Northwest Salmon & Steelhead Recovery Planning & Implementation

Middle Columbia River Steelhead Recovery Domain

Listed Species:

Middle Columbia River Steelhead

Management Units:

Oregon

Washington Gorge *(White Salmon, Klickitat & Rock Creek)*

Yakima Subbasin

Southeast Washington

Middle Columbia River Steelhead DPS Recovery Plan Summary

NOAA's National Marine Fisheries Service (NMFS) has adopted a recovery plan for the protection and restoration of Middle Columbia River steelhead (*Oncorhynchus mykiss*), which spawn and rear in tributaries to the Columbia River in central and eastern Washington and Oregon. The Middle Columbia River steelhead distinct population segment (DPS) was first listed as threatened under the Endangered Species Act (ESA) in 1999. Its threatened status was affirmed on January 5, 2006. The final Middle Columbia River Steelhead Recovery Plan (the Plan) is now available at NOAA's website, http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Mid-Columbia/Mid-Col-Plan.cfm

Nineteen of the 33 salmon and steelhead species in the Northwest are listed as threatened or endangered. The Middle Columbia River steelhead is among those with the best prospects for recovery, although it will require considerable investment of long-term effort and funding for protection and restoration.

This recovery plan summarizes information from four locally developed recovery plans for management units encompassing Middle Columbia River tributaries in Washington and Oregon. The management unit plans, included as appendices to the DPS Plan, provide recovery actions for the steelhead populations and major population groups that make up the DPS. The Plan draws upon the work of the Interior Columbia Technical Recovery Team (ICTRT), a team of scientists appointed by NMFS to provide a solid scientific foundation for recovery planning.

This Plan also uses information from two "modules" developed by NMFS to address conditions in the Columbia River mainstem and estuary that affect all Middle Columbia steelhead: the Hydro Module, based on the NMFS 2008 Biological Opinion on the Federal Columbia River Power System (FCRPS), and the Estuary Module (NMFS 2007). In addition to proposed actions in the management unit plans, the Plan relies upon Hatchery and Genetic Management Plans and *Artificial Production for Pacific Salmon* (Appendix C of the Supplemental Comprehensive Analysis, NMFS 2008 Biological Opinion) to address hatchery effects. For harvest effects, the Plan refers to fishery management planning through the 2008 *U.S. v. Oregon* agreement for mainstem fisheries, and Fisheries Management Evaluation Plans for tributary fisheries.

Snake River Salmon Recovery

YAKIMA BASIN FISH AND WILDLIFE RECOVERY BOARD

Management Unit Recovery Plans

For the purpose of recovery planning, NMFS defined four management units in the Middle Columbia River steelhead spawning region, based on jurisdictional boundaries as well as areas where local planning efforts were underway. The management unit plans are the work of local groups and county, state, Federal, and tribal entities within the Middle Columbia River region on both sides of the river.

Oregon Management Unit

Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Steelhead Distinct Population Segment

The Oregon Department of Fish and Wildlife (ODFW) is the lead for the Oregon Steelhead Conservation and Recovery Plan. ODFW drew together three groups to help with the plan: the Middle Columbia Recovery Planning Team, made up of ODFW staff biologists and representatives from eight state natural resource agencies; a planning forum, the Middle Columbia Sounding Board, made up of representatives of local communities, agricultural water users, Federal and non-Federal land managers, governing bodies, tribes, and industry and environmental interests; and an Expert Panel of 12 biologists to examine limiting factors and threats for the 10 independent Middle Columbia steelhead populations in Oregon.

Yakima Management Unit

Yakima Steelhead Recovery Plan

The Yakima Basin Fish and Wildlife Recovery Board developed the Yakima Basin Steelhead Recovery Plan. The Board includes representatives from the Yakama Nation, Benton, Kittitas, and Yakima counties, and 18 of the 24 municipalities in the Yakima Basin.

Southeast Washington Management Unit

Snake River Salmon Recovery Plan for Southeast Washington

The Snake River Salmon Recovery Board developed the Southeast Washington Recovery Plan. The Board consists of representatives of the Confederated Tribes of the Umatilla Indian Reservation; a county commissioner and citizen representative from Asotin, Columbia, Garfield, Walla Walla, and Whitman counties; a landowner representative from Asotin, Columbia, and Garfield counties; and the Walla Walla county irrigation district.

Washington Gorge Management Unit

Recovery Plan for the Klickitat Population of Middle Columbia River Steelhead

Recovery Plan for the Rock Creek Population of Middle Columbia River Steelhead

Recovery Plan for the White Salmon Population of Middle Columbia River Steelhead – to be finalized as part of the Lower Columbia River Salmon and Steelhead Recovery Plan

The Washington Gorge management unit comprises three subbasins, which do not so far have a Washington State-sponsored salmon recovery planning board. NMFS prepared a recovery plan for each of these subbasins, in collaboration with the Yakama Nation, Washington Department of Fish and Wildlife (WDFW), Klickitat County, the Washington Governor's Salmon Recovery Office, other Federal agencies, state agencies, local governments, and the public.

The Middle Columbia Recovery Forum

NMFS initiated a collaborative process to develop this plan for the entire Middle Columbia River steelhead DPS. The Middle Columbia Recovery Forum (Mid-C Forum) is a group convened by NMFS, many of whose members led the preparation of the management unit plans. The Mid-C Forum contributed substance as well as scientific and critical review to the DPS plan. Participants in the Mid-C Forum include ODFW, WDFW, the Yakama Nation, Confederated Tribes of the Warm Springs Indian Reservation, Confederated Tribes of the Umatilla Indian Reservation, Washington Governor's Salmon Recovery Office, Oregon Governor's Natural Resources Office, Snake River Salmon Recovery Board, Yakima Basin Fish and Wildlife Recovery Board, US Bureau of Reclamation, US Fish and Wildlife Service, US Forest Service, US Army Corps of Engineers, Klickitat County, and NMFS Northwest Region.

Steelhead Distribution & Life History

The spawning range of the Middle Columbia River steelhead DPS extends over an area of approximately 35,000 square miles in the Columbia plateau of eastern Washington and eastern Oregon. The DPS includes all naturally spawned populations of steelhead in streams from above the Wind River in Washington and the Hood River, in Oregon, upstream to, and including, the Yakima River in Washington, excluding steelhead from the Snake River Basin.

The species *Oncorhynchus mykiss* exhibits perhaps the most complex suite of life history traits of any species of Pacific salmonid. These fish can be anadromous or freshwater residents (and under some circumstances, apparently yield offspring of the opposite form). Steelhead can spawn more than once, whereas all other *Oncorhynchus* except cutthroat trout (*O. clarki*) spawn once and then die.

Within the range of West Coast steelhead, spawning migrations occur throughout the year, with seasonal peaks of activity. The "runs" are usually named for the season in which the peak occurs. Most steelhead can be categorized as one of two run types, based on their sexual maturity when they re-enter freshwater and how far they go to spawn. In the Pacific Northwest, summer steelhead enter freshwater between May and October and require several months to mature before spawning; winter steelhead enter freshwater between November and April and spawn shortly thereafter. Summer steelhead usually spawn farther upstream than winter steelhead. The Middle Columbia River steelhead DPS includes populations of inland winter steelhead in the Klickitat River, White Salmon River, Fifteenmile Creek, and possibly Rock Creek.

Middle Columbia River Steelhead Populations & Major Population Groups

The ICTRT identified 20 historical populations of Middle Columbia River steelhead. This identification was based on genetic information, geography, life history traits, morphological traits, and population dynamics. Seventeen of these populations are extant, and three extirpated (White Salmon River, Deschutes Crooked River above Pelton Dam, and Willow Creek).

The ICTRT stratified the Middle Columbia River steelhead populations into major population groups (MPGs) based on ecoregion characteristics, life history types, and other geographic and genetic considerations. It identified four MPGs: Cascades Eastern Slope Tributaries, Yakima Basin, John Day Basin, and Umatilla/Walla Walla. The John Day Basin MPG is wholly within Oregon and the Yakima Basin MPG is wholly within Washington. The other two include populations on both sides of the Oregon/Washington boundary.

Current Status

The status of a salmon or steelhead species is expressed in terms of likelihood of persistence over 100 years, or in terms of risk of extinction within 100 years. The ICTRT defined viability at two levels: less than 5 percent risk of extinction within 100 years (viable) and less than 1 percent risk of extinction within 100 years (highly viable). A third category, "maintained," represents a less than 25 percent risk. The risk level of the DPS as a whole is built up from the aggregate risk levels of the populations and MPGs. The abundance, productivity, spatial structure, and diversity of the component populations (the "viable salmonid population," or VSP, parameters) must be taken into account to determine the risk level.

The Middle Columbia River steelhead DPS does not currently meet viability criteria because its four component MPGs are not at low risk. However, for this DPS the outlook is relatively optimistic. One population, North Fork John Day, is currently at very low risk or "highly viable." Two populations are currently viable (Deschutes Eastside, Fifteenmile); eleven are at moderate risk, with good prospects for improving. However, three large populations at high risk (Deschutes Westside, Naches, and Upper Yakima) are important to DPS viability; these present significant challenges.

Significant programs are underway for natural recolonization (White Salmon) or reintroduction (Deschutes Crooked River above Pelton Dam) of two of the extirpated populations to historically accessible habitat; success of these programs should help improve overall DPS viability.

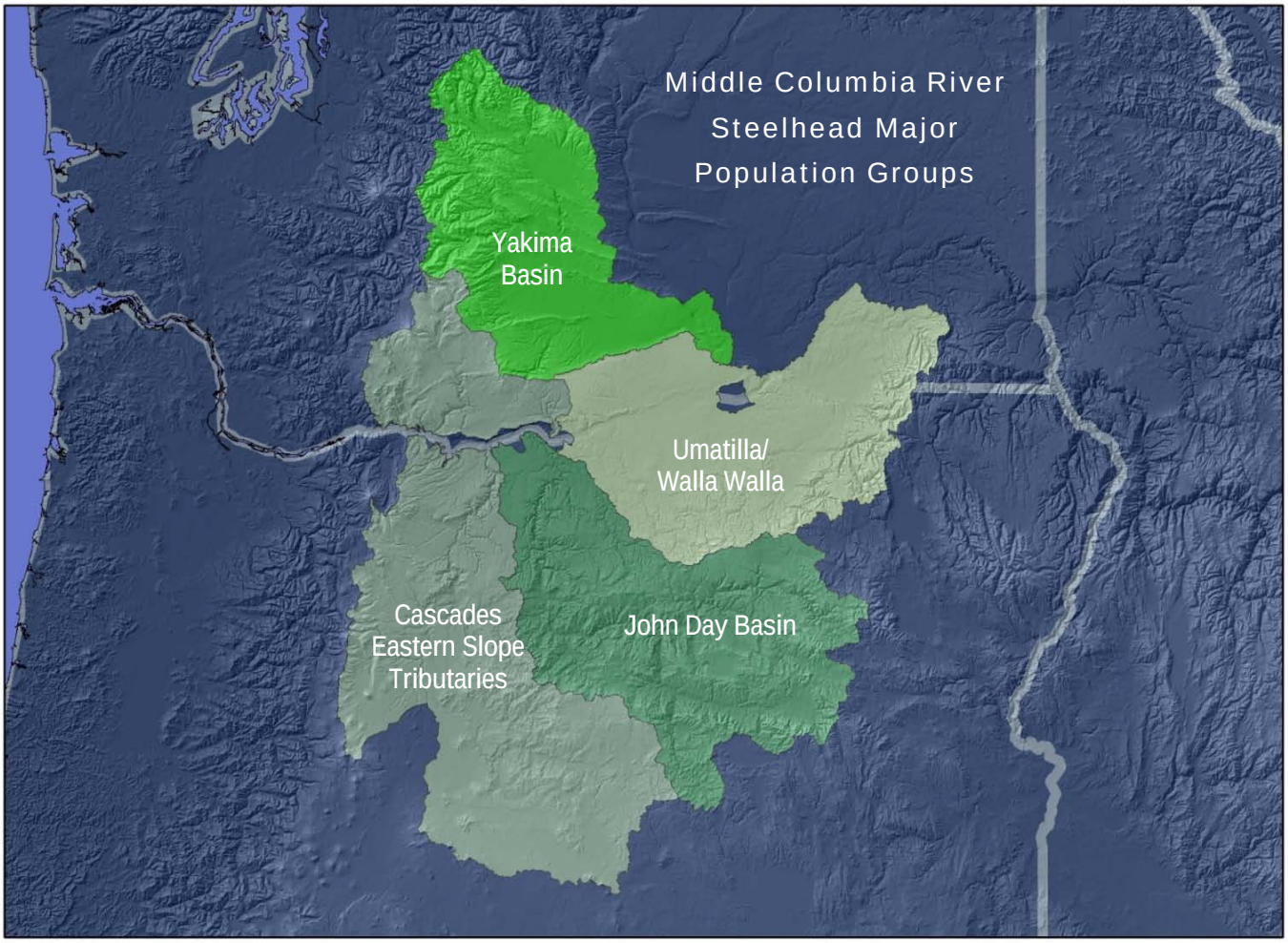
The table on the following page summarizes the current status of the Middle Columbia River steelhead populations, showing 10-year geometric mean abundance by population, estimated productivity, and the minimum abundance threshold needed for long-term viability. The table also includes the 10-year geometric mean proportion of hatchery spawners for the populations where data are available, and the risk ratings of high, moderate, low, and very low, for abundance and productivity combined, and spatial structure and diversity combined.

Middle Columbia River Steelhead

Middle Columbia River steelhead DPS populations: Summary of abundance, productivity, risk ratings, and minimum abundance thresholds (Source: ICTRT, Current Status Reviews: Interior Columbia Basin Salmon and Steelhead ESUs. Vol. III. May 2008). (Numbers subject to periodic updates as additional information becomes available.)

Population	Abundance Threshold[1]	Size Category	Run Timing	10-year Geomean abundance	Abundance Range	10-yr Hatchery Fraction[2]	Produc-tivity[3]	Productivity Standard Error	A&P Risk[4] Rating	SSD Risk Rating
Eastern Cascades MPG										
Deschutes (westside)	1000[5]	Large (Inter)	Summer	456	108-1283	0.26	1.05	0.15	H	M
Deschutes (eastside)	1000	Intermed.	Summer	1599	299-8274	0.39	1.89	0.27	L	M
Klickitat River	1000	Intermed.	Wtr & Smr						M	M
Fifteenmile Creek	500	Basic	Winter	703	231-1922	0	1.82	0.20	L	L
Rock Creek	500	Basic	Summer	Insufficient Data					H	M
White Salmon	500	Basic		Functionally extirpated					N/A	N/A
Crooked River	2250	Very Large	Summer	Extirpated						
Yakima River MPG										
Upper Yakima River	1500	Large	Summer	85	34-283	0.02	1.12	0.22	H	H
Naches River	1500	Large	Summer	472	142-1454	0.06	1.12	0.22	H	M
Toppenish River	500	Basic	Summer	322	44-1252	0.06	1.60	0.30	M	M
Satus Creek (trib only)	1000	Intermed.	Summer	379	138-1000	0.06	1.73	0.14	M	M
John Day Basin MPG										
Lower Mainstem John Day	2250	Very Large	Summer	1800	563-6257	0.1	2.99	0.24	M	M
North Fork John Day	1500	Large	Summer	1740	369-10,235	0.08	2.41	0.22	VL	L
Upper Mainstem John Day	1000	Intermed.	Summer	524	185-5169	0.08	2.14	0.33	M	M
Middle Fork John Day	1000	Intermed.	Summer	756	195-3538	0.08	2.45	0.16	M	M
South Fork John Day	500	Basic	Summer	259	76-2729	0.08	2.06	0.27	M	M
Umatilla/Walla Walla MPG										
Umatilla River	1500	Large	Summer	1472	592-3542	0.36	1.50	0.15	M	M
Walla Walla Mainstem	1000	Intermed.	Summer	650	270-1746	0.02	1.34	0.12	M	M
Touchet River	1000	Intermed.	Summer	Insufficient Data					H	M
Willow Creek	1000	Intermed.	Summer	Extirpated					N/A	N/A

[1] Abundance threshold for viability based on habitat intrinsic potential
[2] Average proportion of hatchery spawners over most recent 10 years in the data series.
[3] Geomean return per spawner calculated over most recent 20 years in data series.
[4] Abundance & Productivity Risk Ratings: H = high risk, M= moderate risk, L = low risk, VL = very low risk
[5] The Deschutes Westside steelhead population is classified as Large in terms of spatial structure, but its abundance threshold may be considered 1000 or 1500 because of lack of access to historical habitat. See Carmichael, Richard W., Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Steelhead DPS. 2009



Limiting Factors & Threats

The reasons for a species' decline are generally described in terms of limiting factors and threats. NMFS defines limiting factors as the biological and physical conditions that limit a species' viability – e.g., high water temperature – and defines threats as those human activities or natural processes that cause the limiting factors. For example, removing the vegetation along the banks of a stream can cause higher water temperatures, because the stream is no longer shaded. The threats contributing to the limiting factors and causes for a species' decline are often described in terms of the "four Hs" – habitat (usually relating to the effects of land use and tributary water use), hydropower, harvest, and hatcheries. While the term "threats" carries a negative connotation, it does not mean that activities identified as threats are inherently undesirable. They are typically human activities that may at times have unintended negative consequences on fish populations—and that can also be managed in a manner that may minimize or eliminate the negative impacts.

Limiting Factors & Threats for the Middle Columbia River Steelhead DPS

At a general level, based on information from the ICTRT, the four management unit plans, and the modules, the major factors limiting the viability of Middle Columbia River steelhead populations are the following:

- Degraded tributary habitat
- Impaired fish passage in the mainstem Columbia River and tributaries
- Hatchery-related effects
- Predation/competition/disease

Two other factors, degradation of estuarine and nearshore marine habitat and harvest-related effects, pose some risk to steelhead viability for the entire DPS, but less than the other factors. Climate change represents a potentially significant threat to recovery of Middle Columbia River steelhead populations. Changes in climate may exacerbate existing problems with water quantity (lower summer stream flows) and water quality (higher summer water temperatures).

Limiting Factors & Threats for the Major Population Groups

Cascades Eastern Slope Tributaries MPG

Tributary habitat. Degraded riparian areas, lack of suitable spawning habitat, low or altered stream flows, degraded water quality (especially high water temperatures), impaired floodplain connectivity and function, altered channel structure and complexity, and impaired fish passage.

Mainstem Columbia River passage. Direct mortality; delayed upstream migration of returning adults; and cumulative impact of hydropower system on mainstem and estuary habitat. Effects are least for the Fifteenmile Creek and Klickitat River populations, which pass only one mainstem dam. The Deschutes River populations pass two mainstem dams, and the Rock Creek population passes three.

Hatchery related effects. Hatchery fish straying into natural spawning areas pose risks to genetic traits and productivity of naturally produced steelhead. Out-of-subbasin steelhead, primarily from the Snake River, stray onto natural spawning grounds in the Deschutes River. Hatchery steelhead released in the Klickitat River may have effects on the naturally produced steelhead.

Blocked migration to historically accessible habitat. Currently, the Pelton-Round Butte Hydroelectric Project, constructed at river mile 100 on the mainstem Deschutes River, creates a barrier to anadromous fish attempting to reach spawning and rearing areas in the upper basin. Plans are underway to reinitiate fish passage facilities at the Pelton-Round Butte complex and reintroduce steelhead to the upper basin.

Predation/competition/disease. Predation, competition, and disease issues in mainstem and estuary can affect all of the Middle Columbia River steelhead populations. In addition, it is possible that the abundance of the Deschutes River Westside steelhead population may be limited by competition with a large resident population of rainbow trout.

John Day River MPG

Mainstem passage. These populations must pass three dams; thus, limiting factors include direct mortality of pre-smolts and smolts at John Day, The Dalles, and Bonneville dams; delayed upstream migration of returning adults; false attraction of returning adults over McNary Dam; and cumulative impact of hydropower system on mainstem and estuary habitat.

Hatchery related effects. Concern over competition for resources with wild fish and potential hybridization with natural-origin fish resulted in termination of all hatchery stocking of O. mykiss in the John Day River basin in 1997. However, hatchery strays, primarily from the Snake River, have been observed in all John Day populations, particularly in the lower John Day mainstem. Hatchery fish straying into natural spawning areas pose risks to genetic traits and productivity of naturally produced steelhead.

Tributary habitat. For all five John Day populations, degraded floodplain and degraded channel structure (key habitat quantity and habitat diversity), altered sediment routing, water quality (high temperatures), and altered hydrology are limiting factors. For the Lower and Upper Mainstem and South Fork populations, passage obstructions in some of the smaller tributaries are also significant.

Predation/competition/disease. Predation, competition, and disease issues in mainstem and estuary can affect all of the Middle Columbia River steelhead populations.

Umatilla/Walla Walla MPG

Mainstem passage. The Walla Walla and Touchet populations must pass four major mainstem Columbia River dams; the Umatilla population must pass three. Limiting factors include direct mortality; delayed upstream migration of returning adults; cumulative impact of hydropower system on mainstem and estuary habitat; and, because they must migrate farther upstream than most of the other populations, higher exposure to altered habitat as well as avian and piscine predators in the mainstem Columbia.

Tributary habitat. For all three populations, water quality (temperature), sediment problems, blocked and impaired fish passage, degraded floodplain and channel structure (resulting in lack of spawning and rearing habitat) and hydrologic alterations are limiting factors.

Hatchery related effects. Hatchery fish are not identified as a threat to the Umatilla population. Non-endemic-origin hatchery fish are considered a potential threat to the Walla Walla wild steelhead population. Currently, data are insufficient to determine whether hatchery effects are a problem for the Touchet River population.

Predation/competition/disease. Predation, competition, and disease issues in mainstem and estuary can affect all of the Middle Columbia River steelhead populations.

Yakima Basin MPG

Mainstem passage. The Yakima steelhead populations must pass four mainstem Columbia River dams. Limiting factors include direct mortality; delayed upstream migration of returning adults, and cumulative impact of hydropower system on mainstem and estuary habitat. As the farthest upstream populations of Middle Columbia River steelhead, they undergo higher exposure to altered habitat as well as avian and piscine predators in the mainstem Columbia.

Tributary habitat. Fish habitat in the Yakima subbasin is substantially affected by irrigation systems. Limiting factors include altered hydrology (low summer flow because of withdrawals in tributaries and the lower Yakima, scouring peak flows because of degraded watershed conditions, high summer delivery flows in mainstem Yakima and Naches rivers, reduced winter and spring flows due to irrigation storage, delivery, and withdrawals); degraded riparian areas; blocked and impaired fish passage (primarily due to storage and diversion dams, as well as entrainment in unscreened diversions); altered sediment routing; degraded water quality; loss of historical habitat due to blocked or impaired fish passage; degraded floodplain connectivity and function (loss of off-channel habitat, side channels and connected hyporheic zone); degraded channel structure and complexity; reduced outmigrant survival in the mainstem Yakima.

Hatchery related effects. The Yakima populations have the lowest rates of hatchery strays in the DPS, and hatchery effects are not considered a significant limiting factor.

Predation/competition/disease. Of the Middle Columbia River steelhead populations, the Yakima basin populations have the longest migration through the mainstem Columbia River. They may therefore be more vulnerable to some factors such as avian and piscivorous fish predation. For example, Yakima steelhead are consumed by Caspian tern and double-crested cormorants nesting on islands at the mouth of the Snake River.

Recovery Goals & Delisting Criteria

The recovery goals that are incorporated into locally developed recovery plans may include delisting and other "broad sense" goals that may go beyond the ESA requirements for delisting to address, for example, other legislative mandates or social, economic, or ecological values. Delisting criteria must meet the ESA requirements, while recovery may be defined more broadly.

Recovery criteria are of two kinds: the biological viability criteria, which deal with the parameters of abundance, productivity, spatial structure, and diversity at the population, MPG, and DPS levels, and the "threats" criteria, which relate to the five listing factors detailed in the ESA (The present or threatened destruction, modification, or curtailment of [the species'] habitat or range; over-utilization for commercial, recreational, scientific or educational purposes; disease or predation; the inadequacy of existing regulatory mechanisms; or other natural or human-made factors affecting its continued existence). The threats criteria define the conditions under which the listing factors, or threats, can be considered to be addressed or mitigated. Together the biological and threats criteria make up the "objective, measurable criteria" required under ESA section 4(f)(1)(B) for the delisting decision. NMFS' delisting criteria may include these as well as other technical and policy considerations.

NMFS' biological viability criterion for Middle Columbia River steelhead is to have all four major population groups at viable (low-risk) status, with representation of all the major life history strategies present historically, and with the abundance, productivity, spatial structure and diversity attributes required for long-term persistence.

However, it may not be necessary for all of the populations to attain low risk in order to provide sufficient viability for the MPGs or the DPS as a whole. The possible combinations of risk status for populations in each MPG that would allow the DPS to meet viability criteria are called "recovery scenarios."

Recovery Strategy

NMFS' 2006 listing decision for Middle Columbia River steelhead called upon Federal, state, and tribal entities to manage land, hydropower, hatchery, and harvest activities in a manner that would support steel-head recovery. This plan reaffirms those recommendations and adds to them the contributions of updated science, basinwide programs, and consensus building among stakeholders. While Federal, state, and tribal entities can make major contributions to the recovery of Middle Columbia steelhead, the actions of individuals on their land, as well as city and county codes and ordinances promoting conservation, are also essential.

The recovery strategy for the Middle Columbia steelhead DPS addresses both basin-wide issues that affect all populations, such as conditions in the migratory corridor, and subbasin and site-specific issues that are the focus of the management unit plans. The DPS Plan describes the overall strategy, summarizes the MPG-level strategies, and refers to the management unit plans for more site-specific, population level actions.

The recovery strategy for the Middle Columbia River steelhead DPS is made up of the following elements:

- Follow the 2006 listing decision recommendations, which call upon Federal, state, and tribal entities to manage land, hydropower, hatchery, and harvest actions to support steelhead recovery.
- Protect and restore tributary habitat and Columbia River mainstem habitat, at both the basin/programmatic level and the local level as detailed in the management unit plans.
- Improve fish passage in the mainstem Columbia River, as detailed in the 2008 FCRPS Biological Opinion (summarized in the Hydro Module) and in the tributaries per the management unit plans.
- Implement hatchery reforms at the population and site-specific level through Hatchery and Genetic Management Plans (HGMPs) as required by the Biological Opinion.
- Address ecosystem imbalances in predation, competition, and disease through the strategies and actions in the management unit plans, estuary module, and FCRPS Biological Opinion.
- Maintain current low harvest levels, through fishery management planning for mainstem fisheries through the *U.S. v. Oregon* 10-year agreement, updated Fisheries Management Evaluation Plans and Tribal Resource Management Plans for tributary fisheries, Pacific Salmon Treaty, and Pacific Fishery Management Council processes.
- Protect and restore the estuary and Columbia River plume as detailed in the Columbia River Estuary module.
- Respond to climate change threats with a strategy based on the principle of preserving biodiversity.
- Implement the Plan through effective coordination and governance.
- Research critical uncertainties, monitor and evaluate implementation and effectiveness and adjust course as appropriate through adaptive management.

NMFS believes that if this strategy is implemented and the biological response is as expected, the DPS is likely to achieve viable status within 25 to 50 years.

Protect & Restore Habitat

Actions to protect and improve habitat in the tributaries and Columbia mainstem are essential to achieving recovery objectives for the Middle Columbia steelhead DPS. Unlike some other salmonid species, steelhead, which are “stream-type” salmonids, use mainstem tributary, upper tributary, and side channel habitats for spawning, juvenile rearing, and overwintering. Steelhead populations are particularly susceptible to the effects of degraded freshwater habitat because most steelhead spend one or more years in freshwater before migrating. Specific measures to improve tributary habitat are contained in the management unit plans and are summarized below by MPG.

Relatively little information is available concerning Middle Columbia River steelhead use of mainstem Columbia River habitat above Bonneville, aside from passage through the dams. NMFS believes it is important to assess nearshore habitat and cold water refugia in the mainstem and to explore opportunities for, and potential benefits from, restoration and protection of these areas.

Improve Fish Passage – Mainstem Columbia River

Passage for juvenile steelhead migrating to the ocean and adult steelhead returning to their natal streams is limited primarily by the four Federal dams on the Lower Columbia River mainstem – Bonneville, John Day, The Dalles, and McNary – which are part of the Federal Columbia River Power System (FCRPS). NMFS issued a biological opinion on the effects of FCRPS operations on salmonids, including Middle Columbia River steelhead, and on the predicted results of current and planned improvements to the system that are intended to improve fish survival (NMFS 2008). These improvements are expected to increase the in-river survival of Middle Columbia River juvenile steelhead by 0.3 percent, 5.1 percent, 8.2 percent, and 10.2 percent, depending on the number of dams they must pass. The survival of steelhead adults through the four dams is thought to be relatively high at the present time (about 98.5 percent per project from Bonneville to McNary), and is expected to be maintained or improved.

The current plan for operation of the FCRPS through 2018 (NMFS 2008) contains the following actions intended to address the needs for survival and recovery of ESA-listed salmon and steelhead:

- Continue adult fish passage operations that have resulted in improved survival.
- Improve juvenile fish passage: install removable spillway weirs or similar surface bypass devices at John Day and McNary dams, an extended tailrace spill wall at The Dalles Dam, and various modifications at Bonneville Dam. Passage for steelhead smolts at each of the four Lower Columbia River mainstem projects must reach 96 percent survival.
- Continue and enhance spill for juvenile fish passage.
- Continue reservoir operations and river flows to benefit spring migrating juveniles.
- Develop dry water year operations to better protect migrating juveniles.

The State of Oregon also proposes additional measures for the FCRPS that NMFS did not include in the FCRPS Biological Opinion.

Improve Fish Passage - Tributaries

Actions to address fish passage in tributaries include:

- Implement locally developed management unit plans to improve fish passage in tributaries.
- Implement recommendations regarding improved passage and flow management by the U.S. Bureau of Reclamation below all its facilities in the Yakima River and the Umatilla River subbasins, provision of fish passage into significant tributaries, and provision of passage over at least two of its storage dams in the Yakima Basin.
- Implement recommendations regarding improvement of fish passage, screening, and flow management in the Walla Walla River subbasin by the U.S. Army Corps of Engineers, and alteration of the flood operating rule for Mill Creek, or alternatively screening the diversion into Bennington Lake.
- Provide passage into the upper Deschutes River above Pelton-Round Butte complex and into the White Salmon River above Condit Dam.

Hatchery Reforms

Hatchery programs must implement reforms and comply with the ESA. Three major scientific reviews are providing important information to help develop specific recovery actions for hatchery programs. These reviews include the Mitchell Act Environmental Impact Statement, the U.S. Fish and Wildlife Service Hatchery Review, and the congressionally established Hatchery Scientific Review Group (HSRG). Collectively, these scientific reviews are evaluating every anadromous fish hatchery program in the Columbia Basin and providing significant new information to help guide future actions. Several agreements, including the 2008 FCRPS Biological Opinion, are in place to ensure that hatchery programs are brought up-to-date with actions that are consistent with recovery.

NMFS is working with the funding agencies and hatchery operators to update and complete Hatchery and Genetic Management Plans (HGMPs) for every hatchery program in the Middle Columbia region as a means of organizing hatchery review and reform. New or updated HGMPs should be in place to guide operations before 2010. The HGMPs are the basis for NMFS' biological opinions on hatchery programs under ESA sections 7 and 10 and the 4(d) rule, which relate to incidental and direct take of listed species. The HGMPs describe each hatchery's operations and actions to support recovery and minimize ecological or genetic impacts, such as straying and other forms of competition with naturally produced fish.

Evaluating the factors that influence interactions between hatchery fish and naturally produced fish under varying freshwater conditions and ocean conditions is an important area of future research. This is dealt with in more detail in Appendix C of the 2008 FCRPS Biological Opinion.

The management unit plans propose various actions to reduce deleterious effects of hatcheries on natural production. For example, the Oregon Steelhead Conservation and Recovery Plan proposes increased marking of Columbia Basin hatchery steelhead with coded-wire tags to better identify the origin of strays, and trapping and removal of strays in the Deschutes populations. Regional consensus has not been reached on all hatchery strategies, and the Mid-Columbia Forum will continue to pursue agreement on appropriate site-specific strategies. The Klickitat subbasin plan recommends a targeted monitoring program to determine abundance and productivity of natural spawners, determine the proportion of hatchery and wild spawners in the Klickitat subbasin, and determine the adverse effects of Skamania broodstock on the Klickitat population, if any. See further details in each management unit plan.

Reduce Predation, Competition & Disease

Predation, competition and disease are grouped together as a category of concern because ultimately these factors relate to balance and imbalance in the ecosystem. Improving habitat for salmonids throughout the life cycle is the best strategy for addressing these limiting factors. Specific measures can also be taken, as follows.

Extensive research on predation and efforts at predator control in the Columbia Basin have been undertaken for decades. Control of piscivorous predation has focused

largely on targeted sports fisheries to remove more of the predators and/or direct removal by physical or chemical means. Sport fisheries target northern pikeminnow, smallmouth bass, channel catfish, and walleye. Predation in the estuary is a major source of mortality on both adults and juveniles of all listed populations. These issues are discussed in greater detail in the Estuary Module.

Altering Rice Island to prevent tern and cormorant nesting was effective in reducing avian predation in the estuary, and the NMFS 2008 FCRPS Biological Opinion requires further reduction in bird habitat on East Sand Island. The Biological Opinion also requires development of plans to control Caspian terns and double-crested cormorants that nest in islands upstream of Bonneville Dam.

A pinniped hazing program has been implemented at Bonneville Dam since 2005, but the efforts have largely been ineffective against California sea lions, which are not listed as threatened or endangered. The animals may leave the area temporarily but return as soon as hazing stops. Under section 120 of the Marine Mammal Protection Act, states can ask for permission to kill individually identifiable sea lions or seals that are having a "significant negative impact" on at-risk salmon and steelhead, and NMFS can grant that permission, if certain legal standards are met. In March 2008, NMFS granted the request of the states of Oregon, Washington, and Idaho to lethally remove problem California sea lions. Any animals that are captured may be euthanized if no permanent holding facility can be found for them. NMFS and representatives of zoos and aquariums are compiling a list of pre-approved permanent holding facilities interested in receiving a limited number of captured sea lions as an alternative to euthanasia. NMFS has authorized the states to remove as many as 85 animals annually, but estimates that only about 30 animals will be removed each year, given the conditions in its authorization.

In addition, non-lethal deterrence methods such as firecrackers, rubber projectiles, and capture, marking, and relocation will be continued.

Disease in salmonids is caused by multiple factors and probably cannot be directly addressed by recovery actions except in specific instances of known causal factors. It is more likely that nearly all of the recommended recovery actions that improve spawning, rearing, and passage conditions for steelhead and increase the survival, abundance, and productivity of naturally produced fish will result in decreasing incidence of disease.

Maintain Low Impacts from Fisheries

Although in general harvest is not considered a major threat for the Middle Columbia River steelhead DPS, it is important to ensure that impacts from fisheries do not impede recovery, and to monitor and verify impacts and reduce existing uncertainties. The U.S. v. Oregon agreement for 2008-2018 will maintain current low impacts on Middle Columbia steelhead in the lower mainstem and treaty mainstem fisheries. The Fisheries Management and Evaluation Plans (FMEPs) submitted by the States of Oregon and Washington and approved by NMFS under the 4(d) rule of the ESA provide a mechanism for developing, implementing, and adjusting recreational fisheries to maintain the currently estimated low impacts on steelhead. Furthermore, NMFS requires the states to implement, monitor, and evaluate the effects of these plans and to report annually. The continuing and additional monitoring and evaluation under the FMEPs is expected to further reduce uncertainties regarding fisheries impacts.

Address Climate Change

Water temperature and stream flow are factors that will remain important throughout steelhead freshwater habitat. All strategies and actions that help to lower water temperature or prevent further increase will help to mitigate climate change. Protecting and/or restoring riparian areas to increase shade, as recommended in the Plan, is an important strategy for minimizing water temperature increases. Additional actions include purchasing water rights to leave more water in streams and restoration actions to improve channel complexity and establish side-channel rearing. Diversity in terms of both location and biological characteristics gives any species resilience in the face of environmental change. This principle underlies the viability criteria as well as the recovery strategies presented in this plan.

Recovery Strategies for the Four Major Population Groups

These summaries of recovery strategies for the four major population groups are drawn from the management unit plans and the ICTRT's status assessment.

Cascades Eastern Slope Tributaries MPG

Population	ICTRT Risk Status
Fifteenmile Creek (Oregon)	Viable
Deschutes Eastside (Oregon)	Viable
Klickitat (Washington)	(provisional) Moderate risk – insufficient data, hatchery influence
Rock Creek (Washington)	(provisional) High risk – insufficient data
Deschutes Westside (Oregon)	High risk
White Salmon (Washington)	Functionally extirpated (with program for natural recolonization of historical habitat after Condit Dam is removed in 2009)
Crooked River (Oregon)	Extirpated (with program for reintroduction to historical habitat)

Recovery Scenario: For the Eastern Cascades Slope Tributaries MPG to be considered viable, the Klickitat, Fifteenmile, and both the Deschutes Eastside and Westside populations should reach at least viable status. The management unit plans also call for at least one population to be highly viable, consistent with ICTRT recommendations. The Rock Creek population should reach "maintained" status (25 percent or less risk level). MPG viability could be further bolstered if reintroduction of steelhead into the Crooked River succeeds and if the White Salmon population successfully recolonizes its historical habitat.

Key actions proposed:

- Protect, improve, and increase freshwater habitat for steelhead production. Improvements to freshwater habitat should be targeted to address specific limiting factors in specific areas as described in the Oregon Steelhead Recovery Plan and the Washington Gorge plans.
- Reduce straying of out-of-DPS hatchery fish onto natural spawning grounds within the Deschutes subbasin.
- Restore historical passage to the upper Deschutes subbasin including the Westside tributaries and Crooked River above Pelton Round Butte dam complex and the White Salmon River above Condit Dam.
- Improve survival in mainstem and estuary through actions detailed in NMFS Estuary Module (NMFS 2007) and FCRPS Biological Opinion.
- Improve hatchery management to minimize impacts from hatchery releases on naturally produced steelhead within the Deschutes Westside and Eastside subbasins and the Klickitat subbasin.
- Fill data gaps for better assessment of Klickitat and Rock Creek steelhead populations.
- Coordinate among scientists, planners, and implementers of recovery actions on both sides of the Columbia River for sequencing of recovery actions and monitoring for adaptive management.

John Day River MPG

Population	ICTRT Risk Status
North Fork John Day	Highly viable
Upper Mainstem John Day	Moderate risk
Lower Mainstem John Day	Moderate risk
Middle Fork John Day	Moderate risk
South Fork John Day	Moderate risk

Recovery Scenario: For the John Day River MPG to reach viable status, the Lower Mainstem John Day River, North Fork John Day River, and either the Middle Fork John Day River or Upper Mainstem John Day River populations should achieve at least viable status. The management unit plan also calls for at least one population to be highly viable, consistent with ICTRT recommendations.

Key Actions proposed:

- Protect and improve freshwater habitat conditions and connectivity for steelhead production. Improvements to freshwater habitat should be targeted to address specific factors in specific areas as described in the Oregon Steelhead Conservation and Recovery Plan.
- Improve hatchery management to reduce straying from out-of-DPS hatchery fish onto natural spawning grounds within the John Day subbasin.
- Improve survival in mainstem and estuary through actions detailed in NMFS Estuary Module (NMFS 2007) and FCRPS Biological Opinion (NMFS 2008).

Yakima River MPG

Population	ICTRT Risk Status
Upper Yakima River	High Risk
Naches River	High Risk
Satus Creek	Moderate Risk
Toppenish Creek	Moderate Risk

Recovery Scenario: For the Yakima River MPG to achieve viable status, two populations should be rated as viable, including at least one of the two classified as Large - the Naches River and the Upper Yakima River. The remaining two populations should, at a minimum, meet the Maintained criteria. The management unit plan also calls for at least one population to be highly viable, consistent with ICTRT recommendations.

Key actions proposed:

- Protect and enhance habitat in key tributary watersheds in the Yakima Basin.
- Restore passage to blocked areas in the Naches and Upper Yakima population areas.
- Alter irrigation delivery and storage operations in the Yakima Basin to improve flow conditions for Middle Columbia River steelhead and use managed high flows to maintain floodplain habitat.
- Improve channel and floodplain function and reduce predation through the mainstem Yakima and Naches rivers.
- Improve survival in the mainstem Columbia River and its estuary through actions detailed in NMFS Estuary Module (NMFS 2007) and FCRPS Biological Opinion (NMFS 2008).

Umatilla/Walla Walla MPG

Population	ICTRT Risk Status
Umatilla River	Moderate Risk
Walla Walla River	Moderate Risk
Touchet River	High Risk (provisional because of insufficient data)

Recovery Scenario: For the Umatilla/Walla Walla MPG to be viable, two populations should meet viability criteria. The management unit plan also calls for at least one population to be highly viable, consistent with ICTRT recommendations. The Umatilla River is the only large population, and therefore needs to be viable. Either the Walla Walla River or Touchet River population also needs to be viable.

Key actions proposed:

- Protect and improve freshwater habitat conditions and access for steelhead production. Improvements to freshwater habitat should be targeted to address specific factors in specific areas as described in the Southeast Washington Plan and the Oregon Steelhead Conservation and Recovery Plan.
- Improve hatchery management to reduce straying from out-of-DPS hatchery fish onto natural spawning grounds within the Umatilla/Walla Walla subbasins.
- Improve survival in mainstem and estuary through actions detailed in NMFS Estuary Module (NMFS 2007) and FCRPS Biological Opinion (NMFS 2008).
- Coordinate among planners, scientists, and implementers of recovery actions on both sides of the Columbia River for sequencing, monitoring, and adaptive management.

Time & Cost

It is important to consider the unique characteristics and challenges of estimating time and cost for salmon and steelhead recovery, given the complex relationship of these fish to the environment and to human activities on land. There are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions as well as long-term and future funding. NMFS estimates that recovery of the Middle Columbia River steelhead DPS could take 25 to 50 years, although the optimistic view is that it could be much sooner. The management unit plans contain extensive lists of actions to recover the Middle Columbia River steelhead DPS populations. These projects were developed using the most up-to-date assessment of Middle Columbia River steelhead recovery needs. The management unit plans focus, for the most part, on actions within the next 5 to 15 years.

The minimum total estimated cost of restoring habitat for the Middle Columbia River steelhead DPS is approximately $235 million over the initial 5-year period, and approximately $996 million over 25 to 50 years for all DPS-wide recovery actions for which sufficient information exists upon which to base an estimate.

This estimate includes expenditures by local, tribal, state, and Federal governments, private business, and individuals in implementing both capital projects and non-capital work. Administrative costs are embedded in the total management unit cost estimates in the table above. Preliminary research, monitoring and evaluation costs have, in some cases, been estimated at the management unit level; however, these costs are not included at this time pending completion of research and monitoring plans and further development of each project.

Cost estimates for proposed recovery projects were developed using the methods described in each management unit plan. No cost estimates are provided for (1) baseline actions (programs that are already in existence and would occur regardless of this recovery plan), which are listed as Not Applicable; or (2) actions that need costs to be developed, need unit costs, and/or need project scale estimates, which are listed as To Be Determined. Each management unit will work with regional experts to identify costs, scale, or unit costs for actions that require more information during the public comment period. Individual management unit costs will be updated with this new information for the final steelhead DPS recovery plan.

Summary of Cost Estimates for Habitat Projects for Middle Columbia River steelhead DPS

Recovery Plan	First 5 Years ($M)	Project / Program Total ($M)
Oregon	$ 103.5	$512.8
Yakima Steelhead[6]	$91.9	$269.3
SE Washington[7]	$25.5	$76.4
Klickitat[8],[9]	$12.9	$129.4
Rock Creek[10]	$0.9	$1.8
White Salmon Steelhead	N/A	$6.5
DPS Totals	**$234.7**	**$996.2**

[6] The Yakima steelhead plan estimates costs for the first 6 years, and includes a preliminary RME cost estimate of $300K/year. The 5-year estimate is extrapolated from the 6-year cost data.
[7] The SE Washington plan estimates annual steelhead implementation costs at about $5 million per year. The 5-year estimate is extrapolated by multiplying the annual amount by five.
[8] The Klickitat plan estimates costs for the first 10 years. The 5-year estimate was extrapolated by dividing the 10-year amount in half.
[9] The Klickitat plan uses a 50-year period to estimate its total project costs.
[10] The Rock Creek plan estimates costs for the first 3 years and for years 4 to 10. The 5-year estimate was extrapolated by dividing the 10-year amount in half.

The cost estimates do not include expenses associated with implementing actions within the lower Columbia River, estuary, or Federal Columbia River Power System (FCRPS). Cost estimates for the FCRPS are contained in NMFS 2008. Cost estimates for the estuary are included in a module that NMFS developed because of the basin-wide scope and applicability of the actions to all 13 ESUs and DPSs listed as threatened or endangered in the Columbia Basin. The module is incorporated into the Plan by reference, and it is available on the NMFS Web site: www.nwr.noaa.gov/Salmon Recovery Planning/ESA Recovery Plans/Other Documents.cfm. The estuary recovery costs could be further refined following public comment on the module and on the ESA recovery plan for the three listed lower Columbia River ESUs and one listed lower Columbia River steelhead DPS in 2009 and 2010. There are few estimated costs for recovery actions associated with harvest to report at this time, because no actions are currently proposed that go beyond those already being implemented through U.S. v. Oregon and other harvest management forums. In the event that additional harvest actions are implemented through these forums for the purpose of achieving steelhead recovery, those costs will be added during the implementation phase of this recovery plan. All cost estimates will be refined and updated over time.

Cost estimates from the draft cost chapters in the individual management plans were developed as consistently as possible, in that they all applied guidance provided by NMFS. However, the approaches vary to some degree given the local and independent nature of the planning groups. Costs developed in the management unit plans were estimated using several basic assumptions (i.e., neither baseline costs nor out-of-basin costs were included in the estimates) and used similar cost calculation methodologies. There are, however, differences in the timeframes for cost estimates, whether administrative costs were included or not, and whether research, monitoring and evaluation costs were calculated. The proposed management unit plans' cost estimates will be refined based on public comment, and final cost estimates will be included in the final DPS recovery plan and management unit plans.

Implementation

NMFS' vision for recovery implementation is that actions identified in salmon and steelhead recovery plans be carried out in a cooperative and collaborative manner. Effectively implementing recovery actions for Middle Columbia Steelhead will require coordinating the actions of diverse private, local, state and federal parties across two states.

- In Washington, regional recovery boards have taken the lead on coordinating recovery implementation within the Yakima and Snake management units.
- In Oregon, an implementation coordinator and reformed advisory board will be the lead on recovery plan implementation, supported by the governance structure for the Oregon Plan for Salmon and Watersheds.
- Actions in the Columbia River, its estuary, and the ocean are implemented by a broad range of partners, including NMFS, the Bonneville Power Administration, the Bureau of Reclamation, the Army Corps of Engineers, federal land management agencies, state and tribal fisheries co-managers, the Columbia River Estuary Partnership, and local parties and jurisdictions interested in salmon recovery.
- The Mid-C Forum will take the lead in efforts to coordinate the actions of these many players at a DPS level, supported by both local and regional Science Teams.

Adaptive Management and Research, Monitoring and Evaluation

Adaptive management in salmon recovery planning is a method of decision making in the face of uncertainty. It is a process of adjusting management actions and/or directions based on new information. To do this, it is essential to incorporate a plan for monitoring, evaluation, and feedback into an overall implementation plan for recovery. The plan should link results to feedback on design and implementation of actions.

A regional, collaborative research, monitoring and evaluation plan to support adaptive management for the Middle Columbia River steelhead will be developed as part of implementing this recovery plan.

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