HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Winthrop National Fish Hatchery Leavenworth Fisheries Complex
Species or Hatchery Stock:	Spring Chinook Salmon *Oncorhvnchus tshawvtscha*
Agency/Operator:	U.S. Fish and Wildlife Service (USFWS)
Watershed and Region:	Methow River, tributary to the Columbia River, Washington State
Date Submitted:	July 31, 2009
Date Last Updated:	November 21, 2012

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.
Winthrop National Fish Hatchery (WNFH)

1.2) Species and population (or stock) under propagation, and ESA status.
Methow River Composite stock of spring Chinook salmon *(Oncorhynchus tshawytscha)*, listed as Endangered.

1.3) Responsible organization and individuals

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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:
The US Bureau of Reclamation (BOR) acts as the primary funding entity. Other involved parties include those associated with the Columbia River Fish Management Plan and the *US v. Oregon* court decision as well as other co-managers not party to *US v Oregon* such as the Confederated Tribes of the Colville Reservation (CCT).

1.4) Funding source, staffing level, and annual hatchery program operational costs.
WNFH is funded by the BOR at about $1,000,000 annually and is staffed by 6 FTE's. Fish marking, evaluation, and fish health programs are not included in the above operational costs. The Mid-Columbia Fishery Resource Office (MCRFRO) is responsible for overseeing fish marking and monitoring and evaluation activities for the Leavenworth Fisheries Complex including WNFH. The Olympia Fish Health Center (OFHC) monitors fish health and provides veterinary services for WNFH. Both the MCRFRO and OFHC receive partial funding from BOR for these activities.

1.5) Location(s) of hatchery and associated facilities.
WNFH is part of the Leavenworth Fisheries Complex, which also includes Leavenworth and Entiat NFH's, as well as the MCRFRO. WNFH is located about ½ mile west of Winthrop, WA on the Methow River, 50.4 river miles (rm) above its confluence with the Columbia River. Fish

released from and those returning to WNFH must travel about 524 river miles and negotiate passage through nine Columbia River hydroelectric dams.

1.6) Type of program.
Integrated Harvest

1.7) Purpose (Goal) of program.
Mitigation: The goal of this program is to compensate for lost fish production due to the construction of Grand Coulee Dam through the rearing and release of juvenile spring Chinook salmon such that sufficient numbers of returning adults are available for harvest as well as providing sufficient broodstock for production.

1.8) Justification for the program.
Due to the construction of Grand Coulee Dam, approximately 1,140 miles of former salmonid spawning and rearing habitat was blocked. This loss of habitat equates to an estimated reduction of thousands of adult salmonids returning to the Columbia River annually. WNFH, which is part of the Leavenworth Fisheries Complex, was constructed to help mitigate for a portion of these losses.

The spring Chinook salmon program at WNFH began in 1974 utilizing the "Carson NFH stock". When Upper Columbia River spring Chinook were listed as endangered under the Endangered Species Act (ESA) in 1999, WNFH began to phase-out the unlisted, non-indigenous Carson stock and began to propagate a Methow River Composite stock. The Methow River Composite stock is considered a hatchery component of the Upper Columbia River spring Chinook evolutionary significant unit (ESU). This hatchery stock was initiated at Methow Fish Hatchery (MFH) and has incorporated hatchery origin and natural origin adults returning to the Methow River and Chewuch River Basins. Currently this stock is cooperatively managed by MFH and WNFH and is the only spring Chinook stock propagated at WNFH. Although the Methow River Composite is a listed stock, the lack of available natural origin adults available for incorporation into the brood stock has, in practice, rendered this program to the status of a non-integrated hatchery stock. This lack of integration with the natural population poses a genetic risk to the natural population. Furthermore, the Upper Columbia River Salmon Recovery Board (UCSRB; UCSRB 2007), U.S. Fish and Wildlife Service's Hatchery Review Team (HRT; USFWS 2007) and the Hatchery Science Review Group (HSRG; HSRG 2009) suggested that the large number of hatchery origin adults returning to the Methow River Basin (between the WNFH and MFH programs) are excess to recovery and conservation needs. In an effort to lessen the potential genetic and ecological impacts to the natural-origin population presented by the over-escapement of hatchery origin adults, a number of changes are proposed to the WNFH spring Chinook program including: 1) Release goals in the Methow River Basin will be reduced from a 600,000 yearling smolt release to 400,000. The remaining 200,000 will be transferred annually to the CCT as parr or eyed eggs for use in the Okanogan basin or mainstem Columbia River releases until sufficient local brood is available to support these CCT programs (sufficient return to allow local brood collection may not be feasible for 12 or more years); 2) WNFH production will be 100% marked with an adipose fin clip, in addition to a coded wire tag, to make them available for lower river selective harvest and if deemed appropriate by co-managers, a local Methow

River harvest; 3) The WNFH hatchery ladder will be left open throughout the adult migration season to attract and remove as many WNFH-origin adults as possible (with a target of removing ≥ 80% of the hatchery run); 4) To minimize the genetic risk that WNFH adults might present to the natural population, WNFH plans to adopt a "stepping stone" model of broodstock management (Fig. 1, see USFWS 2007 (Alternative 5) for detailed information on this recommendation). In this scenario WNFH would incorporate excess MFH adults into the brood, and the MFH program would focus on incorporating natural origin brood as appropriate. Furthermore, this model of broodstock management would allow WNFH to serve as a potential "genetic reserve" for the listed Methow Basin spring Chinook salmon stock, though the Methow Hatchery population would be the preferred stock for the Methow River; and 5) In addition to the above changes, the USFWS in cooperation with the CCT and other comanagers are working to determine how best to assist the CCT with a variety of programs including the reintroduction of spring Chinook to the Okanogan Basin and initiation of a segregated spring Chinook program at Chief Joseph Hatchery. This may include an increase in the transfer of Methow Composite gametes, eyed eggs, or fingerlings. Overall, these actions will provide WNFH adults for harvest, reduce the over-escapement of hatchery spring Chinook in the Methow River Basin, and minimize future genetic risks the WNFH program may pose to the natural population.

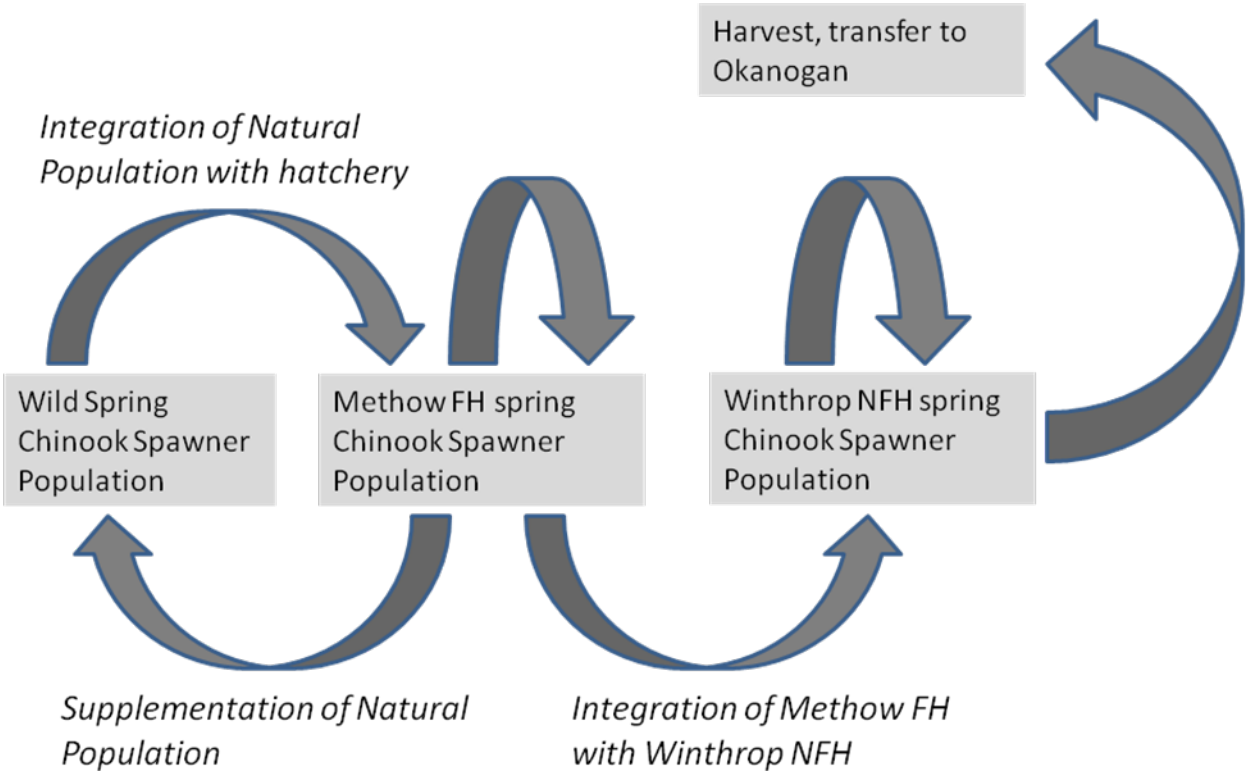

Figure 1. Schematic representation of a "stepping stone" model of broodstock integration between Winthrop NFH and Methow Fish Hatchery. The Winthrop program would seek to utilize both Methow FH origin and Winthrop NFH origin adults for brood and the Methow program would utilize both natural origin and Methow FH origin adults for brood.

The above changes are based upon HRT and HSRG recommendations and co-manager meetings. The changes and actions described in this HGMP that are subject to consensus by the parties to the US v OR Management Agreement have been discussed in that forum and the US v OR Management Agreement has been revised to align with the details presented in this HGMP.

If in the future, the details and management actions described in this HGMP are found to not adequately minimize risks posed by this program to ESA listed populations in the Methow River Basin; then the FWS will likely propose to shift the 400,000 smolts proposed for release in the Methow to release sites outside the Methow River Basin (Okanogan Basin or mainstem Columbia River at Chief Joseph Dam) where returning adults would be available for harvest and would not mix and spawn with the depressed Methow River stocks. A shift in release sites such as this would require a considerable amount of coordination between the USFWS, CCT, and other comanagers in relation to currently planned CCT spring Chinook programs at Chief Joseph Hatchery and in the Okanogan basin as well as the consensus of the parties to the US v OR Management Agreement. Changes of this magnitude would not likely be possible during the term of this permit cycle and will be considered if necessary in future consultations.

1.9) List of program "Performance Standards".
See section 1.10.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."
Performance Indicators are designated as "Risk assessment" (**R**) or "Benefits" (**B**).

Legal Mandates:
Performance Standard (1): Program contributes to Tribal Trust responsibilities and mitigation requirements as stated in the Columbia River Fish Management Plan and the *U.S. v. Oregon* decision.

> *Indicator (a):* **(B)** Number of fish released by program, returning, or caught, as applicable to given mitigation requirements.

Performance Standard (2): Program addresses ESA responsibilities.

> *Indicator (a):* **(R)** ESA consultations under Section 7 and 10 have been completed. A Biological Opinion (Permit # 1300) has been issued to the facility. Modifications to existing BA's are done in a timely manner.

Harvest:
Performance Standard (3): Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.

> *Indicator (a):* **(R)** Marking rate by mark type for each release group.

> *Indicator (b):* **(R)** Sampling rate by mark type for each fishery.

Indicator (c): **(R)** Number of marks of this program observed in fishery samples and estimated total contribution of this population to fisheries by fishery.

Conservation of Wild/Naturally Spawning Populations:
Performance Standard (4): Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas, when desired.

Indicator (a): **(B)** Annual number of spawners on spawning grounds by age.

Indicator (b): **(B)** Spawner-recruit ratios.

Indicator (c): **(B)** Annual number of redds in selected natural production index areas.

Performance Standard (5): Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production and to evaluate effects of the program on the local natural population.

Indicator (a): **(R)** Marking rates and type of mark.

Indicator (b): **(R)** Number of marks and estimated total proportion of this population in juvenile dispersal and in adults on natural spawning grounds.

Life History Characteristics:
Performance Standard (6): Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken.

Indicator (a): **(R)** Temporal distribution of broodstock collection and of naturally produced population at point of collection.

Indicator (b): **(R)** Age composition of broodstock collected and of naturally produced population at point of collection.

Performance Standard (7): Broodstock collection does not significantly reduce potential production in natural rearing areas.

Indicator (a): **(R)** Number of spawners of natural origin removed for broodstock.

Indicator (b): **(R)** Number and origin of spawners migrating to natural spawning areas.

Indicator (c): **(R)** Number of eggs or juveniles placed in natural rearing areas.

Performance Standard (8): Life history characteristics of the natural population do not change as a result of this artificial production program.

> *Indicator (a):* **(R)** Specific life history characteristics to be measured in the artificially produced population.

Performance Standard (9): Annual release numbers do not exceed estimated basin-wide and local habitat capacity including spawning, freshwater rearing, migration corridor, and estuarine and near-shore rearing.

> *Indicator (a):* **(R)** Carrying capacity criteria for basin-wide and local habitat including method of calculation.
>
> *Indicator (b):* **(R)** Annual release numbers from all programs in basin and subbasin, including size and life-stage at release and length of acclimation by program.
>
> *Indicator (c):* **(R)** Location of releases and natural rearing areas.
>
> *Indicator (d):* **(R)** Timing of hatchery releases compared to natural populations.

Genetic Characteristics:

Performance Standard (10): Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.

> *Indicator (a):* **(R)** Total number of natural spawners reaching the collection facility.
>
> *Indicator (b):* **(R)** Total number of spawners estimated to pass the collection facility to spawning areas compared to minimum effective population size required for those natural populations.
>
> *Indicator (c):* **(R)** Timing of collection compared to overall run timing.

Performance Standard (11): Juveniles are released on-station or after sufficient acclimation to maximize homing ability to intended return locations.

> *Indicator (a):* **(R)** Location of juvenile releases.
>
> *Indicator (b):* **(R)** Length of acclimation period.
>
> *Indicator (c):* **(R)** Release type whether forced, volitional, or direct stream release.
>
> *Indicator (d):* **(R)** Proportion of adult returns to program's intended return location compared to returns to unintended dams, fisheries, and artificial or natural production areas.

Performance Standard (12): Juveniles are released at fully smolted stage.

Indicator (a): **(R)** Level of smoltification at release compared to a regional smoltification index (when developed). Release type whether forced, volitional, or direct stream release.

Research Activities:
Performance Standard (13): The artificial production program uses standard scientific procedures to evaluate various aspects of artificial propagation.

Indicator (a): **(R)** Scientifically based experimental design with measurable objectives and hypotheses.

Performance Standard (14): The artificial propagation program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objective and evaluate beneficial and adverse effects on natural populations.

Indicator (a): **(R)** Monitoring and evaluation framework including detailed time line.

Indicator (b): **(R)** Annual and final reports.

1.11) Expected size of program.

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

Approximately 360 (not to exceed 400) adults are needed for the production of 600,000 juveniles annually. WNFH will seek to incorporate an average (10 yr) of 20-30% MFH origin adults into the broodstock.

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

Table 1. Current proposed annual release numbers for spring Chinook at Winthrop NFH.

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling	Okanogan River basin or at Chief Joe Dam (Col. R)†	Up to 200,000‡
Yearling	Methow River	400,000

†When CCT facilities become available this transfer will likely switch to the transfer of eyed eggs.
‡This is part of the CCT Okanogan spring Chinook salmon program, details can be found in the appropriate CCT HGMP.

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

See Table 2 and Table 3. (data source: Regional Mark Information System, MCRFRO records, and Snow et al. 2011)

Table 2. Winthrop National Fish Hatchery spring Chinook salmon yearlings released by broodyear and total return to basin.

Brood Year	Broodstock Utilized	Yearlings Released	Basin Return	%Basin Return	Total Return	% Total Return	Return per Spawner
1996	180	324,851	1,162	0.358%	1,238	0.381%	6.86
1997	303	545,062	3,175	0.583%	3,748	0.688%	12.38
1998	210	377,696	945	0.250%	1,324	0.351%	6.31
1999	98	175,869	519	0.295%	649	0.369%	6.64
2000	112	201,604	478	0.237%	541	0.268%	4.83
2001	256	461,678	437	0.095%	465	0.101%	1.81
2002	321	578,307	552	0.095%	562	0.097%	1.75
2003	398	550,214	625	0.114%	638	0.116%	1.60
2004	334	484,090	693	0.143%	790	0.163%	2.37
2005	400	589,693	1,072	0.182%	1,117	0.189%	2.79
2006	367	509,045	2,211	0.434%	2,576	0.506%	7.02
2007	323	371,959	na	na	na	na	na
2008	411	495,978	na	na	na	na	na
2009	348	426,980	na	na	na	na	na

Table 3. Methow Basin hatchery (Winthrop National Fish Hatchery ,WNFH and Methow Fish Hatchery, MFH) and wild spring Chinook returns to natural spawning areas and hatcheries. Winthrop NFH origin contributions by run year and within basin tributaries are noted.

Run Year	Wells Dam Count	Met. Spawn Escap.	Met. Wild Spawn	Met. Hat. Spawn	Met. Basin Natural Spawners			Total WNFH to Met. Basin	Total WNFH Nat. Spawn	Total WNFH Hatch.	WNFH Natural Spawners			WNFH % Spawners (pHOS) by Tributary Basin			WNFH Collection	
					Met.	Chew.	Twisp				Met.	Chew.	Twisp	Met.	Chew.	Twisp	WNFH	MFH
2000	2,130	978	117	833	639	83	256	1070	176	894	163	7	6	25.5%	8.7%	2.2%	739	155
2001	9,989	10971	1,832	9,139	7,588	2,493	890	4059	3727	333	3460	259	7	45.6%	10.4%	0.8%	199	134
2002	5,909	2637	345	2,292	1730	666	241	1129	571	558	490	53	29	28.3%	7.9%	12.1%	177	381
2003	2,361	1138	58	1,080	605	490	43	488	172	316	159	13	0	26.3%	2.6%	0.0%	264	52
2004	2,846	1497	488	1,009	821	335	341	478	153	325	139	10	4	16.9%	3.0%	1.2%	296	29
2005	2,715	1376	527	849	747	508	121	424	98	326	87	11	0	11.7%	2.1%	0.0%	320	6
2006	4,365	1748	328	1,420	1070	513	165	565	237	327	204	28	5	19.1%	5.5%	2.8%	253	74
2007	2,131	1079	266	813	697	277	105	629	280	349	255	25	0	36.6%	8.9%	0.0%	293	56
2008	2,926	1058	283	719	640	252	166	699	293	407	249	44	0	38.9%	17.3%	0.0%	347	60
2009	4,804	2641	564	2,077	1741	771	129	1109	768	340	641	123	4	36.8%	16.0%	3.4%	318	22
2010	8,565	2369	562	1,807	1621	496	252	2294	553	1741	473	73	7	29.2%	14.7%	2.8%	1721	20
2011	8,219	2936	961	1,975	1823	869	244	1961	489	1472	423	66	0	23.2%	7.6%	0.0%	1439	33

Data provided courtesy of WDFW/Douglas PUD draft report "Monitoring and Evaluation of Wells and Methow Hatchery Programs in 2011." Snow et al. 2011 in addition to WDFW (C. Frady) WNFH, MCRFRO, and Regional Mark Information System (RMIS) records. WNFH collection at MFH includes brood adults captured at Wells Dam and Twisp weir.

1.13) Date program started (years in operation), or is expected to start.
The current SCS program began in 1974. The phasing-out of the Carson stock began in 1999 and production of the listed Methow River Composite stock began.

1.14) Expected duration of program.
Ongoing

1.15) Watersheds targeted by program.
Methow River Basin (WRIA 48). Returning adults of WNFH origin are expected to return to the Methow Basin only, although some are harvested in lower Columbia River and ocean fisheries. Adults returning from the transferred fish are expected to return to the Okanogan River basin or to the base of Chief Joseph Dam.

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.
The WNFH mitigation program was recently reviewed by the HRT (USFWS 2007). With co-manager input, program alternatives were proposed and discussed and the preferred alternative (#5) is being implemented (1/3 of the 600K production will go to the Okanogan Basin or to Chief Joseph Dam for CCT's program). Also, FWS proposes to fin-clip all production for harvest purposes. Please refer to the full USFWS 2007 report at http://www.fws.gov/pacific/fisheries/hatcheryreview/reports.html for complete details. This program was also recently reviewed by the HSRG (2009). The recommendations from the HSRG were very similar to those of the HRT. The HSRG had two main recommendations: "If managers decide to keep the existing on-station program at Winthrop for harvest objectives, it will require; 1) adipose fin-clipping the entire production; 2) removal of 80% or more of the unharvested returning adults".

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

2.1) List all ESA permits or authorizations in hand for the hatchery program.
ESA consultation with NOAA Fisheries: Permit #1300 (spring Chinook production), exp. 12/31/07.
ESA consultation with NOAA Fisheries: Permit #1396 (steelhead production), exp.10/2/08.
USFWS – Sub-permit MCFRO-12 (research), exp. 12/31/2012.

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.

The NMFS ESA-listed salmonid species most likely affected by the WNFH SCS program are Upper Columbia River spring Chinook salmon and steelhead (*O. mykiss*). An extensive volume of literature exists to describe these species and specific ESA-listed stocks of concern. This literature has been extensively summarized by Mullan et al. (1992a & b), Chapman et al. (1995), Peven (2007), and Snow et al. (2008). Electronic versions of these summaries are available upon request.

Spring Chinook Salmon

Most Columbia River adult spring Chinook salmon spend two 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). Adults sampled from Upper Columbia tributaries predominantly spend two years in the ocean and are four years old. The estimates of age of adult spring Chinook sampled in the Upper Columbia comport well with those for fish sampled at Bonneville Dam and other Columbia basin tributaries. These data suggest that over 50% of spring Chinook salmon in the Columbia River basin spend one year in fresh water and two in salt water (Age 4). About 20-40% spend an extra year in saltwater before returning to the river. Most stream-type Chinook, throughout their geographic range, average approximately four years of age except those from the Yukon River, Alaska.

In the Methow River basin, the average age class for naturally produced adults has been approximately 7% age 3, 56% age 4, and 37% age 5 (Table 4). Age structure does not appear to vary much between major spawning areas ranging between approximately 3-10% for age 3, 53-57% for age 4, and 37-40% for age 5 (Table 4).

Table 4. Age structure of Methow Basin spring Chinook salmon per major spawning area (based on Chapter 5 Appendices D-J, Snow et al. 2008).

	Number				Percent		
Subbasin/year	**3**	**4**	**5**	**Total**	**3**	**4**	**5**
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
Average	**2**	**145**	**39**	**187**	**2.8**	**57.4**	**39.8**
Twisp							
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 Basin							
2001	42	1366	424	1832	2.3	74.6	23.1
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**

Mullan (1987) presented data compiled from Howell et al. (1985) on the number of returning male and female hatchery spring Chinook salmon in the mid-Columbia River. From those data, we calculated the sex ratios for Leavenworth, Entiat, and Winthrop NFH populations. The range (female to male) for the three stocks was 1.27:1 to 1.86:1. From sampling at Wells Dam in 2007 and 2008, estimates of sex ratio ranged (males to females) from 1.5:1 to 1.9:1 for hatchery fish and 1.1:1 – 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).

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 River Basin, fecundity (hand counted) averaged 5,100 (range: 2,600-8,100) between 1992 and 1994 (Chapman et al. 1995). Since 2000, four year old wild females averaged 4,000 eggs while five year old wild fish averaged 4,800 eggs (Table 5). For hatchery fish, four year old fish averaged 3,800 eggs and five year old fish averaged 4,400 (Table 5). In general, hatchery fish for a given age have a lower fecundity than wild fish. As shown in Table 7, there are gaps between years, primarily for wild fish, especially five-year-olds.

Table 5. Fecundity of Methow 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 Basin				
	3,981	3,771	4,843	4,413

In 2007, wild smolt length averaged just over 100 mm fork length (FL) (Table 6). Wild parr (fall-run) averaged almost 91 mm FL. Little variation occurs between years in smolt length (C. Snow, pers. comm).

Table 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

Fork length from returning wild and hatchery spring Chinook salmon has been measured in recent years as part of the hatchery evaluation program (Table 7). There appears to be little difference between streams or between wild and hatchery fish, although hatchery fish in general are smaller.

Table 7. Mean fork length by age, sex, and brood of spring Chinook collected for the Methow Hatchery program, 1998-2005 (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	
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 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 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	
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*

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; Chelan and Douglas PUD, unpublished data). 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 (Mullan 1987). Adults destined for the Methow basin migrate past Wells Dam and enter the subbasin in May and June, peaking after mid-May. Differences in migration timing have been shown to be present between, but not within, age classes. Hatchery three year olds migrated to Wells Dam later than hatchery four and five year olds as well as wild five year olds (Snow et al. 2008).

Methow 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. The order of importance is: the mainstem Methow, Twisp, Chewuch, Lost River, and Early Winters Creek. No significant differences have been detected in the distribution of hatchery and wild carcasses (females) within each subbasin (Snow et al. 2008).

Spawning occurs from late July through mid-September. There have been no significant differences in spawn timing between hatchery and wild fish (females) within or among

subbasins, although it appears hatchery fish spawn earlier than wild fish except in the Twisp River which had the lowest proportion of hatchery origin spawners (Snow et al 2008).

Fry emerge the spring following spawning and are assumed to smolt as yearlings, although fall parr migrations from upper reaches have been observed (Hubble 1993, Hubble and Harper 1999, Snow et al. 2008). However, where these fall migrants rear prior to smolting the next spring is still unknown.

Fryer et al. (1992) summarized age information of spring Chinook sampled at Bonneville Dam from 1987 through 1991. They found no adult scales with two stream annuli (2.x), although in every year there were some fish estimated to have entered the ocean in their first year of life (0.x; probably from the Snake River basin). Adults sampled in the Upper Columbia tributaries have shown no 0.x or 2.x life histories.

Individuals that never migrated to the sea make up some portion of the spawning population (Healey 1991, Mullan et al. 1992a). Mullan et al. (1992a) indicate that precocious maturation of male spring Chinook is common in the mid-Columbia basin and is characteristic of both hatchery and wild stocks. Mullan et al. (1992a) examined 20,000 wild juvenile Chinook in tributaries of the mid-Columbia River during 1983-1988 and found that precocious males made up about 1% of the sample. However, if jacks (age-2 males that return after 1 year in the ocean) are included, the percentage of males that mature precociously would be much greater than 10%.

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 depression of the redd with an adult female or male and female pair. Gebhards (1960) reports 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% had consumed eggs. Furthermore, most (85.1%) of the dead precocious males that he found were partly or completely spent.

The mechanism that determines the life history strategy of Chinook is not well understood (Gross 1991). It has been well demonstrated however, that in addition to genetic factors, growth rate and energy reserves are a large factor determining residualism rates (Larsen et al. 2004, 2006) in many salmonid species including Atlantic salmon (Rowe and Thorpe 1990), Chinook salmon (Clarke and Blackburn 1994, Larsen et al. 2004, 2006), and steelhead (Sharpe et al. 2007). Early maturing Chinook (precocious) males may play an important 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.

Smolt trapping has occurred in the Methow 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 (Figure 2 and 3), although trap efficiencies may influence the absolute numbers of fish caught on a given date.

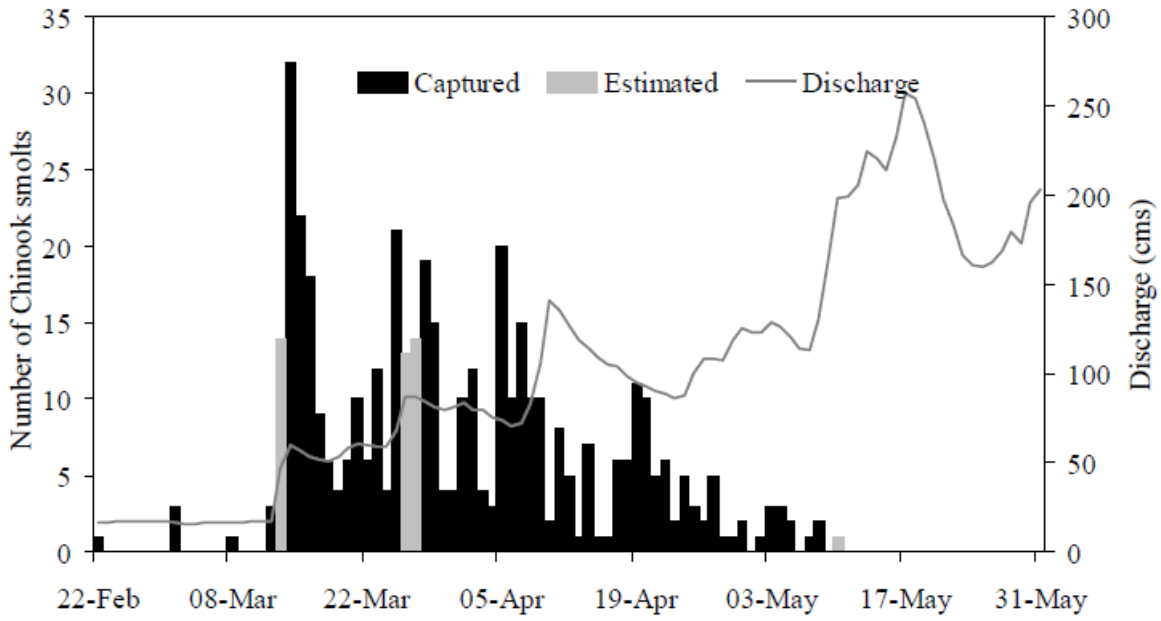

Figure 2. Daily capture of wild Chinook salmon smolts from the Methow River trap in 2007 (Figure 3, Chapter 3 from Snow et al. 2008).

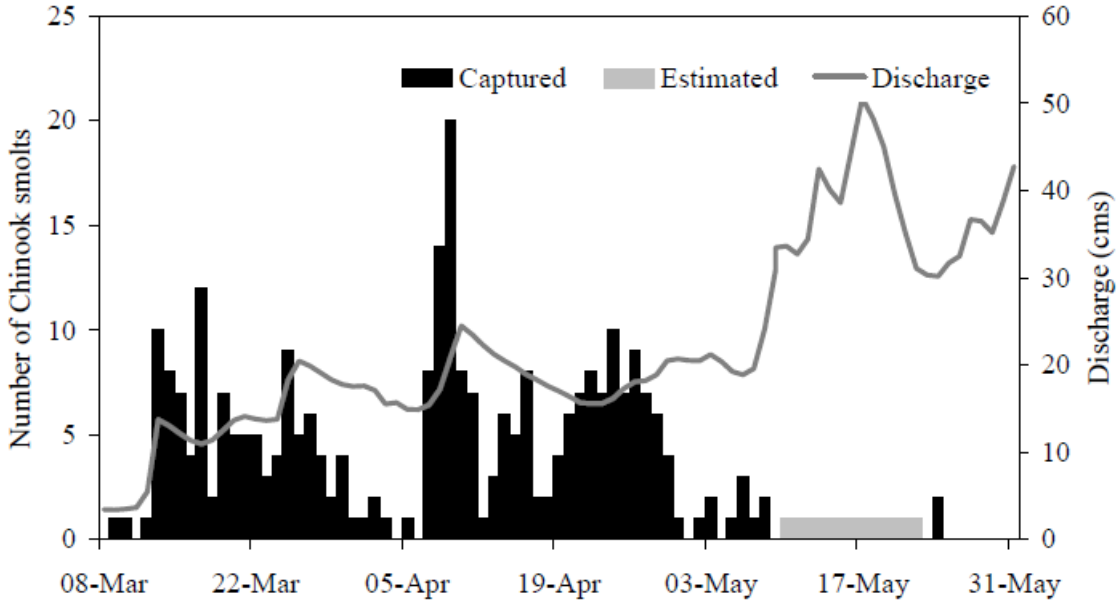

Figure 3. Daily capture of wild Chinook salmon smolts from the Twisp River trap in 2007 (Figure 6, Chapter 3 from Snow et al. 2008).

As previously stated, a substantial parr (subyearling) migration occurs within the Methow Basin and appears in two main phases: throughout the summer and then again in the fall (Figure 4).

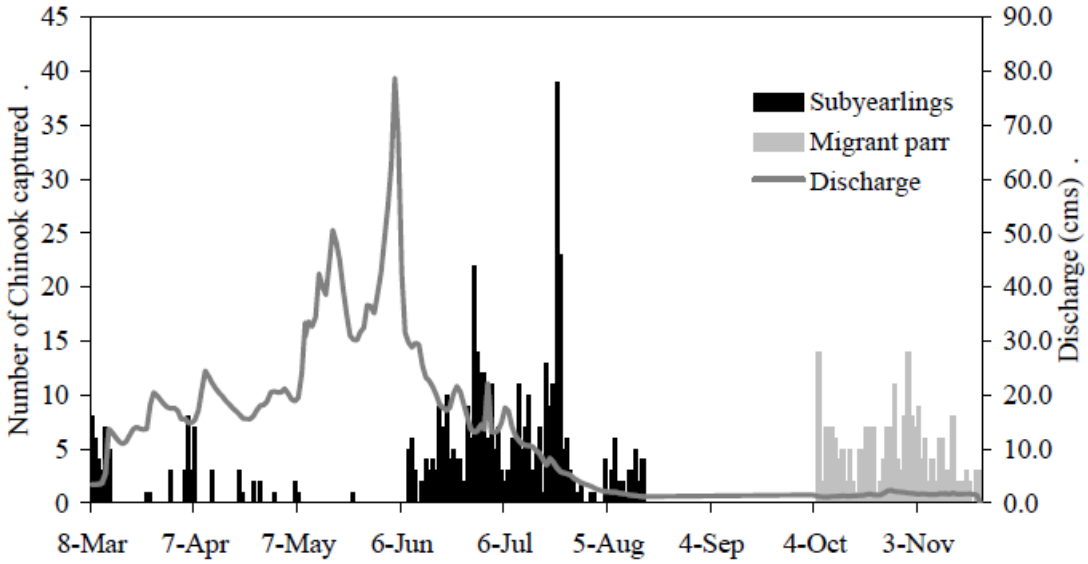

Figure 4. Daily capture of subyearling wild spring Chinook and migrant parr at the Twisp River trap in 2007 (Figure 7, Chapter 3 from Snow et al. 2008).

Summer Steelhead

Chapman et al. (1994) summarized information for 459 naturally produced adult steelhead that were collected at Wells Dam, Wells Reservoir, and the Methow River between 1987 and 1993 (Table 8). They found that the majority of both males and females had spent two years in the ocean (Table 8, Figure 5). Between 1997 and 2006, 478 naturally produced fish were sampled at Wells Dam. The majority of these fish had spent one year in the ocean (Table 8, Figure 1). We are uncertain why this discrepancy exists, although saltwater ageing was estimated from otoliths between 1987-1993, and with scales between 1997-2006.[1]

In previous summaries of hatchery origin age structure (Mullan et al. 1992a; 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 between 1987-1993 (Table 9).

[1] It is unlikely that saltwater age estimation would be affected by the differing methods. However, freshwater age estimation may be underestimated using scales for steelhead (Peven 1990, Mullan et al. 1992a).

Table 8. The number and percentage of steelhead by saltwater age and sex from Chapman et al. (1994) for years 1987-1993, and Snow et al. (2008) for years 1997-2006.

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
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**

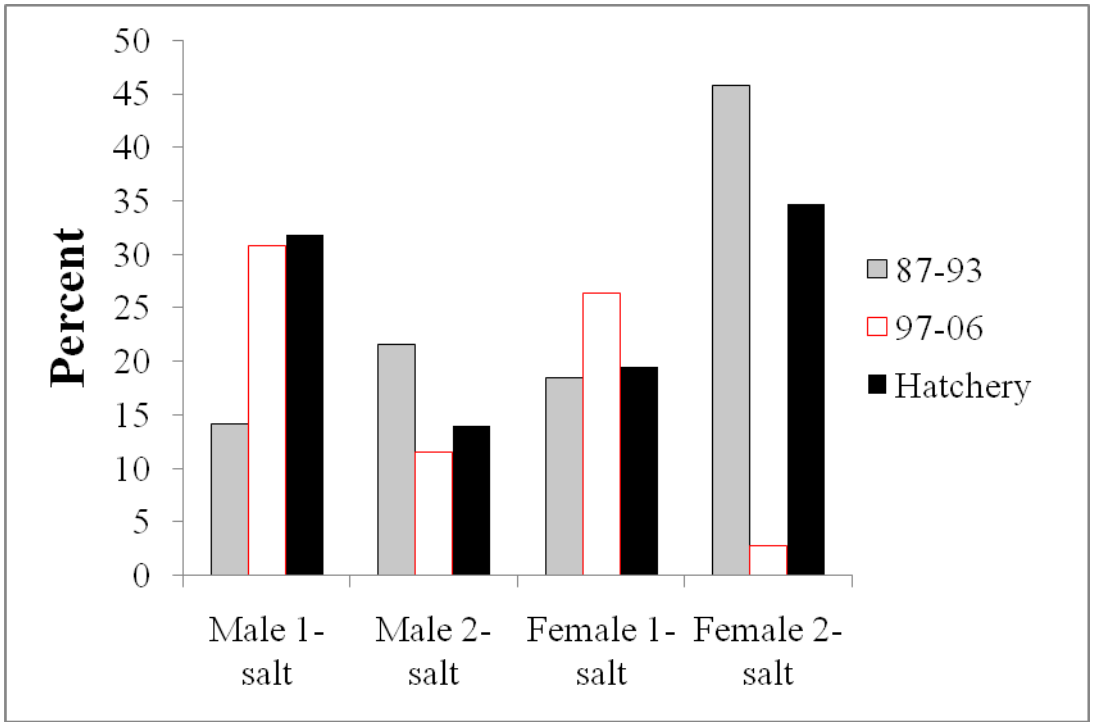

Figure 5. Comparison of saltwater age structure of naturally produced steelhead sampled between1997-2006 and naturally produced and hatchery origin fish between 1987-1993, based on Table 8 and 9.

Table 9. 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**

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. 1992a, Chapman et al. 1994).

For fish sampled at Wells Dam between 2000 and 2006, 1-salt naturally produced fish average fecundity was higher than hatchery origin 1-salt fish while for 2-salt fish, hatchery origin fish had slightly higher fecundity (Table 10).

Table 10. 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).

	1-salt			**2-salt**	
Year	**H**	**W**		**H**	**W**
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**

In the Upper Columbia River Basin, naturally produced steelhead smolts sampled at Rock Island Dam have averaged between 163-188 mm FL (Peven and Hays 1989, Peven et al.1994). In the Methow Basin, smolt trapping has been on-going since the mid 1990s and, in general, length frequency of juveniles does not vary greatly between years (C. Snow, pers. comm), and mean FL ranged from approximately 130-180 mm FL (this includes “transitional” juveniles that may or may not be smolting; Table 11).

Table 11. Mean length and weight at migration age of wild transition and smolt summer steelhead captured at the Methow (A) and Twisp (B) smolt traps in 2007 (Tables 2 and 4, respectively, from Chapter 3 of Snow et al. 2008).

A

Age	*N* (%)	Fork (mm)			Weight (g)			K-factor
		Mean	*N*	SD	Mean	*N*	SD	
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

B

Age	*N* (%)	Fork (mm)			Weight (g)			K-factor
		Mean	*N*	SD	Mean	*N*	SD	
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

Chapman et al. (1994) reported that adult female steelhead sampled at Wells from 1982-1992 ranged from 57-81 cm and 67-75 cm for fish spending one and two years in the ocean, respectively. Adult males ranged from 59-66 cm and 69-77 for one and two ocean fish.

The length frequency of broodstock captured in 2006 for the steelhead supplementation program comports well with previous sampling at Wells Dam (Table 12). In general, hatchery origin fish are similar in size as naturally produced fish.

Table 12. Mean fork length (cm) by saltwater age, sex, and origin for broodstock sampled at Wells Hatchery Complex facilities, 1997-2006 (Chapter 1, Appendix C from Snow et al. 2008).

Brood year	Male				Female			
	1-salt		2-salt		1-salt		2-salt	
	H	W	H	W	H	W	H	W
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**

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, passing over the Upper Columbia River dams in April and May of the following year. For example in 2006, naturally produced fish began their migration earlier than hatchery origin fish (Table 13). The run timing observed in 2006 followed a typical beginning (July) and ending (October) for a calendar year. However, it is important to reiterate that a portion of the fish that spawned upstream of Wells Dam pass the dam in the following spring after over-wintering in the mainstem Columbia River.

Table 13. 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

There is no Methow-specific information on run timing but 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).

In the Methow River, steelhead currently spawn in the Twisp River, mainstem Methow River, Early Winters Creek, Lost River, Chewuch River, Beaver Creek, Black Canyon Creek, Lost River, Buttermilk, Boulder, Eight-Mile, Suspension and Little Suspension creeks, and Lake creeks (Snow et al. 2008). Spawning occurs in the late spring of the calendar year following entry into the river 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 subbasin occurred during the week of April 15th. Peak spawning in the remaining three subbasins all occurred between April 15th and 30th. 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]), the water conditions present during summer steelhead spawning ground surveys adults do not typically allow observation of adults while on the redd, and carcasses are quickly washed away making recovery unreliable. These conditions combine to confound the surveyor's ability to determine the origin of spawning adults (Snow et al. 2008) and is an identified data need for the Methow Basin and the whole of the Upper Columbia Basin.

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 1-7 years with the highest percentages at ages 2 and 3. Female smolts (63% of fish sampled) were older and larger for most age classes than males.

Steelhead can residualize in tributaries and never migrate to sea, thereby becoming resident rainbow trout. Conversely, progeny of resident rainbow trout can migrate to the sea and thereby become steelhead. This dynamic expression of life-history makes *O. mykiss* very challenging to understand and manage. It is difficult to summarize one life history strategy (anadromy) without due recognition of the other (non-migratory). The two strategies co-mingle on some continuum with certain stream residency at one end and certain anadromy on the other. Upstream distribution is limited by low heat budgets (about 1,600 temperature units) (Mullan et al. 1992). The response of steelhead/rainbow complex in these cold temperatures is residualism, presumably because growth is too slow within the time window for smoltification. However, these headwater rainbow trout contribute to anadromy via emigration and displacement to lower reaches where warmer water improves growth rate and subsequent opportunity for smoltification. Early maturing male steelhead (precocious) and resident rainbow trout 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. They probably play a greater role in spawning in years like 1994 and 1995 when numbers of spawners were so low that adult females were widely dispersed.

[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, examination of carcasses, as in the case of spring Chinook salmon, is not possible.

Smolt trapping has occurred in the Methow 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 (Figure 6 and 7), although trap efficiencies may influence the absolute numbers of fish caught on a given date.

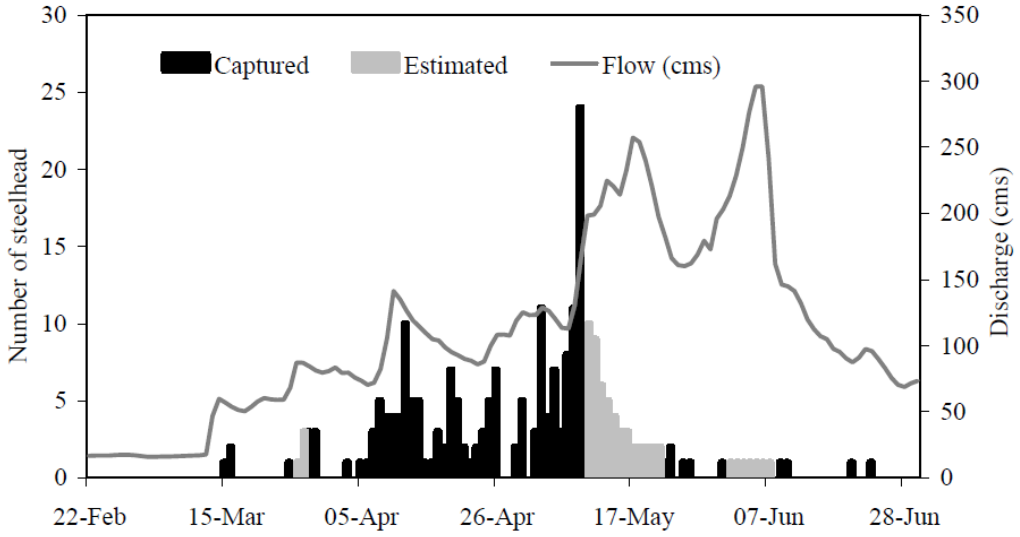

Figure 6. Daily capture of wild steelhead smolts and transitional parr from the Methow River trap in 2007 (Figure 5, Chapter 3 from Snow et al. 2008).

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

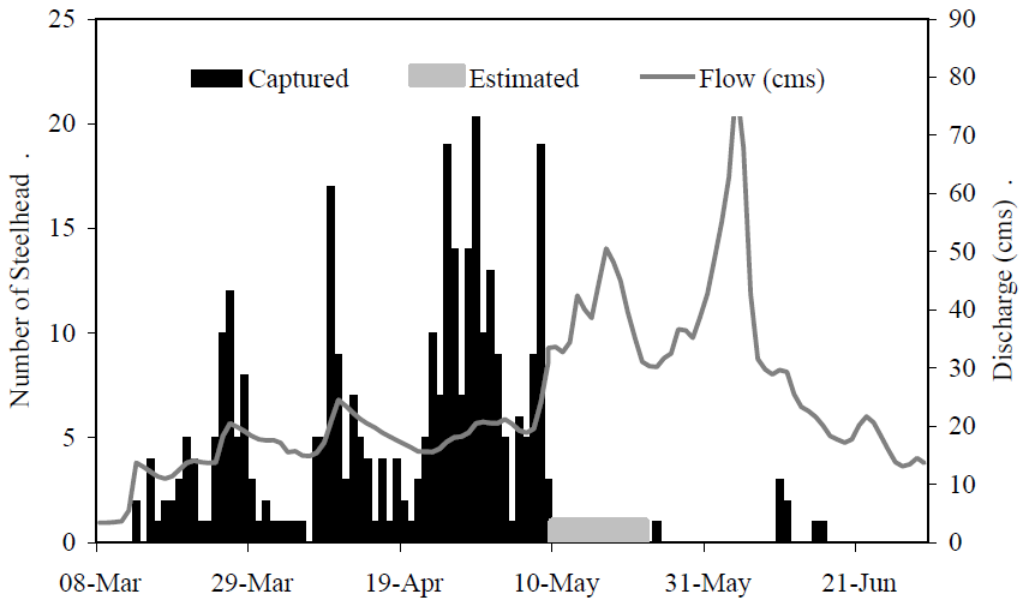

Figure 7. Daily capture of wild steelhead smolts and transitional parr from the Twisp River trap in 2007 (Figure 8, Chapter 3 from Snow et al. 2008).

As previously stated, a substantial parr migration occurs within the Methow Basin and appears in two main phases; throughout the summer and then again in the fall (Figure 8).

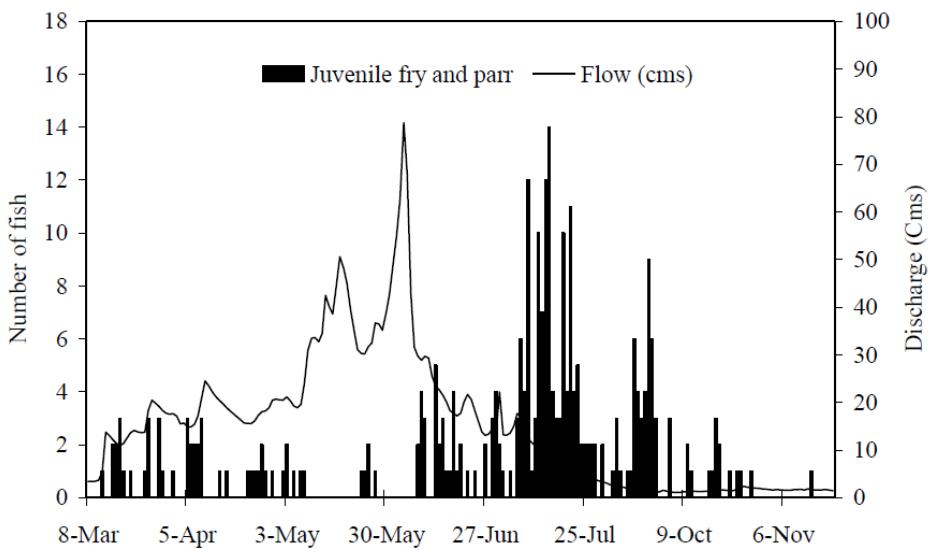

Figure 8. Daily capture of wild steelhead fry and parr at the Twisp River trap in 2007 (Figure 9, Chapter 3 from Snow et al. 2008).

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program.

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

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.

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

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

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds (*see definitions in "Attachment 1").*

Methow spring Chinook Major Population Group (MPG)
The Interior Columbia Technical Recovery Team (ICTRT) 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 wild spawners and an intrinsic productivity of greater than 1.75 spawner to spawner (S/S) to be viable. The Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan (UCSRB 2007) incorporated the abundance goal of 2,000 naturally produced spawners (geo-mean over 12 years) but incorporated an earlier recommendation from the ICTRT of an intrinsic productivity of 1.2. Regardless of which productivity metric is used, the Methow spring Chinook currently are considered to have a greater than 25% chance of becoming extinct within 100 years.

Methow summer steelhead MPG
The Interior Columbia Technical Recovery Team (ICTRT) 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 wild spawners and an intrinsic productivity of greater than 1.1 spawner to spawner (S/S) to be viable. The Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan (UCSRB 2007) incorporated the abundance goal of 1,000 naturally produced spawners (geo-mean over 12 years) and an intrinsic productivity of 1.1. Methow summer steelhead currently are considered to have a greater than 25% chance of becoming extinct within 100 years.

- 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 MPG

During the period 1960 to 1999, returns per spawner for spring Chinook in the Methow subbasin 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 recruits from successive return years that originated from the same broodyear and dividing the sum by the number of spawners for that brood year) has varied but remains low, especially in the Methow River spawning area (Table 14).

Table 14. The natural replacement rate of Methow River basin spring Chinook between the 1992 and 2001 broodyears (data from Chapter 5, Appendix A from Snow et al. 2008).

	NRR		
Year	**Chewuch**	**Methow**	**Twisp**
1992	0.09	0.09	0.28
1993	0.49	0.21	0.11
1994	0.26	0.16	0.28
1995	5.46	2.79	3.20
1996			
1997	7.47	3.48	10.17
1998			
1999	0.10	0.06	0.30
2000	0.81	0.40	1.27
2001	0.11	0.03	0.15
Geo-mean	*0.50*	*0.26*	*0.60*

Methow summer steelhead MPG

In UCSRB (2007), the returns per spawner were expressed as either a hatchery spawner effectiveness of 100% or 0%. The geo-mean of returns per spawner if hatchery spawner effectiveness was 100% = 0.09 and 0.84 if hatchery spawner effectiveness was 0% up to the 1996 brood. More recently, Snow et al. (2008) estimated that the total (not accounting for hatchery spawner effectiveness) average return per spawner as 0.30 for brood years 1996-2001 (Table 15).

Table 15. The natural replacement rate of Methow River basin steelhead between the 1996 and 2001 broodyears (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***

- 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 MPG

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

More recently, the estimated escapement of naturally produced spring Chinook salmon has ranged from approximately 45 (1995) to 1,800 fish (2001) (Table 16).

Table 16. Estimated escapement of spring Chinook salmon in the Methow River, 1992-2007 (based on App. A and D, Chapter 5 from Snow et al. 2008).

	Estimated Escapement							
	Chewuch		Methow		Twisp		Total	
	H	W	H	W	H	W	H	W
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	596	8	18	25	1,079	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	541	152	65	40	809	266

Methow summer steelhead MPG

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 (1996-2007) geo-mean is estimated at 329 fish (Table 17).

Table 17. Estimated return of naturally produced steelhead to the Methow River between 1988-2007. Information based on UCSRB (2007) and Snow et al. (2008).

Return year	Estimated naturally produced return
1988	316
1989	401
1990	315
1991	552
1992	252
1993	130
1994	90
1995	77
1996	140
1997	66
1998	151
1999	326
2000	316
2001	587
2002	434
2003	579
2004	669
2005	547
2006	499
2007	409

- 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 MPG

The percentage of hatchery origin fish on the spawning grounds has been rising since 2001; in particular, in the Chewuch and Methow spawning areas since 2005 (Table 18).

Table 18. Percentages of hatchery origin spring Chinook salmon spawners in the Methow Basin, based on Table 16.

Return Year	Percentages							
	Chewuch		**Methow**		**Twisp**		**Total**	
	H	**W**	**H**	**W**	**H**	**W**	**H**	**W**
2001	70.6	29.4	92.2	7.8	43.1	56.9	83.3	16.7
2002	88.3	11.7	95.0	5.0	24.9	75.1	86.9	13.1
2003	94.9	5.1	98.7	1.3	41.9	58.1	94.9	5.1
2004	86.3	13.7	75.8	24.2	28.7	71.3	67.4	32.6
2005	56.9	43.1	70.4	29.6	28.1	71.9	61.7	38.3
2006	73.7	26.3	88.0	12.0	60.6	39.4	81.2	18.8
2007	73.3	26.7	78.1	21.9	61.9	38.1	75.3	24.7
Average	*77.7*	*22.3*	*85.5*	*14.5*	*41.3*	*58.7*	*78.7*	*21.3*

Methow summer steelhead MPG

Using the percentage of wild fish sampled at Wells Dam as a surrogate for the percentage of wild fish on the spawning grounds shows that the percentage of hatchery steelhead on the spawning grounds is typically greater than 90% (Figure 9). The long term average percentage of naturally produced fish sampled at Wells Dam is approximately 8% (Figure 9).

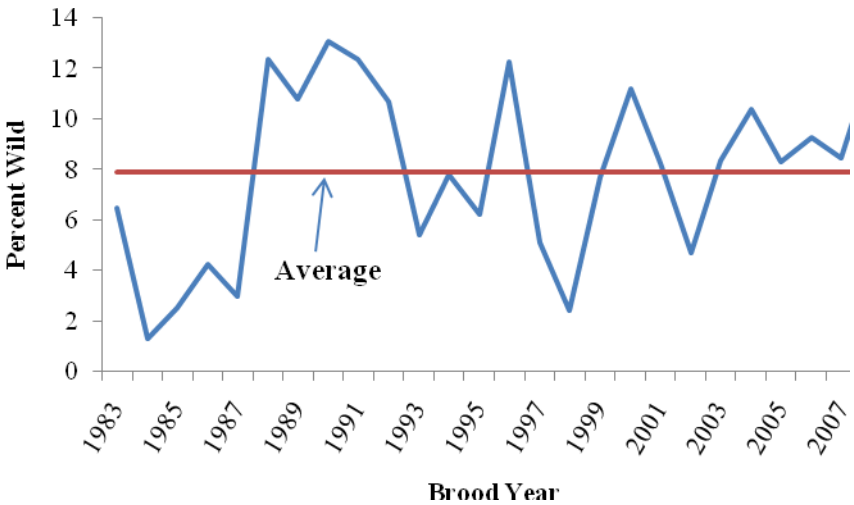

Figure 9. Percent of naturally produced steelhead sampled in the run at large at Wells Dam for the 1983-2008 brood years. Data from UCSRB (2007) and C. Snow, pers. comm.

2.2.3) <u>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</u>

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Broodstock Collection

Because of the ESA listed status of the stock propagated at WNFH, a minimum "take" of up to 400 adults would occur annually. This broodstock collection will be confined to adults of WNFH and MFH origin. Fish will be collected as volunteers to the WNFH ladder as well as trapping facilities at the MFH. Brood will be collected from throughout the run and fish of natural origin, though rarely encountered, would be returned to the river or transferred to the MFH for use as brood. The WNFH program will target inclusion of both WNFH and MFH origin adults. For more information regarding broodstock collection and incorporation of MFH adults see Sections 1.8, 1.11.1, and 7.

Adult Management

In addition to the "take" for brood, FWS also proposes a combination of fishery and manual removal strategies to manage the over-escapement of hatchery origin returns (HOR). These actions are in line with previous HRT and HSRG recommendations and if successful will greatly reduce the potential negative impacts of allowing hatchery adults to mix and spawn with the already depressed natural Methow River SCS population. Additional information and detail regarding adult management of hatchery spring Chinook in the Methow River basin can be found in the following document: *Supporting Information Submitted to the National Marine Fisheries Service Regarding the Winthrop NFH Hatchery Spring Chinook HGMP(Nov 2012)*. This

document was submitted as a supplement to this HGMP and describes an analysis completed by the USFWS, WDFW, and DPUD to examine the combined effectiveness of adult management actions described in this HGMP and the Methow FH spring Chinook salmon HGMP.

Conservation Fisheries

Conservation fisheries are one tool to remove hatchery origin fish in order to manage for specific percentages of hatchery origin spawners (pHOS) and the proportionate natural influence index (PNI) goals. The use of a mass marking scheme (adipose fin removal) will make WNFH fish available for removal in selective fisheries located throughout the Columbia River basin. Furthermore, we expect that as marked WNFH adults return in greater numbers that local selective fisheries will be developed in mainstem areas upstream of Wells Dam as well as within the Methow River Basin. Development and promulgation of fisheries is the purview of the Washington State Department of Fish and Wildlife (WDFW) and any take of NMFS ESA listed fish associated with a conservation fishery on WNFH spring Chinook would be addressed in consultation between WDFW their comanagers and NMFS and is not considered within the confines of this HGMP.

Manual Removal

Hatchery spring Chinook that escape a fishery but are excess to broodstock needs will be removed as they volunteer to the Winthrop hatchery ladder. This collection will occur throughout the duration of the run. This will be the primary tool for managing over-escapement of HOR (post fishery). Additional information concerning the disposition of excess hatchery adults removed at the hatchery can be found in section 7.5. In the future, this activity may instead occur at appropriate weir or fish trapping facilities yet to be developed in the Methow River Basin. Because the current boulder dam fails to direct fish into the bypass channel, the existing trapping facility at Foghorn Dam is largely ineffective. This facility, pending improvements and infrastructure changes, may in the future be used for removal of excess HOR. Future, potential hatchery adult management methods will require ESA consultation before implementation.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

Broodstock Collection

The WNFH spring Chinook program has utilized ESA listed HOR Methow River Composite fish for broodstock resulting in direct mortality. These adults have originated from both WNFH and the nearby MFH. Since 2000, only one natural origin adult spring Chinook has entered the facility's holding ponds (collected and used for brood in 2005). More information on broodstock collection can be found in sections 1.11, 6, and 7 as well as Tables 2, 23, and 24.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

If the take of listed natural origin spring Chinook salmon is exceeded the USFWS will consult with NMFS and other pertinent co-managers to adaptively manage the spring Chinook program at WNFH to address these issues. These discussions will occur directly between the parties as well as within management forums such as the Mid-Columbia HCP Hatchery Committees and the US v OR Production Advisory Committee.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies

The Columbia River Fish Management Plan is an outcome from US v Oregon and identifies production and harvest program goals and other program considerations such as rates of marking for stocks of salmon and steelhead originating above Bonneville Dam. Many of the actions described in this HGMP concern aspects of the program that are also covered under the US V OR Management Agreement and required coordination with the US v Oregon parties. Discussions with the parties occurred in the 2010-2012 calendar years and consensus was reached such that the US v OR Management Agreement has been revised and the actions described in this HGMP are now aligned with the details described in the Management Agreement.

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

WNFH was authorized by the Grand Coulee Fish Maintenance Project, April 3, 1937 and reauthorized by the Mitchell Act (52 Stat.), May 11, 1938. WNFH was built to mitigate for the lost anadromous fish production due to the construction of Grand Coulee Dam. The original authorities to establish WNFH were:

- Grand Coulee Dam Project, 49 Statute 1028,08/30/1935
- Grand Coulee Fish Maintenance Project, 04/03/1937
- Mitchell Act, 52 Statute 345, 05/11/1938
- Columbia Basin Project Act, 57 Statute 14, 03/1 0/1943
- Mitchell Act (amended), 60 Statute 923, 08/14/1946
- Fish and Wildlife Coordination Act, 60 Statute 1080, 08/14/1946

Additionally, WNFH complies with the following federal treaties and orders:

- Treaty with the Walla Walla, Cayuse, Umatilla Tribes
- Treaty with the Yakama Nation
- Treaty with the Nez Perce
- Treaty with the Tribes of Middle Oregon
- Executive Order (Treaty with Bands of Colville)
- US. v. Oregon (Sohappy v. Smith, "Belloni decision", Case 899)
- Endangered Species Act of 1973,87 Statute 884
- Salmon and Steelhead Conservation and Enhancement Act, 94 Statute 3299
- Pacific Salmon Treaty Act of 1985 (US.lCanada Pacific Salmon Treaty), Public Law 995,16 U.S.C. 3631

Purpose of the Hatchery Program -Societal and Biological

The goal of the hatchery program is to compensate for lost fish production due to the construction of Grand Coulee Dam through the rearing and release of juvenile spring Chinook salmon such that sufficient numbers of returning adults are available for harvest as well as providing sufficient broodstock production.

3.3) Relationship to harvest objectives.

Historically, WNFH has operated as a segregated harvest augmentation program and the WNFH stock was not included in the ESA-listed UCR spring Chinook salmon ESU. Beginning in 1998, the Methow River Composite stock (Chewuch and Methow River origin) program was developed and WNFH management objectives were modified to support conservation of localized stocks. In 2001, all pure non-localized (i.e. Carson) stock on station at WNFH (broodyears 1999 and 2000) were transferred out of basin as part of an interagency agreement. Excess HOR (Methow River Composite stock only) to WNFH from 2001 onward have been encouraged to spawn naturally. The vast majority of spring Chinook spawning in the Methow River Basin are of hatchery origin and few wild adults are available for incorporation into the WNFH broodstock. In 2003, it was estimated that 96.2%, 93.1%, and 40.0% of the Methow, Chewuch, and Twisp River spawning populations were composed of hatchery adults (Humling and Snow 2004).

Following recommendations recently published by the HSRG (2009), HRT (USFWS 2007), and in the *Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan* (UCSRB 2007) (remove excess adults of hatchery origin), the fishery co-managers may need to consider the development of a harvest program using the current ESA-listed stock. In an effort to reduce negative impacts caused by hatchery fish spawning in the wild, the USFWS plans to adipose fin-clip the spring Chinook juveniles released from WNFH. With the addition of an ad-clip, returning adults of WNFH origin would be made available for harvest in various fisheries and be easily distinguished from NOR. Removal of WNFH fish in a fishery would reduce the number of hatchery adults returning to the Methow River Basin, thus lowering the potential for negative genetic or ecological impacts presented by hatchery adults inundating natural spawning areas.

While the adipose clipped adults would be available for lower Columbia River fisheries, the development of a “local” fishery (Methow River and/or mainstem Columbia River) is the

purview of the WDFW and would need to proceed within the appropriate harvest management forums and agreements.

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

WNFH spring Chinook are represented in all Columbia River harvest fisheries and, to a limited extent, marine and estuary fisheries. From 2000 to 2010 an average of 185 (6 – 685) adults were harvested annually representing an average of 11% (1% - 35%) of the average total return (ave: 1,385, range: 449 – 4987) for the same period (Table 19).

Table 19. Winthrop NFH spring Chinook returns by harvest fishery, 2000 – 2010 using data provided by the Regional Mark Information System (RMIS) for estimated CWT recoveries expanded to account for unmarked groups.

Harvest Fishery/Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total	Average
Marine/Estuary Harvest	3	3		9		1		2				**19**	**4**
Columbia River Sport		401	207	42	12	16	4	4	3	7	4	**700**	**70**
Columbia River Gillnet	5	266	328	52	15	4			128	10	391	**1,200**	**133**
Freshwater Sport/Net		6	13	2	27					2		**50**	**10**
Treaty Ceremonial	24	13	25				2					**64**	**16**
Total	**33**	**689**	**573**	**105**	**54**	**21**	**6**	**7**	**131**	**19**	**395**	**2,033**	**185**

All estimates are subject to change and should never be considered complete or absolute. Data may take several years to come available and are expected to update annually.

3.4) Relationship to habitat protection and recovery strategies.

As previously mentioned, WNFH is a mitigation facility constructed to compensate for the loss of spawning and rearing habitat due to the construction of Grand Coulee Dam. This program currently has no direct linkage to habitat restoration or recovery efforts.

3.5) Ecological interactions.

Table 20. Expected fish species present in the Methow River.

Salmonid Species	Scientific Name	Non-Salmonid Species	Scientific Name
Spring Chinook salmon	*Oncorhynchus tshawytscha*	Longnose dace	*Rhinichthys cataractae*
Summer Chinook salmon	*O. tshawytscha*	Mottled sculpin	*Cottus bairdi*
Sockeye salmon	*O. nerka*	Largescale sucker	*Catostomus macrocheilus*
Coho salmon	*O. kisutch*	Bridgelip sucker	*C. columbianus*
Summer steelhead	*O. mykiss*	Pacific lamprey	*Entosphenus tridentatus*
Westslope cutthroat trout	*O. clarki lewisi*	Northern pikeminnow	*Ptychocheilus oregonensis*
Redband trout	*O. mykiss gairdneri*	Redside shiner	*Richardsonius balteatus*
Bull trout	*Salvelinus confluentus*		
Brook trout	*S. fontinalis*		
Mountain whitefish	*Prosopium williamsoni*		

1) Populations that could negatively impact WNFH spring Chinook salmon.
Both introduced (e.g. walleye, *Sander vitreus* and smallmouth bass, *Micropterus dolomieu*) and native predators (e.g. northern pikeminnow, *Ptychocheilus oregonensis*) consume large numbers of juvenile spring Chinook as they migrate through the Columbia River system (Poe et al. 1991, Rieman et al. 1991, Tabor et al. 1993). Exacerbating this impact of predation are observations that northern pikeminnow are able to rapidly adjust their diet and foraging habits to key in on the opportunity presented by the release and seaward migration of large numbers of hatchery fish (Shively et al. 1996). Furthermore, pikeminnow predation is typically concentrated downstream of mainstem hydropower facilities where juvenile fish are less dispersed than normal and potentially disoriented and/or stressed following navigation through the hydro facility. Ongoing programs designed to control the size of predator populations and to redesign juvenile bypass facilities to avoid the aggregation of large numbers of predators below mainstem dams are attempting to minimize the impacts of predation and increase the survival of seaward migrating juvenile salmonids.

The potential negative impact of introduced species on Columbia River salmonids is not confined to predation but may also include deleterious impacts caused by non-native plant (e.g. Japanese knotweed, Eurasion water milfoil, purple loosestrife) and invertebrate (e.g. New Zealand mudsnail, Siberian freshwater shrimp) species. Whether piscine, plant, or invertebrate, the degree of impact that invasive non-native species may be having on indigenous Columbia River salmonid populations is largely unknown (Sanderson et al. 2009).

2) Populations that could be negatively impacted by WNFH spring Chinook salmon.
The potential ecological effects of WNFH fish on natural salmonid populations is broken down into two sections: A) effects associated with juvenile releases and B) effects associated with adult returns.

A) Juvenile Releases
Hatchery origin juvenile Chinook salmon released from WNFH can potentially interact with listed spring Chinook salmon and steelhead juveniles. Both of these species are present year round in the Upper Columbia River mainstem and tributary areas. Spring Chinook fry emerge from the gravel in late winter or early spring at an average size of approximately 30 mm (FL) and most fry immediately move downstream to mainstem rearing areas (NMFS 2001). Natural origin spring Chinook salmon in the upper Columbia River initiate seaward migration as yearlings between April and June at an average size of 87 to 127 mm (FL; NMFS 2001). Steelhead fry emerge from the gravel in the late spring through August at a size of 30 to 33 mm (FL; NMFS 2001) and disperse to downstream rearing areas in the late summer and early fall. Upper Columbia River steelhead begin seaward migration as age 2+ (43.2%) or 3+ (46.4%) smolts (Peven 1990) during April and May at an average size of 136 to 188 mm (Chapman et al. 1994).

Inter and intraspecific competition between juvenile hatchery and natural origin salmonids has the potential to negatively impact natural populations through density dependent mechanisms

resulting in habitat displacement, competition for critical resources such as food and cover, and reduced growth or survival of individual salmonids from natural populations (Fresh et al. 1997). Conversely, the presence of hatchery fish in the estuary and the mainstem migratory corridors may act to buffer migrating natural origin salmonids from the effects of piscine and avian predation (Fresh et al. 2005).

Whether the release of juvenile Chinook salmon from WNFH negatively impacts juvenile natural origin salmonids is not completely understood but is thought to be unlikely or minimal. Other studies examining the impact of hatchery releases of Chinook salmon (both stream and ocean type) on natural salmonid populations have found little if any evidence for negative interactions (Flagg et al. 2000). Riley et al. (2004) were able to demonstrate that the release of hatchery fall Chinook (ocean type) into two coastal Washington streams had little if any effect on the density, microhabitat use, and size of natural origin coho salmon and steelhead juveniles. Similarly, in a larger river system (Sacramento River) in California, Weber and Fausch (2004) saw no effect of large scale hatchery releases of fall Chinook salmon on the abundance and size distribution of natural origin Chinook salmon. Authors in both of these studies attribute this lack of an effect to the fact that migrating salmonids typically occupy habitats distinct from the rearing areas occupied by natural origin fish and to the practice of releasing hatchery fish that are prepared to begin downstream migration that actively migrate out of the system thereby minimizing temporal and spatial overlap.

Residualization by WNFH yearling spring Chinook salmon, leading to the occurrence of precocious male spring Chinook, may be a risk factor for listed wild adult spring Chinook in the Methow River Basin (NMFS 2001). These precocious fish may contribute to reproduction in natural spring Chinook spawning areas but the extent of any contribution is unknown. The risk of adverse effects may be reduced by an apparent higher mortality rate for these precocious fish relative to non-maturing juvenile fish and a low stray rate to areas outside of the hatchery release location (NMFS 2001). Overall, spring Chinook, summer Chinook, sockeye, and coho salmon released from hatcheries as yearling smolts do not have the same potential to residualize as steelhead (NMFS 2001). Furthermore, production strategies designed to release uniform sized smolt groups likely limits the potential for residualization of hatchery salmon releases (NMFS 2001).

The estuarine portions of the Columbia River are increasingly being recognized as key rearing areas for juvenile salmonids; notably, listed populations of ocean-type chum, Chinook, and coho salmon from the lower Columbia basin (Fresh et al. 2005, Bottom et al. 2005). Competition with salmonids released from hatcheries throughout the basin may negatively impact these listed populations during estuary rearing (Fresh et al. 2005). These negative density dependent interactions are unlikely in the case of Chinook salmon released from WNFH as stream-type Chinook salmon smolts spend little time in the estuary and are thought to occupy deeper mid-channel habitats distinct from the shallow low velocity near shore rearing areas preferred by fry and sub-yearling fall Chinook and chum salmon (Bottom et al. 2005).

B) Returning Adults:

Little is known about individual stocks of Chinook salmon and steelhead trout between the time they leave the estuary as smolts and return as adults to spawn. Available information is inferred from coded-wire tag (CWT) data taken from fish harvested at sea. These data, however, do not give us insight into fish behavior nor inter-specific interactions among stocks in the ocean. Since spring Chinook are harvested at an extremely low rate, WNFH fish are not an important factor in determining ocean harvest regulations and quotas that could affect listed species.

Adults returning to WNFH are trapped as volunteers to the hatchery from late May to mid-July. There is potential that listed natural-origin spring Chinook may also be trapped at the hatchery as volunteers. Scale and CWT analysis of spring Chinook adults collected at WNFH indicates that very few wild spring Chinook stray into the hatchery. For years 2000 to 2008, only one confirmed natural origin adult has entered the facility and been used for broodstock.

Since production began utilizing the ESA listed Methow River Composite stock, adults collected in excess of brood needs have been returned to the river to spawn naturally. Recent studies have shown that hatchery fish are not as successful spawning in the wild as their natural origin counterparts. The number of WNFH origin adults on the spawning grounds (Methow River Basin) has averaged 750 annually (2000 to 2008; range=138 to 3,313).

Hatchery adults can stray and return to unintended locations. Returning adults of WNFH origin appear to have a strong fidelity to areas close to the hatchery. For years 2000 to 2008, of the 6,748 estimated returning adults of WNFH origin to the Methow River Basin, 91.2% (6,156) have spawned in the Methow River in close proximity to the hatchery. For these same years, 8.2% (556) of these have been found in the Chewuch River and less than 1% each for the Twisp and Lost rivers and Wolf Creek.

C) Summary

To minimize the ecological impacts WNFH spring Chinook may pose to natural salmonid populations, the USFWS has implemented or is proposing to implement several measures as detailed throughout this document. Many of these precautions are based on guidance provided by NMFS in their recent 2008 Biological Opinion (NOAA 2008) which included a list of appropriate management practices to minimize the risk of negative ecological interactions to natural populations. Measures that have already been implemented or are proposed in the WNFH program include: 1) release fish at a size and condition factor that leads to their prompt emigrations to the ocean, 2) control the level of hatchery origin fish (HOF) spawning in the wild to avoid superimposition of natural origin fish (NOF) spawning redds and to limit competitive interactions between the progeny of naturally spawning HOF and naturally spawning NOF, 3) control hatchery fish natural spawning so that rearing habitat carrying capacity is not exceeded, and 4) mark fish externally so they can be distinguished for harvest purposes and collected for hatchery broodstock. The use of these practices minimizes the risk of negative ecological interactions between WNFH spring Chinook salmon juveniles and natural salmonid populations.

3) Populations that have a positive impact on WNFH spring Chinook salmon.
None currently identified.

4) Populations positively impacted by WNFH spring Chinook salmon.
None currently identified.

SECTION 4. WATER SOURCE

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.

Winthrop NFH withdraws approximately 75% (up to 50 cubic feet per second [cfs]) of its water supply from the Methow River at Foghorn Dam (Figure 10) and 25% from ground water supply (Table 21). A surface water withdrawal of 50 cfs represents about 3% of the Methow River's mean annual discharge of 1,592 cfs (Mullan et al. 1992). Due to fish health considerations, Winthrop NFH has reduced its use of Methow River water which also lessens its impact to upper Columbia River spring Chinook salmon. Foghorn Dam fish ladder and intake was reconstructed in 1996. The inlet to the intake area has fish exclusion racks designed by NOAA Fisheries personnel. In 2005, a water metering device was installed at the head of the Foghorn Ditch. About 400 m down the initial intake on the Foghorn Ditch is the intake for MFH. Below the MFH (about 140 m) on the Foghorn Ditch is a gate and fish bypass channel. The gate opens from the bottom of the ditch and the bypass channel spills over a concrete weir. The bypass channel leads back to the Methow River. About 400 m below the bypass is the Winthrop NFH intake. This intake has a trash rack at the ditch leading to the screen chamber. The screen chamber consists of a 10 ft. diameter 3/32" mesh rotary screen built and serviced by the WDFW screen shop from Yakima, WA. The WDFW maintenance crew periodically checks to ensure that there are no entryways larger than 3/32" that lead to the hatchery intake pipe. In addition, directly below the hatchery intake and screen chamber, a new NOAA fisheries compliant screen was constructed and installed in 2000 to prevent natural-origin fish from entering the Foghorn Irrigation Ditch. Bypass pipes lead fish away from both screens to the main bypass channel which leads back to the Methow River.

Table 21. Winthrop NFH Water Certificates.

Certificate #	Source	Purpose/use	Priority Date	Amount
7209-A	Groundwater. Infiltration gallery and well	Fish propagation	04/06/1967	1500 gpm, 2400 af/yr
7590 - A	Groundwater. Infiltration gallery and well	Fish propagation, operation and maintenance of hatchery	02/17/1971	1500 gpm, 2400 af/yr
CCVOL1206	Spring Branch Springs	Irrigation for operation and maintenance of fish hatchery	6/23/1891	10 cfs
CS4-SWC848	Methow River & Infiltration Gallery 3	Fish propagation	01/10/1922	50 cfs Up to 10 cfs of the 50 cfs can be diverted from Infiltration Gallery 3

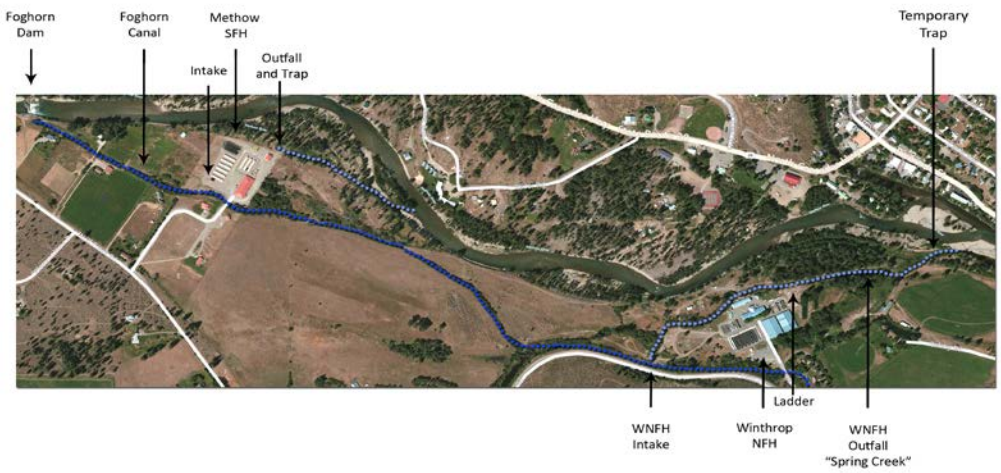

Figure 10. Aerial map depicting location of current Winthrop NFH water sources, control points, pollution abatement, and effluent discharge.

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.

The intake and water delivery systems are in compliance with NOAA Fisheries criteria. Winthrop NFH complies with the current National Pollutant Discharge Elimination System (NPDES) permit standards (WAG-13-0000). To avoid impacts to listed fish, the fish screen is observed daily by WNFH personnel. All fish entering the screen chamber are spilled into a concrete trough leading to a bypass channel which leads back to the Methow River.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Adults that enter WNFH via the ladder are held in two 12’ x 70’ x 4.5’ deep concrete ponds. The current carrying capacity of the holding facility is 1000 spring Chinook adults. The holding ponds were reconstructed in 2012 and a new spawning building was constructed to improve collection, sorting, and spawning operations.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).
WNFH has one small (400 gallon) fish hauling vehicle capable of transporting approximately 15 adult Chinook salmon. During spawning, gametes are placed in zip-lock bags, oxygenated, loaded in ice filled coolers, and transported to the hatchery building from the spawning area or occasionally to the MFH by vehicle. Eyed eggs are sometimes shipped in egg boxes by vehicle to the state facility.

5.3) Broodstock holding and spawning facilities.
All adults are held in two 12' x 70' x 4.5' deep ponds. Adults are held at a density of one fish per eight cubic-feet of rearing space and a flow of 1 gpm per adult. Pathogen-free well water supplies the pond. The holding ponds were reconstructed in 2012 and a new spawning building was constructed to improve collection, sorting, and spawning operations.

5.4) Incubation facilities.
Marisource incubation trays (Heath trays) are used for spring Chinook incubation. Trays are loaded with one female per tray and numbered to correlate with ELISA sampling. Flow rates initially are 1 – 2 gpm and increase to 3 gpm at the eyed stage. The eggs remain in the incubation trays through the entire incubation cycle, however some may be culled pending ELISA results (prior to hatch). After "picking" concludes and ELISA results are confirmed, the eggs are sample-counted, weighed, and enumerated. Each tray (220 total) is loaded with the eggs from one female and water flow is maintained at 3 to 5 gpm. The water source is 100% ground water throughout incubation and temperatures range from 39 (chilled) to 52° F (unchilled). When the temperature units are equal for each take, all eggs/alevin are put on chilled water in order to delay emergence to correlate with the timing of natural emergence. Formalin treatments are not necessary during incubation.

5.5) Rearing facilities.
Rearing units include 30 – 8' x 80' raceways, 16 – 12' x 100' raceways, 16 – Foster-Lucas ponds, and 34 starter tanks. Emergence occurs in late February and early March and fry are moved from the trays to the starter tanks or Foster-Lucas ponds. Total rearing space for the starter tanks is 89 cubic feet and flows are 15 to 20 gpm. By the end of April, all fry are moved out to the Foster-Lucas ponds. Each July, the juveniles are marked and moved to their final rearing units which include 30 – 8' x 80' raceways and 5 of the 12' x 100' raceways.

5.6) Acclimation/release facilities.

River water is introduced at the yearling stage in October or November for acclimation. In the following spring, yearlings (smolts) are force released out of the above-mentioned raceways and ponds. Dam boards are pulled and the smolts travel through an underground pipe system which empties at the base of the collection ladder.

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

No major disasters with SCS have occurred in the past 15 years. Bird predation and disease problems contributed to significant mortalities prior to 1993. A hole in the bottom of one of the Foster-Lucas ponds was blamed for the loss of about 100,000 fry in 1991. The Foster-Lucas ponds are some of the original ponds installed in 1940 and have continual deterioration problems which require constant patching of walkways, pond floors, and pond walls.

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.

The hatchery is staffed full-time, eight hours per day. Three employees live in residential quarters on hatchery grounds. The hatchery has a centrally located low-water alarm which is connected to an automatic dialer. If the dialer fails, a paging system engages and contacts employees up to five miles away. A low water level switch also triggers a horn alarm to alert employees. If power is lost to the facility, a back-up generator engages automatically to restore power. The hatchery sometimes loses its surface water source (Foghorn Ditch) during extreme cold spells during the winter months. Flows to all rearing units are trimmed during these events and the facility must depend on available ground water. Fortunately, these events are usually short-lived (2-4 days), surface water is restored, and major mortality or emergency releases are prevented. See section 7.7, 9.1.6, and 9.2.7 for a discussion of practices in place to reduce disease transmission risks.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Table 22. History of egg source for the current SCS program at WNFH.

Egg Source	Broodyear	Stock Origin
Cowlitz River Hatchery	1974	Cowlitz River
Little White Salmon NFH	74, 75, 78	Little White Salmon River
Carson NFH	76, 77, 79, 81, 85, 86	Commingled-Bonneville Dam
Winthrop NFH (Methow R.)	78, 80 to present	Commingled hatchery stock
Leavenworth NFH	79, 80, 84, 89 – 92	Commingled hatchery stock
Klickitat SFH	1989	Klickitat River
Methow River	1999	Methow River
Methow River (Composite)	2000 – 12	Methow FH

6.2) Supporting information.

6.2.1) History.

A spring Chinook salmon propagation program at WNFH started in 1974 with releases in 1976. Since 1974, eggs have been obtained from several lower Columbia River sources as well as from Leavenworth NFH (Table 22). The Little White Salmon stock originated in 1967 from fish of unknown origin returning to the Little White Salmon River. These adults were probably descendants of several different stocks. The Carson NFH stock originated from a collection of commingled adults captured at Bonneville Dam. Use of the Methow River Composite stock at WNFH began in 2000. The Methow River Composite incorporated listed hatchery origin and natural origin Methow River and Chewuch River stocks and is cooperatively managed at both WNFH and MFH.

6.2.2) Annual size.

Approximately 400 listed Methow River Composite adults are needed for broodstock, half male and half female. As described earlier (Section 1.8), a stepping stone model of broodstock integration will be implemented with MFH spring Chinook. Therefore the USFWS will target inclusion of 20-30% of the brood from MFH origin. Gametes from natural origin fish will be transferred to the MFH if needed or otherwise incorporated into the program at WNFH.

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

Natural origin adults are generally not captured or utilized for the WNFH program. Occasionally, a natural origin adult (<1/year on average) is collected and utilized at the facility. In addition, progeny in excess to the needs of the MFH conservation program are sometimes transferred to WNFH to help increase natural influence and reduce domestication risks. (See “Stepping Stone” diagram Figure 1)

6.2.4) Genetic or ecological differences.

The Methow River Composite stock was initiated at MFH in 1998. Prior to that year separate broodstocks for the Chewuch and Methow Rivers were maintained at MFH. However, the two programs were combined because of extremely low numbers of returning adults upstream of Wells Dam in the mid-1990's. Beginning in 2000, WNFH transferred all Carson NFH lineage SCS on station for releases outside the Methow Basin and started propagating the ESA listed Methow River Composite stock.

6.2.5) Reasons for choosing.

The Methow River Composite stock was chosen to help reduce genetic and ecological risks to natural origin spring Chinook salmon in the Methow River Basin.

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.

Broodstock is obtained from adults volunteering to the hatchery's collection ladder and only a few, if any, natural origin spring Chinook salmon are encountered per year. Natural origin spring Chinook salmon adults will be transferred to the MFH (if needed for brood), utilized in the WNFH program, or released back into the Methow River. The genetic risks posed to the natural Methow River population of spring Chinook by this hatchery program will be minimized by integration with the MFH and the use of indigenous Methow River Composite HOR adults.

SECTION 7. BROODSTOCK COLLECTION

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

Adults only.

7.2) Collection or sampling design.

Broodstock are obtained from adults volunteering to the hatchery's collection ladder. The ladder operates from mid-May into September which covers the full spectrum of the run. Although very few NOR are incorporated into the WNFH program, Methow River Composite HOR adults from MFH do enter the adult ponds and are utilized when appropriate. Because NOR are utilized at MFH, although at a low rate, WNFH will target the incorporation of MFH origin adults (20-30%, 10 year average) in order to minimize the genetic risks posed to the natural population. In any given year, MFH origin adults or gametes will be transferred to the MFH until their brood needs are met and at that point WNFH will utilize excess MFH origin adults to the extent possible.

7.3) Identity.

All adults used for broodstock will be of WNFH or MFH origin as identified by adipose fin clip and CWT codes. CWTs will be read prior to spawning in order to determine origin (Twisp, Methow, Winthrop). Gametes of Twisp stock origin (HOR) will be transferred to MFH for use in their Twisp River program. Methow River Composite HOR adults of MFH origin will be transferred to MFH as appropriate or incorporated into the WNFH brood.

7.4) Proposed number to be collected:

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

Approximately 360 adults are needed to secure program goals. WNFH will target the incorporation of 20-30% (10-year average) MFH adults in the brood

7.4.2) Broodstock collection levels for the last twelve years, or for most recent years available:

For years 2001 to 2008, an average of 29% of adults spawned at WNFH have originated from MFH releases of the Methow River Composite stock (Table 23).

Table 23. Number and hatchery origin of Methow River Composite broodstock used for the Winthrop National Fish Hatchery spring Chinook program 2001-2011. These totals do not include lost or unread CWTs.

Brood Year	Methow Fish Hatchery	%	Winthrop National Fish Hatchery	%
2001	196	54	166	46
2002	191	52	177	48
2003	142	35	264	65
2004	46	13	296	87
2005	135	29	337	71
2006	107	30	254	70
2007	32	10	293	90
2008	36	9	347	91
2009	80	20	325	80
2010	72	18	330	82
2011	85	23	291	77
Mean	111	29	267	71

Table 24. Total broodstock collection levels for the last twelve years including adults collected for removal based on stock origin (i.e. the non-indigenous Carson NFH stock).

Year	Adults Females	Males	Jacks	Eggs	Juveniles
2000	603	385	104	1,664,022	456,103
2001	219	126	41	690,328	526,361
2002	265	123	0	918,611	578,133
2003	266	76	91	1,004,718	550,214
2004	292	106	50	760,799	484,090
2005	228	156	115	784,272	589,693
2006	193	207	15	558,932	509,045
2007	145	70	125	503,608	380,000
2008	231	152	34	884,923	495,978
2009	283	236	896	768,737	426,980
2010	1250	804	265	639,563	551,509
2011	625	381	959	658,050	

Data source: WNFH records

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.
All adipose fin clipped adults collected in surplus of broodstock needs will be: 1) provided to the Colville Confederated Tribes for use as brood for the initiation of Okanogan and/or Chief Joseph Hatchery programs, 2) surplused to local Native American tribes for ceremonial and subsistence purposes or other approved outlets (e.g. Federal prison system, local food banks, etc.), or 3) spawned with the full intent of shipping green or eyed eggs to the Colville Confederated Tribe for rearing and mainstem Columbia River release at Chief Joseph Hatchery. Excess hatchery origin adults of MFH origin (or gametes from those adults) will be transported to the MFH or if not needed for MFH brood they will be utilized for any of the above described options for excess WNFH adults. In addition, other viable options for use of excess HOS captured at the hatchery, including the use of carcasses in nutrient supplementation projects, will be considered within existing fish management and fish disease policies and forums and adopted as appropriate. Overall, the FWS proposes to vigorously reduce or eliminate excess HOR adults of WNFH origin from spawning and/or competing with Methow River Basin natural origin adults in the wild. This adult management will be conducted to the highest degree possible using existing hatchery infrastructure and staffing. Improvements to existing trapping facilities at Foghorn Dam or development of new facilities in the Methow River Basin would greatly increase the ability of the USFWS to meet this management goal. The USFWS is actively working with BOR, WDFW, DPUD, and other comanagers to address this infrastructure need.

If the above options are deemed inappropriate when considered within fishery management forums, or the WNFH is unable to adequately reduce HOR escapement, then the USFWS will consider transfer of their spring Chinook production to releases in areas outside the Methow River Basin (Okanogan Basin or upper Columbia River mainstem near Chief Joseph Dam).

7.6) Fish transportation and holding methods.
Broodstock will be collected and held in the adult holding ponds at WNFH. Fish in excess to broodstock needs, if transferred, will be moved in a 400 gallon fish hauling tank mounted on the bed of a flatbed truck. The tank is equipped with an aerator and oxygen. Fish may be transported to the Methow River, MFH, Omak Creek, or Chief Joseph Hatchery.

7.7) Describe fish health maintenance and sanitation procedures applied.
Fish health services are provided by staff from the USFWS OFHC which is a full service aquatic health facility capable of monitoring, diagnostics, and certification procedures that meet or exceed all national, international, integrated hatchery operations team (IHOT), or co-manager requirements.

During collection and holding of adult salmon, formalin is administered 3 days per week for one hour at a concentration of 200 ppm. Antibiotic injections are given to the female broodstock to control the vertical and horizontal transmission of *Renibacterium salmoninarum* under the supervision of the attending Veterinary Medical Officer. Injections are done at approximately 30 day intervals to control levels of *R. salmoninarum*. During spawning operations, adult

populations are tested for all reportable fish pathogens at the minimum assumed pathogen prevalence level (APPL) of 5%. At least 150 female adults are tested for viruses and all females are individually tested for levels of *R. salmoninarum* by ELISA. The results are used to segregate egg groups into relative risk groups to reduce and contain any vertical transmission of *R. salmoninarum* and resultant Bacterial Kidney Disease. All eggs and accompanying containers are disinfected with iodine solution during the water hardening process following fertilization. Well water is used exclusively for adult holding, spawning, and egg incubation to further reduce disease risks.

7.8) Disposition of carcasses.
All carcasses are disposed of in an earthen pit at Winthrop NFH.

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.
The risk of fish disease amplification will be minimized by following co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines. Since "wild" fish rarely enter the collection facility, there is a minimal likelihood for adverse genetic or ecological effects to the natural population.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.
Prioritized based on hatchery or natural origin. Two stocks currently utilized in the hatchery programs within the basin are Methow River Composite and Twisp River stocks. Fish of natural origin (by scale pattern) will be transferred to the MFH to be crossed with the listed Methow Composite stock. All Twisp River stock gametes are transferred to the MFH.

8.2) Males.
The run is consistently comprised of 60% females and 40% males. Therefore, all males are used at least once and jacks are included over the 10% level, if necessary, to fulfill broodstock requirements. When necessary, some adult males are used twice, but no more than twice, to compensate for the differing sex ratio. Backup males are only used when a problem is noticed with the milt (blood, water, etc.).

8.3) Fertilization.
Gametes are fertilized as 1:1 individual matings. Factorial matings have occurred in the past when returning adult numbers dropped below 50 individuals in order to maximize the effective population size. Fertilization does not occur until stock origin has been determined (coded wire tag). Therefore, all gametes are placed in individual zip-lock bags, oxygenated, and placed in coolers. Any containers used during the spawning and/or fertilization process are disinfected in

an iodophore solution between fish. All eggs are water hardened in a 75 ppm iodophore solution for 30 minutes.

8.4) Cryopreserved gametes.
Not used.

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.
The Winthrop/Carson stock has been phased out of WNFH as of 2000, meaning that no eggs or fish of pure Carson origin have been out-planted to the Methow River Basin since release year 2000. The spring Chinook goal for WNFH will be to rear and release 400,000 Methow River Composite stock annually. WNFH will continue to support the MFH's efforts to incorporate "wild" fish as broodstock by transporting captured "wild" fish to them. Factorial mating schemes will be used if effective population size drops below 50 individuals.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.
Survival goals for green egg to fry and fry to smolt are 95% each (IHOT 1995).

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

Table 25. Number of eggs taken and survival rates to eye-up and ponding, 1997 to 2011.

Brood Year	# Eggs Taken	% Eye-up	% Eyed to Ponding
1997	608,896	97	85
1998	376,848	95	98
1999	234,515	96	100
2000	2,216,759	93	99
2001	736,637	90	96
2002	1,004,028	93	99
2003	1,180,297	88	98
2004	842,397	90	95
2005	826,177	95	99
2006	632,964	93	99
2007	527,132	96	94
2008	912,368	97	99
2009	808,505	96	98
2010	802,126	97	100
2011	691,140	93	99

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

Has not been an issue for most return years. Excess Carson stock eggs were taken during the phase out period (2000 – 2004) and transferred to the Okanogan Basin or Lower Columbia River. Provided that brood is available, WNFH will collect approximately 10% above the production goal number of 600,000 smolts in order to compensate for normal losses and culling for females with high ELISA readings. An additional option, assuming excess brood is available, is for the hatchery to collect gametes to be transferred (as green eggs, eyed eggs, or juveniles) to the CCT for use in the initiation of the Okanogan and/or Chief Joseph Hatchery programs. The USFWS is currently working cooperatively with the CCT and other co-managers to determine the most appropriate means for the Leavenworth Fisheries Complex to assist with these new programs at Chief Joseph Hatchery.

9.1.3) Loading densities applied during incubation.

Spring Chinook salmon eggs average around 1800 eggs per pound although there can be significant variation to this mean value from year to year depending on adult size and age composition for a particular brood year. Heath trays are loaded at one female per tray through the entire incubation cycle (3000 to 6000 eggs/tray). Flows through the incubation stacks are 1 to 2 gpm to the eyed stage and 3 to 5 gpm from the eyed to button-up fry stage.

9.1.4) Incubation conditions.

All spring Chinook salmon eggs are incubated on 100% ground water. This water source is free of silt, does not create fungus problems, and provides temperatures in the 39 (chilled) to 52 ˚F (unchilled) range during incubation. Dissolved oxygen is relatively constant at 9 ppm on the inflow and not less than 8 ppm at the outflow. It is not necessary to use formalin during incubation since *saprolegnia* fungus or silt have not been a problem.

9.1.5) Ponding.

Spring Chinook are fully buttoned up at 1800 daily temperature units (DTU) when they are ponded-out. Swim-up fry average 1.3 to 1.4 inches (1100 to 1400 fish per pound). Ponding is forced as trays are removed from the Heath stacks and transferred to a plastic tub of water and moved to the appropriate start tanks. Density indices are kept below 0.13 lbs/cu.ft./inch during early rearing.

9.1.6) Fish health maintenance and monitoring.

Disease monitoring is accomplished through daily observations by hatchery staff and monthly monitoring by fish health biologists/pathologists from the OFHC.

Any abnormal situations observed by hatchery personnel are called to the attention of the OFHC which performs diagnostic and confirmatory clinical tests before recommending appropriate treatments. Treatment procedures may include environmental manipulation to control stresses and enhance the fish's ability to recover from infectious agents and/or appropriate chemicals or antibiotics. Antibiotics and chemicals that are registered for fish disease treatments are applied as per labeled instructions. Other therapeutic drugs and chemicals may be applied through

appropriate INAD permits or by allowable extra-label prescription by staff Veterinary Medical Officer or local veterinarian.

Mild cases of coagulated yolk (White Spot) are sometimes present in incubating fry but have been insignificant in terms of losses. Dead eggs are removed by hand at the eyed stage or by a mechanical egg sorting machine in instances where mortality is higher than normal (>5%).

During spawning operations, adult populations are tested for all reportable fish pathogens at the minimum APPL of 5%. At least 150 female adults are tested for viruses and all females are individually tested for levels of *R. salmoninarum* by ELISA. The results are used to segregate egg groups into relative risk groups to reduce and contain any vertical transmission of *R. salmoninarum* and resultant Bacterial Kidney Disease.

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.
See above.

9.2) <u>Rearing</u>:

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 or for years dependable data are available..

Table 26. Percent survival estimates for juvenile SCS, WNFH, 1996 to 2007.

Brood Year	Fry to Fingerling (%)	Fingerling to Smolt (%)
1996	97	99
1997	99	99
1998	96	95
1999	98	100
2000	99	99
2001	99	89
2002	98	96
2003	99	91
2004	95	83
2005	99	89
2006	98	88
2007	99	79
2008	98	80
2009	99	91
2010	99	99

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

Winthrop NFH strives to maintain density indices at or below 0.11 lbs/cu.ft./inch (DI). Actual density indices for various months are displayed in Table 27.

Table 27. Average monthly production density and flow indices, WNFH, 2000 to 2009.

Month	Development Stage	Temp[1] ^{0}F Ave	Water source[2] % Well	Water source[2] % River	Flow GPM[3]	Flow Index (lbs./in.*GPM)[4]	Density Index (lbs./in.*ft^3)[4]
August	Egg	NA	100%	0%	NA	NA	NA
September	Egg	NA	100%	0%	NA	NA	NA
October	Egg	NA	100%	0%	NA	NA	NA
November	Sac Fry	NA	100%	0%	NA	NA	NA
December	Fry	49.3	100%	0%	1,280	0.36	0.08
January	Fry	47.1	100%	0%	1,280	0.36	0.05
February	Fry	46.5	100%	0%	2,400	0.36	0.05
March	Fingerlings	46.8	100%	0%	2,400	0.49	0.06
April	Fingerlings	46.0	100%	0%	2,400	0.33	0.03
May	Fingerlings	48.0	100%	0%	4,500	0.28	0.05
June	Fingerlings	48.0	100%	0%	6,950	0.39	0.05
July	Fingerlings	51.0	100%	0%	6,950	0.43	0.05
August	Fingerlings	52.0	100%	0%	6,950	0.46	0.05
September	Fingerlings	50.3	100%	0%	6,950	0.34	0.07
October	Fingerlings	47.8	60%	40%	11,450	0.39	0.08
November	Yearlings	43.3	50%	50%	11,450	0.40	0.08
December	Yearlings	39.5	50%	50%	6,950	0.40	0.08
January	Yearlings	40.9	40%	60%	6,950	0.42	0.08
February	Yearlings	41.3	30%	70%	11,450	0.43	0.08
March	Yearlings	42.7	20%	80%	11,450	0.48	0.09
April	Smolt	44.0	20%	80%	11,450	0.50	0.10

Unless otherwise indicated, all values are for end of the month totals or values obtained for the last ten days of the month and not daily averages for the month.

Dissolved oxygen is measured during critical periods of disease, elevated temperatures, restricted flows, or fouled water. Minimum D0[2] for salmonids is 5 mg/L (Piper et al., 1992)*. To date WNFH has not been below this value (C. Pasley pers.comm. 5/27/09).

[1]Temperature data is manually measured weekly and averaged for the month

[2]Data indicated approximate water source usage. Actual usage depends on a variety of factors including disease and maintaining water (through well water inclusion) temperatures to minimize the formation of slush ice water.

[3] Estimated GPM used by brood. Calculated by dividing total weight (lbs.) by the length (inches) multiplied by the flow.

[4]Index averaged from Winthrop NFH lot history records from this brood year (2002).

*Piper, R.G., I.B. McElwain, L.E. Orme, J.P. McCraren, L.G. Fowler, & J.R. Leonard. 1982 Fish Hatchery Management. US Department of Interior. Pp 503.Washington DC.

9.2.3) Fish rearing conditions

All spring Chinook salmon are reared on 100% ground water for the first 10 to 12 months if possible. Dissolved oxygen (DO) is periodically measured with a calibrated YSI digital meter or a Common Sensing meter. DO is normally 9 to 10 ppm at the inflow and 8 to 9 ppm at the outflow of all rearing units. Surface water is mixed with ground water during the last 6 to 8 months of rearing, gradually increasing the percentage of surface water until release. The DO of surface water is normally at or near saturation at the given temperature. Thermographs are constantly monitoring temperature of the water sources and weekly temperatures are also taken at each group of rearing units. Ground water temperatures are quite constant with a small range of 47 to 52 ˚F. Surface water temperatures are directly affected by air temperatures and can vary significantly during each day and through the differing seasons. Temperatures can range from as low as 33 ˚F in December to as high as 67 ˚F in August. Total gas pressure has been measured when suspected supersaturation problems occur. A YSI saturometer is used to verify total gas saturation and resulting gas bubble disease which can occur during low well levels. Low water levels in the wells have created cavitation problems with the well pump which produces total gas pressures up to 108 percent saturation. These problems have caused minor mortality. The few gas saturation problems which have occurred here have been solved by strategies such as adding screens to increase spray and nitrogen dissipation, turning down variable speed motors, or shutting pumps down periodically to allow the wells to recharge for a number of days. Also see Table 27.

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.

Table 28. WNFH - Rearing Environment Model for Spring Chinook, average values.

Month	Development Stage	Number on hand	Total Weight	Ave Size (#/lb)	Ave Size (g)	Length Ave (mm)	Condition Factor (K= g/mm^3)	Growth Rate (mm/mo.)	Monthly Growth Rate (weight)
August	Egg	NA	NA	NA	NA	NA	NA	NA	NA
September	Egg	NA	NA	NA	NA	NA	NA	NA	NA
October	Egg	NA	NA	NA	NA	NA	NA	NA	NA
November	Sac Fry	571,355	NA	NA	NA	NA	NA	NA	NA
December	Fry	557,595	511	1091.2	0.4	35.052	9.29E-06	NA	NA
January	Fry	566,027	1,048.00	540.1	0.8	44.196	9.27E-06	9.144	0.4
February	Fry	565,228	1,874.00	301.6	1.5	53.848	9.61E-06	9.652	0.7
March	Fingerlings	555,043	2,941.00	188.7	2.4	62.484	9.84E-06	8.636	0.9
April	Fingerlings	549,413	4,182.00	131.4	3.5	70.612	9.94E-06	8.128	1.1
May	Fingerlings	547,144	5,695.00	96	4.7	78.74	9.63E-06	8.128	1.2
June	Fingerlings	544,957	9,495.00	57.4	8	93.472	9.80E-06	14.732	3.3
July	Fingerlings	542,614	10,852.00	50	9.1	97.79	9.73E-06	4.318	1.1
August	Fingerlings	541,555	12,115.00	44.7	10.1	101.346	9.70E-06	3.556	1
September	Fingerlings	540,209	17,164.00	31.5	14.5	114.046	9.78E-06	12.7	4.4
October	Fingerlings	540,684	20,589.00	26.3	17.2	121.158	9.67E-06	7.112	2.7
November	Yearlings	540,267	21,662.00	24.9	18.2	123.444	9.68E-06	2.286	1
December	Yearlings	539,932	21,519.00	25.1	18.2	123.19	9.74E-06	-0.254	0
January	Yearlings	539,384	22,981.00	23.5	19.2	125.984	9.60E-06	2.794	1
February	Yearlings	539,997	23,912.00	22.6	20	127.508	9.65E-06	1.524	0.8
March	Yearlings	538,191	28,370.00	18.9	23.8	135.128	9.65E-06	7.62	3.8
April	Smolt	545,062	31,042.00	17.3	26.3	139.446	9.70E-06	4.318	2.5

Unless otherwise indicated, all values are for end of the month totals or values obtained for the last ten days of the month and not daily averages for the month.

Dissolved oxygen is measured during critical periods of disease, elevated temperatures, restricted flows, or fouled water. Minimum d0^2 for salmonids is 5 mg/L (Piper et al., 1992)*. To date WNFH has not been below this value (C. Pasley pers.comm. 5/27/09).

*Piper, R.G., I.B. McElwain, L.E. Orme, J.P. McCraren, L.G. Fowler, & J.R. Leonard. 1982 Fish Hatchery Management. US Department of Interior. Pp 503.Washington DC.

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

Energy reserve data, through routine monitoring of body fat content, is not conducted on a routine basis. On a quarterly basis, fish health profiles are conducted through the collection of a Goede Index that ascribes qualitative values to external and internal observations of fish health. Data is available through WNFH. Also see Tables 28 and 29.

Table 29. WNFH feed type, application rates and food/length conversion rates for an average production year.

Month	Development Stage	Feed Type	Feed Fed Per Day (lbs)	Total Fed (lbs./mo.)	Feeding Rate %BW/day[1]	Food Conversion (lbs.Fed/lb. Gain)	Conversion Temp. Units per in. growth[1]
August	Egg	NA	NA	NA	NA	NA	NA
September	Egg	NA	NA	NA	NA	NA	NA
October	Egg	NA	NA	NA	NA	NA	NA
November	Sac Fry	NA	NA	NA	NA	NA	NA
December	Fry	Rangen SM Start	6	176	1.00%	0.33	NA
January	Fry	Rangen SM Start	18	558	1.26%	0.61	63
February	Fry	Rangen SM 1/32	24	667	1.49%	0.66	47
March	Fingerlings	Rangen SM 3/64	41	1265	1.19%	0.67	41
April	Fingerlings	Rangen SM 1/16	50	1512	1.21%	0.76	43
May	Fingerlings	Rangen SM 3/32	54	1681	1.31%	2	38
June	Fingerlings	Rangen SM 3/32	70	2101	1.17%	0.9	46
July	Fingerlings	Rangen SM 3/32	90	2778	0.91%	1.46	42
August	Fingerlings	Rangen SM 3/32	70	2160	0.82%	1.64	53
September	Fingerlings	Rangen SM 3/32	57	1714	0.92%	1.28	59
October	Fingerlings	Rangen SM 3/32	81	2512	0.82%	1.94	60
November	Yearlings	Rangen SM 1/8	198	5944	0.73%	3.79	63
December	Yearlings	Rangen SM 1/8	25	780	0.38%	-7.09	65
January	Yearlings	Rangen SM 1/8	36	1116	0.28%	2.89	68
February	Yearlings	Rangen SM 1/8	108	3345	0.29%	0.78	70
March	Yearlings	Rangen SM 1/8	190	5895	0.43%	0.96	67
April	Smolt	Rangen SM 1/8	258	3877	0.46%	1.04	63

Unless otherwise indicated, all values are for end of the month totals or values obtained for the last ten days of the month and not daily averages for the month.

1-Factor utilized to determine feed application rates calculated as the %body weight(BW) in total mass divided by total pounds fed.

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*).

See Table 29.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Disease monitoring is accomplished by daily visual observations by hatchery staff and once monthly monitoring by fish health biologists/pathologists from the OFHC. At least three weeks prior to release, all smolt lots are tested for reportable pathogens at the 5% APPL. All test records and results are on file at the OFHC.

Any abnormal situations observed by hatchery personnel are called to the attention of the OFHC which performs diagnostic and confirmatory clinical tests before recommending appropriate treatments. Treatment procedures may include environmental manipulation to control stresses and enhance the fish's natural ability to recovery from infectious agents and/or appropriate chemicals or antibiotics. Antibiotics and chemicals that are registered for fish disease treatments are applied as per labeled instructions. Other therapeutic drugs and chemicals may be applied through appropriate INAD permits or by allowable extra-label prescription by staff Veterinary Medical Officer or local Veterinarian.

During the rearing period, fish culture equipment is rinsed in disinfectant following use in each pond. Bird exclusion devices are used on all rearing units to minimize the spread of disease through bird predation. All tools used for pond cleaning, sampling, or other rearing operations are either disinfected between ponds or each pond has its assigned cleaning tools or nets. Employees entering rearing units are required to disinfect their boots or waders between rearing units.

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

Not applicable

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

Not applicable

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

Starting in 2000 Winthrop NFH discontinued propagating the Carson ancestry stock and started propagating the Methow River Composite stock.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Table 30. Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs	0			
Unfed Fry	0			
Fry	0			
Fingerling*	200,000	30 to 35	Fall Transfer	Okanogan Basin or Chief Joe Hatchery†
Yearling	400,000	15 to 20	April 10 - 20	Methow River

* This transfer will likely become a green or eyed egg transfer when CCT facilities are available.

†This transfer is part of CCT programs in the Okanogan River basin and/or Chief Joe Hatchery and is covered as part of their respective HGMPs.

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse: Methow River (WRIA 48)
Release point: River Mile 50.4
Major watershed: Columbia River
Basin or Region: Upper Columbia Basin

For releases from CCT program, please see CCT HGMP.

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

Table 31. Size and release numbers of SCS at WNFH for release years 1999-2012.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1999	0						545,062	13.8
2000	0						377,696	14.1
2001	0						175,869	13.7
2002	187,407	1200					201,604	17.8
2003	408,000	1200					461,678	19.6
2004	367,912	1200					578,133	17.3
2005	139,650	1200					550,214	15.7
2006	15,639	1200					484,090	14.8
2007	9,667	1200					589,693	18.4
2008	11,400	1200					509,045	15.0
2009	0						380,000	17.0
2010	0						495,978	15.3
2011	0						426,980	14.4
2012	0				90,220	34	551,509	15.3
Average	81,405	1200			6,444	34	451,968	15.9

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

Table 32. Release dates, how, what stage, and where released, WNFH.

Migration Year	Release Date	Type Release	Life Stage	Release Site
2005	April 15	Forced	Yearling/smolt	Methow River at Winthrop
2006	April 20	Forced	Yearling/smolt	Methow River at Winthrop
2007	April 11	Forced	Yearling/smolt	Methow River at Winthrop
2008	April 14	Forced	Yearling/smolt	Methow River at Winthrop
2009	April 16	Forced	Yearling/smolt	Methow River at Winthrop
2010	April 19	Forced	Yearling/smolt	Methow River at Winthrop
2011	April 18	Forced	Yearling/smolt	Methow River at Winthrop
2012	October 7	Forced	Yearling/pre-smolt	Methow River at Winthrop
2012	April 16	Forced	Yearling/smolt	Methow River at Winthrop

Previous to migration year 2000, a specific release date was chosen based on the start of spill operations at downstream hydroelectric projects. Beginning in 2001, the option was given to release during a window of opportunity (increasing flows and turbidity) while bypass operations were in place. The rearing units used for spring Chinook are not set up for volitional release and would require considerable modifications in order to function correctly during a volitional release. Therefore the hatchery continues to force release juvenile spring Chinook on a single date that is timed to both coincide with increasing flows and turbidity as well as the initiation of bypass operations at downstream hydro facilities. The date of release varies based on yearly climatic conditions but generally occurs in mid-April (Table 32).

10.5) Fish transportation procedures, if applicable.

Spring Chinook salmon are generally not transported off station for release. However, if numbers of fish on station exceed program goals and appropriate release sites are available some fish may be transported to tributary streams or to a different watershed. Fish trucks are set up with oxygen tanks and aerators. Truck tanks are loaded at 0.3 to 0.5 pounds of fish per gallon of water.

10.6) Acclimation procedures.

At this time, all acclimation occurs at WNFH. Fish are reared on 100% ground water for the first 10 to 12 months of the 18-month rearing cycle, if possible. River water is gradually introduced after that time period. The percentage of river water is gradually increased each month to a final mixture of about 80% river water and 20% ground water for at least the last two months of rearing.

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

Starting with brood year 2011, all (100%) spring Chinook salmon will be coded-wire tagged (CWT) and receive an adipose fin-clip. In years where adult returns do not allow the production of more than 200,000 smolts or in cases where a catastrophic event (e.g. disease outbreak, infrastructure failure, etc.,) limits production to less than 200,000 smolts, then the USFWS would seek an alternative marking scheme to differentiate WNFH from other Methow River hatchery programs (and from natural origin fish) but would not expose that brood year to lower river selective fisheries. This marking scheme has been discussed with and has the consensus of the parties to the US v OR Management Agreement and is reflected in the latest revision to the US v OR Management Agreement.

Broods previous to 2000 were also adipose fin clipped. From brood year 2000 to 2010, listed stocks did not receive a fin clip, only a CWT, while unlisted stocks received a fin clip to help differentiate listed and unlisted stocks without having to kill the fish first (Table 33). Passive Integrated Transponders (PIT) are also used on a smaller scale. Numbers of PIT- tagged fish released have ranged from 2,000 to 27,500 in recent years.

Table 33. Winthrop NFH spring Chinook releases by life stage and applied mark and/or tag, 1990 – 2008.

Brood Year	Release Year	Yearlings	Sub-Yearlings	Fry	TOTAL	CWT # Tagged	% Adipose Clipped	# PIT Tagged
1989	1990		203,471		203,471			
1989	1991	1,055,056			1,055,056	107,670	10%	
1990	1991		417,864	164,900	582,764			
1990	1992	624,771			624,771	90,620	15%	
1991	1993	950,624			950,624	189,187	20%	1,489
1992	1994	556,313			556,313	140,873	25%	1,398
1993	1995	770,847			770,847	164,456	21%	1,496
1994	1996	112,395			112,395	110,878	99%	1,493
1995	1997	14,620			14,620	14,620	100%	
1996	1998	324,851			324,851	324,851	100%	9,542
1997	1999	545,062			545,062	513,724	94%	7,490
1998	2000	377,696			377,696	364,632	97%	7,490
1999	2001	175,869			175,869	171,496	98%	7,422
2000	2002	201,604			201,604	201,604	0%	27,459
2001	2002		64,683		64,683	59,474	0%	
2001	2003	461,678			461,678	439,785	57%	19,962
2002	2004	578,307			578,307	513,687	7%	19,887
2003	2005	550,214			550,214	527,836	18%	3,600
2004	2006	484,090			484,090	457,074	0%	4,489
2005	2007	589,693			589,693	589,098	37%	3,833
2006	2008	509,045			509,045	496,067	0%	2,987
2007	2009	371,959			371,959		20%	
2008	2010	495,978			495,978			
2009	2011	426,980			426,980			
2010	2012	641,729			641,729		0%	

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

Fish that are found to be surplus to approved needs will be transferred for acclimation and released outside the Methow basin (e.g. Okanogan or Mainstem Chief Joseph Hatchery). WNFH does not have the capability (space or water) to rear surplus spring Chinook salmon to the smolt stage.

10.9) Fish health certification procedures applied pre-release.

Sixty fish from all juvenile lots are sampled and tested for reportable bacterial and viral pathogens with methods that meet or exceed all national, international, IHOT or co-manager requirements. Monthly monitoring of juveniles for parasites, gill, internal organ, and overall condition continues until release.

10.10) Emergency release procedures in response to flooding or water system failure.
Emergency releases could occur only when no other choice is available. National Marine Fisheries Service must be contacted within 24 hours after the release. Listed spring Chinook salmon are the preferred fish to be released first followed by listed summer steelhead as their impacts to wild fish would be less than coho salmon.

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.
All releases of spring Chinook salmon occur when fish are fully smolted in mid to late April. Releases are normally timed with rising river conditions which helps move fish out of the system swiftly. Spring Chinook salmon released from this facility do not stay around for more than 24 hours following a release. Sonar equipment at Wells Dam, the first dam about 60 miles below WNFH, usually detects large schools of WNFH fish within 24 hours of release time. Passive Integrated Transponders (PIT) verify this movement with detections at Rocky Reach Dam shortly thereafter. Very few residual fish, generally less than a dozen, are observed at the hatchery outfall for any length of time following a release.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

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

Monitoring and evaluation of many of the aforementioned performance indicators are currently conducted by WDFW as part of Douglas and Chelan Public Utility District (DCPUD) funded programs at Methow (spring Chinook) and Wells Hatcheries (steelhead). This is largely due to the timing and nature of how programs at Wells Hatchery and WNFH were developed. Because of the numerous changes occurring to both USFWS WNFH and DCPUD steelhead programs in the Methow Basin there is an identified need to develop a single cohesive M&E Plan that addresses the needs of both USFWS and WDFW (DCPUD funded) programs and that incorporates the programmatic changes proposed in this and other forthcoming HGMPs. Using the framework provided in the existing DCPUD M&E Plan the USFWS will develop a new M&E plan for WNFH that addresses all of the performance indicators and programmatic changes discussed in this HGMP. The USFWS anticipate that much of this M&E will continue to be conducted by WDFW and the USFWS will continue to work cooperatively within the Wells HCP framework to ensure that changes at all of the Methow Basin hatchery programs are addressed by the appropriate parties. This may entail an increased M&E responsibility for the USFWS as changes at the MFH and WNFH are realized.

The USFWS and WDFW, as the two hatchery operators in the Methow Basin, are working cooperatively with other parties working in the Methow Basin (e.g. USGS, BOR, Wild Fish Conservancy) to enable improved coordination between research and monitoring projects evaluating habitat restoration and the research, monitoring and evaluation efforts associated with hatchery programs. We anticipate that future research monitoring and evaluation efforts at WNFH will largely be developed in the context of and in cooperation with these other parties.

Legal Mandates

Performance Indicator 1:

- Ensure, when possible, that production numbers meet those negotiated through *U.S. v. Oregon.*
- Estimate WNFH's contribution to harvest through CWT recoveries.

Performance Indicator 2:

- ESA consultations under Section 7 and 10 have been submitted and accepted. Modifications to existing BA's are completed to cover any program changes.

Harvest

Performance Indicators 3a – 3c:

- Estimate number of fish harvested through CWT recoveries.
- Mark production sufficiently to obtain statistically valid evaluation data. Current production is 100% marked.
-

Conservation of Wild/Naturally Spawning Populations

Performance Indicators 4a – 4c and 5a and 5b:

- Estimate contribution to natural spawning through retrieval and de-coding of CWT's obtained on the spawning grounds. Also see above.

Life History Characteristics

Performance Indicators 6a – 9d:

- Release numbers do not exceed mitigated requirement or level stated in hatchery BiOp.
- Ensure release dates coincide with wild fish migration timing.
- Smolts are released during or just prior to smoltification which promotes a rapid migration.
- Estimate travel time and survival through the Columbia corridor using data obtained from PIT tag recoveries at mainstem hydroelectric dams.
- Bio-sample all returning adults at the hatchery. Produce annual report covering life history characteristics of the hatchery population.
- Hatchery brood is comprised entirely of adults volunteering into the facility. Ladder

is open throughout the run to cover the full spectrum of the return.

- Because of the rarity of natural origin adults entering the holding ponds (one since 2000), the collection of brood at WNFH should not affect natural production in the basin.
- The production goal for releases into the Methow River has been reduced by ~33%. Once carrying capacity for the Methow River Basin has been determined, production numbers could be adjusted with co-manager approval.

Genetic Characteristics

Performance Indicators 10a – 12a:

- Juveniles are force released directly from the hatchery to promote homing back to the facility.
- Mark juveniles sufficiently to obtain valid stray-rate estimates.
- Stray rates are calculated through CWT recoveries on the natural spawning grounds.
- Estimate optimal release time using historical emigration data and hatchery records.
- As in years past, continue to take tissue samples from the hatchery population for genetic comparison to the "natural" population.
- Continue to obtain and utilize adults taken from throughout the entire spectrum of the run.
- If allowed, remove all hatchery adults entering the facility in excess of brood needs. Donate to pre-approved sources.

Research Activities

Performance Indicators 13 – 14:

- Promote and conduct experiments as stated in the 2001 NMFS BiOp, when feasible. Study designs are peer reviewed when applicable.
- Annual reports are prepared covering bio-sampling of hatchery adults, return estimates by brood year, harvest, and stray rates.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.
Current funding fully supports the evaluation program as is. The BOR has been supportive of funding, as necessary.

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.

Conduct monitoring and evaluation program in accordance with guidelines presented in the Biological Opinion covering this facility.

SECTION 12. RESEARCH

Specific research projects are not currently underway or proposed for the WNFH spring Chinook program. We do anticipate that research will play a key role in the future improvement and assessment of this program. As research projects are developed, they will be provided to NMFS and other appropriate parties for consideration as a supplement to this HGMP.

12.1) Objective or purpose.

Indicate why the research is needed, its benefit or effect on listed natural fish populations, and broad significance of the proposed project.

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

12.6) Dates or time period in which research activity occurs.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

12.8) Expected type and effects of take and potential for injury or mortality.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

12.10) Alternative methods to achieve project objectives.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

(*e.g. "Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.")*.

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 David B. Fluing Date: 11/21/2012

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Spring Chinook Salmon ESU/Population: Upper Columbia River / Methow Subbasin Activity: Broodstock Collection				
Location of hatchery activity: WNFH Dates of activity: May 15 – Sept 15 Hatchery program operator: USFWS-WNFH				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c) NOR fish (may be transferred to MFH for brood)			10	
Capture, handle, and release c) HOR, MFH origin transferred for brood at MFH fish			200	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e) HOR MFH and WNFH origin			400	
Intentional lethal take f)Management of HOR escapement			500 to 1,450 annually for pHOS management†	
Unintentional lethal take g)			Up to 10% of (e) above	
Other Take (specify) h)				

a. Contact with listed fish through 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 occurring due to 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.
†This is a HOR collection level that will vary annually depending on the size of the HOR run and will target a pHOS management goal of ≤0.25. This range is the WNFH portion of the total HOR removal identified in the basin wide analysis completed by USFWS, DPUD, and WDFW.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.