UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to NMFS No.:
2007/09078

October 22, 2009

Christopher Doley
Director, NOAA Restoration Center
1315 East-West Highway
Silver Spring, Maryland 20910

Re: Programmatic Biological and Conference Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Restoration Actions Funded or Carried Out by the NOAA Restoration Center in the Pacific Northwest Using the Damage Assessment, Remediation and Restoration Program (DARRP) and the Community-based Restoration Program (CRP)

Dear Mr. Doley:

The enclosed document contains a formal and informal programmatic opinion (Opinion) prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7(a) (2) of the Endangered Species Act (ESA) on the effects of implementing actions proposed to be funded or carried out by the NOAA Restoration Center (NOAARC) in the Pacific Northwest. These actions are being proposed to fulfill natural resource responsibilities assigned to NOAARC under the Clean Water Act, the Superfund Act, the Oil Pollution Act of 1990, the National Marine Sanctuaries Act, and the Fish and Wildlife Coordination Act. Actions covered in this Opinion modify actions described in a programmatic biological opinion previously issued to NOAARC on July 12, 2004.[1] Those changes are summarized in the consultation history section of the Opinion.

In this Opinion, NMFS concludes that the proposed actions are not likely to jeopardize the continued existence of the following 21 species: Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha*), Upper Willamette River spring-run (UWR) Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, Snake River (SR) spring/summer run Chinook salmon, SR fall-run Chinook salmon, Puget Sound (PS) Chinook salmon, Columbia River (CR) chum salmon (*O. keta*), Hood Canal (HC) summer-run chum salmon, LCR coho salmon (*O. kisutch*), Oregon Coast (OC) coho salmon, Southern Oregon/Northern California Coasts (SONCC) coho salmon, Lake Ozette (LO) sockeye salmon (*O. nerka*), SR sockeye salmon, LCR steelhead (*O. mykiss*), UWR steelhead, Middle Columbia River (MCR) steelhead, UCR steelhead, Snake River Basin (SRB) steelhead, PS steelhead, southern green sturgeon (*Acipenser medirostris*), or eulachon (*Thaleichthys pacificus*).

1 Endangered Species Act – section 7 consultation: programmatic biological and conference opinion and Magnuson-Stevens Fishery Conservation and Management Act essential fish habitat consultation for NOAA Restoration Center programs, July 12, 2004 (refer to 2002/01967).

Moreover, NMFS concludes that the proposed action is not likely to result in the destruction or adverse modification of critical habitat designated for each of the above salmon and steelhead species – with the exception of LCR coho salmon for which critical habitat has not been proposed – or southern green sturgeon. Critical habitat has not been proposed for eulachon.

As required by section 7 of the ESA, this Opinion includes reasonable and prudent measures with terms and conditions that are necessary to minimize the impact of incidental take associated with this action. The action agency and applicant, if any, must comply with these terms and conditions for exemption from the prohibition against taking in section 7(o) to apply. However, southern green sturgeon are not protected by take prohibitions of the ESA until proposed protective regulations become effective. Therefore, this incidental take statement does not apply to southern green sturgeon until those regulations are in place. Further, eulachon are not protected by take prohibitions until listed and, if listed as threatened, protective regulations become effective. The incidental take statement does not apply to eulachon until that species until it is listed, protective regulations are in place, and this conference opinion is confirmed by NMFS as a biological opinion.

This document also presents the results of our consultation on the proposal's effect on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes four conservation recommendations to avoid, minimize, or otherwise offset likely adverse effects to EFH. Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the recommendations, the action agency must explain why the recommendations will not be followed, including the justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the agency. Therefore, we request that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

If you have any questions regarding this Opinion, please contact Marc Liverman, QAQC Coordinator in the Oregon State Habitat Office at 503-231-2336.

Sincerely,

Michael Tehan

for Barry A. Thom
Acting Regional Administrator

cc: Megan Callahan-Grant, PNWRC
Lee Folliard, USFWS
Paul Henson, USFWS
Jennifer Steger, PNWRC

Endangered Species Act - Section 7
Programmatic Biological and Conference Opinion

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Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation

Restoration Actions Funded or Carried Out by the
NOAA Restoration Center in the Pacific Northwest
Using the Damage Assessment, Remediation and Restoration Program (DARRP),
and the Community-based Restoration Program (CRP)

Agency:	National Marine Fisheries Service, NOAA Restoration Center
Consultation Conducted By:	National Marine Fisheries Service, Northwest Region
Date Issued:	October 22, 2009
Issued by:	Michael Jehan for Barry A. Thom Acting Regional Administrator
Refer to:	**2007/09078**

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INTRODUCTION

This document contains a biological opinion (Opinion) and incidental take statement prepared in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, *et seq*.), and implementing regulations at 50 CFR 402. The National Marine Fisheries Service (NMFS) also completed an essential fish habitat (EFH) consultation, prepared in accordance with section 305(b) (2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801, *et seq*.) and implementing regulations at 50 CFR 600.

The docket for this consultation is on file at the Oregon State Habitat Office in Portland, Oregon.

The NOAA Restoration Center (NOAARC) proposed to fund or carry out 12 categories of action related to stream and wetland restoration and fish passage. The primary purpose of the NOAARC programs is improve habitat for living marine resources, including anadromous fish listed as threatened and endangered under the ESA.

Background and Consultation History

On July, 19, 2007, NOAARC reinitiated the programmatic consultation completed July 12, 2004,[1] for restoration actions funded or carried out by NOAARC and completed in Oregon, Washington and Idaho. Funding for these actions will be provided by the Damage Assessment, Remediation and Restoration Program (DARRP) and the Community-based Restoration Program (CRP), often in combination with resources provided by U.S. Fish and Wildlife programs, including the Partners for Fish and Wildlife Program, Coastal Program and Recovery Program.[2] DARRP is cooperatively implemented by the NOAA Restoration Center, NOAA's National Ocean Service's Office of Response and Restoration, and the Office of General Counsel. These programs are authorized by the Comprehensive Environmental Response, Compensation, and Liability Act (also known as CERCLA or Superfund), the Oil Pollution Act, the Clean Water Act, and the Marine Protection, Research and Sanctuaries Act. The CRP, which involves communities in the restoration of local marine and estuarine habitats, is authorized by the Fish and Wildlife Coordination Act. Depending on the action, other cooperating entities may include Federal agencies, states, tribes, local governments, non-governmental and nonprofit organizations, businesses, schools, and private landowners. Since 2004, NOAARC reported that it funded or carried out from five to 21 (with an average of 12) restoration actions per year using this programmatic biological opinion. Those actions were distributed as follows: Puget Sound 48%, Willamette/Lower Columbia 10%, Interior Columbia 17%, Oregon Coast 21%, and Southern Oregon/Northern California Coasts 5%.

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[1] Endangered Species Act – section 7 consultation: programmatic biological and conference opinion and Magnuson-Stevens Fishery Conservation and Management Act essential fish habitat consultation for NOAA Restoration Center programs, July 12, 2004 (refer to NMFS No.: 2002/01967).
[2] See, programmatic biological and conference opinion and Magnuson-Stevens Fishery Conservation and Management Act essential fish habitat consultation for restoration actions funded by the U.S. Fish and Wildlife Service in Oregon and southwest Washington using the Partners for Fish and Wildlife, Coastal, and Recovery Programs, in preparation (refer to NMFS No.: 2004/00155).

Based on consideration of NMFS' growing experience with the likely effects of restoration actions, including specifically the extent of entry into riparian areas and stream channels,[3] and the intensity and duration of the disturbances that are likely to result, several actions that were formerly included in this programmatic Opinion have now been separated and analyzed in a letter of concurrence.[4] These include the following types of actions:

- Riparian Habitat Restoration: Installation of livestock fencing and riparian revegetation.
- Instream Habitat Restoration: Installation of wood and boulder instream structures, not including boulder weirs.
- Upland Habitat Restoration – outside the riparian area: Installation of livestock fencing, livestock watering facilities, control and removal of invasive/non-native plants.
- Coastal and Estuarine Habitat Restoration: Installation of wood and boulder instream structures, not including boulder weirs.

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[3] For this Opinion only, "riparian area" means land: (1) within a distance equal to the height of one "site potential tree " (SPTH) of any natural waterbody occupied by ESA-listed salmon or steelhead during any part of the year, or designated as critical habitat; (2) within 100 feet of any "natural waterbody" within ¼ mile upstream of areas occupied by ESA-listed salmon or steelhead, or designated as critical habitat, and that is physically connected by an aboveground channel system such that water, sediment, or woody material delivered to such waters will eventually be delivered to water occupied by ESA-listed salmon or steelhead or designated as critical habitat; and (3) within 50 feet of any "natural water" more than a ¼ mile upstream of areas occupied by ESA-listed salmon or steelhead, or designated as critical habitat, and that is physically connected by an above-ground channel system such that water, sediment, or woody material delivered to such waters will eventually be delivered to water occupied by listed salmon or designated as critical habitat.

"SPTH" means the average height, at age 100, of the tallest, mature, native conifer species that is capable of growing in the soils found at that site and for which height measurements are noted in the soil survey reports published by National Resource Conservation Service (NRCS). Each local NRCS field office maintains the surveys for its area. West of the Cascade Mountains summit, the STPH will be based on either Douglas-fir or western hemlock. East of Cascade Mountains summit, the species could be ponderosa pine, lodgepole pine, western larch, Englemann spruce, subalpine fir, grand fir or Douglas-fir. For sites that historically supported cottonwood as the largest tree, the SPTH is the average height, at age 75, of a black cottonwood tree growing under those site conditions. For saltwater areas, the riparian area will begin at the mean higher high water (MHHW); for lakes, the riparian area begins at the high-water mark or the edge of an immediately contiguous wetland, and for wetlands the riparian area begins at the upper wetland boundary. Distances from a stream or waterbody are measured horizontally from, and perpendicular to, the bankfull elevation, the edge of the channel migration area, or the edge of any associated wetland, whichever results in the greatest riparian area width.

"Natural waterbody" means any perennial or seasonal water or wetland, except water conveyance systems that are artificially constructed and actively maintained for irrigation.

"Channel" means the channel migration zone, (i.e., the area where the active channel of a stream is prone to movement over time) (Rapp and Abbe 2003). Streams, regardless of size, that are tributary to a main channel have the same width riparian area as the main channel. All side channels that have flowing water when the main channel is at bankfull stage have a riparian area along each bank that is similar in size and plant composition to the riparian area along the main channel. A riparian area that follows the bankfull line of a watercourse continues around the upland edge of contiguous wetlands. Wetlands that are within the active floodplain, (*i.e*., the floodprone area) but are not contiguous to a channel, will have a riparian area as described above for waterbodies.

For discussions of the ability of a riparian area to protect aquatic habitats against the adverse effects of upland disturbance, see Johnson and Ryba 1992, FEMAT 1993, Castelle *et al.* 1994, Spence *et al.* 1996, and USDA and NRCS 1999.

[4] Endangered Species Act section 7 Informal Consultation and Magnuson-Stevens Fishery Conservation and Management Act essential fish habitat consultation for NOAA Restoration Center Programs, in preparation.

- Road and Trail Improvements – outside the riparian area: Abandonment of roads and trails, closure of roads and trails, decommissioning of roads and trails, improvement of roads and trails.
- Surveys, Assessments, and Monitoring Activities: Physical data collection.
- Marine Debris removal and prevention activities.

Proposed Action

The NOAARC proposes to fund or carry out 12 categories of action related to stream and wetland restoration and fish passage, specifically:

1. **Fish Passage Restoration** to improve fish passage by installing or improving fish ladders at an existing facility, constructing individual or a series of boulder weirs, or removing, replacing, or improving culverts.

2. **Invasive and Non-native Plant Control**, including use of manual, mechanical, biological, and chemical methods, to improve the composition and abundance of native riparian plant communities.

3. **Juniper Tree Removal** from riparian areas to improve native vegetation diversity and watershed function.

4. **Livestock Stream Crossings and Off-Channel Livestock Watering Facilities** to reduce livestock damage to riparian soils and vegetation, streambanks, channel substrates, and water quality by (a) providing controlled access for walkways that livestock use to transit through riparian areas and stream channels, and (b) reducing their attraction to riparian areas and stream channels by providing upslope water facilities to help distribute livestock away from riparian areas and aquatic habitats. This action does not include riparian or upland grazing.

5. **Off- and Side-Channel Habitat Restoration** to reconnect historical stream channels with floodplains, increase habitat diversity and complexity, improve flow heterogeneity, provide long-term nutrient storage and substrate for aquatic macroinvertebrates, moderate flow disturbances, increase retention of leaf litter, and provide refuge for fish during high flows by restoring or modifying hydrologic and other essential habitat features of historical river floodplain swales, abandoned side channels, and historical floodplain channels.

6. **Piling Removal** to improve water quality by eliminating chronic sources of toxic contamination.

7. **Set-back or Removal of Existing Berms, Dikes, and Levees** to reconnect stream channels with floodplains, increase habitat diversity and complexity, moderate flow disturbances, and provide refuge for fish during high flows by either removing existing berms, dikes or levees or increasing the distance that they are set back from active streams or wetlands. This action includes the removal of fill, such as dredge spoils from

past channelization projects, road, trail, and railroad beds, dikes, berms, and levees from floodplains to restore natural floodplain functions. Such functions include overland flow during high flows, dissipation of flood energy, increased water storage to augment low flows, sediment and debris deposition, growth of riparian vegetation, nutrient cycling, and development of side channels and alcoves.

8. **Shellfish Restoration** to restore or re-introduce populations of molluscan shellfish into bays, estuaries, or the marine environment by (a) enhancement of settling substrate, (b) placement of juveniles or adults into the marine/estuarine environment, and planting submerged aquatic vegetation (SAV) as part of a shellfish restoration action.

9. **Streambank Restoration** to restore eroding streambanks by (a) bank shaping and installation of coir logs or other soil reinforcements as necessary to support riparian vegetation; (b) planting or installing large wood, trees, shrubs, and herbaceous cover as necessary to restore ecological function in riparian and floodplain habitats; or (c) a combination of the above methods.

10. **Water Control Structure Removal** to reconnect stream corridors, reestablish wetlands, improve fish passage, and restore more natural channel and flow conditions by removing small dams,[5] channel-spanning weirs, earthen embankments, subsurface drainage features, spillway systems, tide gates, outfalls, pipes, instream flow redirection structures (*e.g.*, drop structure, gabion, groin), or similar devices used to control, discharge, or maintain water levels.

11. **Wetland Restoration** to restore degraded wetland by (a) excavation and removal of fill materials; (b) contouring to reestablish more natural topography; (c) setting back existing dikes, berms and levees; (d) reconnecting historical tidal and fluvial channels; (d) planting native wetland species; or (e) a combination of the above methods. This action does not include installation of water control structures or fish passage structures.

12. **Road and Trail Erosion Control and Decommissioning** within the riparian area to (a) limit erosion by installing or upgrading cross-drainage culverts, water bars, and water dips; road prism shaping; revegetation of fill and cut slopes; removal and stabilization of side cast materials; and grading or resurfacing with gravel, bark chips, or other permeable materials; and to (b) close, decommission, or both, existing roads or trails to restore the bed to more natural conditions by removing cross-drainage and stream culverts, contour shaping of the road or trail base, removing road fill to native soils, soil stabilization, and tilling compacted surfaces to reestablish native vegetation.

Proposed Design Criteria

The NOAARC proposes to apply the following proposed design criteria (PDCs), in relevant part, as binding requirements for every action funded or carried out under this opinion as shown by

[5] "Small dams" include instream structures that Structures (1) up to 10 feet in height for streams with an active channel width of less than 50-feet and a slope less than 4%, or (2) up to 16.4 feet in height for streams with an active channel width of less than 50-feet and a slope greater than 4% are covered by this Opinion (see Poff and Hart 2002).

use of the directive word "will." The words "should" or "may" are used with recommendations and indicate PDCs or parts of PDS that are not binding as requirements. Measures described under "Administration" apply to NOAARC as it manages the implementation of this programmatic Opinion. Measures described under "General Construction" apply, in relevant part, to each action that involves a construction component. Measures described under "Types of Action" apply, in relevant part, to each of the actions as described. The NOAARC will ensure that all other measures apply to each party that is given funding for, or carries out, an action under this Opinion.

Administration

1. NOAARC review. The NOAARC will confirm that each action funded or carried out under this Opinion is within the present or historical range of an ESA-listed fish considered in this Opinion, or designated critical habitat. Further, for those actions that are interdependent or interrelated with actions proposed by USFWS or other Federal agencies, those agencies will decide which agency will be designated as the lead for the overall ESA consultation, including monitoring and reporting. Generally, this decision will be based on which agency has the principal responsibility for the project. For those actions that NOAARC will be the lead, NOAARC will individually review and approve each action to ensure that all adverse effects to ESA-listed fish and their designated critical habitats are within the range of effects considered in this Opinion.

2. Site assessment for contaminants. The NOAARC will complete a site assessment with the following elements to identify the type, quantity, and extent of any potential contamination for any action that involves off- and side-channel habitat restoration; set-back or removal of an existing berm, dike or levee; or removal of a water control structure that may impound contaminated sediments: (a) A review of readily available records, such as former site use, building plans, records of any prior contamination events; (b) a site visit to observe the areas used for various industrial processes and the condition of the property; (c) interviews with knowledgeable people, such as site owners, operators, and occupants; neighbors; local government officials; and (d) a report that includes an assessment of the likelihood that contaminants are present at the site.

3. Request for NMFS fish passage review. For any proposed action that involves: (a) A diversion of surface water using gravity or by pumping at a rate that exceeds 3 cubic feet per second (cfs); or (b) a boulder weir or fish ladder for fish passage restoration, NOAARC will ensure that the action is also individually reviewed by the appropriate state office of the NMFS' Habitat Conservation Division for consistency with criteria in NMFS (2008, or the most recent version) and approved by that office as consistent with this Opinion before that action is funded or carried out.[6]

[6] The best way to begin fish passage review by NMFS is during informal consultation during the preliminary development project phase, when project team members are developing goals and objectives with stakeholders. When requested, NMFS will provide an estimate of the time necessary to complete the review based on the complexity of the proposed action and work load considerations at the time of the request. NMFS will make its best effort to complete this review in less than 30-days, as other work priorities allow, although approval may be delayed if a substandard design is submitted for review during the post-design or action implementation stage and significant revision is necessary.

4. NMFS notification. The NOAARC will submit an action notification form (see Appendix A and B) to NMFS with the following information no later than 30-days before beginning construction in-water work on any action that will be funded or carried out under this Opinion: (a) NOAARC contact person; (b) the action name; (c) the name and contact person of any other Federal agency or agencies for which NOAARC is acting as the lead for purposes of this consultation; (d) the type of activity; (e) the location of the action site by latitude and longitude (including decimal degrees), and 6th field hydrological unit code (HUC); (f) expected start and end dates for the completion of any in-water work; (g) for any action requiring a site assessment for contaminants, include a copy of the report explaining the likelihood that contaminants are present at the site; (h) for any action requiring NMFS fish passage review, a copy of all comments or recommendations received as a result of the review – if the NMFS fish passage review is not complete before the action notification form is sent, the form will include a request for that review; and (i) sufficient information to ensure that the proposed action fits all applicable design criteria and that all adverse effects to ESA-listed fish and their designated critical habitats are within the range of effects considered in this Opinion.

5. Action completion. The NOAARC will submit an action completion form (see Appendices A and C) to NMFS within 60 days of completing all work or, for actions involving work below ordinary high water (OHW), within 60 days of completing all work below OHW, with the following information: (a) NOAARC contact person; (b) the action name; (c) the name and contact person of any other Federal agency or agencies for which NOAARC is acting as the lead for purposes of this consultation; (d) the type of activity; (e) the location of the action site by latitude and longitude (including decimal degrees), and 6th field HUC; (f) start and end dates for the completion of in-water work; (g) for any action involving water control structure removal, a copy of information used to satisfy the data requirements and analysis for structure removal as described below in the design criteria for the water control structure removal; (h) photos of habitat conditions before, during, and after action completion; (i) any dates work ceased due to high flows; (j) evidence of compliance with fish screen criteria, as defined below, for any pump used; (k) a summary of the results of pollution and erosion control inspections, including any erosion control failure, contaminant release, and correction effort; (l) the number, type, and diameter of any pilings removed or broken during removal; (m) a description of any riparian area cleared within 150 feet of OWH; (n) the linear feet of bank alteration; (o) a description of turbidity monitoring results for upland and wetland actions that do not have an in-water work component; (p) a description of site restoration completed; and (q) a completed fish-salvage reporting form (see Appendix A and D) for any action that requires fish salvage. The NOAARC will use CIRS to submit this report when the online system becomes available. Until CIRS is available, NOAARC will submit reports to NMFS by email at this address: noaarc.biop.nwr@noaa.gov.

6. Funding conditions. The NOAARC will include each applicable design criterion as a condition of funding for every action funded or carried out under this Opinion.

7. Site access. The NOAARC will retain the right of reasonable access to the site of actions funded or carried out using this Opinion to monitor the use and effectiveness of terms and conditions for the period identified in the landowner agreement or other similar agreement.

8. ***Salvage notice.*** The NOAARC will include the following notice as part of each project funded or carried out using this Opinion and, for actions completed by NOAARC, provide the notice in writing to the action supervisor:

> If a sick, injured or dead specimen of a threatened or endangered species is found, the finder must notify NMFS' Office of Law Enforcement at 503-231-6240 or 206-526-6133. The finder must take care in handling of sick or injured specimens to ensure effective treatment, and in handling dead specimens to preserve biological material in the best possible condition for later analysis of cause of death. The finder also has the responsibility to carry out instructions provided by the Office of Law Enforcement to ensure that evidence intrinsic to the specimen is not disturbed unnecessarily.

9. ***Annual program report.*** The NOAARC will provide an annual monitoring report to NMFS by February 15 each year that describes NOAARC's efforts to carry out this Opinion. The report will include the following information: (a) An assessment of overall program activity, (b) a map showing the location and type of each action funded and carried out under this Opinion, (c) a list of any actions which NOAARC funded or carried out using this Opinion and any actions for which NOAARC was designated as the lead agency for ESA purposes by the USFWS or other Federal agencies, and (d) any other data or analyses that NOAARC deems necessary or helpful to assess habitat trends as a result of actions funded or carried out under this Opinion. The NOAARC will use CIRS to submit this report when the online system becomes available. Until CIRS is available, NOAARC will submit reports to NMFS by email at this address: noaarc.biop.nwr@noaa.gov

10. ***Reinitiation.*** If NOAARC chooses to continue programmatic coverage under this Opinion beyond 5 years after the date of issuance, it will reinitiate consultation.

General Construction

11. ***Flagging sensitive areas.*** The action area will be flagged to identify sensitive resource areas, such as the extent of herbicide buffers, areas below ordinary high water, and wetlands.

12. ***Temporary erosion controls.*** Temporary erosion controls will be in place before any significant alteration of the action site.

13. ***Temporary access roads.*** Existing ways will be used whenever possible. Temporary access roads will not be built on slopes greater than 50%, where grade, soil, or other features suggest a likelihood of excessive erosion or failure. Soil disturbance and compaction will be minimized within 150 feet of a natural waterbody or wetland. All temporary access roads will be obliterated when the action is completed, the soil will be stabilized, and the site will be revegetated. Temporary roads in wet or flooded areas will be restored by the end of the applicable in-water work period.

14. Fish passage. Fish passage will be provided for any adult or juvenile fish likely to be present in the action area during construction, unless passage did not exist before construction or the stream is dry at the time of construction. After construction, adult and juvenile passage that meets NMFS' fish passage criteria (NMFS 2008, or most recent version) will be provided for the life of the action.

15. In-water work period. In Oregon, all work within the wetted channel, including any herbicide application, will be completed during periods of time listed in the Oregon Guidelines for Timing of In-water Work to Protect Fish and Wildlife Resources (ODFW 2008, or the most recent version), except that the winter work window is not approved for actions in the Willamette River below Willamette Falls. In-water work periods for actions in Washington state will be obtained from NMFS in Lacey, Washington, and for actions in Idaho state, the in-water work period will be obtained from NMFS in Boise, Idaho. Hydraulic and topographic measurements as part of a restoration action may be completed at any time, provided that the affected area is not occupied by adult fish congregating for spawning or an area where redds are occupied by eggs or pre-emergent alevins.

16. Work area isolation. Any work area within the wetted channel will be completely isolated from the active stream whenever ESA-listed fish are reasonably certain to be present, or if the work area is 300 feet or less upstream from spawning habitats, except for large wood restoration actions. When work area isolation is required, a work area isolation plan will be prepared and carried out, commensurate with the scope of the action, that includes the following information: (a) The name, phone number, an address of a fishery biologist that will be responsible for accomplishing each component of the plan, and who is experienced and competent with work area isolation, identification of spawning habitats, and methods necessary to ensure the safe handling of all fish and; (b) an estimate of stream flows likely to occur during isolation; (c) a plan view of all isolation elements and fish release areas; (d) a list of equipment and materials necessary to complete the plan, including a fish screen that meets NMFS fish screen criteria (NMFS 2008, or most recent version) for any pump used to dewater the isolation area; (e) and the sequence and schedule of dewatering and rewatering activities.

17. Capture and release. Any fish that may be trapped within the isolated work area will be captured and released using a trap, seine, electrofishing, or other methods as prudent to minimize the risk of injury, then released at a safe release site. Capture and release will be supervised by a fishery biologist experienced with work area isolation and competent to ensure the safe handling of all fish.

18. Electrofishing. If electrofishing will be used to capture fish for salvage NMFS' electrofishing guidelines will be followed (NMFS 2000). Those guidelines are available from the NMFS Northwest Region, Protected Resources Division, Portland, Oregon.

19. Construction water. Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate. Diversions will not exceed 10% of the available flow .

20. ***Fish screens.*** Fish screens for surface water that is diverted by gravity or by pumping at a rate that exceeds 3 cfs will be submitted to NMFS for review and approval. All other diversions will have a fish screen that meets the following specifications: (a) An automated cleaning device with a minimum effective surface area of 2.5 square feet per cfs, and a nominal maximum approach velocity of 0.4 feet per second (fps), or no automated cleaning device, a minimum effective surface area of 1 square foot per cfs, and a nominal maximum approach rate of 0.2 fps; and (b) a round or square screen mesh that is no larger than 2.38 mm (0.094") in the narrow dimension, or any other shape that is no larger than 1.75 mm (0.069") in the narrow dimension. Each fish screen will be installed, operated, and maintained according to NMFS' fish screen criteria (NMFS 2008, or most recent version).

21. ***Erosion and pollution control plan.*** A erosion and pollution control plan will be prepared and carried out, commensurate with the scope of the action, that includes the following information: (a) The name, phone number, an address of the person responsible for accomplishing the plan; (b) best management practices to confine vegetation and soil disturbance to the minimum area, and minimum length of time, as necessary to complete the action, and otherwise prevent or minimize erosion associated with the action, including ensuring that sediment will be removed from erosion controls once it has reached 1/3 of the exposed height of the control; (c) best management practices to confine, remove, and dispose of construction waste, including every type of debris, discharge water, concrete, cement, grout, washout facility, welding slag, petroleum product, or other hazardous materials generated, used, or stored on-site; (d) procedures to contain and control a spill of any hazardous material generated, used or stored on-site, including notification of proper authorities; and (e) steps to cease work under high flows, except for efforts to avoid or minimize resource damage.

22. ***Pollution and erosion control inspections.*** The applicant will complete and record the following water quality observations to ensure that the in-water work area is not contributing visible pollution to water: (a) Take a turbidity sample using an appropriately and regularly calibrated turbidimeter, or a visual turbidity observation, every four hours when work is being completed, or more often as necessary to ensure that the in-water work area is not contributing visible sediment to water, at a relatively undisturbed area approximately 100 feet upstream from the project area, or 300 feet from the project area if subject to tidal or coastal scour. Record the observation, location, and time before monitoring at the downstream point. (b) Take a second visual observation, immediately after each upstream observation, approximately 50 feet upstream from the project area in streams that are 30 feet wide or less, 100 feet from the project area for streams between 30 and 100 feet wide, 200 feet from the discharge point or nonpoint source for streams greater than 100 feet wide, and 300 feet from the discharge point or nonpoint source for areas subject to tidal or coastal scour. Record the downstream observation, location, and time. (c) Compare the upstream and downstream observations - if more turbidity or pollutants are visible downstream than upstream, the activity must be modified to reduce pollution and continue to monitor every four hours, or more often as necessary. (d) If the exceedance continues after the second monitoring interval, the activity must stop until the pollutant level returns to background. (e) If monitoring or inspections show that the pollution controls are ineffective, immediately mobilize work crews to repair, replace, or reinforce controls as necessary.

23. ***Choice of equipment.*** Heavy equipment will be selected and operated in a manner that minimizes adverse effects to the environment (e.g., minimally-sized, low pressure tires, minimal hard turn paths for tracked vehicles, temporary mats or plates within wet areas or sensitive soils).

24. ***Vehicle staging and use.*** All vehicles and other heavy equipment will (a) be stored, fueled, and maintained in a vehicle staging area placed 150 feet or more from any natural waterbody or wetland; (b) inspected daily for fluid leaks before leaving the vehicle staging area for operation within 50 feet of any natural waterbody or wetland; (c) steam cleaned before operation below ordinary high water, and as often as necessary during operation, to remain grease free.

25. ***Stationary power equipment.*** Generators, cranes, and any other stationary equipment operated within 150 feet of any natural or wetland will be maintained as necessary to prevent leaks and spills from entering the water.

26. ***Work from top of bank.*** To the extent feasible, heavy equipment will work from the top of the bank, unless work from another location would result in less habitat disturbance.

27. ***Site restoration.*** Any large wood, native vegetation, topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration. When construction is finished, all streambanks, soils, and vegetation will be cleaned up and restored as necessary to renew ecosystem processes that form and maintain productive fish habitats. Fencing will be installed as necessary to prevent access to revegetated sites by livestock or unauthorized persons.

Types of Actions

<u>Fish Passage Restoration</u>.

28. ***Boulder weir and fish ladder review and approval.*** The NOAARC will not fund a project to install, maintain, or improve a boulder weir or fish ladder until the action has been reviewed and approved by NMFS for consistency with NMFS' fish passage criteria (NMFS 2008, or most recent version). Fish passage actions that would not require prior approval will still complete an action completion report.

29. ***Culvert removal and replacement***. Culverts may be completely removed. All culvert replacement projects will be designed using approved stream simulation methods (NMFS 2008, or most recent version). Structure width will be 1.5 times the active channel width[7] or the entire flood prone area if the stream channel is incised or lacks a functional floodplain. Incised channels are defined as those with entrenchment ratios (flood prone width/bankfull channel width) of less than 1.4. Acceptable replacement structures include bridges, structural arches, bottomless culverts, and embedded pipes that allow for a full stream simulation design.

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[7] Active channel width means the stream width measured perpendicular to stream flow between the ordinary high water lines, or at the channel bankfull elevation if the ordinary high water lines are indeterminate. This width includes the cumulative active channel width of all individual side- and off-channel components of channels with braided and meandering forms, and measure outside the area influence of any existing stream crossing, e.g., five to seven channel widths upstream and downstream.

Hydraulic designs, culverts with external fishways, and baffled culverts are not proposed in this action.

Invasive and Non-native Plant Control.

30. ***Non-herbicide methods.*** The number of workers will be on-site will be minimized while treating areas within the riparian zone by manual and mechanical plant control (*e.g*., hand pulling, clipping, stabbing, digging, brush-cutting, mulching or heating with radiant heat, pressurized hot water, or heated foam).

31. ***Power equipment.*** Gas-powered equipment with tanks larger than 5 gallons will be refueled in a vehicle staging area placed 150 feet or more from any natural waterbody, or in an isolated hard zone such as a paved parking lot.

32. ***Maximum herbicide treatment area.*** The area treated with herbicides above bankfull elevation, within riparian areas, will not exceed 10-acres above bankfull elevation and 2 acres below bankfull elevation, per 1.6-mile reach of a stream, per year.

33. ***Herbicide applicator qualifications.*** Herbicides will be applied only by an appropriately licensed applicator using an herbicide specifically targeted for a particular plant species that will cause the least impact. The applicator will be responsible for preparing and carrying out and the herbicide transportation and safely plan, as follows.

34. ***Herbicide transportation and safety plan.*** The applicator will prepare and carry out an herbicide safety/spill response plan to reduce the likelihood of spills or misapplication, to take remedial actions in the event of spills, and to fully report the event. At a minimum, the plan will: (a) Address spill prevention and containment; (b) estimate and limit the daily quantity of herbicides to be transported to treatment sites; (c) require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling; (d) require a spill cleanup kit be readily available for herbicide transportation, storage and application; (e) outline reporting procedures, including reporting spills to the appropriate regulatory agency; (f) ensure applicators are trained in safe handling and transportation procedures and spill cleanup; (g) require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition; (h) address transportation routes so that hazardous conditions are avoided to the extent possible; (i) specify mixing and loading locations away from waterbodies so that accidental spills do not contaminate surface waters; (j) require that spray tanks be mixed or washed further than 150 feet of surface water; (k) ensure safe disposal of herbicide containers; (l) identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft.

35. ***Herbicides.*** The only herbicides proposed for use under this Opinion are (some common trade names are shown in parentheses):[8]

a. aquatic imazapyr (*e.g*., Habitat)

[8] The use of trade, firm, or corporation names in this Opinion is for the information and convenience of the action agency and applicants and does not constitute an official endorsement or approval by the U.S. Department of Commerce or NMFS of any product or service to the exclusion of others that may be suitable.

b. aquatic glyphosate (*e.g.*, AquaMaster, AquaPro)
c. aquatic triclopyr-TEA (*e.g.*, Renovate 3)
d. chlorsulfuron (*e.g.*, Telar, Glean, Corsair)
e. clopyralid (*e.g.*, Transline)
f. glyphosate (*e.g.*, Rodeo)
g. imazapic (*e.g.*, Plateau)
h. imazapyr (*e.g.*, Arsenal, Chopper)
i. metsulfuron-methyl (*e.g.*, Escort)
j. picloram (*e.g.*, Tordon)
k. sethoxydim (*e.g.*, Poast, Vantage)
l. sulfometuron-methyl (*e.g.*, Oust, Oust XP)
m. triclopyr (*e.g.*, Garlon 3A, Tahoe 3A)

36. Herbicide adjuvenants. The only adjuvenants proposed for use under this Opinion are as follows (Table 1). Polyethoxylated tallow amine (POEA) surfactant and herbicides that contain POEA (*e.g*., Roundup) will not be used.

Table 1. Herbicide adjuvenants, trade names, mixing rates, and application areas.

Adjuvant Type	Trade Name	Mixing Rate (per gallon)	Application Areas
Surfactants	Activator 90	0.16 - 0.64 fl oz	Upland
	Agri-Dee	0.16 - 0.48 fl oz	Riparian
	Hasten	0.16 - 0.48 fl oz	Riparian
	LI 700	0.16 - 0.48 fl oz	Riparian
	R 11	0.16 - 1.28 11 oz	Riparian
	Super Spread	0.16 - 0.32 fl oz	Riparian
	Syl-Tae	0.16 - 0.48 fl oz	Upland
Drift Retardants	41-A	0.03 - 0.06 fl oz	Riparian
	Vale	0.16 fl oz	Upland

37. Herbicide carriers. Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil.

38. Herbicide mixing. Herbicides will be mixed more than 150 feet from any natural waterbody to minimize the risk of an accidental discharge.

39. Herbicide application rates. Herbicides will be applied at the lowest effective label rates, including the typical and maximum rates given below (Table 2). For broadcast spraying, application of herbicide or surfactant will not exceed the typical label rates.

Table 2. Typical and maximum rates for herbicide applications.

Herbicide	Typical Rate (pounds of active ingredient per acre)	Maximum Rate (pounds of active ingredient per acre)
Imazapic	0.1	0.1875
Clopyralid	0.35	0.5
metsulfuron-methyl	0.03	0.15
Imazapyr	0.45	1.5
sulfometuron-methyl	0.045	0.38
chlorsulfuron	0.056	0.25
triclopyr	1.0	10.0
picloram	0.35	1.0
sethoxydim	0.3	0.45
glyphosate	2.0	8.0

40. ***Herbicide application methods.*** Liquid or granular forms of herbicides will be applied as follows: (a) Broadcast spraying – hand held nozzles attached to back pack tanks or vehicles, or by using vehicle mounted booms; (b) spot spraying – hand held nozzles attached to back pack tanks or vehicles, hand-pumped spray, or squirt bottles to spray herbicide directly onto small patches or individual plants using; (c) hand/selective – wicking and wiping, basal bark, fill ("hack and squirt"), stem injection, cut-stump; (d) triclopyr – will not be applied by broadcast spraying.

41. ***Minimization of herbicide drift and leaching.*** Herbicide drift and leaching will be minimized as follows: (a) Do not spray when wind speeds exceed 10 miles per hour, or are less than 2 miles per hour; (b) be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind; (c) keep boom or spray as low as possible to reduce wind effects; (d) increase spray droplet size whenever possible by decreasing spray pressure, using high flow rate nozzles, using water diluents instead of oil, and adding thickening agents; (e) do not apply herbicides during temperature inversions, or when ground temperatures exceed 80 degrees Fahrenheit; (f) do not spray when rain, fog, or other precipitation is falling or is imminent. Wind and other weather data will be monitored and reported for all broadcast applications.

42. ***Herbicide buffer distances.*** The following no-application buffers, which are measuredin feet and are based on herbicide formula, stream type, and application method, will be observed during herbicide applications (Table 3). Herbicide applications based on a combination of approved herbicides will use the most conservative buffer for any herbicide included. Buffer widths are in feet, measured as map distance perpendicular to the bankfull elevation for streams, the upland boundary for wetlands, or the upper bank for roadside ditches. Before herbicide application begins, the upland boundary of each applicable herbicide buffer will be flagged or marked to ensure that all buffers are in place and functional during treatment.

Table 3. No-application buffers for herbicides, by stream type and application method.

Herbicide	Perennial Streams and Wetlands, and Intermittent Streams and Roadside Ditches with flowing or standing water present			Dry Intermittent Streams, Dry Intermittent Wetlands, Dry Roadside Ditches		
	Broadcast Spraying	Spot Spraying	Hand Selective	Broadcast Spraying	Spot Spraying	Hand Selective
Labeled for Aquatic Use						
aquatic glyphosate	100	waterline	waterline	50	none	none
aquatic imazapyr	100	15	waterline	50	none	none
aquatic triclopyr-TEA	**Not Allowed**	15	waterline	**Not Allowed**	none	none
Low Risk to Aquatic Organisms						
Imazapic	100	15	bankfull elevation	50	None	none
Clopyralid	100	15	bankfull elevation	50	None	none
metsulfuron-methyl	100	15	bankfull elevation	50	None	none
Moderate Risk to Aquatic Organisms						
Imazapyr	100	50	bankfull elevation	50	15	bankfull elevation
sulfometuron-methyl	100	50	5	50	15	bankfull elevation
Chlorsulfuron	100	50	bankfull elevation	50	15	bankfull elevation
High Risk to Aquatic Organisms						
Triclopyr	**Not Allowed**	150	150	**Not Allowed**	150	150
Picloram	100	50	50	100	50	50
Sethoxydim	100	50	50	100	50	50
Glyphosate	100	50	50	100	50	50

Juniper Tree Removal.[9]

43. Juniper tree removal methods. Where NOAARC determines that western juniper trees are expanding into neighboring plant communities to the detriment of native riparian vegetation, soils, or streamflow, those trees may be thinned or completely removed by uprooting smaller trees, cutting larger trees with a chainsaw, or a combination of both techniques. More aggressive methods such as bulldozing, "chaining," and burning are not proposed.

44. Management of juniper slash. Chain sawed trees may be left in place, lower limbs may be cut and scattered, or all or part of the trees may be used for streambank or wetland restoration, e.g., manipulated as necessary to protect riparian or wetland shrubs from grazing by livestock or wildlife or otherwise restore ecological function in floodplain, riparian, or wetland habitats.

[9] For additional information on the biology, ecology and management of western juniper, see Azuma, Hisrote and Dunham (2005) and Miller *et al.* (2005).

Livestock Stream Crossings and Off-Channel Livestock Watering Facilities.

45. Livestock stream crossings. When a livestock crossing or ford is necessary: (a) The number of crossings will be minimized; (b) existing access roads or trails and stream crossings will be used whenever possible, unless new construction would result in less habitat disturbance and the old trail or crossing is retired; (c) access roads or trails will be provided with a vegetative buffer that is adequate to avoid or minimize runoff of sediment and other pollutants to surface waters, and otherwise minimize disruption or riparian vegetation; (d) crossings will not be placed in areas where ESA-listed species spawn or are suspected of spawning, or within 300-feet upstream of such areas; (e) essential crossings will be designed and constructed or improved to handle reasonably foreseeable flood risks, including associated bedload and debris, and to prevent the diversion of streamflow out of the channel and down the trail if the crossing fails; (f) bank cuts, if any, will be stabilized with vegetation and protect approaches and crossings with clean, appropriately sized rock when necessary to prevent erosion; (g) livestock crossings will not create barriers to the passage of adult and juvenile fish; (h) whenever a culvert or bridge, including bridges constructed from flatbed railroad cars, boxcars, or truck flatbeds, is used to create the crossing, the span will maintain a clear, unobstructed opening above the general scour elevation that is at least as wide as 1.5 times the active channel width;[10] (i) stream crossings and water gaps will be designed and constructed to a width of 15-feet or less to minimize the time livestock will spend in the crossing or riparian area.

46. Off-channel livestock watering facilities. When an off-channel watering facility is necessary, it will (a) avoid steep slopes; (b) ensure that each livestock water development has a float valve or similar device limiting use to demand, a return flow system, a fenced overflow area, or similar means to minimize water withdrawal and potential runoff and erosion.

Off- and Side-Channel Habitat Restoration.[11]

47. Off- and side-channel habitat restoration. Reconnection of historical off- and side-channels habitats that have been blocked includes the removal of plugs, which impede water movement through off- and side-channels. In addition, off- and side-channel improvements will include minor excavation within historical channels; the area of disturbance will be no greater than 10% of the total off- or side-channel volume. The purpose of the additional sediment removal is to provide unimpeded flow through the side-channel to minimize fish entrapment. Excavation depth will never exceed the maximum thalweg depth in the main channel. Excavated material removed from off- or side-channels shall be hauled to an upland site or spread across the adjacent floodplain in a manner that does not restrict floodplain capacity. Creation of new side-channels is not proposed. Data requirements and analysis for off- and side-channel habitat

[10] Active channel width means the stream width measured perpendicular to stream flow between the ordinary high water lines, or at the channel bankfull elevation if the ordinary high water lines are indeterminate. This width includes the cumulative active channel width of all individual side- and off-channel components of channels with braided and meandering forms, and measure outside the area influence of any existing stream crossing, *e.g.*, five to seven channel widths upstream and downstream.

[11] For additional information on methods and design considerations for off- and side-channel habitat restoration, see "side channel/off-channel habitat restoration" in WDFW *et al.* (2004).

restoration include evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, and remote sensing information.

Piling Removal.

48. Piling removal. The following steps will be used to minimize creosote release, sediment disturbance, and total suspended solids: (a) Installation of a floating surface boom to capture floating surface debris; (b) keeping all equipment (*e.g.*, bucket, steel cable, vibratory hammer) out of the water, grip piles above the waterline, and complete all work during low water and low current conditions; (c) dislodging the piling with a vibratory hammer, whenever feasible--never intentionally break a pile by twisting or bending; (d) slowly lifting the pile from the sediment and through the water column; (e) placing the pile in a containment basin on a barge deck, pier, or shoreline without attempting to clean or remove any adhering sediment (a containment basin for the removed piles and any adhering sediment may be constructed of durable plastic sheeting with sidewalls supported by hay bales or another support structure to contain all sediment, and return flow may be directed back to the waterway); (f) filling the holes left by each piling with clean, native sediments; (g) disposing of all removed piles, floating surface debris, any sediment spilled on work surfaces, and all containment supplies at a permitted upland disposal site.

49. Broken piles. (a) If a pile breaks above the surface of uncontaminated sediment, or less than 2 feet below the surface, every attempt short of excavation will be made to remove it entirely. If the pile cannot be removed without excavation, saw the stump off at least 3 feet below the surface of the sediment. (b) If a pile breaks above contaminated sediment, saw the stump off at the sediment line; if a pile breaks within contaminated sediment, make no further effort to remove it and cover the hole with a cap of clean substrate appropriate for the site. (c) If dredging is likely in the area of piling removal, use a global positioning device (GPS) to note the location of all broken piles for future use in site debris characterization.

Set-back or Removal of Existing Berm, Dike, and Levee.[12]

50. Set-back existing berm, dike, and levee approval. To the greatest degree possible, non-native fill material, originating from outside the floodplain of the action area will be removed from the floodplain to an upland site. Where it is not possible to remove or set-back all portions of dikes and berms, or in areas where existing berms, dikes, and levees support abundant riparian vegetation, openings will be created with breaches. Breaches shall be equal to or greater than the active channel width (as defined above) to reduce the potential for channel avulsion during flood events. In addition to other breaches, the berm, dike, or levee shall always be breached at the downstream end of the project and/or at the lowest elevation of the floodplain to ensure the flows will naturally recede back into the main channel thus minimizing fish entrapment. When necessary, loosen compacted soils once overburden material is removed. Overburden or fill comprised of native materials, which originated from the project area, may be used within the floodplain to create set-back dikes and fill anthropogenic holes provided that does not impede floodplain function.

[12] For additional information on methods and design considerations for levee removal and modification, see "levee removal and modification" in WDFW *et al.* (2004).

Shellfish Restoration.

51. ***Shell sources.*** Shell or other substance used for substrate enhancement will be procured from clean sources that do not deplete the existing supply of shell bottom. Shells will be steam cleaned, left on dry land for a minimum of one month, or both, before placement in the aquatic environment. Shells from the local area will be used whenever possible.

52. ***Substrate enhancement in submerged aquatic vegetation.*** When placing shell substrate, juveniles, adults, or spat-on-shell in areas occupied by submerged aquatic vegetation, there will be an implementation plan submitted, detailing existing condition, density, and spatial extent of eelgrass; and proposed planting density and anticipated effects to eelgrass density and long term viability. The implementation plan will provide reasonable assurances that submerged aquatic vegetation will not be significantly impacted, that there will be a net environmental benefit resulting from the action, or both.

53. ***Native species.*** Molluscan shellfish and any co-planted submerged aquatic vegetation used for restoration will be species native to the project area.

Streambank Restoration.[13]

54. ***Streambank shaping.*** Without changing the location of the bank toe, NOAARC will restore damaged streambanks to a natural slope, pattern, and profile suitable for establishment of permanent woody vegetation. This may include sloping of unconsolidated bank material to a stable angle of repose, or the use of benches in consolidated, cohesive soils. The purpose of bank shaping is to provide a more stable platform for the establishment of riparian vegetation, while also reducing the depth to the water table, thus promoting better plant survival.

55. ***Soil reinforcement.*** NOAARC will complete all soil reinforcement earthwork and excavation in the dry. Use soil layers or lifts that are strengthened with biodegradable fabrics and penetrable by plant roots.

56. ***Large Wood.*** NOAARC will include large wood in each streambank restoration action to the maximum extent feasible. Large wood must be intact, hard, and undecayed to partly decaying, and should have untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or fragmented wood found lying on the ground or partially sunken in the ground is not acceptable. Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.

57. ***Use of Rock in Streambank Restoration.*** Rock will not be used for streambank restoration, except as ballast to stabilize large wood.

[13] For additional information on methods and design for bank shaping; installation of coir logs and soil reinforcements; anchoring and placement of large wood; woody plantings; and herbaceous cover, see WDFW and Inter-Fluve (2006), and "riparian restoration and management" in WDFW *et al.* (2004).

58. ***Planting or installing vegetation.*** NOAARC will use a diverse assemblage of species native to the action area or region, including trees, shrubs, and herbaceous species. Do not use noxious or invasive species.

59. ***Fertilizer.*** NOAARC will not apply surface fertilizer within 50 feet of any stream channel.

60. ***Fencing.*** NOAARC will install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.

Water Control Structure Removal.

61. ***Water control structure removal.*** This action includes removal of water control structures, including small dams, channel-spanning weirs, subsurface drainage features, tide gates, or instream flow redirection structures. Any instream water control structure that is greater than 16.4 feet high, may impound contaminated sediment, acts as grade control and may initiate a head-cut upstream if removed are not proposed.

Data requirements and analysis for structure removal include: (a) A longitudinal profile of the stream channel thalweg for 20 channel widths upstream and downstream of the structure shall be used to determine the potential for channel degradation; (b) a minimum of three cross-sections – one downstream of the structure, one through the reservoir area upstream of the structure, and one upstream of the reservoir area outside of the influence of the structure) to characterize the channel morphology and quantify the stored sediment; (c) sediment characterization to determine the proportion of coarse sediment (>2mm) in the reservoir area; (d) a survey of any downstream spawning areas that may be affected by sediment released by removal of the water control structure. Reservoirs with a d35 greater than 2 mm (*i.e*., 65% of the sediment by weight exceeds 2 mm in diameter) may be removed without excavation of stored material, if the sediment contains no contaminants; reservoirs with a d35 less than 2 mm (*i.e*., 65% of the sediment by weight is less than 2 mm in diameter) will require partial removal of the fine sediment to create a pilot channel, in conjunction with stabilization of the newly exposed streambanks with native vegetation.

Wetland Restoration.[14]

62. ***Wetland restoration.*** The NOAARC will include each applicable design criterion for restoration construction and other specific types of actions as applicable (*e.g*., restoration construction; off-and side channel restoration; set-back of existing berms, dikes, and levees; and removal of water control structures) to ensure that all adverse effects to fish and their designated critical habitats are within the range of effects considered in this Opinion.

The NMFS relied on the foregoing description of the proposed action, including all PDCs, to complete this consultation. However, unforeseen occurrences or changed circumstances encountered while carrying out the proposed action may require a significant change in the

[14] For additional information on methods and design for wetland restoration, see NRC (2001).

proposed design, construction methods, or other on-the-ground practices. These changes may, in turn, result in effects of the action which exceed the amount or extent of taking specified in the incidental take statement or otherwise affect listed species or designated critical habitat in ways not previously considered. Therefore, the action agency or other cooperating party must keep NMFS informed of any such changes to ensure that conclusions drawn during consultation remain valid.

Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For this consultation, the action area includes all upland, riparian and aquatic areas that will be affected by the completion of the individual actions that are funded or carried out under this Opinion by NOAARC. This includes the upland, riparian and aquatic area extending no more than 150 feet upstream and 300 feet downstream from the action footprint, where aquatic habitat conditions will be temporarily degraded until site restoration is complete. This estimate is based on an analysis of typical turbidity flux downstream from a nonpoint discharge in a stream with a low flow channel that is greater than 200 feet, although the actual turbidity flux at each project site is likely to be proportionately smaller for streams with a smaller low flow channel width (Rosetta 2005), or may be somewhat greater for project areas that are subject to tidal or coastal scour.

The precise number of these actions that will occur each year is unknown, although between 2004 and 2008, the number ranged from as few as five or as many as 21 actions per year. Those actions were distributed among recovery domains as follows: Puget Sound 47%, Willamette/Lower Columbia 10%, Interior Columbia 18%, Oregon Coast 21%, and Southern Oregon/Northern California Coasts 4%. However, due to an increased emphasis on completion of recovery actions as various salmon and steelhead recovery planning products are becoming available, and to recent Congressional appropriations for habitat restoration and mitigation activities, NMFS assumes that the maximum number of actions funded or carried each year under the proposed action may increase by a factor of three, up to a total of 63 actions per year. All actions funded or carried out under this Opinion will occur within the states of Oregon, Washington, or Idaho.

The NOAARC concluded that the proposed action was "likely to adversely affect" 21 ESA-listed or proposed described in (Table 4). Similarly, NOAARC concluded that the proposed action was "likely to adversely affect" critical habitat designated or proposed for 18 species. Critical habitat has not been designated or proposed for LCR coho salmon, PS steelhead, or eulachon.

The overall action area is also designated as EFH for Pacific Coast groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Pacific Coast salmon (PFMC 1999), or is in an area where environmental effects of the proposed action may adversely affect designated EFH for those species.

Table 4. Federal Register notices for final rules that list threatened and endangered species, designate critical habitats, or apply protective regulations to listed species considered in this consultation. Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered; "P" means proposed for listing or designation.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (*Oncorhynchus tshawytscha*)			
Lower Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River spring-run	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River spring-run	E 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	ESA section 9 applies
Snake River spring/summer run	T 6/28/05; 70 FR 37160	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Snake River fall-run	T 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160
Puget Sound	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Chum salmon (*O. keta*)			
Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Hood Canal summer-run	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Coho salmon (*O. kisutch*)			
Lower Columbia River	T 6/28/05; 70 FR 37160	Not applicable	6/28/05; 70 FR 37160
Oregon Coast	T 2/11/08; 73 FR 7816	2/11/08; 73 FR 7816	2/11/08; 73 FR 7816
Southern Oregon/Northern California Coasts	T 6/28/05; 70 FR 37160	5/5/99; 64 FR 24049	6/28/05; 70 FR 37160
Sockeye salmon (*O. nerka*)			
Lake Ozette	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Snake River	E 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	ESA section 9 applies
Steelhead (*O. mykiss*)			
Lower Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Middle Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	ESA section 9 applies
Snake River Basin	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Puget Sound	T 5/11/07; 72FR26722	Not applicable	P 2/7/07; 72 FR 5648
Green sturgeon (*Acipenser medirostris*)			
Southern	T 4/07/06; 71 FR 17757	10/09/09; 74 FR 52300	P 5/21/09; 74 FR 23822
Eulachon (*Thaleichthys pacificus*)			
Eulachon	P 3/13/09; 74 FR 10857	Not applicable	Not applicable

ENDANGERED SPECIES ACT

Section 7(a) (2) of the ESA requires Federal agencies to consult with NMFS to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The Opinion that follows records the results of the interagency consultation for this proposed action. An incidental take statement is provided after the Opinion that specifies the impact of any taking of threatened or endangered species that will be incidental to the proposed action, reasonable and prudent measures that NMFS considers necessary and appropriate to minimize such impact, and nondiscretionary terms and conditions (including, but not limited to, reporting requirements) that must be complied with by the Federal agency and applicant (if any) to carry out the reasonable and prudent measures.

Biological Opinion

This Opinion presents NMFS' review of the status of each listed species[15] considered in this consultation, the condition of designated critical habitat, the environmental baseline for the action area, all the effects of the action as proposed, and cumulative effects (50 CFR 402.14(g)). For the jeopardy analysis, NMFS analyzes those combined factors to conclude whether the proposed action is likely to appreciably reduce the likelihood of both the survival and recovery of the affected listed species.

The regulatory definition of "destruction or adverse modification" at 50 CFR 402.02 was not used for the critical habitat analysis in this Opinion. Instead, NMFS relied on statutory provisions of the ESA, including those in section 3 that define "critical habitat" and "conservation," in section 4 that describe the designation process, and in section 7 that sets forth the substantive protections and procedural aspects of consultation, and on agency guidance for application of the destruction or adverse modification standard.[16] Following these guides, NMFS considered the status of the entire designated area of the critical habitat considered in this consultation, the environmental baseline in the action area, the likely effects of the action on the function and conservation role of the affected critical habitat, and cumulative effects. The NMFS used that assessment to determine whether, with implementation of the proposed action, critical habitat would remain functional, or retain its current ability for the primary constituent elements (PCEs) to become functionally established, to serve the intended conservation role for the species.[17]

Status of the Species and Critical Habitats

The summaries that follow describe the status of the 21 ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this Opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, can be found in the listing regulations and critical habitat designations published in the Federal Register (Table 4, above).

The status of species and critical habitat sections below are organized into five recovery domains (Table 5) to better integrate recovery planning information that NMFS is developing on the conservation status of the species and critical habitats considered in this consultation. Recovery domains are the geographically-based areas that NMFS is using to prepare multi-species recovery plans. Southern green sturgeon are under the jurisdiction of NMFS' Southwest Region,

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[15] An "evolutionarily significant unit" (ESU) of Pacific salmon (Waples 1991), a "distinct population segment" (DPS) of steelhead (71 FR 834; January 5, 2006), a DPS of southern green sturgeon (71 FR 1757; April 7, 2006), and a DPS of eulachon 74 FR 10857; March 13, 2009) are all "species" as defined in section 3 of the ESA.

[16] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (November 7, 2005) (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a) (2) of the Endangered Species Act).

[17] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (November 7, 2005) (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a) (2) of the Endangered Species Act).

which has not yet convened a recovery team for this species. Nor has a recovery team yet been convened for eulachon, a species under the jurisdiction of NMFS' Northwest Region.

Table 5. Recovery planning domains identified by NMFS and their ESA-listed salmon and steelhead species.

Recovery Domain	**Species**
Puget Sound	PS Chinook salmon HC summer-run chum LO sockeye salmon PS steelhead
Willamette-Lower Columbia	LCR Chinook salmon UWR Chinook salmon CR chum salmon LCR coho salmon LCR steelhead UWR steelhead
Interior Columbia	UCR spring-run Chinook salmon SR spring/summer Chinook salmon SR fall-run Chinook salmon LO sockeye salmon SR sockeye salmon UCR steelhead MCR steelhead SRB steelhead
Oregon Coast	OC coho salmon
Southern Oregon/Northern California Coasts	SONCC coho salmon

For each recovery domain, a technical review team (TRT) appointed by NMFS has developed, or is developing, criteria necessary to identify independent populations within each species, recommend viability criteria for that species, and analyze factors that limit species survival. The definition of a population used by each TRT to analyze salmon and steelhead is set forth in the "viable salmonid population" (VSP) document prepared by NMFS for use in conservation assessments of Pacific salmon and steelhead (McElhany *et al*. 2000). The boundaries of each population are defined using a combination of genetic information, geography, life-history traits, morphological traits, and population dynamics that indicate the extent of reproductive isolation among spawning groups. To-date, the TRT have divided the 19 species of salmon and steelhead considered in this Opinion into a total of 303 populations, although the population structure of PS steelhead has yet to be resolved. The overall viability of a species is a function of the VSP attributes of its constituent populations. Those attributes are abundance, population growth rate, population spatial structure, and diversity. Until a viability analysis of a species is completed, the VSP guidelines recommend that all populations should be managed to retain the potential to achieve viable status to ensure a rapid start along the road to recovery, and that no significant parts of the species are lost before the full recovery plan is implemented (McElhany *et al.* 2000).

The status of critical habitat was based primarily on a watershed-level analysis of conservation value that focused on the presence of listed ESA-listed species and physical features (*i.e.*, the PCEs) that are essential to their conservation. This analysis for the 2005 designations of salmon and steelhead species was completed by Critical Habitat Analytical Review Teams (CHARTs) that focused on large geographical areas corresponding approximately to recovery domains (NOAA Fisheries 2005). Each watershed was ranked using a conservation value attributed to the quantity of stream habitat with PCEs, the present condition of those PCEs, the likelihood of achieving PCE potential (either naturally or through active restoration), support for rare or important genetic or life history characteristics, support for abundant populations, and support for spawning and rearing populations. In some cases, our understanding of these interim conservation values has been further refined by the work of TRTs and other recovery planning efforts that have better explained the habitat attributes, ecological interactions, and population characteristics important to each species.

A similar team, referred to as a Critical Habitat Review Team (CHRT) was convened for southern green sturgeon, as reported in the proposed rule. That team identified and analyzed the conservation value of particular areas occupied by southern green sturgeon, and unoccupied areas they felt may be necessary to ensure the conservation of the species. The CHRT did not identify those particular areas using HUC nomenclature, but did provide geographic place names for those areas, including the names of freshwater rivers, the bypasses, the Sacramento-San Joaquin Delta, coastal bays and estuaries, and coastal marine areas (within 110 m depth) extending from the California/Mexico border north to Monterey Bay, California, and from the Alaska/Canada border northwest to the Bering Strait; and certain coastal bays and estuaries in California, Oregon, and Washington.

Status of the Species. Natural variations in freshwater and marine environments have substantial effects to the abundance of salmon, steelhead, and green sturgeon populations. Of the various natural phenomena that affect most populations of salmon and steelhead, changes in ocean productivity are generally considered the most important. Salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation probably contributes to significant natural mortality, although the levels of predation are largely unknown. In general, salmon and steelhead are eaten by pelagic fishes, birds, and marine mammals.

Over the past few decades, the sizes and distributions of the salmon and steelhead populations considered in this Opinion, like the other salmon and steelhead species that NMFS has listed, generally have declined because of natural phenomena and human activity, including the operation of hydropower systems, over-harvest, hatcheries, and habitat degradation. Enlarged populations of terns, seals, sea lions, and other aquatic predators in the Pacific Northwest have been identified as factors that may be limiting the productivity of some Pacific salmon and steelhead populations (Bottom *et al*. 2005, Fresh *et al*. 2005). It is also likely that climate change will play an increasingly important role in determining the abundance of salmon and steelhead by exacerbating long-term problems related to temperature, stream flow, habitat access, predation, and marine productivity (CIG 2004, Scheuerell and Williams 2005, Zabel *et al.* 2006, ISAB 2007).

Southern green sturgeon occur in all four coastal recovery domains, although they are only known to spawn in the Sacramento River system. Therefore, only subadults and adults may be present in recovery domains north of San Francisco Bay. Eulachon also occur in all coastal recovery domains. However, the status of these species will only be presented once, with information presented for the Puget Sound recovery domain. Each species consist of a single population.

Puget Sound (PS) Recovery Domain. Species in the PS recovery domain include PS Chinook salmon, HC summer-run Chinook salmon, LO sockeye salmon, PS steelhead, southern green sturgeon, and eulachon. Although the PS-TRT has not yet addressed southern green sturgeon or eulachon, it has identified 39 demographically independent populations of Pacific salmon and steelhead, plus number of PS steelhead populations that has yet to be determined (Table 6). These populations were further aggregated into strata, groupings above the population level that are connected by some degree of migration, based on ecological subregions.

Table 6. Demographically-independent populations of ESA-listed salmon and steelhead in the PS recovery domain.

Species	Populations	Combined Extinction Risk
PS Chinook salmon	22	Very High
HC summer—run chum salmon	16	Very High
LO sockeye salmon	1	Very High
PS steelhead	Not available	Very High

PS Chinook salmon. This species includes all naturally spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington, and progeny of 26 artificial propagation programs. The PS-TRT identified 22 historical populations, grouped into five major geographic regions, based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity (Table 7).

The major factors limiting recovery of PS Chinook salmon include degraded floodplains and in-river channel structure, riparian area degradation and loss of in-river large wood, degraded estuary conditions and loss of estuarine habitat, excessive sediment in spawning gravels, degraded water quality, and high water temperatures (NMFS 2006).

Table 7. PS Chinook salmon populations.

Geographic Region	Population (Watershed)
Strait of Georgia	North Fork Nooksack River
	South Fork Nooksack River
Strait of Juan de Fuca	Elwa River
	Dungeness River
Hood Canal	Skokomish River
	Mid Hood Canal River
Whidby Basin	Skykomish River
	Snoqualamie River
	North Fork Stilaguamish River
	South Fork Stilaguamish River
	Upper Skagit River
	Lower Skagit River
	Upper Sauk River
	Lower Sauk River
	Suiattle River
	Upper Cascade River
Central/South Basin	Cedar River
	North Lake Washington/Sammish River
	Green/Duwamish River
	Puyallup River
	White River
	Nisqually River

HC summer-run chum salmon. This species includes all naturally spawned populations of summer-run chum salmon in Hood Canal and its tributaries, populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington, and progeny of eight artificial propagation programs. The PS-TRT identified 16 historical populations, including seven that are extinct, based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity (Table 8).

The major factors limiting recovery of PS Chinook salmon include degraded floodplains and in-river channel structure, riparian area degradation and loss of in-river large wood, degraded estuary conditions and loss of estuarine habitat, excessive sediment in spawning gravels, degraded water quality, reduced streamflow in migration areas, and predation on adults by otters or seals (NMFS 2006).

Table 8. HR summer-run chum salmon populations.

Population (Watershed)	
Union River	Dungeness River
Lilliwaup Creek	Big Beef Creek – extinct
Hamma Hamma River	Anderson Creek – extinct
Duckabush River	Dewatto Creek – extinct
Dosewallips River	Tahuya River – extinct
Big/Little Quilcene River	Skokomish River – extinct
Snow/Salmon River	Finch Creek – extinct
Jimmycomelately Creek	Chimacum Creek – extinct

LO sockeye salmon. This species includes all naturally spawned populations of sockeye salmon in Ozette Lake and streams and tributaries flowing into Ozette Lake, Washington, and progeny of two artificial propagation programs. The Lake Ozette Technical Recovery Team concluded that extant spawning aggregations in Lake Ozette are different subpopulations within a single population (Currens *et al.* 2007, Haggerty *et al.* 2008b). LO sockeye are currently at high risk of extinction due to the current, limited distribution of Lake Ozette sockeye spawners (Haggerty *et al.* 2008a).

The major factors limiting recovery of PS Chinook salmon include riparian area degradation and loss of in-river large wood, degraded tributaries and river conditions, and predation on adults by otters or seals (NMFS 2006).

PS steelhead. This species includes all naturally spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations, in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive), and the Green River natural and Hamma Hamma winter-run steelhead hatchery stocks. The Puget Sound Steelhead TRT has not completed assessments of the population structure or viability of this species.

The most significant factors responsible for the decline of PS steelhead are past and present hatchery practices involving hatchery stocks that were either founded outside this species' range, or have undergone extensive hatchery domestication, thus leading to serious diversity and interbreeding effects (Berejikian *et al.* 2002). Other factors include diminishing abundance and productivity for most natural PS steelhead populations, including those in Skagit and Snohomish rivers, previously considered strongholds, the low abundance of several summer run populations, and sharply diminishing abundance of some steelhead populations, especially in south Puget Sound, Hood Canal, and the Strait of Juan de Fuca.

Southern green sturgeon**.** Southern green sturgeon includes all naturally-spawned populations of green sturgeon that occur south of the Eel River in Humboldt County, California. When not spawning, this anadromous species is broadly distributed in nearshore marine areas from Mexico to the Bering Sea. Although it is commonly observed in bays, estuaries, and sometimes the deep riverine mainstem in lower elevation reaches of non-natal rivers along the west coast of North America, the distribution and timing of estuarine use are poorly understood.

The principal factor for the decline of southern green sturgeon is the reduction of its spawning area to a single known population limited to a small portion of the Sacramento River. Other factors include degradation of freshwater and estuarine habitat quality, water diversions, and fishing. The viability of this species is still under assessment. Southern green sturgeon occur in three recovery domains: Puget Sound (although this area was excluded from proposed critical habitat), the Willamette and Lower Columbia, Oregon Coast, and Southern Oregon/Northern California Coasts.

Eulachon. Eulachon includes populations spawning in rivers south of the Nass River in British Columbia, Canada, to, and including, the Mad River in California. Eulachon leave saltwater to spawn in their natal streams late winter through early summer, and typically spawn at night in the lower reaches of larger rivers fed by snowmelt. After hatching, larvae are carried downstream and widely dispersed by estuarine and ocean currents. Eulachon movements in the ocean are poorly known although the amount of eulachon bycatch in the pink shrimp fishery seems to indicate that the distribution of these organisms overlap in the ocean.

The most significant factor responsible for the decline of eulachon is change in ocean conditions due to climate change (Gustafson *et al*. 2004). Other factors include many adverse effects related to dams and water diversions, artificial fish passage barriers, increased water temperatures, insufficient streamflow, altered sediment balances, water pollution, over-harvest, and predation. The viability of this species is under assessment although abrupt and continuing declines in abundance throughout its range and the added vulnerability that a small population size presents for this type of highly fecund, broadcast spawning species are of particular concern. Eulachon occur in four recovery domains: Puget Sound, the Willamette and Lower Columbia, Oregon Coast, and Southern Oregon/Northern California Coasts.

Willamette and Lower Columbia (WLC) Recovery Domain. Species in the WLC recovery domain include LCR Chinook, UWR Chinook, CR chum, LCR coho, LCR steelhead, and UWR steelhead, southern green sturgeon, and eulachon. Although the WLC-TRT has not yet addressed southern green sturgeon or eulachon, it has identified 107 demographically independent populations of Pacific salmon and steelhead (Table 9). These populations were further aggregated into strata, groupings above the population level that are connected by some degree of migration, based on ecological subregions. All 107 populations use parts of the mainstem of the Columbia River and the Columbia River estuary for migration, rearing, and smoltification.

McElhany *et al.* (2007) found that, for populations in Oregon, the combined extinction risk is very high for LCR Chinook, UWR Chinook salmon, CR chum salmon, LCR coho salmon, and moderate for LCR steelhead and UWR steelhead, although the status of those species with populations in Washington is still under assessment.

Table 9. Demographically-independent populations in the WLC recovery domain. Combined extinction risks for salmon and steelhead based on analysis of Oregon populations only.

Species	Populations	Combined Extinction Risk
LCR Chinook salmon	32	Very High
UWR Chinook salmon	7	Very High
CR chum salmon	17	Very High
LCR coho salmon	24	Very High
LCR steelhead	23	Moderate
UWR steelhead	4	Moderate

***LCR Chinook salmon*.** This species includes all naturally-spawned populations of Chinook salmon in the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River; the Willamette River to Willamette Falls, Oregon, exclusive of spring-run Chinook salmon in the Clackamas River; and progeny of seventeen artificial propagation programs. The WLC-TRT identified 22 historical populations of LCR Chinook salmon – seven in the coastal subregion, six in the Columbia Gorge, and nine in the western Cascades. Twelve of those populations occur within the action area (Table 10) and only Sandy River late fall Chinook is considered "viable" (McElhany *et al.* 2007).

The major factors limiting recovery of LCR Chinook salmon include altered channel morphology, loss of habitat diversity, excessive sediment, high water temperature, reduced access to spawning/rearing habitat, and harvest impacts (NMFS 2006).

Table 10. LCR Chinook salmon populations.

Stratum		Spawning Population (Watershed)
Ecological Subregion	Run Timing	
Coast Range	Fall	Young Bay
		Grays River
		Big Creek
		Elochman River
		Clatskanie River
		Mill Creek
		Scappoose River
Columbia Gorge	Spring	Upper Cowlitz River
		Cispus River
		Tilton River
		Big White Salmon River
		Hood River
	Early Fall ("tule")	Upper Gorge Tributaries
		Big White Salmon River
	Fall	Upper Cowlitz River
		Lower Cowlitz River
		Coweeman River
		Toutle River
		Lower Gorge Tributaries
		Hood River
Western Cascade Range	Spring	Toutle River
		Kalama River
		Lewis River
		Sandy River
	Early Fall ("tule")	Lewis River
		Salmon Creek
		Sandy River
	Fall	Kalama River
		Clackamas River
		Washougal River
	Late Fall ("bright")	Lewis River
		Sandy River

UWR Chinook salmon. The species includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River and in the Willamette River, and its tributaries, above Willamette Falls, Oregon, and progeny of seven artificial propagation programs. All seven historical populations of UWR Chinook salmon identified by the WLC-TRT occur within the action area and are contained within a single ecological subregion, the western Cascade Range (Table 11); only the Clackamas population is characterized as "viable" (McElhany *et al.* 2007).

The major factors limiting recovery of UWR Chinook salmon identified by NMFS include lost/degraded floodplain connectivity and lowland stream habitat, degraded water quality, high water temperature, reduced streamflow, and reduced access to spawning/rearing habitat (NMFS 2006).

Table 11. UWR Chinook salmon populations. Overall viability risk: "extinct or very high" means greater than 60% chance of extinction within 100 years; "relatively high" means 60 to 25% risk of extinction in 100 years; "moderate" means 25 to 5% risk of extinction in 100 years, "low or negligible" means 5 to 1% risk of extinction in 100 years; "very low" means less than 1% chance of extinction in 100 years, and NA means not available. A low or negligible risk of extinction is considered "viable."

Stratum		Spawning Population (Watershed)	Overall Viability Risk
Ecological Subregion	Run Timing		
Western Cascade Range	Spring	Clackamas	Low
		Mollala	Relatively High
		North Santiam	Very high
		South Santiam	Very high
		Calapooia	Very high
		McKenzie	Moderate
		Middle Fork Willamette	Very high

CR chum salmon. This species includes all naturally-spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon, and progeny of three artificial propagation programs. The WLC-TRT identified 17 historical populations of CR chum salmon and aggregated these into four strata (Myers *et al.* 2006). Unlike other species in the WLC recovery domain, CR chum salmon spawning aggregations were identified in the mainstem Columbia River. These aggregations generally were included in the population associated with the nearest river basin. Three strata and eight historical populations of CR chum salmon occur within the action area (Table 12); of these, none are "viable" (McElhany *et al.* 2007).

The major factors limiting recovery of CR chum salmon include altered channel morphology, loss of habitat diversity, excessive sediment, reduced streamflow, harassment of spawners, and harvest impacts (NMFS 2006).

Table 12. CR chum salmon populations.

Stratum		Spawning Population (Watershed)
Ecological Subregion	Run Timing	
Coast Range	Fall	Young's Bay
		Grays River
		Big Creek
		Elochman River
		Clatskanie River
		Mill Creek
		Scappoose Creek
Columbia Gorge	Summer	Cowlitz River
	Fall	Cowlitz River
		Lower Gorge Tributaries
		Upper Gorge Tributaries
Western Cascade Range	Fall	Kalama River
		Salmon Creek
		Lewis River
		Clackamas River
		Washougal River
		Sandy River

LCR coho salmon. This species includes all naturally-spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood rivers; in the Willamette River to Willamette Falls, Oregon; and progeny of 25 artificial propagation programs. The WLC-TRT identified 24 historical populations of LCR coho salmon and divided these into two strata based on major run timing: early and late (Myers *et al.* 2006). Three strata and nine historical populations of LCR coho salmon occur within the action area (Table 13). Of these nine populations, Clackamas River is the only population characterized as "viable" (McElhany *et al.* 2007).

In general, late coho salmon spawn in smaller rivers or the lower reaches of larger rivers from mid-November to January, coincident with the onset of rain-induced freshets in the fall or early winter. Spawning typically takes place within a few days to a few weeks of freshwater entry. Late-run fish also tend to undertake oceanic migrations to the north of the Columbia River, extending as far as northern British Columbia and southeast Alaska. As a result, late coho salmon are known as "Type N" coho. Alternatively, early coho salmon spawn in the upper reaches of larger rivers in the Lower Columbia River and in most rivers inland of the Cascade Crest. During their oceanic migration, early coho salmon tend to migrate to the south of the Columbia River and are known as "Type S" coho salmon. They may migrate as far south as the waters off northern California. While the ecological significance of run timing in coho salmon is fairly well understood, it is not clear how important ocean migratory pattern is to overall diversity and the relative historical abundance of Type N and Type S life histories largely is unknown.

The major factors limiting recovery of LCR coho salmon include degraded floodplain connectivity and channel structure and complexity, loss of riparian areas and large wood recruitment, degraded stream substrate, loss of stream flow, reduced water quality, and impaired passage (NMFS 2007).

Table 13. LCR coho salmon spawning populations.

Stratum		Spawning Population (Watershed)
Ecological Subregion	Run Type	
Coast Range	N	Young's Bay
		Grays River
		Big Creek
		Elochman Creek
		Clatskanie River
		Mill, Germany, Abernathy Creeks
		Scappoose River
Columbia Gorge	N	Lower Gorge Tributaries
	S	Upper Gorge Tributaries
		Big White Salmon River
		Hood River
Western Cascade Range	N	Lower Cowlitz River
		Coweeman River
		Salmon Creek
	N and S	Cispus River
		Upper Cowlitz River
		Tilton River
		North Fork Toutle River
		South Fork Toutle River
		Kalama River
		North Fork Lewis River
		East Fork Lewis River
		Clackamas River
		Washougal River
		Sandy River

LCR steelhead. The species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams and tributaries to the Columbia River between and including the Cowlitz and Wind rivers, Washington; in the Willamette and Hood rivers, Oregon; and progeny of ten artificial propagation programs; but excluding all steelhead from the upper Willamette River basin above Willamette Falls, Oregon, and from the Little and Big White Salmon rivers, Washington. The WLC-TRT identified 23 historical populations of LCR steelhead (Myers *et al.* 2006). Within these populations, the winter-run timing is more common in the west Cascade subregion, while farther east summer steelhead are found almost exclusively.

Summer steelhead return to freshwater long before spawning. Winter steelhead, in contrast, return from the ocean much closer to maturity and spawn within a few weeks. Summer steelhead spawning areas in the Lower Columbia River are found above waterfalls and other features that create seasonal barriers to migration. Where no temporal barriers exist, the winter-run life history dominates. Six strata and 23 historical populations of LCR steelhead occur within the action area (Table 14).

The major factors limiting recovery of LCR steelhead include altered channel morphology, lost/degraded floodplain connectivity and lowland stream habitat, excessive sediment, high water temperature, reduced streamflow, and reduced access to spawning/rearing habitat (NMFS 2006).

Table 14. LCR steelhead populations spawning.

Stratum		Population (Watershed)
Ecological Subregion	Run Timing	
Columbia Gorge	Summer	Wind River
		Hood River
	Winter	Lower Gorge Tributaries
		Upper Gorge Tributaries
		Hood River
West Cascade Range	Summer	Kalama River
		North Fork Lewis River
		East Fork Lewis River
		Washougal River
	Winter	Cispus River
		Tilton river
		Upper Cowlitz River
		Lower Cowlitz River
		North Fork Toutle River
		South Fork Toutle River
		Coweeman River
		Kalama River
		North Fork Lewis River
		East Fork Lewis River
		Clackamas River
		Salmon Creek
		Sandy River
		Washougal River

UWR steelhead. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in the Willamette River, Oregon, and its tributaries upstream from Willamette Falls to the Calapooia River. The WLC-TRT identified five historical populations of UWR steelhead, all with winter run timing (Myers *et al.* 2006). Only winter steelhead historically existed in this area because flow conditions over Willamette Falls allowed only late winter steelhead to ascend the falls, until a fish ladder was constructed in the early 1900s and summer steelhead were introduced. Summer steelhead have become established in the McKenzie River where historically no steelhead existed, although these fish were not considered in the identification of historical populations. UWR steelhead are currently found in many tributaries that drain the west side of the upper Willamette River basin. Analysis of historical observations, hatchery records, and genetic analysis strongly suggested that many of these spawning aggregations are the result of recent introductions and do not represent a historical population. Nevertheless, the WLC-TRT recognized that these tributaries may provide juvenile rearing habitat or may be temporarily (for one or more generations) colonized during periods of high abundance.

One stratum and five historical populations of UWR steelhead occur within the action area (Table 15), although the west-side tributaries population was included only because it is important to the species as a whole, and not because it is independent. Of these five populations, none are "viable" (McElhany *et al.* 2007).

The major factors limiting recovery of UWR steelhead include lost/degraded floodplain connectivity and lowland stream habitat, degraded water quality, high water temperature, reduced streamflow, and reduced access to spawning/rearing habitat (NMFS 2006).

Table 15. UWR steelhead populations. Overall viability risk: "extinct or very high" means greater than 60% chance of extinction within 100 years; "relatively high" means 60 to 25% risk of extinction in 100 years; "moderate" means 25 to 5% risk of extinction in 100 years, "low or negligible" means 5 to 1% risk of extinction in 100 years; "very low" means less than 1% chance of extinction in 100 years, and NA means not available. A low or negligible risk of extinction is considered "viable."

Stratum		Population Spawning (Watershed)	Overall Viability Risk
Ecological Subregion	Run Type		
West Cascade Range	Winter	Molalla	Moderate
		North Santiam	Moderate
		South Santiam	Moderate
		Calapooia	Moderate
		West-side Tributaries	Moderate

Interior Columbia (IC) Recovery Domain. Species in the IC recovery domain include UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, UCR steelhead, MCR steelhead, and SRB steelhead. The IC-TRT identified 82 demographically-independent populations of those species based on genetic, geographic (hydrographic), and habitat characteristics (Table 16). In some cases, the IC-TRT further aggregated populations into "major groupings" based on dispersal distance and rate, and drainage structure, primarily the location and distribution of large tributaries (IC-TRT 2003). All 82 populations identified use the lower mainstem of the Snake River, the mainstem of the Columbia River, and the Columbia River estuary, or part thereof, for migration, rearing, and smoltification.

Table 16. Demographically-independent populations of ESA-listed salmon and steelhead in the IC recovery domain.

Species	Populations
UCR spring-run Chinook salmon	3
SR spring/summer Chinook salmon	31
SR fall-run Chinook salmon	1
SR sockeye salmon	1
UCR steelhead	4
MCR steelhead	17
SRB steelhead	25

The IC-TRT also recommended viability criteria that follow the VSP framework (McElhany *et al.* 2006) and described biological or physical performance conditions that, when met, indicate a population or species has a 5% or less risk of extinction over a 100-year period (IC-TRT 2007, see also NRC 1995). As of this writing, the IC-TRT has applied the viability criteria to 68 populations, although it has only completed a draft assessment for 55 populations (IC-TRT 2006). Of those assessments, the only population that the TRT found to be viable was the North Fork John Day population of MCR steelhead. The strength of this population is due to a combination of high abundance and productivity, and good spatial structure and diversity, although the genetic effects of the large number of out-of-species strays and of natural spawners that are hatchery strays are still significant long-term concerns.

UCR spring-run Chinook salmon. This species includes all naturally-spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam in Washington (excluding the Okanogan River), the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to Chief Joseph Dam in Washington, and progeny of six artificial propagation programs. The IC-TRT identified four independent populations of UCR spring-run Chinook salmon in the upriver tributaries of Wenatchee, Entiat, Methow, and Okanogan (extirpated), but no major groups due to the relatively small geographic area affected (IC-TRT 2003, McLure *et al.* 2005). The IC-TRT considered that this species is at high risk of extinction because all extant populations are at high risk (IC-TRT 2006).

The major factors limiting recovery of UWR spring-run Chinook salmon include altered channel morphology and flood plain, riparian degradation and loss of in-river large wood, reduced streamflow, impaired passage, hydropower system mortality, and harvest impacts (NMFS 2006).

SR spring/summer run Chinook salmon. This species includes all naturally-spawned populations of spring/summer run Chinook salmon in the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins; and progeny of fifteen artificial propagation programs. The IC-TRT identified 31 historical populations of SR spring/summer run Chinook salmon, and aggregated these into major population groups (Table 17) (IC-TRT 2003, McLure *et al.* 2005). This species includes those fish that spawn in the Snake River drainage and its major tributaries, including the Grande Ronde

River and the Salmon River, and that complete their adult, upstream migration past Bonneville Dam between March and July. Each of these populations are part of the Grande Ronde and Imnaha River major group, and all face a high risk of extinction (IC-TRT 2006).

The major factors limiting recovery of SR spring/summer run Chinook salmon include altered channel morphology and flood plain, excessive sediment, degraded water quality, reduced streamflow, and hydropower system mortality (NMFS 2006).

Table 17. SR spring/summer run Chinook salmon populations.

Major Group	Spawning Populations (Watershed)	Major Group	Spawning Populations (Watershed)
Lower Snake River	Tucannon River	Middle Fork Salmon River (continued)	Camas Creek
	Asotin River		Loon Creek
Grande Ronde and Imnaha rivers	Wenaha River		Pistol Creek
	Wallowa-Lostine River		Sulphur Creek
	Minam River		Bear Valley Creek
	Catherine Creek		March Creek
	Upper Grande Ronde		U. Middle Fork main
	Imnaha River mainstem	Upper Mainstem Salmon	N. Fork Salmon River
	Big Sheep Creek		Lemhi River
Lookingglass Creek			Pahsimeroi River
Little Salmon	Little Salmon River		Upper Salmon l. main
South Fork Salmon River	South Fork Main Stem		East Fork Salmon River
	Secesh River		Yankee Fork
	East Fork South Fork		Valley Creek
Chamberlin Creek			Upper Salmon main
Middle Fork Salmon River	Big Creek	Panther Creek	
	L. Middle Fork main		

SR fall-run Chinook salmon. This species includes all naturally-spawned populations of fall-run Chinook salmon in the mainstem Snake River below Hells Canyon Dam, and in the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River, and progeny of four artificial propagation programs. The IC-TRT identified three populations of this species, although only the lower mainstem population exists at present, and it spawns in the lower main stem of the Clearwater, Imnaha, Grande Ronde, Salmon and Tucannon rivers (IC-TRT 2003, McLure *et al.* 2005). Unlike the other listed Chinook species in this recovery domain, most SR fall-run Chinook have a subyearling, ocean-type life history in which juveniles outmigrate the next summer, rather than rearing in freshwater for 13 to 14 months before outmigration. The IC-TRT has not completed a viability assessment of this species.

The major factors limiting recovery of SR fall-run Chinook salmon include reduced spawning/rearing habitat, degraded water quality, hydropower system mortality, and harvest impacts (NMFS 2006).

SR sockeye salmon. This species includes all anadromous and residual sockeye salmon from the Snake River basin, Idaho, and artificially-propagated sockeye salmon from the Redfish Lake captive propagation program. The IC-TRT identified historical sockeye production in at least five Stanley Basin lakes and in lake systems associated with Snake River tributaries currently cut off to anadromous access (*e.g.*, Wallowa and Payette Lakes), although current returns of SR sockeye are extremely low and limited to Redfish Lake (IC-TRT 2007).

The major factors limiting recovery of SR sockeye salmon include altered channel morphology and flood plain, reduced streamflow, impaired passage, and hydropower system mortality (NMFS 2006).

MCR steelhead. This species includes all naturally-spawned steelhead populations below natural and artificial impassable barriers in streams from above the Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington, excluding steelhead from the Snake River basin; and progeny of seven artificial propagation programs. The IC-TRT identified 20 historical populations of MCR steelhead in five major groups (Table 18) (IC-TRT 2003, Mc Lure *et al.* 2005).

The major factors limiting recovery of MCR steelhead include altered channel morphology and flood plain, excessive sediment, degraded water quality, reduced streamflow, impaired passage, and hydropower system mortality (NMFS 2006).

Table 18. MCR steelhead populations.

Major Group	Population (Watershed)
Cascade Eastern Slope Tributaries	Klickitat River
	Fifteenmile Creek
	Deschutes River Eastside Tributaries
	Deschutes River Westside Tributaries
	White Salmon– access blocked above Condit Dam
	Deschutes – extirpated above Pelton Dam
	Crooked River - extirpated
John Day River	Lower Mainstem John Day River
	North Fork John Day River
	Middle Fork John Day River
	South Fork John Day River
	Upper Mainstem John Day River
	Willow Creek – extirpated
Rock Creek	Rock Creek
Walla Walla and Umatilla rivers	Umatilla River
	Walla Walla River
	Touchet River
Yakima River	Satus Creek
	Toppenish Creek
	Naches River
	Upper Yakima

UCB steelhead. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S.-Canada border, and progeny of six artificial propagation programs. Four independent populations of UCR steelhead were identified by the IC-TRT in the same upriver tributaries as for the previous species (*i.e.*, Wenatchee, Entiat, Methow, and Okanogan) and, similarly, no major population groupings were identified due to the relatively small geographic area involved (IC-TRT 2003, McLure *et al.* 2005). The IC-TRT has not completed a viability assessment of this species, although all extant populations are considered to be at high risk of extinction (IC-TRT 2006).

The major factors limiting recovery of UCR steelhead include altered channel morphology and flood plain, riparian degradation and loss of in-river large wood, excessive sediment, degraded water quality, reduced streamflow, hydropower system mortality, harvest impacts, and hatchery impacts (NMFS 2006).

SRB steelhead. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho, and progeny of six artificial propagation programs. These fish are genetically differentiated from other interior Columbia steelhead populations and spawn at higher altitudes (up to 6,500 feet) after longer migrations (more than 900 miles). The IC-TRT identified 25 historical populations in five major groups (Table 19) (IC-TRT 2003, McLure *et al.* 2005). The IC-TRT has not completed a viability assessment of this species.

The major factors limiting recovery of SRB steelhead include altered channel morphology and flood plain, excessive sediment, degraded water quality, reduced streamflow, hydropower system mortality, harvest impacts, and hatchery impacts (NMFS 2006).

Table 19. SRB steelhead populations.

Major Group	Spawning Populations (Watershed)
Lower Snake River	Tucannon River
	Asotin River
Clearwater River	Lower Clearwater River
	S. Fork Clearwater
	Lolo Creek
	Selway Creek
	Lochsa River
	N. Fork Clearwater - extirpated
Grande Ronde River	Lower Grande Ronde
	Joseph Creek
	Wallowa River
	Upper Grande Ronde
Salmon River	Little/Lower Salmon
	South Fork Salmon
	Secesh River
	Chamberlain Creek
	L. Middle Fork Salmon
	U. Middle Fork Salmon
	Panther Creek
	North Fork Salmon
	Lemhi River
	Pahsimeroi River
	East Fork Salmon
	Upper Main Salmon
Imnaha	Imnaha River
Hells Canyon	Hells Canyon Tributaries

Oregon Coast (OC) Salmon Recovery Domain. The OC recovery domain includes one species, the OC coho salmon, and covers Oregon coastal streams south of the Columbia River and north of Cape Blanco. Streams and rivers in this area drain west into the Pacific Ocean, and vary in length from less than a mile to more than 210 miles in length. All, with the exception of the largest, the Umpqua River, drain from the crest of the Coast Range. The Umpqua transects the Coast Range and drains from the Cascade Mountains. The OC recovery domain covers cities along the coast and inland, including Tillamook, Lincoln City, Newport, Florence, Coos Bay and Roseburg, and has substantial amounts of private forest and agricultural lands. It also includes portions of the Siuslaw and Umpqua National Forests, lands managed by the U.S. Bureau of Land Management, and the Tillamook and Elliott State Forests.

OC coho salmon. This species includes all naturally-spawned populations of coho salmon in Oregon coastal streams south of the Columbia River and north of Cape Blanco, and progeny of five artificial propagation programs. The OC-TRT identified 56 historical populations, grouped into five major "biogeographic strata," based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity (Table 20) (Lawson *et al.* 2007). The OC-TRT concluded that, if recent past conditions continue into the future, OC coho salmon are moderately likely to persist over a 100-year period without artificial support, and have a low to moderate likelihood of being able to sustain their genetic legacy and long-term adaptive potential for the foreseeable future (Wainwright *et al.* 2007).

The major factors limiting recovery of OC coho salmon include altered stream morphology, reduced habitat complexity, loss of overwintering habitat, excessive sediment, high water temperature, and variation in ocean conditions (NMFS 2006).

Table 20. OC coho salmon populations. Population type "D" means dependent; "FI" means functionally independent; and "PI" means potentially independent.

Stratum	Population	Type	Stratum	Population	Type
North Coast	Necanicum	PI	Mid-Coast (cont.)	Alsea	FI
	Ecola	D		Big (Alsea)	D
	Arch Cape	D		Vingie	D
	Short Sands	D		Yachats	D
	Nehalem	FI		Cummins	D
	Spring	D		Bob	D
	Watseco	D		Tenmile	D
	Tillamook	FI		Rock	D
	Netarts	D		Big (Siuslaw)	D
	Rover	D		China	D
	Sand	D		Cape	D
	Nestucca	FI		Berry	D
	Neskowin	D		Sutton	D
Mid-Coast	Salmon	PI	Lakes	Siuslaw	FI
	Devils	D		Siltcoos	PI
	Siletz	FI		Tahkenitch	PI
	Schoolhouse	D		Tenmile	PI
	Fogarty	D	Umpqua	Lower Umpqua	FI
	Depoe	D		Middle Umpqua	FI
	Rocky	D		North Umpqua	FI
	Spencer	D		South Umpqua	FI
	Wade	D	Mid-South Coast	Threemile	D
	Coal	D		Coos	FI
	Moolack	D		Coquille	FI
	Big (Yaquina)	D		Johnson	D
	Yaquina	FI		Twomile	D
	Theil	D		Floras	PI
	Beaver	PI		Sixes	PI

Southern Oregon and Northern California Coasts (SONCC) Recovery Domain. The SONCC recovery domain includes one ESA-listed species: the SONCC coho salmon. The SONCC recovery domain extends from Cape Blanco, Oregon, to Punta Gorda, California. This area includes many small-to-moderate-sized coastal basins, where high quality habitat occurs in the lower reaches of each basin, and three large basins (Rogue, Klamath and Eel) where high quality habitat is in the lower reaches, little habitat is provided by the middle reaches, and the largest amount of habitat is in the upper reaches of the subbasins.

SONCC coho salmon. This species includes all naturally-spawned populations of coho salmon in coastal streams between Cape Blanco, Oregon, and Punta Gorda, California, and progeny of three artificial propagation programs. The SONCC-TRT identified 50 populations that were historically present based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity (Williams *et al.* 2006). In some cases, the SONCC-TRT also identified groups of populations referred to as "diversity strata" largely based on the geographical arrangement of the populations and basin-scale environmental and ecological characteristics. Of those populations, 13 strata and 17 populations occur within the action area (Table 21).

The SONCC-TRT developed a framework to assess the viability of this species (Williams *et al*. 2008). Although quantitative data do not yet exist to complete a viability assessment, the SONCCTRT recommended the following specific actions: (1) Secure all extant populations, (2) begin collecting distribution and abundance data, (3) minimize straying from hatcheries to natural spawning areas, and (4) begin critical research on climate change and its potential impact.

The major factors limiting recovery of SONCC coho salmon include loss of channel complexity, loss of estuarine and floodplain habitat, loss of riparian habitat, loss of in-river wood, excessive sediment, degraded water quality, high water temperature, reduced streamflow, unscreened water diversions, and structures blocking fish passage (NMFS 2006).

Table 21. SONCC coho salmon populations in Oregon. Populations that also occur partly in California are marked with an asterisk. Population type "D" means dependent; "E" means ephemeral; "FI" means functionally independent; and "PI" means potentially independent.

Population		Population Type
River Basin	Subbasin	
Elk River		FI
Mill Creek		D
Hubbard Creek		E
Brush Creek		D
Mussel Creek		D
Euchre Creek		E
Rogue River *	Lower Rogue River	PI
	Illinois River*	FI
	Mid Rogue/Applegate*	FI
	Upper Rogue River	FI
Hunter Creek		D
Pistol River		D
Chetco River		FI
Winchuck River		PI
Smith River *		FI
Klamath River *	Middle Klamath River	PI
	Upper Klamath River	FI

Status of the Critical Habitats. NMFS designated critical habitat for all species considered in this Opinion, except LCR coho salmon, for which critical habitat has not been proposed or designated (Table 4). To assist in the designation of critical habitat for ESA-listed species of salmon and steelhead in 2005, NMFS convened Critical Habitat Analytical Review Teams, or "CHARTs," organized by major geographic areas that roughly correspond to salmon recovery planning domain (NOAA Fisheries 2005). Each CHART consisted of Federal biologists and habitat specialists from NMFS, the Fish and Wildlife Service, the Forest Service, and the Bureau of Land Management, with demonstrated expertise regarding salmon and steelhead habitat and related protective efforts within that domain.

Each CHART assessed biological information pertaining to areas under consideration for designation as critical habitat to identify the areas occupied by listed salmon and steelhead, determine whether those areas contained PCEs essential for the conservation of those species, and whether unoccupied areas existed within the historical range of the listed salmon and steelhead that may also be essential for conservation. The CHART then scored each habitat area based on the quantity and quality of the physical and biological features; rated each habitat area as having a ''high,'' ''medium,'' or ''low'' conservation value; and identified management actions that could affect habitat for salmon and steelhead.

The ESA gives the Secretary of Commerce discretion to exclude areas from designation if he determines that the benefits of exclusion outweigh the benefits of designation. Considering economic factors and information from CHARTs, NMFS partially or completely excluded the following types of areas from the 2005 critical habitat designations:

1. Military areas. All military areas were excluded because of the current national priority on military readiness, and in recognition of conservation activities covered by military integrated natural resource management plans.

2. Tribal lands. Native American lands were excluded because of the unique trust relationship between tribes and the federal government, the federal emphasis on respect for tribal sovereignty and self governance, and the importance of tribal participation in numerous activities aimed at conserving salmon.

3. Areas With Habitat Conservation Plans. Some lands covered by habitat conservation plans were excluded because NMFS had evidence that exclusion would benefit our relationship with the landowner, the protections secured through these plans outweigh the protections that are likely through critical habitat designation, and exclusion of these lands may provide an incentive for other landowners to seek similar voluntary conservation plans.

4. Areas With Economic Impacts. Areas where the conservation benefit to the species would be relatively low compared to the economic impacts.

In designating these critical habitats, NMFS organized information at scale of the watershed or 5th field HUC because it corresponds to the spatial distribution and site fidelity scales of salmon and steelhead populations (WDF *et al.* 1992, McElhany *et al.* 2000). For earlier critical habitat designations for Snake River salmon and SONCC coho salmon, similar information was not available at the watershed scale, so NMFS used the scale of the subbasin or 4th field HUC to organize critical habitat information. For southern green sturgeon, the CHRT identified and designated critical habitat as "specific areas" within freshwater rivers, the bypasses, the Sacramento-San Joaquin Delta, coastal bays and estuaries, and coastal marine areas (within 110 m depth).

NMFS reviews the status of designated critical habitat affected by the proposed action by examining the condition and trends of PCEs throughout the designated area. These PCEs vary slightly for some species, due to biological and administrative reasons, but all consist of site types and site attributes associated with life history events (Tables 22 – 24).

Table 22. PCEs of critical habitats designated for ESA-listed salmon and steelhead species considered in the Opinion (except SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, and SONCC coho salmon), and corresponding species life history events.

Primary Constituent Elements		**Species Life History Event**
Site Type	**Site Attribute**	
Freshwater spawning	Substrate Water quality Water quantity	Adult spawning Embryo incubation Alevin growth and development
Freshwater rearing	Floodplain connectivity Forage Natural cover Water quality Water quantity	Fry emergence from gravel Fry/paar/smolt growth and development
Freshwater migration	Free of artificial obstruction Natural cover Water quality Water quantity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Estuarine areas	Forage Free of artificial obstruction Natural cover Salinity Water quality Water quantity	Adult sexual maturation and "reverse smoltification" Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Nearshore marine areas	Forage Free of artificial obstruction Natural cover Water quantity Water quality	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing
Offshore marine areas	Forage Water quality	Adult growth and sexual maturation Adult spawning migration Subadult rearing

Table 23. PCEs of critical habitats designated for SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, SONCC coho salmon, and corresponding species life history events.

Primary Constituent Elements		Species Life History Event
Site	**Site Attribute**	
Spawning and juvenile rearing areas	Access (sockeye) Cover/shelter Food (juvenile rearing) Riparian vegetation Space (Chinook, coho) Spawning gravel Water quality Water temp (sockeye) Water quantity	Adult spawning Embryo incubation Alevin growth and development Fry emergence from gravel Fry/paar/smolt growth and development
Adult and juvenile migration corridors	Cover/shelter Food (juvenile) Riparian vegetation Safe passage Space Substrate Water quality Water quantity Water temperature Water velocity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Areas for growth and development to adulthood	Ocean areas – not identified	Nearshore juvenile rearing Subadult rearing Adult growth and sexual maturation Adult spawning migration

Table 24. PCEs of critical habitat proposed for southern green sturgeon and corresponding species life history events.

Primary Constituent Elements		Life History Event
Site Type	**Site Attribute**	
Freshwater riverine system	Food resources Migratory corridor Sediment quality Substrate type or size Water Depth Water flow Water quality	Adult spawning Embryo incubation, growth and development Larval emergence, growth and development Juvenile metamorphosis, growth and development
Estuarine areas	Food resources Migratory corridor Sediment quality Water flow Water depth Water quality	Juvenile growth, development, seaward migration Subadult growth, development, seasonal holding, and movement between estuarine and marine areas Adult growth, development, seasonal holding, movements between estuarine and marine areas, upstream spawning movement, and seaward post-spawning movement
Coastal marine areas	Food resources Migratory corridor Water quality	Subadult growth and development, movement between estuarine and marine areas, and migration between marine areas Adult sexual maturation, growth and development, movements between estuarine and marine areas, migration between marine areas, and spawning migration

Climate change is likely to have negative implications for the conservation value of designated critical habitats in the Pacific Northwest (CIG 2004, Scheuerell and Williams 2005, Zabel *et al.* 2006, ISAB 2007). Average annual Northwest air temperatures have increased by approximately 1^{o}C since 1900, or about 50% more than the global average warming over the same period (ISAB 2007). The latest climate models project a warming of 0.1 to 0.6^{o}C per decade over the next century. According to the ISAB, these effects may have the following physical impacts within the next 40 or so years:

- Warmer air temperatures will result in a shift to more winter/spring rain and runoff, rather than snow that is stored until the spring/summer melt season.
- With a shift to more rain and less snow, the snowpack will diminish in those areas that typically accumulate and store water until the spring freshet.
- With a smaller snowpack, these watersheds will see their runoff diminished and exhausted earlier in the season, resulting in lower stream flows in the June through September period.
- River flows in general and peak river flows are likely to increase during the winter due to more precipitation falling as rain rather than snow.
- Water temperatures will continue to rise, especially during the summer months when lower stream flows and warmer air temperatures will contribute to the warming regional waters.

These changes will not be spatially homogeneous across the entire Pacific Northwest. Sites with elevations high enough to maintain temperatures well below freezing for most of the winter and early spring would be less affected. Low-lying areas that historically have received scant precipitation are likely to be more affected. The ISAB (2007) also identified the likely effects of projected climate changes on Columbia River salmon and their habitat. These effects may include, but are not limited to, depletion of cold water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration patterns, accelerated embryo development, premature emergence of fry, and increased competition among species. Similar effects are likely to occur to some extent throughout the Pacific Northwest.

PS Recovery Domain. Critical habitat has been designated in Puget Sound for PS Chinook salmon, HC summer-run chum salmon, and LO sockeye salmon. Major tributary river basins in the Puget Sound basin include the Nooksack, Samish, Skagit, Sauk, Stillaguamish, Snohomish, Lake Washington, Cedar, Sammamish, Green, Duwamish, Puyallup, White, Carbon, Nisqually, Deschutes, Skokomish, Duckabush, Dosewalips, Big Quilcene, Elwha, and Dungeness rivers and Soos Creek.

Salmon life history stages that require properly functioning freshwater habitat components have been affected by natural and man-made influences. In the steep mountainous and foothill areas of the Puget Sound basin, relatively unconsolidated glacial deposits and heavy rainfall make this region vulnerable to landslides (WDNR 1993, WDNR 1997a, WDNR 1997b). Lands prone to shallow rapid landslides are often managed for timber, because they are unsuited to most other uses. Landslides can occur naturally, but inappropriate land use practices greatly accelerate their frequency. Fine sediment enters the channel from unpaved roads. Unpaved roads are widespread on forestlands, and to a lesser extent, in rural residential areas and recreational forestlands. Forestlands throughout the Puget Sound basin have extensive networks of unpaved roads. Historical logging removed most of the riparian trees from the stream channels. Subsequent agricultural and urban conversion permanently altered riparian vegetation in the river valleys, leaving either no trees, or a thin band of trees. The riparian zones along many agricultural areas are now dominated by alder, invasive canary grass and blackberries, and provide substantially reduced shade and large wood recruitment.

Diking, agriculture, revetments, railroads and roads in lower stream reaches have caused significant loss of secondary channels in major valley floodplains in this region. Confined main channels create high-energy peak flow events that remove smaller substrates and large wood. The loss of side-channels, oxbow lakes, and backwater habitats results in a significant loss of juvenile salmonid rearing and refuge habitat. When the water level of Lake Washington was dropped nine feet in the 1910s, thousands of acres of wetlands along the shoreline of Lake Washington, Lake Sammamish and the Sammamish River corridor were drained and converted to agricultural and urban uses.

Loss of riparian habitat, elevated water temperatures, elevated levels of nutrients, increased nitrogen and phosphorus, and higher levels of turbidity, presumably from urban and highway runoff, wastewater treatment, failing septic systems, and agriculture or livestock impacts, have been documented in many Puget Sound tributaries.

Peak stream flows have increased over time due to paving (roads and parking areas), reduced percolation through surface soils on residential and agricultural lands, simplified and extended drainage networks, loss of wetlands, and rain-on-snow events in higher elevation clear cuts.

Dams constructed for hydropower generation, irrigation, or flood control have substantially affected Puget Sound Chinook salmon populations in a number of river systems. The construction and operation of dams have blocked access to spawning and rearing habitat (*e.g*., Elwha River dams block anadromous fish access to 70 miles of potential habitat) changed flow patterns, resulted in elevated temperatures and stranding of juvenile migrants, and degraded downstream spawning and rearing habitat by reducing recruitment of spawning gravel and large wood to downstream areas. These actions tend to promote downstream channel incision and simplification, limiting fish habitat. Water withdrawals reduce available fish habitat and alter sediment transport. Hydropower projects often change flow rates, stranding and killing fish, and reducing aquatic invertebrate (food source) productivity (Hunter 1992).

If migrating fish are diverted into unscreened or inadequately screened water conveyances or turbines, unnecessary mortality results. Blockages by dams, water diversions, and shifts in flow regime due to hydroelectric development and flood control projects are major habitat problems in many Puget Sound tributary basins.

The nearshore marine habitat has been extensively altered and armored by industry activities and intensive residential development near the mouths of many of Puget Sound's tributaries. A railroad runs along large portions of the eastern shoreline of Puget Sound, eliminating natural cover along the shore and natural recruitment of beach sand.

Degradation of the near-shore environment has occurred in the southeastern areas of Hood Canal in recent years, resulting in late summer marine oxygen depletion and significant fish kills. Circulation of marine waters is naturally limited, and partially driven by freshwater runoff, which is often low in the late summer. However, human development has increased nutrient loads from failing septic systems along the shoreline, and from use of nitrate and phosphate fertilizers on lawns and farms. Shoreline residential development is widespread and dense in many places. The combination of highways and dense residential development has impacted both physical and chemical characteristics of the near-shore environment.

The Ozette Lake tributary basin is 77 mi^2 and drained by several large tributaries and numerous smaller tributaries. Land use in the Lake Ozette watershed has ranged from traditional Native American management of old-growth forest, to European settler homesteading along the lake and stream valleys, to commercial timber production and National Park management. Currently, land ownership in the watershed is 73% private land, 15% Olympic National Park, 11% Washington State, and 1% Tribal. Private timber companies own approximately 93% of the four largest tributaries to Lake Ozette. Logging accelerated over the period of record, with 8.7% of the watershed area clear-cut by 1953, increasing to 83.6% of the watershed area clear-cut by 2003. Natural disturbance in the watershed was dominated by wind and hydrogeomorphic events, while contemporary disturbance additionally includes logging, road construction and maintenance, residential and agricultural development, channelization and direct and indirect stream wood clearance.

In summary, critical habitat throughout the Puget Sound basin has been degraded by numerous management activities, including hydropower development, loss of mature riparian forests, increased sediment inputs, removal of large wood, intense urbanization, agriculture, alteration of floodplain and stream morphology (*i.e*., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, dredging, armoring of shorelines, marina and port development, road and railroad construction and maintenance, logging, and mining. Changes in habitat quantity, availability, and diversity, and flow, temperature, sediment load and channel instability are common limiting factors in areas of critical habitat.

W LC Recovery Domain. Critical habitat was designated in the WLC recovery domain for UWR spring-run Chinook salmon, LCR Chinook salmon, LCR steelhead, UWR steelhead, and CR chum salmon. In addition to the Willamette and Columbia River mainstems, important tributaries on the Oregon side of the WLC include Youngs Bay, Big Creek, Clatskanie River, and Scappose River in the Oregon Coast subbasin; Hood River in the Gorge; and the Sandy, Clackamas, Mollala, North and South Santiam, Calapooia, McKenzie, and Middle Fork Willamette rivers in the West Cascades subbasin.

The Willamette River, once a highly braided river system, has been dramatically simplified through channelization, dredging, and other activities that have reduced rearing habitat by as much as 75%. In addition, the construction of 37 dams in the basin blocked access to more than 435 miles of stream and river spawning habitat. The dams alter the temperature regime of the Willamette River and its tributaries, affecting the timing and development of naturally-spawned eggs and fry. Agriculture, urbanization, and gravel mining on the valley floor logging in the Cascade and Coast Ranges contribute to increased erosion and sediment loads throughout the basin.

The mainstem Willamette River has been channelized and stripped of large wood. Development began to encroach on the riparian forest beginning in the 1870s (Sedell and Froggatt 1984). Gregory *et al.* (2002a) calculated that the total mainstem Willamette River channel area decreased from 41,000 to 23,000 acres between 1895 and 1995. They noted that the lower reach, from the mouth of the river to Newberg (RM 50), is confined within a basaltic trench, and that due to this geomorphic constraint, less channel area has been lost than in upstream areas. The middle reach from Newberg to Albany (RM 50 to 120) incurred losses of 12% primary channel area, 16% side channels, 33% alcoves, and 9% islands. Even greater changes occurred in the upper reach, from Albany to Eugene (RM 187). There, approximately 40% of both channel length and channel area were lost, along with 21% of the primary channel, 41% of side channels, 74% of alcoves, and 80% of island areas.

The banks of the Willamette River have more than 96 miles of revetments; approximately half were constructed by the U.S. Army Corps of Engineers. Generally, the revetments were placed in the vicinity of roads or on the outside bank of river bends, so that while only 26% of the total length is revetted, 65% of the meander bends are revetted (Gregory *et al.* 2002c). The majority of dynamic sections have been armored, reducing adjustments in channel bed and sediment storage by the river, and thereby diminishing both the complexity and productivity of aquatic habitats (Gregory *et al.* 2002b).

Riparian forests have diminished considerably in the lower reaches of the Willamette River (Gregory *et al.* 2002d). Sedell and Frogatt (1984) noted that agriculture and cutting of streamside trees were major agents of change for riparian vegetation, along with snagging of large wood in the channel. The reduced shoreline, fewer and smaller snags, and reduced riparian forest comprise large functional losses to the river, reducing structural features, organic inputs from litter fall, entrained allochthonous materials, and flood flow filtering capacity. Extensive changes began before the major dams were built, with navigational and agricultural demands dominating the early use of the river. The once expansive forests of the Willamette River floodplain provided valuable nutrients and organic matter during flood pulses, food sources for macroinvertebrates, and slow-water refugia for fish during flood events. These forests also cooled river temperatures as the river flowed through its many channels.

Gregory *et al.* (2002d) described the changes in riparian vegetation in river reaches from the mouth to Newberg, from Newberg to Albany, and from Albany to Eugene. They noted that the riparian forests were formerly a mosaic of brush, marsh, and ash tree openings maintained by annual flood inundation. Below the City of Newberg, the most noticeable change was that conifers were almost eliminated. Above Newberg, the formerly hardwood-dominated riparian forests along with mixed forest made up less than half of the riparian vegetation by 1990, while agriculture dominated. This conversion represents a loss of recruitment potential for large wood, which functions as a component of channel complexity, much as the morphology of the streambed does, to reduce velocity and provide habitat for macroinvertebrates that support the prey base for salmon and steelhead. Declining extent and quality of riparian forests have also reduced rearing and refugia habitat provided by large wood, shading by riparian vegetation which can cool water temperatures, and the availability of leaf litter and the macroinvertebrates that feed on it.

Hyporheic flow in the Willamette River has been examined through discharge measurements and was found to be significant in some areas, particularly those with gravel deposits (Fernald *et al.* 2001). The loss of channel complexity and meandering that fosters creations of gravel deposits decreases the potential for hyporheic flows, as does gravel mining. Hyporheic flow processes water and affects its quality on reemerging into the main channel, stabilizing variations in physical and chemical water characteristics. Hyporheic exchange was found to be significant in the National Water-Quality Assessment of the Willamette Basin (Wentz *et al.* 1998). In the transient storage zone, hyporheic flow is important for ecological functions, some aspects of water quality (such as temperature and dissolved oxygen), and some benthic invertebrate life stages. Alcove habitat, limited by channelization, combines low hydraulic stress and high food availability with the potential for hyporheic flows across the steep hydraulic gradients in the gravel separating them from the main channel (Fernald *et al.* 2001).

On the mainstem of the Columbia River, hydropower projects, including the Federal Columbia River Hydropower System (FCRPS), have significantly degraded salmon and steelhead habitats (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2005a, NOAA Fisheries 2006). The series of dams and reservoirs that make up the FCRPS block an estimated 12 million cubic yards of debris and sediment that would otherwise naturally flow down the Columbia and replenish shorelines along the Washington and Oregon coasts.

Industrial harbor and port development are also significant influences on the Lower Willamette and Lower Columbia rivers (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2005a, NOAA Fisheries 2006). Since 1878, 100 miles of river channel within the mainstem Columbia River, its estuary, and Oregon's Willamette River have been dredged as a navigation channel by the Army Corps of Engineers. Originally dredged to a 20-foot minimum depth, the Federal navigation channel of the Lower Columbia River is now maintained at a depth of 43 feet and a width of 600 feet. The Lower Columbia River supports five ports on the Washington State side: Kalama, Longview, Skamania County, Woodland, and Vancouver. In addition to loss of riparian habitat, and disruption of benthic habitat due to dredging, high levels of several sediment chemicals, such as arsenic and polycyclic aromatic hydrocarbons (PAHs), have been identified in Lower Columbia River watersheds in the vicinity of the ports and associated industrial activities.

The most extensive urban development in the Lower Columbia River subbasin occurs in the Portland/Vancouver area. Outside of this major urban area, the majority of residences and businesses rely on septic systems. Common water quality issues with urban development and residential septic systems include higher water temperatures, lowered dissolved oxygen, increased fecal coliform bacteria, and increased chemicals associated with pesticides and urban runoff.

The Columbia River estuary has lost a significant amount of tidal marsh and tidal swamp habitat that are critical to juvenile salmon and steelhead, particularly small or ocean-type species (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2005a, NOAA Fisheries 2006). Edges of marsh areas provide sheltered habitats for juvenile salmon and steelhead where food, in the form of amphipods or other small invertebrates which feed on marsh detritus, is plentiful, and larger predatory fish can be avoided. Historically, floodwaters of the Columbia River inundated the margins and floodplains along the estuary, allowing juvenile salmon and steelhead access to a wide expanse of low-velocity marshland and tidal channel habitats. In general, the riverbanks were gently sloping, with riparian and wetland vegetation at the higher elevations of the river floodplain becoming habitat for salmon and steelhead during flooding river discharges or flood tides. Sherwood *et al.* (1990) estimated that the Columbia River estuary lost 20,000 acres of tidal swamps, 10,000 acres of tidal marshes, and 3,000 acres of tidal flats between 1870 and 1970. This study further estimated an 80% reduction in emergent vegetation production and a 15% decline in benthic algal production.

Habitat and food-web changes within the estuary, and other factors affecting salmon population structure and life histories, have altered the estuary's capacity to support juvenile salmon (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2005a, NOAA Fisheries 2006). Diking and filling activities that decrease the tidal prism and eliminate emergent and forested wetlands and floodplain habitats have likely reduced the estuary's salmon-rearing capacity. Moreover, water and sediment in the Lower Columbia River and its tributaries have levels of toxic contaminants that are harmful to fish and wildlife (LCREP 2007). Contaminants of concern include dioxins and furans, heavy metals, polychlorinated biphenyls (PCBs) and organochlorine pesticides such as DDT. Simplification of the population structure and life-history diversity of salmon possibly is yet another important factor affecting juvenile salmon viability. Restoration of estuarine habitats, particularly diked emergent and forested wetlands, reduction of avian predation by terns, and flow manipulations to restore historical flow patterns might significantly enhance the estuary's productive capacity for salmon, although historical changes in population structure and salmon life histories may prevent salmon from making full use of the productive capacity of estuarine habitats, even in their presently altered state.

The NMFS recently proposed critical habitat for southern green sturgeon, including coastal U.S. marine waters within 110 m depth from Monterey Bay, California, including Monterey Bay, north to Cape Flattery, Washington, including the Straits of Juan de Fuca, Washington, to its U.S. boundary; the Sacramento River, lower Feather river, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; the Lower Columbia River estuary; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, and Yaquina Bay), and Washington (Willapa Bay and Grays Harbor). In addition to the general exclusions listed above, the CHART determined that the following areas within the SONCC Domain will be excluded from critical habitat designations: Elkhorn Slough, Tomales Bay, Noyo Harbor, Eel River estuary, Klamath/Trinity River estuary, and the Rogue River estuary. Excluded estuary areas extend to the head of tide. The CHART based their determination on these areas having a "low" or "ultra-low" conservation value and a lack of documentation that southern green sturgeon use these areas extensively.

IC Recovery Domain. Critical habitat has been designated in the IC recovery domain, which includes the Snake River Basin, for SR spring/summer Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon, SR sockeye salmon, MCR steelhead, UCR steelhead, and SRB steelhead. Major tributaries in the Oregon portion of the IC recovery domain include the Deschutes, John Day, Umatilla, Walla Walla, Grande Ronde, and Imnaha rivers.

Habitat quality in tributary streams in the IC recovery domain varies from excellent in wilderness and roadless areas to poor in areas subject to heavy agricultural and urban development (Wissmar *et al.* 1994, Carmichael 2006). Critical habitat throughout the IC recovery domain has been degraded by intense agriculture, alteration of stream morphology (*i.e.*, channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Reduced summer stream flows, impaired water quality, and reduction of habitat complexity are common problems for critical habitat in developed areas.

Migratory habitat quality in this area has been severely affected by the development and operation of the FCRPS dams and reservoirs in the mainstem Columbia River, Bureau of Reclamation tributary projects, and privately owned dams in the Snake and Upper Columbia river basins. For example, construction of Hells Canyon Dam eliminated access to several likely production areas in Oregon and Idaho, including the Burnt, Powder, Weiser, Payette, Malheur, Owyhee, and Boise river basins (Good *et al.* 2005), and Grande Coulee and Chief Joseph dams completely block anadromous fish passage on the upper mainstem Columbia River. Hydroelectric development modified natural flow regimes, resulting in higher water temperatures, changes in fish community structure leading to increased rates of piscivorous and avian predation on juvenile salmon and steelhead, and delayed migration for both adult and juveniles. Physical features of dams such as turbines also kill migrating fish. In-river survival is inversely related to the number of hydropower projects encountered by emigrating juveniles.

Similarly, development and operation of extensive irrigation systems and dams for water withdrawal and storage in tributaries have drastically altered hydrological cycles. A series of large regulating dams on the middle and upper Deschutes River affect flow and block access to upstream habitat, and have extirpated one or more populations from the Cascades Eastern Slope major population (IC-TRT 2003). Similarly, operation and maintenance of large water reclamation systems such as the Umatilla Basin and Yakima Projects have significantly reduced flows and degraded water quality and physical habitat in this domain.

Many stream reaches designated as critical habitat in the IC recovery domain are over-allocated under state water law, with more allocated water rights than existing streamflow conditions can support. Irrigated agriculture is common throughout this region and withdrawal of water increases summer stream temperatures, blocks fish migration, strands fish, and alters sediment transport (Spence *et al.* 1996). Reduced tributary stream flow has been identified as a major limiting factor for all listed salmon and steelhead species in this area except SR fall-run Chinook salmon (NMFS 2005).

Many stream reaches designated as critical habitat are listed on the state of Oregon's Clean Water Act section 303(d) list for water temperature. Many areas that were historically suitable rearing and spawning habitat are now unsuitable due to high summer stream temperatures. Removal of riparian vegetation, alteration of natural stream morphology, and withdrawal of water for agricultural or municipal use all contribute to elevated stream temperatures. Contaminants such as insecticides and herbicides from agricultural runoff and heavy metals from mine waste are common in some areas of critical habitat.

OC Recovery Domain. In this recovery domain, critical habitat has been designated for OC coho salmon. Many large and small rivers supporting significant populations of coho salmon flow through this domain, including the Nehalem, Nestucca, Siletz, Yaquina, Alsea, Siuslaw, Umpqua, Coos, and Coquille.

The historical disturbance regime in the central Oregon Coast Range was dominated by a mixture of high and low-severity fires, with a natural rotation of approximately 271 years. Old-growth forest coverage in the Oregon Coast Range varied from 25 to 75% during the past 3,000 years, with a mean of 47%, and never fell below 5% (Wimberly *et al.* 2000). Currently, the Coast Range has approximately 5% old-growth, almost all of it on Federal lands. The dominant disturbance now is logging on a cycle of 30 to 100 years, with fires suppressed.

The state of Oregon (2005) completed an assessment of habitat conditions in the range of OC coho in 2005. Oregon's assessment mapped how streams with high intrinsic potential for coho salmon rearing are distributed by land ownership categories. Agricultural lands and private industrial forests have by far the highest percentage of land ownership in high intrinsic potential areas and along all coho stream miles. Federal lands have only about 20% of coho stream miles and 10% of high intrinsic potential stream reaches. Because of this distribution, activities in lowland agricultural areas are particularly important to the conservation of Oregon coastal coho.

The coho assessment concluded that at the scale of the entire domain, pools are generally abundant, although slow-water and off-channel habitat (which are important refugia for coho during high winter flows) are limited in the majority of streams when compared to reference streams in minimally-disturbed areas. Amounts of large wood in streams are low in all four ODFW monitoring areas and land-use types relative to reference conditions. Amounts of fine sediment are high in three of the four monitoring areas, and were comparable to reference conditions only on public lands. Approximately 62 to 91% of tidal wetland acres (depending on estimation procedures) have been lost for functionally and potentially independent populations of coho.

As part of the coastal coho assessment, the Oregon Department of Environmental Quality (ODEQ) analyzed the status and trends of water quality in the range of OC coho using the Oregon water quality index, which is based on a combination of temperature, dissolved oxygen, biological oxygen demand, pH, total solids, nitrogen, total phosphates, and bacteria. Using the index at the species scale, 42% of monitored sites had excellent to good water quality, and 29% show poor to very poor water quality. Within the four monitoring areas, the North Coast had the best overall conditions (6 sites in excellent or good condition out of 9 sites), and the Mid-South coast had the poorest conditions (no excellent condition sites, and only 2 out of 8 sites in good condition). For the 10-year period monitored between 1992 and 2002, no sites showed a declining trend in water quality. The area with the most improving trends was the North Coast, where 66% of the sites (6 out of 9) had a significant improvement in index scores. The Umpqua River basin, with one out of 9 sites (11%) showing an improving trend, had the lowest number of improving sites.

SONCC Recovery Domain. Critical habitat in this recovery domain has been designated for SONCC coho salmon. Many large and small rivers supporting significant populations of coho salmon flow through this area, including the Elk, Rogue, Chetco, Smith and Klamath. The following summary of critical habitat information in the Elk, Rogue, and Chetco rivers is also applicable to habitat characteristics and limiting factors in other basins in this area.

The Elk River flows through Curry County, drains approximately 92 square miles (or 58,678 acres) (Maguire 2001). Historical logging, mining, and road building have degraded stream and riparian habitats in the Elk River basin. Limiting factors identified for salmon and steelhead production in this basin include sparse riparian cover, especially in the lower reaches, excessive fine sediment, high water temperatures, and noxious weed invasions (Maguire 2001).

The Rogue River drains approximately 5,160 square miles within Curry, Jackson and Josephine counties in southwest Oregon. The mainstem is about 200 miles long and traverses the coastal mountain range into the Cascades. The Rogue River estuary has been modified from its historical condition. Jetties were built by the U.S. Army Corps of Engineers in 1960, which stabilized and deepened the mouth of the river. A dike that extends from the south shore near Highway 101 to the south jetty was completed in 1973. This dike created a backwater for the large shallow area that existed here, which has been developed into a boat basin and marina, eliminating most of the tidal marsh.

The quantity of estuary habitat is naturally limited in the Rogue River. The Rogue River has a drainage area of 5,160 square miles, but the estuary at 1,880 acres is one of the smallest in Oregon. Between 1960 and 1972, approximately 13 acres of intertidal and 14 acres of subtidal land were filled in to build the boat basin dike, the marina, north shore riprap and the other north shore developments (Hicks 2005). Jetties constructed in 1960 to stabilize the mouth of the river and prevent shoaling have altered the Rogue River, which historically formed a sill during summer months (Hicks 2005).

The Lower Rogue Watershed Council's watershed analysis (Hicks 2005) lists factors limiting fish production in tributaries to Lower Rogue River watershed. The list includes water temperatures, low stream flows, riparian forest conditions, fish passage and over-wintering habitat. Limiting factors identified for the Upper Rogue River basin include fish passage barriers, high water temperatures, insufficient water quantity, lack of large wood, low habitat complexity, and excessive fine sediment (RBCC 2006).

The Chetco River is in the southwest corner of Oregon, almost entirely within Curry County, with a drainage of approximately 352 square miles. The Chetco River estuary has been significantly modified from its historical condition. Jetties were erected by the U.S. Army Corps of Engineers in 1957, which stabilized and deepened the mouth of the river. These jetties have greatly altered the mouth of the Chetco River and how the estuary functions as habitat for salmon migrating to the ocean. A boat basin and marina were built in the late 1950s and eliminated most of the functional tidal marsh. The structures eliminated shallow water habitats and vegetation in favor of banks stabilized with riprap. Since then, nearly all remaining streambank in the estuary has been stabilized with riprap. The South Coast Watershed Council's watershed analysis (Maguire 2001) states the factors limiting fish production in the Chetco River appear to be high water temperature caused by lack of shade, especially in tributaries, high rates of sedimentation due to roads, poor over-wintering habitat due to a lack of large wood in tributaries and the mainstem, and poor quality estuary habitat (Maguire 2001).

Environmental Baseline for the Action Area

Because the action area for this programmatic consultation includes combined action areas for which exact locations within the region are not yet known, it was not possible to precisely define the current condition of fish or critical habitats in the action area, the factors responsible for that condition, or the conservation role of those specific areas. Therefore, to complete the jeopardy and destruction or adverse modification of critical habitat analyses in this consultation, NMFS made the following assumptions regarding the environmental baseline in each area that will eventually be chosen to support an action: (1) The purpose of the proposed action is to fund or carry out stream restoration and fish passage improvements for the benefit of listed species; (2) each individual action area will be occupied by one or more listed species; (3) the biological requirements of individual fish in those areas are not being fully met because aquatic habitat functions, including functions related to habitat factors limiting the recovery of the species in each area, are impaired; and (4) active restoration at each site is likely to improve the factors limiting recovery of salmon and steelhead in that area.

As described above in the Status of the Species and Critical Habitats section, factors that limit the recovery of salmon and steelhead vary with the overall condition of aquatic habitats on private, state, and Federal lands. Many stream, estuarine and marine habitats and riparian areas have been degraded by the effects of land and water use, including road construction, forest management, agriculture, mining, urbanization, and water development. Each of these economic activities has contributed to a myriad of interrelated factors for the decline of salmon and steelhead. Among the most important of these are changes in stream channel morphology, degradation of spawning substrates, reduced instream roughness and cover, loss and degradation of estuarine rearing habitats, loss of wetlands, loss and degradation of riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants) degradation, blocked fish passage, direct take, and loss of habitat refugia.

The environmental baseline also includes the anticipated impacts of all Federal actions in the action area that have already undergone formal consultation. For example, from 2001 through 2006, the Corps authorized 118 restoration actions in Oregon under the programmatic consultations, and more than 800 other actions related to transportation features, over and in-water structures, and bank stabilization. The U.S. Army Corps of Engineers, Bonneville Power Administration, and Bureau of Reclamation have also consulted on large water management actions, such as operation of the Federal Columbia River Power System, the Umatilla Basin Project, and the Deschutes Project. The U.S. Forest Service and U.S. Bureau of Land Management consult on Federal land management throughout Oregon, including restoration actions, forest management, livestock grazing, and special use permits.

It is very likely that a few action areas for some of these previously consulted upon actions will overlap with action areas for restoration actions covered under this new iteration of NOAARC's programmatic consultation. Impacts to the environmental baseline from these previous actions vary from short-term adverse effects to long-term beneficial effects.

Effects of the Action

Under the administrative portion of this action, NOAARC will evaluate each individual action to ensure that the following conditions are true: (1) This Opinion will only applied to proposed actions in areas where ESA-listed salmon, steelhead, sturgeon, or eulachon, or their designated critical habitats, or both, are present; (2) the anticipated range of effects of the action will be within the range considered in this Opinion; (3) the action will be carried out consistent with the proposed PDCs; and (4) the action and program level monitoring and reporting requirements will be met. Although that process will not, by itself, affect a listed species or critical habitat, it determines which factors must be considered to analyze the effects of each individual action that will be funded or carried out under this Opinion.

The actions that are likely to have the most significant effects are those that will disturb the banks and channels of natural waterbodies. Those actions include fish passage restoration, manual and mechanical plant control, juniper removal, livestock crossings, off-channel restoration, piling removal, bank set-backs, and removal of water control structures. The effects analysis for these actions begins by describing a common set of predicted effects related to construction, although an additional analysis based on effects specific to each type of action follows.

The analysis of effects then examines actions that will limit construction to upland and riparian areas. The effects of these actions will be less severe due to the buffering effect of a zone of undisturbed vegetation and soils between the action's footprint and natural waterbodies. Those actions will include upland plant control, chemical plant control, upland juniper removal, construction and maintenance of livestock water facilities, and wetland restoration. Plant control using herbicides will create an additional effect pathway when they drift or are otherwise transported into natural waterbodies.

Restoration Construction. The direct physical and chemical effects of the construction associated with the proposed actions typically begin with surveying, minor vegetation clearing, placement of stakes and flagging, and minor movement of personnel and sometimes machines over the action area. The next stage, site preparation, may require development of access roads, construction staging areas, and materials storage areas that affect more of the action area. If additional earthwork is necessary to clear, excavate, fill, or shape the site, more vegetation and topsoil may be removed, deeper soil layers exposed, and operations may extend into the channel. The final stage of construction consists of any action necessary to undo the short-term disturbance, and may include replacement of large wood, native vegetation, topsoil, and native channel material displaced by construction.

Vegetation, soil and channel disturbance caused by construction can disrupt the vegetative and fluvial processes in the action area that create and maintain habitat function, such as delivery of wood, particulate organic matter, and shade to a riparian area and stream; development of root strength for slope and bank stability; and sediment filtering and nutrient absorption from runoff (Darnell 1976, Spence *et al.* 1996). Although the sizes of areas likely to be adversely affected by actions proposed to be funded or carried out under this Opinion are small, and those effects are likely to be short lived (weeks or months), even small denuded areas will lose organic matter and dissolved minerals, such as nitrates and phosphates. The microclimate at each action site where vegetation is removed is likely to become drier and warmer, with a corresponding increase in wind speed, and soil and water temperature. Water tables and spring flows (if present) in the immediate area may be temporarily reduced. Loose soil will temporarily accumulate in the construction area. In dry weather, this soil can be dispersed as dust and, in wet weather, loose soil will be transported to streams by erosion and runoff, particularly in steep areas.

Erosion and runoff during precipitation and snowmelt will increase the supply of sediment streams and rivers, where they will increase total suspended solids and sedimentation and, in some cases, stream fertility. Increased runoff also increases the frequency and duration of high stream flows and wetland inundation in construction areas. Higher stream flows increase stream energy that can scour stream bottoms and transport greater sediment loads farther downstream that would otherwise occur. Sediments in the water column reduce light penetration, and can increase water temperature and modify water chemistry. Redeposited sediments can fill pools, reduce the width to depth ratio of streams, and change the distribution of pools, riffles, and glides.

During dry weather, the physical effects of increased runoff will reduce ground water storage, lower stream flows, and lower wetland water levels. The combination of erosion and mineral loss can reduce soil quality and site fertility in upland and riparian areas. Concurrent in-water work can compact or dislodge channel sediments, thus increasing total suspended solids and allowing currents to transport sediment downstream where it will eventually be redeposited.

Continued operations when the construction site is inundated can significantly increase the likelihood of severe erosion and contamination.

The use of heavy equipment for vegetation removal and earthwork compacts soils, thus reducing soil permeability and infiltration. The use of heavy equipment also creates a risk that accidental spills of fuel, lubricants, hydraulic fluid, coolants, and other contaminants may occur. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain polycyclic aromatic hydrocarbons (PAHs), which can be acutely toxic to salmonid fish and other aquatic organisms at high levels of exposure and can cause sublethal adverse effects to aquatic organisms at lower concentrations (Heintz *et al.* 1999, 2000; Incardona *et al.* 2004, 2005, 2006). The discharge of construction water used for vehicle washing, concrete washout, pumping for work area isolation, and other purposes can carry sediments and a variety of contaminants to riparian areas and streams.

Some of these adverse effects will abate almost immediately, such as increased total suspended solids caused by boulder or large wood restoration. Others will be long-term conditions that may decline quickly but persist at some level for weeks, months, or years, until riparian and floodplain vegetation are fully reestablished. Failure to complete site restoration, or to prevent disturbance of newly-restored areas by livestock or unauthorized persons, will delay or prevent recovery of processes that form and maintain productive fish habitats.

The direct physical and chemical effects of post-construction site restoration to be included as parts of the proposed actions are essentially the reverse of the construction activities that go before it. Bare earth will be protected by various methods, including seeding, planting woody shrubs and trees, and mulching. This will dissipate erosive energy associated with precipitation and increase soil infiltration. It also will accelerate vegetative succession necessary to restore the delivery of to riparian areas and streams, root strength necessary for slope and bank stability, leaf and other particulate organic matter input, sediment filtering and nutrient absorption from runoff, and shade. Microclimate will become cooler and moister, and wind speed will decrease. Whether recovery occurs over weeks, months or years, the disturbance frequency (*i.e.*, the number of restoration actions per unit of time, at any given site) is likely to be extremely low, as is the intensity of the disturbance as a function of the quantity and quality of overall habitat conditions present within an action area.

Restoration of aquatic habitats is fundamentally about allowing stream systems to express their capacities, *i.e*., the relief of human influences that have suppressed the development of desired habitat mosaics (Ebersole *et al.* 2001). Thus, the time necessary for recovery of functional habitat attributes sufficient to support species recovery following any disturbance, including construction necessary to complete a restoration action, will vary by the potential capacity of each habitat attribute. Recovery mechanisms such as soil stability, sediment filtering and nutrient absorption, and vegetation succession may recover quickly (*i.e*., months to years) after completion of the proposed action. Recovery of functions related to wood recruitment and microclimate may require decades or longer. Functions related to shading of the riparian area and stream, root strength for bank stabilization, and organic matter input may require intermediate lengths of time.

The rate and extent of functional recovery is also controlled in part by watershed context. Most proposed actions will occur in areas where productive habitat functions and recovery mechanisms were absent or degraded before construction took place. These sites are only likely to be functionally restored if the pre-construction environment retains the ecological potential to function properly, as evidenced by the residual productivity of riparian soils and channel conditions with balanced scour and fill processes. The prospect for ecological recovery might be further limited by ecological and social factors at the watershed and landscape scales. Thus, ecological recovery of an action area surrounded by intensive land use and severe upstream disturbance is likely to be less successful than the recovery of a site surrounded by wildlands where the headwaters are protected. To some extent, the proposed actions will help to compensate for low residual ecological potential and accelerate recovery. However, in and of themselves, the proposed actions may not fully overcome severe site constraints imposed by low site capability.

The indirect effects, or effectiveness, of habitat restoration actions, in general, have not been well documented, in part because they often concentrate on instream habitat without addressing the processes that led to the loss of the habitat (Fox 1992, Simenstad and Thom 1996, Zedler 1996, Cederholm *et al.* 1997, Roper *et al.* 1997). Nonetheless, the careful, interagency process used by NOAARC to develop the proposed action ensures that it is reasonably certain to lead to some degree of ecological recovery within each action area, including the establishment or restoration of environmental conditions associated with functional habitat and high conservation value.

Fish Passage Restoration. In addition to restoration construction effects discussed above, the effects of fish passage restoration using the proposed PDCs to construct step weirs are likely to include development of a backwater upstream of the weir, with reduced velocities and greater depths at a variety of flows, accelerated flow through the weir, and deposition of sediment immediately downstream of the weir ("tailouts") (WDFW and Inter-Fluve 2006). Adding a fish ladder to an existing facility, or improving a culvert for fish passage, is likely to decrease stream gradient in at least a portion of the reach, which will reduce stream energy and may cause aggradation due to sedimentation and provide access to previously blocked habitat (WDFW and Inter-Fluve 2006).

Invasive and Non-native Plant Control. The effects of invasive and non-native plant control using the proposed PDCs were recently analyzed by NMFS.[18] The types of plant control actions analyzed here are a conservative (*i.e*., less aggressive) subset of the types of actions considered in that analysis, and the effects presented here are summarized from that analysis. This proposed action includes manual, mechanical, biological and herbicidal treatment. Each type of treatment is likely to affect fish and aquatic macrophytes through a combination of pathways, including disturbance, chemical toxicity, dissolve oxygen and nutrients, water temperature, sediment, instream habitat structure, forage, and riparian and emergent vegetation (Table 25). NMFS did not identify adverse effects to macroinvertebrates from herbicide applications that follow these proposed PDCs. These effects pathways are described in detail below.

[18] Endangered Species Act – Section 7 Consultation: Programmatic Biological Opinion – Umatilla and Wallowa-Whitman National Forests Invasive Plant Treatments Project (refer to NMFS No: 2008/06525) (in preparation).

Table 25. Potential pathways of effects of invasive and non-native plan control.

Treatment Methods	Pathways of Effects							
	Disturbance*	**Chemical toxicity**	**Dissolved oxygen and nutrients**	**Water temperature**	**Fine sediment and turbidity**	**Instream habitat structure**	**Forage**	**Riparian and emergent vegetation**
Manual	X					X	X	X
Mechanical	X			X	X		X	X
Biological				X	X			
Herbicides		X	X	X	X	X	X	X

*****Stepping on redds, displacing fish, interrupting fish feeding, or disturbing banks.

Manual and mechanical treatments are likely to result in mild restoration construction effects (discussed above). Thus, these treatments are likely to affect a definite, broad area, and to produce at least minor damage to riparian soil and vegetation. In some cases, this will decrease stream shade, increase suspended sediment and temperature in the water column, reduce organic inputs (*e.g.*, insects, leaves, woody material), and alter streambanks and the composition of stream substrates. However, these circumstances are likely to occur only in rare circumstances, such as treatment of an invasive plant monoculture that encompasses a small stream channel. This effect would vary depending on site aspect, elevation, and amount of topographic shading, but is likely to decrease over time at all sites as shade from native vegetation is reestablished.

Biological controls work slowly, typically over several years, and are designed to work only on the target species. Thus, biological controls produce a smaller reduction of riparian and instream vegetation over a smaller area than manual and mechanical treatments. As treated invasive plants die, native plants are likely to become reestablished at each site, and they will restore soil and bank stability from root systems, and stream shade. Therefore, any adverse effects due to biological treatments, by themselves, are likely to be very mild.

NMFS identified three scenarios for the analysis of herbicide application effects: (1) Runoff from riparian application; (2) application within perennial stream channels; and (3) runoff from intermittent stream channels and ditches. Stream margins often provide shallow, low-flow conditions, may have a slow mixing rate with mainstem waters, and may also be the site at which subsurface runoff is introduced. Juvenile salmon and steelhead, particularly recently emerged fry, often use low-flow areas along stream margins. Wild Chinook salmon rear near stream margins until they reach about 60 mm in length. As juveniles grow, they migrate away from stream margins and occupy habitats with progressively higher flow velocities. Nonetheless, stream margins continue to be used by larger salmon and steelhead for a variety of reasons, including nocturnal resting, summer and winter thermal refuge, predator avoidance, and flow refuge.

Spray and vapor drift are important pathways for herbicide entry into aquatic habitats. Several factors influence herbicide drift, including spray droplet size, wind and air stability, humidity and temperature, physical properties of herbicides and their formulations, and method of application. For example, the amount of herbicide lost from the target area and the distance the herbicide moves both increase as wind velocity increases. Under inversion conditions, when cool air is near the surface under a layer of warm air, little vertical mixing of air occurs. Spray drift is most severe under these conditions, since small spray droplets will fall slowly and move to adjoining areas even with very little wind. Low relative humidity and high temperature cause more rapid evaporation of spray droplets between sprayer and target. This reduces droplet size, resulting in increased potential for spray drift. Vapor drift can occur when a herbicide volatilizes. The formulation and volatility of the compound will determine its vapor drift potential. The potential for vapor drift is greatest under high air temperatures and with ester formulations. For example, ester formulations triclopyr are very susceptible to vapor drift, particularly at temperatures above 80°F.

When herbicides are applied with a sprayer, nozzle height controls the distance a droplet must fall before reaching the weeds or soil. Less distance means less travel time and less drift. Wind velocity is often greater as height above ground increases, so droplets from nozzles close to the ground would be exposed to lower wind speed. The higher that an application is made above the ground, the more likely it is to be above an inversion layer that will not allow herbicides to mix with lower air layers and will increase long distance drift. Several proposed PDCs address these concerns by ensuring that herbicide treatments will be made using ground equipment or by hand, under calm conditions, preferably when humidity is high and temperatures are relatively low. Ground equipment reduces the risk of drift, and hand equipment nearly eliminates it.

Surface water contamination with herbicides can occur when herbicides are applied intentionally or accidentally into ditches, irrigation channels or other bodies of water, or when soil-applied herbicides are carried away in runoff to surface waters. Direct application into water sources is generally used for control of aquatic species. Accidental contamination of surface waters can occur when irrigation ditches are sprayed with herbicides or when buffer zones around water sources are not wide enough. In these situations, use of hand application methods will greatly reduce the risk of surface water contamination.

The contribution from runoff will vary depending on site and application variables, although the highest pollutant concentrations generally occur early in the storm runoff period when the greatest amount of herbicide is available for dissolution. Lower exposures are likely when herbicide is applied to smaller areas, when intermittent stream channel or ditches are not completely treated, or when rainfall occurs more than 24 hours after application. Under the proposed action, some formulas of herbicide can be applied within the bankfull elevation of streams, in some cases up to the water's edge. Any juvenile fish in the margins of those streams are more likely to be exposed to herbicides as a result of overspray, inundation of treatment sites, percolation, surface runoff, or a combination of these factors.

Groundwater contamination is another important pathway. Most herbicide groundwater contamination is caused by "point sources," such as spills or leaks at storage and handling facilities, improperly discarded containers, and rinses of equipment in loading and handling areas, often into adjacent drainage ditches. Point sources are discrete, identifiable locations that discharge relatively high local concentrations. Proposed PDCs minimize these concerns by ensuing proper calibration, mixing, and cleaning of equipment. Non-point source groundwater contamination of herbicides is relatively uncommon but can occur when a mobile herbicide is applied in areas with a shallow water table. Proposed PDCs minimize this danger by restricting the formulas used, and the time, place and manner of their application to minimize offsite movement.

In summary, the proposed PDCs, including limitations on the herbicides, adjuvenants, carriers, handling procedures, application methods, drift minimization measures, and riparian buffers, will greatly reduce the likelihood that significant amounts of herbicide will be transported to aquatic habitats, although some herbicides are still likely to enter streams through aerial drift, in association with eroded sediment in runoff, and dissolved in runoff, including runoff from intermittent streams and ditches. The indirect effects or long-term consequences of invasive, non-native plant control will depend on the long-term progression of climatic factors and the success of follow-up management actions to exclude undesirable species from the action area, provide early detection and rapid response before such species establish a secure position in the plant community, eradicate incipient populations, and control existing populations.

Juniper Tree Removal. The direct adverse effects of juniper tree removal will include minor restoration construction effects (*i.e*., soil compaction, erosion, loss of upland vegetation) caused by the movement of personnel over the action area. Moreover, this action will convert living trees to woody debris and slash that will be left within the action area at densities that are likely to range from less than 1 to more than 8 tons per acre (Azuma *et al*. 2005). This increase in fuel loading will increase the likelihood or intensity of fire, especially during the first 2 to 3 years while needles are still attached, although post-settlement reduction in the extent and return interval of fire is considered to be the most important factor allowing western juniper to expand into neighboring plant communities (Miller *et al.* 2005). Beneficial effects of the tree removal and retention of slash residue will include increased soil cover that will reduce erosion, increased soil nutrients and organic matter content, and increased distribution and abundance of native vegetation than is otherwise typical for sites that have been degraded by increasing dominance of western juniper. The indirect effects of juniper tree removal using these methods will depend on the long-term progression of climatic factors and the success of follow-up management actions to address fire, livestock management, and other site-specific factors driving woodland succession.

Livestock Crossing and Off-channel Watering Facilities. The direct effects of constructing a livestock crossing or off-channel watering facility using the proposed PDCs will be similar to the restoration construction effects discussed above. Indirect effects are likely to be beneficial, including reducing the likelihood that livestock, particularly cattle, will have unrestricted access to a riparian area or stream channel for shade, forage, drinking water, or to cross the stream. This, in turn, is likely to reduce the likelihood that livestock will disturb streambeds, spawning areas or redds, or erode streambanks, and will improve water quality by increasing riparian vegetation and reducing sediment and nutrient loading to streams.

Off- and Side-channel Habitat Restoration. Side channel wetlands and ponds provide important habitats for juvenile fish. Many historical off- and side-channels have been blocked from main stream channels for flood control or by other land management activities, or have ceased functioning due to other in-stream sediment imbalances. This action includes removal of fill material to passively reconnect existing stream channels to historical off- and side-channels. This action does not include meander reconstruction or the creation of new off- and side-channel habitats. When these areas are more regularly and permanently available, as in larger river basins, they can provide additional benefits such as high quality protected spawning habitat, especially for coho and chum salmon that actively seek these areas, and have high value as summer and winter rearing habitat for coho salmon (Saldi-Caromile *et al*. 2004).

The direct effects of using the proposed PDCs to reconnect stream channels with historical river floodplain swales, abandoned side channels, and floodplain channels are likely to include relatively intense restoration construction effects, as discussed above. The indirect effects are likely to include equally intense beneficial effects to habitat diversity and complexity (WDFW 2004), including increased overbank flow and greater potential for groundwater recharge in the floodplain; attenuation of sediment transport downstream due to increased sediment storage; greater channel complexity and/or increased shoreline length; increased floodplain functionality reduction of chronic bank erosion and channel instability due to sediment deposition; and increased width of riparian corridors. Increased riparian functions are likely to include increased shade and hence moderated water temperatures and microclimate; increased abundance and retention of wood; increased organic material supply; water quality improvement; filtering of sediment and nutrient inputs; more efficient nutrient cycling; and restoration of flood-flow refuge for ESA-listed fish (Saldi-Caromile *et al*. 2004,).

Piling Removal. Piling removal using the proposed PDCs will re-suspend sediments that are inevitably pulled up with, or attached to, the piles. If sediment in the vicinity of a pile is contaminated, or if the pile is creosote treated, those contaminants will be included with the re-suspended sediments, especially if a creosote-treated pile is damaged during removal, or if debris from a broken pile is allowed to re-enter or remain in the water. The indirect effects of piling removal are likely to include reduction of resting and areas for piscivorous birds, hiding habitat for aquatic predators such as large and smallmouth bass, and, in the case of creosote piles, a chronic source of PAH pollution.

Set-back Existing Berms, Dikes, and Levees. The direct and indirect effects of this type of proposed action are very similar to off- and side-channel habitat restoration discussed above, although the effects of this type of action may also include short-term or chronic instability of affected streams and rivers as channels adjust to the new hydrologic conditions. Moreover, this type of action is likely to affect larger areas overall because the area isolated by a berm, dike or levee is likely to be larger than that included in an off- or side-channel feature.

Shellfish Restoration. The placement of cultch, spat-on-shell, or live shellfish as part of shellfish restoration can negatively impact affect benthic organisms and submerged aquatic vegetation (SAV) in the project due to burial, excessive turbidity, or space competition. Eelgrass (*Zostera marina*) is a particularly important habitat component of Pacific Northwest estuaries, and is susceptible to decline from physical disturbance. This is especially true if the rhizome matrix is disrupted (Boese *et al*. 2009). However, since shellfish restoration generally will not disturb the substrate, it is likely that shellfish restoration conducted under this Opinion will not disrupt rhizomes, but may reduce shoot density or percent cover.

Introduction of non-native species, predators, and pathogens is a potential mechanism for harmful effects of shellfish restoration. Although many safeguards are now in place to protect against such introductions, shellfish have historically been a vector for a variety of non-indigenous species. The proposed action will minimize this danger by ensuring that shell or other substance used for substrate enhancement will be procured from clean sources that are then steam cleaned, left on dry land for a minimum of 1 month, or both, before placement in the water.

In some cases, the planting of SAV is included as part of a shellfish restoration activity. During revegetation activities, workers may disturb the surrounding sediment locally by compacting sediment due to foot traffic, or may disturb existing vegetation. Harvest of SAV from donor beds may harm the donor SAV bed, and may increase turbidity temporarily. For kelp restoration projects, there is potential for damage from divers or equipment, disruption of bottom sediment from diving finds, and impacts resulting from the transplanting of kelp to restoration sites.

Streambank Restoration. In addition to restoration construction effects discussed above, the proposed streambank restoration action is likely to reestablish native riparian forests or other appropriate native riparian plant communities, provide increased cover (large wood, boulders, vegetation, and bank protection structures) and a long-term source of all sizes of instream wood, reduce fine sediment supply, increase shade, moderate microclimate effects, and provide more normative channel migration over time.

Water Control Structure Removal. In addition to the restoration construction effects discussed above, removing a water control structure (*e.g*., small dam, earthen embankment, subsurface drainage features tide gate, gabion) using the proposed PDCs is likely to have significant local and landscape-level effects to processes related to sediment transport, energy flow, stream flow, temperature, and biotic fragmentation (Poff and Hart 2002). The diversity of water control structures distributed on the landscape combined with the relative scarcity of knowledge about the environmental response to their removal makes it difficult to generalize about the ecological harm or benefits of their removal. However, many small water control structures are nearing the end of their useful life due to sediment accumulation and general deterioration, and are likely to be either intentionally removed by parties concerned about liability that may arise from failure, or fail due to lack of maintenance. Thus, it is likely that in some cases the best outcome of a restoration action based on removal of a water control structure will be a minimization of adverse effects that may have followed an unplanned failure, such as reducing the size of a contaminated sediment release, or preventing an unplanned sediment pulse, controlling undesirable species, or ensuring fish passage around any remnant of the structure.

When a water control structure is specifically targeted for restoration, it may have less significant adverse effects and more beneficial effects than a structure that is removed primarily for safety or economic reasons, but neither action is likely to entirely restore pristine conditions. The legacy of flow control includes altered riparian soils and vegetation, channel morphology, and plant and animal species composition that frequently take many years or decades to fully respond to restoration of a more natural flow regime. The indirect effects or long-term consequences of water control structure removal will depend on the long-term progression of climatic factors and the success of follow-up management actions to manage sediments, exclude undesirable species, revegetate restored, and ensure that continuing water and land use impacts do not impair ecological recovery.

Removal of tide gates or tidal levees is likely to result in restoration of estuarine functions related to regulation of temperature, tidal currents, and salinity; increased habitat abundance from distributary channels, that increase in size after tidal flows are allowed to inundate and scour on a twice daily basis; reduction of fine sediment in-channel and downstream; reduced estuary filling due to increased availability of low-energy, overbank storage areas for fine sediment; restoration of fish access into tributaries, off- and side-channel pond and wetlands; restoration of saline-dependent plant species; increased primary productivity; increased estuarine food production; and restoration of an estuarine transition zone for fish and other species migrating through the tidal zone (Giannico and Souder 2004, 2005; Saldi-Caromile *et al.* 2009)

Wetland Restoration. Wetland restoration projects using the proposed PDCs are likely to have effects similar to those of restoration construction; off-and side channel restoration; set-back of existing berms, dikes, and levees; and removal of water control structures, as described above.

Road and Trail Erosion Control and Decommissioning. Road and trail erosion control decommissioning typically includes one or more of the following actions – installing or upgrading drainage features, revegetation of fill and cut slopes, removal and stabilization of side cast materials, grading or resurfacing with permeable materials, blocking (with a berm or by bridge removal), or complete removal of the roadbed with recontouring of the roadbed to match the original slope. A significant amount of information is available regarding the adverse effects of roads on aquatic habitats (*e.g*., Jones *et al.* 2000, Trombulak and Frissell 2000, Gucinski *et al.* 2001). Increased introduction of invasive species and delivery of fine sediment derived from roads has been linked with decreased fry emergence, decreased juvenile densities, loss of winter carrying capacity and increased predation of fishes, decreased benthic production and increased algal production. Improper culvert placement can limit or eliminate fish passage. Moreover, roads can greatly increase the frequency of landslides, debris flows, and other mass movements.

Unfortunately, much less information is available on the specific effects of road and trail restoration or removal, and its effectiveness for reversing adverse habitat conditions attributed to the presence of road and trail systems. The short-term effects of these actions using the proposed PDCs will include the restoration construction effects and, in the case of culvert removal, fish passage restoration, discussed above. The long-term effects of road and trail restoration or removal appear to include mitigation of many of the negative effects to aquatic habitats that have been associated with roads (Manej 2001, McCaffery *et al*. 2007), but the large variance stream substrate conditions and other stream habitat characteristics that are important to fish make it difficult to assign measurable effects to road decommissioning (Madej 2001, McCaffery *et al.* 2007). Thus, road and trail erosion control and decommissioning are likely to result in restoration of riparian and stream functions as a result of reduced sediment yield and improved fish passage.

Effects to Listed Species. Just as completion of each action is likely to have a similar set of effects to the environment because they are all based on a similar set of underlying construction actions, each salmon and steelhead species is likely to respond to those effects in a similar way because of underlying similarities in their biology.

Less is known about southern green sturgeon and eulachon although key differences in the distribution and biology of these two species make it reasonable to assume that the effects of the proposed action on them are likely to be within range of effects described below. Both species are broadly distributed in marine areas along the western coast of North America and only enter the action area in a relatively few subtidal and intertidal areas. In the case of southern green sturgeon, subadult and adult individuals enter the action area for non-breeding, non-rearing purposes. Because of their age, location, and life history, these individuals are relatively distant from, and insensitive to, the effects of the action described below, and those effects are unrelated to principal factor for the decline of this species, *i.e*., the reduction of its spawning area in the Sacramento River. Eulachon are also limited to a relatively few subtidal and intertidal areas, but they return to those areas with a presumed fidelity that indicates close association between a particular stock and its spawning environment (Gustafson *et al*. 2008). Moreover, eulachon face numerous potential threats throughout every stage of their life cycle, although the severity of shoreline construction effects and water quality, the most significant effects described below, have been ranked as "very low" and "low," respectively (Gustafson *et al*. 2008).

The physical and chemical changes in the environment associated with construction, especially decreased water quality (*e.g*., increased total suspended solids and temperature, and decreased dissolved oxygen), are likely to affect a larger area than direct interactions between fish and construction personnel. Design criteria related to in-water work timing, sensitive area protection, fish passage, erosion and pollution control, choice of equipment, in-water use of equipment, and work area isolation have been proposed to avoid or reduce these adverse effects. Those measures will ensure that the action agency will (1) not undertake restoration at sites occupied by spawning adult fish or where occupied redds are present, (2) defer construction until the time of year when the fewest fish are present, and (3) otherwise ensure that the adverse environmental consequences of construction are avoided or minimized.

It is unlikely that individual adult or embryonic salmon or steelhead will be adversely affected by the proposed action because all in-water construction will be deferred until after spawning season has passed and fry have emerged from gravel, except in some coastal and Willamette Valley locations, where adult salmon or steelhead may be present during part of the in-water work, and some mid-Columbia locations, where juvenile steelhead may still be emerging from the gravel. The use of heavy equipment in-stream in spawning areas can disturb or compact spawning gravel, and upland erosion and sediment delivery can increase substrate embeddedness. These factors make it harder for fish to excavate redds, and decrease redd aeration (Cederholm *et al.* 1997). However, the degree of instream substrate compaction and upland soil disturbance likely to occur under most of these actions is so small that significant sedimentation of spawning gravel is unlikely. If, for some reason, an adult fish is migrating in an action area during any phase of construction, it is likely to be able to successfully avoid construction disturbances by moving laterally or stopping briefly during migration, although spawning itself could be delayed until construction was complete (Gregory 1988, Sigler 1988, Servizi and Martens 1991, Feist *et al.* 1996). To the extent that the proposed actions are successful at improving flow conditions and reducing sedimentation, intergravel flow, future spawning success and embryo survival in the action area will be enhanced.

In contrast to adult and embryonic fish that will likely be absent during in-water construction, juveniles will be present. Most direct effects of the proposed actions are likely be caused by the isolation of in-water work areas, although other combined lethal and sublethal effects would be greater without the isolation. An effort will be made to capture any juvenile fish present within the work isolation area and to release it at a safe location, although some may evade capture and later die when the area is dewatered. Fish that are captured and transferred to holding tanks can experience trauma if care is not taken in the transfer process. Fish can also experience stress and injury from overcrowding in traps, if the traps are not emptied on a regular basis. The primary contributing factors to stress and death from handling are differences in water temperatures between the river and wherever the fish are held, dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on salmon and steelhead increases rapidly from handling if the water temperature exceeds 64^{o}F, or if dissolved oxygen is below saturation. Debris buildup at traps can also kill or injure fish if the traps are not monitored and cleared on a regular basis. Design criteria related to the capture and release of fish during work area isolation will avoid most of these consequences, and ensure that most of the resulting stress is short-lived (NMFS 2002).

Rapid changes and extremes in environmental conditions caused by construction are likely to cause a physiological stress response that will change the behavior of juvenile fish (Moberg 2000, Shreck 2000). For example, reduced input of particulate organic matter to streams, addition of fine sediment to channels, and mechanical disturbance of shallow-water habitats are likely to cause displacement from, or avoidance of, preferred rearing areas. Actions that affect stream channel widths are also likely to impair local movements of juvenile fish for hours, days, or longer. Downstream migration may also be impaired. These adverse effects will vary with the particular life stage, the duration and severity of the stressor, the frequency of stressful situations, the number and temporal separation between exposures, and the number of contemporaneous stressors experienced (Newcombe and Jenson 1996, Shreck 2000).

Juvenile fish may compensate for, and adapt to, some of these disturbances so that they continue to perform necessary physiological and behavioral functions, although in a diminished capacity. However, fish that are subject to prolonged, combined, or repeated stress by the effects of the action, combined with poor environmental baseline conditions, will likely suffer a metabolic cost that will be sufficient to impair their rearing, migrating, feeding, and sheltering behaviors and thereby increase the likelihood of injury or death. Because juvenile fish in the project areas are already subject to stress as a result of degraded watershed conditions, it is likely that a small number of those individuals will be subject to increased mortality due to increased competition, disease, and predation, and reduced ability to obtain food necessary for growth and maintenance (Sprague and Drury 1969, Newcombe and Jenson 1996, Moberg 2000). As explained more fully below in the amount or extent of take section, approximately 100 juveniles are likely to be injured or killed during in-water work area isolation.

In addition to the short-term adverse effects of construction on listed species described above, each type of action will also have the following long-term effects to individual fish. Because each proposed action will increase the amount of habitat available within the underlying stream or river, promote development of more natural riparian and stream channel conditions to improve aquatic functions, or both, the habitat available for fish will larger, more productive, or both. This will allow more complete expression of essential biological behaviors related to reproduction, feeding, rearing, and migration. If habitat abundance or quality is a limiting factor for ESA-listed fish in streams affected by these proposed actions, the long-term effects of access to larger or more productive habitat may increase juvenile survival or adult reproductive success. However, any individual response to habitat gain will also depend on many other factors, such as the quality and quantity of newly available habitat, and the abundance and nature of the predators, competitors, and prey that reside there.

The effect of the loss of individual fish at the population level can be thought of as the integrated response of all those individuals to adverse environmental change caused by the effects of the proposed actions. Instantaneous measures of population characteristics, such as population abundance, population spatial structure and population diversity, are the sum of individual characteristics within a particular area, while measures of population change, such as population growth rate, are measured as the productivity of individuals over the entire life cycle (McElhany *et al.* 2000). Thus, although the expected loss of a small number of individuals will have an immediate effect on population abundance at the local scale, the effect will not extend to measurable population change unless it reaches a scale that can be observed over an entire life cycle.

Because the juvenile-to-adult survival rate for salmon and steelhead is less than 0.001, the effects of a proposed action would have to kill hundreds or even thousands of juvenile fish in a single population before those effects would be equivalent even to a single adult, and would have to kill many times more than that to affect the abundance or productivity of the entire population over a full life cycle. Moreover, because the geographic area that may be affected by the proposed action is so large, the juvenile fish that are likely to be killed may be drawn from more than 300 independent populations. The adverse effects of each proposed actions will be too infrequent, short-term, and limited to kill more than a small number of juvenile fish at a particular site or even across the range of a single population, much less when that number is even partly distributed among all populations within the action area. Thus, the proposed actions will simply kill too few fish, as a function of the size of the affected populations and the habitat carrying capacity after each action is completed, to meaningfully affect to the primary VSP attributes of abundance or population growth rate for any single population. This is also true for very small populations of endangered species considered in this Opinion, *i.e.*, UCR spring-run Chinook salmon and SR sockeye salmon, for which a combination of low abundance, river-type ecology, and a distribution within the action area that is restricted to the mainstem of the Columbia River make it unlikely that individuals from those species will be injured or killed by the proposed action.

The remaining VSP attributes are within-population spatial structure, a characteristic that depends primarily on spawning group distribution and connectivity, and diversity, which is based on a combination of genetic and environmental factors (McElhany *et al.* 2000). Because the proposed actions are only likely to have short-term adverse effects to spawning sites, if any, and in the long term will improve spawning habitat attributes, they are unlikely to adversely affect spawning group distributions or within-population spatial structure. Similarly, because the proposed action does not affect basic demographic processes through human selection, alter environmental processes by reducing environmental complexity, or otherwise limit a population's ability to respond to natural selection, the action will not adversely affect population diversity.

At the species level, biological effects are synonymous with those at the population level or, more likely, are the integrated demographic response of one or more subpopulations (McElhany *et al.* 2000). Because the likely adverse effects of any action funded or carried out under this Opinion will not adversely affect the VSP characteristics of any salmon or steelhead population, or the productivity of southern green sturgeon or eulachon populations, the proposed actions also will not have any adverse effects at the species level.

The effects of proposed action, as a whole, on the 21 species considered in this Opinion will be the combined effects of all of the individual actions that are funded or carried out under this Opinion. Combining the effects of many actions does not change the nature of the effects caused by individual actions, but does require an analysis of the additive effects of multiple occurrences of the same type of effects at the individual fish, population, and species scales. If the adverse effects of one action are added to the effects of one or more additional actions in the same place and time, individual fish may experience a more significant adverse effect than if only one action was present. This would occur when the action area for two or more recovery actions overlap, *i.e.* , are placed within 100 to 300 feet of each other and are constructed at approximately the same time.

Monitoring information shows that up to 21 restoration actions per year have been completed under the 2004 NOAARC Opinion, with far fewer being completed in any single recovery domain. While those numbers have not significantly increased from year to year, recent economic stimulus legislation included hundreds of millions of dollars for "habitat restoration and mitigation activities" that are likely to support an increase in the level of these activities. Even if the number of restoration actions statewide increases three times, to include 63 actions per year, it is very unlikely that two or more would occur within 100 to 300 feet of each other. Further, the strong emphasis on use of proposed PDCs to minimize the short-term adverse effects of these actions, the small size of individual action areas, and the design of actions that are likely to result in a long-term improvement in the function and conservation value of each action area will ensure that individual fish will not suffer greater adverse effects if two or more action areas do overlap. Moreover, the rapid onset of beneficial effects from these types of actions is likely to improve the baseline for subsequent actions so that adverse effects are not likely to be additive at the population or watershed scale.

Effects to Critical Habitat. Completion of each action is likely to have the following effects to the PCEs or habitat qualities essential to the conservation of each species. These effects will vary somewhat in degree between actions because of differences in the scope of construction at each, and in the current condition of PCEs and the factors responsible for those conditions. This assumption is based all of the actions being based on the same set of underlying construction actions, and the PCEs and conservation needs identified for each species are also essentially the same. In general, ephemeral effects are likely to last for hours or days, short-term effects are likely to last for weeks, and long-term effects are likely to last for months, years or decades. Actions with more significant construction component are likely to adversely affect larger areas, and to take a longer time to recover, than actions based in restoration of a single habitat element. However, they are also likely to have correspondingly greater conservation benefits.

1. Freshwater – spawning, juvenile rearing, adult and juvenile migration

- **a. Access, free of artificial obstructions, free passage, migratory corridor.** Short-term decrease due work area isolation, and a long-term increase in access into tributaries, floodplain habitats like side channels, off-channel ponds, wetlands, and main channels due to (1) removal of barriers to fish passage, (2) an improvement in access due to other actions that remove velocity barriers by restoring floodplain functions, and that reduce sites for predators to rest and hide.
- **b. Cover/shelter, natural cover.** Short-term decrease due riparian area and channel disturbance, and a long-term increase due to improved riparian function and floodplain connectivity, and increased stream habitat diversity and complexity.
- **c. Floodplain connectivity.** Short-term decrease due to increased soil compaction and riparian disturbance, and a long-term improvement due to (1) increased overbank flow, greater groundwater recharge and sediment storage in the floodplain, (2) increased storage of flood water, (3) attenuation of sediment transport downstream due to greater channel complexity, increased shoreline length, increased interaction with the active channel, increased width of the riparian corridor, and increased riparian function (increased abundance and retention of wood, increased organic material supply, filtering of sediment and nutrient inputs, nutrient cycling).
- **d. Food resources, forage.** Short-term decrease due riparian and channel disturbance, and a long-term increase in food resources and forage due to improved habitat diversity and complexity, improved riparian function and floodplain connectivity, and increased leaf litter retention.
- **e. Riparian vegetation.** Short-term decrease due riparian disturbance, and a long-term improvement due to (1) shift in vegetative community composition and distribution toward more native species; (2) increased width of the riparian corridor.
- **f. Sediment quality, substrate type or size.** Short-term degradation due to restoration construction effects, stream channel entry and substrate compaction, and a long-term improvement due to attenuation of sediment transport downstream due to (1) sediment storage, (2) greater stream channel complexity, (3) increased shoreline length, stabilization of stream channels due to chronic erosion or sediment deposition.
- **g. Space**. See access, above.
- **h. Spawning gravel**. See sediment quality, above.

i. **Water quality, temperature, velocity**. Short-term decrease in water quality, increase in temperature, and increase in velocity due riparian and channel disturbance, and a long-term change in energy distribution within and between the channel and floodplain toward more natural flow velocity, and reduced flood potential to downstream areas due to increased storage of flood water, greater channel complexity and increased shoreline length.

j. **Water quantity, depth**. Little or no short-term effect on water quantity or depth; long-term reduction in flood potential in downstream areas due to greater storage and delayed release of flood water, greater channel complexity, and increased shoreline length.

2. **Estuarine areas**

a. **Forage.** Short-term decrease due to restoration construction effects; long-term increased foraging habitat abundance from reestablishing historical distributary channels that increase in size after tidal flows are allowed to inundate and scour twice a day, increased width of the riparian corridor to produce forage, increased fish access into tributaries and floodplain habitats (side channels, off-channel ponds and wetlands) to forage, and increased estuarine food production.

b. **Free of obstruction, free passage.** Short-term decrease due to restoration construction effects; long-term increase due to restoration of an estuarine transition zone (tidal currents, temperature, salinity) for fish migrating through the tidal zone, restoration of estuarine functions of temperature, tidal currents, and salinity, and reduced sites for avian predator resting and hunting.

c. **Natural cover.** Short-term decrease due to restoration construction effects, long-term increase due to: (1) shift in vegetative community composition and distribution toward more native species, including salt marsh species; (2) reestablishment of cover in historical distributary channels; (3) increase riparian vegetation and habitat complexity; (4) increased fish access for cover habitat in tributaries and floodplain habitats; (5) reduced filling of estuaries by fine sediment due to increases in overbank storage of fine sediments.

d. **Salinity.** No short-term effect, and a small long-term effect towards more pre-development salinity conditions due to restoration of estuarine functions related to groundwater connections and tidal circulation.

e. **Water quality.** As above.

f. **Water quantity.** As above.

3. **Marine areas – for growth and development to adulthood**

a. **Free passage.** No effect.

b. **Water quality.** No effect

c. **Water quantity.** No effect.

d. **Forage.** No effect.

e. **Natural cover.** No effect.

As noted above, relatively few restoration actions in a single recovery domain have been completed using the prior version of this Opinion in a single year. It is unlikely, but not impossible, that two or more actions per year would occur in a single 5th field watershed. The intensity of the predicted effects within the action area, in terms of the total condition and value of PCEs after each action is completed, and the severity of the effects, given the recovery rate for those same PCEs, are such that the function of PCEs and the conservation value of critical habitat are likely to be only impaired for a short time due to restoration actions funded or carried out under this Opinion. The PCE conditions in each action area are likely to quickly return to, or exceed, pre-action levels. Thus, it is unlikely that several actions within the same watershed, or even within the same action area, would have an important adverse effect on the function of PCEs or the conservation value of critical habitat at the action area, watershed, or designation scales.

As noted above, the long-term effectiveness of habitat restoration actions, in general, have not been well documented. In part, this is because they often concentrate on instream habitat without addressing the processes that led to the loss of the habitat (see Fox 1992, Zedler 1996, Simenstad and Thom 1996, Cederholm *et al.* 1997, and Roper *et al.* 1997). Nevertheless, the proposed actions are reasonably certain to lead to some degree of ecological recovery within each action area, including the establishment or restoration of environmental conditions associated with functional habitat and high conservation value. Fish passage improvement actions, in particular, may have long-term beneficial effects at the watershed or designation-wide scale.

Cumulative Effects

Between 2000 and 2008, the combined population of Oregon, Washington, and Idaho grew from 10.6 to 11.9 million, an increase of approximately 9%.[19] Each of the three states grew by about the same percentage (9%), and the population is projected to grow at a similar rate for the next 5 years. The NMFS assumes that future private and state actions will continue within the action areas, increasing as population rises.

The most common activities reasonably certain to occur in the action areas addressed by this consultation are agricultural activities, operation of non-Federal hydropower facilities, urban and suburban development, recreational activities, logging, road construction and maintenance, and metals and gravel mining. Many of these activities are not subject to ESA consultation and would result in some adverse effects to salmon, steelhead, and their habitat. Some of the activities, such as logging and development, are subject to regulation under state programs, and the effects to fish and stream habitats are reduced to varying degrees under these programs. These activities will result in negative effects to abundance, productivity, and spatial structure of salmon and steelhead at the population scale, and result in some degradation of the condition of critical habitat PCEs.

Throughout Oregon, Washington, and Idaho, watershed councils, Native American tribes, local municipalities, conservation groups, and others will continue to carry out restoration projects in support of salmon and steelhead recovery. Many of these actions will be covered by this consultation, or by future individual consultations, in which cases their effects will not be cumulative effects. Some of the private or state-funded actions for which funding commitments and necessary approvals already exist will not undergo consultation, and will result in beneficial cumulative effects. These beneficial effects will be similar to those described in the Effects to Listed Species section of this Opinion. These effects will result in small improvements to

[19] Source: U.S. Bureau of the Census, Washington, D.C.

abundance, productivity, and spatial structure of salmon and steelhead at the population scale, and result in some improvement to the condition of critical habitat PCEs.

When considered together, these cumulative effects are likely to have a small negative effect on salmon and steelhead population abundance, productivity, and spatial structure. Similarly, the condition of critical habitat PCEs will be slightly degraded by the cumulative effects.

Conclusion

After reviewing the best available scientific and commercial information available regarding the current status of the 21 species considered in this Opinion (*i.e*., LCR Chinook salmon, UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, PS Chinook salmon, CR chum salmon, HC summer-run chum salmon, LCR coho salmon, OC coho salmon, SONCC coho salmon, LO sockeye salmon, SR sockeye salmon, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, PS steelhead, southern green sturgeon, and eulachon), the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of these species, and is not likely to destroy or adversely modify their designated critical habitats. These conclusions are based on the following considerations.

Of those species and populations for which viability has been assessed by a TRT, virtually all face a moderate to very high risk of extinction. Although NMFS considers variation in ocean productivity to be the most important natural phenomenon affecting the productivity of these species – except southern green sturgeon, for which loss of spawning area is the greatest factor for decline – NMFS identified many other factors associated with the freshwater phase of their life cycle that are also limiting the recovery of these species. These factors include, but are not limited to, elevated water temperatures; excessive sediment; reduced access to spawning and rearing areas; reductions in habitat complexity, instream wood, and channel stability; degraded floodplain structure and function, and reduced flow. CHART teams determined that most designated critical habitat for ESA-listed salmon and steelhead has a high conservation value, based largely on its restoration potential. Baseline conditions for these PCEs vary widely, from poor to excellent.

The programmatic nature of the action prevents a precise analysis of each action that eventually will be funded or carried out under this Opinion, although each type of action will be carefully designed and constrained by comprehensive design criteria such that construction will cause only short-term, localized, and minor exacerbation of factors limiting the viability of the listed species. Also, actions are likely to be widely distributed across all recovery domains in Oregon, Washington and Idaho, so adverse effects will not be concentrated in time or space within the range of any listed species. In the long term, these restoration actions will contribute to a lessening of many of the factors limiting the recovery of these species, particularly those factors related to fish passage, degraded floodplain connectivity, reduced aquatic habitat complexity, and riparian conditions, and improve the currently-degraded environmental baseline, particularly at the site scale. A very small number of individual fish, far too few to affect the abundance, productivity, distribution, or genetic diversity of any salmon or steelhead population, will be affected by the adverse effects of any single action permitted under the proposed action. Because the VSP characteristics at the population scale will not be affected, the likelihood of survival and recovery of the listed species will not be appreciably reduced by the proposed action. Similarly, the short-term adverse effects of each action on PCEs are likely to be relatively brief (lasting days to weeks) and mild, while the long-term effects (lasting weeks to years) are likely to contribute to lessening of the factors limiting the recovery of these species during the freshwater phase of their life cycle.

Conservation Recommendations

Section 7 (a) (1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. The following conservation recommendations are discretionary measures that NMFS believes are consistent with this obligation and therefore should be carried out by NOAARC:

1. The effectiveness of some types of stream restoration actions are not well documented, partly because decisions about which restoration actions deserve support do not always address the underlying processes that led to habitat loss. NMFS recommends that NOAARC encourage applicants to use species recovery plans to help ensure that their actions will address the underlying processes that limit fish recovery.

2. NMFS also recommends that NOAARC evaluate whether the regulatory streamlining provided by this Opinion influences the design of restoration actions, or acts as an incentive that increases the likelihood that restoration actions will be completed.

Please notify NMFS if NOAARC carries out these recommendations so that we will be kept informed of actions that minimize or avoid adverse effects and those that benefit the listed species or their designated critical habitats.

Reinitiation of Consultation

Reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and (a) the amount or extent of taking specified in the Incidental Take Statement is exceeded, (b) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered, (c) the identified action is subsequently modified in a manner that has an effect to the listed species or critical habitat that was not considered in the biological opinion; or (d) a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16).

Failure to provide timely reporting may constitute a modification of the programmatic consultation that has an effect to listed species or critical habitat that was not considered in the biological opinion and thus may require reinitiation of this consultation. This programmatic consultation expires 5 years from the date of issuance. New actions should not be funded or carried out under this consultation after this date. To reinitiate consultation, contact the Oregon

State Habitat Office of NMFS and refer to the NMFS Number assigned to this consultation (2007/09078).

Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering. "Harass" is defined by the Fish and Wildlife Service as an intentional or negligent act or omission that creates the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Section 7(o)(2) provides that any incidental take that is in compliance with the reasonable and prudent measures and terms and conditions specified in a written take statement shall not be considered to be a prohibited taking of the species concerned.

Take prohibitions of the ESA do not apply to a species until it is listed and, if listed as threatened, protective regulations are in effect. Therefore, this incidental take statement does not apply to southern green sturgeon until protective regulations are in place. Moreover, this incidental take statement does not apply to eulachon until after the listing process is complete, protective regulations are in effect, and this conference opinion is confirmed by NMFS as a biological opinion issued through formal consultation.

Amount or Extent of Take

The proposed restoration actions will occur beside and within streams and estuaries occupied by the following ESA-listed and proposed species: LCR Chinook salmon, UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, PS Chinook salmon, CR chum salmon, Hood Canal summer-run chum salmon, LCR coho salmon, OC coho salmon, SONCC coho salmon, LO sockeye salmon, SR sockeye salmon, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, PS steelhead, southern green sturgeon, and eulachon (proposed). As described below, each type of proposed action is likely to cause the incidental take of one or more of these species.

Juvenile life stages are most likely to be affected, although adults will sometimes also be present when the actions occur in coastal areas or the Willamette Valley, and when actions do not involve work within the active channel and therefore may not be constrained by application of an in-water work window. The habitat that will be affected by the proposed restoration actions will typically be marginal in quality, and will not be limited at the site-specific or watershed scale. High quality habitat that will be protected or restored by the proposed actions is less common and likely to play a key role in conservation of these species. Nonetheless, the proposed actions are reasonably certain to cause the following adverse effects and incidental take of the species noted above.

Juvenile fish will be captured during work area isolation necessary to minimize construction-related disturbance of streambank and channel areas caused by fish passage restoration; manual or mechanical plant control; juniper removal; livestock crossings or off-channel watering facilities; off- or side channel reconstruction; set-back of an existing berm, dike or levee; streambank restoration; water control structure removal; or wetland restoration. Some of those fish will be injured or killed. Disturbance that cannot be avoided by work area isolation, including during shellfish restoration, will lead to short-term increases in suspended sediment, temperature, dissolved oxygen demand and contaminants. For instream actions, these disturbances will also lead to short-term decreases in the functionality of physical habitat features, such as floodplain connectivity, natural cover, riparian vegetation, in-stream flow, stream substrate, space, and safe passage conditions. Those conditions will harm and harass adult and juvenile fish, increasing their likelihood of injury or death by denying them the opportunity to use the action area as they normally would for reproduction, rearing, feeding, or migration, thus reducing their energy reserves and exposing them to an increased likelihood of predation, competition and disease.

Similarly, adult and juvenile fish will be harmed and harassed by the effects of construction-related disturbance of upland and riparian areas for actions related to plant control, juniper removal, upland livestock water facilities, and wetland restoration. The effects of those actions will include short-term reductions in water quality, as described above, but little or no physical effects on streambanks and channels. Those conditions will also harm and harass adult and juvenile fish as described above. Herbicide applications will result in herbicide drift or transportation into streams that will harass listed species by chemically impairing normal fish behavioral patterns related to feeding, rearing, and migration.

This incidental take will occur within a “take zone” that extends up to 150 feet upstream and 300 feet downstream from each action’s footprint for the duration of the construction period, commonly hours to months, and may continue intermittently for weeks, months, or years until riparian and floodplain vegetation are restored and a new topographic equilibrium is reached. In the accompanying biological opinion, NMFS determined that this level of incidental take is not likely to result in jeopardy to the listed species. Incidental take within this zone that meets the terms and conditions of this incidental take statement will be exempt from the taking prohibition.

Monitoring information shows that no more than 21 actions per year have been completed under the prior NOAARC programmatic Opinion. As noted above, however, due to an increased emphasis on completion of recovery actions as various salmon and steelhead recovery planning products are becoming available, and to recent Congressional appropriations for habitat restoration and mitigation activities, NMFS assumes that the maximum number of actions funded or carried out each year under the proposed action may increase by a factor of three, up to a total of 63 actions per year.

Capture of Juvenile Fish During In-water Work Area Isolation. NMFS assumes that of the 63 actions per year that are likely to be funded or carried out under this Opinion, (a) approximately 70% (*i.e*., 44 actions per year) will require in-water work area isolation; (b) each action requiring in-water work area isolation is likely to result in the capture of l00 or fewer of the 21 ESA-listed salmon or steelhead species considered in this Opinion,[20] and (c) of those, less than 2% are likely to be injured or killed, including by delayed mortality, and the remainder are likely to survive with no long-term adverse effects. Thus, NMFS anticipates that up to 4,410 juvenile individuals of the salmon and steelhead species considered in the consultation will be captured, per year, and up to 88 juvenile individuals will be injured or killed, per year, (*i.e*., 63 x 0.70 x 100 = 4,410; and 4,410 x 0.02 = 88) as a result of work necessary to isolate in-water construction areas. Because these fish are from different species that are similar to each other in appearance and life history, and to unlisted species that occupy the same area, it is not possible to assign this take to individual species. NMFS does not anticipate that any adult fish will be taken in this manner.

Habitat-related Effects. Take caused by the habitat-related effects of this action cannot be accurately quantified as a number of fish because the distribution and abundance of fish that occur within an action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional and operate across far broader temporal and spatial scales than will be affected by the proposed action. Thus, the distribution and abundance of fish within each action area cannot be predicted precisely based on existing habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be harmed or harassed if their habitat is modified or degraded by the proposed action. In such circumstances, NMFS uses the causal link established between the activity and the likely changes in habitat conditions affecting the listed species to describe the extent of take as a numerical level of habitat disturbance.

Construction-related disturbance of streambank and channel areas. The best available indicator for the extent of take due to construction-related disturbance of streambank and channel areas is the total length of stream reach that will be modified by construction each year. This variable is proportional to the amounts of harm and harassment that each action is likely to cause through short-term degradation of water quality and physical habitat. NMFS assumes that up 63 actions per year may be funded or carried out under this Opinion, and that each action may modify up to 300 lineal feet of riparian and shallow-water habitat; therefore, the extent of take for this group of actions is 18,900 linear stream feet per year.

Construction-related disturbance of upland areas, riparian areas, wetland areas, and piling removal. The best available indicator for the extent of take due to construction-related disturbance of upland areas (including actions related to manual and mechanical plant control, juniper removal, upland livestock water facilities, and bank restoration), riparian areas, wetland restoration, and during piling removal is a visible increase in suspended sediment. This variable is proportional to the water quality impairment those actions will cause, including increased

[20]Because of the large size of subadult and adult southern green sturgeon, NMFS assumes that they are not likely to be captured during in-water work area isolation. Juvenile and adult eulachon may be captured in this way but, due to the recent listing of eulachon, monitoring data are not yet available to estimate how many.

sediment, temperature, and contaminants, and reduced dissolved oxygen. NMFS assumes that an increase in sediment will be visible in the immediate vicinity of the action area and for a distance downstream, and the distance that increased sediment will be visible is proportionate both to the size of the disturbance and to the width of the wetted stream as follows (see Rosetta 2005), and whether the area is subject to tidal or coastal scour. Therefore, the extent of take for this category is as follows – a visible increase in suspended sediment up to 50 feet from the project area in streams that are 30 feet wide or less, up to 100 feet from the discharge point or nonpoint source of runoff for streams between 30 and 100 feet wide, up to 200 feet from the discharge point or nonpoint source for streams greater than 100 feet wide, or up to 300 feet from the discharge point or nonpoint source for areas subject to tidal or coastal scour.

Application of herbicides. Direct measurement of herbicide transport using the most commonly accepted method of residue analysis (*e.g*., liquid chromatography–mass spectrometry; Pico *et al.* 2004) are burdensome and expensive for the type and scale of herbicide applications proposed. Thus, use of those measurements in this take statement as an extent of take indicator is likely to outweigh any benefits of using herbicide as a simple and economical restoration tool, and act as an insurmountable disincentive to their use for plant control under this Opinion. Further, the use of simpler, indirect methods, such as olfactometric tests, do not correlate well with measured levels of the airborne pesticides, and may raise ethical questions (Brown *et al.* 2000) that cannot be resolved in consultation. Therefore, the best available indicators for the extent of take due to the proposed application of herbicides, *i.e*., herbicide applications within riparian areas, is the extent of treated areas, which will be up to 10 acres above bankfull elevation and 2 acres below bankfull elevation, per 1.6 mile reach of any stream, per year.

In summary, the best available indicators for the extent of take for these proposed actions are as follows: ***(a) for actions that involve construction-related disturbance of streambank and channel,*** the extent of take indicator is 16,800 linear stream feet per year; ***(b) for actions that involve construction-related disturbance of upland areas, riparian areas, wetland areas, and piling removal,*** the extent of take indicator is an increase of visible sediment beyond the discharge point or nonpoint source of runoff; and ***(c) for actions that involve application of herbicide within the riparian area,*** the extent of take indicator is a treated area of up to 10 acres above bankfull elevation and 2 acres below bankfull elevation, per 1.6 mile reach of any stream, per year.

NMFS assumes that the proposed actions will continue to be distributed among the recovery domains in the same proportion as in the past and has assigned this take to individual recovery domains whenever possible (Table 26).

In the accompanying Opinion, NMFS determined that this level of incidental take is not likely to result in jeopardy to the listed species.

Table 26. Indicators for the amount and extent of take, per year, by recovery domain – additional indicators for extent of take based on visible sediment discharge and herbicide application area apply to each action.)

RECOVERY DOMAIN Estimated number of actions per year (total = 63)	AMOUNT OF TAKE PER YEAR Juvenile fish captured during in-water work area isolation (total = 4,410)	EXTENT OF TAKE PER YEAR Linear feet of stream reach modified (total = 16,800)
Puget Sound, 30	2,073	7,896
Willamette/Lower Columbia, 6	441	1,680
Interior Columbia , 11	794	3,024
Oregon Coast, 13	926	3,528
Southern Oregon/Northern California Coasts, 3	176	672

Reasonable and Prudent Measures

The following measures are necessary and appropriate to minimize the impact of incidental take of listed species from the proposed action.

The NOAARC shall:

1. Minimize incidental take from administration of the programmatic biological opinion on NOAA Restoration Center Northwest activities by ensuring that the PDCs are used in all actions funded or carried out using this approach.

2. Ensure completion of a comprehensive monitoring and reporting program regarding all actions funded or carried out using the programmatic biological opinion on NOAA Restoration Center Northwest activities.

The measures described below are non-discretionary, and must be undertaken by NOAARC or, if an applicant is involved, must become binding conditions of any funding provided to the applicant, for the exemption in section 7(o) (2) to apply. The NOAARC has a continuing duty to regulate the activity covered by this incidental take statement. If NOAARC (1) fails to assume and implement the terms and conditions or (2) fails to require an applicant to adhere to the terms and conditions of the incidental take statement through funding conditions, the protective coverage of section 7(o) (2) may lapse. To monitor the impact of incidental take, NOAARC or applicant must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement.

1. To implement reasonable and prudent measure #1 (design criteria), NOAARC shall ensure that:
   a. Every action funded or carried out under this Opinion will be administered by NOAARC consistent with design criteria 1 through 10.
   b. For each action with a general construction element, NOAARC will apply design criteria 11 through 27 as conditions of funding.
   c. For specific types of actions, NOAARC will apply design criteria 27 through 62 as appropriate, as conditions of funding.

2. To implement reasonable and prudent measure #2 (monitoring and reporting), NOAARC shall ensure that:

   a. The NOAARC will submit a monitoring report to NMFS by February 15 each year that describes NOAARC's efforts to carry out this Opinion. The report will include an assessment of overall program activity, a map showing the location and type of each action funded or carried out under this Opinion, and any other data or analyses NOAARC deems necessary or helpful to assess habitat trends as a result of actions completed under this Opinion.
   b. The NOAARC will attend an annual coordination meeting with NMFS by March 31 each year to discuss the annual monitoring report and any actions that will improve conservation under this Opinion, or make the program more efficient or more accountable.
   c. If NOAARC chooses to continue programmatic coverage under this Opinion, it will reinitiate consultation within 5 years of the date of issuance.

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions, or proposed actions that may adversely affect EFH. Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that may be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council (PFMC) described and identified EFH for groundfish (PFMC 2005); coastal pelagic species (PFMC 1998b); and Chinook salmon, coho salmon, and Puget Sound pink salmon (PFMC 1999). The proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages of Chinook and coho salmon; groundfish; and coastal pelagic species. Based on information provided in the BA and the analysis of effects presented in the ESA portion of this document, NMFS concludes that the proposed action will have the following adverse effects to EFH designated for those species:

1. Freshwater EFH quantity will be reduced due to short-term construction effects, including reduced riparian permeability and increased riparian runoff, and will increase slightly over the long-term due to improved riparian function and floodplain connectivity.

2. Freshwater EFH quality will be reduced due to a short-term increase in turbidity, dissolved oxygen demand, and water temperature due to riparian and channel disturbance, and will improve over the long term due to improved riparian function and floodplain connectivity.

3. The quality of tributary substrate will be reduced in the short term due to increased compaction and sedimentation, and will increase over the long term due to gravel placement, increased sediment storage from boulders and large wood.

4. Floodplain connectivity will decrease in the short-term due to increased compaction and riparian disturbance during construction, and a will improve over the long term due to off- and side channel habitat restoration, set-back of existing berms, dikes, and levees, and removal of water control structures.

5. Forage availability will decrease in the short term due to riparian and channel disturbance, and improve over the long term due to improved habitat diversity and complexity, and improved riparian function and floodplain connectivity.

6. Natural cover will decrease in the short term due to riparian and channel disturbance, and increase in the long term due to improved habitat diversity and complexity, improved riparian function and floodplain connectivity, and off- and side channel habitat restoration.

7. Fish passage will be impaired in the short term due to decreased water quality and in-water work isolation, and improved over the long-term due to improved water quantity and quality, habitat diversity and complexity, forage, and natural cover.

8. Estuarine EFH may be temporarily reduced due to short-term increases in turbidity, benthic disturbance, and damage to submerged aquatic vegetation.

EFH Conservation Recommendations

The following three conservation recommendations are necessary to avoid, mitigate, or offset the impact of the proposed action on EFH. These conservation recommendations are a subset of the ESA terms and conditions:

1. The effectiveness of stream restoration actions is not well documented, partly because decisions about which restoration actions deserve support do not always address the underlying processes that led to habitat loss. Therefore, NMFS recommends that NOAARC encourage applicants to use species recovery plans to help ensure that their actions will address the underlying processes that limit fish recovery.

2. NMFS also recommends that NOAARC evaluate whether the availability of regulatory streamlining provided by this Opinion influences the design of restoration actions, or acts as an incentive that increases the likelihood that restoration actions will be completed.

3. As appropriate to each action issued a regulatory permit under this Opinion, NMFS recommends that NOAARC include the project design criteria for administration, construction, and types of actions as enforceable permit conditions, except 1 (confirm ESA-listed fish presence), 8 (salvage notice), 17 (fish capture and release) and 18 (electrofishing).

4. Some coastal pelagic species managed under the Coastal Pelagic Species Fishery Management Plan (CPFMP) spawn in estuaries (PFMC 1998) and depend on submerged aquatic vegetation beds. Pacific herring (*Clupea harengus pallasi*) and other coastal species lay adherent eggs on native eelgrass and other solid substrates. To avoid disruption of spawning activity and/or direct harm to eggs, shellfish restoration activities should be timed to avoid critical spawning and egg development periods for species managed under the CPFMP.

Statutory Response Requirement

Federal agencies are required to provide a detailed written response to NMFS' EFH conservation recommendations within 30 days of receipt of these recommendations [50 CFR 600.920(j) (1)]. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse affects of the activity on EFH. If the response is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations. The reasons must include the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the

EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

Supplemental Consultation

The NOAARC must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations [50 CFR 600.920(k)].

DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these Data Quality Act (DQA) components, documents compliance with the DQA, and certifies that this Opinion has undergone pre-dissemination review.

Utility: Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users.

Consultation by Federal agencies with NMFS is required under section 7 of the ESA whenever a Federal agency approves, funds or carries out an action that might affect a listed species. This consultation and Opinion was required under the ESA to determine whether a suite of habitat restoration actions funded or carried out by the NOAA Restoration Center would result in jeopardy for ESA-listed species. This Opinion provides non-discretionary terms and conditions designed to avoid and minimize impacts to listed species that may occur during implementation of certain restoration actions.

In addition, consultation is required under the MSA for any Federal action that could affect designated EFH for coho, pink, and Chinook salmon; groundfish; and coastal pelagic species. The EFH section in the Opinion includes EFH Conservation Recommendations that are adopted as mandatory.

The information contained in this Opinion is beneficial for grant recipients, consultants, contractors, and state and Federal agency staff. Individual copies were provided to the appropriate entities. This consultation will be posted on the NMFS Northwest Region website (http://www.nwr.noaa.gov) and on the Restoration Center website (http://www.nmfs.noaa.gov/habitat/restoration). The format and naming adheres to conventional standards for style.

Integrity: This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and

Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

Objectivity:

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01, et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.920(j).

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the Literature Cited section. The analyses in this Opinion/EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation; and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

LITERATURE CITED

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Appendices A-D

Appendix A: NOAARC PROGRAMMATIC EMAIL GUIDELINES

Use the NOAARC Programmatic email box (noaarc.biop.nwr@noaa.gov) to transmit the following information to NMFS regarding use of this NOAARC Programmatic Biological Opinion (Opinion): an Action Notification, an Action Withdrawal, an Action Completion Report, a Fish Salvage Report, or an Annual Program Report.

The following forms are provided for NOAARC use: Action Notification, Action Completion, and Fish Salvage. These forms must be submitted to the NOAARC Programmatic email box (noaarc.biop.nwr@noaa.gov) ***in pdf format.***

When transmitting an Action Notification that includes a request for NMFS review, NOAARC must ensure the final project is being submitted to avoid multiple submittals and withdrawals.

In rare occurrences, a withdrawal may be necessary and unavoidable. In this situation, please specify in the email subject line that the project is being withdrawn. There is no form for a withdrawal, simply state the reason for the withdrawal and submit to the email box, following the email titling conventions. If a previously-withdrawn notification is resubmitted later, this resubmittal will be regarded as a new action notification.

An automatic reply will be sent upon receipt, but no other communication will be sent from the programmatic email box; this box is used for **Incoming Only**. All other predecisional communication should be conducted **outside** the use of the noaarc.biop.nwr@noaa.gov email.

The NOAARC will send only **one** project per email submittal, and will attach all related documents. These documents **must be in pdf format** and will include the following:

1. Action Notification Form, the Action Completion Form, or the Salvage Report
2. Map(s) and project design drawings (if applicable)
3. Final project plan.

In the subject line of the email (see below for requirements), clearly identify the specific submittal category (action notification, project completion, withdrawal, or salvage report), and the Restoration Center Database number. The submitted documents must contain identifying information, including the Applicant Name, County, Waterway, and State.

Email Titling Conventions

Use caution when entering the necessary information in the subject line. **If these titling conventions are not used, the email will not be accepted.** Ensure that you clearly identify:

1. The specific submittal category: (a) Action Notification; (b) Action Completion Report; (c) Fish Salvage Report; or (d) Annual Report
2. Restoration Center Database number
3. Applicant Name
4. County
5. Waterway
6. State

Appendix B: NOAARC PROGRAMMATIC ACTION NOTIFICATION FORM

Submit this completed Action Notification Form ***in pdf format*** with the following information to NMFS at noaarc.biop.nwr@noaa.gov. The NOAARC programmatic biological opinion email box is to be used for **incoming only**.

Use the NMFS Public Consultation Tracking System-Consultation Initiation and Reporting System (CIRS) to submit this report when the online system becomes available.

NMFS Review and Approval. Any action that involves (a) diversion of surface water using gravity or by pumping at a rate that exceeds 3 cubic feet per second (cfs), or (b) a boulder weir or fish ladder for fish passage restoration, must be individually reviewed and approved by the appropriate state office of the NMFS Habitat Conservation Division before that action is funded or carried out. These reviews are best initiated in the context of informal consultation during the preliminary development project phase, when project team members are developing goals and objectives with stakeholders. When requested, NMFS will provide an estimate of the time necessary to complete the review based on the complexity of the proposed action and work load considerations at the time of the request. Approval may be delayed if a substandard design is submitted for review during the post-design or action implementation stage and significant revision is necessary.

NMFS Tracking #: 2007/09078

Action Identification:

1. Restoration Center Database #: ________________________
2. NOAARC contact person: ________________________
3. Action name: ________________________
4. Name and contact information for any other Federal agency or agencies for which NOAARC is acting as the lead for purposes of this consultation: ________________________________
5. The location of the action site by latitude and longitude (including decimal degrees), and 6th field HUC: ________________________
6. Planned start and end dates for the completion of any in-water work:
Start: ____________________ End: ________________________
7. For any action requiring a site assessment for contaminants, include a copy of the report explaining the likelihood that contaminants are present at the site.
8. For actions that involve (a) diversion of surface water using gravity or by pumping at a rate that exceeds 3 cubic feet per second (cfs), or (b) a boulder weir or fish ladder for fish passage restoration, include a copy of all comments or recommendations received as a result of the review. If the NMFS fish passage review is not complete before this action notification form is sent, use this form to request that review.
9. For actions that involve removal of a water control structure, include a copy of data and analysis as described in the water control structure removal design criteria.
10. Attach sufficient information to ensure that the proposed action fits all applicable design criteria and that all adverse effects to ESA-listed fish and their designated critical habitats are within the range of effects considered in this Opinion

11. **Type of Action:** *Identify the type of action proposed.*

☐ Fish passage restoration
☐ Invasive and non-native plant control
☐ Juniper tree removal
☐ Livestock crossings and off-channel watering facilities
☐ Off- and side channel habitat restoration
☐ Piling removal
☐ Set-back or remove existing berms, dikes, and levees
☐ Shellfish restoration
☐ Streambank restoration
☐ Water control structure removal
☐ Wetland restoration
☐ Road and trail erosion control and decommissioning

12. **NMFS Species/Critical Habitat Present in Action Area:** *Identify the species and critical habitats present in the action area (N/A means not applicable):*

Species	*Critical Habitat*	
☐	☐	LCR Chinook salmon
☐	☐	UWR Chinook salmon
☐	☐	UCR spring-run Chinook salmon
☐	☐	SR spring/summer run Chinook salmon
☐	☐	SR fall-run Chinook salmon
☐	☐	PS Chinook salmon
☐	☐	CR chum salmon
☐	☐	HC summer-run chum salmon
☐	☐	LCR coho salmon
☐	☐	OC coho salmon
☐	☐	SONCC coho salmon
☐	☐	LO sockeye salmon
☐	☐	SR sockeye salmon
☐	☐	LCR steelhead
☐	☐	UWR steelhead
☐	☐	MCR steelhead
☐	☐	UCR steelhead
☐	☐	SRB steelhead
☐	N/A	PS steelhead
☐	☐	southern green sturgeon
☐	N/A	eulachon

13. **<u>Terms and Conditions:</u>** *Check the terms and conditions from the biological opinion that will be included as conditions for any action funded or carried out under this Opinion.*

Administration

- ☐ NOAARC review
- ☐ Request for NMFS fish passage review
- ☐ Action completion
- ☐ Site access
- ☐ Annual program report
- ☐ Site assessment for contaminants
- ☐ NMFS notification
- ☐ Funding conditions
- ☐ Salvage notice
- ☐ Reinitiation

General Construction

- ☐ Flagging sensitive areas
- ☐ Temporary access roads
- ☐ In-water work period
- ☐ Capture and release
- ☐ Construction water
- ☐ Erosion and pollution control plan
- ☐ Vehicle staging and use
- ☐ Work from top of bank
- ☐ Temporary erosion controls
- ☐ Fish passage
- ☐ Work area isolation
- ☐ Electrofishing
- ☐ Fish screens
- ☐ Choice of equipment
- ☐ Stationary power equipment
- ☐ Site restoration

Types of Actions

<u>Fish Passage Restoration</u>

- ☐ Boulder weir and fish ladder review and approval
- ☐ Culvert removal and replacement

<u>Invasive and Non-native Plant Control</u>

- ☐ Non-herbicide methods
- ☐ Maximum herbicide treatment area
- ☐ Herbicide transportation and safety plan
- ☐ Approved herbicide adjuvenants
- ☐ Herbicide mixing
- ☐ Approved herbicide application methods
- ☐ Required herbicide buffer distances
- ☐ Power equipment
- ☐ Herbicide applicator qualifications
- ☐ Approved herbicides
- ☐ Approved herbicide carriers
- ☐ Approved herbicide application rates
- ☐ Minimize herbicide drift and leaching

<u>Juniper Tree Removal</u>

- ☐ Approved juniper tree removal methods
- ☐ Management of juniper slash

<u>Livestock Stream Crossings and Off-Channel Livestock Watering Facilities</u>

- ☐ Livestock stream crossings
- ☐ Off-channel livestock watering facilities

<u>Off- and Side Channel Habitat Restoration</u>

- ☐ Off- and side channel habitat restoration

<u>Piling Removal</u>

- ☐ Piling removal
- ☐ Broken piles

Set-back or Removal of Existing Berm, Dike, and Levee

☐ Set-back existing berm, dike, and levee approval

Shellfish Restoration

☐ Shell sources
☐ Native species
☐ Substrate enhancement in submerged aquatic vegetation

Streambank Restoration

☐ Streambank shaping
☐ Large wood
☐ Planting or installing vegetation
☐ Fencing
☐ Soil reinforcement
☐ Use of rock in streambank restoration
☐ Fertilizer

Water Control Structure Removal

☐ Water control structure removal

Wetland Restoration

☐ Wetland restoration

Appendix C: NOAARC PROGRAMMATIC ACTION COMPLETION FORM

Within 60 days of completing all work below ordinary high water (OHW) as part of an action completed under NOAARC programmatic biological opinion, submit the completed Action Completion Form ***in pdf format*** with the following information to NMFS at noaarc.biop.nwr@noaa.gov.

Use the NMFS Public Consultation Tracking System-Consultation Initiation and Reporting System (CIRS) to submit this report when the online system becomes available.

NMFS Tracking #: 2007/09078

1. Restoration Center Data Base #: ______________________________________
2. NOAARC Contact Person: ______________________________________
3. Action Name: ______________________________________
4. The name and contact person of any other Federal agency or agencies for which NOAARC is acting as the lead for purposes of this consultation: ________________________
5. The type of activity: ______________________________________
6. The location of the action site by latitude and longitude (including decimal degrees), and 6th field HUC: ______________________________________
7. Actual start and end dates for the completion of in-water work:
Start: ____________________ End: __________________________
8. For any action involving water control structure removal – a copy of information used to satisfy the data requirements and analysis for structure removal as described below in the design criteria for the water control structure removal.
9. Photos of habitat conditions before, during, and after action completion.
10. Any dates work ceased due to high flows.
11. Evidence of compliance with fish screen criteria (NMFS 2008, or most recent version) for any pump used.
12. A summary of the results of pollution and erosion control inspections, including any erosion control failure, contaminant release, and correction effort.
13. The number, type, and diameter of any pilings removed or broken during removal.
14. A description of any riparian area cleared within 150 feet of OHW.
15. For action involving bank alteration, the linear feet of bank alteration.
16. For upland and wetland actions that do not have an in-water work component, a description of turbidity monitoring results.
17. For actions involving herbicides, the number of acres above bankfull elevation and below bankfull elevation treated per 1.6 mile reach of a stream, the herbicides used, application methods, and riparian buffer applied.
18. A description of site restoration.
19. A completed fish salvage reporting form (see Appendices A and D) for any action that requires fish salvage.

Appendix D: NOAARC Programmatic Fish Salvage Reporting Form

Within 10 days of completing a capture and release as part of an action completed under the NOAARC programmatic biological opinion, the applicant or must submit a complete Salvage Reporting Form, or its equivalent, ***in pdf format*** with the following information to NMFS at noaarc.biop.nwr@noaa.gov.

Use the NMFS Public Consultation Tracking System-Consultation Initiation and Reporting System (CIRS) to submit this report when the online system becomes available.

NMFS Tracking #: 2007/09078

1. Restoration Center Database #: ________________________________
2. NOAARC Contact Person: ________________________________
3. Action name: ________________________________
4. Date of fish salvage operation: ________________________________
5. Supervisory fish biologist (name, address, and telephone number):
   ____
6. A description of methods used to isolate the work area, remove fish, minimize adverse effects on fish, and evaluate their effectiveness.
7. A description of the stream conditions before and following placement and removal of barriers.
8. A description of the number of fish captured, release site, condition at release, number injured, and number killed by species.