
Methow Basin total		*326,270*		
H x H	Ad-clip	82,415	Similkameen River	4/16 to 5/9/01
H x H	Ad-clip	112,605	Okanogan River	4/23 to 5/9/01
H x H	Ad-clip	13,800	Salmon Creek	4/18/01
H x H	Ad-clip	19,950	Omak Creek	4/30 to 5/1/01
Okanogan Basin total		*228,770*		
Grand total		*555,040*		

MONITORING AND EVALUATION

Smolt Condition Assessment

Smolt condition was assessed through visual external examination and assigning a numeric value to each sampled fish based on four different stages of development. Numeric values were designated for fish assessed as smolts = 1, transitional fish = 2, parr = 3, and residual fish = 4. The numeric values from sampled fish were averaged for each sample date to detect changes in smolt condition of the entire population over time. Each of the two earthen ponds were sampled eight times during the release period (Figures 3 and 4). Both earthen pond populations exhibited the strongest signs of smoltification on the 4 May sample date.

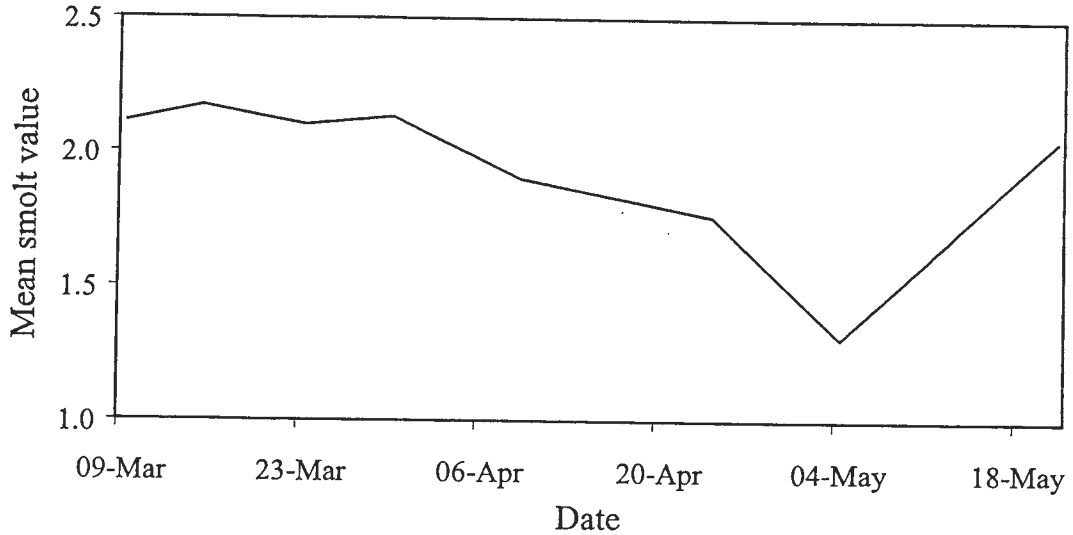

Figure 3. Mean smolt condition assessment value by date for the 2000 brood Wells Hatchery H x W summer steelhead.

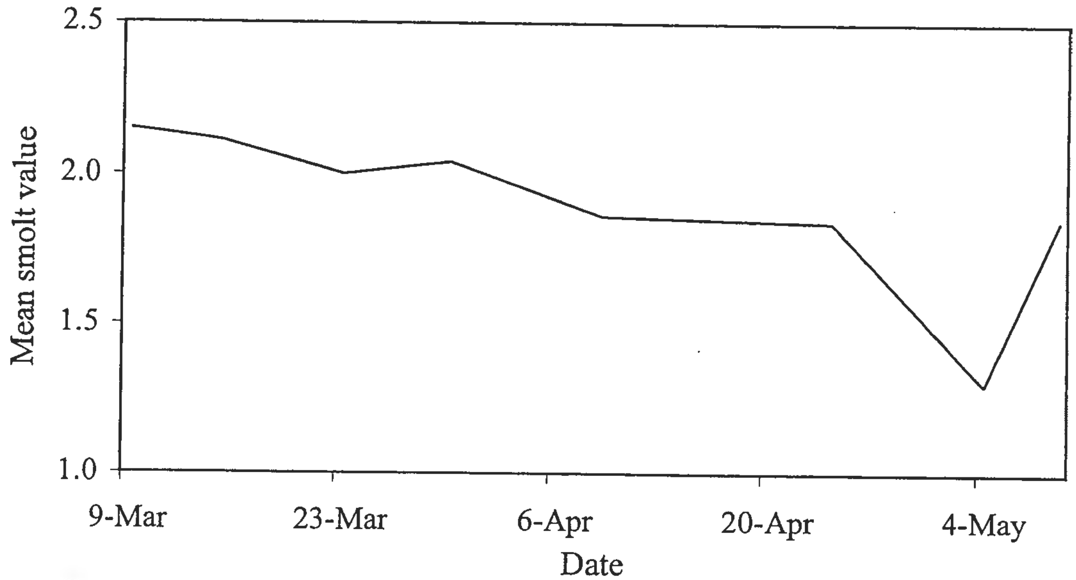

Figure 4. Mean smolt condition assessment value by date for the 2000 brood Wells Hatchery H x H summer steelhead.

Residualism

The number of potential non-migrant fish released from Wells Hatchery was estimated through visual assessment. After each holding pond was seined and all remaining fish were forced into the traps, samples were taken from the H x H ($N = 105$) and H x W fish ($N = 107$) to determine the percent of each population that appeared to be non-migrants (e.g., parr and residual fish). An estimated 3,432 H x H and 7,073 H x W non-migrants were released from the 2000 brood (Table 10).

Table 10. Estimation of non-migrant fish within forced releases and total populations.

Date	Stock	Forced release group		Entire population		
		N	Non-migrants (%)	Migrants (%)	Non-migrants (%)	
5/09/01	H x H	12,000	28.6	227,770 (98.5)	3,432	1.50
5/21/01	H x W	14,175	49.9	326,270 (97.9)	7,073	2.17

2000 BROOD SUMMARY

Pre-spawn survival of the 2000 brood was greater than the standard set in the spawning protocols. Fertilized egg to ponding survival (egg to fry) was below the Integrated Hatchery Operations Team standards set for egg to fry survival (IHOT 1995). Ponding to release survival (fry to smolt) of the H x W population was also below the set standard (Table 11).

The collection of 392 adult steelhead for the 2000 brood of Wells summer steelhead provided enough eggs for the hatchery to exceed the production goal of 480,000 smolts by approximately 75,040 fish (15.6%). The excess was due primarily to the low pre-spawn mortality rate of 2.8% and the low male to female ratio of 0.84:1 within the broodstock. Despite the production excess, the 2000 releases of steelhead smolts into the Upper Columbia Evolutionary Significant Unit (ESU) were below the ESU production cap of 1.16 million hatchery produced steelhead.

Table 11. Survival standard (%) and level achieved for the 2000 brood Wells Hatchery summer steelhead.

Stage	Standard	Survival achieved		
		Overall	H x W	H x H
Pre-spawn	95.0	97.2	- -	- -
Unfertilized egg to fry	90.0	83.6	- -	- -
Fry to smolt	90.0	89.7	89.2	90.5

RECOMMENDATIONS

The Wells Hatchery steelhead program attempts to maximize the inclusion of wild steelhead genes within the broodstock by maximizing the H x W crosses of the spawning adults. Maximizing the H x W crosses was difficult because of the small percentage of wild fish within the broodstock, and because hatchery fish mature earlier than wild fish within the hatchery environment. Wild fish are often injected with pituitary hormone to accelerate their maturity in order to facilitate H x W crosses. Ideally, spawning at the hatchery should mimic the timing of naturally spawning fish.

Wells steelhead are intended to supplement the number of steelhead returning to the Methow and Okanogan Rivers to assist in the recovery of this ESA listed species. It is important that hatchery produced fish be able to spawn successfully in the natural environment in order to realize the benefits of the supplementation effort. If the difference in maturation timing is present on the spawning grounds, it is worth questioning whether there is also a difference in viability between hatchery and wild origin steelhead when they are spawning naturally.

Reisenbichler and McIntyre (1977) found that when genetically different hatchery steelhead on the Deschutes River interbred with wild fish, fewer smolts were produced than could be produced from a pairing of two wild fish. This early finding is supported by more recent work from Kostow et. al. (2003) and McLean et. al. (2003) which both reported significant differences in the reproductive success of naturally spawning hatchery and wild steelhead. The reproductive success of Wells steelhead could be investigated within the controlled environment of the unused spawning channel at Wells Hatchery. The ability of Wells stock steelhead to contribute significantly to the production of wild fish (i.e., reproductive success) is a key tenet of the supplementation program, and a critical uncertainty. Investigating the reproductive ability of Wells steelhead may provide crucial information, and focus the hatchery program on more effective recovery efforts.

Adult steelhead are held in a covered building that reduces their exposure to natural light. This is intended to delay the spawn timing of the broodstock to more closely mimic the timing of naturally spawning steelhead. In addition, eggs from the earliest spawn days are transferred to other hatcheries in an attempt to avoid further spawn timing divergence from the continual propagation of early spawning fish. It is apparent that reduced exposure to the natural light cycle and early egg transfers have not been enough to significantly delay the spawn timing of the hatchery fish. Holding the steelhead in colder water, in addition to the reduced natural light may delay the maturity of the hatchery fish enough to avoid the use of pituitary hormone injections. Colder holding water temperatures have been shown to delay spawn timing in hatchery origin rainbow trout (Morrison and Smith 1986).

Wild fish typically represent less than 10% of the total steelhead collected for broodstock. This prevents the hatchery from pairing wild fish with other wild fish because the number of W x W crosses that could be achieved would be relatively small and consequently the number of H x H crosses would be much greater. It is unlikely that W x W crosses will become feasible at the hatchery until the proportion of wild fish within the broodstock increases substantially.

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PROGRESS REPORT FOR WELLS HATCHERY SUMMER STEELHEAD; 2001 BROOD YEAR

APPENDIX J

Annual Progress Report For Wells Hatchery Summer Steelhead

2001 Brood Year

Prepared for
Public Utility District No. 1 of Douglas County

By

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May 2004

Washington Department of Fish and Wildlife
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ABSTRACT

Trapping of upper Columbia River summer steelhead for Wells Hatchery broodstock began on 17 July and finished on 15 November 2000. Wells Hatchery collected 385 steelhead from the west ladder and 13 steelhead from the east ladder of Wells Dam. Wild adults represented 8.0 % of the broodstock collected. Eight female and four male steelhead died prior to spawning (3.0%). The hatchery spawned 161 male and 173 female steelhead between 20 December 2000 and 28 March 2001 to produce an estimated 987,634 eggs. Three additional females were spawned but the eggs were not viable. On 28 March 2001, the hatchery crew returned 39 hatchery and three wild male steelhead and four hatchery and three wild female steelhead to the Methow River at approximately 50 rkm. A total of 455,900 eyed eggs were transferred to other facilities, with an estimated 492,668 fertilized eggs retained at the hatchery for Wells programs.

Wells Hatchery released a total of 390,965 steelhead from the 2001 brood, representing 81.4% of the program release goal of 480,000 fish specified in the 2000 brood collection protocols. Of those fish, an estimated 264,110 H x W smolts were planted in the Methow River and its tributaries (94.3% of basin goal) and an estimated 126,855 H x H smolts in the Okanogan River and its tributaries (63.4% of the basin goal). All steelhead releases were accomplished between 29 April and 23 May 2002. The unfertilized egg to fry survival was 82.5% for the H x W progeny, and 84.5% for the H x H progeny. Fry to smolt survival was 95.9% and 94.3% for the H x W and H x H juveniles, respectively. Unfertilized egg to smolt survival was 79.3% for the Wells program steelhead.

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ACKNOWLEDGMENTS

This project was funded by the Public Utility District Number One of Douglas County, Washington. Their financial and technical assistance was much appreciated. The assistance of the Wells Hatchery crew, specifically Jerry Moore, Gary Osborne, Ace Trump, Stewart Mitchell, Dennis Schott, and Able Gonzales, was crucial to the data gathering effort necessary for this report. Heather Bartlett assisted with much of the sampling of the adult steelhead covered in this report. I thank John Sneva for providing the scale and age analysis, and Bob Rogers for his assistance with the fish health monitoring. Andrew Murdoch, Mike Tonseth, and Michael Humling provided constructive criticism of earlier drafts of this report.

INTRODUCTION

Hatchery production of summer steelhead in the Columbia River above Priest Rapids Dam was sporadic until the late 1960's, when Chelan and Wells hatcheries began operation. Wells and Chelan hatchery productions are part of the Wells Dam and Rocky Reach Dam mitigation agreements, respectively.

Collection of summer steelhead for hatchery production above Priest Rapids Dam occurred at both Priest Rapids and Wells Dams until 1982 (Mullen et al. 1992). The adult steelhead were held and spawned at Wells Hatchery and the progeny were released into the upper Columbia River and it's tributaries. Thereafter, Wells Dam became the primary collection site for adult steelhead used for hatchery production above Wells Dam. In August 1997, the National Marine Fisheries Service (NMFS) listed the populations in the Upper Columbia Summer Steelhead Evolutionary Significant Unit, to include all populations upstream from the mouth of the Yakima River, as endangered under provisions of the Endangered Species Act of 1973. Hatchery steelhead were included in the listing and deemed critical to the recovery effort. However, it was noted that a major threat to the genetic integrity of wild fish comes from past and present hatchery practices. This report covers all hatchery activities relating to the trapping, spawning, rearing, and release of the 2001 brood Wells summer steelhead.

BROODSTOCK COLLECTION

The adult collection goal for the 2001 brood of summer steelhead was 395 fish collected from the run at large migrating upstream of Wells Dam. Trapping of 2001 brood summer steelhead began on 17 July and finished on 15 November 2001. Peak collection occurred during the week of 7 September 2000 (Figure 1). The hatchery retained 398 fish during the collection period (100.7% of goal). An additional 81 hatchery and 32 wild steelhead were examined for marks and released above Wells Dam during the trapping period. Nine hatchery and four wild steelhead were retained for broodstock from the east ladder of Wells Dam. Thirty two fish retained for broodstock were wild origin fish (8.0%, Table 1). The adult steelhead were held in well water in a covered pond until spawning. Formalin treatments to control fungus began on 27 November 2000 and continued approximately every other day for 1 h at a concentration of 1:7,500 through 25 March 2001.

Scale and otolith samples were used to verify age and origin information from the broodstock. Two hundred seven of the 345 readable scales collected from the broodstock were 1-ocean fish (60.0%). An additional 138 steelhead were 2-ocean fish (40.0%). Hatchery origin steelhead were identified by an adipose fin-clip ($N = 269$), blank wire cheek tags ($N = 46$), or fin erosion indicative of hatchery rearing ($N = 8$). Of the adipose fin-clipped fish retained for broodstock, 30 were also cheek tagged; one had an orange-left elastomer tag; and one a green-left elastomer tag. Cheek tagged fish were part of an experiment to determine the relative survival of H x H and H x W steelhead. Elastomer tagged fish were strays from the Wenatchee steelhead program.

Male fish were typically greater in fork length than females of the same age, and the difference increased as ocean age increased (Table 2). None of the hatchery origin fish collected for broodstock spent more than one winter in fresh water. Greater than 90% of the natural origin steelhead in the broodstock spent more than one winter in fresh water (Table 3).

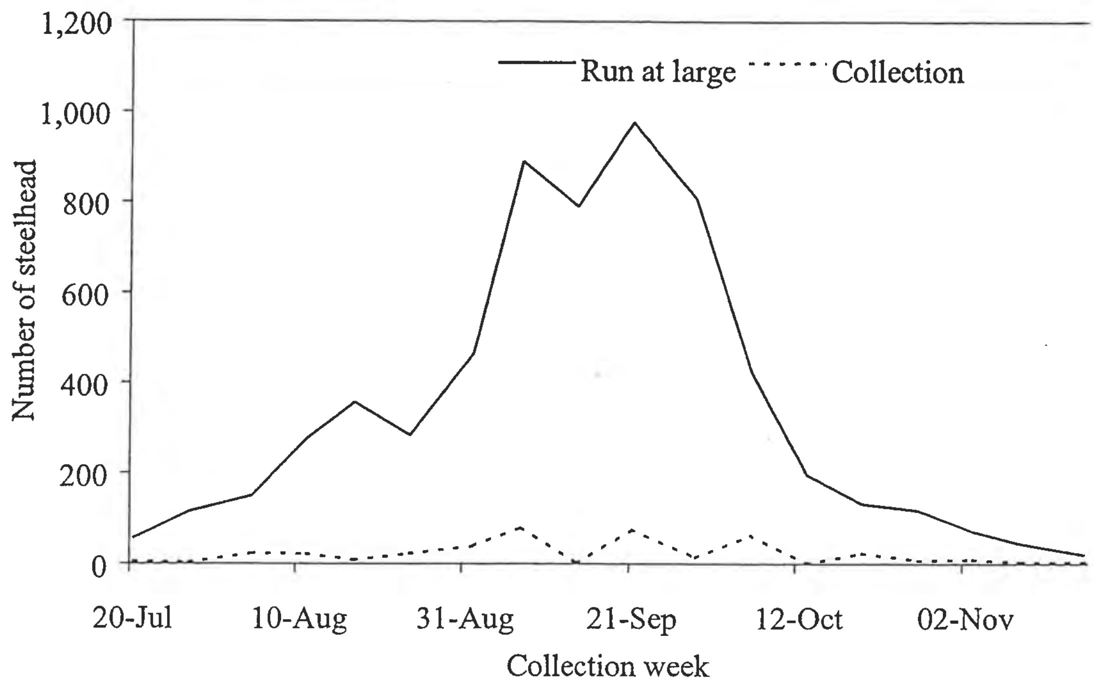

Figure 1. Collection of 2001 brood summer steelhead from Wells Dam.

Table 1. Sex and age composition of Wells Hatchery 2001 steelhead broodstock.

Sex	Hatchery	Wild	Total
Male	188 (47.2%)	19 (4.7%)	207 (52.1%)
Female	178 (44.7%)	13 (3.2%)	191 (47.9%)
Total	366 (91.9%)	32 (8.0%)	398 (100%)

Table 2. Mean fork length (cm) by sex, age, and origin of 2001 brood Wells summer steelhead determined by scale analysis.

Origin	Age 1.1	1.2	2.1	2.2
		Males		
Hatchery (*N*, SD)	61.3 (119, 3.3)	76.0 (27, 5.0)		
Wild (*N*, SD)	62.0 (1, --)		60.1 (13, 3.8)	82.5 (2, 4.9)
		Females		
Hatchery (*N*, SD)	60.3 (65, 2.5)	72.9 (105, 3.4)		
Wild (*N*, SD)			59.4 (7, 3.0)	73.0 (3, 2.5)

Table 3. Comparison of fresh water (1.X, 2.X) and salt water (X.1, X.2) ages of Wells Hatchery 1997 through 2001 summer steelhead broodstocks based on scale and otolith analysis.

Origin		Brood year 1997	1998	1999	2000	2001
Hatchery	*N*	295	419	356	324	319
	1.X	99.3%	100%	99.4%	99.6%	100%
	2.X or more	0.67%	0.0%	0.56%	0.3%	0.0%
Wild	*N*	21	11	25	39	26
	1.X	9.5%	36.3%	12.0%	10.2%	3.8%
	2.X or more	90.4%	63.6%	88.0%	89.7%	96.1%
Hatchery	*N*	313	435	372	333	322
	X.1	76.3%	46.2%	50.8%	61.5%	58.3%
	X.2 or more	23.6%	53.7%	49.1%	38.4%	41.6%
Wild	*N*	21	12	27	41	26
	X.1	52.3%	75.0%	37.0%	63.4%	80.7%
	X.2 or more	47.6%	25.0%	62.9%	36.5%	19.2%

SPAWNING

Spawning began at the hatchery on 20 December 2000 and was completed on 28 March 2001 (Table 4). Eight hatchery origin male steelhead, three hatchery origin female steelhead, and one wild female steelhead died prior to spawning (3.0%). Peak spawning occurred during the month of February 2001 ($N = 126$).

Spawn timing of the 2001 brood hatchery origin steelhead was significantly earlier when compared to wild steelhead within the broodstock ($P < 0.01$). A similar spawn timing disparity was observed in the 1999 and 2000 broods (Snow 2002, 2004). Due to the difference in spawn timing of the hatchery and wild components, pituitary glands from previously spawned steelhead were emulsified and used as an intramuscular injection to accelerate the maturation of wild fish. These injections are necessary to facilitate genetic crosses between hatchery and wild steelhead, and influence the spawn timing comparisons of the respective stocks (Figure 2). Pituitary injections were applied to all wild fish on 14 February 2001. On 14 March 2001, all wild fish and 15 hatchery females were given pituitary injections.

Wild and hatchery broodstock were held together in a covered pond that provided minimal natural daylight. The fish were held in well water with an average temperature of 11.1°C. Columbia River water averaged 6.1°C between January and April 2001 when spawning occurred at the hatchery. Since steelhead are spring spawners, reduced natural light during the holding period should delay their spawn timing, but the warmer well water at the hatchery may negate that effect.

Wells Hatchery spawned 161 male and 173 female steelhead. Three additional female steelhead were spawned, but did not produce viable eggs. Wild male steelhead were used more than once as primary fertilizers to increase the total number of eggs produced from H x W crosses. The adjusted egg collection was 987,634 eggs. The mean (SD) fecundity of the 2001 brood females ($N = 169$) was 5,639 (1,722). The mean fecundity of 2-salt females ($N = 97$; 6,627) was significantly greater ($P < 0.001$) than the mean fecundity of 1-salt females ($N = 71$; 4,315). The male to female spawn ratio was 0.9:1. On 28 March 2001, the hatchery crew returned 39 hatchery male, three wild male, four hatchery female, and three wild female steelhead to the Methow River between the towns of Twisp and Carlton.

Kidney and spleen samples were collected from all lethal spawned steelhead to detect Infectious Hematopoietic and Pancreatic viruses. Ovarian fluid was also collected from 60 females for additional viral monitoring. No viral pathogens were detected in the 2001 brood.

Table 4. Spawning summary of 2001 brood Wells summer steelhead.

Spawn date	Females spawned	Estimated number of eggs[a]		
		H x H	H x W	Total
20-Dec-00	8	50,500		50,508
27-Dec	10	32,200	21,400	53,610
03-Jan-01	4	26,500		26,504
10-Jan	12	53,800	20,100	73,912
17-Jan	20	72,400	35,400	107,820
24-Jan	20	10,734		110,754
31-Jan	8	54,300		54,308
07-Feb	10	46,700		46,710
14-Feb	25	64,800	67,200	132,025
21-Feb	18	67,600	36,600	104,218
28-Feb	13	31,800	45,000	76,813
07-Mar	8	24,900	11,600	36,508
14-Mar	4	21,500	2,550	24,054
21-Mar	10		51,700	51,710
28-Mar	6		38,550	38,556
Total	176	657,734	330,100	988,010

[a] Actual egg collection is calculated at the eyed stage.

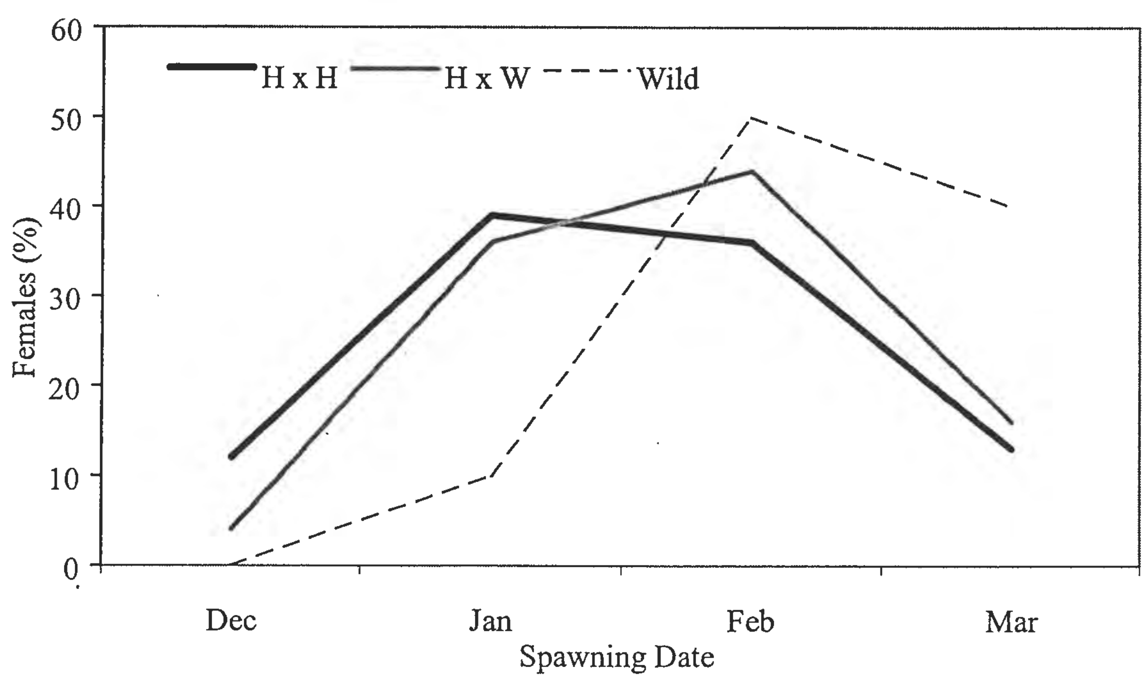

Figure 2. Percent of 2001 brood female steelhead spawned by origin and month.

JUVENILE REARING

Eggs were incubated on well water at a density of a single female per tray. After the eggs reached the eyed stage, eggs designated for other programs were transferred. The remaining eyed eggs were incubated at a density of 7,500 eggs per tray. Approximately 305,600 eyed eggs from the earliest H x H spawners were transferred to Klickitat Hatchery. An additional 150,300 eggs from H x H spawners were transferred to the Winthrop National Fish Hatchery. Estimated unfertilized egg to fry survival was 82.5% for the H x W progeny and 84.5% for the H x H progeny.

Fry were moved from incubation trays to troughs inside the hatchery after blastopore closure. The juvenile steelhead were transferred to outside rearing ponds when they reached a mean weight of approximately 0.50 g per fish. The H x W and H x H fish were reared in outside raceways prior to tagging for 212 and 122 days, respectively.

The H x W juveniles experienced 11,148 mortalities during rearing at Wells Hatchery (4.0%). The H x H juveniles experienced 7,655 mortalities during rearing at Wells Hatchery (5.7%). Mortalities were primarily attributed to marking activities and juvenile transfers within the hatchery. No major fish health problems were encountered during the rearing of the H x W or H x H juveniles (Table 5).

Table 5. Fish health examinations conducted on the 2001 brood Wells steelhead during rearing at Wells Hatchery.

Date	Diagnosis	Recommendations/observations	
27-Apr-01	Healthy	No recommendation	Gills good, no evidence of fungus.
20-Jun-01	Healthy	No recommendation	Fat levels at 1+.
30-Jul-01	Healthy	No recommendation	Fat levels at 1+.
29-Oct-01	Healthy	No recommendation	Some eroded caudals, gills good.
5-Dec-01	Healthy	No recommendation	Gills good, light Ich noted on skin.
27-Feb-02	Healthy	No recommendation	Gills good, fat levels at 1+.

Juvenile Marking

The 2001 brood steelhead were marked differently based on their parental origin. Hatchery x wild progeny were marked with yellow elastomer in the adipose tissue anterior to the left eye (LYE) when at approximately 20 FPP and were not adipose fin clipped. Progeny of H x H crosses were adipose fin-clipped only. Juvenile steelhead were marked at different times depending on the type of mark they were given, and the size requirements for the mark (Table 6).

Table 6. Juvenile tagging summary of 2001 brood Wells Hatchery steelhead.

Genetic cross	Dates	Mark	*N*	Rate (%)	FPP
H x H	9/7/01 to 9/10/01	Ad-clip	118,890	96.8	34
H x W	11/13/01 to 11/30/01	LYE	279,473	94.1	20

Smolt Release

Organosomatic indexing (OSI) was conducted on both populations at Wells Hatchery prior to release (Table 7). The normality indices were 95% for the H x H fish and 91% for the H x W population, indicating that the sampled fish appeared healthy overall (Goede 1993; Goede and Barton 1990).

Table 7. Results of OSI sampling conducted on 2001 brood Wells Hatchery summer steelhead prior to release in 2001 ($N = 20$ per sample).

Program	Indices		Male : Female	Hematocrit	Leucocrit	Plasma
	Normality	Feeding	ratio	(%)	(%)	protein
H x H	95	100	1.0:1.0	51.4	0.75	6.33
H x W	91	100	1.2:1.0	48.7	0.6	6.11

In addition to OSI sampling, periodic smolt condition assessment, and pre-release length and weight sampling was also preformed. At release, the 2001 brood had mean fork lengths of 181.8 mm and 194.7 mm for the H x W and H x H groups, respectively (Table 8). The H x H population had a significantly greater fork length at release than the H x W population ($P < 0.001$). The H x W and H x H juvenile releases occurred between 29 April and 23 May 2002 (Table 9). Fry to smolt survival for the 2001 brood juveniles was 95.9%, and 94.3% for the H x W and H x H fish, respectively.

Table 8. Results of pre-release sampling conducted on the 2001 brood Wells summer steelhead.

Stock	Date	*N*	Fork length (mm)	Weight	Condition factor	FPP	CV
H x H	4/10/2002	80	194.7	87.3	1.18	5.1	7.9
H x W	4/11/2002	100	181.8	72.9	1.21	6.2	14.8

Table 9. Wells Hatchery 2001 brood steelhead releases by location.

Stock	*N*	Location	Date(s)
H x W	84,475	Twisp River	4/29/02 to 5/23/02
H x W	85,615	Chewuch River	4/29/02 to 5/23/02
H x W	94,020	Methow River	4/29/02 to 5/23/02
H x W total	*264,110*		
H x H	58,090	Okanogan River	4/29/02 to 5/23/02
H x H	39,545	Similkameen River	5/02/02 to 5/16/02
H x H	20,520	Omak Creek	5/07/02 to 5/09/02
H x H	8,700	Salmon Creek	5/8/02
H x H total	*126,855*		
Grand total	*390,965*		

MONITORING AND EVALUATION

Smolt Condition Assessment

Smolt condition was assessed through visual external examination and assigning a numeric value to each sampled fish based on four different stages of development. Numeric values were designated for fish assessed as smolts = 1, transitional fish = 2, parr = 3, and residual fish = 4. The numeric values from sampled fish were averaged for each sample date to detect changes in smolt condition of the entire population over time. Each of the two earthen ponds were sampled seven times during the release period from Wells Hatchery (Figure 3). The H x W population exhibited the strongest signs of smoltification on 14 May 2002. The H x H population exhibited the strongest signs of smoltification on 21 May 2002.

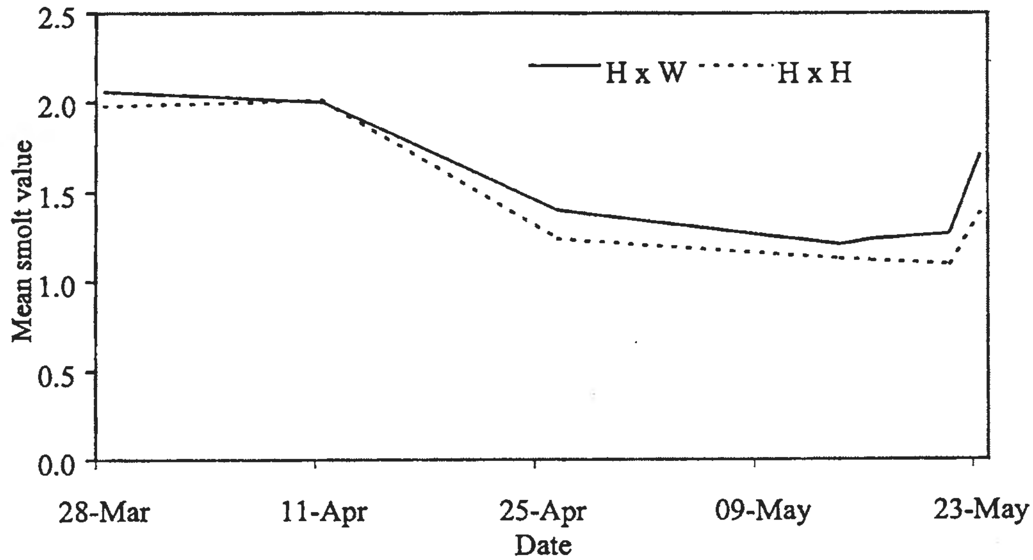

Figure 3. Mean smolt condition assessment value by date for the 2001 brood Wells Hatchery summer steelhead.

Residualism

The number of potential non-migrant fish released from Wells Hatchery was estimated through visual assessment after each holding pond was seined and all remaining fish were forced into the traps. Samples were taken from the H x H ($N = 212$) and H x W fish ($N = 400$) to determine the percent of each population that appeared to be non-migrants (e.g., parr and residual fish). An estimated 992 H x H and 4,909 H x W non-migrants were planted from the 2001 brood (Table 10).

Table 10. Estimation of non-migrant fish within forced releases and total populations.

Date	Stock	Forced release group		Entire population	
		N	Non-migrants (%)	Migrants (%)	Non-migrants (%)
5/23/02	H x H	12,400	8.0	126,855 (99.2)	992 (0.8)
5/23/02	H x W	17,850	27.5	264,110 (98.1)	4,909 (1.9)

2001 BROOD SUMMARY

Pre-spawn survival of the 2001 brood was greater than the standard set in the spawning protocols. Fertilized egg to ponding survival (i.e., egg to fry) of the H x W and H x H progeny was below the Integrated Hatchery Operations Team standards set for egg to fry survival (IHOT 1995). Ponding to release survival (fry to smolt) was above the set standard for both populations (Table 11).

Wells Hatchery did not meet release goals specified for the 2001 brood steelhead. The release of 390,965 smolts represented 81.4% of the release goal of 480,000 smolts specified in the 2000 collection protocol. The collection of 398 adult steelhead would likely have provided adequate gametes for program requirements if females had not been released ($N = 7$) and gamete transfers had not exceeded requirements by 130,317 eggs. The adult collection in 2000 represented an extraction rate of 5.95% of the steelhead returning to Wells Dam.

Table 11. Survival standard (%) and level achieved for the 2001 brood Wells Hatchery summer steelhead.

Stage	Standard	Survival achieved (%)		
		Overall	H x W	H x H
Pre-spawn	95	96.9	--	--
Unfertilized egg to fry	90	83.2	82.5	84.5
Fry to smolt	90	95.4	95.9	94.3

RECOMMENDATIONS

The Wells Hatchery steelhead program attempted to maximize the influence of wild steelhead genes within the broodstock by prioritizing H x W crosses of the spawning adults. Maximizing the mating of H x W fish is made difficult because of the small percentage of wild fish within the broodstock and because hatchery fish mature earlier than wild fish within the hatchery environment. Wild fish are often injected with pituitary hormone to accelerate their maturity in order to facilitate H x W crosses. Ideally, spawning of hatchery and wild fish at the hatchery should be similar and at best, mimic the timing of naturally spawning fish.

Wells steelhead are intended to supplement the number of steelhead returning to the Methow and Okanogan Rivers to assist in the recovery of this ESA listed species. It is important that hatchery produced fish be able to spawn successfully in the natural environment in order to realize the benefits of the supplementation effort. If the difference in maturation timing observed in the hatchery is present on the spawning grounds, it is worth investigating whether there is also a difference in reproductive success of hatchery and wild steelhead.

Reisenbichler and McIntyre (1977) found that when genetically different hatchery steelhead on the Deschutes River interbred with wild fish, fewer smolts were produced than could be produced from a pairing of two wild fish. This early finding is supported by more recent work from Kostow et. al. (2003) and McLean et. al. (2003) which both reported significant differences in the reproductive success of naturally spawning hatchery and wild steelhead. The reproductive success of Wells steelhead could be investigated within the controlled environment of the unused spawning channel at Wells Hatchery. The ability of Wells-stock steelhead to contribute significantly to the production of wild fish is a key tenet of the supplementation program, and a key uncertainty. Investigating the reproductive ability of Wells steelhead may provide crucial information, and focus the hatchery program on more effective recovery efforts.

The adult steelhead are held in a covered building that reduces their exposure to natural light. This is intended to delay the spawn timing of the broodstock to more closely mimic the timing of naturally spawning steelhead. In addition, eggs from the earliest spawn days are transferred to other hatcheries in an attempt to avoid further spawn timing divergence from the continual propagation of early spawning fish. It is apparent that reduced exposure to the natural light cycle and early egg transfers have not been enough to significantly delay the spawn timing of the hatchery fish. Holding the steelhead in colder water, in addition to the reduced natural light, may delay the maturity of the hatchery fish enough to avoid the use of pituitary hormone injections. Colder holding water temperatures have been shown to delay spawn timing in hatchery origin rainbow trout (Morrison and Smith 1986).

Wild fish typically represent less than 10% of the total steelhead collected for broodstock. This prevents the hatchery from pairing wild fish with wild fish because the number of W x W crosses that could be achieved would be relatively small, and consequently the number of H x H crosses would be much greater. It is unlikely that W x W crosses will become feasible at the hatchery until the proportion of wild fish within the broodstock increases substantially.

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METHOW RIVER BASIN STEELHEAD SPAWNING GROUND SURVEYS IN 2004

APPENDIX K

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October 26, 2004

To: Rick Klinge and Shane Bickford

From: Michael Humling and Charlie Snow

Subject: Methow River Basin Steelhead Spawning Ground Surveys in 2004.

The objective of conducting steelhead spawning ground surveys was to estimate spawning abundance and distribution within the Methow River Basin and monitor changes over time that result from the release of juvenile hatchery steelhead. The Methow River basin was divided into four geographic units; the upper Methow, lower Methow, Chewuch, and Twisp. Index areas were established within each unit based on known spawning activity and redd distribution information from surveys conducted between 2001 and 2003 (Table 1). Index areas were also established in smaller tributaries identified as important spawning areas (i.e., Beaver Creek, Lost River, Early Winters Creek).

The large number of low order tributaries in the Methow Basin cannot be surveyed annually without considerable cost. We utilized the Washington State Conservation Commission's Salmon, Steelhead and Bull Trout Habitat Limiting Factors Report for the Methow Basin (2000) to identify low order tributaries within each unit accessible to steelhead. Tributaries identified within each unit were grouped together and randomly assigned a survey year beginning in 2004 (Table 2). Streams identified for 2004 served as representative stream for the geographic unit and were surveyed weekly identical to index areas. A different tributary will serve as the representative stream each year according to these assignments (i.e., rotating panel). Spawner densities (redds/km) for each index tributary surveyed were used to estimate the number of redds in tributaries not surveyed that year based on length (km) of available spawning habitat. This rotating panel methodology is intended to provide redd estimates for smaller tributaries that may be important spawning areas, but have not been surveyed historically.

Surveys were conducted by foot or by raft on a weekly basis throughout the spawning season. Steelhead redds within the index areas were individually flagged with the date, redd number, and redd location recorded on each flag. Each redd location was also recorded with Global Positioning System (GPS) technology for subsequent mapping (Appendix 2). When spawning was perceived to be near completion within the index areas, surveys were then conducted on all reaches in the unit. We recorded the total number of visible redds within each unit, and expanded those redds observed outside the index areas by the visible: not visible ratio from index area counts. Expanded redd counts from outside the index areas were combined with total redd counts within the index areas to estimate the total redd count for each stream (Table 3).

Table 1. Summer steelhead survey reaches and index areas for the Methow River Basin.

Code	Reach (rkm)	Index area (rkm)
	Methow River	
M1	Confluence (0.0) – Twisp R. (64.0)	Gold Creek Br. (30.4) – Carlton Br. (43.5)
M2	Twisp R. (64.0) – Winthrop Br. (79.6)	NA
M3	Winthrop Br. (79.6) – Mazama Br. (104.6)	Weeman Br. (94.4) – Mazama Br. (104.6)
M4	Mazama Br. (104.6) – Ballard CG (123.2)	NA
	Twisp River	
T1	Confluence (0.0) – Buttermilk Br. (20.3)	Twisp Weir (12.8) – Buttermilk Br. (20.3)
T2	Buttermilk Br. (20.3) – Road End CG (42.2)	NA
	Chewuch River	
C1	Confluence (0.0) – Camp 4 Br. (32.6)	Boulder Creek (12.8) – 8 Mile Creek (16.0)
C2	Camp 4 Br. (32.6) – 30 Mile CG (48.0)	NA
	Beaver Creek	
BV1	Confluence (0.0) – Hwy 20 (3.2)	Hwy 153 (0.5) – Fish Screen (1.6)
BV2	Hwy 20 (3.2) – Lester Rd (10.7)	NA
	Lost River	
L1	Confluence (0.0) – Sunset Cr. (11.2)	Confluence (0.0) – Lost River Br. (0.8)
	Early Winters Creek	
E1	Confluence (0.0) – Klipchuch CG (7.2)	Confluence (0.0) – Diversion Dam (0.8)
	Suspension Creek	
Sus1	Confluence (0.0) – Fork (0.3)	Confluence (0.0) – Fork (0.3)
	Methow FH Outfall Creek	
MH1	Confluence (0.0) – Hatchery trap (0.25)	Confluence (0.0) – Hatchery trap (0.25)
	Winthrop NFH Outfall Creek	
WN1	Confluence (0.0) – Hatchery trap (0.5)	Confluence (0.0) – Hatchery trap (0.5)

CG = Campground

River conditions throughout the basin in 2004 impacted our ability to count steelhead redds. Discharge values were above average from the first week of March through the second week of May, with a significant increase in flow occurring the week of 10 April, when peak spawning typically occurs (Figure 1). High turbid water restricted surveyors' ability to safely wade or raft some reaches, and decreased redd-life and visibility.

Table 2. Methow River basin rotating panel tributary creeks and survey year designations.

Reach code	Tributary	Survey year	Survey length (rkm)
	Lower Methow River Unit		
BC1	Black Canyon Creek	2004	1.1
GD1	Gold Creek	2005	8.3
FR1	French Creek	2006	0.2
LI1	Libby Creek	2007	3.5
	Upper Methow River Unit		
LBO1	Little Boulder Creek	2004	0.2
W1	Wolf Creek	2005	4.8
GT1	Goat Creek	2006	2.1
HA1	Hancock Creek[a]	-	0.2
	Chewuch River Unit		
AN1	Andrews Creek	2004	0.5
BD1	Boulder Creek	2005	1.9
LK1	Lake Creek	2006	9.4
TW1	Twenty mile Creek	2007	1.3
	Twisp River Unit		
EA1	Eagle Creek	2004	0.5
WR1	War Creek	2005	1.2
BM1	Buttermilk Creek	2006	3.8
SO1	South Creek	2007	1.4

[a]Access denied by landowner, Little Boulder Creek will be sampled again in 2007.

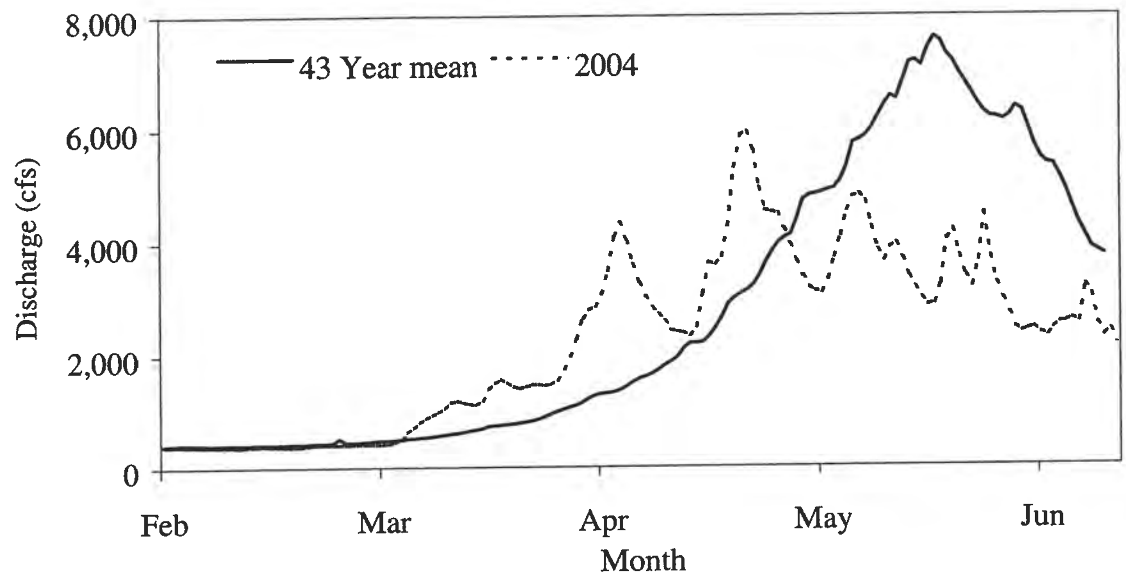

Figure 1. The 43-year mean and 2004 discharge (cfs) at USGS monitoring station #12449950 (Methow River near Pateros, Washington).

An estimated total 1,031 steelhead redds were identified throughout all surveyed reaches in the Methow Basin in 2004. Spawning steelhead were first observed in the Methow basin during the week of 7 March 2004. Peak redd counts occurred during the third week of April for all index sections. Spawning activity was observed at water temperatures ranging between 2.2 and 10.5 °C, with peak spawning occurring at water temperatures between 4.4 and 7.2 °C. Mainstem spawning areas including the Twisp, Methow, and Chewuch rivers accounted for 62.2% ($N = 641$) of the steelhead redds within the basin. Tributary spawning areas including Lost River, Early Winters Creek, Beaver Creek, and the expanded rotating panel creeks accounted for 37.8% ($N = 390$) of the steelhead redds within the basin (Tables 3 - 4). The upper Methow River unit had the greatest number of redds overall with 49.3% ($N = 509$) of the basin total. The Twisp River and lower Methow River units accounted for 24.8% ($N = 256$) and 18.2% ($N = 188$) of the basin total, respectively. The Chewuch unit accounted for only 7.5% of the basin redd counts in 2004 ($N = 78$).

The greatest concentration of spawning in the upper Methow River unit occurred in the 9km downstream of Weeman Bridge (rkm 94 to 85), where 53.7% of mainstem spawning occurred ($N = 93$). Spawning within the upper Methow River index reach (Weeman Bridge to Mazama Bridge) accounted for 11.5% of mainstem spawning in 2004 ($N = 20$) and 7.0% of mainstem spawning in 2003. Tributary spawning areas including Lost River ($N = 31$), Early Winters Creek ($N = 24$), Suspension Creek ($N = 40$), and the outfalls at Methow ($N = 18$) and Winthrop ($N = 113$) hatcheries accounted for 44.4% of the redds in the upper Methow unit. Rotating panel creeks accounted for 21.6% of the redds ($N = 110$) located in the upper Methow River unit. The high spawner density in the rotating panel index creek resulted in high numbers of expanded redds in non-surveyed creeks.

Steelhead spawning was dispersed throughout the Chewuch River unit. Spawning proportions in each reach ranged from 3.8% to 29.4% of the 78 redds counted. Mainstem spawning accounted for 94.8% of the Chewuch basin redds ($N = 74$), of which a total of five redds (6.7%) were counted in the index reach (Eightmile Creek to Boulder Creek). Redd counts in the index reach in 2003 ($N = 134$) were 47.1% of the mainstem redd counts, indicating a change in spawning distribution from 2003 to 2004. Tributary spawning (Eightmile Creek) accounted for 5.1% ($N = 4$) of the redds in the Chewuch unit. No redds were counted in rotating-panel creeks in the Chewuch unit.

Steelhead spawning was dispersed throughout the surveyed reaches in the Twisp River, with a total of 243 redds counted in the mainstem in 2004 (94.9%). The Twisp River was the most heavily utilized mainstem spawning area, containing 37.9% of all redds counted in Methow River basin mainstem spawning areas. Tributary spawning accounted for an additional 13 redds (5.0%) in the Twisp Basin. The index reach (Buttermilk bridge to Twisp weir) accounted for 38.2% ($N = 93$) of the mainstem redds in 2004. Index area redds were 47.1% and 46.2% of the mainstem totals in 2001 and 2003, respectively. No redds were counted in rotating-panel creeks in 2004, but redds were found in Little Bridge Creek ($N = 11$) and the Methow Salmon Recovery Foundation pond outlet channel ($N = 2$).

Spawning was dispersed throughout the surveyed reaches in the lower Methow River unit. A total of 151 redds were counted in the mainstem Methow River (80.3% of unit total), with an additional 37 redds counted in unit tributaries (19.6%). The highest proportion of mainstem redds ($N = 42$; 28.1%) were counted in the lowest reach between the lower Burma Road Bridge and the confluence with the Columbia River (Rkm 20.9 to 0.0). Spawning within the index reach (Carlton Bridge to Gold Creek Bridge) accounted for 21.8% ($N = 33$) of the mainstem redds in 2004, and 15.1% of mainstem redd counts in 2003. Tributary spawning was documented only in Beaver Creek with a total of 37 redds counted. Spawning activity was first observed in the lower Methow River during the week of 7 March. Spawning was observed in Beaver Creek (lower Methow tributary) during the week of 14 March. No redds were counted in lower Methow River unit rotating-panel creeks in 2004.

Surveys accounted for a total of 1,031 redds within the Methow Basin. The Fish Passage Center (www.fpc.org) reports a total of 9,963 steelhead over Wells Dam in 2003 (2004 brood). Approximately 1,034 steelhead were removed from the spawning population during an open fishery in 2003-2004 (K. Truscott, WDFW pers. comm.). Based on the male to female ratio of the Wells Hatchery broodstock for hatchery (1.13:1) and wild fish (1.15:1), redd counts in 2004 represent 2,979 steelhead, and 33.3% of the estimated spawning escapement above Wells Dam of 8,929 fish.

Length of accessible stream may not be the most accurate abiotic variable to use in estimating the number of redds within a stream. In the Wenatchee Basin, it has been suggested that water temperature severely restricts spawning to the lower 13 km of the Chiwawa River (50 km available). Methodologies for estimated the number of redds for tributaries in rotating panel will be refined after all tributaries have been surveyed at least once. The abiotic variable that best describes the extent of steelhead spawning (i.e., water temperature, gradient) can be used to recalculate historical redd estimates.

Table 3. Summer steelhead index area redd counts by survey week in 2004 (ns = not surveyed).

Survey reach	Index surveys by week												Index total	Reach total	Expanded total
	1 to 29 Mar	5 Apr	12 Apr	19 Apr	26 Apr	3 May	10 May	17 May	24 May	31 May	7 Jun	14 Jun			
							Lower Methow River								
LM1	1	1	ns	6	0	ns	12	12	4	ns	ns	ns	36	45	113
LM2	ns	ns	ns	ns	ns	ns	ns	ns	6	ns	ns	ns	NA	6	38
BC1	ns	0	ns	ns	0	ns	0	ns	ns	0	ns	ns	0	0	0
BV1	5	7	2	1	ns	3	ns	2	1	ns	ns	ns	21	21	21
BV2	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	16	NA	16	16
Total	6	8	2	7	0	3	12	14	11	0	0	16	57	88	188
							Upper Methow River								
UM1	0	3	0	1	2	0	5	0	0	2	6	0	19	28	113
UM2	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	10	ns	NA	10	60
L1	ns	0	0	ns	1	0	ns	2	0	ns	0	ns	3		31
EW1	ns	0	0	0	1	0	ns	0	0	ns	0	ns	1		24
LBO1	0	1	2	ns	0	ns	ns	0	0	ns	0	ns	3	3	110
SUSP1	1	7	ns	18	4	0	7	1	2	ns	0	ns	NA	40	40
MSFH1	2	3	4	ns	1	ns	4	4	ns	ns	ns	ns	NA	18	18
WNFH1[a]	33	29	ns	27	ns	ns	ns	ns	ns	ns	ns	ns	NA	113	113
Total	36	43	6	46	9	0	16	7	2	2	16	0	26	212	509
							Chewuch River								
C1	ns	1	ns	2	ns	ns	1	0	1	ns	ns	ns	5	17	37
C2	ns	ns	ns	ns	ns	ns	ns	ns	ns	13	ns	ns	NA	13	37
AN1	ns	ns	ns	0	ns	ns	ns	ns	ns	0	ns	ns	0	0	0
EM1	3	0	0	0	1	ns	0	0	ns	ns	ns	ns	NA	4	4
Total	3	1	0	2	1	0	1	0	1	13	0	0	5	34	78
							Twisp River								
T1	2	7	0	17	47	0	13	0	0	10	0	0	96	96	120
T2	ns	ns	ns	ns	ns	ns	ns	ns	ns	57	ns	ns	NA	57	123
EA1	ns	ns	ns	0	0	ns	ns	ns	ns	ns	ns	ns	0	0	0
LBC1	0	0	ns	4	ns	ns	7	ns	ns	ns	ns	ns	NA	11	11
MSRF1	ns	1	ns	1	ns	ns	ns	ns	ns	ns	ns	ns	NA	2	2
Total	2	8	0	22	47	0	20	0	0	67	0	0	96	166	256
							Methow River Basin								
Total	47	60	8	77	57	3	49	21	14	82	16	16	184	500	1,031

[a] Data courtesy of Chris Pasley-USFWS.

Table 4. Rotating panel tributary stream redd counts in 2004.

Stream	Code	Index Year	Expansion type	Redds	
				Counted	Expanded
			Lower Methow River Unit		
Black Canyon	BC1	2004	Total count	0	0
Gold	GD1	2005	Density (redds/rkm)	ns	0
French	FR1	2006	Density (redds/rkm)	ns	0
Libby	LI1	2007	Density (redds/rkm)	ns	0
Total				0	0
			Upper Methow River Unit		
Little Boulder	LBO1	2004	Total count	3	3
Wolf	W1	2005	Density (redds/rkm)	ns	72
Goat	GT1	2006	Density (redds/rkm)	ns	32
Hancock[a]	HA1	2007	Density (redds/rkm)	ns	3
Total				3	110
			Chewuch River Unit		
Andrews	AN1	2004	Total count	0	0
Boulder[b]	BD1	2005	Total count	0	0
Lake[b]	LK1	2006	Total count	0	0
Twentymile	TW1	2007	Density (redds/rkm)	ns	0
Total				0	0
			Twisp River Unit		
Eagle	EA1	2004	Total count	0	0
War	WR1	2005	Density (redds/rkm)	ns	0
Buttermilk	BM1	2006	Density (redds/rkm)	ns	0
South	SO1	2007	Density (redds/rkm)	ns	0
Total				0	0

[a]Access denied by landowner.
[b]Tributaries surveyed to verify results of expansions.
ns - not surveyed.

Steelhead carcasses were recovered in the Twisp River ($N = 1$) and Methow River ($N = 1$), but carcass recoveries were not significant enough to make inferences about the respective spawning populations in those rivers. All carcasses recovered were observed to be of hatchery origin either exhibiting an adipose fin-clip (Methow River), or yellow elastomer in adipose tissue behind the left eye (Twisp River).

While our survey methodology will continue to evolve to encompass a greater number of tributaries and refine the rotating panel methodology, we are able to make the following observations based upon results since 2001 when initial surveys were conducted.

1) Spawning ground surveys within the Methow Basin can effectively estimate spatial and temporal distribution of spawning steelhead in most years. Our rotating panel methodology for surveying smaller tributaries will be examined to determine the appropriate abiotic variable for delineating steelhead spawning habitat.

2) The accuracy of redd counts in the lower Methow River (M1, M2) may increase by expanding the index area redd counts from peak spawning instead of post spawning. This may provide a more reliable estimation in reaches that are prone to the rapid fluctuations in water volume, velocity, and clarity that affect redd life.

3) Steelhead spawning distribution suggests that the Twisp River is the most heavily utilized tributary in the Methow River Basin. We were unable to determine from redd counts whether the high utilization of the Twisp River was due to more favorable surveying conditions, higher survival of hatchery releases, or recruitment of hatchery-origin spawners released as smolts in other locations. The 2003 and 2004 smolt releases in the Methow Basin were differentially marked based upon parental origin, with the only adipose-present releases occurring in the Twisp River. In future surveys, we will attempt to differentiate the spawning adults based on release location (e.g., ad-clipped or ad-present) to determine whether adults from other tributaries are a significant proportion of the spawning population in the Twisp River.

4) The extent to which hatchery steelhead disperse into areas where supplementation has not occurred is difficult to estimate without differential marking of hatchery-origin fish. Beaver Creek has not been supplemented with steelhead smolts, but has exhibited high relative recruitment of adult spawners in section BV1 in 2002 (70 redds), 2003 (15 redds), and 2004 (21 redds). The majority of creeks we surveyed had little or no spawning activity, but the rotating panel methodology will assist us in identifying important spawning tributaries within the Methow River basin.

cc: Andrew Murdoch
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Jennifer Molesworth
Kirk Truscott
Robert Jateff
John Jorgensen
Joe Foster
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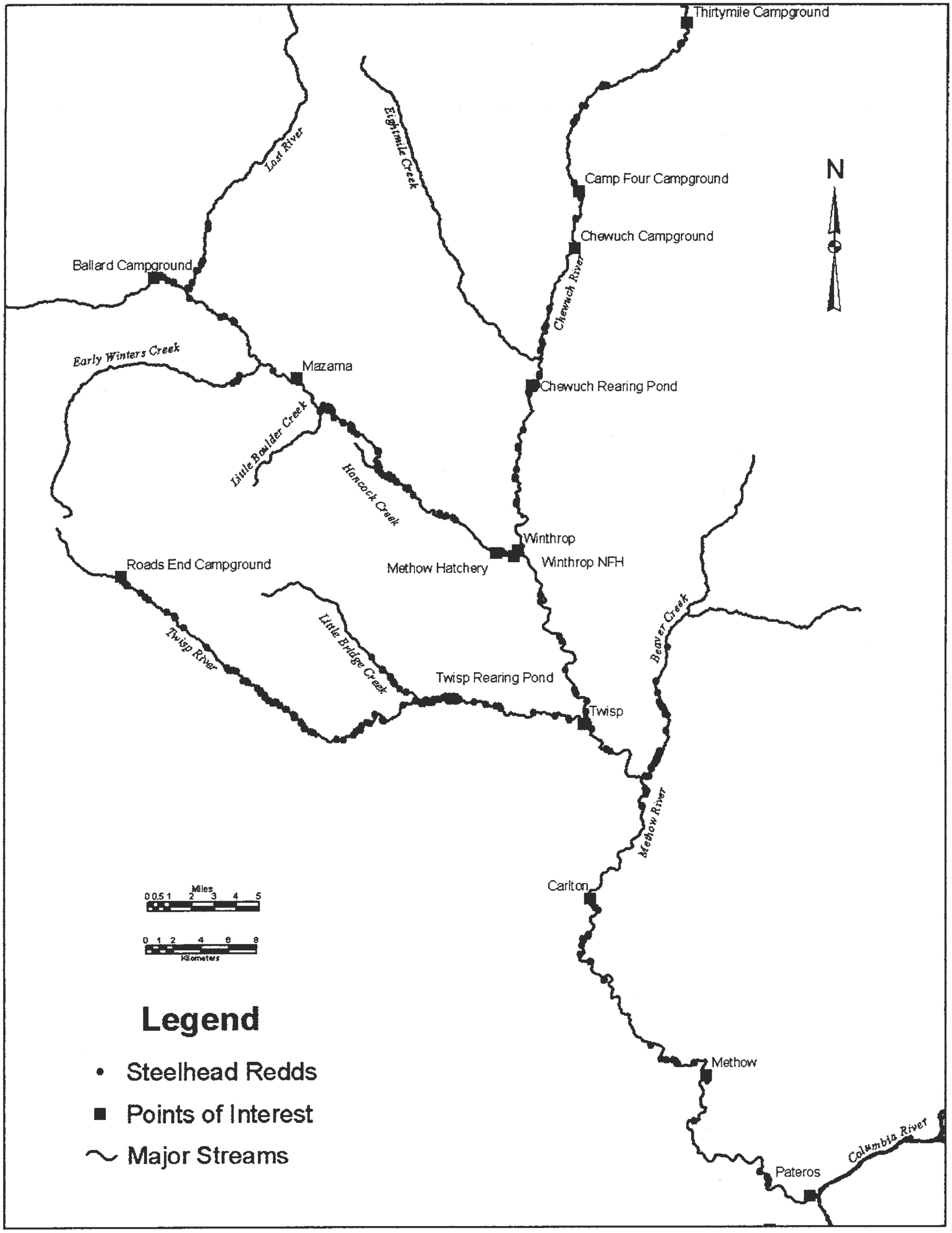
Rod Woodin

Appendix 1. Steelhead spawning surveys in the Methow River basin, 2001-2003. Redd counts are based on total observations (2001; 2002), and expanded values from comprehensive index area counts (2003-2004).

Reach/river	2001	2002	2003	2004
		Lower Methow River		
M1	--	--	227	113
M2	--	--	89	38
BV1	--	70	15	37
Gold Creek	--	--	2	0
Rotating panel tributaries	--	--	--	0
Subtotal	--	70	333	188
		Upper Methow River		
M3	--	156	389	195
M4	--	--	230	60
Lost River	--	11	5	31
WNFH Spring Creek	21	171	61	113
Rotating panel tributaries	--	--	--	110
Subtotal	21	338	685	509
		Twisp River Basin		
T1	147	350	514	133
T2	42	--	182	123
Rotating panel tributaries	--	--	--	0
Subtotal	189	350	696	256
		Chewuch River Basin		
C1	--	105	247	37
C2	--	--	37	37
Eightmile Creek	--	5	20	4
Rotating panel tributaries	--	--	--	0
Subtotal	--	115	305	78
Methow Basin Total	210	873	2,019	1,031

Appendix 2. 2004 Methow Basin steelhead redd GPS locations.



MINUTES OF THE
WELLS COORDINATING COMMITTEE
FOR 2004

APPENDIX L

WELLS COORDINATING COMMITTEE MEETING SUMMARY

February 2, 2004

Agreements Reached:

1.

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I. GENERAL MID-COLUMBIA ISSUES

A. Transition from the Mid-Columbia to the HCP Process

Graves updated the committee on progress associated with the transition from the Mid-Columbia Process to the HCP Process for Chelan and Douglas PUD's. He said that Douglas and Chelan PUD's submitted license amendment applications to FERC in early November for Wells, Rocky Reach, and Rock Island Dams. Interventions and protests were filed by the Yakama Nation, Columbia River Intertribal Fisheries Commission, and American Rivers. Chelan, and Douglas PUD's filed responses to the interventions and protests in late January. NOAA Fisheries will be introducing the HCP to FERC on February 11, 2004. There will be 10 minutes given to NOAA to introduce the HCP and 10 minutes given to the Interveners to present their position. The parties to the HCP will be asking that FERC approve the HCP by March 1, 2004 which would effectively replace the Mid-Columbia Agreement for Rock Island and Rocky Reach Dams with the Rock Island and Rocky Reach HCP processes and replace the Wells Settlement Agreement with the Wells HCP process.

II. WELLS DAM

A. Chewuch Trap

Bickford reviewed progress on plans for development of a broodstock collection facility on the Chewuch River which would, when developed, replace the ladder trap at Fulton Dam. Donahue distributed drawings developed for the proposed trap. He discussed the design features of the proposed facility. He described the provisions incorporated into the design that would allow the angle or height of the weir to be adjusted. Donahue explained the position the primary landowner has taken concerning the extent of facilities to be constructed on the site. They would like to make the facilities as unobtrusive as possible. Bickford pointed out the difference between the provisions for raising and lowering the weir for the proposed Chewuch River trap compared to the Twisp River trap weir.0

Woodin asked what would keep the river flow from scouring under the beam at the proposed Chewuch River trap. Donahue said the site is basically a shallow pool with the hydraulic control downstream at a bend in the river. This would actually back water onto the weir. Bickford said sandbags would be used along the upstream side of the beam which should help prevent scour. Nordlund asked about river profiles at the trap site and Donahue said he would send those to Nordlund when he returned to his office.

Woodin asked about trapping during higher flows. Bickford said the Chewuch River generally peaks at 6000 cfs. They anticipate the trap would not be fishing for about 10 days around the peak flows. They expect they wouldn't miss many fish by lowering the weir when flows reach 4000 cfs and then returning the weir to fishing position on the declining flows. Marco asked when a decision would have to be made to install the facility in 2004. Bickford said the property leases, etc would not be completed before June at the earliest. If it is necessary to go through a condemnation proceeding, this would take about 18 months. He said there are seven property owners associated with the access and trap/weir location.

Woodin asked what species were being trapped in British Columbia using this system. Bickford said this system is used for enumerating the migration of sockeye in a number of locations using basically the same concept. In other locations they have trapped coho and chinook.

Woodin suggested adding a hypalon or similar membrane erosion skirt to help avoid scour. Bickford said some of the LGL drawings include an erosion skirt and maybe that needs to be reconsidered.

Woodin questioned the location of the trap box along the shoreline. Given the Twisp River results this would dictate a trap box location along the bank. Bickford said conditions at the Chewuch site would basically result in peak velocities through the trap box location along the gabions. The box location may need to be adjusted as experience is gained.

Graves asked what Douglas needs from the Committee, at this time. Bickford said preliminary approval could be helpful in property/access negotiations but they would be going back and considering comments and discussion from today's meeting. Nordlund asked if the weir would be removed after the trapping season or left on the bottom. Bickford said they envision removing the weir panels, trap box, and abutment panels on an annual basis. The beams and anchor system would remain in place.

Nordlund asked Bickford if he would characterize the British Columbia sites as similar river sites to the Chewuch site. Bickford described the British Columbia locations he had observed. One site that passes thousands of sockeye is more similar to the Wenatchee River in width (300 + feet wide). The system is removed annually and has been successfully used for five or six years. The Chewuch site was rated very favorably by LGL personnel.

Bickford said they would finalize the design and bring the matter to the Committee at the next Wells Committee meeting for approval.

B. Twisp River Trap

Bickford reviewed the process Douglas PUD is going through to obtain approval to install the Twisp Facility modifications. He said if the necessary permits are not received within the next two weeks, construction would be delayed until fall since the spring construction window is about February 15 to April 1. Nordlund asked Bickford to list him as a contact since that would let the habitat biologists with NOAA Fisheries, know he has reviewed the drawings. A point was raised concerning why a 404 Permit was required. Bickford said it was their hope that a 404 Permit wouldn't be required but they have been informed that the Permit is necessary.

C. Wells Bypass Operations

Klinge reviewed the operating plan previously distributed to the Committee. The 2004 plan is basically identical to the 2003 plan. Graves said he felt the plan worked in 2003 and he is not opposed to using the same operating plan in 2004. Marco asked if this was a continuous operation. Klinge said the bypass operates continuously once it is turned on. A point of time is identified, for record keeping purposes, when the spring migration ends and the summer migration begins. Woodin asked if any maintenance has been necessary on the baffles. Klinge said they are all out now by requirement, but they will all be in place by April 1.

Woodin asked about ladder maintenance at Wells this year. Klinge said the west ladder should be watered by the end of next week (February 13). The east ladder would then be de-watered for routine inspection. No unusual maintenance is anticipated.

Klinge reminded the Committee that there are two draft documents out for review. These are: Methow Basin Spring Chinook Natural Production Study Report for 2001, and Methow Basin Spring Chinook Natural Production Study Report for 2002. Both of these reports were prepared by the Yakama Nation Fisheries Resource Management Program under contract with Douglas PUD. Klinge acknowledged the comments already received.

Klinge also reminded the Committee of the March 18 meeting of the Wells Committee at Vancouver, B.C. for a demonstration by the Canadians of the Okanagan Flow Management model. The meeting announcement was distributed to the Committee to the Committee in November 2003.

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The next meeting of the Wells Coordinating Committee will be March 18, 2004 in Vancouver, B.C.

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Mike Erho	The Committee	mike.erho@verizon.net

WELLS COORDINATING COMMITTEE MEETING SUMMARY
March 31, 2004

Agreements Reached:
1. The Committee approved the proposed 2004 Wells Juvenile Bypass Operating Plan.
2. The Committee approved the current design for the Chewuch River broodstock collection facility minus the provision for chain-link fencing.

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I. GENERAL MID-COLUMBIA ISSUES

A. Transition from the Mid-Columbia to the HCP Process

Seaman reported on progress toward the transition from the Mid-Columbia Process to the HCP Process. Bickford stated that the only issue delaying FERC action on the HCP's is the completion of the FWS' biological opinion and incidental take statements for bull trout. He said the third week in May or first week in June could see the FERC send out license amendments for the three mid-Columbia projects covered by HCP Agreements. Should the bull trout consultation take more than two weeks to complete, then FERC approval of the HCP's could be delayed into early summer.

Lewis asked how coordination for the Grant PUD projects might be carried out since there are no HCP Agreements for Priest Rapids or Wanapum Dams. Hammond responded by saying that he didn't know how the coordination would take place but there were several possibilities. Graves said one option might be for the HCP Coordinating Committee and the Mid-Columbia Coordinating Committee to meet on the same day with one meeting following the other. This would appear to be one issue that will need to be addressed as the HCP Process comes on line.

B. Steelhead Broodstock Protocol

Woodin raised an issue concerning the 2003 brood steelhead egg take. He reported that do to a higher proportion of males in the broodstock collected in 2003, the egg take would end up approximately 100,000 eggs short. He said they are giving consideration to opening up the entrance channel to the Wells Hatchery for additional broodstock collection right away to make up for some of the shortage. Praye said about 40 female steelhead would be required to make up the shortfall. Woodin asked if the Committee had any concerns regarding the additional broodstock collection. There were no objections voiced by the Committee.

C. Future Coordinating Committee Meetings

The Committee discussed the possibility of a May 2004 Mid-Columbia tour and meeting. There was no decision made as to when the meeting and tour would take place. Hammond said Grant PUD would need a meeting of the Mid-Columbia Coordinating Committee in late June to discuss the results of the 2004 evaluation and consider whether or not to proceed with construction of a bypass. June 29 was suggested as the date for that meeting. Bickford said Douglas PUD wished to reschedule the meeting with the Canadians on the Okanagan Flow

Management Project which was originally scheduled for March 18 and subsequently cancelled due to meeting conflicts. The Canadian parties suggested June 2 or 3 for a meeting and expressed a willingness to travel to the Seattle area for the meeting. The Committee agreed to set June 3, 2004 as the date for a meeting with the Canadian parties.

II. WELLS DAM

A. Wells Juvenile Bypass Operating Plan for 2004

Bickford reviewed previous discussion concerning the 2004 Wells Juvenile Bypass Operating Plan. He reported that the proposed 2004 plan would be the same as the 2003 plan which had previously received Committee approval and which had functioned successfully. The proposed 2004 Operating Plan was discussed at the February 2, 2004 Wells Coordinating Committee. He said the Wells Settlement Agreement requires Committee approval and that is what is needed today. The Committee approved the proposed 2004 Wells Juvenile Bypass Operating Plan.

B. Chewuch River Broodstock Trap Design

Bickford reviewed the previous discussions concerning the design of a proposed Chewuch River broodstock collection facility which would represent a new effort to improve spring chinook broodstock collection in the Chewuch Basin. At the February 2, 2004 Wells Coordinating Committee meeting a location and design for the new collection facility was discussed. Woodin had raised questions regarding possible undermining of the weir under certain water conditions. Fish Pro revised the plans to address Woodin's concerns and the revised drawings were distributed to the Committee on 3/17/04. Bickford said that Douglas PUD had budgeted for construction and the necessary property acquisitions and leases had been secured. What is needed, at this point, is formal Committee approval. Nordlund expressed reservations concerning the addition of chain link fencing in the revised plans. He said he was concerned about the possibility of the fencing lifting off the bottom in places allowing fish to enter and become trapped under the fencing. There was discussion concerning the possibility of constructing a concrete sill across the river at the proposed trap site. There would be some benefits in terms of long-term operations but Bickford pointed out the prevailing sentiment among the property owners involved was to make the facility removable on an annual basis with no permanent structures in the streambed. Bickford said they would have to start over again in the property acquisition process to permit a permanent structure in the river. This would likely delay the whole process beyond 2005. Following this discussion, the Committee approved the revised design of the Chewuch River broodstock collection facility as long as the provision for chain link fencing was removed.

C. Twisp River Broodstock Collection Trap Modifications

Bickford said that all the necessary permits for modification of the Twisp River Trap have not been received. It is unlikely that the permits will be received in time for the work to be done prior to the beginning of the 2004 spring chinook broodstock collection period. He said the trap would be operated in the same configuration as used in 2003 which proved to be quite successful. Bickford said they hoped to receive the necessary permits in time for the modifications to be completed in time for the 2005 trapping season.

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The next meeting of the Wells Coordinating Committee will be June 3, 2004 in the Seattle or Sea/Tac area.

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WELLS COORDINATING COMMITTEE
MEETING SUMMARY
May 4, 2004

Agreements Reached
1. The Committee approved the CRITFC request to sample adult sockeye from the left bank ladder at Wells Dam in 2004.

I. JOINT ITEMS

A. 1196 Permit Status

Clubb asked Petersen for an update on the status of the 1146 Permit. Petersen said NOAA Fisheries and Washington Department of Fisheries and Wildlife had talked yesterday and now have a better understanding of concerns but she doesn't have a good handle on when the Permit might be complete. In response to Clubb's question, Petersen said it was her opinion that the old 1196 Permit is no longer valid. She said one scenario is that the WDF&W would sign the Permit and then petition for modification. Clubb stressed the need to know if there is 1196 Permit coverage for the work they are involved in for spring chinook in the Methow Basin.

Scribner asked if there is a concern over the number of hatchery fish in the broodstock. Scribner also asked Petersen if there is an issue with NOAA Fisheries on hatchery fish in the broodstock. Petersen said NOAA feels it is important to have wild fish in the broodstock on an annual basis. Bartlett said WDF&W has attempted to balance the mitigation broodstock needs with conservation goals. Bartlett went on to say WDF&W is prepared to sign the 1196 Permit but they want some assurance that in certain years they would be able to deviate from the black and white provisions included in the 1196 Permit language. It was pointed out that the 1196 Permit is to cover a 10-year period and while the Permit language might not be a problem under present run conditions, there might be problems experienced should future Chiwawa runs only contain 100 wild fish. During smaller return years, WDF&W would hope to be able to adjust the broodstock protocol appropriately. Murdoch suggested submitting a simplified version of the Permit provisions to NOAA that would deal with year to year nuances as necessary through annual broodstock protocols.

B. 2004 Run Forecast Discussion

Scribner asked for clarification on non-ESA listed spring chinook in the run. Truscott said there could be a small component of 5-year old 100% Carson stock fish returning to the WNFH. He said WDF&W would not avoid collection of 5-year old fish because of the small number of Carson stock fish that might be present.

Peven asked Bartlett for clarification on when the Chiwawa program would be modified (referring to Paragraph 1 on page 3 of the Run Forecast). Scribner said that if there is an HCP provision that reduces Wenatchee Basin spring chinook production, this would be a problem for his constituents. Petersen explained the NOAA Fisheries position concerning the relationship between Chelan PUD spring chinook production and Lake Wenatchee sockeye production. Cates explained that the proposed actions have not been formalized, at this point, since the HCP Hatchery Committee is operating on an ad hoc basis and there are a number of factors that will have to be considered before the matter is finalized.

Bickford proposed a wording change on page four of the run forecast document that would reduce the target for broodstock collection of Methow spring chinook from a number sufficient to produce 513,000 smolts to 349,000 smolts if the Wells HCP is approved. Bickford said if the HCP is approved before eggs are collected, then either adults, eggs, or fry would need to be returned to the river in order to ensure that the program does not exceed the 349,000 Wells HCP smolt production target. Should the HCP be approved after eggs are collected then Douglas PUD would go ahead and rear those fish., Douglas PUD would go ahead and rear those fish. Petersen asked Bickford if the sockeye production improvements had been documented. Bickford said that the Wells Coordinating Committee had previously agreed to pursue Okanagan sockeye mitigation through flow management improvements and had eliminated the spring chinook substitution from future mitigation alternatives for sockeye. Should the flow management program fail to meet mitigation goals then other sockeye mitigation opportunities, as identified in the "Sockeye Enhancement Decision Tree" would be pursued. Douglas PUD agreed to rear additional spring chinook, in lieu of sockeye, during the three year flow management evaluation. That provision ends with the collection of eggs from the 2003 broodyear (smolts to be released in 2005). Bickford reviewed the current spring chinook production program at Methow Hatchery and changes upcoming when the HCP agreements are approved.

There was discussion concerning when adult broodstock could be returned to the river if excess fish were collected. It is understood that after fish are inoculated there would be a waiting period before they could be returned to the river and that may be close to the time of spawning. Clubb said he feels it would be more reasonable to target an egg take of 349,000 which would include Douglas PUD's obligation under either the Settlement Agreement or the Wells HCP and Chelan's Methow spring chinook obligations under their HCP. Petersen said she agreed with Clubb's position. Bartlett said it is WDF&W's desire to keep the production level at the Methow Hatchery at 550,000. Bickford said that Douglas PUD understands that WDF&W would like to maximize production out of the Methow Facility and that is why Douglas PUD has been talking to Grant PUD about possibly picking up the difference between the 550,000 and 349,000 production levels. Hammond clarified Grant PUD's position regarding their participation in the Methow Hatchery spring chinook program. He said they are waiting for the Bi-Op before they can commit to their participation in the Methow program. Bickford pointed out that in order to accommodate the higher number (550,000 smolts) at Methow Hatchery the following conditions would have to be met: 1) approval of the Wells HCP, 2) the Grant PUD Bi-Op, 3) agreement between Douglas and Grant PUD's concerning Grant's participation in the Methow program, and 4) approval of the HCP Hatchery Committee.

Petersen announced that the Grant PUD Bi-Op has been signed which clears the way for Grant and Douglas to discuss an agreement which would permit Grant to use Methow Hatchery capacity to meet Grant mitigation obligations. Bickford pointed out that the Wells HCP Hatchery Committee would have to approve that agreement. Scribner said it is important to consider the "big picture" before agreeing to a long-term arrangement.

Petersen said that given what Hammond had said, it is important for the co-managers to meet early-on to set management goals. Following that, Hammond said the Hatchery sub-committee under the Bi-Op should be activated and consider that matter. A meeting of co-managers was set for 9 AM on 5/13/04 discuss future mitigation goals in the Methow and Wenatchee Basins as they relate to Grant PUD's BiOp obligations.

Bickford called attention to changes to paragraph 1 on page 6 of the Escapement and Broodstock Forecasts concerning the use of Foghorn Trap in 2004 and deleting the reference to Chewuch Dam trapping. Also, Twisp weir and Fulton Dam trap will be available for use in 2004. He pointed out that the new Chewuch Trap will hopefully be available in 2005. If it is available then the Fulton Dam trap would be abandoned during future brood collection years.

C. Broodstock Protocol Document Discussion

Scribner asked how many years the Twisp River spring chinook captive brood fish have been released. Murdoch replied, about five years. There hasn't been an evaluation of survival other than survival in the hatchery. Bickford stated that Aqua Seed has done a good job of keeping fish alive but the problem is how to incorporate captive brood fish into the production program. Scribner questioned why we are continuing down the captive brood path if we aren't getting anything out of it. Maybe a standard supplementation program would be better. Bartlett said discussions are taking place considering the captive program. Scribner said he would like to see empirical data upon which to make a decision on the efficacy of the captive program.

A question was raised concerning different fecundity shown for Methow Basin and Wenatchee Basin spring chinook. No explanation was offered.

Scribner asked for clarification on what would happen if Chewuch River spring chinook broodstock collection falls short of the target number. Murdoch said they would increase hatchery outfall collection. Scribner asked if it would be possible to use Winthrop Hatchery outfall trapped fish for the Chewuch program if that is the only way to meet Chewuch program goals. The expectation of the Committee is that it is unlikely that it would be necessary to use Winthrop Hatchery outfall trapped fish to meet Methow Hatchery broodstock needs. Possible Five-year old Carson stock fish returning to the Winthrop Hatchery would complicate the potential use of Winthrop Hatchery outfall trapped fish for the Methow Hatchery program.

It was pointed out that the Twisp River captive brood program will cease after the few 5-year old females are spawned in 2004 using milt from anadromous males.

There was discussion of study fish needs for Grant PUD survival studies. Bickford said that fish, either yearling chinook or steelhead, for survival studies are reared separately from production fish at the Wells Hatchery. Peven pointed out that a Chelan PUD survival study, using steelhead in 2006, is dependent upon the results of a 2005 survival study. Hammond asked Bickford if 120,000 yearling chinook for survival studies are not being reared at Wells Hatchery. could steelhead for both Chelan PUD and Grant PUD survival studies be reared at Wells Hatchery at the same time. Bickford replied that they probably could not because of the difference in size between steelhead and yearling chinook. Peven said fish for the Chelan studies could be moved to Turtle Rock under those circumstances. The Committee was informed that there will be a need for 270,000 yearling steelhead survival study fish in 2006 which would require broodstock collection in 2004.

Scribner raised a question regarding what he perceived as the possible development of a wild broodstock program in the Twisp Basin. Bartlett said this is being considered as a feasibility study at this time. Murdoch said the Twisp presents possibly the only opportunity for a wild steelhead program in the Methow Basin. This may be important in the possible re-start of the

Wells steelhead program to incorporate a higher proportion of wild fish into the Wells Hatchery broodstock.

Chelan PUD Programs

Seaman said there needs to be clarifying language to signify the appropriate committees in the Broodstock Protocol document since the HCP's haven't, as yet, been approved.

Murdoch said they tried to incorporate in season assessment of how broodstock collection is going. Nothing in the proposed protocol changes from the 2003 broodstock protocol except, later on, it provides for adjustment based on run timing and numbers. The intent is to always meet broodstock goals, as long as the fish are there, and not be constrained by the protocol itself. Contingencies are built in to meet this intent. The broodstock protocol is intended to be implemented over a five year period consistent with the Monitoring and Evaluation Plan.

Scribner referred to table 4 on page 11 of the broodstock protocol document and asked if there was a contingency for collection of steelhead broodstock in the spring. Murdoch said that could be a viable contingency but there are complications, they have found, in terms of spawn timing and the fact that there is a high proportion of males in the fish collected in the spring. A question was raised regarding attraction to the Chiwawa trap. Peven said they have been meeting on this issue and they think they have located a replacement pump. Murdoch said they would have the flexibility to operate 24 hours per day, seven days per week to make up for a period when the trap was out of use due to high flows, etc. There was discussion concerning why the Chiwawa program has operated at less than 100% of the agreed on program. Peven pointed out that there is a potential for collecting the target number of broodstock but numbers of fish and the constraints of the 1196 Permit limited the numbers collected over the past several years.

Concerning the White River program on page 14, Hammond suggested deleting the last two sentences which refer to captive brood spawning, incubation, and rearing to pre-smolts.

Petersen suggested that it would be helpful to add run-timing graphs for all decision making flow charts. Murdoch said that he would do that.

Hammond said the Grant PUD programs need to be added to the broodstock protocol document.

D. Sockeye Sampling at Wells Dam

Klinge distributed a letter from the Columbia River Intertribal Fisheries Commission concerning bio-sampling of sockeye adults at Wells Dam. This is a continuation of previous work carried out by CRITFC. Klinge said Douglas PUD would again like to have formal Committee approval of that request. The Committee approved the CRITFC's request to sample adult sockeye from the left bank ladder at Wells Dam in 2004.

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The Committee was reminded of the Wells Committee meeting scheduled for June 3, 2004 at Sea/Tac when the results of the Okanagan Flow Management Study will be presented.

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WELLS COORDINATING COMMITTEE
CANADIAN OKANAGAN BASIN TECHNICAL WORK GROUP
JOINT MEETING SUMMARY
JUNE 3, 2004

I. Welcome and Introductions

Rick Klinge welcomed the group and gave a brief review of the background of the joint Wells Coordinating Committee and Canadian Okanagan Basin Technical Working Group effort to develop the Okanagan Fish and Water Management (OFWM) process. He said this is the fourth year of the effort. September 2005 will be the time when a decision will be made as to whether or not this process represents a viable mitigation measure to meet Douglas County PUD's sockeye mitigation responsibilities.

Elmer Fast reviewed the history of this joint effort and covered the coordination that has taken place in arriving at the place we are at today. He acknowledged the extensive efforts put in by Kim Hyatt in development of a tool that not only will be extremely beneficial to the fishery and water management of the Okanagan Basin but represents a unique approach that may be applied to other water basins in North America and other parts of the world.

Kim Hyatt acknowledged the cooperative nature of the effort and highlighted Douglas PUD's foresight in providing funding for the process that has developed. He pointed out the contributions of the various "team members" who were instrumental in development of the model.

Hyatt said the presentation of the status of the OFWM would be done in three parts. Brian Symonds will cover the historical aspects of the fish and flow management in the Okanagan Basin. Hyatt will cover the science that has gone into the development of the tool that resulted from this effort. Clint Alexander will cover the "tool" itself and explain the function of the model.

II. Historical Aspects of Okanagan Basin Fish and Flow Management

Symonds described the features of the Okanagan Lake Regulatory System (OLRS). He said the drainage area is 6090 square kilometers and the surface area of the lake 341 square kilometers. Average flow is 14.7 cms with flow concentrated in the months of April, May, and June. Symonds said the lack of real-time data has impacted the results of water management decisions on natural resources. Marco asked if Vaseaux and Skaha Lakes represent possible buffers for the effects of Okanagan Lake outflows on the sockeye production area. Symonds said Vaseaux Lake is just a widening of the river and is only used for day to day tweaking of flows. Skaha Lake has limited use as a possible buffer. Symonds said that the OLRS rules were developed based on average conditions. General operating rules, when followed during various variabilities of inflows, resulted in losses to fisheries resources. Symonds went on to list some of the operating challenges associated with the managing the OLRS. These are listed below:

1. Variability of freshet inflow volumes
2. Uncertainty of inflow volume forecasts
3. Limited river channel capacity relative to instantaneous lake and river inflows
4. Limited discharge capacity at the dams
5. Water temperature variability and impact on different life stages
6. Uncertainty regarding incremental impacts of changes in flow and lake levels on fish populations during various life stages
7. Need to accommodate competing economic, environmental, and social demands

Peven asked if there was any way the model could be used for reducing summer water temperatures. Symonds said there is some limited ability to advance or delay discharges. However, there is little that can be done in dry years.

Woodin asked about forecasting capabilities. Symonds reviewed the methodology used to forecast runoff. He said knowing how fish developing is coming along is extremely helpful in being able to regulate flows to minimize negative impacts to fisheries resources.

III. Origins and Objectives of the FWMT Project-Kim Hyatt

Hyatt pointed out the fact that there are competing interest in developing the FWM process. The Federal government interest in sockeye and the Provincial interest in kokanee was used as an example. Hyatt noted that Okanagan sockeye represent a stock near the southern boundary of its range. Hyatt reviewed the extremely complex nature of the regulatory processes that govern fish and water management. Hyatt said the principal objective of the FWMT is to facilitate water management decisions that are more "fish-friendly" while avoiding significant increases in property losses associated with water supply variations.

Hyatt reviewed the GlenFir report on potential measures to meet Okanagan sockeye mitigation obligations. In 2000 the OBTWG recommended to Douglas PUD that the flow management option be pursued as that was the preferred option of that group. In 2001-02 the FWMT proposal to Douglas PUD suggested 10-15% average annual gain for sockeye production is feasible. A team was assembled and sub-models were designed and reviewed by front line fish and water managers. In 2002-03 bio-physical models were coded and coupled as functional prototype of a FWMT decision system. The system was tested with single year historical data and critiqued by fish and water managers. In 2003-04 the FWMT system design was extended, refined, and tested with single-year data sets in real time. A 25-year retrospective analysis of the model was then conducted.

Hyatt discussed the components of the FWMT model including the geographic scope, FWMT components, and the temporal scope and reviewed the primary team members responsible for imputing the various components. The geographic scope includes Lake Okanagan, Okanagan River at Penticton, Okanagan River at Oliver, and Lake Osoyoos. Hyatt graphed the relationship of the various components in development of the model and the highlighted the FWMT biological data required. He said Lake Okanagan kokanee are an important indicator of FWMT performance (the kokanee sub-model). The model focuses on spawn timing, spawner depth distribution, and lake level.

Hyatt went on to describe the Water Management Rules that were included in the development of the model. Rule three calls for efforts to minimize draw-down of Okanagan Lake between times of peak spawning and date of 100% fry emergence. Rule four calls for minimizing the number of buildings flooded at Penticton and specifically not to exceed 75

cms in the Okanagan River at Penticton. Rule five calls for providing summer flows for recreation and, if possible, maintains flows of 10-20 cms in August and September if OBA and other water demands are satisfied.

Hyatt said Okanagan sockeye are a keystone indicator of FWMT decision system performance. He referred to historical declines in Okanagan sockeye stocks as indicated by Columbia River sockeye salmon catch and Wells Dam sockeye passage. He said, on average, sockeye are 10-times less abundant than Okanagan kokanee. Hyatt said the sockeye sub-model requires annual information on: 1) migration and spawn timing which is controlled by temperature, 2) spawner distribution which is controlled by fish abundance, 3) Available spawning area which is controlled by flow, and 4) Total egg deposition. Hyatt said that time to egg hatch and fry emergence determine the interval sockeye are at risk to production losses from desiccation or scour in a given year. The FWMT sockeye sub-model applies drought and desiccation or flood scour functional relationships to annual egg and alevin estimates by specific vulnerable intervals by sub-habitat types to produce annual estimates of production.

Hyatt reviewed Water Management "Rules" 6, 7, 8, and 9 from the OBWM Agreement. Rule six calls for flows of 8.5 to 12.7 cms for adult migration from August 1 to September 15. Rule seven calls for flows of 9.9 to 15.6 cms from September 16 to October 31 for adult spawning. Rule eight calls for flows of 5 to 28.3 cms from November 1 to February 15 for egg and alevin incubation, and Rule nine covers fry emergence and migration. Hyatt discussed the FWMT and density dependant rearing limitations in Lake Osoyoos. He said that sockeye growth decreases as fry numbers increase. In the absence of severe water temperature and oxygen constraints, rearing capacity is defined by Lake Osoyoos trophic status, particularly phosphorous concentrations. He said that there are rearing limitations in Lake Osoyoos caused by a temperature/oxygen "squeeze in the summer with temperatures in excess of 17 degrees C. and oxygen levels under 4 ppm. He said they have proposed a "Rule" ten which would call for, under drought conditions and an early onset of the water temperature/oxygen "squeeze", cumulative flow at or above 1.1 cubic meters in August and September, to avoid induction of high density independent mortality processes for rearing fry. This raises the question of water for adult returns or to benefit rearing fry facing a temperature/oxygen squeeze. Hyatt said they need information to verify fry losses to a temperature/oxygen squeeze.

In reviewing his presentation, Hyatt said the FWMT System is a coupled set of biophysical models of key relationships (among climate, water, fish, and property) used to predict consequences of water management decisions. The FWMT may be used to explore water management decisions in a prospective-mode going forward or in a retrospective mode looking back on historic water supply, climate, and fish years.

IV. Structure and Functional Properties of the FWMT Decision System - Clint Alexander

Alexander described several key concepts used in development and use of the FWMT. These included: 1) Use of best information for decision data, 2) Mixed time step including weekly forecasts and daily information for actual conditions, 3) Five locations for data collection including Okanagan Lake, Penticton, Okanagan Falls, McIntyre Dam, and Oliver, B.C. and 4) Inflow uncertainty handled as best guess, low, and high forecasts. Woodin asked if the model counts mortality from desiccation and losses from scour. Hyatt said the model doesn't allow fish to be "killed" more than once. Alexander said the FWMT

can be demonstrated on-line in season. He also said that documentation can also be done on-line.

V. Retrospective Analysis

Hyatt posed the question, if the FWMT had be used between 1974 and 2003, what release decisions would have been made and what would be the results be in terms of sockeye abundance? Retrospective analysis was used to project what the results would have been if the FWMT had been available and used during that period. Apprentice water management training was used to quantify smolt production results from water management using FWMT compared to the historic decisions that were made. Reference cases were used to compare actual outcomes and what would have resulted from use of FWMT. Results were compared using water year types and included natural variation as well as manager experience. Retrospective "movies" were shown for water years 1991 and 1994. Apprentice manager "management" of flows based on model use were compared to what actually happened based on actual water management. Results of the Retrospective Analysis showed and overall average improvement in sockeye production of 55%. For the analysis, each year started with 12,000 spawners. The increases in sockeye smolts out of the system shown in the Retrospective Analysis isn't what is important but the percentage increase in smolts out as a result of water management decisions using the FWMT. Results indicated that the greatest benefit came during years of more normal flow ranges rather than the years of low or high flows. The water manager has little operational flexibility to optimally manage flows at the low and high ends of the spectrum.

Hyatt referred to the Douglas PUD sockeye mitigation responsibility of 7% and said that even if the indicated 55% improved production due to water management optimization is on the high side, there is still a large margin for error and still make the 7% production improvement goal. Hyatt said additional measures are pointed to which could influence benefits such as water releases to lessen the temperature/oxygen squeeze, which have yet to be demonstrated.

VI. Next Step in the FWMT Process

Hyatt said that based on the Retrospective Analysis he recommends moving from a "proof of concept" prototype to a routinely used and well maintained operational tool to increase average production of Okanagan sockeye. He said there will be a meeting in Penticton on June 11 to address details in moving the FWMT System from a developmental to operational environment but high level needs are already known. Hyatt listed some of the known needs.

1. Improve documentation - users manuals, model and data base maintenance documentation, science foundations documentation and peer review.
2. Maintain Data - water temperature; discharge; spawner distribution, abundance and biological traits; incubation and emergence timing and success; rearing fry distribution, abundance and bio-traits; and smolt production.
3. Refine the FWMT model - respond to users requests for real-time access to weekly rather than monthly net inflow data, a cumulative egg loss report.
4. Identify FWMT "home" - likely DFO Informatics Group within the Science Branch or HEB.
5. Test FWMT Predictions and Assumptions - e.g. FWMT increases Okanagan

sockeye production; floods and drought events reduce production; water releases will mitigate water temperature/oxygen squeeze; spawning habitat quantity and quality don't induce strong density dependent limits on Okanagan sockeye production; employ routine assessment data and focused adaptive management experiments.

Hyatt said there is one more year left in the development, testing, documentation process. They will be working on needs for next year at a June 11, 2004 meeting. Canadian participants are very pleased with the results to date. Hyatt said he has no reservations about the fact that there are real benefits to be realized from the use of the FWMT.

Graves said the FWMT looks good and is consistent with his agencies interest in natural production improvements. He is interested in what can be done about the water temperature/oxygen squeeze in Lake Osoyoos and water temperature effects on adult sockeye in the Okanagan River and Lake Osoyoos.

Clubb said he would like to see the Wells Coordinating Committee think about where we go from here and how the current effort fits in with the goal of sockeye mitigation for the Wells Project.

The meeting ended at about 4 PM. The meeting attendees were appreciative of the efforts of the Canadian parties and the comprehensive report on the development of the FWMT.

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No date was set for a future Wells Coordinating Committee meeting. It is anticipated that the Wells HCP will be approved by FERC as early as mid-June.

ATTENDANCE LIST

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2004 MEMBERSHIP LIST OF THE WELLS COORDINATING COMMITTEE

APPENDIX M

Appendix M

2004 Membership List of the Wells Coordinating Committee

Ron Boyce
Oregon Department of Fish and Wildlife

Brian Cates
U.S. Fish and Wildlife Service

Ritchie Graves
NOAA Fisheries

Mike Erho
Wells Coordinating Committee Chairman

Cary Feldmann
Power Purchasers

Bob Heinith
Umatilla Tribes

Rick Klinge
Douglas County P.U.D.

Jerry Marco
Colville Confederated Tribes

Bob Rose
Yakama Indian Nation

Rod Woodin
Washington Department of Fish and Wildlife

LONG TERM SETTLEMENT AGREEMENT
FOR THE WELLS HYDROELECTRIC PROJECT

APPENDIX N

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Public Utility District No. 1 of Douglas County, Washington)	Project No. 2149 Docket No. E-9569

SETTLEMENT AGREEMENT

This Settlement Agreement is entered into this 1st day of October, 1990, by the Public Utility District No. 1 of Douglas County, Washington (the PUD), Puget Sound Power & Light Company, Pacific Power and Light Company, the Washington Water Power Company, Portland General Electric Company (collectively the Power Purchasers), the Washington Department of Fisheries, the Washington Department of Wildlife, the Oregon Department of Fish and Wildlife, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the Confederated Tribes and Bands of the Yakima Indian Nation, the Confederated Tribes of the Umatilla Reservation, and the Confederated Tribes of the Colville Reservation (collectively the Joint Fishery Parties).

I. GENERAL

A. PURPOSE AND SCOPE

1. This Agreement establishes the PUD's obligations with respect to the installation and operation of juvenile downstream migrant bypass facilities and measures; hatchery compensation for fish losses; and adult fishway operation at least until March 1, 2004, as described in subsection I.C. For purposes of the Wells Project, these measures, in conjunction with existing hatchery

compensation programs, and when carried out pursuant to this Agreement, shall be conclusively considered to fulfill the PUD's obligation to protect, mitigate, and compensate for the anadromous fish resource at least until March 1, 2004. These measures are expected to contribute to the Northwest Power Planning Council's goals of rebuilding the natural spawning populations of salmon and steelhead in the Columbia Basin and providing harvest opportunities.

2. This Agreement establishes the Joint Fishery Parties' obligations in support of this settlement. This Agreement also requires evaluation programs for fishery measures and establishes procedures for coordination between the PUD and Power Purchasers and the Joint Fishery Parties.

3. It is the intent of the Parties that this Agreement shall be the basis for the dismissal of the Mid-Columbia proceeding, Docket No. E-9569, insofar as it pertains to the Wells Project, and for compliance by the PUD with the Northwest Power Planning Council's 1987 Columbia River Basin Fish and Wildlife Program, as amended.

4. The fish passage, mitigation, and compensation measures set out in this Agreement are intended to implement Article 41 of the License for Project No. 2149 issued by FERC to the PUD. The PUD's obligations under this Agreement shall be enforceable as if they were conditions of its FERC license. Notwithstanding any other provision of its FERC license, once this Agreement is approved by FERC the PUD shall be bound by the terms of this

Agreement.

5. For purposes of this Agreement, except under subsections VI.B, VII.B and E, VIII.B and D, the Power Purchasers collectively will be a single Party. For all purposes under this Agreement, except under subsections VI.B, VII.B and E, VIII.B and D, the Power Purchasers shall participate through a single representative, whom they will designate from time to time.

B. <u>DURATION</u>

The term of this Agreement shall commence on the date of execution by all Parties and shall continue for the term of the current license for the Wells Project, plus the term of any annual licenses which may be issued after the current license has expired.

C. <u>MODIFICATIONS TO THE AGREEMENT</u>

1. Notwithstanding subsection I.B, at any time after March 1, 2004, any Party may request all other Parties to commence negotiations to modify the terms and conditions of this Agreement in whole or in part. Any such modification shall be subject to FERC approval, except that the Parties may agree to implement on an interim basis, pending FERC approval, any measure not requiring prior FERC approval. No Party shall file a petition with FERC pursuant to subsection I.C.2 to modify this Agreement without first presenting the proposed modification to all Parties and allowing a reasonable opportunity to negotiate, not to exceed 90 days without consent of all Parties.

2. Subject to the limitation stated in the above subsection, at any time after March 1, 2004, any Party to this Agreement may:

(a) Request the imposition by the FERC of different, additional, reduced or modified fish protection measures;

(b) Bring any cause of action, raise any defense or claim, or rely on any theory related to this Agreement in any appropriate forum;

(c) Petition any appropriate administrative agency or political body for relief, including the deletion or addition of one or more measures otherwise in effect under this Agreement; or

(d) Take other appropriate action relating to any issue or matter addressed by this Agreement or which could have been addressed by this Agreement or that otherwise relates to the fisheries issues of the Wells Project.

3. In any action under this subsection I.C, the petitioning Party shall have the burden of proof. The Parties will continue to implement this Agreement pending final resolution of any modification sought in the FERC, or until the relief sought becomes effective by operation of law, or unless otherwise agreed.

4. With respect to any petition or suit filed pursuant to this subsection I.C and any subsequent judicial review thereof, nothing in this Agreement shall bar, limit or restrict any Party from raising any relevant issue of fact or law, regardless of whether such issue is or could have been addressed by this Agreement. Notwithstanding any other provision of this Agreement, no claim shall be made for damages arising from the failure to provide or the provision of inadequate downstream fish passage facilities or programs, or upstream adult passage facilities, or

both, that might have arisen during the period March 7, 1979, through March 1, 2004.

5. Notwithstanding any other provision of this subsection I.C, any Party may participate in any legislative or administrative proceeding dealing with fish protection or compensation issues provided, that, consistent with this subsection, no Party shall advocate or support the imposition of fish protection, mitigation, or compensation measures at the Wells Project that are different from or in addition to those required by this Agreement until after March 1, 2004.

6. The Parties intend that this subsection I.C shall apply to each and every provision of this Agreement, and therefore the terms of this subsection are hereby incorporated by reference into and shall apply to every other provision of this Agreement as if set out fully in each such provision.

D. <u>RESOLUTION OF DISPUTES</u>

1. Any dispute between the Parties concerning compliance with this Agreement shall be referred for consideration to the Wells Project Coordinating Committee (the Coordinating Committee) established under Section V. The Coordinating Committee shall convene as soon as practicable following issuance of a written request by any Party. All decisions of the Coordinating Committee must be unanimous. In the event the Coordinating Committee cannot resolve the dispute within fifteen (15) days after its first meeting on a dispute, it will give notice of its failure to resolve the dispute to all Parties. Thereafter, if the dispute qualifies

under subsection I.D.2, any Party may request the FERC to refer the dispute to (1) the presiding judge in the Mid-Columbia proceeding; or (2) in the event the Mid-Columbia proceeding is terminated, to the Chief Administrative Law Judge of the Commission; or (3) to the Division of Project Compliance and Administration within the Office of Hydropower Licensing, or its successor (any one of which is hereinafter referred to as the Decisionmaker), in the order listed herein (unless otherwise agreed by the Parties or directed by FERC), for expedited review in accordance with the procedures set forth in this subsection. Any issue in dispute that is not subject to the expedited review process may be referred to the FERC for resolution pursuant to the FERC's Rules of Practice and Procedure.

2. The expedited review process specified in this subsection shall be utilized, unless otherwise agreed pursuant to subsection I.D.5, to resolve any issue(s) in dispute between the Parties that arises under this Agreement where the amount in controversy is less than $325,000 (1988 dollars). For the purpose of this subsection I.D, the amount in controversy shall be determined by calculating the difference between the calculated annual cost of the Joint Fishery Parties' proposal for resolution of the dispute and the calculated annual cost of the PUD's proposal for resolution of the dispute.

3. Under the expedited review process, each Party that desires to present an initial position statement to the Decisionmaker shall file the statement with the Decisionmaker and all other Parties within twenty (20) days of mailing of notice by a

Party that expedited review is requested. Responsive statements shall be filed and served within forty (40) days of the mailing of the notice. The Decisionmaker shall set a date for submission of any briefing, affidavits or other written evidence and a further date for hearing of oral evidence and argument. Except by agreement of all Parties involved in the dispute, the hearing shall be held not later than seventy (70) days after the date of mailing of the requesting Party's notice or as soon thereafter as the Decisionmaker shall be available. The hearing shall be held in Seattle, Portland or any other location agreed upon by the Parties, or mandated, upon a finding of special circumstances, by the Decisionmaker. The Decisionmaker shall decide all matters presented within fifteen (15) days of the hearing or as soon thereafter as possible.

4. All decisions under the expedited review process shall be effective upon issuance and pending appeal, if any. Nothing in this subsection I.D shall limit or restrict the right of any Party to petition the FERC for de novo review of any decision under the expedited review process. All such appeals shall be in accordance with the FERC's Rules of Practice and Procedure.

5. The Parties may agree to refer any issue subject to expedited review to a third party Decisionmaker other than someone within FERC for processing pursuant to this subsection or as otherwise agreed by the Parties.

E. EFFECTIVE DATES

1. Except as otherwise specified in this subsection I.E, this Agreement shall become effective upon the issuance of a final order by the FERC approving this Agreement.

2. Notwithstanding subsection I.E.1 above, the Parties will immediately upon execution of this Agreement, implement the provisions of the Agreement that do not require formal FERC approval.

3. The Parties agree to immediately seek interim approval by the FERC of Section IV of this Agreement in order to implement construction of hatchery facilities.

II. JUVENILE FISH PASSAGE

A. GENERAL SCOPE OF JUVENILE PASSAGE MEASURES

1. Subject to the schedules, criteria, and conditions in this Agreement, the PUD will fund the installation, operation, maintenance, and evaluation of juvenile fish bypass systems and measures at the Wells Project. Bypass systems and measures are those intended to attract and route juvenile salmonids past operating powerhouse generating units.

2. All facilities under this Agreement shall be designed and constructed using quality materials and then current engineering standards for the purpose of obtaining a high quality product designed to require low maintenance and have a long useful life.

B. BYPASS SYSTEM

The PUD will continue to implement a program of controlled spill using five (5) bypass baffles at the Wells Project to meet the criteria set out in subsections II.C, D, and E.

C. NORMAL BYPASS OPERATIONS CRITERIA

1. No turbine will be operated during the juvenile migration period unless the adjacent bypass system is operating according to the following criteria.

2. The five (5) bypass system bays will be Nos. 2, 4, 6, 8, and 10. Operation of the turbines will be in pairs with the associated bypass system bays, as follows:

Turbines Operated	Bypass Bays Operated
1 and/or 2	2
3 and/or 4	4
5 and/or 6	6
7 and/or 8	8
9 and/or 10	10

(For example, if turbines 1, 5, and 6 are operating, bypass systems 2 and 6 will be operating.)

3. At least one bypass will be operating continuously throughout the juvenile migration period, even if no turbines are operating.

4. The bypass systems and spillgates will be operated in configuration K of the 1987 bypass system report (bottom spill, 1 foot spill gate opening, 2,200 cfs, vertical baffle opening) for all bypass system bays.

5. If top spill is shown to be as effective as bottom spill in bypass bays 2 and 10, then top spill will be allowed in these bays.

6. If the Chief Joseph Dam Uncoordinated Discharge Estimate is 140,000 cubic feet per second (140 Kcfs) or greater for the following day, all five bypass systems will be operated continuously for 24 hours regardless of turbine unit operation.

7. If the Chief Joseph Dam Uncoordinated Discharge Estimate is less than 140 Kcfs, bypass system operation will be as follows:

Number Turbines Operating	Minimum Number Bypass Systems Operating
10	5
9	5
8	4
7	4
6	3
5	3
4	2
3	2
2	1
1	1
0	1

D. <u>BYPASS OPERATIONS TIMING CRITERIA</u>

1. Bypass systems will be in place at least two (2) weeks prior to preseason forecasted beginning of juvenile migration.

2. Bypass systems will remain in place for at least two (2) weeks after the juvenile migration period ends.

3. Monitoring of fish runs will begin when bypass baffles are in place and will end when the baffles are removed.

4. Bypass systems will be available to operate continuously, 24 hours per day, during the juvenile migration period.

E. BYPASS PERFORMANCE CRITERIA

1. At a minimum, bypass system operations will be provided as described in subsections II.B, C, and D for the entire juvenile migration period as defined in the annual operations plan under subsection II.F, and subject to the provisions of subsection II.F.3.

2. Bypass operations as described in subsections II.B, C, and D are intended to provide fish passage efficiency (FPE) of at least eighty percent (80%) for the juvenile spring migration, and FPE of at least seventy percent (70%) for the juvenile summer migration. For purposes of this Agreement, FPE is expressed by the following formula:

Where A = Sum of daily migrants successfully passed by the device during the spring or summer migration

and B = Sum of daily migrants passing through the turbine unit intakes during the same migration

$$FPE = \frac{A}{A + B} \times 100$$

3. If bypass operations under subsections II.B, C, and D do not meet the minimum FPE levels specified in subsection II.E.2, the PUD will modify those operations by implementing one or more of the following measures:

(a) Change in configuration or addition of lights or other physical changes.

(b) Change in "normal operation" under subsection II.C to operation of five bypass system bays at forecast flow of 120 Kcfs.

4. Unless and until these modifications are in place to meet the minimum FPE levels specified in subsection II.E.2, or if these modifications are not sufficient to meet the FPE levels specified therein, then the PUD will increase spillbay bypass flow up to two times normal operation (up to a total of 4.4 Kcfs) per bypass at night (1 hour before sunset to sunrise) for the period:

(a) During which 80% of the spring migration pass the Wells Project;

(b) During which 80% of the summer migration pass the Wells Project, or for 40 days, whichever is less.

5. If portions of the runs do not receive protection at the minimum FPE levels specified under subsection II.E.2, then compensation will be provided based on the difference between the minimum FPE levels specified in subsections II.E.2 and 3 and the actual FPE achieved during the evaluation provided under subsections II.H.1 and 2. The appropriate level of compensation will be calculated based on actual loss. The form of this additional compensation (i.e., fish production) will be determined by the Joint Fishery Parties in consultation with the PUD.

F. ANNUAL OPERATIONS PLANS

1. The PUD will develop an annual bypass systems operations plan consistent with the criteria in subsections II.B, C, D, and E in consultation with the Joint Fishery Parties by the December prior to each migration period. The plan will be reviewed and approved by the Coordinating Committee by March 1 of each year. The plan will be developed from inseason projected hatchery release

dates from facilities above Wells and previous passage monitoring data. The plan will contain predicted dates for the beginning and end of the juvenile migration period; criteria for identifying the beginning and end of the spring and summer runs; and procedures for bypass operations within the constraints of subsections II.B, C, D, and E, including dates for installation and removal of spill baffles, dates for run time monitoring, and criteria for initiation and cessation of bypass operations. If unanimous agreement cannot be reached within the Coordinating Committee regarding all items in the plan, disagreements will be resolved by expedited dispute resolution under subsection I.D.

2. A Bypass Team will be established composed of one representative each for the Party fishery agencies, the Party tribes, and the PUD.

3. Notwithstanding the provisions of subsections II.F.1 and 2 above, the Bypass Team may agree to relax the operations and performance criteria of subsections II.C and E for a period between the end of the juvenile spring migration and the beginning of the juvenile summer migration. Such a modification can only be made with the agreement of all of the members of the Bypass Team, and will be limited to one or more of the following measures:

(a) Less than continuous 24-hour operation of bypass systems.

(b) Fewer than one bypass system operated for two adjacent turbines operated.

(c) Less than 1 foot spill gate slot opening.

4. Once the annual bypass plan is adopted, decisions regarding adjustments to the plan will be made by unanimous agreement of the Bypass Team. If unanimous agreement cannot be reached, the decision on such adjustments will be by majority vote of the Bypass Team.

G. ANNUAL PASSAGE MONITORING PLAN

1. The PUD shall develop an Annual Passage Monitoring Plan, in consultation with the Joint Fishery Parties for review and approval by the Coordinating Committee by March 1 of each year. The Plan will include development of inseason indices of relative fish abundance on a daily basis and annual estimates of juvenile migrant production. Estimates of relative abundance will be used to guide bypass operations decisions under subsections II.E.4, II.F.1, II.F.3, and II.F.4. Estimates of juvenile migrant production will be used as the basis for compensation adjustments (Hatchery-Based Compensation - Phase IV) as provided in subsection IV.A.3.

H. FPE EVALUATION PLAN

1. The PUD shall develop an FPE evaluation plan, in consultation with the Joint Fishery Parties, for review and approval by the Coordinating Committee by March 1, 1990. The purpose of the plan shall be to evaluate whether minimum FPE levels set out in subsection II.E are being met. The plan will provide for evaluation beginning in 1990 and continuing for at least three consecutive years after baffles are installed and operating in accordance with this Agreement in all five (5) bypass bays. If physical or

operational changes are made to the bypass systems, additional FPE evaluation under a new or amended plan will be required to provide at least three consecutive years of evaluation after completion of the changes.

2. It is the goal of evaluations under the plan to be able to determine FPE within plus or minus five percent (5%) at the ninety-five percent (95%) confidence level. If the FPE point estimates are equal to or greater than eighty-five percent (85%) for the spring run and seventy five percent (75%) for the summer run, then the accuracy of plus or minus ten percent (10%) at the ninety percent (90%) confidence level is acceptable. If the FPE point estimate for the spring run is between eighty (80) and eighty-five (85) percent, or the FPE point estimate for the summer run is between seventy (70) and seventy-five (75) percent, the PUD will implement one of the following actions:

(a) Take the necessary steps to achieve a FPE accuracy of plus or minus five percent (5%) at the ninety-five percent (95%) confidence level, or

(b) Take steps outlined in subsection II.E.3 to increase the FPE point estimates to eighty-five percent (85%) and seventy-five percent (75%) for the spring and summer runs, respectively.

3. The PUD will fund a biometrician or statistician selected by unanimous agreement of the Coordinating Committee to review the draft plan to ensure that the plan meets the objectives of subsections II.H.1 and 2, and to review results developed under the plan.

III. ADULT FISH PASSAGE

A. GENERAL SCOPE OF ADULT PASSAGE MEASURES

The current operating and maintenance criteria for facilities for the passage of adult anadromous fish over the Wells Project Dam are specified in this Section III. Changes in these criteria must be by unanimous agreement of the Coordinating Committee.

B. WATER DEPTH CRITERIA

The water depth over the weirs of the adult fish ladder will be 1.0 to 1.2 feet.

C. ENTRANCE CRITERIA

1. Head: 1.5 feet

2. Gate Settings:

a) March 1 - November 30

	Side Wing Gate	End Wing Gate
(i) Spill less than 80 Kcfs	4 ft	6 ft
(ii) Spill greater than 80 Kcfs	Closed	8 ft

(iii) Low level fixed orifice entrance to be open whenever side gate is closed.

b) December 1 - February 28

(i) Side and end gates open 2 feet six days per week for 24-hour periods.

(ii) Side and end gates open 4 feet and 6 feet, respectively, one day per week for a 24-hour period.

D. ATTRACTION JET CRITERIA

1. Jets are located in a vertical line immediately upstream of the side wing gates.

2. Lower jet (30-inch diameter) will operate only when the low level fixed orifice entrance is open.

3. Three 24-inch diameter jets (at elevations 700, 708, and 717 msl) will each be discharging when tailwater reaches that level.

E. STAFF GAUGE AND WATER LEVEL INDICATOR CRITERIA

Staff gauge and water level indicators will:

1. Be located upstream and downstream of all entrances, and at convenient locations for viewing along ladder.

2. Be located upstream and downstream of adult fishway exit trashrack.

3. Be readable at all water levels and be kept clean.

4. Be checked against panel board water surface readings to insure proper adjustment of water level sensing equipment.

F. TRASHRACK CRITERIA

1. Visible buildups of debris will be cleaned immediately from picketed leads near counting stations, and from trashracks at adult fishway exits.

2. The staff gauges upstream and downstream of the adult fishway exit trashrack will be monitored for water surface differential, which will reflect buildup on submerged trashrack. The trashrack will be cleaned immediately if the differential reading is greater than 0.3 feet.

G. MONITORING AND EVALUATION OF ADULT PASSAGE

1. In 1990, the PUD, in consultation with the Joint Fishery Parties, will develop a study plan to determine the extent of adult

delay and mortality at the Wells Project. The study plan will be reviewed and approved in advance by the Coordinating Committee. Studies will begin in 1991 and continue for a period of time determined by the Coordinating Committee based on preliminary results.

2. If the study identifies delays and/or mortality, the operating criteria specified in this Section III will be changed to alleviate these problems. If changes in the operating criteria do not alleviate the problems, adult passage facility modifications will be made. Provided, however, that any disagreements over the appropriateness of facility modifications of $325,000 or less (1988 dollars) may be taken through the expedited dispute resolution procedure in subsection I.D. And, provided further, that any disagreements over the appropriateness of facility modifications of more than $325,000 (1988 dollars) may be resolved under the FERC Rules of Practice and Procedure at any time.

IV. HATCHERY-BASED COMPENSATION

The PUD will fund a hatchery-based compensation program (the "Program") as provided in this Section IV. The Program will include the design, construction, operation, maintenance and evaluation of facilities required to implement the elements of a production plan (the "Production Plan") as set forth in this Section. The purpose of the Program is to mitigate for fish passage losses at Wells Dam. The Program is composed of adult collection sites; a central hatchery facility for incubation, early rearing, and adult holding; and acclimation facilities in the tributaries above Wells Dam for final rearing and release.

A. PRODUCTION PLAN

1. The Joint Fishery Parties have developed the Production Plan to define the requirements of hatchery-based compensation under this Agreement. The Production Plan describes juvenile rearing and release requirements, including species mix and target release sizes; and related broodstock requirements under subsection IV.D.

2. The Production Plan will be reviewed annually by the Joint Fishery Parties, and may be modified by the Joint Fishery Parties in consultation with the PUD. Modifications to the Production Plan may include changes to the species mix and rearing and release strategies as required to accommodate the Joint Fishery Parties' management needs. Modifications to the Production Plan will not require an increase in the rearing capability of the Program beyond that required to satisfy Phases One and Two of the Production Plan as shown in subsections IV.A.3(a) and (b) or Phases Three and Four of the Production Plan to be determined as shown in sections IV.A.3(c) and (d). The Production Plan and any modifications thereto will be consistent with guidelines and procedures developed under the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program.

3. The Production Plan is comprised of four phases of hatchery-based compensation as described below. It also includes related broodstock requirements under subsection IV.D.

(a) Phase One

Phase One will begin in 1991 and will consist of the following compensation elements:

(1) 49,200 pounds of spring chinook yearlings at about 15/pound;

(2) 8,000 pounds of sockeye juveniles at about 25/pound; and

(3) 30,000 pounds of steelhead smolts at about 6/pound

(4) After 1991, space to rear additional steelhead will be provided by the PUD at Wells Hatchery, if such space is available and not needed to meet other PUD fish production responsibilities. The PUD will not be obligated to fund or supply well water to rear the fish.

(b) Phase Two

Phase Two will begin after evaluation of the Phase One Production Plan and will be restricted to the Program required by either the Phase Two A or Two B Production Plan as shown below. At the time of implementation, the Phase Two A or Phase Two B Production Plan may be modified based on other Phase One evaluations described in subsection IV.C, Studies and Evaluations, subject to the provisions of subsection IV.A.2.

(1) Phase Two A

Increase sockeye production from 8,000 pounds to 15,000 pounds of juveniles at about 25/pound.

(2) Phase Two B

(i) Eliminate sockeye production;

(ii) Add 15,000 pounds of summer chinook yearlings at about 10/pound; and 6,500 pounds of zero-age summer chinook juveniles at about 40/pound.

(c) Phase Three

Phase Three will begin as soon as practicable following Coordinating Committee approval of the results of the Wells Project juvenile mortality/survival study or no later than the third brood year after Coordinating Committee determination of the adjustments required and will consist of the following compensation elements:

(1) Except for steelhead, which shall remain at 30,000 pounds, adjust compensation requirement to reflect the difference between the juvenile mortality rate determined by the mortality/survival study under subsection IV.C.5 and the assumed mortality rate shown in Appendix A; and

(2) Adjust compensation requirement to reflect unavoidable and unmitigated adult losses, as determined by Coordinating Committee approved estimates from studies conducted under subsection III.G, and converted to juvenile production based on adult to smolt ratio estimates as described in Appendix B.

(d) Phase Four

Phase Four will begin at such time as the Coordinating Committee approved five-year rolling average estimate of juvenile run size, estimated as described in subsection IV.C.6 and Appendix A, increases to at least 110% of the 9,034,700 estimated juvenile migrant salmon production used to establish the Phase One and Phase Two compensation levels shown in subsections IV.A.3(a) and

IV.A.3(b). Phase Four will consist of compensation adjustment, if requested by the Joint Fishery Parties, to reflect the percentage increase in juvenile run size, except for steelhead, which shall remain at 30,000 pounds. The Joint Fishery Parties, in consultation with the PUD, will determine the appropriate form of compensation (i.e., fish production) for any adjustments required in Phase Four.

B. COMPENSATION PROGRAM

1. The facilities provided in the Program will be designed, constructed, operated, maintained, and evaluated to produce the hatchery-based compensation set forth in the Production Plan.

2. If the evaluations described in subsection IV.C indicate that the Program is not meeting the production levels called for in the Production Plan, then reasonable modifications to the Program will be made.

3. The PUD will only be obligated to assure the capability of facilities provided under this Agreement to produce high quality juvenile fish at the compensation levels shown in subsection IV.A.3.

4. The Program facilities described in this Agreement are in addition to the existing mitigation program at Wells. The existing mitigation program at Wells consists of annual production of 50,000 pounds of steelhead and 56,500 pounds of summer chinook salmon. Under the 1984 Mid-Columbia Stipulation, which expired in 1989, 400,000 summer chinook at 90/pound have been reared at Wells for release into the Methow River. This production will continue until

Phase One production is initiated. Nothing in this Agreement will affect the annual production of 25,000 pounds of steelhead under the Oroville-Tonasket agreement between the PUD and the U.S. Bureau of Reclamation.

5. Facilities provided in the Program will consist of:

(a) <u>Phase One</u>

Phase One compensation facilities, including satellite facilities, shall be capable of rearing and releasing 57,200 pounds of salmon and 30,000 pounds of steelhead annually.

(b) <u>Phase Two</u>

Phase Two compensation facilities shall be capable of increased production to accommodate the Production Plan as described in subsection IV.A.3(b).

(c) <u>Phase Three</u>

Phase Three compensation facilities shall be capable of production levels to reflect the compensation adjustments which may be required as described in subsection IV.A.3(c).

(d) <u>Phase Four</u>

Phase Four compensation facilities shall be capable of production levels to reflect the compensation adjustments which may be required as described in subsection IV.A.3(d). Facilities for the required adjustments will be constructed by the PUD as soon as practicable and be operational no later than the third brood year following the Joint Fishery Parties request under subsection IV.A.3(d).

6. Production and acclimation facilities used in the Program shall be consistent with planning efforts underway by the Northwest Power Planning Council to the fullest extent practicable. The biological criteria and guidelines described in subsection IV.D shall apply to production and acclimation facilities used in the Program.

C. STUDIES AND EVALUATIONS

1. The PUD will develop and fund studies in 1990, approved by unanimous agreement of the Coordinating Committee, to determine:

(a) Potential for spawning and rearing sockeye in unutilized habitat in the Okanogan and Similkameen systems;

(b) Potential for establishing sockeye populations in the new habitat.

2. The PUD will fund the Joint Fishery Parties' effort to determine the success of Phase One sockeye compensation based on review of smolt production. The Joint Fishery Parties may make this determination after the evaluation of the third brood year's production.

3. The PUD will fund the Joint Fishery Parties to develop and conduct studies to evaluate the adequacy of the Program and the effectiveness and success of the Production Plan subject to the provisions of Section V, Coordinating Committee. The studies will meet standards developed for similar efforts under the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program. The studies will pass the test of reasonableness with respect to cost and duration.

(a) The studies will involve marking a portion of the juvenile fish produced under subsection IV.B and will involve recoveries of juvenile and adult fish to estimate various parameters such as fish health, fishery contribution, survival, spawning time and spawning locations.

(b) The PUD will fund recovery efforts at Wells Dam and hatchery and tributary spawning areas above Wells Dam. Existing recovery operations, currently funded through different sources, will be utilized to the extent possible. Approved studies may require the PUD's participation in funding a portion of other recovery efforts.

(c) The evaluations provide data necessary to determine the success of the Program to produce the intended compensation levels and the effectiveness of the Production Plan to meet management objectives.

(d) Evaluation of the Production Plan and Program effectiveness will be initiated in Phase One for all species in the Production Plan.

(e) To the extent that the Joint Fishery Parties elect to modify the Production Plan, the PUD will fund studies to evaluate the modifications. The studies will be mutually agreeable and are intended to evaluate only the changes called for in the modification. The studies will be consistent with the provisions of Section V, <u>Coordinating Committee</u>.

(f) The PUD will fund an analysis of annual fish production and adult contribution to harvest and escapement to be conducted by the Joint Fishery Parties. The analysis will be consistent with the provisions of Section V, Coordinating Committee. Draft and final reports will be provided to the Parties.

5. No later than 1990, a Wells Project juvenile mortality/survival study will be developed by the PUD in consultation with the Joint Fishery Parties and approved by unanimous agreement of the Coordinating Committee. The studies will begin in 1991, after the installation of new turbine runners at the Wells Project, for the purpose of determining juvenile losses.

6. The PUD will provide data from its ongoing, annual adult passage monitoring program that will allow the Joint Fishery Parties to compute the five-year rolling average estimate of juvenile run size which will be the basis for Phase Four compensation, as indicated in subsection IV.A.3(d). Calculation of increases in juvenile run size will be based on fish from existing mitigation programs, natural production and future compensation programs. The method of calculation will be as described in Appendices A and B.

D. PRODUCTION/ACCLIMATION FACILITIES

Production and acclimation facilities under this Section shall be consistent with planning efforts underway by the Northwest Power Planning Council to the fullest extent practicable. The following biological criteria and guidelines shall apply to production and acclimation facilities under this subsection IV.D. Criteria are not to be exceeded. Guidelines are not to be exceeded if practicable.

1. Salmon Criteria

(a) Adult Holding

(i) Density not to exceed one (1) fish per ten (10) cubic feet of space.

(ii) Flow must be at least one (1) gallon per minute per 20 pounds of fish.

(b) Juvenile Rearing

(i) Density not to exceed 0.75 pounds of fish per cubic foot of rearing space for yearling chinook to a size of 10 fish per pound. Maximum density is achieved at release date. The density through out the rearing period is proportionately lower and directly related to fish size.

(ii) Pond or raceway loading rate not to exceed 6.0 pounds of fish per gallon of water per minute inflow for yearling chinook at a size of 10 fish per pound. Maximum loading rate is achieved at release date. The loading rate throughout the rearing period is proportionately lower and directly related to fish size.

(iii) Density for sockeye juveniles in net pens not to exceed 0.33 pounds of fish per cubic foot of rearing space.

(c) Water Supply

(i) Water will be of highest quality practicably available at appropriate sites. Ground water may be required at sites. All water supplies will be pathogen free if practicable. The water source must not preclude transfer of the stocks being reared to their point of origin due to presence of fish disease organisms in the rearing water supply.

(ii) Reuse of water is not acceptable for either egg incubation or juvenile rearing.

(iii) Reuse water is acceptable for adult holding.

(iv) Effluent water from egg incubation may require treatment for fish diseases (e.g., chlorination/dechlorination).

(v) Construction of facilities must accommodate the potential to treat the juvenile rearing and adult holding water for disease pathogens.

(d) General

(i) Facilities must have the capability to maintain stock segregation from adult holding through incubation and rearing.

(ii) Facilities must have reasonable capability to provide for isolation and treatment of diseased fish.

(iii) Protection from mammalian and avian predators must be provided.

2. Salmon Guidelines

(a) Water Temperatures

(i) Egg incubation - no greater than 55°F nor less than 38°F.

(ii) Fry starting - 48-52°F.

(iii) Juvenile rearing - not to exceed 52°F.

(iv) Adult holding - not to exceed 55°F.

(b) Release Size, Time, and Location

(i) Yearling spring chinook - 15 fish/pound in late April.

(ii) Yearling summer chinook - 10 fish/pound in late April.

(iii) Subyearling summer chinook - 40 fish/pound in June.

(iv) Subyearling sockeye - 25 fish/pound in June.

(v) Juvenile fish will be acclimated and released in tributaries above Wells Dam.

(c) Adult Brood Stock

(i) Sufficient adults of the appropriate species and stocks will be trapped and held to meet the egg requirements for each phase of salmon production.

(ii) Fifty percent (50%) of the adults trapped will be females and it is assumed there will be approximately eighty percent (80%) survival of eggs from trapping of females to ponding of fry.

(iii) Adult brood stock will be collected at the following sites:

a) Spring chinook - Chewack River, Methow River above Winthrop, and Twisp River above river mile 2.0.

b) Summer chinook and sockeye - at Wells Dam

(iv) Tributary brood stock collection facilities will require an annually installed rack and a semi-permanent box trap.

(v) Wells Dam brood stock collection may require a separator/sorter in the left bank fishway. The final design of the left bank trap and any modification of the right bank trap will be approved by unanimous agreement of the Coordinating Committee.

(vi) The adults will be transferred in a water-to-water system from traps to tank trucks to holding ponds.

(vii) The PUD shall provide funds for personnel to separate and sort adult fish in the right bank fishway at Wells Dam and at other required adult collection sites. All brood stock collection shall be conducted in a manner to minimize delay of non-target species and individual fish.

3. Steelhead Criteria

The goal for this program is to use the existing facilities including well and river water, raceways, rearing ponds, house, shop, freezer, office, etc., in the manner they are being used now. Most of the following criteria and guidelines fit the existing program.

(a) Adult Holding

(i) Density not to exceed 2.5 pounds of fish per cubic foot of water.

(ii) Flow must be at least one gallon per minute for 3.3 pounds of fish.

(b) Juvenile Rearing

(i) Density: Calculated density limit not to exceed Pipers density formula: W= D x V x L where

W = Permissible weight in pounds.

D = Density index (.25 for raceways and .03 for rearing ponds).

V = Useable volume in container in cubic feet.

L = Fish length in inches.

ii) Water flow: Calculated flow should not allow weight to exceed Pipers flow formula:

W= F x L x I where

W = Permissible weight in pounds.

F = The loading factor from Table 1.

L = Fish length in inches.

I = Water flow in gallons per minute.

Table 1. Load factor as related to water temperature and elevation.

Water Temperature(°F)	Load Factor(lbs/in/gpm) Raceways(1)	Rearing Ponds(2)
40	2.70	3.62
41	2.61	3.53
42	2.52	3.44
43	2.43	3.35
44	2.34	3.26
45	2.25	3.17
46	2.16	3.08
47	2.07	2.99
48	1.98	2.90
49	1.89	2.81
50	1.80	2.72
51	1.73	2.65
52	1.67	2.59
53	1.61	2.53
54	1.55	2.47
55	1.50	2.42
56	1.45	2.37
57	1.41	2.33
58	1.36	2.28
59	1.32	2.24
60	1.29	2.21
61	1.25	2.17
62	1.22	2.14
63	1.18	2.10
64	1.15	2.07

1) From Piper et al. 1978
2) From Wells hatchery

(c) Water Supply

(i) Water supply to be of highest quality practicably available using ground and river water. Any disease contracted because of water source must not stop release of fish in local watersheds.

(ii) Reuse water not acceptable for egg incubation.

(iii) Reuse water normally acceptable (unless disease problem) for adult holding.

(iv) Effluent water from egg incubation will require treatment for fish diseases.

(v) Adult holding and juvenile rearing water may have to be treated for disease pathogens.

(d) General

(i) Facilities must have reasonable capability to provide for isolation and treatment of diseased fish.

(ii) Protection from mammalian and avian predators must be provided.

4. Steelhead Guidelines

(a) Water Temperatures

(i) Egg incubation: 38°F to 55°F

(ii) Fry starting: 48°F to 54°F

(iii) Juvenile Rearing not to exceed 57°F

(iv) Pre-smolt not to exceed 54°F

(v) Adult holding not to exceed 54°F

(b) Release age, time, size and location

(i) Released as yearlings

(ii) April 10 to May 10 at six to the pound.

(iii) Juvenile steelhead will be released in tributaries or into the mainstem above Wells Dam.

(c) Adult Broodstock

(i) Fifty percent (50%) will be females and assume eighty percent survival of eggs to ponding of fry.

(ii) Adults will normally be trapped at the existing facilities on the right bank, however new trap at left bank may be used sometimes.

(iii) Adults will be transferred in water from traps to holding ponds.

V. WELLS PROJECT COORDINATING COMMITTEE

A. COORDINATING COMMITTEE

There shall be a Wells Project Coordinating Committee composed of one (1) technical representative of each Party to this Agreement. The Coordinating Committee shall meet whenever requested by any two (2) Parties following a minimum of ten (10) days written notice (unless waived), or pursuant to subsection I.D, and shall act only by unanimous agreement of all Parties. Any Joint Fishery Party may, at any time, elect by written notice not to participate in the Coordinating Committee. The PUD shall fund a neutral third party to record and distribute minutes of Coordinating Committee meetings.

B. USE OF COMMITTEE

The Coordinating Committee will be used as the primary means of consultation and coordination between the PUD and the Joint Fishery Parties in connection with the conduct of studies and implementation of the measures set forth in this Agreement and for dispute resolution pursuant to subsection I.D. All study designs and modifications to study designs will be subject to agreement by all Parties.

C. STUDIES AND REPORTS

1. All studies and reports prepared under this Agreement will be available to all Parties as soon as reasonably possible. Draft reports will be circulated through Coordinating Committee representatives for comment, and comments will either be addressed in order or made an appendix to the final report.

2. All studies will be conducted following accepted techniques and methodologies in use for similar studies in the Columbia Basin. All studies will be based on sound statistical design and analysis.

3. Fish passage efficiency tests will be conducted using hydroacoustic means and direct capture methods for species identification.

VI. JOINT FISHERY PARTIES' RESPONSIBILITIES

A. LIMITATION OF MID-COLUMBIA PROCEEDING

The Joint Fishery Parties agree to join with the PUD to request that the FERC terminate the Mid-Columbia proceeding insofar as it pertains to the Wells Project. The Parties specifically agree to reserve the right to enforce the terms and conditions of this Agreement before the FERC.

B. <u>SUPPORT FOR RELICENSE</u>

The PUD's FERC license for the Wells Hydroelectric Project expires in 2012. The Joint Fishery Parties agree to be supportive of the PUD's new or renewal license application to the FERC, provided that the PUD has adhered to the terms and conditions of this Settlement Agreement, as well as any future terms, conditions, and obligations agreed upon by the Parties hereto or imposed upon the PUD by the FERC. To the extent that the PUD has met such terms and conditions, the Joint Fishery Parties agree that the PUD is a competent license holder with respect to its obligations to anadromous fish resources. Nothing in this paragraph shall limit or preclude any Party hereto from requesting at the time of any license renewal the provision of or supporting different, modified or additional fish protection measures and compensation; or from requiring that the fishery protection measures contained in a competing license application be included as a condition of the PUD's new license, or in the absence of such additional or modified measures in a new license, or in the absence of measures contained in a competing license application requested by the Joint Fishery Parties, from requesting that the PUD's new or renewal license application be denied.

C. STIPULATION OF ADEQUACY

The Joint Fishery Parties stipulate that the performance of the PUD's responsibilities under this Agreement constitutes adequate fish protection and full compensation for all fishery losses caused by the Wells Project at least until March 1, 2004. It is further stipulated that this Agreement satisfies any obligations of any Party relating to the adequacy of fish protection and compensation for fish losses caused by the Wells Project, and arising under applicable laws and regulations, including but not limited to the Federal Power Act, the Pacific Northwest Electric Power Planning and Conservation Act, and the Electric Consumers Protection Act of 1986, at least until March 1, 2004. This Agreement shall not otherwise affect the rights of any Party except as expressly covered by this Agreement.

D. FISH AND WILDLIFE PROGRAM

The Joint Fishery Parties stipulate that the performance of the PUD's responsibilities under this Agreement shall constitute full compliance with the applicable provisions of the Northwest Power Planning Council's 1987 Fish and Wildlife Program, at least until March 1, 2004. The Joint Fishery Parties stipulate that the PUD shall receive full credit for its hatchery production in meeting any requirements that may be established as a result of implementation of Section 203 of the Council's Program.

E. LIMITATION ON REOPENING

The Joint Fishery Parties shall not invoke or rely upon any reopener clause set forth in any license applicable to the Wells

Project for the purpose of obtaining additional fish measures or changes in project structures or operations pertaining to fishery issues until after March 1, 2004.

F. ADDITIONAL MEASURES

The Joint Fishery Parties shall refrain from contending on their own behalf or supporting any contention by other persons in any proceeding or forum that additional fish measures or changes in project structures or operations pertaining to fishery issues should be imposed at the Wells Project until after March 1, 2004.

VII. MISCELLANEOUS

A. COOPERATION

The Parties shall cooperate in conducting studies and shall provide assistance in obtaining any approvals or permits which may be required for implementation of this Agreement.

B. NOTICES

All written notices to be given pursuant to this Agreement shall be mailed by first-class mail, postage prepaid, to each Party at the address listed below or such subsequent address as a Party shall identify by written notice to all other Parties. Notices shall be deemed to be given three (3) days after the date of mailing.

C. WAIVER OF DEFAULT

Any waiver at any time by any Party hereto of any right with respect to any other Party with respect to any matter arising in connection with this Agreement shall not be considered a waiver with respect to any subsequent default or matter.

D. ENTIRE AGREEMENT -- MODIFICATIONS

All previous communications between the Parties hereto, either verbal or written, with reference to the subject matter of this Agreement are hereby abrogated, and this Agreement duly accepted and approved, constitutes the entire agreement between the Parties hereto, and no modifications of this Agreement shall be binding upon any Party unless executed or approved in accordance with the procedures set forth in subsection I.C.

E. BENEFIT AND ASSIGNMENT

This Agreement shall be binding upon and inure to the benefit of the Parties hereto and their successors and assigns provided, no interest, right or obligation under this Agreement shall be transferred or assigned by any Party hereto to any other Party or to any third party without the written consent of all other Parties, except by a Party:

(a) To any person or entity into which or with which the Party making the assignment or transfer is merged or consolidated or to which such Party transfers substantially all of its assets; or

(b) To any person or entity that wholly owns, is wholly owned by or is wholly owned in common with the Party making the assignment or transfer.

F. FORCE MAJEURE

The PUD shall not be liable for failure to perform or for delay in performance due to any cause beyond its reasonable control. This may include, but is not limited to, fire, flood, strike or other labor disruption, act of God, act of any governmental authority or of the Joint Fishery Parties, embargo, fuel or energy unavailability, wrecks or unavoidable delays in transportation, and inability to obtain necessary labor, materials or manufacturing facilities from generally recognized sources in the applicable industry. The PUD will make all reasonable efforts to resume performance promptly once the force majeure is eliminated.

G. INFLATION CALCULATIONS

All dollars specified in this Agreement are 1988 dollars. Dollar figures shall be adjusted annually for each year after 1988 based on the "Consumer Price Index for All Urban Consumers" published by the Bureau of Labor Statistics of the U.S. Department of Labor. If this index is discontinued or becomes unavailable, a comparable index agreeable to all Parties will be substituted.

H. METHOW RIVER HATCHERY WATER SUPPLY

1. The PUD agrees to cooperate with the Washington Department of Fisheries (WDF) to secure the necessary water rights and permits for facilities to be provided under this Agreement.

2. With respect to the proposed Methow River hatchery, the Parties agree that WDF and the PUD may utilize for the proposed Methow River hatchery facility up to 7 cfs of the water right now

held by the U.S. Fish and Wildlife Service (FWS), and subject to full or partial recall by FWS for any reason. The PUD shall not obtain legal title or ownership of the FWS water right.

3. To the extent that the utilization of water does not occur or is recalled or returned to FWS, the PUD and WDF shall use their best efforts to acquire an alternative source of water that meets applicable State requirements for water rights in order to satisfy obligations under this Agreement.

4. The PUD agrees to cooperate with WDF to secure the necessary permits in order to construct and provide for the operation of the proposed Methow River hatchery. The hatchery will be designed and constructed with the capability of installing pump-back facilities for returning the flow to the point of diversion.

5. If hatchery and/or river water supply requirements dictate the need for installation of a pump-back scheme, the PUD shall install and WDF shall operate the pump-back facilities.

VIII. <u>REGULATORY APPROVAL</u>

A. <u>FERC ORDERS</u>

All Parties agree to join in the filing of an offer of settlement with the FERC based on this Agreement and to request that the FERC issue appropriate orders approving the settlement. All Parties shall refrain from seeking judicial review of the FERC orders approving this Agreement.

B. <u>PERFORMANCE CONTINGENT ON APPROVAL</u>

Performance of all Parties' obligations under this Agreement is expressly made contingent on obtaining all necessary regulatory approvals, specifically including all FERC orders referred to in subsection VIII.A above, and all applicable federal, state and local permits. It is expressly agreed by all Parties that this Agreement shall be submitted to the FERC as a unit and any material modification of its terms, approval of less than the entire Agreement, or addition of material terms by the FERC shall make this Agreement voidable at the option of any Party.

C. NO PREJUDICE

All Parties stipulate that neither FERC approval nor any Party's execution of this Agreement shall constitute approval or admission of, or precedent regarding, any principle, fact or issue in the Mid-Columbia proceedings, or any other FERC proceeding, including subsequent modification proceedings under Section I.

D. EXECUTION

This Agreement may be executed in counterparts. A copy with all original executed signature pages affixed shall constitute the original Agreement. The date of execution shall be the date of the final Party's signature. Approval of this Agreement must be acknowledged by the Commissioner of Indian Affairs and the Secretary of the Interior, or their delegates, to the extent required by 25 U.S.C. § 81.

E. AUTHORITY

Each Party to this Agreement hereby represents and acknowledges that it has full legal authority to execute this Agreement and shall be fully bound by the terms hereof.

F. ACTION FOR NONCOMPLIANCE

Notwithstanding any other provision of this Agreement, any Party may seek relief arising solely from noncompliance with this Agreement by any Party; provided, all requests for specific performance of any provision of this Agreement shall be filed with the FERC pursuant to subsection I.D.

IN WITNESS WHEREOF, the Parties have executed this Agreement the day and year first written above.

APPENDIX A

JUVENILE MIGRANT LOSS ESTIMATES USED FOR COMPENSATION PLANS IN THE WELLS DAM SETTLEMENT AGREEMENT

1. <u>Steelhead</u>

The number of juvenile steelhead migrants killed by passage through the Wells Project reservoir and dam were not estimated for the purposes of this Settlement Agreement. As an alternative the parties have agreed to continue steelhead production programs and plans initiated under previous Mid-Columbia settlements.

2. <u>Salmon Loss Estimates</u>

The number of juvenile salmon migrants killed by passage through the Wells Project reservoir and dam were estimated as follows:

a. The number of juvenile migrant salmon, by species and race, entering the Wells Reservoir was estimated for natural production by applying sex ratios, egg per female data and theoretical egg to migrant survival rates to the numbers of adults passing above Wells Dam to spawn. These juvenile migrant numbers were computed annually and averaged over the passage years 1975-1984 for spring and summer chinook and averaged over the passage years 1975-1986 for sockeye. The recent average level of hatchery releases at Winthrop National Fish Hatchery were added to the spring chinook migrant estimates. The resulting estimates of average annual numbers of juvenile migrant salmon entering Wells reservoir are:

Spring Chinook	=	1,504,400
Summer Chinook	=	2,913,300
Sockeye	=	4,617,000
Total	=	9,034,700

b. The total project mortality at Wells, including reservoir mortality, was estimated to be 14%. Applying this mortality rate to the population estimates in Item 1 above results in the following estimates of juvenile migrants killed by species:

Spring Chinook	=	210,600
Summer Chinook	=	407,900
Sockeye	=	646,400
Total loss	=	1,264,900

3. Derivation of Production Plan

a. The Phase I compensation Production Plan and Program is an initial step in production which is not intended to provide full compensation for juvenile migrant losses. The lack of full compensation is due to the experimental nature and developmental aspects of the sockeye Production Plan and Program.

b. To accommodate logistic and per-unit cost factors in Phase I development, about 225,000 (15,000 pounds) spring chinook were substituted for 231,000 sockeye.

c. Items (1) through (3) below describe the derivation of the hatchery-based compensation levels included in the body of the Agreement.

(1) Steelhead production is set at 30,000 lbs./year to continue the successful program initiated under prior Mid-Columbia Settlement Agreements.

(2) Phase I compensation includes a pilot program for hatchery production of sockeye. The sockeye production level is set to allow assessment of Program success rather than provide full compensation for the estimated juvenile losses at Wells.

(3) The Phase II Chinook/Sockeye Production Plan is sized to mitigate for estimated juvenile losses:

	Estimated Annual Losses at Wells	Annual Production Phase IIA	or Phase IIB
Spring Chinook	210,600	450,000	450,000
Summer Chinook	407,900	400,000	810,000
Sockeye	646,400	375,000	-
TOTALS	1,264,900	1,225,000	1,260,000

4. Chelan PUD/Douglas PUD Compensation Exchange

In recognition of the specific requirements for spring and summer chinook rearing facilities and the characteristics of the water supply at the PUD's proposed spring chinook rearing facility on the Methow River, the Joint Fisheries Parties, Douglas PUD and Chelan County PUD have reviewed the respective compensation

obligations of Douglas PUD as set forth in this Agreement, and Chelan County PUD under terms of the Rock Island Settlement. In consideration of biological efficiency and logistical effectiveness, the parties have agreed to adjusted compensation obligations under this agreement and the Rock Island
Settlement in the following manner:

a. Douglas PUD will assume responsibility for 19,200 pounds of Methow River sub-basin spring chinook production.

b. Chelan PUD will assume responsibility for 40,000 pounds of Methow River summer chinook production.

The resulting changes in production with the Douglas-Chelan compensation exchange agreement are (number of juveniles/year):

	Douglas Production	Chelan Production
Spring Chinook	Increases 288,000	Decreases 288,000
Summer Chinook	Decreases 400,000	Increases 400,000
Sockeye	No Effect	No Effect

c. The resultant Douglas PUD annual compensation program under this agreement (Phase II Production) is:

<u>Phase IIA</u>

30,000 lbs. of Steelhead @ 6/lb.

49,200 lbs. of Spring Chinook @ 15/lb.

15,000 lbs. of Sockeye @ 25/lb.

OR

<u>Phase IIB</u>

30,000 lbs. of Steelhead @ 6/lb.

49,200 lbs. of Spring Chinook @ 15/lb.

15,000 lbs. of Summer Chinook @ 10/lb.

6,500 lbs. of Summer Chinook at 40/lb.

APPENDIX B

DETERMINATION OF RESPONSIBILITY FOR HATCHERY COMPENSATION

For each year of determination, calculate an average smolt output as follows:

1. Calculate a 5-year running average adult run (by species) for naturally spawned fish (Ays) as follows:

$$\bar{A}ys = \frac{Ay + Ay-1 + Ay-2 + Ay-3 + Ay-4}{5}$$

Where Ay is the total adult count for each species at Wells minus the hatchery escapement for the species in year y; Ay-1 = the same in the previous year (y-1) and so on.

2. Multiply Ays by the average expected adult to smolt production factor Kys for each species, where Kys is calculated as follows:

   a. Spring Chinook:

   Ksp = 0.94 (Wells Dam to spawner survival)
   x 0.50 (sex ratio) x 5000 (eggs/female)
   x 0.10 (av. survival to smolt) = 235

   b. Summer Chinook:

   Ksu = 0.94 x 0.50 x 5000 x 0.30 = 705

c. Sockeye:

$$Kso = 0.94 \times 0.50 \times 2700 \times 0.12 = 152$$

3. Add the number of hatchery smolts HSys by species, which is a running average of the same 5 years as in Ays.

$$\overline{HSys} = \frac{HSy + HSy\text{-}1 + HSy\text{-}2 + HSy\text{-}3 + HSy\text{-}4}{5}$$

4. Total smolts (by species):

$$\overline{S}ys = Kys \times \overline{A}ys + \overline{HS}ys$$

5. Grand Total = Sum of all species:

$$Sgt = \overline{S}sp + \overline{S}su + \overline{S}so + \overline{.}..$$

6. If other salmon species or races, for which the above smolt production factors (Kys) do not apply, become established in the production areas above Wells Dam, appropriate K factors for these fish will be established by consensus of the Coordinating Committee. Juvenile migrant production will be computed for these species or races. These numbers will be included in the grand total for juvenile migrant production and the 5-year running averages.

WELLS PHASE IV THEORETICAL CALCULATION EXAMPLE

NATURAL PRODUCTION

DATA USED IN EXAMPLE CALCULATION OF NATURAL PRODUCTION

Adult Count	Ay	Ay-1	Ay-2	Ay-3	Ay-4	5 Year Average
Spring Chinook	3,000	2,200	3,100	5,000	2,900	3,240
Summer Chinook	2,400	2,800	3,700	4,000	4,700	3,520
Sockeye	40,000	20,000	35,000	15,000	30,000	28,000

Ay = Wells Count Minus Hatchery Escapement for Year Y

Ksp = Calculated Spring Chinook Smolts

Ksu = Calculated Summer Chinook Smolts

Ksoe = Calculated Sockeye Smolts

Spring Chinook $\bar{A}y = \dfrac{Ay + Ay\text{-}1 + Ay\text{-}2 + Ay\text{-}3 + Ay\text{-}4}{5}$

$= \dfrac{3000 + 2200 + 3100 + 5000 + 2900}{5}$

$= 3240$

Summer Chinook $\bar{A}y = \dfrac{Ay + Ay\text{-}1 + Ay\text{-}2 + Ay\text{-}3 + Ay\text{-}4}{5}$

$= \dfrac{2400 + 2800 + 3700 + 4000 + 4700}{5}$

$= 3520$

Sockeye $\bar{A}y = \dfrac{Ay + Ay\text{-}1 + Ay\text{-}2 + Ay\text{-}3 + Ay\text{-}5}{5}$

$= \dfrac{40{,}000 + 20{,}000 + 35{,}000 + 15{,}000 + 30{,}000}{5}$

$= 28{,}000$

Ksp, su, soc = Adult/redd factor x sex ratio x eggs/female x eggs to smolt survival x dam count minus hatchery return

Calculated Average Total Smolts (Natural)

Spring Chinook	Ksp	=	.94 x .50 x 5000 x .10 x 3240
		=	235 x 3240
		=	761,400
Summer Chinook	Ksu	=	.94 x .50 x 5000 x .30 x Ay
		=	705 x 3520
		=	2,481,600
Sockeye	Ksoc	=	.94 x .50 x 2700 x .12 x Ay
		=	152 x 28,000
		=	4,263,800

Average Total Natural Smolts

= Ksp + Ksu + Ksoc
= 761,400 + 2,481,600 + 4,263,800
= 7,506,800

HATCHERY PRODUCTION

DATA USED IN EXAMPLE DETERMINATION OF HATCHERY PRODUCTION

SMOLT PRODUCTION IN MILLIONS BY YEAR

Hatchery	Y	Y-1	Y-2	Y-3	Y-4	5 Year Average
Winthrop	1.5	1.1	1.0	.95	.95	1.1
Methow	.8	.8	.675	.40	.25	.585
Twisp Acclimation	.40	.40	.40	.25	.2	.33
Sockeye Net Pens	.2	.2	.2	.15	.1	.17

Hatchery Smolt Production

Winthrop Hatchery = $\dfrac{1{,}500{,}000 + 1{,}100{,}000 + 1{,}000{,}000 + 950{,}000 + 950{,}000}{5}$

= 1,100,000

Methow Hatchery = $\dfrac{800{,}000 + 800{,}000 + 675{,}000 + 400{,}000 + 250{,}000}{5}$

= 585,000

Twisp Accl. Pond = $\dfrac{400,000 + 400,000 + 400,000 + 250,000 + 200,000}{5}$

= 330,000

Sockeye Net Pens* = $\dfrac{200,000 + 200,000 + 200,000 + 150,000 + 100,000}{5}$

= 170,000

*Need Adjustment Factor For Survival To Migration

Average Total Hatchery Smolts

Winthrop	=	1,100,000
Methow	=	585,000
Twisp	=	330,000
Net Pens	=	170,000
		2,185,000

Average Total Hatchery/Natural Smolts
(5 Year Average for Years Y-4, Y-3, Y-2, Y-1 and Y)

Natural	=	7,779,000
Hatchery	=	2,185,000
Total	=	9,964,000

PHASE IV DETERMINATION

Base Number Smolts Used for Initial Compensation	=	9,034,700
Calculated Average Natural + Hatchery Smolts in Years Y-4, Y-3, Y-2, Y-1 and Y	=	9,964,000
Calculated Average Natural + Hatchery Smolts Minus Base Number Smolts	=	929,300
Difference Between Base Number Smolts and Calculated Natural + Hatchery Smolts X Wells Project Mortality Rate	=	929,300 X .14
= Additional Smolts Possible Under Phase IV		130,102

FOR PUBLIC UTILITY DISTRICT NO. 1
OF DOUGLAS COUNTY, WASHINGTON:

Howard Frey
Commissioner

Michael [illegible]
Commissioner

T. James Davis
Commissioner

FOR PUGET SOUND POWER & LIGHT COMPANY:

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FOR PACIFIC POWER & LIGHT COMPANY:

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FOR THE WASHINGTON WATER POWER COMPANY:

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FOR PORTLAND GENERAL ELECTRIC COMPANY:

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FOR THE WASHINGTON DEPARTMENT
OF FISHERIES:

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FOR THE WASHINGTON DEPARTMENT
OF WILDLIFE:

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FOR PUBLIC UTILITY DISTRICT NO. 1
OF DOUGLAS COUNTY, WASHINGTON:

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Commissioner

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Commissioner

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Commissioner

FOR PUGET SOUND POWER & LIGHT COMPANY:

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FOR PACIFIC POWER & LIGHT COMPANY:

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FOR THE WASHINGTON WATER POWER COMPANY:

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OF WILDLIFE:

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OF DOUGLAS COUNTY, WASHINGTON:

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Commissioner

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OF DOUGLAS COUNTY, WASHINGTON:

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Commissioner

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Commissioner

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Commissioner

FOR PUGET SOUND POWER & LIGHT COMPANY:

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FOR PACIFIC POWER & LIGHT COMPANY:

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FOR THE WASHINGTON WATER POWER COMPANY:

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FOR PORTLAND GENERAL ELECTRIC COMPANY:

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FOR THE WASHINGTON DEPARTMENT
OF FISHERIES:

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FOR THE WASHINGTON DEPARTMENT
OF WILDLIFE:

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FOR PUBLIC UTILITY DISTRICT NO. 1
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Commissioner

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Commissioner

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FOR PACIFIC POWER & LIGHT COMPANY:

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FOR THE WASHINGTON WATER POWER COMPANY:

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FOR PORTLAND GENERAL ELECTRIC COMPANY:

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FOR THE WASHINGTON DEPARTMENT
OF FISHERIES:

[signature] 6/11/90
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FOR THE WASHINGTON DEPARTMENT
OF WILDLIFE:

Ray Ryan 6/11/90
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FOR THE OREGON DEPARTMENT OF
FISH AND WILDLIFE:

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FOR THE NATIONAL MARINE
FISHERIES SERVICE:

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FOR THE U.S. FISH & WILDLIFE SERVICE:

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FOR THE CONFEDERATED TRIBES AND BANDS
OF THE YAKIMA INDIAN NATION:

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FOR THE CONFEDERATED TRIBES
OF THE UMATILLA INDIAN RESERVATION:

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FOR THE CONFEDERATED TRIBES
OF THE COLVILLE RESERVATION:

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FOR THE OREGON DEPARTMENT OF
FISH AND WILDLIFE:

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FOR THE NATIONAL MARINE
FISHERIES SERVICE:

Rolland A. Schmitten

FOR THE U.S. FISH & WILDLIFE SERVICE:

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FOR THE CONFEDERATED TRIBES AND BANDS
OF THE YAKIMA INDIAN NATION:

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FOR THE CONFEDERATED TRIBES
OF THE UMATILLA INDIAN RESERVATION:

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FOR THE CONFEDERATED TRIBES
OF THE COLVILLE RESERVATION:

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FOR THE OREGON DEPARTMENT OF
FISH AND WILDLIFE:

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Marvin L. Plenert

Marvin L. Plenert, Regional Director
FOR THE U.S. FISH & WILDLIFE SERVICE

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FOR THE CONFEDERATED TRIBES AND BANDS
OF THE YAKIMA INDIAN NATION:

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FOR THE CONFEDERATED TRIBES
OF THE UMATILLA INDIAN RESERVATION:

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FOR THE CONFEDERATED TRIBES
OF THE COLVILLE RESERVATION:

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FOR THE OREGON DEPARTMENT OF
FISH AND WILDLIFE:

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FOR THE NATIONAL MARINE
FISHERIES SERVICE:

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FOR THE U.S. FISH & WILDLIFE SERVICE:

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FOR THE CONFEDERATED TRIBES AND BANDS
OF THE YAKIMA INDIAN NATION:

Levi George
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FOR THE CONFEDERATED TRIBES
OF THE UMATILLA INDIAN RESERVATION:

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FOR THE CONFEDERATED TRIBES
OF THE COLVILLE RESERVATION:

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FOR THE OREGON DEPARTMENT OF
FISH AND WILDLIFE:

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FOR THE NATIONAL MARINE
FISHERIES SERVICE:

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FOR THE U.S. FISH & WILDLIFE SERVICE:

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FOR THE CONFEDERATED TRIBES AND BANDS
OF THE YAKIMA INDIAN NATION:

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FOR THE CONFEDERATED TRIBES
OF THE UMATILLA INDIAN RESERVATION:

Edward H. Patawa

FOR THE CONFEDERATED TRIBES
OF THE COLVILLE RESERVATION:

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FOR THE OREGON DEPARTMENT OF
FISH AND WILDLIFE:

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FOR THE NATIONAL MARINE
FISHERIES SERVICE:

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FOR THE U.S. FISH & WILDLIFE SERVICE:

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FOR THE CONFEDERATED TRIBES AND BANDS
OF THE YAKIMA INDIAN NATION:

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FOR THE CONFEDERATED TRIBES
OF THE UMATILLA INDIAN RESERVATION:

____

FOR THE CONFEDERATED TRIBES
OF THE COLVILLE RESERVATION:

Jude C. Stensgar

____

<u>F.E.R.C. ORDER DISMISSING THE WELLS SETTLEMENT AGREEMENT</u>

APPENDIX O

109 FERC ¶ 61,208

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Pat Wood, III, Chairman;
Nora Mead Brownell, Joseph T. Kelliher,
and Suedeen G. Kelly.

Public Utility District No. 1 of Chelan County, Washington	Project Nos. 2145-062 and 943-089
Public Utility District No. 1 of Douglas County, Washington	Project No. 2149-113

ORDER ON REHEARING

(Issued November 23, 2004)

1. On June 21, 2004, the Commission issued a master order and three project-specific companion orders in this proceeding. The orders approve project-specific Anadromous Fish Agreement and Habitat Conservation Plans (HCPs) regarding the operation of the Rocky Reach Project No. 2145 and the Rock Island Project No. 943, which are licensed to Public Utility District No. 1 of Chelan County, Washington (Chelan) and the Wells Project No. 2149, which is licensed to Public Utility District No. 1 of Douglas County, Washington (Douglas).[1]

2. A joint request for rehearing was filed by the Columbia River Inter-Tribal Fish Commission, the Confederated Tribes and Bands of the Yakama Nation (Yakama) and the Confederated Tribes of the Umatilla Indian Reservation (together, CRITFC). A joint request for rehearing and clarification was filed by Chelan, Douglas, the National Marine Fisheries Service (NOAA Fisheries), the Washington Department of Fish and Wildlife

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[1] *P.U.D. No. 1 of Chelan County, WA*,., 107 FERC ¶ 61,280 (master order); *P.U.D. No. 1 of Chelan* County, WA, 107 FERC ¶ 61,281 (Rocky Reach); *P.U.D. No. 1 of Chelan County*,. *WA*, 107 FERC ¶ 61,282 (Rock Island); *P.U.D. of Douglas County, WA*, 107 FERC ¶ 61,283 (Wells).

(WDFW), and the Confederated Tribes of the Colville Reservation (together, the HCP Parties). In this order, we grant in part and deny in part CRITFC's request for rehearing and grant the HCP Parties' request for clarification and rehearing. This order is in the public interest because it clarifies the role of Indian tribes that declined to execute the HCPs, but have an interest in the management of the HCP plan species and their habitats.

Background

3. The lengthy and complex background to this order is set forth in detail in the master order.[2] We summarize that order here in order to provide context for the following discussion.

4. The Mid-Columbia River is home to various species of salmon and steelhead trout. Some of these anadromous fish are federally listed as threatened or endangered. These listings are the result in part of the presence of many large hydropower projects on the Columbia River, including the four Mid-Columbia River projects. From upstream to downstream these are the Wells Project No. 2149, the Rocky Reach Project No. 2145; the Rock Island Project No. 943, and the Wanapum-Priest Rapids Project No. 2114.[3]

5. In 1978, various federal and state agencies and Indian tribes petitioned the Commission to require all of the Mid-Columbia projects to provide increased minimum flows and spills at each dam to assist the migration of salmon and steelhead trout. These actions were consolidated and set for hearing before an administrative law judge. The proceeding became known as the Mid-Columbia proceeding. In due course, interim and longer-term settlement agreements were filed with respect to some of the Mid-Columbia projects. In that context, the Mid-Columbia Coordinating Committee (MCCC) was established to coordinate the activities of all participants in the proceeding.[4]

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[2] Master order, 107 FERC at 62,310-313.

[3] Wanapum-Priest Rapids is licensed to Public Utility District No. 2 of Grant County, Washington.

[4] The MCCC was established in a limited-term settlement agreement that expired in 1985, but continued to function at the direction of the presiding judge. *See P.U.D. No. 1 of Chelan County, WA,* 34 FERC ¶ 63,044 at 65,164 (1986)

6. Other, longer-term settlement agreements were approved in 1987 and 1990 with respect to Rock Island and Wells, respectively. The Rock Island Agreement was incorporated into a new license for that project. The Wells Agreement was incorporated into the Wells license, and the Mid-Columbia proceeding was terminated as to the Wells Project. Various studies related to downstream passage at Rocky Reach Project continued, and the Mid-Columbia Proceeding remained open as it pertains to that project.

7. The Endangered Species Act (ESA)[5] authorizes NOAA Fisheries and the U.S. Fish and Wildlife Service (FWS) to issue an incidental take permit for listed species, which allows the permittee to conduct an activity that results in an incidental take of listed species. An incidental take permit may be issued in association with an HCP, which is a long-term planning document for minimizing and mitigating impacts of the permitted action.

8. In the mid-1990s, the licensees, NOAA Fisheries, FWS, WDFW, the above-mentioned tribes, and American Rivers entered into negotiations to develop HCPs for the Mid-Columbia projects.

9. In April 2002, project-specific HCPs were executed for Rocky Reach, Rock Island, and Wells.[6] NOAA Fisheries subsequently issued an Environmental Impact Statement in connection with the HCPs, as well as project-specific Biological Opinions pursuant to section 7 of the ESA. It thereafter issued an incidental take permit for the operation of each project.

10. In 2003, the Chelan and Douglas filed separate applications for approval of the project-specific HCPs and for their incorporation as articles in the applicable licenses. The Rock Island and Wells applications requested that those licenses be amended by replacing the 1987 Rock Island and 1990 Wells Agreements, respectively, with the project-specific HCPs. There was no pre-existing Rocky Reach agreement on anadromous fisheries to be replaced.

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[5] 16 U.S.C. §§ 1531-1543.

[6] No HCP has been executed for Wanapum-Priest Rapids.

11. The Commission commenced license amendment proceedings, in which it adopted NOAA Fisheries' EIS. In the master order, we approved the HCPs and incorporated them into the relevant licenses. As noted, timely requests for rehearing were filed by CRITFC and the HCP Parties.

12. On October 4, 2004, NOAA Fisheries filed a letter responding to CRITFC's arguments regarding participation by CRITFC in decision-making pursuant to the HCPs.

Discussion

A. NOAA Fisheries' Filing

13. Under Rule 213(a)(2) of the Commission's Rules of Practice and Procedure,[7] an answer may not be made to a request for rehearing unless otherwise ordered by the decisional authority. We have allowed such answers where the party seeking rehearing makes new arguments or the answer will assist the Commission in addressing the issues.[8]

14. Here, NOAA Fisheries' response includes a new proposal to provide for consultation with the non-signatory Indian tribes, said to be supported by all of the HCP Parties. This proposal will assist us in addressing issues pertaining to the continuing role of the non-signatory Indian tribes in management of the anadromous fishery. We will therefore accept NOAA Fisheries' filing.

B. CRITFC Concerns

15. The 1987 Rock Island and 1990 Wells Agreements which were replaced by the Rock Island and Wells HCPs provided for certain flows, hatchery programs, and other measures to assist the anadromous fishery. In its protest, Yakama argued that these agreements are contracts and that the consent of all signatories is required in order to remove them from the Rock Island and Wells licenses. It characterized the

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[7] 18 C.F.R. § 385.213(a)(2)(2004).

[8] *See, e.g.*, *Central Nebraska Public Power and Irrigation District*, 52 FERC ¶ 61,339 at 62,344 (1990); *Southern California Edison Co. and San Diego Gas and Electric Co.*, 49 FERC ¶ 61,091 at 61,357 (1989).

Commission's approval of the HCPs as unilateral termination of the prior agreements, and asked that the HCPs be either rejected or modified to ensure that they provide for Yakama's continued participation in management of the species covered by those plans.

16. We denied both requests. The 1987 Rock Island Agreement provided that any party could, after the year 2000, initiate negotiations or file a petition to modify that agreement's terms and conditions, or to replace it in whole or part. We found that the 1990 Wells Agreement contained a similar provision and, in any event, both licenses contain a reservation of Commission authority at any time during the license term to require alterations to project facilities and operations if warranted by changed circumstances.[9]

17. On rehearing, CRITFC essentially reiterates Yakama's previously-rejected contract arguments. It does not dispute that the agreements and license article provisions permit modification or replacement of the 1987 Rock Island and 1990 Wells agreements, but states that the signatories never contemplated replacement of those agreements with agreements that deny the CRITFC tribes a continuing role in management of Mid-Columbia fisheries.[10]

18. The 1987 Rock Island and 1990 Wells Agreements say nothing about the terms of any future modifications or replacement agreements, and CRITFC's position on the signatories' intentions is not shared by the signatories other than Yakama. In any event, when these agreements were incorporated into the licenses as articles, they became subject to this Commission's jurisdiction, and are to be construed in the context of the entire license, including the Commission's reserved authority. We exercise that reserved authority by determining what is in the public interest in light of all relevant considerations. CRITFC's arguments in that regard are considered below.[11]

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[9] Master order, 107 FERC at 62,316.

[10] CRITFC rehearing request at 6-9.

[11] CRITFC also asserts that Douglas violated the 1990 Wells Agreement by discussing with NOAA Fisheries and others the possibility of developing HCPs in the mid-1990s and submitting its application to amend the Wells license in November 2003. That agreement provides that a party may request the other parties to begin negotiations to modify the terms of that agreement "any time after March 1, 2004." CRITFC

(continued...)

19. In the master order we found that it would not be in the public interest to allow the non-signatory tribes to participate in HCP processes unless they are bound by the same rules of participation as the signatories.[12] We did however recognize that these tribes have an important interest in the recovery of the Columbia River fishery, and stated our expectation that, although the Mid-Columbia proceeding was no longer be open as to any of the three projects, the MCCC would continue to function as a forum for coordination and discussion among the interested entities of issues common to the Mid-Columbia River Basin.[13]

20. CRITFC renews its request that the HCPs be modified to provide for the participation by the non-signatory tribes in HCP committee activities and decision-making. First, it reiterates previously-rejected[14] arguments that the government's trust responsibility to the tribes requires the Commission to ensure that the non-signatory tribes have a decision-making role in management of the Columbia River fishery and, further, requires the Commission to reject the HCPs because they do not go far enough toward these tribes' goals of a sustainable, harvestable fishery.[15] CRITFC's rehearing request includes no new facts or argument that would cause us to change our conclusion that our responsibility to fully consider the concerns of Indian tribes, as we have done

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rehearing request at 9, *citing* Wells Agreement at 3. Any objections CRITFC might have had to the HCP negotiations were effectively waived by CRITFC's active participation in those negotiations. *See* CRITFC rehearing request at 4 ("The Tribes. . . participated in these discussions since their inception.").

[12] Master order, 107 FERC at 62,327.

[13] *Id.* Subsequently, on August 18, 2004, the Commission's Chief Administrative Law Judge returned the Mid-Columbia proceeding from the presiding judge to the Commission. 108 FERC ¶ 63,024. That action did not terminate the proceeding. Because, however, the Commission has already terminated the proceeding with regard to Rocky Reach, Rock Island, and Wells, the proceeding is alive only as it pertains to Wanapum-Priest Rapids.

[14] *See* master order, 107 FERC at 62,319-20 and 62,323-25.

[15] CRITFC rehearing request at 14-18.

here, does not require us to reach a specific result. Thus, we are not required to treat the non-signatory tribes as though they are signatories, over the objections of and to the detriment of the signatories, including other Indian tribes. We also see no facts or arguments that cause us to question our conclusions regarding the sufficiency of the HCPs.

21. CRITFC also contends that a decision-making role in implementation of the HCPs for the non-signatory tribes is needed in order to prevent the compromise of their interests in other Columbia River Basin fishery fora. More specifically, it states that the HCPs provide for a reduction in subyearling salmon production in favor of yearling salmon production, and that that is inconsistent with agreements made in the context of the United States-Canada Pacific Salmon Treaty,[16] and *U.S. v. Oregon* processes[17] to provide for production of non-hatchery subyearling summer Chinook salmon in tributary habitat and mitigation for the loss of summer Chinook resulting from the operation of Wells, Rocky Reach, and Rock Island.[18] CRITFC also states that the HCPs do not provide mitigation for the loss of coho salmon resulting from project operations, in contrast to efforts by the Yakama Nation to rebuild that stock. CRITFC adds that reduced production of spring Chinook under the HCPs will undermine the CRITFC tribes' goal of

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[16] Treaty Between the Government of the United States and the Government of Canada Concerning Pacific Salmon, entered into force January 28, 1985, amended by exchange of notes and entered into force on June 30, 1999. This treaty was adopted to promote rational management of Pacific salmon stocks through international cooperation.

[17] CRITFC evidently refers here to procedures and processes developed in the context of the Columbia River Fish Management Plan (CRFMP), which was accepted as a partial settlement of the consolidated cases in *U.S. v. Oregon*, Civ. No. 68-513 and *U.S. v. Washington*, Civ. No. 9213. The CRFMP provides a framework for protecting, rebuilding, and enhancing salmon runs and for allocating and planning in-river harvest activities. *See generally*, *U.S. v. Oregon*, 699 F. Supp. 1456, 1458-60 (D. Or.1988), *aff'd*, 913 F.2d 576 (9th Cir. 1990), *cert. denied*, 501 U.S. 1250 (1991) and *U.S. v. Oregon*, Civ. No. 68-513-MA, Opinion of Feb. 29, 1992, 1991 WL 613238.

[18] CRITFC rehearing request at 12. CRITFC provides no citations or other documentary evidence of the purported agreements.

sustainable, harvestable levels of anadromous fish.[19] Finally, CRITFC contends that the public interest is served by the tribes having a decision-making role on the HCP committees because tribal representatives have technical expertise lacking in federal and state agencies because of their work on salmonid issues throughout the Pacific Northwest and Canada and because they have a unique cultural perspective.[20]

22. NOAA Fisheries states that the HCP Parties remain opposed to participation by non-signatory parties in the HCP Coordinating Committees, even in a non-voting capacity, but have agreed to invite them to participate in HCP implementation as non-voting members of the Tributary and Hatchery Committees, in the hope that they will gain confidence in the HCP processes and ultimately become signatories. NOAA Fisheries adds that it is an active participant in *U.S. v. Oregon* and Pacific Salmon Treaty proceedings and is mindful of the need for decisions made in the HCP context to be consistent with the management goals of those other fora and the commitments made therein.[21]

23. We remain convinced that the public interest is best served by approving the HCPs and by requiring any entity wishing to have a decisional role in their implementation to be bound by the same rules that apply to entities that have signed them. To decide

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[19] *Id.* at 12-13.

[20] *Id.* at 13-14.

[21] NOAA Fisheries response at 2. We infer that this proposal supersedes the HCP Parties' proposal in their rehearing request that, if consultation with non-signatories is needed, the Commission should permit the HCP Parties to provide quarterly briefings on the status of HCP implementation to any interested entities, and that such briefing also be used as a forum for discussion, albeit not decision-making. *See* HCP Parties' rehearing request at 15-16.

The HCP Parties also indicate that NOAA Fisheries is committed to further consultation and coordination with the non-signatory tribes. HCP Parties' rehearing request at 16. We commend NOAA Fisheries for this commitment, which we hope will lead to better understanding and to substantive agreements between the HPC Parties and the non-signatory tribes.

otherwise would unduly favor the non-signatory tribes, who would then have the benefits of participation in the implementation process without accepting the concomitant responsibilities.

24. The Coordinating Committees are the primary means of consultation and coordination between the licensees and the other signatories in connection with the conduct of studies and implementation of the measures set forth in the HCPs to benefit the fishery. They have the authority to oversee all aspects of standards, methodologies, and implementation of these measures. They are also responsible for preparing annual progress reports, ensuring timely circulation of studies and reports prepared pursuant to the agreements, and approval and implementation of the survival standards established in the Passage Survival Plans for each project.[22] The Coordinating Committees are also responsible for dispute resolution when the other committees are unable to agree.

25. The Tributary Committees are charged with implementing the Tributary Conservation Plans of the project-specific HCPs by selecting tributary habitat improvement projects and approving project budgets.[23] The Hatchery Committees are responsible for overseeing development of recommendations for implementing the hatchery elements of the HCPs, including improvements, monitoring, and evaluation, as identified in the Hatchery Compensation Plans.[24] If the members of either of these committees are unable to agree, the matter is referred to the Coordination Committee.

26. The HCPs are not likely to achieve their goals if some voting participants are bound by the goals, implementation processes and measures, and dispute resolution provisions, while others may prevent action or dispute resolution by opting out whenever they are dissatisfied. For that reason, we will not modify the licenses to require that non-signatories be offered committee memberships. We conclude, however, the HCP Parties' offer of non-voting membership on the Tributary and Hatchery Committees is a reasonable means of ensuring that the views of the CRITFC tribes are heard on these committees and that their expertise and experience continue to be a factor in the decision-

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[22] *E.g.*, Rocky Reach HCP section 4.

[23] *E.g.*, *id.*, section 7.

[24] *E.g.*, *id.*, section 8.

making processes of the various committees. Given the CRITFC tribes' decision not to become party to the settlement, we do not believe that requiring the HCP Parties to extend the tribes additional authority would be in the public interest.

C. Pre-HCP Coordinating Committees

27. In the master order we stated that, although the Mid-Columbia proceeding was terminated with respect to the three projects with HCPs, the MCCC continued to exist and that we expected it to continue to function as a forum for coordination and discussion among interested entities of issues common to the Mid-Columbia River basin.[25] The HCP Parties state on rehearing that it is time to abolish the Wells and Rock Island Coordinating Committees and the MCCC, which served as the decision-making forum for Rocky Reach prior to the Rocky Reach HCP.[26] They state that the HCP Coordinating Committees have superseded all of these pre-HCP committees for collaborative decision-making for Wells, Rocky Reach, and Rock Island, and that using these pre-HCP committees for coordination and consultation now is likely to create misunderstandings and disputes about applicable processes and decisional authority, and thereby interfere with the workings of the HCP Coordinating Committees.[27] We agree. For that reason, and because we are requiring Chelan and Douglas to offer the non-signatory tribes non-voting membership on the Tributary and Hatchery Committees, we will terminate the obligations of Chelan and Douglas to participate in the MCCC, to the extent it may still be functioning, with respect to these three projects. *See* Ordering Paragraph (C).

D. Clarification and Corrections

28. CRITFC and the HCP Parties note that neither the master order nor the companion orders explicitly remove the 1987 Rock Island and 1990 Wells Settlement Agreements from those licenses.[28] It was our intention to do so, and we give explicit effect to that intention in Ordering Paragraphs (A) and (B), respectively.

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[25] Master order, 107 FERC at 62,327.

[26] HCP Parties' rehearing request at 11-16.

[27] *See P.U.D. No. 1 of Chelan County, WA,* 34 FERC ¶ 63,044 at 65,164 (1986).

[28] CRITFC rehearing request at 9; HCP Parties at 3-8.

29. The HCP Parties also request that we remove from the Rock Island license Articles 401 and 402, which were added in order to implement the 1987 Rock Island Settlement Agreement. Ordering paragraph (B) does so.

30. Finally, the U.S. Fish and Wildlife Service's Reasonable and Prudent Measures (RPMs) and associated Terms and Conditions regarding bull trout, which were appended to the project-specific orders, were also inadvertently appended to the master order. Ordering Paragraph (D) below deletes the appendix.[29]

The Commission orders:

(A) Ordering Paragraph (A) of the order at 54 FERC ¶ 61,056 at 61,210 (1991) approving and making part of the license for the Wells Project No. 2149 the 1990 Wells Settlement Agreement, is hereby removed from the Wells Project license.

(B) Ordering Paragraph (F) of the order at 46 FERC ¶ 61,033 at 61,208 (1989) approving and making part of the license for the Rock Island Project No. 943 the 1987 Rock Island Settlement Agreement, and license articles 401 and 402 implementing said settlement agreement (46 FERC at 61,208), are hereby removed from the Rock Island Project license.

(C) Public Utility District No. 1 of Chelan County, Washington, and Public Utility District No. 1 of Douglas County, Washington, are no longer required to participate in processes of the Mid-Columbia Coordinating Committee as those processes pertain to the Rocky Reach Project No. 2145, Rock Island Project No. 943, and Wells Project No. 2149.

(D) The order issued June 21, 2004 in this proceeding, 107 FERC ¶ 61,280, is amended by deletion of the appendix thereto.

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[29] The Wells and Rock Island orders attach the RPMs and Terms and Conditions applicable to those projects, but incorrectly state in the text that the Rocky Reach RPMs and Terms and Conditions are attached. The text should be read to refer to the appropriate Wells and Rock Island RPMs and Terms and Conditions, respectively.

(E) The request for rehearing of CRITFC and the request for rehearing and clarification filed by the HCP Parties, both filed on July, 21, 2004, are hereby granted or denied to the extent discussed herein, and are otherwise denied.

By the Commission.

(S E A L)

Linda Mitry,
Deputy Secretary.