# FINAL

# HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

| | |
|---|---|
| **Hatchery Program:** | Umatilla River Summer Steelhead Program |
| **Species or Hatchery Stock:** | Umatilla River Summer Steelhead stock 091 |
| **Agency/Operator:** | Oregon Dept. of Fish & Wildlife/CTUIR |
| **Watershed and Region:** | Umatilla/Columbia/Oregon |
| **Draft Submitted:**<br>**Submitted for Take Permit:**<br>**Updated Draft Submitted:** | July 19, 2005<br>January 7, 2011<br>May 2, 2017 |
| **Date Last Updated:** | April 26, 2017 |

## SECTION 1. GENERAL PROGRAM DESCRIPTION

**1.1) Name of hatchery or program**.

Umatilla River Summer Steelhead Program

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

Endemic Umatilla River Summer Steelhead (*Oncorhynchus mykiss*) (stock 091). Both the hatchery and wild populations of the Umatilla River summer steelhead (stock 091) are listed as "Threatened" under the federal ESA.

**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:**
*Confederated Tribes of the Umatilla Indian Reservation* - Co-managers and operators of acclimation and adult collection facilities.

*Bonneville Power Administration* – Provides funding for hatchery operations, acclimation, adult collection and monitoring and evaluation activities.

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

Umatilla Hatchery is funded by the Bonneville Power Administration. Oregon

Department of Fish & Wildlife operates the facility, and staff consists of one F&W Manager 1, one F&W Senior Technician, four and a half F&W Technician, two Facility Maintenance Specialists, and six months of Administrative support. For the Fiscal Year 2008 Umatilla Hatchery operation budget was $966,664.

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

*Adult Collection* - Summer steelhead broodstock are collected at the Three Mile Falls Dam adult trapping facility located approximately four miles upstream from the mouth of the Umatilla River, near the town of Umatilla, in Umatilla County, Oregon. The regional mark processing center site code for Three Mile Falls Dam is 5F33427 H27 24.

*Holding and Spawning* - Summer steelhead broodstock are transferred to Minthorn Springs (Minthorn) for holding and spawning. Minthorn is located approximately four miles east of Mission in Umatilla County, Oregon. The facility is located on Minthorn Springs Creek. The creek is approximately one mile long with the facility located near the mouth at approximately Umatilla RM 64. The regional mark processing center site code for this facility is 5F33414 H14 22.

*Incubation and Rearing (from green egg to smolt)* - Green eggs are transferred from Minthorn facility to Umatilla Hatchery for incubation and rearing. Umatilla Hatchery is located along the Columbia River approximately two miles west of Irrigon in Morrow County, Oregon. The regional mark processing center site code for Umatilla Hatchery is 5F33449 H49 21.

*Acclimation to Release* - Juvenile summer steelhead are transferred to the Minthorn Springs and Pendleton acclimation facilities for final rearing and release. The Minthorn facility description is discussed above under the "Holding and Spawning" facility, which is approximately four miles east of Mission in Umatilla County, at RM 64, where 50,000 smolts are released. The Pendleton Acclimation Facility is located on the Umatilla River at RM 56 in Umatilla County, Oregon, where 50,000 smolts are released.

*Direct Release*- About 50,000 smolts are direct released at Thornhollow on the Umatilla River, RM 73.5.

**1.6) Type of program.**

*Integrated Harvest Program* - The Umatilla River Summer Steelhead Program integrates supplementation and harvest augmentation.

The hatchery program utilizes steelhead endemic to the Umatilla Basin. Recently, the program transitioned to using 70 wild-origin and 40 non-stray hatchery-origin adults with CWT, from using 100% of the brood stock from wild adults. Hatchery-origin adults are being incorporated into broodstock at a rate of no more than 33% of the actual spawners, there will be no hatchery x hatchery crosses.
The program will continue to release smolts in three locations. The first location

(Thornhollow) is high in the drainage and shall be favorable for returned adults to enter the natural spawning areas; the second location is at Minthorn Springs which is in the downstream from Thornhollow; and the third release location is at further downstream and located near Pendleton which shall be a good area for adult harvests.

**1.7) Purpose (Goal) of program.**

The goals of the Umatilla River Summer Steelhead Program are threefold: 1) Enhance production through supplementation of hatchery-produced fish using 100% wild broodstock (pNOB); 2) Provide sustainable tribal and non-tribal harvest opportunities (augmentation); and 3) Maintain the genetic influence of the natural population (PNI $\geq$0.67) over hatchery-produced fish (pHOS $\leq$0.33) in the natural spawning ground above Three Mile Falls Dam (see Table 1, Section 2.2.1). Note: Actual composition of hatchery-origin fish on the spawning grounds is expected to be less due to proposed release locations.

**1.8) Justification for the program.**

The Umatilla River hatchery summer steelhead program is intended to both augment and supplement the natural population. The hatchery program uses endemic broodstock, all hatchery releases are adipose fin clipped and juvenile releases are made in natural production areas and at the upper fishery boundary. The intent is to provide additional fish for harvest and to increase production of the natural population, while maintaining the genetic characters of the natural population.

**1.9) List of program "Performance Standards"**

See Section 1.10 below.

## 1.10) List of program “Performance Indicators”, designated by "benefits" and "risks"

### 1.10.1) “Performance Indicators” addressing benefits.

| | Benefits | |
|---|---|---|
| **Performance Standard** | **Performance Indicator** | **Monitoring and Evaluation** |
| Program meets legally mandated rebuilding objectives. | Release 150,000 Summer Steelhead (STS) smolts into the Umatilla River. | Monitor releases to insure numbers fall within IHOT guidelines of ±10% of stated goal. |
| Program meets legally mandated harvest objectives. | Program provides adults for main-stem treaty and non-treaty harvest. | Assess contribution to main-stem fisheries. |
| Program provides predictable, stable, and increased harvest opportunity. | Within tributary treaty and non-treaty harvest seasons occur annually. | Frequency of treaty and non-treaty tributary fisheries will be determined. |
| Restore and create viable natural spawning populations. | Natural adult return and escapement objectives to Three Mile Falls Dam are met. | Monitor adult returns at Three Mile Falls Dam to assess contribution of naturally produced adults. Monitor spawning escapement, redds, and juvenile production numbers. |
| Program is self sufficient utilizing in-basin broodstock. | Enough eggs are collected annually from broodstock collected at Three Mile Falls Dam to meet program release goals. | Broodstock holding and survival data and spawning data including fecundity and viability are monitored to ensure that production goals are met. |
| Release groups are sufficiently marked in order to assess contribution to rebuilding and fisheries goals. | All hatchery fish released are differentially marked either externally (e.g. adipose fin removal) or internally (e.g. coded wire tag). | Adults enumerated at Three Mile Falls Dam, collected for broodstock, harvested, or recovered as carcasses are checked for marks and coded-wire tags to determine survival rates and run composition. |
| Achieve within hatchery performance measures. | IHOT standards are being met. | Rearing and fish health parameters are monitored to ensure that fish culture standards are being attained. |
| Conduct hatchery and natural production RM&E to improve program performance. | Develop comprehensive subbasin RM&E plan. | Determine if RM&E tasks outlined in the plan are being implemented. |
| Communicate and coordinate effectively with co-managers in the Columbia River basin. | Participate in US v Oregon production advisory committee (PAC) meetings. | Provide technical information for PAC reports. |

### 1.10.2) “Performance Indicators” addressing risks.

| | Risks | |
|---|---|---|
| **Performance Standard** | **Performance Indicator** | **Monitoring and Evaluation** |
| Minimize impacts to ESA listed and other native species from enumeration and broodstock collection activities. | Level of trapping and handling mortality of STS at Three Mile Falls Dam. | Trap and recovery tank mortalities will be enumerated. |
| Minimize number of natural STS collected for broodstock. | Pre-spawn mortality of STS brood at Minthorn Springs. | Holding pond mortalities will be enumerated. |
| Minimize impacts to ESA listed and other native species from disease transmission. | Program will be in compliance with IHOT fish health transfer guidelines. | ODFW pathology will examine the fish at least once per month and just prior to transfer. |
| Minimize impacts to ESA listed and other native species from juvenile hatchery releases. | Smolts will be released. | Outmigration timing and survival will be monitored at Three Mile Falls Dam. |
| Minimize impacts to ESA listed and other native species from program adults straying. | Number of program adults captured in other basins. | CWT and PIT tag recoveries of program adults are accessed through the PSMFC data bases and summarized. |
| Minimize impacts to ESA listed and other native species from program related harvest activities. | Number or percent of natural STS taken or caught and released in treaty and non-treaty tributary fisheries. | Creel surveys are conducted by the state and Tribal agencies to ensure take limitations for STS are not being exceeded. |
| Manage number of hatchery origin STS in natural spawning areas. | Number or percent of hatchery STS observed in natural spawning areas and observed passing Three Mile Falls Dam. | Redd surveys are conducted by CTUIR and the number of hatchery adults pass enumerated at Three Mile Falls Dam |

**1.11) Expected size of program.**

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

Annual broodstock collection goal is for 70 wild-origin and 40 non-stray hatchery-origin adults with CWT.

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

| Life Stage | Release Location | Annual Release Level |
|---|---|---|
| **Eyed Eggs** | | 0 |
| **Unfed Fry** | | 0 |
| **Fry** | | 0 |
| **Fingerling** | | 0 |
| **Yearling** | Minthorn (RM 64) | 50,000 (Acclimated) |
| | Pendleton (RM 56) | 50,000 (Acclimated) |
| | Thornhollow RM 73.5) | 50,000 (Direct release) |

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

- Estimated smolt-to-adult survival: Subbasin Plan goal for smolt to adult survival is 1.0%. The average smolt-to-adult survival from brood years 1991-2004 ranged from 0.1-1.1% and averaged 0.50% (Appendix Table 1, Clarke et al. 2009).

- Total adult production: Subbasin Summary goal is 1,500 hatchery adult returns to Three Mile Falls Dam (TMFD). Since run year 1987-88, hatchery adult returns to TMFD have ranged from 165 to 1,895 and averaged 773 (Clarke et al. 2009).

- Non-endemic hatchery steelhead enumerated at TMFD from run years 1992-93 to 2007-08 comprised an average of 17.6% of hatchery returns and 6.0% of combined hatchery and natural returns (Appendix Figure 1; Clarke et al. 2009). Most non-endemics originated from hatchery smolt releases in the Tucannon and Wallowa rivers. Seventy-six percent of Tucannon River and 41% of Wallowa River non-endemics were enumerated at TMFD in the fall. Up-river coded-wire tag recovery from 1992 to 2006 suggests only 59% of non-endemics observed at TMFD remained in the system in winter and spring.

- Adult escapement to natural production areas: Since run year 1987-88, hatchery adult

escapement to natural production areas have ranged from 102 to 1,661 and averaged 836 in the most recent 12 years (Section 2.2.2, Contor et al. 2008). Since run year 1987-88, wild adult returns to TMFD have ranged from 724 to 3,621 and averaged 1,752 or 68% of the natural spawners (Clarke et al. 2009; Table 1).

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

The current summer steelhead program (100% rearing at Umatilla Hatchery) began in 1991 with smolt releases in 1992. However, hatchery steelhead smolts have been released into the Umatilla River Basin since 1967 (Section 10.3).

**1.14) Expected duration of program.**

This is an on-going program and expected to continue indefinitely.

**1.15) Watersheds targeted by program.**

The Umatilla Summer Steelhead Program targets hatchery releases in the mainstem of the Umatilla River and Meacham Creek.

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

No alternative actions have been developed by either the co-managers or the Hatchery Scientific Review Group (HSRG) for this program.

The original smolt production goal of 210K was never achieved and was revised due to water shortages at Umatilla Hatchery. The original steelhead adult return target of 9,670 was recently reduced to 5,500 (4,000 natural and 1,500 hatchery) as part of the planning process.

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

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

The program operates under the HGMP submitted to NOAA Fisheries on July 19, 2005. This is an updated version of the previously submitted HGMP. In addition, 4d rule research permit # 13765 covers the Outmigration and Survival Study by ODFW.

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

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

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

Umatilla River Summer Steelhead (*Oncorhynchus mykiss*; stock 091) of both wild- and hatchery-origin are included as part of the Mid-Columbia ESU and listed as "Threatened" under the federal ESA. The listed steelhead will be directly affected during brood collection and only wild fish will be used for spawning. The past returns of wild- and hatchery-origin summer steelhead to Three Mile Falls Dam are listed in Table 1.

Table 1. Summer steelhead adult returns to Three Mile Falls Dam and percentage of natural- and hatchery-origin fish, 1987-2008[1].

| Year | # Hatchery Fish | # Wild Fish | Total | % Hatchery Fish | % Wild Fish |
|---|---|---|---|---|---|
| 1987-88 | 165 | 2315 | 2480 | 7 | 93 |
| 1988-89 | 370 | 2104 | 2474 | 15 | 85 |
| 1989-90 | 245 | 1422 | 1667 | 15 | 85 |
| 1990-91 | 387 | 724 | 1111 | 35 | 65 |
| 1991-92 | 523 | 2246 | 2769 | 19 | 81 |
| 1992-93 | 616 | 1297 | 1913 | 32 | 68 |
| 1993-94 | 345 | 945 | 1290 | 27 | 73 |
| 1994-95 | 657 | 874 | 1531 | 43 | 57 |
| 1995-96 | 785 | 1296 | 2081 | 38 | 62 |
| 1996-97 | 1463 | 1014 | 2477 | 59 | 41 |
| 1997-98 | 903 | 862 | 1765 | 51 | 49 |
| 1998-99 | 750 | 1135 | 1885 | 40 | 60 |
| 1999-00 | 752 | 2140 | 2892 | 26 | 74 |
| 2000-01 | 1091 | 2571 | 3662 | 30 | 70 |
| 2001-02 | 1895 | 3621 | 5516 | 34 | 66 |
| 2002-03 | 963 | 2117 | 3080 | 31 | 69 |
| 2003-04 | 1287 | 2101 | 3388 | 38 | 62 |
| 2004-05 | 756 | 1722 | 2478 | 31 | 69 |
| 2005-06 | 488 | 1480 | 1968 | 25 | 75 |
| 2006-07 | 914 | 2566 | 3480 | 26 | 74 |
| 2007-08 | 901 | 2232 | 3133 | 29 | 71 |
| **Average** | **774** | **1752** | **2526** | **31%** | **69%** |

[1]Source: Clarke et al. 2009

To estimate the duration of naturally-produced steelhead in freshwater and salt water, scale samples were taken and processed in order to determine the years spent in the two different environments. Based on scale analysis, over 87.5% of natural adult summer steelhead returning to TMFD spent two years in freshwater before outmigration (Figure 1). Nearly equal numbers of total age 4 (46%) and age 5 (48%) adult steelhead returned in all years combined. There is considerable variability from year to year as shown by the 2007 data (Figure 2).

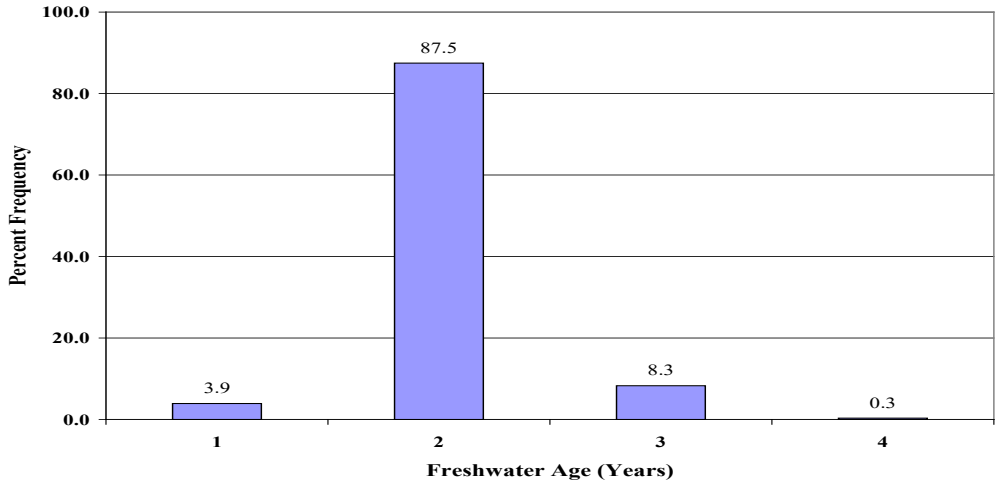



Figure 1. Years of Freshwater Rearing of Natural Summer Steelhead Adults Returning to the Umatilla River, 1983, 1989, 1990, 1992, and 1994-2004, 2006,2007 (n=918). (Source: Clarke et al. 2009)

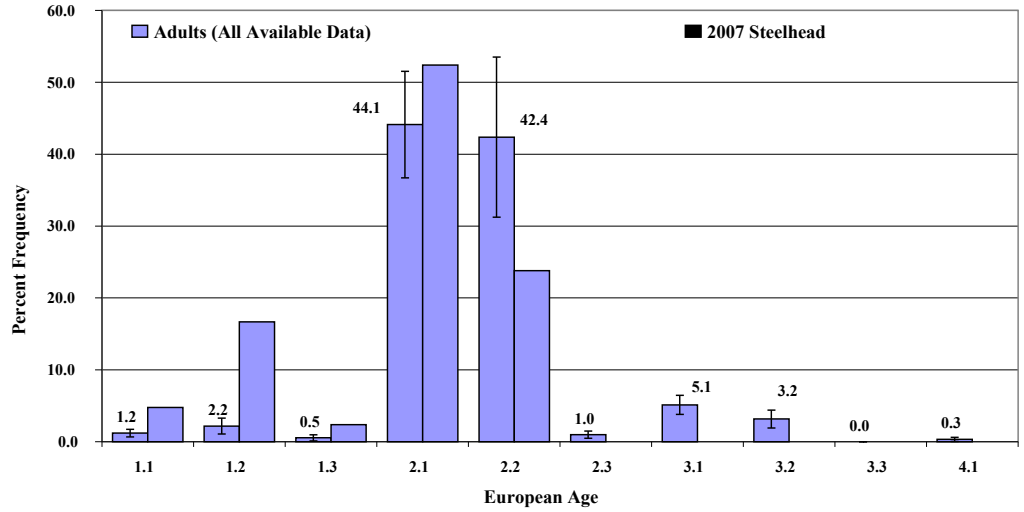



Figure 2. Combined European Age (years of freshwater and salt water rearing) of Natural Summer Steelhead Adults Returning to the Umatilla River (solid bars1983, 1989, 1990, 1992, and 1994-2004, 2006, 2007 return years, n = 918 with plus and minus one standard deviation; banded bars, 2007 data only; n = 42). (Source: Clarke et al. 2009)

Table 2a-2c. Life History Tables of Umatilla STS by River Reach.

2a) From the mouth of the Umatilla to the mouth of McKay Creek (RM 0-50.5).

| Life History Stage | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Adult Migration | x | x | x | x | x | x | x | x | | | | |
| Pre-spawning Holding | | | | | | | | | | | | |
| Spawning | | | | | | | | | | | | |
| Incubation | | | | | | | | | | | | |
| Rearing | x | x | x | x | x | x | x | x | x | x | x | x |
| Juvenile Migration | x | x | x | x | x | x | x | x | x | x | | |

2b) From the mouth of McKay Creek to the mouth of Meacham Creek (RM 50.5-79) and mid-basin streams.

| Life History Stage | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Adult Migration | x | x | x | x | x | x | x | x | | | | |
| Pre-spawning Holding | | | | | x | x | x | x | | | | |
| Spawning | | | | | | x | x | x | | | | |
| Incubation | | | | | | x | x | x | x | | | |
| Rearing | x | x | x | x | x | x | x | x | x | x | x | x |
| Juvenile Migration | x | x | x | x | x | x | x | x | x | | | |

2c) From the mouth of Meacham Creek to the forks (RM 79-89 and headwater streams).

| Life History Stage | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Adult Migration | x | x | x | x | x | x | x | x | | | | |
| Pre-spawning Holding | | | | | x | x | x | x | | | | |
| Spawning | | | | | | x | x | x | | | | |
| Incubation | | | | | | x | x | x | x | | | |
| Rearing | x | x | x | x | x | x | x | x | x | x | x | x |
| Juvenile Migration | x | x | x | x | x | x | x | x | x | | | |

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

Juveniles of ESA listed summer steelhead in the Umatilla River may be incidentally affected during the monitoring and evaluation of program performance. See Section 2.2.3 (Table 6) for incidental mortality of juvenile steelhead. Strays of program fish have not been well documented, although they may stray into the Deschutes, John Day, or Walla Walla basins, but expected to be minimal, if any. Therefore, 40% (20K) smolts of each release group shall have CWT and left ventral fin clip. Additional 1,500 of each release group shall have PIT tagging. These markings shall be used to determine juvenile out-migration timing, survival, and straying of released fish.

### 2.2.2) Status of 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.**

*Abundance and Productivity:* The population viability thresholds of 5% extinction probability over 100 years for summer steelhead defined by the Mid-Columbia Steelhead ESA Recovery Plan are a 10-year geometric mean of 1,500 natural origin spawners and a SAR adjusted and delimited return/spawner productivity of 1.26 (NMFS 2008). Current viability measures reported for the Umatilla population by NMFS (2008) were 1,472 natural spawners and 1.50 return/spawner productivity.

**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.**

Figure 3 below shows progeny-to-parent and smolts per female productivity measures for the Umatilla River naturally-produced steelhead (Clarke et al. 2009, White et al. 2007). All available egg-to-smolt survival and smolt-to-adult return data for Umatilla natural steelhead are presented in Table 3 (White et al. 2007).

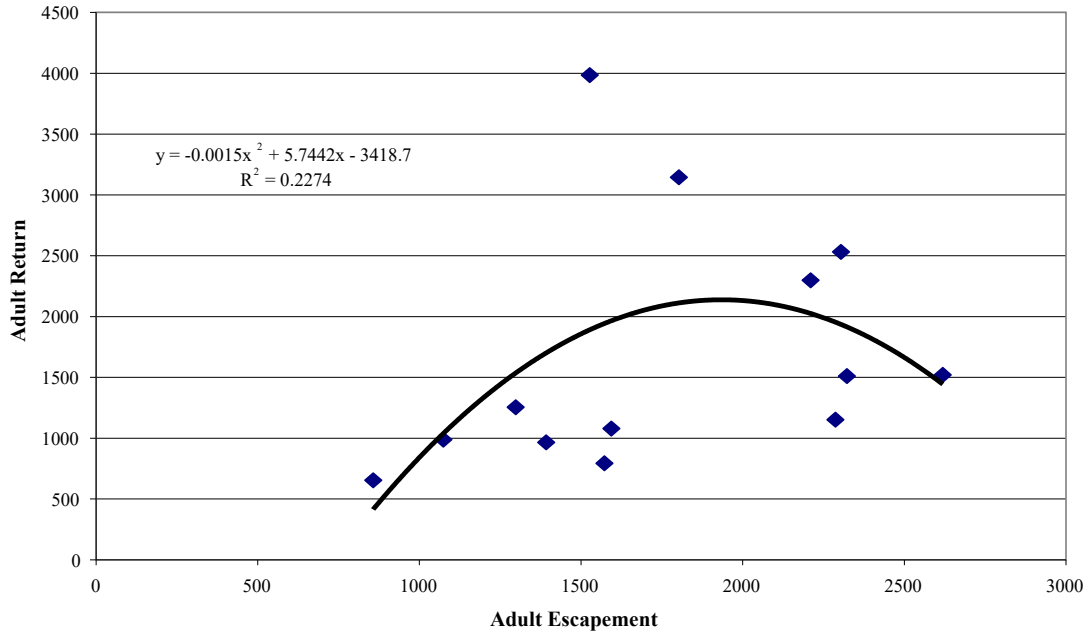



Figure 3. Stock-recruitment curve for Umatilla summer steelhead, 1988-1999 brood years. (Source: Clarke et al. 2009 and White et al. 2007)

Table 3. Egg-to-smolt survival and smolt-to-adult return (SAR) for Umatilla natural steelhead. Data are incomplete for number of smolts produced by the 2003 and 2004 broods, and number of adult returns from the 2001 and 2002 broods. Note: the numbers in the smolt columns vary due to variations in the number of years spent in freshwater before out migration. (Source: White et al. 2007)

| EGG-TO-SMOLT SURVIVAL | | | | SMOLT-TO-ADULT RETURN | | | |
|---|---|---|---|---|---|---|---|
| Brood Year | No. Eggs | No. Smolts | Survival (%) | Outmigration Year | No. Smolts | No. Returns | SAR (%) |
| 1993 | 6,116,187 | 52,010 | 0.85 | 1995 | 54,361 | 837 | 1.54 |
| 1994 | 4,323,435 | 68,162 | 1.58 | 1996 | 73,361 | 1,040 | 1.42 |
| 1995 | 4,824,913 | 26,295 | 0.54 | 1997 | 22,221 | 1,025 | 4.61 |
| 1996 | 5,761,557 | 59,278 | 1.03 | 1998 | 59,182 | 3,151 | 5.32 |
| 1997 | 6,969,537 | 46,532 | 0.67 | 1999 | 46,530 | 2,295 | 4.93 |
| 1998 | 5,267,468 | 83,144 | 1.58 | 2000 | 81,759 | 4,015 | 4.91 |
| 1999 | 5,809,681 | 32,573 | 0.56 | 2001 | 33,844 | 1,131 | 3.34 |
| 2000 | 7,278,281 | 73,177 | 1.01 | 2002 | 77,016 | 2,268 | 2.94 |
| 2001 | 12,631,251 | 26,813 | 0.21 | | | | |
| 2002 | 13,813,433 | 37,559 | 0.27 | | | | |
| 2003 | 11,815,091 | 56,855 | 0.48 | | | | |
| 2004 | 7,214,651 | 31,423 | 0.44 | | | | |
| **93-04 Mean** | **7,279,574** | **50,554** | **0.83** | **95-02 Mean** | **56,034** | **1,970** | **3.63** |

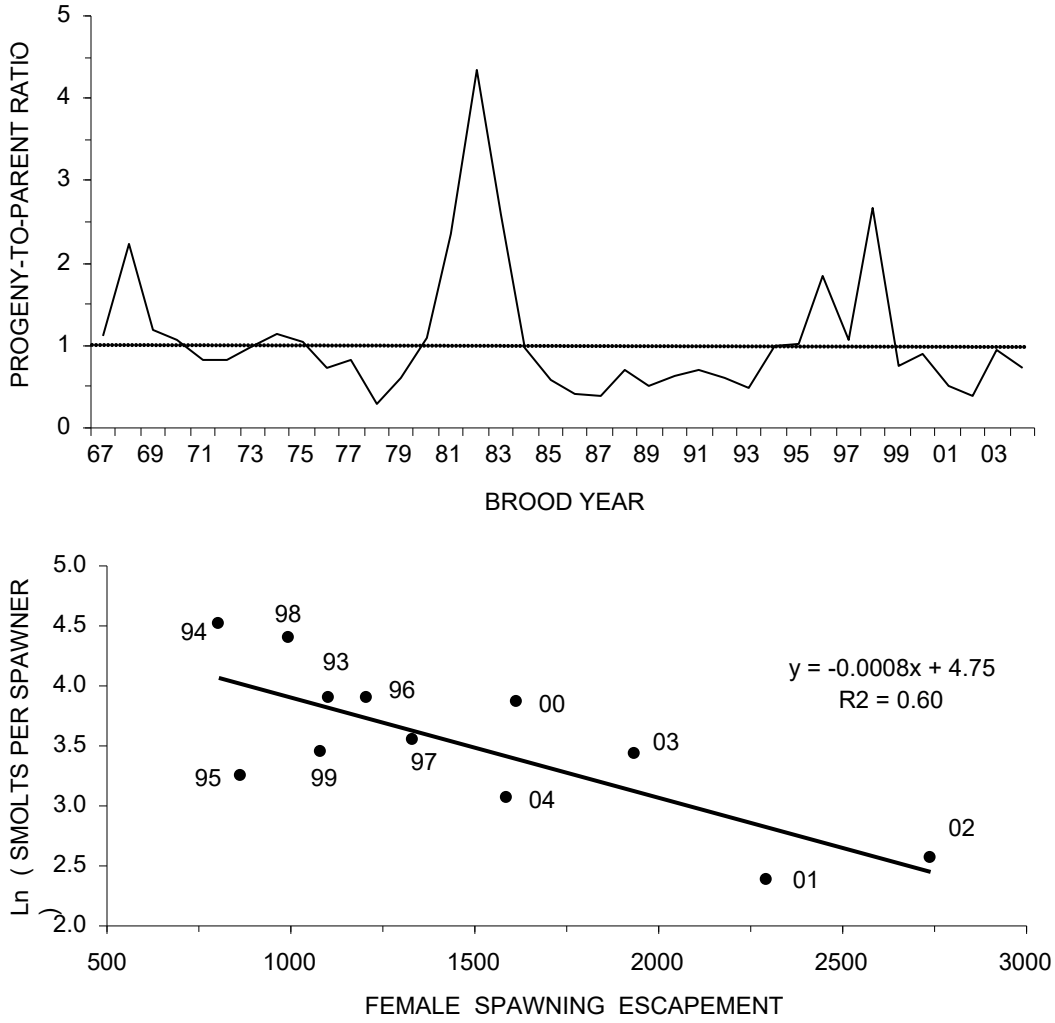



Figure 4. Progeny-to-parent ratios (top graph) and smolts per female spawner productivity measures (bottom graph) for Umatilla River naturally-produced steelhead. Parents were hatchery and natural spawning escapement; progeny were estimates of natural adults produced; smolts were estimated abundance of juvenile out migrants to the lower Umatilla River.

**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.**

The number and percent of adult steelhead available to spawn of wild- and hatchery-origin since 1996 are presented in Table 4.

Table 4. Disposition of summer steelhead (STS) adults returning to the Umatilla River at and above Three Mile Falls Dam, 1996-2008. (Data for the run year 2007-08 are preliminary).

| RUN YEAR | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| Total Steelhead | 2081 | 2477 | 1765 | 1885 | 2892 | 3662 | 5516 | 3080 | 3388 | 2478 | 1968 | 3480 | 3133 |
| Natural STS | 1296 | 1014 | 862 | 1135 | 2140 | 2571 | 3621 | 2117 | 2101 | 1722 | 1480 | 2566 | 2232 |
| Hatchery STS | 785 | 1463 | 903 | 750 | 752 | 1091 | 1895 | 963 | 1287 | 756 | 488 | 914 | 901 |
| Natural STS Sacrificed or Mort | 7F-1M | 5F | 1F-1M | 1F | 0 | 2F | 1F | 1F | 2F | 2F 2M | 1F | 0 | 1F |
| Hatchery STS Sacrificed or Mort | 58F-15M | 51F-44M | 43F-27M | 51F-23M | 29F-13M | 69F2 8M | 26F2 3M | 54F 28M | 35F-27M | 23F 20M | 26F 14M | 22F 24M | 34F 49M |
| Natural STS Taken for Brood[a] | 52F-50M | 50F-50M | 40F-40M | 47F-49M | 44F-57M | 46F4 6M | 47F-47M | 49F 51M | 38F-41M | 42F 39M | 35F 42M | 40F 40M | 43F-42M |
| Hatchery STS Taken for Brood | 14F-17M | 10M | 11F-19M | 15M | 15M | 10M | 10M | 9M | 10F-9M | 10F 9M | 10F 10M | 10F 10M | 5F 5M |
| Natural Females Available to Spawn | 863 | 689 | 549 | 720 | 1317 | 1753 | 1944 | 1472 | 1063 | 1029 | 646 | 1521 | 1496 |
| Hatchery Females Available to Spawn | 342 | 641 | 450 | 370 | 308 | 547 | 800 | 465 | 540 | 377 | 122 | 383 | 377 |
| Total Females Available to Spawn | 1205 | 1330 | 999 | 1090 | 1625 | 2300 | 2744 | 1937 | 1603 | 1406 | 768 | 1904 | 1873 |
| Natural Males Available to Spawn | 323 | 220 | 226 | 313 | 722 | 724 | 1571 | 538 | 951 | 605 | 750 | 964 | 644 |
| Hatchery Males Available to Spawn | 275 | 660 | 308 | 205 | 284 | 350 | 861 | 346 | 574 | 249 | 159 | 347 | 308 |
| Total Males Available to Spawn | 598 | 880 | 534 | 518 | 1006 | 1074 | 2432 | 884 | 1525 | 854 | 909 | 1311 | 952 |
| Natural STS Available to Spawn | 1186 | 909 | 775 | 1033 | 2039 | 2477 | 3515 | 2010 | 2014 | 1634 | 1396 | 2485 | 2140 |
| Hatchery STS Available to Spawn | 617 | 1301 | 758 | 575 | 592 | 897 | 1661 | 811 | 1114 | 626 | 281 | 730 | 685 |
| Total STS Available to Spawn | 1803 | 2210 | 1533 | 1608 | 2631 | 3374 | 5176 | 2821 | 3128 | 2260 | 1677 | 3215 | 2825 |
| Redds Observed in Index Reaches | 119 | 138 | 126 | 218 | 238 | 382 | 347 | 322 | 208 | 218 | 50 | 190 | |
| Index Reaches Miles Surveyed | 21.4 | 21.4 | 21.4 | 21.4 | 21.4 | 21.4 | 19.4 | 21.4 | 19.9 | 21.4 | 17 | 19.5 | |
| Total Redds Per Mile in Index Reaches | 5.6 | 6.4 | 5.9 | 10.2 | 11.1 | 17.9 | 17.9 | 15.0 | 10.5 | 10.2 | 3.1 | 9.7 | |

[a] *Does not include excess brood released back to the river at the end of spawning operations.*

**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.**

From brood years 1996-2008, the percent of hatchery origin adults available to spawn has ranged from 16.8-58.9 and averaged 31.9% (Table 5).

Table 5. Percent of hatchery-origin adults in the Umatilla River spawning ground, 1996-2008.

| Brood Year | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Percent of Spawners Hatchery Origin | 34.2 | 58.9 | 49.4 | 35.8 | 22.5 | 26.6 | 32.1 | 28.7 | 35.6 | 27.7 | 16.8 | 22.7 | 24.2 |

**2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of 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**.

The Three Mile Falls Dam adult collection facility is operated on a daily basis from August 16 until December 1st. During this time period, the facility is operated to collect fall Chinook and summer steelhead broodstock and to enumerate and record biological data on all returning salmonids including coho. All adults collected are anesthetized with $CO_2$. Fish not collected for broodstock are transferred to recovery tanks prior to release back into the Umatilla River.

Beginning December 1st, the trapping facility is generally operated for five days and is then closed for nine days. Returning adults are allowed to volitionally migrate upstream when the trap is not being operated and adult returns are video enumerated. During this time period, the trap is operated to collect summer steelhead and spring Chinook broodstock and to collect biological data. Trapping and transportation of all salmonids is implemented in the spring when passage flow criteria of 150 cfs for 30 days after release cannot be met. The trap is generally not operated from July 15 to August 16.

Operation of the adult collection and enumeration facility as described above may also lead to the incidental take of listed fish during handling activities. In addition, the current goal is to collect 100 unmarked steelhead for broodstock to provide the eggs for the hatchery program.

A complete list of activities for the ODFW's Umatilla Hatchery Monitoring and

Evaluation project (#1990-005-00), the ODFW's Evaluation of Juvenile Salmonid Outmigration and Survival in the Lower Umatilla River Basin project (#1989-024-01), the CTUIR's Umatilla Basin Natural Production Monitoring and Evaluation project (#1990-005-01), and the CTUIR's Development of Progeny Marker for Salmonids to Evaluate Supplementation project (#2002-030-00) are provided in their respective Statements of Work to the Bonneville Power Administration.

Excerpt from the 2010 annual Operation plans summarizing M&E activities

**A. Steelhead**

**1. Umatilla Hatchery, 2009 brood**- Determine and compare rearing performance, smolt condition, juvenile migration performance, and smolt-to-adult survival of steelhead released from the Minthorn and Pendleton facilities, and those direct stream released near Bonifer site. Lengths (300), weights (100), smolt conditions, and descaling (100) will be sampled from fish at transfer to and release from acclimation facilities. Thornhollow may be used in low river flow emergencies. To determine juvenile migration performance to TMFD, John Day and Bonneville Dams approximately 1,500 fish per raceway will be PIT tagged. To determine smolt-to-adult survival we will ADLV+CWT mark 20,000 fish from each of the three release groups. All remaining fish will be marked AD.

**B. Spring Chinook salmon**

**1. Umatilla Hatchery, 2008 brood yearlings-** Determine and compare rearing performance, smolt condition, juvenile migration performance, and smolt-to-adult survival of each of three yearling spring Chinook salmon release groups (standard transfer released in March, fall transfer released in March, and fall transfer released in December). Lengths (300 fish), weights (100 fish), smolt conditions, and descaling (100 fish) will be sampled from fish at transfer to and release from acclimation facilities. To determine migration performance we will PIT-tag 4,600 fish from one Michigan series for each of the two fall transfer release groups (3 raceways) in October 2009 and transfer them to Imeques acclimation facilities. An additional group of 2,300 fish will be PIT-tagged in one Michigan series (3-raceways) of the standard release group in January 2009.

**2. Umatilla Hatchery, 2009 brood yearlings-** To determine migration performance we will PIT-tag 2,300 fish in each of the 2 Harvest Group releases, and 1,500 fish in the Conservation Group release. Smolt-to-adult survival of the *Conservation Group* will be determined by coded-wire-tagging and all released fish will be without fin clips. For the *Harvest Group*, we will mark 40,000 fish (ADCWT) in release groups that are transferred to Imeques in fall and winter. All remaining *Harvest Group* production will be AD clipped.

**C. Fall Chinook salmon**

**1. Umatilla Hatchery, 2009 brood sub-yearlings-** Determine rearing performance,

smolt condition, juvenile migration performance, and smolt-to-adult survival of fall Chinook salmon reared at Umatilla Hatchery and released into the Umatilla River. Lengths (300 fish), weights (100 fish), smolt conditions, and descaling (100 fish) will be sampled from fish at transfer to and release from acclimation raceways. To determine juvenile migration performance we will PIT tag 800 fish in May 2010.

**2. Bonneville Hatchery, 2008 brood yearlings-** Determine and compare smolt condition, and smolt-to-adult survival of yearling fall Chinook salmon release at Thornhollow and Pendleton. Lengths (300 fish), weights (100 fish), smolt conditions, and descaling (100 fish) will be sampled from fish at transfer to and release from acclimation raceways. To determine and compare smolt-to-adult survival release groups, 25,000 fish from each of the two release groups will be marked ADCWT. All remaining fish will be marked Ad clipped.

**D. All broods-**Determine and compare smolt-to-adult survival, fishery contribution, straying, relative smolt-to-survival, adult production, Umatilla River return, and life history characteristics of all rearing and release strategies from groups at Umatilla and Bonneville hatcheries. Table 8 presents the CWT and PIT tagging plan for hatchery monitoring and evaluation for fish released in 2010.

**NATURAL PRODUCTION EVALUATION (CTUIR)**

A. Monitor natural spawning activities of hatchery and natural adult spring Chinook, fall Chinook and coho salmon, and summer steelhead in the Umatilla River Basin.

B. Estimate tribal harvest of adult salmon and steelhead returning to the Umatilla River Basin.

C. Determine age, growth of spring Chinook salmon and summer steelhead in the Umatilla River Basin.

D. Salvage stranded salmon or steelhead as needed.

E. Adult Passage Evaluations: Determine fallback ratios and passage routes, rates, and delays at diversions. Determine holding and spawning locations of:

- Summer steelhead (tag 60 adults)
- Fall Chinook (tag 15 adults)
- Coho (tag 15 adults), and
- Collaborate with the Lamprey Project,
- Install and monitor 5 fixed site receivers on major diversions.

F. Juvenile Outmigration Monitoring:

- Collaborate with ODFW M&E project to estimate wild STS smolt production, survival, and migration timing.

- Operate Meacham Creek smolt trap and PIT tag wild salmonids.
- Collaborate at Three Mile Dam with the Lamprey Project and ODFW M&E.
- Collaborate at diversion dams with Bureau of Reclamation M&E Project.
- Install new PIT tag detectors at Three Mile Falls Dam, WEID bypass channel, and adult ladder.

**Bureau of Reclamation Monitoring and Evaluation Program:**

**Summer Steelhead – 2009 Brood**

The Columbia Cascades Area Office for the Bureau of Reclamation (BOR) has requested 4,500 ad clipped Umatilla Hatchery summer steelhead smolts (HSTS) to assess *take* in BOR operated Feed and Maxwell irrigation canals. This first component will assess *take* from production releases of steelhead as they migrate through the Umatilla River. This component requires approximately 4,500 smolts, 1,500 for each release site; BOR will provide PIT tags (model #TX1411SGL or alternative) and Bonneville Power Administration (BPA) will fund ODFW staff (through their ongoing M&E project) to insert production release PIT tags. ODFW M&E staff will insert 4,500 fish with PIT tags between January and March 2010 to assess the production releases. These fish will be utilized for the out migrations study as well as *take* assessment. Fish and Wildlife Service, Abernathy Laboratory, will provide technical expertise and monitoring of the detection systems at Feed and Maxwell Canals and TMFD. Additional systems maybe installed later, if needed. Pending results will determine the number of PIT fish for ongoing studies. BOR will also contract with CTUIR to survey and salvage stranded fish within the Feed and Maxwell canals after the irrigation season when facilities are shutdown.
Note: Release numbers may change or PIT tags reallocated as results are determined.

**Juvenile Outmigration Monitoring & Evaluation:**

A. Operate and maintain smolt trap and PIT tag detection system at Three Mile Falls Dam.
B. PIT tag up to 3,000 natural summer steelhead smolts.
C. Estimate the abundance and survival of natural summer steelhead smolts.
D. Monitor the life history characteristics of natural summer steelhead smolts.
E. Collaborate with the Hatchery M&E and Natural Production M&E projects to estimate the productivity of natural summer steelhead.
F. Collaborate with the Natural Production M&E project on the design and installation of new PIT tag antennas at Three Mile Falls Dam.

**CTUIR's Activities to Develop Progeny Marker for Salmonids:** Following a habitat inventory a back pack electro shocking survey will be conducted for capturing and sampling juvenile steelhead. A multiple removal method will be used for calculating population estimates of juvenile steelhead in Iskuulpa Creek and lethal fish samples will be taken annually from about 200 juveniles of zero age group and 100 additional samples

from fish of ages one and two. Juveniles will be anesthetized using MS-222. Juveniles taken for otoliths will be euthanized with an overdose of MS-222. After the first year of introducing the strontium marker we will focus our otolith sampling to the zero age fish only. After the second year we will focus our otolith sampling to zero and yearling age juveniles. After the third and succeeding years we collect samples from all age classes.

CTUIR also monitors freshwater mussels and lamprey.

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

Since 2001, mortality at Three Mile Falls Dam of natural steelhead has ranged from 0.00% to 0.23% of the total annual natural STS return (0-4 fish) with an average of 0.074%. Past mortality and broodstock collection data is included in Table 4. Past numbers of juveniles sampled, and sampling mortality, is shown in Table 6.

Table 6. Annual number of juvenile summer steelhead sampled, and sampling mortalities, in the Umatilla River, 1995 to 2007.

| | Number Sampled | | Sampling Mortalities | |
|---|---|---|---|---|
| Year | Hatchery | Natural | Hatchery | Natural |
| 1995[a] | 10,652 | 1,869 | 21 | 7 |
| 1996 | 12,432 | 3,451 | 50 | 14 |
| 1997 | 162 | 194 | 4 | 7 |
| 1998 | 1,924 | 2,642 | 50 | 7 |
| 1999 | 1,882 | 1,816 | 28 | 27 |
| 2000 | 1,078 | 626 | 0 | 1 |
| 2001 | 4,980 | 847 | 50 | 15 |
| 2002 | 1,029 | 630 | 14 | 6 |
| 2003 | 1,172 | 1,015 | 7 | 35 |
| 2004 | 1,071 | 660 | 3 | 6 |
| 2005 | 2,197 | 1,992 | 103 | 10 |
| 2006 | 1,720 | 1,020 | 9 | 18 |
| 2007 | 763 | 693 | 12 | 7 |

[a] Includes fish sampled using a fyke net at river mile 0.5 and fish captured at Feed, Maxwell and Westland Canal traps.

**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).**

Table 7. Annual Take levels for ESA listed summer steelhead.

| Life Stage | Activity | Type of Take | Number |
|---|---|---|---|
| Adult | Broodstock | Lethal | 100 |
| Adult | Capture/handling/release | Non-lethal/Lethal | 3,500/5 |
| Adult | Radio Tagging | Non-lethal | 50 |
| Adult | Progeny mark sampling Capture/handle/release | Non-lethal/lethal | 300/3 |
| Hatchery JVs | Capture/handle/release | Non-lethal/Lethal | 12,000/150 |
| Hatchery JVs | Progeny mark sampling | Non-lethal/Lethal | 700/100 |
| Natural JVs | Capture/handle/release | Non-lethal/Lethal | 12,000/120 |
| Natural JVs | Progeny mark sampling | Non-lethal/Lethal | 5,000/300 |

**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.**

Outmigration and Survival Study - As per NOAA Fisheries' 4d rule research permit #13765, we will reduce numbers collected by adjusting the sample times and avoid sampling when large numbers of natural steelhead are passing through the sampling facility. To reduce the number of mortalities from fish jumping out of the sample tank or from other areas, we will apply covers and screens to prevent escape and monitor the facility closely. Monitoring information is mostly obtained through remote interrogation of tags, without any handling. No contingency actions are planned for the adult handling or broodstock collection.

## 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 program is included in Table B.6 of the *US v. Oregon* 2008-2017 Management Agreement of the Columbia River Fish Management Plan. The program is also consistent with the NPCC Umatilla/Willow Subbasin Plan and follows the 1995 Integrated Hatchery Operations Team (IHOT) Policy and Procedures for Columbia Basin Anadromous Salmonid Hatcheries. The program has incorporated many of the HSRG principles; although it doesn't include removal of limited number of hatchery origin adults above TMFD as it would eliminate sport and Tribal harvests in the basin.

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

1. CTUIR. 1994. Wildlife Mitigation Plan (Draft) May 1996, Columbia Basin Salmon Policy. 1995 pages 9-10, and Water Assessment Report;
2. NMFS - Salmon & Steelhead Enhancement Plan for the Washington and Columbia River Conservation areas.Vol 1. chapter 4, 37pages;
3. Reeve, R. 1988. Umatilla River Drainage Anadromous Fish Habitat Improvement Plan;
4. CTUIR/ODFW. 1990. Umatilla Hatchery Master Plan;
5. OWRD. 1988. Umatilla Basin Report;
6. BOR. 1988. Umatilla basin Project Planning Report;
7. Umatilla County - Comprehensive Plan. 1983, chapter 8;
8. USNF - Umatilla National Forest Land & Resource Management Plan. 1990, chapter 2, page 13. and Final EIS. 1990, chapter III, pages 59-62;
9. CTUIR/ODFW. 1990. Umatilla River Subbasin Salmon and Steelhead Production Plan;
10. Boyce, R. 1986. A Comprehensive Plan for Rehabilitation of Anadromous Fish Stocks in the Umatilla River Basin;
11. USFWS & NMFS. 1982. Umatilla R. Planning Aid Report; and
12. USBR and BPA. 1989. Umatilla Basin Project. Initial project workplan presented to the NWPPC, May 1989.
13. US v Oregon, 2008-2017 Management Agreement
14. Mid-Columbia River Steelhead Recovery Plan

This HGMP is consistent with these plans and commitments.

**3.3) Relationship to harvest objectives.**

ODFW and CTUIR co-managers developed steelhead harvest guidelines as part of the Umatilla Hatchery Master Plan (CTUIR and ODFW, 1989). This plan identified hatchery broodstock, spawning escapement, and tag collection for evaluation as priorities, and specified numbers of fish allocated to these uses at varying run sizes. The plan was designed to allow harvest of fish returning in excess of the aforementioned priorities and needs. However, this plan is no longer current as a result of several adaptations in program management. Broodstock and evaluation needs are only about half what was originally projected, and non-tribal sport fishing regulations have changed to exclude the harvest of natural steelhead. No formal harvest plan has been drafted since then because the shift in non-tribal fishing regulations was expected to adequately protect natural fish while still providing fisheries and natural spawning augmentation.

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

Tribal and non-tribal fisheries for both wild and hatchery summer steelhead existed prior to the implementation of the Master Plan. Beginning in 1992, non-tribal sport fishery regulations were changed and only hatchery (adipose clipped) summer steelhead had been harvested with a two fish per day limit until 2001, and 3 fish per day thereafter. Harvest in the non-tribal fishery from run years 1992-93 to 2007-08 ranged from 19-204 and averaged 94 fish per year. Anglers released an average of 28 hatchery- and 277 natural-origin steelhead per year (Appendix Table 2).

Tribal members are still allowed to harvest both natural and hatchery summer steelhead in the Umatilla River. Harvest in the tribal fishery from run years 1993 to 2008 ranged from 20-118 hatchery- and 0-11 natural-origin steelhead, and averaged 54 hatchery- and 4 natural-origin steelhead per year (Appendix Table 3). Data on released fish are not available.

Umatilla hatchery-produced summer steelhead contributed to out-of-basin tribal and non-tribal fisheries. Almost all out-of-basin harvest was in the Columbia River (74%), mid-Columbia tributaries (21%), and lower Snake River (5%). Harvest ranged from 53-427 and averaged 139 fish per year (Appendix Table 4).

Juvenile hatchery steelhead also contribute to fisheries for adult steelhead, spring Chinook, and trout in the Umatilla River above Three Mile Falls Dam (Appdx. Table 5).

**3.4) Relationship to habitat protection and recovery strategies.**

The Umatilla Summer Steelhead Program is a part of an overall Umatilla Basin Salmon and Steelhead Restoration Plan. In addition to on-going hatchery operations, fish passage and habitat restoration efforts are being implemented along with monitoring and evaluation of both the hatchery and natural components of the restoration program.

Factors limiting the natural production of steelhead in the Umatilla River Basin include channelization, low summer flows, warm water temperatures, sediment, and poor habitat diversity caused by urban and rural development/land management practices. Ocean conditions and the mortalities and stress from the operation of hydropower projects on the mainstem Columbia River are important factors outside the basin. There continues to be degradation to fish habitat in these areas that hampers improvement efforts.

**3.5) Ecological interactions.**

(1) Interactions with species that could negatively impact program: The program may be negatively impacted by a variety of freshwater and marine predators during migration periods such as northern pikeminnow, smallmouth bass, seagulls, cormorants, Caspian terns, and pinnipeds which could significantly reduce overall survival rates of program fish.

(2) Interactions with species that could be negatively impacted by program: Co-occurring natural steelhead populations in the Umatilla River and ESA listed salmon

and steelhead populations in the mainstem Columbia River could be negatively impacted by co-mingling with program fish in migration corridors. Impacts could potentially occur from competition for food, predation, disease transmission, or density dependent effects. In order to minimize the potential for any of these effects to occur, program fish are released as full term yearling smolts. The program also follows the protocols outlined by IHOT (1995) to minimize the potential for disease transmission to occur.

In addition, hatchery steelhead smolts that residualized have been documented in Boston Canyon Creek, lower Meacham Creek, and the middle and lower mainstem Umatilla River. These hatchery smolts are much larger than wild juvenile *O mykiss* of the same age, and may compete with wild juvenile *O. mykiss*, bull trout, Pacific lamprey, coho and Chinook salmon, Margined Sculpin, Mountain whitefish and other non-game fish for limited summer and winter rearing habitat or prey upon them. Residual fish were detected when smolts were acclimated in Bonifer ponds. No comparisons on residualism have been made to the current direct streams releases. There are no planned activities to addresses this potential difference nor planned changes to acclimate releases.

(3) Interactions with species that could positively impact program: Other Salmonid species that naturally spawn in the target stream may positively impact program fish by contributing nutrients from decaying carcasses that increase productivity of the Umatilla River.

(4) Interactions with species that could be positively impacted by program: The program provides a benefit to other Salmonid species in the basin by contributing nutrients from decaying carcasses that increase productivity of the Umatilla River. Summer steelhead also plays an important role in community ecology since this population historically existed sympatrically with other species in the basin.

In addition, migrating hatchery fish may overwhelm predator populations, providing a potential protective effect to natural steelhead in the migration corridor. Offspring from natural spawning of program fish may also provide a forage source for both bull trout and natural steelhead smolts.

## 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.**

*Umatilla Hatchery* - The water source for the Umatilla Hatchery comes from the Columbia River through a 'Ranney' well system (infiltration gallery system). The system was initially designed and constructed to produce a maximum of 15,000 gpm of water. However, actual water capacity is 5,500 gpm, and several wells have been subject to

failure (Jack Hurst, ODFW). Water from the well system averages 12.2°C (54°F). Water quality exceeds BPA requirements (BPA 1987) for all hatchery uses. Water is withdrawn under certificate #72181, permit G 10870, and, certificate #72182, permit #G 11210. Discharged effluents are monitored as per NPDES general permit 300 J.

*Three Mile Falls Dam* - The water source for the Three Mile Falls Dam adult facility is pumped directly from the Umatilla River. The Denil steep-pass utilizes 2,900 gpm and the holding pond uses 1,450 gpm. Both the steep-pass and holding pond pumps run continuously. The fish lock system uses 630 gpm, but is used only during handling operations (approximately two hours per day). Water temperatures have been measured at Three Mile Falls Dam ranging from approximately 0°C (32°F) in winter to over 21°C (70°F) during the summer. Sediment loads vary dramatically and large sediment loads are experienced annually during high flow conditions. The water source is the same as used by the natural population.

*Minthorn Juvenile Acclimation and Adult Holding Facility* - Minthorn receives its water from Minthorn Springs Creek, which is formed from the inflow of several springs located immediately south of the Umatilla River. Water through the brood holding area is supplied by gravity and ranges from approximately 500 to 2,100 gpm. The water supply to the raceways is pumped from the creek with a single-pass water-pumping rate of approximately 800 gpm per each of two raceways. During the summer steelhead adult holding period (mid-September to late May), average monthly water temperatures range from approximately 7 to 13°C (45 to 55°F). During the juvenile acclimation period (April), temperatures range from 6.5 to 14°C (44 to 57°F), with an average of 9°C (48ºF). High sediment loads are experienced in some years during high flow conditions.

*Pendleton Acclimation Facility* - Water for the Pendleton juvenile acclimation and release facility is pumped directly from the Umatilla River. Water flow is approximately 1,600 gpm per pond. During the juvenile acclimation period (April), daily temperatures range from approximately 4.5 to 13.0ºC (40.0 to 55ºF). High sediment loads are experienced in some years during high flow conditions.

*Natural Production*-- Natural spawners use the water available in the streams of the Umatilla River Basin. Water quality is relatively high in the headwater streams where steelhead spawn and rear. The spawning streams contrast greatly to the lower Umatilla River and lower tributaries where sediment loads are high in the spring and summer water temperatures are often lethal to salmonids (Contor et al. 1998). Water quality in this desert basin contrasts to the hatchery, as there are often large daily fluctuations in water temperature. During the winter and spring, rain-on-snow events interspersed with cold periods often produce large fluctuations in stream flow. During spawning and incubation, the streams are often high and turbid.

**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.**

*Minthorn/Pendleton Acclimation* - Acclimation facility intake screens conform to NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish.

*Umatilla Hatchery*—Rearing water source is 100% well water and operating under NPDES general permit # 300 J.

## SECTION 5. FACILITIES

### 5.1) Broodstock collection facilities (or methods)

*Three Mile Falls Dam* - Broodstock collection is conducted solely at the Three Mile Falls Dam's east bank adult trapping facility. The facility consists of a vertical slot fish ladder, Denil steep-pass, adult holding pond (raceway), and fish handling and sorting complex. The dimensions of the holding pond are 14' wide by 36' long by 3.5' deep (approximately 1,800 cubic feet). The holding pond has a jump screen located at the upper end and jump-out panels located at both upper corners to prevent adults from jumping out of the pond. In addition, the pond is equipped with a spray bar system to discourage jumping. The holding pond is located above the 100 year flood level.

The water supply for the holding pond is pumped directly from the Umatilla River at a rate of 1,450 gpm. A low water discharge alarm is located on the pond supply line to signal any loss of flow to the holding pond. An emergency generator system was installed in 2016 to provide back-up power to the holding pond pumps. In addition the pumps for the fall Chinook broodstock facility at Three Mile Falls Dam are tied into the holding facility and can be used to supply additional water in case of mechanical failure of the trapping facility pumps. The adult holding facility pumps are backed up by an emergency generator. Two other emergency procedure options are available to on-site personnel. During power outages or other short term losses of flow, the outlet gate from the pond can be closed to maintain water depth. For long term losses of water supply, adults can be dip netted out of the pond and returned to the river.

Adults are crowded into the fish lock and raised up to the handling platform where they are loaded into the anesthetic tank. Adults collected are anesthetized with $CO_2$ and then selected for broodstock or returned to the river. The operation of the facility has no effect on the critical habitat for summer steelhead.

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

Broodstock are transported in 370-gallon fish transport tanks, which are mounted on dual axle trailers and pulled by pick-up truck. The trailers are equipped with compressed oxygen aeration and re-circulation systems with 8" discharge outlets.

## 5.3) Broodstock holding and spawning facilities.

*Minthorn Acclimation/Adult Holding* - Since 1988, all summer steelhead spawning has occurred at Minthorn. The facility includes a concrete channel that functions as a fish ladder/trap, inlet/outlet water control structure, and broodstock holding area. The brood holding area is approximately 25 feet long by 8 feet wide. Water through the pond is supplied by gravity from Minthorn Springs Creek. Depth is controlled by dam boards and is usually held at 4 feet. The pond has vertical bar screens with 1½ inch spacing at both the influent and effluent ends.

The holding area is surrounded by a chain link fence topped with barbed wire and metal screening that provides both security and prevents fish from jumping out or escaping due to flood events. Floating covers are placed over approximately one third of the pond to help alleviate disturbances to the fish and to help prevent fish from jumping. The top of the concrete walls and bottom of the chain link fence are overlapped with rubber matting so that if the fish do jump, injuries will be minimized. The fence has three access gates for unloading adults and spawning. Adjacent to the pond is a concrete slab used during the spawning operation. The entire facility is covered with a roof to provide protection for fish, eggs and personnel. In an extreme emergency, the fish can be released into Minthorn Springs Creek by pulling the effluent screen and dam boards and letting the fish swim out volitionally.

Beginning in early February and continuing through the end of the spawning season, the fish are treated five days per week with hydrogen peroxide to help control pre-spawning losses due to fungus. A one-hour flow through treatment at approximately 100 ppm active ingredient is used. ODFW Fish Health personnel are available to address disease concerns.

The location of the facility blocks approximately one mile of habitat that might be utilized for spawning and rearing. This habitat is limited for spawning activities, because flows are as low as 500 gpm and temperatures often exceed 20º C (68ºF) during the period from June to September.

## 5.4) Incubation facilities.

*Umatilla Hatchery* - Fertilized eggs are transported from Minthorn to Umatilla Hatchery in five-gallon buckets with water and ice. Umatilla hatchery incubation equipment consists of four separate units of Marisource incubators (Heath tray type). Water can be used directly from wells or mixed with chilled water. Three units can be supplied with well water at 12.2ºC (54ºF) or mixed with chilled water 7.2ºC (45º F) for any combination of temperatures from 7.2-12.2ºC (45-54º F) provided that 300 gpm of chilled water is not exceeded. The fourth unit can be mixed with water chilled to 3.3ºC (38º F) to achieve any combination of temperatures from 3.3-12.2ºC (38–54º F) provided that 60 gpm of chilled water is not exceeded. Numerous systems continually monitor temperature, mechanical systems, electrical systems, and flow. Alarms sound if any system fails or is out of criteria. Continual monitoring of systems and preventative

maintenance is used to prevent system failure. An emergency gas powered pump installed in the aeration tower structure supplies water for incubation in the event of aeration lift pump failure. In the event of total system failure resulting in total loss of water, eggs may be transported to Irrigon Hatchery (if they are still operational and have necessary space). Pathogen free water is used for all program fish incubated at Umatilla Hatchery. This is a direct preventive measure for minimizing the risk of introducing pathogens into the hatchery program, thus minimizing the risks to fish in the natural environment after these fish are released. Sanitary measures are taken at Umatilla Hatchery to prevent transmission of pathogens from one stock to another by disinfecting equipment in Iodophor.

**5.5) Rearing facilities.**

*Umatilla Hatchery* **-** Umatilla Hatchery has three different types of rearing units. There are eight 21' Canadian style early rearing tanks located in the main building adjacent to incubation. Water is pumped to the aeration tower and gravity fed to the tanks. Steelhead rearing starts in these tanks in early July. The fish are moved outside to Oregon ponds when densities reach approximately 80 pounds in each tank. Umatilla Hatchery has 10 Oregon style ponds. Rearing dimensions are 91' X 18.75' X 3.67'. These ponds are designed for serial reuse in groups of 2 ponds, upper and lower. They also can be supplied with fresh water individually, if necessary.

Steelhead are reared in the Oregon ponds until fish are equally divided, (un-graded) into three Michigan ponds in late October, at a density of 50,000 fish each. The Umatilla Hatchery has 24 Michigan style ponds, with rearing dimensions of 91' X 9' X 2.75'. Water is supplied to these ponds in reuse groups of three ponds each. Each pond has a submersible pump that supplies 950 gpm of water to oxygen contact columns, located at the head of each pond. Oxygen is introduced and unwanted saturated gas is removed from incoming water at this point. Each pond has its own oxygen supply line. Supplemental oxygen is delivered from oxygen bulk liquid tank on site. Steelhead are reared at enhanced densities to utilize available well water efficiently.

All ponds have a high-low water level alarm, and for Michigan ponds, pump failure and oxygen flow alarms. In the event of total system failure, fish could be moved to nearby Irrigon Hatchery if pond space is available, fish could be transported to available Umatilla acclimation facilities or direct stream released into the Umatilla River if acclimation facilities are unavailable. Monitoring and maintenance of the water supply system occurs on a regular basis.

Pathogen free water is used for all production reared at Umatilla Hatchery. This is a direct preventive measure for minimizing the risk of introducing pathogens into hatchery phase of this program, thus minimizing the risks to fish in the natural environment after these fish are released. Sanitary measures are taken at Umatilla Hatchery to prevent transmission of pathogens from one stock to another by disinfecting equipment in Iodophor. In addition, a fish health program is in place to monitor and evaluate the health status of summer steelhead juveniles reared at Umatilla Hatchery.

**5.6) Acclimation/release facilities.**

Two groups of 50,000 fish each are transferred in the spring to acclimation ponds on the Umatilla River, at Pendleton and Minthorn. Another group of 50,000 fish is released into the Umatilla River at Thornhollow (RM 73.5). The direct stream release occurs in conjunction with the releases from the acclimation facilities.

*Minthorn Acclimation Facility* - The Minthorn Acclimation Facility includes two 10 hp pumps, standby generator, two raceways (each 120' x 12' x 4' feet), and outlet pipe for releasing fish. The pumps and generator are located in the upper level of an enclosed pump house well above the historical 100-year flood levels. Water is pumped from Minthorn Springs Creek to each of the raceways. The outlets of the ponds have two one-quarter inch wire screens and one vertical bar screen to keep fish from escaping. The ponds are covered with netting to prevent bird predation.

In case of power failure, a standby generator provides emergency power to the pump(s). In addition, there is a backup pump and both ponds are equipped with high-level and low-level float alarms. In the event of a power or pump failure or pond level alarm, a phone alarm dials out to ten telephone or pager numbers until the alarm has been acknowledged. Fish are released from the facility by pulling the dam boards, lowering the pond and crowding the fish out. The fish then exit the pond through an underground pipe to Minthorn Springs Creek. During an extreme emergency situation, fish are released in this same manner. The ponds are thoroughly cleaned and disinfected prior to fish being placed into them, and ODFW Fish Health personnel are available to address disease concerns.

The location of the Minthorn facility blocks approximately one mile of habitat in Minthorn Springs Creek that might be utilized for spawning and rearing. Summer utilization for rearing is limited however; as flows are as low as 500 gpm and temperatures often exceed 20$^{o}$ C (68$^{o}$F) during the period of June to September.

*Pendleton Acclimation Facility* - Facility includes a water intake structure with automatic screen cleaner, pump station, standby generator, water head box/distribution system, storage building, four acclimation ponds (approximately 13,000 cubic feet each; one of which is used for acclimating summer steelhead), settling pond for pond cleaning, and water outlet and fish release structure. Water is supplied by gravity flow to the pump station where it is pumped into the head distribution box. Water is then supplied by gravity from the head distribution box to the individual ponds. Water flow is approximately 1,600 gpm per pond. The operation of the facility has no effect on the critical habitat for summer steelhead.

Fish are held for approximately two to three weeks and then are volitionally released for one week. The volitional release is accomplished by pulling the effluent screen and allowing the fish to volitionally swim over a notched dam board and down the outlet channel directly into the Umatilla River. The fish are taken off feed one to two days prior

to the fish being released. The effluent dam boards are removed and the pond is lowered. The remaining fish are then crowded out of the pond using a seine. During an extreme emergency situation, fish are released in this same manner.

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

*Umatilla Hatchery*-- There have been no operational difficulties or disasters at Umatilla that have led to significant fish mortality; however, a broken pipe line led to the evacuation of fish in 2006. Well/electrical problems forced the early direct stream released of all 150,000 summer steelhead juveniles in 2017.

*Minthorn Adult Holding* - Theft and harassment of broodstock has been a problem in the past years, but added security facilities (fencing/barbwire) seem to have eliminated the problem.

*Minthorn Acclimation Facility* – In earlier years, there had been occurrences where fish became over crowded in the release pipe/channel and increased losses were observed. Release procedures have been changed and no significant losses have occurred in recent years.

*Pendleton Acclimation Facility* - There have been no operational difficulties or disasters at the facility that have led to significant fish mortality.

**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.**

These issues are covered in Sections 5.3 through 5.6.

## 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.**

The broodstock is endemic summer steelhead stock of the Umatilla River.

**6.2) Supporting information.**

**6.2.1) History.**

Summer steelhead releases of Skamania and Oxbow hatchery stocks were made in the Umatilla River basin from 1967 through 1970 (see section 10.3). In 1975, one release of

Umatilla stock steelhead occurred; and fish releases every year since 1981 have been from endemic Umatilla River stock.

Since 1982-83, all broodstock for the program have been trapped at Three Mile Falls Dam. Brood fish were collected at the west bank ladder from 1982-83 to 1986-87 and at the east bank ladder from 1987-88 to the present.

From 1982-83 to 1989-90, only unmarked adults were collected for broodstock. From 1990-91 through 2007-2008, first generation hatchery adults were also incorporated into the broodstock to ensure meeting broodstock goals. Only unmarked adults are being collected in 2008-2009.

Unmarked adults collected are assumed to be endemic Umatilla stock, but could include strays (wild and hatchery) from other basins. Hatchery adults collected for brood were assumed to be first generation Umatilla stock. Beginning in 2004, only hatchery steelhead with coded wire tags indicating Umatilla origin were used for spawning.

### 6.2.2) Annual size.

Since brood year 2014 the program has been collecting 70 wild-origin and 40 non-stray hatchery origin adults with CWT for spawning. Any surplus wild broodstock will be out planted in Meacham Creek and hatchery adults will be sacrificed for CWT.

Historic summer steelhead broodstock collected for holding/spawning since 1982-1983 has varied from 52 during the 1983-84 run year to 225 during the 1991-92 run year (Appendix Tables 6 and 7). Historically, the ratio of males to females has varied. The collection goal for the 2008-09 brood-year was 100 adults (50 pairs of unmarked adults).

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

Since brood year 2014 the program has been collecting 70 wild-origin and 40 non-stray hatchery origin adults with CWT for spawning. Any surplus wild broodstock will be out planted in Meacham Creek and hatchery adults will be sacrificed for CWT. Hatchery-origin adults are being incorporated into broodstock at a rate of no more than 33% of the actual spawners, there will be no hatchery x hatchery crosses.

From 1982 to 1990, only unmarked summer steelhead were collected for broodstock (Appendix Table 7). Beginning in 1990, first generation hatchery fish were also collected to ensure meeting broodstock goals. The proportion of hatchery fish collected has ranged from 2.3% of the total number collected in 1992-93 to 51.0% in 1990-91. The collection goal for the 2008-09 brood-year is 100 natural adults.

### 6.2.4) Genetic or ecological differences.

The broodstock for this program is collected entirely from the Umatilla River and are all of natural origin.

**6.2.5) Reasons for choosing.**

The endemic stock was selected because of their sufficient abundance and based on the tenet that they would have the best local adaptations and highest likelihood of natural reproductive success in the Umatilla Basin. Umatilla Basin's natural steelhead survived more than 100 years of human impact in a desert system including dam barriers, dewatering of migration corridors, roads, logging, grazing, and urban agricultural development.

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

The risk of population genetic diversity loss will be reduced by selecting the indigenous summer steelhead population for use as broodstock in this program.

## SECTION 7. BROODSTOCK COLLECTION

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

All fish collected for broodstock purposes are adults.

**7.2) Collection or sampling design.**

The broodstock collection goals for steelhead are to: 1) collect healthy, naturally produced adults; 2) collect a cross section of the run based on arrival time at the Three Mile Falls Dam collection facility; 3) collect males and females at a one to one ratio, and 4) collect one-salt and two-salt adults at the same ratio as observed in the run.

All brood are collected at the east bank adult facility from September through mid April. Beginning in December, adults returning to Three Mile Falls Dam are trapped for five days and allowed to volitionally migrate for nine days. Brood is collected during the five day trapping periods. Monthly collection rates are established prior to the return season by averaging the monthly return percentages over the last five years. The percent of one-salt and two-salt adult returns is monitored continuously throughout the season and a similar proportion of one-salt and two-salt adults are selected for brood. Determinations of one-salt and two-salt adults are based on a fork length of less than and greater than 26 inches, respectively. The 1:1 male to female ratio in the brood is not representative of the ratio in the total return. Females generally comprise between 60-70% of the total run in recent years.

Adults returning to Three Mile Falls Dam ascend a vertical slot fish way ladder, but are precluded from swimming upstream by use of a barrier gate at the top of the ladder. Adults then ascend a Denil steep-pass and fall into an adult holding pond where they are

trapped. Disposition of the fish trapped generally occurs daily in order to minimize upstream passage delays. During periods when few adults are being trapped, adults may be held up to 72 hours. During handling operations, all adults are anesthetized with $CO_2$ to minimize stress. Mortality of listed steelhead can occur during the holding and handling operations at Three Mile Falls Dam. Over the last eight years, average annual mortality at the facility has been 0.074% with a range of 0.00%-0.23%.

**7.3) Identity.**

There is only one population of summer steelhead in the Umatilla Basin above the Three Mile Falls Dam. All unmarked adults that enter the trap at Three Mile Falls Dam are assumed to be of Umatilla origin (but could include unmarked out-of-basin strays), and may be selected for broodstock.

**7.4) Proposed number to be collected:**

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

Since brood year 2014 the program has been collecting 70 wild-origin and 40 non-stray hatchery origin adults with CWT for spawning. Any surplus wild broodstock will be out planted in Meacham Creek and hatchery adults will be sacrificed for CWT. Hatchery-origin adults are being incorporated into broodstock at a rate of no more than 33% of the actual spawners, there will be no hatchery x hatchery crosses.

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

(See Appendix Tables 6 and 7)

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

All hatchery fish returning to Three Mile Falls Dam in excess of those needed for CWT recovery are released upstream. These fish are available for both harvest and natural production. Hatchery fish are no longer collected for broodstock. In the past, excess hatchery fish collected for broodstock but not spawned were sacrificed for CWT recovery.

**7.6) Fish transportation and holding methods.**

Umatilla steelhead broodstock are collected at the Three Mile Falls Dam adult collection facility and are then transported to the Minthorn facility for holding and spawning. Adults collected are anesthetized with $CO_2$, prior to handling. Broodstock are transported in a 370-gallon fish transport tank, which is mounted on a dual axle trailer and is pulled by a pick-up truck. The trailer is equipped with compressed oxygen aeration and a re-circulation system. Transit time is approximately one hour. Water temperatures are monitored in the tank and at the release site to ensure that the temperature difference

between tank water and release site is minimal.
Since 1988, all summer steelhead holding/spawning has occurred at Minthorn Springs Facility. Adults are held in a concrete pond with a total volume of 800 cubic feet (see section 5.2 for more details). Historically, holding densities have ranged from approximately 3.6 to 7.3 cubic feet per adult and flows have varied from approximately 2.2 to 19.0 gpm per adult. The broodstock goal for 2009 is 100 adults, which will result in a maximum density of approximately 8.0 cubic feet per adult and a flow of 5.0 to 21.0 gpm per adult. The variation is a result of lower flows in Minthorn Springs Creek in the fall and late spring and because 1,600 gpm is diverted into the acclimation ponds during April when juveniles are being acclimated.

Total mortality of fish held at Minthorn has ranged from 1.5 to 45.0% and has averaged 18.4%. Over the past 6 years however (2003-04 through 2007-09), it has averaged 4.3%. Mortality of unmarked fish has ranged from 0.9 to 41.4% and has averaged 18.3%. In some years, however, a portion of the males were live spawned and held through the end of the spawning season. Had these fish been killed at the time of spawning, mortality numbers would have been lower in holding tanks. Pre-spawn mortality is built into the broodstock collection goals.

Table 8. Pre-spawning mortality from cohorts 2003 through 2009.

| Run Year | Adults collected | Mortality | Percent Mortality |
|---|---|---|---|
| 2002-03 | 109 | 49 | 45 |
| 2003-04 | 121 | 5 | 4.1 |
| 2004-05 | 119 | 10 | 8.4 |
| 2005-06 | 119 | 7 | 5.9 |
| 2006-07 | 120 | 5 | 4.2 |
| 2007-08 | 110 | 4 | 3.6 |
| 2008-09 | 100 | 3 | 3.0 |
| Note: Adults were not treated with formalin in 2002-03 which may have caused the increase in mortality | | | |

**7.7) Describe fish health maintenance and sanitation procedures applied.**

*Minthorn Adult Holding* -At the Minthorn adult facility, hydrogen peroxide is dripped into the inflowing water to achieve a maximum concentration of 100 ppm active ingredient. The treatment is applied for one hour to control fungus and parasites, at a frequency of five times per week beginning in early February and continuing through the end of the spawning season.

**7.8) Disposition of carcasses.**

All summer steelhead broodstock carcasses are placed in a tribal landfill and buried.

**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.**

All broodstock are collected from natural origin fish returning to the Umatilla River at Three Mile Falls Dam, with minimal handling stress. Collected brood fish are anesthetized with $CO_2$ prior to transportation. Broods are transported in large fish transport tanks with sufficient water and oxygen supplementation. To minimize the genetic impacts on their progeny, broodstock are collected from representative cross sections of the entire run with respect to both run timing and age classes in order to mimic the characteristics of 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.**

*Minthorn Adult Holding*--From late March to late May, broodstock are sorted weekly for maturation. Fish are anesthetized with MS-222 and ripe fish are held in live totes until all fish have been sorted. All ripe females are spawned. Males, at a proposed rate of one male for every ripe female, are randomly selected from the broodstock population.

**8.2) Males.**

The goal is not to re-use males, but historically, this has sometimes been unavoidable. Obtaining adequate quantity and quality of milt from the males is often difficult, and in a limited number of instances, re-use of males has been necessary. Backup males are not generally used because matrix spawning schemes are utilized as described in section 8.3.

**8.3) Fertilization.**

A 3 x 3 spawning matrix is utilized whenever possible and matings are random. When only two females are available, a 2 x 2 matrix is used and when only one female is available, the eggs are fertilized with the milt from a single male. Each 1 x 1, 2 x 2, or 3 x 3 cross is considered a single-family group.

Females are killed and bled by severing the caudal peduncle. The undersides of the fish are cleansed with a solution of Argentyne and are then wiped with a clean towel. The eggs from each female are stripped into a colander to remove excess ovarian fluid and divided equally into the appropriate number of cups.

Live males are cleansed with Argentyne and then the milt is stripped into individual cups. If sufficient quantity and quality is obtained, the milt is used and the males are

killed. If sufficient milt quantity and quality is not obtained, any milt that may have been stripped is discarded and the males are returned to the holding pond for further maturation. During matrix spawning, the milt from a single male is used to fertilize a portion of the eggs from each female. After the milt is added, well water from Umatilla Hatchery is added and the eggs and sperm are mixed and allowed to stand for approximately one minute or longer.

The fertilized eggs from each cup (one family group) are then poured into a bagged net and combined. The eggs are then placed into a bucket with Umatilla Hatchery well water, rinsed, and then are placed into a solution of Argentyne and allowed to water harden for one hour. At the end of the hour, the eggs are again placed into a bucket of fresh well water and ice with a watertight lid for transport to Umatilla Hatchery. Nets, spawning knives and other equipment are disinfected with Argentyne between each family group.

At the time the males and females are stripped, milt and ovarian fluid samples are taken to test for replicating viral agents. After spawning, pyloric caeca, kidney and spleen samples are also taken to test for culturable pathogens.

Fish health procedures used for disease prevention during spawning include draining of ovarian fluid from eggs by use of colander and water hardening eggs in iodophor @ 100 ppm for a minimum of 15 minutes and then for 10 minutes at the hatchery upon arrival to the facility.

**8.4) Cryopreserved gametes.**

There has been no cryopreservation of Umatilla River summer steelhead gametes.

**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.**

See Section 8.3.

## 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.**

**9.1) Incubation:**

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

The number of eggs taken since 1983 has varied from a low of 100,000 eggs in 1984 to a high of 410,000 in 1991 (Appendix Table 9). During those years, smolt production goals

for the Umatilla River varied significantly. Since 1993, eggs takes have been between 181,000 to 255,000 eggs. The current production goal is for 201,000 green eggs, which will produce 150,000 smolts. The survival objective from green egg to ponding is 75% (Appendix Table 9).

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

There have been a few occasions where excess eggs have been collected due to unanticipated high fecundities or viabilities. As long as these surpluses are within 10% of program goals then they are reared to smolt and released as part of the standard production program. If identified early, excess eyed eggs can be euthanized or released in the Umatilla River. Surplus parr maybe released at Barnhart or Reith Bridges after marking.

**9.1.3) Loading densities applied during incubation.**

*Umatilla Hatchery* --Incubation consists of four isolated units or sections of Marisource (Heath tray type) incubators as described in section 5.4. Loading densities are 11,000 eggs/tray.

**9.1.4) Incubation conditions.**

*Umatilla Hatchery* --Oxygen saturation levels average 10 ppm influent and 9 ppm effluent. Water flows are regulated to a minimum of 4 gal/min, with individual egg take temperatures ranging from 38 to 54$^{o}$ F.

**9.1.5) Ponding.**

*Umatilla Hatchery* --Steelhead are ponded during the first week of July at 950 temperature units, 3,500 fish/pound, and 100% button-up.

**9.1.6) Fish health maintenance and monitoring.**

Umatilla Hatchery --Eggs brought to Umatilla Hatchery are disinfected in 100 ppm iodophor for 10 minutes. Fungus is controlled with formalin treatments at a concentration of 1667 ppm (1:600). Treatments are scheduled seven times per week for 15 minutes. Little mortality has been attributed to yolk-sac malformation. After eyeing, dead eggs are hand picked.

**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.**

*Umatilla Hatchery* --Eggs will be incubated using well water only to minimize the risk of catastrophic loss due to siltation.

## 9.2) Rearing:

**9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1991-02), or for years dependable data are available.**

*Umatilla Hatchery* --The fry to smolt survival objective is 94%. A total of 158,000 fry are ponded to produce 150,000 smolts. Grading of fish was suspended in BY 2002, therefore no pre-smolts are programmed, and 100% reared are released as smolts. Appendix Table 9 shows egg take and survival for summer steelhead.

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

*Umatilla Hatchery* --Swim-up fry are transferred from Heath incubators to Canadian troughs in July while they are at an average size of approximately 3,500 fry/lb. In August they are transferred or ponded in an Oregon raceway at size of about 450 fish/lb. In the fall, they are equally split into three Michigan raceways. Density and loading for Michigan and Oregon raceways are presented in Appendix Table 10.

**9.2.3) Fish rearing conditions.**

*Umatilla Hatchery* --The maximum and minimum dissolved oxygen concentrations in Michigan and Oregon raceway's influent and effluent were 14.5 and 5.7, and 10.6 and 5.7 PPM, respectively (see Appendix Table 8).

**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 9. Monthly average growth (fish/lb) and food conversion of Umatilla Hatchery summer steelhead (Brood year 2001).

| Month | Fish/lb | Conversion |
|---|---|---|
| July | 737 | 1.2 |
| August | 143 | 1.0 |
| September | 57 | 1.4 |
| October | 29 | 1.3 |
| November | 17 | 1.05 |
| December | 10.0 | 1.0 |
| January | 6.8 | 1.18 |
| February | 5.7 | 1.26 |
| March | 4.9 | 1.46 |

| Month | Fish/lb | Conversion |
|---|---|---|
| April | 5.0 | 1.0 |

Length, weight, and condition factor are evaluated during monthly, pre-release, and release monitoring (Appendix Table 11).

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

No energy reserve parameters are monitored or evaluated. Growth rates were determined from monthly length-weight monitoring. Mean growth rates of fry from recent broods were 0.70 mm/d (SD=0.06) for length and 0.51 g/d (SD=0.08) for weight.

**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*).**

Umatilla steelhead are fed Bio-vita starter, Bio-vita fry feed, and Bio-Clark feed. Fish are fed every half hour up to 34 times per day by mechanical feeders at rates of approximately 2.8% - 6.0% body weight. A cumulative conversion rate of 0.94 pounds of feed fed per pound of weight gained was reported in 2008 (1st year on these feed types).

Feed technology is constantly improving. New food types will be periodically assessed.

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

Monthly monitoring follows specific protocols in the Umatilla Fish Health Monitoring and Evaluation work statement. Each species and stock at Umatilla Hatchery is monitored monthly for pathogens and parasites. A minimum of ten moribund or dead fish per stock are tested for systemic bacteria.

Other Infections - Juvenile fish are treated for bacterial infections if necessary with Aquaflor (florfenicol) under an Investigational New Animal Drug Permit (INAD).

Sanitation procedures - Statewide fish health management policy (September 12, 2003) provides guidelines for preventative and therapeutic fish health strategies that will be followed in this program.

Table 10. Disease history (2004-2009) of Umatilla River summer steelhead adults spawned at Minthorn adult facility and juveniles[a] reared at Umatilla Hatchery.

| Disease or Organism | Adults | Juveniles |
|---|---|---|
| IHN Virus | Yes | No |
| EIBS Virus | No | No |
| *Aeromonas salmonicida* | No | No |
| *Aeromonas/Pseudomonas* | Yes | Yes |
| *Flavobacterium psychrophilum* | No | Yes |
| *Fl. columnare* | No | No |
| *Renibacterium salmoninarum* | No | No |
| *Yersinia ruckeri* | No | No |
| *Carnobacterium sp.* | No | No |
| *Ichthyobodo* | No | No |
| *Gyrodactylus* | No | Yes |
| ***phthirius multifilis*** | No | No |
| ***s*** | No | No |
| ***rya (Scyphidia)*** | No | No |
| ***linids*** | No | No |
| ***epods*** | Yes | No |
| Coagulated Yolk Disease | No | Yes |
| External Fungi | Yes | Yes |
| Internal Fungi | No | Yes |
| ***lus cerebralis*** | No | No |
| ***yxa shasta*** | Yes | No |

[a] "Yes" indicates detection of the pathogen but in many cases no disease or fish loss was associated with presence of the pathogen. "No" indicates the pathogen has not been detected in that stock.

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

*Umatilla Hatchery* – Time of year and visual estimates of smoltification (parr, intermediate smolt, smolt) in combination with condition factor (see Section 9.2.4) are used to evaluate smolt readiness. Data from previous descaling evaluations are presented in Appendix Table 12.

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

None are used.

### 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.

Fish will be reared to a size and released at a time that encourage out-migration and minimize residualism. All fish will be 100% marked. Strict health monitoring, disease prevention, and treatment protocols will be used.

## SECTION 10. RELEASE

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

### 10.1) Proposed fish release levels.

Table 11. Proposed fish release levels.

| Age Class | Maximum Number | Size (fpp) | Release Date | Location |
|---|---|---|---|---|
| **Eggs** | 25,000* | | fall | McKay or Meacham |
| **Unfed Fry** | 0 | | | |
| **Fry** | 0 | | | |
| **Fingerling** | 0 | | | |
| **Yearling** | 50,000 | 4.5/LB | Late April | Minthorn (acclimated) |
| | 50,000 | 4.5/LB | Late April | Pendleton (acclimated) |
| | 50,000 | 4.5/LB | Late April | Thorhollow (RM 73.5) (direct release) |

*Placeholder for surplus production

**10.2) Specific location(s) of proposed release(s).** This information has also been provided in Section 1.5.

**Stream, river, or watercourse:** Umatilla River
**Release point:** Minthorn Springs (RM 63.8)
**Major watershed:** Umatilla River
**Basin or Region:** Mid-Columbia River

**Stream, river, or watercourse:** Umatilla River
**Release point:** (RM 73.5) – Direct Stream
**Major watershed:** Umatilla River
**Basin or Region:** Mid-Columbia River

**Stream, river, or watercourse:** Umatilla River
**Release point:** Pendleton Acclimation (RM 56.0)
**Major watershed:** Umatilla River
**Basin or Region:** Mid-Columbia River

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

Table 12. Actual numbers and sizes of fish released by age class during the program.

| Release year | Hatchery | Number Released | Age at Release | Release Location | Date of Release | Type of Release | Number per Pound | Stock |
|---|---|---|---|---|---|---|---|---|
| 1967 | Gnat Creek | 109,805 | | | | Direct | 75.0 | Skamania |
| 1967 | Oak Springs | 238,020 | | | | Direct | 117.0 | Idaho (Oxbow) |
| 1967 | Wallowa | 142,240 | | | | Direct | 240.0 | Idaho (Oxbow) |
| 1968 | Gnat Creek | 23,100 | | | | Direct | 66.0 | Skamania |
| 1968 | Gnat Creek | 150,000 | Eggs | | | Direct | Eggs | Skamania |
| 1969 | Oak Springs | 174,341 | | | | Direct | 145.0 | Skamania |
| 1970 | Carson | 39,489 | | | | Direct | 8.0-9.0 | Skamania |
| 1975 | Wizard Falls | 11,094 | | | | Direct | 9.0 | Umatilla River |
| 1981 | Oak Springs | 17,558 | Yearling | Upper Umatilla R. | | Direct | 6.0-9.0 | Umatilla River |
| 1981 | Oak Springs | 9,400 | Subyearling | Upper Umatilla R. | | Direct | 145.0 | Umatilla River |
| 1982 | Oak Springs | 59,494 | Yearling | Upper Umatilla R. | | Direct | 7.0-8.0 | Umatilla River |
| 1982 | Oak Springs | 67,940 | Subyearling | Upper Uma. R. | | Direct | 124.0 | Umatilla River |
| 1983 | Oak Springs | 60,500 | Yearling | Upper Umatilla R. | | Direct | 11.0 | Umatilla River |
| 1983 | Oak Springs | 52,700 | Subyearling | Upper Umatilla. R. | | Direct | 62.0 | Umatilla River |
| 1984 | Oak Springs | 57,939 | Yearling | Bonifer | May | Forced | 6.5 | Umatilla River |
| 1985 | Oak Springs | 22,000 | Yearling /b | Bonifer | Spring | Forced | 135.0 | Umatilla River |
| 1985 | Oak Springs | 53,850 | Yearling | Bonifer | May | Forced | 7.0 | Umatilla River |
| 1986 | Oak Springs | 39,134 | Yearling /b | Bonifer | Spring | Forced | 150.0 | Umatilla River |
| 1986 | Oak Springs | 54,137 | Yearling | Bonifer | May | Forced/Vol. | 8.4 | Umatilla River |
| 1987 | Oak Springs | 1,485 | Yearling | Meacham Cr. (RM 11) | May | Direct | 5.5 | Umatilla River |
| 1988 | Oak Springs | 30,549 | Yearling | Minthorn | April | Forced | 7.4 | Umatilla River |
| 1988 | Oak Springs | 30,757 | Yearling | Nr. Minthorn | April | Direct | 6.5 | Umatilla River |

| Release year | Hatchery | Number Released | Age at Release | Release Location | Date of Release | Type of Release | Number per Pound | Stock |
|---|---|---|---|---|---|---|---|---|
| 1988 | Oak Springs | 33,984 | Yearling | Umatilla RM 23 | May | Direct | 10.3 | Umatilla River |
| 1988 | Oak Springs | 10,033 | Subyearling | Umatilla RM 89 | December | Direct | 57.5 | Umatilla River |
| 1988 | Irrigon | 24,618 | Unfed fry | S. F. Umatilla R. | June | Direct | 3200.0 | Umatilla River |
| 1989 | Oak Springs | 29,852 | Yearling | Minthorn | May | Forced | 6.6 | Umatilla River |
| 1989 | Oak Springs | 29,586 | Yearling | Nr. Minthorn | May | Direct | 5.6 | Umatilla River |
| 1989 | Oak Springs | 22,274 | Yearling | Bonifer | April/May | Forced | 5.5 | Umatilla River |
| 1990 | Oak Springs | 59,747 | Yearling | Bonifer | May | Forced | 5.9-7.7 | Umatilla River |
| 1990 | Oak Springs | 29,446 | Yearling | Nr. Bonifer | May | Direct | 5.5 | Umatilla River |
| 1991 | Oak Springs | 42,610 | Yearling | Bonifer | May | Forced | 6.2-7.5 | Umatilla River |
| 1991 | Oak Springs | 29,325 | Yearling | Nr. Bonifer | May | Direct | 8.7 | Umatilla River |
| 1991 | Oak Springs | 3,998 | Yearling | Umatilla RM 3 | April | Direct | 12.5 | Umatilla River |
| 1992 | Umatilla | 19,977 | Yearling | Bonifer | March | Forced | 5.8 | Umatilla River |
| 1992 | Umatilla | 47,458 | Yearling | Minthorn | March | Forced | 5.8 | Umatilla River |
| 1992 | Umatilla | 64,550 | Yearling | Meacham Cr. (RM 0.5) | April | Direct | 5.0 | Umatilla River |
| 1992 | Umatilla | 67,419 | Yearling | Meacham Cr. (RM 0.5) | April/May | Direct | 5.5 | Umatilla River |
| 1992 | Umatilla | 5,443 | Yearling | Umatilla RM 3 | April | Direct | 5.8 | Umatilla River |
| | | | | | | | | |
| 1993 | Umatilla | 44,824 | Yearling | Bonifer | April | Forced | 4.5 | Umatilla River |
| 1993 | Umatilla | 47,979 | Yearling | Minthorn | April | Forced | 5.6 | Umatilla River |
| 1993 | Umatilla | 65,465 | Yearling | Bonifer | May | Forced | 6.1 | Umatilla River |
| 1994 | Umatilla | 51,403 | Yearling | Bonifer | April | Forced | 4.9 | Umatilla River |
| 1994 | Umatilla | 49,598 | Yearling | Minthorn | April | Forced | 5.1 | Umatilla River |
| 1994 | Umatilla | 52,097 | Yearling | Bonifer | May | Forced | 5.2 | Umatilla River |

| Release year | Hatchery | Number Released | Age at Release | Release Location | Date of Release | Type of Release | Number per Pound | Stock |
|---|---|---|---|---|---|---|---|---|
| 1994 | Umatilla | 1,732 | Yearling | Umatilla RM 27.3 | April | Direct | 5.7 | Umatilla River |
| 1995 | Umatilla | 48,539 | Yearling | Bonifer | April | Forced | 5.6 | Umatilla River |
| 1995 | Umatilla | 49,983 | Yearling | Minthorn | April | Forced | 4.7 | Umatilla River |
| 1995 | Umatilla | 47,941 | Yearling | Bonifer | May | Forced | 5.5 | Umatilla River |
| 1996 | Umatilla | 47,543 | Yearling | Minthorn | April | Forced | 5.1 | Umatilla River |
| 1996 | Umatilla | 49,377 | Yearling | Bonifer | April | Forced | 5.3 | Umatilla River |
| 1996 | Umatilla | 49,783 | Yearling | Thornhollow | May | Forced | 5.1 | Umatilla River |
| 1997 | Umatilla | 46,788 | Yearling | Minthorn | April | Volitional | 4.6 | Umatilla River |
| 1997 | Umatilla | 41,555 | Yearling | Bonifer | April | Volitional | 5.4 | Umatilla River |
| 1997 | Umatilla | 48,944 | Yearling | Bonifer | May | Volitional | 4.9 | Umatilla River |
| 1998 | Umatilla | 49,084 | Yearling | Minthorn | April | Volitional | 4.7 | Umatilla River |
| 1998 | Umatilla | 41,088 | Yearling | Bonifer | April | Volitional | 5.9 | Umatilla River |
| 1998 | Umatilla | 47,313 | Yearling | Bonifer | Apr/May | Volitional | 5.5 | Umatilla River |
| 1999 | Umatilla | 41,843 | Yearling | Minthorn | April | Volitional | 4.9 | Umatilla River |
| 1999 | Umatilla | 44,226 | Yearling | Bonifer | April | Volitional | 5.5 | Umatilla River |
| 1999 | Umatilla | 35,564 | Yearling | Bonifer | April/May | Volitional | 5.9 | Umatilla River |
| 1999 | Umatilla | 9,878 | Subyearling | Umatilla RM 2.8 | November | Direct | 43.9 | Umatilla River |
| 2000 | Umatilla | 51,659 | Yearling | Minthorn | March/ April | Volitional | 4.8 | Umatilla River |
| 2000 | Umatilla | 52,736 | Yearling | Minthorn | April | Volitional | 4.7 | Umatilla River |
| 2000 | Umatilla | 49,343 | Yearling | Bonifer | April | Volitional | 6.4 | Umatilla River |
| 2001 | Umatilla | 50,829 | Yearling | Minthorn | March/ April | Volitional | 4.8 | Umatilla River |
| 2001 | Umatilla | 48,291 | Yearling | Bonifer | March/ April | Volitional | 5.4 | Umatilla River |
| 2001 | Umatilla | 41,403 | Yearling | Minthorn | April | Volitional | 4.7 | Umatilla River |
| 2002 | Umatilla | 54,917 | Yearling | Bonifer | April | Volitional | 5.1 | Umatilla River |

| Release year | Hatchery | Number Released | Age at Release | Release Location | Date of Release | Type of Release | Number per Pound | Stock |
|---|---|---|---|---|---|---|---|---|
| 2002 | Umatilla | 47,521 | Yearling | Minthorn | April | Volitional | 4.5 | Umatilla River |
| 2002 | Umatilla | 54,366 | Yearling | Pendleton | April | Volitional | 4.2 | Umatilla River |
| 2002 | Umatilla | 608 | Yearling | Pendleton | April | Direct | 3.6 | Umatilla River |
| 2002 | Umatilla | 1,218 | Yearling | Minthorn | April | Direct | 4.2 | Umatilla River |
| 2003 | Umatilla | 41,369 | Yearling | Bonifer | April | Volitional | 4.8 | Umatilla River |
| 2003 | Umatilla | 42,805 | Yearling | Minthorn | April | Volitional | 4.0 | Umatilla River |
| 2004 | Umatilla | 43,590 | Yearling | Meacham Cr. | April | Direct | 4.04 | Umatilla River |
| 2004 | Umatilla | 43,115 | Yearling | Pendleton | April | Volitional | 4.5 | Umatilla River |
| 2004 | Umatilla | 43,863 | Yearling | Minthorn | April | Volitional | 4.5 | Umatilla River |
| 2005 | Umatilla | 54,252 | Yearling | Pendleton | April | Volitional | 4.3 | Umatilla River |
| 2005 | Umatilla | 49,859 | Yearling | Thornhollow | April | Volitional | 4.4 | Umatilla River |
| 2005 | Umatilla | 51,587 | Yearling | Thornhollow | April | Volitional | 4.3 | Umatilla River |
| 2006 | Umatilla | 45,456 | Yearling | Meacham Cr. | April | Direct | 4.6 | Umatilla River |
| 2006 | Umatilla | 45,271 | Yearling | Pendleton | April | Volitional | 4.4 | Umatilla River |
| 2006 | Umatilla | 40,149 | Yearling | Minthorn | April | Volitional | 4.3 | Umatilla River |
| 2006 | Umatilla | 43,054 | Subyearling | River mile 48 | October | Direct | 46.9 | Umatilla River |
| 2007 | Umatilla | 40,422 | Yearling | Meacham Cr. | April | Direct | 4.8 | Umatilla River |
| 2007 | Umatilla | 53,606 | Yearling | Minthorn | April | Volitional | 4.9 | Umatilla River |
| 2007 | Umatilla | 43,725 | Yearling | Pendleton | April | Volitional | 5.0 | Umatilla River |
| 2008 | Umatilla | 47,055 | Yearling | Meacham Cr. | April | Direct | 6.6 | Umatilla River |
| 2008 | Umatilla | 54,014 | Yearling | Minthorn | April | Volitional | 6.8 | Umatilla River |
| 2008 | Umatilla | 51,362 | Yearling | Pendleton | April | Volitional | 6.4 | Umatilla River |

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

Section 10.3 details historical hatchery steelhead releases in the Umatilla River. Since 1984, all releases have been in the spring (March to early June), other than a small release

of subyearlings in December, 1988 & 1999. From 1993 to 2003, all yearling steelhead were acclimated prior to release, other than small evaluation groups. Between 2004 and 2012, one group of fish was direct stream released into Meacham Creek due to facility constraints at Bonifer Pond. Since 2013 one group of fish has been direct stream released at Thornhollow (RM 73.5).Acclimated fish were force released from 1993 to 1996. Since1997, there has been approximately a one week volitional release period prior to force out. Future releases are also planned to be volitional.

**10.5) Fish transportation procedures, if applicable.**

Juvenile summer steelhead are transported to Pendleton/Minthorn/Thornhollow, using 2,000- and 5,000-gallon fish transport trucks. Transport tanks are equipped with supplemental oxygen, aerators, and alarms.

**10.6) Acclimation procedures.**

*Minthorn Acclimation* --Historically, the proposed acclimation period has been four weeks. Beginning in 2004, however, only two groups of fish will be acclimated while one group will be released directly into Meacham Creek (near Bonifer Pond) at RM 2. The fish are fed Silver Cup Slow Sinking Salmon Feed twice each day at rate of approximately 0.4 to 0.6% BWD. Mortalities are removed daily and ODFW pathology personnel are available to address specific disease concerns. Temperature and dissolved oxygen measurements are taken daily during acclimation, and on the day of release, ODFW Fish Health Services sample the fish for descaling, weight and fork length.

Beginning in 1997, acclimated groups have been allowed to release volitionally for the final week of holding before the remaining fish are forced out. At Minthorn, one of three effluent screens in each of the two ponds is removed and the fish are allowed to swim over a V-notched dam board and through an underground pipe directly into Minthorn Springs Creek. One to two days before the remaining fish are released; they are taken off feed to reduce stress. The ponds are lowered and the fish are slowly crowded out. The fish are released over a two day period (one pond/day).

*Pendleton Acclimation* --At Pendleton, the effluent screen is pulled and the fish are allowed to volitionally swim over a notched dam board and down the outlet channel directly into the Umatilla River. The fish are taken off feed one to two days prior to the remaining fish being released. The effluent dam boards are removed and the pond is lowered. The fish are then crowded out of the pond using a seine.

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

All (100%) hatchery steelhead released into the Umatilla River are adipose fin clipped. Program goals are evaluated by annually tagging 40 percent of each release group with coded wire tags (20,000 fish in each group of 50,000). The CWT fish are also given a left

ventral fin clip for visual identification at Three Mile Falls Dam. In addition, 1,500 juveniles in each release group of 50,000 are PIT-tagged to monitor out migration timing, survival and straying.

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

All fish reared to the smolt stage are released as part of the program.

**10.9) Fish health certification procedures applied pre-release.**

All monitoring will be consistent with the ODFW fish health policy. A minimum of four weeks prior to release grab-sampled fish of each species and stock are examined as follows:

- Kidney for *R. salmoninarum* by ELISA from 60 fish per brood year (spring Chinook)
- Gill tissue and body scrapings by microscopy from a minimum of five fish
- Gill/kidney/spleen tissue pools (5 fish per pool) from 10 fish per raceway for culturable viruses.

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

*Minthorn Acclimation* --The Minthorn acclimation/release facility includes two-10 hp pumps (one primary and one backup), standby generator, two raceways, and outlet pipe for releasing fish. The pumps and generator are located in the upper level of an enclosed pump house well above the historical 100-year flood levels. Water is pumped from the creek to each of the raceways. In case of power failure, a standby generator provides emergency power to the pump(s). In addition, if the primary pump fails, the backup pump will automatically start. Both ponds are also equipped with high-level and low-level float alarms. In the event of a power failure, pump failure, or pond level alarm, a phone alarm will dial out to ten phone or pagers numbers until someone acknowledges the alarm. Fish are released from the facility by pulling the dam boards, lowering the pond and crowding out the fish. The fish then exit the pond through an underground pipe to Minthorn Springs Creek. In an extreme emergency, fish are also released in this manner.

*Pendleton Acclimation* --The Pendleton acclimation/release facility includes three vertical turbine pumps (two primary and one backup), standby generator, four acclimation ponds (one of which is used for acclimating summer steelhead), and outlet pipes on each pond for releasing fish. In case of power failure, a standby generator provides emergency power to the pump(s). If one of the two primary pumps fails, the backup pump will automatically start. In the event of a power or pump failure, a phone dialer will begin calling up to 10 telephone numbers (stating there is an alarm condition at the facility) until the alarm is acknowledged. In addition, there are low water level sensors which will also trigger a dial out. Fish are released from the facility by pulling the dam boards, lowering the pond and crowding out the fish using a seine. The fish then exit the pond through an underground pipe to the Umatilla River. In an extreme emergency, fish are also released in this manner.

**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**

Fish are released as full-term smolts in order to minimize residualism and expedite out migration. Two-thirds of the production is also acclimated and volitionally released in order to expedite out migration and minimize interaction with natural fish in the migration corridor. The volitional release strategy also helps prevent predators from focusing on fish released at the same time in large groups.

## 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.**

The Comprehensive Research, Monitoring, and Evaluation Plan for Umatilla Subbasin Summer Steelhead and Chinook Salmon was finalized in January 2006 (Schwartz and Cameron 2006). BPA supported the plan, but recognized that funding was limited to expand current monitoring.

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

Funding and staff are not available to implement all the tasks outlined in the M&E Plan. However, the tasks associated with the Performance Indicators identified in Section 1.10 are funded. The following is a list of unfunded steelhead monitoring and evaluation projects that should be implemented.

- Monitor and assess the residualization of hatchery and naturally reared steelhead and spring Chinook salmon. Residualized steelhead and spring Chinook salmon will be sampled during river surveys. Residuals will be classified based on the presence of a fin clip or wire tag for hatchery fish, the length-frequency distribution for natural Chinook salmon, and using outlier analysis for the juvenile population. Resident redband trout populations will be similarly noted, but are recognized as part of the Umatilla steelhead population. Estimated costs are for two seasonal biologists employed for 3 months each: $25,600 annually.
- Evaluate hatchery steelhead spawning in Birch Creek. Birch Creek is managed as a natural steelhead sanctuary in the Umatilla River basin. However, there is currently no effort to quantify hatchery steelhead straying into Birch Creek. An in-stream PIT tag detection array, located in lower Birch Creek, will be used to evaluate hatchery steelhead use of Birch Creek. In addition, we will use this equipment to estimate the percentage of returning natural-origin adult steelhead to the Umatilla River that spawn in Birch Creek. Returning hatchery and natural origin adult steelhead are

trapped at the Three Mile Falls Dam ladder, and there they will be PIT-tagged. Cost of the PIT tag detection array is dependent on a number of factors, including the wetted channel width, the power source, and the agency that does the installation. We estimate that this project could be completed for $60,000.

- Experimental rearing of steelhead in Oregon raceways. Currently, the smolt-to-adult survival (SAS) of Umatilla Hatchery steelhead does not meet established goals. One possible explanation is that steelhead are currently reared at high densities in Michigan-style oxygen-supplemented raceways. Rearing at lower densities in more conventional Oregon raceways has been shown to improve Chinook salmon SAS, and may similarly improve steelhead SAS. A paired rearing experiment, employing both Michigan and Oregon raceways at the Umatilla Hatchery, is needed to understand the benefits of Oregon raceway rearing. Additional cost for the experiment is for coded-wire tags to track smolt-to-adult survival and stray rate. Cost: $10,000.

**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.**

- NMFS guidelines will be followed in all electro-fishing activities.
- Fish trapping, handling, marking, and tagging activities will be conducted by skilled technicians, following appropriate protocols.
- Experienced surveyors will conduct spawning surveys. Surveyors will walk along the stream, crossing when necessary, avoiding and counting redds and observing fish.
- Experienced fish culturists and pathologists will produce fish within Umatilla hatchery and acclimation facilities.

## SECTION 12. RESEARCH

**12.1) Objective or purpose.**

The proposal for CTUIR's Development of Progeny Marker for Salmonids to Evaluate Supplementation project (#2002-030-00) can be found on the Columbia Basin Fish and Wildlife Authority website. The purpose of the project is twofold; 1) to evaluate if a strontium solution can artificially elevate the Sr: Ca ratios in the otoliths of O. mykiss progeny by using an intra peritoneal cavity injection of strontium chloride into pre-spawning adult female steelhead and 2) to assess population genetic structure of juvenile steelhead in Iskuulpa Creek by using a combination of strontium retention coupled with a pedigree analysis to distinguish between progeny of hatchery and wild naturally spawning females.

**12.2) Cooperating and funding agencies**.

This project is funded by Bonneville Power Administration.

**12.3) Principle investigator or project supervisor and staff.**

Project supervisor is Gene Shippentower, project leader is Travis Olsen and project technician is David Wolf.

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

Same stock as described in Section 2.

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

A deflection board weir with a trap box is installed in Iskuulpa Creek for fish sampling for evaluating the reproductive success of hatchery origin fish that spawn naturally. A deflection board weir is series of panels made of PVC electrical tubing suspended above the stream bed and can float and sink depending on stream flow conditions. Panels are anchored across the stream bed channel using a system of mild carbon steel plates. Trap will be checked daily after the panels and fish live box have been installed. All fish trapped will be anesthetized with MS-222 and sampled (length, weights, fin clipped). Females are then injected with 1cc/500 g of body weight of either a solution containing zero or 20,000 ppm of strontium chloride hexahydrate ($SrCl_2$* $6H_2O$). Hatchery females are injected with the 20,000-ppm strontium solution and natural are injected with a saline (0.9 % salt) solution. A portion of both the females and males trapped will be radio tagged, released and then tracked by radio telemetry to determine spawning distribution within Iskuulpa Creek. The take of adult fish has been shown in the Take Table 7 (Section 2.2.3).

Following a habitat inventory a back pack electro shocking survey will be conducted for capturing and sampling juvenile steelhead. A multiple removal method will be used for calculating population estimates of juvenile steelhead in Iskuulpa Creek and for taking a lethal sample from about 300 juveniles annually (see Take Table 7, Section 2.2.3). Juveniles will be anesthetized using MS-222. Juveniles taken for otoliths will be euthanized with an overdose of MS-222. After the first year of introducing the strontium marker we will focus our otolith sampling to the zero age fish only. After the second year of we will focus our otolith sampling to zero and yearling age juveniles. After the third year and succeeding years we collect samples from all age classes.

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

Installation of a deflection board weir will be assembled annually on September 30 of each year and disassembled on May 30 of the following year or until there are seven consecutive days of zero trapping. When trap is in operation CTUIR staff check and process fish daily. Electro shocking surveys for collecting and sampling juveniles will occur between August and October.

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

After capture, adult male and female fish are anesthetized using MS-222 with a sodium bicarbonate buffer. Following the sampling and tagging protocols, fish are allowed to recover from anesthesia in a live box with air stones and released above the weir. Juveniles will also be anesthetized using MS-222. After sampling, juveniles will be allowed to recover in either an aerated bucket or a flow through net pen prior to release back into the stream.

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

Expected types of take include mortality or injury to adults are from fish jumping at the weir, holding in the trap box, and handling. Potentially, take could occur on "green" adults or kelts unable to negotiate the floating picket part of the weir while attempting to migrate downstream.

In addition, injury to juveniles could occur during electro-fishing collection for genetic sampling. Lethal take would occur on fish sampled for otoliths and potentially from an overdose of MS-222.

**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.**

Take numbers for this project are included in the totals listed in Table 7, Section 2.2.3.

**12.10) Alternative methods to achieve project objectives.**

**A**lternative methods for achieving the objective or purpose of this project are; 1) introduce the strontium injections to adult steelhead captured and released at Three Mile Falls Dam and 2) introduce the strontium injections to adult steelhead used for brood.

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

Adult and juvenile salmonids including Coho, Chinook, and bull trout are encountered periodically in Iskuulpa Creek. No mortality related to this project is anticipated since observations of these species are infrequent.

**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.**

As the number of returning steelhead increases, the trap will be checked on a more frequent basis (2-3x/day) in order to minimize holding time and density.

## SECTION 13. ATTACHMENTS AND CITATIONS

**Citations:**


BOR (U. S. Bureau of Reclamation). 1988. Umatilla Basin Project Oregon planning report – Final environmental impact statements. BOR Pacific Northwest Region, Boise, Idaho.

Boyce, R.R. 1986. A comprehensive plan for rehabilitation of anadromous fish stocks in the Umatilla river basin. Final report of Oregon Department of Fish and Wildlife to Bonneville Power Administration, Portland, Oregon.

BPA (Bonneville Power Administration). 1987. Environmental Assessment: Umatilla Hatchery. Office of Power and Resources Management. Portland, Oregon.

Clarke, L. R., W. A. Cameron, R. W. Stonecypher, and R. W. Carmichael. 2009. Umatilla monitoring and evaluation annual report: 2008. Annual Report to the Bonneville Power Administration, Project 1990-005-00, Portland, Oregon.

Contor, C. R., E. Hoverson, and P. Kissner. 1998. Umatilla Basin natural production monitoring and evaluation. Annual Report to the Bonneville Power Administration, Report DOE/BP-75349-4, Portland, Oregon.

Contor, C. R., J. Wolf, D. Thompson, R. Harris. 2008. The Umatilla Basin natural production monitoring and evaluation project: 2007 annual progress report. Annual Report to the Bonneville Power Administration, Project 1990-005-01, Portland, Oregon.

CTUIR and ODFW (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department Fish & Wildlife). 1989. Umatilla Hatchery Master Plan. Report for the Northwest Power Planning Council, Portland, Oregon.

CTUIR and ODFW (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department Fish & Wildlife). 1990. Umatilla River subbasin salmon and steelhead production plan. Report to the Northwest Power Planning Council, Portland, Oregon.

IHOT. 1995. Integrated Hatchery Operations Team: Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries, 1994 Annual Report. Annual Report to the Bonneville Power Administration, Portland, Oregon.

NMFS (National Marine Fisheries Service). 2008. Proposed middle Columbia River steelhead distinct population segment ESA recovery plan, September, 2008.

Reeve, R., S. Williams, J. Neal and J. Sanchez. 1988. Umatilla River Drainage Anadromous Fish Habitat Improvement Implementation Plan. March 1988, Available from: Bonneville Power Administration, Portland, Oregon, 53 pages.

Schwartz, J. and W. Cameron. 2006. Comprehensive research, monitoring, and evaluation plan for Umatilla Subbasin summer steelhead and Chinook salmon. Monitoring and evaluation plan to Bonneville Power Administration and Northwest Power and Conservation Council, Portland, Oregon.

White, T., J. Hanson, S. Jewett, and R. Carmichael. 2007. Evaluation of juvenile salmonid outmigration and survival in the lower Umatilla River Basin, 2003-2006 Annual Report to Bonneville Power Administration. BPA Report DOE/BP-00024721-1, Portland, Oregon.

## 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."

Name and Title of Applicant: Kevin Blakely, John Day Watershed District Manager, ODFW

Signature: _____ Date _____

Certified by: Scott Patterson, Fish Propagation Program Manager, ODFW, Salem

Signature: _____ Date: _____

## SECTION 15. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS.

**(Anadromous salmonid effects are addressed in Section 2)**

### 15.1) List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.

The UBNPME project monitoring and evaluation activities are conducted under USFWS Section 10 permit #TE-844468-8. ODFW monitoring and evaluation activities are conducted under a Section 6 agreement between the State of Oregon and the United States Fish and Wildlife Service.

The USFWS Biological Opinion for the Umatilla Hatchery Program, Bonneville Power Administration, Umatilla and Wallowa counties, Oregon and Walla Walla County, Washington (USFWS ref # 13420-2008-F-0109) provides Section 7 coverage for incidental take of bull trout under these programs.

### 15.2) Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

**Other Listed Species:**

| Common Name | Scientific Name | Status |
|---|---|---|
| **Fish:** | | |
| Bull trout [1] | *Salvelins confluentus* | Threatened |

[1] Listing unit is the Columbia River Distinct Population Segment

Columbia Basin bull trout (*Salvelinus confluentus*) are listed as Threatened and occur in the project area. There are at least two bull trout life history types in the Umatilla Basin; resident and fluvial. The ad-fluvial life history type, which includes bull trout that migrate down to the mainstem Columbia River, likely exists at an extremely low level as seven adults have been observed at Three Mile Falls Dam since 1995. In the Umatilla River some fish have been observed as far down as Pendleton; but most are found in upper mainstem areas above Gibbon.

Within the Umatilla Basin bull trout status has been highly variable (Table 12) but is generally considered to be viable. In recent years, redd counts in the Umatilla River have declined. Hatchery juveniles may provide a forage base benefit to bull trout.

Table 12. Number of Bull Trout Redds Observed Annually in the Umatilla River, 1994 – 2008 (source: Paul Sankovich, USFWS, La Grande, OR).

| Bull Trout Redds, Umatilla Basin | | |
|---|---|---|
| **Year** | **Total Redd** | **Redds in Index Sites** |
| 1994 | 42 | 29 |
| 1995 | 24 | 19 |
| 1996 | 37 | 28 |
| 1997 | 32 | 32 |
| 1998 | 84 | 81 |
| 1999 | 153 | 144 |
| 2000 | 143 | 128 |
| 2001 | 103 | 99 |
| 2002 | 53 | 48 |
| 2003 | 49 | 43 |
| 2004 | 56 | 45 |
| 2005 | 28 | 28 |
| 2006 | 25 | 24 |
| 2007 | 13 | 13 |
| 2008 | 19 | 19 |

**Proposed:** None

**Candidate Species**

| Common Name | Scientific Name |
|---|---|
| Columbia spotted frog | *Rana luteiventris* |
| Washington ground squirrel | *Spermophilus washingtoni* |
| Yellow-billed Cuckoo | *Coccyzus americanus* |
| Western Boreal Toad | *Bufo boreas* |

**Critical Habitat:** Umatilla River basin contains critical habitat for bull trout.

**15.3) <u>Analyze effects.</u>**

4.10 Summary of Effects [from the USFWS Biological Opinion, see above]
The proposed action is not expected to cause any habitat effects; therefore, the effects of the Project elements are expected to be limited to direct and indirect effects to bull trout. The release of over one million hatchery-raised Chinook, steelhead, and Coho smolts into the Umatilla River, each year, will likely result in direct or indirect interactions between the hatchery-raised fish and bull trout. Hatchery fish will eat prey, occupy space in the river, provide food for predators, influence nutrient flow through carcasses, and potentially introduce pathogens (Pearsons et al. 2007, Pearsons and Hopley 1999).

Based on Project timing and location, all life stages of bull trout (except fry) will most likely be exposed to at least some type of effect from the Project within the action area. A small number of bull trout may be temporarily disrupted from their normal behavior during Project activities such as adult broodstock collection, smolt releases, and adult

releases. However, these effects are not expected to significantly disrupt behavior patterns of bull trout. Additionally, based on past experience with Project activities, the Service expects death or significant injury to be extremely rare from Project activities and only associated from activities at Three Mile Falls Dam. Project activities are not likely to adversely affect bull trout local populations in the Umatilla and Walla Walla River core areas and effects to the Umatilla-Walla Walla Recovery Unit are likely to be minimal.

## 15.4) Actions taken to minimize potential effects.

The USFWS Biological Opinion contains one reasonable and prudent measure: Minimize the amount and extent of incidental take associated with adult collection activities at Three Mile Falls Dam. To implement Reasonable and Prudent Measure #1 (collection activities), the project proponents must:
a. Ensure bull trout captured at Three Mile Falls Dam are held in a separate container, and if transport is warranted, bull trout are transported separate from anadromous salmonids, and released at a safe but different location than the anadromous salmonids.
b. Ensure bull trout captured at Three Mile Falls Dam are released as quickly as possible.
c. Record all observations of bull trout and report this information to the Service on an annual basis. Reports should be sent, by January 31 of each year, to:
Field Supervisor
La Grande Field Office
3502 Highway 30
La Grande, OR 97850

## 15.5) References

CTUIR, et al.. Umatilla/Willow Subbasin Plan. Prepared for the Northwest Power and Conservation Council, Portland, Oregon.

USFWS, 2008. Biological Opinion for the Umatilla Hatchery Program, Bonneville Power Administration, Umatilla and Wallowa counties, Oregon and Walla Walla County, Washington (USFWS ref # 13420-2008-F-0109), September 12, 2008.

# APPENDICES

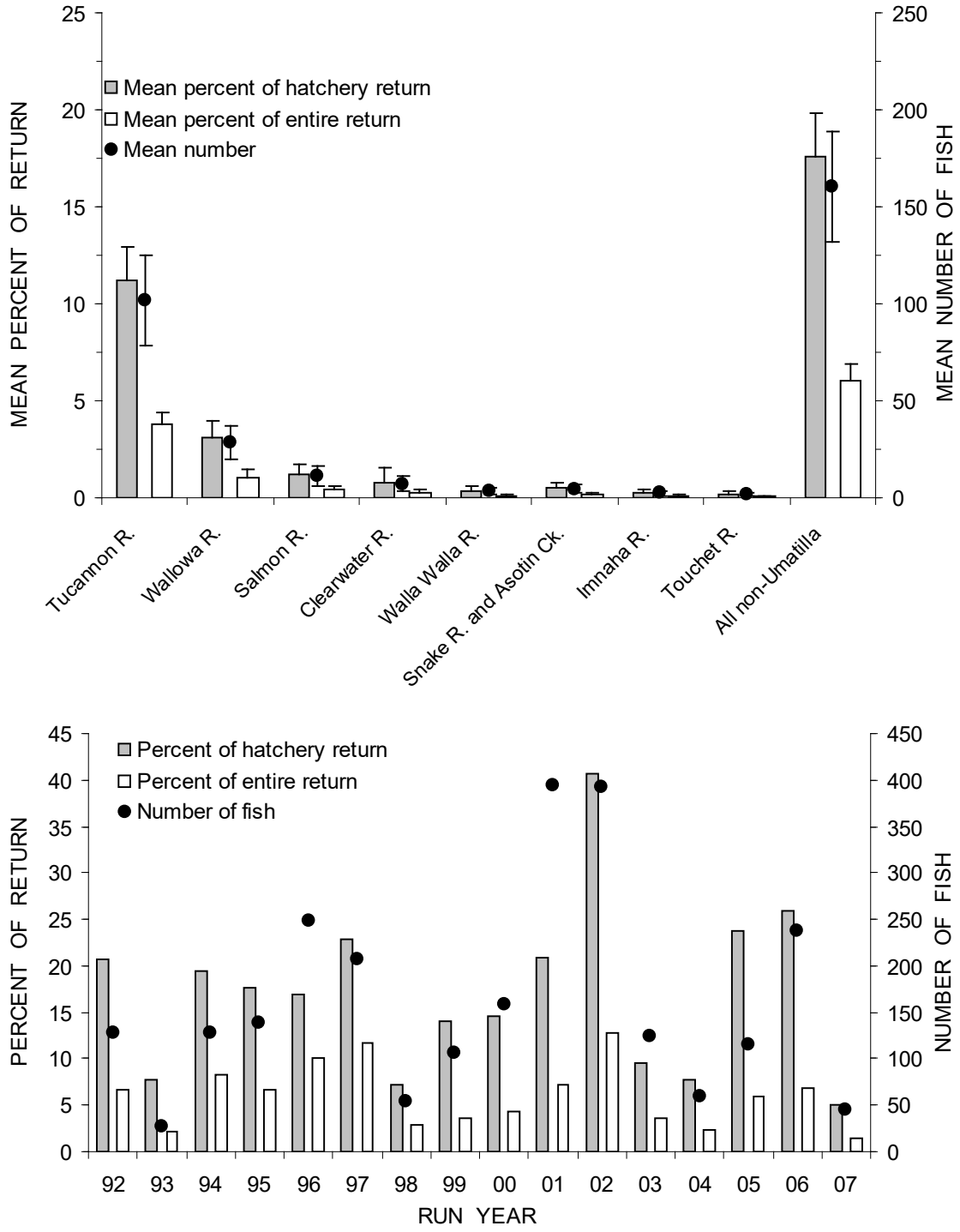
Appendix Table 1. Number of adults produced, smolt-to-adult survival (SAS), smolt-to-adult return (SAR), and percent of adult production that returned to the Umatilla River for summer steelhead reared at Umatilla Fish Hatchery, coded-wire-tagged (CWT) and released in the Umatilla River, 1991-2004 broods.

| BY[a] | Size[b] Grade | Size at release (fish/lb) | Release[c] site | Forced release date | No.[d] CWT recovered | No. adults produced | SAS (%) | SAR[e] (%) | Adult production returned to Umatilla River[e] (%) |
|---|---|---|---|---|---|---|---|---|---|
| 91 | Lrg | 5.8 | B+M | 03-29-92 | 28 | 185 | 0.274 | 0.217 | 79.0 |
| 91 | Lrg | 5.0 | MCk | 04-30-92 | 2 | 13 | 0.020 | 0.000 | 0.0 |
| 91 | Sm | 5.5 | MCk | 05-01-92 | 3 | 19 | 0.028 | 0.028 | 100.0 |
| **Mean or Total** | | **5.4** | | | **33** | **217** | **0.109** | **0.083** | **76.1** |
| 92 | Lrg | 4.5 | BS | 04-18-93 | 69 | 313 | 0.698 | 0.593 | 85.0 |
| 92 | Sm | 6.1 | BS | 05-13-93 | 9 | 49 | 0.075 | 0.075 | 100.0 |
| 92 | Lrg | 5.6 | MN | 04-16-93 | 47 | 248 | 0.517 | 0.423 | 82.0 |
| **Mean or Total** | | **5.5** | | | **125** | **610** | **0.385** | **0.327** | **84.9** |
| 93 | Lg | 4.9 | BS | 04-11-94 | 40 | 402 | 0.782 | 0.6.13 | 78.4 |
| 93 | Sm | 5.2 | BS | 05-12-94 | 3 | 18 | 0.035 | 0.029 | 82.7 |
| 93 | Lg | 5.1 | MN | 04-14-94 | 36 | 353 | 0.712 | 0.522 | 73.3 |
| **Mean or Total** | | **5.1** | | | **79** | **773** | **0.505** | **0.385** | **76.2** |
| 94 | Lg | 5.6 | BS | 04-11-95 | 64 | 513 | 1.057 | 0.900 | 85.2 |
| 94 | Sm | 5.5 | BS | 05-12-95 | 14 | 102 | 0.213 | 0.202 | 95.2 |
| 94 | Lg | 4.7 | MN | 04-13-95 | 88 | 751 | 1.503 | 1.124 | 74.9 |
| **Mean or Total** | | **5.3** | | | **166** | **1,366** | **0.933** | **0.748** | **80.3** |
| 95 | Lg | 5.3 | BS | 04-24-96 | 23 | 147 | 0.298 | 0.251 | 84.2 |
| 95 | Sm | 5.1 | TH | 05-09-96 | 11 | 75 | 0.151 | 0.131 | 87.1 |
| 95 | Lg | 5.1 | MN | 04-12-96 | 50 | 344 | 0.724 | 0.663 | 91.6 |
| **Mean or Total** | | **5.2** | | | **84** | **566** | **0.386** | **0.344** | **89.1** |
| 96 | Lg | 5.4 | BS | 04-10-97 | 23 | 139 | 0.334 | 0.320 | 95.4 |
| 96 | Sm | 4.9 | BS | 05-15-97 | 1 | 7 | 0.014 | 0.014 | 100.0 |
| 96 | Lg | 4.6 | MN | 04-11-97 | 43 | 283 | 0.605 | 0.532 | 87.9 |
| **Mean or Total** | | **4.9** | | | **67** | **429** | **0.312** | **0.283** | **90.5** |

[a] *BY = brood year.*
[b] *Sm = small grade, Lg = large grade, Ng = not graded.*
[c] *MCk = Meacham Creek near Bonifer Springs acclimation site, B+M = Bonifer Springs and Minthorn acclimation sites, BS = Bonifer Springs acclimation site, MN = Minthorn acclimation site, Thornhollow acclimation site.*
[d] *Number of coded-wire tags recovered.*
[e] *Return to Umatilla River mouth = number of fish counted at Three Mile Falls Dam plus harvest below Three Mile Falls Dam estimated from creel surveys.*

Appendix Table 1. (continued)

| BY[a] | Size[b] Grade | Size at release (fish/lb) | Release[c] site | Forced release date | No.[d] CWT recovered | No. adults produced | SAS (%) | SAR[e] (%) | Adult production returned to Umatilla River[e] (%) |
|---|---|---|---|---|---|---|---|---|---|
| 97 | Lg | 5.9 | BS | 04-16-98 | 45 | 288 | 0.701 | 0.475 | 67.7 |
| 97 | Sm | 5.5 | BS | 05-04-98 | 26 | 206 | 0.435 | 0.342 | 78.8 |
| 97 | Lg | 4.7 | MN | 04-17-98 | 57 | 459 | 0.935 | 0.689 | 73.6 |
| **Mean or Total** | | **5.2** | | | **128** | **953** | **0.693** | **0.506** | **72.9** |
| 98 | Lg | 5.5 | BS | 04-13-99 | 30 | 296 | 0.669 | 0.635 | 94.9 |
| 98 | Sm | 5.9 | BS | 05-04-99 | 9 | 140 | 0.394 | 0.388 | 98.7 |
| 98 | Lg | 4.9 | MN | 04-14-99 | 52 | 479 | 1.145 | 0.765 | 66.8 |
| **Mean or Total** | | **5.4** | | | **91** | **915** | **0.752** | **0.607** | **80.8** |
| 99 | Lrg | 6.4 | BS | 03-19-00 | 32 | 445 | 0.902 | 0.632 | 70.1 |
| 99 | Lrg | 4.8 | MN | 03-16-00 | 62 | 672 | 1.301 | 0.890 | 68.5 |
| 99 | Sm | 4.7 | MN | 04-15-00 | 49 | 543 | 1.030 | 0.857 | 83.2 |
| **Mean or Total** | | **5.3** | | | **143** | **1,660** | **1.080** | **0.796** | **73.8** |
| 00 | Lrg | 5.4 | BS | 04-06-01 | 11 | 62 | 0.128 | 0.110 | 85.2 |
| 00 | Lrg | 4.8 | MN | 04-04-01 | 10 | 81 | 0.159 | 0.106 | 67.1 |
| 00 | Sm | 4.7 | MN | 04-26-01 | 10 | 35 | 0.085 | 0.070 | 83.5 |
| **Mean or Total** | | **5.0** | | | **31** | **178** | **0.127** | **0.097** | **76.7** |
| 01 | Lg | 5.1 | BS | 04-09-02 | 57 | 674 | 1.227 | 1.078 | 87.8 |
| 01 | Sm | 4.5 | MN | 04-29-02 | 26 | 263 | 0.540 | 0.521 | 96.4 |
| 01 | Lg | 4.2 | PD | 04-30-02 | 41 | 375 | 0.682 | 0.611 | 89.7 |
| **Mean or Total** | | **4.6** | | | **124** | **1,312** | **0.827** | **0.745** | **90.0** |
| 02 | Ng | 4.8 | BS | 04-28-03 | 17 | 109 | 0.263 | 0.237 | 90.1 |
| 02 | Ng | 4.0 | MN | 04-29-03 | 19 | 134 | 0.313 | 0.245 | 78.0 |
| 02 | Ng | 4.4 | PD | 04-30-03 | 27 | 163 | 0.381 | 0.372 | 97.4 |
| **Mean or Total** | | **4.4** | | | **63** | **406** | **0.320** | **0.286** | **89.0** |
| 03 | Ng | 4.4 | MCk | 04-29-04 | 9 | 62 | 0.141 | 0.141 | 100.0 |
| 03 | Ng | 4.0 | MN | 04-28-04 | 23 | 169 | 0.388 | 0.298 | 76.8 |
| 03 | Ng | 4.5 | PD | 04-29-04 | 32 | 190 | 0.441 | 0.350 | 79.7 |
| **Mean or Total** | | **4.3** | | | **64** | **421** | **0.322** | **0.263** | **81.5** |
| 04 | Ng | 4.4 | TH-1 | 04-28-05 | 15 | 116 | 0.264 | 0.260 | 98.5 |
| 04 | Ng | 4.0 | TH-2 | 04-28-05 | 18 | 170 | 0.390 | 0.333 | 85.4 |
| 04 | Ng | 4.5 | PD | 04-28-05 | 11 | 81 | 0.188 | 0.179 | 95.9 |
| **Mean or Total** | | **4.3** | | | **44** | **367** | **0.281** | **0.257** | **91.8** |
| **Grand Mean** | | **5.0** | | | **89** | **727** | **0.502** | **0.409** | **82.4** |
| **5-yr Mean** | | **4.5** | | | **65** | **537** | **0.375** | **0.330** | **85.8** |




Appendix Figure 1. Non-endemic hatchery steelhead enumerated at Three Mile Falls Dam, Umatilla River, Oregon, run years 1992-2007. Top: Mean and SE for number of fish by smolt release origin and their percent contribution to the hatchery and entire summer steelhead return to Three Mile Falls Dam. Bottom: Total number of non-Umatilla origin fish by run year and their percent contribution to the hatchery and entire summer steelhead return to Three Mile Falls Dam. Run year designations are timing of summer entry into freshwater.

Appendix Table 2. Annual angling effort (angler hours), harvest, and catch of adult hatchery summer steelhead in the Umatilla River non-tribal fishery estimated from creel surveys, run years 1992-2007. Run year designations are timing of summer entry into freshwater.

| Run Year | No. Fishable Days | No. Days Sampled | No. Anglers Interviewed | No. Angler Hours | No. Hatchery Steelhead Harvested | No. Hatchery Steelhead Released | No. Natural Steelhead Released |
|---|---|---|---|---|---|---|---|
| 1992 | 98 | 132 | 543 | 5,293 | 38 | 5 | 134 |
| 1993 | 126 | 137 | 577 | 4,504 | 19 | 7 | 37 |
| 1994 | 164 | 134 | 1,070 | 6,172 | 61 | 24 | 172 |
| 1995 | 167 | 135 | 880 | 4,560 | 60 | 10 | 162 |
| 1996 | 182 | 172 | 1,409 | 5,930 | 91 | 25 | 180 |
| 1997 | 200 | 118 | 898 | 6,676 | 101 | 43 | 238 |
| 1998 | 175 | 104 | 1,179 | 9,097 | 101 | 31 | 272 |
| 1999 | 155 | 96 | 1,154 | 8,545 | 78 | 22 | 454 |
| 2000 | 187 | 110 | 1,455 | 7,283 | 90 | 24 | 181 |
| 2001 | 184 | 97 | 1,624 | 12,057 | 204 | 56 | 733 |
| 2002 | 161 | 105 | 1,395 | 10,502 | 119 | 23 | 254 |
| 2003 | 177 | 107 | 1,599 | 9,895 | 82 | 31 | 292 |
| 2004 | 212 | 180 | 1,183 | 6,790 | 75 | 15 | 197 |
| 2005 | 190 | 128 | 1,194 | 8,173 | 58 | 43 | 375 |
| 2006 | 206 | 118 | 1,125 | 7,785 | 178 | 86 | 461 |
| 2007 | 178 | 111 | 868 | 8,189 | 145 | 5 | 289 |
| **Mean** | **172** | **125** | **1,152** | **7,551** | **94** | **28** | **277** |

Appendix Table 3. Annual harvest adult summer steelhead in the Umatilla River tribal fishery, run years 1992-2007. Run year designations are timing of summer entry into freshwater. Data are not available on numbers of steelhead released.

| Run Year | No. Hatchery Steelhead Harvested | No. Natural Steelhead Harvested | Run Year | No. Hatchery Steelhead Harvested | No. Natural Steelhead Harvested |
|---|---|---|---|---|---|
| 1992 | 25 | 5 | 2000 | 84 | 0 |
| 1993 | 20 | 5 | 2001 | 118 | 11 |
| 1994 | 20 | 5 | 2002 | 56 | 6 |
| 1995 | 39 | 0 | 2003 | 77 | 6 |
| 1996 | 33 | 0 | 2004 | 47 | 3 |
| 1997 | 33 | 5 | 2005 | 98 | 6 |
| 1998 | 39 | 5 | 2006 | 31 | 1 |
| 1999 | 99 | 0 | 2007 | 52 | 6 |

Appendix Table 4. Contribution of Umatilla hatchery steelhead to fisheries outside of the Umatilla River Basin, 1994-2007.

| Year | Ocean Fisheries | COLUMBIA RIVER | | | MID-COLUMBIA TRIBUTARY | LOWER SNAKE RIVER |
|---|---|---|---|---|---|---|
| | | Tribal Fisheries | Non-Tribal Commercial Fishery | Non-Tribal Recreational Fishery | Recreational Fisheries | Recreational Fishery |
| 1994 | 2 | 44 | 0 | 24 | 0 | 0 |
| 1995 | 0 | 48 | 0 | 110 | 0 | 3 |
| 1996 | 0 | 63 | 0 | 75 | 0 | 28 |
| 1997 | 0 | 71 | 0 | 74 | 67 | 0 |
| 1998 | 0 | 26 | 0 | 19 | 10 | 0 |
| 1999 | 0 | 34 | 0 | 18 | 74 | 22 |
| 2000 | 0 | 53 | 0 | 31 | 158 | 0 |
| 2001 | 2 | 12 | 0 | 333 | 79 | 0 |
| 2002 | 0 | 27 | 0 | 57 | 15 | 0 |
| 2003 | 0 | 29 | 0 | 22 | 2 | 26 |
| 2004 | 2 | 28 | 0 | 23 | 0 | 0 |
| 2005 | 0 | 19 | 0 | 30 | 2 | 18 |
| 2006 | 0 | 21 | 0 | 64 | 0 | 2 |
| 2007 | 0 | 0 | 0 | 92 | 0 | 0 |
| **Mean** | **<1** | **34** | **0** | **69** | **29** | **7** |

Appendix Table 5. Contributions of hatchery steelhead smolts to Umatilla River fisheries upriver of Three Mile Falls Dam. Catch data was collected while surveying adult steelhead and spring Chinook salmon fisheries, thus only a portion of the trout fishery (late-May through October) was sampled. Means include years in which no smolts were caught.

| Year | Survey Period | No. Anglers Interviewed | Angling Effort (hours) | No. Hatchery Smolts Harvested | No. Hatchery Smolts Released |
|---|---|---|---|---|---|
| | **ADULT STEELHEAD FISHERY**[a] | | | | |
| 1999 | Jan-Mar | 627 | 5,098 | 0 | 42 |
| 2001 | Mar | 102 | 808 | 0 | 4 |
| 2002 | Jan-Mar | 416 | 5,052 | 0 | 192 |
| 2003 | Feb | 158 | 908 | 0 | 0 |
| 2007 | Jan | 74 | 663 | 0 | 4 |
| 2008 | Feb | 167 | 1,089 | 0 | 68 |
| **Mean** | | | | **0** | **31** |
| | **SPRING CHINOOK SALMON FISHERY** | | | | |
| 1996 | May 25 – Jun 14 | 495 | 2,900 | 161 | 225 |
| 1997 | May 17 – Jun 22 | 395 | 3,341 | 27 | 80 |
| 1999 | May 29 – Jun 20 | 240 | 1,483 | 22 | 37 |
| 2000 | May 06 – Jun 03 | 214 | 4,274 | 0 | 181 |
| 2001 | May 03 – Jun 02 | 324 | 3,736 | 0 | 0 |
| 2002 | May 16 – Jun 07 | 222 | 6,864 | 0 | 195 |
| 2003 | May 24 – May 27 | 43 | 293 | 0 | 67 |
| 2004 | Jun 03 – Jun 23 | 19 | 230 | 0 | 0 |
| 2005 | No Fishery | 0 | 0 | 0 | 0 |
| 2006 | May 26 – Jun 18 | 338 | 4,072 | 0 | 0 |
| 2007 | May 10 – May 22 | 63 | 689 | 0 | 9 |
| 2008 | May 28 – Jun 29 | 136 | 1,866 | 0 | 10 |
| **Mean** | | | | **18** | **67** |
| | **TROUT FISHERY** | | | | |
| 1996 | May 25 – Jun 14 | 519 | 2,342 | 454 | 341 |
| 1997 | May 24 – Jun 22 | 314 | 1,240 | 382 | 345 |
| 1999 | May 29 – Jun 20 | 120 | 1,433 | 85 | 73 |
| 2000 | May 27 – Jun 03 | 43 | 192 | 13 | 2 |
| 2001 | May 26 – Jun 02 | 42 | 285 | 0 | 0 |
| 2002 | May 25 – Jun 07 | 63 | 241 | 36 | 52 |
| 2003 | May 24 – May 27 | 23 | 240 | 62 | 25 |
| 2004 | Jun 03 – Jun 23 | 4 | 48 | 0 | 0 |
| 2005 | No Survey | na | na | na | na |
| 2006 | May 26 – Jun 18 | 3 | 15 | 15 | 0 |
| 2007 | No Survey | na | na | na | na |
| 2008 | May 28 – Jun 29 | 6 | 20 | 0 | 10 |
| **Mean** | | | | **105** | **85** |

[a] *Only months that smolts were caught are presented even though the upriver adult steelhead fishery is surveyed from December or January until closure in mid-April. Retention of smolts is prohibited during this fishery.*

Appendix Table 6. Umatilla River summer steelhead broodstock collection.

| Run Year | Number Collected | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Marked | | | Unmarked | | | Total | | |
| | Males | Females | Total | Males | Females | Total | Males | Females | Total |
| 82-83 | 0 | 0 | 0 | unknown | unknown | 161 | unknown | unknown | 161 |
| 83-84 | 0 | 0 | 0 | 20 | 32 | 52 | 20 | 32 | 52 |
| 84-85 | 0 | 0 | 0 | 25 | 79 | 104 | 25 | 79 | 104 |
| 85-86 | 0 | 0 | 0 | 11 | 58 | 69 | 11 | 58 | 69 |
| 86-87 | 0 | 0 | 0 | 57 | 91 | 148 | 57 | 91 | 148 |
| 87-88 | 0 | 0 | 0 | 73 | 78 | 151 | 73 | 78 | 151 |
| 88-89 | 0 | 0 | 0 | 72 | 88 | 160 | 72 | 88 | 160 |
| 89-90 | 0 | 0 | 0 | 49 | 57 | 106 | 49 | 57 | 106 |
| 90-91 | 47 | 56 | 103 | 46 | 53 | 99 | 93 | 109 | 202 |
| 91-92 | 54 | 42 | 96 | 117 | 119 | 236 | 171 | 161 | 332 |
| 92-93 | 42 | 50 | 92 | 64 | 64 | 128 | 106 | 114 | 220 |
| 93-94 | 19 | 23 | 42 | 46 | 47 | 93 | 65 | 70 | 135 |
| 94-95 | 34 | 34 | 68 | 43 | 43 | 86 | 77 | 77 | 154 |
| 95-96 | 17 | 14 | 31 | 50 | 52 | 102 | 67 | 66 | 133 |
| 96-97 | 10 | 0 | 10 | 50 | 50 | 100 | 60 | 50 | 110 |
| 97-98 | 19 | 11 | 30 | 43 | 43 | 86 | 62 | 54 | 116 |
| 98-99 | 15 | 0 | 15 | 55 | 55 | 110 | 70 | 55 | 125 |
| 99-00 | 15 | 0 | 15 | 60 | 55 | 115 | 75 | 55 | 130 |
| 00-01 | 10 | 0 | 10 | 53 | 53 | 106 | 63 | 53 | 116 |
| 01-02 | 10 | 0 | 10 | 50 | 50 | 100 | 60 | 50 | 110 |
| 02-03 | 9 | 0 | 9 | 51 | 49 | 100 | 60 | 49 | 109 |
| 03-04 | 9 | 10 | 19 | 50 | 52 | 102 | 59 | 62 | 121 |
| 04-05 | 9 | 10 | 19 | 50 | 50 | 100 | 59 | 60 | 119 |
| 05-06 | 10 | 10 | 20 | 50 | 50 | 100 | 60 | 60 | 120 |
| 06-07 | 10 | 10 | 20 | 50 | 50 | 100 | 60 | 60 | 120 |
| 07-08 | 5 | 5 | 10 | 50 | 50 | 100 | 55 | 55 | 110 |

Appendix Table 7. Umatilla River summer steelhead broodstock spawning (only wild brood will be used in 2009).

| Run Year | Number Spawned | | | | | | | | | Eggs Taken | Mean Fecundity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Marked | | | Unmarked | | | Total | | | | |
| | Males | Females | Total | Males | Females | Total | Males | Females | Total | | |
| 82-83 | 0 | 0 | 0 | Unk | 33 | unk | unk | 33 | unk | 132,000 | 4,000 |
| 83-84 | 0 | 0 | 0 | unk | 21 | unk | unk | 21 | unk | 100,000 | 4,762 |
| 84-85 | 0 | 0 | 0 | unk | 33 | unk | unk | 33 | unk | 150,000 | 4,545 |
| 85-86 | 0 | 0 | 0 | unk | 30 | unk | unk | 30 | unk | 166,000 | 5,533 |
| 86-87 | 0 | 0 | 0 | 30 | 37 | 67 | 30 | 37 | 67 | 239,760 | 6,480 |
| 87-88 | 0 | 0 | 0 | 31 | 31 | 62 | 31 | 31 | 62 | 121,980 | 5,545 |
| 88-89 | 0 | 0 | 0 | 42 | 42 | 84 | 42 | 42 | 84 | 214,712 | 5,803 |
| 89-90 | 0 | 0 | 0 | 28 | 25 | 53 | 28 | 25 | 53 | 130,274 | 5,922 |
| 90-91 | 11 | 31 | 42 | 52 | 33 | 85 | 63 | 64 | 127 | 410,356 | 6,412 |
| 91-92 | 0 | 0 | 0 | 86 | 86 | 172 | 86 | 86 | 172 | 476,871 | 5,545 |
| 92-93 | 1 | 2 | 3 | 48 | 47 | 95 | 49 | 49 | 98 | 255,441 | 5,213 |
| 93-94 | 0 | 17 | 17 | 48 | 31 | 79 | 48 | 48 | 96 | 234,432 | 4,884 |
| 94-95 | 9 | 13 | 22 | 31 | 28 | 59 | 40 | 41 | 81 | 223,525 | 5,452 |
| 95-96 | 13 | 8 | 21 | 31 | 32 | 63 | 44 | 40 | 84 | 215,408 | 5,385 |
| 96-97 | 2 | 1 | 3 | 37 | 38 | 75 | 39 | 39 | 78 | 209,639 | 5,375 |
| 97-98 | 13 | 8 | 21 | 30 | 38 | 68 | 43 | 46 | 89 | 228,622 | 5,080 |
| 98-99 | 4 | 0 | 4 | 35 | 41 | 76 | 39 | 41 | 80 | 224,716 | 5,481 |
| 99-00 | 8 | 0 | 8 | 34 | 42 | 76 | 42 | 42 | 84 | 200,825 | 4,782 |
| 00-01 | 0 | 0 | 0 | 41 | 41 | 82 | 41 | 41 | 82 | 226,685 | 5,529 |
| 01-02 | 4 | 0 | 4 | 32 | 36 | 68 | 36 | 36 | 72 | 180,955 | 5,027 |
| 02-03 | 2 | 0 | 2 | 29 | 30 | 59 | 31 | 30 | 61 | 184,827 | 6,161 |
| 03-04 | 0 | 0 | 0 | 44 | 44 | 88 | 44 | 44 | 88 | 215,539 | 4,899 |
| 04-05 | 0 | 2 | 2 | 42 | 40 | 82 | 44 | 42 | 86 | 190,108 | 4,526 |
| 05-06 | 0 | 2 | 2 | 42 | 40 | 82 | 42 | 42 | 84 | 239,170 | 5,695 |
| 06-07 | 0 | 2 | 2 | 42 | 40 | 82 | 42 | 42 | 84 | 198,771 | 4,733 |
| 07-08 | 0 | 3 | 3 | 43 | 40 | 80 | 43 | 43 | 86 | 227,347 | 5,287 |

Appendix Table 8. Water quality comparisons between Michigan and Oregon raceways during summer steelhead production from 1992 to 1998.

| | | | Inlet | | | Outlet | | |
|---|---|---|---|---|---|---|---|---|
| Parameter | Strategy | Pass | N | Means | Min-Max | N | Means | Min-Max |
| Temperature (˚C) | Michigan | A | 113 | 12.4 | 10.4-15.2 | 113 | 12.4 | 10.4-15.1 |
| | | B | 93 | 12.5 | 10.6-15.0 | 93 | 12.5 | 10.6-15.0 |
| | | C | 87 | 12.5 | 10.2-14.9 | 86 | 12.5 | 10.3-15.2 |
| | Oregon | A | 52 | 14.9 | 12.8-16.3 | 52 | 15.0 | 12.5-16.4 |
| | | B | 13 | 14.9 | 13.5-16.0 | 13 | 14.9 | 13.5-15.9 |
| pH | Michigan | A | 108 | 7.78 | 6.83-8.63 | 108 | 7.68 | 6.79-8.30 |
| | | B | 88 | 7.71 | 7.08-8.30 | 88 | 7.63 | 6.73-8.18 |
| | | C | 82 | 7.64 | 6.85-8.24 | 81 | 7.60 | 6.73-8.14 |
| | Oregon | A | 46 | 7.87 | 7.10-8.71 | 46 | 7.83 | 6.75-8.74 |
| | | B | 11 | 7.82 | 7.61-8.02 | 11 | 7.81 | 7.67-8.04 |
| Oxygen (mg/L) | Michigan | A | 110 | 12.1 | 8.7-17.9 | 110 | 9.1 | 5.7-11.9 |
| | | B | 90 | 12.7 | 8.7-19.5 | 90 | 9.5 | 6.2-12.9 |
| | | C | 82 | 13.0 | 9.3-17.6 | 81 | 9.8 | 7.2-14.5 |
| | Oregon | A | 52 | 9.7 | 8.1-14.3 | 51 | 8.7 | 5.7-10.6 |
| | | B | 13 | 9.2 | 8.3-9.9 | 13 | 8.3 | 7.5-9.0 |
| Unionized Ammonia (μ/L) | Michigan | A | | | | 88 | 0.56 | 0.03-2.56 |
| | | B | | | | 70 | 1.12 | 0.12-7.48 |
| | | C | | | | 65 | 1.49 | 0.23-11.75 |
| | Oregon | A | | | | 45 | 0.35 | 0.03-1.47 |
| | | B | | | | 11 | 0.52 | 0.11-1.20 |

Appendix Table 9. Egg take and survival of summer steelhead reared at Umatilla Hatchery during brood years 1992 to 2008.

| Brood Year | Number of eggs taken or received | Egg-to-fry survival (%) | Egg-to-smolt survival[a] (%) |
|---|---|---|---|
| 1992 | 423,810 | 81 | 73 |
| 1993 | 255,000 | 74 | 75 |
| 1994 | 234,000 | 85 | 83 |
| 1995 | 223,525 | 87 | 77 |
| 1996 | 224,000 | 82 | 72 |
| 1997 | 209,639 | 82 | 76 |
| 1998 | 228,622 | 63 | 54 |
| 1999 | 224,716 | 76 | 74 |
| 2000 | 200,825 | 79 | 76 |
| 2001 | 226,685 | 75 | 71 |
| 2002 | 180,955 | 73 | 69 |
| 2003 | 184,827 | 75 | 71 |
| 2004 | 215,539 | 78 | 72 |
| 2005 | 190,108 | 64 | 69 |
| 2006 | 239,170 | 87 | 76 |
| 2007 | 198,771 | 87 | 77 |
| 2008 | 227,347 | 77 | |

[a] *Survival estimate is based on green egg-to-smolt stage.*

Appendix Table 10. Rearing conditions immediately before transfer for summer steelhead in Michigan raceways at Umatilla Fish Hatchery from brood years 1991-2007.

| Brood year | Maximum density ($lb/ft^3$) | Maximum loading (lb/gal/min) | Maximum total number reared per gpm in system |
|---|---|---|---|
| 1991 | 5.4-6.7 | 11.8-14.6 | 210 |
| 1992 | 4.0-4.5 | 8.9-9.9 | 167 |
| 1993 | 3.8-4.6 | 8.4-10.1 | 161 |
| 1994 | 4.0-4.2 | 9.7-10.2 | 154 |
| 1995 | 4.1-4.3 | 9.8-10.4 | 154 |
| 1996 | 3.4-3.9 | 8.1-9.3 | 145 |
| 1997 | 3.7-3.8 | 8.7-9.1 | 145 |
| 1998 | 2.1-3.5 | 5.1-8.2 | 128 |
| 1999 | 5.03 | 11.9 | 163 |
| 2000 | 3.82 | 9.0 | 149 |
| 2001 | 5.30 | 12.6 | 166 |
| 2002 | 3.80 | 9.0 | 134 |
| 2003 | 4.28 | 10.1 | 138 |
| 2004 | 5.25 | 12.4 | 164 |
| 2005 | 4.26 | 10.1 | 138 |
| 2006 | 3.84 | 9.1 | 145 |
| 2007 | 3.28 | 7.8 | 161 |

Appendix Table 11. Mean length, weight, and condition factor at release for summer steelhead reared in first, second, and third pass Michigan raceways from Umatilla Hatchery, 1991-2007.

| Brood Year | Date | Pass | Length (mm) N | Length (mm) Mean | Weight (g) N | Weight (g) Mean | Condition factor N | Condition factor Mean |
|---|---|---|---|---|---|---|---|---|
| 1991 | 4/29/92 | A | 323 | 194.3 | 100 | 91.0 | 100 | 1.13 |
| | 3/29/92 | B | 328 | 200.0 | 101 | 90.2 | 101 | 1.09 |
| | 3/29/92 | C | 316 | 186.9 | 99 | 76.7 | 99 | 1.12 |
| 1992 | 5/13/93 | A | 298 | 199.6 | 110 | 74.8 | 110 | 0.93 |
| | 4/16/93 | B | 308 | 198.2 | 98 | 80.9 | 98 | 1.01 |
| | 4/18/93 | C | 324 | 220.1 | 108 | 102.4 | 108 | 0.93 |
| 1993 | 4/14/94 | A | 320 | 205.9 | 103 | 86.7 | 103 | 0.97 |
| | 3/16/94 | B | 312 | 198.3 | 125 | 88.7 | 125 | 1.05 |
| | 3/17/94 | C | 315 | 214.2 | 106 | 93.8 | 106 | 0.94 |
| 1994 | 5/12/95 | A | 315 | 206.3 | 128 | 82.6 | 128 | 0.90 |
| | 3/14/95 | B | 300 | 209.7 | 101 | 96.2 | 101 | 1.00 |
| | 3/15/95 | C | 316 | 205.9 | 117 | 81.4 | 117 | 0.90 |
| 1995 | 5/9/96 | A | 303 | 207.9 | 100 | 87.3 | 100 | 0.99 |
| | 4/12/96 | B | 312 | 206.8 | 102 | 89.9 | 102 | 0.98 |
| 1996 | 5/15/97 | A | 301 | 208.3 | 99 | 93.3 | 99 | 0.99 |
| | 4/11/97 | B | 502 | 208.1 | 381 | 99.5 | 380 | 1.08 |
| | 4/10/97 | C | 304 | 203.5 | 202 | 84.8 | 202 | 0.95 |
| 1997 | 5/4/98 | A | 255 | 187.0 | 106 | 71.9 | 106 | 1.04 |
| | 4/17/98 | B | 302 | 209.3 | 208 | 95.5 | 208 | 1.01 |
| | 4/17/98 | C | 289 | 202.3 | 198 | 77.0 | 198 | 0.94 |
| 1998 | 5/4/99 | A | 323 | 194.7 | 100 | 76.4 | 100 | 0.98 |
| | 4/14/99 | B | 347 | 207.3 | 102 | 91.9 | 102 | 1.04 |
| | 4/15/99 | C | 316 | 207.7 | 105 | 83.2 | 105 | 0.96 |
| 1999 | 4/11/00 | B | 69 | 194.3 | 67 | 70.6 | 67 | 0.93 |
| | 4/4/00 | C | 610 | 206.4 | 214 | 93.8 | 214 | 1.05 |
| | 4/26/00 | A | 325 | 201.7 | 210 | 96.5 | 210 | 1.08 |
| 2000 | 4/3/01 | C | 303 | 207.3 | 101 | 94.7 | 101 | 1.03 |
| | 4/6/01 | B | 310 | 207.9 | 101 | 84.7 | 101 | 0.93 |
| | 4/26/01 | A | 319 | 205.9 | 111 | 96.9 | 111 | 1.03 |

Appendix Table 11. (continued)

| Brood Year | Date | Pass | Length (mm) N | Length (mm) Mean | Weight (g) N | Weight (g) Mean | Condition factor N | Condition factor Mean |
|---|---|---|---|---|---|---|---|---|
| 2001 | 4/9/02 | C | 316 | 211.1 | 99 | 88.2 | 99 | 0.93 |
| | 4/30/02 | B | 311 | 222.7 | 105 | 108.0 | 105 | 1.00 |
| | 4/29/02 | A | 333 | 210.3 | 197 | 100.1 | 197 | 1.03 |
| 2002 | 3/26/03 | A | 300 | 212.4 | 98 | 103.2 | 98 | 1.08 |
| | 3/27/03 | B | 297 | 216.5 | 97 | 93.8 | 97 | 0.95 |
| | 3/27/03 | C | 608 | 217.8 | 199 | 112.1 | 199 | 1.00 |
| 2003 | 3/26/04 | A | 299 | 194.4 | 111 | 78.0 | 111 | 1.05 |
| | 3/26/04 | B | 300 | 198.0 | 98 | 81.3 | 98 | 1.05 |
| 2004 | 4/1/05 | A | 315 | 203.0 | 107 | 93.8 | 107 | 1.15 |
| | 4/1/05 | B | 329 | 208.8 | 106 | 108.9 | 106 | 1.13 |
| | 4/1/05 | C | 315 | 210.4 | 97 | 109.6 | 97 | 1.10 |
| 2005 | 4/24/06 | A | 336 | 206.6 | 99 | 98.5 | 99 | 1.00 |
| | 4/25/06 | B | 310 | 213.1 | 116 | 103.7 | 116 | 0.99 |
| | 4/25/06 | C | 569 | 211.2 | 210 | 104.3 | 210 | 0.99 |
| 2006 | 4/16/07 | A | 2,001 | 186.4 | 101 | 75.9 | 101 | 1.02 |
| | 4/25/07 | B | 609 | 205.0 | 199 | 93.7 | 199 | 1.03 |
| | 4/27/07 | C | 313 | 199.0 | 108 | 90.5 | 108 | 1.02 |
| 2007 | 4/22/08 | A | 330 | 179.4 | 101 | 67.5 | 101 | 1.06 |
| | 4/24/08 | B | 621 | 186.8 | 216 | 66.1 | 216 | 0.98 |
| | 4/24/08 | C | 314 | 189.6 | 117 | 70.4 | 117 | 0.94 |

Appendix Table 12. Mean proportion of descaled, partially descaled, and undamaged summer steelhead reared in Michigan raceways at Umatilla Fish Hatchery for brood years 1991-2007.

| Brood Year | Sample Date | Pass | Smolting | | | | Descaling | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Smolt | Intermediate | Parr | | Descaled | Partial | None |
| 1991 | | A | | | | | 0.01 | 0.43 | 0.56 |
| | | B | | | | | 0.05 | 0.39 | 0.61 |
| 1992 | | A | | | | | 0.08 | 0.30 | 0.62 |
| | | B | | | | | 0.03 | 0.56 | 0.41 |
| | | C | | | | | 0.02 | 0.58 | 0.40 |
| 1993 | | A | | | | | 0.05 | 0.13 | 0.82 |
| | | B | | | | | 0.01 | 0.50 | 0.49 |
| | | C | | | | | 0.11 | 0.33 | 0.56 |
| 1994 | | A | | | | | 0.13 | 0.39 | 0.48 |
| | | B | | | | | 0.00 | 0.21 | 0.79 |
| | | C | | | | | 0.09 | 0.42 | 0.50 |
| 1995 | | A | | | | | 0.03 | 0.70 | 0.28 |
| | | B | | | | | 0.01 | 0.31 | 0.69 |
| 1996 | | A | | | | | 0.12 | 0.48 | 0.41 |
| | | B | | | | | 0.02 | 0.35 | 0.63 |
| | | C | | | | | 0.32 | 0.57 | 0.11 |
| 1997 | | A | | | | | 0.00 | 0.04 | 0.96 |
| | | B | | | | | 0.04 | 0.32 | 0.64 |
| | | C | | | | | 0.05 | 0.34 | 0.61 |
| 1998 | | A | | | | | 0.03 | 0.12 | 0.85 |
| | | B | | | | | 0.00 | 0.06 | 0.94 |
| | | C | | | | | 0.01 | 0.15 | 0.84 |
| 1999 | 2/28/2000 | B | 0.02 | 0.97 | 0.00 | 0.01 | 0.03 | 0.81 | 0.16 |
| | | C | 0.04 | 0.96 | 0.00 | 0.00 | 0.05 | 0.74 | 0.21 |
| | 4/5/2000 | A | 0.01 | 0.96 | 0.00 | 0.03 | 0.01 | 0.14 | 0.85 |
| 2000 | 3/5/2001 | A | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| | | B | 0.00 | 0.99 | 0.00 | 0.01 | 0.00 | 0.00 | 1.00 |
| | | C | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| 2001 | 2/25/2002 | B | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.97 |
| | | C | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| | | A | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |

Appendix Table 12 (continued)

| Brood Year | Sample Date | Pass | Smolting | | | Descaling | | |
|---|---|---|---|---|---|---|---|---|
| | | | Smolt | Intermediate | Parr | Descaled | Partial | None |
| | 3/20/2002 | A | 0.01 | 0.99 | 0.00 | 0.01 | 0.01 | 0.98 |
| | 4/8/2002 | B | 0.11 | 0.89 | 0.00 | 0.00 | 0.00 | 1.00 |
| 2002 | 3/26/03 | A | 0.07 | 0.93 | 0.00 | 0.00 | 0.00 | 1.00 |
| | 3/27/03 | B | 0.07 | 0.93 | 0.00 | 0.00 | 0.00 | 1.00 |
| | 3/27/03 | C | 0.12 | 0.89 | 0.00 | 0.00 | 0.00 | 1.00 |
| 2003 | 3/26/04 | A | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| | 3/26/04 | B | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| 2004 | 4/1/05 | A | 0.12 | 0.88 | 0.00 | 0.00 | 0.00 | 1.00 |
| | 4/1/05 | B | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 1.00 |
| | 4/1/05 | C | 0.24 | 0.76 | 0.00 | 0.00 | 0.00 | 1.00 |
| 2005 | 4/24/06 | A | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| | 4/25/06 | B | 0.20 | 0.80 | 0.00 | 0.00 | 0.00 | 1.00 |
| | 4/25/06 | C | 0.17 | 0.83 | 0.00 | 0.00 | 0.00 | 1.00 |
| 2006 | 4/16/07 | A | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| | 4/25/07 | B | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| | 4/27/07 | C | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| 2007 | 4/22/08 | A | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| | 4/24/08 | B | 0.01 | 0.99 | 0.00 | 0.00 | 0.00 | 1.00 |
| | 4/24/08 | C | 0.04 | 0.96 | 0.00 | 0.00 | 0.00 | 1.00 |