HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Chelan PUD Methow Spring Chinook Program
Species or Hatchery Stock:	Upper Columbia River Spring Chinook (*Oncorhynchus tshawytscha*)
Agency/Operator:	Chelan County Public Utility District No. 1 (Chelan PUD) Washington Department of Fish and Wildlife (WDFW)
Watershed and Region:	Methow Sub-basin/Columbia Cascade Province
Date Submitted:	September 14, 2015
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LIST OF ACRONYMS AND ABBREVIATIONS

BKD	bacterial kidney disease
CCT	Confederated Tribes of the Colville Indian Reservation
cfs	cubic foot per second
Chelan PUD	Public Utility District No. 1 of Chelan County
CI	confidence interval
CWT	coded wire tag
ELISA	enzyme-linked immunosorbent assay
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FDA	Food and Drug Administration
FERC	Federal Energy Regulatory Commission
FL	fork length
fpp	fish per pound
gpm	gallons per minute
HCP	Habitat Conservation Plan
HGMP	Hatchery and Genetic Management Plan
HRR	hatchery replacement rate
HOR	hatchery origin recruit
HSRG	Hatchery Scientific Review Group
ICTRT	Interior Columbia Basin Technical Recovery Team
IHOT	Integrated Hatchery Operations Team
ITS	incidental take statement
JFP	Joint Fisheries Parties
M&E	monitoring and evaluation
mg/kg	milligrams per kilogram
NFH	National Fish Hatchery
NMFS	National Marine Fisheries Service
NNI	No Net Impact
NOR	Natural-origin recruit
NOS	natural-origin spawner
NPDES	National Pollution Discharge Elimination System
NRR	Natural Replacement Rate
NTTOC	non-target taxa of concern
O&M	operation and maintenance
OD	optical density
PFMC	Pacific Fisheries Management Council
pHOS	proportion of hatchery-origin spawners
PIT	passive integrated transponder
PNFHPC	Pacific Northwest Fish Health Protection Committee

PNI	Proportionate Natural Influence
pNOB	proportion of natural-origin broodstock
ppm	parts per million
RCW	Revised Code of Washington
S/S	spawner to spawner
SAR	Smolt-to-Adult Return
UCR	Upper Columbia River
UCSRB	Upper Columbia Salmon Recovery Board
USFWS	U.S. Fish and Wildlife Service
VSP	Viable Salmonid Population
WDFW	Washington State Department of Fish and Wildlife
WRIA	Water Resources Inventory Area
YN	Yakama Nation

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Chelan PUD Methow River Spring Chinook Program.

1.2) Species and population (or stock) under propagation, and ESA status.

Upper Columbia River Spring Chinook (*Oncorhynchus tshawytscha*), Endangered.

1.3) Responsible organization and individuals

Permit applicants:

Public Utility District No. 1 of Chelan County (Chelan PUD) and Washington State Department of Fish and Wildlife (WDFW).

Chelan PUD and WDFW are joint permit applicants with specific responsibilities under the proposed permit: 1) Chelan PUD as funder of facilities, operation and maintenance (O&M), and hatchery program monitoring and evaluation (M&E); and 2) WDFW as authorized fisheries manager and as Chelan PUD's current hatchery operator and implementing contractor for the M&E Plan. Future contractors for Chelan PUD, whether for hatchery operations or M&E, may conduct those activities under Chelan PUDs authorization.

Name (and title): Alene Underwood, Fish and Wildlife Manager
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Agency or Tribe: WDFW
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Email: korthjwk@dfw.wa.gov

Authorized Agent:

The Yakama Nation (YN) will play an important role in the implementation of the proposed permit. The YN operate facilities that may be used to acclimate Chelan PUD's Methow Spring Chinook salmon. The Yakama Nation is an Authorized Agent of Chelan PUD.

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and

extent of involvement in the program:

- Rock Island and Rocky Reach Habitat Conservation Plan (HCP) Hatchery Committees: Oversee development of recommendations for implementation of the hatchery elements of the HCP; Hatchery Committee members include representatives from Chelan PUD, WDFW, Confederated Tribes of the Colville Indian Reservation, Confederated Bands and Tribes of the Yakama Nation, National Marine Fisheries Service (NMFS), and U.S. Fish and Wildlife Service (USFWS)
- Washington Department of Fish and Wildlife (WDFW): current contracted hatchery operator and co-permittee for the current permit (number 1196)
- Confederated Bands and Tribes of the YN
- Confederated Tribes of the Colville Indian Reservation (CCT): NMFS: Administration of the Endangered Species Act
- USFWS: Administration of the Endangered Species Act
- Joint Fisheries Parties (JFP): USFWS, NMFS, WDFW, YN, and CCT

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Chelan PUD funds this program as authorized and obligated by the Rocky Reach and Rock Island HCPs. The total annual operational cost is expected to be between $250,000 and $750,000.

1.5) Location(s) of hatchery and associated facilities.

Several facilities will be involved in the implementation of this hatchery program, all located in the Columbia River basin in Washington (Table 1-1). See Section 5 for the activities to occur at each of these facilities.

Table 1-1. Facilities in Chelan PUD's Methow River Spring Chinook Hatchery Program.

Facility	Water body	River Mile	Basin Name	State	WRIA
Methow Hatchery	Methow River	51.0	Columbia River	WA	48
Chewuch Acclimation Pond	Chewuch River	8.0	Columbia River	WA	48
Yakama Nation Expanded Acclimation sites such as Goat Wall (RM 68.0)	Various	Various	Columbia River	WA	48
Other locations as approved by the HCP Hatchery Committees	Various	Various	Columbia River	WA	48

Notes:
WRIA = Water Resources Inventory Area
HCP = Habitat Conservation Plan

1.6) Type of program.

Integrated Recovery Program.

1.7) Purpose (Goal) of program.

With respect to Chelan PUD, the purpose of this hatchery program is to satisfy the hatchery compensation requirements of the Rock Island and Rocky Reach Hydroelectric Projects HCPs. The HCPs were executed pursuant to Section 10 of the Endangered Species Act (ESA) as a vehicle to permit Chelan PUD to carry out its functions in a manner consistent with the ESA. The overriding goal of the HCPs—developed in accordance with the ESA's goals of conserving and facilitating the recovery of natural populations—is to achieve No Net Impact (NNI) on anadromous salmonids as they pass the Projects. NNI goals should be met in a manner consistent with the objective of rebuilding natural populations. Under the terms of the HCPs, and for the purpose of achieving NNI, Chelan PUD provides the funding and capacity required to meet hatchery compensation for all Plan Species for unavoidable losses at the projects.

Section 8 of the HCPs details the objectives, responsibilities, and requirements of hatchery programs required as mitigation for the operation of the project.

Section 8 includes the following objective:

8.1 Hatchery Objectives
8.1.2 The District shall implement the specific elements of the hatchery program consistent with overall objectives of rebuilding natural populations and achieving NNI. Species specific hatchery program objectives developed by the JFP [Joint Fisheries Parties] may include contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest.

In addition, the JFP developed program goal statements that have been documented in the *Conceptual Framework for Chelan PUD Hatchery Programs* (Murdoch and Peven 2007). The stated spring Chinook program goal is to support the recovery of ESA-listed species by increasing the abundance of the natural adult population, while ensuring appropriate spatial distribution, genetic stock integrity, and adult spawner productivity (Murdoch and Peven 2005).

1.8) Justification for the program.

The artificial propagation program for Methow spring Chinook specifically addresses the unavoidable losses associated with the operation of Rock Island and Rocky Reach Projects, and contributes to the long-term persistence of ESA-listed Upper Columbia River spring Chinook by increasing the abundance of the population. NMFS has determined that the program is likely necessary to prevent the extinction of the ESU until habitat conditions that limit the productivity of naturally produced spring Chinook in the region are improved.

1.8.1) Legal Agreements and Requirements

This application includes actions required of Chelan PUD pursuant to its Rock Island and Rocky Reach HCPs, which are included as conditions of Chelan's FERC licenses to operation these projects. Other actions that are beyond Chelan PUD's HCP obligations but represent important fishery management activities also may be implemented by the JFP. This section is intended to provide background and context to aid in the interpretation and application of the terms and obligations set forth below and in the existing Hatchery and Genetic Management Plan (HGMP). Specifically, this section: 1) identifies and describes the purposes and objectives of the HCPs, as relevant to the hatchery program; 2) outlines certain responsibilities and obligations of Chelan PUD based on the commitments and assurances provided in the HCPs; and 3) describes certain obligations and responsibilities applicable to the requested permit.

Chelan PUD's HCPs

Section 8 of the HCPs details the objectives, responsibilities, and requirements of hatchery programs required as mitigation for the operation of the Projects. Specifically, Section 8.1.1 indicates that Chelan PUD shall provide hatchery compensation for spring Chinook salmon originating upstream of the Rocky Reach and Rock Island Dams.

Adaptive Management & Section 10 Permits

Chelan PUD's spring Chinook hatchery program obligations under the HCPs are implemented through an adaptive management process set forth in the HCPs and overseen by the HCP Hatchery Committees. Specifically, the HCP Hatchery Committees may periodically adjust Chelan PUD's hatchery production levels (see HCPs at Section 8.4.3) and make program modifications to achieve program objectives, including changes to facilities, release methods, and rearing strategies necessary to achieve and maintain NNI (see HCPs at Section 8.6.1).

The HCPs' adaptive management processes are integral to the effective operation of the spring Chinook hatchery program described in this application. Any updated Section 10 permit and associated environmental reviews should incorporate, rely on, and anticipate compliance with the HCPs' adaptive management provisions. Incorporating adaptive management into the requested Section 10 permit, as contemplated by the HCPs, will minimize the need for future modification of the Section 10 permit and facilitate the efficient management and oversight of the program by the HCP Hatchery Committees. As an HCP Hatchery Committee member, NMFS plays a key role in this process.

The program described herein represents an attempt to use the adaptive management provisions of the HCP to address the Hatchery Scientific Review Group (HSRG 2009) recommendation wherein Proportionate Natural Influence is greater than or equal to 0.67. The HSRG recognized that short-term Proportionate Natural Influence (PNI) goals may be difficult to meet when abundance levels are low, "The HSRG recommends that managers continue to operate the programs as currently planned in the near term. The HSRG acknowledges that managing for the recommended PNI values

for a Primary population may not be possible or appropriate when abundance levels are low." Generally, under the HSRG recommendations, the proportion of hatchery-origin spawners (pHOS) should be reduced to extent practicable while the proportion of natural-origin broodstock (pNOB) should be maximized.

Roles and Responsibilities of Applicants:
In accordance with their respective obligations and authorities, the specific roles and responsibilities of Chelan PUD and WDFW in conducting permit activities are as follows:

The Chelan PUD will:

- Provide and maintain or acquire hatchery capacity for the Methow spring Chinook hatchery program.
- Fund or conduct hatchery operations related to spawning, incubation, rearing, and acclimation activities at locations approved by the HCP Hatchery Committee.
- Fund or conduct hatchery monitoring and evaluation under Section 8 of the HCPs.

The WDFW will:

- Collect broodstock, conduct hatchery operations, and implement M&E as a contractor to Chelan PUD[1].
- Take such actions as necessary to achieve pHOS and achieve PNI goals, in consultation with the JFP.
- Implement fishery-related management plans and activities, in consultation with the JFP.

1.8.2) Program Summary

Since 2004, Chelan PUD has provided funding for the Methow spring Chinook program at the Douglas PUD-owned Methow Hatchery for its required HCP production. Currently, Chelan PUD's Methow program will release 60,516 smolts representing about 10% of the total spring Chinook releases in the Methow Sub-basin (623,765 smolts). The Douglas and Grant PUDs Methow spring Chinook production groups comprise 26% (i.e., 163,249 smolts), which are also reared at the Methow Hatchery, and the USFWS comprises the remaining 64% (i.e., 400,000 smolts) at their own hatchery in Winthrop.

Chelan PUD and WDFW have distinct roles and responsibilities for implementing the actions described in this application, and as necessary, Chelan PUD and WDFW will coordinate with Douglas and Grant PUDs to facilitate these actions to the extent they are similar in nature and intent. Chelan PUD has an independent responsibility to meet hatchery compensation obligations described in the HCPs. WDFW has the responsibility and authority to conduct activities necessary to manage fisheries resources of the State of Washington. Harvest is not addressed in the HCPs because it is not within the regulatory jurisdiction of the Federal Energy Regulatory Commission (FERC) license (NMFS 2007). Annual decisions related to the active management of adult returns, including fisheries and the disposition of collected adults, are subject to the JFP and ESA regulators.

[1] The Chelan PUD currently funds WDFW to operate its hatcheries and conduct M&E activities under a separate agreement.

Chelan PUD's juvenile spring Chinook will be released into the Methow Sub-basin from acclimation sites/facilities located on the Methow River or the Chewuch River.

The purpose of releasing juvenile fish at acclimation sites is to improve adult homing, to natural spawning areas where they can ostensibly contribute to the abundance and productivity of natural populations.

The desire to have hatchery-origin fish contribute to the abundance of natural populations is the cornerstone of hatchery supplementation. "At the core of a conservation program is the objective of increasing the number of spawning adults (i.e., the combined number of naturally produced and hatchery fish) in order to affect a subsequent increase in the number of returning naturally produced fish or natural origin recruits (NOR). In order for the natural population to remain stable or to increase, the Natural Replacement Rate (NRR), or the ratio of NORs to the parent spawning population, must be at a level where parents are being replaced by their offspring as spawners in the next generation. It is possible to affect an increase in natural origin spawners through supplementation with a stable or decreasing NRR. However, if the NRR is below replacement (NRR<1.0) and prolonged, termination of the supplementation program will result in a declining natural population. The proportion of the hatchery-origin spawners (pHOS) that will increase natural production without creating adverse effects to the genetic diversity or reproductive success rate of the natural population is unknown, and may be dependent on how individual hatchery programs are operated, as well as available spawning and rearing habitat. Some programs may restrict pHOS to reduce the risk to the natural population with the intent of optimizing productivity, concomitantly reducing the overall number of spawners" (Hillman et al. 2013).

Recognizing that allowing hatchery fish to spawn in areas with natural populations also poses an inherent risk of negative interactions with natural origin fish, Chelan PUD will provide WDFW with tools and resources to ensure that WDFW has the capability to remove as many Chelan PUD-origin hatchery fish as necessary to meet pHOS and PNI goals. (Table 1-2).

Table 1-2. Expected adult returns based on SAR data and program release quantities for Methow River releases (does not include Twisp program).

Methow Production	SAR (%)	Smolts Released	Expected Hatchery Returns (% of total)
Methow Hatchery (Chelan PUD)	0.273 [1]	60,516	165 (9.9%)
Methow Hatchery (Douglas and Grant PUDs)	0.273 [1]	134,126	366 (22.1%)
Winthrop NFH (USFWS)	0.282 [2]	400,000	1,128 (68.0%)
		Total Adult Returns:	1,659

Notes:
1 = Source: Murdoch et al. 2012
2 = Source: USFWS 2012
SAR = Smolt-to-Adult Return; NFH = National Fish Hatchery; USFWS = U.S. Fish and Wildlife Service

Achieving PNI goals, will require decisions and actions to control the proportion of hatchery-origin spawners on the spawning grounds (i.e., pHOS). Chelan PUD will mark fish and provide funding and access to available infrastructure to ensure that WDFW, as an authorized manager, can conduct actions necessary to meet PNI targets.

It is expected that pHOS management will be based on the abundance of hatchery- and natural-origin adult returns with emphasis on removing higher numbers of hatchery fish as natural origin escapements increase. It is expected that it may take several years to fully develop the operational approaches to remove excess hatchery-origin fish due to the uncertainty in effectiveness and aggressiveness of the proposal. Between now and 2017, the effectiveness of these approaches will be further challenged by larger adult returns from pre-recalculation production levels released from acclimation sites throughout the Methow Sub-basin. On March 18, 2016 the HCP Hatchery Committee approved the below gene-flow management approach to attain a PNI of no less than 0.67 (Table 1-3).

Table 1-3. Expected PNI and pHOS levels under adult management.

NOR	pNOB	pHOS	Expected PNI
300	0.75	0.4	0.67
500	0.8	0.4	0.76
900	1	0.3	0.80
1500	1	0.25	0.80
2000	1	0.25	0.80
2500	1	0.25	0.80

It is expected that, despite the small size of Chelan PUD's program, adult management activities will be implemented. To facilitate the removal of excess hatchery-origin fish, Chelan PUD has identified the following tools and approaches:

- **Broodstock collection:** Excess hatchery-origin adults from the Methow conservation program may be used as broodstock for the Winthrop National Fish Hatchery (NFH) spring Chinook program and the Chief Joseph Hatchery (CJH) spring Chinook program when managing for pHOS. The number of broodstock available for other facilities will decrease commensurate with increasing escapement of hatchery returns to the natural spawning grounds in order to meet spawning escapement goals.
- **PIT tag and external marks:** Chelan PUD will passive integrated transponder (PIT) tag an HCP-HC agreed upon level of smolts released from Chelan PUD's program to identify returning adults to be potentially removed using non-lethal sorting techniques at any traps located throughout the Sub-basin. Chelan PUD will also fund external marking required for conservation and harvest management. Chelan PUD will fund up to 100 percent external marking if necessary to support adaptive management and ESA compliance of the program. WDFW will determine annual external marking levels and coordinate or obtain approval

from other managers as needed.

- **Wells Trap:** Hatchery-origin returns may be managed at the ladder traps at Wells Dam in years when pHOS requires adjustment and minimum spawning escapement goals have been achieved (Douglas PUD 2010).
- **Methow Hatchery:** Hatchery-origin returns may be managed at the Methow Hatchery outfall trap in years when pHOS requires adjustment and minimum spawning escapement goals have been achieved.
- **Winthrop Hatchery:** Hatchery-origin returns may be managed at the Methow Hatchery outfall trap in years when pHOS requires adjustment and minimum spawning escapement goals have been achieved.
- **FTE funding to WDFW:** In order to ensure that WDFW has the capacity to manage excess hatchery origin spring Chinook from Chelan's program, Chelan PUD will provide funding to WDFW sufficient to support up to one full-time employee.
- **Fishery:** While implementation of fisheries may help reduce the number of hatchery-origin adults in the future, a fishery is not part of the proposed action at this time. Any fisheries in the sub-basin will be directed at Winthrop NFH returning adults and will be analyzed in a separate consultation.

1.9) List of program "Performance Standards".

See Tables 1-4 and 1-5 in Section 1.10.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

1.10.1) "Performance Indicators" addressing benefits.

The performance indicators in Table 1-3 are from the M&E Plan developed and approved by the HCP Hatchery Committees, titled *Monitoring and Evaluation for PUD Hatchery Programs funded by Chelan PUD* (Hillman et al. 2013). In the context of benefits and risks, the target (Table 1-3) represents the opportunity for benefits to accrue, leading to a specific program goal (Table 1-4), whereas the failure to meet a target represents the risk of not meeting the stated goals. Additional performance indicators addressing operational and program risks are identified in Table 1-5.

Table 1-4. Program objectives, indicators, and goals for conservation hatchery programs including productivity and monitoring indicators (also applies to safety-net programs when used to support a conservation program).

Type	Objective	Indicator	Target	Goals
Productivity Indicator	Determine if the program has increased the number of naturally spawning adults	Abundance of natural spawners Adult productivity (NRR)	Increase No Decrease	Rebuild natural populations
Productivity Indicator	Determine if the proportion of hatchery fish affects freshwater productivity	Residuals vs. pHOS Juveniles per redd vs. pHOS	No relationship No relationship	Rebuild natural populations
Monitoring Indicator	Determine if run timing and distribution meets objectives	Migration timing Spawn timing Redd distribution	No difference No difference No difference	Rebuild natural populations and maintain genetic diversity
Monitoring Indicator	Determine if program has affected genetic diversity and population structure	Allele frequency (hatchery vs. wild) Genetic distance between populations Effective population size Age and size at maturity	No difference No difference Increase No difference	Maintain genetic diversity
Monitoring Indicator	Determine if hatchery survival meets expectations	HRR HRR	HRR>NRR HRR>Goal	Rebuild natural populations
Monitoring Indicator	Determine if stray rate of hatchery fish is acceptable	Out of basin Within basin	≤5% ≤10%	Rebuild natural populations and maintain genetic diversity

Type	Objective	Indicator	Target	Goals
Monitoring Indicator	Determine if hatchery fish were released at program targets	Size and number	= Target	Rebuild natural populations
Monitoring Indicator	Provide harvest opportunities when appropriate	Harvest	Escapement goals	Harvest opportunity

Notes:
HRR = hatchery replacement rate
NNR = natural replacement rate

1.10.2) "Performance Indicators" addressing risks.

Table 1-5. Performance Indicators Addressing Risks

Performance Standards	Performance Indicators	Monitoring and Evaluation
1. Artificial propagation activities comply with Endangered Species Act (ESA) responsibilities to minimize impacts and/or interactions to ESA-listed fish	Program complies with Section 10 permit conditions including juveniles are raised to smolt-size (approximately 15 to 18 fish/pound) and released at a time that fosters rapid migration downstream. Smolts will be 100% mass marked and CWT to identify them from naturally produced fish.	As identified in the Hatchery and Genetic Management Plan (HGMP): monitor size, number, date of release and mass mark quality. Additional monitoring metrics include straying, in-stream evaluations of juvenile and adult behaviors, natural-origin recruits (NOR)/hatchery-origin recruits (HOR) ratio on the spawning grounds, fish health documented. Required data are generated through the Monitoring and Evaluation (M&E) Plan and provided to NMFS as required per annual report compliance.
2. Ensure hatchery operations comply with state and federal water quality and quantity standards through proper environmental monitoring.	All facilities meet WDFW water-right permit compliance and National Pollution Discharge Elimination System (NPDES) requirements (NPDES permit No.WAG-5011).	Flow and discharge reported in monthly NPDES reports. Environmental monitoring of total suspended solids, settle-able solids, in-hatchery water temperatures, in-hatchery dissolved oxygen, nitrogen, ammonia, and pH will be conducted and reported as per permit conditions.
3. Water intake systems minimize impacts to listed wild salmonids and their habitats.	Intake screens designed and operated to assure approach velocities and operating conditions provide protection to wild salmonid species.	Intake system designed to deliver permitted flows. Operators monitor and report as required. Hatcheries participating in the programs will maintain all screens associated with water intakes in surface water areas to prevent impingement, injury, or mortality to listed salmonids.
4. Hatchery operations comply with all ESA permit requirements.	Section 10 annual reports are submitted in compliance with permits.	Section 10 annual reports are submitted in compliance with permits.

Performance Standards	Performance Indicators	Monitoring and Evaluation
5. Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols including Integrated Hatchery Operations Team (IHOT), co-managers Fish Health Policy, and drug usage mandates from the Federal Food and Drug Administration.	Hatchery goal is to prevent the introduction, amplification, or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks and to produce healthy smolts that will contribute to the goals of this facility.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites, and/or pathological changes, as needed.
6. The risk of catastrophic fish loss due to hatchery facility or operation failure is minimized.	Staffing allows for rapid response for protection of fish from risk sources (such as water loss or power loss). Backup generators to provide an alternative source of power to supply water during power outages. Protocols in place to test standby generator and all alarm systems on a routine basis. Alarm systems installed and operating at each rearing vessel to detect loss of or reduced flow and reduced operating head in rearing vessels. Densities at minimum to reduce risk of loss to disease. Sanitation – all equipment is disinfected between uses on different lots of fish including nets, crowders, boots, raingear, etc.	Hatchery engineering design and construction accommodate security measures. Operational funding accommodates security measures. Training in proper fish handling, rearing, and biological sampling for all staff. Staff are trained to respond to alarms and operate all emergency equipment on station. Maintenance is conducted as per manufacturer's requirements and according to hatchery maintenance schedules.

Performance Standards	Performance Indicators	Monitoring and Evaluation
7. Broodstock collection and juvenile hatchery releases minimize ecological effects on listed wild fish.	Hatchery spring Chinook reared to sufficient size such that smoltification occurs within nearly the entire population, reducing residence time in streams after release (CV length $\leq$ 10%, condition factor 0.9 to 1.0). Smolts acclimated and imprinted on surface water from the natal steam to enhance smoltification and reduce residence time in the tributaries and mainstem migration corridors. All spring Chinook encountered in hatchery broodstock collection operations will be held for a minimal duration in the traps; generally less than 24 hours and follow permit protocols. Spring Chinook trapped in excess of broodstock collection goals will be released upstream or returned to natal streams immediately.	Fish culture and evaluation staff, monitor behavior, coefficient of variation in length, and condition. Fish health specialists will certify all hatchery fish before release. Up to three downstream juvenile smolt traps will be used to monitor the outmigration of hatchery and wild fish. Outmigration may also be monitored through PIT tag detection systems at mainstem passage facilities. Broodstock collection protocols developed each season and reviewed by the HCP Hatchery Committees.

Notes:
CV = coefficient of variation
CWT = coded wire tag

1.11) Expected size of program.

60,516 smolts

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

36 natural origin adults at a sex ratio of 1:1 (see Section 7.4).

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

See Tables 1-2 and 5-1.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

1.12.1) Number of Adults Produced

The number of adults produced by this program is expected to range from 13 to 320 fish with a geometric mean of 165. Tables 1-6, 1-7, and 1-8 provide expected and historic production information for the program, respectively.

Table 1-6. Expected range of adult production originating from Chelan PUD's Methow spring Chinook obligation based on HCP SAR target and observed SARs.

SAR Origin	SAR %	Source of SAR	Expected Number of Adults Produced (from 60,516 smolt release)
HCP target	.300	Table 6 in Appendix D in Murdoch and Peven 2005	182
Historical geometric mean for Methow releases	.273	Murdoch et al. 2012	165
Historical geometric mean for Chewuch releases	.120	Murdoch et al. 2012	73
Min SAR (since 1993 brood year)	.022	Murdoch et al. 2012	13
Max SAR (since 1993 brood year)	.528	Murdoch et al. 2012	320

Notes:
SAR = smolt-to-adult return
HCP = Habitat Conservation Plan

Table 1-7. Historical Methow spring Chinook SARs from Chelan PUD-funded Methow Releases (Murdoch et al. 2012).

Brood Year	Smolts Released	Adult Returns	SAR %
1993	210,849	192	0.091
1994	4,477	1	0.022
1995	28,878	122	0.422
1996	202,947	500	0.246
1997	332,484	821	0.247
1998	435,670	2300	0.528
1999	180,775	145	0.08
2000	266,392	852	0.32
2001	130,787	508	0.388
2002	181,235	599	0.331
2003	48,831	57	0.117
2004	65,146	316	0.485
		Mean	**0.273**

Note:
SAR = smolt-to-adult return

Table 1-8. Historical Chewuch spring Chinook SARs from Chelan PUD-funded Chewuch Releases (Murdoch et al. 2012).

Brood Year	Smolts Released	Adult Returns	SAR %
1992	40,881	39	0.1
1993	284,165	116	0.04
1994	11,854	2	0.02
1996	91,672	37	0.04
1997	132,759	295	0.22
2001	261,284	738	0.28
2002	254,238	699	0.27
2003	127,614	61	0.05
2004	204,906	194	0.09
		Mean	**0.12**

Note:
SAR = smolt-to-adult return

1.12.2) Stray Rates

In this section, the term "stray" refers to the number or proportion of Methow spring Chinook hatchery fish that are released as smolts into the Methow sub-basin but return either to the Twisp River (within population) or return to a basin other than the Methow (among population) (e.g., Entiat Basin). The number of strays originating from Chelan PUD's program is expected to be low because: 1) Chelan PUD will acclimate juveniles on Methow River water, which will maximize homing fidelity; and 2) the number of adults produced by the program is expected to be very small based on release sizes and empirical smolt-to-adult return (SAR) data. Based on comparisons with existing programs, the proportion of strays within and among populations is expected to remain below the 10 percent and 5 percent target levels, respectively.

The ecological effect (and genetic risk) of straying is a function of the number of fish that stray to a receiving population. The size of a program (in smolts released) and the associated historic smolt to adult returns (SAR) for a given program provide basic parameters for estimating the abundance of adult returns and, therefore, the magnitude of their contribution as strays in the future. In the description below, the numerical abundance of strays, relative to historic Methow and Chewuch releases (i.e., smolts released) and SARs are examined for comparisons to Chelan PUD's proposed program.

The size of the proposed Chelan PUD Methow Spring Chinook Program (60,516 smolts) would be 16.5 percent of the combined historical Methow and Chewuch spring Chinook production releases (60,516/366,666 = 16.5 percent) and 18.7 percent of the mean number of smolts released annually from the combined locations (i.e., 323,160) during brood years reported in the *Five Year Monitoring and Evaluation Report* (60,516/323,160 = 18.7 percent; Murdoch et al. 2012). In the future, the proposed Douglas and Grant PUD programs are expected to release 134,126 smolts, which will result in cumulative program releases slightly larger than half the size of the historic Methow and Chewuch releases (194,642/366,666 = 53.1 percent [based on historic release goals]; and 194,642/323,160 = 60.2 percent [based on mean number of smolts released annually]). The SAR rate is expected to be the same (0.273 and 0.12, for Methow and Chewuch, respectively; Murdoch et al. 2012).

For Chewuch releases, analysis of stray rates between independent populations did not begin until 2000 due to lack of spawning ground data in prior years. Surveyors recovered Chewuch spring Chinook carcasses on the Twisp River, where adults from Chewuch released spring Chinook comprised an average of 0.7% of the spawning population.. The proportion of adult Chewuch released hatchery spring Chinook in the spawning population in the Twisp River was significantly lower (t-test: $P < 0.0001$) than the maximum target of 10%. Under the new program, Chelan PUD would be releasing fewer than 36% of the number of smolts that were released previously which could proportionally reduce the number of adult strays. Scaling the expected number of adult returns with release sizes and SARs (i.e., 60,516 planned smolt release compared with 172,189 historic mean smolt release and expected SAR of 0.12%) suggests that the expected number of strays from Chewuch would be based on a population of 73 returning adults as opposed to 206 returning adults, historically. From the perspective of a

potential receiving population, smaller numbers of adults from the hatchery program translate to fewer potential strays and a proportionally smaller effect on the receiving population.

For the Chewuch releases, among population stray rates were very low (Murdoch et al. 2012): "The only other independent population from which Chewuch River releaseshave been recovered on the spawning grounds was the Similkameen River in 2001". An estimated five fish spawned in the Similkameen River. This likely posed little genetic risk to the Okanogan summer Chinook population due to the fact that spring Chinook are unlikely to cross breed with summer Chinook due to differences in spawn timing, and the high abundance of summer Chinook spawners in the Similkameen and Okanogan river basins. Among population straying would be further reduced by the small program size.

In the event that stray rates exceed the permit targets, Chelan PUD may fund additional in-basin imprinting opportunities such as 1) development of new water sources within the Sub-basin; 2) early life history acclimation (i.e., incubation and fry); or 3) other measures approved by the HCP Hatchery Committees as part of the adaptive framework of the HCPs.

1.13) Date program started (years in operation), or is expected to start.

The historic Methow spring Chinook program at the Methow Hatchery began in 1992. The Upper Columbia River (UCR) spring Chinook salmon evolutionarily significant unit (ESU) was listed as endangered on March 24, 1999 (NMFS 1999) with supplementation activities as conditioned by Section 10 permit No. 1196 starting at Methow Hatchery with brood year 2000 fish. The proposed program as described in this HGMP would commence with brood year 2013 (release year 2015).

1.14) Expected duration of program.

The program is intended to continue for the remaining 50-year term of the Rocky Reach and Rock Island HCPs, which were approved by the FERC in 2004. The HCP Hatchery Committees agreed to current production levels for the 2014 to 2023 release years on December 14, 2011.

1.15) Watersheds targeted by program.

Methow Sub-basin/Columbia Cascade Province, Water Resources Inventory Area (WRIA) 48.

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

This hatchery program is adaptively managed by the Rocky Reach and Rock Island HCP Hatchery Committees, which have agreed to the collective goal of recovery and sustainability of the population within the context of meeting the HCP requirement of NNI. The HCP Hatchery Committees therefore aim for a program of adequate size and characteristics to meet this goal. During the development and implementation of the HCPs, many alternatives were, and will continue to be, considered for this program. The HCP Hatchery Committees have concluded that a larger program would not be consistent with the HSRG's recommendations (HSRG 2009) to reduce artificial production in the Methow Sub-basin, while a smaller or non-existent program may fail to

support recovery as described in the Recovery Plan (UCSRB 2007). Thus, the HCP Hatchery Committees developed the program described in this HGMP to meet the current biological, agency, and HCP goals.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS.

(USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1) List all ESA permits or authorizations in hand for the hatchery program.

2.1.1) Section 10(a)(1)(A) Permit Number 1196

Artificial production of UCR spring Chinook is presently covered under Section 10(a)(1)(A) Permit No. 1196, initially set to expire January 20, 2014, but continues to be covered by an extension of the permit (issued September 20, 2013) until a new permit is issued for this program as described in this HGMP. Activities described in the application for this permit have been previously authorized under terms and conditions of the *Biological Opinion on Artificial Propagation in the Columbia River Basin* (NMFS 1999). WDFW submits annual reports as conditioned by Section 10 permit No. 1196 covering the period from January 1 to December 31 each year.

2.1.2) Rocky Reach and Rock Island Habitat Conservation Plans

In 2002, the Rocky Reach and Rock Island HCPs were signed by WDFW, USFWS, NMFS, and the Colville Confederated Tribes, and approved by FERC on June 21, 2004. The Yakama Nation signed the HCPs in March of 2005. The overriding goal of the HCPs is to achieve NNI on anadromous salmonids as they pass Rocky Reach and Rock Island Dam. One of the main objectives of the hatchery component of NNI is to provide species-specific hatchery programs that may include contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest. The HCPs are intended to be a comprehensive 50-year adaptive management plan for anadromous salmonids and their habitat as affected by the Rocky Reach and Rock Island Hydroelectric Projects. The HCPs were designed to address Chelan PUD requirements for FERC licensing and as such included all of the parties' terms, conditions, and recommended measures related to regulatory requirements to conserve, protect and mitigate plan species pursuant to ESA, the Federal Power Act, the Fish and Wildlife Coordination Act, the Essential Fish Habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act, the Pacific Northwest Electric Power Planning and Conservation Act, and Title 77 Revised Code of Washington (RCW). The HCP also obligates the parties to work together to address water quality issues.

2.2) Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1) Description of NMFS ESA-listed salmonid population(s) affected by the program.

Adult Age Class

Methow Spring Chinook Population

Most Columbia River adult spring Chinook spend 2 years in the ocean before migrating back to their natal streams (Mullan 1987; Fryer et al. 1992; Chapman et al. 1995; Snow et al. 2008).

In the Methow Sub-basin, the average age class for naturally produced adults since 2001 has been approximately 7% age 3, 56% age 4, and 37% age 5 (Table 2-1). Age structure does not appear to

vary much between major spawning aggregates, ranging between approximately 3 to 10% for age 3, 53 to 57% for age 4, and 37 to 40% for age 5 (Table 2-1). These estimates of age for spring Chinook sampled in the UCR comport well with spring Chinook sampled at Bonneville Dam where approximately 50% are estimated at age four and between 20% and 40% are age-5 (Chapman et al, 1995).

Table 2-1. Age structure of Methow Sub-basin spring Chinook salmon per major spawning area (based on Chapter 5 Appendices D-J, Snow et al. 2008).

	Number				Percent		
Sub-basin/year	**1.1**	**1.2**	**1.3**	**Total**	**1.1**	**1.2**	**1.3**
Methow							
2001	16	286	292	594	2.7	48.1	49.2
2002	1	21	64	86	1.2	24.4	74.4
2003	5	1	2	8	62.5	12.5	25.0
2004	3	196	0	199	1.5	98.5	0.0
2005	0	182	39	221	0.0	82.4	17.6
2006	0	101	27	128	0.0	78.9	21.1
2007	6	42	104	152	3.9	27.6	68.4
Average	4	118	75	198	10.3	53.2	36.5
Chewuch							
2001	8	641	83	732	1.1	87.6	11.3
2002	0	23	55	78	0.0	29.5	70.5
2003	4	2	19	25	16.0	8.0	76.0
2004	0	46	0	46	0.0	100.0	0.0
2005	2	206	11	219	0.9	94.1	5.0
2006	0	86	49	135	0.0	63.7	36.3
2007	1	14	59	74	1.4	18.9	79.7
Twisp							
Average	2	145	39	187	2.8	57.4	39.8
2001	18	439	49	506	3.6	86.8	9.7
2002	66	115	181	362	18.2	31.8	50.0
2003	6	4	15	25	24.0	16.0	60.0
2004	16	227	0	243	6.6	93.4	0.0
2005	0	73	14	87	0.0	83.9	16.1
2006	0	45	20	65	0.0	69.2	30.8
2007	2	0	38	40	5.0	0.0	95.0
Average	15	129	45	190	8.2	54.4	37.4
Total Sub-basin							
2001	42	1366	424	1832	2.3	74.6	23.1

Sub-basin/year	Number				Percent		
	1.1	1.2	1.3	Total	1.1	1.2	1.3
2002	67	159	300	526	12.7	30.2	57.0
2003	15	7	36	58	25.9	12.1	62.1
2004	19	469	0	488	3.9	96.1	0.0
2005	2	461	64	527	0.4	87.5	12.1
2006	0	232	96	328	0.0	70.7	29.3
2007	9	56	201	266	3.4	21.1	75.6
Average	22	393	160	575	6.9	56.0	37.0

Methow Summer Steelhead Population

Chapman et al. (1994) summarized information for 459 naturally produced adult steelhead collected at Wells Dam, Wells Reservoir, and the Methow River between 1987 and 1993 (Table 2-2). They found that the majority of both males and females had spent 2 years in the ocean (Table 2-2; Figure 2-1). Between 1997 and 2006, 478 naturally produced fish were sampled at Wells Dam. The majority of these fish had spent 1 year in the ocean (see Table 2-2, Figure 2-1). It is uncertain why this inconsistency exists, although salt water ageing was estimated from otoliths between 1987 and 1993 and with scales between 1997 and 2006. In addition, sample sizes were small in many years.

In previous summaries of hatchery-origin age structure (Mullan et al. 1992; Chapman et al. 1994), most hatchery-origin fish were designated as 1-salt. While this still appears to be true for males, females appear to have shifted to more 2-salt, which is more similar to wild fish between 1987 and 1993 (Table 2-3).

Table 2-2. The number and percentage of steelhead by saltwater age and sex from Chapman et al. (1994) for years 1987 to 1993, and Snow et al. (2008) for years 1997 to 2006.

Brood year	Male				Female				Total
	1-salt		2-salt		1-salt		2-salt		
	#	%	#	%	#	%	#	%	
1987	12	16.9	8	11.3	16	22.5	35	49.3	71
1988	9	13.4	12	17.9	9	13.4	37	55.2	67
1989	16	18.2	25	28.4	16	18.2	31	35.2	88
1990	5	5.7	24	27.3	12	13.6	47	53.4	88
1991	16	22.5	9	12.7	28	39.4	18	25.4	71
1992	2	5.9	8	23.5	1	2.9	23	67.6	34
1993	5	12.5	13	32.5	3	7.5	19	47.5	40
Total	65	14.2	99	21.6	85	18.5	210	45.8	459
1997	18	31.6	10	17.5	14	24.6	15	26.3	57
1998	5	41.7		0.0	4	33.3	3	25.0	12

Brood year	Male				Female				Total
	1-salt		2-salt		1-salt		2-salt		
	#	%	#	%	#	%	#	%	
1999	5	18.5	4	14.8	5	18.5	13	48.1	27
2000	13	31.7	4	9.8	13	31.7	11	26.8	41
2001	14	53.8	2	7.7	7	26.9	3	11.5	26
2002	3	16.7	1	5.6	5	27.8	9	50.0	18
2003		0.0	9	33.3		0.0	18	66.7	27
2004	53	45.3		0.0	55	47.0	9	7.7	117
2005	15	22.7	9	13.6	15	22.7	27	40.9	66
2006	21	24.1	16	18.4	8	9.2	42	48.3	87
Total	147	30.8	55	11.5	126	26.4	150	31.4	478

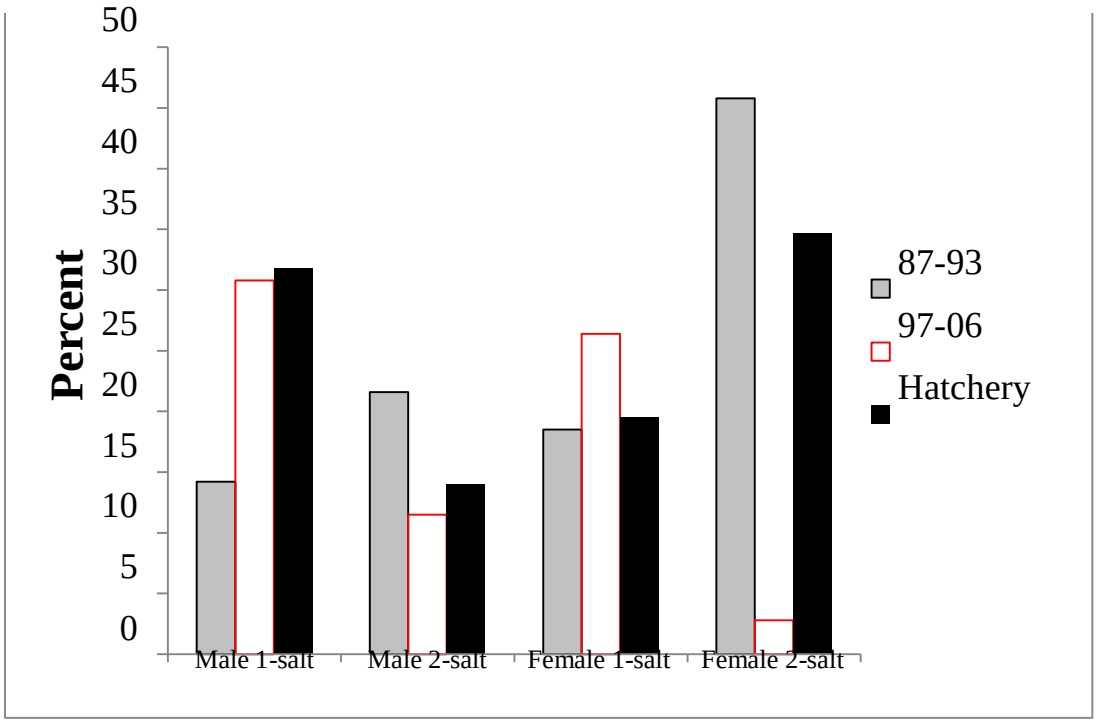


Figure 2-1. Comparison of saltwater age structure of naturally produced steelhead sampled between 1997-2006 and naturally produced and hatchery-origin fish between 1987 and 1993, based on Table 2-2 and 2-3.

Table 2-3. Numbers and percentages of steelhead by sex, saltwater age, and origin sampled at Wells Dam between 1997 and 2006 (based on Appendix C, Chapter 1 of Snow et al. 2008).

Brood year	Male				Female				Total
	1-salt		2-salt		1-salt		2-salt		
	#	%	#	%	#	%	#	%	
1997	145	46.5	20	6.4	94	30.1	53	17.0	312
1998	122	28.2	64	14.8	78	18.0	169	39.0	433
1999	123	33.2	41	11.1	66	17.8	141	38.0	371
2000	113	34.7	28	8.6	87	26.7	98	30.1	326
2001	12	5.7	27	12.8	66	31.3	106	50.2	211
2002	106	28.3	68	18.2	50	13.4	150	40.1	374
2003	30	11.2	89	33.1	17	6.3	133	49.4	269
2004	183	59.0	3	1.0	118	38.1	6	1.9	310
2005	93	29.5	53	16.8	31	9.8	138	43.8	315
2006	98	32.6	58	19.3	22	7.3	123	40.9	301
Total	1,025	31.8	451	14.0	629	19.5	1,117	34.7	3,222

Methow Core Area Bull Trout

Mullan et al. 1992 found that headwater male bull trout (potentially non-migratory ecotype) in the Methow River began to mature at age 5, and were all mature by age 6. Females from the same area began to mature at age 7 and were all mature by age 9. Mullan et al. (1992) found bull trout that did not mature until 9 years of age which are the oldest (at first maturity) reported within the literature. The oldest bull trout sampled in the Methow River was 12 years (Mullan et al. 1992).

2.2.1.2) Sex Ratio

Methow Spring Chinook Population

Mullan (1987) presented data compiled from Howell et al. (1985) on the number of returning male and female hatchery spring Chinook in the mid-Columbia. From those data, the sex ratios for Leavenworth, Entiat, and Winthrop populations were calculated. The range (female to male) for the three stocks was 1.27:1 to 1.86:1 (based on lethal biological sampling).

Sampling at Wells Dam in 2007 and 2008, estimates of sex ratio (using ultrasound) ranged (males to females) from 1.5:1 to 1.9:1 for hatchery fish and 1.1:1 to 1.5:1 for wild fish (C. Snow, pers. comm). It is important to note that determining sex of fish from Wells Dam months prior to sexual maturity is not considered accurate for spring Chinook, which may explain the difference between these data and those described above from Chapman et al. (1994).

Methow Summer Steelhead Population

Based on the most recent information available (Appendix C, Chapter 1 of Snow et al. 2008), the female to male ratio for hatchery-origin and naturally produced fish is 1.2:1 and 1.3:1, respectively. This is similar to what has been reported previously (Mullan et al. 1992; Chapman et al. 1994).

Methow Core Area Bull Trout Population

In Mullan et al. (1992), the overall female to male ratio was 1.11:1, but for mature fish, almost twice the percentage of the population of males was mature (14.6 percent of the females and 24.3 percent of the males).

2.2.1.3) Fecundity

Methow Spring Chinook Population

Fecundity from wild and hatchery spring Chinook salmon has been measured in recent years as part of the hatchery supplementation evaluation program. In the Methow Sub-basin, fecundity (hand-counted) averaged 5,100 (range: 2,600 to 8,100) between 1992 and 1994 (Chapman et al. 1995). Since 2000, four-year-old wild females averaged about 4,000 eggs, while 5-year-old wild fish averaged about 4,800 eggs (Table 2-4). For hatchery fish, 4-year-old fish averaged about 3,800 eggs, and 5-year-old fish averaged about 4,400 (Table 2-4). As shown in Table 2-4, there are gaps between years, primarily for wild fish, especially 5-year-olds.

Table 2-4. Fecundity of Methow Sub-basin spring Chinook (from Chapter 1, Appendix D of Snow et al. 2008).

	Age 4		Age 5	
Stock/year	**Wild**	**Hatchery**	**Wild**	**Hatchery**
Met Comp				
2000		3,759		
2001	3,753	3,949		
2002		3,905		3,318
2003		3,795		4,839
2004	3,565	3,510		3,510
2005	3,823	3,475		3,261
Average	3,714	3,732		3,732
Twisp				
2000		3,820		5,292
2001	4,720	3,922	4,941	4,469
2002		4,653		
2003		3,195		5,867
2004	3,811	3,496		
2005	4,216		4,745	4,745
Average	4,249	3,817	4,843	5,093
Average for Sub-basin				

Stock/year	Age 4		Age 5	
	Wild	Hatchery	Wild	Hatchery
	3,981	3,771	4,843	4,413

Methow Summer Steelhead Population

For fish sampled at Wells Dam between 2000 and 2006, 1-salt naturally produced fish average fecundity was higher than 1-salt hatchery-origin fish, while for 2-salt fish, hatchery-origin fish had slightly higher fecundity (Table 2-5).

Table 2-5. Mean fecundity by salt-age and origin of 2006 brood summer steelhead sampled at Wells Complex hatchery facilities (Appendix D, Chapter 1 from Snow et al. 2008).

Year	1-salt		2-salt	
	Hatchery	Wild	Hatchery	Wild
2000	4,837	5,760	6,049	
2001	4,356	3,865	6,624	6,714
2002	4,786	4,721	6,744	6,586
2003	4,241		6,545	6,954
2004	4,543	4,517	5,865	4,832
2005	4,547	5,370	6,575	6,627
2006	4,652	4,203	6,858	6,397
Average	4,566	4,739	6,466	6,352

Methow Core Area Bull Trout Population

Fecundity of bull trout varies with size. Fraley and Shepard (1989) found that fecundity averaged almost 5,500 eggs (up to over 12,000 in one individual) for migratory bull trout from the Flathead River. Martin et al. (1992) noted females between 271 and 620 millimeters (mm) long produced 380 to over 3,000 eggs in southeastern Washington streams. Mullan et al. (1992) found one bull trout that was 300 mm in the Methow Sub-basin had a fecundity of fewer than 200 eggs.

2.2.1.4) Size Range

Methow Spring Chinook Population

Juveniles

In 2007, wild smolt length averaged 100.7 mm fork length (FL) (Table 2-6). Wild parr (fall-run) averaged almost 90.7 mm FL. Little variation in smolt length occurred between years (C. Snow, pers. comm.).

Table 2-6. Summary of length and weight of migrating Chinook juveniles in the Methow River in 2007 (from Chapter 3, Table 1 Snow et al. 2008).

Brood	Origin/Stage	Fork Length (mm)			Weight (g)			K-factor
		Mean	*N*	SD	Mean	*N*	SD	
2005	Wild smolt	100.7	395	8.6	11.6	393	2.9	1.1
2005	Hatchery smolt	129.9	186	17.5	27.8	186	11.2	1.3
2006	Wild fall parr	90.7	67	10.8	8.9	67	3.1	1.2

Notes:
N = number of observations
SD = standard deviation
K-factor = condition factor

Adults

Length measurements (FL) from wild and hatchery spring Chinook salmon have been measured in recent years as part of the hatchery evaluation program (Table 2-7). There appears to be little difference between streams or between wild and hatchery fish (Table 2-7).

Table 2-7. Mean fork length by age, sex, and brood of spring Chinook collected for the Methow Hatchery program, 1998 to 2005 (from Chapter 1, Appendix C of Snow et al. 2008).

Stock/Sex/Year		Age - 3		Age - 4		Age - 5	
		Hatchery	Wild	Hatchery	Wild	Hatchery	Wild
Met Comp - male							
1998		54.0	52.0	79.0	74.9	94.0	92.7
1999		52.0		78.0	76.4		100.0
2000		52.1		73.3			
2001		60.0		80.6			
2002		48.3		79.0		100.0	
2003		49.0	51.0			96.7	
2004		48.3		72.0			
2005		52.1		72.3			
Average		*52.0*	*51.5*	*76.3*	*75.7*	*96.9*	*96.4*
Met Comp - female							
1998				76.3	76.1	87.2	89.0
1999				78.0	77.6		86.5
2000				74.5			
2001				76.9			
2002				76.3		87.3	
2003				75.3			
2004				73.4	75.0	76.0	
2005				74.3	71.0	81.0	

Stock/Sex/Year		Age - 3		Age - 4		Age - 5	
		Hatchery	Wild	Hatchery	Wild	Hatchery	Wild
Average				*75.6*	*74.9*	*82.9*	*87.8*
Twisp - male							
1998				79.5		87.0	
1999		50.8					
2000		52.0	45.0	71.0			98.0
2001		63.0	52.5	79.3	75.3		
2002		46.3					
2003		50.7	50.0		67.0		
2004		49.0	45.7	72.2	71.6		
2005		49.6			82.0		
Average		*51.6*	*48.3*	*75.5*	*74.0*	*87.0*	*98.0*
Twisp - female							
1998				77.0		90.5	
1999					78.5		89.3
2000				75.1			91.0
2001				76.9	79.6	92.5	88.0
2002				75.0			
2003				70.7			93.4
2004				73.0	75.8		
2005					81.0		88.5
Average				*74.6*	*78.7*	*91.5*	*90.0*
Total Sub-basin Average - male							
1998		54.0	52.0	79.3	74.9	90.5	92.7
1999		51.4		78.0	76.4		100.0
2000		52.1	45.0	72.2			98.0
2001		61.5	52.5	80.0	75.3		
2002		47.3		79.0		100.0	
2003		49.9	50.5		67.0	96.7	
2004		48.7	45.7	72.1	71.6		
2005		50.9		72.3	82.0		
Average		*52.0*	*49.1*	*76.1*	*74.5*	*95.7*	*96.9*
Total Sub-basin Average - female							
1998				76.7	76.1	88.9	89.0
1999				78.0	78.1		87.9
2000				74.8			91.0
2001				76.9	79.6	92.5	88.0
2002				75.7		87.3	

Stock/Sex/Year		Age - 3		Age - 4		Age - 5	
		Hatchery	Wild	Hatchery	Wild	Hatchery	Wild
2003				73.0			93.4
2004				73.2	75.4	76.0	
2005				74.3	76.0	81.0	88.5
Average				*75.3*	*77.0*	*85.1*	*89.6*

Methow Summer Steelhead Population

Juveniles

In the Upper Columbia Basin, naturally produced steelhead smolts sampled at Rock Island Dam have averaged between 163 to188 mm FL (Peven and Hays 1989; Peven et al.1994). In the Methow Sub-basin, smolt trapping has been ongoing since the mid-1990s. In general, length frequency of juveniles does not vary greatly between years (C. Snow, pers. comm.) and averages between from approximately 130 to 180 mm FL (this includes "transitional" juveniles that may or may not be smolting; Table 2-8).

Table 2-8. Mean length and weight at migration age of wild transition and smolt summer steelhead captured at the Methow and Twisp smolt traps in 2007 (Tables 2 and 4, respectively, from Chapter 3 of Snow et al. 2008).

Age	N (%)	Fork (mm)			Weight (g)			K-factor
		Mean	*N*	SD	Mean	*N*	SD	
Methow								
1	6 (4.3)	138.7	6	17.8	32.6	6	14.4	1.2
2	122 (86.5)	175.2	122	20.1	55.3	117	20.1	1.0
3	12 (8.5)	181.5	12	22.4	58.4	10	22.7	1.0
4	1 (0.7)	174.0	1	--	51.3	1	--	0.9
Twisp								
1	7 (2.4)	128.6	7	14.6	24.3	6	7.8	1.1
2	231 (80.8)	162.2	229	17.4	42.7	226	12.9	1.0
3	43 (15.0)	180.6	43	20.5	58.6	43	17.7	1.0
4	5 (1.7)	177.2	5	9.6	56.8	5	11.1	1.0

Notes:
N = number of observations
SD = standard deviation
K-factor = condition factor

Adults

Chapman et al. (1994) reported that female steelhead sampled at Wells from 1982 to 1992 ranged from 57 to 81 centimeters (cm) and 67 to 75 cm for fish spending 1 and 2 years in the ocean, respectively. Males ranged from 59 to 66 cm and 69 to 77 cm for 1-year and 2-year ocean fish.

The length frequency of broodstock captured in 2006 for the Wells steelhead program comports well with previous sampling at Wells Dam above (Table 2-9). In general, hatchery-origin fish are similar in size to naturally produced fish.

Table 2-9. Mean fork length (cm) by saltwater age, sex, and origin for broodstock sampled at Wells Hatchery Complex facilities, 1997 to 2006 (Chapter 1, Appendix C from Snow et al. 2008).

Brood year	Male				Female			
	1-salt		2-salt		1-salt		2-salt	
	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild
1997	64.2	63.8	76.6	74.5	62.3	61.6	71.9	74.3
1998	64.8	65.6	79.3		62.1	64.0	75.3	74.3
1999	63.3	64.0	80.0	80.8	62.3	61.8	74.3	73.8
2000	63.4	62.9	77.8	76.0	61.4	62.5	73.8	76.8
2001	61.2	60.9	76.1	82.5	60.2	59.4	72.9	73.3
2002	64.3	63.7	78.3	76.0	62.9	63.8	73.6	74.7
2003	61.9		78.6	81.6	60.4		74.7	75.8
2004	60.9	64.2	73.0		60.1	62.2	67.5	73.4
2005	60.4	62.1	74.0	75.6	59.4	62.5	71.8	73.4
2006	60.3	65.2	75.6	77.4	59.7	61.4	70.9	72.7
Average	62.5	63.6	76.9	78.1	61.1	62.1	72.7	74.3

Methow Core Area Bull Trout

Juveniles

Length at age of bull trout found in Methow River tributaries by Mullan et al. (1992) were the shortest by age group of any other lengths reported in the literature (Goetz 1989; Wydoski and Whitney 2003). Table 2-10 shows the age range of all bull trout sampled by Mullan et al. (1992) in the 1980s. Considering that males began maturing at age 5 and females by age 7 (see above), all lengths shown in Table 2-10 for fish aged 5 and younger can be considered juveniles, and all of those older than that may be juveniles or adults (assume that older than age 8 would be adults). Juvenile mean length ranged from between 51 and 195 mm FL.

Table 2-10. Mean fork length (mm) of bull trout sampled in the Methow Sub-basin (Mullan et al. 1992).

Stream	Age											
	1	2	3	4	5	6	7	8	9	10	11	12
Methow River				188.0	257.0							
Gold Creek					230.5							
Wolf Creek	58.3	86.8		168.2	199.5		229.5	250.0				
Early Winters Creek	52.6	89.7	124.0	136.2	174.5	198.0	200.0	186.0	210.0	188.7		205.0
Lake Creek	49.0				152.0							
WF Methow River	50.8	82.4			190.0		207.0					
Chewuch River						255.0						
EF Buttermilk Creek	48.3	87.4	112.0	130.0	204.0	231.0				324.0		
Monument Creek	42.3				179.0							
Lost Creek				195.0								
Cedar Creek	51.6				172.0							
Twisp River	58.3	97.6	120.5	163.8								
South Creek			116.0									
Average	51.4	88.8	118.1	163.5	195.4	228.0	212.2	218.0	210.0	256.4		205.0

Notes:
EF = east fork
WF = west fork

Adults

BioAnalysts (2002) compared a sample of resident and fluvial fish from the Methow Sub-basin and found that the fluvial fish were two to three times larger than resident fish of the same age. BioAnalysts (2004) tagged adult migratory bull trout at Rock Island, Rocky Reach, and Wells Dam in 2001 to 2003. For fish tagged in 2002 at Wells Dam, bull trout averaged 57.3 cm FL. Most of the fish tagged at Wells Dam eventually headed to the Methow Sub-basin (some fish tagged at both Rocky Reach and Rock Island also headed in some years to the Methow Sub-basin).

2.2.1.5) Migration Timing

Methow Spring Chinook Population Mainstem Columbia River

Adult spring Chinook destined for areas upstream from Bonneville Dam (upriver runs) enter the Columbia River beginning in March and reach peak abundance (in the lower river) in April and early May (WDF and ODFW 1994). Fifty percent of the spring Chinook run passes Priest Rapids and Rock

Island dams by mid-May, while most pass Wells Dam somewhat later (Howell et al. 1985). Chinook that pass Rock Island Dam are considered "spring-run" fish from the beginning of counting (mid-April) through approximately the third week of June (French and Wahle 1965; Mullan 1987).

Methow River

Methow Sub-basin spring Chinook migrate past Wells Dam and enter the sub-basin in May and June, peaking after mid-May. Differences in migration timing have been observed between, but not within, age classes. Hatchery 3-year-olds migrated to Wells Dam later than hatchery 4- and 5-year-olds (Snow et al. 2008). The Lower Columbia River fishery routinely commences during the earliest part of the run, which may have contributed to a decline in 5-year-old hatchery returns, which are available for harvest.

Methow Summer Steelhead Population

Mainstem Columbia River

Adults return to the Columbia River in the late summer and early fall. A portion of the returning run over-winters in the mainstem reservoirs, ascending UCR dams in April and May of the following year.

In 2006, naturally produced fish began their migration earlier than hatchery-origin fish (Table 2-11). The run timing observed in 2006 followed a typical beginning (July) and ending (October) for a calendar year. However, a portion of the fish that spawned upstream of Wells Dam passed the dam in the following spring after over-wintering in the mainstem Columbia River which may be a result of intermittent availability of adult fish passage from roughly December through February.

Table 2-11. Migration of hatchery and wild steelhead to Wells Dam between 31 July and 26 October, 2006 (Table 6, Chapter 4 from Snow et al. 2008).

Origin	*N*	Cumulative Migration Date			
		25%	50%	75%	100%
Hatchery	6,002	7-Sept	19-Sept	28-Sept	26-Oct
Wild	489	27-Aug	11-Sept	28-Sept	26-Oct

Methow River

Currently, data on Methow-specific information on run timing is limited. Steelhead are known to enter the river in late summer (August), through the following May, based on observations from trout and steelhead fisheries and radio telemetry studies (English et al. 2001, 2003). The recent installation of a PIT tag array infrastructure in the Methow River and its tributaries, combined with ongoing juvenile and adult PIT tagging programs should provide data regarding migration patterns/timing for steelhead.

Methow Core Area Bull Trout Population
The focus of this discussion is on fluvial bull trout. Bull trout were tagged by BioAnalysts (2004) between May 1 and the first week of June in a 3-year study (2001-2003). Most bull trout entered the Methow by the end of June and were found in possible spawning locations (usually in August) well before the initiation of spawning. Most tagged bull trout left tributary streams by late November.

During the study period (2001 to 2003) bull trout entered Mid-Columbia tributaries from April to September, but most (94 percent) entered tributaries during May, June, and July. At the time bull trout entered tributary streams, the mean daily temperatures in the mainstem Columbia River varied from 5.4°C to 19.6°C. Similarly, tributary mean daily temperatures ranged from 7.5°C to 17.2°C. Most bull trout (92.3 percent) entered tributaries before the Columbia River reached a mean temperature of 15°C.

2.2.1.6) Spawning Range

Methow Spring Chinook Population
Methow Sub-basin spring Chinook spawn primarily in the upper reaches of the Chewuch, Twisp, and Methow rivers, including the Lost River, Early Winters, and Wolf Creek tributaries. In descending order of numbers, redds were counted in the mainstem Methow, Twisp, Chewuch, Lost rivers, and Early Winters Creek. No significant differences have been detected in the distribution of hatchery and wild carcasses (females) within each subwatershed (Snow et al. 2008).

Methow Summer Steelhead Population
In the Methow Sub-basin, steelhead currently spawn in the Twisp River, mainstem Methow River, Early Winters Creek, Lost River, Chewuch River, Beaver Creek, Black Canyon Creek, Buttermilk, Boulder, Eight-Mile, Suspension, and Little Suspension, and Lake creeks (Snow et al. 2008).

Methow Core Area Bull Trout
Bull trout are currently known to spawn in Lost, Chewuch, West Fork Methow, and Twisp rivers, Little Bridge, Early Winters, Goat, Wolf, East Fork Buttermilk, Blue Buck (in Beaver Creek watershed), Gold, and Lake creeks (Douglas PUD 2010).

2.2.1.7) Spawning Timing

Methow Spring Chinook Population
Spawning occurs late July through mid-September. There have been no significant differences in spawn timing between hatchery and wild fish (females) within or among sub-basins, although it appears hatchery fish spawn earlier than wild fish (Snow et al. 2008).

Methow Summer Steelhead Population
Spawning occurs in the late spring following entry into the river of the previous calendar year and usually ranges from mid-late March through May. Spawn timing within the index areas shows that

the peak spawn timing in 2007 in the Chewuch watershed occurred during the week of April 15. Peak spawning in the remaining three watersheds all occurred between April 15 and 30. Differences in spawn timing between hatchery and wild fish has not been assessed because many hatchery fish do not possess an externally visible mark (i.e., ad-clip[1]), thus confounding the surveyors' ability to determine the origin of spawning adults (Snow et al. 2008).

Methow Core Area Bull Trout Population

Bull trout are strongly influenced by water temperature during all life stages and for all ecotypes. Most bull trout spawn from mid-September through October, with timing related to declining water temperatures. Spawning sites are commonly found in areas of groundwater interchange, both from the subsurface to the river and from the river to the subsurface. Association with areas of groundwater interchange can promote oxygen exchange and mitigate severe winter temperatures including the formation of anchor ice.

Within the Methow Sub-basin, spawning begins in headwater streams in late September and continues through October, with commencement closely tied to water temperature between 9°C and 11°C (Brown 1992). After spawning, fluvial and adfluvial kelts return to their more moderate environments, while resident forms seek winter refuge. In Methow drainage tributaries, bull trout spawning and early rearing is confined to streams cold enough (less than 1,600°C annual temperature units) to support them in areas below barrier falls (Mullan et al. 1992). In most cases, such reaches are very short (less than 5 miles).

2.2.1.8) Juvenile Life History Strategy

Methow Spring Chinook Population

Fry emerge the spring following spawning and typically smolt as yearlings; however, fall parr migrations from upper reaches have also been observed (Hubble 1993; Hubble and Harper 1999; Snow et al. 2008). Rearing location of these fall migrants prior to smolting the next spring is unknown.

Fryer et al. (1992) summarized age information of spring Chinook sampled at Bonneville Dam from 1987 through 1991. No adult scales with two stream annuli (2.x) were found, although in every year there were some fish estimated to have entered the ocean in their first year of life (0.x was probably from the Snake River Basin). Adults sampled in the UCR tributaries have shown only shown a 1.x life history.

Individuals that never migrated to the ocean make up some portion of the spawning population (Healey 1991; Mullan et al. 1992). Mullan et al. (1992) indicate that precocious maturation of male spring Chinook is common in the mid-Columbia basin and is characteristic of both hatchery and wild stocks. Generally the largest males show evidence of early maturity (Rich 1920). This may explain

[1] All hatchery-origin fish are externally marked, but a portion have only elastomer tags, which would not be readily visible to surveyors. It is also important to note that since steelhead are iteroparous, and they spawn during a period of increasing stream discharge, examination of carcasses, as in the case of spring Chinook salmon, is not possible.

why large numbers of hatchery fish mature precociously, since they are typically larger at age than their wild counterparts.

Harstad et al. (in review) measured the proportion of minijacks among males released from several spring-run and summer-run Chinook salmon hatchery programs throughout the Columbia River Basin for brood years 1999 through 2010. The hatcheries surveyed included both segregated (only hatchery-origin broodstock) and integrated (some natural-origin broodstock) programs. Minijacks were found in all programs monitored, and rates varied approximately 10-fold across release groups ranging from 7.9 - 71.4% of males in spring Chinook salmon programs. Mullan et al. (1992a) examined 20,000 wild juvenile Chinook in tributaries of the mid-Columbia River from 1983 to 1988 and found that precocious males made up about 1 percent of the sample. However, if jacks (age-3 males that return after 1 year in the ocean) are included, the percentage of males that mature precociously would be much greater than 10 percent.

The extent that precocious males contribute to reproduction is unknown. In the Upper Columbia Basin, males that mature in freshwater during their first or second summer may contribute to reproduction and may contribute more than jacks under certain conditions. For example, Leman (1968) and Mullan et al. (1992b) observed only precocious males attending large female Chinook in small headwater streams that were accessible only at high water. In Marsh Creek and Elk Creek, Idaho, precocious males occurred most frequently where there was active spawning (Gebhards 1960). These fish usually lay within the depressions of redds with an adult female or male and female pair. Gebhards (1960) reported seeing between 4 and 30 precocious males within redds. Apparently these fish frequent spawning areas to reproduce, not to forage on eggs. Gebhards (1960) analyzed the stomach contents of several precocious males and found that only 5 percent had consumed eggs. Furthermore, most (85.1 percent) of the dead precocious males found were partly or completely spent.

The mechanism that dictates the life history tactic of Chinook is not well understood (Gross 1991), however, recent studies have indicated that growth rates can be a large factor determining the incidence of precocial and residualism rates in hatchery fish (Larsen et al. 2004, 2006; Sharpe et al. 2007). In the wild, juvenile size is determined by many variables, such as genotype, egg size, time of hatching, water flow, water temperature, territory quality, stream productivity, predation pressure, and population density. Changes in these variables may therefore affect the life history of Chinook.

Precocious males may play a significant role in reproduction in the Upper Columbia Basin, spawning successfully not only as "sneakers" in the presence of older males, but as the sole male present in some areas and in some years when spawner numbers are very low. Precocious males may play a greater role in spawning in years when numbers of spawners were low (i.e., 1994 and 1995) that adult females were widely dispersed.

Methow Summer Steelhead Population

The life-history pattern of steelhead in the Upper Columbia Basin is complex (Chapman et al. 1994). In the Upper Columbia region, Peven et al. (1994) observed smolt ages ranging from 1 to 7 years, with the highest percentages at ages 2 and 3. Female smolts (63 percent of fish sampled) were older and larger for most age classes than males.

Steelhead can residualize in tributaries and never migrate to the ocean, thereby becoming resident rainbow trout. Conversely, progeny of resident rainbow trout can migrate to the ocean and thereby become steelhead. This dynamic expression of life-history characteristics makes *O. mykiss* very challenging to understand and manage. Upstream distribution is limited by low heat budgets (about 1,600°C temperature units) (Mullan et al 1992a). The potential response of steelhead/rainbow in these cold water temperatures may be residualism, presumably because growth is too slow within the time window for smoltification. However, these headwater rainbow trout may contribute to anadromy via emigration and displacement to lower reaches, where warmer water improves growth rate and subsequent opportunity for smoltification.

Methow Core Area Bull Trout Population

Migratory juveniles usually rear in natal streams for 1 to 4 years before emigration (Goetz 1989; Fraley and Shepard 1989; Pratt 1992). Methow sub-basin juvenile bull trout rear in the coldest headwater locations until they reach a size that allows them to compete with other fish (75 to 100 mm; Mullan et al. 1992). Non-migratory forms above barrier falls probably contribute a limited amount of recruitment downstream; nevertheless, this recruitment contributes to fluvial and adfluvial productivity. The fluvial forms migrate to the warmer mainstem Methow and Columbia rivers (e.g., Twisp River, Wolf Creek), while the adfluvial populations (e.g., Lake Creek, Cougar Lake) migrate to nearby lakes.

2.2.1.9) Smolt Emigration Timing

Methow Spring Chinook Population

Smolt trapping has occurred in the Methow Sub-basin since the mid-1990s as part of the hatchery evaluation program. In general, yearling spring Chinook (smolts) migrate down the Methow River between early March and the end of May to early June. The peak of the migration in 2007 appeared later in the Twisp River compared to the Methow River site (Figures 2-2 and 2-3), although trap efficiencies and periods when traps are inoperable may influence the absolute numbers of fish caught on a given date.

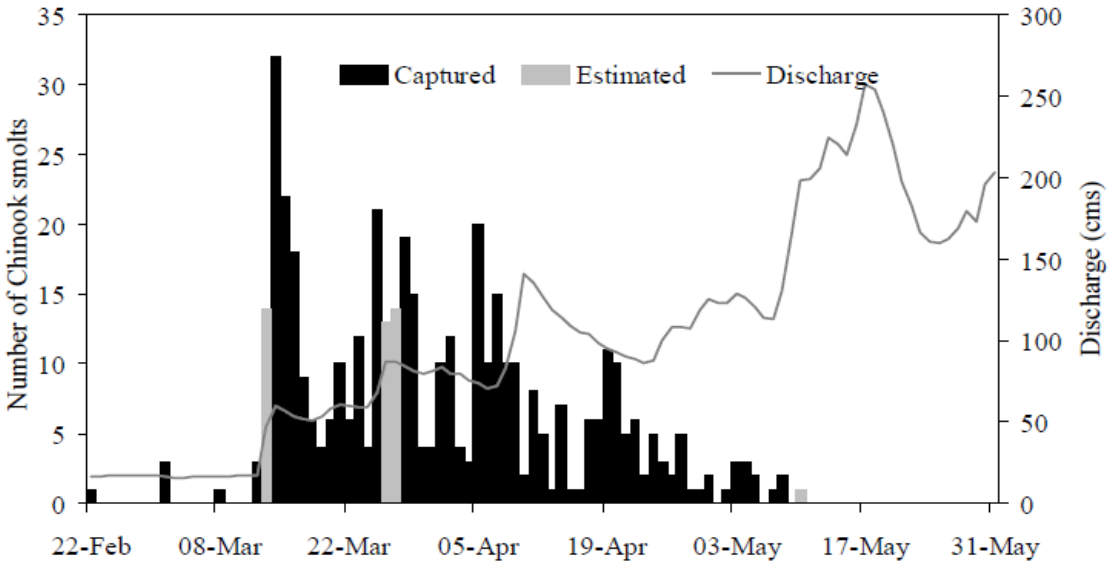


Figure 2-2. Daily capture of wild Chinook salmon smolts from the Methow River trap in 2007 (Figure 3, Chapter 3 from Snow et al. 2008).

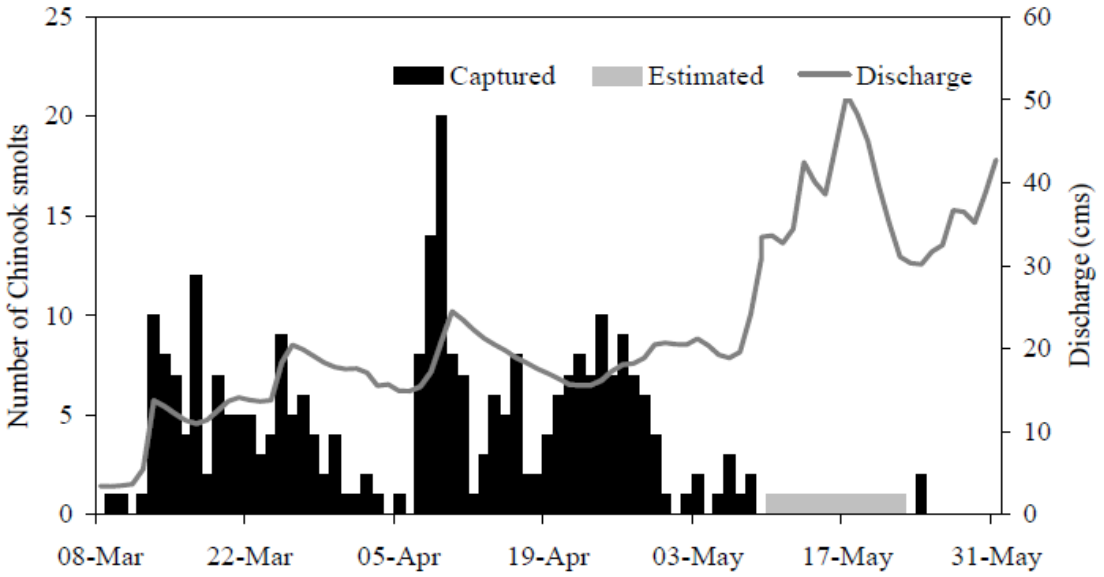


Figure 2-3. Daily capture of wild Chinook salmon smolts from the Twisp River trap in 2007 (Figure 6, Chapter 3 from Snow et al. 2008).

As previously stated, a substantial parr migration occurs within the Methow Sub-basin, and appears in two main phases—throughout the summer and then again in the fall (Figure 2-4).

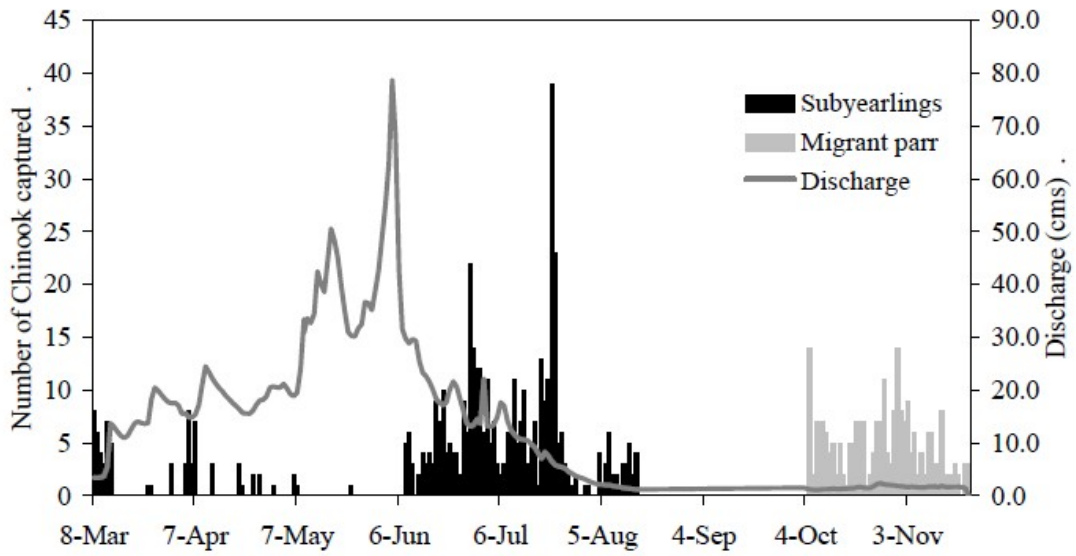


Figure 2-4. Daily capture of sub-yearling wild spring Chinook and migrant parr at the Twisp River trap in 2007 (Figure 7, Chapter 3 from Snow et al. 2008).

Methow Summer Steelhead Population

Smolt trapping has occurred in the Methow Sub-basin since the mid-1990s as part of the hatchery evaluation program. In general, *O. mykiss* juveniles[1] migrate down the Methow River between early March and the end of May to early June. The peak of the migration in 2007 appeared later in the Twisp River compared to the Methow River site (Figures 2-5 and 2-6), although trap efficiencies and periods when traps are inoperable may influence the absolute numbers of fish caught on a given date.

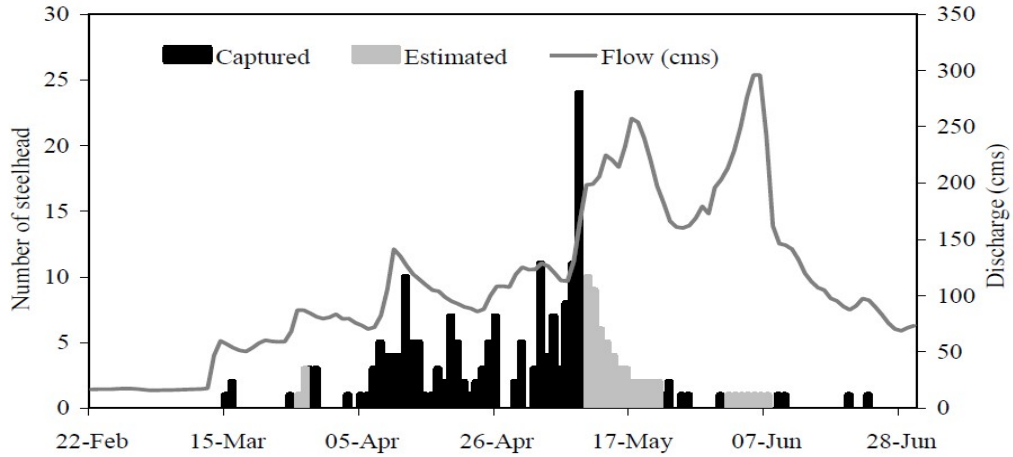


Figure 2-5. Daily capture of wild steelhead smolts and transitional parr from the Methow River trap in 2007 (Figure 5, Chapter 3 from Snow et al. 2008).

[1] Because it is not possible to determine whether juvenile O. mykiss are "trout" or "steelhead," we refer to them by their scientific nomenclature.

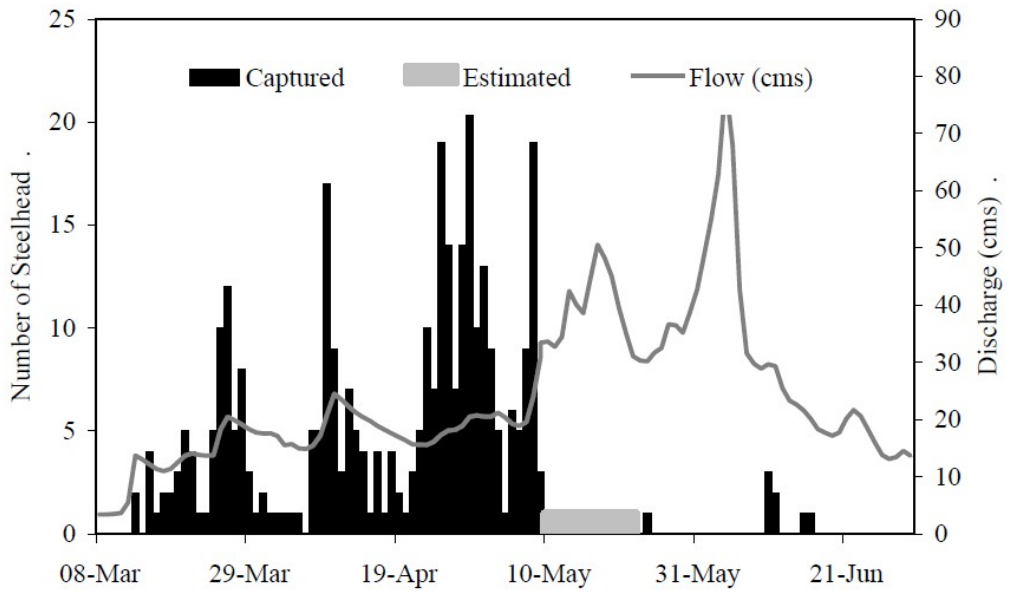


Figure 2-6. Daily capture of wild steelhead smolts and transitional parr from the Twisp River trap in 2007 (Figure 8, Chapter 3 from Snow et al. 2008).

As previously stated, a substantial parr migration occurs within the Methow Sub-basin, and appears in two main phases—throughout the summer and then again in the fall (Figure 2-7).

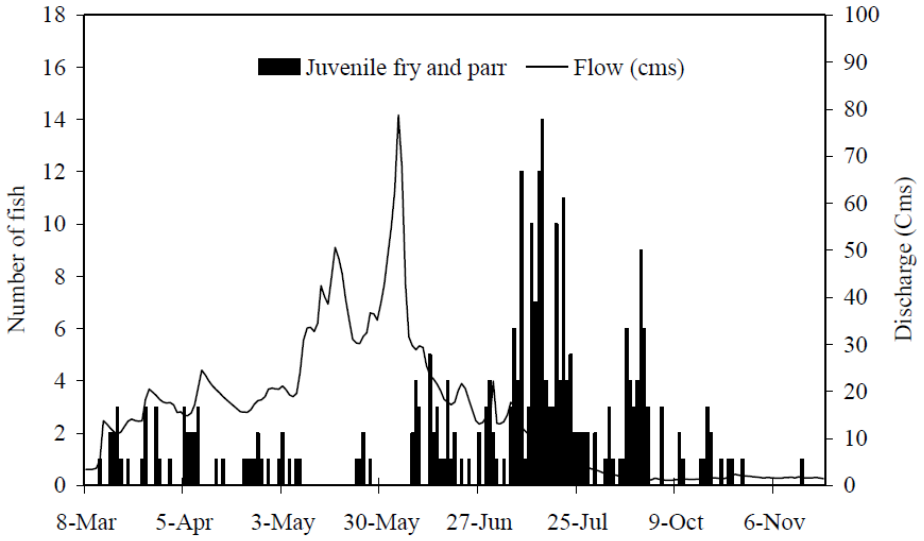


Figure 2-7. Daily capture of natural-origin steelhead fry and parr at the Twisp River trap in 2007 (Figure 9, Chapter 3 from Snow et al. 2008).

Methow Core Area Bull Trout Population
All of the fish that BioAnalysts (2004) tagged in their 3-year study appeared to have spent a minimum of three years in their natal stream prior to migrating to the Columbia River.

2.2.1.10) Spatial and Temporal Distribution of Spawners in Relation to Fish Release Location

Methow Spring Chinook Population
Snow et al. (2008) found no significant differences in spawn timing between hatchery and natural-origin fish (females) within or among sub-basins. However, hatchery fish tended to spawn earlier than naturally produced fish, except in the Twisp River (which had the lowest proportion of hatchery-origin spawners).

Snow et al. (2008) found no significant differences in the distribution of hatchery and natural-origin carcasses (females) within each major spawning area. However, hatchery fish tended to spawn lower in each of the spawning areas than naturally produced fish.

Methow hatchery spring Chinook are typically released in three locations in the Methow Sub-basin. All current acclimation sites use surface water for rearing prior to release to increase homing fidelity. Despite this, an estimated 49 percent of the Twisp-released fish spawning in the Methow Sub-basin spawned in areas other than the Twisp River. However, because abundance of Twisp-stock fish is relatively low, their prevalence typically comprises a small proportion of the escapement within other spawning areas (i.e., Methow and Chewuch rivers). Similarly, an estimated 43 percent of the Chewuch-released fish spawned in areas other than the Chewuch River, but because release numbers are much greater, contribution of these fish to other spawning areas can be high. Conversely, an estimated 28 percent of Methow-released fish spawned in areas other than the Methow River (Snow et al. 2008).

Methow Summer Steelhead Population
There is currently no way to differentiate steelhead by origin on the spawning grounds; this issue has been identified by the Upper Columbia Regional Technical Team as an important data gap.

Methow Core Area Bull Trout Population
There are currently no hatchery programs for bull trout in the Methow River.

– Identify the NMFS ESA-listed population(s) that will be <u>directly</u> affected by the program.

Methow Spring Chinook Population

Common Name	Endangered Species Act	Natural population targeted for integration
Spring Chinook salmon (UCR)	Endangered	Methow River spring Chinook

Methow Summer Steelhead Population

Common Name	Endangered Species Act	Natural population targeted for integration
Steelhead trout (UCR)	Threatened	Methow River summer steelhead

Methow Core Area Bull Trout

There are currently no hatchery programs for bull trout in the Methow River.

– Identify the NMFS ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

Common Name	Endangered Species Act
Spring Chinook salmon (UCR)	Endangered
Steelhead trout (UCR)	Threatened
Bull trout (Columbia River)	Threatened[a]

[a] USFWS listed

2.2.2) Status of NMFS ESA-listed salmonid population(s) affected by the program.

2.2.2.1) Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds

Methow Spring Chinook Population

The ICTRT (2007) has classified the Methow River spring Chinook as a "Very Large" population in size based on its historic habitat potential. A "Very Large" population is one that requires a minimum abundance of 2,000 natural-origin spawners and an intrinsic productivity of greater than 1.75 spawner to spawner (S/S) to be viable. The Recovery Plan (UCSRB 2007) incorporated the abundance goal of 2,000 naturally produced spawners (geometric mean over 12 years), but incorporated an earlier recommendation from the ICTRT of an intrinsic productivity of 1.2.

Methow spring Chinook currently are considered to have a greater than 25 percent chance of becoming extinct within 100 years.

Methow Summer Steelhead Population

The ICTRT (2007) has classified the Methow River summer steelhead as an "Intermediate" population in size based on its historic habitat potential. An "Intermediate" population is one that requires a minimum abundance of 1,000 natural-origin spawners and an intrinsic productivity of greater than 1.1 S/S to be viable. The Recovery Plan (UCSRB 2007) incorporated the abundance goal of 1,000 naturally produced spawners (geometric mean over 12 years) and an intrinsic productivity of 1.1.

Methow summer steelhead are currently considered to have a greater than 25 percent chance of becoming extinct within 100 years.

Methow Core Area Bull Trout Population

Because of a lack of detailed information on the population dynamics of bull trout in the Upper Columbia Basin, a different approach was used to estimate Viable Salmonid Population (VSP) parameters for bull trout (UCSRB 2007). Bull trout abundance was estimated as the number of redds times 2.0 to 2.8 fish per redd. This approach provided a range of abundance estimates for bull trout within each core area (USFWS 2004, 2005). Productivity was based on trends in redd counts, while diversity was based on general life-history characteristics of bull trout (resident, fluvial, and adfluvial) within each core area. Although these parameters were less rigorous than the parameters used to estimate status of spring Chinook and steelhead, they provide relative indices of abundance, productivity, and diversity.

In the final listing rule (63 FR 31647), USFWS identified eight bull trout sub-populations in the Entiat, Wenatchee, and Methow river sub-basins (USFWS 1998). USFWS identified eight sub-populations within this recovery unit: Lake Wenatchee, Ingalls Creek, Icicle Creek, Entiat system, Methow River, Goat Creek, Early Winters Creek, and Lost River. USFWS considered half of these to be "at risk of stochastic extirpation" due to: a) their inability to be re-founded, b) presence of a single life history form, c) limited spawning areas, and d) relatively low abundance. In the 5-year review (USFWS 2008), the USFWS determined that the Methow core area was at high risk of extinction.

2.2.2.2) Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

Methow Spring Chinook Population

During the period 1960 to 1999, returns per spawner for spring Chinook in the Methow sub-basin ranged from 0.05 to 5.21 (UCSRB 2007). The 12-year geometric mean of returns per spawner during this period ranged from 0.41 to 1.02. The geometric mean at the time of listing (1999) was 0.51.

Since 1999, the natural replacement rate (the number of adult recruits from successive return years that originated from the same brood year, divided by the sum of the number of spawners for that brood year) has varied, but remains low, especially in the Methow River spawning area (Table 2-12). The most recent geometric mean of productivity remains near 0.51, (which is the same as the time of ESA listing for the Chewuch and Twisp spawning areas). Approximately half of the productivity is located in the Methow spawning area, which coincidentally has the highest proportion of hatchery-origin spawners.

Table 2-12. The natural replacement rate (NRR) of Methow Sub-basin spring Chinook between the 1992 and 2001 brood years (data from Chapter 5, Appendix A from Snow et al. 2008).

Year	NRR		
	Chewuch	Methow	Twisp
1992	0.11	0.10	0.30
1993	0.52	0.17	0.13
1994	0.30	0.20	0.34
1995	5.53	2.83	3.23
1996	12.75	17.89	8.64
1997	12.68	5.98	17.25
1998	12.66	3.73	17.75
1999	0.11	0.07	0.31
2000	1.10	0.52	1.72
2001	0.13	0.04	0.18
2002	0.32	0.15	0.48
Geometric mean	*1.00*	*0.53*	*1.16*

Methow Summer Steelhead Population

In the UCSRB (2007), the returns per spawner were expressed as either a hatchery spawner effectiveness of 100 percent or 0 percent. The geometric mean of returns per spawner is 0.09 if hatchery spawner effectiveness was 100 percent, and 0.84 if hatchery spawner effectiveness was 0 percent (brood years 1960 to 1996).

More recently, Snow et al. (2008) estimated that the total (not accounting for hatchery spawner effectiveness) average return per spawner was 0.30 for brood years 1996 to 2001 (Table 2-13); which falls between the two values reported in the UCSRB (2007).

Table 2-13. The natural replacement rate (NRR) of Methow Sub-basin steelhead between the 1996 and 2001 brood years (data from Chapter 4, Table 16 from Snow et al. 2008).

Parent Brood	Recruits	NRR
1996	315	0.56
1997	684	0.28
1998	730	0.30
1999	167	0.11
2000	848	0.40
2001	595	0.16
Average	557	0.30

Methow Core Area Bull Trout Population

Numbers of redds counted in the Methow sub-basin appear to have increased since the mid-1990s. This reflects both an actual increase in redds and an artifact of improved survey methods. Data from recent years of surveys (2000 to 2007), with similar, indicate an increasing trend in redds, ranging from 147 in 2000 to 231 in 2007 (see below).

2.2.2.3) Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Methow Spring Chinook Population

From 1960 to 2003, abundance of age 3+ naturally produced spring Chinook in the Methow sub-basin ranged from 33 to 9,904 adults. During this period the 12-year geometric mean (1988-1999) of spawners in the sub-basin ranged from 480 to 2,231 adults. The 12-year geometric mean at the time of listing (1999) was 480 spawners (UCSRB 2007).

More recently (1992 to 2008), the estimated escapement of naturally produced spring Chinook has ranged from approximately 58 (2003) to 1,832 fish (2001), with a geometric mean of 363 (Table 2-14).

Table 2-14. Estimated escapement of spring Chinook in the Methow River, 1992 to 2008 (based on Appendices A and D, Chapter 5, from Snow et al. 2008 and unpublished 2009 WDFW data).

Return Year	Estimated Escapement							
	Chewuch		Methow		Twisp		Total	
	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild
1992		422		924		316		1,662
1993		184		537		426		1,147
1994		63		172		74		309
1995		6		27		12		45
1996								
1997		123		155		72		350
1998								
1999		21		70		25		116
2000	52	83	546	611	235	256	833	950
2001	1,761	732	6,994	594	384	506	9,139	1,832
2002	588	78	1,644	86	60	181	2,292	345
2003	465	25	597	8	18	25	1,080	58
2004	289	46	622	199	98	243	1,009	488
2005	289	219	526	221	34	87	849	527
2006	378	135	942	128	100	65	1,420	328
2007	203	74	545	152	65	40	813	266
2008	166	86	468	172	126	40	760	298

Return Year	Estimated Escapement							
	Chewuch		Methow		Twisp		Total	
	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild
Geometric mean	310	84	873	158	86	92	1,342	363

Methow Summer Steelhead Population

Between 1988 and 2007, the run of naturally produced steelhead returning to the Methow River has ranged from 66 (1995) to 669 (2004). The most recent 12-year average (1996 to 2007) geometric mean is estimated at 329 fish (Table 2-15).

Table 2-15. Estimated return of naturally produced steelhead to the Methow River, 1988-2009. Information based on UCSRB (2007) and Snow et al. (2008) and unpublished WDFW data.

Return year	Estimated naturally produced return	12-year running geometric mean of return
1988	316	116
1989	401	126
1990	315	160
1991	552	184
1992	252	242
1993	130	240
1994	165	275
1995	128	250
1996	222	247
1997	96	224
1998	186	221
1999	350	229
2000	436	236
2001	702	247
2002	651	262
2003	847	272
2004	638	294
2005	558	331
2006	472	362
2007	762	420
2008	898	472

Methow Core Area Bull Trout Population

Bull trout redd surveys in the Methow sub-basin began in the early 1990s. Total numbers of redds within the sub-basin have ranged from 4 to 231 (Table 2-16). , Using 2.0 and 2.8 fish per redd (UCSRB 2007), abundance ranged between 22 and 647 fish per year in the Methow Sub-basin (Table 2-17).

Table 2-16. Bull trout redds from the Methow Sub-basin between 1992 and 2007 (pers. comm., Barb Kelly and Gene Shull, USFWS and USFS, respectively).

Stream/	Methow River Sub-basin															
Watershed[1]	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Lower Methow watershed					2	2	1	0		0	1	0		14	4	4
Twisp watershed	4	5	4	25	0	2	86	101	105	76	93	86	101	87	89	108
Chewuch watershed				22	13	9	8	0	18	31	22	20	10	43	54	46
Upper Methow watershed	7			28	29	18	40	30	42	47	79	21	58	71	63	73
Redd Total:	11	5	4	75	44	31	135	131	165	154	195	127	169	215	210	231
Miles Surveyed Total:				18.7	25.6	20.2	26.7	27.8	22.9	42.5	28.7	30.6	30.7	33.3	32.3	32.8

[1] Lower Methow includes Crater Creek, Middle Methow includes Wolf and Goat Creeks, and Upper Methow includes the upper mainstem Sub-basin (Early Winters subwatershed, and lower Lost River subwatershed).

Note: Not all bull trout redd counts were complete, and length of stream surveyed has varied between some surveys, in many cases with new survey reaches being added in recent years. Please refer to the annual spawning survey reports for more complete information.

Table 2-17. The number of bull trout estimated to spawn in the Methow Sub-basin between 1992 and 2007, based on Table 2-16 and using either 2.0 fish per redd (f/r) or 2.8.

Year	Total Redds	Fish @ 2.0 f/r	Fish @ 2.8 f/r
1992	11	22	31
1993	5	10	14
1994	4	8	11
1995	75	150	210
1996	44	88	123
1997	31	62	87
1998	135	270	378
1999	131	262	367
2000	165	330	462
2001	154	308	431
2002	195	390	546
2003	127	254	356
2004	169	338	473
2005	215	430	602
2006	210	420	588
2007	231	462	647

2.2.2.4) Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Methow Spring Chinook Population

The proportion of hatchery-origin fish on the spawning grounds has been increasing since 2001, and in particular, in the Chewuch and Methow spawning areas since 2005 (Table 2-18). Except for 2007, the proportion of hatchery-origin fish spawning in the Twisp has remained consistently below 30 percent (Table 2-18).

Table 2-18. Proportions of hatchery-origin spring Chinook spawners in the Methow Sub-basin, based on Table 2-14.

Return Year	Proportions							
	Chewuch		Methow		Twisp		Total	
	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild
2001	41.4	58.6	48.0	52.0	30.1	69.9	42.1	57.9
2002	46.9	53.1	48.7	51.3	24.9	75.1	45.7	54.3
2003	48.7	51.3	49.7	50.3	29.5	70.5	51.4	48.6
2004	46.9	53.1	48.7	51.3	19.9	80.1	43.0	57.0

Return Year	Proportions							
	Chewuch		Methow		Twisp		Total	
	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild
2005	56.9	43.1	70.4	29.6	28.1	71.9	61.7	38.3
2006	86.3	13.7	75.8	24.2	28.7	71.3	65.4	34.6
2007	73.3	26.7	78.1	21.9	61.9	38.1	69.5	30.5
2008	65.9	34.1	73.1	26.9	75.9	24.1	71.8	28.2
Average	*58.3*	*41.7*	*61.6*	*38.4*	*37.4*	*62.6*	*56.3*	*43.7*

Methow Summer Steelhead Population

Using the proportion of natural-origin fish sampled at Wells Dam as a surrogate for the percentage of natural-origin fish on the spawning grounds shows that the proportion of hatchery steelhead on the spawning grounds is typically greater than 90 percent (Figure 2-8). The long-term average percentage of naturally produced fish sampled at Wells Dam is approximately 8 percent (Figure 2-8).

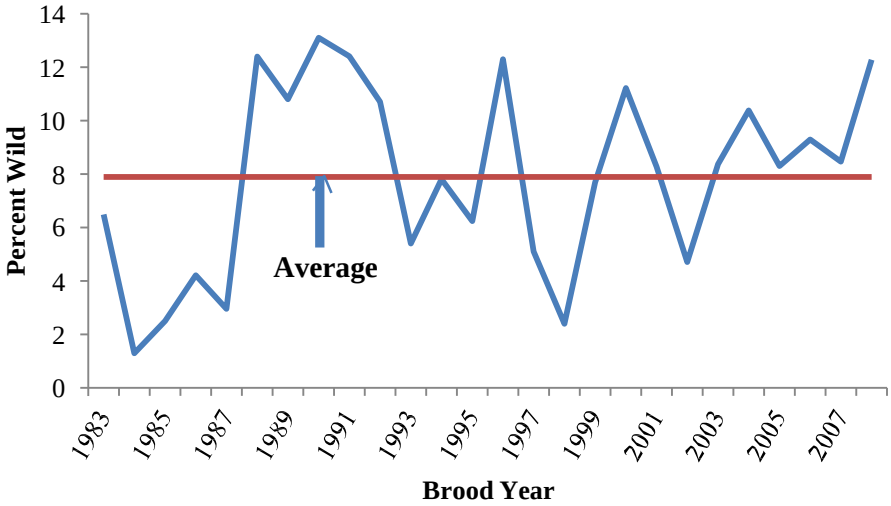


Figure 2-8. Percent of naturally-produced steelhead sampled in the run at large at Wells Dam for the 1983 to 2008 brood years (Data from UCSRB 2007 and C. Snow, pers. Comm)

Methow Core Area Bull Trout Population

There are currently no hatchery programs in the Methow Sub-basin.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take

See Tables 2-19 and 2-20 for estimated levels of annual take.

Hatchery Program Activities.
These activities include:

- Collection of broodstock (up to 36 natural-origin adults) will occur through trap operations at Wells Dam. See Table 5-1.
- Transfer of natural and hatchery-origin adults and fertilized eggs between the trapping locations and spawning/incubation facilities at Wells and Methow Hatchery; and holding/artificial spawning of collected adults at Methow hatchery.
- Propagation and incubation from the fertilized egg through the smolt life stage at the Methow Hatchery.
- Transfer of fingerlings and pre-smolts from the Methow Hatchery for rearing in acclimation facilities as outlined in Table 5-1.
- Release of smolts into the Methow Sub-basin from acclimation facilities/locations in the Methow Sub-basin as approved by the HCP Hatchery Committees.
- Monitoring of the programs in the hatchery environment using standard techniques such as growth and health sampling as detailed in the M&E Plan (Hillman et al. 2013).
- Monitoring of the programs in the natural environment using standard techniques such as juvenile fish traps, adult spawner surveys, etc., as described in detail in the M&E Plan (Hillman et al. 2013).

Adult Management Activities
Take of hatchery and natural origin spring Chinook may also occur as a result of adult management of hatchery spring Chinook to meet spawning escapement objectives (abundance of hatchery/wild origin composition on the spawning grounds). These activities may occur at Wells Trap, and/or at the hatchery outfalls and weirs throughout the Methow Sub-basin (or other locations as determined by the HCP-HC).

Adult Removal at Trapping Facilities/Locations

- **Funding:** Chelan PUD will provide funding for up to one full-time employee (for all spring Chinook hatchery programs) for adult management activities associated with Chelan PUD's NNI hatchery compensation. This funding includes manual adult management activities up to the point at which spring Chinook are removed at the trapping facilities and placed in holding containers. WDFW is responsible for coordinating the funding for adult management activities from the point at which fish are placed in holding containers when removed and/or for a fishery. The JFP will determine the disposition of the fish placed in the holding containers.

- **Permit Holder:** Chelan PUD and WDFW will be co-permit holders for adult management activities up to the point at which spring Chinook are removed from the trapping facilities and placed in holding containers. WDFW will be the permit holder for adult management activities from the point at which fish are placed in holding containers.
- **Agent:** WDFW, as co-permittee, is currently under contract with Chelan PUD and will remain so until the contract expires and is not renewed or renegotiated.

Table 2-19. Estimated levels of take of Upper Columbia River (UCR) spring Chinook by hatchery activity.

Listed species affected: UCR Spring Chinook **ESU/Population:** Methow Population **Activity:** Implement Hatchery Program

Location of hatchery activity: Methow Hatchery, Chewuch Acclimation Pond, Wells Dam, Methow screw trap and other M&E activities/locations.

Dates of activity: Broodstock collection: May-August; screw traps spring thaw to ice up **Hatchery program operator:** Currently WDFW

Type of Take	Annual Take of Listed Fish By Life Stage (*Number of Fish*)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)		Up to 20%	Up to 100% of run at-large to support broodstock sorting and adult management	Up to 100%
Collect for transport (b)	NA	Up to 1,500 NO and 5,000 HO juveniles for smolt trap efficiency trials	Up to 33% of the NO return or 36 NORs, whichever is less.[i] management	NA
Capture, handle, and release (c)	NA	Release up to 60,516 hatchery smolts	Up to 100% of run at-large to support broodstock sorting and adult management	NA
Capture, handle, tag/mark/tissue sample, and release (d)	NA	Trap up to 20% natural and hatchery population from any Methow tributary	Up to 100% of the natural and hatchery returns	100%
Removal (e.g. broodstock) (e)	NA	NA	Up to 33% of the NO return or 36 NORs, whichever is less.[i]	NA
Intentional lethal take (f)	Up to 3% of total NO and up to 20% HO egg take for BKD mgmt.	Up to 300 HO juveniles per parental or rearing group to evaluate early maturation/precocity rates/levels.	Up to 33% of the NO return or 36 NORs for broodstock, whichever is less.[i] Up to 100% of hatchery returns for pHOS/PNI management.	NA
Unintentional lethal take (g)		Up to 2% of fish encountered	NA	NA
Other Take (specify) (h)	NA	NA	NA	NA

Notes:

a. Observation and/or harassment of listed fish associated with stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled, and released upstream or downstream.

d. Take associated with tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other take not identified above as a category.

i. Up to 45 HO adults for broodstock may be collected on an annual basis depending on the strength of the NO return to satisfy Chelan PUD's HCP production obligation for Methow spring Chinook and/or to manage for BKD.

Table 2-20. Estimated levels of take of Upper Columbia River (UCR) Summer Steelhead by hatchery activity.

Listed species affected: UCR Summer Steelhead **ESU/Population:** Methow and Okanogan Populations **Activity:** Implement Hatchery Program

Location of hatchery activity: Methow Hatchery, Chewuch Acclimation Pond, Wells Dam, Methow screw trap and other M&E activities/locations.

Dates of activity: Broodstock collection: May-August; screw traps spring thaw to ice up **Hatchery program operator:** Currently WDFW

Type of Take	Annual Take of Listed Fish By Life Stage (*Number of Fish*)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)	NA	NA	NA	NA
Collect for transport (b)	NA	NA	NA	NA
Capture, handle, and release (c)	NA	NA	Up to 100 adults	NA
Capture, handle, tag/mark/tissue sample, and release (d)	NA	Trap up to 20% natural and hatchery population from any tributary	Trap up to 20% NOR and HOR population from any tributary	NA
Removal (e.g. broodstock) (e)	NA	NA	NA	NA
Intentional lethal take (f)	NA	NA	NA	NA
Unintentional lethal take (g)	NA	Not to exceed 2% of fish encountered.	Up to 9 adults; not to exceed 1% oftrapped steelhead	NA
Other Take (specify) (h)	NA	NA	NA	NA

Notes:

a. Observation and/or harassment of listed fish associated with stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled, and released upstream or downstream.

d. Take associated with tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other takes not identified above as a category.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan or other regionally accepted policies Explain any proposed deviations from the plan or policies.

The objectives of this program are established in the Rocky Reach and Rock Island HCPs and described in Section 1. Implementation of the HCPs is a cornerstone of recovery efforts for the UCR spring Chinook and as such, has been imbedded in the Recovery Plan (UCSRB 2007). The Upper Columbia Salmon Recovery Board (UCSRB) led the development of the Recovery Plan which was adopted by NMFS as a final ESA recovery plan for UCR spring Chinook and steelhead on October 9, 2007. The UCSRB coordinates recovery planning in the UCR region with funding from the Washington State Governor's Salmon Recovery Office. A link to the NMFS webpage describing the plan is at http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Upper-Columbia/Index.cfm.

Section 5.3.1 of the Recovery Plan describes the hatchery programs currently being implemented in the Upper Columbia ESU. Implementing entities include CCT, YN, USFWS, WDFW, Chelan PUD, Douglas PUD, and Grant PUD. Coordinating and technical bodies have been established to guide implementation of Chelan, Douglas and Grant County PUDs' hatchery programs (Coordinating Committees and Hatchery Committees), required by the PUD HCPs and by Grant County PUD's Biological Opinion (2008). The HCP and Priest Rapids Coordinating and Hatchery Committees include participation by the relevant PUD(s) and CCT, YN, USFWS, NMFS, and WDFW. This HGMP, to the extent consensus can be reached by the HCP-HC, will also be consistent with the principles advocated by the Hatchery Scientific Review Group on UCR spring Chinook artificial supplementation programs (HSRG 2009). These principles will be reflected in the program production size and duration, M&E, and in the artificial production strategies.

3.1.1) HSRG – Upper Columbia Review

The HSRG, as part of the Pacific Salmon Hatchery Reform Project, has completed a review of 178 hatchery programs and 351 salmonid populations in the Columbia River Basin. The project was conducted by the Columbia River HSRG, composed of 14 members, nine of whom were affiliated with agencies and tribes in the Columbia River Basin. The remaining five members were unaffiliated biologists. The objective was to produce recommendations that are based on broad policy agreements and are supported by consistent technical information about hatcheries, habitat, and harvest. The Upper Columbia Hatchery Programs Regional Review began in April 2008, and the final HSRG recommendations were published January 31, 2009 in Appendix E to the Columbia River Hatchery Reform System-Wide Report (HSRG 2009). Principles of the HSRG are incorporated into this HGMP to the extent agreements have been reached within the HCP-HC process.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

3.2.1) Rocky Reach and Rock Island Habitat Conservation Plans

Biological Opinions with incidental take statements (ITSs) were issued for the Rocky Reach and Rock Island hydroelectric projects HCPs on August 12, 2003. The Rocky Reach FERC license was also consulted upon by NMFS on July 9, 2007. The amended Incidental Take Permit No.1196 (NMFS 2004) added Chelan PUD to the permit as a joint permit holder with WDFW and Douglas PUD on January 20, 2004. The artificial propagation activities of this program are included within the HCPs; see Sections 1.7 and 1.8 for more detailed information regarding the HCPs. The production levels specified in the HGMP are consistent with those currently in place under the HCP Hatchery Committees; therefore this HGMP is consistent with the HCPs.

3.2.2.) 2008-2017 / United States v. Oregon / Management Agreement

The purpose of this Management Agreement is to provide a framework within which the signatory parties can use their authorities to protect, rebuild, and enhance UCR fish runs while fairly sharing harvestable fish between Treaty and non-Treaty fisheries. The Management Agreement specifies harvest limits and artificial production measures for stocks of salmon and steelhead originating above Bonneville Dam. The hatchery production goal for the Methow Composite stock of spring Chinook as shown in Appendix B, Table B1 of the Management Agreement (released from Twisp and Chewuch River acclimation Sites as well as Methow Hatchery itself) is 550,000 yearling juveniles initially incubated and reared at the Methow Hatchery.

These production programs are implemented and/or adjusted based on modifications to productions levels through processes established under the mid-Columbia HCPs, the Priest Rapids Salmon and Settlement Agreement, and discussions associated with Part III.H of the Management Agreement. The current program involves the release of smolts from the Methow Hatchery; some Methow Hatchery production is acclimated at ponds located in the Twisp and Chewuch watersheds. The Management Agreement is entered as an order of the 7th US District Court in /*US v. Oregon*/ and, as such, its terms are binding on the parties. The mitigation production levels specified in this HGMP are identical to those of the Management Agreement; therefore, this HGMP is consistent with *US v. Oregon*.

This program does not affect the management, assessment, or goals of fisheries that occur outside of the Methow sub-basin. Low numbers of Methow spring Chinook are harvested in ocean fisheries. Impacts of ocean fisheries are regulated under authority of the Pacific Salmon Commission and the Pacific Fishery Management Council. Fisheries under these jurisdictions have been reduced in recent years in response to ESA listings. Mainstem Columbia River fisheries are regulated under a co-management framework pursuant to litigation in *US v Oregon*. The *2008-2017 United States v Oregon Management Agreement* provides the harvest management framework for spring Chinook fisheries below McNary Dam. The harvest schedule is designed to allow some level of harvest, while protecting the majority of ESA-listed NOR adults passing through the fisheries.

Allowable harvest rates are scaled to the abundance of the total run projected to pass Bonneville Dam and the abundance of NOR spring Chinook projected to enter the Snake River. The allowable harvest rates for Treaty and non-Treaty fisheries are designed to achieve a 50/50 sharing of harvestable fish in the non-selective Tribal fisheries and mark-selective non-Tribal fisheries in accordance with Treaty fishery case-law standards. Total allowable fishery impacts in combined mainstem fisheries range from less than 5.5 percent on total runs of less than 27,000 fish to a maximum of 17 percent on runs of 488,000 fish or more. Nevertheless, lower-mainstem commercial and recreational fisheries annually commence prior to confirmation of the forecasted run-size by actual fish counts at Bonneville Dam, potentially resulting in a disproportionate harvest of the early returning component of the UCR spring Chinook run, which historically comprised older, more-fecund fish (i.e., Age-5 fish) (Eldridge et al. 2010).

Fisheries in the UCR basin are currently limited by the need to protect ESA-listed UCR spring Chinook salmon and UCR steelhead. Fisheries in the migration corridor and ocean are also limited to protect these populations and to minimize harvest impacts on other listed salmon and steelhead returning to other Columbia River basin and Snake River basin areas as noted above. NMFS evaluates and authorizes annual fisheries proposed by the JFP in the action area each year through separate Section 7 biological opinions.

Until the spring of 2000—when a relatively large run of hatchery spring Chinook salmon returned and provided a small commercial Tribal fishery in the lower Columbia River—no commercial season for spring Chinook salmon had taken place since 1977. Present Columbia River harvest rates are very low compared with those from the late 1930s through the 1960s (NMFS 2008).

Harvest actions outside the action area, such as in the ocean, mainstem Columbia River, and other basin areas will be managed through the *U.S. v Oregon* and Pacific Fisheries Management Council (PFMC) planning and management processes, with guidance from NMFS. Proposed releases of spring Chinook salmon, summer Chinook salmon, sockeye salmon, and coho salmon juveniles into the UCR basin are not expected to create any substantial harvest complications with listed species. NMFS involvement with the co-managers in the PFMC and *U.S. v Oregon* fishery planning processes will adequately limit harvest effects on listed salmon and steelhead. Proposals for future fisheries will continue to be addressed by NMFS through separate Section 7 consultation processes.

3.3) Relationship to harvest objectives.

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

There have been no recreational fisheries on Methow spring Chinook in the Methow River since the stock was listed in 1999. Neither formal creel survey nor punch card data were available to estimate total catch or effort in fisheries prior to 1999. The primary goal of the hatchery program is to support recovery of listed Methow spring Chinook and to contribute to the recovery of the UCR spring Chinook ESU and to the extent possible contribute to harvest opportunities. Implementation of fisheries is not the purview of Chelan PUD and thus a specific fisheries plan is not included in this

HGMP. Implementation of fisheries may help reduce the number of hatchery-origin adults; however, under current marking agreements, a fishery would be directed at Winthrop NFH returning adults, and not necessarily at fish originating from this program. Therefore, a fishery may help overall adult management in the Sub-basin, but may not have a substantial effect on adult management of Chelan PUD's spring Chinook production in the Methow Sub-basin unless alternative marking strategies were employed.

3.4) Relationship to habitat protection and recovery strategies.

Although habitat in much of the upper reaches of the Methow Sub-basin is in near pristine condition, habitat complexity, connectivity, water quantity, and riparian function have been compromised by human activities in other parts of the Methow Sub-basin, including portions where the majority of spring Chinook spawn. The Recovery Plan (UCSRB 2007) details specific objectives and actions for habitat protection and restoration necessary for the recovery of UCR salmon and steelhead populations.

Chelan PUD also provides funding for projects for the protection and restoration of HCP Plan Species habitat. The PUD provides this funding as a requirement of the Rocky Reach and Rock Island HCPs to compensate for up to two percent unavoidable project mortality. This HCP requirement, combined with the survival standards and hatchery compensation, satisfies Chelan PUDs mitigation obligation for passage losses due to the operation of Rocky Reach and Rock Island Dams.

3.5) Ecological interactions.

Potential effects of the Methow Hatchery spring Chinook hatchery program on salmonids and non-salmonids; salmonid and non-salmonid physical environments; potential effects of other supplementation programs; and natural-origin fish have been evaluated in the NMFS Biological Opinion (2004) and Environmental Assessment (NMFS 2002) for a multi-year authorization for an annual take of UCR spring Chinook salmon and UCR steelhead associated with the spring Chinook supplementation program (Permit 1196). Potential effects from the program are regulated by existing policies regarding hatchery operations, maintenance protocols, fish health practices, genetic effects, ecological interactions, and fish cultural practices, as prescribed in the 1994 IHOT annual report (IHOT 1995).

3.5.1) Populations that could negatively impact the program.

Predation

Fish, mammals, and birds are the primary natural predators of spring Chinook in the Upper Columbia Basin. Several fish species may consume spring Chinook. Northern pikeminnow (*Ptychocheilus oregonensis*), walleye (*Sander vitreus vitreus*), and smallmouth bass (*Micropterus dolomieu*) have the potential to negatively affect the abundance of juvenile Chinook (Gray and Rondorf 1986; Bennett 1991; Poe et al. 1994; Burley and Poe 1994). Adult salmonids within the

Upper Columbia Basin are opportunistic feeders and are therefore capable of preying on juvenile spring Chinook. Those adult salmonids likely to have some effect on the survival of juvenile salmonids include (in order of greatest likely impact), adult bull trout, rainbow trout, cutthroat trout, brook trout, and brown trout.

Juvenile hatchery spring Chinook salmon are liberated as yearling smolts through volitional releases. Because fish are released as yearling smolts, potential predation by native and non-native predators is thought to be reduced compared to sub-yearling releases.

Predation by piscivorous birds on juvenile salmonids may also represent a large source of mortality. The NMFS (2000) identified gulls *(Larus* spp.), cormorants (*Phalacrocorax* spp.), and Caspian terns *(Sterna caspi*a) as the most important avian predators in the Columbia River Basin. In the Columbia River estuary, avian predators consumed an estimated 16.7 million smolts (range, 10 to 28.3 million smolts), or 18 percent (range, 11 to 30 percent), of the smolts reaching the estuary in 1998 (Collis et al. 2000, as cited in Douglas PUD 2010). Caspian terns consumed primarily salmonids (74 percent of diet mass), followed by double-crested cormorants *(P. auritu*s; 21 percent of diet mass) and gulls (8 percent of diet mass).

Predation and delayed mortality for returning adult salmon as a result of wounding by marine mammals may negatively affect spring Chinook salmon. The incidence of wounds noted at Lower Granite Dam during 1991 was 20.9 percent for adult spring migrants and 9.4 percent for summer migrant salmon (Park 1993). In 1992, the numbers were 17.4 percent and 7.6 percent, respectively. Although UCR Chinook do not pass Lower Granite Dam, the losses there may be similar to losses experienced by UCR Chinook along their migration route.

Competition and potentially predation could also occur between juvenile spring Chinook and hatchery steelhead that reside in the mainstem Columbia River and in the Methow Sub-basin. Although the degree of steelhead residualism is unknown, it is thought to average between 5 and 10 percent of the number of fish released (USFWS 1994, as cited in Douglas PUD 2010).

Pathogens and Parasites

To improve imprinting and subsequent homing fidelity, the hatchery program commonly utilizes surface water to provide long and short term acclimation. Pathogens can be present in the surface water and can be transmitted horizontally from natural origin spring Chinook (e.g., bacterial kidney disease) and/or from decaying carcasses, which may shed parasites (e.g., *Dermocystidium*). Pathogens and parasites present in the surface water may be transported through the water intake, which can pose a significant risk to the program.

3.5.2) Populations that could be negatively impacted by the program.

The potential ecological effects of Methow spring Chinook on natural salmonid populations is broken down into three sections: 1) effects associated with juvenile releases; 2) effects associated with adult returns; and 3) effects associated with both juveniles and adults. Effects to non-salmonid

species are unknown at this time, but will be addressed as part of Objective 12 of the M&E Plan (Hillman et al. 2013).

Juvenile Releases

Hatchery-origin juvenile spring Chinook from this program can potentially interact with natural-origin spring Chinook and steelhead juveniles. These species are present year-round in the UCR mainstem and tributary areas. Natural-origin spring Chinook salmon in the UCR initiate seaward migration as yearling fish between March and June (Chapman et al. 1995). Natural-origin steelhead fry emerge from the gravel in the late spring through August and disperse to downstream rearing areas in the late summer and early fall. UCR steelhead begin seaward migration as age 2+ (43.2 percent) or 3+ (46.4 percent) smolts (Peven 1990) during April and May at an average size of 136 to 188 mm (Chapman et al. 1994).

After initial incubation and rearing on well water at the Methow Hatchery, yearling juvenile spring Chinook salmon will be acclimated on and released into natal waters. Fish not leaving acclimation ponds volitionally will be forced out in May. Historically, it has been seldom necessary to force fish. The target release size of 15 to 18 fish per pound (fpp) for hatchery-origin spring Chinook yearlings is specified in the M&E Plan. This target for release size is intended to produce rapidly migrating juveniles that, because of their rapid migration, should not compete for resources with naturally produced spring Chinook or other species.

Adult Returns

Little is known about interactions between individual stocks of spring Chinook released into the Columbia River system from this hatchery program and other salmonids between the time they leave the estuary and return as adults to spawn. Available information is inferred from coded wire tag (CWT) data taken from fish harvested from the ocean. Based on this available data, it is assumed that ocean harvest of upper Columbia spring Chinook will continue to be minimal (2008 to 2017 US v. OR Management Agreement) and for practical purposes is assumed to be zero (FCRPS/Three Treaty Tribes MOA 2008). These data, however, do not give us insight into fish behavior nor inter-specific interactions among stocks in the ocean. However, given the assumed zero harvest of Methow spring Chinook in ocean fisheries, the Methow spring Chinook hatchery program is not a factor in determining ocean harvest regulations and quotas that could affect listed species.

Returning adult hatchery spring Chinook that stray to natural spawning areas may compete for spawning gravel and/or breed with native fish, potentially altering genetic fitness and influencing their ability to survive in the ecosystem. Guidance on acceptable out-of-basin stray rates of hatchery fish is 5 percent or less of total brood return (HSRG 2009). Due to the chronically low abundance of NORs in the Methow Sub-basin, hatchery-origin spawners may be necessary to provide an adequate number of spawners on the spawning grounds; however, strays from out-of-basin hatchery programs are undesirable. Overall, 14.5 percent of the estimated number of hatchery fish spawning in the Methow Sub-basin in 2007 strayed from other independent

populations (Entiat, Chiwawa, and Dworshak Hatchery releases). These fish comprised 26.6 percent of the hatchery fish spawning in the Chewuch River subwatershed, and 17.2 percent of those spawning in the upper Methow; no out-of-basin strays were recovered in the Twisp River (Snow et al. 2008). Methow Hatchery stocks have comprised less than 5 percent of the estimated spawning escapement in the Entiat River between run years 1997 to 2006 (Snow et al. 2008).

The concept of within-basin straying in the Methow Sub-basin is controversial because hatchery spring Chinook of Methow/Chewuch-composite origin have been assigned arbitrarily to release location, either directly from the Methow Hatchery or from the Chewuch acclimation pond, with the goal that greater than 90 percent of them will return to the spawning grounds, rather than to the hatchery. Nevertheless, any fish recovered by the hatchery program M&E staff is classified as a within-basin stray if it is not within the stream in which it was released, regardless of the origin of its parents or length of acclimation at the release site. Table 3-1 summarizes the proportion of CWT recoveries by hatchery stock in the Chewuch, Methow and Twisp Rivers from run years 2000 to 2012. Stray rates of Twisp and Chewuch hatchery spring Chinook salmon were high for the 1998 and 2000 broods examined. Releases in both these watersheds were accomplished through the use of acclimation ponds supplied with local irrigation withdrawal from the Twisp and Chewuch rivers. Stray rates may decrease with a longer acclimation time, but longer acclimation at the current facilities may only be possible with eliminating dependence on water withdrawal from the ditch by obtaining a dedicated surface water and groundwater right that would extend the acclimation period.

Annual monitoring and evaluation, as required in the HCP, will be used to assess and direct future hatchery program operations to avoid exceeding the acceptable levels of strays from this hatchery program. Assuming that extended acclimation would translate into reduced straying; the current 30-day rearing period (if not zero days due to debris or ice) is apparently not adequate to control stray rates from these sub-basins (C. Snow, WDFW, pers. comm.). However, stray rates are not known for natural-origin fish in the Methow Sub-basin; thus, it is uncertain whether or not the rates of straying observed for fish originating from the Methow Hatchery differ from the rates within the natural population.

Potential adverse impacts to steelhead and bull trout during spring Chinook broodstock collection are negligible; WDFW has established specific procedures for handling non-target species to reduce negative effects (NMFS 2002). In addition, impacts to bull trout from the supplementation of spring Chinook are expected to be negligible (NMFS 2002).

Table 3.1. Proportion of CWT recoveries comprising estimated spawning escapement in the Methow Sub-basin. Percent of spawning escapement comprised by NOR fish is not included. Recoveries from 1998 and 2000 brood MetComp releases are listed as MetComp because no specific release location could be assigned (Chewuch and Methow River releases).

Estimated spawning escapement				Hatchery stock (% of spawning escapement)					
Run Year	HOR	NOR	Total	Chewuch	Methow	Twisp	Winthrop	MetComp	Out-of-basin
				Chewuch River					
2000	52	31	83	8.4	8.4	0.0	8.7	--	18.5
2001	1,761	732	2,493	33.8	2.0	0.2	10.4	2.1	0.2
2002	588	78	666	3.6	0.0	0.0	7.9	69.7	0.0
2003	465	25	490	0.0	1.5	0.0	2.6	78.5	0.5
2004	289	46	335	5.1	1.1	0.0	3.0	70.7	0.0
2005	289	219	508	41.9	3.6	0.4	2.1	4.0	3.8
2006	378	135	513	28.8	3.2	0.9	5.5	- -	7.4
2007	203	74	277	20.0	8.4	0.0	8.9	- -	19.4
2008	166	86	252	26.7	4.5	0.0	17.3	- -	10.4
2009	500	271	771	30.8	9.9	1.5	16.0	- -	1.5
2010	341	155	496	39.0	6.7	0.4	14.7	- -	2.5
2011	499	370	869	39.2	4.1	0.0	7.6	- -	13.0
2012	281	81	342	51.8	3.2	2.3	2.3	- -	5.0
				Methow River					
2000	574	65	639	2.5	38.0	2.9	25.5	- -	0.0
2001	6,994	594	7,588	7.9	27.8	0.4	45.6	1.8	0.4
2002	1,644	86	1,730	0.6	4.6	1.1	28.3	47.1	0.0
2003	597	8	605	0.0	5.1	4.0	26.3	43.3	0.6
2004	622	199	821	3.6	4.5	4.4	16.9	35.6	0.0
2005	526	221	747	32.2	16.2	1.6	11.7	1.2	1.7
2006	942	128	1,070	22.8	25.2	4.6	19.1	- -	7.0
2007	545	152	697	12.3	6.8	7.2	36.6	- -	6.9
2008	468	172	640	11.8	16.2	0.4	38.9	- -	3.1
2009	1,480	261	1,741	10.9	27.2	2.3	36.8	- -	3.4
2010	1,370	251	1,621	10.8	34.9	0.8	29.2	- -	0.4
2011	1,391	432	1,823	28.1	21.4	3.9	23.2	- -	5.1
2012	691	63	754	28.0	40.2	8.1	7.8	- -	2.5
				Twisp River					
2000	235	21	256	0.0	0.0	72.6	2.2	- -	0.0
2001	384	506	890	1.5	0.8	19.6	0.8	0.0	0.0
2002	60	181	241	0.0	0.0	9.1	12.1	3.1	0.0
2003	18	25	43	0.0	0.0	30.2	0.0	0.0	0.0
2004	98	243	341	0.0	0.0	19.7	1.2	1.3	4.4
2005	34	87	121	2.6	0.0	15.8	0.0	0.0	0.0
2006	100	65	165	0.0	2.5	40.0	2.8	- -	0.0
2007	65	40	105	0.0	0.0	55.2	0.0	- -	0.0
2008	126	40	166	2.7	0.0	60.1	0.0	- -	4.0
2009	97	32	129	0.0	0.0	55.6	3.4	- -	3.4
2010	96	156	252	1.4	0.0	30.1	2.8	- -	1.4
2011	85	159	244	2.5	0.0	17.4	0.0	- -	32.4

2012	146	56	202	2.2	1.1	62.4	1.1	- -	1.1

Both Juveniles and Adults

Negative effects to other species that may result from the program could occur from impacts to water quantity and water quality. To limit impacts to water quantity, the program complies with water-right permits established for the hatchery to prevent over appropriation of surface water. Hatchery surface water intakes are screened to current criteria. Water quality will be affected by effluent from the hatchery, but the hatchery facility is required to operate under NPDES permits issued by Washington State Department of Ecology. Hatchery effluent standards and state criteria for point-source discharge are set forth in the permit to protect aquatic life and the habitat in the area below the discharge point. Considering that the effluent produced from the hatchery facility complies with Environmental Protection Agency standards, coupled with the low percentage of effluent to discharge (dilution factor), there are probably minimal impacts to other species.

Hatchery-raised fish may be a source of pathogen transmission to natural-origin fish in the natural environment. This impact may occur from release sites in headwater spawning and/or rearing areas and throughout the entire migration corridor (e.g., BAMP 1998). Pathogens responsible for diseases are present in both hatchery and natural populations, although hatchery fish are probably more susceptible to disease pathogens because of the high rearing densities and resultant stress.

To mitigate for potential BKD transmission to fish in the natural environment, the HCP Hatchery Committees approved the following BKD management protocols:

- Hatchery-origin eggs/progeny with ELISA titers of OD ≥ 0.12 will be culled.
- Wild-origin eggs/progeny with ELISA titers of OD ≥ 0.12 will be raised at lower density of 0.06.
- All hatchery- and natural-origin eggs/progeny with ELISA titers of OD > 0.19 will be culled from the program.
- At the first signs of infection with BKD, juvenile spring Chinook will be treated with orally administered erythromycin (100 mg/kg fish) for 28 days. The treatment should be repeated if there is evidence that the BKD agent has persisted in the hatchlings.
- When less than 5 percent of the program production is in the 0.12 ≤ OD ≤ 0.19 range, the Hatchery Committees may elect not to rear these fish to program size and instead utilize the available hatchery space for other purposes.

3.5.3) Populations that have a positive impact on the program.

Chinook, steelhead, and coho carcasses of both hatchery and natural-origin fish deposited within the Methow sub-basin are likely to have a positive influence on nutrient levels within the sub-basin. Increased nutrient levels are likely to provide a more productive environment within which the natural-origin and hatchery spring Chinook can rear and migrate. Marine-derived nutrients brought to the Methow Sub-basin by adult spring Chinook should benefit all species there (Stockner 2003).

3.5.4) Populations positively impacted by the program.

The Methow Sub-basin native fish assemblage is expected to benefit from nutrients derived from carcasses of returning adult Methow Hatchery spring Chinook at dispersed locations throughout the

sub-basin (Stockner 2003). This hatchery program is designed to promote natural spawning of spring Chinook salmon in a more widely dispersed manner (relative to the unsupplemented condition) consistent with available spawning habitat in the Methow River watershed and its sub-watersheds. The dispersed spawning will likely have a positive effect on bull trout, resident rainbow trout, and westslope cutthroat trout populations scattered throughout the Methow sub-basin because these salmonids will consume salmon eggs, fry, and parr (and flesh from carcasses).

SECTION 4. WATER SOURCE

Responsibilities: Chelan PUD is responsible for funding and carrying out the activities described in Section 4. Chelan PUD and WDFW will be co-permit holders for the activities described in Section 4.

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Methow Hatchery

Methow Hatchery has both groundwater and surface water supplies. The facility was built with four wells capable of producing the full groundwater right of 10 cubic feet per second (cfs) (4,500 gallons per minute [gpm]). Groundwater temperatures are steady at 8.9°C year round. Maintenance on the four wells in 1995 and 1996 revealed that the total output of the wells had declined to 8.8 cfs (4,000 gpm). Thus, a fifth well was added in 1999, and a sixth well in 2007, restoring groundwater production capacity to 4,500 gpm. Methow Hatchery also has senior uninterruptible rights to 7 cfs (3,142 gpm) of surface water and 18 cfs of junior interruptible water rights, both diverted from Foghorn Irrigation Ditch. This water is used primarily for final rearing, but can be used for any rearing stage after incubation. The 7 cfs surface-water right is held by USFWS, but granted to Douglas PUD by USFWS under the terms of a Memorandum of Understanding in exchange for improvements to the intake structure of the Foghorn Ditch plus improvements to the ladder at Foghorn Dam.

Chewuch Pond

Water for the Chewuch Pond is diverted from the Chewuch Canal Company irrigation ditch (Water Right Claim No. 095223) via an easement for delivery of water (6 cfs) from February 1 through May 1.

Goat Wall – Yakama Nation

The Goat Wall acclimation site is accessed through privately owned property and consists of a watered slough located downstream from the Lost River. Water to the pond is supplied through a diversion on Gate Creek and through natural groundwater seepage (Cold Creek). Additional details about this pond can be found in the Biological Opinion for the Mid-Columbia Coho Reintroduction Project (NMFS 2014).

Winthrop NFH

The USFWS HGMP for the Winthrop NFH contains information on water source for the hatchery. None of the hatchery facilities employed to carry out the proposed artificial propagation programs de-water river reaches used by listed fish for migration, spawning, or rearing. All hatcheries owned and/ or operated by WDFW discharge water in compliance with NPDES General Permit No. WAG 13, valid through August 1, 2015. This permit is administered in Washington by the Washington State Department of Ecology under agreement with the United States Environmental Protection Agency.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Water withdrawal for use in hatcheries is monitored through the Washington State Department of

Ecology and the Washington State Chapter 90.03 RCW water code. None of the hatchery facilities employed to carry out the proposed artificial propagation programs de-water river reaches used by listed fish for migration, spawning, or rearing. Water intakes into artificial propagation facilities shall be screened in compliance with 1995 NMFS screening criteria and as per the 1996 addendum to those criteria (NMFS 1996). As an alternative, they will comply with transitional criteria set forth by NMFS in 2000 for juvenile fish screens constructed prior to the establishment of the 1995

criteria, to minimize risks to listed salmon and steelhead. WDFW will inspect and monitor the water intake screen structures at their hatchery facilities to determine if listed salmon and steelhead are being drawn into the facility.

At Methow Hatchery and Chewuch Acclimation Pond water withdrawal for hatchery use is regulated by the Washington State Department of Ecology under Chapter 90.03 of the RCW (water code). None of the hatchery facilities employed to carry out the proposed artificial propagation programs de-water river reaches used by listed fish for migration, spawning, or rearing. All hatcheries owned and/ or operated by WDFW discharge water in compliance with NPDES General Permit No. WAG 135000, valid through March 31, 2021 This permit is administered in Washington by the Washington State Department of Ecology under agreement with the United States Environmental Protection Agency.

Winthrop NFH

The USFWS HGMP for the Winthrop NFH contains information on water source for the hatchery.

SECTION 5. FACILITIES

Responsibilities: Chelan PUD is responsible for providing the funding for the activities described in this section. WDFW is currently responsible for conducting the activities described in this section. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires or is not renewed or renegotiated.

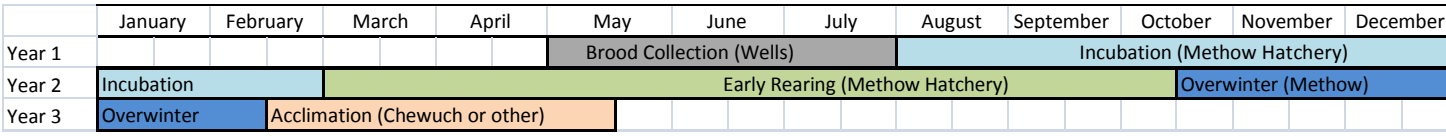
Several facilities will be used in the implementation of this hatchery program, depending on activity type (Table 5-1).

Table 5-1. Facilities and activities in Chelan PUD's Methow River spring Chinook hatchery program.

Activity	Facility
Broodstock Collection	Wells Dam, Methow Hatchery and/or Winthrop Hachery outfalls and other locations approved by HCP Hatchery Committees
Adult Holding	Wells Dam, Methow Hatchery and Winthrop NFH and other locations approved by HCP Hatchery Committees
Spawning	Methow Hatchery
Incubation	Methow Hatchery and other locations approved by HCP Hatchery Committees
Early Rearing	Methow Hatchery and other locations approved by HCP Hatchery Committee
Overwinter Rearing	Methow Hatchery and other locations approved by HCP Hatchery Committees
Final Acclimation	Chewuch Acclimation Pond (DCPUD owned), Proposed Yakama Nation Goat Wall Acclimation Site, and other locations approved by the HCP Hatchery Committees

[1] The use of this facility for broodstock collection will be contingent on HCP Hatchery Committees approval.

Table 5-2. Three-year hatchery life-history for Chelan PUD's spring Chinook Methow production depicting residence at different facilities.



5.1) Broodstock collection facilities and methods.

The Methow Hatchery spring Chinook program uses returning spring Chinook adults collected at Wells Dam, weirs located within the Methow Basin, and volitional returns to adult capture facilities, including the Methow Hatchery outflow channel and trap (Methow River at Rkm 82.1); the WNFH volunteer ladder (Methow River at Rkm 81.1), the Twisp River weir and trap

(Twisp River at Rkm 10); and the Wells Dam east and west bank fishway traps (Columbia River at Rkm 830). Broodstock may also be collected via hook-and-line angling, in the Methow sub-basin as approved by the HCP Hatchery Committee.

Wells Dam Trap

Trapping at Wells Dam generally occurs at the east and west ladder traps beginning in early May, or at such time as the first spring Chinook are observed passing Wells Dam, and continues through about the third week of June. The trapping schedule consists of 3 days per week (Monday through Wednesday), and up to 16 hours per day. Non-lethal tissue samples (fin clips) for genetic analysis and scale samples will be obtained from adipose present, non-CWT, non-ventral clipped spring Chinook (suspected natural-origin spring Chinook) collected at Wells Dam for origin analysis.

Winthrop NFH

In years when low natural-origin returns are expected that would preclude meeting the full conservation program, the Winthrop NFH outfall may be used to collect hatchery-origin adults, as approved by the HCP Hatchery Committees. This is expected to occur very infrequently.

Methow Hatchery Outfall

In years when low natural-origin returns are expected that would preclude meeting the full conservation program, the Methow Hatchery outfall may be used to collect hatchery-origin adults, as approved by the HCP Hatchery Committees.

Tributary Spawning Grounds

Interim or stopgap measures to collect locally adapted natural-origin broodstock through angling, tangle netting or other method in select tributaries such as the Chewuch River may be implemented, if approved by the HCP Hatchery Committees to increase the likelihood of meeting Chelan's production obligations. Known or suspected spring Chinook spawning locations will be targeted for tangle netting and/or angling. Snorkeling in several pools will be conducted prior to deploying any nets for spring Chinook capture and active spawners will be avoided. Because there is considerable concern over the potential risk via harassment, removal, or displacement of spawning or near spawning condition adults, use of this methodology will only be considered and approved on an annual basis by the HCP Hatchery Committees, and requires a parallel path to develop a long term viable broodstocking methodology.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Fish transportation equipment used will ensure safe, water to water transfer of ESA listed fish. Equipment will be mechanically reliable and will allow for ease of disinfection to occur. Dissolved oxygen levels and temperature will be monitored within the tanks and at trapping and receiving locations. Salt will be used as a stress reduction measure when hauling adults.

5.3) Broodstock holding and spawning facilities.

Broodstock holding may occur at Methow or Wells hatchery facilities, all of which have been used historically and safely for listed spring Chinook. These facilities include the following features:

- They allow for safe containment of adults including appropriate temperature regimes
- They provide measures to try to calm adults (e.g. spray system)
- They provide adequate flow of water under normal operating conditions
- They are alarmed for low flow
- They allow separate holding vessels between stocks.

Spawning facilities are integrated into the broodstock holding facilities. The spawning facilities allow for broodstock to be sorted for "ripeness" and then spawned. The spawning area can be cleaned easily.

5.4) Incubation facilities.

Incubation and early rearing is expected to occur at Methow Hatchery. Methow Hatchery has three separate incubation rooms with 16 Heath stacks per room to accommodate the segregation of progeny from the two primary Methow Basin spawning drainages. Winthrop NFH was used for early incubation for brood year 2013; the use of Winthrop NFH in future years would be contingent upon approvals from the HCP Hatchery Committees.

The incubation facilities:

- Provide adequate flow of pathogen free water under normal operating conditions
- Allow for manipulation of water temperatures
- Are alarmed for low flow
- Provide for individual female segregation throughout viral sampling

5.4.2) BKD Management:

Chelan PUD proposes to implement a BKD management approach that relies on HSRG recommendations as well as historic program data (from 1996 to 2008) consistent with agreements in the HCP-HC (2007). At present, many of the decisions in the program will depend on a lethal, enzyme-linked immunosorbent assay (ELISA) to determine the probability of broodstock transmitting BKD vertically to their progeny. In the future, non-lethal screening techniques may offer new opportunities to manage for BKD. Until that time, however, the incidence of BKD in the Methow Spring Chinook Program will be minimized using three management practices: prevention,

treatment and replacement.

Prevention

Disinfection and antibiotics: Female (hatchery- and natural-origin) spring Chinook broodstock will be injected before spawning with an appropriate antibiotic (e.g., azithromycin at 40 milligrams per kilogram [mg/kg] fish) and the resulting eggs will be surface disinfected with iodophor consistent with methods in The Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State.

Screening: Female broodstock will be assayed (ELISA) to determine titer level (e.g., OD).

Culling titer progeny of OD ≥ 0.12: Hatchery-origin eggs/progeny with ELISA titers of OD 0.12 or greater will be culled from the program.

Rearing titer progeny of OD ≥ 0.12 ≤ OD 0.19: Wild-origin eggs/progeny with ELISA titers between OD 0.12 and 0.19 will be raised at a lower density of 0.06.

Culling titer progeny of OD > 0.19: All hatchery- and natural-origin eggs/progeny with ELISA titers of OD greater than 0.19 should be culled from the program.

Screening (future): The HCP Hatchery Committees will evaluate emerging technology to provide non-lethal BKD screening (e.g., near infrared spectroscopy and genetic tests) as these tools become commercially available.

Treatment

Antibiotics: At the first signs of infection with BKD, juvenile spring Chinook will be treated with orally administered antibiotics at a type, dosage, and duration as determined by fish health personnel. The treatments may be repeated if there is evidence that the BKD agent has persisted in the hatchlings and fish health determines additional treatment is warranted. For adults, antibiotics are administered to minimize vertical transmission from parent to progeny no less than two weeks prior to spawning and then every four week thereafter during spawning.

Rearing Density: Chelan PUD will provide adequate facilities to rear up to 20 percent of the conservation program at a lower density (0.06 density index). The low density rearing environment would be designated for wild origin fish with titers of 0.12 ≤ OD ≤ 0.19[1]. When less than 5 percent of the program production is in the 0.12 ≤ OD ≤ 0.19 titer range, the HCP Hatchery Committee may elect not to rear these fish to program size and instead utilize the available hatchery space for other purposes.

Replacement

Broodstock Collection: Up to 20 percent extra hatchery-origin spring Chinook females may be collected to meet any production shortfalls related to culling hatchery fish with titers of OD greater than 0.12 and

wild fish with titers of OD greater than 0.19. The 20% culling allowance is included in the 45 HO adults identified in Table 2-19 to meet production shortfalls in the event of low NO abundance. Unused HO broodstock will be additive to HO adults removed under pHOS management plans.

[1] These values may change depending on lab technologies and methodologies employed.

5.5) Rearing facilities.

Overwinter rearing of fish on Methow River surface water would occur at the Methow Hatchery beginning in October and carry through until transfer to spring acclimation facilities.

5.5.1) Program Targets

- If additional overwinter acclimation/rearing sites become available during the life of the permit, the target size at transfer to overwinter acclimation/rearing sites would be approximately 26 to 30 fish per pound.
- If additional overwinter acclimation/rearing sites other than Methow Hatchery become available during the life of the permit, the target transfer date to overwinter acclimiation/rearing sites would occur October to November of the year prior to release depending on annual temperature variation and observed temperature differentials between transfer and receiving facilities and pathogen load of receiving water.

5.6) Acclimation/release facilities.

Final acclimation of Chelan PUD's spring Chinook program may occur within the Yakama Nation Goat Wall Expanded Acclimation site or other sites approved by the HCP Hatchery Committees. Any one or a combination of (depending on size of the facility), acclimation facilities described below may be used as a final acclimation site. Presently only spring acclimation facilities exist for releases other than those scheduled for on-site at Methow Hatchery.

Goat Wall (Yakama Nation): The Goat Wall acclimation site is a disconnected side channel system on the upper Methow River, located near of the mouth of the Lost River (Methow River; river mile 70 [river kilometer 112]). There is a pond at the downstream end of a disconnected side channel. The pond is fed by both surface water and groundwater. Surface water is provided by a diversion on the adjacent Gate Creek, and groundwater is supplied by Cold Creek (a groundwater seep). The estimated capacity is 34,000 spring Chinook. Additional details about this pond can be found in the Biological Opinion for the Mid-Columbia Coho Reintroduction Project (NMFS 2014).

Chewuch Acclimation Pond (Douglas County PUD): The Chewuch Acclimation Pond is owned by Douglas County PUD and has been operated by the WDFW since 1994 to acclimate spring Chinook (under existing permit 1196). The existing facility is comprised of a Hypalon-lined pond with 24,000 cubic feet of volume (150 feet long by 40 feet wide and 4 feet deep) and receives 2,700 gallons per minute of surface water flow from the Chewuch River.

5.6.1) Program Targets

- Target transfer date to acclimation site: February-March, as determined by WDFW and YN hatchery operators, depending on annual temperature differences between Methow Hatchery and the final release facility
- Target release size: 15 to 18 fish per pound
- Target release dates: April to May 1
- Release method: volitional

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

In May 1997, 100 percent of the coho reared in the Chewuch acclimation pond died when the intake screens were plugged by detritus. The incident occurred prior to installation of the auto dialer alarm system.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

For broodstock collection activities:

- All species will be held for a minimal duration in the traps and holding areas (less than 24 hours).
- Traps and holding areas will be locked or secured against tampering or vandalism.
- All natural-origin spring Chinook in excess of broodstock goals will be released upstream immediately without harm.
- All non-target taxa of concern (NTTOC) will be released upstream immediately without harm.
- Spring Chinook will be transferred using water-to-water techniques.
- Broodstock collection protocols will be developed in coordination with the HCP Hatchery Committees annually.

Broodstock collection specific to tangle netting and/or hook and line:

- Primary wild spring Chinook spawning areas will be identified using historical NOR spawning data. Only those areas (pools) of the river immediately above and below the spawning areas will be targeted for netting rather than a randomized approach. conduct the tangle netting.
- Targeted pools will be snorkeled to determine what, if any level of bull trout presence exists; if bull trout are not observed or if they are located in an area that can be avoided by the netting while targeting Chinook then the crews will proceed.
- If a bull trout is incidentally caught in the net, it will be immediately removed and released, preferably in an area that it isn't likely to be re-encountered.
- If more bull trout are encountered than is reasonable and prudent, all netting activities will cease.
- Fish transportation equipment will ensure safe transportation of collected

broodstock including equipment that is mechanically reliable and that can be disinfected, equipment to monitor dissolved oxygen levels, and salt will be available and used as a stress reduction measure if needed.

For adult holding and rearing activities:
Operational failures due to power/water loss, flooding, freezing, vandalism, predation, and disease may result in catastrophic losses to holding and rearing adults and juveniles. Flow reductions, flooding, and poor fish culture practices may all cause hatchery facility failure or the catastrophic loss of ESA-listed fish under propagation. To protect endangered spring Chinook, all efforts will be made to ensure that the survival of adult spring Chinook held for broodstock collection at the hatchery facility is maximized. Rapid response in the event of power or water loss or freezing is provided by a combination of staffing, automatic alarm paging systems, and redundant power supplies to the facilities. In addition, Chelan PUD has developed an emergency/incident response protocol in the event that activities occur that could result in take. This protocol defines the notification pathway that should occur and ensures that, 24 hours per day, 7 days per week, Chelan PUD hatchery facilities are monitored and supported to minimize take.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Responsibilities: Chelan PUD is responsible for providing the funding for the activities described in this section. WDFW is currently under contract to conduct the activities described in this section. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

6.1) Source.

The broodstock selected represents natural populations native or adapted to the watersheds in which hatchery fish will be released. Broodstock will be of wild x wild (WxW) parentage or hatchery x wild (HxW) parentage. Hatchery x hatchery (HxH) crosses may be used only in years of very low abundance to meet the production obligation. Wild-origin broodstock collection will not exceed 33 percent of the wild run. Hatchery-origin broodstock will be used to augment wild-origin broodstock to the extent necessary to meet the program production target in the event wild-origin broodstock are not available. The pNOB will be maximized to the extent possible to meet a PNI goal of greater than 0.67 annually.

6.2) Supporting information.

6.2.1 History.

Natural-origin spring Chinook broodstock collections began in 1996 as shown in Table 6-1. Native (natural) Methow spring Chinook were ESA-listed in 1999.

Table 6-1. Collection sites and history for Methow Sub-basin spring Chinook broodstock.

Broodstock Source	Origin	Year(s) Used	
		Begin	End
Methow River spring Chinook composite (Methow and Chewuch MaSAs[1] collected at Winthrop NFH Hatchery or Methow	Hatchery	1998	Ongoing
Twisp River spring Chinook (Twisp River MaSA[1]) collected at Winthrop NFH or Methow Hatchery outfall	Hatchery	1998	Ongoing
Methow spring Chinook composite (Methow and Chewuch MaSAs[1]) collected at Wells Dam	Natural	1996	Ongoing
Twisp River spring Chinook (Twisp River MaSA[1]) collected at Wells Dam and/or the Twisp Weir	Natural	1996	Ongoing

[1] Major spawning aggregate.

.

6.2.2) Annual size.

Under the current program, up to 36 NO fish will be collected for broodstock. Historic broodstock collection is summarized in Table 6-2. The sex ratio of broodstock is expected to be close to 1:1. In years of low NO abundance, up to 45 HO adults (includes up to 20% culling allowance for BKD management) from conservation program and/or safety net returns may be collected to satisfy Chelan PUDs Methow spring Chinook production obligation under the HCP's.

Table 6-2. Numbers of wild and hatchery spring Chinook collected for Methow Sub-basin program broodstock, numbers that died before spawning, and numbers of spring Chinook spawned, 1994 to 2008. Unknown origin fish (i.e., undetermined by scale analysis; no elastomer, CWT, or fin clips; and no external evidence of hatchery residence) were considered naturally produced (in part from Snow et al. 2008).

Brood	Wild spring Chinook					Hatchery spring Chinook					Total
year	Number collected[1]	Pre-spawn loss	Mortality[2]	Number spawned	Number Not Used	Number collected[1]	Pre-spawn loss	Mortality[2]	Number spawned	Number Not Used	number spawned

1994	16	0	0	16	0	2	0	0	2	0
1995	18 0	0	0	0	0	11	0	0	11	0
1996	11 117	0	0	117	0	95	4	0	86	5
1997	203 12	0	0	12	0	272	0	0	270	2
1998	282 94	0	0	94	0	88	2	0	79	7
1999	173 49	0	0	49	0	141	14	0	115	12
2000	164 6	0	0	6	0	339	23	0	306	10
2001	312 52	2	0	49	1	357	10	0	228	119
2002	277 0	0	0	0	0	438	21	0	367	50
2003	367 42	1	0	41	0	218	9	0	166	43
2004	207 50	5	0	45	0	304	4	0	299	1
2005	344 9	0	0	9	0	281	2	0	265	14
2006	274 9	1	0	8	0	342	13	0	320	9
2007	328 23	0	0	23	0	204	2	0	169	33
2008	192 56	2	0	52	2	327	4	0	308	15
Avg.	360 36	1	0	35	0.2	228	7	0	199	21
	234									

Notes:
1 – The sum of broodstock collected at all sites.
2 – Mortality includes fish that died of natural causes typically near the end of spawning and were not needed for
the program or were immature fish killed at spawning.

6.2.3) Past and proposed level of natural fish in broodstock.

Based on CWT and scale analysis on brood years 1994 through 2005, 15.9 percent of the 1,581 spring Chinook trapped for the Methow Sub-basin program were natural-origin and 84.1 percent were hatchery-origin (Snow et al. 2008). Annual broodstock contribution from natural-origin fish ranged from 0 to 58 percent during this period. See Section 1.8.2 for proposed broodstock composition. See Table 6-2 for the historical natural and hatchery composition of past overall combined broodstock collections. For the proposed program, the proportion of natural-origin fish will be maximized in an effort to attain 100 percent natural origin broodstock. This requires that the collection of NORs for broodstock does not exceed 33 percent of the NORs to the Methow Sub- basin.

6.2.4) Genetic or ecological differences.

Small et al. (2007) provided a recent review of the genetic characteristics of Methow Sub-basin spring Chinook. Fish samples from 1992 through 2006 were obtained from the Winthrop NFH and both natural and hatchery-origin fish from the Methow, Twisp, and Chewuch rivers. Twisp hatchery and natural-origin collections formed a discrete group distinct from a Methow-Chewuch-Winthrop NFH group. Methow River fish were very similar to the Winthrop NFH collections and differentiatedfrom Chewuch River fish collected in 1992 to 1993. The Methow and Chewuch Rivers fish became more similar after developing the broodstock that combines the Methow and Chewuch River fish. Assignment tests indicated that if natural-origin fish were collected at Wells Dam for broodstock and assigned with a moderate probability threshold (10 times more likely to have come from one collection as from another), there is low risk of incorrectly identifying a Methow-Chewuch fish as a Twisp fish, and even lower risk of incorrectly identifying a Twisp fish as a Methow-Chewuch fish.

In addition to genetic similarity, the broodstocks chosen display morphological and life history traits similar to the natural populations.

The annual adult broodstock collection protocol is keyed on target numbers at various collection sites, currently operated by WDFW, that provide broodstock for Mid-Columbia PUD mitigation program facilities. This adult broodstock collection protocol is an interim and dynamic hatchery broodstock collection plan, which may be altered following HCP Hatchery Committee discussions. As such, there may be significant in-season changes in broodstock numbers, locations, or collection times, brought about through continuing JFP consultation and in-season monitoring of the anadromous fish runs to the Columbia River above Priest Rapids Dam.

6.2.5) Reasons for choosing.

The goal of the program is to rebuild and recover listed UCR spring Chinook in the Methow Sub- basin. Multiple sub-basins have contributed to the UCR spring Chinook genetic makeup. The sources for collection provide broodstock from distinguishable stocks for rebuilding and recovery of the listed UCR spring Chinook in the Methow.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

The broodstock protocols were designed to mitigate for potential genetic effects from hatchery domestication and to avoid introgression with fish from other spawning aggregates.

SECTION 7. BROODSTOCK COLLECTION AND ADULT MANAGEMENT

Responsibilities: Chelan PUD is responsible for providing the funding for the activities described in this section. WDFW is currently contracted to conduct the activities described in this section. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Only adults will be collected for broodstock.

7.2) Broodstock and adult management collection activities.

7.2.1) Broodstocking activities

WDFW, in coordination with the HCP Hatchery Committee, will annually develop site-based broodstock-collection protocols for NMFS approval. These objectives and protocols may be adjusted in-season to meet changes in the abundance, composition, and location of adult returns, and to minimize impacts on non-target fish. The protocol described below will be used to facilitate the collection of hatchery spring Chinook broodstock throughout the run while achieving the target extraction rate and ensuring full broodstock collection.

Based on forecasted run size, the HCP Hatchery Committees will identify target PNI levels and associated pHOS, pNOB values (also see Section 1.9 of this document), and overall broodstock targets for all of the Methow programs. Based on the target PNI levels and broodstock numbers, WDFW will develop weekly broodstock-collection goals. WDFW and the HCP Hatchery Committee will use in-season data (e.g., dam counts, PIT-tag detections) to verify pre-season estimates of run size and composition to ensure that the selected PNI, pHOS, and broodstock goals are appropriate, and will modify those goals in-season as necessary. Weekly collection goals will target the collection of broodstock distributed throughout the run.

Broodstock will be of WxW or HxW parentage. HxH crosses may be used only in years of very low abundance. Wild-origin broodstock collection will not exceed 33 percent of the wild run. Hatchery-origin broodstock will be used to augment wild-origin broodstock to the extent necessary to meet the program production target. The pNOB will be maximized to the extent possible to meet a PNI goal of greater than 0.67 annually. Adults will be trapped at existing Rocky Reach and Wells traps, as described below.

As described in Section 5.1, broodstock may be collected at any of the following locations in a given year: Wells Dam, Winthrop National Fish Hatchery/Methow Hatchery outfalls (in the event sufficient NORs are not available for the program, HORs from the conservation programs could be used for broodstock if collected at Winthrop NFH or Methow Hatchery outfalls), or on tributary spawning grounds as approved by the HCP-HC.

7.2.1 Adult management activities

Broodstock collection: Excess hatchery origin adults from the Methow conservation program may be used as broodstock for the Winthrop NFH spring Chinook program and the CJH spring Chinook program when managing for pHOS. .

PIT tag and external marks: Chelan PUD will passive integrated transponder (PIT) tag an HCP-HC agreed upon level of smolts released from Chelan PUD's program to identify returning adults to be potentially removed using non-lethal sorting techniques at any traps located throughout the Sub-basin. Chelan PUD will also fund external marking required for conservation and harvest management as agreements allow. Chelan PUD will fund marking as necessary to support the adaptive management and ESA compliance of the program. The JFP will determine the appropriate mark, marking levels and obtain approval from other managers as needed.

Wells Trap: Hatchery origin returns may be managed at the ladder traps at Wells Dam in years when pHOS requires adjustment and minimum spawning escapement goals have been achieved (Douglas PUD 2010).

Full-time Employee funding to WDFW: In order to ensure that WDFW has the capacity to manage excess hatchery origin spring Chinook from Chelan's program, Chelan PUD will provide funding to WDFW sufficient to support up to a full-time equivalent staff person.

Fishery: Implementation of fisheries may contribute to reducing the number of hatchery-origin adults; however, under present marking strategies in for spring Chinook in the Methow Sub-basin, a fishery would be directed at Winthrop NFH returning adults and not necessarily at fish originating from this program. Therefore, a fishery may help overall adult management in the sub-basin, but may not have a substantial effect on adult management of Chelan PUD's spring Chinook production in the Methow River unless alternative marking strategies were employed.

7.3) Identity.

Through a combination of marking, infrastructure, and FTE funding, Chelan PUD will ensure that WDFW has the tools necessary to successfully remove at least 165 hatchery-origin fish annually (i.e., 100 percent of the expected average number of fish produced by Chelan PUD's program), if

necessary. These removals may include Chelan PUD origin fish or other hatchery production groups originating from the Methow Sub-basin depending on prioritization by managers. The funding by Chelan PUD will ensure that WDFW has capacity to remove fish at any facility (not restricted to Chelan PUD owned facilities). WDFW will remove excess hatchery origin fish, as authorized under applicable laws and regulatory frameworks. Attainment of annual pHOS goals will be monitored by the M&E program (Hillman 2013).

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

- Approximate number of adults collected: not to exceed 36 NORs or up to 45 HORs. The program is focused on using NORs in the brood to maximize pNOB. However, 20 percent more HORs[1] may be collected to make up for production shortfalls resulting from BKD management. The number of brood required to produce 60,516 smolts (i.e., 38) is derived from Douglas PUD (2010) where 142 broodstock were required to produce 225,000 smolts. Chelan PUD's proposed program is 26.9 percent of Douglas PUD's program (i.e.,
  60,516/225,000), and 26.9 percent of 142 is 38. These values are based on a current, mean age-4 fecundity of 3,714, an egg-to-smolt survival of 90 percent and pre-spawn survival of 95 percent (Douglas PUD 2010).
- Sex Ratio 1:1

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Table 7-1, below, provides information for broodstock collection for recent years.

Table 7-1. Natural and hatchery-origin broodstock collected at Methow Sub-basin traps, brood years 1992 to 2008.

	Chewuch River		Methow River		Twisp River	
Brood Year	Naturals	Hatchery	Naturals	Hatchery	Naturals	Hatchery
1992	25	5	0	0	20	0
1993	91	9	26	55	30	1
1994	11	1	0	1	5	0
1995	0	0	0	11	0	0
1996	21	45	74	25	22	25
1997	1	66	11	191	0	15
1998	0	0	93	77	1	11
1999	0	0	33	117	16	24
2000	0	0	0	276	6	63
2001	18	73	0	250	34	34
2002	0	126	0	297	0	15
2003	2	60	0	126	40	32
2004	1	134	0	145	49	25
2005	2	134	0	130	7	17
2006	1	125	8	189	0	28
2007	0	0	19	168	4	36
2008	0	0	44	296	12	31

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs. Excess

hatchery origin adults from the Methow program may be used as broodstock for the Winthrop NFH spring Chinook program, the CJH spring Chinook program when managing for pHOS, and or the Douglas and Grant County PUD hatchery programs. The number of broodstock available for other facilities will decrease commensurate with increasing escapement of hatchery returns to the natural spawning grounds in order to meet spawning escapement goals.

Additional hatchery fish removed as part of adult management may be used for ceremonial/subsistence use by the Tribes, food banks, distribution to minor spawning areas,
nutrient enhancement projects or other acceptable use as determined by the Joint Fisheries Parties.

7.6) Fish transportation and holding methods.

Fish will be removed from traps daily or more often as needed to minimize capture and handling effects on listed fish and placed in truck-mounted transport tanks using fish socks or other water-to- water handling methods. The tanks will be supplied with river water from the trapping site, and fish will be transported to adult broodstock ponds at the appropriate facility.

7.7) Describe fish health maintenance and sanitation procedures applied.

Fish health maintenance, management, and sanitation procedures/criteria for all life stages will be consistent with the IHOT, Pacific Northwest Fish Health Protection Committee (PNFHPC), Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State dated July 2006, and WDFW's Fish Health Manual dated November 1996.

7.8) Disposition of carcasses.

IHOT, PNFHPC, state, or tribal guidelines are followed for broodstock fish health inspection, transfer of eggs or adults, and broodstock holding and disposal of carcasses. Carcasses of ESA-listed fish spawned in captivity may be outplanted in the Methow River watershed for nutrient enrichment if disease protocols as determined by the JFP fish health specialists are met, donated for educational purposes, incinerated, buried on-station after completion of spawning, or disposed of at waste disposal facilities.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Specifically, the following measures will be employed to minimize the likelihood of adverse effects to listed natural fish (NMFS 2003):

- ESA-listed fish must be handled with extreme care and kept in water to the maximum extent possible during sampling and processing procedures. Adequate circulation and replenishment of water in holding units is required. When using methods that capture a mix of species, ESA-listed fish must be processed first. The transfer of ESA-listed fish must be conducted using equipment that holds water during transfer.
- Visual observation protocols must be used instead of intrusive sampling methods whenever possible. This is especially appropriate when merely ascertaining the presence of

anadromous fish.

- In trapping operations directed at the collection of broodstock, measures that minimize the risk of harm to listed salmon and steelhead shall be applied. These measures include, but are not limited to, limitations on the duration (hourly, daily, or weekly) of trapping in mainstem river areas to minimize capture and handling effects on listed fish; limits on trap holding duration of listed fish prior to release; application of procedures to allow safe holding, careful handling, and release of listed fish; and allowance for free passage of migrating listed fish through trapping sites in mainstem and tributary river locations when those sites are not being actively operated.
- ESA-listed juvenile fish will not be handled if the water temperature exceeds 21°C at the capture site. Under these conditions, ESA-listed fish will only be identified and counted.
- If water temperature at adult trapping sites exceeds 21°C, the trap operation shall cease pending further consultation with NMFS to determine if continued trap operation poses substantial risk to ESA-listed species.
- Target species that require handling other than visual observation will be anesthetized.
- Annual broodstock collection and spawning protocols shall be developed for the UCR ESA-listed Methow spring Chinook artificial propagation programs. Protocols will be coordinated with the JFP and HCP Hatchery Committees and must be submitted to NMFS Salmon Recovery Division by April 15 of the collection year.
- Monitor the incidence of, and minimize capture, holding, and handling effects on, listed salmon and steelhead encountered during trapping. Incidentally captured listed UCR spring Chinook salmon adults that are not intended for use as broodstock in concurrently operated and previously authorized listed stock recovery programs shall be carefully handled and immediately released upstream.
- Ensure that the hands of fish handlers are free of sunscreen, lotion, or insect repellent.
- Non-target species will be bypassed, minimally handled, or will be fully recovered (if anesthetized) and immediately released upstream of the trapping site.

SECTION 8. MATING

Responsibilities: Chelan PUD is responsible for providing the funding for the activities described in this section. WDFW is currently contracted to conduct the activities described in Section 8. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW until this contract expires and is not renewed or renegotiated.

8.1) Selection method.

In situ stock separation of ESA-listed spring Chinook, Carson origin, and out-of-basin stray fish is accomplished through scale sample, genetic analysis, and CWT analysis; only natural-origin and appropriate hatchery origin adults will be spawned. Though not preferred, some HxH crosses may be necessary for the Methow/Chewuch component in some years with very low escapement.

8.2) Males.

Spawning ratio protocols reflect the need to maintain genetic diversity of the Chinook populations. To mitigate for potential negative effects associated with a low effective population size, a minimum of a 2x2 factorial mating which results in a 1:1 spawning ratio may be utilized. However, in the event there are insufficient ripe males on a given spawn day, wild males may be utilized twice as a primary spawner if required to maximize WxW crosses before an unused hatchery male is selected for mating. Males collected for broodstock will be randomly selected from the pond at the time they are encountered provided they are sexually mature (i.e., expressing gametes). The annual Broodtock collection protocols, submitted, reviewed, and approved annually by the HCP HC provide additional details about mating and spawning on a program-by-program basis.

8.3) Fertilization.

Prior to fertilization, ovarian fluid from all females will be sampled for regulated and reportable viral pathogens. Kidney and spleen samples from all males and female spawners will be examined for regulated viral pathogens and other pathogens as necessary. As changes in techniques and technology occur, this methodology may be updated if approved by the HCP Hatchery Committees.

Spawning ratio protocols reflect the need to maintain genetic diversity of the Methow spring Chinook populations. A factorial mating strategy to increase (maximize) effective population size will be implemented when possible. In some cases, not enough females, males, or fish of the necessary stock/origin will be available on an individual spawn day, and a standard one-male-to-one-female strategy will be employed. Annual spawning protocols will detail the specifics of the spawning ratios.

After fertilization, eggs will be water hardened in iodophor in pathogen-free well water, according to standard fish health protocols. Individual egg lots will be incubated in isolation until pathogen testing has confirmed them free of pathogens. Any egg lots with regulated viral pathogens will be destroyed in accordance with fish health protocols.

8.4) Cryopreserved gametes.

None.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

- A 1:1 equivalent mating ratio will be employed.
- Inclusion of natural origin jack Chinook in the run-at-large broodstock collections helps to alleviate occasional low adult male occurrence. The hatchery broodstock will remain genetically similar to, and representative of, the upriver spring Chinook populations. However, when appropriate to do so, hatchery origin age-3 males will be excluded from the broodstock to minimize the risk associated with producing progeny from younger age at maturity fish.
- Fish health procedures used for disease prevention will include biological sampling of spawners. Generally, kidney/spleen samples will be collected from all female spawners to test for the presence of viral pathogens. The ELISA will be conducted on kidney samples from all females. This assay detects the antigen for *Renibacterium salmoninarium*, the causative agent of BKD.
- Factorial mating to increase effective population size.
- Maximize pNOB to decrease the potential effects of domestication selection.

SECTION 9. INCUBATION AND REARING -

Responsibilities: Chelan PUD is responsible for providing the funding for the activities described in Section 9. WDFW is currently contracted to conduct the activities described in Section 9. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW until this contract expires and is not renewed or renegotiated.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Egg-take goals will vary annually dependent upon the necessary level of over-collection for BKD management. Currently, the over-collection rate is determined annually based on the average of high-titer (ELISA OD ≥ 0.12) females from the previous five brood years; for 2009, the over-collection rate was 12 percent for hatchery origin fish.

Table 9-1. Hatchery life stage survival rate standards and level achieved (%) by stock and brood year for Met-Comp spring Chinook, brood years 1999 to 2008. Standards are in parentheses.

Brood Year	Unfertilized egg to eyed (92.0)	Eyed egg to ponding (98.0)	30 d after ponding (97.0)	100 d after ponding (93.0)	Ponding to release (90.0)	Transport to release (95.0)	Unfertilized egg to release (81.0)
1999	95.4	100.0	99.5	99.5	99.2	---	94.6
2000	96.5	100.0	99.6	99.4	99.0	99.9	92.7
2001	93.2	100.0	99.3	99.1	97.0	99.8	90.8
2002	96.0	100.0	98.6	98.6	96.5	98.5	92.7
2003	90.0	100.0	98.8	98.3	93.0	99.8	77.9
2004	94.8	96.2	99.2	99.2	96.6	99.8	84.6
2005	96.9	96.9	99.6	99.5	90.4	99.6	87.7
2006	93.9	95.0	89.4	89.4	76.5	96.2	68.2
2007	92.9	94.8	99.6	99.3	95.7	99.1	84.2

9.1.2) Cause for, and disposition of surplus egg takes.

To meet production goals and counter the effect of culling related to BKD management, WDFW may collect up to 20 percent extra hatchery-origin spring Chinook females (replacing hatchery fish with titers of OD greater than 0.12 and wild fish with titers of OD greater than0.19). In general, permit conditions specify a maximum number of broodstock that can be collected as determined by expected pre-spawning survival of broodstock, fecundity, and survival-to-release of progeny. To facilitate achievement of the production target of 60,516 smolts while anticipating the need to cull progeny of high-ELISA (BKD) females, current annual protocols for broodstock collection include collection of up to 12 percent additional broodstock above that necessary for the production target. Given the deliberate over-collection for BKD management, culling of hatchery-origin eggs may occur

as required to manage BKD and/or maintain production at no more than 60,516 yearling smolts. Under any circumstances, culling will be selective for hatchery-origin egg lots with the highest ELISA OD values. Culling of eggs from natural-origin females will not occur unless their ELISA levels are determined by WDFW Fish Health to be a substantial risk to the program.

9.1.3) Loading densities applied during incubation.

IHOT species-specific incubation recommendations will be followed for water quality, flows, temperature, substrate, and incubator capacities. Fertilized eggs from each female will be incubated in individual iso-buckets to the eyed-egg stage to segregate for ELISA values and then transferred to Heath stack incubators, with the progeny of one female per Heath tray (approximately 4,000 eggs per tray). Incubation conditions will be based on loading densities recommended by Piper et al. (1982).

9.1.4) Incubation conditions.

Eggs will be incubated full-term (green egg to emergence) at the Methow Hatchery.

9.1.5) Ponding.

Spring Chinook fry are transferred from Heath trays for ponding upon button-up and swim-up. Ponding generally occurs after the accumulation of 1,650 to 1,750 temperature units. Unfed fry are transferred to the rearing ponds from early May through early June. The normal weight for fry initially ponded at the Methow Hatchery for brood years 1989-95 was 0.45 grams (1000 fish per pound). The fry fork length recorded for the same brood years was 36 to 40 mm. More recently fry have been ponded at between 1200 and 3000/lb.

9.1.6) Fish health maintenance and monitoring.

Eggs will be examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus is prescribed by fish-health specialists, and may include treatment with formalin or other accepted fungicides. Non-viable eggs and sac-fry will be removed by bulb-syringe. Adherence to WDFW, PNFHPC, and IHOT (1995) fish disease-control policies reduces the incidence of diseases in fish produced and released from hatcheries. All lots will be monitored for BKD; no eggs will be retained from hatchery-origin females with ELISA OD values 0.12 or greater. Culling of eggs from natural-origin females will not occur unless their ELISA levels are determined by WDFW Fish Health to be a substantial risk to the program (generally >0.19). Juveniles from natural-origin females with ELISA levels of 0.12 or greater will be differentially tagged for evaluation purposes. If the program is under the target 60,516 goal, some low-ELISA fish may be reared at lower densities.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

All eggs brought to the facility will be surface-disinfected with iodophor (as per disease policy). Eggs will be incubated in pathogen free, silt-free well water to ensure maximum egg survival and minimize potential loss from disease. All equipment (nets tank and rain gear) will be disinfected with iodophor between different fish/egg lots. Different fish/egg lots will be physically isolated from each other by separate ponds or incubation units. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water. Tank trucks will be disinfected between the hauling of different fish lots. Foot baths containing iodophor will be strategically located on the hatchery grounds (i.e., entrance to "clean" or isolated areas of the incubation room) to prevent spread of pathogens. Formalin drips will be applied to prevent fungal spread from dead eggs. Flow, dissolved oxygen, and temperature units will be monitored per IHOT or program guidelines.

In order to minimize the likelihood for adverse genetic and ecological effects as a result of fish mortality, redundant power supplies will be provided to the hatcheries for supplying power to the pumps as well as an alarm to alert hatchery personnel of electrical failure or water flow/elevation changes.

See Section 5.4.2 regarding measures to be applied regarding BKD.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

See Table 9-1 in Section 9.1.1.

9.2.2) Density and loading criteria (goals and actual levels).

Table 9-2, below, represents current density and loading criteria. The HCP Hatchery Committee may adjust criteria as deemed necessary.

Table 9-2. Density and fish loading criteria for spring Chinook

Rearing Criteria	Spring Chinook	
Rearing Criteria	ELISA ≤0.119[1]	ELISA ≥0.12
Density index (lbs/cf-in)	0.12	0.06
Flow index (lbs/gpm-in)	0.75	0.60
Acclimation Criteria	Spring Chinook	
Density index (lbs/cf-in)	0.10	0.06
Flow index (lbs/gpm-in)	1.00	0.60

Note: 1 – The 0.119 threshold was developed jointly by the USFWS and WDFW. Natural origin fish with an ELISA >0.19 will be culled.

9.2.3) Fish rearing conditions

Temperature, dissolved oxygen, and pond turnover rate will be monitored. IHOT standards for water quality, alarm systems, predator control measures (netting) to provide the necessary security for the cultured stock, loading, and density will be followed. Settleable solids, unused feed, and feces will be removed regularly to ensure proper cleanliness of rearing containers. All ponds will be vacuumed weekly for the yearlings. Ponds will be pressure washed between broods. Temperature and dissolved oxygen will be monitored and recorded daily during fish rearing.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

These data have not been collected monthly at the Methow Hatchery, where this program was historically implemented.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

These data have not been collected monthly at the Methow Hatchery, where this program was historically implemented.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Table 9-3. Food type information.

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (%B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversion During Period
December-January	BioDiet Starter	3-4	1.0-3.0	0.025	0.8
February-March	BioDiet Starter	2-3	1.0-2.0	0.02	1.0
April-May	BioVita	2	1.0-2.0	0.02	1.0
June-September	BioVita	1-2	1.0-1.5	0.02	1.0
October-April	BioVita	1	1.0	0.02	1.0

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures. Standard fish-health monitoring will be conducted by a fish-health specialist at frequencies appropriate to the life stage and susceptibility to disease. Significant fish mortality attributable to unknown causes will be sampled appropriately for study (i.e., viral assay, bacterial culture, and histopathology). Fish health maintenance strategies are described in IHOT (1995). Incidence of viral pathogens in spring Chinook broodstock will be determined by sampling fish at spawning in accordance with the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Populations of particular concern may be sampled at the 100 percent level and may require segregation of eggs/progeny in early incubation or rearing.

Typical disease treatments include:

- Formalin – prophylactic fungal treatment and post-handling
- Aquamycin – fed for BKD treatment and prophylaxis
- Tulathromycin – fed and injected to manage BKD
- Chloramine T – bath to treat external bacteria

Fish will be monitored daily by staff during rearing for signs of disease, through observations of feeding behavior and monitoring of daily mortality trends. A fish health specialist will monitor fish health often as determined necessary. More frequent care will be provided as needed if disease is noted. Hatchery specialists under the direction of the fish health specialist will provide treatment for disease. Sanitation will consist of raceway cleaning as necessary by brushing, and disinfecting equipment. Fish-health examinations will be performed on all spring Chinook production lots throughout the rearing period and pre-release.

All equipment (nets, tanks, and boots) will be disinfected with iodophor between different fish/egg lots. Tank trucks will be disinfected between the hauling of adult and juvenile fish. Foot baths containing disinfectant will be strategically located on the hatchery grounds to prevent spread of pathogens.

The general policy is to bury dead juvenile fish and eggs to minimize the risk of disease transmission to natural fish. Adult spring Chinook carcasses will be buried or disposed of in an approved landfill if individuals have been treated with antibiotics and died within the withdrawal period. All adults injected with maturation accelerating hormones (such as sGnRHa implants) will be disposed of in an approved landfill, consistent with Investigational New Animal Drug requirements.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

Degree of smoltification will be monitored through monthly collection of data indicating average condition factor (Kfl) of the populations. Gill ATPase levels have been monitored in the past to attempt to indicate degree of smoltification. However, this index has not been found to be a useful tool for determining when to begin releases, due to the delay in obtaining results from sampling and the finding that ATPase levels do not actually increase until the smolts are actively migrating in

the Columbia River (Petersen et al. 1999). In general, hatchery staff observe fish behavior and appearance to make fine scale, best professional opinion adjustments to release timing/truck planting within the release window. Behavioral smoltification cues include increased activity and swimming adjacent to the edges of rearing vessels. Appearance cues include loss of parr marks, silvery appearance, caudal fin banding, and scale loss.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

Currently, natural rearing methods are approached through the transfer of most Chinook smolts to acclimation ponds at release locations. The acclimation ponds provide lower density rearing vessels for the fish on their natal water prior to release. Additionally, in the case of the Yakama Nation acclimation locations, most of these locations support the concept of rearing smolts in natural ponds. This concept has been tested over the last decade as part of the Yakama Nation's coho restoration project in the Wenatchee and Methow Rivers. The coho restoration project has demonstrated both high survival rates (juveniles and adults) as well as adult returns with SARs comparable or higher than established supplementation program in the Upper Columbia (YN 2010)

9.2.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during propagation

- Marked fish from outside of the Mid-Columbia region will be excluded from the Methow broodstock. Progeny from adults captured at Wells Dam that are from the Entiat or Wenatchee sub-basins will be returned to their tributary of origin, if this action is consistent with fish health protocols. This will require reading of CWTs during spawning.
- Adults may be PIT tagged (or individually marked by some means) to identify them by time of arrival. If too many adults are collected because the actual run size differs substantially from the prediction, adults may be selected for return to the river for natural spawning or, alternatively, removed for control of pHOS. This will be performed in a manner that allows an adequate representation of the gene pool and is consistent with ongoing disease prophylaxis treatments. Origins of late arriving adults (i.e., spring Chinook versus summer Chinook) will be based on timing and morphological and phenotypic differences.
- In-situ stock separation of Methow/Chewuch composite from other or stray fish via genetic analysis, scale analysis, PIT-tag identification, and/or reading of CWTs during spawning operations will continue.

SECTION 10. RELEASE

Responsibilities: Chelan PUD is responsible for providing the funding for the activities described in Section 10. WDFW is currently contracted to conduct the activities described in Section 10. Consistent with these responsibilities, Chelan PUD and WDFW will be co-permit holders for the activities described in this section with WDFW designated as an agent under a current contract between Chelan PUD and WDFW and until this contract expires and is not renewed or renegotiated.

10.1) Proposed fish release levels.

Table 10-1. Approximate size and number targets for production of spring Chinook smolts from Chelan PUD's Methow River spring Chinook Hatchery Program. Targets are subject to change at the discretion of the HCP Hatchery Committees.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs	None	NA	NA	NA
Unfed Fry	None	NA	NA	NA
Fry	None	NA	NA	NA
Fingerling	None	NA	NA	NA
Yearling	60,516 (+/-10%)	15 – 18	April – May	Methow River

10.2) Specific location(s) of proposed release(s).

Table 10-2. Release Locations for Chelan PUD's Methow River Spring Chinook Hatchery Program

Release Location	Waterbody	Release Point (RM)
Goat Wall Acclimation Site	Methow River	68.0
Chewuch Pond	Chewuch River	8.0
Other locations approved by the HCP Hatchery Committee	Methow Sub-Basin	To be determined

All sites are in the (Upper) Columbia River watershed in WRIA 48. Future acclimation facilities/sites within the Methow Sub-basin may be developed by others and may receive releases of spring Chinook from Chelan PUD's Chinook program at the discretion of the HCP Hatchery Committees.

10.3) Actual numbers and sizes of fish released by age class through the program.

Table 10-3. Methow River yearling spring Chinook smolt releases, 1994 to 2005.

Release Year	Methow River		
	No.	Date (MM/DD)	Avg Size (fpp)
1994	-	-	-
1995	210,849	4/15	15.9
1996	4,477	4/22	14.5
1997	28,878	4/15	14.1
1998	202,947	4/15	18.1
1999	332,484	4/15	18.3
2000	218,499	4/17	16
2001	180,775	4/17	11.0
2002	66,454	4/16	16.9
2003	130,787	4/21	16.0
2004	181,235	4/2-14	15.8
2005	48,831	4/18	16.0

Note:
Data source: Snow et al. (2008), and WDFW unpublished data.

10.4) Actual dates of release and description of release protocols.

See Section 10.3 (Table 10-3) for recent release dates. Releases from the acclimation ponds begin in early April. Operators allow roughly 20 day volitional release before the remaining fish are forced out by May 1, consistent with the end of the water right period.

10.5) Fish transportation procedures, if applicable.

Pre-smolts will be transported from the hatchery to the acclimation sites by tanker truck. Current fish-transport procedures include crowding and loading into distribution trucks via a fish pump. Distribution trucks are reliable and safe, and water is tempered as appropriate. Fish are tempered to within 3°C of the receiving water prior to release into the ponds. Loading densities are from 0.3 to 0.5 pounds of fish per gallon of water. Fish are volitionally released directly from the ponds to the river and do not require additional transportation.

10.6) Acclimation procedures

Transfer date to acclimation sites would range from February to March depending on annual temperature variation and the necessity to temper fish to within 3°C of receiving water. Pre-smolts

will be transferred from the Methow Hatchery to the acclimation ponds where fish are acclimated for approximately 30 days. Fish will be provided a volitional release and are expected to migrate quickly from the acclimation facilities.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

All juveniles will be 100 percent CWT marked. All smolts will be marked to distinguish specific program and hatchery crosses and to facilitate removal of hatchery-origin fish in selective fisheries. Additionally 25 percent of the hatchery releases would be PIT-tagged so they can be easily detected and removed at sorting/collection facilities prior to spawning.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Broodstock and egg collections are designed to minimize the potential for egg surpluses. Egg surpluses, if any, will be culled (see Section 9.1.2). Thus, surplus smolts are not expected. If smolt surpluses do exists, transfer to other programs, provided they meet fish health and population acceptance criteria may occur or smolts may be out-planted to a recipient lake (without connectivity to the Columbia River system) for a resident program if supported by the JFP.

10.9) Fish health certification procedures applied pre-release.

Fish health and disease conditions are continuously monitored in compliance with the requirements of the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (Co-managers 1998), requirements of the Section 10 ESA permit issued, and guidelines of IHOT (1995). Spring Chinook will be monitored daily by staff during rearing for signs of disease through observations of feeding behavior and monitoring of daily mortality trends. A fish health specialist will monitor fish health as least monthly; these inspections must adhere to the disease prevention and control guidelines established by the PNFHPC. More frequent care will be provided as needed if disease is noted. Prior to release, the population health and condition will be established by the Area Fish Health Specialist. This is commonly done 1 to 3 weeks before release, and up to 6 weeks before release on systems with pathogen-free water and little or no history of disease.

10.10) Emergency release procedures in response to flooding or water system failure.

Emergency releases shall be allowed in the event of flooding, water loss to raceways, or vandalism that necessitates early release of ESA-listed spring Chinook to prevent catastrophic mortality. Any emergency releases made by the hatchery operators will be reported immediately to the NMFS Salmon Recovery Division in Portland, Oregon.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

The risk of ecological hazards to listed species resulting from liberations of hatchery-origin spring Chinook will be minimized through the following measures:

- Hatchery spring Chinook will be reared to sufficient size such that smoltification occurs within nearly the entire population, reducing residence time in the streams after release and promoting rapid seaward migration which can reduce precocious maturation.
- Spring Chinook smolt releases will be timed to improve survival at mainstem dams and to reduce the duration of interactions with wild fish and non-target taxa.
- Acclimation in natal stream water will contribute to smoltification, reducing the residence time in the rivers and mainstem corridors.
- Hatchery spring Chinook smolts will be released when environmental conditions exist that promote rapid emigration.
- Total number of smolts released with expected adult contribution to natural spawning will be managed with consideration of HCP obligations as well as tributary carrying capacity.
- All artificially propagated UCR spring juveniles shall be externally or internally marked prior to release according to the coordinated marking scheme under development by the HCP Hatchery Committees.

Variance from this smolts-only release requirement shall only be allowed in the event of an emergency, such as flooding, water loss to raceways, or vandalism that necessitates early release of ESA-listed spring Chinook to prevent catastrophic mortality. Any emergency spring Chinook releases made by the action agencies will be reported immediately to the NMFS Salmon Recovery Division in Portland, Oregon.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

Monitoring and evaluation plays an important role in helping measure program results and determining future directions (adaptive management). The HCP Hatchery Committee has developed a rigorous monitoring plan and program for the Methow River Spring Chinook Program (Hillman et al. 2013). Currently, the M&E program monitors survival and growth within the hatchery and the effects of hatchery fish on population productivity, genetic diversity, run and spawn timing, spawning distribution, and age and size at maturity. This information is collected directly from or derived from spawning ground surveys, broodstock sampling, stock composition sampling (stock assessment), hatchery juvenile sampling, smolt trapping, precocity sampling, PIT tagging, CWT tagging, genetic sampling, disease sampling, and snorkeling. Importantly, the monitoring and evaluation program is consistent with the draft monitoring and evaluation plan prepared by NMFS for the *Upper Columbia Spring Chinook and Steelhead Recovery Plan* (see Appendix P to the Recovery Plan) and the Ad Hoc Supplementation Monitoring and Evaluation Workgroup recommendations (Galbreath et al. 2008).

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

The existing M&E program document (Hillman et al. 2013) describes the data collection effort in detail (see Section 11.1).

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Chelan PUD will continue to fund hatchery M&E according to its obligations in the Rock Island and Rocky Reach HCPs. In 2013, Chelan PUD's M&E obligations were updated by the Hatchery Committee (Hillman et al. 2013). It is expected that Chelan, Douglas, and Grant PUDs will proportionally co-fund the M&E activities for spring Chinook in the Methow Sub-basin.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

The current HCP approved M&E Plan describes this section fully (Hillman et al. 2013).

SECTION 12. RESEARCH

12.1) Objective or purpose.

Other than what data collection and analysis is encompassed within the M&E activities described in Section 11 and Appendices A, B, and C, no specific research projects are ongoing or proposed in association with the Methow Hatchery spring Chinook program. Any unanticipated, future research that may be associated with this program must be approved by the HCP Hatchery Committees.

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____