



Executive Summary

2008 Willamette Project Biological Opinion

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The purpose of this Executive Summary is to provide a general overview of the 2008 Willamette Project Biological Opinion. This Executive Summary is not intended to interpret or change the Willamette Project Biological Opinion in any way and if there are any inconsistencies between this summary and the biological opinion, the latter controls. Only the Willamette Project Biological Opinion is the legal document called for by the Endangered Species Act, Section 7(b).

The National Marine Fisheries Services (NMFS) completed a consultation with the U.S. Army Corps of Engineers, Bonneville Power Administration, and the Bureau of Reclamation (Action Agencies) on July 11, 2008, on the impact of the Willamette River Basin Project on species listed for protection under the Endangered Species Act. NMFS found that the Action Agencies' Proposed Action alone was not sufficient to avoid jeopardy or adverse modification of critical habitat for two species: Upper Willamette River Chinook salmon and the Upper Willamette River steelhead, and would destroy or adversely modify their critical habitat.

As a result, NMFS provided additional measures to mitigate for the projects' effects. These measures include fish passage at three dams, temperature control downstream of another dam, changes in downstream flows, screening of irrigation diversions, improved hatchery practices and facilities and habitat improvement projects. NMFS concluded that with the additional measures and timelines, combined with the Proposed Action, the Willamette Project could be operated and maintained without threatening the continued existence of the two Upper Willamette River salmonid species or destroying their critical habitat. NMFS' decision means that the species should survive, with an adequate potential for the species' recovery.

This summary of NMFS' Willamette River Project Biological Opinion captures major elements of the Action Agencies' Proposed Action, NMFS analysis, and the resulting "reasonable and prudent alternative" actions. The Biological Opinion, issued by NMFS on July 11, 2008, contains detailed analyses undertaken in making its determination.

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Introduction

The Willamette Project consists of 13 multipurpose dams, five fish hatcheries, and approximately 42 miles of revetments¹ in western Oregon's Willamette River basin. The U.S. Army Corps of Engineers (USACE) operates and maintains the dams and revetments, the Bonneville Power Administration (BPA) markets the hydropower generated at the dams, and the U.S. Bureau of Reclamation (Reclamation) sells a portion of the water stored in Project reservoirs for irrigation. These three Federal agencies are referred to here as the "Action Agencies."

NMFS' Biological Opinion is the product of an interagency consultation on effects of the Willamette Project on aquatic species listed under the Endangered Species Act (ESA). The consultation encompassed the configuration, operation, and maintenance of the Project and its effect on 13 species of Pacific salmon and steelhead (salmonids) as well as green sturgeon and Southern Resident killer whales.

The Action Agencies also consulted on proposed action effects on essential fish habitat (EFH), as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

NMFS is responsible for administering the ESA with respect to these species and is responsible for EFH consultations under the Magnuson-Stevens Act. The ESA requires Federal agencies to ensure their actions do not jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. To "jeopardize the continued existence" means to engage in an action that is expected to reduce the likelihood of the survival and recovery of a listed species. The Magnuson-Stevens Act requires the agencies to consult with NMFS if their actions may adversely affect essential fish habitat.

The Willamette Project consultation began in 1999. In 2006, the Action Agencies and NMFS merged the consultation with another to include the impacts of the Action Agencies' artificial production programs (hatcheries) in the Willamette River basin with the analysis of other issues in this Biological Opinion. The Action Agencies also consulted with the U.S. Fish and Wildlife Service on ESA-listed species within their jurisdiction.

The Willamette Project adversely affects Upper Willamette River Chinook and Upper Willamette River steelhead by blocking access to a large amount of their historical habitat upstream of the dams and by contributing to degradation of their remaining downstream habitat. The Action Agencies proposed several measures to address these effects in their Proposed Action, but many of their proposals were in the form of studies that would determine the most effective action to take. Overall, these actions were not sufficient to ensure the species' survival with an adequate potential for recovery, or to prevent destruction or adverse modification to their critical habitat. Therefore, NMFS concludes that the Proposed Action would jeopardize these two species and provides a Reasonable and Prudent Alternative (RPA) with additional measures that, combined with the Proposed Action, will allow for survival of the species with an adequate potential for recovery, and avoid destruction or modification of critical habitat. These RPA measures include providing passage at three dams and temperature control at another,

¹ Fortified riverbanks intended to keep the river from meandering.

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adjustments to downstream flows, improving water quality, improving hatchery practices, screening irrigation diversions and conducting habitat mitigation. Some of the flow modifications have already begun. Other measures will be implemented in the short-term to decrease the species' risk of extinction until the longer-term passage and temperature control measures are completed.



Figure 1. Principal Project facilities in the Willamette Basin

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The Willamette River Basin Project

Fern Ridge Dam, constructed on the Long Tom River near Eugene, Oregon in 1941, was the first element of the USACE's Willamette River Basin plan. Over the next 27 years, the USACE constructed twelve more dams in the basin on the Santiam, McKenzie, Middle Fork Willamette and Coast Fork Willamette subbasins.

In addition to their use in flood damage reduction, which is the principal purpose of the Willamette Project, the reservoirs in the Willamette basin contain over 1.5 million acre-feet of multi-purpose water storage. The Project also provides stored water to support irrigation, navigation, power generation, instream flows for aquatic life, wildlife habitats, recreation, and municipal and industrial waters supply. Eight of the dams have power generating capability totaling about 180 aMW.

When the dams in the Willamette basin were built, they blocked significant salmon spawning and rearing habitat. Project operations degraded the remaining downstream habitat by altering downstream flows and water temperature patterns, blocking sediment and large wood transport, and reducing peak flows. As partial mitigation for the dams, the USACE built five hatcheries and associated facilities, which have supported key fisheries but also reduced the genetic diversity of fish stocks in the Willamette basin and presented competition for the natural-origin fish.

Action Agencies' Proposed Action

The Action Agencies' Proposed Action, in this consultation with NMFS, is the continued operation and maintenance of the Willamette Project to meet all authorized project purposes. The Action Agencies propose to continue maintaining about 42 miles of revetments, or reinforced riverbanks designed to keep the river from meandering, and operation of five fish hatcheries in the Willamette basin that were constructed and are at least partially funded by the Action Agencies as mitigation for impacts of the construction of the Willamette Project. In addition, the USACE and Reclamation propose to continue marketing stored water from Willamette Project reservoirs to serve irrigation uses. Since this consultation has been ongoing for a number of years, the Proposed Action has evolved over time. A USACE Biological Assessment in 2000 represented the Willamette Project as it was operated at the time of the 1999 ESA listing of Upper Willamette River steelhead and Upper Willamette River Chinook salmon. The Supplemental Biological Assessment, issued in May 2007, incorporates and modifies measures meant to address project effects on listed species in the 2000 Biological Assessment.

The Action Agencies' Proposed Action includes measures to study project effects; modify hatcheries, flows, and water quality; conduct research, monitoring, and evaluation; and coordinate among agencies. The Action Agencies requested that NMFS issue its Biological Opinion for a term of 15 years.

However, as described in further detail below, the Proposed Action would continue to have significant adverse impacts on Upper Willamette River Chinook salmon and steelhead and their critical habitat which are being addressed through the additional action in the RPA.

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Species Affected by the Willamette Project

Thirteen ESA-listed salmon and steelhead species are likely to be affected by the Proposed Action. These species are: Upper Willamette River Chinook salmon (*Oncorhynchus tshawytscha*), Lower Columbia River Chinook, Upper Columbia River spring-run Chinook, Snake River spring/summer run Chinook, Snake River fall-run Chinook, Columbia River chum salmon (*O. keta*), Lower Columbia river coho salmon (*O. kisutch*), Snake River Sockeye salmon (*O. nerka*), Upper Willamette River steelhead (*O. mykiss*), Lower Columbia River steelhead, Middle Columbia River steelhead, Upper Columbia River steelhead, and Snake River basin steelhead. Green sturgeon and killer whales are also considered in NMFS' analysis. Each of these species is considered in NMFS' analysis. NMFS has determined that of these species, Upper Willamette River Chinook salmon and Upper Willamette River steelhead are most affected because their spawning and rearing habitat and portions of their migratory habitat are in close proximity to the Willamette Project dams.

The Upper Willamette River Chinook is currently at a high risk of extinction. The Willamette project contributes to this risk by blocking access to major spawning and rearing habitat for four of seven Chinook populations, and by degrading their remaining downstream habitat. The Upper Willamette winter steelhead is at a moderate risk of extinction. Willamette steelhead have more widespread spawning habitat in the tributaries unaffected by Project dams, which is why their risk of extinction is not as high as Chinook salmon.

The range of Lower Columbia River Chinook, coho, and chum salmon and Lower Columbia River steelhead has historically included the Clackamas River, which is a tributary to the Willamette. These fish also use the mainstem of the Lower Willamette as rearing and/or migratory habitat. They are likely to be affected by the Proposed Action, but to a lesser extent than the Upper Willamette species.

Middle Columbia River steelhead, Snake River Chinook, steelhead, and sockeye salmon, and Upper Columbia River Chinook and steelhead all spawn outside the Willamette River basin. But these species use the Lower Columbia River, from the confluence of the Willamette to the coastal estuary and plume, for migration. Willamette Project flow operations are likely to have a minor affect on the quantity and quality of their rearing habitat in the lower Columbia River and estuary, including designated critical habitat, but are not expected to harm these species at the population level.

Green sturgeon only encounter the effects of the Willamette Project in the Columbia River below the confluence with the Willamette, including the lower Columbia River, plume, and estuary. Adults are known to be found in this area only during late summer and fall. However, they prefer deep water habitats that are generally unaffected by flow changes of the small magnitude expected from the Willamette Project. Based on the best available information, the principal factor in the decline of the Southern DPS is the reduction of the spawning habitat in the Sacramento River, which is unaffected by the Willamette Project. Therefore, the Willamette Project is not likely to adversely affect green sturgeon.

The Southern Resident killer whale Distinct Population Segment (DPS) consists of three pods, identified as J, K, and L pods. Several potential factors that may have caused their decline or may be

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limiting recovery, include prey availability and quality within their coastal range. Although there is limited information, changes in prey abundance would affect the entire population of Southern Resident killer whales. The best available information indicates that salmon are the preferred prey of killer whales year round, including in coastal waters, and that killer whales prefer Chinook salmon. Although Willamette Project operations cause losses of natural-origin Upper Willamette Chinook salmon, Project-related hatchery production increases the number of Chinook salmon that reach the ocean. Therefore, the Willamette Project is not likely to adversely affect Southern Resident killer whales.

NMFS' Environmental Baseline

In analyzing the extent to which the Proposed Action affects these species, NMFS described the environmental baseline for the Willamette River basin, which can be summarized as follows.

- Over the last century and a half, habitat degradation, hatchery influences, harvest rates, and dams have adversely affected Chinook salmon and winter steelhead populations and their designated critical habitat.
- Construction of the Willamette Project dams blocked access to a substantial portion of the historical habitat and adversely affected habitat downstream of the dams. The dams still have major impacts in terms of habitat loss, altered water temperatures, and altered flows that affect channel structure and floodplain connectivity.
- The quantity and quality of remaining spawning and rearing habitat has been significantly degraded by multiple factors. The best quality habitat is located in the headwater areas, with many of these areas inaccessible to fish due to the impassable dams.
- Hatchery Chinook have significantly affected the genetic integrity of all Chinook populations. Hatchery fish spawning in the wild has been extensive. Hatchery runs make up a greater and greater proportion of the returns over the decades.
- Fishery harvest levels were high in the past, but have now been reduced significantly. It is likely that harvest is no longer a principal limiting factor for Willamette Chinook and steelhead.
- Human population and development in the Willamette basin continues to grow. Today the basin supports about 75 percent of the population in the state of Oregon, and habitat quantity and quality has declined in response.
- Variations in climate (e.g. El Niño and La Niña), longer term cycles in ocean conditions pertinent to salmon survival (e.g., Pacific Decadal Oscillation), and ongoing global climate change and its implications for both oceanic and inland habitats all affect freshwater and marine environments of critical importance to salmon and steelhead. Potential effects of climate change include altered precipitation and temperature levels in the basin that may affect the operation of the Willamette Project and streamflow and water temperature regimes in currently accessible habitat used by rearing and migrating salmon and steelhead.

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It is against this backdrop that NMFS conducted its analysis of the effects of the Willamette Project and determined whether the Proposed Action poses jeopardy or adverse modification to critical habitat.

Effects of the Proposed Action

Effects of the Proposed Action include both direct and indirect effects on species and their critical habitat. NMFS conducted two related analyses, one for jeopardy and one for critical habitat. For the jeopardy analysis, NMFS considered whether the Proposed Action is likely to reduce the abundance, productivity, diversity, and/or distribution of a listed species. For the critical habitat analysis, NMFS evaluated the effect of the Proposed Action on essential features of the habitat by comparing them with and without the action.

There are parts of the Proposed Action that will provide important coordination and data collection but have few, if any, direct effects on ESA-listed salmon and steelhead. These include the WATER committee process and Willamette System Review Study. The WATER committee process includes federal and state agencies, Tribes, and local interests in collaborative review and recommendations to USACE. The Willamette review study would help provide information regarding the feasibility and relative benefits of various mitigation measures.

The effects of activities such as RM&E studies, water contracts, revetments, and hatchery programs are similar throughout the basin, as summarized below:

- RM&E studies would provide the basis for improving conditions for Upper Willamette Chinook and steelhead that are trapped, examined, released, confined, relocated, marked or tagged, and otherwise subjected to handling operations in field studies.
- Water contracts would make up a small percentage of available storage, but would further reduce streamflow in limited habitat downstream from Project dams. In some tributaries, water diversion by contractors would reduce the frequency with which minimum streamflows are met, adversely affecting adult holding and passage and reducing available rearing habitat.
- Revetments simplify habitat and diminish its suitability and capacity to support larger and more productive populations.
- Hatcheries in the Willamette basin that produce spring Chinook salmon, summer steelhead, and resident rainbow trout affect listed salmon and steelhead in a number of ways. The effects range from water quality risks posed by hatchery effluent to loss of genetic variability and to harvest regimes directed at catching hatchery fish that may incidentally take natural-origin fish.

NMFS analyzed the effects of the Proposed Action in each subbasin in the Willamette basin for specific salmon and steelhead populations that could be affected by the Proposed Action. These effects are summarized below:

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- **Middle Fork Willamette:** The Proposed Action would allow adverse conditions to persist for this population of Upper Willamette Chinook salmon. The Middle Fork population would continue to have limited upstream and downstream passage, preventing safe access to historical spawning and rearing habitat. Habitat downstream of the projects would continue to be degraded by lack of sediment and large wood transport, altered flow regimes, and altered water quality.
- **McKenzie:** The Proposed Action would continue to degrade habitat and restrict access to historical spawning and rearing habitat for the McKenzie population of Upper Willamette Chinook salmon. The McKenzie population is a stronghold population and remains the most productive run of natural-origin spring Chinook in the basin. Strays from Willamette basin hatcheries would continue to decrease fitness and productivity of the natural population. Operations would continue to degrade downstream habitats by altering the natural flow regime and interrupting the transport of large wood and sediments. Preliminary monitoring of the recently installed temperature control tower at Cougar Dam has, however, shown that it has restored normative water temperatures to fish habitat in the McKenzie and increased productivity of salmon spawning below the dam.
- **Calapooia and Molalla:** The Proposed Action would have a relatively small effect on the Calapooia and Molalla populations of Upper Willamette Chinook salmon and steelhead, but would contribute to continued degradation of habitat. In addition, continued release of an out-of-basin hatchery stock poses genetic risks to the Molalla Chinook populations.
- **South Santiam and North Santiam:** The Proposed Action would continue to prevent the North and South Santiam populations of Upper Willamette Chinook salmon and steelhead from accessing historical habitat and continue to degrade water quality and physical habitat. Hatchery Chinook pose risks and potential benefits to the populations. The irrigation water contract program would continue to reduce streamflow. Revetments would contribute to the continued loss of floodplain connectivity and off-channel habitat in the South Santiam.
- **Clackamas:** The Proposed Action would have a relatively minor effect in the lower Clackamas River, where Upper Willamette Chinook and Lower Columbia River Chinook, coho, and steelhead populations exist. The continued existence and maintenance of revetments would contribute to reduced habitat function along the mainstem Clackamas River, which could lead to diminished abundance and productivity.
- **Coast Fork Willamette and Long Tom:** The Proposed Action would have a relatively minor effect on Upper Willamette Chinook and steelhead in these Westside tributaries.
- **Mainstem Willamette:** The Proposed Action would cause continued decline in Upper Willamette Chinook salmon and steelhead populations, as a result of reduced peak flows and floodplain connectivity, as well as diminished habitat complexity, particularly above Willamette Falls. The Proposed Action would eliminate sediment and large wood transport from over one-quarter of the watershed, and revetments would restrict channel movement. The Action Agencies' proposal would protect water quality from further degradation by

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maintaining flows at prescribed levels and providing spring flows at Willamette Falls for steelhead passage.

Summary of Effects of the Proposed Action on UWR Chinook Salmon & Steelhead

The Proposed Action does not adequately address the effects of the Willamette Project on UWR Chinook or steelhead. Principal deficiencies are:

- Chinook and steelhead populations important to the viability of their respective ESU/DPSs will be limited to use degraded spawning and rearing habitat below Project dams where space, water temperatures, and physical habitat conditions do not meet the species biological requirements.
- Inadequate plan for upgrading adult collection facilities.
- No plan for developing adequate downstream passage facilities for juveniles of either species and for steelhead kelts.
- Lack of measures to improve rearing habitat affected by Project revetments.
- Inadequate plan for reducing straying of hatchery-origin UWR Chinook into the area reserved for natural production above Leaburg Dam in the McKenzie subbasin.
- Lack of specific measures to address the adverse effects of the summer steelhead hatchery program on listed fish.

NMFS considered these deficiencies in its jeopardy analyses for UWR Chinook and steelhead in Sections 8.1 and 8.2.

Summary of Effects of the Proposed Action on Critical Habitat for UWR Chinook Salmon & Steelhead

The Proposed Action does not adequately address the effects of the Willamette Project on critical habitat for UWR Chinook or steelhead. Principal deficiencies are:

- Spawning and rearing habitat will not have adequate water quality, floodplain connectivity, forage, and natural cover for the conservation of the species.
- Inadequate plan for providing safe passage at adult collection facilities.
- No plan for developing safe downstream passage facilities for juveniles of either species.
- Lack of measures to improve floodplain connectivity and natural cover in rearing habitat affected by Project revetments.

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NMFS considers these deficiencies in its adverse modification (of critical habitat) analyses for UWR Chinook and steelhead in Sections 8.1 and 8.2.

Jeopardy and Critical Habitat Decision

NMFS' jeopardy standard for the Willamette Project is survival with an adequate potential for recovery. The agency applied this standard to its determination of the effects of the Willamette Project.

NMFS concluded that the effects of the Proposed Action are likely to jeopardize the continued existence of Upper Willamette River Chinook salmon and Upper Willamette River steelhead. Moreover, the Proposed Action would continue the significant adverse effects of the Willamette Project, preventing survival and recovery of these two species. The Proposed Action also is likely to destroy or adversely modify the critical habitat needed by these fish. While the Proposed Action includes measures to reduce effects of the project, the measures do not sufficiently reduce the risks of jeopardy for the Chinook salmon and steelhead.

With regard to the other salmonid species considered in the consultation, NMFS concluded that the effects of the Willamette Project are likely to be minor and unlikely to jeopardize their continued existence or destroy or adversely modify their critical habitat. NMFS concluded the Proposed Action was not likely to adversely affect green sturgeon and Southern Resident killer whales.

In light of its jeopardy and critical habitat decision, NMFS provided the Action Agencies with an RPA to avoid jeopardy and the destruction or adverse modification of habitat for Upper Willamette Chinook and steelhead.

Measures in the RPA

NMFS provides the Action Agencies with a reasonable and prudent alternative (RPA) to avoid jeopardizing the continued existence of UWR Chinook salmon and UWR steelhead, and avoid destroying or adversely modifying their critical habitat. NMFS' RPA includes the measures in the Proposed Action, adds new measures, and modifies others in the PA. The RPA measures fall into several general categories: fish passage, water quality, flows, water contracts, hatcheries, and habitat.

NMFS' RPA builds on the studies in the Proposed Action by adding on-the-ground measures that the Action Agencies will complete to address Project effects on listed anadromous fish. Therefore, NMFS' RPA specifically lists measures that the Action Agencies will carry out after the necessary studies and designs are completed to verify feasibility.

The significant long-term new measures include the construction and operation by the Action Agencies of three new downstream fish passage facilities and one temperature control structure. These measures necessarily will take a number of years to plan, design, and complete before operation. UWR Chinook salmon are at high risk of extinction, and there are many measures in

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the RPA that the Action Agencies will carry out in the shorter term that will ensure that the UWR Chinook will not go extinct in the near future. These measures include temperature control, flow modifications, hatchery reforms and upgrades, passage upgrades, irrigation diversion screens, and habitat mitigation projects. These measures will also benefit UWR steelhead.

The major additional actions in the RPA that will be implemented on-the-ground and provide significant benefits to listed salmon and steelhead population recovery include:

- Construction and operation of downstream passage facilities at Cougar Dam to safely pass emigrating Chinook salmon by 2014; at Lookout Point Dam by 2021; and at Detroit Dam by 2023.
- Implementation of improved water temperature control (using existing infrastructure) downstream of Detroit/Big Cliff Dam effective in 2009 and beyond.
- Long term temperature improvements at Detroit Dam through operational changes or structural modifications by 2018.
- Construction of a sorter/separator at Leaburg Dam on the McKenzie River by 2014 to create a natural fish sanctuary above Leaburg Dam.

Other important RPA measures are summarized below:

Coordination

NMFS' RPA directs the Action Agencies to clarify decision-making and agency roles in the proposed WATER committee process. The RPA specifies that by December 2008, the agencies will complete a charter that makes clear how decisions will be made by the Action Agencies and how subcommittees will be formed. This committee and its subcommittees will be made up of federal and state agencies and tribes, with input from other affected entities, and will help inform Action Agency decisions on implementing or modifying RPA measures as information becomes available.

Flow Management

NMFS' RPA reinforces the likelihood that flow targets and ramping rates will be met and clarified the roles of the three agencies involved. NMFS adds a requirement that gauging stations be established and operated to determine if flows released from the dams are available downstream for tributary habitat, and that flow studies, together with gauging results, be used to amend tributary and mainstem flow objectives, if indicated for improved fish habitat conditions. The RPA requires amending tributary flow requirements as appropriate based on information the Action Agencies will collect in the next few years. The RPA also requires the Action Agencies to work with Oregon to protect water released for fish conservation purposes.

Water Contract Program

NMFS' RPA requires that water diversions for new and renewing water contracts have fish protective devices such as fish screens. Existing contract holders will be required to install devices by 2010. The RPA also imposes a limit on contracts to ensure adequate streamflows remain in tributaries below Project dams, especially in the North and South Santiam rivers. The RPA adds a requirement that diversions be curtailed in deficit water years.

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Fish Passage

NMFS' RPA includes specific fish passage measures, and a timeline by which they must be completed and operating. The three new downstream passage facilities at Cougar, Detroit, and Lookout Point were mentioned above. The Action Agencies' outplant program above Willamette Project dams will be upgraded as a means of upstream passage during the term of this Biological Opinion. The RPA requires improving the adult fish collection and handling process in the Proposed Action and adds a requirement for additional adult release sites above the dams and a timeline for completion.

There are additional requirements for the Action Agencies to pursue interim operating measures that will increase safe downstream fish passage through dams and reservoirs. The RPA underscores the need for long-term passage solutions at the Willamette Projects, specifically Cougar, Lookout Point, and Detroit, and lays out the studies and timelines for implementing these structural changes.

Water Quality

The RPA requires interim temperature control measures at Detroit Dam by 2009, and evaluation of the potential for interim temperature control measures at other Project dams. NMFS directs the Action Agencies to construct a water temperature control structure or implement permanent operational changes at Detroit Dam, or at another one or more of the Project dams, by 2018.

Hatcheries

The RPA directs the agencies to pursue hatchery reforms to minimize the effect of hatchery fish on natural-origin stocks and to operate hatchery programs according to hatchery and genetic management plans. NMFS calls on the Action Agencies to improve collection facilities associated with the hatchery program and to continue the mass marking of hatchery fish. Hatchery-related risks will be significantly reduced to the McKenzie Chinook population by the implementation of a fish sorting facility at Leaburg Dam that allows hatchery fish to be separated from natural-origin fish destined for upstream spawning grounds. The RPA also lays out controls to be exercised with outplanting in order to limit genetic risks to natural-origin fish posed by hatchery-produced stock.

Habitat

NMFS' RPA adds requirements for completing habitat mitigation projects, including the completion of at least two projects by 2010, with additional projects to be completed each year from 2011 to 2023. These projects would be identified and prioritized by a new off-site habitat mitigation program. NMFS has added the requirement that the Action Agencies collect large woody debris in the Willamette Project reservoirs and make it available for habitat restoration projects and a requirement that the agencies find funding and complete a study of restoring habitat at revetments.

ESA Compliance and Coordination

NMFS' RPA requires the Action Agencies to collaborate with NMFS on structural modifications at the dams to insure they are designed and constructed in a way that has the least impact to ESA-listed species. Further, the RPA requires the Action Agencies to use best management practices during construction and operation of structures and facilities to reduce adverse effects on fish and fish habitat.

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Research, Monitoring & Evaluation

To improve the effectiveness of the RM&E program in the Proposed Action, NMFS adds requirements with regard to its own input into what information the agencies need to obtain and what specific studies will be conducted. NMFS is also requiring flow and ramping rate studies early on and changes to operations based on the information. NMFS has also added requirements to the Action Agencies RM&E on fish passage above the Willamette Project dams, as well as on water quality. There is a requirement for RM&E to follow up on the effectiveness of improvements to hatchery programs and habitat in the Willamette basin to determine if they are reducing adverse effects to ESA-listed species. Based on the information, alternatives may be necessary to meet biological objectives.

In addition, the long-term studies and evaluations will provide information for potential additional measures for the Action Agencies to implement beyond the 15 year time frame for this Biological Opinion. These measures could include additional fish passage facilities, temperature control, flows and water quality modifications.

Maintenance

The RPA requires the Action agencies to develop and maintain an inventory of maintenance needs that could potentially harm listed fish. The Action Agencies will be required to correct deficiencies in a timely manner.

Consideration of Climate Change

The RPA includes several measures that are consistent with the recommendations from the Independent Scientific Advisory Board's 2007 Climate Change Report to proactively address anticipated effects of climate change. Ongoing climate change is likely to pose additional problems for salmon in the Willamette basin by increasing water temperatures and changing the amount and timing of streamflows. The RPA requires actions to improve the Action Agencies' ability to control water temperatures downstream from its projects. It also requires the Action Agencies to use water stored in Project reservoirs to meet minimum and maximum flow objectives in a manner that addresses changes in seasonal streamflow patterns related to climate change. Additionally, the RPA requires studies to ensure that these requirements are adequate and will operate to meet revised objectives, if needed. Finally, the RPA calls for habitat improvement projects that will enhance habitat conditions on the mainstem Willamette and its tributaries, by improving habitat complexity, providing floodplain and hydraulic connectivity, and using large wood taken from Project reservoirs to create deep, cool water pools in downstream reaches. These actions address the ISAB's recommendations by increasing habitat connectivity and the availability of thermal refugia.

Conclusion on Effects of the RPA

NMFS concluded that with the adoption of the RPA, the Action Agencies could continue to operate and maintain the Willamette Project dams and revetments, the hatchery programs in the basin, and the water contracts program without posing jeopardy to the listed species, or adversely modifying their critical habitat. The RPA provides specific measures that will contribute to recovery by improving the conditions that are limiting abundance, productivity, spatial distribution, and diversity of Upper Willamette River Chinook salmon and steelhead. These measures include passage facilities, flow modifications, temperature control, water quality

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modifications, hatchery improvements, irrigation diversion screens, and habitat mitigation projects and the RPA provides increased certainty that measures under the Proposed Action will be accomplished within a reasonable amount of time. These RPA measures as modified throughout the term of the Biological Opinion, will allow UWR Chinook salmon and steelhead to survive with an adequate potential for recovery because they will address effects of the Willamette Project on these listed fish.

Some of the RPA measures require major construction activities that take a significant amount of time to plan, fund, and execute. These will be completed between 2015 and 2023, including passage at dams in the Middle Fork and South Santiam, which will provide safe passage to and from historical upstream habitat, and temperature control to improve downstream habitat in the North Santiam. It will take several generations of the salmon life-cycle to respond to the positive improvements in the operation of the Willamette Project and associated measures. Numerous other near-term measures, such as changes to flow, screening irrigation diversions, hatchery program modifications, and habitat mitigation projects, can be implemented more quickly and will begin to benefit the species in a shorter period of time.

After a species-by-species review of the expected benefit of the measures outlined in the RPA, NMFS concludes that the Upper Willamette River Chinook salmon and the Upper Willamette River steelhead are expected to survive with an adequate potential for recovery and that their critical habitat will likely remain functional. NMFS concludes that the RPA is not likely to jeopardize the continued existence of either species or destroy or adversely modify critical habitat for these species.

NMFS concludes that Proposed Action as modified by the RPA may affect, but is not likely to adversely affect the Southern DPS of North American green sturgeon because the effects of changes to flows in the lower Columbia River and estuary are likely to be slight to negligible.

NMFS concurs with the Action Agency determination that the Proposed Action as modified by the RPA may affect, but is not likely to adversely affect Southern Resident killer whales. While the Willamette Project operations cause high levels of mortality to returning UWR Chinook, hatchery production contained in the Proposed Action and RPA increases the adult Chinook salmon available to Southern Resident killer whales as prey; with the net result that killer whale prey base is not reduced. The long term improvement of UWR Chinook is a benefit to Southern Resident killer whales in the long term.

Conclusion on EFH consultation

NMFS also provides recommendations to conserve EFH pursuant to the Magnuson-Stevens Fishery Conservation and Management Act. In its consultation on the Act, NMFS considered the essential fish habitat (EFH) for two species of federally managed Pacific salmon – Chinook and coho salmon – and four non-salmonid fish – starry flounder, English sole, northern anchovy, and Pacific sardine.

The Proposed Action, including the RPA, affects EFH in portions of the states of Oregon and Washington, and the Columbia River estuary and plume. NMFS determined that the impacts to

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EFH for unlisted Chinook and coho salmon species are the same as those described in the Biological Opinion for the ESA-listed species.

NMFS concludes that the Proposed Action, including the RPA, would adversely affect EFH for Willamette basin populations of Chinook and coho because there would be changes to flows and water quality. Effects on EFH of non-salmonid fish species would be minimal. NMFS recommends that the Action Agencies adopt the measures spelled out in the Incidental Take Statement of the ESA consultation and place a high priority on restoring fish access to blocked habitats.