

## Overview

This volume sets forth local actions for recovering salmon and steelhead and enhancing other fish and wildlife species within each subbasin addressed by this plan. The subbasin-specific strategies and measures supplement or refine the regional strategies and actions discussed in the Strategies and Measures chapter of Volume I. It should be noted that the lower Columbia River mainstem and estuary subbasin description follows a different format than all other subbasins for three primary reasons: 1) a lack of habitat data consistent with the other subbasins, 2) the unique role of the lower mainstem and estuary for all salmonid populations in the Columbia River basin, and 3) the joint planning and recovery effort with the State of Oregon.

This volume provides for each subbasin:

- An overview or summary of the subbasin description, the species of interest, biological objectives, limiting factors and threats, strategies and measures, programs, and implementation plans.
- Biological objectives and descriptions of salmonids, other fish, and wildlife species of interest in each basin. For salmon and steelhead the goals are taken from the Regional Recovery Scenario discussed in the Biological Objectives chapter of Volume I of the Management Plan. Biological goals for other fish and wildlife species are also described in the Biological Objectives chapter.
- Estimates of the relative contribution of various limiting factors to the decline in status of fish populations. For salmonids, this discussion includes both in-basin and out-of-basin threats and limiting factors.
- Proposed strategies and measures for addressing the threats and limiting factors and achieving subbasin biological goals. These include subbasin stream and watershed habitats, estuary and lower Columbia mainstem habitats, hydropower, harvest, hatcheries and ecological interactions. Salmonid strategies and measures supplement broader regional strategies and measures.
- An evaluation of existing federal, state, and local programs that play varying roles in implementing the strategies and measures.

This volume focuses on subbasin-specific actions that support regional recovery goals. Anadromous fish populations will benefit from local actions in the subbasin of origin as well as regional actions that affect out-of-subbasin factors. Strategies and actions that address harvest, hatcheries, Columbia River mainstem habitat, estuary habitat, and ecological interactions are primarily regional in nature and are covered extensively in Volume I of this plan. Subbasin chapters represent the relative significance of each factor category for each population to place in-basin and out-of-basin factors into perspective. Volume II concentrates on actions to be implemented within the confines of each subbasin. These include actions tailored for specific local threats and regional actions with subbasin components. Local habitat threats and actions are a particular emphasis in this subbasin volume. The intent is to tailor regional strategies for habitat protection and restoration to the specific features of each subbasin.

Habitat attributes and conditions in each subbasin are identified, described, and analyzed in the Technical Foundation. Within the estuary and mainstem, we currently lack the tools to relate

physical processes and conditions to biological responses of focal species; thus, objectives and strategies for the estuary and mainstem subbasins have been developed based on the best available data and professional judgement. For other subbasins, stream and watershed processes were analyzed using the Ecosystem Diagnosis and Treatment (EDT) model and the Integrated Watershed Assessment (IWA) approach. The analytical results were integrated with the plan's biological objectives to prioritize subwatersheds, reaches, and habitat attributes for protection and/or restoration. Designation of priority areas is based on species, population recovery targets, fish distribution, critical life history stages, current habitat conditions, and the potential benefits in fish population performance that could be expected by protecting or restoring habitat. Habitat measures included in this plan address the most important limiting factors in the most critical areas for focal species within each subbasin. This plan also includes a description of the programs that are currently in place to address limiting factors. Where limiting factors are not being adequately addressed by current programs, the gaps are identified and opportunities for addressing the gaps are discussed.

The following sections summarize the components that are found in each of the subbasin chapters in this volume. For each subbasin component, descriptions are given as to the type of information that is presented, how the information ties in with other components, source and methods for deriving the information, and references to other Recovery Plan sections where more detailed information can be found.

## **Basin Overview**

The basin overview provides a general orientation to the basin and also serves as a summary of other subbasin components. This section introduces the reader to the biophysical characteristics of the river basin with respect to factors that affect fish and wildlife species. The information is intended to set the stage for discussions of species, limiting factors, and threats that follow. Maps and statistics of land ownership and land-use patterns provide context for discussions of human impacts to habitat and habitat-forming processes, both within river corridors and across the landscape. Information on the magnitude and direction of human population growth is presented because of its use in estimating trends in habitat impacts and for identifying areas for habitat preservation measures. Also included in these sections is a general overview of the programs that are in place within the basin and how effective these programs are at addressing key limiting factors. Not only does the overview summarize information presented in other chapter components, but it also summarizes information contained in the subbasin chapters of the Technical Foundation Volume II. Interested readers are referred to those chapters for additional detail.

## **Species of Interest**

The species of interest section provides brief summaries of the focal species that are found within the basin. These include anadromous salmonids as well as other species of interest. The section begins with a description of the biological objectives for salmon and steelhead. The objectives are followed by discussions of the individual populations, with reference to population abundance, productivity, life history characteristics, distribution, and hatchery influence. Much of this information is a summary of the Focal Fish Species sections found in the subbasin chapters of Volume II of the Technical Foundation. Interested readers are referred to those chapters for additional detail, including species distribution maps.

All Columbia Basin anadromous fish utilize the lower Columbia migration corridor and the estuary habitat as juveniles and adults. Historical abundance of wild salmon and steelhead has declined significantly, however the current abundance of juveniles migrating through the lower Columbia to the estuary remains significant as a result of Columbia Basin hatchery production. In 1990, the combined wild and hatchery juvenile salmon and steelhead produced in the Columbia Basin was estimated at about 350 million fish. The abundance of wild lower Columbia white sturgeon and eulachon has fluctuated over the past 100 years, but current abundance may be within the range of historical levels. Pacific lamprey abundance has declined similar to salmon. There are no hatchery programs for lower Columbia white sturgeon, eulachon, or lamprey.

## **Potentially Manageable Impacts**

The potentially manageable impacts section provides a breakdown of the fish population impacts resulting from various human-induced mortality factors. These mortality factors include the 4-H's (hydropower, stream habitat, hatchery, and harvest) plus estuary and predation impacts (manageable). This information helps determine the relative level of recovery effort that is needed in each broad category of impact. The method for calculating the impact values can be found in the Technical Foundation Volume I, Chapter 5.

## **Limiting Factors, Threats, and Measures**

Limiting factors, threats, and measures are identified with respect to stream habitat, estuary and Columbia mainstem habitat, hydropower, harvest, hatcheries, and ecological interactions. A description of each of these categories follows:

### ***Hydropower Operations and Configuration***

This section describes the influence of hydropower operations on salmon and steelhead populations. The primary hydropower-related impacts stem from flow regulation and passage obstructions. The subbasins most affected by hydropower operations are the Cowlitz and Lewis rivers, and the Wind River (Bonneville Dam and Pool effects). Other populations are affected by mainstem Columbia hydro operations and flow regimes which affect habitat in migration corridors and in the estuary. Many of the measures needed to address hydropower impacts in the Cowlitz and Lewis subbasins are being developed as part of facility re-licensing negotiations between dam owners and the Federal Energy Regulatory Commission (FERC). Regional hydropower measures are identified in the Strategies and Measures chapter in Volume I.

### ***Harvest***

The harvest section describes the level of impact due to harvest in commercial and recreational fisheries. Harvest of lower Columbia River populations occurs in the ocean, estuary, Columbia mainstem, and within subbasins. With the exception of fall chinook, harvest has a relatively minor impact on lower Columbia populations. Harvest measures were first identified at the regional level (Strategies and Measures chapter – Management Plan Volume I) and are applied to individual subbasins in the Management Plan Volume II subbasin chapters.

### ***Hatcheries***

The hatchery discussion gives a general overview of the hatcheries operating in the subbasin and the degree of impact to native fish populations. Hatcheries can adversely affect wild fish through reductions in fitness, direct competition, and disease introduction. Hatchery measures were first identified at the regional level (Strategies and Measures chapter – Management Plan Volume I) and are applied to individual subbasins in the Management Plan Volume II subbasin chapters.

### ***Ecological Interactions***

Ecological interactions focus on how salmon and steelhead, other fish species, and wildlife interact with each other and the subbasin ecosystem. Issues include competition and predation associated with introduced fish species, nutrient dynamics (i.e., carcasses), and invasive plant and animal species. Many of these issues apply uniformly to all of the subbasins in the region, especially when they refer to out-of-basin interactions. In most cases, this section simply references the Recovery Plan sections where the effects of ecological interactions are evaluated.

### ***Habitat - Estuary and Lower Columbia Mainstem***

This section briefly summarizes the primary habitat conditions in the estuary and lower Columbia mainstem that affect the populations originating within the subbasin. Conditions in the estuary and mainstem Columbia affect all lower Columbia salmon and steelhead populations similarly, with the primary differences being length of mainstem travel and estuary residence times. In most cases, this section simply gives reference to the Recovery Plan sections that contain more in-depth discussions of estuary and mainstem Columbia impacts and measures to address them.

### ***Habitat - Subbasin Streams and Watersheds***

Subbasin habitat limiting factors, threats, and measures are identified for the areas of greatest priority to focal species. This information was generated in three phases:

- 1) Identification of spatial priorities,
- 2) Identification of limiting factors and threats in priority areas, and
- 3) Identification of the type and location of recovery measures that will best address the limiting factors and threats.

The first phase involved the identification of spatial priorities at the reach and subwatershed (7<sup>th</sup> field Hydrologic Unit Code) scale. Spatial priorities were first determined at the reach scale. Reach priorities reflect population importance as well as multi-species benefits. Reach-scale priorities were initially identified within individual populations (species) through the EDT Restoration and Preservation Analysis. This resulted in reaches grouped into categories of high, medium, and low priority for each population. See the subbasin chapters of Volume II of the Technical Foundation for additional information on reach priorities for individual populations.

Within a subbasin, reach rankings for all of the modeled populations were combined, using population designations as a weighting factor. Population designations have been determined from the Preferred Alternative Scenario evaluation process, a first take on designating populations according to their contribution to meeting Endangered Species Act (ESA) recovery

criteria. These population designations will continue to be refined throughout the course of recovery planning. The Preferred Alternative Scenario population designations are ‘primary’, ‘contributing’, and ‘stabilizing’, reflecting the level of emphasis that needs to be placed on population recovery in order to meet ESA recovery criteria. See the Biological Objectives chapter in Volume I of this Management Plan for more information on population designations.

Reaches were placed into tiers according to the following rules:

Tier 1: all high priority reaches for one or more primary populations;

Tier 2: all reaches not included in Tier 1 and which are medium priority reaches for one or more primary species and/or all high priority reaches for one or more contributing populations;

Tier 3: all reaches not included in Tiers 1 and 2 and which are medium priority reaches for contributing populations and/or high priority reaches for stabilizing populations; and

Tier 4: reaches not included in Tiers 1, 2, and 3 and which are medium priority reaches for stabilizing populations and/or low priority reaches for all populations.

Spatial priorities were also identified at the subwatershed scale. Subwatershed-scale priorities were directly determined by reach-scale priorities. Scaling up from reaches to the subwatershed level was done in recognition that actions to protect and restore critical reaches might need to occur in adjacent and/or upstream upland areas. For example, high sediment loads in a Tier 1 reach may originate in an upstream contributing subwatershed where sediment supply conditions are impaired because of current land use practices. Subwatersheds were ranked according to the following rules:

Group A: includes one or more Tier 1 reaches.

Group B: includes one or more Tier 2 reaches, but no Tier 1 reaches.

Group C: includes one or more Tier 3 reaches, but no Tier 1 or 2 reaches.

Group D: includes only Tier 4 reaches.

Spatial priority maps display the spatial priorities at both the reach scale and the subwatershed scale. Reach scale priorities are most useful for identifying habitat recovery measures in channels, floodplains, and riparian areas. Subwatershed scale priorities are most useful for identifying landscape level recovery measures that are intended to address watershed processes. Subwatershed-scale priorities can be used in conjunction with the IWA (see subbasin chapters in the Technical Foundation) to identify watershed process restoration and preservation opportunities.

In the subbasin chapters of this volume, we sometimes refer to general *areas* of a river basin as opposed to individual reaches or subwatersheds. Areas (as opposed to individual reaches) are used as a basis for the discussions for a number of reasons. First, in most basins, high priority reaches tend to be clustered in certain locations within the basin. This reflects the occurrence of unique biophysical characteristics and land-use patterns in different portions of a basin. Second, many recovery measures will affect multiple reaches in a given area as opposed to only impacting individual reaches. Third, grouping reaches allows for us to manage for the uncertainty that is inherent in the technical assessments by scaling back from a very high resolution (individual reaches) to a slightly coarser resolution (groups of reaches). For instance, a

short tier 4 reach (low priority) sandwiched between two tier 1 (high priority) reaches is likely affected by the same impacts to habitat as the surrounding reaches, despite its different designation. With reach groupings, this low priority reach would be considered together with its neighboring high priority reaches when limiting factors, threats, and measures are identified.

In most cases, only the areas with the lowest tier reaches (i.e., tier 1 or 2) were included as priority areas, since these represent the most important areas to emphasize for species recovery. Limiting factors and threats are specified for priority areas. Measures were also specified for priority areas, with reference given to individual high priority reaches in some cases. Tier 3, 4, and non-tiered reaches are considered secondary priority, except in cases where other information sources (i.e., sources other than those used to derive reach tiers) indicate significant impairment. Information on habitat conditions in areas of secondary priority can be found in the subbasin chapters in Volume II of the Technical Foundation.

A summary table is included in each subbasin chapter except for subbasins where EDT was not applied (Estuary Tributaries, Columbia Gorge Tributaries, and Little White Salmon). The summary table presents species-specific information within priority areas and also includes the watershed process impairment ratings. Its greatest utility has been to serve as a starting point for developing a scientifically-based list of habitat limiting factors and recovery measures within subbasins. The summary table provides a useful link between the assessments conducted as part of the Technical Foundation and the habitat measures identified in this Management Plan. The table does not represent any new information, but rather organizes information from the various existing assessments in a manner that emphasizes the most important habitat conditions in the most important places. Since it focuses predominantly on only the most important features affecting fish populations, it should be used in conjunction with the other subbasin information in order to develop a complete picture of subbasin conditions. Listed on the left side of the table are the subwatersheds and the reaches contained within them. The other columns identify reaches used by particular species, reach priorities by species, critical habitat factors by species, critical life stages by species, recovery emphasis by species, and watershed process conditions.

The second phase of the habitat evaluation involves identifying habitat limiting factors and threats. All of the potential limiting factors and threats occurring throughout the region were first identified in the Limiting Factors and Threats chapter of the Management Plan (Volume I). This list served as a pool from which to select the limiting factors and threats that apply at the subbasin level. These results are presented by priority area within each subbasin. Limiting factors for individual salmon and steelhead populations were obtained from a combination of sources, including the EDT habitat factor analysis, the IWA watershed process ratings, the barrier assessment (see Technical Foundation Volume II and appendices for these analyses), and air photo analysis. The EDT habitat factor analysis was used as a first cut for identifying limiting factors. Generally, only high or medium impact habitat factors (those represented by a large or medium sized dot in the EDT habitat factor analysis diagram) were used to infer key limiting factors. Riparian, flow, or sediment limiting factors were added according to the IWA impairment ratings. Habitat connectivity was included as a limiting factor if the barrier analysis suggested there was a passage issue, or if blockages to off-channel habitat (i.e., through hydromodifications) could be inferred from coarse-scale air photo analysis.

Habitat threats are the landscape conditions or land-use practices that are believed to be the primary contributors to the limiting factors. It is important to note that limiting factors refer to

local (reach-scale) conditions believed to be directly impacting fish. Threats, on the other hand, may be local or non-local. Non-local threats may impact in-stream limiting factors in a number of ways, including: 1) through their effects on habitat-forming processes – such as the case of forest road impacts on reach-scale fine sediment loads, 2) due to an impact in a contributing stream reach – such as riparian degradation reducing wood recruitment to a downstream reach, or 3) by blocking fish passage to an upstream reach. Threats were determined from a variety of sources including GIS data layers, Washington Conservation Commission Limiting Factors Analyses, air photo analysis, barrier analysis, personal knowledge of investigators, or known cause-effect relationships between stream conditions and land-uses.

The third phase of the habitat evaluation involves identifying habitat measures. All of the potential measures throughout the region were first identified in the Strategies and Measures chapter of the Management Plan (Volume I). This list served as a pool from which to select the measures that apply at the subbasin level. Habitat measures are the actions that are believed to offer the greatest potential to effectively address limiting factors and threats. Measures may refer to preservation or restoration actions and may include active or passive restoration. Measures may refer to stream corridor actions or to actions on hillslopes that are intended to address watershed process impairments. Measures may also reflect programmatic actions in addition to on-the-ground types of activities. Measures are specified for priority areas within a basin. In some cases, especially when the measure refers to a localized activity, the individual high priority reaches are also identified. The measures list includes the primary limiting factors and threats that would be addressed, the target species, the estimated time until habitat benefits would be realized, and a brief discussion. The list of species reflects the populations that are the primary focus of the measure, not simply the species that are present.

## **Programs**

Each subbasin chapter includes a programs section that includes a description of the programs that are currently in place that will accomplish subbasin measures. Where measures are not being adequately addressed by current programs, the gaps and actions needed to address the gaps are identified. Additional information on programs can be found in Volume IV of the Technical Foundation.