Helpful Tips for Reading the Fact Sheets

1. Fact sheets are included for Oregon's 10 existing Mid-C steelhead populations and the non-essential, experimental [ESA 10(j)] Upper Deschutes-Crooked River population since reintroduction and passage efforts above Pelton-Round Butte Complex aim to restore steelhead to their historically accessible areas {see Figure ES-1 (page 1) and Figure 1 (page 4) for population delineations}.
2. **2016 status** refers to an existing (extant) population's viability status, defined as probabilities of extinction risk over a 100-year time period, and based on the 2016 NMFS 5-year status review[3] of four viability criteria:
   - ***Abundance***—the average number of naturally produced spawners in a population over a generation or more;
   - ***Productivity***—performance of a population over time in terms of recruits per spawner;
   - ***Spatial structure***—a population's geographic distribution and the processes that affect that distribution; and
   - ***Diversity***—the distribution of genetic, life history, and phenotypic variation within and among populations.
3. **Population status & trends** figures summarize abundance, hatchery proportion, and recruits per spawner raw data.
   - The **abundance** graph displays the smoothed trend of estimated annual natural-origin spawner (light blue shaded area) and total spawner data (natural- and hatchery-origin; dark blue shaded area), the recovery minimum natural-origin spawner (NOSA) abundance threshold (black dashed line), and 10-year rolling geometric mean of natural-origin spawners (orange trendline).
     – Unlike the traditional average (arithmetic mean), the geometric mean (geomean) is used because it tends to dampen the effect of very high or low values in the dataset.
   - The **hatchery proportion** graph displays the annual raw data (red squares) and trend (dashed line) estimates, 5-year rolling average proportion of hatchery-origin spawners (pHOS) data (tan trendline), and the HSRG's recommended population-specific thresholds for low-risk hatchery influence (black dashed line). pHOS provides a measure of the population's genetic diversity risk[4].
   - The **adult recruits per spawner (R/S)** graph displays annual raw data (purple points and trend), 20-year rolling geometric mean estimates (green trendline), population replacement threshold (R/S=1; gray dotted line), and recovery minimum productivity threshold (black dotted line)[5]. R/S is a measure of population productivity or growth rate. Values above replacement (R/S>1) indicate a growing population; values less than one indicate that the population did not replace the number of parents in that brood year[5].
   - Conservation and Recovery Plan **viability thresholds** (e.g., abundance and productivity) start at **1999**, the year Mid-C steelhead were ESA-listed as threatened.
   - Data is available on ODFW's Salmon and Steelhead Recovery Tracker[6] (http:/odfwrecoverytracker.org/) and StreamNet's Coordinated Assessments Data Exchange (http://cax.streamnet.org/) websites. Population-specific viability criteria data collection and analysis methods are further described in Carmichael et al. 2015[7].
4. **Primary threats and limiting factors** are summarized for each population. Addressing primary threats is the highest priority for improving a population's viability and meeting recovery goals. Consequently, secondary threats (e.g., harvest, predation, etc.) are not presented in the fact sheets. An asterisk (*) indicates new primary threats and/or limiting factors based on research and monitoring evidence.
5. **Actions implemented** to addresses the primary threats are summarized in the narrative, graphs, and tables for each population.
   - A recovery **strategy** is a management objective designed to address specific threats and factors limiting the Middle Columbia steelhead viability and achieve the recovery goals of establishing naturally self-sustaining, abundant, productive, and diverse populations.
   - A recovery **action** is the specific management practice or policy required in a specified geographic area to close the gap between current conditions and full achievement of a recovery strategy.
   - A **project** is a completed activity or suite of activities implemented to achieve a particular protection and/or restoration purpose. Multiple projects may address a single recovery plan action.
   - Mainstem Columbia River **hydrosystem** passage and operations remain a primary threat impacting all of Oregon's Mid-C Steelhead populations. Detailed information regarding this threat is provided on pages 39-40.
   - The **research, monitoring, and evaluation (RM&E)** bar graph and text box summarize the status of Oregon's Mid-C Plan RM&E actions implemented as of December 2016.
     – **RM&E Status**: ***Fully Implemented*** 🟢 = RM&E objective is fully funded and executed to evaluate associated monitoring questions; ***Partially Implemented*** 🟡 = RM&E objective is active, but only partially funded and executed to evaluate associated monitoring questions; ***Not Started*** 🔴 = implementation of the RM&E objective is neither funded nor started to date.
     – **Appendix A** tables provide a detailed summary of the RM&E objectives, monitoring questions, and status in terms of current efforts, new work added, future work planned, and/or remaining implementation gaps for each population.
   - **Tributary habitat** pie charts were developed from the **Appendix B** tables that summarize habitat protection and restoration activities completed January 2010 through December 2016 for each population and their relationship to recovery actions and strategies identified in the plan. Many of the habitat recovery actions are defined at the HUC10 or watershed scale in the plan, therefore multiple projects may address the same recovery action. Additionally, many projects require long-term maintenance to ensure their implementation success. The habitat tables and graphs reflect the best available information from existing reporting databases, state/tribal/federal agency staff, and local restoration practitioners.
   - Where applicable, **tributary hydrosystem** and **hatchery** text boxes describe the implementation status of high priority strategic actions to address tributary hydrosystem and hatchery influence limiting factors for a population(s).
6. **Major population group (MPG)** summaries describe priority recovery gaps and management recommendations for each MPG.

Fifteenmile Creek Summer Steelhead Population

Population Status & Trends

- 2016 Status: **Maintained** (moderate, 6-25%, extinction risk)[3]; it is the only wild population in the MPG
- The recent 10-year geomean natural origin abundance estimate of **353** (range 129—737, Spawning Years 2007—2016) is **below** the minimum abundance threshold of 500 spawners for low risk extinction (Figure 3)[1,6].
- Hatchery proportion was not documented until 2011, when weirs were installed to count natural origin and hatchery steelhead. During 2011-2016, hatchery strays accounted for an average of **~4%** of total natural spawners (range 2—7%), which is **below** the HSRG's low risk hatchery-origin spawner threshold of 5% for a primary population (Figure 4)[4,6].
- The recent 20-year geomean recruits per spawner estimate is **1.09** (range 0.19—5.00, Brood Years 1991-2010), **slightly above** population replacement (R/S=1) **and below** the minimum threshold for recovery (R/S =1.56; Figure 5)[1,5,6].
- **New Information**: Monitoring evidence, based on 10 years' of PIT-tagged steelhead data in Fifteenmile Creek, strongly indicates that the population is of the summer ecotype. Very few of the steelhead originally PIT-tagged in Fifteenmile Creek return at a time consistent with winter steelhead run-timing[8,9]. Tributary overshoot is significantly impacting the majority of Fifteenmile adult wild steelhead returns. In 2014, 2015 and 2016, a total of 73% (32 of 44), 87% (27 of 31) and 77% (23 of 30) of returning Fifteenmile Creek steelhead that passed Bonneville Dam also passed The Dalles Dam, respectively[8-11]. Survival of returning adults from Bonneville Dam to Fifteenmile Creek for spawning years 2014, 2015, and 2016 was 53%, 48%, and 47%, respectively; suggesting high mortality rates of pre-spawn steelhead adults during Columbia River residence[9] (see pages 39-40 for more information). Abnormally dry conditions since 2010 have likely contributed to lower steelhead smolt production[9].

Revised Primary Threats & Factors Limiting Population Viability[1,8-11]

Hydrosystem: Mainstem Columbia River passage and facility operations; *tributary overshoot (adult returns)

Tributary Habitat: Degraded water quality (high water temperature), altered sediment routing, impaired fish passage, degraded channel structure and complexity, degraded floodplain connectivity and function, and altered hydrology (low flows)

Figure 3. Natural Spawning Abundance

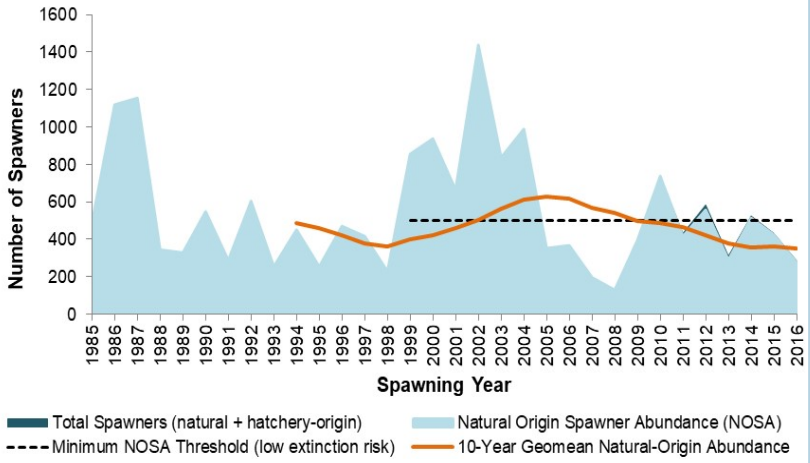


Figure 4. Hatchery Proportion of Natural Spawners

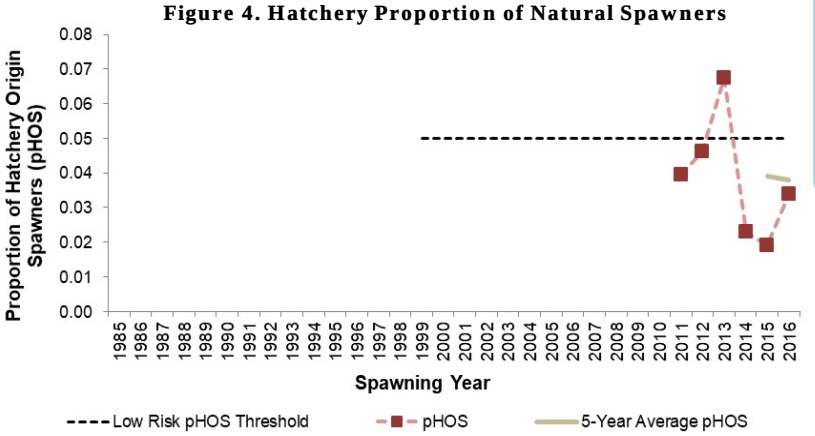


Figure 5. Adult Recruits per Spawner

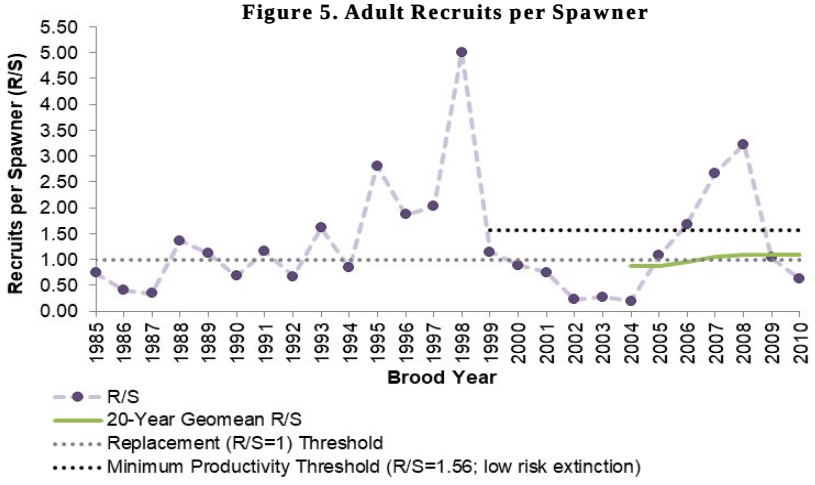
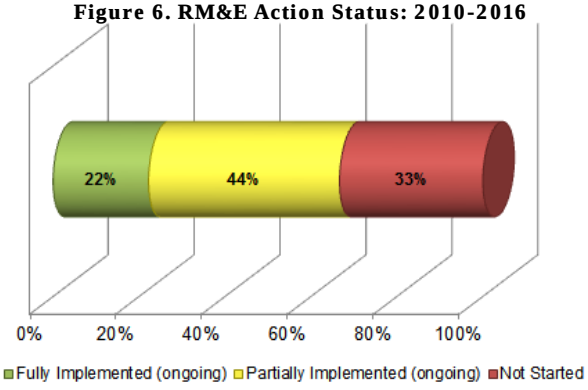


Figure 6. RM&E Action Status: 2010-2016



Research, Monitoring, & Evaluation (RM&E): 2010-2016

- The plan specifies **nine** RM&E recovery actions for the Fifteenmile Creek steelhead population[1]. Only **two** of nine actions (**22%**) were fully funded and implemented as of December 2016. The majority of actions were partially implemented (**44%**) or not started (**33%**) (Figure 6).
- **Six** RM&E actions are ranked highest/high priority. **Two** of these were fully implemented.
- Critical **monitoring gaps**:
  - Proposed future funding cuts to the Fifteenmile Creek steelhead lifecycle project will significantly compromise data collection and evaluation of population viability, threats/limiting factors, and trends towards recovery (Objectives 1-8, Appendix A, Table A-1).
- See **Appendix A, Table A-1** for detailed RM&E action status information.

Fifteenmile Creek Summer Steelhead Population

Tributary Habitat Protection & Restoration: 2010—2016

- **127** tributary habitat strategic recovery actions are identified in the plan for the Fifteenmile Creek steelhead population[1]. **34** actions (**27%**) were implemented through multiple projects during January 2010—December 2016.
- **~137** partners, including private landowners, completed an estimated **128** habitat projects in the population area. **82%** (n=105) of the projects had a nexus to one or more recovery plan actions (Figure 7); **90%** (n=95) of the plan-nexus projects implemented high/highest priority recovery actions (Figure 8) and of these, **39%** (n=37) occurred in high protection and/or restoration benefit areas (Figure 9).
- Predominant recovery plan strategies implemented: **Strategy 6—**providing sufficient instream flow during critical periods; **Multiple Strategies** (combinations of strategies 1, 3, 4, 5, and/or 8); **Strategy 5—**restoring riparian condition and large woody debris (LWD) recruitment (Figure 10). This is mostly consistent with the plan's highest priority tributary habitat recovery strategies (1, 4, 5, and 6) for the population[1].
- **Implementation highlights**:
  - Since 2013, the Fifteenmile Creek Action Plan for Stream Temperatures (FAST) and predictive stream temperature model-driven alert system[12] has resulted in a local irrigators voluntarily curtailing their surface water withdrawals to increase streamflows (~11.88 cfs total) and buffer the effects of extreme temperatures during critical rearing periods[13] (Strategy 6).
  - Continued leasing, exclusion fencing, off-channel water source development, and revegetation of riparian areas. ~91% of the Fifteenmile Creek subbasin is enrolled in CREP[14] (Strategies 1 and 5).
  - Eight stream fords were replaced with bridges and instream habitat structures were installed in the major steelhead spawning areas of Dry Creek, Eightmile, and Fifteenmile Creeks (Strategies 1, 2, and 4).
- **Critical gaps**:
  - There is insufficient data to adequately assess whether restoration projects completed thus far have improved steelhead habitat quantity and quality, and population viability. Future funding is uncertain for the Fifteenmile Creek steelhead life cycle monitoring project. Adult and juvenile steelhead distribution, current habitat status, and habitat restoration effectiveness data-is needed to quantify relationships between fish and habitat use (Objectives 2, 4, and 8 in **Appendix A, Table A-1**).
- See **Appendix B, Table B-1** for a summary of completed habitat projects and associated treatment metrics.

Figure 7. Completed Habitat Projects

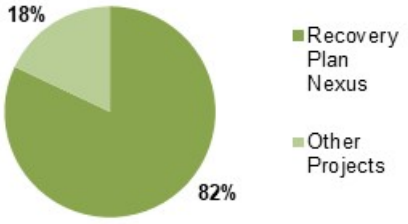


Figure 8. Recovery Plan Actions Addressed

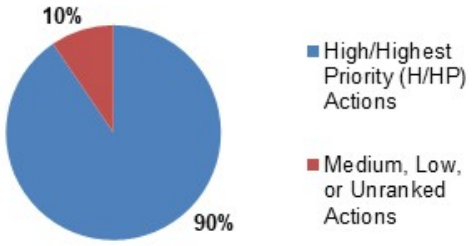


Figure 9. High Priority Plan Actions Implemented in Recovery Benefit Areas

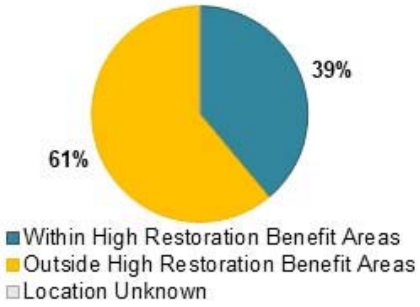


Figure 10. Recovery Plan Strategies Implemented: 2010—2016

Bold Strategies = highest priority

Adult steelhead are detected at tributary weir traps, video weirs, and PIT-tag arrays in Fifteenmile Creek. Photos: Derrek Faber (ODFW).

Deschutes River Eastside Summer Steelhead Population

Population Status & Trends

- 2016 Status: **Viable** (low, 1-5%, extinction risk)[3]
- The recent 10-year geomean natural origin abundance estimate of **1,705** (range 1,288—2,071, Spawning Years 2007—2016) is **above** the minimum abundance threshold of 1,000 spawners for low risk extinction (Figure 11)[1,6].
- During 2012-2016, hatchery strays accounted for an average of **10%** of total natural spawners (range 2% - 20%), which is **above** the HSRG's low risk hatchery-origin spawner threshold of 5% for a primary population (Figure 12)[4,6].
- The recent 20-year geomean recruits per spawner estimate is **0.91** (range 0.19—4.66, Brood Years 1999—2010), **below** population replacement (R/S=1) and the minimum threshold for recovery (R/S =1.35; Figure 13)[1,5,6].
- **New Information**: Population natural-origin abundance is determined from adult weir/traps, kelt traps and spawning ground surveys in Bakeoven and Buck Hollow Creeks, and spawning ground surveys in Trout Creek[7]. Higher smolt-to-adult returns to Bonneville Dam than to Bakeoven and Buck Hollow Creeks suggests that some adults either permanently strayed or died on the migration route prior to spawning[15]. Age composition of natural-origin steelhead is more diverse and represented by four age classes (age-3, age-4, age-5, age-6) in Bakeoven and Buck Hollow Creeks as compared to hatchery origin steelhead (two age classes, age-3 and age-4)[15].

Primary Threats & Factors Limiting Population Viability[1]

Hydrosystem: Mainstem Columbia River passage and facility operations

Tributary Habitat: Degraded riparian condition, altered hydrology (low flows), degraded water quality (high water temperature), degraded channel structure and complexity, degraded floodplain connectivity and function, and impaired fish passage

Hatchery: Effects of naturally spawning stray hatchery fish on viability of wild fish

Figure 11. Natural Spawning Abundance

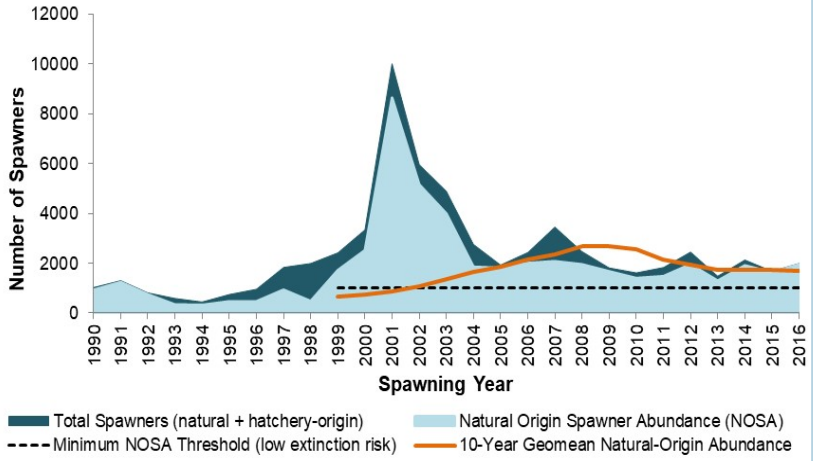


Figure 12. Hatchery Proportion of Natural Spawners

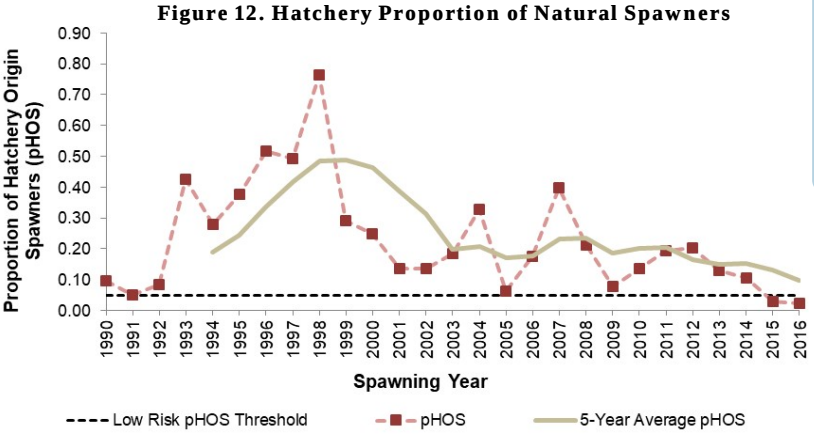


Figure 13. Adult Recruits per Spawner

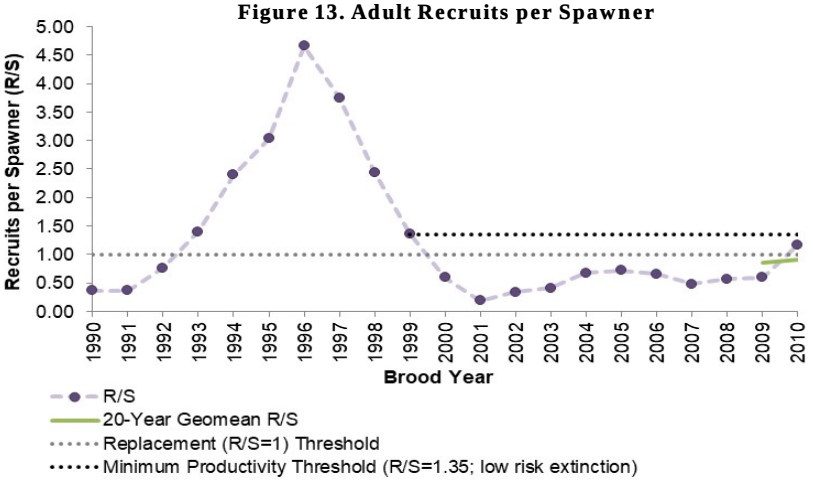
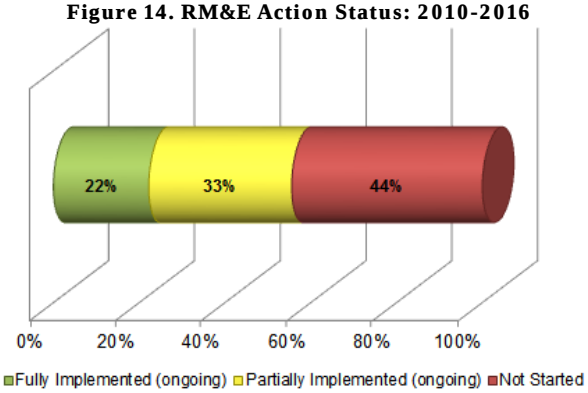


Figure 14. RM&E Action Status: 2010-2016



Research, Monitoring, & Evaluation (RM&E): 2010-2016

- The plan specifies **nine** RM&E recovery actions for the Deschutes Eastside steelhead population[1]. Only **two** of nine actions (**22%**) were fully funded and implemented as of December 2016. The majority of actions were partially implemented (**33%**) or not started (**44%**) (Figure 14).
- **All nine** RM&E actions are ranked highest/high priority. **Two** of the highest priority and **zero** of the high priority actions were fully implemented.
- Critical **monitoring gaps**:
  - Additional funding is needed to fully implement the high/highest priority population spatial structure, habitat status/trend, freshwater productivity, disease, and implementation effectiveness monitoring objectives (see Objectives 2, and 4-9, Appendix A, Table A-2).
- See **Appendix A, Table A-2** for detailed RM&E action status information.

Tributary Habitat Protection & Restoration: 2010—2016

- **98** tributary habitat strategic recovery actions are identified in the plan for the Deschutes River Eastside steelhead population[1]. **28** actions (**29%**) were implemented through multiple projects during January 2010—December 2016.
- **~130** partners, including private landowners, completed an estimated **112** habitat projects in the population area. **56%** (n=63) of the projects had a nexus to one or more recovery plan actions (Figure 15); **54%** (n=34) of the plan-nexus projects implemented high/highest priority recovery actions (Figure 16) and of these, **56%** (n=19) occurred in high protection and/or restoration benefit areas (Figure 17).
- Predominant recovery plan strategies implemented: **Strategy 8**—restoring upland processes to minimize erosion; **Strategy 5**—restoring riparian condition and LWD recruitment; **Multiple Strategies** (combinations of strategies 2, 4, 5, 6, and/or 8); and **Strategy 6**—providing sufficient instream flow during critical periods (Figure 18). This is somewhat consistent with the plan's highest priority tributary habitat recovery strategies (1, 2, 4, 5, and 6) for the population[1].
- **Implementation highlights**:
  - ~133 riparian land miles and ~56 linear stream miles protected/treated via conservation easements, exclusion fencing, native plant revegetation, and noxious weed treatment within the population area (Strategies 1 & 5).
  - Five (5) diversion barriers removed (110 total stream miles made accessible) and irrigation system efficiency improvements (~1.8 cfs conserved, ~21 stream miles improved/protected for flow) in the Trout Creek subbasin (Strategies 2 & 6).
  - Instream habitat and channel complexity actions (installation of boulder and large wood structures and pool development) applied to ~0.7 miles in Trout Creek (Strategy 4).
  - Road relocated from the floodplain in Trout Creek; invasive weed treatment, upland native plant reseeding, and water and sediment control basins installed in Bakeoven, Buck Hollow, and Trout Creeks. (Strategy 8).
- **Critical gaps**:
  - There is insufficient data to adequately assess whether restoration projects completed thus far have improved steelhead habitat quantity and quality, and population viability. Additionally, future monitoring funding/capacity is uncertain. Population distribution, current habitat status, and habitat restoration effectiveness data is needed to identify relationships between fish and habitat use (Objectives 2, 4, and 8 in **Appendix A, Table A-2**).
- See **Appendix B, Table B-2** for a summary of completed habitat projects and associated treatment metrics.

Figure 15. Completed Habitat Projects

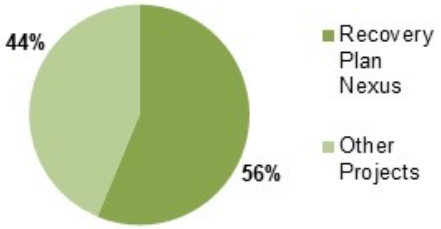


Figure 16. Recovery Plan Actions Addressed

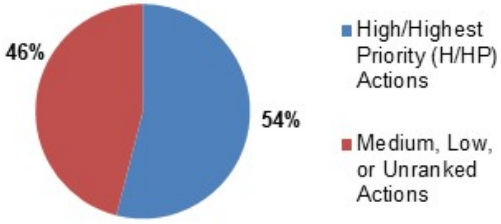


Figure 17. High Priority Plan Actions Implemented in Recovery Benefit Areas

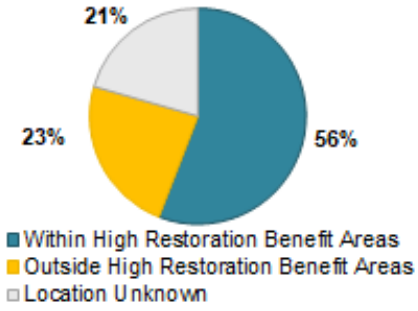
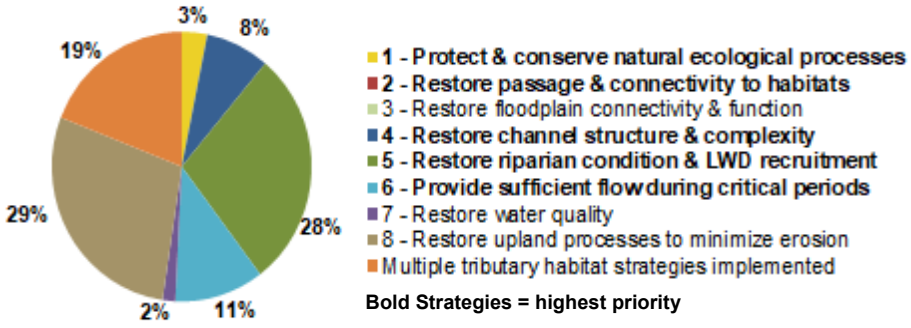


Figure 18. Recovery Plan Strategies Implemented: 2010—2016



Tributary Management Actions to Reduce Hatchery Origin Strays Spawning Naturally: 2010—2016

The plan specifies five strategic hatchery and harvest actions, one of which is non-consensus (**NC**), for the Deschutes River Eastside population[1]. **Hatchery Action**—Construct trapping facilities in Buck Hollow and Bakeoven Creeks to evaluate the effects of hatchery strays on steelhead production, productivity & life history; **Hatchery Action**—Improve trapping facilities and expand trapping operations on Trout Creek to trap remove all hatchery strays; **Hatchery Action (NC)**—Modify and operate Sherars Falls trap to collect and remove out-of-subbasin hatchery fish; **Hatchery Action**—Increase efforts to monitor incidence of hatchery fish on spawning ground through additional stream surveys; and **Harvest Action**—Develop educational outreach program to promote increased retention of hatchery steelhead caught by anglers .

Current Status = Partially Implemented. Trapping facilities were constructed on Buck Hollow and Bakeoven Creeks in November 2008[15]. Additional stream surveys monitor the incidence and effects of hatchery fish on spawning grounds. Due to concerns with handling natural-origin fish and the fate of trapped strays, modifying the trap at Sherars Falls will be considered after all other hatchery actions are implemented and evaluated. Only hatchery steelhead may be harvested in the Deschutes River when/where a non-tribal fishery is open according to ODFW Fishing Regulations[16]. Continued funding of highest priority RM&E Objectives 1 and 3 is needed to support genetic sample analysis, evaluate hatchery influence on natural-origin steelhead viability, and implement management actions that advance recovery (**Appendix A, Table A-2**).

Deschutes River Westside Summer Steelhead Population

Population Status & Trends

- 2016 Status: **High Risk** (high, >25%, extinction risk)[3]
- The recent 10-year geomean natural origin abundance estimate of **619** (range 329—1,195, Spawning Years 2005—2016) is well **below** the minimum abundance threshold of 1,500 spawners for low risk extinction (Figure 19)[1,6].
- During 2012-2016, hatchery strays accounted for an average of **5%** of total natural spawners (range 5% - 6%); the HSRG did not assign a low risk hatchery-origin spawner threshold for this stabilizing population (Figure 20)[4,6].
- The recent 20-year geomean recruits per spawner estimate is **1.00** (range 0.34—3.75, Brood Years 1991—2010); **at** population replacement (R/S=1) **and below** the minimum threshold for recovery (R/S =1.26; Figure 21)[1,5,6].
- **New Information**: Population natural-origin abundance is determined from spawning ground surveys on the mainstem Deschutes River and Shitike Creek, and adult weir/trap counts at the Warm Springs National Fish Hatchery. Sherars Falls trap count metrics provide adjunct natural- and hatchery-origin abundance data when data is missing in the mainstem Deschutes River, Shitike Creek, or Warm Springs River[7]. Additional funding is needed to fully implement the population monitoring recovery actions and improve the detection of viability, threats, and management action effectiveness status and trends.

Primary Threats & Factors Limiting Population Viability[1]

Hydrosystem: Mainstem Columbia River passage and facility operations and Pelton-Round Butte Complex passage and operations

Tributary Habitat: Degraded channel structure and complexity, altered sediment routing, degraded water quality (high water temperature), altered hydrology (low flows), and lack of fish passage over Pelton-Round Butte Complex

Hatchery: Effects of naturally spawning stray hatchery fish on viability of wild fish

Figure 19. Natural Spawning Abundance

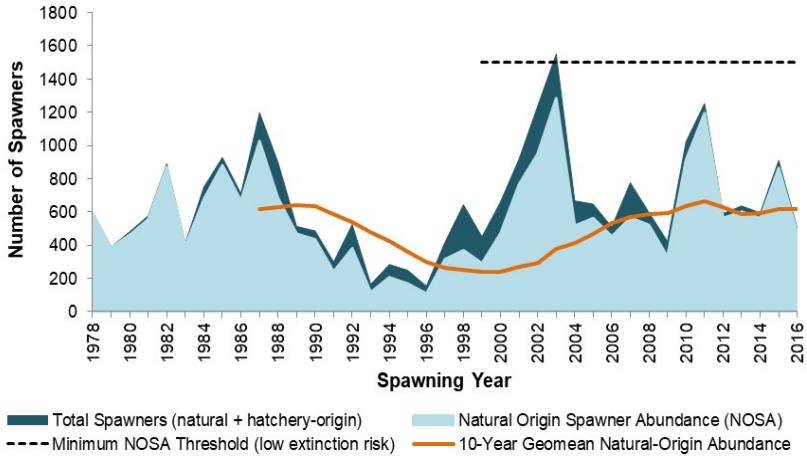


Figure 20. Hatchery Proportion of Natural Spawners

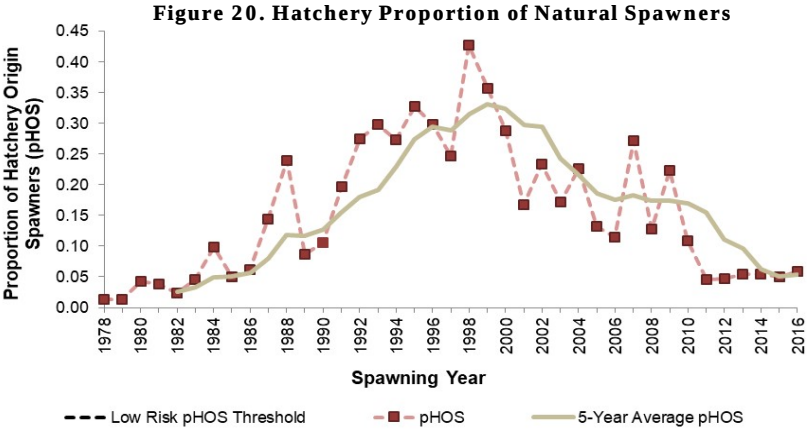


Figure 21. Adult Recruits per Spawner

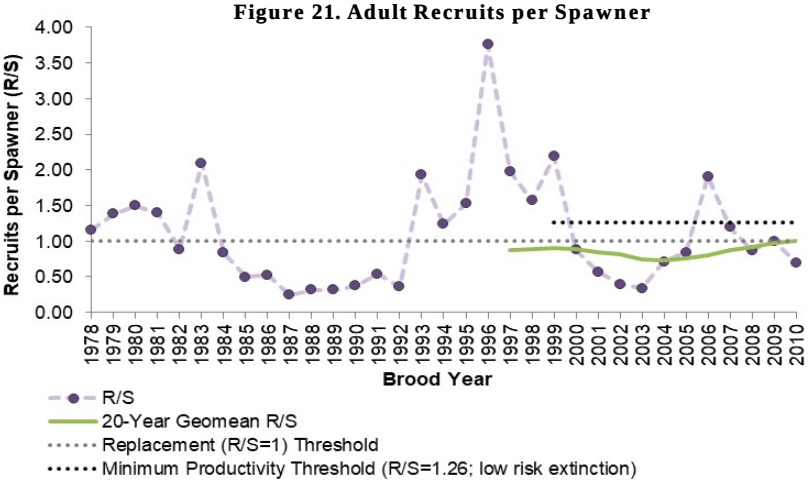
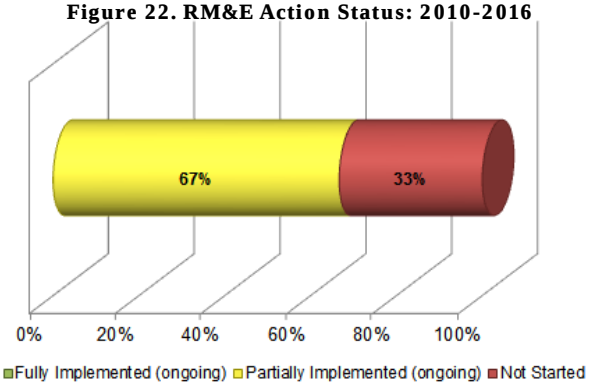


Figure 22. RM&E Action Status: 2010-2016



Research, Monitoring, & Evaluation (RM&E): 2010-2016

- The plan specifies **nine** RM&E recovery actions for the Deschutes Westside steelhead population[1]. **None** of nine actions (**0%**) were fully funded and implemented as of December 2016. The majority of actions were partially implemented (**67%**) or not started (**33%**) (Figure 22).
- **All nine** RM&E actions are ranked high/highest priority in the plan.
- Critical **monitoring gaps**:
  - Additional funding is needed to fully implement the high/highest priority population viability (abundance, freshwater productivity, spatial structure), habitat status/trend, implementation compliance, and effectiveness monitoring objectives (Objectives 1,2, 4, 5, & 8, Appendix A, Table A-3).
- See **Appendix A, Table A-3** for detailed RM&E action status information.

Deschutes River Westside Summer Steelhead Population

Tributary Hydrosystem Facilities and Operations: 2010—2016

Restoring passage and sustainable natural steelhead production to blocked habitats in the Deschutes and Crooked Rivers is a highest priority action identified in the plan[1]. **Current Status = Fully Implemented, Ongoing.** The Pelton-Round Butte Selective Water Withdrawal and Fish Transfer Facility (PRB SWW/FTF) has been in operation since 2010. Steelhead smolts/fry reintroduction above the Project is ongoing. Phase 2 of the Reintroduction Plan[17] (passage of returning adult steelhead above the Project) was initiated in 2012. Monitoring fish passage and migration, fish collection facility attraction, hydrology, water quality, habitat, disease, and predation is underway. Additional years of monitoring data are needed to evaluate status and trends of Project activities, effectiveness, and fish response.

Tributary Habitat Protection & Restoration: 2010—2016

- **139** tributary habitat strategic recovery actions are identified in the plan for the Deschutes Westside steelhead population[1]. **28** actions (**20%**) were implemented as of December 2016.
- **~104** partners, including private landowners, completed an estimated **76** habitat projects in the population area. **86%** (n=65) of the projects had a nexus to one or more recovery plan actions (Figure 23); **62%** (n=40) of the plan-nexus projects implemented high/highest priority recovery actions (Figure 24) and of these, **25%** (n=10) occurred in high protection and/or restoration benefit areas (Figure 25).
- Predominant recovery plan strategies implemented: **Strategy 6** – providing sufficient instream flow during critical periods; **Strategy 8** – restore upland processes to minimize erosion; **Strategy 1** – protect/conserve natural ecological processes; and **Multiple Strategies** (combinations of strategies 2, 3, 4, 5, and/or 8) (Figure 26). This is mostly consistent with the plan's highest priority tributary habitat recovery strategies (1, 2, 4, 5, and 6) for the population[1].
- **Implementation highlights**:
  - Irrigation system efficiency improvements and instream water leases (annual and permanent) in the Deschutes River and Whychus Creek (Strategy 6).
  - Establishment of the Whychus Canyon Preserve and Aspen Hollow Preserve protecting 4.5 linear stream miles, respectively, of Whychus Creek; adoption of the Spring Creek Headwaters Conservation Easement in the Metolius River (Strategy 1).
  - Large wood placement in 4 instream miles of the Warm Springs River (Strategy 4).
- **Critical gaps**:
  - There is insufficient data to adequately assess whether restoration projects completed thus far have improved steelhead habitat quantity and quality, and population viability. Additional funding is needed to fully implement the habitat related research objectives, including the collection and evaluation of habitat quantity/quality, environmental limiting factors, habitat restoration effectiveness, and instream flow data (Objectives 2, 4, and 8 in **Appendix A, Table A-3**).
- See **Appendix B, Table B-3** for a summary of completed habitat projects and associated treatment metrics.

Figure 23. Completed Habitat Projects

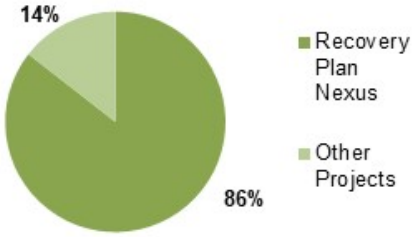


Figure 24. Recovery Plan Actions Addressed

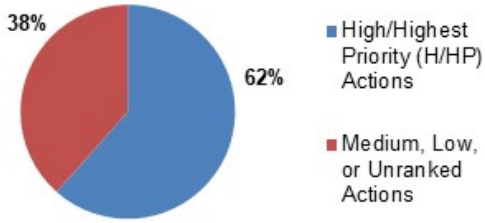


Figure 25. High Priority Plan Actions Implemented in Recovery Benefit Areas

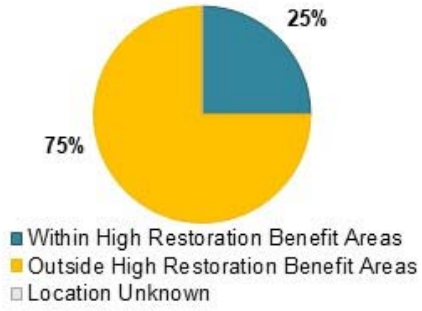


Figure 26. Recovery Plan Strategies Implemented: 2010—2016

Tributary Actions to Reduce Hatchery Strays & Restore Natural Production: 2010—2016

The plan specifies four, consensus, strategic actions for the Deschutes River Westside population[1]: **Hatchery Action**—Investigate opportunities/risks associated with incorporating naturally produced Deschutes River summer steelhead into Round Butte Hatchery (RBH) broodstock; **Hatchery Action**—Begin collecting and removing hatchery steelhead at the Shitike Creek Trap; **Harvest Action**—Develop educational outreach program to promote increased retention of hatchery steelhead caught by anglers; **Hydro-Hatchery Action**—Develop and implement a comprehensive plan for steelhead reintroduction into the Upper Deschutes-Crooked Rivers above Pelton-Round Butte Complex (PRBC). **Current Status = Partially Implemented**. Partners are interested in incorporating natural-origin Deschutes River steelhead into the RBH broodstock to improve stock vigor. The Shitike Creek Weir was redesigned/reinstalled in 2016; a policy decision on the removal of hatchery steelhead at the trap has not been determined by CTWSRO. Only hatchery steelhead may be harvested in the Deschutes River when/where a non-tribal fishery is open per ODFW Fishing Regulations[16]. Full funding of RM&E Objectives 1 and 3 is needed to expand monitoring efforts of hatchery influence on Deschutes River Westside summer steelhead viability (**Appendix A, Table A-3**). As of December 2016, a total of 2,986,464 steelhead fry and 69,831 smolts have been released into the Upper Deschutes River and Whychus Creek[18,19] (**Figure 27, page 12**); 38,343 Upper Deschutes-Crooked River steelhead smolts passed downstream of the PRB SWW/FTF[19-23] (**Figure 28, page 12**). A total of 358 upper-basin origin steelhead adults returned to Pelton Adult Fish Trap and were released upstream of the Project to spawn naturally[18] (**Figure 29, page 12**).

Crooked River Summer Steelhead Population (ESA 10(j) Experimental)

Population Status & Trends

- 2016 Status: **Experimental**; In 2013, NOAA-NMFS designated the Upper Deschutes/Crooked River steelhead population area above Pelton-Round Butte Complex (PBRC) as nonessential, experimental under ESA Section 10(j)[24].
- Steelhead distribution was restricted in Crooked River by construction of Ochoco Dam (RM 10) in 1921 and Bowman Dam (RM 70) in 1961. Since 1968 access to habitat above RM 100 on the mainstem Deschutes River has been blocked entirely due to inadequate passage at Pelton-Round Butte dams, thus terminating access to the Crooked River drainage. Steelhead reintroduction efforts and PBRC fish passage improvements were initiated in 2007 and are ongoing.
- Annual (2007-2016) Upper Deschutes-Crooked River fry and smolt release numbers are presented in Figure 27. A total of **3,211,678 steelhead fry** and **89,328 smolts** have been **released** into the Crooked River and its tributaries (Ochoco and McKay Creeks) since 2008[18,19].
- Figure 28 depicts the annual (2010-2016) number of Upper Deschutes-Crooked River steelhead smolts passed downstream of PRBC. A total of **38,343 smolts** were captured at the PRB SWW/FTF, **transported and released in the lower Deschutes River**[19-23].
- Annual (2011-2016 Run Year) totals of upper-basin and wild origin steelhead adult returns to the Pelton Adult Fish Trap are summarized in Figure 29. **806 wild origin steelhead returned** to the Pelton Trap. **358 total upper-basin origin steelhead adults returned** to the Pelton Trap **and** were **released upstream** of the Project to spawn naturally[18].
- In order for the Crooked River population to achieve a low risk of extinction over 100 years, productivity will need to be greater than or equal to 1.19 recruits per spawner at the minimum abundance threshold of 2,250 spawners[1].
- **New Information**: Approximately ~60% (run year average) of total upriver adult steelhead returns were last detected in the Crooked River basin, with the farthest upstream detection approximately 3.5 miles below Bowman Dam (Crooked River RM 70)[25]. Reducing the incidence of gas bubble disease and providing winter flow releases from Bowman Dam would improve *O. mykiss* survival and juvenile *O. mykiss* overwintering habitat availability and survival below the dam[26].

Primary Threats & Factors Limiting Population Viability[1]

Hydrosystem:
Mainstem Columbia River passage and facility operations and Pelton-Round Butte Complex passage and operations

Tributary Habitat:
Degraded channel structure and complexity, degraded floodplain connectivity and function, degraded riparian condition, degraded water quality (high water temperature), altered hydrology (low flows), altered sediment routing, and impaired fish passage

Figure 27. Upper Deschutes-Crooked River Fry and Smolt Releases

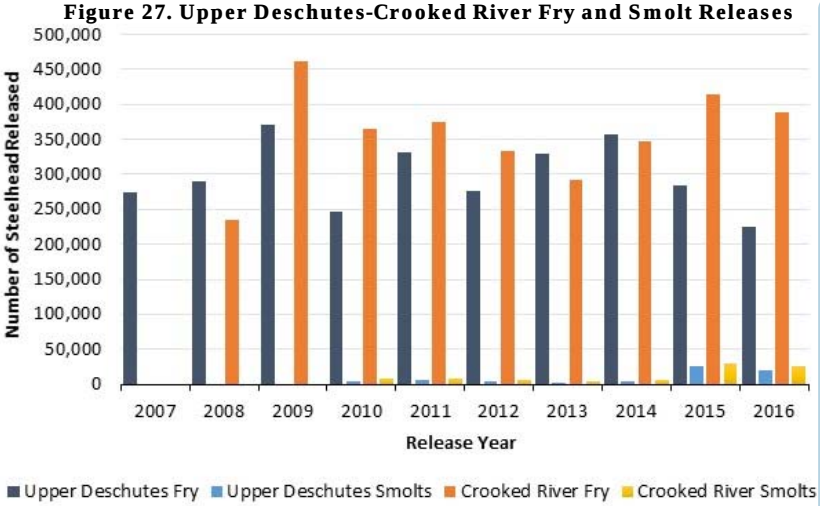


Figure 28. Smolts Passed Downstream of Pelton Round Butte Project

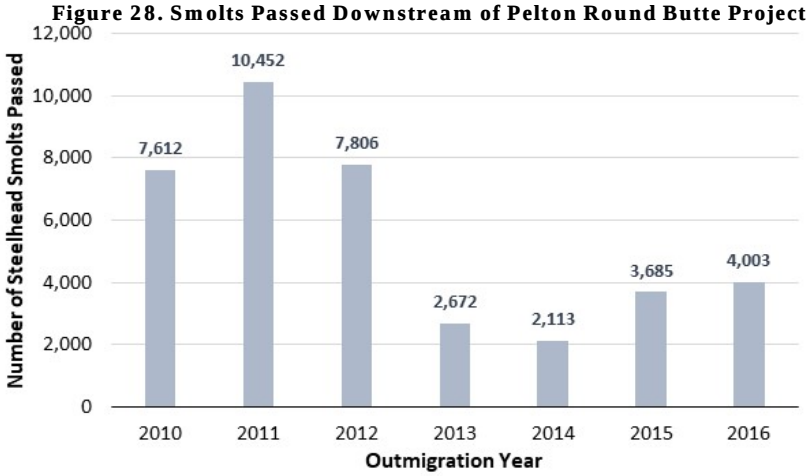
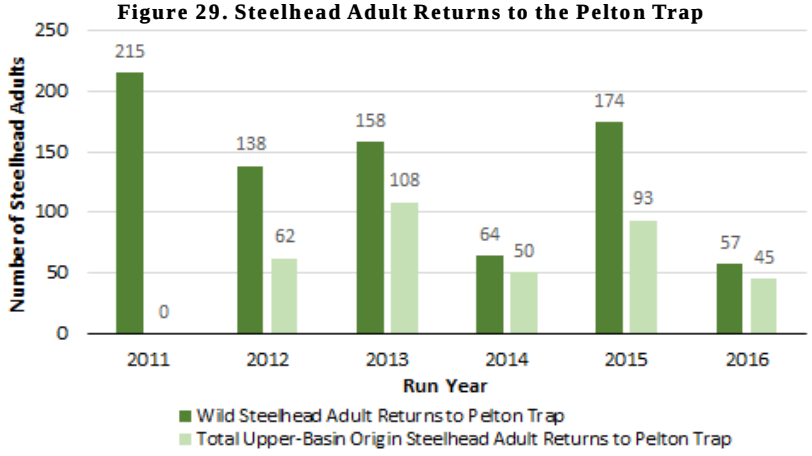


Figure 29. Steelhead Adult Returns to the Pelton Trap



Research, Monitoring, & Evaluation (RM&E): 2010-2016

- The Mid-C Recovery Plan does not include RM&E actions for the Crooked River steelhead population[1]. However, ODFW staff complete annual redband trout (resident *O. mykiss*) surveys below Bowman Dam, and PGE, CTWSRO, and ODFW staff conduct annual monitoring associated with the ODFW-CTWSRO Upper Deschutes-Crooked River Steelhead and Spring Chinook Salmon Reintroduction Plan[17] and operation of the Pelton-Round Butte Complex, including the Selective Water Withdrawal and Fish Passage facilities.
- Critical **monitoring gaps**:
  - An extensive monitoring program is needed to evaluate life-stage specific fish and environmental variable (flow, temperature, total dissolved gas, macroinvertebrates) responses to Bowman Dam seasonal flow modifications[26].

Crooked River Summer Steelhead Population (ESA 10(j) Experimental)

Tributary Habitat Protection & Restoration: 2010—2016

- **333** tributary habitat strategic recovery actions are identified in the plan for the Crooked River steelhead population area[1]. **33** actions (**10%**) were implemented through multiple projects during January 2010—December 2016.
- **~123** partners, including private landowners, completed an estimated **89** habitat projects in the population area. **33%** (n=29) of the projects had a nexus to one or more recovery plan actions (Figure 30); **76%** (n=22) of the plan-nexus projects implemented high/highest priority recovery actions (Figure 31). *Note: Steelhead protection/restoration priority benefit areas were not modeled for the Crooked River population area when the plan was developed. Therefore, information regarding a project's location in a high restoration benefit area is not reported for this population.*
- Predominant recovery plan strategies implemented: **Strategy 2** – restoring passage and connectivity to habitats; **Strategy 5** – restoring riparian condition and LWD recruitment; and **Multiple Strategies** (combinations of strategies 2—6); and **Strategy 8** – restore upland processes to minimize erosion (Figure 32). This is mostly consistent with the plan's highest priority tributary habitat recovery strategies (1-6) for the population[1].
- **Implementation highlights**:
  - Fish passage barriers and screens removed and/or modified to improve fish passage on the Lower Crooked River (e.g., Stearns Dam removal in 2013) and Allen, McKay, and Lower Ochoco Creeks (Strategy 2).
  - Continued conservation easements, exclusion fencing, off-channel water source development, and revegetation of riparian areas throughout the population area (Strategies 1 and 5).
  - Stream channel reconnection and instream habitat restoration in Lower Ochoco and Lower McKay Creeks; irrigation efficiency and instream flow improvements in Lower Ochoco Creek and Lower Crooked River (Strategies 3, 4, and 6).
- **Critical gaps**:
  - There is insufficient data, at this time, to adequately assess whether restoration projects completed thus far have improved steelhead habitat quantity and quality at the population scale.
- See **Appendix B, Table B-4** for a summary of completed habitat projects and associated treatment metrics.

Figure 30. Completed Habitat Projects

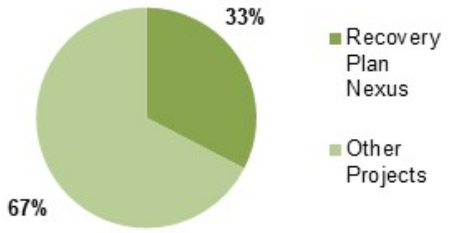


Figure 31. Recovery Plan Actions Addressed

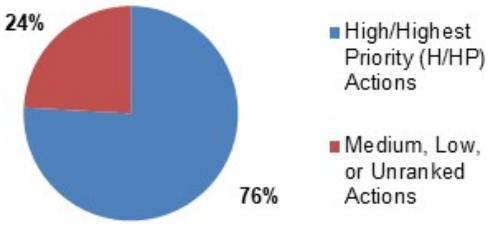


Figure 32. Recovery Plan Strategies Implemented: 2010—2016

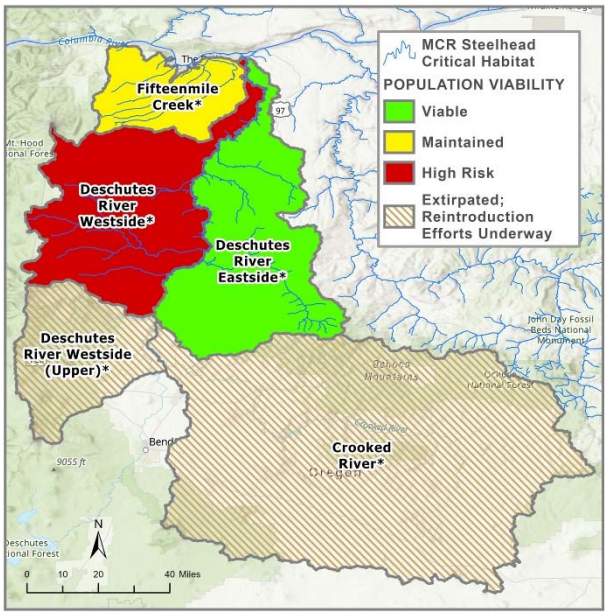
Photo: Mike Gauvin (ODFW), in October 2011, holding the first reintroduced Upper Deschutes-Crooked River steelhead adult that returned to Pelton-Round Butte Trap.

Tributary Actions to Restore Natural Production: 2010—2016

The plan specifies the following consensus, strategic action for the Crooked River population[1]: **Hydrosystem-Hatchery Action**—Develop and implement a comprehensive plan for steelhead reintroduction into the Upper Deschutes-Crooked Rivers above Pelton-Round Butte Complex (PRBC; Project) to restore natural production in blocked habitats.

Current Status = Fully Implemented, Ongoing. Steelhead fry and smolt releases into the Crooked River under the Phase 1 of the Reintroduction Plan[17] were initiated in spring 2008 and are ongoing. The Pelton-Round Butte Selective Water Withdrawal and Fish Transfer Facility has been in operation since 2010. Phase 2 of the Reintroduction Plan[17]—passage of returning adult steelhead above the Project was initiated in 2012. Reintroduction summary data are presented in Figures 27-29 (page 12). Monitoring fish passage and migration, fish collection facility attraction, hydrology, water quality, habitat, disease, and predation is underway. Additional years of monitoring data are needed to evaluate the status and trends of Project activities, effectiveness, and fish response.

Cascades Eastern Slope Tributaries MPG: summary & recommendations



Viability Status

% of Oregon Viable Extant Populations in the MPG[3]

33%

The Deschutes River Eastside population is the only viable (low extinction risk) population in the Oregon portion of the Cascades Eastern Slope Tributaries MPG[3]. The Fifteenmile Creek (moderate extinction risk) and Deschutes River Westside (high extinction risk) populations need to achieve at least viable status. One of these three extant populations will need to achieve highly viable status (very low extinction risk) to contribute to MPG viability[1-3]. Reintroduction efforts are ongoing in the upper portion of the Deschutes River Westside and Crooked River population areas. As of 2013, steelhead reintroduced above the Pelton-Round Butte Complex into these population areas are classified as non-essential, experimental 10(j) populations under the ESA[24]. Beyond ESA-delisting, Oregon's long-term goal is to achieve broad-sense recovery (low to very low extinction risk) for all four population areas[1].

Priority Recovery Gaps & Near-Term Recommendations

Highest priority, recovery gaps and recommended near-term (through 2022) actions for Oregon populations of Middle Columbia River Steelhead within the Cascades Eastern Slope Tributaries MPG include:

Fifteenmile Creek Tributary Overshoot

Tributary overshoot is a significant limiting factor for the Fifteenmile Creek population, with ~78% natural-origin steelhead adults passing above The Dalles Dam (i.e., overshooting the Fifteenmile Creek confluence) in recent run years (2014-2016)[8-11]. Increased monitoring is needed to assess overshoot causal mechanisms and viability impacts at the population scale. Tributary overshoot pre-spawn mortality may be reduced in the near-term by maintaining perpetual surface-water migration corridors as an alternative to turbine passage for overshoot adults migrating downstream through the mainstem Columbia River system and returning to their natal tributaries during December—March[9]. Increased monitoring and providing downstream surface-water passage routes are highest priority recommendations (see pages 39-40 for additional information).

Fifteenmile Creek Population Viability and Threats Criteria Monitoring and Evaluation

The ODFW Fifteenmile Creek Steelhead Life Cycle Monitoring Project collects data on fish abundance, productivity, adult distribution, and survival changes over time (Table A-1, Objectives 1 & 5). Monitoring data strongly indicates that this wild population exhibits a summer-run life-history[8,9]. The majority of Fifteenmile steelhead pass Bonneville Dam earlier than other Mid-Columbia steelhead populations and overwinter in the mainstem Columbia River for several months prior to entering Fifteenmile Creek in early spring[9]. Recent adult steelhead return survival from Bonneville Dam to Fifteenmile Creek averaged ~44-59% (2010-2016 spawning years), indicating high pre-spawn mortality during mainstem Columbia River migration and residence[9]. Low mainstem adult survival is contributing to low population abundance (below the viability criteria minimum threshold of 500 natural-origin (N-O) spawners) and productivity in recent years[9]. Furthermore, abnormally dry conditions and drought events since 2010 have likely contributed to lower and more variable steelhead smolt production and a potential cohort failure of the 2015 brood year[9].

In 2015, ODFW district staff received grant funding from OWEB to conduct seasonal steelhead adult and juvenile surveys and temperature monitoring associated with the Lower Mill Creek Side Channel Restoration Project (pre- and post-implementation monitoring). Continued full life cycle monitoring of the Fifteenmile Creek population viability (abundance, productivity, spatial structure, and diversity) is highest priority. Additional monitoring funding is needed to characterize: juvenile distribution, pre-spawn adult mortality factors, out-of-basin hatchery stray effects, the contribution of minor spawning areas (e.g., Mill Creek) to population viability and life-history ecotype, habitat quantity and quality, and implementation effectiveness. These recommendations are consistent with the highest and high priority RM&E actions identified in the Oregon Mid-C Recovery Plan (see Appendix A Table A-1).

Deschutes River Eastside Population Viability and Threats Criteria Monitoring and Evaluation

Data regarding fish abundance, productivity, and survival changes over time is currently being collected for the

Deschutes River Eastside population. The 10-year geomean estimated abundance has been consistently above the 1,000 N-O spawners viability threshold in recent years. However, the 20-year geomean recruits/spawner estimate is below population replacement (R/S=1) and 5-year average pHOS (hatchery strays) remains above the HSRG's low risk threshold (of 5%). Steelhead distribution and habitat status/trend data is needed to identify relationships between fish and habitat use. Increased funding is needed to conduct the high/highest priority population spatial structure, freshwater productivity, threats status/trends (hydrosystem, habitat, hatchery, harvest, disease), and management effectiveness monitoring objectives (see Appendix A Table A-2).

Deschutes Westside Population Viability and Threats Criteria Monitoring and Evaluation

Limited data regarding fish abundance, productivity, and survival changes over time is currently being collected for the Deschutes River Westside steelhead population. The 10-year geomean natural origin abundance continues to track well below viability criteria (1,500 N-O spawners). The most recent 20-year geomean recruits/spawner estimate is at replacement (R/S=1) but below the minimum recovery threshold (R/S=1.26). Adult and juvenile distribution and habitat status/trend data is needed to identify relationships between fish, habitat use, and primary habitat limiting factors. Additional funding is needed to implement the high/highest priority population viability (abundance, freshwater productivity, spatial structure), threats status/trends (hydrosystem, habitat, hatchery, harvest, disease), and implementation effectiveness monitoring objectives identified in the recovery plan (see Appendix A Table A-3).

Pelton-Round Butte Complex (PRBC) Fish passage, Fish Reintroduction, and Water Quality

Whychus Creek (Deschutes River) and McKay and Ochoco Creeks (Crooked River), major tributaries within the reintroduction area, now contain both anadromous (steelhead) and resident (redband trout) *O. mykiss*[27]. Stream habitat surveys and modeling results indicate that 298 miles of tributaries within the reintroduction area are favorable for *O. mykiss* (140 mi for steelhead; 158 mi for resident redband trout), with an estimated parr capacity of 630,528 fish (130,271 steelhead parr, 500,257 redband parr) and steelhead smolt production potential of 65,135 fish (49,544 smolts from the Crooked River subbasin; 15,591 from the Middle Deschutes and Whychus Creek)[28]. Due to Fish Committee concerns about the low numbers of upriver adult steelhead returns and the impact of reintroduction stocking on native redband trout, future monitoring efforts will include in-depth analysis of residualism rates[27]. Habitat modeling data may optimize reintroduction stocking success by focusing releases in those areas with the highest quality habitat[28]. Additional years of monitoring data are needed to effectively evaluate fish reintroduction, passage and migration, fish collection facility attraction, flow patterns, water quality, habitat, and fish disease.

Opal Springs Diversion Dam Passage (Crooked River)

In October 2011, the Deschutes Valley Water District (DVWD) reached a Settlement Agreement with the National Marine Fisheries Service, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, Oregon Department of Fish and Wildlife, and Trout Unlimited concerning fish passage at the Opal Springs Hydroelectric Project[29]. Opal Springs Dam on the lower Crooked River (RM 8) is identified as a priority fish passage barrier in the Mid-Columbia Recovery Plan[1] and ranked the second highest priority on Oregon's 2013 Statewide Fish Passage Priority List[30]. 2012-2016 PGE radio-tag monitoring data suggests that the majority of upper basin origin adult steelhead passed above the Pelton Trap into Lake Billy Chinook are returning to the Crooked River Basin[25]. Project engineering designs for a permanent fish ladder were completed in 2012. As of 2016, DVWD, ODFW, and OWEB have secured the majority of funding for project construction in 2018-2019. Providing passage would restore access to approximately 94 miles of medium-high quality habitat for ESA-listed steelhead and bull trout in the Crooked River, and McKay and Ochoco Creeks. Such passage is necessary to ensure the success of fish reintroduction efforts above the Pelton-Round Butte Complex and the Deschutes Partnership's tributary habitat protection and restoration projects for Mid-Columbia steelhead in the Upper Deschutes and Crooked River basins (n.b., the Deschutes Partnership includes the Crooked River Watershed Council, Deschutes Land Trust, Deschutes River Conservancy, and Upper Deschutes Watershed Council).

Minimize Hatchery Impacts on Natural Origin Steelhead Viability (MPG-wide)

Reducing the genetic and ecological effects of stray hatchery fish in natural spawning areas is essential for protecting the viability and diversity of Oregon's Fifteenmile Creek and Deschutes River natural origin steelhead. Snake River hatchery strays could be a vector for whirling disease in Fifteenmile Creek and the Deschutes River. Currently, RME Objective 6 which is a moderate priority for the Fifteenmile Creek population and high priority for the Deschutes River Eastside is not funded or implemented at this time. This high priority objective is only partially implemented for the Deschutes River Westside population. Additional funding allocations are necessary to fully implement monitoring at

the population level to determine the effect of disease on the viability of the Fifteenmile Creek, Deschutes River Eastside, and Deschutes River Westside steelhead populations. The Deschutes River Eastside 5-year rolling average pHOS continues to be well above the HSRG recommended low-risk threshold of 5%. Population viability performance continues to track well below the abundance and productivity recovery thresholds for the Deschutes River Westside population. Proposed funding elimination of the Fifteenmile Creek and Deschutes River Life Cycle Monitoring Projects will terminate the collection of baseline monitoring data necessary for detecting hatchery fish presence, evaluating viability impacts to natural-origin populations and management action effectiveness, and guiding additional strategies to further reduce hatchery effects and promote population persistence.

Highest priority actions to minimize hatchery influence on natural origin steelhead populations within Fifteenmile Creek and the Deschutes River include: (1) continued monitoring of the incidence of hatchery fish on the spawning grounds; (2) improving Round Butte hatchery broodstock; (3) improving Shitike Creek Weir operations; (4) monitoring disease incidence and risk to population viability; and (5) identifying additional management opportunities to minimize both out-of-basin and in-basin hatchery effects.

Bowman Dam Flow Modifications and Monitoring (Crooked River)

ODFW monitoring indicates that quantity and timing of flow releases from Bowman Dam is limiting overwintering habitat (low discharge) and spring water quality (nitrogen supersaturation causing gas bubble disease) for resident redband trout and juvenile steelhead and Chinook salmon[26]. High priority management recommendations include: (1) releasing sufficient water during the winter to provide suitable overwintering habitat in the priority core area (Bowman Dam to Prineville); (2) modifying the dam to minimize or eliminate the occurrence of gas bubble disease; and (3) implementing a comprehensive monitoring program to document life-stage specific fish response to flow modifications and identify optimum seasonal conditions[26].

Improving Habitat Quantity and Quality (MPG-wide)

Since 2010, several comprehensive irrigation efficiency projects have been implemented to improve water delivery system infrastructure and water withdrawal monitoring, and transfer conserved water to instream water rights in: Fifteenmile Creek (Wasco SWCD, private landowners, and The Freshwater Trust), Trout Creek (Deschutes River Eastside population; Jefferson SWCD, Deschutes River Conservancy, and private landowners), the Middle Deschutes River (Deschutes River Westside population; Central Oregon Irrigation District Pilot), and Whychus Creek (Deschutes River Westside population; Three Sisters Irrigation District Fish, Deschutes River Conservancy). Efforts are ongoing within the Fifteenmile Creek, Deschutes River, and Crooked River basins to address passage barriers and restore instream, riparian, and floodplain habitat (see Appendix B, Tables B1-B4).

Critically low streamflows, high instream water temperatures, and reduced habitat connectivity and complexity (instream and peripheral) remain key tributary limiting factors for the Fifteenmile Creek, Deschutes River Eastside, Westside, and Crooked River steelhead populations. Actions that measurably (1) protect and conserve high quality steelhead habitats, (2) reduce the occurrence of low instream flows and high water temperatures, and (3) increase habitat connectivity and complexity (floodplain-riparian) are highest priority to promote population recovery and resilience to climate change[1,77] (refer to the Oregon Mid-C Plan recovery action spreadsheets for each population[31]).

Expected benefits to Fifteenmile Creek, Deschutes River, and Crooked River steelhead from implementing these recommendations:

- **Increase steelhead survival in the mainstem Columbia River migration corridor and the number of natural-origin adult returns to natal spawning tributaries.**
- **Increase detection of viability criteria gaps including the threats/factors limiting population and MPG viability.**
- **Improve population genetic diversity and adaptive capacity through revised broodstock practices and hatchery program actions that reduce the incidence of hatchery fish on the spawning grounds.**
- **Increase tributary habitat connectivity and productivity by (a) addressing high priority physical barriers to fish passage and (b) protecting and improving streamflows and instream water temperatures to support steelhead rearing and migration.**