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An Ecosystem Approach to Salmonid Conservation

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Abstract

Populations of wild anadromous and resident salmonids continue to decline throughout much of the Pacific Northwest and northern California. Several stocks are presently listed as threatened or endangered under the Federal Endangered Species Act. Degradation of freshwater and estuarine habitats contribute substantially to this decline. Although Federal, State, and Tribal programs have been established, no coordinated, region-wide strategy exists to develop habitat conservation plans, foster habitat protection and restoration beyond minimum requirements on nonfederal lands, or encourage education and training.

This document provides the technical basis from which government agencies and landowners can develop and implement an ecosystem approach to habitat conservation planning, protection, and restoration of aquatic habitat on nonfederal lands. The report also describes a process for developing, approving, and monitoring habitat conservation plans, pre-listing agreements, and other conservation agreements for nonfederal lands to be consistent with the mandates of applicable legal requirements.

Three parts constitute the body of the document. Chapters 1-10 supply the technical foundation for understanding salmonid conservation principles from an ecosystem perspective: over 50 years of reported scientific research has been synthesized to describe physical, chemical, and biological processes operating across the landscape, within riparian areas, and in aquatic ecosystems as well as the effects of human activities on these processes. Chapters 11-16 provide a general conceptual framework for achieving salmonid conservation on nonfederal lands in the Pacific Northwest, including specific guidelines for developing, monitoring, and implementing habitat conservation plans within the larger context of basin and regional conservation goals. An appendix lists information resources that landowners and agencies may find useful in developing and evaluating habitat conservation plans. Over 1100 sources are cited within this document.

The perspective we present in this document is anchored in the natural sciences. Although we touch on social, economic, and ethical concerns, an exhaustive discussion of these issues is beyond the report's scope. Nevertheless, our socioeconomic systems and values shape our perceptions of natural resources and drive our demands for them. The fate of salmonids in the Pacific Northwest is inextricably interwoven into this natural-cultural fabric. Just as conservation strategies that are not based on sound ecological principles will ultimately fail, ecological approaches that ignore socioeconomic values, political realities, and ethical issues are also at high risk of failure. In light of this inter-dependency between biological and social realms, we view this document as one piece of a conservation-restoration puzzle to be integrated into a more comprehensive assessment of what we as a society want and value, what legacy we wish leave to future generations, and how we can get there from here.

Key words

salmonids, aquatic ecosystems, aquatic habitat, land-use effects, environmental monitoring, environmental law, environmental regulations, disturbances, management systems, riparian habitat, watershed processes, habitat restoration, conservation

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Notice

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Preface

Populations of wild anadromous and resident salmonids are in decline throughout much of the Pacific Northwest and northern California. Several stocks are presently listed as threatened or endangered under the Federal Endangered Species Act (ESA), and continued losses are likely to result in additional ESA listings. A significant cause of salmonid declines is degradation of their freshwater and estuarine habitats. Although Federal, State, and Tribal conservation and restoration programs have been established, there is no coordinated, region-wide Federal strategy for developing habitat conservation plans pursuant to ESA, for fostering habitat protection and restoration beyond minimum ESA requirements on nonfederal lands, or for providing education and training in habitat protection and restoration strategies.

The National Marine Fisheries Service, the Environmental Protection Agency, and the Fish and Wildlife Service (the "Agencies") seek to develop 1) a training and outreach strategy to implement a coordinated ecosystem approach to ESA's habitat conservation planning as well as additional protection and restoration of aquatic habitat on nonfederal lands and 2) a process for developing, approving, and monitoring habitat conservation plans (HCPs), pre-listing agreements, and other conservation agreements for nonfederal lands that is consistent with the mandates of ESA, the Clean Water Act, and other applicable State and Federal requirements. This document provides the technical basis from which these goals can be accomplished. The primary intended audience is agency personnel who have background in the biological and physical sciences and who are responsible for overseeing land management activities. Use of technical terms that may be unfamiliar to some readers was at times unavoidable; consequently, the document may be less accessible to those without formal technical training in scientific disciplines.

The document is organized generally into three parts. Chapters 1-10 (Part I) provide the technical foundation for understanding salmonid conservation principles from an ecosystem perspective. We discuss the physical, chemical, and biological processes operating across the landscape, within riparian areas, and in aquatic ecosystems; these processes ultimately influence the ability of streams, rivers, and estuaries to support salmonids. Specific habitat requirements of salmonids during each life stage are detailed. We then review the effects of land-use practices on watershed processes and salmonid habitats, focusing on the impacts of logging, grazing, farming, mining, and urbanization on hydrology, sediment delivery, channel morphology, stream temperatures, and riparian function. An overview is presented on the importance of ocean variability in determining production of anadromous salmonids and the implications of this variability on restoration of freshwater habitats of salmonids. Next, land-use practices that minimize impacts to salmonids and their habitats are discussed, followed by a brief review of Federal laws that pertain to the conservation of salmonids on private lands. The Technical Foundation concludes with a review of strengths and weaknesses of existing programs for monitoring aquatic ecosystems; this chapter provides the basis for monitoring recommendations presented in Part II.

Chapters 11-16 (Part II) provide a general conceptual framework for achieving salmonid conservation on nonfederal lands in the Pacific Northwest, as well as specific guidelines for the development of Habitat Conservation Plans (HCPs) pursuant to the Endangered Species Act. We propose a hierarchical approach to the development and evaluation of HCPs and other conservation efforts, stressing the need for site- or

watershed-level conservation efforts to be developed and evaluated within the larger context of basin and regional conservation goals. We outline critical issues that should be addressed at the scales of region and basin, watersheds, and individual sites while planning HCPs. We present details of specific elements for planning effective HCPs and criteria for evaluating the potential effectiveness of HCP provisions where such criteria are supported by current scientific information. Included in this discussion is an evaluation of the effectiveness of State rules for riparian management to protect specific processes that directly affect aquatic habitats. Compliance and assessment monitoring strategies for HCPs and other conservation efforts are proposed. The document concludes with a suggested strategy for implementing salmonid conservation efforts on nonfederal lands. An appendix (the third part) lists sources of data that landowners and agencies may find useful in developing and evaluating habitat conservation plans. Over 1100 sources are cited within this document and listed in the references section.

The perspective we present in this document found its anchor in the natural sciences. Although we touch on social, economic, and ethical concerns, an exhaustive discussion of these issues is beyond the scope of the document. Nevertheless, it is our socio-economic systems and values that shape our perceptions of natural resources and drive our demands for them. The fate of salmonids in the Pacific Northwest is inextricably interwoven into this natural-cultural fabric. Just as conservation strategies that are not based on sound ecological principles will ultimately fail, ecological approaches that ignore socioeconomic values, political realities, and ethical

issues are also at high risk of failure. Scientific information influences how society both views and values natural resources such as salmon. At the same time, social values influence where we devote our research efforts (and hence the strengths and weaknesses of our knowledge base) and the feasibility of implementing what is ecologically sound. In light of this interdependency between the biological and social realms, we view this document as one piece of a conservation and restoration puzzle to be integrated into a more comprehensive assessment of what we as a society want and value, what legacy we wish leave to future generations, and how we can get there from here.

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Finally, numerous others--too many to mention individually--have met with us to discuss specific issues, have suggested documents to review or other experts to contact, have provided us materials to review, or have offered access to libraries and document collections.

Acronyms

AFS	American Fisheries Society	NPS	National Park Service (DOI)
BIA	Bureau of Indian Affairs	NRC	National Research Council
BLM	Bureau of Land Management (DOI)	NRCS	Natural Resources Conservation Service {formerly SCS} (USDA)
BOR	Bureau of Reclamation (DOI)	ODEQ	Oregon Department of Environmental Quality
CDF	California Department of Forestry	ODF	Oregon Department of Forestry
CDFG	California Department of Fish & Game	ODFW	Oregon Department of Fish and Wildlife
CDWR	California Department of Water Resources	ODSL	Oregon Division of State Lands
CFR	Code of Federal Regulations	OSPRD	Oregon State Parks & Recreation Department
CRFC	Columbia River Fisheries Council	OWRRI	Oregon Water Resources Research Institute
CSWQCB	California State Water Quality Control Board	PAH	polyaromatic hydrocarbon
DO	dissolved oxygen	PCB	polychlorinated biphenyl
DOC	U.S. Department of Commerce	PFMC	Pacific Fishery Management Council

DOI	U.S. Department of Interior	PSMFC	Pacific States Marine Fisheries Commission
EMAP	Environmental Monitoring and Assessment Program (EPA)	PSWQA	Puget Sound Water Quality Authority
EPA	U.S. Environmental Protection Agency	PWD	Public Works Department, City of Olympia, Washington
ERS	Economic Research Service (USDA)	REO	Regional Ecosystem Office [BLM, NMFS, FWS, BIA, EPA, FS]
FEMAT	Forest Ecosystem Management Assessment Team	SAB	Science Advisory Board {for EPA}
FS	Forest Service (USDA)	SCS	Soil Conservation Service {superseded by NRCS} (USDA)
FWS	Fish and Wildlife Service (DOI)	TFW	Timber, Fish, and Wildlife Group
GAO	General Accounting Office (U.S. Congress)	TU	turbidity units
GIS	geographic information system	URL	universal resource locator
GPO	Government Printing Office	USC	U.S. Code
GS	Geologic Survey (DOI)	USDA	U.S. Department of Agriculture
IDFG	Idaho Department of Fish & Game	WACT	Watershed Analysis Coordination Team
IDWR	Idaho Department of Water Resources	WDE	Washington Department of Ecology
LWD	large woody debris	WDF	Washington Department of Fisheries {superseded by WDFW}
MSG	California State Board of Forestry Monitoring Study Group	WDFW	Washington Department of Fisheries and Wildlife {superseded WDF and WDW}
NIFC	Northwest Intertribal Fish Commission	WDNR	Washington Department of Natural Resources
NMFS	National Marine Fisheries Service (DOC, NOAA)	WDW	Washington Department of Wildlife {superseded by WDFW}
NOAA	National Oceanic and Atmospheric Administration (DOC)	WFPB	Washington Forest Practices Board
NPCC	Northwest Power Planning Council	WSSP	Washington State Shoreline Program

Parentheses () indicate the department to which an agency belongs.
 Brackets [] indicate member agencies.
 Squiggly brackets { } indicate additional information.

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