Section 5 - Anadromous fish

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5. Anadromous Fish

[Editor's note: Because of their quantity and uncertain status, tables in this section are numbered sequentially within sub-sections, e.g. tables in Section 5.1.1 are numbered 5.1.1-1. 5.1.1-2, etc. Figures are numbered sequentially within the section, e.g. 5-1. 5-2, etc.]

5.1 Introduction

This section organizes a wide range of information concerning restoration of habitat and productivity of anadromous fish in the Columbia Basin. It first presents a scientific conceptual framework for salmon restoration, then describes both the areas of consensus and areas of disagreement between federal, state, and tribal programs for improving habitat and production. The conceptual framework, based on the conceptual foundation of the ISG report, *Return to the River*, is the first step in responding to both the ISG report and the federal Memorandum of Agreement.

This part of the multi-year implementation plan is a work in progress. The conceptual framework needs to be refined. The fish and wildlife managers then need to link goals, objectives, and strategies to the framework. The watershed is a key level of analysis and a key management unit for all of this work. Much has been done, but more work is needed to develop a comprehensive watershed approach to restoration.

In this section the Council and the Columbia River Inter-Tribal Fish Commission propose a way to develop a comprehensive watershed assessment that identifies key habitat and corridors for anadromous fish, resident rish, and wildlife for each subregion in the Columbia Basin. They also describe a process to prioritize habitat and production projects within watersheds. The fish and wildlife managers will discuss these proposals as they work to integrate the conceptual framework into decisions about implementation.

In developing this first Multi-Year Implementation Plan, fishery managers used the subbasin plans originally developed in 1987 as the basis for the ecological objectives and strategies for anadromous fish. A compilation of the subbasin plans and other plans can be found in Appendix 1: *Subbasin Habitat and Production Objectives and Strategies for Anadromous Fish.* While this material provides a useful set of activities, it needs to be linked to the framework. This will improve the ability to set priorities among subregions and within subregions for production and habitat activities.

5.1.1 Section Overview

Section 5.2 presents the conceptual framework for salmon restoration. Section 5.3 describes how a subregional approach will help to organize habitat and production efforts in an ecologically comprehensive way. In this section, too, is CRITFC's proposal for watershed aessment and setting priorities for projects. Section 5.4 contains key technical and policy issues that must be resolved among the fish and wildlife managers. Section 5.5 elaborates on scientific methods for integrated research, monitoring, and evaluation, based on the conceptual framework.

The rest of Section 5 goes further into the specifics of this effort to reach consensus in planning and action. Section 5.6 reviews the influence of human activities on the Columbia River Basin aquatic

ecosystem. Section 5.7 Summarizes the distribution and status of anadromous fish in the Columbia Basin. Section 5.8 summarizes the similarities and differences in regional production and habitat goals, policies, objectives, and strategies contained in the three major regional plans. Section 5.9 provides a similar review on the subbasin level. In Section 5.10 is a description of 1997 anadromous fish production and habitat projects funded by BPA and federal agencies under the Fish and Wildlife Program, and a summary of their costs. Finally, Section 5.11 describes various basinwide projects, activities, and agencies involved in planning and management of anadromous fish resources.

This chapter was prepared by the Watershed Production and Habitat Committee, an ad hoc committee made up of representatives from the federal, state, and tribal fishery agencies in the Columbia Basin, U.S. Forest Service, NPPC, the Corps, BPA, and other interests.

5.1.2 Defining a Watershed-Based Approach

A watershed (also called subbasin) is an area circumscribed by ridgetops, within which all the water flows through a network of tributaries into a common stream. Watersheds serve as organizing units for the study and management of fisheries, wildlife, water quality, and land use. A comprehensive approach to salmon recovery needs to be based on a comprehensive approach to watersheds, including all the lands organized by watershed -- federal, state, tribal, and privately owned -- because everything that goes on in a watershed bears some relation to the whole.

Traditionally, resident fish, anadromous fish, and wildlife have been managed by specialized agencies, each with its own budget and agenda. In the effort to bring together all of these interests into an integrated, ecosystem perspective, the watershed concept is key. Since habitat improvements targeted for one population will benefit others, watershed restoration can be the focal point for a comprehensive ecosystem approach to restoration for all three program elements.

This section describes a process to develop a comprehensive watershed assessment that identifies key habitat and corridors for anadromous fish, resident fish, and wildlife for each subregion of the Columbia Basin. A comprehensive approach should be based on established methodologies to identify carrying capacity and limiting factors in each watershed. The approach will need to address all of the species and all of the lands in each watershed. Restoration efforts in one part of the watershed can be frustrated by damaging actions in other parts of the watershed.

Integrated, coordinated planning for each subbasin can reap habitat benefits for all, while being very cost effective. For example, improved riparian habitat in a tributary will benefit streamside wildlife. It will benefit spawning and rearing anadromous and resident fish, resulting in more returning adults, which in turn will benefit fish predators such as eagles, otters, bears, and others. Secondary losses to wildlife caused by previous declines in fish populations will be mitigated.

Furthermore, since it has to address uses on all the lands, not just those under agency or tribal management, a comprehensive watershed approach can succeed only if it has full support at the grass roots level. Fish and wildlife interests need to provide funding to support a comprehensive approach, but it has to happen at the watershed level, with extensive local participation. This requires public

education, making technical resources available, and developing clear criteria for clearly defined factors involved in watershed restoration.

Research and monitoring must be conducted within a regional framework that provides methods and criteria for monitoring and evaluating project outcomes. This is important because the Columbia River Basin is a connected ecosystem. Subbasin changes will have effects on river mainstems; for example, if stream restoration creates lower temperatures in the smaller tributaries, these will affect mainstem temperatures. Larger subregional and regional processes need to be monitored as well as those pertaining to individual subbasins and projects with an understanding for how they fit together. This not only will provide better information, but it will be more cost effective.

In developing a truly comprehensive, ecosystem, watershed-based approach, this Multi-Year Implementation Plan is only one piece -- although it is an important one. Leadership is necessary to connect these agreements among fish and wildlife managers to the economic and political realities on the ground, by watershed councils and larger subregional watershed groupings, and to move forward with practical actions that support natural processes of recovery. Annual work plans will have to be developed using principles and criteria developed in the Multi-Year Plan.

Combining discussion of watershed habitat with natural and artificial fish production has a solid conceptual basis in the three major plans for salmon recovery -- 1994 Columbia River Basin Fish and Wildlife Program of the Northwest Power Planning Council, the federal Draft National Marine Fisheries Service Proposed Recovery Plan for Snake River Salmon, and *Wy-Kan Ush-Mi Wa-Kish-Wit* -- Spirit of the Salmon: The Columbia River Anadromous Fish Restoration Plan of the Columbia River Inter-Tribal Fish Commission. Watersheds serve as the home for all living things and as such provide the essential organizing structure for both habitat restoration and production activities.

The many diverse subbasins of the Columbia Basin provide the habitat necessary to sustain the rich diversity of anadromous fish, resident fish, and wildlife found in the Northwest. It is widely recognized, however, that the habitat required for salmonid migration, spawning, incubation, and juvenile rearing has been severely degraded by the cumulative effects of human activity, including flow regulation by dams and irrigation diversions, inundation of habitat by dams, sedimentation from forestry and agricultural practices, and introduction of non-native biota. Habitat restoration and production activities are, therefore, the cornerstone of the protection and restoration of anadromous fish as well as fish and wildlife in general. The overall goals of a watershed-based production and habitat program are to halt declining population trends, increase adult returns to the spawning grounds, increase natural survival rates, and provide harvest opportunities.

Maintaining and restoring natural production through watershed habitat actions is a very high priority; however, because opportunities to achieve significant production increases through natural production are limited, additional increases will have to be achieved through artificial production and supplementation. Supplementation is the enhancement of natural fish populations with hatchery fish that are bred and reared to become naturally returning and spawning fish.

Since most populations in the Columbia Basin are depressed and declining, many will require some level of artificial propagation assistance to help counter the current artificially induced mortalities throughout their life cycle. Use of artificial propagation technology is also essential to reestablish numerous extirpated populations. Habitat-related mortality factors that likely contributed to the demise of these populations will also be critical to address in concert with production measures. Artificial production actions should not be viewed as taking the place of habitat protection and restoration, nor should these actions be kept on hold until all habitat-related factors are satisfactorily addressed. In most instances, a closely linked watershed approach that calls for both habitat and artificial propagation will be required to achieve adult return goals for natural production, broodstock collection, and harvest in Columbia River tributaries.

Habitat protection and restoration and increased production can be achieved at the watershed level. Local watershed groups provide leadership to work in partnership with fishery scientists to target high priority areas for habitat actions and production. Local watershed groups working with state, tribal and federal fishery scientists can develop cooperative methods to restore salmon.

5.1.3 Agreement on Watershed Production and Habitat

This Multi-Year Plan is being developed by the federal and state agencies and tribalgovernments (managers) in the regions that are responsible for managing fish and wildlife resources, with the support and participation of numerous other organizations and individuals. At the core of this effort is the identification of common production goals and methods. As described later in this section, the managers are working on identifying areas of agreement as to targeted stocks and methods of production -- natural, supplementation, or artificial (hatchery).

The current approach to funding the NPPC Fish and Wildlife Program addresses the separate hydropower impacts on anadromous fish species, resident fish species, and wildlife species and their associated habitats. This lack of integrated interdisciplinary project implementation should be discouraged at the watershed level, and the combined expertise and funds of these separate disciplines should be coordinated toward similar results and projects that are focused on the overall goal of watershed restoration.

Resident fish and wildlife projects resulting from losses at dams that still pass anadromous fish should direct their efforts at habitats and river reaches that benefit the resident fish, wildlife, and salmonid restoration effort, consistent with an approved watershed restoration plan. Wildlife and resident fish expertise represented on the interdisciplinary team will only benefit the overall project and provide a "double bang" for the invested restoration dollar.

This is a crucial step. Once the managers agree on the populations and production methods in a particular watershed, a series of systematic, logical decisions can be made in all areas on how to prioritize and allocate finite resources to support the production goals. Important questions include: Which of the stocks deserve priority? Are habitat improvements necessary to support the production goals? Which stages in the life history of a particular stock warrant expenditures? Are mainstem operations also key? Is there a need for construction or modification of mainstem structures to support

the production goals? Is there anything that can be done in the estuary or ocean to support the targeted stocks?

Because there are multiple goals that the basinwide effort is trying to reach (recover listed stocks, prevent additional stocks from declining to the point where they need to be listed, double the run size), an overall strategy is needed that addresses all the goals in a manner that is internally consistent. The watershed and subregional approaches offer a significant advantage. By identifying common goals, policies, and strategies for an individual watershed, it should be possible to move forward with production, habitat, and other measures in support of those specific goals without having to wait for complete basinwide agreement. This is a key step towards untangling the gridlock and stalemate that have existed for too long.

It is apparent that the overall goals are not completely consistent. The most important example is that current policy is based on the idea that the doubling goal cannot be met, given existing constraints, with natural production only. That is why the overall plan contains elements of natural, supplemented, and artificial production. By implementing the program at the watershed level, work can proceed within a watershed where agreement exists. Care must be taken, however, to ensure that one measure, such as artificial production or supplementation, does not defeat an important goal, such as natural production in a nearby locale.

5.2 A Conceptual Framework for Salmon Restoration

Declining salmon populations in the Columbia River Basin have impoverished users of the resource and the cultural resources of the region. Hundreds of millions of dollars are being spent annually on efforts to restore these once flourishing salmon stocks. While the Fish and Wildlife Program of the Northwest Power Planning Council is the largest of these efforts, many other state, federal, and private groups make significant contributions towards salmon restoration each year.

If the region is to use limited resources wisely and to the greatest benefit of the declining salmon populations, these restoration efforts must be more closely coordinated. A draft review of the Fish and Wildlife Program by a panel of independent scientists (ISG 1996) identified the lack of a common conceptual approach as a major impediment to effective salmon restoration. The scientific panel went further to propose a new conceptual foundation based upon their understanding of biological processes and the status of salmon in the Columbia River Basin. The ISG's conceptual foundation is based upon three principles:

1. Restoration of Columbia River salmon must address the entire natural and cultural ecosystem that encompasses the continuum of freshwater, estuarine, and ocean habitats where salmon complete their life histories. This consideration includes human developments as well as natural habitats.

2. Sustained salmon productivity requires a network of complex and interconnected habitats that are created, altered, and maintained by natural physical processes in freshwater, the estuary, and the ocean. These diverse and high-quality habitats are crucial

for salmon spawning, rearing, migration, maintenance of food webs, and predator avoidance.

3. Life history diversity, genetic diversity, and metapopulation organization are ways salmon adapt to their complex and connected habitats. This biodiversity and its organization contribute to the ability of salmon to cope with the environmental variation that is typical of freshwater and saltwater environments.

The members of the Columbia Basin Fish and Wildlife Authority agree with these basic tenets and have incorporated them into this plan.

The CBFWA members are also obligated to incorporate into this plan certain budget management and program accountability procedures recently agreed to by the federal agencies participating in restoration of Columbia River salmon populations. These procedures are intended to provide greater accountability for the allocation of limited resources and the results obtained.

The following description of a conceptual framework for this plan is the first step in responding to both the ISG report and the federal Memorandum of Agreement. It consists of three parts: 1) the biological framework; 2) the tasks necessary to act consistent with the biological framework; and 3) a set of common tools with which to carry out those tasks. As this plan develops and is refined over time, we will provide more explicit descriptions of specific elements of this conceptual framework.

The Biological Framework

The conceptual framework was developed with an aim toward utility for salmon management but also with the important goal of maintaining consistency with an ecosystem approach and with the conceptual foundation recommended by ISG. The framework views salmon as an indicator, or diagnostic, species for the ecosystem. The salmon's perspective, its perception of the environment, becomes a view of the system as a whole. Within the limitations of the perspective of the salmon and our ability to interpret it, this approach provides a framework for formulating strategies for salmon in the context of ecosystem management.

The framework is simple in concept but with sufficient dimensional complexity to accommodate temporal, spatial, and biological detail. Conceptual simplicity is important because unless ideas can be communicated clearly and without ambiguity nothing is gained. The usefulness of this type of framework should be measured by how well it generates insights into ecological patterns and relationships that might otherwise be missed or glossed over. As a theoretical construct, it is a simplification of nature against which to test and expand human experience.

Ecosystems are by nature hierarchical. Concepts and terms must be consistent at all levels in the hierarchy. Therefore the framework was designed so that analyses made at different scales—from tributary watersheds to successively larger watersheds (e.g., Wallowa River to the Grande Ronde River to the Snake River to the Columbia Basin)—might be related and linked. Ultimately, conditions within these watersheds can be linked to those within the Pacific Ocean.

The hierarchical nature of the conceptual framework enables consideration of conditions for sustainability that link all components of an extensive and complex life history, such as that exhibited by salmon, over successively larger spatial scales. It is the key to our ability to assess the cumulative effects of concurrent actions spread across the geographic range of salmon.

In its simplest form, the conceptual framework is a pathway for linking potential management actions (or natural events) to outcomes that may be relevant to society's values or objectives (Figure 5-1). It provides a system of logic (rationale) to explain how actions are transferred into desired outcomes.

The framework consists of a sequence of relationships. The flow of logic proceeds as follows: 1) any event or action taken by humans within the ecosystem has some effect on attributes, or conditions, of the environment; these attributes may be abiotic (such as sediment loading or water temperature) or biotic (such as increases in abundance of a particular species by hatchery outplanting); 2) in turn, these changes in environmental attributes affect how populations within the ecosystem perform (i.e., survive and function); and 3) the resulting performance of populations creates an outcome that has direct relevance to resource status. The flow of information through these relationships is bi-directional.

The purpose of this type of logical construct is to promote a better understanding of these relationships. Too often events or actions are presumed to translate more or less directly to objectives without a clear rationale of how their effects flow through the ecosystem. This framework requires explicit consideration of possible pathways.

The framework explains possible consequences in a manner consistent with existing knowledge and information, and it requires that all assumptions necessary to ecosystem planning be identified. It thereby becomes a vehicle for learning and communicating.

At the core of the framework are relationships between environmental attributes and biological performance. The term "biological performance" refers to the way in which a population responds to environmental conditions. There is a wide array of possible performances for species like salmon over the range of conditions that have existed in the Pacific Northwest. We have chosen three attributes (capacity, productivity and diversity) as initial indicators of the response of salmon populations to environmental attributes.

The importance of spatial-temporal heterogeneity is embedded in this framework. Actions ("what") take place in space ("where") and time ("when") dimensions, which in turn, have variable effects on environmental attributes over those same dimensions. An ecosystem perspective needs to incorporate these dimensions.

Today, the cumulative impacts of regional development have damaged conditions of the original reference state to such a degree that the persistence of many naturally spawning populations is in question. There is broad agreement that we should improve conditions to maintain healthy naturally reproducing salmon runs. This requires us to restore many of the characteristics of the reference state.

We are uncertain, however, of how far we must move toward reference state conditions to accomplish that goal (Figure 5-2).

Salmon complete their life cycle by utilizing a series of environments through time and over a wide geographic area from the continental divide to the Gulf of Alaska. We can use the approach pictured in Figure 1 to organize our approach to salmon restoration by each life stage (Figure 5-3). Segmenting the life history into workable parts is necessary because it then may be possible to directly measure the environmental and biological responses to an action or set of actions (the change in sediment levels as bank stability increases, for instance, and the resulting changes in biological response) or determine responses through inferential methods. This is virtually impossible to do across the entire life cycle because the confounding effects of natural variability at each successive life stage obscure the results of an action. This approach allows us to focus our efforts on a meaningful segment (in space and time) of the salmon's life history while maintaining a logically consistent and integrated approach over the entire life cycle.

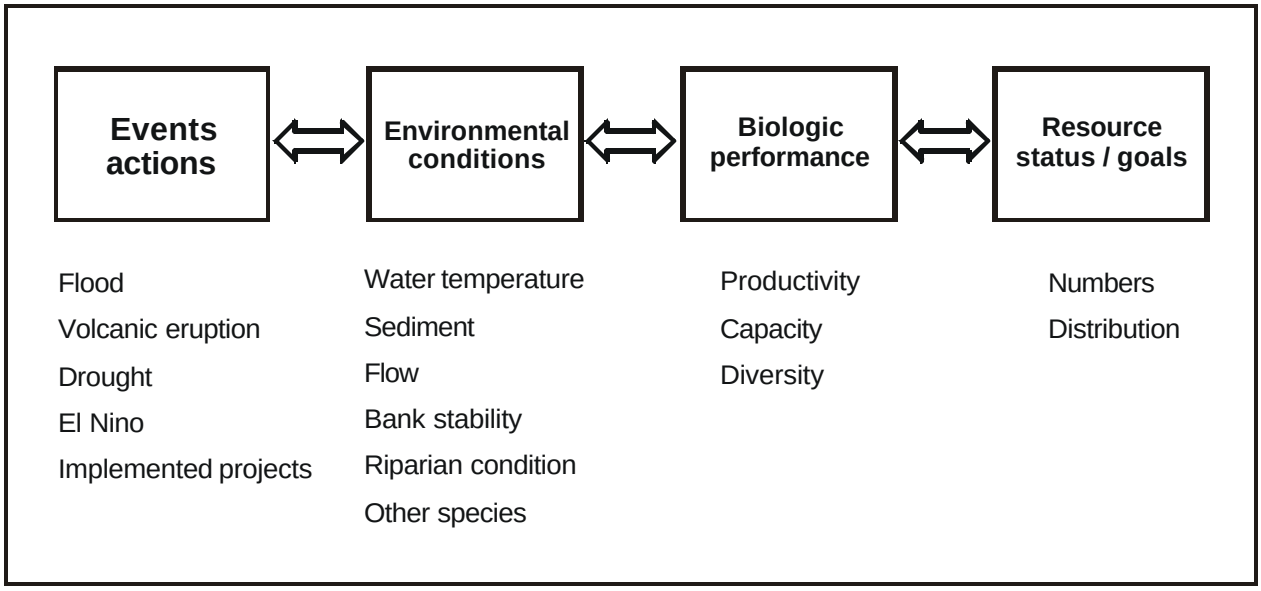

Figure 5- 1 A schematic description of the "reference state" showing the functional links between environmental events and resource status

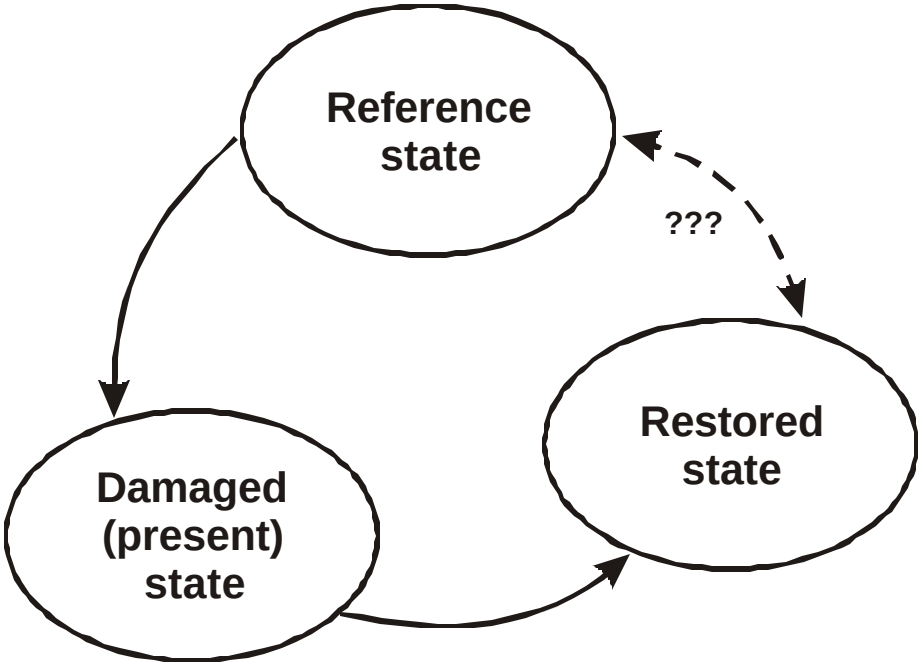

Figure 5- 2 Present condition and future direction relative to the reference state

The impacts of development on reference state conditions at every life stage, and the task of restoring healthy natural production, are enormous. As the region developed, society imposed a set of additional considerations and influences on the reference state. Development of the region brought with it new actions, uses, and other impacts that changed the environmental conditions that salmon need to support healthy naturally reproducing populations (Figure 5-4). Sometimes these changes affected key environmental conditions directly such as the construction of dams, withdrawal of water for irrigation, or using the stream channel for stock watering. Other changes affected the salmon's environment in more subtle ways: the introduction of new fish species and the logging of large portions of watersheds, for instance.

Development also brought increased demands on the salmon resource as food, and for income and recreation. These increased uses created additional perceptions of the resource and its status. Tribal fishermen noticed declines in returns to many traditional tributary fishing sites. Commercial fishermen probably noticed the declines in the return of harvestable adults, even though sport fishermen could still easily catch many fish for personal consumption. The perceptions of resource status varied between particular groups, their use of the resource, and the location of interest. In many cases it was easy to assign responsibility for the declines to other groups rather than identify, and accept responsibility for, local problems.

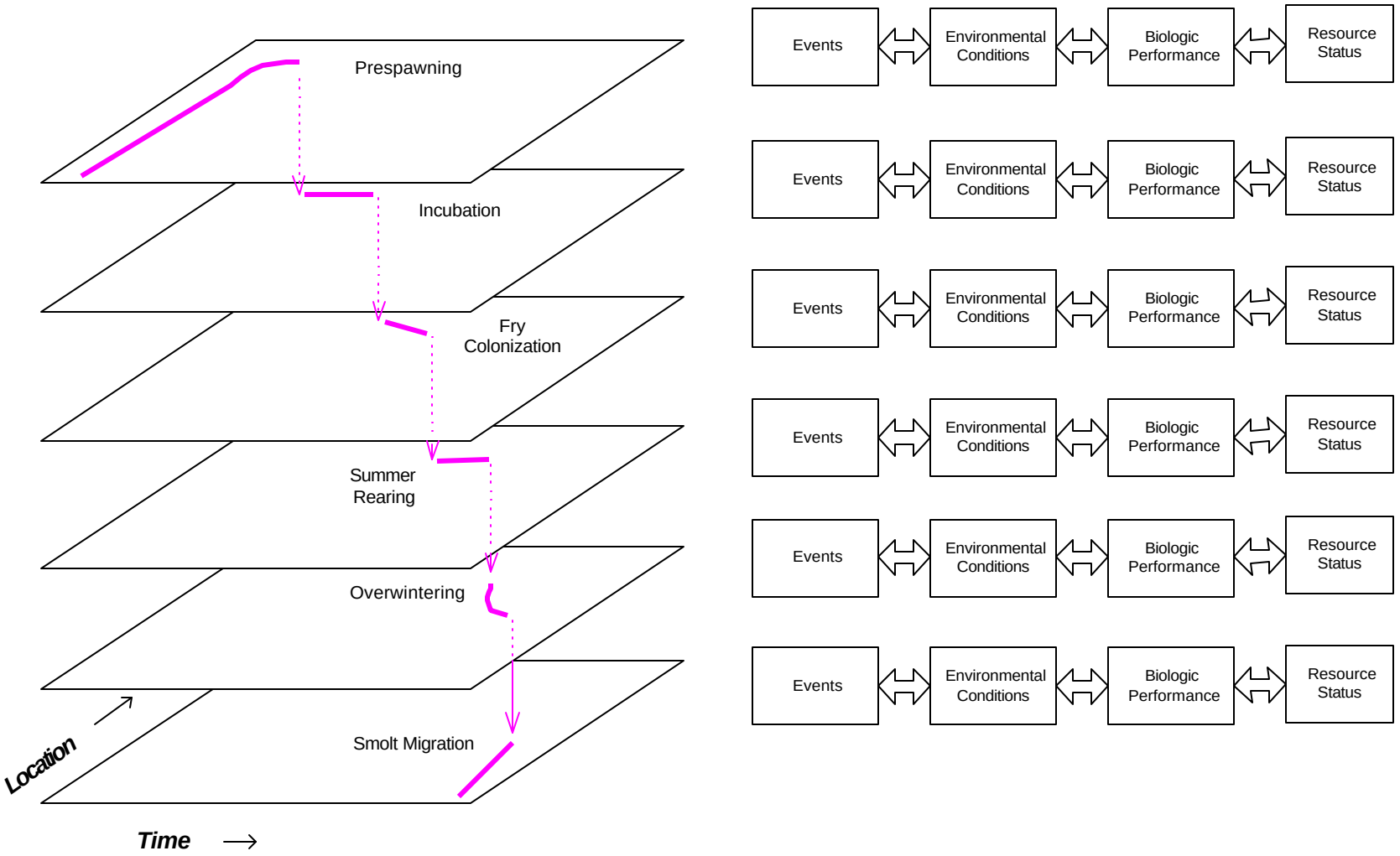

Figure 3. Schematic of a portion of the salmon life history showing how the proposed biological framework can be applied to sequential life history stages (adapted from Mobrand, in press).

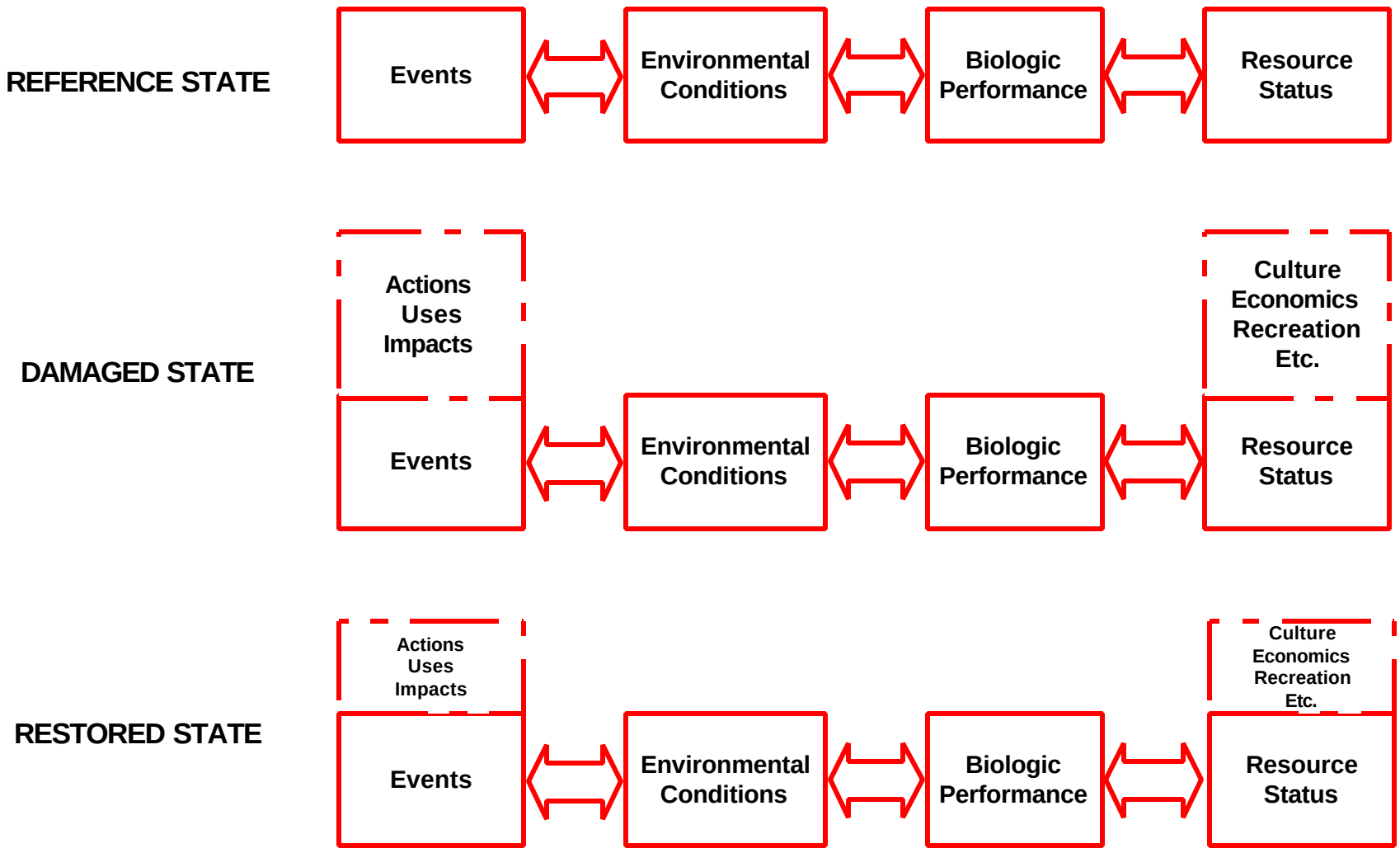

Figure 4. The effect of development on salmon populations and changes needed to move toward restoration

As we move the system back toward the reference state, we will have to bring the additional impacts caused by development into line with the needs of the natural ecosystem. As we do this, our perception of the desired resource status will also change and achieve a balance with reality.

The Northwest Power Planning Council's Fish and Wildlife Program contains a set of goals and measures to achieve those goals. The ISG report criticizes the program for not having strong connections between those measures and goals. That is, it has not been demonstrated how the measures are expected to lead to the goals. The report also strongly recommends that the Council program must include both the biological and cultural dimensions of the problem in any proposed solution. This can be done using the framework approach described above.

The factors affecting environmental conditions, including natural events, the effects of development, and projects to restore salmon, can be viewed as measures in the context of the Council's program (Figure 5-5). Except for natural events, they are the collection of actions which society imposes on the salmon ecosystem.

Similarly, the physical resource status, combined with various expressions of cultural and social needs, represents a statement of regional goals and objectives, both expressed and implied. Cultural goals are, in fact, often expressed in terms of a particular statement about resource status. Thus we have goal statements like "5000 spring chinook in Anywhere Creek" that are intended to meet certain local cultural goals. The tribal salmon restoration plan has the intent of restoring salmon species in the areas from which they have been lost ("In-place, in-kind" mitigation). That is also an expression of a set of cultural values, expressed as a statement about physical resource status.

A strength of the approach we describe here is that it provides specific operational linkages, which can be measured or tested inferentially, between goals and actions to achieve those goals. Actions are evaluated within the context of all factors affecting environmental conditions, thus allowing us to evaluate the impact and likelihood of success of restoration actions.

Finally, the proposed framework provides a structured method for developing and conducting monitoring and research programs. In general terms, monitoring activities are focused at measuring the status of the described events, environmental conditions, biologic performance indicators, and resource status (Figure 5-6). Research projects generally focus on determining and describing the functional relationships between these four sets of variables. The overall assessment of these events and their effect on resource status is termed evaluation.

Necessary Tasks

Applying the biological framework to salmon restoration efforts requires that people and groups perform an explicit set of tasks on a regular (but not necessarily annual) basis. These tasks have

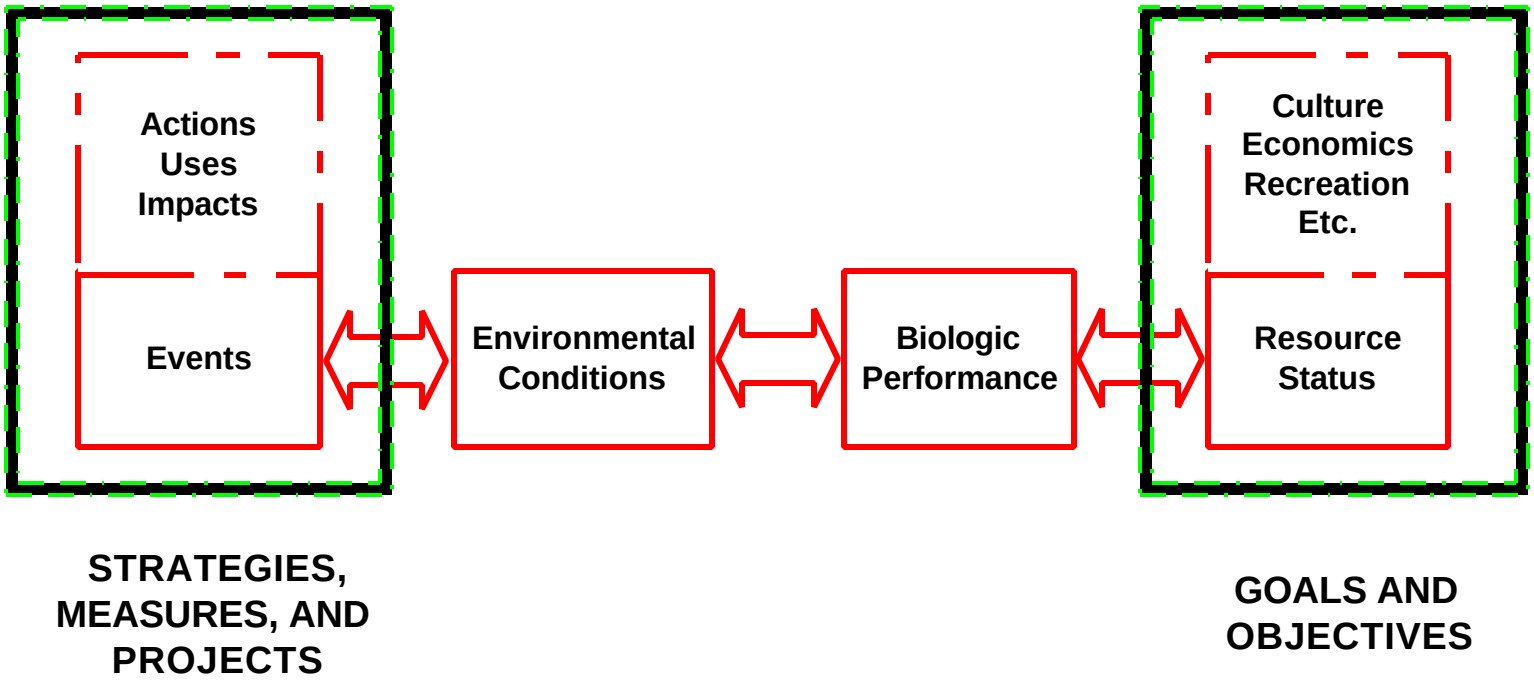

Figure 5. The relationship between restoration goals and measures to meet those goals.

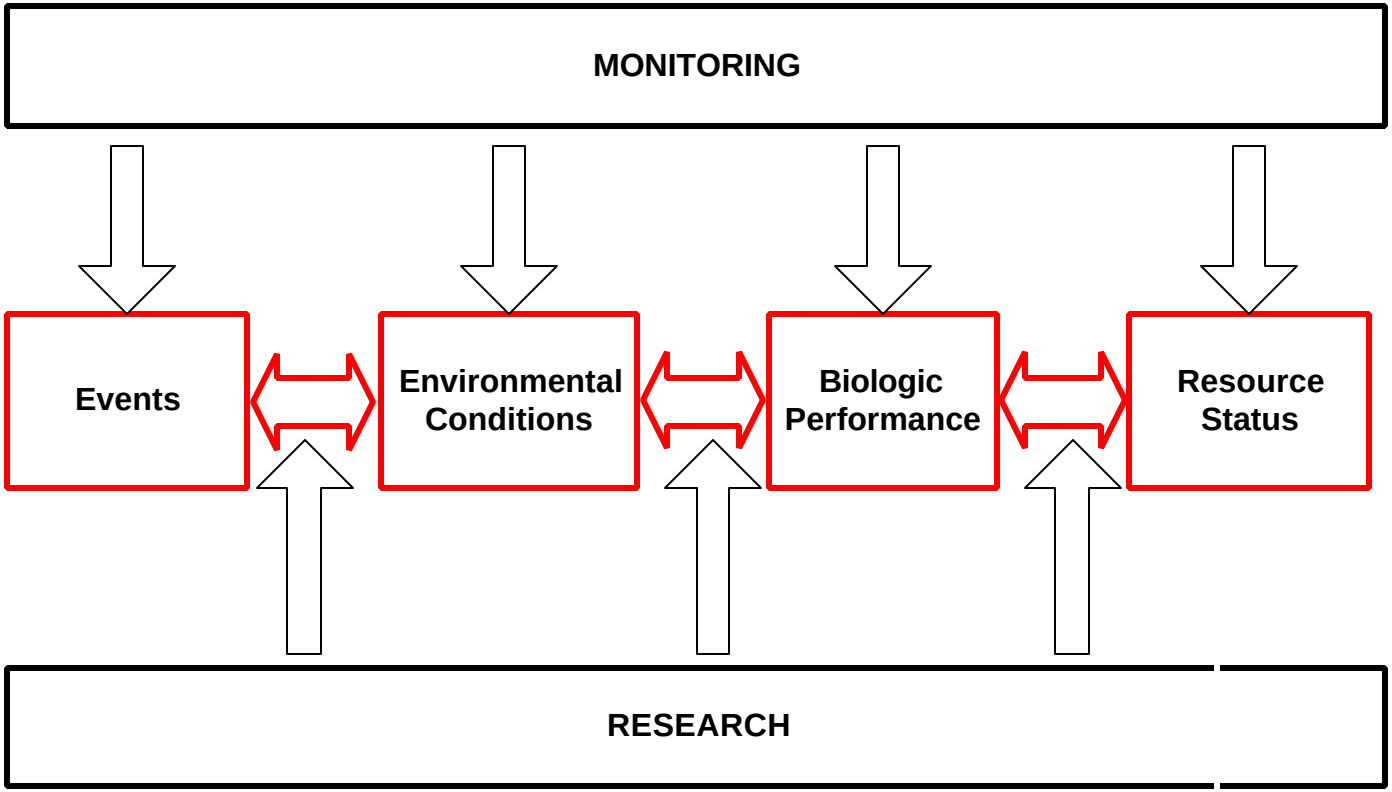

Figure 6. The relationship of research and monitoring within the proposed biological framework.

often been described elsewhere when the adaptive management approach has been described. They are briefly described again here. Since these tasks are cyclical and occur in a regular order, it is not too important where in the cycle we begin the description.

The first step is to **describe (or reevaluate** on successive cycles) the scope and nature of **the problem** and system of interest. While this has been done numerous times, those descriptions now need to be reorganized within the framework described above.

Based upon an understanding of the problem, parties must **formulate a set of goals and objectives**. Care should be taken that cultural and societal goals are incorporated and stated in addition to biological goals.

The next step is to use the framework to **allocate resources and identify actions**, and the expected changes in environmental conditions and biological performance indicators, expected to achieve the goals.

Monitoring the system as actions are implemented provides the information needed to **evaluate** project and program effectiveness. Note that these two steps are explicitly required by the MOA. The evaluation task should explicitly address the questions needed to refine or revise the program goals and strategies, thus starting the cycle again.

The remainder of this chapter describes many of these tasks in greater detail. These descriptions are largely taken from the three existing restoration plans. While they are not strictly formulated in terms of the conceptual framework, they are consistent with it. Future revisions of this plan will make those relationships clearer.

Essential Tools

The region should develop a set of standard tools to assist in conducting the five tasks above. These tools fall in the areas of 1) information management, 2) technical analysis, and 3) communication. Collectively, these shared tools provide the information feedback necessary to implement an adaptive management process. Descriptions of the individual tools will be left to a later draft of this document. In passing we note that the StreamNet and PATH projects appear to embody key elements in one or more of these three categories.

Next Steps

As this multi-year plan evolves we will need to add the following information. Tentative time lines are proposed for each step.

- Refine and extend the description of this conceptual framework (Next draft by 1/31/97)

- Summarize current activities in terms of the biological framework (2/28/97?)
- Assign responsibilities to groups and individuals for conducting identified tasks (2/28/97?)
- Set priorities for funding in FY99 and annually thereafter (9/30/97?).

5.3 Developing a Subregional Approach and Criteria for Prioritizing Projects

This section describes one method proposed by CRITFC and NPPC of addressing the prioritization of habitat and production projects within watersheds in the Columbia River basin; a CRITFC-proposed process of prioritization and discussion of criteria; and other examples of criteria that could be applied in a prioritization process.

5.3.1 CRITFC and NPPC Proposal for a Subregional Approach for the Columbia River Basin

Over the last few decades a great deal of money has been spent within the region to restore fish and wildlife. Recent evaluations have suggested that fish restoration projects can be compromised by the damaging actions of other landowners in a watershed. The task of habitat and species restoration is too big for the fish and wildlife managers to do on their own.

The starting point for improved coordination will be the subregional process that brings relevant interests together to address the needs of priority fish and wildlife populations in particular watersheds. A total watershed perspective, in which fish and wildlife needs, land and water conditions, and local, private, and government initiatives are viewed together, will play an essential role in the ultimate success of efforts to rebuild fish and wildlife populations.

5.3.1.1 Description and Function of a Subregional Approach

The Columbia River Basin Fish and Wildlife Program calls for the development and implementation of a subregional approach. This approach needs to address anadromous fish, resident fish, and wildlife. As outlined in the program and from discussions in regional forums, there are two related functions of the subregional approach: 1) to prioritize habitat and production activities for fish and wildlife, and 2) to encourage and maintain watershed approaches, which are an important basis for successful implementation of the program activities addressing habitat and production. The Council is convinced that these two functions will result in coordination between fish and wildlife habitat and production measures as well as coordination of these measures with other activities in a subbasin or watershed. Without this coordination, implementation of program activities will be greatly compromised.

The program identifies six subregions for purposes of the subregional approach. These subregions contain subbasins that are similar in regard to fish and wildlife populations, climate, and geology. The six subregions

are the following: Lower Columbia (the area below Bonneville Dam), Lower Mid-Columbia (the area between Bonneville Dam and the Snake River), Upper Mid-Columbia (the area between the Snake River and Chief Joseph Dam), Upper Columbia (the area above Chief Joseph Dam), Lower Snake (the area between the mouth of the Snake River and Hells Canyon Dam), and Upper Snake (the area above Hells Canyon Dam). For purposes of the program, subbasins are defined as major tributaries of the Columbia and Snake mainstems and sections of those mainstems including other smaller tributaries. These are the basic watershed units for the program. Attached is a draft list of 53 subbasins grouped by the six subregions (see Table 5.3-1).

The subregional approach will bring together the policies, objectives, and priorities of local watershed-based efforts with the policies, objectives, and priorities at the regional level. It is intended to be a membrane through which the concerns of the region are addressed at the watershed or local level, and vice versa. Specifics about how watershed approaches operate in each of the subbasins are left to those parties interested and involved in any particular subbasin. The program calls for involvement from appropriate fish and wildlife agencies, tribes, utilities, Bonneville, land and water managers, private land owners, citizens groups, the Council, and others.

The subregional approach is not intended to duplicate or subsume the activities or functions of other programs or processes. The Council recognizes the success and value of other watershed efforts in the Columbia River Basin. It intends for this approach to build on and fill needs in existing programs and processes. As much as possible, appropriate ongoing activities and institutions should be used to address the functions identified for the subregional approach.

As discussed above, the functions of the subregional approach are twofold. Specific aspects of these functions follow.

A. Prioritize Habitat and Production Activities.

- Activities performed by regional fish and wildlife managers and documented in the Multi-Year Implementation Plan

    - Identify specific/achievable objectives and strategies for each fish and wildlife population in the Columbia River Basin (Existing objectives and strategies are listed in Appendix 1 of Section 5.

    - Prioritize fish and wildlife populations across the region.

    - Identify priority actions for priority fish and wildlife populations that are not project-specific (e.g. reduce sediment in the upper South Fork of X subbasin, reduce water temperature in the lower mainstem of X subbasin).

- Activities performed by local watershed groups with assistance from local fish managers

Table 5.3- 1 List of Columbia River Basin subregions and watersheds within each subregion

LOWER COLUMBIA RIVER SUBREGION

- Cowlitz Subbasin
- Elochoman Subbasin
- Grays Subbasin
- Kalama Subbasin
- Lewis Subbasin
- Lower Columbia Mainstem Subbasin
- Sandy Subbasin
- Washougal Subbasin
- Willamette Subbasin
  - Clackamas River
  - Coast Fork And Long Tom
  - Coast Range
  - McKenzie River
  - Middle Fork Willamette River
  - Molalla and Pudding Rivers
  - Santiam and Calapooia Rivers
  - Tualatin River

LOWER MID-COLUMBIA RIVER SUBREGION

- Big White Salmon Subbasin
- Deschutes Subbasin
- Fifteenmile Subbasin
- Hood Subbasin
- John Day Subbasin
- Klickitat Subbasin
- Lower Mid-Columbia Mainstem Subbasin
- Umatilla Subbasin
- Walla Walla Subbasin
- Wind Subbasin

UPPER MID-COLUMBIA RIVER SUBREGION

- Chelan Subbasin
- Crab Subbasin
- Entiat Subbasin
- Methow Subbasin
- Okanogan Subbasin

- Upper Mid-Columbia Mainstem Subbasin
- Wenatchee Subbasin
- Yakima Subbasin

UPPER COLUMBIA RIVER SUBREGION

- Bitterroot Subbasin
- Blackfoot Subbasin
- Clark Fork Subbasin
- Coeur d'Alene Subbasin
- Flathead Subbasin
- Kootenai Subbasin
- Pend Oreille Subbasin
- Spokane Subbasin
- Upper Columbia Mainstem Subbasin

LOWER SNAKE RIVER SUBREGION

- Asotin Subbasin
- Clearwater Subbasin
- Grande Ronde Subbasin
- Imnaha Subbasin
- Lower Snake Mainstem Subbasin
- Palouse Subbasin
- Salmon Subbasin
- Tucannon Subbasin

UPPER SNAKE RIVER SUBREGION

- Boise Subbasin
- Malheur Subbasin
- Mid-Snake/Boise Subbasin?
- Mid-Snake/Powder Subbasin?
- Owyhee Subbasin
- Payette Subbasin
- Snake Headwaters Subbasin?
- Upper Snake Subbasin?
- Weiser Subbasin

- Propose projects to address priority actions consistent with the multi-year implementation plan.

- Annual funding decisions

    - By regional fish and wildlife managers:

        * Allocate habitat and production project funding among the subregions.

        * Prioritize production projects within subregions.

        * Approve high-priority projects that cannot wait for consideration in the annual prioritization process.

    - By subregional teams

        * Prioritize habitat projects proposed by fish and wildlife managers, watershed groups, and others. Document in a proposed annual work plan.

B. Encourage and Maintain Watershed Approaches (Through Subregional Coordinators and Others).

- Provide assistance, as needed, in forming and implementing watershed approaches in subbasins.

- Facilitate communication/education within and across watersheds.

- Work with watershed groups to ensure consistency with regional goals, objectives, strategies, and policies, and to take local information to regional managers.

- Coordinate local monitoring, evaluation, and research activities in each subregion with regional efforts.

- Address needs for technical assistance, as necessary, for watershed groups.

- Develop and update subbasin and watershed plans.

- Help identify funding sources and opportunities for cost sharing.

- Address fish and wildlife implementation difficulties.

- Help address federal statutes, such as National Environmental Policy Act and Endangered Species Act, as needed.

5.3.1.2 Structure of a Subregional Approach

A. Groups

- Regional Fish and Wildlife Managers

  The role of the regional fish and wildlife managers is to lay out a technical road map for the region and its subregions (including regional priorities, the roles of the subregions and their watersheds, and habitat and production goals for subregions and their watersheds). The technical roadmap is laid out in a Multi-Year Implementation Plan that is updated annually. The regional managers also allocate funds across subregions, make decisions on production funding, and make decisions on requests for "emergency" funding.

  Subgroups of regional fish and wildlife managers are a major technical link between the region and the watersheds. They can take knowledge of regional objectives and priorities to the watersheds, and take information from the watersheds up to the region to be used in adjusting the regional program.

- Subregional Teams

  Subregional teams are composed of fish and wildlife managers (tribes and state and federal agencies) and local representatives (watershed councils, local government, local agency representatives, utilities, land and water managers, private landowners, environmental groups, fish and wildlife interest groups, and others). The primary tasks of these teams are (1) to link watersheds to the region and vice versa, (2) annually prioritize habitat projects for funding, and (3) identify conflicts with other resource management plans in the subregion, along with options for resolving those conflicts. Of particular importance is the annual selection of habitat projects for funding under the Fish and Wildlife Program. Decisions would be made in the context of regional priorities and policies identified in the Multi-Year Implementation Plan and would require identification of priority populations of fish and wildlife and related habitat objectives. A decision-making group is needed in each subregion responsible for these purposes.

- Local Watershed Groups

  The role of the local watershed groups is to develop and implement action plans that are consistent with regional objectives. Action plans would include goals, strategies, and implementation plans. Ideally, action plans would incorporate and be consistent with subbasin plans.

- Transition to Subregional Approach

  Alternative A

  Decision-making groups are needed to be functional in each subregion starting in early 1997. This would allow prioritization of projects for funding in fiscal year 1998 to occur under a process that starts in early 1997 and is completed in the summer. The fish and wildlife managers will make final recommendations and submit them to the Council at that time. In any case, the program recognizes that all interests in each subregion need to participate in this process. In this first year of implementation this could be accomplished by widely distributing the request for proposals in order to solicit projects from all interests in each subregion. In addition, the meetings of the decision-making group should be fully open to attendance by all interests. This will require broad distribution of notice of meetings and related materials.

  Concurrent with prioritization during this first year, it would be useful to more fully address the need for involvement of all interests at the subregional level. This would be accomplished by the Council assembling a regional group of local watershed experts to recommend approaches for fully involving appropriate interests. Recommendations of this ad hoc group would be completed by summer 1997. This would facilitate implementation of these recommendations in the prioritization process for fiscal year 1999 projects.

  Alternative B

  Similar to Alternative A for production projects. Production projects would be prioritized in the process set out to be completed in the summer of 1997. Habitat projects would have a different schedule. Priority populations and actions would be identified by the fish and wildlife managers and submitted for independent scientific review by May. A final set of priorities would be available for requesting proposals in the summer. Final project selections would occur by the end of December or early January, which allows for contracting to occur before the field season begins in the early spring of 1998. This alternative would also include the assembling of a regional group of local watershed experts to recommend approaches for fully involving appropriate interests. Recommendations of this ad hoc group would also be completed by summer 1997. This schedule would allow these recommendations to be used in the prioritization process at the end of 1997.

B. Staff Needs for Implementation of the Subregional Approach

Effective implementation of the subregional approach will require staff responsible for ensuring that necessary activities occur. Staff needs include those for a regional coordinator for the effort, subregional coordinators, and watershed coordinators. Without the assignment of staff to tasks in these specific areas it is doubtful that the subregional approach can succeed. That said, the prevailing thought in the region is that process and staffing costs must be kept to a minimum. Simply stated, as much of the available funding as possible should go on-the-ground. This proposed approach takes this concern into full consideration.

- Regional Coordination

The regional coordinator would be a full-time position. The coordinator would be stationed at the Columbia Basin Fish and Wildlife Authority offices in Portland. Duties would include overseeing the subregional coordinators and ensuring that the regional perspective is incorporated at the subregional and subbasin levels. The coordinator would take the lead in ensuring that prioritization of habitat and production projects occurs and that development of watershed approaches proceeds in a successful manner.

- Subregional Coordination

The subregional coordinators would staff the subregional decision-making groups. These positions would be located in the subregions being coordinated. It is not clear over the long-term how many subregional coordinators are needed. Initially it is probable that three subregional coordinators would be adequate. Each coordinator would be responsible for two subregions. As least through the summer of 1997, their focus would be on the fiscal year 1998 prioritization process. These positions have been envisioned two alternative ways.

Alternative A

These positions could be one- to two-year appointments. Employees of governmental, public, and private organizations would fill these positions on a full-time basis over the term of the appointment. At the end of the appointment term the employee would return to his or her prior organization. This would allow the region to tap into existing expertise and organizations to use these positions as training opportunities. Ideally these positions would be funded at least partially by the organization from which the employee is on loan.

Alternative B

These positions could be more long-term oriented, giving incumbents more time to develop job skills and working relationships, and providing better continuity because of institutional memory. This could make the positions more effective. The positions would probably need to be fully

funded by the ratepayers under this alternative, although cost-share could be pursued, especially with federal agencies.

- Subbasin Coordination

  The subbasin coordinator positions are independent of the regional and subregional coordinators. As stated above, specifics about how watershed approaches operate in each of the subbasins are left to those interested and involved in any particular subbasin. It has been the experience of the model watersheds under the Fish and Wildlife Program that full-time coordinators are integral to the success of these efforts. Program funds have been used for some of these positions, but the program states that this funding should be viewed only as startup dollars. A purpose of the subregional approach would be to work with appropriate entities to establish means for subbasin coordinators to be self sustaining in regard to funding.

C. Funding Needs for Subregional Approach

Need	Product	Funding
Six Subregional Decision-Making Bodies	Travel for Meetings	$20,000
Regional Coordinator	Salary, Office Space, Administrative Assistance	$100,000
Three Subregional Coordinators (assumes a 50% cost share)	Salary, Office Space, Administrative Assistance	$150,000
TOTAL		$270,000

5.3.2 Criteria for Prioritizing Habitat and Production Projects for Fish and Wildlife Program Funding

Criteria for prioritizing sburegional projects need to flow from the regional level, and they should be available for use early in 1997 for the prioritization process. The criteria should include Fish and Wildlife Program policies and priorities as well as other biological criteria identified by the fish and wildlife managers. Further, the request for project proposals form needs to request information that will allow the criteria to be effectively applied to the proposals. At this point there is substantial disagreement on this issue. This section contains discussions drawn from various sources of criteria that might be used.

5.3.2.1 A Proposal by CRITFC for Setting Priorities for Watershed-Based Habitat and Production Activities

The traditional approach to fisheries management has focused on portions of streams or rivers for project or research attention. However, as emphasized in the report of the Columbia Basin Independent Scientific Group, *Return to the River*, the watershed must be used as the management unit in restoring

aquatic habitats and populations (p. 149). A watershed approach incorporates all features of aquatic systems including physical, chemical, and biological components. Watershed analysis is the scientific analysis of the most significant ecological and social forces affecting aquatic habitat conditions within a watershed. It is a dynamic process, constantly changing with new information, ideas, and syntheses.10

At present, this level of analysis is available for few, if any, of the anadromous and nonanadromous watersheds of the Columbia Basin. This comprehensive analysis, taking into account all the activities within a watershed, is the ultimate goal for identifying priority actions for watershed production and habitat restoration.

In the Columbia Basin, watershed analysis should be consistent with the conceptual framework proposed by scientists of the Columbia Basin Fish and Wildlife Authority. (see Section 5.2, *A Conceptual Framework for Salmon Restoration*). Watershed analysis will provide the tool to understand the relationship between environmental attributes and biological performance. In addition, monitoring and evaluation activities should be directed to measure the status of the described events (habitat restoration/protection), environmental conditions, biologic performance, indicators, and resource status.

It will be necessary to fund this level of watershed analysis in order to assure that limited fish and wildlife restoration dollars will be directed to the highest-priority areas, whether to protect high-quality habitat or to provide fish to high-quality habitat through supplementation. The comprehensive nature of these watershed assessments may attract a variety of funding sources.

Evaluating Priorities

In the interim, the fish and wildlife managers have started a three-tiered process to evaluate priorities.

■ Tier 1 - Qualitative Analysis - A broad, qualitative analysis is provided as a part of the Interim Draft of the Multi-Year Implementation Plan. It is a compilation of information from the NPPC subbasin plans, the Spirit of the Salmon plan, and other readily available data.

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10 A six-step process was outlined in the federal guide for watershed analysis, *Ecosystem Analysis at the Watershed Scale*:
1. Characterization of the watershed
2. Identification of key issues and questions
3. Description of current conditions
4. Description of reference conditions
5. Synthesis and interpretation of information
6. Recommendations

Fish status was taken from the Spirit of the Salmon plan table of stocks that are extirpated (E) or badly damaged (BDD). The BDD stocks have declined 50 percent from the first counts made historically. This table in the Spirit of the Salmon plan does not consider steelhead. Also, it emphasizes a declining trend and does not put much emphasis on statistically stable populations that are at a very low population size.

Current production agreements were tabulated at Agreements of Fish Managers, CBFWA - October 10-11, 1996, by the agencies and tribes. Stocks for which there is consensus to proceed with supplementation are listed as well as those with plans under discussion. It may be that in practice, there will be difficulty agreeing on the level of supplementation even when there is an agreement to supplement.

Production potential (Source: NPPC subbasin plans and Spirit of the Salmon plan) might ideally come from an estimate of current carrying capacity and carrying capacity of the restored subbasin. The difference would indicate the potential for improvement.

Current production potential could possibly be estimated by dividing current natural fish populations by stream miles in the basin. Unfortunately, this information is very sparse and unreliable. Population sizes are estimated from redd counts from index areas. Esstimates of expansion to the entire subbasin are subject to much error. In addition, the stream miles in the subbasin should be those miles actually used in spawning and rearing, which is different from total miles in the basin. Because of uncertainties involved in deriving a fish/mile estimate per subbasin that is meaningful, probably more emphasis should be placed on the tribal production goal for each subbasin as a criterion for how much habitat restoration work to do. In terms of habitat restoration needed, probably subbasins such as Little White and Big White could be given low priority in comparison to Yakima River and Umatilla River.

Infrastructure information is provided in the Watershed Infrastructure Survey recently completed in the Multi-Year planning process. An analysis needs to be made of the watershed infrastructure necessary to support local ownership and leadership in watershed protection and restoration.

■ Tier 2 - Quantitative Analysis - This analysis will incorporate actual data, stream temperatures, cobble imbeddedness, and channel complexity. This analysis should use the data developed as a part of the Interior Columbia Ecosystem Management Plan. It will take approximately three months to complete this level of analysis

■ Tier 3 - Detailed Watershed Assessments - These assessments will be done on a watershed level and will identify the relationship between broad-scale watershed conditions and fish restoration. These watershed assessments will be done in conjunction with locally based watershed groups to promote public understanding of watershed conditions and the identification of priority actions for multiple benefits including fish and wildlife restoration.

Prioritizing Habitat Actions

Development of habitat action priorities can proceed under three stages of analysis:

1) **Do a qualitative analysis of information available or develop a priority list based on best professional judgement. Also, freely employ any political or social criteria.**

Here are some possibilities:

a. *Divide the money equally among subbasins.* If one takes the most extreme position of saying that all subpopulations of any stock or species, no matter what their size, contribute significant genetic information that cannot be lost, all habitat deserves restoration. With this view, restoration funds should be spread to all watersheds in all subbasins. Dividing the total dollars available by the number of subbasins would ensure that the public throughout the entire CRB woulc become increasingly aware of the movement to develop watershed restoration plans. It would give impetus to development of the necessary infrastructure and accompanying public education.

It is likely that with the small amount of money available to do habitat work, little can be done to stay ahead of simultaneous habitat destruction. ***Possibly more benefit can be derived from developing infrastructure and public education in the long run*.** The total BPA dollars could also be divided among subbasins in proportion to anadromous watershed area. This area could be calculated from the headwaters to the mouth or possibly the watershed area supporting spawning and rearing should be emphasized. This would eliminate watershed area and stream length in the migration corridor (unless passage improvements are needed).

b. *Concentrate on the least-damaged habitat*. One could argue that it is best to put money into saving and restoring the least-damaged habitat because this habitat could be the breadbasket of production and diversity (species diversity, genetic diversity). However, there are very few such areas left. A few include the Middle Fork Salmon River, Selway River, White Sand Creek, North Fork John Day River, North Fork Umatilla.

c. *Concentrate on the most-damaged habitat*. It is also rational to argue that we should put money into restoring the heavily damaged habitat. These subbasins might still have some naturally spawning stocks and would have a great potential for habitat improvement and consequently, fish production. But if the subbasin is too damaged, the cost of improvement might be very high and recovery times too long to be able to show the potential for habitat approaches to be helpful in salmon restoration. The Walla Walla might be an example of this situation.

Habitat damage from urbanization, building of major highways, and railroads would be difficult to overcome. Habitat damage from cattle grazing is ubiquitous but often does not involve permanent reduction in production capacity of the stream. Consequently, restricting livestock access to streams would provide a high chance for success if the political and public resistance hurdles can be overcome.

d. *Apportion money to all subbasins that do not have severe tributary passage problems.* For example, supplementation on the Big White Salmon River depends on solving passage problems at Condit Dam. Improving habitat above the dam should have lower priority than fixing accessible habitat, as long as money is very limited. However, if one has the attitude that habitat improvement or protection is nonessential so long as mainstem Columbia or Snake River passage is a major impediment, serious loss in habitat quality could occur during the time period in which dam-passage is corrected. This would limit the long-term production potential.

2) **Refine the analysis of the current habitat situation by evaluating data available on habitat conditions**. Such information might be available from the USFS and BLM for federal lands and in the ICBEMP databases.

3) **Do a detailed watershed assessment.** Watershed assessment/analysis is a procedure used to characterize the human, aquatic, riparian, and terrestrial features, conditions, processes, and interactions (collectively referred to as "ecosystem elements" within a watershed. It provides a systematic way to understand and organize ecosystem information. Watershed analysis serves as an important tool for identifying priority anadromous production and restoration actions.

Some Recommendations

A useful approach is to prioritize actions that would have the greatest benefit to salmon regardless of where they are applied. See the Coarse Screening Process (Rhodes et al. 1994). Sediment deposition on stream substrate, decreases in bank stability, increase in water temperature, and reduction in streamflow from natural are among the most significant impacts occurring in salmon streams. The key land management actions affecting these habitat parameters are livestock grazing, riparian logging or clearing and roadbuilding, existing roads, irrigation withdrawal, and farming into the zones. Aside from these activities, passage barriers of many sizes seriously impede fish migration.

Any restoration action should be applied in the current spawning and rearing portion of the watershed; after success is achieved there, restoration should proceed downstream. There may be limited cases in which localized actions taken in the lower watershed could be effective in restoring critical habitat. For example, livestock impacts on the lower Imnaha in areas critical to fall chinook spawning might require restoration. Even though upper watershed restoration for the Imnaha is probably of lower priority than for the John Day or Grande Ronde, local actions in the lower Imnaha might be of high importance.

Existing areas of high quality should not be degraded further. It is far more difficult and expensive to restore habitat than to prevent the degradation in the first place.

Within any subbasin, certain smaller watersheds should be prioritized for treatment, assuming a) there is enough restoration money that can be applied in them to be effective, b) there is not ongoing habitat degradation in the watershed that would result in a net decline in stream productivity, c) other essential streams or reaches needed for the fish stock to complete its life cycle are present, in fair

condition, and are also receiving priority treatment. If this strategy is applied in the John Day subbasin, one might start by giving the South Fork a low priority at the moment. It is very degraded and supports only steelhead. The upper North Fork arises in wilderness but has historic mining impacts. This upper basin provides cold water to the system, but tributaries in the lower North Fork are being systematically degraded by the USFS and private landowners. Both spring chinook and steelhead would benefit from habitat restoration and protection. The USFS needs to commit itself to antidegradation in this subbasin. This includes refraining from logging riparian zones in bull trout habitat in the interest of water temperature control. Grazing control in the private and USFS lands is also a priority. Given these improvements, population recovery should be feasible in this system.

In stage one development of a priority list of subbasins and watersheds within subbasins, priorities should be identified. The Spirit of the Salmon plan lays out the importance of maintaining and restoring all remaining anadromous fish-bearing habitat. The Spirit of the Salmon plan is not a plan designed to negotiate further sacrifices of habitat quantity or quality. It does not imply that the Walla Walla subbasin is less important than the Salmon River. The Spirit of the Salmon plan also indicates that all historical fish stocks should be restored to the basins in which they occurred.

Rationale for placing the majority of habitat restoration money in a few subbasins or watersheds within subbasins includes being able to demonstrate in the shortest time possible that a) habitat can be restored by taking recommended actions, and b) population size will increase in proportion to increase in habitat quality. Habitat improvement is also needed to the extent that production goals are dependent on natural production. Natural production can come from supplementation and also from wild stock having no supplementation program. Supplementation agreements were identified to indicate basins having a need for habitat improvement to sustain supplemented populations.

5.3.2.2 Northwest Power Planning Council Fish and Wildlife Program Language Including Policies and Priorities that Should be Addressed by the Criteria

Program Section 3.1D.1

- Explain whether the measure would address factors that limit weak stocks. Rebuilding weak populations, especially populations listed under the Endangered Species Act, should be given priority.

- Provide reasons for concluding that the project would pose no appreciable risk to biological diversity among or within anadromous fish, resident fish, or wildlife populations, using the best available tools (such as the Regional Assessment of Supplementation Projects, Chapter III.C of the Integrated System Plan, Habitat Project Selection Criteria) and data (such as the wild and natural production data in Section 7.2C, hatchery analyses in Section 7.3B and cumulative impacts studies in Section 7.2D) to support reasoning.

- For proposed artificial production measures, explain whether the measure would make use of existing production facilities and, if not, why not.

- Approach the needs of target populations from an ecosystem perspective. Give special priority to projects that are part of model watersheds or other coordinated watershed programs.

- Expedite consideration of appropriate, locally based habitat projects.

- If a measure is designed to create harvest opportunities, explain whether those opportunities will be in tributaries or other areas where there would be no significant, additional harvest pressure on weak populations.

- Explain any steps needed to ensure that activities to benefit one species will not inappropriately harm another.

- Explain whether the measure would help address a critical uncertainty (Section 3.2C).

- Provide estimates of cost and biological effectiveness of proposed measures for the target fish and/or wildlife population. Relate biological effectiveness to success in meeting survival targets, rebuilding schedules, performance standards, or other relevant, biologically based factors. Specify the time period over which improvement may be expected.

- Explain how the measure would be monitored and evaluated.

Program Section 4.1A

- Priority should be given to activities that aim to rebuild weak upriver populations, including populations listed under the Endangered Species Act.

- Program activities should pose no appreciable risk to biological diversity among or within fish populations (including resident fish), unless they address critical uncertainties or test important hypotheses. The best available data and assessment tools should be used to evaluate biological risk before determining whether to proceed, and activities should be followed-up with monitoring and evaluation.

- The region should approach habitat and production activities from a total-watershed perspective, not as activities that occur in isolation from land and water conditions in watersheds. Special priority should be given to projects that are part of model watersheds or other coordinated watershed programs, especially those with local community involvement.

- While the bulk of the region's attention is currently focused on threatened and endangered stocks, it is important not to lose sight of this region's obligations to fulfill Indian treaties and provide fish for Indian and non-Indian harvesters. Investments and adjustments should be

made to provide harvest opportunities in tributaries or other areas and to facilitate rebuilding weak populations.

- Consistent with the Council's adaptive management policy, priority should be given to activities that address critical uncertainties and/or test important hypotheses. Activities should be designed as experiments so that the results fill in the region's understanding of salmon and their survival requirements. Even a measure that poses risks for a population may be acceptable if the potential learning benefits are high enough.

- Because of concerns over the basin's salmon carrying capacity, the effects of hatchery-produced fish on those that spawn in streams, and the cost of hatcheries, new salmon production facilities generally should not be constructed unless it is clear that the need for fish cannot be met with existing facilities, or a new facility would be a better way to achieve the program's goals.

- The subregional process (Section 3.1D) should generate important information on the costs and biological effectiveness of habitat and production measures. This information will contribute to the independent evaluation of program cost-effectiveness by the Independent Scientific Group (Section 3.2B), and be reflected in the annual implementation work plan (Section 3.1B.2).

- For at least the next five years, the preponderance of the ratepayers' investment should be directed to rebuilding weak stocks. Both the potential biological value of weak stocks and the requirements of the Endangered Species Act suggest that the path to doubling must begin with weak populations. This weak-stock priority includes populations listed under the Endangered Species Act, but is not limited to these populations. The Northwest Power Act calls for a long-term approach to fish and wildlife mitigation, not simply a reaction to immediate problems. Treaties with Indian tribes and with Canada call for the United States' best efforts to rebuild these populations to self-sustaining, harvestable levels. The Council is committed to this cooperative effort. Moreover, there are many weak salmon populations not listed under the Endangered Species Act. It is in the region's interest to take forceful steps to strengthen these populations before it becomes necessary to list them. Limiting ratepayer investments to threatened or endangered species in these circumstances is simply an invitation for new Endangered Species Act petitions.

- While the preponderance of the ratepayers' investments should be directed to weak stocks, weak stocks should not be the exclusive focus of the program. Over the past decades, Indian tribes and other harvesters have given up harvest on species after species, and that disturbing trend appears to be continuing. For tribal fishing rights to have meaning, there must be enough fish in the rivers to allow a reasonable harvest. Upriver fishers are entitled to salmon populations that are more than museum specimens. In the long-term, as weak stocks are rebuilt, harvest opportunities may be expanded throughout the basin, consistent with rebuilding targets. In the short term, the region should also make investments and

adjustments to provide harvest opportunities in tributaries or other areas where there will be no significant negative effect on weak populations.

Program Section 7.6A

- Protect and improve habitat conditions to ensure compatibility with the biological needs of salmon, steelhead and other fish and wildlife species.

- Ensure human activities affecting production of salmon and steelhead in each subbasin are coordinated on a comprehensive watershed management basis.

- At a minimum, maintain the present quantity and productivity of salmon and steelhead habitat. Then, improve the productivity of salmon and steelhead habitat critical to recovery of weak stocks. Next, enhance the productivity of habitat for other stocks of salmon and steelhead. Last, provide access to inaccessible habitat that has been blocked by human development activities.

- Improve and maintain coordination of land and water activities to protect and improve the productivity of salmon and steelhead stocks. The Council encourages local cooperation and coordination to address habitat protection and improvement and to resolve problems created by competing missions. The Council encourages private parties to be proactive and to work cooperatively with resource managers to maintain and improve habitat.

- Develop and implement procedures to ensure compatibility and compliance with the Council's habitat goal, policies and objectives. Implement and require compliance with state, federal, local and tribal laws, regulations and policies relating to Columbia River Basin salmon and steelhead habitat regulation and management.

- Give highest priority to habitat protection and improvement in areas of the Columbia Basin where low or medium habitat productivity or low pre-spawning survival for identified weak populations are limiting factors. Give priority to habitat projects that have been integrated into broader watershed improvement efforts and that promote cooperative agreements with private landowners.

- For actions that increase habitat productivity or quantity, give priority to actions that maximize the desired result per dollar spent. Also, give higher priority to actions that have a high probability of succeeding at a reasonable cost over those that have great cost and highly uncertain success.

- Provide elevated or new funding necessary for the successful and timely implementation of the items listed in this section. Funding sources for implementing provisions of the habitat section should include, but not be limited to, the U.S. Forest Service, Bureau of Land Management, Bureau of Reclamation, Soil Conservation Service, National Marine Fisheries

Service, U.S. Fish and Wildlife Service, Corps of Engineers, Agricultural Stabilization and Conservation Service, Bonneville Power Administration, other relevant federal agencies, all relevant state agencies, local governments, private landowners, resource users and tribes. Cost and effort sharing is encouraged.

- Encourage the involvement of volunteers and educational institutions in cooperative habitat enhancement projects. Promote public outreach and encourage education in watershed and resource management and protection throughout the basin.

5.3.2.3 Criteria Identified by the Northwest Power Planning Council for the April 1996 Early Action Watershed Package

- Demonstrate addressing an objective from a subbasin or other plan in a manner consistent with associated strategy from that plan.

- Demonstrate that proposal will be implemented in the context of the regional approach to monitoring, evaluation, and research.

5.3.2.4 Criteria Used by the Anadromous Fish Managers to Prioritize Projects for Fiscal Year 1997

Factors for Evaluating Anadromous Fish Restoration Projects in the Columbia River Basin

A. Priority Stock: Does the project contribute or help evaluate the survival changes necessary to rebuild naturally reproducing populations? Maximum 20 points: 10 for status, 6 for number of stocks, 4 for genetic conservation.

1) Stock status:

Guidance: If project affects multiple stocks, choose the highest applicable category. Refer to the attached ISP stock list for guidance.

a. Stocks which are declining and will continue to decline under present conditions (e.g., badly damaged and declining stocks, and stocks listed under the ESA)
10 pts

b. Stocks which are marginally maintaining themselves under present conditions,
8 pts

c. Stocks which have been extirpated but whose habitat can support a naturally reproducing stock.

6 pts

d. Stocks which are presently healthy but are in danger of declining without additional protection.
6 pts

e. Enhance healthy stocks.
2 pts

2) The number of stocks affected. Projects would be prioritized according to the number stocks benefiting from the project.

1 stock	2 pts
2-5 stocks	4 pts
5+ stocks	6 pts

3) Genetic conservation.
Project has positive or neutral effects 4 pts
Project has negative genetic conservation effect 0 pts

B. Natural Production Need: Does the project directly increase survival to adult returns? When and by how much? Maximum 20 points: 10 for timing and 10 for magnitude of the increase.

Guidance: This category of criteria asks alternative questions based on whether the project addresses a documented or undocumented source of mortality. Project reviewers should assign points to either criteria 1a <u>or</u> criteria 2a, <u>and</u> to either 1 b <u>or</u> 2b.

1) Does the projects increase DOCUMENTED sources of survival and significantly increase return of naturally reproducing adults:
   a. When will the benefits be realized?

1 generation	10 pts
2 generations	6 pts
more than 2 generations	4 pts

   b. How significant is the proportional increase from the existing population level?

100% or greater	10 pts
50% - 99%	6 pts
less than 50%	4 pts

2) Does the projects increase UNDOCUMENTED sources of survival and significantly increase return of naturally reproducing adults:
   a. When will the benefits be realized?

1 generation	5 pts
2 generations	3 pts

more than 2 generations 2 pts

b. How significant is the proportional increase from the existing population level?
100% or greater 5 pts
50% - 99% 3 pts
less than 50% 2 pts

C. Utilization Need: Does the project enable or contribute to meeting fish utilization goals? 20 points maximum: 10 for magnitude of effect and 10 for effect on stocks needing protection.

Guidance: A utilization goal may be either consumptive (e.g., catch to a fishery) or non-consumptive (e.g., brood stock, education/viewing). A utilization goal should be from a specific written plan. The following questions should be scored based upon the magnitude of a project's impact, usually measured in numbers of fish. Points should be given only to projects whose benefits occur within two cycles.

1) Does the project enable achievement of utilization goals (e.g., as described in the CRFMP and/or a subbasin plan)? 0-10 pts

AND

2) Does the project decrease the impacts on a priority stock (see below)? 0-10 pts

D. Increased Learning: Does the project contribute to increased learning in the context of an overall adaptive management salmon restoration program? 20 points maximum.

Guidance: First determine the appropriate category for each project then assign points within the indicated range according to the significance of the information produced.

1) Project provides essential information within a critical path decision-making about a conservation measure. 0-20 pts

Guidance: Projects that fall within this category are those that develop and maintain long-term data bases and/or resolve controversy or uncertainty over critical issues having basin-wide management implications (e.g., survival under different migration scenarios or hatchery/natural fish interactions).

2) Project provides essential information within a critical path decision-making about a utilization measure. 0 - 15 pts

5.4 Key Technical and Policy Issues

[Note: The Chapter 5 Work Group has not completed and reached agreement on this section. The Work Group will continue to work on this and other sections of Chapter 5 through the internal review period.]

The Watershed Production and Habitat Committee identified several key policy issues that need to be addressed and options for resolution in order to allow coordinated implementation of production and habitat projects identified in the NPPC and Spirit of the Salmon and other plans.

5.4.1 Key Technical and Policy Issues

Issue 1. Lack of common set of regional and subbasin production goals, policies, objectives, and strategies.

As discussed in Section 5.4, the differences in the production and habitat goals, policies, objectives, and strategies of the three regional recovery plans largely reflect differences in the goals, policies, and management responsibilities of NPPC, NMFS, and the tribes in restoration of Columbia River salmon and steelhead. The management focus of the tribes is to restore historical tribal fisheries in the lower Snake and lower mid-Columbia subregions; hence, the production goals of the Spirit of the Salmon plan are higher in those subregions than the NPPC and NMFS. For example, the Spirit of the Salmon plan adult production goals for salmon and steelhead (in terms of escapement to the subbasins) for the Yakima, Clearwater, and Salmon River basins are 235,700 adults higher than the NPPC plan (771,700 vs 536,000). These differences in production goals largely explain the differences in hatchery supplementation strategies contained in the plans (see Section 5.5).

In addition, the management responsibilities of NPPC, NMFS, and the Tribes define the management scope of the three plans in terms of basin coverage and species addressed. The NMFS plan includes goals, objectives, and strategies for only the listed wild Snake River salmon stocks, whereas the NPPC and Spirit of the Salmon plans include goals, objectives, and strategies for all salmon and steelhead stocks in the Columbia Basin for wild and hatchery fish combined. The Spirit of the Salmon plan also includes goals and objectives for lamprey, which aren't addressed by NPPC and NMFS.

There is a sense of urgency among the fisheries managers to implement artificial propagation measures to reverse the declining trend in fish runs, but numerous critical uncertainties remain regarding the timing and magnitude of implementation. The tribes have proposed a more aggressive artificial production program to rapidly increase the size of small populations to prevent their extinction and loss of genetic diversity. It would be necessary to significantly increase hatchery releases to accommodate all the fishery managers' adult return tributary goals (natural production, broodstock collection, and harvest). Clearly, there is a need to identify a common set of restoration goals and objectives including all salmon and steelhead stocks in the Columbia Basin, as well as lamprey. Fishery managers are working to

devise a balanced and/or diversified approach that addresses the needs to move fast, to limit potential negative impacts on wild/natural spawning populations, and at the same time to gain knowledge regarding critical uncertainties. An adaptive management approach will be necessary to implement prompt corrective actions despite the sometimes incomplete knowledge of the resource (see Section 5.9). This will likely rely upon intensive research of various representative approaches or critical uncertainties in specific tributaries and be tied to a systematic monitoring and evaluation strategy.

The fishery managers will continue to work on a balanced approach that meets the restoration and conservation needs of the NPPC and the fishery managers. It is anticipated that discussions will continue through the Production Advisory Committee (PAC) under *US v Oregon*. Discussions will center on reaching agreement on regional and subbasin production goals, objectives, and strategies, including a common set of hatchery broodstocks used, magnitude of hatchery releases, and reintroductions.

The following issues are subsets of Issue 1. The process and timeframe for resolution are the same as discussed above.

Sub-Issue 1A. Lack of common understanding on how to determine appropriate hatchery broodstocks

The appropriate broodstock source or pooling of sources to use in supplementation projects is sometimes a point of issue. NMFS's position is founded on the concept of the evolutionarily significant unit (ESU), which bases population distinctiveness on genetic information from numerous artificially defined geographic areas. The tribal position holds that perceived geographic and reproductive isolation should not be used as the key indicator for population distinctiveness. The tribes support artificial propagation for supplementation based on practicality and scientific principles that include but are not limited to genetic information. A balance of supplementation actions or combinations of different strategies in different locations is being worked out by the fishery managers. It is hoped that a balance will be achieved so as to not limit supplementation actions, a critical component for a comprehensive watershed-based fish rebuilding effort.

Sub-Issue 1B. Reprogramming existing hatcheries or building new facilities

The co-managers may have policy differences related to the need for new hatchery facilities in addition to existing programs. The issue focuses on the tribal position that existing facilities can be reprogrammed or filled to capacity, where space exists, to meet anticipated artificial production needs. The tribes propose that existing facilities have been constructed to mitigate for actions already taken, and the capacities and programs designed for those facilities are scaled to replace production lost. Reprogramming or using available space to support planned supplementation programs does not satisfy both past mitigation settlements and future production plans.

Issue 1C. Use of hatcheries to supplement natural populations

Fishery managers agree that both habitat enhancement and artificial propagation will be necessary to rebuild many of the Columbia Basin fish populations that are seriously depressed and have not shown an ability to reverse their declining trends without intervention. The concept of supplementation is widely supported, but decisions on appropriate broodstocks and release numbers are sometimes at issue. In order to address the critical nature of continuing population declines, the fishery managers will need to reach agreement on supplementation issues in a timely manner. The necessary technology for artificial propagation facilities and the species and streams to be supplemented are often agreed upon. However, fishery managers will need to continue to settle any unresolved details regarding broodstocks and release levels and issues regarding operation of the facilities (see tribal co-management).

The co-managers also disagree on the planning effort needed and the acceptable level of genetic and ecological risk before a supplementation project is implemented and on the time scale to rebuild supplemented populations. Tribal managers tend to encourage aggressive action plans that prioritize demographic aspects of rebuilding over genetic concerns, focus less on risks if biologically reasonable supplementation practices are used, and support accelerated rebuilding to harvestable levels in the shortest reasonable time. State and federal fishery managers support more conservative supplementation plans with lower genetic risk to wild stocks and slower rebuilding schedules.

Issue 1D. Effects of hatchery practices and production on natural fish populations

Policy differences exist between the tribes and the state and federal fishery managers over issues concerning the proper use of hatcheries to supplement or restore natural production. Tribal policy emphasizes returning hatchery fish to natural habitats capable of supporting natural production. The tribes' approach is to avoid interactions between hatchery and wild fish and exceeding natural production carrying capacity by developing proper linkages between artificial production actions and the habitat where they are targeted (CRITFC 1995). In contrast, state and federal co-managers may in some cases prohibit by statute the release or return of hatchery-produced fish into habitats containing naturally produced fish.

There is considerable literature describing the various impacts of hatchery practices and production on natural populations, but little information to quantify those impacts (NMFS 1995-98 Biological Opinion on Hatchery Operations). Impacts on naturally produced species from artificial propagation programs may occur from operation of hatchery facilities, interactions between hatchery and natural populations in the natural environment, and collection of broodstock. Hatchery actions may adversely affect natural production directly via mixed stock fisheries, predation, broodstock collection, and disease transmission and indirectly through genetic and ecological interactions in the natural environment.

In NMFS's 1995 Proposed Recovery Plan, it is recommended that the fishery managers consult with NMFS and the Fish Production Committee to develop and implement management plans for Snake River salmon gene bank and supplementation programs. These management plans are proposed to include: 1) specific numerical goals, 2) genetic management strategy, 3) disease management strategy, 4) monitoring and evaluation strategy, 5) reintroduction and supplementation strategy, and 6) facilities management strategy.

Section 7 of the Council's program recognizes that maintenance of biological diversity and genetic integrity of wild and naturally spawning populations of salmon and steelhead is crucial to restoration and management of these populations. Implementation of several measures intended to address these aspects has lagged. These measures include those found in sections 7.1B, 7.1C, 7.1D, and 7.1E. The Council directs staff to work with the anadromous fish managers to ensure these issues are incorporated into the five-year implementation plan presently under development. As a first step, this effort will focus on assessing what has occurred related to this area of the program. This assessment will result in specific project proposals to be submitted to the Council for consideration by the end of February 1997. The Council expects that these projects will be funded starting in FY 1998.

What has been done to resolve the issue:

Options for resolution:

Timeframe (3, 6, 9, or 12 months)for resolution:

Issue 2. Lack of agreement on how implementation of strategies will meet goals and objectives and how success will be measured

Issue:

[Discuss differences between NPPC and Spirit of the Salmon in how benefits of strategies were evaluated and how success will be measured]

What has been done to resolve the issue:

Options for resolution:

Timeframe (3, 6, 9, or 12 months)for resolution:

Issue 3. Funding allocation for hatcheries

Issue:

Funding capped by the Memorandum of Agreement between BPA, NPPC, and others places a series of issues before all interests in the basin. Further, changes in the Northwest congressional delegations have reduced the flexibility of the region to address funding opportunities for ongoing Mitchell Act commitments for fish production and protection and for habitat improvement. Prior to the cap the region had embarked on an extensive program to rebuild anadromous fish resources impacted by hydro development and other actions. The program included capital construction, research, and long-term

monitoring of resource status. In the absence of the cap, outyear costs for operation and maintenance and increases from inflation were incorporated as part of the cost of doing business. The cap, however, does not accommodate increases in expenses for existing programs, a change that now forces participants to absorb increases in costs and/or defer new starts in favor of maintaining existing activities. An alternative is cooperative decisions to terminate some activities in favor of new starts.

Reductions in Mitchell Act funding are coinciding with decisions to adjust production to address new needs. The region must soon address how to retrofit some existing facilities, how to relocate and redistribute production, and how to cover those costs out of existing or reduced budgets.

The region is initiating efforts to rebuild and maintain habitat that will contribute to rebuilding of anadromous and resident fish resources. The habitat "program" is in addition to the existing production, O&M, research, and monitoring and evaluation actions that may fully use existing funding. The issues in funding are now issues of reallocation of existing funding and issues of priority within existing programs and between these programs and new programs. The encompassing issue is where the region wants to go now. Once that is decided, the region can direct how it will get there by how it allocates available funds within the cap and incorporates appropriated funds from both state and federal resource managers.

What has been done to resolve the issue:

Options for resolution:

Timeframe (3, 6, 9, or 12 months)for resolution:

Issue 4: Tribal co-management

Issue:

Rulings in *US v Oregon* have reaffirmed Treaty rights retained by Northwest Tribes to participate in the harvest, production, and management of fishery resources. The forum provided by the Columbia River Fishery Management Program begins to level the playing field in the area of harvest and harvest management through direct participation by tribal fishers and managers. The physical presence of participants in these activities validates the legal precepts established elsewhere.

The playing field for production management, however, does not have the appearance of being level or consistent with the expectations of co-management. The background behind the present system of production facilities underscores the state and federal governance and funding processes and the capabilities of government systems much bigger than tribal governments to construct and operate fish production facilities for the benefit of the citizenry. The net result is a momentum that continues programs of the past and is slow to respond or adjust to real needs to change. However, for co-management to achieve the needs of the region it has become imperative that the region establish a physical presence for

the tribal co-managers in the area of fish production. The reality of ownership of fish in the migration and harvest areas of the Columbia River system by tribal governments levels both the harvest and production forums for all participants.

While prior authorizations by state and federal governments for the construction and operation of present production facilities delay, they do not preclude the opportunity or the appropriateness of enabling tribal governments to achieve equity in producing fish. Co-management needs to respond equitably to the range of interests brought by all participants to the management forum. Recognizing the need for tribal co-managers to participate with parity in the area of fish production is an essential step in achieving co-management. The next step is to achieve parity by resolving the administrative processes that delay transfer of facilities and funding and to support new construction in geographic areas where property transfers would serve no purpose. Co-management is a continuing process of resolving issues and is enhanced by all parties having comparable status and opportunity to influence the decision process.

What has been done to resolve the issue:

Options for resolution:

Timeframe (3, 6, 9, or 12 months)for resolution:

5.5 Research, Monitoring, and Evaluation

5.5.1 Overview

Success of regional efforts to rebuild depleted stocks of anadromous fish in the Columbia River depends, in large part, on the ability to assemble and incorporate necessary information in a timely fashion to support regional decision-making. While a considerable body of scientific information is available regarding the Columbia Basin ecosystem, few would argue with the need for improved coordination and integration of information on anadromous fish populations, and their responses to their environments, to guide recovery programs under the Endangered Species Act and the NW Power Act. A science-based approach to fisheries recovery will require a systematic effort to identify information needs, analyze existing information and hypotheses, locate information gaps, and initiate new research, monitoring, and evaluation as needed to assist management decision-making.

In addition to clarifying underlying questions of fish biology and ecology, information and decision-making must efficiently interact to deal with a highly variable natural system. There is increasing appreciation among scientists of the dynamic nature of natural biological systems. Biologists recognize that complex ecosystems such as the Columbia River are moving targets that continually change over time (Hilborn and Ludwig 1993). The combination of factors that limit salmon production in one decade may change in the next. Fish populations worldwide, and salmon in particular, display short and long-term cycles of appreciable amplitude that confound efforts to implement fixed management plans. This

highlights the need for an adaptive approach that explicitly recognizes uncertainty and anticipates the unexpected. A concerted effort is required to continually evaluate the ecosystem and link this information to an adaptive management program.

5.5.1.1 Need for a coordinated approach to information gathering and management

The region has devoted considerable effort to the investigation of various aspects of Columbia River fisheries. Biological research on the Columbia River began in the late 19th century with development of the first artificial production facilities and with efforts to explain annual fluctuations in commercial salmon catch (Cone and Ridlington 1996). Answers to questions regarding salmon in the Columbia River have been actively pursued throughout this century. The pace of research has accelerated as human development activities have reduced the river's ability to support large salmon populations. At present, many millions of dollars are devoted annually to fisheries research in the basin connected to the rebuilding programs of the Council and the National Marine Fisheries Service. For the most part, the existing programs and alternative recovery and restoration options have common information needs. A coordinated approach could provide assurance that, while uncertainties exist and will continue, the region has a process that will supply needed information to increase the likelihood of success of anadromous fish recovery and restoration efforts.

All three strategic plans for Columbia River anadromous fish recovery and restoration have been structured around survival improvements necessary to rebuild up-river salmonid runs. Each effort has taken a basic life-cycle approach, outlining a series of actions aimed at gaining survival improvements that collectively would sustain salmon and steelhead recovery. Each of these strategic plans recognizes that there are key uncertainties or critical hypotheses associated with the proposed actions. An aggressive adaptive management approach to address critical questions or assumptions is a common theme among the strategic plans developed by the NWPPC, NMFS, and the CRITFC tribes. The following sections will describe the specific research, monitoring, and evaluation initiatives that are being implemented in response to the plans. Those efforts fall into four basic categories:

- Efforts aimed at producing information that would contribute to regional decisions among competing strategies
- Efforts to evaluate major approaches or techniques
- Efforts to further elucidate key uncertainties regarding survival in particular life stages
- Efforts to monitor overall performance or response to the aggregate effect

Survival through the juvenile life stage, particularly as affected by the hydropower system during mainstem passage, is a major focus of the strategic plans. There is general agreement among the plans that mortalities during this life stage increased substantially as a result of the construction and operation of the hydropower system, and that significant survival improvements must be obtained to address these losses. Proposed strategies for improving juvenile survival include enhanced transportation options and improved in-river survival approaches. In-river survival strategies would combine improved flow or velocity conditions with improved passage at the mainstem dams through installation of effective surface collection technology or enhanced bypass screening options. Actions that have been proposed to improve velocity include options to draw down Snake River reservoirs and/or John Day pool to

spillway crest or to natural river levels. The NWPPC Strategy for Salmon and the NMFS 1995-98 Biological Opinion both call for a structured approach to deciding on a longer-term strategy to deal with downstream migration mortalities. The NMFS Plan calls for simultaneous evaluation of improved transportation and in-river survival options, leading up to the selection of a particular juvenile passage alternative in 1999. Implementation would follow in 2000, pending congressional authorization. The NMFS decision strategy calls for a key decision in 1996 regarding drawdown options to carry forward for consideration as part of the long-term approach. The NWPPC Strategy for Salmon calls for drawdowns at Lower Granite and Little Goose in 1995-97 and for decisions on possible additional drawdown alternatives by 2002. The decision points called for in those plans allow for the collection or compilation of additional engineering and biological information to ensure that regional decision-makers can make an informed choice among alternatives in a timely fashion. A detailed discussion of the research and evaluation efforts associated with the critical decisions is incorporated into the appropriate sections below.

The Multi-Year Implementation Plan focuses on efforts to be funded by the Bonneville Power Administration. Efforts are also underway to develop a Mid-Columbia Habitat Conservation Plan that would further address survival improvements for salmonid runs originating above the confluence of the Yakima River. The planned approach to juvenile passage at the Mid-Columbia facilities will involve adaptive management strategies. The approach incorporates an aggressive schedule for implementing and testing prototype surface collection technologies, improved screening, and gas abatement measures. An evaluation program is under development and will be a critical element in the effort.

5.5.1.2 Objectives of this section

Development of a work plan to guide research, monitoring, and evaluation is intended to promote a science-based approach to recovery and restoration of salmonid populations in the Columbia River Basin. The work plan is very much a work in progress and will continue to be revised and expanded in the future. The plan described here provides guidelines for research, monitoring, and evaluation that can guide prioritization of efforts in the near term. The remainder of this section identifies research, monitoring, and evaluation priorities within the context of the conceptual framework and based on identified regional decisions.

5.5.1.3 Definitions

1. Applications of information:
a. Research: Information is used to form a body of basic biological and physical knowledge upon which to base actions.
b. Evaluation. Information is collected and analyzed to determine effectiveness of programs, strategies, and actions relative to a priori set criteria (Management and ecological objectives and performance standards).
c. Management actions. Information is used to weigh potential risks and benefits to select alternative management options and to guide specific actions within the options.
2. Data Collection.

a. Monitoring. Routine, ongoing collection of information for research, evaluation, and management actions.
b. Experimentation. Directed information collection to test or refine identified hypotheses. This includes restricted research experiments, large-scale management experiments, and evaluations.

5.5.2 Organization of Informational Needs

Information needs are organized with reference to the scale of the effect or question being addressed. Within each of the levels, research, monitoring, and evaluation needs can be identified. Further, ongoing RM&E activities that relate to these levels can be organized while needed information can be highlighted.

This structure can be illustrated by describing the four organizational levels. The basinwide or regional level refers to information needs for questions and effects operating at the level of the Columbia River salmonid ecosystem. This includes climatic/oceanic effects and estuarine effects. These factors affect all species and populations originating from the Columbia River Basin. We stress, however, that this does not imply that the effects are equal for all species and populations; in fact, there are distinct species/race/population differences that are important aspects of questions addressed at this level.

System Integration Units (SIUs) reflect questions made with reference to specific salmonid species and races in distinct geographic areas. These areas correspond to the term subregions used elsewhere. The term System Integration Unit is taken from a similar concept used in System Planning (CBFWA 1990). Factors that are common to the area and populations included in an SIU are mainstem passage and mixed stock harvest. Although not explicitly addressed at this time, factors that were previously included at the higher organizational level (climatic, oceanic and estuarine) may also operate at this level as well. For example, there are likely differences in climatic effects between SIUs.

The third organizational level is the subbasin. Questions at this level can address subbasin in total, in groups, or for specific subbasins. For example, questions about production augmentation (hatcheries and supplementation) may be addressed in general or for problems in specific subbasins. Land use practices and their impacts on natural and augmented production could also be addressed in this manner.

The hierarchical nature of this structure has important implications for program structure and especially for research, monitoring, and evaluation. A basic principle of hierarchical structure is that higher levels of system organization constrain the action of lower levels, while, at the same time, the action of the higher levels reflects the actions at lower levels. In other words, within ecological structures, “the slow and the big control the fast and the small...” (Holling 1996). Thus, the performance of the Columbia River ecosystem as a whole reflects the myriad of actions at lower levels of organization such as individual subbasins. At the same time, the lower levels are constrained by the upper organizational levels; subbasin performance is constrained by system actions such as mainstem habitat conditions or even higher levels such as regional climatic patterns. The implication of this for the informational feedback component is that research, monitoring, and evaluation designed to address performance at a particular

ecosystem level must be linked to similar efforts at higher and lower levels. Actions designed at isolated levels of system organization are unlikely to provide needed information on system performance.

5.5.2.1 System Studies

One of the first steps in an adaptive management process for restoring salmon stocks listed under the Endangered Species Act is to identify and describe major uncertainties concerning survival and recovery for the stocks of interest. These major uncertainties should be characterized as a set of distinct alternative hypotheses (aggregate hypotheses for survival over the salmon life-cycle) about how the stocks will respond to alternative management approaches. These sets of alternative hypotheses can also be expressed in the form of a model or models. The Plan for Analyzing and Testing Hypotheses (PATH) process was established for this purpose. Presently, the PATH group is defining alternative aggregate hypotheses and performing retrospective analyses for Snake River salmon populations.

Failure to identify and implement effective recovery measures within the next five years greatly increases the risk of extinction of endangered stocks precipitated by the current low population sizes. Only an active strategy involving experimental manipulation of conditions to create a range of conditions for which responses can be measured is likely to identify effective measures within this critical time frame. Given the uncertainties associated with a number of life stages for Snake River salmon populations, the most reasonable approach would be to take this type of actively adaptive management strategy to implement a recovery program. An active strategy could purposefully construct a range of alternative models that are consistent with the historical stock performance and use these to identify management strategies that provide balance between probing for information (directed experimentation) and caution about short-term conservation concerns for stock survival (Hilborn and Walters, 1992). In contrast, a passive adaptive management strategy (not perturbing present system, status quo management), given the nature of uncertainties, would have two major problems: 1) the rate of learning from experimentation would be extremely slow or not at all (Hilborn and Winton 199?); and 2) given the dire conservation status of the stocks, this approach may prove to be highly risky.

Criteria need to be established in terms important to stock survival and recovery. For the hydropower management actions, the cumulative stock response should be evaluated in terms of smolt-to-adult or adult-to-adult survival rates sufficient for short-term preservation and the potential to recover in the long-term. While use of survival rate criteria is key to sound resource decisions, survival rates exhibit natural variability that can confound interpretation of responses to management actions. Therefore, the experimental design should attempt to control or account for the natural variability.

Rationale for an Indicator Stock Program:

The key to a successful adaptive management strategy is to design directed experiments to assess the overall effect of management actions on stock response in abundance or production. The problem lies in estimating transient stock response to management changes where there may be progressive, cyclic, or irregular impacts due to uncontrolled factors such as climatic changes or progressive anthropogenic impacts. Transient response can be defined as any pattern of population size or population change over time that does not involve just a sudden shift from one level to another (Walters et al. 1989). Walters et

al. describe an experimental design approach to system impact measurement in the face of uncontrolled factors as follows:

> When looking at a particular case situation, the impact measurement question can be stated as: "How does the behavior of this treated system differ from what it would have been in the absence of treatment?" Phrased this way, it is clear that there is no scientific way to guarantee answering the question correctly because there is no way in nature to both treat and not treat the same case systems at the same time.
>
> Given that there is no scientific way to be sure of correctly measuring the impact, it is necessary to rephrase the impact measurement question into a more modest one that can be approached empirically. Three heuristic rephrasings that have been widely used are the following:
>
> (1) Is the post-treatment behavior unlikely in view of past experience with the system?
>
> (2) Is the behavior unlikely in view of how other, similar ("control") systems have behaved since the treatment?
>
> (3) Is the new behavior repeatable (reproducible) when other (replicate) systems are subject to the same treatment?
>
> Each of these questions involves making some prediction about how the initial case system would have behaved had it not been treated: that is, each involves some way of modeling that unobservable behavior.

The proposed indicator stock program uses the terms "experiment," "control," "treatment," and "replicate" consistent with Walters et al. (1989). Depending on the hypothesis or management action, replicates could be defined, for example, as populations in different streams within pristine (control) versus logged (treatment) drainages, or as populations within regions affected by different numbers of dams and/or with different management strategies. The experimental design seeks to measure *systematic differences* in stock survival between treatments and controls to test the consistency of the observations with the alternative hypotheses about stock performance under broad classes of management action.

One frequently used experimental approach to system impact measurement has been to evaluate pre-treatment (i.e. current conditions) versus post-treatment response for the stock of interest (experimental unit). However, as described above, uncontrolled temporal factors can cause misinterpretation of experimental results. There appears to be a growing scientific concern that pre-treatment versus post-treatment comparisons (for natural resource experiments) are very risky and a poor way to evaluate population response (Hilborn and Walters 1992, Holt 1977, Hurlburt 1984, McAllister and Peterman 1992, Sainsbury 1988, Walters et al. 1989). It is important to note that adding more measurements per treatment unit (more marks, sampling stations in each unit) is of limited value and that the critical need is to monitor additional independent units (Hurlburt 1984).

A more reasonable approach for experimental design of a biological monitoring program would be to have experiments with treatment stock versus spatial and temporal index stock controls. It is reasonable to assume several stock units (streams or subbasins) with similar life history characteristics within the Columbia River basin and the region will respond similarly to some of the uncontrolled factors, since these stock units will be directly subjected to many of the same factors (estuarine, oceanographic, and climatic changes). This is parallel to classic concepts of replication and control in experimental design.

Several replicate treated stock units (Snake River stocks) and control units (down-river stocks and coastal stocks) can be monitored to make probabilistic statements of confidence concerning treatment (Walters et al. 1989).

However, there are some concerns that there are genetic differences and habitat differences amongst control and experimental stock units that may not support the assumption that these units are subjected to the same uncontrolled factors. Evaluations will be needed to test whether these differences affect survivals, between treatment and control units, in a systematic manner large enough to invalidate this approach.

The biological monitoring program should contain replicate treatment stock units and replicate spatial control units. This experimental design should enable managers to : 1) test whether treatments produce repeatable effects in situations with similar conditions; 2) distinguish treatment effects from natural variation; 3) estimate the variance associated with various parameters; and 4) test significance (McAllister and Peterman 1992). Finally, this experimental design should provide the ability to distinguish amongst competing aggregate hypotheses for salmon population survival and recovery.

The analyses of spawner and recruit data, from index stock treatment and spatial replicate design, would provide a cumulative stock response to management actions. This key cumulative assessment cannot be provided by merely pooling a number of mechanistic evaluations. The combination of these mechanistic assessments are prone to propagation of error and do not account for covariance among life stage impacts. Without appropriate controls, the results from pooling mechanistic evaluations and assumptions can be misleading.

The following is an outline of the elements that should be contained in a biological monitoring program to achieve the desired experimental design.

A Monitoring Framework

The lack of basic salmon stock productivity data, collected annually, is a major impediment to assessing changes in stock performance. A core set of information, such as the age, sex, and size composition of escapements, coupled with estimates of catch in intercepting fisheries, would allow managers to estimate the productivity of individual stocks and track changes in stock productivity over time. This basic data set, if available for stocks in different geographic areas and for each salmon species, would allow managers to:
Provide treatment and control groups for experimental analysis.
Implement a “staircase” approach (Walters et al. 1989) to experimental design to control for environmental fluctuations.
Evaluate aggregate hypotheses (e.g. from the PATH process).
Understand how healthy stocks perform under natural variations so we can better interpret the performance of, and design effective recovery plans for, damaged stocks.
Improve data consistency across stocks and watershed, thus improving the analytical accuracy.
Distinguish the response of salmon to restoration actions from natural variation

Assess adaptive management experiments (maximize learning through management)
Maintain long-term databases of salmon productivity.

Because of the geographic extent of the salmon's life cycle and the many entities involved in fishery management issues, monitoring activities will require the cooperation and coordination of many groups and programs. These participants must understand the importance of their monitoring actions in an overall framework. This framework is essentially a stratified sampling design composed of defined geographic areas, species, and stocks of interest, and a hierarchical set of data elements.

Spatial Structure

The immediate region of interest comprises those portions of watersheds from San Francisco Bay to the Canadian border that historically supported, and are still accessible to, the various salmon species. Most of these watersheds still contain salmon populations, although certain species and/or populations have been extirpated from historic ranges.

Monitoring should focus on naturally reproducing salmon stocks, although some hatchery populations will likely be included to monitor harvest rates. Table 5.5-1 is an initial list of regions and candidate rivers identified to date, and focused primarily on the Columbia River. Within each of these rivers, we have identified an initial list of candidate salmon populations. In addition to salmon, we should consider resident salmonid populations (e.g. cutthroat and bull trout) that are also candidates for listing under the Endangered Species Act.

Integration with existing programs

Much of the information needed for a system-level monitoring program is being collected for some salmon stocks. We call here for integration and expansion of these existing efforts to obtain regionally consistent and coordinated information on appropriate naturally reproducing stocks.

Data Hierarchy

A coordinated monitoring program must provide a consistent set of base information for all monitored stocks. Additional measurements are needed from fewer stocks to elucidate production mechanisms and dynamics within particular life stages.

5.5.2.2 System Integration Unit Level

Base Data - all regions, all stocks

The most basic information needed is that used to estimate total survival throughout all life history stages. This is most easily collected as adult salmon enter their natal stream or on the spawning grounds. The basic data elements are:

Number of spawning adults, or an index of abundance such as index area redd counts.

Age composition of returning adults - tag recoveries, otolith analysis, and length/frequency analysis are all useful. Length/frequency analysis should be supplemented by tag recoveries or otolith analysis for confirmation of age class break points to account for annual variations in marine growth conditions.

Sex ratio of returning adults - This is used to estimate potential egg deposition, the denominator in a simple estimate of total life cycle survival (the numerator is total returning adults).
Harvest rates.
Adult conversion rates.

Table 5.5- 1 Candidate regions, rivers, and stocks for routine monitoring within an adaptive management program

REGION	BASIN	RIVER	SPECIES/RACE				
			River-Type Chinook (Spring)	Ocean-Type Chinook (Fall)	Sockeye	Steelhead	Coho
Columbia River	Snake	South Fork Salmon (multiple index areas)	X			X	
		Middle Fork Salmon (multiple index areas)	X			X	
		Upper Salmon (multiple index areas above Lemhi)	X		X	X	
		Main Salmon (below middle fork multiple index areas)	X			X	
		Lemhi	X				
		Imnaha	X			X	
		Wenaha	X				
		Lostine	X				
		Minam	X				
		Catherine Cr.	X				
		Upper Grande Ronde	X				
		Joseph Cr.				X	
		Clearwater (multiple index areas in Selway, Lochsa, & South Fork	X	X		X	

REGION	BASIN	RIVER	SPECIES/RACE				
			River-Type Chinook (Spring)	Ocean-Type Chinook (Fall)	Sockeye	Steelhead	Coho
		Cl.)					
		Snake Mainstem		X			
		Tucannon	X				
	Mid Columbia	Methow	X				
		Okanogan			X		
		Wenatchee	X	X	X		
	Bonneville Dam to Priest Rapids Dam	Hanford Reach		X			
		Yakima	X				
		John Day	X			X	
		Deschutes	X			X	
		Klickitat	?				
	Below Bonneville Dam	McKenzie	X				
		Clackamas	?				X
		Lewis		X			
Oregon Coast	N.F. Umpqua		X	X			use present index streams
	Nehalem			X			
	Siletz			X			
	Siuslaw			X			
	Coos			X			
	Rogue			X			
Wash. Coast	Queets			X			
	Clearwater						X
	Hoh			X			?

Estimate recruits by brood year.

Additional information should be collected periodically from the spawning grounds as time and resources permit. This might be done every few years as environmental conditions (particularly stream flows and temperature during spawning) and salmon numbers vary. Useful information can be obtained from:
Multiple spawning surveys and counts outside established index areas to determine the temporal and spatial variability in spawning
Carcass recovery to determine the percentage of retained eggs
Scale samples to determine hatchery or natural origin of spawners

The index stocks need to be selected in order to represent various SIUs for various levels of freshwater habitat conditions within an SIU. The selection of index stocks needs to take a treatment/control approach into consideration. Where feasible, spawner, recruit, and smolt index data should also be collected on aggregate populations with an attempt to separate wild and hatchery production.

5.5.2.3 Tributary Habitat Level

Spawner-to-smolt survival - each region, but not all stocks

Index stocks of each species within each region should be studied more intensively to understand the dynamics of factors affecting egg-to-smolt survival. These need to be identified for various levels of habitat condition (good versus poor condition). The selection should implement a "staircase" approach (Walters et al. 1989) to experimental design to control for environmental fluctuations over SIUs. The following types of information would be particularly useful:
Parr abundance or an index of abundance as determined by snorkel surveys, mark-recapture, or multiple removal methods, depending on logistic considerations in each watershed.
Estimates of the number of smolt outmigrating. For river-type chinook, this should be done in the fall and spring to estimate numbers during each of the typical movement periods. Fall sampling should be done for other species to determine whether there is significant downstream movement at that time.
Pit tags or marks should be considered for downstream-moving fish, as logistics allow, to estimate their timing through the hydropower system and contribution to future spawning.

Smolt-to spawner survival

Monitoring during this portion of the salmon life cycle should include at least the elements described in Table 5.5-2. Monitoring priorities should emphasize information that will directly benefit management decisions and track the magnitude of natural environmental fluctuations.

Table 5.5- 2 Summary of important observations necessary to an adaptive management approach for managing Columbia Basin salmon resources above Bonneville Dam

Environment	Salmon Life Stage	Location	Trait	Parameter
Index Tributaries[a]	Adult	Tributary mouth	*Abundance*[b]	Escapement
			Length frequency[b]	Age composition
			Sex ratio[b]	Number females
	Adult, egg→smolt	Representative sites	*Temperature, silt, riparian condition, etc.*	Quality of habitat
	Parr	Within stream	*Abundance*[b]	Egg→parr survival
	Smolt	Tributary mouth	*Abundance*[b]	Parr→smolt survival
				Egg→smolt survival
Mainstem	Smolt	Uppermost dam	Abundance	No. entering hydropower system
		Bonneville Dam	*Abundance*	Survival through hydropower system
	Parr, smolt	Representative sites	*Pollutant levels, flow,riparian condition, temperature, etc.*	Quality of habitat
Ocean	Subadult, adult	Various	Catch by fishery	Harvest rates
		Various	*Temperature, upwelling, etc.*[c]	Index of natural survival
Mainstem	Adult	Lower river fishery	Catch	Harvest rate
		Bonneville Dam	Abundance	Return by species
		Zone 6 fishery	Catch	Harvest rate

a Areas suitable for monitoring will be identified by the US v Oregon Technical Advisory Committee.
b Information is available in a few areas but is not collected for most stocks.
c Information exists but has not been analyzed for application to salmon management.

Environment	Salmon Life Stage	Location	Trait	Parameter
		Intermediate dams	Abundance	Interdam losses by project
		Uppermost dam	Abundance	Total interdam loss
		Representative sites	*Pollutant levels, flow, temperature, etc.*	Quality of habitat

Italicized traits are not being monitored routinely

Monitoring to better understand natural processes in the ocean, for instance, should only be undertaken after the basic program described above is in place and as limited resources allow.

Habitat and climate data

Base data - all subbasins

Baseline descriptions of each managed watershed should be developed as soon as possible and updated every 5-10 years. This will allow managers to track long-term changes in the environment and the potential effects on salmon production. This information should include parameters that are useful indicators of changes in usage patterns and the condition of each watershed, such as, for example, the following:

- Land ownership
- Road density, by type
- Amount of land in various stages of use (e.g. age categories of forested land, grazing allotments, irrigated and nonirrigated agriculture, etc.)
- Soil types
- Digital elevation databases
- Rainfall and temperature
- Streamflows at representative sites throughout the watershed

Intensive data - for indicator watersheds

The following data should be collected at 1) the upstream and downstream ends of areas used by salmon for spawning and rearing; 2) the watershed mouth and the mouth of each significant tributary; 3) the boundaries of all federally managed lands; 4) other significant sites, as appropriate.

- Water temperature - at least daily maxima and minima
- Discharge

- Substrate sediment condition - Measure at least at the beginning and end of periods when salmon are present in the reach. Measurements should include both surface fine sediment and cobble embeddedness.
- Bank stability
- Channel morphology
- Large woody debris
- Pool frequency and residual volume
- Riparian condition
- Macroinvertebrate community
- Functional relationships between 1) upland watershed conditions and in-channel conditions, and 2) in-channel conditions

5.5.3 Mainstem River Habitats

Mainstem river habitats represent a critical phase in the life history of Columbia River salmonid stocks. Each species of salmon depends upon the mainstem for a different combination of needs. Snake River spring chinook, summer chinook, and steelhead have evolved to move quickly through the mainstem of the Snake and Columbia to the ocean in the late spring of their second year of life. Sockeye are believed to follow a similar pattern. Fall chinook exhibit a different life history pattern, emigrating down through the mainstem as subyearlings. Fall chinook juveniles use mainstem habitat for a prolonged period of growth and rearing. Snake River fall chinook juveniles begin to emigrate from their spawning and rearing areas in the upper Snake basin in the late spring. The emigration of individual fish appears to be triggered by an interaction of growth, flow, and temperature. The migration of subyearlings out of these areas continues throughout the summer into the fall. The emigrating juveniles depend upon mainstem habitat throughout the migration for food and protection from predators.

In-river migrants are subject to mortality from several sources as a result of the hydropower system. Migrating juveniles die as they attempt to pass each of the dams on their path to the estuary. The level of mortality associated with dam passage is a function of the proportion of the outmigration going through each of several possible migration routes - over the spillway, through bypass systems, or through the turbines. Mortality is incurred as a result of passage through the reservoirs as well. Under current operations, a portion of the outmigration of both yearling and subyearling migrants originating in the Snake basin is collected from bypass systems for transportation around downstream dams to the lower river or estuary. Mortality is incurred in this route as well. The impact of passage through the system or via transportation can have both direct and indirect or latent effects.

5.5.3.1 Mainstem Strategy: Work plan

All three of the major strategic plans recognize that juvenile migration mortality associated with the hydropower system must be addressed to allow for recovery of up-river salmon runs. The plans focus on a limited set of basic strategies available to accomplish this objective. The NMFS Biological Opinion includes a commitment to make a decision regarding the appropriate long-term strategy for addressing

mainstem passage mortalities by 1999. The decision process called for in the Biological Opinion recognizes that a final decision regarding a long-term mainstem strategy will involve biological requirements, engineering capabilities, and economic consideration. An organized approach to making the decision on a long-term strategy to address mainstem hydropower impacts is essential.

The following work plan identifies the key biological questions to be addressed in making a decision regarding a mainstem strategy, the information available to apply to those questions, and the expectations for additional information to become available by the 1999 decision point.

The critical biological considerations associated with deciding on an appropriate long-term strategy to address mainstem hydropower impacts on juvenile migrants center on three fundamental questions:

1. What level of survival from smolt-to-adult return is necessary for the recovery of Snake River salmon stocks?

2. What options are available to improve smolt-to-adult survival of Snake River salmon stocks?

3. What is the expected level of improvement in survival associated with each of these options?

In addition to direct survival considerations, the different approaches to achieving long-term survival objectives for migrating salmon may have other biological effects on both listed and unlisted stocks. For example, some options would provide for increased spawning habitat for mainstem spawning stocks such as fall chinook. The options may have different ecological effects on both the aquatic and nearshore terrestrial regimes. These effects should also be taken into account in the decision-making process.

5.5.3.2 Survival Objective

Background

All three of the major planning efforts aimed at the restoration or recovery of Columbia Basin salmon runs have taken a life history approach to analyzing both the impacts and options for improving the status of these runs. Each of the plans recognizes that successful restoration will require addressing the ecological requirements of the salmon in each of these life history stanzas. All of the Snake River salmon species use the mainstem Snake and the lower Columbia as a migration corridor to the sea. In addition, fall chinook make use of the mainstem for spawning and rearing. The latter consideration will be addressed further below. The focus in this section is on survival associated with passage through the mainstem corridor. Direct measurements of pre-dam survival for Snake River salmon runs are not available. Inferences regarding historical levels of survival can be made based upon measurements under current conditions and comparisons of indices of total survival developed based upon run

reconstructions of stocks originating in different areas of the Columbia Basin. The ongoing PATH project is currently summarizing available information and applying it to define survival goals for the mainstem migration components.
add in basic description of PATH*

Key Considerations

The goal of mainstem measures is to achieve a level of survival that will, in combination with actions to address other life history stanzas, result in rebuilding and long-term maintenance of Columbia Basin salmonid runs. Establishing survival targets for the different Snake River salmon species requires consideration of at least three factors: the overall survival needs of each species relative to natural variation resulting from uncontrolled environmental factors (i.e., estuarine and ocean survival fluctuations), and our ability to measure performance directly or indirectly. In addition, setting a survival target for mainstem migration should reflect the level of improvement to be gained in other life history stanzas.

Available Information

An interim survival goal for Snake River Spring chinook has been developed through the retrospective analysis phase of the PATH process. The survival goal is expressed in terms of smolt-to-adult return (SAR) above Lower Granite Dam.

> ***....interim smolt-to-adult return (SAR) goal of 2-6 percent, based on (1) Snake River SARs during the 1960s, when the stocks were believed to be healthy; (2) Warm Springs SARs during a period in which the stock was believed to be healthy; and (3) theoretical SARs associated with a range of Snake River egg-to-smolt survival rates from the last three decades (draft PATH Retrospective Analysis, 1996)***

The interim SAR goal of 2-6 percent encompasses survival associated with downstream migration (reflecting both direct mortalities during passage and delayed effects due to passage), estuarine and ocean survival, and adult upstream passage effects. An interim smolt passage survival goal has been developed through PATH as well, based on approximating the survival that occurred during the 1960s for juvenile salmon migrating from Lewiston to Bonneville Dam. The Snake River salmon stocks were stable at healthy levels during this period. The proposed interim survival objective is expressed as a range, 50 - 70 percent direct survival to below Bonneville Dam, combined with delayed mortality no higher than that which occurred during the 1960s.

Ongoing Efforts

Further development of survival objectives is underway through the PATH project. It would be advantageous to develop a simple set of survival targets against which to judge alternative measures. The strategies described below have different potential effects under different environmental conditions, including the range of annual water conditions during outmigration. It may therefore be necessary to express the target in terms of a risk assessment (see Biological Requirements Workgroup, 1994).

The PATH exercise has focused on spring/summer chinook to date. Expansion to address fall chinook and steelhead is planned for FY 97. Strategies for accelerating the development of information for those species are under discussion.

5.5.3.3 Mainstem Options

Alternative Strategies

There are four basic strategies being considered as long-term options for addressing mainstem survival for Snake River chinook. Each of these options will be assessed as part of an overall strategy, including improvements aimed at migration through the mainstem Columbia River and efforts to restore or protect habitat within the subbasins.

A. Transportation of fish to below Bonneville Dam

B. Modifications to existing dams to reduce mortalities

C. Combination of transportation under some conditions with improved in-river conditions under other conditions

D. Drawdown to natural river for one or more of the mainstem Snake River dams

The decision on a long-term strategy to address migration mortalities is critical to meeting recovery objectives for Snake River salmon runs. Modeling analyses conducted in association with the development of the 1994-98 Hydropower Biological Opinion clearly indicated the need for substantial improvement in survival, and the degree of uncertainty regarding which of the alternatives listed Given the significant declines in Snake River salmon runs in recent years, a decision on the appropriate long-term strategy must be made in a timely fashion. The 1994-98 Hydropower Biological Opinion lays out a structured process for making the decision and initiating implementation by 1999. The PATH process has been summarizing available information on the potential benefits and impacts of the alternative strategies in response to that need. To date the program has focused on spring/summer chinook. A retrospective analysis of available information has been largely completed. Efforts to complete an analysis of spring/summer chinook are underway. Assessments of fall chinook and steelhead are in the planning stages, with initial discussions scheduled for workshops in the spring of 1997. The following summaries of the major options are constructed largely from PATH documents.

5.5.3.4 Expected Survival

Transportation: Transportation of spring migrant smolts around the dams and reservoirs of the hydropower system began in the early 1970s, primarily in reaction to high levels of mortality. The concept is quite simple; capture and transport around the dams avoids the high level of mortality associated with the cumulative effects of passing through the series of projects between the upper Snake and the estuary. The effectiveness of transportation has been seriously questioned, as the up-river runs have continued to decline despite the barging of 60-70 percent or more of the smolts arriving at the uppermost dams in the mainstem Snake. The recently completed PATH retrospective report reviews available information regarding the ability of transportation to provide the necessary survival increment to achieve rebuilding. The report concludes that:

> Direct mortality from collection to release from barges is relatively low.
>
> Delayed effects of transportation are uncertain. The PATH document summarizes the major lines of evidence supporting or rejecting a hypothesis that significant delayed mortality occurs.
>
> Direct measurements of smolt-to-adult survival (SAR) for transported smolts versus in-river migrating smolts are needed to better understand the relative potential for transportation. Such studies should be coupled with up-river/down-river comparisons in order to better elucidate the general mortality rates that apply to one or more sets of populations.
>
> Given the relatively high survival rates from collection to release, little improvement in survival can be projected from changes in release strategy or collection operations.

The most significant new information being generated prior to the decision point is the comparative tagging study of transported and in-river migrating yearling chinook in the Snake River. PIT tagging experiments designed to estimate the SAR for transported and in-river migrating yearling smolts were initiated by NMFS with the 1995 outmigrant year. Spring/summer chinook return primarily at ages 3, 4, and 5. Relatively complete brood returns from the 1995 and 1996 outmigration should be available for use in the decision process prior to the 1999 decision target. Both of the outmigrations occurred coincident with relatively good in-river water conditions. Relative survivals of transported versus in-river migrants under poor to moderate flow conditions will have to be extrapolated from recent historical data and the returns from post-1995 tagging efforts.

Projection of yearling chinook migrant survivals under a full transportation option will involve combining the results of the past and ongoing survival studies with an assessment of the maximum collection potential at the Snake River dams.

Because of the relatively low numbers of naturally produced fall chinook migrants in recent years, parallel SAR studies have not been conducted. In the short term, assessments of the relative survivals of subyearling migrants that are transported or migrate in-river will be indirect, through analysis of historical data. The recent increase in available hatchery production of Snake River fall chinook from the Lyons Ferry program may provide opportunities for surrogate SAR evaluations. Information from such studies

would not be available until after the 1999 decision point called for in the Biological Opinion. Continued studies of the relative survival of transported versus in-river migrating juveniles could still be justified, given the multi-year time line for full implementation of the two major options requiring major modifications to the projects.

Improved Passage:
Passage mortalities at each of the hydropower dams encountered by outmigrating smolts represent a major portion of the hydropower-induced mortality. Smolts pass through the dams through three different routes: through the turbines, over the spillways, or via bypass routes. It is generally accepted that the highest level of mortality is associated with turbine passage. Efforts to increase passage survival by increasing the diversion of smolts to the spillway or through bypass facilities are being evaluated. The primary technology being investigated involves surface bypass—attempts to increase the efficiency of collection and subsequent passage of smolts through spill or bypass.

The primary studies of surface collection technology underway are related to design and efficiency. The total potential survival improvement that could be expected from successful implementation of the technology to the Snake River dams can be estimated from information currently available. The PATH Retrospective Analysis summarizes information on the potential for improvements, proposed operations, and modifications to implement evaluations. Passage survival rates have averaged 87-92 percent in recent years, reflecting improved inriver passage conditions and guidelines. Given eight dams between the upper Snake River tributaries and the estuary, the cumulative survival is on the order of 33-51 percent, below the level associated with recovery. Given current proposed variations of surface collection technology, an approximate 2 percent gain in survival may be achievable, insufficient to meet the survival goal. PATH assessments indicate little potential for improving direct survival through reservoirs.

River Naturalization: The PATH retrospective analysis has concluded that significant improvements in juvenile survival can be achieved through the drawdowns of three to four Snake River mainstem dams to natural river level. The expectation is that the interim juvenile survival target level can be reached with this option. This action would also be expected to reduce adult mortalities associated with project passage. The PATH prospective effort is continuing to evaluate the potential improvement. For spring chinook, that assessment should be completed by the summer of 1997. No specific additional research has been recommended.

Additional Mainstem Actions
All three plans call for consideration of operating the John Day project at or near spillway crest. This action would return a considerable stretch of the mainstem Columbia to natural river conditions and has been recommended in the recent Independent Science Group report, *Return to the River* (September 1996). In addition to the potential survival improvements associated with such operations, the stretch of mainstem that would be uncovered resembles the Hanford Reach. Therefore it has been projected that substantial fall/summer chinook habitat would become available through this action. PATH has not developed specific estimates of the potential contribution of such an action to recovery goals. Efforts are

underway to evaluate the potential gains in survival against uncertainties regarding the effectiveness of dam passage measures given a drawn down situation.

5.5.3.5 Other Biological Considerations

The river naturalization option results in biological changes beyond survival effects for migrating salmon. Consideration of this option will also involve an assessment of the impacts of a return to natural river conditions on the current resident fish and wildlife populations. Additional spawning and rearing habitat for chinook may be created by year-round drawdowns to natural river levels.

5.5.3.6 Risk and Uncertainty

PATH Decision Analysis: Participants in the PATH effort have begun the development of a structured decision analysis building on the retrospective analyses completed for spring/summer chinook. That assessment will directly incorporate alternative sets of assumptions regarding natural variation in survival and the effectiveness of alternative actions. The methodology of the proposed assessment has been widely applied in business situations. Applications to fisheries management problems have been described in the literature (e.g., Sainsbury, 1988; McAllister and Peterman, 1992; Walters, 1981, 1986; and Hilborn, et al. 1994).

The decision analysis framework will allow consideration of the cumulative effect of the mainstem options described above in combination with measures aimed at improving survival during other life history stages. In addition to being a direct aid to decision-making on the appropriate long-term option for mainstem improvements, the methodology can be used as a sensitivity analysis in defining future research, monitoring, and evaluation needs.

5.5.3.7 Summary: Priority Research, Monitoring & Evaluation - Mainstem

Table 5.5.3-1 summarizes priorities for research, monitoring, and evaluation on the Columbia River Mainstem.

5.5.3.8 Mainstem Operations - Research, monitoring, and evaluation Needs

5.5.3.8.1 Gas Bubble Disease Research

Background

The impact of dissolved gas generated by the hydroelectric system is a major concern. Generally, dissolved gas levels increase with spill at the projects. Spill results from two basic circumstances: 1) uncontrolled spill results when flows exceed the hydraulic capacity at a given project; 2) controlled spill results from the fish spill program.

The spill program at hydroelectric dams on the lower Snake and Columbia Rivers is an integral part of the adaptive management strategy outlined in the 1995 Federal Columbia River Power System (FCRPS) Biological Opinion and of NMFS's Proposed Recovery Plan for Snake River Salmon. The annual implementation of the FCRPS spill program is based on the hypothesis that specific amounts of prescribed spill will improve inriver survival of migrating juvenile salmonids while minimizing environmental hazards to adult salmonids and other aquatic biota. In addressing this hypothesis, NMFS must ensure that the biological effects of spill and the resulting dissolved gas supersaturation (DGS), whether resulting from the spill program or from involuntary spill, are monitored and that the data obtained are relevant for management decisions necessary to protect salmon and other river inhabitants from gas bubble disease (GBD).

A gas bubble disease monitoring program is developed each year by NMFS in coordination with the members of the Dissolved Gas Team to address monitoring objectives. The monitoring effort provides information used to make in-season spill management decisions. The research plan will provide information on the efficacy of the monitoring program and on physical and biological parameters relevant to spill management. Information collected under the research plan is NOT intended for in-season decision-making. New information gained through both research and monitoring programs, together with existing information, will provide the basis for evaluation of proposed future changes in either the monitoring program or the spill program. The following sections are derived from the NMFS gas bubble disease research plan released on April 26, 1996.

Research Objectives

The uncertainties addressed by the NMFS research plan were first highlighted by the GBD Expert Panels convened in June and December 1994 (NMFS Panel on GBD 1994, 1995), and further defined during the 1995 monitoring season by the Biological Monitoring Inspection Team of the GBD Technical Work Group (GBDTWG) in their inspection and research priorities reports (NMFS/EPA GBDTWG Inspection Team 1995a, 1995b). Based on those reports and following deliberations with representatives from regional fisheries agencies, tribes, and consultants, one broad goal to support the GBD monitoring program was identified. These deliberations also identified five objectives that address the three major elements of this goal.

The NMFS research plan contains one goal and five objectives. Each objective is accompanied by a brief discussion of the application of the information to be collected. Table 5.5-3 lists research projects that form the basis of a comprehensive strategy for addressing each research objective. However, these projects are not yet fully agreed upon. A more complete discussion of these approaches is contained in the NMFS research plan.

Goal: To assure that the gas bubble disease monitoring program accurately represents the condition of fish throughout the system and to enhance our understanding of the relation between exposure and increased levels of DGS and mortality.

There are three elements to this goal:

1) **Validate the Effectiveness of GBD Monitoring.** Determine whether the prevalence of GBD among juvenile salmonids in the Columbia and Snake Rivers is accurately reflected by monitoring at dams.

Table 5.5- 3 Mainstem RM&E priorities

Topic	Short Term 1997-99	Intermediate 5 - 10 Years
Survival Target	Ongoing: PATH effort to refine by Mid-1997	
Potential Improvements		
Transportation	Smolt-to-adult survival studies, including comparative assessments of in-river migrants and lower river stocks Continue reach survival studies, including fall chinook. Coordinate smolt survival studies with Mid-Columbia survival monitoring programs	Continue SAR studies for transport and in-river migrants during implementation phase for long-term option. Expand the range of smolt survival studies to Bonn. Dam Evaluate contribution of bird/mammal predation to delayed mortality Formally estimate direct mort. associated with collection and release. Estimate straying rates of transported vs in-river migrants
Improved In-River	Surface collector prototype efficiency studies, gas abatement option development Estimate predator harvest rates and changes in smolt predation associated with the reservoir predator removal program.	Evaluate effect of migration delays on survival.
Natural River	Projected survival improvements, 2 or 4 Dam Options - 1997	

2) Evaluate the Relevance of GBD Signs. Determine the relationship between signs of GBD and survival and reproductive success for species of concern at all life stages.

3) Evaluate Range of DGS in the Migration Paths of Salmonids. Determine the expanse and variability of DGS downstream from spilling dams.

In addressing these elements five objectives were identified:

I) Validate the Effectiveness of GBD Monitoring.

Objective 1: Determine if there is a difference in the incidence and severity of signs of GBD between migratory fish in the reservoir and in fish sampled through the Smolt Monitoring Program.

II) Evaluate the Relevance of GBD Signs.

Table 5.5- 4 Summary of proposed gas bubble disease research projects and estimated funding needs

Ultimate priority and funding depends on final approval of an experimental design. The conduct and final funding of some proposals will also depend on in-season river conditions.

Research Objective	Description of proposed research	Cost ($K) FY97
1.1, 2.3	experimental exposure - dam passage and reservoir survival	150
1.2, 2.4.2, 3.1	physical capture - forebay and reservoir	500
1.3	lab: GBD sign changes w/pressure	
2.1	GBD effects on resident fish	200
2.2	lab: GBD signs/mortality	75
2.2	lab: dynamic exposure; loss of signs, depth, and activity[1]	250
2.2	lab: sublethal effects -- BKD	
2.4.1	mortality, signs and depth distribution in traveling net-pen[1]	400
2.4.2 and 3.1	juvenile salmon depth distribution from radio tags	750
2.4.2 and 3.1	juvenile salmon depth distribution from hydroacoustics	500
2.5	controlled in-river conditions	
2.6	GBD effects in adults[1]	150
2.8	GBD effects in invertebrates	
3x	adult distribution[1]	150
4.2.1	non-lethal gill exam	
4.2.2	acoustical and optical examinations	
4.3.2	fin tissue destruction	
4.4	gill emboli	
Total		3,125

1 These projects are not in the CBFWA proposed FY 97 budget and have not been reviewed or agreed upon.

Objective 2: Determine the progression of GBD signs as the result of exposure to DGS and the relation between signs, health, and survival of aquatic species indigenous to the Columbia and Snake Rivers.

Objective 3: Describe the migratory distribution of juvenile and adult salmonids, particularly with respect to vertical distribution in the reservoir and relate fish distribution to the distribution of DGS.

Objective 4: Determine whether the protocol and examination techniques used in the GBD monitoring program optimize the detection of GBD signs demonstrated to affect fish health and survival, while minimizing impacts to individuals and populations.

III) Evaluate Range of DGS in the Salmonid Migration Path.

Objective 5: Determine the physical characteristics of dissolved gas throughout the hydrosystem under specific spill and flow regimes.

5.5.4 Subbasin Habitat and Artificial Production

5.5.4.1 Subbasin Habitats

Extensive habitat destruction has occurred as subbasins have been developed. Extractive resource uses (e.g. logging and mining) and development (e.g. dry land and irrigated agriculture, grazing, urbanization, flood control) have disrupted natural ecological processes and fragmented the remaining habitat available to salmon. The net effect is that entire salmon populations have been lost, and those remaining exhibit less diversity and are isolated from each other rather than interacting as formerly.

While we can describe the effects of habitat destruction on salmon populations in general terms, we are less certain about how to proceed in specific situations. A major reason for this uncertainty is the difficulty of assessing the cumulative effects of all site-specific conditions and actions within the river continuum context of physical and biological processes that determine salmon production. A second major impediment is the general lack of key information in a readily available format and location. Thus, even if we had a reasonable understanding of the effects of land use patterns on fish survival, we often do not have the information available to assess potential effects of changes in land uses on improving salmon survival.

Efforts to restore salmon populations and their habitat in the Columbia Basin must, therefore, proceed along parallel tracks. First, aggressive actions must be undertaken to halt ongoing deterioration and restore natural ecological processes and habitat conditions. Second, we must undertake a broader effort to assess the present condition of watersheds, monitor changes over time as restoration projects are implemented, and make that information easily available to interested parties.

Recommendations

The following recommendations were taken from one of the three restoration plans, the ISG report, or PATH documents. While each of these documents had a different focus with respect to habitat issues, we found no important inconsistencies or conflicts between them.

- Establish a network of habitat reserve areas within index watersheds to establish experimental natural baselines and provide a biological hedge against possible failure of BMP's in treated areas.

- Determine the functional relationships between key in-channel and riparian conditions and salmonid survival.

- Determine the functional relationships between upland watershed land use activities and riparian and in-channel conditions.

- Emphasize restoration actions that both improve and reconnect fragmented habitat within watersheds.

- Protect existing salmon life history patterns and restore habitat that will encourage reestablishment of lost life history patterns.

Research, Monitoring, and Evaluation

- Measure trends in fish populations and population structure annually.
- Establish baseline benchmarks for watershed condition at the subbasin level and update them every five years (6 per year). See Section 5.5.2.2.
- Develop life history profiles for each salmon population.
- Determine the relative contributions of fall-migrating and spring-migrating spring chinook to future returns.
- Maintain PATH indicator fish stocks:

Spring chinook: Middle Fork Salmon (Sulphur Cr., Bear Valley Cr., Marsh Cr.)
South Fork Salmon (Poverty Flats Cr., Johnson Cr.)
Imnaha River
Grande Ronde (Minam R., Catherine Cr., Lostine R., Upper Grande Ronde R., Wenaha R.)
John Day R.
Wenatchee R.
Methow R.
Entiat R.
Warm Springs R.
Klickitat R.

Fall Chinook:	Hanford Reach
	Lewis R.

- Establish up to two index watersheds in each subregion. Evaluate the following subbasins for their suitability as index watersheds to address habitat and production R/M/E needs identified above.

Middle Fork Salmon R.
Grande Ronde R.
John Day R.
Deschutes R.
Wenatchee R.
Hanford Reach
Lewis R.

- How much and what types of watershed restoration are needed to produce a given amount of change in in-channel conditions and, subsequently, on fish survival?
- What are the functional relationships between land use practices/watershed condition and in-channel conditions?
- What are the functional relationships between in-channel conditions and fish survival?

5.5.4.2 Artificial Production

Artificial production, for purposes of this plan, consists of two very distinct strategies. Traditionally, the term “artificial production” or “hatchery” has referred to the system of mitigation or production hatcheries built to replace losses of natural populations as the hydropower system was constructed. The philosophy behind this strategy was that hatcheries could provide a technological solution to loss of functional ecosystems that would allow continued development of the Columbia Basin. A secondary purpose of the mitigation hatchery system was to maintain the economic viability of commercial and sport fisheries that had developed through the early 1970s.

The problems caused by this technological approach to ecological losses have received wide publicity. Foremost among these was the belief that hatcheries could produce an unlimited supply of adult salmon. An unquestioned reliance on hatcheries also diverted attention away from the continuing problems imposed upon the remaining natural populations by development. Fisheries were managed to minimize surplus returns to hatcheries, which often resulted in overharvest of comingled natural populations. While hatchery brood stock selection practices did alter the size and age composition from that of the original populations, the ecologic interactions between hatchery-reared and naturally produced salmon are less clear.

The second distinct strategy involving artificial production is often called supplementation. This approach uses artificial production technology in a limited manner complementary to the needs of natural

populations. The guiding philosophy, rather than being a technological "fix" to allow continued development, is to use available technology in a limited manner to give naturally producing populations a survival "boost" to compensate until natural survival rates can be increased. The remainder of this section addresses only those issues associated with this type of supplementation program.

All three plans include some type of supplementation actions as part of salmon restoration efforts. There seems to be broad agreement that while all would prefer to rely only on natural production, that approach is unrealistic and far too risky given the level of development in the basin and projections for the future.

While the basic concepts of supplementation have been well described (RASP 19__; Cuenco, et al. 19__), the practical application of the supplementation strategy needs further elaboration. Specifically, the uncertainties and assumptions identified in RASP and Cuenco et al. need to be tested and quantified.

Recommendations

- Develop protocols for assessment, management, and monitoring of potential risks of mitigation hatcheries and supplementation projects.
- Determine the potential for and magnitude of ecological, behavioral, and energetic interactions of mitigation hatchery, supplemented and native fish populations.
- Determine the potential for and magnitude of conservation hatcheries and captive brood programs on salmon and resident fish.

Research, Monitoring, and Evaluation

- What are the effects of supplementation on natural populations?
- What are the effects of captive brood (and rearing) on natural populations?
- What is the efficacy of alternative strategies for reestablishing extirpated populations?

Work in progress.

5.5.5 Estuarine and Early Ocean Habitat

Survival through the estuarine and oceanic life history phases affects productivity of salmonids and the changes in survival at these phases can strongly influence the ability of management actions to compensate for human-caused impacts. The estuary is the region between the uppermost influence of marine waters and the Columbia River bar. Freshwater outflow from the river, the Columbia River plume, is a major oceanographic feature joining the estuary with the nearshore marine environment. Growth and survival of salmonids migrating through these regions in their first year of marine life are considered to be critical factors in determining overall year-class strength. High positive correlations between returns of coho salmon precocious males (jacks) after only a few months at sea and numbers of adults returning from the same brood class one year later support this assumption. Understanding the fluctuations in estuarine and ocean survival and the mechanisms that control those variations can help the resource manager discriminate between natural variability and responses to anthropogenic alterations.

In recent years, researchers have begun to associate variation in the survival of salmon runs with short and long-term fluctuations in oceanographic and climatic conditions (for summaries see ISG 1996, NRC 1995, Emmett and Schiewe 1997). Their effects on salmonid survival can be accentuated since periods of reduced ocean productivity and poor freshwater conditions (low stream flows and high water temperatures resulting from lower levels of precipitation) tend to co-occur. Assessments of alternative strategies for restoring upper Columbia and Snake River salmonid runs must account for variations in natural survival associated with climatic conditions.

One class of aggregate hypotheses regarding the decline of Snake River chinook runs incorporates detrimental changes in the estuarine or nearshore environment caused by alteration of the flow pattern of the Columbia. The proposed mechanisms have invoked changes in the positive effects of the Columbia River plume on estuarine and nearshore productivity or alterations in the dispersion of juveniles in relation to predators.

There is clear evidence that the Columbia River estuary regime has been significantly altered by human actions. Seasonal flow patterns have been altered, salmonid habitat has been altered as a result of dredging and urbanization. Exotic species introductions and shifts within salmon species, including the development of large-scale hatchery programs, have radically changed the species mix in the Columbia River estuary. The relative importance of these factors to juvenile salmon survival for stocks throughout the basin is not well understood.

Expanded research, monitoring, and evaluation efforts aimed at estuarine and nearshore survival relationships are called for in each of the Columbia River salmon restoration plans. Critical topics identified in those strategic planning efforts are summarized in Table 5.5-5. Generally, those recommendations fall into three categories:

A. Understanding and accounting for the effects of environmental variation on estuarine and early ocean survival on an interannual and interdecadal scale

B. Evaluating the potential relationship between changes in the Columbia River plume caused by hydropower development, and juvenile fish survival

C. Evaluating potential relationships between migration characteristics (including timing of entry, size, and distribution patterns) and variation in estuarine and early ocean survival

Table 5.5- 5 Recommended estuary and early ocean research, monitoring, and evaluation actions from the three plans (NPPC Strategy for Salmon, NMFS 1995-98 BiOp, and the Spirit of Salmon)

	NPPC	BioOp	Spirit of the Salmon

Environmental Indices	..monitoring program to identify optimal timing for residency in the estuary and the nearshore environment (7.1A.1)	The BPA, COE and BOR shall cooperate in investigations of the relationship between fluctuations in estuarine and ocean environment and salmon abundance. The BPA, COE and BOR shall cooperate in investigations of environmental requirements of juvenile salmonids in the estuary and nearshore ocean.	Develop and refine environmental indices based on available information.
Survival Patterns	Establish monitoring program to identify optimal timing for residency in the nearshore environment	The BPA shall proceed with evaluation of whether the number and timing of migrating juvenile salmonids affect available prey resources in the Columbia River and its estuary.	Evaluate fluctuations of survival of above Bonneville populations Develop biological index based on variations in growth
Plume Effects	Evaluate effects of alteration and timing of ocean plume	The BPA, BOR, and COE shall investigate the relationship between the amount and timing of Columbia River flows and ocean survival of salmonids.	
Estuary	Fund an evaluation of tributary, mainstem, estuary, plume near-shore ocean and marine salmon survival, ecology, carrying capacity and limiting factors.		

Increasing our understanding of estuarine and nearshore ocean environments and the role they play in salmonid survival could provide management options to increase adult returns. Extended investigations of estuarine or nearshore processes can be very expensive and will of necessity require relatively long time series of information to produce useful inferences. It is critical that research, monitoring, and evaluation efforts regarding these areas be carefully designed to address specific hypotheses or assumptions regarding salmon survival. Conditions that might vary in the estuary and nearshore ocean and may affect salmonid survival include the abundance of predators (birds, fish, and marine mammals), alternative prey for those predators (anchovies, Pacific herring, and sand lance), and salmonid prey

(allowing smolts to grow rapidly reducing their vulnerability to predators). The recently completed carrying capacity project funded through BPA in response to measure 7.1A of the NWPPC Strategy for Salmon reached the same conclusion, recommending the systematic development of a framework before extensive research and monitoring efforts are initiated. Given the general increase in interest in nearshore and estuarine processes, it will be beneficial to look at other broad-scale monitoring and research efforts being proposed or conducted in the region for opportunities to establish indices as well.

The PATH project has been evaluating alternative hypotheses regarding the decline of Snake River chinook and the proposed strategies for recovery. One of the key questions being evaluated in that effort is: Can transportation of fish to below Bonneville Dam compensate for the effect of the hydrosystem on juvenile survival rates of Snake River spring/summer chinook salmon during their downstream migration? (Question 3b(i)). To address concerns for delayed mortality effects on transported fish, the draft conclusions to the retrospective analysis being conducted through the PATH project has identified the potential need to:

> conduct field and lab evaluations of possible mechanisms leading to hypothesized delayed mortality, including susceptibility of barged and trucked smolts to fish, bird, and mammal predation following release and to disease and impaired saltwater adaptation relative to non-transported migrants.

This recommendation will be further developed and evaluated in the 1996-97 PATH cycle.

Ongoing Research, Monitoring, and Evaluation

There are a variety of ongoing and planned ocean/estuarine research, monitoring, and evaluation activities related to Northwest salmonid resources. Some of the major activities include:

NMFS - Coastal Zone Studies Division: Salmonid Alternative Prey and Predator Study. Since 1994, NMFS has been performing annual ichthyoplankton surveys off the Oregon/SW Washington coast to quantify the abundance and distribution of baitfish and evaluate environmental conditions relative to salmonid ocean survival. In 1997, they plan to broaden this research by capturing marine predators (Pacific mackerel and Pacific hake) to identify the relationship between their feeding habits, baitfish abundance, and salmonid survival.

NMFS - Pacific Fisheries Environmental Group: In 1996, this research project began developing a database containing various biological and physical oceanographic data of the Pacific Ocean and performing retrospective analysis of these data relative to ocean salmon survival.

NMFS - Environmental Conservation Division: In 1996, NMFS began a long-term study to evaluate the relationship between disease, natural and anthropogenic factors that influence disease prevalence, and salmonid survival; and also identify the relationship between anthropogenic contamination and growth and survival of juvenile salmonids.

GLOBEC (Global Ocean Ecosystem Dynamics): This research, funded by National Science Foundation (NSF) and NOAA's Coastal Ocean Program, will identify the effect of changing ocean conditions on salmonid survival starting in 1997.

SEA (Sound Ecosystem Analysis program): Ongoing research on the distribution, abundance, and ecology of salmonids and Pacific herring in Prince William Sound. Funded by the Exon Valdez Trust Fund. This research is identifying the controlling physical and biological parameters influencing salmonid and Pacific herring populations in Prince William Sound.

Ocean Carrying Capacity Study: The NMFS Auk Bay lab is leading this multinational research program (initiated in 1996), whose objective is to identify the capacity of the North Pacific Ocean to sustain salmonid production and growth offshore of Alaska. Funded by the North Pacific Anadromous Fish Commission, this research consists of sampling both coastal marine habitats and the Alaska Gyre for various life stages of salmonids.

C-CAP (Coastal Change Analysis Program): A nationwide NOAA-funded program that is using satellite imagery to analyze the relationship between changes in watershed and estuarine habitat to living marine resources. A pilot study report, focused on the Columbia River estuary, Tillamook Bay, and Willapa Bay, should be available in early 1997.

Canadian research: Various Canadian research programs focus on the role of ocean conditions on salmonid survival. Past research has identified the Pacific mackerel and Pacific hake as significant marine predators of juvenile salmonids, and have found that predator abundance and distribution is mediated by ocean temperatures.

PNCERS (Pacific Northwest Coastal Ecosystem Research Study): Funded by NOAA's Coastal Ocean Program, this study will be initiated in 1997 and will identify how variations in environmental conditions in Northwest river basins, estuaries, and marine ecosystem effect salmonid populations.

Estuarine and Marine Sanctuaries: Both the South Slough Estuarine Reserve and the Olympic Marine Sanctuary have initiated annual physical and biological surveys of their respective coastal habitats. Although not focused on salmonids, the eventual long-term data set may provide valuable insights into salmonid survival in these areas.

Universities

Oregon State University: Scientists at Oregon State University are analyzing the coded-wire tag database to identify how size and growth effect ocean survival rates. They have also just finished a study identifying the feeding habits of hatchery and nonhatchery fish in Coos Bay, Oregon.

University of Washington: Scientists at the University of Washington are investigating relationships among broad-scale oceanographic and climatic patterns (e.g., regime shifts) and salmon production in the Northeast Pacific. Scientists are also investigating relationships between hatchery production of selected chinook salmon stocks over broad spatial scales, and their oceanic distribution.

PATH - Relationship among oceanic and estuarine environmental indices to Columbia River salmon survival, productivity, and abundance.

Recommendations

The relationship between juvenile survival and nearshore ocean/climatic factors has been the topic of several workshops and review efforts in recent years (e.g., NRC, 1995; ISG, 1996; Johnson, et al., 1996, Emmett and Schiewe 1997). At the present time, there is not a clear consensus on critical factors or patterns in environmental conditions relating to the survival of Columbia River salmonids. A long-term monitoring program including provisions for evaluating trends in the survival of indicator stock groups

representative of the Columbia River salmonid population units should be developed and implemented. The objective of the program would be to provide information allowing for the separation of environmental effects and natural fluctuations or cycles in ocean survival from the effects of actions aimed at improving survival at various life stages. In order to efficiently develop and implement such a program, the following three steps are recommended.

1. 1997-98: Develop a summary of available information and hypotheses relating trends in survival of Columbia River salmonids to oceanographic and climatic conditions from recent workshops. The effort should specifically address the development and evaluation of hypotheses relating changes in the estuarine, nearshore coastal, and offshore habitats to changes in survival of Columbia River salmon populations. Include an identification of ongoing research efforts and potential opportunities in other funding arenas.

2. 1998-99: Using the findings from Step 1, develop options for inclusion in a 5-10 year research and monitoring proposal for a long-term monitoring effort to provide information on annual and decadal trends in factors affecting Columbia River salmonid survival. Program elements would include potential environmental indices, proposed modifications to regional tagging programs, and priority research or evaluation actions to address critical uncertainties identified through ongoing efforts to clarify hypotheses regarding actions to rebuild Columbia River salmon runs.

3. 1999: Evaluate the proposed options and implement as appropriate.

Overall costs of salmonid ocean research does not have to be prohibitively expensive, especially if all ongoing and proposed research projects work collaboratively. An annual strategy meeting of all research scientists engaged in ocean and salmon research would facilitate this effort. This collaboration could be modeled after the California Cooperative Fisheries Investigations (CalCoFI) or the North Pacific Marine Science Organization (PICES).

5.6 Influence of Human Activities on the Columbia River Basin Aquatic Ecosystem

Section 5.6 is excerpted from:

1. CBFWA. Review of the History, Development, and Management of Anadromous Fish Production Facilities in the Columbia River Basin, February 1990
2. Lee, D. et al. 1996. Broadscale assessment of aquatic species and habitats. In T.M. Quigley and S.J. Arbalbide tech. editors. An assessment of ecosystem components in the Interior Columbia Basin and portions of the Klamath and Great Basins. USDA Forest Service, Pacific Northwest Research Station Gen.Tech. Report. PNW-GTR-XXX.

By the late 1800s, human activities had begun to alter the Columbia River Basin, including the hydrologic function of rivers and streams and features that served as important habitat for aquatic life. By 1860 livestock grazing had reduced extensive willow coverage along many streams to scattered patches (Elmore and Kaufman 1994; Vavra and others 1994). Virtually every major tributary in the basin that was navigable (by canoe) had been altered by removing waterfalls, boulders, and log jams.

Throughout the Basin the story was the same: sloughs and backwaters were isolated; pools were filled; log jams were cleared; and boulders were blasted. Clearing streams and rivers for passage of boats and milling of logs reduced the interaction of the stream system and flood-plain vegetation. Constructing drains, ditches, and dikes in valley bottoms and lowlands also reduced terrestrial-aquatic interaction. Flood control levees diminished or eliminated complex sloughs and side channels that were valuable rearing areas for salmonids and riparian dependent species.

Marble Creek on the St. Joe River in Idaho provides one example of these activities. In 1911 there were numerous debris jams that had existed for many years (Blake 1971). In a 29-kilometer stretch ending at Homestead Creek, more than 1,180 cubic meters (500,000 board feet) of marketable timber were removed from the stream channel. An additional amount of wood was used to fuel steam-powered equipment used in the logging operation. Fishing in the creek prior to 1911 had been described as exceptional, but Blake (1971) noted that large fish vanished after log drives.

In the early 1900s, the construction of large dams began as isolated areas of the Columbia River basin like the Central Idaho Mountains and the Wenatchee River system were gradually settled. Water withdrawals for irrigation were also developed early and rapidly. From the 1860s to 1930s dredges and hydraulic mining followed each new gold or silver discovery. Low-gradient reaches of streams were excavated, and whole valleys were transformed. Large reaches in low-gradient sections were inundated with fine sediments. Vast wetlands were filled and became farms and hay fields. Because many lakes were barren of fish, numerous species were introduced to provide recreational fishing.

In short, the ecological integrity of streams, lakes, and wetlands was significantly compromised by the 1920s. Increasing human population, technological advances (for example, centrifugal pumps), and availability of heavy equipment after World War II greatly accelerated the development of new irrigation projects, timber harvest, dam construction, and road building. Individually and in combination, these activities continued to fragment and compromise the remaining hydrologically connected and vegetated reaches of streams.

5.6.1 Water Quality

The extent and intensity of land development and land-use activities within the Basin have increased during the past century. Environmental disturbances from non-mechanized, agriculturally based settlements have evolved into perturbations associated with urban and suburban development, industrialization, and intensive large-scale and mechanized agricultural practices. Even areas that have been developed solely for recreational use have not escaped degradation. Aquatic ecosystem perturbations related to these activities include: 1) thermal pollution; 2) toxicity due to the presence of organic compounds (synthetic and natural) and heavy metal ions; 3) introduction of pathogenic organisms; 4) organic wastes that result in potentially catastrophic changes in dissolved oxygen levels; 5) acidification; 6) elevated sedimentation rates; and 7) increased eutrophication (Ellis 1989).

5.6.2 Dams, Water Storage, and Withdrawals

One of the most significant changes in the Columbia River Basin is associated with efforts to store, control, and direct water. Thousands of dams, ranging from tiny stock ponds in the driest regions to the largest hydroelectric facilities on the Columbia River (Grand Coulee Dam with a storage capacity of 6.4 billion cubic meters), are presently found in the area.

Construction of dams in the Columbia River basin has greatly reduced the accessible range of anadromous fishes and has interrupted migrating patterns of migratory forms of nonanadromous fishes. Spawning and rearing areas for anadromous fishes in the upper Columbia River basin were isolated after the Grand Coulee (1941) and Chief Joseph (1955) dams were completed. Since 1967, Hells Canyon Dam has blocked anadromous fish access to the Snake River and tributaries above the dam.

Even with fish passage facilities, detrimental effects from dams occur as a result of direct mortality of juveniles in turbines and bypass systems. Indirect mortality is caused by delays in migration of adults and juveniles as a result of inability to find routes around dams, slack water, physiological stress, and increased susceptibility to predators. Reservoir operation has resulted in long-term changes in downstream water temperatures and the annual discharge of water and sediments. The pattern and timing of the annual hydrograph have been altered in most basins on scales ranging from hours to months and even years. In many instances dams have changed large river systems to isolated fluvial fragments between lakes. In arid parts of the Basin, stream diversions have reduced flows to a trickle.

Water withdrawals for off-stream uses include rural domestic use, stock watering, irrigation, public water supply, commercial and industrial supply, and thermoelectric cooling. Agricultural irrigation is by far the dominant off-stream use in the Basin. Overall it accounts for more than 10 times the combined volumes of water withdrawn by public supply, industry, and thermoelectric power plants (Jackson and Kimerling 1993).

Intensive irrigation in the Columbia River basin began prior to 1840 at mission settlement sites established near Walla Walla, Washington, and Lewiston, Idaho. By 1890 the irrigated area in the basin had increased to 200,000 hectares. During the next decade, irrigation expanded rapidly and totaled 930,000 hectares by 1910. Great tracts of land located in the arid region east of the Cascade Mountains could not support dryland farming, and farmers turned to irrigation to provide their crop water needs. By the mid-1960s, 2.6 million hectares of land were under irrigation in the Basin (table 4.7; Northwest Power Planning Council 1993). Most streams in the Pacific Northwest are now fully or over-appropriated (BPA and others 1995).

In the upper Salmon River, fish are adequately protected from larger diversions on migration corridors, but many small tributaries where spawning and rearing occur have unscreened diversions. These streams historically provided habitat to anadromous and nonanadromous fishes. Keifenheim (1992) indicated that salmon and steelhead no longer use many small streams in the upper Salmon River area because of irrigation withdrawals. Currently instream flow reductions in these streams may result in migration barriers, substantially diminished spawning and rearing habitat, or poor water quality. Although most of

these small streams were not likely to have produced large numbers of fish historically, the total loss of spawning and rearing habitat may be significant.

In the current anadromous fish production areas of Oregon above Bonneville Dam, there are approximately 550 water diversions, most of which have fish screens. However, most (80 percent) of these screens are several decades old and do not meet current criteria to adequately protect juvenile fish. There are about 55 pump-intakes on the Oregon side of the mainstem Columbia River, most of which should be adequately screened by the beginning of the 1996 irrigation season, and about 140 screened pump-intakes occur on Columbia River tributaries.

On the mainstem Columbia and Snake rivers in Washington, there are about 200 pump diversions, most of which should be adequately screened by the beginning of the 1996 irrigation season. There are approximately 150 gravity diversion fish screens above Bonneville Dam; flows on several of these diversions exceed 28 cubic meters/second. There also are approximately 690 pump-intakes on tributaries in this portion of the Basin, but only about one-fourth have fish screens that currently are in compliance.

5.6.3 Farming and Grazing

The amount of land in the Pacific Northwest dedicated to agriculture is relatively small (approximately 16 percent). However, agricultural practices can have considerable effects on aquatic resources because the lands are often located on historic flood plains and valley bottoms. The effects of farming on aquatic systems include loss of native vegetation, bank instability, loss of floodplain function, removal of large woody debris sources, changes in sediment supply, changes in hydrology, increases in water temperature, changes in nutrient supply, chemical pollution, channel modification, and habitat simplification (Spence and others 1995). Nutrient and pesticide runoff pollutes many tributaries of the Columbia River. The loss of native vegetation extends very near to the stream channel as farmers try to extend the amount of tillable land.

Riparian areas maintain stream structure and function through processes such as water filtration, bank stabilization, water storage, groundwater recharge, nutrient retention, regulation of light and temperature, channel shape and pattern (morphology and micro-topography), and dispersal of plants and animals (Cummins and others 1984; Gregory and others 1991; Minshall 1967, 1994; Sullivan and others 1987). Because of the availability of water, forage, and thermal cover, riparian areas are often overgrazed by livestock. Overgrazing by livestock can lead to a reduction of soil structure, soil compaction, and damage or loss of vegetative cover. All of these processes contribute to an increase in the rate and erosive force of surface runoff (Meehan and Platts 1978; Thurow 1991). Grazing is a major nonpoint source of channel sedimentation (Dunne and Leopold 1978; MacDonald and others 1991; Meehan 1991; Platts 1991). Grazed watersheds typically have higher stream sediment levels than ungrazed watersheds (Lusby 1970; Platts 1991; Rich and others 1992; Scully and Petrosky 1991). Increased sedimentation is the result of grazing effects on soils (compaction), vegetation (elimination),

hydrology (channel incision, overland flow), and bank erosion (sloughing) (Kauffman and others 1983; MacDonald and others 1991; Parsons 1965; Platts 1981a, 1981b; Rhodes and others 1994).

Sediment loads that exceed natural background levels can fill pools, silt spawning gravels, decrease channel stability, modify channel morphology, and reduce survival of emerging salmon fry (Burton and others 1993; Everest and others 1987; MacDonald and others 1991; Meehan 1991; Rhodes and others 1994). In addition, runoff contaminated by livestock wastes can cause an increase in potentially harmful bacteria (for example, *Pseudomonas aeruginosa* and *Aeromonas hydrophila*) (Taylor and others 1989; Hall and Amy 1990; Thurow 1991). Compared to ungrazed sites, aquatic insect communities in stream reaches associated with grazing activities often are composed of organisms more tolerant of increased silt levels, increased levels of total alkalinity and mean conductivity, and elevated water temperatures (Rinne 1988).

5.6.4 Timber Harvest Activities

Soil and site disturbance that inevitably occur during timber harvest activities are often responsible for increased rates of erosion and sedimentation (Chamberlain and others 1991; FEMAT 1993; MacDonald and others 1991; Meehan 1991; Reid 1993; Rhodes and others 1994); modification and destruction of terrestrial and aquatic habitats (FEMAT 1993; van Kesteren 1986); changes in water quality and quantity (Bjornn and Reiser 1991; Brooks and others 1992; Chamberlain and others 1991; Rhodes and others 1994); and perturbation of nutrient cycles within aquatic ecosystems (Rowe and others 1992). Physical changes affect runoff events, bank stability, sediment supply, large woody debris retention, and energy relationships involving temperature (Li and Gregory 1995). All of these changes can eventually culminate in the loss of biodiversity within a watershed (FEMAT 1993; Rowe and others 1992).

Increased delivery of sediments, especially fine sediments, is usually associated with timber harvesting and road construction (Eaglin and Hubert 1993; Frissell and Liss 1986; Havis and others 1993; Platts and Megahan 1975). As the deposition of fine sediments in salmonid spawning habitat increases, mortality of embryos, alevins, and fry rises. Erosion potential is greatly increased by reduction in vegetation, compaction of soils, and disruption of natural surface and subsurface drainage patterns (Chamberlain and others 1991; Rhodes and others 1994). Generally, logged slopes contribute sediment to streams based on the amount of bare compacted soils that are exposed to rainfall and runoff. Slope steepness and proximity to channels determine the rate of sediment delivery.

Water quality (for example, water temperature, dissolved oxygen, and nutrients) can be altered by timber harvest activities (Chamberlain and others 1991). Stream temperature is affected by eliminating stream-side shading, disrupted subsurface flows, reduced stream flows, elevated sediments, and morphological shifts toward wider and shallower channels with fewer deep pools (Beschta and others 1987; Chamberlain and others 1991; Everest and others 1985; MacDonald and others 1991; Reid 1993; Rhodes and others 1994). Dissolved oxygen can be reduced by low stream flows, elevated temperatures, increased fine inorganic and organic materials that have infiltrated into stream gravels

retarding intergravel flows (Bustard 1986; Chamberlain and others 1991). Nutrient concentrations may increase following logging but generally return quickly to normal levels (Chamberlain and others 1991).

Because the supply of large woody debris to stream channels is typically a function of the size and number of trees in riparian areas, it can be profoundly altered by timber harvest (Bisson and others 1987; Sedell and others 1988; Robison and Beschta 1990). Shifts in the composition and size of trees within the riparian area affect the recruitment potential and longevity of large woody debris within the stream channel. Large woody debris influences channel morphology, especially in forming pools and instream cover, retention of nutrients, and storage and buffering of sediment. Any reduction in the amount of large woody debris within streams, or within the distance equal to one site-potential tree height from the stream, can reduce instream complexity (Rainville and others 1985; Robison and Beschta 1990). Large woody debris increases the quality of pools, provides hiding cover, slow water refuges, shade, and deep water areas (Rhodes and others 1994). Ralph and others (1994) found instream wood to be significantly smaller and pool depths significantly shallower in intensively logged watersheds. The size of woody debris in a logged watershed in Idaho was smaller than that found in a relatively undisturbed watershed (Overton and others 1993).

5.6.5 Road Construction

Roads contribute more sediment to streams than any other land management activity (Gibbons and Salo 1973; Meehan 1991), but most land management activities, such as mining, timber harvest, grazing, recreation, and water diversions are dependent on roads. Most sediment from timber harvest activities is related to roads and road construction (Chamberlain and others 1991; Dunne and Leopold 1978; Furniss and others 1991; Megahan and others 1978; MacDonald and Ritland 1989) and associated increased erosion rates (Beschta 1978; Gardner 1979; Meehan 1991; Reid 1993; Reid and Dunne 1984; Rhodes and others 1994; Swanson and Dyrness 1975; Swanston and Swanson 1976). Serious degradation of fish habitat can result from poorly planned, designed, located, constructed, or maintained roads (Furniss and others 1991; MacDonald and others 1991; Rhodes and others 1994). Roads can also affect water quality through applied road chemicals and toxic spills (Furniss and others 1991; Rhodes and others 1994). The likelihood of toxic spills has increased with the large number of roads paralleling streams.

Roads directly affect natural sediment and hydrologic regimes by altering streamflow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition, stream temperatures, water quality, and riparian conditions within a watershed. For example, interruption of hill-slope drainage patterns alters the timing and magnitude of peak flows and changes base stream discharge (Furniss and others 1991; Harr and others 1975) and sub-surface flows (Furniss and others 1991; Megahan 1972). Road-related mass soil movements can continue for decades after the roads have been constructed (Furniss and others 1991). Such habitat alterations can adversely affect all life-stages of fishes, including migration, spawning, incubation, emergence, and rearing (Furniss and others 1991; Henjum and others 1994; MacDonald and others 1991; Rhodes and others 1994).

Poor road location, concentration of surface and sub-surface water by cross slope roads, inadequate road maintenance, undersized culverts, and sidecast materials can all lead to road-related mass movements (Lyons and Beschta 1983; Swanston 1971; Swanston and Swanson 1976; Wolf 1982). Sediment production from logging roads in the Idaho batholith was 770 times higher than in undisturbed areas; approximately 71 percent of the increased sediment production was due to mass erosion (Megahan and Kidd 1972) and 29 percent was due to surface erosion.

Roads greatly increase the frequency of landslides, debris flow, and other mass movements (Dunne and Leopold 1978; Furniss and others 1991; Megahan and others 1992). Mass movement in the western Cascade Range in Oregon was 30 to 300 times greater in roaded than in unroaded watersheds (Sidle and others 1985). Megahan and others (1992) found that 88 percent of landslides within Idaho were associated with roads. Roads were considered to be primary factor in accelerated mass movement activity in the Zena Creek drainage (Idaho batholith) following 1964-65 winter storms (Gonsior and Gardner 1971). Out of 89 landslides examined in the South Fork of the Salmon River, 77 percent originated on road hillslopes (Jensen and Cole 1965). Cederholm and others (1981) found that increases (above natural levels) in the percentage of fine sediment in fish spawning habitat occurred when the area of roads exceeded 3.0 percent of the Clearwater River (Washington) basin area. Increased stream channel sedimentation in Oregon and Washington watersheds east of the Cascade Range has also been associated with road density (Anderson and others 1992; McIntosh and others 1995).

Road/stream crossings can also be a major source of sediment to streams resulting from channel fill around culverts and subsequent road crossing failures (Furniss and others 1991). Plugged culverts and fill slope failures are frequent and often lead to catastrophic increases in stream channel sediment, especially on old abandoned or unmaintained roads (Weaver and others 1987). Unnatural channel widths, slope, and stream bed form occur upstream and downstream of stream crossings (Heede 1980), and these alterations in channel morphology may persist for long periods of time. Channelized stream sections resulting from riprapping of roads adjacent to stream channels are directly affected by sediment from side casting, snow removal, and road grading; such activities can trigger fill slope erosion and failures. Because improper culverts can reduce or eliminate fish passage (Belford and Gould 1989), road crossings are a common migration barrier to fishes (Evans and Johnston 1980; Furniss and others 1991; Clancy and Reichmuth 1990).

5.6.6 Mining Activities

Mining activities can affect aquatic systems in a number of ways: through the addition of large quantities of sediments, the addition of solutions contaminated with metals or acids; the acceleration of erosion, increased bank and streambed instability, and changes in channel formation and stability. Sediments enter streams through erosion of mine tailings (Besser and Rabeni 1987), by direct discharge of mining wastes to aquatic systems, and through movement of groundwater (Davies-Colley and others 1992).

Surface mining practices of dredging and placer mining have altered aquatic habitats by destroying riparian vegetation and reworking channels. Gold mining in Idaho's Crooked River forced unnatural

meanders in some streams and straightened others (Nelson and others 1991). Some streams, such as the upper reaches of the Grande Ronde River (McIntosh and others 1994a), have been severely altered and now flow underground through rubble dredged from the stream bottoms decades ago.

5.6.7 Non-Native Fish Species Introductions

The introduction of non-native fishes and aquatic invertebrates has had an important influence on species assemblages and aquatic communities throughout the Columbia River Basin. Currently at least 35 species, subspecies, or stocks of fish have been introduced to the Basin or have moved to habitats within the Basin where they did not occur naturally. Most introductions have been centrarchid (sunfishes and basses), ictalurid (catfishes), cyprinid (minnows), and salmonid fishes, but a few exotic fishes such as the Oriental weatherfish, *Misgurnus anguillicaudatus*, appear to have been introduced through the aquarium trade. At least eight native fish species or subspecies have been transported, some widely within the Basin, outside their historic ranges. This latter group includes Yellowstone, Lahontan, and westslope cutthroat trout; fall chinook salmon; coho salmon; white sturgeon; steelhead; and interior redband (rainbow) trout.

Such introductions have led to the elimination of some native populations, while further fragmentation and isolation of other populations have left them more vulnerable to future extirpation. Although introductions have provided increased fishing opportunities and socioeconomic benefits, they have also led to catastrophic failures in some fisheries and expanded costs to management of declining stocks (Bowles and others 1991; Gresswell 1991; Gresswell and Varley 1988; Wydoski and Bennett 1981).

5.6.8 Hatcheries

The history of hatchery development, management, and operation in the Columbia River Basin spans a period of over 120 years. Development of fish propagation facilities in the Columbia River Basin followed the development and expansion of the commercial fishery. The first commercial cannery began operation on the Columbia River in 1866, and by 1883, 40 canneries were operating on the river. Concerns about overfishing led to the construction of the first fish hatchery, which was built on the Clackamas River in 1876. In the 1890s state and federal governments began artificial propagation on a large scale (CBFWA February 1990).

Beginning in the 1930s, the anadromous fishery resources of the Columbia River were affected as a series of large multipurpose dams for hydroelectric power, flood control, and navigation were constructed on the mainstem river. Concerns for the welfare of the fishery resources had very little influence over the path this development followed. Within a span of about 30 years, 40 percent of the habitat above Bonneville Dam was destroyed by inundation. The dams also blocked spawning and rearing habitat for anadromous fish. Loss of habitat for sockeye salmon was particularly severe. Nursery lakes for sockeye salmon historically amounted to at least 222,850 acres, but by 1939 only 4 percent remained accessible. Many unique and valuable salmon and steelhead stocks were eliminated during this short span of time. When Grand Coulee Dam was completed in 1941, access by salmon and steelhead

was blocked to 1,140 miles of the upper Columbia River drainage. To maintain the remaining runs from this area, returning salmon and steelhead were trapped at Rock Island Dam and transported and released above temporary weirs on the Wenatchee, Okanogan, and Entiat Rivers and at three newly constructed fish hatcheries operated by the U. S. Fish and Wildlife Service (USFWS): Leavenworth, Entiat, and Winthrop. The salvage operation helped to restore runs in these tributaries and may have preserved some of the genetic diversity of the fish that were trapped. However, because the habitat in the tributaries where the fish were released was limited, the operation could not provide mitigation for the lost habitat above Grand Coulee Dam (CBFWA February 1990)

Over the next 30 years hatchery production of sockeye salmon was eliminated, and production of other anadromous fish at Leavenworth, Entiat, and Winthrop steadily dwindled. Emphasis on production gradually shifted from salmon to trout. Salmon production at Entiat and Winthrop was terminated in 1965 and only small numbers of coho and spring chinook continued to be reared at Levenworth. As a result of efforts of the Grand Coulee Rehabilitation Committee, this trend in production was reversed in 1975 when Congress appropriated funds to rehabilitate the three hatcheries and return them to anadromous production (CBFWA February 1990).

In the early 1950s, salmon and steelhead runs below the blocked areas were showing signs of recovery, but between 1957 and 1975 eleven new dams were completed on the mainstem Columbia and Lower Snake Rivers. The decline of amadromous fish runs due to hydroelectric development continued and a number of attempts were made to mitigate and compensate for the tremendous losses. For example, artificial spawning channels were constructed at Priest Rapids, Turtle Rock, and Wells to replace lost spawning habitat that had been inundated by the construction of Priest Rapids, Wanapum, Rocky Reach, and Wells dams. After several years of operation these facilities failed because of excessive pre-spawning mortality of adult fish, poor survival of deposited eggs and fry, and generally poor production. The artificial spawning channels were eventually converted to conventional hatchery production (CBFWA February 1990).

Mitigation of fish losses was also attempted by providing passage for anadromous fish around the dams. Fish passage facilities have generally been successful in passing fish around the run-of-the-river or low dams. However, most attempts to provide passage around high dams failed. The attempts at providing passage were very expensive and the failures served to further heighten the tragic and irretrievable loss of fish stocks that formally migrated to the areas above the high dams (CBFWA February 1990).

In these and other instances, hatchery production was the only means chosen to compensate for the losses. However, the compensation provided generally has lagged years behind the initial fish losses. It has included a number of species substitutions and has not mitigated for losses of species including coho, sockeye, and fall chinook salmon. For example, the Lower Snake River Fish and Wildlife Compensation Plan (LSRCP) was not authorized by Congress until 1976. The first hatchery facility (McCall Hatchery) was not completed until 1981, or 20 years after the impact on the fish runs began. In the interim, salmon and steelhead runs in the Snake River declined to low levels. The final hatchery in the plan (Clearwater) was not completed until 1990, or nearly 30 years later. Final listing of Snake River

sockeye salmon as an endangered species occurred in November 1991, and Snake River spring/summer and fall chinook salmon were listed in August 1994 (CBFWA February 1990).

The primary purpose of propagation programs has been mitigation--that is, the fish production to compensate for loss of natural population due to overharvest, blockage of migratory routes, and habitat degradation. Currently, nearly all hatchery programs in the Columbia River Basin are linked directly to mitigating fish mortality and/or lost habitat caused by water development projects in the basin. These include hatcheries operating under the Mitchell Act, LSRCP, Corps of Engineers mitigation, and numerous private hydroelectric projects licensed by the Federal Energy Regulatory Commission (FERC) (NMFS Proposed Snake River Recovery Plan March 1995). Hatchery production supports the bulk of the total annual adult production of 2.5-3.0 million salmon and steelhead. Hatchery fish comprise over 95 percent of the coho, 70 percent of the spring chinook, about 80 percent of the summer chinook, over 50 percent of the fall chinook, and about 70 percent of the steelhead in the basin. Approximately 190 million juvenile salmon and steelhead are released from more than 90 hatcheries and satellite facilities located in the Columbia River Basin (CBFWA February 1990).

This mitigation is used in place of alternatives that directly address impediments to natural population conservation. Some production is also dedicated to species conservation and supplementation research programs. Mitigation and supplementation efforts are important obligations that have resulted from Columbia River development. In fulfilling these obligations, program implementation must avoid (or adequately minimize) adverse effects on natural populations that can arise from ecological and genetic interactions with hatchery fish (NMFS Proposed Recovery Plan for Snake River Salmon, March 1995). Hatchery production has helped to support important treaty Indian, sport, and commercial fisheries during a period when most of the natural production became severely depressed. However, the general success of hatchery production has not been without cost to the natural production. Coho salmon populations in the Basin suffered declines as a result of early irrigation development and other water use projects. The remaining natural coho production has been nearly eliminated because largely uncontrolled mixed-stock fisheries relied heavily on the more abundant hatchery coho and overfished the less abundant natural coho stocks. The Northwest Power Planning Council (Council) has estimated that annual losses in run sizes due to hydropower development and operation range from 5 to 11 million adult fish. In its amended Program of February 1987, the Council established an interim goal of doubling the adult run size at the time; in effect, increasing the runs by 2.5 million fish. Unless major increases in survival of salmon and steelhead are achieved by improving mainstem passage and by increasing the effectiveness of current hatchery production including off-station releases, new hatchery production in the Basin may have to be increased substantially to achieve the Council's doubling goal. The challenge will be to carefully integrate hatchery production and supplementation of natural production with other measures, including the application of more sophisticated harvest controls, to achieve the proper balance of natural and artificial production (CBFWA February 1990).

In April 1995, NMFS rendered a Biological Opinion for 1995 to 1998 Hatchery Operations in the Columbia River Basin. At issue were the Columbia River hatchery programs and the effect of facilities operations, juvenile releases, adult collection, and related monitoring and evaluation on three listed species of Snake River salmon. In developing this opinion, NMFS considered the information

presented. In summary NMFS concluded, based on differences between the proposed action and proposed Recovery Plan, that hatchery operations as described by the action agencies were likely to jeopardize the continued existence of listed Snake River sockeye salmon, Snake River spring/summer chinook salmon, and Snake River fall chinook salmon. Within the Biological Opinion, NMFS identified "Reasonable and Prudent Alternatives" to proposed actions by the states. NMFS believes the reasonable and prudent alternatives will reduce impacts from hatchery programs by reducing competition with and predation on chinook salmon and sockeye salmon fry. Thus, NMFS concluded that the reasonable and prudent alternative does not jeopardize the continued existence of listed Snake River salmon stocks (NMFS Biological Opinion for 1995 to 1998 Hatchery Operations in the Columbia River Basin, April 5, 1995).

Much of the attention and debate relative to the current operation and management of hatcheries is focused on the following four major areas of concern: 1) Genetic risk associated with the operation and management of hatcheries; 2) The impact of hatcheries on fish health; 3) Improving the effectiveness of hatchery production; and 4) Hatchery performance in meeting compensation goals (CBFWA February 1990). While considerable literature exists that qualitatively describes the various impacts of hatchery practices and production on natural fish populations, there is little or no information quantifying those impacts (NMFS Biological Opinion for 1995 to 1998 Hatchery Operations in the Columbia River Basin, April 5, 1995).

5.6.9 Commercial and Recreational Harvest

Commercial harvest in the Columbia River basin contributed to the decline of spring and summer chinook salmon beginning in the late 1800s (Fulton 1969) and to the decline of fall chinook since 1920 (Lichatowich and Mobrand 1995). Lichatowich and Mobrand (1995) divided the history of the chinook salmon fishery into four phases: initial development (1866-1888), sustained production (1889-1922), resource decline (1923-1958), and maintenance at a depressed level (post 1958). Historical ocean and river harvest rates exceeded 80 percent (Ricker 1959). Prior to 1880, chinook salmon were the primary target of the commercial fishery, but harvest probably shifted to steelhead and other species as chinook salmon runs declined (Mullan and others 1992). Landings of steelhead declined steadily during the 1930s and 1940s as exploitation rates exceeded 60 percent [Northwest Power Planning Council (NWPPC) 1986].

5.6.10 Habitat Fragmentation and Simplification

The physical environment and the natural and human-caused disturbances to that environment profoundly influence the structure, composition, and processes defining aquatic ecosystems. Aquatic habitat fragmentation (impassable obstructions, temperature increases, and water diversion) and simplification (channelization, removal of woody debris, channel bed sedimentation, removal of riparian vegetation, and water flow regulation) have resulted in a loss of diversity within and among native fish populations.

The loss or degradation of habitats resulting from anthropogenic activities has not occurred in a random or uniformly dispersed fashion. Often lower elevation lands are more accessible, have wider floodplain valleys, and are more easily developed; hence, habitat degradation has been greater in lower watersheds or in the lower reaches of larger systems. Dams and water diversions often result in fragmented streams and rivers. As a result, watersheds retaining the best remaining habitats are not well dispersed throughout the individual basins; they are often restricted to less productive headwater areas. Small streams in the headwater basins actually represent more extreme or sensitive environments with limited resilience to disturbance, increased synchrony among the populations, and relatively poor potential for dispersal throughout the entire Basin.

5.7 Distribution and Status of Anadromous Fish Species in the Columbia Basin (may be incorporated elsewhere in MYIP)

5.7.1 Anadromous fish species by subregion

(table showing anadromous fish species by subregion-see Table 6.1 in Resident Fish plan).

5.7.2 Distribution

(figures showing anadromous fish distribution within four anadromous fish subregions).

5.7.3 Historical and current runs

into the Columbia River (graphs showing counts of each anadromous species at Bonneville, Priest Rapids, and Ice Harbor dams).

5.7.4 Historical and current tributary escapements

(tables showing escapements of each anadromous species in each subbasin).

5.8 Regional Production and Habitat Goals, Policies, Objectives, Strategies, Plans and Programs

5.8.1 Background and origin of the three salmon recovery plans.

5.8.1.1 *Wy-Kan-Ush-Mi Wa-Kish-Wit* ¾ Spirit of the Salmon

(See more detailed discussion of this document in Section 2.) The *Wy-Kan Ush-Mi Wa-Kish-Wit* — Spirit of the Salmon: The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs, and Yakama Tribes, is a plan developed and approved by the Columbia River Treaty Tribes. It is the culmination of the work of the Nez Perce, Umatilla, Warm Springs, and Yakama

fish and wildlife committees and the technical work of reservation fisheries and the Columbia River Inter-Tribal Fish Commission staffs.

The plan sets a goal of restoring adult salmon returns above Bonneville Dam to 4 million annually, in a manner that sustains natural production to support tribal, commercial, ceremonial, and subsistence harvest. The plan takes a "gravel-to-gravel" approach, focusing on the entire life cycle of the salmon and the impacts of development in the tributary, mainstem estuary, and ocean. The plan recommends using an adaptive management approach that requires action in the face of uncertainty but depends heavily on monitoring and evaluation. The plan emphasizes working through watershed-based science, recovery actions, and monitoring, and community-based watershed groups.

5.8.1.2 Northwest Power Planning Council 1994 Columbia River Basin Fish and Wildlife Program

(See more detailed discussion in Section 2 of this plan.) The Northwest Power Planning Council is an interstate compact agency with representatives of the states of Oregon, Washington, Idaho, and Montana. Its activities are related to the fish and wildlife mandates of the Northwest Power Act and include amendment and oversight of Columbia Basin Fish and Wildlife Program measures. The Council also facilitates the actions of groups such as the Independent Scientific Advisory Board and the Fish Operations Executive Committee (reorganized into the Executive Committee) called for by the program.

The Council's Columbia River Basin Fish and Wildlife Program is a long-range plan addressing river operations, passage, production, habitat, and harvest. It is designed to balance competing river uses while strengthening and rebuilding fish and wildlife throughout the basin. The Council's aim is to make future Endangered Species Act petitions unnecessary and ultimately to produce healthy and harvestable populations of salmon and steelhead, resident fish, and wildlife.

5.8.1.3 National Marine Fisheries Service Proposed Recovery Plan for Snake River Salmon

(See more detailed discussion in Section 2 of this document.) In 1995, the National Marine Fisheries Service (NMFS) released a Proposed Recovery Plan for Snake River Salmon as required under the Endangered Species Act. The Recovery Plan's objectives are the following: (1) to improve Columbia Basin environmental health; (2) to increase self-sustaining natural salmon populations to levels where protections under the ESA are unnecessary; (3) to avoid declines in other fish and wildlife species; and (4) to restore salmon stocks to levels sufficient to sustain Native American cultures and the lifestyles and economies important to the Pacific Northwest and the nation. Guiding principles include preservation of stock structure, priority for sustainable natural production, protection of remaining high quality habitats, and habitat improvements to more closely approximate the natural environment.

The Recovery Plan calls for immediate action, not extended studies before any measures are taken. Tasks are prioritized to first address those factors most responsible for salmon declines. The plan states

that construction and operation of the Federal Columbia River Power System is a major reason why Snake River salmon are threatened or endangered with extinction; therefore, many of its recommended measures have to do with dam and reservoir operations, barging juveniles past dams, and structural changes to reduce mortality at the 13 mainstem dams that juvenile and adult fish must pass in the Columbia and Snake rivers. The Recovery Plan also calls for landscape-scale approaches to first protect, expand, and reconnect fragmented high quality habitats, and then to restore degraded habitats important to fish and wildlife.

5.8.2 NPPC, NMFS, and Spirit of the Salmon production goals, policies, objectives, and strategies

In this section, we summarize and describe the similarities and differences in production goals, policies, objectives, and strategies contained in the three regional recovery plans: NPPC's 1994 Fish and Wildlife Program, NMFS's Proposed Recovery Plan, and the Spirit of the Salmon plan. Our definitions of goals, policies, objectives, and strategies are as follows:

Goals: Broad statements describing the outcome of implementation of recommended measures. For example, NMFS's goal is to improve the health of the Columbia River ecosystem to meet recovery objectives and make future ESA listings unnecessary.

Policies: "A principle or plan, or course of action as pursued by a government agency." An example is NMFS's policy to limit hatchery production in the Columbia Basin to 197.4 million smolts, 20.2 million in the Snake.

Objectives: In this chapter, we have defined production objectives in terms of adults (at the regional level in terms of adult returns to the mouth of the Columbia and at the subbasin level in terms of adult escapement). For example, NPPC's goal is to double adult returns to the Columbia and the Spirit of the Salmon to increase from 0.5 to 4.0 million. Natural and hatchery production objectives should be provided if available.

Strategies: Actions to meet objectives. These need to include specific actions (like number of hatchery fish releases to meet production objectives or habitat improvements to meet habitat objectives.) For example, Table C, Volume II of the Spirit of the Salmon lists the number of smolt releases to meet tributary escapement objectives. Strategies can also include a whole host of other actions like those listed in the table on p.143 of the same source (e.g. conservation of genetic integrity, or reprogramming of existing hatchery stocks and facilities).

Table 5.8-1 is a side-by-side display of the production goals, policies, objectives, and strategies of the NPPC, NMFS, and Spirit of the Salmon plans. This display provides a quick opportunity to review all three plans for common or shared elements, as well as unique elements.

Each of the three plans is divided into a production and habitat section. To aid in cross referencing between each plan all the goals, policies, objectives, and strategies have been sequentially numbered. The numbering does not imply priority or relative importance of any item however.

In reviewing the plans it is immediately clear that each plan represents the interests and needs of its principals. Nonetheless, all three plans share a universal interest in rebuilding and restoring the salmonid resources of the Columbia Basin. By keeping in mind the sharing of a common need it appears possible to work together. The region subscribes to an adaptive management approach which encourages a variety of efforts to achieving the same ends. The purpose of the MYIP is to display both similarities and differences in plans and provide the region with the opportunity to work together rather than separately. By recognizing similarities it may be possible to develop a master plan that is more efficient economically. By recognizing differences it may be possible to achieve different needs more quickly.

The initial review of the goal statement of each plan provides the direction each plan takes. The NPPC production goal of doubling the adult salmonid returns to the basin focuses on hatchery production. This goal is substantially different from the NMFS production goal, which is sharply focused on the NMFS obligation under ESA to recover listed Snake River salmonids to the point they can be delisted. While recovery of listed species or populations is an important element of the NPPC goal of doubling adult returns, the NMFS goal can be achieved without meeting the NPPC goal. The Spirit of the Salmon goal is to restore anadromous fishes so they can meet the historical cultural and economic practices of the tribes. Doubling adult returns is a step toward

Table 5.8- 1 Regional production goals, policies, objectives, strategies for NPPC, NMFS, CRITFC

N P P C	N M F S	C R I T F C
GOAL 1. Double adult returns.	**GOAL** 1. Recover Snake River spring/summer chinook salmon, Snake River fall chinook salmon, and Snake River sockeye salmon to the point they can be delisted.	**GOALS** 1. Restore anadromous fishes to the rivers and streams that support the historical cultural and economic practices of the tribes. (These are generally areas above Bonneville Dam.) 2. Emphasize strategies that rely on natural production and healthy river systems to achieve this goal. 3. Protect tribal sovereignty and treaty rights. 4. Reclaim the anadromous fish resource and the environment on which it depends for future generations.
POLICY 1. Build new hatcheries if determined necessary to mitigate for hydropower losses. 2. Consider the impacts of artificial production. 3. Continue to update IHOT policies on fish health, genetics, interactions, performance standards, and regional hatchery coordination. 4. Don't exceed carrying capacity for juvenile salmonids via hatchery operations. 5. States and tribes are to develop wild and naturally spawning population conservation policy. 6. Fish managers will prioritize measures. 7. Implementation of subbasin plans must	**POLICY** Not specified.	**POLICY** 1. Reproductive isolation (ESU concept) should not be used as the key indicator of population distinctiveness, therefore limiting potential recovery actions (i.e. supplementation).

N P P C	N M F S	C R I T F C
incorporate genetic diversity. 8. Use existing hatcheries and reprogram production rather than new production and facilities.		
OBJECTIVE 1. Do not exceed the carrying capacity through operations of hatcheries.	**OBJECTIVES** 1. Conserve remaining Snake River salmon gene pools through implementation of captive broodstock/supplementation/gene bank programs. 2. Improve survival of Columbia River Basin anadromous salmonids by improving the quality of fish released from hatcheries. 3. Reduce adverse interactions (predation, competition) between listed salmon and hatchery steelhead. 4. Conduct research to facilitate management that optimizes hatchery production and conserves natural populations. 5. Minimize impacts on listed salmon from interations between Columbia Basin hatchery and natural salmon.	**OBJECTIVES** 1. Within 7 years, halt the declining trends in salmon, sturgeon, and lamprey populations originating upstream of Bonneville Dam. 2. Within 25 years, increase the total adult salmon returns of stocks originating above Bonneville Dam to 4 million annually and in a manner that sustains natural production to support tribal commercial as well as ceremonial and subsistence harvests. 3. Within 25 years, increase sturgeon and lamprey populations to naturally sustainable levels that also support tribal harvest opportunities. 4. Restore anadromous fishes to historical abundance in perpetuity.
STRATEGIES 1. Audit hatchery performance at least every three years. 2. Check progress in assessing impacts on natural salmon from hatchery salmon. 3. Develop impact assessment to examine	**STRATEGIES for Objective 1** 1. Develop and implement management plans for Snake River spring/summer chinook salmon conservation hatchery programs. 2. Develop and implement management plans for Snake River fall chinook salmon	**STRATEGIES** 1. Implement active restoration measures identified in Subbasin Plans in Volume II. 2. Develop monitoring programs at various geographic scales of resolution. 3. Secure fish protection on private lands in

N P P C	N M F S	C R I T F C
effects of hatchery/wild stock interactions. 4. Do independent peer review for risk to biological diversity. 5. Do population vulnerability analyses or risk analyses. 6. Make subbasin plans available through CIS. 7. Obtain expert review of production plans. 8. Review existing procedures for conducting population vulnerability analyses for depleted salmon and steelhead stocks. 9. Study adverse effects of sound on hatchery fish survival. 10. Study rearing/release strategies. 11. Use methodology to assess impacts of proposed new artificial production to address NEPA and E&A requirements. 12. Use NPPC list of detailed elements to be considered in Master Plans. 13. Use products of RASP and Council's genetics team in production planning. 14. (Address Pacific lamprey) 15. Adopt management to rebuild Columbia River Chum. 16. Continue life history studies of Snake River fall chinook. 17. Continue Snake River Sockeye captive brood program. 18. Develop basin wide guidelines to minimize genetic and ecological impacts of hatchery fish	conservation hatchery programs. 3. Develop and implement management plans for Snake River fall chinook salmon conservation hatchery programs. 4. Conduct research and develop operational protocols to improve the husbandry of captive broodstocks **STRATEGIES for Objective 2** 1. Develop an index of measures to evaluate hatchery smolt quality and improve adult returns. 2. Columbia River hatcheries should optimize rearing densities at levels low enough to produce smolts of acceptable quality for post-release survival and high enough to produce significant adult contribution. 3. Design and carry out production-scale experiments at appropriate Columbia River Basin hatcheries to test individual release strategies and evaluate smolt quality indices believed to improve smolt quality. 4. Develop new, natural rearing systems that minimize behavioral changes in hatchery-reared fish. **STRATEGIES for Objective 3** 1. Plan and develop steelhead acclimation/release ponds in Snake River salmon spawning/nursery areas. Incorporate	conjunction with public land management. 4. Protect the remaining wetlands and intertidal areas in the estuary upon which anadromous fish are particularly dependent. 5. Protect existing estuary habitat complexity. 6. Increase abundance of naturally reproducing populations through outplanting/supplementation while keeping genetic risk at acceptable levels. 7. Utilize artificial propogation for supplementation and reintroductions based on scientific principles and practicality. 8. Conduct routine/extensive monitoring activities in all watersheds having active habitat/production restoration programs. 9. Redirect Mitchell Act propogation facility capacity and implement mitigation for John Day Dam. 10. Implement recommended supplementation and reintroduction projects according to RASP (1992 a&b) and Cuenco et al (1993) protocols. 11. Implement a program to restore lamprey, under the overall leadership of the tribes. 12. Document recovery trends in habitat condition and to further define relationships among land use, instream habitat condition, and salmon production. 13. Undertake an immediate assessment of remaining and potential estuary habitat.

N P P C	N M F S	C R I T F C
on wild fish. 19. Develop design for supplementation of Snake River fall chinook. 20. Develop master plans for situations where there is no NEPA information to evaluate new hatchery projects. 21. Make management goals to rebuild natural populations of lower-river coho. 22. Update subbasin plans using Appendix A of Spirit of the Salmon. 23. Use Coordinated Habitat and Production process for new production measures. 24. Use subbasin plans, etc., to develop project-specific plan. 25. Analyze alternative hatchery institutional arrangements between implementors and managers. 26. Create a study plan to address critical uncertainties and research needs. 27. Design study to evaluate impacts of artificial propagation on Columbia Basin anadromous and resident fish. 28. Determine level of differentiation needed to i.d. stock boundaries and genetic differences for Columbia Basin salmonids. 29. Develop a project-specific plan for FY97-FY06 upon NPPC approval incorporate into BPA's AIWP. 30. Develop index to predict best time for smolt migration.	into management plans including an implementation schedule and plans to monitor and evaluate their effectiveness in minimizing steelhead residualism. 2. Target release of hatchery steelhead smolts to 170 to 220 mm total length. 3. Initiate studies to determine the effects of ecological interactions between hatchery and natural fish in the Columbia River Basin. 4. Target trout stocking away from the primary chinook salmon spawning and nursery areas of the Snake River Basin. 5. Limit trout stock in lakes used for Snake River sockeye salmon recovery efforts **STRATEGIES for Objective 4** 1. Develop an external, distinguishable, cost-effective mark for salmon to assist management entities in differentiating salmon stocks. 2. Design and conduct research to study the genetic basis of variation in life history traits in Pacific salmon. 3. Conduct research to determine the levels of inbreeding and outbreeding depression in salmonid populations. 4. Design a study to evaluate river, estuary, and ocean carrying capacity and assess relative impacts of principal environmental limiting factors on smolt and adult survival.	14. Identify and implement opportunities to reclaim former wetland areas by breaching existing dikes and levees. 15. Reestablish sustained peaking flows that drive critical river and estuarine processes. 16. Base population distinctiveness on a variety of indicators which includes but is not limited to genetic information. 17. Develop assessment methodology for identifying individual stocks in order to track population dynamics. 18. Establish and monitor escapement checkpoints in a least intrusive manner at mainstream dams and in index subbasins. 19. Conduct more intensive monitoring (to include fish life history survivals) in a set of eight established index watersheds. 20. See Table 5B.4 p 5B-17 for supplementation/reintroduction. 21. Provide Operation and Maintenance funds and transfer hatcheries. 22. Construct tribal production facilities. 23. Implement supplementation projects that have met the screening criteria of RASP (1992b) and Cuenco et al (1993). 24. Implement supplementation projects for other declining populations (identified in the subbasin Plans by CRITFC 1992) according to the RASP and Cuenco et al protocols. 25. Review and implement tribal proposals for

N P P C	N M F S	C R I T F C
31. Develop method to assess impacts of proposed new artificial production projects. 32. Develop performance standards for natural, supplemented and hatchery stocks 33. Develop programs to improve fish health. 34. Evaluate tributary, mainstem, estuary, plume, near-shore and marine salmon survival, ecology, carrying capacity and limiting factors. 36. Explore expansion of scope of bi-state study to study all of the Columbia Basin 37. Focus on needs of upriver stocks and if necessary move lower river stocks upriver. 38. Fund research, development and demonstration of improved husbandry practices at hatcheries. 39. Identify immediate measures that can improve estuary conditions and identify water volume needs in estuary. 40. Identify ways to improve estuary habitat. 41. Identify wild and natural populations and indicator populations for monitoring. 42. Recommend approach to identify genetic conservation units. 43. Review current efforts to conserve genetic diversity. 44. Specify new production measures to assist weak stocks and to provide harvest in tributaries.	**STRATEGIES for Objective 5** 1. Develop and implement management plans for salmon supplementation and mitigation programs in the Columbia Basin. 2. Limit hatchery releases of anadromous fish for purposes other than Snake recovery to 20.2 million until management plans are complete and justify modifications to production.	supplementation according to the Cuenco et al protocols. 26. Evaluate and condition additional proposals for hydroelectric and water withdrawals developments, navigation projects, and shoreline developments on the basis of their impact on estuarine ecology.
MONITORING 1. Analyze basinwide trends in hatchery fish	**MONITORING** Not specified.	**MONITORING** Not specified.

N P P C	N M F S	C R I T F C
survival. 2. Do monitoring and evaluation on hatchery/wild stock interactions. 3. Do long-term monitoring and evaluation of Snake River sockeye salmon 4. Set up a monitoring program. 5. When monitoring wild/natural and indicator populations include status, genetic/morphological traits, limiting factors and carrying capacity.		

achieving the Spirit of the Salmon goal as is recovering listed species and populations. However, neither the NPPC nor NMFS plans achieve the Spirit of the Salmon goals. The Spirit of the Salmon plan also differs in its approach by focusing on natural production rather than hatchery production and by emphasizing the restoration of a healthy river system throughout the basin as the best way to rebuild anadromous fish populations. The Spirit of the Salmon includes sturgeon and lamprey as anadromous resources. The NPPC plan mentions lamprey but the NMFS plan does not include either sturgeon or lamprey as stocks of concern.

5.8.3 NPPC, NMFS, and CRITFC habitat goals, policies, objectives, and strategies

In this section, we discuss areas of agreement and disagreement among the three major regional plans regarding habitat goals, policies, objectives, and strategies. These three plans have been compared in order to identify the areas of consensus and begin working on them, and to identify the differences and indicate how and when to start resolving them. (Goals, policies, objectives, and strategies are defined in Section 5.8.2.)

Table 5.8-2 is a side-by-side comparison of habitat goals, objectives, and strategies of the three plans. The habitat components of each plan reflect differences in approach as well as differences in need. To achieve rebuilding by doubling adult returns, the NPPC emphasizes procedures and processes ranging from cooperation among interest groups to legislation. NPPC also relies heavily on the objectives and strategies of other plans developed by federal land managers and reviewed by NMFS through the ESA Section 7 Consultation process. The NMFS plan focuses first on federal lands, since the federal land managers are also bound by the recovery plans for listed species and populations and by the reasonable and prudent alternatives developed in the Section 7 Consultation process. The ESA also directs the federal agencies to act prudently to rebuild species to preclude the need to list and take more restrictive actions that may be required by recovery plans. Consequently the NMFS plan also recognizes the need to work cooperatively with nonfederal land managers to preclude the need for listing and to achieve effective and economical results from habitat restoration efforts on federal lands.

The CRITFC plan takes a more holistic approach to habitat management because it seeks to restore watersheds for anadromous fish in addition to other cultural and economic needs of the Tribes. Substantial emphasis is placed on strategies that are more inclusive and more intensive than those called for by the federal land managers and concurred with by NPPC. The Tribes seek to fulfill their roles as resource managers and to engage federal and nonfederal land and water resource managers in affirmative actions to rebuild habitat for fishery and other purposes.

The strategies employed by all three plans rely on the same fundamental principles but differ in specific application. This is consistent with the different focus that drives each plan. Achieving a common set of strategies becomes possible where the plans can achieve common goals and objectives. For instance, all the plans call for strategies that keep genetic risks to acceptable levels. All the plans include strategies to improve existing hatchery production and release techniques. All the plans call for continued hatchery production. All the plans call for strategies

Table 5.8- 2 Regional habitat goals, policies, objectives and strategies for NPPC, NMFS, CRITFC

N P P C	N M F S	C R I T F C
GOAL 1. Maintain quality and quantity of salmonid habitat.	NMFS position on Habitat Restoration is subject to further review. The following views are for discussion only and are subject to change. **GOAL** 1. Recover Snake River spring/summer chinook salmon, Snake River fall chinook salmon, and Snake River sockeye salmon to the point they can be delisted.	**GOAL** Not specified.
POLICY 1. At a minimum, maintain present quantity and productivity of salmon and steelhead habitat; then improve productivity of habitat critical to weak stocks; next enhance the productivity of habitat for other stocks; last provide access to inaccessible habitat blocked by human actions. 2. Ensure human activities are coordinated on watershed management basis. 3. Give high priority to protection in areas where poor habitat is limiting factor for weak stocks. 4. Prioritize actions that are most cost-effective, and likely to succeed. 5. Provide increased funding for habitat restoration measures.	**POLICY** (Interim policy on Pacific Salmon under the Endangered Species Act subject to further review by NMFS)	**POLICY** Not specified.
OBJECTIVES	**OBJECTIVES**	**OBJECTIVES**

N P P C	N M F S	C R I T F C
1. Criteria for screening and passage to follow NMFS guidelines. 2. Establish Best Management Practices (BMPs) under the clean water act to improve salmonid production, monitor results. 3. Follow guidelines of Anadromous Fish Habitat Policy and Implementation Guide, PACFISH, etc. 4. Identify and protect lands with perennial or intermittent streams for fish protection. 5. States should make regulations that calls for water conservation programs that save 25% more water by 2005, for instream flows. 6. Prioritize FSOC projects for weak stocks. 7. Take immediate recovery actions in streams where objectives are not being met. 8. Use following objectives until more site-specific guidelines are in place: Fines in redds 20%, cobble embeddedness < 30%, maintain > 90% of streambanks in stable condition, attempt to maintain rearing habitat at < 60 F, and do not exceed 68 F, meet instream flow needs, protect wetlands, restrict withdrawals that do not consider effects on anadromous fish, retain large woody debris, retain riparian vegetation, improve stream morphology, conduct watershed analyses prior to management activities, limit vegetation disturbance near streams to distances detailed	1. Protect and restore important habitat on federal lands. 2. Develop long-term approaches for ecosystem management at the landscape and watershed scale on federal lands. 3. Develop an ecosystem approach that integrates federal and nonfederal land management. 4. Protect remaining high quality habitat, restore degraded habitats, and provide connectivity between high quality habitats. 5. Encourage implementation of Recovery Plan actions to restore the health of the Columbia and Snake River ecosystem and to recover listed Snake River salmon species. 6. Use the recovery plan to prioritize and formulate reasonable and prudent measures to minimize harmful effects of federal and nonfederal activities in the Snake River in Section 7 Consultations. 7. Develop and implement subbasin habitat management plans. 8. Establish specific riparian management objectives. 9. Establish a process for developing habitat conservation plans and agreements that would help nonfederal land owners protect and restore Snake River salmon habitat. 10. On federal lands, follow ecological goals	Not specified.

N P P C	N M F S	C R I T F C
in this Council measure, road-building consistent with sediment limits and provision of passage, grazing with plans to recover habitat or maintain, return flows consistent with water quality standards, timber harvest and mining consistent with these objectives, riparian area recreation must maintain habitat objectives. 9. Encourage public and volunteer activity.	(V-1-9, 10) and riparian management objectives. 11. Continue existing moratoria on issuing water rights in the Snake/Columbia River mainstems. 12. Advocate continuation of the Conservation Reserve Program.	
STRATEGIES 1. Address PACFISH objectives via the Eastside and Upper Columbia River Basin EIS. 2. Coordinate water quality activities relative to Columbia Basin fish and wildlife with integrated basinwide approach. 3. Develop habitat conservation plans that satisfy ESA. 4. Develop interstate mechanisms to protect flows for salmonids. 5. Fund the Fish Screening Oversight Committee to set direction, priorities, biological criteria, etc., for screening projects. 6. Program and state screening plans should integrate with Mitchell Act program to ensure integrated system wide screening program. 7. Adjust state water quality standards to program habitat goal, if necessary. 8. Apply model watershed approach to	**STRATEGIES** 1. Designate USFS & BLM riparian habitat conservation areas and protect them from activities that would degrade riparian or stream habitats or adversely affect listed salmon. 2. Identify and protect watersheds that contain or support both high quality habitat and habitat that can be readily restored (Priority Watersheds). 3. Develop and enforce non-point source pollution standards for areas supporting listed Snake River salmon. Determine extent of effects of mixing/dilution zones allowed in current water quality regulations. Review water quality standards, compliance, and enforcement procedures; and make necessary changes. 4. Control recreational activities that may impact habitat critical to Snake River salmon.	**STRATEGIES** 1. Secure fish protection on private lands in conjunction with public land management. 2. Actively support ongoing watershed approaches. 3. Provide active coordination and participation in watershed restoration activities. 4. Apply the Coarse Screening Process and in-channel and land use standards on public lands throughout all watersheds upstream from Bonneville Dam that are accessible to anadromous fish. 5. Use the Coarse Screening Process land management standards, and other appropriate approaches to identify and guide actions on private lands to achieve the in-channel conditions needed to support healthy naturally reproducing salmon populations. 6. Enforce existing land use and water quality

N P P C	N M F S	C R I T F C
subbasins. 9. Assess availability of flows for salmonids, with range of 50 to 95% probability of water availability. 10. Continue to improve livestock management plans. 11. Design and implement four water conservation projects to provide added flow and enhanced water quality for weak stocks. 12. Develop legislation to obtain greater compliance with fish screen laws in each state. 13. Do a study plan on existing water quality information, with recommendations for information needs and priority problems. 14. Each model should include all interested parties, compile all existing programs, identify needs, salmonid productivity limiting factors, and priority actions, list all resources, including volunteers. 15. Evaluate ability of native plant nurseries to supply plant materials for fish habitat projects. 16. Explore alternatives for expeditiously funding high priority habitat projects. 17. Implement one water lease project in the Yakima subbasin and three in the Snake Basin. 18. Improve and maintain coordination of habitat activities to protect salmonid productivity.	5. Ensure that inwater activities do not result in habitat destruction. 6. Ensure that water diversions have operational screens. 7. Riparian management objectives. 8. Pool frequenty varies by channel width from 9 pools/mi for 200 ft. wide streams to 96 pools/mi for 10 ft. wide streams. 9. No measurable increase in maximum water temperature and max. temp. <64F in migration and rearing habitats, and <60F in swapping habitats. 10. Large woody debris (>12 in. diameter and 35 ft. long) >20 pieces/mi in forested systems; fine sediment <20% in spawning habitat, and if cobble embeddedness is used, <30% in rearing habitat; streambank stability 90% in non-forested systems. 11. Lower bank angle <90 on at least 75% of banks in non-forested systems; width:depth ratio <10, stratified by channel type. 12. Develop and implement a training and outreach strategy. 13. Establish riparian habitat conservation areas; protect riparian habitat conservation areas from further degradation in any watershed containing designated critical habitat; provide for a network of well-distributed watersheds containing high quality	laws and regulations. 7. Halt any additional consumptive withdrawal of water from salmon subbasins until adequate instream flows and tribal instream flow reserved water rights are protected. 8. Use monitoring standards from the Coarse Screening Process. 9. Trend monitoring will be used to document recovery. to restore watershed, floodplain, and riparian conditions, and to improve existing salmon-production capability of in-stream habitat. 10. Halt any further impairments of wetlands. Prevent additional soil compaction. Prevent removal of riparian vegetation. Prohibit activities that would contribute to the creation or maintenance of peak flows earlier or greater than those that would occur naturally. Immediately undertake adaptive management activities, through restoration and protection actions, to reduce or eliminate nonpoint source impacts. Implement a comprehensive review and monitoring program for water quality and substrate parameters affecting salmon, lamprey, and sturgeon and their food sources. Implement a biomonitoring program. Prohibit all known permitted sources of persistent, bioaccumulative toxins affecting anadromous

N P P C	N M F S	C R I T F C
19. Propose water quality monitoring stations and fund setup. 20. Review adequacy of laws to protect fish flows. 21. Review and improve, if necessary, mining practices to promote salmonid productivity. 22. Local watershed managers to provide alternative plans (from the Council's), if appropriate, for Council consideration. 23. Do land acquisitions in privately owned areas, to improve salmonid production, on a willing-seller and buyer basis. 24. Enforce water rights, check diversions for flow measure devices. Identify water spreading cases, recommend alternatives for water conservation. 25. Assess dredging activities. 26. Establish instream flows, manage water rights consistent with salmon protection. Acquire water rights on willing-seller/buyer basis. 27. Analyze sources of pollutants. 28. Fund periodic inspections of all underwater diversions in mainstem Columbia and Snake.	spawning and rearing habitat and having the best potential for restoration (priority watersheds); manage priority watersheds in a manner that minimizes risk to the existing physical and ecological conditions; set restoration priorities in priority watersheds to help ensure that the nest generation of high quality habitat evolves and that high quality habitats expand and reconnect; require that land management be planned only after analysis of the best available information on watershed processes and functions is complete; develop baseline information and monitor the effects of land management to maintain consistency with implementation requirements and to achieve ecological goals and riparian management objectives; begin gathering information for developing options for long-term, ecosystem-based recovery strategies. 14. (Applies to federal lands only) Use watershed analysis results to adjust operating plans, or prohibit operations to prevent degradation; to the maximum extent possible, prohibit mine development in riparian habitat conservation areas. 15. Ensure that inwater activities do not result in habitat destruction. 16. Identify and require improvements to	species or their habitat in the Columbia River Basin. 11. Reduce discharges of other contaminants to meet water quality criteria fully protective of designated beneficial uses for anadromous fish. 12. Implement the Upper Grande Ronde Salmon Habitat Protection, Restoration and Monitoring Plan in the Upper Grande Ronde watershed. 13. Mandate utilization of most efficient irrigation methods. 14. Ensure that no consumptive uses are occurring in excess of the amount permitted. 15. Conduct baseline surveys of watershed and in-channel conditions by ground-based survey and aerial photographic methodology in all watersheds upstream from Bonneville Dam. 16. Monitor egg-to-smolt survival, total smolt production, and production per spawning pair in salmon-bearing watersheds. 17. Identify other high priority reintroduction indicated in CRITFC, and the Subbasin Plans in Volume II. 18. Meter groundwater and surface water withdrawals.

N P P C	N M F S	C R I T F C
	small hydropower projects (licensed or unlicensed) that adversely affect fish habitat. 17. Determine instream flow protection levels needed to protect all salmon life stages. 18. Determine effects of water withdrawals on salmon survival. 19. Complete a subbasin-by-subbasin inventory and assessment of all water withdrawal sites and develop subbasin plans to conserve water. 20. Ensure all water withdrawal facilities are screened to reduce mortality of migrating salmonids. 21. Evaluate feasibility of reintroducing Snake River fall chinook above Hells Canyon Dam. 22. Provide incentives to assist with protection of riparian areas on private lands where grazing occurs. 23. Conduct site assessments to ascertain the extent and condition of water diversion screening. Ensure that gravity and pumped water diversions have operational screens that meet NMFS criteria. Ensure that any diversions affecting salmon streams are equipped with lockable headgates and gauges that measure instantaneous and seasonal flows. 24. Eliminate “push-up” berms through development of alternatives, such as screened	

N P P C	N M F S	C R I T F C
	intakes and/or consolidation of withdrawal sites. 25. Develop hydrographs of the Columbia River Basin. 26. Maintain Rapid River spring/summer chinook salmon stock at Rapid River Hatchery for possible reintroduction above the Hells Canyon complex. 27. Reintroduce spring/summer chinook salmon into Panther Creek, Idaho, once water quality is restored. 28. Reintroduce spring/summer chinook in the Lochsa and Selway rivers once an appropriate stock is identified.	

and actions that improve knowledge of estuarine habitat used by salmonids. All the plans call for strategies that develop and implement management plans.

The habitat component of each plan also includes strategies that can be applied to common objectives. These strategies include improving and protecting riparian habitat on nonfederal lands to achieve overall habitat improvement and to make investment on federal lands effective. Strategies in all the plans support ongoing watershed restoration actions.

The strategies call for enforcement of water quality standards. The strategies call for improved water use practices to improve instream flows and enhance water quality. The NPPC and NMFS habitat plans call for application of riparian objectives and standards developed by USFS and BLM land management plans. The Spirit of the Salmon strategies are more encompassing than the federal land manager standards in the other two plans but are not inconsistent with them in terms of objectives. The differences in strategies between the three plans are fundamentally differences of degree rather than intent. The exception is found, however, in the Spirit of the Salmon, where substantial emphasis is placed on the role of the Tribes as the lead managers. This strategy is consistent with Treaty Rights and the status of the Tribes as sovereigns and co-managers of the Columbia Basin ecosystems.

5.8.4 Other Plans, Programs, and Relevant Documents

5.8.4.1 *US v Oregon* Columbia River Fish Management Plan (CRFMP)

The Columbia River Fish Management Plan is the existing plan that is the outcome of a series of lawsuits regarding treaty fishing rights on the Columbia River. This lawsuit, known as *US v Oregon*, is a continuing lawsuit since the first court decision was made in 1969. It helps direct the treaty and non-treaty fisheries on the Columbia River. The plan was signed by the parties to the *US v Oregon* lawsuit in 1988 and is due to expire in 1998. Besides addressing the fisheries, the plan also addresses many of the production facilities on the Columbia River system.

5.8.4.2 Pacific Salmon Treaty (PST) Programs

5.8.4.3 Northwest Power Planning Council Integrated System Plan (ISP)

The Integrated System (ISP) was developed by the anadromous fish managers under the auspices of the Columbia Basin Fish and Wildlife Authority. This was accomplished over a three-year period and included participation by a wide range of interested parties, including tribes; state and federal fish, water, and land management agencies; utilities; Bonneville Power Administration environmental groups; sport and commercial fishing groups; local governments; interested citizens; Northwest Power Planning Council; and others. It was completed in June 1991 under a contract funded by the Northwest Power Planning Council. Fundamental to the ISP was the development of management plans for the 31 subbasins that continue to produce salmon and steelhead in the Columbia River Basin. These subbasin

plans form the building blocks for the ISP. They contain objectives and alternative strategies for increasing anadromous fish production. From the alternative strategies, planners recommended particular strategies for implementation based on a number of criteria, including public, agency, and tribal support; a Simple Multi-Attribute Rating Technique rating; and whether they met management objectives.

The ISP is organized into four major parts. The first summarizes the system goals, policies, and programs that have guided the subbasin and system planning process. The second part summarizes information in the 31 subbasin plans by salmon and steelhead stock such as subbasin production objectives, the recommended strategies to meet those objectives, and projected increases in fish numbers according to computer model analyses. The third part integrates all 31 subbasin plans, projecting progress toward the Northwest Power Planning Council's Fish and Wildlife Program doubling goal, identifying major conflicts to reaching that goal, analyzing harvest and fish passage issues, and developing a means to evaluate the genetic risks of proposed strategies. The fourth part outlines the fish agencies' and Indian tribes' recommendations to the Northwest Power Planning Council. Recommendations include stocks and areas of emphasis, specific activities to be implemented, a summary of estimated costs, future monitoring and evaluation needs, and the need for future planning and annual review of the ISP.

The ISP and associated subbasin plans have not yet been updated. The Northwest Power Planning Council's Fish and Wildlife Program calls for updating the subbasin plans by the end of 1995. Section 5.10 contains the objectives and strategies listed in the subbasin plans as well as other objectives and strategies developed by the state and tribal fishery agencies since the completion of the ISP. It is expected that this compilation will form the basis for updating the subbasin plans in 1997. The importance of this update is that the Council has called for every salmon and steelhead habitat and production project implemented under its program to explicitly demonstrate that it is addressing an objective consistent with associated strategies listed in a subbasin plan.

5.8.4.4 Lower Snake River Compensation Program (LSRCP)

After 15 years of planning by the state and federal fishery agencies and Corps of Engineers, the Lower Snake River Compensation Plan (LRSCP) was authorized under the Water Resources Act of 1976. Its principal anadromous fishery mitigation feature is the construction of nine hatcheries and 11 satellite rearing and release facilities for steelhead, spring chinook, summer chinook, and fall chinook. The steelhead, spring chinook, and summer chinook facilities, with the exception of the Lyons Ferry and Tucannon programs, were constructed above Lower Granite Dam. The fall chinook program was constructed below Little Goose Dam. There were no mitigation programs for sockeye or coho. Although the hatchery program, like other mitigation programs such as the Mitchell Act and John Day, were intended to compensate for fish losses associated with the passage through the mainstem dams, it was known that those fish were from naturally reproducing stocks. Therefore, the original intent of such programs was to supplement the natural stocks. Because of the failure to return enough fish to the hatcheries and to support sport fisheries, these efforts in the Snake River have been for the most part

abandoned. In the case of fall chinook, the original intent was to only supply fish to the various commercial and sport fisheries. This has now been changed to return the fish to the habitat located above Lower Granite Dam, beginning with the first release in 1996.

Future programs will be needed to not only address steelhead, spring chinook and summer chinook, but to recognize that coho and sockeye must also be restored to the natural habitat. A sockeye captive rearing program is currently the only effort being implemented as part of the Bonneville-funded Fish and Wildlife Program. Some of the facilities constructed under the LSRCP are being used for this effort.

5.8.4.5 Northeast Oregon Hatchery Programs (NEOH)

The Northeast Oregon Hatchery project (NEOH) is part of efforts to meet the Northwest Power Planning Council's interim goal of doubling Columbia River salmon and steelhead runs. NEOH original intent (NPPC 1990) was to meet this goal through supplementation of natural populations with hatchery production in the Hood, Grande Ronde, Imnaha, Umatilla, and Walla Walla rivers. The Hood River component of NEOH was separated from NEOH in 1992. Planning for Hood River production facilities has been completed and implementation of trapping/holding facilities has been initiated.

With the listing of Snake River chinook under ESA, NEOH program development and facility development for the Grande Ronde and Imnaha basin have been deferred because of questions on the role of supplementation in recovery of the listed stocks. Specific concerns include what stock(s) should be used, what performance objectives are appropriate, and how to integrate hatchery production so that recovery of endangered populations are not jeopardized.

Co-managers from the Oregon Department of Fish and Wildlife (ODFW) and the tribes are working on these issues. Recently, ODFW and the Umatilla Indian Reservation, Nez Perce Tribe, National Marine Fisheries Service, and U.S. Fish and Wildlife Service asked an expert panel (Panel) to provide advice on the best stock of spring chinook to use in restoration and enhancement of Grande Ronde populations. The Panel advised that using local stocks was preferred to using a hatchery stock in recovery efforts. The fishery agencies and tribes are working together to develop an appropriate Grande Ronde recovery and enhancement program using this new information. Adjustments in NEOH program elements necessary to meet recovery needs are being considered in this process.

Planning for the Walla Walla and Umatilla rivers component of NEOH is continuing.

5.8.4.6 Mitchell Act

The Mitchell Act was passed in 1938 and amended in 1946. It was intended "...to provide for the conservation of the fishery resources of the Columbia River." The program included many purposes, among them habitat restoration such as fish screening and passage projects. These restoration measures were necessary to allow the supplementation of the rivers and streams using artificial production, which was also an important component of the Mitchell Act Program. Although many of the habitat measures were completed, the main focus of the Mitchell Act during the 1950s and 1960s turned towards using the hatcheries to supply the ocean and lower Columbia River commercial and sport fisheries. Once the emphasis was placed upon the fisheries, funds were often transferred from the habitat restoration efforts to the hatchery program. This shifting resulted in the fisheries industry becoming more and more dependent upon the continuing funding of the Mitchell Act hatcheries. When Corps of Engineer funding for construction of hatcheries ended in 1961, approximately 25 hatcheries and three rearing ponds had been constructed. Since that time, additional state or power company hatcheries and rearing ponds have been added to the Mitchell Act funding, creating an additional burden on federal funding. In recent years, the federal appropriations for the hatchery program have begun to be reduced, jeopardizing the continuing operation of the hatcheries and ultimately the ocean and lower Columbia River fisheries. It can be expected that the operation of the Mitchell Act program will become more dependent upon the Bonneville Fish and Wildlife Program, as was evident in 1996 when the Gnat Creek Hatchery (a recently closed Mitchell Act facility) was reopened using Bonneville funds.

5.8.4.7 John Day Mitigation

John Day Dam was completed in 1968 and resulted in the inundation of fall chinook spawning habitat. The Corps of Engineers is authorized to mitigate fish losses caused by inundation of spawning and rearing grounds. House Document 531 authorizes mitigation for fish losses caused by the construction of John Day Lock and Dam. The intent of this document seems clear; "...facilities would include salmon hatchery units which would be operated to make up for any possible fish losses at...John Day [Dam]." (U.S.Congress, House 1950). To compensate for the lost production of natural spawning in the John Day Reach of the Columbia River, a mitigation program was developed during the 1960s and early 1970s by the U.S. Army Corps of Engineers and several state and federal resource agencies. Mitigation was to be for the lost production (including harvest) of 30,000 fall chinook salmon thought to spawn in the area inundated by John Day Dam. After extensive studies and negotiations, it was decided that one half of the mitigation fish would be produced at the Spring Creek National Fish Hatchery (SCNFH) and the balance would be produced at the Bonneville Fish Hatchery. These facilities were to be evaluated over a period of years and the results would determine if future modifications were necessary to meet mitigation.

Originally, mitigation was accomplished using an early-spawning stock of fall chinook produced at these two hatcheries. However, during the late 1970s and early 1980s, parties involved with the original mitigation plan development decided that upriver bright (URB) stocks would better represent fall

chinook production lost from construction of the dam. At this time it was also expressed that mitigation hatchery releases should be made in the area of loss.

Currently, an evaluation of an upriver acclimation site is underway at Ringold Fish Hatchery. This 10-year evaluation will determine whether mitigation for John Day Dam can be met at that upriver site within acceptable costs.

5.8.4.8 Willamette River Mitigation

The U.S. Army Corps of Engineers constructed 11 dams and related hydropower facilities on the Willamette River, Oregon, pursuant to authorization in the Flood Control Act of 17 May 1950, P.L. 516, 81st Congress, and other laws. The construction and operation of these projects resulted in losses of runs of salmon, steelhead, as well as impacts to resident fish populations. House Document 531, 81st Congress, 2nd session, and other projects' authorizations direct the Corps to provide facilities to mitigate loss of natural spawning, feeding, and rearing grounds for fish caused by these projects. A plethora of subsequent federal legislation directs and authorizes the Corps to operate and maintain these facilities in compliance with federal laws for the protection and enhancement of fish and wildlife, water quality, the human environment, and other federally authorized purposes. Oregon, by combining these federal activities at Marion Forks, South Santiam, Willamette, McKenzie, and Leaburg hatcheries, is able to achieve mitigation for these projects. The Corps share of the total O & M costs of these hatcheries is equivalent to its mitigation responsibilities under the authorities cited above.

5.8.4.9 Mid-Columbia Habitat Conservation Plan (HCP)

In an effort to prevent listing of anadromous stocks in the mid-Columbia reach of the river, the tribal, state, and federal fishery managers and the Douglas, Chelan, and Grant County Public Utility Districts (PUD) are developing Habitat Conservation Plans (HCP) in concert with the existing hatchery supplementation programs. The existing supplementation programs include the Eastbank Hatchery and its tributary satellites, Douglas County Methow Spring Chinook Hatchery and its tributary satellites, and the Grant PUD Priest Rapids Hatchery. Tributaries in the mid-Columbia where these habitat restoration and hatchery supplementation efforts are directed include the Wenatchee, Entiat, Methow, and Okanagan rivers, and, with the Grant PUD program, the mainstem Columbia River.

At the mainstem dams, the HCP will address the passage needs of juveniles and adults. All salmon species affected currently or historically will be examined and measures developed and implemented for their restoration in the natural habitat.

5.8.4.10 Hells Canyon Complex Mitigation

In mid-February 1980, an agreement was entered into between and among the Department of Commerce acting by and through the National Marine Fisheries Service, the State of Idaho acting by and through the Idaho Department of Fish and Game, the State of Oregon acting by and through the Oregon Department of Fish and Wildlife, the State of Washington acting by and through the Washington Department of Fisheries and the Washington Department of Game, and the Idaho Power Company. The agreement is the settlement action for construction of the Hells Canyon Complex of dams licensed in August 1955.

Provisions of the agreement include the following:

Spring Chinook

Annual production of 4 million smolts reared at the Rapid River (3,000,000) and Pahsimeroi (1,000,000) hatcheries. One million spring chinook smolts are to be released into the Snake River below Hells Canyon Dam from those adults collected at the dam.

Fall Chinook

Annual production of 1,000,000 smolts to be reared at Oxbow Hatchery. Modification of the Oxbow facility will be ready for use within 6 months of written notification by the fishery agencies of egg availability. The smolts will be transported to the appropriate sites as determined by the fishery agencies.

Steelhead

Annual production of 400,000 pounds of steelhead smolts reared at the Niagara Springs Hatchery, not to exceed 3,200,000 smolts. These smolts will be transported to the upper Salmon River and the Snake River below Hells Canyon Dam.

Trapping Facilities

IPC will provide trapping facilities at Rapid River and Pahsimeroi hatcheries and Hells Canyon Dam for both spring chinook and steelhead. Trapped steelhead at the Hells Canyon site will be held at the Oxbow facility as adults, spawned, and the eyed eggs taken to the Niagara facility.

5.8.4.11 Other Mitigation Agreements

Cowlitz River Mitigation

As mitigation for the construction of hydro facilities on the Cowlitz River, maintain the yearly return of adult salmon to the Cowlitz River collection facility at the following levels: coho 25,500, spring chinook

17,300, and fall chinook 8,300. This goal would be achieved by releases from the Cowlitz Salmon Hatchery near Salkum, Washington. The mitigation goals for gamefish, steelhead and sea-run cutthroat would be for production levels at the Cowlitz Trout Hatchery to provide returns of anadromous gamefish of 38,600 adults for harvest and escapement.

Lewis River Mitigation

For mitigation for the construction of hydro facilities on the Lewis River, maintain the yearly return of adult salmon to the Columbia River at the following levels: coho 71,000 and spring chinook 12,800. This goal would be achieved by releases from the Lewis River and Speelyai Hatcheries. The mitigation goals for gamefish, steelhead and sea-run cutthroat, would be for production levels at Merwin Hatchery to provide 250,000 steelhead and 25,000 sea-run cutthroat adults for harvest and escapement.

Clackamas River Mitigation

In 1975 PGE and ODFW entered into an agreement to construct the Clackamas River Fish Hatchery to mitigate damages to anadromous fish runs on the Clackamas River. This agreement relieved PGE from being required to construct additional fish passage facilities or protective devices at its three mainstem Clackamas River hydroelectric projects. The agreement states that PGE will be responsible for costs associated with rearing 25,000 pounds of salmonids annually at the hatchery.

In 1983 PGE and ODFW entered into an agreement for PGE to finance an expansion of the rearing facilities at the Clackamas Hatchery to improve the salmon and steelhead populations in the Little Sandy River where PGE operates the Bull Run Project. The agreement also provided for PGE to fund the rearing of 12,209 pounds of salmonids annually at the Clackamas River Fish Hatchery for the Little Sandy River.

In 1984 the City of Portland and ODFW entered into an agreement to finance an expansion of the Clackamas River Fish Hatchery to mitigate the alleged damage to fish runs caused by the dams of the Bull Run Hydroelectric Project on the Sandy River. The added rearing facilities would be constructed at the same time as the ones agreed to by PGE. The agreement also provided for the City of Portland to fund the rearing of 32,000 pounds of salmonids annually at the Clackamas River Fish Hatchery.

In addition, the National Marine Fisheries Service provided $500,000 under authority of the Mitchell Act to help finance the original construction of the Clackamas Hatchery. Mitchell Act funding also contributes annually to rearing fish at the hatchery. ODFW also funds a portion of the operation of the hatchery. Overall, Clackamas Hatchery rears 168,879 pounds of salmonids annually. PGE's share is 22.0 percent (37,209 pounds); City of Portland's share is 18.8 percent (32,000 pounds); NMFS's share is 29.6 percent (49,835 pounds), and ODFW's share is 29.6 percent (49,835 pounds).

Deschutes River Mitigation

An agreement was made in 1970 with the goal of maintaining numbers of spring chinook salmon returning to the trapping facility at Pelton Dam at 1,200 adults, with at least 600 being females, and an average return of 1,800 steelhead trout. PGE was responsible for designing and constructing all the fish facilities needed to meet these goals. ODFW has operating control of the hatchery facilities and equipment and PGE pays all costs of operating and maintaining the facilities. Round Butte hatchery began fish-rearing operations in 1971.

Clearwater River Mitigation

Dworshak National Fish Hatchery (DNFH) was completed in 1970 by the Corps of Engineers as mitigation for Dworshak Dam, which blocked B-run steelhead from entering the North Fork of the Clearwater River. The hatchery reared steelhead and resident fish to mitigate for the dam. Steelhead mitigation for Dworshak Dam was calculated based on earlier fish counts at the Lewiston Dam located at the mouth of the Clearwater River. The mitigation goal was to return 20,000 adult B-run steelhead to the Clearwater annually from a smolt release of 2.3 million.

In June 1982 DNFH was expanded from its function as a steelhead mitigation facility to include spring chinook under the Lower Snake River Compensation Plan. The expanded hatchery was designed to rear 70,000 pounds of spring chinook smolts at 20 fish/lb for a total of 1.4 million smolts. The adult return goal for DNFH is 9,135, which translates to a minimum SAR (smolt-to-adult return rate) of 0.65 percent.

5.8.4.12 Integrated Hatchery Operations Team (IHOT)

The Integrated Hatchery Operations Team (IHOT) is a multi-agency group established in the Northwest Power Planning Council's Fish and Wildlife Program. Its members are fishery co-managers from six Tribes, three states, two federal agencies, and seven other entities representing broad interests within the Columbia Basin. IHOT was asked to develop regionally integrated hatchery policies for operating all Columbia Basin anadromous salmonid hatcheries. More than 90 hatcheries in the basin, which are funded, co-managed, and operated by several different entities, produce fish for many different management objectives, including supplementation, restoration, harvest, egg banking, and research.

IHOT produced a policies and procedures manual for these hatcheries, with the purpose of helping to ensure that hatchery operations will be consistent with the regional goal of rebuilding wild and naturally spawning fish runs. This manual provides guidance for the technical operation of hatcheries; it does not set specific production priorities. Production decisions must be provided by fishery co-managers through a negotiated, comprehensive plan that addresses both natural and hatchery production, i.e. the Columbia River Fish Management Plan negotiated under *US v Oregon*.

IHOT also developed an implementation plan that provides specific guidance for initiating actions needed to achieve policy goals. The implementation plan has been developed to ensure that hatchery operations will be coordinated throughout the Columbia River Basin and provide the best possible tool for meeting regional hatchery production responsibilities. The plan outlines the implementation of hatchery audits, which are based on IHOT's policies for hatchery standards. The hatchery audit process will be used to determine if hatcheries are conforming to the established standards. The implementation plan also addresses coordination efforts that are designed to help implement the regional hatchery policies, coordinate operations to minimize impacts on naturally spawning populations, and foster sharing of facilities to increase their effectiveness.

5.8.4.13 Fish Screen Oversight Committee (FSOC)

FSOC was established in 1989 in response to Measure 7.10A of the NW Power Planning Council's Fish and Wildlife Program to coordinate implementation of Columbia Basin fish screening strategies and technical criteria. It is composed of state, federal, tribal, and Council representatives.

Federal Mitchell Act (MA) funding, through the National Marine Fisheries Service (NMFS), is the largest and most important source of funding for fish screening and passage work in the Columbia Basin. Fish screening programs, using this funding source, are administered by state fish and wildlife agencies.

Idaho and Oregon use the majority of federal MA screening funds. Oregon, for example, operates and maintains a total of approximately 450 rotary drum fish screens in the John Day, Umatilla, and Grande Ronde basins. Washington, in contrast, receives little MA funding for its screening programs.

All three states also receive significant funding from the Bonneville Power Administration (BPA) for fish screening activities. BPA and MA funds were used in the the construction of fully equipped fish screening fabrication shops in Oregon (2) and Idaho, and the actual screening of irrigation systems. BPA has also funded the consolidation of irrigation canals, eliminating whole diversions and their fish screening needs. Most funding for fish screening in Washington comes from BPA or state funds.

Reductions in federal monies for fish screening, both in MA funding and from BPA, in the last two years have caused some real concern for Columbia Basin fishery managers. First, construction funds to replace older fish screening devices from the 1950s and 60s in Oregon have been greatly reduced. These screens are not in compliance with newer protection criteria, and are mostly worn out after, in many cases, more than 40 years of continuous use.

Second, fish screening operation and maintenance costs are in jeopardy. Most MA funding, particularly in Oregon and Idaho, is used for the O&M costs of existing rotary drum screens. In Oregon currently, most irrigators (under 30 cfs) have no legal obligation to install or maintain fish screens at their diversions. Idaho does require irrigators to install and maintain fish screens, but currently uses MA funding for this purpose to ensure proper O&M at most screen sites. Further significant MA reductions could threaten these state programs.

Washington is in a stronger position in regard to fish screening O&M in the Columbia Basin. Not only is landowner maintenance of Columbia Basin fish screens mandatory under state law, but since 1983, the irrigation community and Washington Department of Fish and Wildlife (WDFW) have worked together to provide workable options for maintenance. In Washington, landowners can either handle maintenance themselves or contract with WDFW to handle it for them. WDFW also employs two field inspectors within the Basin to follow up with landowners and ensure that maintenance is up to date. Different laws and circumstances in Washington have allowed WDFW to take a stronger oversight role on O&M issues. In Oregon, only the larger irrigators (over 30cfs) have a legal obligation to provide for fish screening, including maintenance.

5.8.4.14 State Wild Fish Policies

Oregon has adopted a series of specific conservation policies, including the Wild Fish Management Policy, to help protect and rebuild populations of wild fish. Similar policies exist or are being developed by Washington and Idaho. The primary objective of Oregon's Wild Fish Management Policy is to conserve the genetic resources of wild fish by implementing actions as necessary to meet specific guidelines. These gene conservation guidelines relate to several important issues, including minimum population size, interbreeding with hatchery fish, and genetic diversity.

Even in the absence of specific conservation policies, management changes to protect and restore wild fish are encouraged by the broad statutory responsibilities of most fish management agencies. Therefore, the main purpose of specific wild fish policies is to clarify exactly what kind of change will be needed, how this change will take place, and how success (or failure) will be measured.

5.8.4.15 Comprehensive Environmental Assessment (CEA)

The Comprehensive Environmental Assessment was developed to address the impacts of the hatchery programs on the Columbia River system. This effort was the result of a threat to seek litigation if the BPA did not do an EIS for the tribal fish hatcheries that were being planned under the NPPC's Fish and Wildlife Program. The effort resulted in the development of a draft Programmatic Environmental Impact Statement that is currently being finalized for distribution for public review. Funding was provided primarily by the Bonneville Power Administration, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. The intent of the effort is to use the PEIS as an overall document to prevent future need for impact statements and head off possible litigation on some of the existing state and federal hatchery programs such as the Mitchell Act program.

5.8.4.16 Northwest Power Planning Council's Model Watersheds

The Northwest Power Planning Council Fish and Wildlife Program habitat objective states, "Ensure human activities affecting production of salmon and steelhead in each subbasin are coordinated on a comprehensive watershed management basis." The Council does not view comprehensive watershed management as a planning process, but as a way of doing business that allows for coordination of the goals and objectives of all interests in order to use available natural, human, and fiscal resources in the most beneficial manner. Thereby, investments in development and usage of resources in a subbasin, including production of fish and wildlife, will benefit.

With this in mind, the Council adopted a program to develop "model" watersheds in 1992. This program recognized that a locally based, bottom-up, voluntary approach for protection and improvement of habitat on private lands was needed to rebuild fish and wildlife populations. Bonneville Power Administration funded the initiation of several model watersheds selected by the states of Idaho, Oregon, and Washington. These were in the Asotin, Grande Ronde, Tucannon, and Upper Salmon subbasins. Starting in 1995, the Council called for the initiation of more watershed approaches. These additions to the program are called focus watersheds. The requirements for focus watersheds are the same as for model watersheds. The terminology has been changed to recognize the intent of the Council to see that watershed approaches are initiated in all the subbasins in the Columbia River Basin over time. Focus watersheds selected to date include the Clearwater, Flathead, Kootenai, McKenzie, and Okanogan subbasins.

The Council expects that the experience gained in the model and focus watersheds will provide results that can be used for implementing watershed approaches in other subbasins. The Council understands that fully attaining a watershed approach will take decades, but incremental progress toward this end should be apparent every year. The Council believes that accomplishment of certain elements in the first year of implementation of each model is critical to success. These include identifying all parties with an interest in each watershed and setting up procedures to ensure that all these parties have the opportunity to participate fully; identifying gaps and conflicts in the existing plans, programs, policies, laws, and other appropriate authorities that hinder comprehensive watershed management in each model watershed and setting out a path and procedures for filling gaps and addressing conflicts; and identifying key factors limiting salmon and steelhead productivity and priority on-the-ground actions to address these factors. Also of importance is that priority on-the-ground actions that address key limiting factors are initiated by the second year of implementation of watershed approaches.

The watershed approaches implemented to date under the Council's program have succeeded in bringing local and other interests together to identify problems and solutions for watershed health in the selected subbasins. Hundreds of projects have been put on the ground, some funded by Bonneville and many others by various other sources.

5.8.4.17 Northwest Forest Plan

The Northwest Forest Plan Record of Decision (NWFP ROD) was signed in April 1994. The area covered by the ROD includes the area within the range of the northern spotted owl. Included in the Plan

are the lower portions of the Columbia River Basin (CRB) west of the Cascade Crest and portions of the CRB east of the Cascade Crest (on the Mt. Hood, Wenatchee, and Okanogan National Forests).

The NWFP addresses the following components of a strategy to improve aquatic conditions:

(1) Riparian reserves

The riparian reserves designate initial reserve widths for protection of riparian areas, as well as specific requirements for timber management, road construction and maintenance, grazing, recreation minerals management, fuel/fire management, research, and restoration activities.

(2) Key watersheds

There are three categories of watersheds:

A) Tier 1 key watersheds -- Those to be maintained for high-risk anadromous salmonids, bull trout, and resident fish.
B) Tier 2 key watersheds -- Those where high quality water is important.
C) Tier 3 non-key watersheds -- All other watersheds in the basin.

(3) Watershed analysis

Watershed analysis (WA) is a systematic procedure to characterize aquatic, riparian, and terrestrial features within a watershed. The Forest Service (FS) and Bureau of Land Management (BLM) will use information gathered during WA to refine riparian reserve boundaries and prescribe land management activities (including watershed restoration and develop monitoring programs).

(4) Watershed restoration

The watershed restoration component of the aquatic strategy is designed to restore currently degraded habitat conditions. The most important components are the control and restoration of road-related runoff and sediment production, restoration of riparian vegetation, and restoration of instream habitat complexity. Restoration programs will initially focus on arresting road related erosion and doing silviculture treatments in riparian reserves to restore large conifer canopies. Instream restoration is inherently short term; upslope and riparian restoration is essential to achieve long-term watershed restoration and stability.

The riparian reserve, key watershed, and watershed analysis components are not unlike those found in the FS/BLM PACFISH direction.

Both BLM and FS are committed to the NWFP and are working collaboratively with the U.S. Fish and Wildlife Service and National Marine Fisheries Service in establishing management criteria for the benefit of resources.

5.8.4.18 Eastside Environmental Impact Statement (EIS)

The United States Department of the Interior Bureau of Land Management (BLM) and U.S.D.A. Forest Service (FS) are in the process of developing a scientifically based ecosystem management strategy for lands administered in the Upper Columbia Basin (CRB) by the FS and BLM **(see map).**

The two agencies anticipate that similar Draft Environmental Impact Statements (DEIS) to amend existing land and resource management plans for the BLM and FS will be available for public comment by mid-winter. These EIS's will be in two parts: 1) The Eastside EIS will cover lands administered by the FS/BLM in Eastern Oregon and Washington. 2) The upper Columbia River Basin EIS will cover similar lands in Idaho, Western Montana, and those portions of the Columbia Basin in Utah, Nevada, and Wyoming.

The DEIS's will outline, in seven alternatives, management actions that could be taken by each agency for managing its lands. The DEIS's will have both aquatic and terrestrial strategies. The aquatic strategy will address specifically how anadromous and resident fish habitat would be managed in the Basin under various scenarios.

Several of the alternatives address watershed analysis and restoration and monitoring to assess compliance with a selected alternative in a collaborative way with other federal agencies and state and tribal governments. The FS and BLM are working with federal regulatory agencies and state and tribal governments and counties to recommend a preferred alternative that will meet the resource, social, and economic needs of the CRB as well as federal policies and laws for managing threatened and endangered species under the Endangered Species Act.

5.8.4.19 Independent Scientific Group (ISG) Report

In 1994 the Northwest Power Planning Council called for an independent scientific group to conduct a biennial review of the science underlying salmon and steelhead recovery efforts and Columbia River Basin ecosystem health. The Council's objective was to provide the region clear and authoritative analysis by impartial experts. In September 1996, the Independent Scientific Group (ISG), now called the Independent Scientific Advisory Board (ISAB), delivered a report to the Council that provides a proposed conceptual foundation for the NPPC's Fish and Wildlife Program, a slightly different conceptual foundation than the one underlying previous program activities.

"Management of the Columbia River and its salmonid populations has been based on the [implicit] belief that the natural ecological processes that characterize a healthy salmonid production system to a large degree can be circumvented, or the natural production process simplified and controlled by humans, while maintaining or even enhancing production. . . . The Independent Scientific Group concluded that these assumptions...drive management toward solutions which attempt to use technologies as substitutes for ecosystem functions." (ISG Report, page 16.)

The scientists go on to say that the measures derived from these assumptions clearly have failed to meet the goal of recovery of salmonids throughout the Columbia River, and that a new conceptual foundation is needed. They recommend treating the Columbia River and its tributaries as both a natural and a cultural system. A natural-cultural ecosystem encompasses all the ecological and social processes that link organisms, including humans, with their environments.

In the report, the ISG recommends that fish and wildlife restoration should be based on the concept of a "normative ecosystem," and should try to recreate as much as possible the ecological conditions that sustained salmon before the river basin was developed. The panel recognizes that human development of the basin has occurred and will continue, and believes that this development can coexist with healthy and diverse salmon populations if enhancement efforts are made with the entire ecosystem in mind.

Three critical elements were identified as part of the conceptual foundation against which recovery actions can be measured and evaluated. All three emphasize a watershed approach to the fish and wildlife mitigation in the Basin.

1) Restoration of the Columbia River salmon must address the entire natural and cultural ecosystem, which encompasses the continuum of freshwater, estuarine, and ocean habitats where salmon complete their life histories.

This consideration includes human developments as well as natural habitat. The ISG recommended that the most promising way to help salmon populations rebuild is to reduce or remove conditions that limit the restoration of high-quality salmon habitat at each of their life history stages. Habitat restoration at the watershed/tributary level will be critical for salmon restoration.

2) Sustained salmon productivity requires a network of complex and interconnected habitats that are created, altered, and maintained by natural physical processes in freshwater, the estuary, and the ocean. These diverse and high-quality habitats are crucial for salmon spawning, rearing, migration, maintenance of food webs, and predator avoidance.

The ISG recommends that a priority be placed on high-quality habitat for production -- for example, the Hanford Reach. This recommendation accords with the tribes' and agencies' emphasis on protecting high-quality habitat at the tributary/watershed level.

3) Life history diversity, genetic diversity, and metapopulation organization are ways salmon adapt to their complex and connected habitats. (Metapopulations are "groups of local populations that are linked by individuals that stray among the populations.") This biodiversity and its organization contribute to the ability to cope with the environmental variation that is typical of freshwater and saltwater environments.

The ISG emphasizes that the availability of complex and connected habitats is a critical contributor to salmon productivity. Also important are the "metapopulations" that maintain themselves by a high degree of homing to natal streams and a variable level of straying. Straying provides the dispersal of genetic

traits needed to successfully recolonize habitat vacated by lost populations. These findings support the value of supplementation.

5.8.4.20 National Research Council (NRC) Report- UPSTREAM

The National Research Council, in response to a request from Congress, assembled an expert Committee on Protection and Management of Pacific Northwest Anadromous Salmonids. The Committee was asked to assess the status of the salmon stocks, analyze the causes of declines, and analyze options for intervention. The report, UPSTREAM, is the result of the study.

The Committee recommended rehabilitation of degraded ecosystems and habitats to make it possible for natural processes of reproduction and production to take place. It concluded that two conditions must be met to achieve long-term protection of natural populations of salmon: 1) Management must recognize and protect the genetic diversity of salmon; and 2) any solution to the salmon problem must take the effects of growth in human population and economic activity into account. The committee stated that its recommendations should be considered on a regional basis and in a comprehensive framework that includes an analysis of their costs, probable effectiveness, and the ability and willingness of various sectors to bear the costs.

5.9 Subbasin Production and Habitat Goals, Objectives, and Strategies

This subsection is organized into four parts. Section 5.9.1 gives a basinwide overview of the current numerical production goals and estimated or projected production costs of hatchery fish produced for release in the Columbia River Basin. Section 5.9.2 summarizes numerical subbasin production goals, objectives, and strategies contained in NPPC subbasin plans, the Spirit of the Salmon, NMFS, state, and other plans derived from the information in Appendix 1 and Volume II of the Spirit of the Salmon. Section 5.9.3 presents subbasin production strategies and broodstocks used, as well as major habitat actions identified for each subbasin in the Spirit of the Salmon. Finally, Section 5.9.4 summarizes habitat objectives and strategies outlined in NPPC subbasin plans, the Spirit of the Salmon, NMFS, state, and other plans derived from the information in Appendix 1 and Volume II of the Spirit of the Salmon.

Section 5.9.1 is a programatic review of hatchery production based on existing hatchery facilities. Sections 5.9.2 and 5.9.4 are a programatic summary relevant to similar or differing production and habitat objectives and strategies specific to different managers' subbasin or regional plans. Section 5.9.3 incorporates production strategies, broodstocks used, and major habitat actions listed for each subbasin in the Spirit of the Salmon on a geographic watershed by watershed basis.

To allow the reader to review all information relevant to a specific watershed, Table 5.9-1 lists the page number in this document where information specific to a single subbasin is described for each production or habitat category. For example, to review a watershed profile of habitat and production

strategies and objectives for the John Day River subbasin, the page numbers listed in Table 5.9-1 reference information including, but not limited to:

1. No hatchery facilities exist in the John Day River subbasin;
2. the NPPC subbasin plan and Spirit of the Salmon call for natural production of spring chinook and summer steelhead;
3. The Spirit of the Salmon plans for the introduction of coho salmon and a proposal for lamprey restoration; and
4. A description of the John Day River watershed from the Spirit of the Salmon.

Table 5.9- 1 Index to subbasin specific production and habitat information

[This table was not completed at the time of the draft's publication.]

5.9.1 Columbia Basin hatchery release goals and projected costs

Present hatchery production release goals for hatcheries that release fish in the Columbia River Basin are presented in Table 5.9.1-1. Estimated present and projected costs for production by species and budget source are shown for each hatchery facility for FY 1997-2001. Because some hatcheries produce fish that are released in more than one watershed, subbasin specific release goals are not apparent in Table 5.9.1-1. For the entire Columbia River Basin, present release goals total ~~~___,___,___ fish.

Table 5.9.1- 1 Multi-Year Implementation Plan Fish Propagation Goals and estimated O&M Funding Requirements (excluding Capital)

SUBREGIONS / Subbasin / Facility	Species	Number	Budget Estimates 1997	1998	1999	5%/YEAR 2000	2001	Budget Source
Rogue River Basin 1/								
Rogue River								
Cole M. Rivers	CHS	1,772,000	651,621	684,202	718,412	754,333	792,049	USACE
	RB	195,372	242,067	254,170	266,879	280,223	294,234	USACE
	COH	200,000	79,155	83,113	87,268	91,632	96,213	USACE
	STW	351,100	279,262	293,225	307,886	323,281	339,445	USACE
	STS	244,500	195,104	204,859	215,102	225,857	237,150	USACE
subtotal		2,762,972	1,447,209	1,519,569	1,595,548	1,675,325	1,759,092	
	RB	69,158	37,860	39,753	41,741	43,828	46,019	STATE
	CO	60,000	8,174	8,583	9,012	9,462	9,936	STATE
	CHF	92,000	15,039	15,791	16,580	17,410	18,280	STATE
subtotal		221,158	61,073	64,127	67,333	70,700	74,235	
Hatchery Total		2,984,130	1,508,282	1,583,696	1,662,881	1,746,025	1,833,326	
Below Bonneville Dam(Lower Columbia River subregion)								
Lower Columbia Mainstem								
OR Fish Pathology-CRFDP			167,635	176,017	184,818	194,058	203,761	MA
OR Production Standards-CRFDP			80,224	84,235	88,447	92,869	97,513	MA
OR Engineering-CRFDP			41,888	43,982	46,182	48,491	50,915	MA
OR Distribution-CRFDP			226,967	238,315	250,231	262,743	275,880	MA
OR IHOT			73,728	77,414	81,285	85,349	89,617	BPA
OR Pathology C. Shasta			47,248	49,610	52,091	54,695	57,430	SFRD
OR O2 Evaluation			90,223	94,734	99,471	104,444	0	BPA

SUBREGIONS	26-Sep-96							
Subbasin						5%/YEAR		Budget
	Facility		Budget Estimates					Source
	Species	Number	1997	1998	1999	2000	2001	
	OR Fish Drug Approval		20,000	21,000	22,050	23,153	24,310	SFRD
	OR CWT Missing Groups		143,231	150,393	157,912	165,808	174,098	BPA
	OR PST Stock ID		81,882	85,976	90,275	94,789	99,528	NMFS
	OR Fish ID		171,287	179,851	188,844	198,286	208,200	NMFS
	OR Fish ID - PSMFC		132,094	138,699	145,634	152,915	160,561	BPA
	OR Stock Assessment		99,876	104,870	110,113	115,619	121,400	NMFS
	OR Little Fall Creek Fishway		5,584	5,863	6,156	6,464	6,787	BPA
	Lower Columbia River		4,200	4,400	4,600	4,850	5,100	USACE
	Fish Health Center		177,000	185,800	195,100	214,700	225,400	FWS
			112,500	118,100	124,000	130,200	136,700	MA
	Olympia FHC		175,000	183,700	192,900	202,600	212,712	BR
	(Mid Columbia)							
	Dworshak FHC		50,000	55,100	57,900	60,800	63,800	USACE
			73,500	77,200	81,000	85,100	89,300	FWS
			85,300	89,600	94,000	98,700	103,700	LSRCP
	Columbia River Fisheries		42,700	44,800	47,100	49,400	51,900	USACE
	Program Office		98,200	103,100	108,300	113,700	119,400	FWS
	(Marking Basin-wide)		258,400	271,300	284,900	29,100	314,100	BPA
	WA Stock Assessment/ESA		148,614	156,045	163,847	172,039	180,641	MA
	WA Kalama Research		218,615	229,546	241,023	253,074	265,728	MA
	WA MA Pathology		137,613	144,494	151,718	159,304	167,269	MA
	WA MA Maintenance		563,124	591,280	620,844	651,886	684,481	MA
	and Fish Transport							

SUBREGIONS	26-Sep-96								
Subbasin							5%/YEAR		Budget
	Facility			Budget Estimates					Source
		Species	Number	1997	1998	1999	2000	2001	
	Administration/Support			279,757	293,745	308,432	323,854	340,046	MA
	WA Marking			154,800	162,540	170,667	179,200	188,160	MA
	Big Creek								
		CHF (tules)	5,700,000	281,755	295,843	310,635	326,167	342,475	MA
		COH	535,000	176,301	185,116	194,372	204,090	214,295	MA
		STW	200,000	158,178	166,087	174,391	183,111	192,266	MA
	subtotal		6,435,000	616,234	647,046	679,398	713,368	749,036	
		COH	60,000	14,960	15,708	16,493	17,318	18,184	BOR
		CHF-RRB	1,000,000	98,291	103,206	108,366	113,784	119,473	R&E
	subtotal		1,060,000	113,251	118,914	124,859	131,102	137,657	
	Total Hatchery		7,495,000	729,485	765,959	804,257	844,470	886,694	
	Gnat Creek								
		CHS	925,000	180,611	254,282	266,996	280,346	294,363	BPA
				61,562	0	0	0	0	MA
	Total Hatchery		925,000	242,173	254,282	266,996	280,346	294,363	
	Klaskanine			57,260	60,123	63,129	66,286	69,600	MA
	Total Hatchery	CO		57,260	60,123	63,129	66,286	69,600	
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	CEDC	COH	650,000	104,000	109,200	114,660	120,393	126,413	STATE
		CHS	75,000	15,000	15,750	16,538	17,364	18,233	STATE
		CHF-RRB	1,600,000	50,811	53,352	56,019	58,820	61,761	R&E/OTHER
	Total Hatchery		2,325,000	169,811	178,302	187,217	196,577	206,406	
	Bonneville								
		CHF-URB	9,641,000	266,562	279,890	293,885	308,579	324,008	USACE
		COH	2,000,000	244,501	256,726	269,562	283,040	297,192	MA
		STW	335,000	88,733	93,170	97,828	102,720	107,856	MA

SUBREGIONS	26-Sep-96								
Subbasin							5%/YEAR		Budget
	Facility			Budget Estimates					Source
		Species	Number	1997	1998	1999	2000	2001	
		STS	215,000	68,338	71,755	75,343	79,110	83,065	MA
	subtotal		12,191,000	668,134	701,541	736,618	773,449	812,121	
		CHF-URB	330,700	17,536	18,413	19,333	20,300	21,315	OTAFD
	subtotal		330,700	17,536	18,413	19,333	20,300	21,315	
	Total Hatchery		12,521,700	685,670	719,954	755,951	793,749	833,436	
	Bonneville H. Evaluation	CHF-URB		82,109	86,214	90,525	95,051	99,804	USACE
	Cascade (also listed under YIN and Umatilla)	COH	1,700,000	540,441	567,463	595,836	625,628	656,909	MA
	Sea Resources								
		CHF-TULE	1,000,000						Private
		COH-S	270,000						Private
	Abernathy								
		CHF-TULE	1,500,000	154,000	161,700	169,785	178,274	187,188	MA
	Sandy								
		COH-S	700,000	372,942	391,589	411,169	431,727	453,313	MA
Grays River									
	Grays River								
		CHF-TULE	1,200,000	28,900	30,345	31,862	33,455	35,128	MA
		COH-S	350,000	32,300	33,915	35,611	37,391	39,261	MA
		STS	375,000	108,800	114,240	119,952	125,950	132,247	MA
Elochoman									
	Elochoman								
		CHF	4,000,000	74,524	78,250	82,163	86,271	90,584	MA
		COH-S	500,000	48,080	50,484	53,008	55,659	58,442	MA
		COH-N	1,200,000	120,200	126,210	132,521	139,147	146,104	MA
	Beaver Creek								
		STS+STW	127,000	240,400	252,420	265,041	278,293	292,208	MA
Cowlitz									
	Cowlitz Salmon								
		CHF-TULE	6,500,000	190,762	200,301	210,316	220,831	231,873	TCL
		CHS-COWLITZ	1,120,000	262,298	275,413	289,184	303,643	318,825	TCL

SUBREGIONS	26-Sep-96								
Subbasin							5%/YEAR		Budget
	Facility			Budget Estimates					Source
		Species	Number	1997	1998	1999	2000	2001	
		COH-N	4,700,000	739,204	776,165	814,973	855,721	898,507	TCL
	Cowlitz Trout								
		STW	600,000	374,329	393,046	412,698	433,333	454,999	TCL
		STS	400,000	249,553	262,030	275,132	288,889	303,333	TCL
	North Toutle								
		CHS-COWLITZ	500,000	82,740	86,877	91,221	95,782	100,571	MA
		CHF-TULE	2,500,000	52,402	55,022	57,773	60,662	63,695	MA
		COH-S	1,100,000	124,110	130,316	136,831	143,673	150,856	MA
		STS	50,000	16,548	17,375	18,244	19,156	20,114	MA
Kalama									
	Fallert Creek								
		COH-S	525,000	79,136	83,093	87,247	91,610	96,190	MA
		CHS	500,000	111,285	116,849	122,692	128,826	135,268	MA
		CHF-TULE	2,000,000	56,879	59,723	62,709	65,845	69,137	MA
	Kalama Falls								
		CHF-TULE	3,500,000	115,500	121,275	127,339	133,706	140,391	MA
		COH-N	900,000	158,400	166,320	174,636	183,368	192,536	MA
	Gobar Pond								
		STS	120,000	62,700	65,835	69,127	72,583	76,212	MA
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Lewis									
	Lewis River/Speelyai								
		CHS	1,215,000	390,529	410,055	430,558	452,086	474,690	PC
		COH-N	2,115,000	452,191	474,801	498,541	523,468	549,641	MA,PC
		COH-S	880,000	184,987	194,237	203,948	214,146	224,853	MA,PC
	Merwin								
		STS	250,000	274,892	288,637	303,068	318,222	334,133	PC
Willamette									
Clackamas									
	Clackamas								
		CHS	1,516,669	599,269	629,232	660,694	693,729	728,415	MA/COP/PGE/STATE
		STW	100,000	69,119	72,575	76,204	80,014	84,015	MA/COP/PGE/STATE
	subtotal		1,616,669	668,388	701,807	736,898	773,743	812,430	
	Clackamas Pathology			25,314	26,580	27,909	29,304	30,769	MA/COP/PGE/STATE
	subtotal			25,314	26,580	27,909	29,304	30,769	
	Hatchery Total		1,616,669	693,702	728,387	764,806	803,047	843,199	

SUBREGIONS	26-Sep-96								
Subbasin							5%/YEAR		Budget
	Facility			Budget Estimates					Source
		Species	Number	1997	1998	1999	2000	2001	
	Eagle Creek								
		COH-S	3,000,000	398,000	417,900	438,795	460,734	483,771	MA
		STW	200,000	47,000	49,350	51,817	54,408	59,849	MA
McKenzie									
	McKenzie	CHS	2,425,000	707,856	743,249	780,411	819,432	860,403	USACE/STATE
	Total Hatchery		2,425,000	707,856	743,249	780,411	819,432	860,403	
	Leaburg								
		RBT	731,750	715,959	751,757	789,345	828,812	870,253	USACE
		STS	100,000	65,227	68,489	71,913	75,509	79,285	USACE
		CT	352,300	28,542	29,970	31,469	33,042	34,694	USACE
	Total Hatchery		1,184,050	809,728	850,216	892,727	937,363	984,231	
Middle Fork									
Willamette									
	Dexter	CHS	3,618,994	819,954	860,952	903,999	949,199	996,659	USACE/STATE
		STS	299,500	255,098	267,853	281,246	295,308	310,073	USACE/STATE
	Total Hatchery		3,918,494	1,075,052	1,128,805	1,185,245	1,244,507	1,306,732	
	Willamette (trout)	RB	537,000	83,579	87,758	92,146	96,753	101,591	STATE
		STW	85,000	39,790	41,780	43,868	46,062	48,365	STATE
	Total Hatchery		622,000	123,369	129,537	136,014	142,815	149,956	
Molalla/Pudding									
Santiam/Calapooia									
	South Santiam								
		CHS	388,018	374,749	393,486	413,161	433,819	455,510	USACE/STATE
	Total Hatchery		388,018	374,749	393,486	413,161	433,819	455,510	
	Roaring River								
		RB	708,850	173,108	181,763	190,852	200,394	210,414	STATE
		STS	186,000	91,622	96,203	101,013	106,064	111,367	STATE

SUBREGIONS	26-Sep-96								
Subbasin							5%/YEAR		Budget
	Facility			Budget Estimates					Source
		Species	Number	1997	1998	1999	2000	2001	
	Total Hatchery		894,850	264,730	277,967	291,865	306,458	321,781	
	Stayton Pond	CHF	0	0	0	0	0	0	MA
	Marion Forks	CHS	843,988	361,557	379,635	398,617	418,547	439,475	
	Minto	STW	100,000	90,051	94,554	99,281	104,245	109,458	USACE/STATE
									USACE/STATE
	Total Hatchery		943,988	451,608	474,188	497,898	522,793	548,932	
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Washougal									
	Washougal								
		CHF-TULE	6,000,000	74,223	77,934	81,831	85,922	90,219	MA
		COH-N	500,000	32,988	34,637	36,369	38,188	40,097	MA
	Skamania								
		STW	345,000	162,336	170,453	178,975	187,924	197,320	MA
		STS	260,000	122,464	128,587	135,017	141,767	148,856	MA
	Vancouver								
		STW	110,000	73,000	76,650	80,483	84,507	88,732	MA
::									
Bonneville Dam to Priest Rapids Dam(Lower-Mid Columbia subregion)									
Lower Mid-Columbia Mainstem									
	Oxbow								
	U./L. Herman Cr.	COH	1,400,000	417,453	438,326	460,242	483,254	507,417	MA
	Total Hatchery		1,400,000	417,453	438,326	460,242	483,254	507,417	
	put cascaade here								
	Spring Creek								
		CHF-BPH	17,100,000	834,000	859,020	901,971	973,269	1,031,666	MA,JD
	Ringold Springs								
		CHS	1,100,000	161,700	169,785	178,274	187,188	196,547	MA
		STS	180,000	100,000	105,000	110,250	115,763	121,551	MA
		CHF-URB	3,500,000	25,000	26,250	27,563	28,941	30,388	MA,JD
	Priest Rapids								
		CHF-URB	6,700,000	430,901	452,446	475,068	498,822	523,763	Grant PUD, JD
	Hanford K-Ponds								
		CHF-URB	700,000	117,100	120,613	124,231	127,958	131,797	BPA
Klickitat									

SUBREGIONS	26-Sep-96								
Subbasin							5%/YEAR		Budget
	Facility			Budget Estimates					Source
		Species	Number	1997	1998	1999	2000	2001	
	Klickitat								
		CHF-URB	4,000,000	79,000	82,950	87,098	91,452	96,025	MA
		COH-N/S	1,350,000	142,200	149,310	156,776	164,614	172,845	MA
		CHS	600,000	94,800	99,540	104,517	109,743	115,230	MA
	Washougal								
		COH-N/S	2,500,000	167,689	176,073	184,877	194,121	203,827	MA
Big White Salmon									
	Big White Ponds								
		CHS	250,000	33,000	34,000	35,000	36,000	37,000	MA
	Willard								
		COH-S	2,000,000	354,600	267,330	280,696	294,731	309,467	MA
Little White Salmon									
	Little White Salmon								
		CHF-URB	2,000,000	70,000	72,100	74,263	76,490	78,785	JD
		CHS	1,000,000	367,000	385,350	404,617	424,848	460,090	MA
Wind									
	Carson								
		CHS	1,420,000	398,000	415,800	436,590	458,419	481,340	MA
Yakima									
	Prosser Ponds								
		CHF-URB	1,700,000	160,500	165,550	170,853	176,420	182,266	MA, JD
	Yakima Tribal Coho								
		COH-S	700,000	50,000	52,500	55,125	57,881	60,775	MA
	Cascade expenses			222,535	233,662	245,345	257,612	270,493	MA
	(duplicated under Cascade)								
	Group Total		2,400,000	433,035	451,712	471,322	491,913	513,534	
Walla Walla									
	S.F. Walla Walla								
	Dayton Pond								
		STS	125,000	162,780	170,919	179,465	188,438	197,860	LSRCP
	Lyons Ferry								
		STS	175,000	244,170	256,379	269,198	282,658	296,790	LSRCP
John Day									
	Little White Salmon	CHS eggs	900,000	8,000	8,000	8,000	9,000	9,000	BPA NEOH
	Umatilla								
	Cascade expenses	COH	1,000,000	314,906	330,651	347,184	364,543	382,770	MA
	(duplicated under Cascade)								

SUBREGIONS	26-Sep-96								
Subbasin							5%/YEAR		Budget
	Facility			Budget Estimates					Source
		Species	Number	1997	1998	1999	2000	2001	
Umatilla									
	Umatilla	CHS	360,000	209,902	220,397	231,417	242,988	255,137	BPA
		CHF	2,937,000	357,183	375,042	393,794	413,484	434,158	BPA
		STS	150,000	211,614	222,195	233,304	244,970	257,218	BPA
	subtotal		3,447,000	778,699	817,634	858,516	901,441	946,514	
	Umatilla Fish distribution			18,353	19,271	20,234	21,246	22,308	BPA
	Total Hatchery		3,447,000	797,052	836,905	878,750	922,687	968,822	
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	Little White Salmon								
		CHS	250,000	61,100	64,155	67,362	70,731	74,267	BPA NEOH
		CHF	350,000	89,400	93,870	98,563	103,491	108,666	BPA NEOH
Hood									
Fifteen-Mile									
Deschutes									
	Oak Springs								
		STW	50,000	29,551	31,029	32,580	34,209	35,919	STATE
		STS	60,460	35,733	37,520	39,396	41,365	43,434	STATE
	subtotal		110,460	65,284	68,548	71,976	75,574	79,353	
		STW	40,000	23,641	24,823	26,064	27,367	28,736	STATE
		STS	35,000	20,685	21,719	22,805	23,945	25,143	STATE
		RB	150,000	134,063	140,766	147,804	155,195	162,954	STATE
			1,150,000	184,281	193,495	203,170	213,328	223,995	STATE
	subtotal		1,375,000	362,670	380,804	399,844	419,836	440,828	
		STS	89,540	TBD	TBD	TBD	TBD	TBD	BPA
		STW	35,000	TBD	TBD	TBD	TBD	TBD	BPA
	subtotal		124,540						
	Total Hatchery		1,610,000	427,954	449,352	471,819	495,410	520,181	
	Warm Springs								
		CHS	800,000	227,200	238,560	250,488	263,012	276,163	FWS

SUBREGIONS	26-Sep-96								
Subbasin							5%/YEAR		Budget
	Facility			Budget Estimates					Source
		Species	Number	1997	1998	1999	2000	2001	
	Round Butte								
	Pelton Ladder	CHS	206,648	78,690	82,625	86,756	91,094	95,648	PGE
		STS	182,000	192,298	201,913	212,009	222,609	233,739	PGE
		KK	100,000	6,348	6,665	6,999	7,349	7,716	PGE
	subtotal		488,648	277,336	291,203	305,763	321,051	337,104	
		CHS	247,000	92,445	97,067	101,921	107,017	112,367	BPA
	subtotal		247,000	92,445	97,067	101,921	107,017	112,367	
	Round Butte			17,854	18,747	19,684	20,668	21,702	PGE
	Fish Pathology			5,951	6,249	6,561	6,889	7,233	BPA
	Total Hatchery		735,648	393,586	413,265	433,929	455,625	478,406	
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Priest Rapids Dam to Chief Joseph Dam(Upper-Mid Columbia subregion)									
	Upper Mid-Columbia Mainstem								
	Wells Dam								
		CHR	804,000	294,976	309,725	325,211	341,472	358,545	Douglas PUD
	Turtle Rock								
		CHR	1,300,000	315,673	330,457	346,079	362,583	380,013	Chelan PUD
	Entiat								
	Entiat								
		CHS	400,000	420,674	441,706	463,793	486,982	511,331	BR
	Turtle Rock								
		STS	40,000	20,000	22,000	24,000	26,000	28,000	Chelan PUD
	Wenatchee								
	Leavenworth								
		CHS	1,625,000	1,025,057	1,122,520	1,178,646	1,237,578	1,299,457	BR
		STS	100,000	44,000	45,000	46,000	48,000	49,000	BR
	Turtle Rock								
		STS	170,000	124,203	130,413	136,934	143,781	150,970	Chelan PUD
	Lake Wenatchee								
		SOC	200,000	37,261	39,124	41,080	43,134	45,291	Chelan PUD
	Chiwawa Ponds								
		CHS	672,000	248,407	260,827	273,868	287,562	301,940	Chelan PUD

SUBREGIONS	26-Sep-96								
Subbasin							5%/YEAR		Budget
	Facility			Budget Estimates					Source
		Species	Number	1997	1998	1999	2000	2001	
	Dryden Pond								
		CHS	864,000	322,929	339,075	356,029	373,830	392,522	Chelan PUD
	Eastbank								
		STS	190,000	136,624	143,455	150,628	158,159	166,067	Chelan PUD
Methow/Okanogan									
	Carlton Pond								
		CHR	400,000	149,044	156,496	164,321	172,537	181,164	Chelan PUD
	Methow Valley								
		CHS	300,000	122,555	128,682	135,116	141,872	148,966	Douglas PUD
	Winthrop								
		CHS	1,200,000	551,872	594,165	623,873	655,067	687,820	BR
		STS	100,000	44,000	45,000	46,000	48,000	49,000	BR
	Chewuck Pond								
		CHS	250,000	99,979	104,978	110,227	115,738	121,525	Douglas PUD
	Twisp Pond								
		CHS	250,000	99,979	104,978	110,227	115,738	121,525	Douglas PUD
	Similkameen Pond								
		CHR	576,000	211,146	221,703	232,788	244,427	256,649	Chelan PUD
	Wells								
		STS	100,000	75,313	79,079	83,033	87,184	91,544	Douglas PUD
	Cassimer Bar								
		SOC							
	Wells								
		STS	350,000	257,320	270,186	283,695	297,880	312,774	Douglas PUD
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Snake River from mouth to Hells Canyon Dam(Lower Snake subregion)									
	Lower Snake Mainstem								
	Lyons Ferry								LSRCP
		STW	90,000	122,085	128,189	134,599	141,329	148,395	LSRCP
		CHF	900,000	610,426	640,947	672,994	706,644	741,976	LSRCP
		CHF	2,500,000	345,908	363,203	381,363	400,432	420,453	LSRCP
	Sweetwater Springs								
	Tucannon								
	Tucannon								
		CHS	64,000	256,859	269,702	283,187	297,346	312,214	LSRCP
	Curl Lake								
		STW	160,000	223,823	235,014	246,765	259,103	272,058	LSRCP

SUBREGIONS	26-Sep-96								
Subbasin							5%/YEAR		Budget
	Facility			Budget Estimates					Source
		Species	Number	1997	1998	1999	2000	2001	
Grand Ronde									
	Cottonwood Pond								
		STS	250,000	345,908	363,203	381,363	400,432	420,453	LSRCP
	Lookingglass								
	Imnaha	CHS	940,000	573,134	601,791	631,880	663,474	696,648	LSRCP
	Total Hatchery		940,000	573,134	601,791	631,880	663,474	696,648	
	Irrigon								
	Wallowa	STS	1,410,000	1,087,474	1,141,848	1,198,940	1,258,887	1,321,831	LSRCP
	Little Sheep Pond								
	Big Canyon Ponds								
	Total Hatchery		1,410,000	1,087,474	1,141,848	1,198,940	1,258,887	1,321,831	
	Wallowa								
		RB	107,600	112,766	118,404	124,325	130,541	137,068	STATE
	Total Hatchery		107,600	112,766	118,404	124,325	130,541	137,068	
	OR Fish Distribution LSRCP			129,341	135,808	142,598	149,728	157,215	LSRCP
	OR Fish Pathology LSRCP			112,175	117,784	123,673	129,857	136,349	LSCRP
	NE Oregon Liberation			43,473	45,647	47,929	50,325	52,842	BPA
Salmon									
	Rapid River								
		CHS	3,000,000	375,000	380,000	385,000	390,000	395,000	IPC
	McCall								
		CHR	1,000,000	350,000	355,000	360,000	365,000	370,000	LSRCP
	South Fork								
		see McCall							
	Pahsimeroi								
		CHR	1,000,000	300,000	305,000	310,000	315,000	320,000	IPC
	Sawtooth								
		CHS	1,600,000	575,000	580,000	585,000	590,000	600,000	LSRCP
	Eastfork Satellite								

SUBREGIONS	26-Sep-96								
Subbasin							5%/YEAR		Budget
	Facility			Budget Estimates					Source
		Species	Number	1997	1998	1999	2000	2001	
		CHS	700,000	see Sawtooth					
Clearwater									
	Clearwater								
		STS	2,300,000	710,000	780,000	850,000	920,000	1,000,000	LSRCP
	Dworshak								
		STS	2,300,000	1,236,720	1,236,720	1,236,720	1,236,720	1,236,720	D
		CHS	1,311,000	314,000	323,420	333,123	343,117	353,410	LSRCP
	Kooskia								
		CHS	800,000	227,200	234,016	241,036	248,268	255,715	FWS
	Powell								
		CHS	300,000	see Clearwater					
	Red River								
		CHS	300,000	see Clearwater					
	Crooked River								
		CHS	800,000	see Clearwater					
::									
Above Hells Canyon Dam(Upper Snake subregion)									
Upper Snake									
	OxBow	no rearing		162,000	170,000	175,000	180,000	185,000	IPC
	Hagerman								
		STS	1,530,000	700,000	721,000	742,630	764,909	787856	LSRCP
		RB	100,000	26,000	26,884	27,798	28,743	30697	FWS
	Niagra Springs								
		STS	1,800,000	680,000	685,000	690,000	695,000	700,000	IPC
	Magic Valley								
		STS	2,000,000	642,000	650,000	655,000	660,000	700,000	LSRCP
Above Chief Joseph(Upper Columbia subregion)									

1/ The Rogue River Basin Project (Lost Creek Dam) produces power marketed by the Bonneville Power Administration (BPA); thus 10.5 percent of its O&M Fish and Wildlife budget is reimbursed to the Treasury by BPA. Cole M. Rivers Fish Hatchery is funded by the Rogue River Basin Project; therefore BPA believes this O&M reimbursement is subject to the MOA.

5.9.2 Subbasin production goals, objectives, and strategies

Anadromous fish production goals, objectives, and strategies specific to each subbasin in the four subregions that still support anadromous fish runs are summarized below. This summary is based on the abbreviated account of production objectives and strategies by species and subbasin contained in the NPPC, Spirit of the Salmon, USFWS, NMFS, and state plans presented in Appendix 1. It also includes summary tables of production strategies and broodstocks prepared by the Watershed Production and Habitat Work Group, followed by a tabular overview of existing hatchery production release goals for FY1997-2001 and the projected costs by subbasin and hatchery.

Discussion in this section focuses on a more cursory overview of each plan's production objectives and strategies compiled from Appendix 1 and presented in Table 5.11. Table 59.2-1 presents for each plan numerical production objectives, how production is measured, the purpose of production as stated or inferred from Appendix 1, and numerical release strategies including broodstocks used. Spirit of the Salmon production information shown in Table 5.9.2-1 is drawn largely from Volume II, because not all Spirit of the Salmon production information has been incorporated into Appendix 1. Significant differences in objectives and strategies among plans as they appear in Appendix 1 and Table 5.9.2-1 must be carefully considered before concluding they constitute a difference in intent on the part of advocates of the plans for reasons including:

1. Appendix 1 plan descriptions may have excluded information presented in the original plans;
2. Original plans may not have information that can be compared to information in another plan;
3. Units of measurement may be expressed in different terms (e.g., one plan expresses a production objective as total escapement to the basin, while another plan expresses it as spawning escapement or inbasin harvest).

Table 5.9.2- 1 Anadromous fish production objectives and strategies by subregion, subbasin and species for NPPC subbasin plans, tribal, state or other plans

		Objectives			Strategies	
Species	Plan	Number*	Purpose		Release No.*	Broodstock
LOWER COLUMBIA, CLACKAMAS SUBBASIN						
Fall Chinook	Subbasin Plan	1000	EM	Maintain gen. diversity & harvest	0	
	State/Other	1000	EM	Natural production & harvest	0	TO BE DETERMINED
Spring Chinook	Subbasin Plan	12400	EM	Natural production & harvest	1240000 S	
	State/Other	12400	EM	Natural production & harvest	1070000 S	
Coho	Subbasin Plan	3000	EM 1	Maintain gen. diversity & harvest	1000000 S	EAGLE CR NFH
	State/Other	3000	EM 1	Natural production & harvest	1000000 S	EAGLE CR NFH
Summer Steelhead	Subbasin Plan	7000	H	Fisheries	175000 S	SKAMANIA/FOSTER
	State/Other	7000	H	Fisheries	175000 S	SKAMANIA/FOSTER
Winter Steelhead	Subbasin Plan	3000	ES 1	Natural production & harvest	380000 S	EAGLE CR NFH, BIG CREEK, NATIVE
	State/Other	3000	ES 1	Natural production & harvest	S	EAGLE CR NFH, BIG CREEK, NATIVE
	LOWER COLUMBIA, COWLITZ SUBBASIN					
Fall Chinook	Subbasin Plan		H	Fisheries	1000000 F	COWEEMAN
		2000	H	Fisheries		TOUTLE
		2000	H	Fisheries		COWLITZ
Spring Chinook		500	H	Fisheries	100000 S	TOUTLE
		10000	H	Fisheries	100000 S	COWLITZ
Coho		7200	H	Fisheries	800000 S	COWLITZ, TOUTLE, COWEEMAN
Summer Steelhead		15000	H	Fisheries	550000 S 3/	COWLITZ
		3000	H	Fisheries	128300 S	TOUTLE
Winter Steelhead				Maintain genetic/bio integrity	0 3/	COWEEMAN (NATURAL)
		250	H	Maintain genetic/bio integrity	0 3/	TOUTLE
		15400		Fisheries	0 3/	COWLITZ
		700	H	Fisheries	4/	COWEEMAN (HATCHERY)
	LOWER COLUMBIA, ELOCHOMAN SUBBASIN					
Chum	Subbasin Plan	4500	H	Maintain gen. diversity & harvest		
Fall Chinook		25000	H	Natural production & harvest	1000000 F 3/	
Coho		25500	H	Natural production & harvest	1000000 S 3/	TYPE-S

** Production measure and broodstock unit codes shown at end of table.*

		Objectives			Strategies		
Species	Plan	Number*	Purpose		Release No.*		Broodstock
Summer Steelhead		1200	H				
Winter Steelhead				Maintain genetic/bio integrity	50000	S	(NATURAL)
		4000	H	Fisheries	50000	S	(HATCHERY)
	LOWER COLUMBIA, GRAYS SUBBASIN						
Chum	Subbasin Plan	5000	H	Maintain genetic/bio integrity		FR	
Fall Chinook		15000	H	Natural production & harvest	100000	F 3/	
Coho		18000	H	Natural production & harvest	1200000	FR	TYPE-S
Winter Steelhead				Maintain genetic/bio integrity	(NATURAL)		
		900	H	Fisheries		S	WASHOUGAL HATCHERY
	LOWER COLUMBIA, KALAMA SUBBASIN						
Fall Chinook	Subbasin Plan	1340	H	Natural production & harvest	3850000	F	
Spring Chinook		2000	H	Fisheries			KALAMA FALLS HATCHERY
Coho		500	H	Hatchery brood & harvest	350000	S	TYPE-N
		750	H	Hatchery brood & harvest	350000	S	TYPE-S
Summer Steelhead		3100	H	Fisheries	0	3/	(HATCHERY)
				Maintain genetic/bio integrity	0	3/	(NATURAL)
Winter Steelhead		1000	H	Fisheries	40000	S 3/	(HATCHERY)
				Maintain genetic/bio integrity			(NATURAL)
	LOWER COLUMBIA, LEWIS SUBBASIN						
Fall Chinook	Subbasin Plan	12000	EM	Natural production & harvest	0		LEWIS (NATURAL)
Spring Chinook		68000	EM	Fisheries	2000000		(HATCHERY)
Coho		6500	ES	Fisheries	5000000	F	TYPE-S, TYPE-N
Summer Steelhead		2200	H	Fisheries	60000	S 3/	E LEWIS (HATCHERY)
				Maintain genetic/bio integrity			(NATURAL)
		6750	H	Fisheries	90000	S	N LEWIS (HATCHERY)
Winter Steelhead		4200	H	Fisheries	60000	S 3/	E LEWIS (HATCHERY)
		3000	H	Fisheries			N LEWIS (HATCHERY)
				Maintain genetic/bio integrity			E LEWIS (NATURAL)
	LOWER COLUMBIA, LOWER COLUMBIA MAINSTEM SUBBASIN						
Chum	Subbasin Plan	15000	H	Natural production & harvest	FR		(TO BE DETERMINED)
Fall Chinook		30000	H 3/	Natural production & harvest	250000	F	ROGUE RIVER
Spring Chinook		6000	H	Fisheries	300000		WILLAMETTE HATCHERY
Coho		45000	H 3/	Natural production & harvest	2000000	S	
Winter Steelhead				Maintain genetic/bio integrity	0		
	LOWER COLUMBIA, MCKENZIE SUBBASIN						

** Production measure and broodstock unit codes shown at end of table.*

		Objectives			Strategies		
Species	Plan	Number*	Purpose		Release No.*		Broodstock
Spring Chinook	Subbasin Plan	18000	EM	Natural production & harvest	1400000	S	MCKENZIE HATCHERY
	State/Other	18000	EM	Nat & hat broodstock & harvest			MCKENZIE HATCHERY
Summer Steelhead	Subbasin Plan	1200	H	Fisheries	120000	S	MCKENZIE HATCHERY
	State/Other	1200	H	Fisheries	120000	S	MCKENZIE HATCHERY
	LOWER COLUMBIA, MOLALLA AND PUDDING SUBBASIN						
Fall Chinook	Subbasin Plan	1450	EM	Fisheries	300000	S	
	State/Other			Fisheries	300000	S	
Spring Chinook	Subbasin Plan	1350	EM	Hatchery brood & harvest	1358000	S /1	
	State/Other	750	EM	Natural production & harvest	1358000	S /1	
Coho				Natural production & harvest	0		
Summer Steelhead	Subbasin Plan	2450	H	Fisheries		S /1	
	State/Other	2450	H	Fisheries		S /1	
Winter Steelhead	Subbasin Plan	4650	EM	Natural production & harvest	75000	S	BIG CREEK
	State/Other	4650	EM	Natural production & harvest	75000	S	BIG CREEK
	LOWER COLUMBIA, SANDY SUBBASIN						
Fall Chinook	Subbasin Plan	1500	ES	Natural production & harvest	0		
Spring Chinook		2500	ES	Natural production & harvest	460000	S	WILLAMETTE
Coho		2500	ES	Nat & hat broodstock & harvest	1000000	S	SANDY HATCHERY EARLY RUN
Summer Steelhead		4500	H	Fisheries	75000		
Winter Steelhead		4500	ES	Natural production & harvest	230000	S	
	LOWER COLUMBIA, SANTIAM AND CALAPOOIA SUBBASIN						
Fall Chinook	Subbasin Plan	4000	ES	Fisheries	2000000	S	
	State/Other	4000	EM	Fisheries			
Spring Chinook	Subbasin Plan	2700	H 18	Nat & hat broodstock & harvest	1000000	S	MARION FORKS AND S SANTIAM
	State/Other	2900	H 18	Nat & hat broodstock & harvest	1000000	S	
Summer Steelhead	Subbasin Plan	10800	H 19	Hatchery brood & harvest	360000	S	
	State/Other	10800	H 19	Hatchery brood & harvest	360000	S	
Winter Steelhead	Subbasin Plan	9100	EM 2	Nat & hat broodstock & harvest	100000	S	NORTH SANTIAM
	State/Other	10970	EM 2	Nat & hat broodstock & harvest	100000	S	
	LOWER COLUMBIA, TUALATIN SUBBASIN						
Coho	Subbasin Plan	600	EM 2	Fisheries	60000	S	
	State/Other	600	EM 2	Fisheries	60000	S	
Winter Steelhead	Subbasin Plan	2000	EM	Fisheries	40000	S	BIG CREEK
	State/Other	2000	EM	Fisheries	30000	S	BIG CREEK

** Production measure and broodstock unit codes shown at end of table.*

		Objectives			Strategies		
Species	Plan	Number*	Purpose		Release No.*		Broodstock
	LOWER COLUMBIA, WASHOUGAL SUBBASIN						
Fall Chinook	Subbasin Plan	2900	ES		6000000	F	LRH, URB
Spring Chinook	Subbasin Plan	500	H	Fisheries	100000		(TO BE DETERMINED)
Coho				Natural production & harvest	4000000		TYPE-S, TYPE-N
Hatchery Summer Steelhead		2125	H	Fisheries	150000	S	(HATCHERY)
Natural Summer Steelhead				Maintain genetic/bio integrity			(NATURAL)
Hatchery Winter Steelhead		2750	H	Fisheries	150000	S	(HATCHERY)
Natural Winter Steelhead				Maintain genetic/bio integrity			(NATURAL)
	LOWER COLUMBIA, WILLAMETTE SUBBASIN						
Fall Chinook	Subbasin Plan	?					
	State/Other	?					
Spring Chinook	Subbasin Plan	45000	EM 5	Fisheries			
	State/Other	100000	EC	Fisheries			
Coho	Subbasin Plan	0	ES 5		500000	P 6	
Summer Steelhead		48400	EM	Fisheries	880000	S	
	State/Other	500	H 5/	Fisheries	880000	S	
Winter Steelhead	Subbasin Plan	33750	EM				
	State/Other	33000	EM	Natural production & harvest			
	LOWER COLUMBIA, WILLAMETTE, COAST RANGE SUBBASIN						
Coho	Subbasin Plan	0	EM		0		
	State/Other		14/		0		
Winter Steelhead	Subbasin Plan	0	EM		0		
	State/Other	675	ES	Natural production & harvest	0		
	LOWER COLUMBIA, WILLAMETTE, MIDDLE FORK SUBBASIN						
Spring Chinook	Subbasin Plan	11250	EM	Hatchery brood & harvest	3950000	S 15	
	State/Other	11250	EM	Nat & hat broodstock & harvest	3950000	S 15	
Summer Steelhead	Subbasin Plan	2250	H	Fisheries	150000	S	
	State/Other	2250	H	Fisheries	150000	S	
Winter Steelhead PREFERRED)	Subbasin Plan	1475	EM	Natural production & harvest	30000	S	WILLAMETTE (NATURAL
	State/Other	800	EM	Natural production & harvest	42000	S	
	LOWER MID-COLUMBIA, BIG WHITE SALMON SUBBASIN						
Fall Chinook	Subbasin Plan	100	F	Fisheries			
	Tribal Plan	100	F		2000000		
Spring Chinook	Subbasin Plan	500	F	Natural spawning			CARSON & L WHITE SALMON
	Tribal Plan	500	F		1450000		

** Production measure and broodstock unit codes shown at end of table.*

		Objectives			Strategies		
Species	Plan	Number*	Purpose		Release No.*		Broodstock
Summer Steelhead	Subbasin Plan	4800	F	Fisheries	40000	S	
Summer Steelhead	Tribal Plan	4800	F	Fisheries	150000		
Winter Steelhead	Subbasin Plan	800	F	Fisheries	40000	S	
	Tribal Plan	800	F	Fisheries			
	LOWER MID-COLUMBIA, DESCHUTES SUBBASIN						
Fall Chinook	Subbasin Plan	7000	ES	Maintain gen. diversity & harvest			
	Tribal Plan	11000					
	State/Other	4000		Maintain gen. diversity & harvest	0		
Spring Chinook	Subbasin Plan	2500	ES	Maintain gen. diversity & harvest	1970000	S	DESCHUTES
	Tribal Plan	10250		Maintain gen. diversity & harvest	1200000		
					1200000		
	State/Other	1300	ES	Maintain gen. diversity & harvest	?		DESCHUTES
Sockeye	Subbasin Plan	1500	F	Fisheries	0		
Summer Steelhead		22000	EM	Nat & hat broodstock & harvest			DESCHUTES
	State/Other	22000	EM	Nat & hat broodstock & harvest	?		DESCHUTES
	LOWER MID-COLUMBIA, FIFTEENMILE SUBBASIN						
Winter Steelhead	Subbasin Plan	900	ES	Natural production & harvest	0		
	Tribal Plan	300	ES	Maintain gen. diversity & harvest			
	LOWER MID-COLUMBIA, HOOD SUBBASIN						
Fall Chinook	Subbasin Plan	600	EM	Natural production & harvest	0		
	Tribal Plan	600	EM	Natural production & harvest			
	State/Other	600	EM	Natural production & harvest	0		
Spring Chinook	Subbasin Plan	1700	EM	Hatchery brood & harvest	300000	S	CARSON
	Tribal Plan	1700		Natural production & harvest	125000		
	State/Other	5000	EM	Hatchery brood & harvest	300000	S	CARSON
Coho	Subbasin Plan	600	EM	Natural production & harvest	0		
	Tribal Plan	600	EM	Natural production & harvest	0		
Summer Steelhead	Subbasin Plan	7000	EM	Nat & hat broodstock & harvest	100000		HOOD
	Tribal Plan	8000	EM	Nat & hat broodstock & harvest	100000		HOOD
Winter Steelhead	Subbasin Plan	6000	EM	Nat & hat broodstock & harvest	100000		HOOD
	Tribal Plan	5000	EM	Nat & hat broodstock & harvest			HOOD
	State/Other	5000	EM	Nat & hat broodstock & harvest			HOOD
	LOWER MID-COLUMBIA, JOHN DAY SUBBASIN						
Fall Chinook	Subbasin Plan						
	Tribal Plan						
Spring Chinook	Subbasin Plan	7000	EM	Natural production & harvest	0		

** Production measure and broodstock unit codes shown at end of table.*

		Objectives			Strategies		
Species	Plan	Number*	Purpose		Release No.*		Broodstock
	Tribal Plan	7000	EM	Natural production & harvest	0		
Coho			TBD				
Summer Steelhead	Subbasin Plan	45000	EM	Natural production & harvest	0		
	Tribal Plan	45000	EM	Natural production & harvest	0		
	LOWER MID-COLUMBIA, KLICKITAT SUBBASIN						
Fall Chinook	Subbasin Plan	40000	1/	Fisheries	URB or BPH		
	Tribal Plan	40000	EM	Natural production & harvest	4000000	BRIGHT	
Spring Chinook	Subbasin Plan	20000	1/	Nat & hat broodstock & harvest	3000000	S	KLICKITAT
	Tribal Plan	20000	EM	Nat & hat broodstock & harvest	600000	KLICKITAT	
Coho	Subbasin Plan	50000	1/	Fisheries			
	Tribal Plan	50000	EM	Natural production & harvest			
Summer Steelhead	Subbasin Plan	25000	1/	Fisheries	250000	S	KLICKITAT
	Tribal Plan	25000	EM	Natural production & harvest			
Winter Steelhead				Nat & hat broodstock & harvest			
	LOWER MID-COLUMBIA, LOWER MID-COLUMBIA MAINSTEM SUBBASIN						
Fall Chinook	Subbasin Plan		/2	Fisheries			URB or BPH
	Tribal Plan			Fisheries	500000		SPRING CR, BONNEVILLE,
OXBOW							
Spring Chinook	Subbasin Plan		/2	Fisheries		F	VARIOUS UPRIVER
Coho				Natural production & harvest		FR	
Summer Steelhead				Maintain gen. diversity & harvest			
	Tribal Plan			Est. runs			
Winter Steelhead	Subbasin Plan			Maintain genetic/bio integrity			
	Tribal Plan			Maintain genetic/bio integrity	0		
	LOWER MID-COLUMBIA, UMATILLA SUBBASIN						
Fall Chinook	Subbasin Plan	21000	EM	Nat & hat broodstock & harvest			
	Tribal Plan	21000	EM	Natural production & harvest	6165000		BONNEVILLE, UMATILLA
HATCHERIES							
Spring Chinook	Subbasin Plan	11000	EM	Hatchery brood & harvest			
	Tribal Plan	11000	EM	Natural production & harvest	589000	S	
Coho	Subbasin Plan	6000	EM	Natural production & harvest	1000000	S	
	Tribal Plan	6000	EM	Natural production & harvest	1500000	CASCADE, HERMAN CR HATCHERIES	
EARLY							
Summer Steelhead	Subbasin Plan	9670	EM	Nat & hat broodstock & harvest			
	Tribal Plan	9670		Nat & hat broodstock & harvest	150000		UMATILLA HATCHERY
	LOWER MID-COLUMBIA, WALLA WALLA SUBBASIN						

** Production measure and broodstock unit codes shown at end of table.*

		Objectives			Strategies		
Species	Plan	Number*	Purpose		Release No.*		Broodstock
Spring Chinook	Subbasin Plan	5000	EM	Nat & hat broodstock & harvest	S		
	Tribal Plan	5000	EM	Natural production & harvest	600000	S	CARSON
Summer Steelhead	Subbasin Plan	11000	EM	Nat & hat broodstock & harvest			
	Tribal Plan	11000	EM	Natural production & harvest	100000	S	NE OREGON, LYONS FERRY
HATCHERIES							
	LOWER MID-COLUMBIA, WIND SUBBASIN						
Fall Chinook	Subbasin Plan			Fisheries	0	3/	BPH TULE
	Tribal Plan			Natural production & harvest	1000000	S	SPRING CREEK HATCHERY
Spring Chinook	Subbasin Plan	9700	EM	Hatchery brood & harvest	1800000	S 3/	CARSON
	Tribal Plan	5000	H	Fisheries	2600000		WIND RIVER
Coho	Subbasin Plan			Fisheries	0	3/	
	Tribal Plan	200	H	Fisheries	500000		WILLARD NNFH
Summer Steelhead		2000	H	Fisheries	150000		SKAMANIA
Hatchery Summer Steelhead	Subbasin Plan	2000	H	Fisheries	40000	S	WIND RIVER (NATURAL)
Natural Summer Steelhead		1557	ES	Maintain genetic/bio integrity	40000	S	WIND RIVER (NATURAL)
	Tribal Plan	2000	EM	Fisheries			
Hatchery Winter Steelhead	Subbasin Plan	200	H	Fisheries	10000	S	WIND RIVER (NATURAL)
Natural Winter Steelhead		300	ES	Maintain genetic/bio integrity	10000	S	WIND RIVER (NATURAL)
	LOWER SNAKE, CLEARWATER SUBBASIN						
Fall Chinook	Subbasin Plan	5000	H	Est. runs	500000	S	LYON'S FERRY HATCHERY
	Tribal Plan	50000	EM	Natural production & harvest	5300000		
	State/Other			Maintain genetic/bio integrity			
Summer Chinook	Subbasin Plan	48000	H	Maintain gen. diversity & harvest			
	Tribal Plan	50000	EM	Natural production & harvest	700000	S FK SALMON	
Spring Chinook	Subbasin Plan	45000	H	Nat & hat broodstock & harvest			
	Tribal Plan	60000	EM	Natural production & harvest	6710000		DWORSHAK, KOOSKIA,
CLEARWATER,							
							NEZ PERCE
Coho	Subbasin Plan	4000	H	Est. runs			
	Tribal Plan	14000	EM	Natural production & harvest	1000000	S	SANDY HATCHERY
A-Run Summer Steelhead	Subbasin Plan	1000	ES	Maintain gen. diversity & harvest			
B-Run Summer Steelhead		74000	EM	Natural production & harvest	6300000	S	DWORSHAK NFH,
CLEARWATER ANADROMOUS							
	Tribal Plan	93100	EM	Natural production & harvest	6500000		HAGERMAN,
MAGIC,CLEARWATER,							
							DWORSHAK
	LOWER SNAKE, GRANDE RONDE SUBBASIN						

** Production measure and broodstock unit codes shown at end of table.*

Species	Plan	Objectives Number*	Purpose	Strategies Release No.*		Broodstock
Fall Chinook SPAWNING	Subbasin Plan	10000	EM Natural production & harvest			MID-COLUMBIA LATE
	Tribal Plan	10000	EM Natural production & harvest	tbd		LYONS FERRY HATCHERY
	State/Other		Maintain genetic/bio integrity			
Spring Chinook	Subbasin Plan	16400	EM Nat & hat broodstock & harvest	2975000	S	
Spring Chinook	Tribal Plan	16000	EM Natural production & harvest	1150000	S	RAPID RIVER
	State/Other		8/ Maintain genetic/bio integrity			
Coho	Subbasin Plan	3500	EM Nat & hat broodstock & harvest			
	Tribal Plan	3500	EM Natural production & harvest	2000000		TANNER CREEK EARLY RUN
Sockeye	Subbasin Plan	2500	EM Nat & hat broodstock & harvest			
	Tribal Plan	2500	EM Natural production & harvest	tbd		MID-COLUMBIA
Summer Steelhead	Subbasin Plan	27500	EM Natural production & harvest	160000	S	PRESENTLY USED STOCK
	Tribal Plan	27500	EM Natural production & harvest	1575000		NEW GRANDE RONDE (LYONS FERRY)
	LOWER SNAKE, IMNAHA SUBBASIN					
Fall Chinook	Subbasin Plan	300	EM Maintain genetic/bio integrity			
	State/Other		9/ Maintain genetic/bio integrity			
Spring Chinook	Subbasin Plan	5740	EM Nat & hat broodstock & harvest	1660000	S	IMNAHA (NATIVE)
	Tribal Plan	5740	EM Natural production & harvest	492000		LOOKINGGLASS
	State/Other		8/ Maintain genetic/bio integrity			
Summer Steelhead	Subbasin Plan	4315	EM Nat & hat broodstock & harvest	330000	S	
	Tribal Plan	4315	EM Natural production & harvest	330000		IRRIGON HATCHERY
	LOWER SNAKE, LOWER SNAKE MAINSTEM SUBBASIN					
Fall Chinook	Subbasin Plan	18300	EM Maintain genetic/bio integrity	1000000	S	SNAKE RIVER
	Tribal Plan	18300	EM Natural production & harvest	900000	S	LYONS FERRY HATCHERY
	State/Other		9/ Maintain genetic/bio integrity			
Spring Chinook	Subbasin Plan		Est. runs			
	State/Other		8/ Maintain genetic/bio integrity			
Summer Steelhead	Tribal Plan		Natural production & harvest	70000		LYONS FERRY HATCHERY
	LOWER SNAKE, SALMON SUBBASIN					
Summer Chinook	Subbasin Plan	112000	EM Maintain gen. diversity & harvest	4400000	S	MCCALL AND PAHSIMEROI H
	Tribal Plan	60200	EM Natural production & harvest	2000000		MCCALL AND PAHSIMEROI H
	State/Other		8/ Maintain genetic/bio integrity			
Spring Chinook H	Subbasin Plan	94000	EM Maintain gen. diversity & harvest	11325000	S	RAPID RIVER AND SAWTOOTH
	Tribal Plan	128000	EM Natural production & harvest	5500000		RAPID RIVER, SAWTOOTH, YANKEE,

** Production measure and broodstock unit codes shown at end of table.*

		Objectives			Strategies		
Species	Plan	Number*	Purpose		Release No.*		Broodstock
							NEZ PERCE
	State/Other		8/	Maintain genetic/bio integrity			
Sockeye	Subbasin Plan	6000	ES	Maintain gen. diversity & harvest			STANLEY BASIN
	Tribal Plan	44500	EM	Natural production & harvest	2000000		MID-COLUMBIA (PP SALMON)
	State/Other		10/	Maintain genetic/bio integrity			
Summer Steelhead	Subbasin Plan	126000	EM	Maintain gen. diversity & harvest	8100000	S 11/	
	Tribal Plan	192900	EM	Natural production & harvest	3900000	12/	
	LOWER SNAKE, TUCANNON SUBBASIN						
Fall Chinook	Tribal Plan	2000	EM	Natural production & harvest	500000	F	LYONS FERRY
	State/Other		8/	Maintain genetic/bio integrity			
Spring Chinook	Subbasin Plan	1152	EM	Maintain gen. diversity & harvest	132000	S	
	Tribal Plan	3000	EM	Natural production & harvest	132000	S	TUCANNON
	State/Other		8/	Maintain genetic/bio integrity			
Coho	Tribal Plan			Natural production & harvest	tbd		
Summer Steelhead		2200	EM	Natural production & harvest	120000	S	NEW TUCANNON (NATURAL),
LYONS							
						FERRY HAT	
Hatchery Summer Steelhead	Subbasin Plan	700	H	Fisheries			CAPTURED NATURAL
Natural Summer Steelhead		1500	ES	Maintain genetic/bio integrity			
	UPPER MID-COLUMBIA, ENTIAT SUBBASIN						
Spring Chinook	Subbasin Plan	1000	H	Natural production & harvest	200000	F	LOCAL
	Tribal Plan	750	H		800000		ENTIAT
Hatchery Summer Steelhead	Subbasin Plan	3000	H	Fisheries	400000		(NATURAL)
	Tribal Plan	3000	H	Fisheries	395000		CHELAN, EAST BANK
Natural Summer Steelhead	Subbasin Plan	1471	ES	Maintain genetic/bio integrity		S 3	
	Tribal Plan	3000	H				
	UPPER MID-COLUMBIA, METHOW SUBBASIN						
Summer Chinook	Subbasin Plan	3000	H	Natural production & harvest	400000		
	Tribal Plan	3000	H	Fisheries	2600000		EASTBANK, WELLS
Spring Chinook	Subbasin Plan	2000	H	Natural production & harvest	1400000		WINTHROP HATCHERY
	Tribal Plan	2000	H		1738000		METHOW, WINTHROP
Hatchery Summer Steelhead	Subbasin Plan	10000	H	Fisheries			
Natural Summer Steelhead		3200	ES	Maintain genetic/bio integrity			
	UPPER MID-COLUMBIA, OKANOGAN SUBBASIN						
Summer Chinook	Subbasin Plan	2000	H	Maintain gen. diversity & harvest	576000		NATURAL
	Tribal Plan	2000	H		2776000		EASTBANK, WELLS

** Production measure and broodstock unit codes shown at end of table.*

		Objectives			Strategies		
Species	Plan	Number*	Purpose		Release No.*		Broodstock
Spring Chinook	Subbasin Plan	1000	H	Fisheries	2125000	F	LEAVENWORTH
Sockeye		15000	H	Maintain gen. diversity & harvest	2000000	S	NATURAL
Summer Steelhead		160	ES	Maintain genetic/bio integrity	500000	S	NATURAL
	Tribal Plan	10000	H	Fisheries	225000		WELLS HATCHERY
	UPPER MID-COLUMBIA, UPPER MID-COLUMBIA MAINSTEM SUBBASIN						
Fall Chinook	Subbasin Plan	1000	H	Fisheries	3600000	F	WELLS HATCHERY
Summer Chinook		1000	H	Natural production & harvest			
Hatchery Coho	Subbasin Plan	0	EM	Replace w/ other species	0	N/A	
	UPPER MID-COLUMBIA, WENATCHEE SUBBASIN						
Summer Chinook	Subbasin Plan	10000	EM	Maintain gen. diversity & harvest	864000	S	WENATCHEE
	Tribal Plan	10000	EM	Natural production & harvest	840000		EAST BANK
Spring Chinook	Subbasin Plan	21000	EM	Nat & hat broodstock & harvest	670000		
	Tribal Plan	21000	EM	Natural production & harvest	772000		LEAVENWORTH, EASTBANK
Sockeye	Subbasin Plan	35000	EM	Maintain gen. diversity & harvest			
	Tribal Plan	35000	EM	Natural production & harvest	250000		DRYDEN AND TUMWATER
DAMS							
Hatchery Summer Steelhead	Subbasin Plan	7500	H	Fisheries			
	Tribal Plan						
Natural Summer Steelhead	Subbasin Plan	4718	ES	Maintain genetic/bio integrity	1100000	S 3	(NATURAL)
	Tribal Plan	6410	EM	Natural production & harvest	300000		WENATCHEE (EAST BANK, LEAVENWORTH)
	UPPER MID-COLUMBIA, YAKIMA SUBBASIN						
Fall Chinook	Subbasin Plan			Maintain gen. diversity & harvest	3600000	S	YAKIMA (WILD AND NATURAL)
	Tribal Plan	6000	EM	Natural production & harvest	3600000		LOWER MAINSTEM/MARION
DRAIN							
Summer Chinook	Subbasin Plan			Est. runs	156000	S	WENATCHEE
	Tribal Plan	12000	EM	Natural production & harvest	200000	S	WENATCHEE
Spring Chinook	Subbasin Plan	15000	H	Maintain gen. diversity & harvest	1600000	S	YAKIMA (WILD AND NATURAL)
	Tribal Plan	26300	EM	Natural production & harvest	850000	S	
Coho	Subbasin Plan	2000	H	Maintain gen. diversity & harvest	2000000	S	CASCADE HATCHERY EARLY
	Tribal Plan	5000	EM	Natural production & harvest	2000000	S	EARLY
Summer Steelhead	Subbasin Plan	4000	H	Maintain gen. diversity & harvest	1600000	S	YAKIMA (WILD AND NATURAL)
	Tribal Plan	29700	EM	Natural production & harvest	400000	S	YAKIMA (WILD AND NATURAL)

Production Objective number codes:
EC = escapement to the Columbia River
EM = escapement to the subbasin
ES = spawner escapement

** Production measure and broodstock unit codes shown at end of table.*

H = harvest

Release number codes (life stage):
F = fingerling
FR = fry
P = presmolt
S = smolt

Notes:

1/ Increase MSY run size at recruitment by this amount

2/ Excess over 40,000 escapement goal

3/ Increase number by this amount

4/ Increase releases to add 500 fish to river at 446 fish/season harvest rate

5/ Above Willamette Falls

6/ Experimental to determine fisheries contribution

7/ Includes both A- and B-Run summer steelhead

8/ NMFS delisting criteria:
- a. The eight-year geometric mean natural cohort replacement rate must exceed 1.0 during the eight years immediately prior to delisting for 80% of the Snake River spring/summer chinook salmon redd survey index areas.
- b. The numerical escapement goal for Snake River spring/summer chinook salmon is an eight-year geometric mean corresponding to at least 60% of the 1962-1967 brood year average redd counts for 80% of available index areas.
- c. A second numerical escapement goal is set at an eight-year geometric mean equal to 60% of the 1962-1967 brood year average count of natural spawners past Ice harbor Dam (I.e., 31,440). This escapement should be measured at Lower Granite Dam, since mortality between Ice Harbor Dam and the site of Lower Granite dam during the 1962-196 period is likely to have been very low. The numerical goals in both "b" and "c" must be met for delisting to be considered. First-generation progeny of captive broodstock or other artificially propagated fish would not be included in the number of natural spawners.

9/ NMFS delisting criteria:
- a. The eight-year geometric mean natural cohort replacement rate must exceed 1.0 during the eight years immediately prior to delisting
- b. The numerical escapement goal for Snake River fall chinook salmon is an eight-year geometric mean of at least 2,500 natural spawners in the mainstem Snake River annually.
- d. First-generation progeny of captive broodstock or other artificially propagated fish would not be included in the number of natural spawners.

10/ NMFS delisting criteria:
- a. The eight-year geometric mean natural cohort replacement rate must exceed 1.0 during the eight years immediately prior to delisting
- b. The numerical escapement goal for Snake River fall chinook salmon is an eight-year geometric mean of at least 1,000 natural spawners annually in Redfish Lake and 500 natural spawners in each of two other Snake River Basin lakes.

11/ Includes both A- and B-Run summer steelhead stocks; Rapid River stock is used for a portion of releases; production from Clearwater Anadromous, Magic Valley, and Niagara Springs hatcheries.

12/ Production from Sawtooth, Pahsimeroi, Magic Valley, Hagerman, and Niagara Springs hatcheries.

13/ Escapement above North Fork Dam

14/ Maintain natural production if it is self-sustaining.

15/ Includes 2,250,000 pre-smolts.

		Objectives		Strategies	
Species	Plan	Number*	Purpose	Release No.*	Broodstock

16/ Includes 1200000 pre-smolts.
17/ Enough smolts to meet harvest objectives
18/ Harvest objective from ODFW plan is 200 greater; reintroduction to Calapooia is hatchery driven for NPPC plan and habitat oriented for ODFW plan.
19/ NPPC plan allocates 500 fish harvest to L N Santiam while ODFW plan allocates 0 harvest to L N Santiam.
20/ Harvest objectives differ among plans.

Commonalities and differences among plans

The production objectives among subbasin plans mirror the goals and policies of each plan described in 5.8.2 above. The plans' objectives all address increasing or maintaining production of anadromous fish stocks, rebuilding depressed stocks, and reestablishing critically reduced or extirpated fish runs. Major differences among the objectives include:

- The level of production to maintain or increase harvest opportunities
- The degree to which hatchery technology is used to maintain self-sustaining stocks or to restore depleted stocks
- Whether to restore depleted stocks
- Whether to expand species' ranges through introductions

Differences among strategies may reflect differing objectives or varying technical approaches to achieving the objectives that are common to each plan.

Lower Snake River Subregion

Production objectives and strategies in the Lower Snake River Subregion vary between the NPPC, NMFS, and Spirit of the Salmon. Numerical objectives for the entire subregion for all fish are generally comparable in the NPPC and Spirit of the Salmon (321,000 and 293,000 fish respectively; Table 5.9.2-1), although some production objectives in NPPC are expressed as harvest only, while Spirit of the Salmon objectives are expressed as total escapement to the basin. Planned numbers of releases appear twice as great in the Spirit of the Salmon as in the NPPC plan (Table 5.9.2-2), but release numbers in the NPPC plan may be underrepresented because some numerical information is not available in Appendix 1.

Differences among objectives and strategies between the Spirit of the Salmon and NPPC subbasin plans are evident in some instances (Table 5-12):

1. **Release numbers** planned differ for fall chinook salmon in the Clearwater subbasin (500,000 in NPPC and 5.3 million in Spirit of the Salmon); spring chinook salmon in the Grande Ronde subbasin (2.98 million in NPPC and 1.15 million in Spirit of the Salmon); summer steelhead in the Grande Ronde subbasin (160,000 in NPPC and 1.58 million in Spirit of the Salmon); spring chinook salmon in the Imnaha subbasin (1.66 million in NPPC and 492,000 in Spirit of the Salmon); spring chinook salmon in the Salmon subbasin (11.3 million in NPPC and 5.5 million in Spirit of the Salmon); summer chinook in the Imnaha subbasin (4.4 million in NPPC and 2.0 million in Spirit of the Salmon); and summer steelhead in the Salmon subbasin (8.1 million in NPPC and 3.9 million in Spirit of the Salmon).
2. **Broodstocks** for planned production appear to be different for fall chinook salmon in the Grande Ronde subbasin (Mid-Columbia late spawning in NPPC and Lyons Ferry

Table 5.9.2- 2 Total production goals and release numbers by subbasin for Columbia Basin anadromous fish

As reported in NPPC subbasin plans (excerpts in Appendix 1) and Vol II of the Spirit of the Salmon. Existing hatchery production is included for comparison.

	Adult Production goals		Juvenile Release numbers	
Subbasin	NPPC	CRITFC	NPPC	CRITFC
BIG WHITE SALMON	6,200	6,200	80,000	3,600,000
DESCHUTES	33,000	21,250	1,970,000	120,000
FIFTEENMILE	900	300	0	0
HOOD	15,900	14,700	500,000	225,000
JOHN DAY	52,000	52,000	0	0
KLICKITAT	135,000	135,000	3,250,000	4,600,000
LOWER MID-COLUMBIA				500,000
UMATILLA	47,670	47,670	1,000,000	8,404,000
WALLA WALLA	16,000	16,000		700,000
WIND	13,757		1,900,000	
TOTAL	320,427	293,120	8,700,000	18,149,000
CLEARWATER	177,000	267,100	6,800,000	20,210,000
GRANDE RONDE	59,900	59,500	3,135,000	4,725,000
IMNAHA	10,655	10,055	1,990,000	822,000
LOWER SNAKE	18,300	18,300	1,000,000	970,000
SALMON	338,000	425,600	23,825,000	13,400,000
TUCANNON	3,352	7,200	132,000	752,000
TOTAL	607,207	787,755	36,882,000	40,879,000
ENTIAT	5,471	6,750	600,000	1,195,000
METHOW	18,200	5,000	1,800,000	4,338,000
OKANOGAN	18,160	12,000	5,201,000	3,001,000
UPPER MID-COLUMBIA	2,000		3,600,000	
WENATCHEE	78,218	72,410	2,634,000	2,162,000
YAKIMA	21,000	79,000	8,956,000	7,050,000

Subbasin	Adult Production goals NPPC	Adult Production goals CRITFC	Juvenile Release numbers NPPC	Juvenile Release numbers CRITFC
TOTAL	143,049	175,160	22,791,000	17,746,000
COWLITZ	56,050		2,678,300	
ELOCHOMAN	60,200		2,100,000	
GRAYS	38,900		1,300,000	
KALAMA	8,690		4,590,000	
LEWIS	102,650		7,210,000	
LOWER COLUMBIA	96,000		2,550,000	
SANDY	15,500		1,635,000	
WASHOUGAL	8,275		10,400,000	
WILLAMETTE	127,150		1,380,000	
CLACKAMAS	26,400		2,795,000	
COAST RANGE, WILL.	0		0	
MCKENZIE	19,200		1,520,000	
MID FK WILLAMETTE	14,975		4,130,000	
MOLALLA/PUDDING	9,900		1,733,000	
SANTIAM/CALAPOOIA	26,600		3,460,000	
TUALATIN	2,600		100,000	
TOTAL	613,090		47,581,300	
GRAND TOTAL	1,683,773		115,954,300	
ABOVE BONNEVILLE	1,070,683	1,256,035	68,373,000	76,774,000

1/ Production and release numbers are compiled from Appendix 1 and the Spirit of the Salmon; numbers for production are not all comparable as some plans use different measures of harvest or escapement. Numbers for releases may not be complete for all species.

Hatchery in Spirit of the Salmon); summer steelhead in Grande Ronde subbasin ("presently used stock" in NPPC and "new Grande Ronde" in Spirit of the Salmon); and sockeye salmon in the Salmon subbasin (Stanley Basin in NPPC and Mid-Columbia in Spirit of the Salmon).

3. **Hatchery program** plans appear different for spring chinook salmon in the Salmon subbasin. The Spirit of the Salmon plans for use of Yankee Fork rearing pond and Nez Perce in addition to Rapid River and Sawtooth Hatcheries, which are the facilities listed in NPPC subbasin plan.

4. **Reestablishment** of coho salmon in the Tucannon River is an objective in the Spirit of the Salmon but not in the NPPC subbasin plan.

Additional anadromous fish production objectives include the restoration of Pacific lamprey to much of its historic range. Lamprey restoration is an objective in the Spirit of the Salmon but not in NPPC subbasin plans.

The NMFS recovery plan describes production objectives for listed species differently than the NPPC subbasin plans and the Spirit of the Salmon. Production objectives in the NMFS plan are delisting criteria:

1. For spring and summer chinook salmon

a. The eight-year geometric mean natural cohort replacement rate must exceed 1.0 during the eight years immediately prior to delisting for 80 percent of the Snake River spring/summer chinook salmon redd survey index areas.
b. The numerical escapement goal for Snake River spring/summer chinook salmon is an eight-year geometric mean corresponding to at least 60 percent of the 1962-1967 brood year average redd counts for 80 percent of available index areas.
c. A second numerical escapement goal is set at an eight-year geometric mean equal to 60 percent of the 1962-1967 brood year average count of natural spawners past Ice harbor Dam (i.e., 31,440). This escapement should be measured at Lower Granite Dam, since mortality between Ice Harbor Dam and the site of Lower Granite dam during the 1962-196 period is likely to have been very low. The numerical goals in both "b" and "c" must be met for delisting to be considered. First-generation progeny of captive broodstock or other artificially propagated fish would not be included in the number of natural spawners.

2. For fall chinook salmon

a. The eight-year geometric mean natural cohort replacement rate must exceed 1.0 during the eight years immediately prior to delisting.
b. The numerical escapement goal for Snake River fall chinook salmon is an eight-year geometric mean of at least 2,500 natural spawners in the mainstem Snake River annually.
c. First-generation progeny of captive broodstock or other artificially propagated fish would not be included in the number of natural spawners.

3. For sockeye salmon

a. The eight-year geometric mean natural cohort replacement rate must exceed 1.0 during the eight years immediately prior to delisting.
b. The numerical escapement goal for Snake River sockeye salmon is an eight-year geometric mean of at least 1,000 natural spawners annually in Redfish Lake and 500 natural spawners in each of two other Snake River Basin lakes.

The NMFS recovery plan limits non-recovery-related hatchery production to 20.2 million anadromous fish in the Snake River basin. The total planned release for the lower Snake River subregion is 36.9

million (including 16.1 million spring chinook salmon) in the NPPC subbasin plans and 40.9 million (including 14.0 million spring chinook salmon) in the Spirit of the Salmon. The extent to which the planned spring chinook releases in the Spirit of the Salmon and NPPC subbasin plans support recovery of listed spring chinook salmon is not clear from the information in Table 5.9.2-1or Appendix 1.

The NMFS recovery plan includes a strategy to limit spring chinook salmon hatchery plants from Lookingglass Hatchery in the Grande Ronde subbasin to 350,000 smolts in Lookingglass Creek. As shown in Table 5.9.2-1, planned releases in the Grande Ronde subbasin are 3.0 million for the NPPC subbasin plan and 1.15 million for the Spirit of the Salmon. Appendix 1 does not contain information specifying whether the Spirit of the Salmon and NPPC subbasin plans include releases into Lookingglass Creek.

Upper Mid-Columbia River Subbregion

Production objectives and strategies in the Upper Mid-Columbia River Subregion vary between the NPPC, NMFS, and Spirit of the Salmon. Numerical objectives for the entire subregion for all fish are different in the Spirit of the Salmon compared to the NPPC subbasin plans (Table 5.9.2-2), but the production objectives are not comparable because for some subbasins the objectives are measured in different terms (Table 5.9.2-1). Overall release numbers presented in the NPPC plan are higher than those in the Spirit of the Salmon.

Differences among objectives and strategies between the Spirit of the Salmon and NPPC subbasin plans are evident in some instances (Table 5.9.2-1):

1. **Release numbers** planned differ for spring chinook salmon in the Entiat river subbasin (200,000 for the NPPC subbasin plan and 800,000 for the Spirit of the Salmon); summer chinook salmon in the Methow River subbasin (400,000 for the NPPC subbasin plan and 2.6 million for the Spirit of the Salmon); sockeye salmon in the Okanogan River subbasin (2.0 million for the NPPC subbasin plan and 375,000 for the Spirit of the Salmon); spring chinook salmon in the Yakima River subbasin (1.6 million for the NPPC subbasin plan and 850,000 for the Spirit of the Salmon); and for summer steelhead in the Yakima River subbasin (1.6 million for the NPPC subbasin plan and 400,000 for the Spirit of the Salmon).
2. **Broodstocks** for planned production appear to be different for spring chinook salmon in the Methow River subbasin (the existing Winthrop Hatchery stock in the NPPC subbasin plan and broodstock from the Methow River subbasin in the Spirit of the Salmon).
3. **Hatchery program** plans appear different for the Methow, Okanogan, and Entiat River subbasins. Plans for development of adult trapping facilities are listed in the Spirit of the Salmon and not in the NPPC subbasin plans. The integration of Chelan and Eastbank hatcheries is listed in the Spirit of the Salmon for production of summer steelhead in the Entiat River subbasin and not in the NPPC.

4. **Reestablishment** of coho salmon in the Methow and Wenatchee River subbasins is listed as an objective for USFWS. Coho reestablishment is not listed in the NPPC subbasin plans and the Spirit of the Salmon. The NPPC subbasin plan lists replacement of coho releases with fall chinook salmon in the Upper Mid-Columbia River subbasin and the Spirit of the Salmon does not.

Additional anadromous fish production objectives include the restoration of Pacific lamprey to much of its historic range. Lamprey restoration is an objective in the Spirit of the Salmon but not in NPPC subbasin plans.

USFWS objectives call for restoration of depleted stocks of biologically unique fish. USFWS objectives specific to species in the Upper Mid-Columbia River subregion include:

1. Maintain the unique biological characteristics and productivity of naturally reproducing populations of resident and anadromous fish and rebuild natural populations to provide sustainable yield.
2. Produce salmon to help compensate for fish losses in the upper Columbia River drainage caused by construction of Grand Coulee Dam. Meet *US v Oregon* objectives while minimizing interactions with other fish populations.
3. Protect existing high quality habitat and repair restorable rearing habitat for juvenile salmonids.

Species addressed by USFWS objectives and strategies in Appendix 1 include:

1. Spring and summer chinook salmon in the Entiat, Methow, Upper Mid-Columbia main stem, and Wenatchee River subbasins
2. Fall chinook salmon in the Upper Mid-Columbia main stem
3. Coho salmon in the Methow and Wenatchee River subbasins
4. Sockeye salmon in the Wenatchee River subbasin
5. Natural populations of summer steelhead in the Entiat and Methow River subbasins

Lower Mid-Columbia River Subbregion

Production objectives and strategies in the Lower Mid-Columbia River Subregion vary between the NPPC, NMFS, and Spirit of the Salmon. Numerical objectives for the entire subregion for all fish appear somewhat higher in the Spirit of the Salmon than in the NPPC subbasin plan (Table 5.9.2-2). However, production objectives for some subbasins are measured in different terms in the two plans and are not directly comparable, and release numbers presented in the NPPC plan are underrepresented because some numerical information for the Umatilla and other subbasins is not presented in Appendix 1.

Differences among objectives and strategies between the Spirit of the Salmon and NPPC subbasin plans are evident in some instances (Table 5.9.2-1):

Release numbers planned differ for spring chinook salmon in the Deschutes River subbasin (2.0 million for the NPPC subbasin plan and 1.2 million for the Spirit of the Salmon); spring chinook salmon in the Hood River subbasin (3.0 million for the NPPC subbasin plan and 125,000 in the Spirit of the Salmon); and fall chinook salmon in the Klickitat River subbasin (3.0 million for the NPPC subbasin plan and 4.0 million in the Spirit of the Salmon).

1. **Broodstocks** for planned production appear different for spring chinook salmon in the Wind River subbasin. Carson stock is planned for use in the NPPC subbasin plan and a new Wind River natural stock is planned for use in the Spirit of the Salmon.
2. **Hatchery program** plans appear different for spring chinook salmon in the Lower Mid-Columbia River subbasin. The NPPC subbasin plan lists the use of Ringold Hatchery rearing ponds in the Hanford Reach and the Spirit of the Salmon does not. For fall chinook salmon in the Wind River, the Spirit of the Salmon lists the reprogramming of Spring Creek Hatchery to release fish into the natural production area of the Wind River and the NPPC subbasin plan does not. For coho salmon in the Wind River subbasin, the Spirit of the Salmon lists the development of adult recapture facilities and the NPPC subbasin plan does not.
3. **Reestablishment** of summer steelhead in the Lower Mid-Columbia River subbasin (Willow Creek) is planned in the NPPC subbasin plan and not in the Spirit of the Salmon. Introduction of coho salmon into the John Day River subbasin is planned in the Spirit of the Salmon and not in the NPPC subbasin plan.

Additional anadromous fish production objectives include the restoration of Pacific lamprey to much of its historic range. Lamprey restoration is an objective in the Spirit of the Salmon but not in NPPC subbasin plans.

In addition to the Spirit of the Salmon and NPPC subbasin plans, ODFW, USFWS, and Warm Springs Tribe plans are presented in Appendix 1. USFWS objectives call for restoration of depleted stocks of biologically unique fish. In the Wind River subbasin, USFWS and the other fisheries managers have identified objectives and strategies to restore wild steelhead runs (Appendix 1).

ODFW plans incorporate objectives and strategies cooperatively with the Tribes's plans. Cooperative management plans for the ODFW and Warm Springs co-managers exist for the Hood and Deschutes River subbasins (Appendix 1). Differences in objectives and strategies between the NPPC plans and ODFW and Warm Springs plans reflect the fact that the subbasin plans were created during the late 1980s and the ODFW plans (adopted by the Oregon Fish and Wildlife Commission) and Warm Springs activities are more recent. ODFW and Warm Springs plans address Pacific lamprey.

Lower Columbia River Subbregion

Fewer fish and wildlife management agencies have jurisdiction in the Lower Columbia River subbregion, and consequently the only major management plans are the NPPC subbasin plans for subbasins in Washington and Oregon. A larger proportion of the production objectives here than for subbasins above Bonneville Dam are directed primarily towards supporting fisheries (Table 5.9.2-1).

In Washington, objectives and strategies for chum salmon production are included in NPPC subbasin plans for the Elochoman, Grays, Lewis, and Lower Columbia River mainstem subbasins (Table 5.9.2-1). Production objectives for sea-run cutthroat are listed in plans for the Cowlitz and Kalama River subbasins (Appendix 1).

USFWS objectives call for restoration of depleted stocks of biologically unique fish. In the Lower Columbia River mainstem subbasin, USFWS has described objectives for the Hardy Creek stock of chum salmon (Appendix 1).

For Oregon, production objectives and strategies described in NPPC subbasin plans differ in some cases from ODFW plans presently in effect. These differences reflect the fact that the NPPC subbasin plans were created during the late 1980s and the ODFW plans (adopted by the Oregon Fish and Wildlife Commission) are more recent.

5.9.3 Subbasin Descriptions, Production Strategies, Broodstocks, and Habitat Actions

A workshop of the Watershed Production and Habitat Workgroup was held on October 10-11, 1996. to identify areas of similarities and differences in current and proposed production strategies and broodstocks of anadromous fish by species and subbasin in the four subregions. Results of this workshop are tabulated in Tables5.9.3-1 to 5.9.3-4 (one for each subregion), and discussed below. For each species and subbasin, the workgroup classifed production strategies into three types: Natural--Managing for natural production with no targeted hatchery releases to increase natural production: Supplementation--Managing for natural production with hatchery releases targeted to increase natural production; Artificial--Managing for artificial production with hatchery releases intended to return adults to a hatchery/broodstock collection site or for fisheries enhancement and not intended to naturally reproduce.

In general, federal, tribal, and state fish managers agree on the goal of increasing the natural runs of salmon, using both natural spawning and supplementation. In addition, there is agreement to restore all species lost, use appropriate broodstocks for restoration, and provide necessary adult capture and juvenile release facilities in existing and restored habitat. However, there is lack of agreement on which species should be prioritized for enhancement, the goals and objectives for enhancement, and strategies to meet goals and objectives (see Section 5.8.2.). These differences are continuing to be addressed and resolved through the workgroup and discussions between the fishery agencies and tribes.

In addition to production strategies and broodstocks, this section presents watershed descriptions and major habitat actions compiled from the Spirit of the Salmon.

5.9.3.1 Lower Columbia River Subregion

The Lower Columbia River subregion includes the Lower Columbia River from its mouth to Bonneville Dam at RM 146, and the following tributary rivers and their subbasins: Cowlitz, Elochoman, Grays, Kalama, Lewis, Sandy, Washougal, Willamette. Tables 5.9.3-1 and 2 organize workshop information on production strategies and broodstocks for this subregion.

Cowlitz

The 2,480-square-mile Cowlitz subbasin drains the west slopes of the Cascade Mountains, including the west slopes of Mount Rainier, Mount Adams, and Mount St. Helens in southwestern Washington. In the lower half of the subbasin the Cowlitz River flows through the Puget-Willamette lowland. It enters the Columbia River at RM 68. Its major tributaries are the Toutle River and the Coweeman River. Parts of the Upper Cowlitz headwaters are in the Mount Rainier National Park and the William O. Douglas, Goat Rocks, and Mount Adams wilderness areas.

In May 1980, the eruption of Mount St. Helens and subsequent mud flows and timber damage destroyed much of the existing streambed and riparian zone habitat in the Toutle River and lower Cowlitz River. Much of the subbasin riparian areas have been affected by logging. Most of the land in the subbasin is privately owned. Land uses include commercial forest (78 percent), other forest (12 percent), cropland (4 percent), pasture (1.5 percent), and urban and residential development (1 percent).

Species:

Spring chinook
Fall chinook
Coho
Summer steelhead
Winter steelhead
Cutthroat

Production Strategies and Broodstocks

Spring chinook managed as hatchery stock, re-establishment of hatchery production in Toutle System is underway. Fall chinook managed as hatchery stock, enhancement is successful with high harvest rates. Coho of both N and S type are produced within the subbasin to support high harvest rates. Summer and winter steelhead are released form hatcheries to support high harvest rates. Production by natural runs is emphasized in tributaries.

Major Habitat Actions

1. Aggressively protect existing habitat.
2. Construct off-channel rearing areas.
3. Seed habitat with fingerlings to maintain optimum production.

Table 5.9.3- 1 Lower Columbia River production strategies

Subbasins by Subregion	Spring Chinook	Summer Chinook	Fall Chinook	Steelhead Summer	Steelhead Winter	Sockeye	Coho	Chum
Lower Columbia River [1]								
Lower Columbia Mainstem				A	A			S? [4], N
Grays [1]			A		SA (P)		A	S? [4], N
Elochoman [1]			A	A	A		A	
Youngs Bay	A		A				A	
Clatskanie			N? [5]		A? [5]		N?	
Cowlitz [1]	S? [3], A		S? [3], A	A	S, A (P) [3]		S? [3], A	
Kalama [1]	A		S, A	A? [14]	S, A (P) [3]		A	
Lewis [1]	A		N	A	S, A (P) [3]		A	
Willamette	A		A?	A	A, S? [2]		A	
Clackamas	N, A		N	A	A, N [8]		S?, A, N [13]	
Santiam	N [14], A		A	A	S? [2], A, N [6], E [7]			
McKenzie	N [14], A			A				
Tualatin					N [14], A, S? [2]			
Coast Range					N			
Long Tom								
MF Willamette	A			A	N [14], A			
Calapooia	E				N			
CF Willamette								
Molalla/Pudding	S? [2]			A	N			
Sandy	A, N [11]		N	A	A, N? [11]		A	
Washougal [1]			S, A	A	A, N? [12]		A	

[1] Washington reviewing Lower Columbia tributaries per Washington wild fish policy and ESA.
[2] CRITFC questions Oregon's supplementation policies.
[3] Washington is reviewing under its wild fish policy.
[4] USFWS may consider outplanting.
[5] Need verification.
[6] Above Foster.
[7] Above Green Peter. Noted because of Congressional interest.
[8] Above North Fork.
[9] Little South Fork.
[10] Upper tribs.
[11] Above Marmot.
[12] Above Skamania Hatchery.
[13] Late run.
[14] Need locations of natural spawning with restricted outpla

S = Supplementation - Managing for natural production assisted by artificial outplanting.
A = Artificial - Production returning to hatchery or adult collection site, not intended to naturally produce; or using artificial production primarily for fisheries enhancement.
N = Natural - Management intent to have naturally spawning fish without targeted artificial enhancement.
(P) = Proposed listed species under Endangered Species Act.
(L) = Species listed under Endangered Species Act.
E = Species is extirpated (extinct) in subbasin.
? = Questions.

d = Disagreement.

Table 5.9.3- 2 Lower Columbia River brood stocks

Subbasins by Subregion	Spring Chinook	Summer Chinook	Fall Chinook	Steelhead Summer	Steelhead Winter	Sockeye	Coho	Chum
Lower Columbia River								
Lower Columbia Mainstem				Skamania	Beaver / Big Creek			Hamilton / Hardy
Grays			Tule	Skamania	Beaver		Toutle	Grays
Elochoman			Tule	Skamania	Beaver		early / late	
Youngs Bay	Willamette		Rogue / Upriver Bright				early	
Clatskanie					Big Creek			
Cowlitz	Cowlitz		Cowlitz / Tule	Skamania	Cowlitz?		Cowlitz / Tule	
Kalama	Kalama / Lewis / Cowlitz		Kalama	Skamania	Beaver? / Kalama?		early / late	
Lewis	Kalama / Lewis / Cowlitz			Skamania	Beaver?		early / late	
Willamette	Willamette		Tule	Skamania			early	
Clackamas	Clackamas			Skamania	Big Creek / Willamette		early (Eagle Creek) / late (Clackamas)	
Santiam	Santiam		Tule	Skamania	Santiam			
McKenzie	McKenzie			Skamania/McKenzie [1]				
Tualatin					Big Creek			
Coast Range								
Long Tom								
MF Willamette	Willamette			Skamania	Marion Forks			
Calapooia								
CF Willamette								
Molalla/Pudding	Willamette				Big Creek			
Sandy	Willamette / Clackamas			Skamania / Foster	Big Creek / Eagle		early (Sandy)	
Washougal			Tule	Skamania	Skamania Merwin / Beaver Creek		late	

[1] Moving toward native broodstock.

Elochoman

The headwaters of the Elochoman River lie in the Willapa Hills in southwest Lewis County and northeast Cowlitz County. The river flows southwesterly into Wahkiakum County to join the Columbia River at RM 38, just downstream from the town of Cathlamet, Washington. The subbasin is 73.3 square miles. Forestry is the major land use, with agriculture in the floodplain.

Species:

Fall chinook
Coho
Chum
Summer steelhead
Winter steelhead
Cutthroat

Production Strategies and Broodstocks

Fall chinook of tule stock are produced from the hatchery and have a high harvest rate; returning adults must be captured in lower river weir for use in propagation. Coho primarily the result of hatchery program, have a high harvest rate. Re-establishment of chum is a priority; use of a local stock is desired. Steelhead stocks are managed for high exploitation rate of hatchery stocks and no exploitation of wild stocks.

Major Habitat Actions

1. Emphasize regulatory programs to protect existing habitat.
2. Ensure adequate numbers of adults are allowed to spawn naturally to seed habitat.
3. Identify and correct man-caused sources of sediment.

Grays

The Grays River originates in the steep, narrow canyons of the Willapa Hills in southeast Pacific County and flows southwest through Wahkiakum County to its confluence with the Columbia River at RM 21. The lower six miles of the river are a slough subject to tidal influence. The basin encompasses 124 square miles. Timber companies own more than 70 percent of the total land area and Washington State 15 percent. The rest is privately owned land, mainly in the floodplain. The major land use is timber and forest products (95 percent). The rest is residential, under cultivation, or pasture.

Species:

Fall chinook
Coho
Chum
Winter steelhead

Production Strategies and Broodstocks

Fall chinook for the Grays River subbasin are managed on a hatchery basis. Natural spawning may occur either above or below the hatchery location depending on water flow. Emphasis is on maintaining

the production capacity of the Toutle stock coho. Chum rebuilding is commencing aim is to increase local stock to a level that will support a fishery and provide escapement. Winter steelhead are managed to reduce impacts on wild steelhead while providing recreational opportunity on the hatchery stock.

Major Habitat Actions

1. Emphasize regulatory programs to protect existing habitat.
2. Ensure adequate numbers of adults are allowed to spawn naturally to seed habitat.
3. Identify and correct man-caused sources of sediment.

Kalama

The 205-square-mile Kalama subbasin begins on the southwest slope of Mount St. Helens and flows 44.5 miles west-southwest to enter the Columbia River below Bonneville Dam in southwest Washington at RM 73.1. The headwaters are in Skamania County, but nearly 99 percent of the basin is in Cowlitz County. Land use is predominantly forestry (96 percent), with small amounts of cropland and the town of Kalama.

Species:

Spring chinook
Fall chinook
Coho
Summer steelhead
Winter steelhead
Cutthroat

Production Strategies and Broodstocks

Spring chinook are managed for an in-river harvest; emphasis is on returning adequate broodstock to the hatchery while providing a portion for natural rearing upstream of the hatchery. Fall chinook are managed on a hatchery basis while supplementing natural production with the appropriate stock. Coho management for both S and N stock emphasizes hatchery component; management for natural fish is difficult. Steelhead and cutthroat management is based on wild stocks with hatchery stock providing harvest opportunity.

Major Habitat Actions

1. Seed environment for optimum natural production.
2. Maintain stream habitat quality and quantity, decreased sedimentation.
3. Maintain present genetic diversity.

Lewis

The Lewis River headwaters arise from the southern flanks of Mount Adams and Mount St. Helens. The mainstem of the river, also known as the North Fork Lewis River, flows southwesterly from its source in Skamania County through three impoundments: Merwin Lake, Yale Lake, and Swift Creek Reservoir. Along the middle and lower sections, the river forms the boundary between Clark and Cowlitz Counties. A major tributary, East Fork Lewis River, enters the mainstem at RM 3.5. From this

point the Lewis River continues west, entering the Columbia river at RM 88. The upper subbasin is in the Gifford Pinchot National Forest and the Mount St. Helens National Volcanic Monument. Below the reservoirs and along the East Fork, most of the land is privately owned and dotted with small farms and residences.

Species:

Spring chinook
Fall chinook
Coho
Chum
Summer steelhead
Winter steelhead
Cutthroat

Production Strategies and Broodstocks

Spring chinook management is on a hatchery stock basis. Acclimation sites are desirable. Fall chinook are managed on a natural basis. Coho salmon both N and S stock are managed on a hatchery basis, emphasis on getting adequate escapement for propagation. Chum enhancement may progress after development of a near-local broodstock.

Major Habitat Actions

1. Provide adequate flows for spawning and rearing populations.
2. Emphasize regulatory programs to protect existing habitat.
3. Ensure adequate numbers of adults are allowed to spawn naturally to seed habitat.
4. Identify and correct man-caused sources of sediment.

Sandy

The 508-square-mile Sandy River subbasin is located in Multnomah and Clackamas counties of northwest Oregon. The Sandy River originates in the Reid, Sandy, and Zigzag glaciers on the west slope of Mount Hood; it flows northwesterly for 55 miles and enters the Columbia River at RM 120.5, just north of the city of Troutdale. Major tributaries include the Bull Run, Zigzag, and Salmon rivers.

Waters of the Sandy subbasin provide about 70 percent of the potable water supply for the Portland metropolitan area. The Bull Run watershed is administered as a closed reserve. About two-thirds of the land is federally owned; recreation, forestry, and agriculture are the major land uses. There is also mining of sand, gravel, clay, and rock, and residential development.

Species:

Spring chinook
Fall chinook
Coho
Summer steelhead
Winter steelhead

Production Strategies and Broodstocks
Fall chinook salmon are managed on a natural stock basis with no hatchery production. Spring chinook salmon production includes both hatchery releases and natural production. Coho salmon are produced at Sandy Hatchery. Hatchery summer and winter steelhead are released to support fisheries and managed to protect native late-run winter steelhead.

Major Habitat Actions

1. Maintain minimum mainstem flows below Marmot Dam.
2. Support Forest Service habitat improvement work to increase pool-to-riffle ratios, gravel entrapment, and cover for adults and juveniles.

Washougal
The Washougal River subbasin, in southwest Washington, drains approximately 240 square miles of steep terrain. The Washougal River enters the Columbia River at RM 121 at the town of Camas. The town of Washougal is also located on the short, confined floodplain at the mouth of the river.

Species:
Spring chinook
Fall chinook
Coho
Summer steelhead
Winter steelhead

Production Strategies and Broodstocks
[Description paragraph with all species combined.]

Major Habitat Actions

1. Establish fish sanctuaries to reduce pre-spawning loss.
2. Stimulate local involvement in habitat improvement activities

Willamette
The Willamette River subbasin is divided into eight subbasins including the Clackamas river, Coast Fork and Long Tom, Coast Range, McKenzie River, Middle Fork Willamette, Molalla and Pudding, Santiam and Calapooia, and Tualatin River subbasins. Specific information on each of these subbasins is included in Appendix 1.

Species:
Spring chinook
Fall chinook
Coho

Summer steelhead
Winter steelhead

Production Strategies and Broodstocks
Production strategies and broodstocks specific to each subbasin are described in Appendix 1.

Major Habitat Actions

Habitat actions address fish passage improvements and maintenance of instream flows. Actions specific to each subbasin are described in Appendix 1.

5.9.3.2 Lower Mid-Columbia River Subregion

The Lower Mid-Columbia subregion includes the Lower-Mid Columbia mainstem from Bonneville Dam to the Yakima River mouth and the Wind, Little White Salmon, Big White Salmon, Hood, Klickitat, Deschutes, Fifteenmile, John Day, Walla Walla, and Umatilla Rivers. Tables 5.9.3-3 and 4 organize workshop information on production strategies and broodstocks for this subregion.

Lower-Mid Columbia Mainstem
The Lower-Mid Columbia mainstem is that portion of the river between Bonneville Dam (RM 145) to the mouth of the Yakima River (RM 335). This section of the river flows westward and forms the border of Oregon and Washington. Besides the major tributaries minor tributaries such as Rock Creek, Eagle Creek, and Herman Creek also are found in this stretch.

Species:
Bright fall chinook
Tule fall chinook
Summer and winter steelhead
Coho
Pacific lamprey

Production Strategies and Broodstocks
Currently there is hatchery production for tule fall chinook (broodstock Bonneville Pool) and bright fall chinook (broodstock upriver brights). Some natural production of tule fall chinook, coho, and winter and summer steelhead occurs in the minor tributaries. The tribes propose changing the release of bright fall chinook from the Bonneville Hatchery to the natural production areas above McNary Dam and in Rock Creek to establish a terminal fishing location. In addition, a minor portion of the tule fall chinook would be released to the Wind River natural habitat. The tribes propose a program to restore lamprey.

Table 5.9.3- 3 Lower Mid-Columbia production strategies

Subbasins by Subregion	Spring Chinook	Summer Chinook	Fall Chinook	Steelhead (Summer)	Steelhead (Winter)	Sockeye	Coho	Chum
Lower Mid-Columbia								
Lower Mid-Columbia Mainstem			A [9]	S, A, (P)	N [1], (P)		[11]	
Big White Salmon Subbasin	E, S [2], A		A	S [2], A, (P)	S, A, (P)		S? [2]	
Deschutes Subbasin	A, N [3]		N	N [3], A	A	E		
Fifteenmile Creek					N			
Hood Subbasin	S, E		N [10]	S, A, (P)	S, (P)		E [10]	
John Day Subbasin	N		E	N				
Klickitat Subbasin	S, A	N [4]	A, S	S, A	N		A, S	
Little White Salmon Subbasin	A, S? [5]		A				A	
Umatilla Subbasin	A, S, E		E, S	S, A			E, S, A	
Walla Walla Subbasin	A, S, E		E	S, A			E	E
Wind Subbasin	A, S? [5]		S? [6]	A, S, N [8], (P)	N		S?	

[1] Minor Oregon tribs.
[2] Change to Supplementation is predicated on the removal of Condit Dam.
[3] Above Warm Springs Hatchery.
[4] Intermittant spawning.
[5] Tribes want to move toward supplementation.
[6] USFWS has questions.
[7] Tribes want to discontinue summer steelhead program.
[8] Given possible listing, will probably manage some tribs as Natural.
[9] Stray hatchery-origin adults spawn in small tributaries to the Columbia Gorge (e.g., Viento, Lindsay, Rode, Mosier, Chenoweth and Mill Creeks).
[10] Stray hatchery-origin adults spawn in the subbasin.
[11] Stray hatchery-origin adults spawn in several small tributaries, including Mill Creek.

S = Supplementation - Managing for natural production assisted by artificial outplanting.
A = Artificial - Production returning to hatchery or adult collection site, not intended to naturally produce; or using artificial production primarily for fisheries enhancement.
N = Natural - Management intent to have naturally spawning fish without targeted artificial enhancement.
(P) = Proposed listed species under Endangered Species Act.
(L) = Species listed under Endangered Species Act.
E = Species is extirpated (extinct) in subbasin.
? = Questions.
d = Disagreement.

Table 5.9.3- 4 Lower Mid-Columbia brood stocks

Subbasins by Subregion	Spring Chinook	Summer Chinook	Fall Chinook	Steelhead A	Steelhead Winter	Sockeye	Coho	Chum
Lower Mid-Columbia								
Lower Mid-Columbia Mainstem			Bonneville Pool hatchery	Skamania				
Big White Salmon Subbasin	Carson / Little White			Skamania / local	Skamania / Merwin		early	
Deschutes Subbasin	Deschutes			Deschutes				
Fifteenmile Creek								
Hood Subbasin	Deschutes			Skamania / Hood River	Hood River			
John Day Subbasin								
Klickitat Subbasin	Klickitat		Upriver Brights	local / Skamania			early / late	
Little White Salmon Subbasin	Carson / Little White		Upriver Brights				Little White	
Umatilla Subbasin	Carson / Umatilla		Upriver Brights / Umatilla	local			early / Umatilla	
Walla Walla Subbasin	[1]			? [1]				
Wind Subbasin	Carson		Bonneville Pool hatchery	Skamania / local			early	

[1] Oregon and Washington use different brood stock: Spring chinook - WA: none. OR: Carson.
Steelhead A. WA: Lyons Ferry / Wells. Local if available. OR: Local if available.

Major Habitat Actions
1. Mainstem flow/spill management.
2. Improve tributary riparian areas.

Wind
The Wind River originates in the Gifford Pinchot National Forest in southwestern Washington. The river flows southward through steep, narrow terrain and enters the Columbia River near Carson, Washington at RM 154.5. Because of the steep terrain, only about 1 percent of the land is urbanized. The major land uses in the subbasin are timber production and harvest. Principal tributaries include Panther, Trout, and Paradise creeks.

Species:
Spring chinook
Fall chinook
Coho
Summer steelhead
Winter steelhead
Pacific lamprey

Production Strategies and Broodstocks
Currently there is hatchery production of spring chinook (broodstock Carson) and summer steelhead (broodstock Skamania). The tribes propose to supplement spring chinook (broodstock Carson), fall chinook (broodstock Bonneville Pool hatchery), coho (broodstock early) and steelhead (broodstock local). The tribes propose a program to restore lamprey.

Major Habitat Actions
1. Remove Trout Creek diversion dam.
2. Restore riparian area throughout watershed.
3. Treat runoff into Martha Creek.

Little White Salmon
The Little White Salmon River originates in the Gifford Pinchot National Forest west of Monte Cristo Peak in southcentral Washington. The river flows south and enters the Columbia near Cooks, Washington at RM 162. Most of the subbasin is contained within the boundaries of the Gifford Pinchot National Forest. The river runs through approximately 8 miles of private land, with urban development located primarily in the unincorporated town of Willard.

Species:
Spring chinook
Fall chinook
Coho
Pacific lamprey

Production Strategies and Broodstocks
Currently there is hatchery production of spring chinook (broodstock Carson and Little White), fall chinook (broodstock Upriver Brights), and coho (broodstock early). The tribes want to move toward supplementation to reestablish natural runs of spring chinook. The tribes propose a program to restore lamprey.

Major Habitat Actions
1. Provide passage at hatchery barrier dam.
2. Restrict or eliminate logging in riparian areas of watershed.

Big White Salmon

The Big White Salmon River originates in the Gifford Pinchot National Forest in southcentral Washington along the southwest slope of Mt. Adams. The river flows south and enters the Columbia River at Underwood, Washington at RM 168.3. Major land uses in the subbasin include timber production, forest, range, and agriculture. Principal tributaries are Trout Lake and Buck and Rattlesnake creeks.

Species:
Spring chinook
Fall chinook
Summer and winter steelhead
Coho
Pacific lamprey

Production Strategies and Broodstocks
Current hatchery production is ongoing for spring chinook (broodstock Carson and Little White Salmon) and summer steelhead (broodstock Skamania) and winter steelhead (broodstock Skamania/Beaver). Supplementation for spring chinook, summer steelhead, and coho is predicated on the removal of Condit Dam. The tribes propose a program to restore lamprey.

Major Habitat Actions
1. Provide passage at Condit Dam.
2. Screen irrigation diversion dams.
3. Restrict grazing along streams.

Hood
Hood River, located in northcentral Oregon, flows in a northeasterly direction and enters the Columbia River at RM 169. The river is bounded on the west by the Cascade Range, the south by the Sandy and White river drainage, and on the east by the Mosier, Mill, Threemile, and Fifteenmile creek drainage. Land in the subbasin is managed primarily for timber production and irrigated agriculture.

Species:

Spring chinook
Fall chinook
Coho
Summer steelhead
Winter steelhead

Production Strategies and Broodstocks

There is agreement on production strategies and broodstocks for the Hood River subbasin: supplementation to reintroduce the now-extirpated spring chinook (broodstock Deschutes); supplementation for summer steelhead (broodstock Hood River) and winter steelhead (broodstock Hood River), and hatchery production of summer steelhead (broodstock Skamania and Hood River). Fall chinook and coho spawn in the natural habitat of the subbasin.

Major Habitat Actions

1. Screen East Fork Irrigation Diversion Dam.
2. Restore riparian vegetation throughout watershed.
3. Improve instream habitat.

Klickitat

The Klickitat River originates along the east slope of the Cascade Mountains in southcentral Washington. The watershed is bounded on the west by Mt. Adams, on the north by Goat Rocks, and on the east by the Simcoe Mountains. The river flows generally southward and enters the Columbia near Lyle, Washington at RM 180.4. Forestry and agriculture are the major economic industries in the subbasin. The Yakama Indian Nation, private individuals, and the state are the major land owners. The principal tributaries are the Little Klickitat River and Big Muddy, Summit, and Outlet creeks. Minor tributaries include White Brush and Trout creeks.

Species:

Spring chinook
Fall chinook
Coho
Summer steelhead
Winter steelhead
Pacific lamprey

Production Strategies and Broodstocks

Currently there is hatchery production of spring chinook (broodstock Klickitat), fall chinook (broodstock Upriver Brights), summer steelhead (broodstock Skamania), and coho (broodstock early and late). Supplementation using local stocks is proposed by the tribes for all species. The tribes propose a program to restore lamprey.

Major Habitat Actions

1. Improve Castile and Lyle falls adult passage.

2. Prevent grazing in upper Klickitat River and Piscoe Creek.
3. Improve water quality in lower river tributaries.
4. Restore flow to Swale Creek and restore riparian area.
5. Improve passage at U.S. Forest Service road crossings.

Fifteenmile Creek

The Fifteenmile Creek Drainage, located in northcentral Oregon, heads into the Mt. Hood National Forest just east of Mt. Hood. The creek flows northeast out of timbered higher elevations before it circles north through dryland wheat country southeast of The Dalles. It enters the Columbia River at RM 192. The Fifteenmile Creek drainage is bounded on the west by the Mosier, Mill, Threemile, and Hood River drainage, on the south by the White River drainage, and on the east by the Deschutes River drainage. The principal tributaries are Eightmile, Ramsey, and Fivemile creeks. The U.S.D.A. Forest Service manages 19 percent of the subbasin for timber production.

Species:

Winter steelhead
Pacific lamprey

Production Strategies and Broodstocks

There is a natural run of winter steelhead that will not be supplemented.

Major Habitat Actions

1. Improve passage conditions.
2. Restore riparian vegetation.
3. Improve stream habitat.

Deschutes

The Deschutes River subbasin in northcentral Oregon flows north through central Oregon and enters the Columbia River at RM 205. Major tributaries are White and Warm Springs rivers and Shitike, Buckhollow, Bakeoven, and Trout creeks. Land ownership in the lower Deschutes River subbasin is primarily private (62 percent) and tribal (21 percent). The major land use in the subbasin is agriculture; grazing is widespread.

Species:

Spring chinook
Fall chinook
Sockeye
Summer steelhead
Pacific lamprey

Production Strategies and Broodstocks

Currently there is hatchery production of spring chinook (broodstock Deschutes) and summer steelhead (broodstock Deschutes). Management will emphasize protection of natural runs of fall chinook that

spawn in the subbasin and spring chinook and summer steelhead that spawn above the Warm Springs Hatchery. Sockeye are virtually extinct in this subbasin.

Major Habitat Actions

1. Provide passage at dams.
2. Restore riparian vegetation and spawning gravel along upper 3 miles of mainstem.
3. Restore riparian vegetation and make instream improvements in Trout, Buckhollow, and Bakeoven Creeks.

John Day

John Day River, in eastcentral Oregon, is the longest free-flowing river with wild anadromous salmon in the Columbia River Basin. The John Day includes 11 counties and is bounded by the Columbia River to the north, the Blue Mountains to the east, the Aldrich Mountains and Strawberry Range to the south, and the Ochoco Mountains to the west. The mainstem John Day River flows from the Strawberry Mountains to its mouth at RM 218 on the Columbia River. Major tributaries include the North Fork and South Fork. Over 60 percent of the subbasin is privately owned. Federal ownership amounts to approximately 37 percent, including lands managed by the U.S.D.A. Forest Service (30 percent), and U.S.D.A. Bureau of Land Management (7 percent).

Species:

Spring chinook
Fall chinook
Coho
Summer steelhead
Pacific lamprey

Production Strategies and Broodstocks

Current production is managed to protect the natural runs of spring chinook and summer steelhead in the John Day subbasin. Reintroduction of fall chinook and coho will be evaluated. The tribes propose a program to restore lamprey.

Major Habitat Actions

1. Restore riparian vegetation in the upper South Fork and tributaries, Middle Fork, upper mainstem, and Camas Creek.
2. Mitigate mine tailings in the North Fork.
3. Increase shade, reduce sediment and other contaminants in the upper South Fork and tributaries, Middle Fork, upper mainstem, and Camas Creek.

Umatilla

The Umatilla River originates on the west slope of the Blue Mountains in the Umatilla National Forest. It flows northwest and enters the Columbia River at RM 289 near Irrigon, Oregon. Principal tributaries include the North Fork and South Fork, as well as Meacham, Birch, McKay, and Butter creeks. The major land ownership is private (51 percent), federal (37 percent), and tribal (11 percent). Forest lands

in the subbasin are managed for timber harvest, grazing, and recreation. Much of the lower subbasin has been developed for irrigated agriculture. Much of the mid-subbasin is used for dryland wheat farming.

Species:

Spring chinook
Fall chinook
Coho
Summer steelhead
Pacific lamprey

Production Strategies and Broodstocks

Currently there are supplementation programs for spring chinook, fall chinook, coho, and summer steelhead. The tribes propose a program to restore lamprey.

Major Habitat Actions

1. Increase shade, reduce sediment and other contaminants in Wildhorse, Squaw, Meacham, Birch creeks and other small tributaries, and mainstem Umatilla River.
2. Restore riparian vegetation in Wildhorse Creek, Squaw Creek, Meacham Creek, Birch Creek, and mainstem Umatilla River.
3. Restrict or remove livestock in Wildhorse Creek, Squaw Creek, Meacham Creek, Birch Creek, and mainstem Umatilla River.
4. Provide adult fish passage improvements at partial barriers in numerous tributaries.

Walla Walla

The Walla Walla River originates in the Blue Mountains of northeast Oregon. It flows generally west and north and enters the Columbia River at RM 315 near Wallula, Washington. The main tributaries are the North Fork, South Fork, and Touchet rivers, and Couse, Birch, Mill, Pine, Dry, Yellowhawk, and Cottonwood creeks. The higher elevation forested lands are managed for timber harvest, livestock grazing, and recreation, whereas mid-elevation lands are managed for dryland farming and grazing. Most of the valley lands are managed for irrigated agriculture. Private land ownership dominates in the subbasin and is approximately 96 percent in Washington state.

Species:

Spring chinook
Summer steelhead
Coho
Chum
Pacific lamprey

Production Strategies and Broodstocks

Currently there is hatchery production of summer steelhead in Washington (broodstock Lyons Ferry and Wells). Supplementation of spring chinook is proposed by the tribes. Spring chinook, coho, and chum are extinct in the Walla Walla subbasin. The tribes propose to reestablish spring chinook as well

as supplementation of steelhead using local stock. Reintroduction of coho and chum will be evaluated and a decision made on their reintroduction. The tribes propose a program to restore lamprey.

Major Habitat Actions

1. Construct juvenile screens and trap and hunt facilities at Little Walla Walla diversion, and screen renovations at several other small diversions.
2. Construct adult passage facilities at Hofer, Maiden, Burlingame, Nursey Bridge, and Little Walla Walla Dams and remove Marie Dorian dam.
3. Increase shade, reduce sediment and other contaminants in mid- to lower mainstem Walla Walla and Touchet rivers and lower North Fork Walla Walla River.

5.9.3.3 Upper Mid-Columbia River Subregion

The Upper Mid-Columbia Subregion includes the Upper-Mid Columbia mainstem, which is defined as the river between the mouth of the Yakima River and Chief Joseph Dam, and the Yakima, Wenatchee, Entiat, Methow, and Okanogan Rivers. Tables 5.9.3-5 and 6 organize workshop information concerning production strategies and broodstocks for this subregion.

Upper Mid-Columbia Mainstem

The mid-Columbia River mainstem is that section of the Columbia River from Yakima River mouth (RM 335) to Chief Joseph Dam (RM 545). This section of the river generally flows southward through eastern Washington until it turns westward in the vicinity of Pasco, Washington. Its principal tributaries are the Wenatchee, Entiat, Methow, and Okanogan rivers. Most of the lesser tributaries support some steelhead spawning.

Species:

Spring chinook
Summer chinook
Fall chinook
Coho
Summer steelhead
Lamprey

Production Strategies and Broodstocks

Currently there is hatchery production for spring chinook in the Hanford Reach (broodstock Cowlitz or local), summer chinook (broodstock Wells and local), and fall chinook (broodstock upriver bright), steelhead (broodstock Skamania and local); supplementation for fall chinook (broodstock upriver bright). For steelhead supplementation is planned for the lesser tributaries (broodstock to be determined).

Major Habitat Actions

1. Mainstem flow/spill management to benefit juvenile survival for numerous subbasins.

2. Restore riparian areas on tributaries.
3. Control milfoil in mainstem reservoir, stabilize pool elevations.
4. Provide passage over barriers in tributaries.

Table 5.9.3- 5 Upper Mid-Columbia production strategies

Subbasins by Subregion	Spring Chinook	Summer Chinook	Fall Chinook	Steelhead A	Steelhead B	Sockeye	Coho
Upper Mid-Columbia							
Upper Mid-Columbia Mainstem [1]		A, S	S, A	S, N [2], (P)			
Hanford Reach	A		S, A	S, A (P)			
Entiat Subbasin	S, A? [3]			S, A? [4], (P)			S [5]
Methow Subbasin	S, A? [3]	S [6]	N [6]	S, A? [4], (P)			S [5]
Okanogan Subbasin	E, S [8]	S	N [6]	S, A? [4]		S	E, S [5]
Wenatchee Subbasin	S, A? [3]	S	N	S, A? [4]		S	S [5]
Yakima Subbasin	S	E, S [7]	S	S		E, S [7]	S [5]
Marion Drain			S [9]				
American	N						
Naches	S			S [7]			S [5]
Satus				S [7]			

[1] Defined as Priest Rapids Dam to Chief Joseph Dam
[2] Some minor tributaries [SPECIFY].
[3] Tribal Restoration Plan involves switching A to S.
[4] Broodstock policy under review per Mid Columbia HCP.
[5] Strategy for reintroduction under development.
[6] Evidence exists that intermittant spawning occurs.
[7] May be plans in the next five years.
[8] Strategy for reintroduction under development.
[9] Strategy still under development.

S = Supplementation - Managing for natural production assisted by artificial outplanting.
A = Artificial - Production returning to hatchery or adult collection site, not intended to naturally produce; or using artificial production primarily for fisheries enhancement.
N = Natural - Management intent to have naturally spawning fish without targeted artificial enhancement.
(P) = Proposed listed species under Endangered Species Act.
(L) = Species listed under Endangered Species Act.
E = Species is extirpated (extinct) in subbasin.
? = Questions.
d = Disagreement.

Table 5.9.3- 6 Upper Mid-Columbia brood stocks

Subbasins by Subregion	Spring Chinook	Summer Chinook	Fall Chinook	Steelhead A	Steelhead B	Sockeye	Coho
Upper Mid-Columbia							
Upper Mid-Columbia Mainstem		Wells/local	Upriver Bright	TBD			
Hanford			Upriver Bright	Skamania/local			
Entiat Subbasin	Leavenworth / local			Wells / local			early/local
Methow Subbasin	local	above Wells		Wells / local			early/local
Okanogan Subbasin	TBD	above Wells		Wells / local		local	early/local
Wenatchee Subbasin	Leavenworth / local	local		Wells / local		local	early/local
Yakima Subbasin	local	Wenatchee	Upriver Bright	local		Wenatchee	early/local
Marion Drain			local				
American							
Naches	local			local			early
Satus				local			

Yakima

The Yakima River originates in the Cascade Mountains at Lake Keechlus. The river flows southeast and enters the Columbia River at RM 335 near Richland, Washington. Major tributaries include the Naches, American, Bumping, Tieton, Little Naches, Cle Elum, and Teanaway rivers, in addition to Satus, Toppenish, Ahtanum, Cowiche, Rattlesnake, and Nile creeks. The major land use in the subbasin includes irrigated agriculture, timber harvest, grazing, and urbanization. Land ownership is approximately 32 percent private, 30 percent tribal, 28 percent federal, and 10 percent state.

Species:

Spring chinook
Fall chinook
Coho
Summer steelhead
Pacific lamprey

Production Strategies and Broodstocks

Currently there is hatchery production for fall chinook (broodstock upriver brights) and coho (broodstock early); a spring chinook hatchery is being constructed in the upper Yakima River and a supplementation program is planned for the Naches River (broodstock local). Summer chinook and sockeye were extirpated from this subbasin. Supplementation as a means of reintroduction (broodstock Wenatchee for summer chinook and Lake Wenatchee for sockeye) within the next 5 years is being evaluated. In addition, the tribes propose to use local coho stock for the supplementation program as some as they are available for the existing releases. Smaller tributaries within the Yakima subbasin (i.e.American River) will be managed to protect natural runs of spring chinook. The tribes also propose a program to restore lamprey.

Major Habitat Actions

1. Establish flows in lower river below Sunnyside Dam.
2. Restrict development along Naches mainstem and upper Yakima River between Easton and Cle Elum.
3. Complete Phase II fish screen facilities.
4. Fully implement the Yakama Indian Nation's Lower Yakima Valley Wetland and Riparian Restoration Plan.
5. Continue to purchase high priority habitat on the Yakima mainstem and tributaries.
6. Implement side channel restoration/construction and overwinter habitat development projects.
7. Support the integration of ancillary programs (YRBWEP) into the NPPC program.
8. Continue to develop complete restoration projects for all tributaries, e.g. Satus Creek.

Wenatchee

The Wenatchee River watershed drains a portion of the east Cascade Mountains in northcentral Washington into Chelan County and enters the Columbia River at RM 486.4. The drainage originates in high mountainous regions of the Cascade Crest, with numerous tributaries draining subalpine regions within the Alpine Lakes and Glacier Peak Wilderness areas. The Little Wenatchee and White rivers

flow into Lake Wenatchee, the source of the Wenatchee River. From the lake outlet, the river descends rapidly through Tumwater Canyon and drops into a lower gradient section in the region of Leavenworth, where Icicle Creek joins the mainstem. Other tributaries include Peshastin Creek, Chiwawa River, and Nason Creek. Much of the basin is managed for timber production. Land ownership is primarily federal (77 percent) and private (22 percent).

Species:

Summer chinook
Spring chinook
Coho
Sockeye
Summer steelhead
Pacific lamprey

Production Strategies and Broodstocks

Currently there is hatchery production for spring chinook (broodstock Leavenworth and local) summer chinook (broodstock Wenatchee), sockeye (broodstock Lake Wenatchee) and steelhead (broodstock Wells). The tribes propose expanding the spring chinook supplementation program using local stock. In addition, the tribes propose to change the Wells steelhead stock to a local stock and implement a supplementation program for steelhead using the existing steelhead facilities (Leavenworth and Eastbank hatcheries) and new adult collection/final rearing facilities. The tribes also propose a supplementation program for reintroduction of coho (broodstock early and local). The tribes propose a program to restore lamprey.

Major Habitat Actions

1. Purchase undeveloped riparian areas in White River, Nason Creek, and Chiwawa River drainage.
2. Reopen side channels along mainstem and Nason Creek.
3. Improve Dryden screens.

Entiat

The Entiat River Subbasin is located in northcentral Washington in Chelan County. The Entiat River flows southeast and enters the Columbia River at RM 483.7. The system has two major tributaries: the North Fork Entiat and Mad River. The subbasin is managed mainly for timber production. Land ownership is primarily federal (84 percent) and private (12 percent).

Species:

Spring chinook
Summer chinook
Coho
Summer steelhead
Pacific lamprey

Production Strategies and Broodstocks

Currently there is hatchery production for spring chinook (broodstock Leavenworth) and steelhead (broodstock Wells). The tribes propose using the Entiat Hatchery to rear local stock for a supplementation program for spring chinook. In addition, the tribes propose to change the Wells steelhead stock to a local stock and implement a supplementation program for steelhead using the existing steelhead facilities (Chelan and Eastbank hatcheries). The tribes also propose a supplementation program for reintroduction of coho (broodstock early and local) and summer chinook (Wenatchee broodstock). The tribes propose a program to restore lamprey.

Major Habitat Actions

1. Close logging roads that no longer are necessary along the upper watershed.
2. Restore riparian vegetation along the entire Entiat River.
3. Develop and implement watershed plan.

Methow

The Methow River is located in northcentral Washington with its source on the eastern slopes of the Cascade Mountains. The river flows southeast and enters the Columbia River at RM 524, near the town of Pateros, Washington. The principal land use in the subbasin is forest, seconded by livestock grazing. The U.S.D.A. Forest Service owns most (94 percent) of the land in the subbasin.

Species:

Spring chinook
Summer chinook
Coho
Summer steelhead
Pacific lamprey

Production Strategies and Broodstocks

Currently there is hatchery production for spring chinook (broodstock Leavenworth, Winthrop and local), summer chinook (broodstock Wells) and steelhead (broodstock Wells). The tribes propose using the Winthrop Hatchery in concert with the Methow Spring Chinook Hatchery for a supplementation program for spring chinook using local stock. In addition, the tribes propose to change the Wells steelhead stock to a local stock and implement a supplementation program for steelhead using the existing steelhead facilities (Wells Hatchery). The tribes also propose a supplementation program for reintroduction of coho (broodstock early and local). The tribes propose a program to restore lamprey.

Major Habitat Actions

1. Implement the Draft Methow Basin Plan for instream flows.
2. Construct percolation channels in upper Methow and Lost rivers.
3. Restore riparian vegetation throughout the entire watershed.

Okanogan

The Okanogan River enters the Columbia between Wells and Chief Joseph dams. This subbasin straddles British Columbia and Washington. It begins near Armstrong, British Columbia, and flows

south through a chain of lakes. The first and largest of these is Lake Okanogan, followed by lakes Skaha, Vaseaux, and Osoyoos. The United States-Canada border divides Lake Osoyoos into two nearly equal parts. From there the river flows about 80 miles south and enters the Columbia River near Brewster at RM 533. The Similkameen River is the main tributary. Forest and rangeland dominate the subbasin. The major landowners include the Colville Indian Tribe and the U.S.D.A. Forest Service.

Species:

Spring chinook
Sockeye
Summer steelhead
Coho
Pacific lamprey

Production Strategies and Broodstocks

Currently there is hatchery production for summer chinook (broodstock Wells), sockeye (broodstock Lake Oosoyoos) and steelhead (broodstock Wells). The tribes propose using local summer chinook stock for a supplementation program. In addition, the tribes propose to change the Wells steelhead stock to a local stock and implement a supplementation program for steelhead using the existing steelhead facilities (Wells Hatchery) and new adult collection/final rearing facilities. The tribes also propose a supplementation program for reintroduction of coho (broodstock early and local). The tribes propose a program to restore lamprey.

Major Habitat Actions

1. Provide passage at Enloe Dam.
2. Provide passage to lakes above Osoyoos Lake.
3. Provide passage on Omak and Salmon creeks.
4. Improve water quality - temperature barrier below second dam.
5. Reassess water management plans above Osoyoos Lake.
6. Assess past mining activities and current water quality impacts on the Similkameen River

5.9.3.4 Lower Snake River Subregion

The Lower Snake Subregion includes the Lower Snake mainstem and the Tucannon, Clearwater, Grande Ronde, Imnaha, and Salmon Rivers. Tables 5.9.3-7 and 8 organize workshop information concerning production strategies and broodstocks for this subregion.

Lower Snake Mainstem

1. The Lower Snake River mainstem is the portion of the river from its junction at the Columbia River at RM 324.2 to Hells Canyon Dam at RM 247. This section of the river generally flows northwest and forms the border of Idaho, Oregon, and Washington until it turns westward at

Table 5.9.3- 7 Lower Snake River production strategies

Subbasins by Subregion	Spring Chinook	Summer Chinook	Fall Chinook	Steelhead A	Steelhead B	Sockeye	Coho	Chum
Lower Snake River								
Lower Snake Mainstem Subbasin	S [6]		S, A (L)	N [1], A, (P)			(E)	
Asotin	N?[22] S (L) [23]			N (P)				
Alpowa	S (L)			N (P)				
Clearwater Subbasin	S, A		S, A (L)	N (P)	N, S, A (P)		S (E)	
Lochasa					N (P)			
Selway	N [22]				N (P)			
Grande Ronde Subbasin	N [2], S, A (L)		S? [3], Nd[2]	N [2], S, A (P)		E	S? [3], (E)	
Lostine	S, (L)			N (P)				
Minam	N, Sd [4], (L)			N (P)				
Catherine	S (L)			S? [5], A, N? [6], (P)				
Upper	S (L)			S? [5], A, N? [6], (P)				
Wenaha	N, Sd [4], (L)			N (P)				
Joseph				N (P)				
Looking Glass	S, A			N (P)				
Imnaha Subbasin	S [7], (L)	S [7], (L)	N (L)	S (P)				
Salmon Subbasin	N [8], S, A, (L)	N [9], S, A, (L)	S? [10], N (L)	N? [11], S, A (P)	S? [12], A (P)	S [13], (L)	S? [14], (E)	
Mid-Mainstem [15]				N (P)				
Secesh + Lake Creek		N (L)			N (P)			
Little Salmon	A	N (L)		N [16], A (P)				
East Fork	S (L)			S (P)	S? [12]			
Middle Fork	N (L)	N (L)		N, S [14], (P)	N, S d [14], (P)		S? [14], (E) d	
South Fork		S, A, Nd [17], (L)			N (P)	S? [18]	S? [18], (E)	
Tucannon Subbasin	S, A (L)		N, S? [19] (L)	S? [20], A (P)			(E) S? [20] d	

[1] Minor tribs.
[2] Lower Grande Ronde.
[3] Tribes have plans to supplement stocks. ODFW and USFFWS have issues.
[4] Tribes want to use in pooling of an endemic GRB stock. ODFW has issues.
[5] Questioned by NMFS.
[6] Concern: outplanting not fully separated from natural.
[7] Spring and Summer both S, but currently not managing for two seperate races.
[8] Minor tribs. [IDENTIFY SPECIFIC TRIBS HERE.]
[9] Indian Riffles.
[10] NPT plans to supplement under discussion.
[11] Minor tribs. No planned action.
[12] SBT plans outplanting, Idaho and NMFS have issues.
[13] Redfish, Petit current, Alturus planned, Yellowbelly under discussion.
[14] SBT wants reintroduction. Unresolved issues.
[15] Defined as French Creek upstream to Middle Fork.
[16] Rapid River.
[17] Disputed N Summer Chinook at Poverty Flat.
[18] In Subbasin Plan, not in IDFG's plan.
[19] Outplanting questioned by NMFS and USFWS.
[20] Question regarding intent to move to local broodstock.
[21] Natural spawning without supplementation in Bear, Running, Whitecap, and I
[22] Evidence exists that intermittent spawning occurs.
[23] Re-introduction/supplementation strategy under development.

S = Supplementation - Managing for natural production assisted by artificial outplanting.
A = Artificial - Production returning to hatchery or adult collection site, not intended to naturally produce; or using artificial production primarily for fisheries enhancement.
N = Natural - Management intent to have naturally spawning fish without targeted artificial enhancement.
(P) = Proposed listed species under Endangered Species Act.
(L) = Species listed under Endangered Species Act.
E = Species is extirpated (extinct) in subbasin.
? = Questions.

d = Disagreement.

Table 5.9.3- 8 Lower Snake River brood stock

Subbasins by Subregion	Spring Chinook	Summer Chinook	Fall Chinook	Steelhead A	Steelhead B	Sockeye	Coho
Lower Snake River							
Lower Snake Mainstem Subbasin	Hells Canyon trap/Rapid River		Lyons Ferry / Snake	Hells Canyon trap			
Asotin	TBD						
Alpowa	TBD						
Clearwater Subbasin	Rapid River / local		Lyons Ferry / Snake		Dworshak / local		Early
Lochasa							
Selway	Rapid River / local						
Grande Ronde Subbasin	local metapopulation / TBD		Lyons Ferry / local [2]	?Wallowa / local WA-Lyons Ferry? [1]			Early
Lostine	local / TBD						
Minum	TBD						
Catherine	local / TBD			Wallowa / local			
Upper	local / TBD			Wallowa / local			
Wenaha	TBD						
Joseph							
Looking Glass	Rapid River / local						
Imnaha Subbasin	Imnaha	Imnaha	Lyons Ferry / local [2]	Imnaha			
Salmon Subbasin	Rapid River / local / carson D	Pashemeroi / South Fork / local	Lyons Ferry	Pashemeroi / Oxbow / local	Dworshak / local		Early
Mid-Mainstem							
Bear Valley							
Canyon							
Secesh							
Little Salmon	Rapid River			Oxbow/Pashemeroi			
Middle Fork				local [D]	local [D]		Early
South Fork		South Fork / local				Wenatchee	Early
Tucannon Subbasin	local		Lyons Ferry / local [2] / Snake	local / Lyons Ferry			Early

[1] Washington and Oregon brood stocks are different.

[2] USFWA has questions regarding use of "local" since Columbia River stray rate is so high. USFWS supports using only known Lyons Ferry / Snake River fall chinook for supplementation.

Lewiston, Idaho, and enters the Columbia. The Snake River subbasin is the largest drainage system entering the Columbia River. Major land uses here are wilderness and agriculture. Two tributaries entering the Lower Snake mainstem are the Asotin and Alpowa creeks.

Species:

Spring chinook salmon
Fall chinook salmon
Summer steelhead
Pacific lamprey

Production Strategies and Broodstocks

Currently there is supplementation and hatchery production of fall chinook (broodstock Lyons Ferry and Snake) and hatchery releases for spring chinook below Hells Canyon Dam (broodstock Rapid River) and steelhead (broodstock Pahsimeroi). Naturally spawning A-Run steelhead are found in the Lower Snake's tributaries. There is intermittent spawning in the Asotin sub-subbasin. The tribes propose to develop a supplementation program using local Asotin broodstock for spring chinook and steelhead providing stocks are large enough. Other alternative stocks may be needed to reestablish runs at which time the returning stocks will be used. The tribes propose a program to restore lamprey.

Major Habitat Actions

1. Restore riparian vegetation in Asotin Creek.
2. Restore the natural river and associated healthy riparian ecosystem or components that most resemble the natural condition.

Tucannon

The Tucannon River originates in the Blue Mountains of the Umatilla National Forest and flows north through Washington State; it enters the Snake near Starbuck at RM 62. The river's principal tributary is Pataha Creek. Land use is dominated by cropland (36.9 percent, primarily for dryland winter wheat), rangeland (35.1 percent), and forestry (27 percent).

Species:

Spring chinook salmon
Fall chinook salmon
Coho salmon
A-run summer steelhead
Pacific lamprey

Production Strategies and Broodstocks

Currently there is supplementation and hatchery production of spring chinook (broodstock local) and steelhead (broodstock local). Naturally spawning A-Run steelhead are found in the Lower Snake's tributaries. The tribes propose to modify the existing supplementation program to release more of the

spring chinook and steelhead smolts in the natural habitat and to begin supplementation programs for fall chinook and coho. The tribes propose a program to restore lamprey.

Major Habitat Actions

1. Increase shade, reduce sediment and other contaminants in mainstem Tucannon River and Pataha Creek.
2. Restore riparian vegetation in mainstem Tucannon River and Pataha Creek.
3. Restrict or remove livestock in mainstem Tucannon River and Pataha Creek.

Clearwater

The Clearwater River Basin is located in northcentral Idaho. The subbasin extends from the Washington and Idaho border in the west to the eastern headwaters along the west slope of the Bitterroot Mountains. The river generally flows westward from the headwaters and enters the Snake at Lewiston, Idaho, RM 139. The main tributaries include the Lochsa, Selway, North Fork and South Fork. Land ownership is mainly federal (61.2 percent) and private sector (32.3 percent). Major land use in the subbasin includes forestry-related activities, agriculture, grazing, and mining.

Species:

Spring chinook salmon
Summer chinook salmon
Fall chinook salmon
Coho salmon
A-run summer steelhead
B-run summer steelhead
Pacific lamprey

Production Strategies and Broodstocks

Currently there is hatchery production of spring chinook (broodstock Rapid River, Carson and local), steelhead (broodstock Dworshak B run). Releases occur at the hatcheries and adult traps. Coho (broodstock early) supplementation began in 1995 and fall chinook (broodstock Lyons Ferry and local) supplementation is to begin in 1997. In addition, the tribes propose to supplement spring chinook, steelhead and coho using local stock for spring chinook and steelhead and once coho are reestablished use local coho stocks. The tribes propose a program to restore lamprey.

Major Habitat Actions

1. Control erosion in Deadman and Canyon creeks.
2. Protect current functioning riparian ecosystems and restore natural river and associated healthy riparian ecosystem or components that most resemble natural condition.
3. Secure floodplain habitats.

Grande Ronde

The Grande Ronde River originates in the Blue Mountains of northeastern Oregon. The watershed is bounded by the Blue Mountains to the west and northwest, and the Wallowa Mountains to the

southeast. Its principal tributaries are the Wenaha, Wallowa, and Minam rivers, and Catherine and Lookingglass creeks. Smaller tributaries include the Bear, Hurricane, Sheep, and Indian creeks. The U.S. Forest Service is the major landowner (45 percent) in the subbasin, and forestry, range, and cropland are the major land uses.

Species:

Spring chinook salmon
Summer chinook salmon
Fall chinook salmon
Coho salmon
A-run summer steelhead
Pacific lamprey

Production Strategies and Broodstocks

Currently there is hatchery production of spring chinook (broodstock Rapid River), steelhead (broodstock Lyons Ferry and Wells). The tribes propose to supplement spring chinook (broodstock local), steelhead (broodstock local) and coho (broodstock early). Once coho are reestablished local coho stocks will be used. The state and federal fishery agencies propose a captive rearing program for spring chinook (broodstock local). The tribes also propose programs to restore sockeye and lamprey.

Major Habitat Actions

1. Increase shade, reduce sediment and other contaminants in upper Grande Ronde and tributaries, mainstem Grande Ronde, Catherine Creek and tributaries, Joseph Creek and tributaries, Wallowa River and tributaries outside wilderness area.
2. Restore riparian vegetation in upper Grande Ronde and tributaries, mainstem Grande Ronde, Catherine Creek and tributaries, Joseph Creek and tributaries, Wallowa River and tributaries outside wilderness area.
3. Work with local ranchers to develop livestock management plans to reduce impacts of livestock in upper Grande Ronde and tributaries, mainstem Grande Ronde, Catherine Creek and tributaries, Joseph Creek and tributaries, Wallowa River and tributaries outside wilderness area.

Imnaha

The Imnaha River originates in the Wallowa/Whitman National Forest in northeast Oregon. From the junction of the North and South forks, the river flows north and enters the Snake River in the Hells Canyon reach at RM 191.7. Big Sheep Creek is the principal tributary. Land ownership is mainly federal (71.5 percent) and private (28.5 percent). Forestry-related uses, including recreation and wilderness, dominate in the subbasin, and the major land use on private land is grazing.

Species:

Spring chinook
Fall chinook
A-run steelhead
Coho

Pacific lamprey

Production Strategies and Broodstocks
Currently there is hatchery production of spring chinook (broodstock local) and steelhead (broodstock local). The tribes propose to expand the spring chinook (broodstock local) and steelhead (broodstock local) supplementation programs. In addition the tribes propose to develop supplementation programs for coho (broodstock early) and fall chinook (broodstock Lyons Ferry). Once coho and fall chinook are reestablished local stocks will be used. The tribes also propose programs to restore sockeye and lamprey.

Major Habitat Actions
1. Terminate Wallowa Valley Improvement Canal Diversion.
2. Restore riparian vegetation throughout the watershed.

Salmon
The Salmon River originates in the Sawtooth Mountains of central Idaho, and, after flowing west through the River of No Return Wilderness, enters the Snake River in the Hells Canyon reach at RM 188. The Salmon River subbasin is the largest in the Columbia River system, excluding the Snake. Major tributaries are the East Fork, Pahsimeroi, Lemhi, South Fork, Middle Fork and Little Salmon rivers. The major land owner in the subbasin is the U.S.D.A. Forest Service (90.3 percent). Major land uses are forestry, recreation, wilderness, agriculture, and grazing.

Species:
Spring chinook
Summer chinook
Fall chinook
Sockeye
A-run summer steelhead
B-run summer steelhead
Pacific lamprey

Production Strategies and Broodstocks
Currently there is hatchery production of spring chinook (broodstock Rapid River and local), summer chinook (broodstock local), sockeye/kokanee (broodstock local) and steelhead (broodstock Dworshak and Snake River). The tribes propose to implement a supplementation program for spring chinook (broodstock local), summer chinook (broodstock local), fall chinook (broodstock Lyons Ferry), sockeye (broodstock Lake Wenatchee and local), coho (broodstock early) and steelhead (broodstock local). Once coho and fall chinook are reestablished local stocks will be used. The state and federal fishery agencies are implementing captive rearing programs for spring chinook (broodstock local) and sockeye/kokanee (broodstock local). The tribes also propose programs to restore sockeye and lamprey.

Major Habitat Actions

1. Irrigation diversion removal.
2. Protect current functioning riparian ecosystems and restore natural river and associated healthy riparian ecosystem or components that most resemble natural condition.
3. Restore habitat degraded by mining activities (especially Grouse Creek, Preacher's Cove, Beartrack, Thompson Creek, Panther Creek and Stibnite Mines).
4. Reconnect tributaries with anadromous fish production.
5. Support model watershed efforts to restore functioning river ecosystems in the Lemhi, Pahsimeroi and Eask Fork.

5.9.4 Subbasin Habitat Goals, Objectives, And Strategies

Anadromous fish habitat goals, objectives, and strategies specific to each subbasin in the four subregions that still support anadromous fish runs are summarized below. This summary is based on the abbreviated account of habitat objectives and strategies by species and subbasin contained in the NPPC, Spirit of the Salmon, USFWS, NMFS, and state plans presented in Appendix 1, and Summary Table A in Volume II of the Spirit of the Salmon.

Table 5.9.4-1 summarizes categories of habitat actions that have been described to meet broad habitat improvement objectives for each of the plans presented in Appendix 1. The following are examples of actions or strategies to meet the objectives in the table:

1. Improve instream flows by headwater dam development, introduction of beavers, or augmentation with existing hydrodevelopment.
2. Improve fish passage by screening diversions, building fish ladders, or removing migration barriers.
3. Restore riparian zones by planting vegetation or fencing to prevent livestock grazing from damaging riparian zones.
4. Increase stream complexity by developing side channels, increasing recruitment of large woody debris, increasing pool to riffle ratios, or adding spawning gravel.
5. Reduce impacts of mining by mitigating past effects, enforcing existing water quality laws or standards, or developing new laws or standards.
6. Reduce impacts of grazing through fencing of riparian areas, management of grazing practices, or enforcing existing laws or standards.
7. Reduce impacts of logging by maintaining riparian zones, forest management practices, or enforcement of existing laws or standards.
8. Reduce impacts of pollution through sedimentation abatement, water development or releases to maintain cool temperatures, or enforcement of water quality standards.
9. Reduce impacts of interspecific interactions by discontinuing catchable trout releases in juvenile rearing areas; implementing predator control programs; or limiting hatchery production in sensitive natural production areas.
10. Improve overall management of water and land resources by enforcing or developing laws and codes governing resource use.

The table was constructed by reviewing Appendix 1 and identifying specific habitat actions for each habitat objective. Habitat actions that were so general they did not fall within one of the categories of objectives have not been included. For example, "determine available habitat" or "implement habitat enhancement projects" are not habitat actions that are included in Table 5.9.4-1. Habitat actions that were not planned for implementation are not all included (e.g., "investigate the feasibility of funding a study of the benefits of providing artificial reefs…"). Habitat actions listed in Table 5.9.4-1 for the Spirit of the Salmon are from Summary Table A in the Spirit of the Salmon Volume II. Some of the actions are not necessarily unique to a subbasin, but rather general programmatic approaches to habitat improvement (e.g., "halt mining, logging, and development in the riparian area and allow the riparian vegetation to recover").

Commonalities and differences among plans

The habitat objectives among the Spirit of the Salmon and NPPC subbasin plans mirror the regional goals and policies of each plan described in 5.8.2 above. The plans' objectives all address habitat improvement and protection to increase or maintain production of anadromous fish stocks, rebuild depressed stocks, and reestablish critically reduced or extirpated fish runs.

Habitat above Bonneville Dam

Many similarities between planned actions to fill habitat objectives exist between the Spirit of the Salmon and NPPC subbasin plans. Actions to improve instream flows and fish passage are common to both plans in most subbasins above Bonneville Dam. Actions to restore riparian zones are common to both plans in many subbasins, but listed more often in the Spirit of the Salmon than in the NPPC subbasin plans. Actions to increase instream complexity are common to both plans in many subbasins, but listed more often in the NPPC subbasin plans than in the Spirit of the Salmon. Actions to minimize negative effects on salmon from interspecific interactions are listed in both plans. However, these actions are unique to individual plans. Actions listed for the Yakima River subbasin in the NPPC subbasin plan include predator control actions, while the Spirit of the Salmon does not list actions to address interspecific interactions. Actions listed for the Grande Ronde River subbasin in the Spirit of the Salmon include discontinuing catchable trout releases in spring chinook salmon production areas, while the NPPC subbasin plan does not list actions to address interspecific interactions.

Major differences among actions to meet habitat objectives listed in the two plans are found in the following areas:

- Reducing the impacts of extractive industry and land or water development on fish habitat
- Enforcing laws and codes that protect fish

Actions for these habitat objectives listed in NPPC subbasin plans are generally listed where a habitat problem unique to a particular subbasin exists, while the Spirit of the Salmon actions often represent a general programmatic approach to land use activities in many of the subbasins. For example, in the Entiat River subbasin the NPPC plan lists reduction of the poaching of adult spring chinook salmon at USFS primitive campgrounds through education and enforcement, while the Spirit of the Salmon

excerpts in Appendix 1 do not list enforcement actions specific to the subbasin. Some actions in the Spirit of the Salmon for subbasins where no actions are listed in the NPPC subbasin plans are subbasin specific. Actions to mitigate for gravel mining in the Walla Walla River subbasin are listed in the Spirit of the Salmon and not the NPPC subbasin plan. Actions to mitigate for impacts of mining tailings in the North Fork of the John Day River are listed in the Spirit of the Salmon but not in the NPPC subbasin plan.

Other Plans

Habitat actions in plans of other agencies are listed in Appendix 1. The NMFS recovery plan lists actions to minimize adverse effects of hatchery-produced fish on native listed salmon in the Lower Snake River subbregion. USFWS plans list actions to improve instream flows and passage conditions in the Upper Mid-Columbia River subbregion, as well as minimizing adverse impacts of interspecific interactions.

Habitat below Bonneville Dam

Fewer fish and wildlife management agencies have jurisdiction in the Lower Columbia River Subbregion and consequently the only major management plans are the NPPC subbasin plans for subbasins in Washington and Oregon. A larger proportion of the habitat actions listed in Appendix 1 for watersheds below Bonneville dam is generally directed towards improving instream flows and fish passage than for watersheds above bonneville Dam. The NPPC subbasin plans as they are reported in Appendix 1 do not include all the habitat objectives that are listed in ODFW subbasin plans.

Table 5.9.4- 1 Habitat objectives addressed by planned habitat actions and strategies by subbasin and salmon restoration and management plans

This table does not include information about USFS, BLM, BOR, and other habitat improvement activities.

	Improve instream flows			Fish passage improvements and maintenance			Restore/protect riparian zone			Increase instream complexity			Reduce impacts of: Mining			Grazing			Logging			Pollution			Interspec interacti
Subbasin	NPPC	TRP	State/ other	NPPC	TRP	State/ other	NPPC	TRP	State/ other	NPPC	TRP	State/ other	NPPC	TRP	State/ other	NPPC	TRP	State/ other	NPPC	TRP	State/ other	NPPC	TRP	State/ other	NPPC
Lower Snake River 1/		**X**		X	X			**X**								**X**								**N**	
Clearwater 2/	X	X		**X**			X	X		X	X			**X**			**X**			**X**			**X**		
Grande Ronde		**X**			**X**		X	X		**X**							**X**			**X**			**X**		
Imnaha		**X**						**X**									**X**			**X**					
Salmon	X	X		X	X		X	X		X	X			**X**		X	X		X	X			**X**	N	
Tucannon	X	X		**X**			X	X		**X**						X	X			**X**		X	X		X
Upper Mid-Columbia	X	X		X	X			**X**		**X**															
Entiat	X	X		**X**		U	X	X		**X**							**X**			**X**					
Methow	X	X	U	**X**				**X**		**X**										**X**		**X**			
Okanogan	X	X		X	X			**X**									**X**			**X**		X	X		
Wenatchee	X	X		X	X	U		**X**									**X**			**X**		**X**			
Yakima 3/	X	X		X	X		X	X		X	X					X	X			**X**			**X**		**X**
Lower Mid-Columbia 4/	X	X		X	X			**X**			**X**														**X**
Big White Salmon				X	X			**X**									**X**			**X**					
Deschutes	X	X	W	X	X	W	X	X	W	X	X	W					**X**			**X**			**X**		
Fifteenmile	X	X		X	X		X	X		X	X					X	X			**X**			**X**		
Hood		**X**		X	X	O,W	X	X	O,W	X	X	O,W					**X**			**X**			**X**		
John Day	X	X		X	X		X	X		X	X			**X**			**X**			**X**			**X**		
Klickitat 5/				X	X		X	X		X	X						**X**			**X**		X	X		**X**
Umatilla 6/	X	X			**X**												**X**			**X**			**X**		
Wind 7/				X	X			**X**			**X**						**X**			**X**					
Walla Walla 6/		**X**			**X**			**X**			**X**			**X**			**X**			**X**					
Lower Columbia				**X**						X		U										**X**			
Cowlitz										**X**												**X**			
Elochoman										**X**												**X**			
Grays				**X**						**X**												**X**			
Kalama																						**X**			
Lewis	**X**			**X**			**X**			**X**						**X**									**X**
Sandy	**X**			**X**						**X**															**X**
Washougal				**X**																					
Willamette 8/			**O**	X		O			**O**						**O**									**O**	**X**
Clackamas 8/	X		O	X		O																			
Coast Fk and Long Tom 8/																									
Coast Range Willamette 8/																									
McKenzie 8/	X		O	X		O																			
Middle Fork Willamette 8/	X		O	X		O																**X**			
Molalla and Pudding 8/																									
Santiam and Calapooia 8/			**O**	X		O																			
Tualatin 8/	X		O	X		O																			

N = NMFS; O = ODFW; U = USFWS; W = CTWSI.

1/ NPPC subbasin plan lists Asotin Creek habitat improvement, but no specifice actions.
2/ NPPC subbasin plans list implementation of other agencies' habitat improvement projects, but do not specify objectives and strategies.
3/ NPPC action "Investigate the feasibility of funding a study of the benefits of providing artificial reefs..." not counted as a strategy in this table.
4/ NPPC subbasin plan calls for feasibility studies or inventories and does not specify habitat objectives or actions.
5/ NPPC subbasin plan lists additional habitat improvements if habitat inventories are first conducted.
6/ NPPC subbasin plan lists tributary habitat restoration feasibilty studies. No specific strategies are listed except for headwater storage to maintain flows. ODFW biologists have commented that headwater storage may be incompatible with bull trout management objectives.
7/ USFWS lists strategies to determine habitat needs for depressed populations of winter steelhead and evaluation of effects of habitat improvements.
8/ Habitat objectives and strategies are listed in ODFW management plans, but have not been transcribed in Appendix 1.

5.10 Production and Habitat Projects and Costs

5.10.1 BPA Production and Habitat Projects and Costs

Table 5.10-1 provides project descriptions of FY 1997 BPA-funded production and habitat projects by subbasin. Additional details of these projects are available in the publication, *FY 1997 BPA-Funded Fish and Wildlife Program Projects* approved by the Northwest Power Planning Council and available through the Columbia Basin Fish and Wildlife Program. Project costs for FY 1997-2001 production and habitat projects are provided in Table 5.10-2.

Table 5.10- 1 FY 97 Anadromous fish production and habitat projects by subbasin

Clearwater Subbasin - Habitat Projects

5520100 O'HARA WATERSHED RESTORATION

This project will involve maintenance and improvement of existing instream structures in a small stream (O'Hara Creek, Selway River subbabsin, Clearwater River basin) supporting at-risk stocks of spring chinook salmon and steelhead trout spawning and rearing. It will also involve extensive road obliteration within the watershed.

9303600 HAYSFORK GLORY HOLE, NEWSOME CREEK PLACER MINE SILT TRAP - NEZ PERCE TRIBE

Assist the USFS, Nez Perce Forest, Elk City Ranger District to construct a sediment dam capable of containing sediment releases over a 50 year time period, thus avoid frequent sediment pond cleaning required every 2-3 years to avert $24,000 per time expense.

9607700 MEADOW CREEK RESTORATION

This is a restoration project encompassing a watershed of 9,770 hectares (24, 115 acre), Emphasis will be placed on restoring the 294 hectare (725 acre) McComas Meadow. Land management including mining, cattle grazing, road construction, timber harvest, and irrigation have impacted stream channel stability and fish habitat. This project will help increase egg to fry survival of Snake River fall chinook (Oncorhynchus tshawytscha). Improved habitat in Meadow Creek will help increase natural production of Snake River spring/summer chinook salmon, steelhead and resident trout. The watershed is currently under U.S. Forest Service management. Meadow Creek (17060305-07) enters the South Fork Clearwater River (17060305) at river kilometer 52.3. The stream is approximately 30 miles east of Grangeville, Idaho.

Clearwater Subbasin - Production Projects

8335000 NEZ PERCE TRIBAL HATCHERY

Design and construct hatchery supplementation facilities for the Nez Perce Tribe to assist in recovery and restoration of spring, summer, and fall chinook in the Clearwater subbasin.

9604300 JOHNSON CREEK ARTIFICIAL PROPAGATION ENHANCEMENT

The Johnson Creek Artificial Propagation Enhancement project seeks to collect native Johnson Creek chinook salmon broodstock for rearing in McCall Hatchery and release of acclimated smolts to preserve and recover the salmon population. Adult collection/holding and juvenile rearing/acclimation facilities on Johnson Creek would be necessary for successful completion of the project.

Deschutes Subbasin - Habitat Projects

9303000 BUCK HOLLOW WATERSHED ENHANCEMENT (SWCD)

Ongoing fisheries habitat and watershed restoration project to improve riparian and instream habitat.

9304500 BUCK HOLLOW WATERSHED ENHANCEMENT (ODFW)

This is an ongoing fisheries habitat and watershed restoration project designed to restore summer steelhead spawning and rearing habitat in Buckhollow. Funding for this project covers technical support and coordination for planning of watershed and fish habitat improvements.

9404200 TROUT CREEK OPERATION & MAINTENANCE

Provide for maintenance of existing habitat improvements to ensure habitat recovery to increase natural production of wild Deschutes River summer steelhead.

Deschutes Subbasin - Production Projects

8902900 HOOD RIVER PRODUCTION PROGRAM - PELTON LADDER - HATCHERY

Production and rearing of Deschutes River spring chinook at Round Butte Hatchery and Pelton Ladder for subsequent release into the Hood and Deschutes rivers.

9500700 HOOD RIVER PRODUCTION PROGRAM - PGE O&M

Provide the necessary O&M work to be done by PGE to ensure Pelton Ladder is maintained in good working order to support the additional water and facilities support that is associated with the

extended rearing of spring chinook in the Pelton Ladder. This capacity is not part of the mitigation requirements of PGE for construction and operation of the Round Butte - Pelton project.

Fifteenmile Subbasin - Habitat Projects

9304000 FIFTEENMILE CREEK HABITAT IMPROVEMENT

This is the ongoing fisheries habitat restoration project for the Fifteenmile Creek Basin designed to restore spawning and rearing habitat for wild winter steelhead. Funding for this project covers O&M of the improvements constructed to date as well as the continuing implementation. Implementation work is primarily riparian fencing and some bank stabilization work.

Grande Ronde Subbasin - Habitat Projects

5507000 GRANDE RONDE SUBBASIN WATERSHED RESTORATION

Conduct watershed planning and education process by identifying problems and developing creative solutions to land use problems impacting water quality/quantity in the Grande Ronde Basin. Implement instream, riparian and wetland enhancement projects for benefits to summer steelhead, spring chinook, and wildlife.

5520900 WALLOWA COUNTY/NEZ PERCE TRIBE SALMON HABITAT RECOVERY PLAN IMPLEMENTATION

The Wallowa County/Nez Perce Tribe Salmon Habitat Recovery Plan (County/Tribe Plan) is a locally developed plan to provide habitat in the County suitable for sustaining spring chinook and other salmonids. A watershed approach to habitat issues and local ownership in the County/Tribe Plan were central to the County/Tribe Plan's development. This project is to help implement the County/Tribe Plan.

8402500 GRANDE RONDE HABITAT ENHANCEMENT

9202601 GRANDE RONDE MODEL WATERSHED - ADMIN/IMPL./RESEARCH

Project will continue coordinating, planning, and implementing habitat restoration in T&E chinook and steelhead streams and building community-wide participation in watershed restoration among the diverse interests of the Grande Ronde basin; developing innovative ideas in watershed planning; seminars for stakeholders; facilitate interagency cooperation in habitat restoration.

9402700 GRANDE RONDE MODEL WATERSHED HABITAT PROJECTS

Project includes over 50 individual watershed restoration projects targeting anadramous fish habitat. Projects will be developed with private landowners, Soil and Water Conservation Districts, and County, State and federal agencies.

9403900 WALLOWA BASIN PROJECT PLANNING - G. R. MODEL WATERSHED

Project planning and implementation of Grande Ronde Model Watershed Plan in Wallowa subbasin. Specific plans for Bear Creek, Lostine River, and Big and Little Sheep Creeks. Instream flow study specific to Lostine River.

Grande Ronde Subbasin - Production Projects

5520700 CAPTIVE BROODSTOCK ARTIFICIAL PROPAGATION

The Captive Broodstock Artificial Propagation program began in 1996 with the collection of juvenile chinook salmon from the Lostine River, Catherine Creek and the upper Grande Ronde River in the Grande Ronde River subbasin. This was done in an effort to preserve these native chinook salmon populations from extinction. Juveniles would be reared in captivity to adults and gametes stripped and raised to smolt size. Acclimated smolts would then be released into each stream in an attempt to preserve and recover the salmon population. Adult collection/holding and juvenile rearing/acclimation facilities on the Lostine River would be necessary for successful completion of the project.

8805301 NORTHEAST OREGON OUTPLANTING FACILITIES MASTER PLAN - NEZ PERCE TRIBE

This project was initiated as one of the Northeast Oregon Hatchery Projects. The project was started in response to the Council's objective of doubling the numbers of salmonids in the system. Project development was stalled by ESA listing. Project will be restarted in 1996.

8805302 NE OREGON HATCHERY - GRAND RONDE SATELLITE FACILITIES

Construct spring chinook juvenile acclimation/release and adult capture facilities in the upper Grande Ronde River and Catherine Creek in the Grande Ronde Basin. Utilize facilities to supplement the seriously depressed natural producing spring chinook populations.

Hood Subbasin - Production Projects

8805304 HOOD RIVER PRODUCTION PROGRAM - ODFW - M&E

This project implements actions outlined in the Hood River Master Plan via a series of M&E actions in the Hood River Basin.

9301900 HOOD RIVER PRODUCTION PROGRAM (PARKDALE DESIGN & CONSTRUCTION)

Construct fish collection and holding facilities at Parkdale (2 adult holding ponds, 2 acclimation ponds and spring, weir and trap in creek, residence, bunkhouse, office and storage building, septic field and effluent treatment, well and piping, roads and paving)

John Day Subbasin - Habitat Projects

8400800 NORTH FORK JOHN DAY HABITAT IMPROVEMENT

Restore summer steelhead and spring chinook salmon habitat in the North Fork John Day River watershed.

8402100 MAINSTEM, MIDDLE FORK, AND N. FORK JOHN DAY RIVER

This project improves habitat access, and the quantity and quality of spawning and rearing habitat available for salmon and steelhead.

9303800 NORTH FORK JOHN DAY AREA RIPARIAN FENCING

Resetting and construction of seasonal electric fence and construction of barb wire exclosure fence.

9605300 NORTH FORK JOHN DAY RIVER DREDGE TAILINGS RESTORATION PROJECT

Restore floodplain function to 9 miles of the North Fork John Day River that was dredge mined in the late 30s.

Klickitat Subbasin - Habitat Projects

5512600 UPPER KLICKITAT MEADOWS RIPARIAN RESTORATION

In general this project would increase fish habitat by restoring the function of the meadow habitat. Riparian bank stabilization and cattle exclusion fencing would create a better pool/riffle habitat, and reduce aggradation of the system. Restoration of fish habitat in the upper Klickitat River would be done by, creating pools and providing bank cover in meadow areas mostly by allowing natural aggradation processes to take place. Rehabilitation of the upper Klickitat must entail (1) exclusion of cattle, (2) stabilization of streambanks, and (3) making the channel narrower and higher (aggradation) by trapping sediment from upstream. The Yakama Nation has recently adopted a new grazing policy which will discontinue grazing within the Klickitat River valley above the confluence with Diamond Fork Creek. This incorporates the high mountains meadows

5512700 KLICKITAT BASIN CULVERT REHABILITATION

In general these projects would increase anadromous and resident fish habitat (i.e. spawning & juvenile rearing) and provide an improved up/downstream migration corridor. Conduct engineering surveys and use results to modify improper culverts. This could take the form of repair, replacement, and/or installing baffles within existing culverts to allow for passage.

5512800 LOWER KLICKITAT RIVER RIPARIAN AND IN-CHANNEL HABITAT ENHANCEMENT PROJECT

The project entails revegetation of degraded riparian areas and eroding stream banks, and restoration/enhancement of in-channel habitat features such as large woody debris, spawning gravel, pool area, velocity refugia, and escape and hiding cover (spawning, rearing and holding). Some level of exclosure fencing, irrigation modification, and land acquisition is also anticipated to allow recovery of the stream systems. The project is located in the vicinity of the towns Klickitat, Wahkiakus, and Glenwood in Klickitat County. Streams identified in the project work include Wheeler Canyon, Swale Creek, Little Klickitat River, Mill Creek, Bowman Creek, Summit Creek, White Creek and Trout Creek.

9506800 KLICKITAT PASSAGE/HABITAT PRELIMINARY DESIGN

The purpose of this project is to implement appropriate measures in the Council's Fish and Wildlife Program relevant to the Yakima/Klickitat Fisheries Project and achieve enhancement through off-site mitigation and salmon recovery for the Columbia River and its tributaries. Conduct an integrated watershed analysis using fisheries surveys, population surveys, habitat inventory, engineering surveys and preliminary design of the passage and habitat improvements that will directly benefit spring chinook, coho, fall chinook, summer and winter steelhead.

Lower Columbia Mainstem Subbasin - Habitat Projects

5507300 HARDY CREEK CHUM SALMON SPAWNING HABITAT IMPROVEMENT PROJECT

The project will examine the extent of changes in the channel profile, bed composition and spawning habitat of Hardy Creek resulting from sediment transport and deposition. Hardy Creek (WRIA #28.0303A) is located about 4 miles downstream of Bonneville Dam.

8612400 INSP SERV FOR LITTLE FALL CREEK PASS RE:86-090

Provide for the operation, maintenance, and repair of the Little Fall Creek passage facilities.

Lower Snake Mainstem Subbasin - Production Projects

5504200 1996 PITTSBURG LANDING O&M AND M&E FUNDING

Yearling fall chinook salmon from Lyons Ferry Hatchery will be reared at the Pittsburg Landing acclimation facility. The fish will be acclimated in the temporary facility for four to six weeks before release into the Snake River in late April, 1996. Similar operation with up to 150,000 fish is also scheduled for 1997 and 1998. The Pittsburg Landing site was selected because of the proximity of spawning habitat for returning adults and because of good road access. Fall chinook salmon are known to successfully spawn and rear in the free-flowing Hells Canyon portion of the Snake River (Garcia et al. 1994).

5521300 BIG CANYON CREEK PORTABLE ACCLIMATION/RELEASE FACILITY

Install, operate, maintain and disassemble a portable acclimation facility to assist in recovery and restoration of fall chinook salmon in the lower Clearwater River. This facility will be used to acclimate approximately 150,000 yearling fall chinook salmon from Lyons Ferry Hatchery from early March to late April, beginning in 1997. The fish will be reared and acclimated in the temporary facility for four to six weeks to a size if approximately 10 fish per pound before release into the Clearwater River. Releases will occur during rising stream flow conditions and at night to minimize predation by birds or other fish. Fish will be released at the same time or slightly preceding fall chinook salmon releases at Lyons Ferry Hatchery. The Big Canyon Creek site was selected due to it's accessibility and because of the proximity of spawning habitat for returning adults; fall chinook salmon are known to spawn and rear in the Clearwater River near the mouth of Big Canyon Creek (B. Arnsberg, pers. comm.).

5521400 PITTSBURG LANDING PORTABLE ACCLIMATION/RELEASE FACILITY

Install, operate, maintain and disassemble a portable acclimation facility to assist in recovery and restoration of fall chinook salmon in the Snake River. This facility will be used to acclimate approximately 150,000 yearling fall chinook from Lyons Ferry Hatchery from early March to late April, beginning in 1996 (See LSRCP Application). The yearling salmon (12 fish per pound) will be reared in sixteen 20' x 4' fiberglass tanks located ona gravel parking lot near the river bank. Snake River water will be pumped at a rate of up to 3.6 cubic feet per second (cfs), or 1600 gallons per minute (gpm), into the tanks and discharged back into the river. A thorough description of construction and installation of the facilities is provided in Weller (the Corps 1995) and Stelle (NMFS 1995). The fish will be reared and acclimated in the temporary facility for four to six weeks to a size if approximately 10 fish per pound before release into the Snake River. Releases will occur during rising stream flow conditions and at night to minimize predation by birds or other fish. Fish will be released at the same time or slightly preceding fall chinook salmon releases at Lyons Ferry Hatchery.The Pittsburg Landing site was selected dur to it's accessibility and because of the proximity of spawning habitat for returning adults; fall chinook salmon are known to spawn and rear in the free-flowing Hells Canyon portion of the Snake River (Garcia et al. 1994).

5521500 ROGERSBURG (ABOVE MOUTH OF GRANDE RONDE RIVER) PORTABLE ACCLIMATION/RELEASE FACILITY

Install, operate, maintain and disassemble a portable acclimation facility to assist in recovery and restoration of fall chinook salmon in the Snake River. This facility will be used to acclimate approximately 150,000 yearling fall chinook salmon from Lyons Ferry Hatchery from early March to late April, beginning in 1997. The fish will be reared and acclimated in the temporary facility for four to six weeks to a size if approximately 10 fish per pound before release into the Snake River. Releases will occur during rising stream flow conditions and at night to minimize predation by birds or other fish. Fish will be released at the same time or slightly preceding fall chinook salmon releases at Lyons Ferry Hatchery.

Methow Subbasin - Habitat Projects

5509900 METHOW BASIN SIDE CHANNEL HABITAT CONSTRUCTION

Create side channel habitats for spring chinook salmon in the Methow Basin by excavating new channels and re-connecting existing channels to the mainstem Methow River and its larger tributaries.

9603401 METHOW VALLEY IRRIGATION DISTRICT CONVERSION

Convert the Methow Valley Irrigation from an inefficient open canal system to a pressurized, efficient system. Ninety percent of the water saved will be dedicated, senior priority date intact, to instream flows in the Methow and Twisp Rivers.

Methow Subbasin - Production Projects

9604000 WENATCHEE AND METHOW RIVER COHO RESTORATION

Restore the population of naturally spawning coho in the Wenatchee and Methow River basins by transferring adult and/or juvenile coho from appropriate lower river hatcheries to selected habitats or acclimation ponds.

No specific subbasin - Habitat Projects

5503000 COLUMBIA RIVER BASIN WATERSHED RESTORATION ACTIVITIES: 1996 AND 1997 FUNDING

5507600 COLUMBIA RIVER BASIN TRIBUTARY ADULT FISH PASSAGE

Assess and rehabilitate adult anadromous fish passage facilities on tributaries throughout the Columbia River Basin.

9306600 OREGON FISH SCREENS PROJECT

Installation & fabrication of fish screens in John Day, Umatilla, & Walla Walla Basins / Installation of DeNiel fish passage structures in the Trout Creek (Deschutes Basin), ensuring access for wild summer steelhead to habitat improved by BPA funded restoration efforts.

No specific subbasin - Production Projects

5504900 FISH MEDICINE FIELD STUDIES

Project will ensure availability of fish medicines essential to the protection and survival of threatened and endangered species under NMFS recovery plans and to fulfill tribal, state and federal obligations under US v Oregon andthe CRBFWP.

Okanogan Subbasin - Habitat Projects

9502100 OKANOGAN WATERSHED PLANNING

Initial model watershed planning for Okanogan watershed.

Salmon Subbasin - Habitat Projects

9107100 SNAKE RIVER SOCKEYE SALMON HABITAT

Investigate feasibility of restoring fertility of historic sockeye nursery lakes; if feasible, fertilize lakes; modify existing barrier dams at sockeye nursery lake outlets to allow passage and enumeration.

9202603 IDAHO MODEL WATERSHEDS ADMIN/IMPL. SUPPORT

Lemhi River basin, Pahsimeroi River basin and East Fork Salmon River basin watershed restoration planning and implementation.

9303501 LOWER RED RIVER MEADOW RESTORATION PROJECT

Restore natural river functions, fisheries habitat, and riparian shrub communities in lower Red River Meadow that have been degraded over time. Historic stream meanders that were cut off by dredging activity will be reconnected to the existing channel. Native riparian shrub communities will be restored to provide bank stabilization, cover, and temperature control.

9306200 SALMON RIVER ANADROMOUS FISH PASSAGE ENHANCEMENT, IDAHO

The purpose of this project is to identify fish passage problems, and making recommendations for project implementation followed by the implementation of habitat enhancement and passage restoration projects on specific reaches of those streams identified above. Improvements include fishways, diversion headgates, improved water distribution, and acquiring instream flow agreements.

9401500 IDAHO FISH SCREENING IMPROVEMENT (SEE NEW NPPC)

Enhance passage of juvenile and adult salmon in Idaho's Anadromous fish corridors by consolidating and screening diversions.

9401700 IDAHO MODEL WATERSHED HABITAT PROJECTS

Develop Resource Management System (RMS) plans for land owners along the priority stream segments of the Lemhi, Pahsimeroi and East Fork of the Salmon River. The RMS would have the objective of maintaining or enhancing the stream side vegetative cover by controlling livestock grazing along the streams through best management practices.

9405000 SALMON RIVER HABITAT O&M/MONITORING & EVALUATION

Maintain habitat improvements and evaluate benefits.

9600700 UPPER SALMON RIVER DIVERSION CONSOLIDATION PROGRAM

Consolidate diversions at two upper Salmon River sites: S-14 (near Salmon, ID) would consolidate four diversions into one, and S-28 (near Challis, ID) would incorporate three diversions and one unscreened pump intake into one diversion. In addition, a new screen at S-32 (phase I of the project) would be constructed to accomodate the additional flow from the consolidated diversions.

Salmon Subbasin - Production Projects

5514000 SALMON RIVER PRODUCTION PROGRAM

Continue development and emergency implementation of high priority supplementation projects; including captive broodstock; stock transfers; hatchery practice and facility reform; side stream incubation, rearing and release; and monitoring and evaluation to rebuild naturally producing Snake River chinook salmon and salmon trout.

9107200 REDFISH LAKE SOCKEYE SALMON CAPTIVE

Establish captive broodstocks of Redfish Lake sockeye salmon, grow to maturity, produce progeny for release to Redfish and other Stanley Basin lakes. Monitor sockeye/kokanee populations, evaluate smolt outmigration by release strategy and lineage.

9204000 REDFISH LAKE SOCKEYE SALMON CAPTIVE BROODSTOCK REARING AND RESEARCH

Incubate and rear juvenile Redfish Lake sockeye salmon; compare freshwater and saltwater rearing for sockeye salmon.

9700100 CAPTIVE REARING INITIATIVE FOR SALMON RIVER CHINOOK SALMON

Rear juvenile chinook to adulthood in captivity and release adults back into natal streams to spawn with each other and naturally returning adults (if any) in order to maintain a minimum level of natural spawners each year. Implement associated M&E to assist future management decisions about the use of hatcheries to preserve salmon populations.

Tucannon Subbasin - Habitat Projects

9202602 EASTERN WA MODEL WATERSHED COORDINATORS

Resource coordinator positions for Asotin Creek, Pataha Creek, and Tucannon River Model Watersheds

9401800 WASHINGTON MODEL WATERSHED HABITAT PROJECTS

Implement projects developed under model watershed plans in Asotin Creek, Pataha Creek and Tucannon River.

Umatilla Subbasin - Habitat Projects

8343600 UMATILLA PASSAGE O&M

Operate and maintain passage facilities at 6 irrigation diversion sites: Three Mile Dam and WEID Canal screens, Maxwell Canal screens, Westland ladder and canal screens, Feed Canal ladder and canal screens, and Stanfield ladder and canal screens, and Dillion canal screens.

8710001 UMATILLA RIVER BASIN ANADROMOUS FISH HABITAT ENHANCEMENT

Conduct watershed project planning and education process by identifying problems and developing creative solutions to land use problems impacting fisheries habitat in the Umatilla River Basin. Implement maintenance and continued instream and riparian habitat enhancement projects for benefits to spring & fall chinook, coho, and steelhead.

8710002 UMATILLA HABITAT IMPROVEMENT / ODFW

This project improves habitat access, and the quantity and quality of spawning and rearing habitat available to steelhead.

8802200 UMATILLA RIVER BASIN TRAP AND HAUL PROGRAM

Provide low-water passage of fish in the lower Umatilla River by trapping fish and hauling to sections of the river with adequate water. Project has immediate survival benefits for spring & fall chinook, coho, and steelhead.

8902700 POWER/REPAY O&M FOR USBR CPR PUMPING PROJ

BPA pays for power to operate pumps and associated facilities needed to carry out water exchanges to enhance flows for fish runs in the Umatilla river

9506000 UMATILLA RIVER RIPARIAN CORRIDORS: SQUAW CREEK WATERSHED PROJECT (ANADROMOUS PORTION)

Apply a watershed protection, restoration and management approach to the Squaw Creek sub-watershed to maximize long-term benefits to wildlife and anadromous and resident fish habitat

9608500 COORDINATION OF WATERSHED PROJECTS IN UMATILLA RIVER BASIN

Provide coordination, through a Umatilla Basin Watershed Council Coordinator, for 1) planning of sub-watershed enhancement and restoration projects and for 2) watershed education projects with the public and schools grade K through 12.

Umatilla Subbasin - Production Projects

8343500 UMATILLA HATCHERY SATELLITE FACILITIES OPERATION AND MAINTENANCE

Acclimate juvenile salmon and steelhead prior to release into the Umatilla River; collect, hold and spawn adult coho and chinook salmon and summer steelhead and provide eggs to Umatilla Hatchery for incubation, rearing and later release into the Umatilla River.

8903500 UMATILLA HATCHERY OPERATIONS AND MAINTENANCE

Umatilla Fish Hatchery provides the majority of the fish production for restoring salmon and supplementing steelhead populations in the Umatilla River.

9000500 UMATILLA HATCHERY - MONITORING/EVAL PROJECTS

Evaluate effects and efficiency of compartmented raceways, rearing density and the use of supplemental oxygen on adult survival of chinook salmon and steelhead.

9101400 UMATILLA HATCHERY SATELLITE FACILITIES - PLANNING, SITING, DESIGN, AND CONSTRUCTION

Umatilla Hatchery satellite facilities will be constructed for acclimation/release of salmon and steelhead smolts in the Umatilla River Basin.

Walla Walla Subbasin - Habitat Projects

9601100 JUVENILE FISH SCREENS AND SMOLT TRAPS AT IRRIGATION DIVERSION DAMS ON THE WALLA WALLA AND TOUCHET RIVERS IN OREGON AND WASHINGTON

The goal of this project is to provide for safe outmigration of smolts in order to enhance summer steelhead and restore spring chinook salmon runs in the Walla Walla Subbasin. The proposed screen/trap facilities would be used to capture smolts for trucking from the Little Walla Walla Diversion to the mouth of the Walla Walla River when conditions are not adequate for safe smolt outmigration (similar to Umatilla program). Existing screen facilities do not provide adequate conditions for bypassing or trapping smolts for transportation.

9601200 ADULT ANADROMOUS FISH PASSAGE IMPROVEMENT AT IRRIGATION DIVERSION DAMS ON THE WALLA WALLA RIVER

The goal of this project is to provide for safe adult passage at several irrigation diversion dams in order to enhance summer steelhead and restore spring chinook runs in the Walla Walla River Basin.

9604600 RIPARIAN AND FISH HABITAT ANALYSIS, PROTECTION AND ENHANCEMENT TO INCREASE NATURAL PRODUCTION OF STEELHEAD AND SPRING CHINOOK IN THE WALLA WALLA RIVER BASIN

9606400 WALLA WALLA COUNTY COOPERATIVE WATERSHED PLAN (DEVELOPMENT AND IMPLEMENTATION)

I. Develop a comprehensive cooperative watershed management plan that will:
   A. Identify the needs and criteria for developing and implementing an integration of conservation efforts and farming practices that will result in the restabilization and restoration of healthy watersheds in Walla Walla, Columbia and Umatilla Counties. Waters include: the Walla Walla River, the Touchet River, Mill Creek and their tributaries.
   B. Educate and inform the agricultural producers, the public, and cooperating entities as to the historical importance of watersheds, their function in sustaining clean, abundant water for use by man, fish & wildlife populations, by an extensive watershed management educational program that stresses the importance of watershed management from the top to the bottom.

C. Prioritize Watershed usage and identify critical areas in desperate need of streambank restabilization and riparian restoration and implement the needed measures to correct the problem.

II. Implement demonstration projects that integrate acceptable conservation practices with Best Management Practices to conserve soil, prevent erosion, improve water quality, restabilize stream banks and restore riparian zones.

Wenatchee Subbasin - Production Projects

9604000 WENATCHEE AND METHOW RIVER COHO RESTORATION

Restore the population of naturally spawning coho in the Wenatchee and Methow River basins by transferring adult and/or juvenile coho from appropriate lower river hatcheries to selected habitats or acclimation ponds.

Yakima Subbasin - Habitat Projects

5510200 YAKIMA RIVER BASIN SIDE CHANNEL SURVEY AND REHABILITATION

Survey the basin by remote sensing, with ground-truthing where necessary, to locate abandoned and seasonally dewatered areas. Develop prescriptions for rehabilitation to prevent juvenile stranding. Where feasible, write restoration prescriptions to reconnect abandoned channels, to increase rearing habitat.

5510500 CABIN CREEK HABITAT ENHANCEMENT PROJECT

The project entails the introduction of large trees with attached root wads and boulders into a stream channel that is totally devoid of roughness elements that create pools and velocity refuge for fish. Planting of riparian vegetation in areas devoid of vegetation or exhibiting bank erosion is also planned. The project is located approximately 1.5 miles northwest of Easton, Washington.

5510800 UPPER YAKIMA TRIBUTARY IRRIGATION IMPROVEMENT

Surface diversions off Little Creek, Big Creek, Swauk Creek, Taneum Creek, Manastash Creek and the Teanaway River dewater the lower channels, or cause flows to decrease to the point that fish cannot access habitat above the diversions. This project would focus on converting surface-diversions to wells, or reducing conveyance loss when most cost-effective.

5510900 TEANAWAY RIVER INSTREAM FLOW RESTORATION

Restoration of instream flows in the Teanaway River through the lease or purchase of land and water rights.

5511300 LITTLE NACHES RIVER RIPARIAN AND IN-CHANNEL HABITAT ENHANCEMENT PROJECT

The project entails revegetation of degraded riparian areas and eroding stream banks, and restoration/enhancement of deficient in-channel habitat features such as large woody debris, pool area, velocity refugia, and escapement and hiding cover. Construction of barriers or exclosures along the river is also anticipated with this project to allow recovery of the riparian and stream channels. The project is located approximately six to twelve miles above the town of Cliffdell in Yakima County. All identified restoration work would be along, or in, the mainstem of the Little Naches River.

5511600 YAKIMA BASIN SIDE CHANNELS

The project entails revegetation of degraded riparian areas and eroding stream banks, and rehabilitation of braided stream channels and side channel rearing habitat. Placement of wood and boulders in the side channels may be necessary to provide hiding and escape cover. Revegetation of adjacent riparian corridors is also sorely needed due to past diking, housing development, recent floods, and conversion of lands to pasture and agriculture. Some level of exclosure fencing and land acquisition is also anticipated to allow recovery of the riverine habitat. The project is located between the towns of Gleed and Naches in Yakima County and includes side and overflow channels of the Naches River.

5511700 YAKIMA RIVER REARING HABITAT ENHANCEMENT, BETWEEN SELAH AND UNION GAPS

Much of the Yakima and lower Naches River was diked and channelized by the Army Corps of Engineers after the 1933 flood. Impacts from diking included loss of side channel and alcove habitat by filling and channel down cutting, lost floodplain storage, increased channel velocities and loss of riparian vegetation. The project would focus on reestablishing side channel and alcove habitat, improving existing velocity cover by building deflectors and adding large woody debris, and restoring riparian habitat by planting native riparian vegetation.

5512000 TOPPENISH/SIMCOE INSTREAM FLOW RESTORATION

Restoration of instream flows in Toppenish and Simcoe creeks through the lease or purchase of land and water rights, or substitution of water sources.

9105700 YAKIMA PHASE 2 SCREEN FABRICATION

Fabricate fish screens to divert anadromous salmonids from Yakima tributary irrigation canals.

9107500 YAKIMA PHASE II SCREENS - CONSTRUCTION

Install new fish screens at all significant diversions in the Yakima River Basin to keep juvenile salmon and steelhead from being diverted and lost in the canals during outmigration. Also includes adult passage improvements at a few sites.

9200900 YAKIMA SCREENS - PHASE II - O & M

Provide preventative and major maintenance on Yakima Basin Phase 2 fish screen facilities. project.

9503300 O&M OF YAKIMA FISH PROTECTION, MITIGATION & ENHANCEMENT FACILITIES

This program provides for O&M by Reclamation of BPA owned anadromous fish passage and protective facilities within the Yakima River Basin. Current facilities include numerous irrigation system fish screens and one major adult fish trapping structure.

9603501 SATUS WATERSHED RESTORATION

Yakima Subbasin - Production Projects

8811500 YAKIMA HATCHERY - CONSTRUCTION

This project holds capital expenses for construction of the upper Yakima River spring chinook hatchery at Cle Elum, Washington, and three satellite acclimation facilities in the upper Yakima River Basin. The project also holds hatchery O&M expenses in RPA 1501.

8812001 YAKIMA/KLICKITAT FISHERIES PROJECT MANAGEMENT

Provide the YIN, the Lead Agency, with the appropriate resources to effectively participate at an acceptable level in the ongoing activities associated with the planning, development, management, and implementation of the YKFP.

8812004 HATCHERY TRAINING AND EDUCATION

Supports the proposed manpower of the YKFP facilities.

9006900 YAKIMA HATCHERY - FINAL DESIGN

Final design of Yakima River spring chinook central outplanting facility at Cle Elum, WA, and preliminary design for three satellite acclimation facilities.

Table 5.10- 2 FY 1997-2001 project costs of BPA funded production and habitat projects

			FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
	Snake Basin							
8909800	IDAHO SUPPLEMENTATION STUDIES (ISS)	IDFG	$875,000	$956,750	$1,004,588	$1,054,817	$1,107,558	$4,998,713
8909801	SALM SUPPLEMENTATION STUDIES IN IDAHO RIVERS - USFWS	USFWS	$125,000	$125,000	$150,000	$150,000	$150,000	$700,000
8909802	SALMON SUPPLEMENTATION STUDIES IN ID RV - NEZ PERCE TRIBE	Nez Perce Tribe	$270,000	$275,000	$280,000	$280,000	$280,000	$1,385,000
9005500	STEELHEAD SUPPLEMENTATION STUDIES IN IDAHO RIVERS	IDFG	$220,000	$231,000	$242,550	$254,677	$267,411	$1,215,638
9202200	WILD SMOLT BEHAVIOR/PHYSIOLOGY (ESA)	NMFS	$350,000	$447,000	$469,000	$493,000		$1,759,000
9403400	ASSESSING SUMMER/FALL CHINOOK RESTORATION IN THE SNAKE RIVER BASIN	Nez Perce Tribe	$203,000	$220,000	$150,000	$160,000	$160,000	$893,000
9602000	1997 HATCHERY PIT TAG STUDY	IDFG	$550,000					$550,000
	SUBTOTAL		$2,593,000	$2,254,750	$2,296,138	$2,392,494	$1,964,969	$11,501,351
	Basin-wide							
5506100	HYDRO REGULATOR MODEL DEVELOPMENT	Columbia River Inter-Tribal Fish Commission	$92,000	$92,000	$92,000			$276,000
8201300	CODED-WIRE TAG RECOVERY	PSMFC	$1,408,294	$1,638,703	$1,720,638	$1,806,670	$1,897,004	$8,471,309
8331900	NEW FISH TAG SYSTEM	NMFS	$800,000	$850,000	$875,000	$900,000	$900,000	$4,325,000
5503000	COLUMBIA RIVER BASIN WATERSHED RESTORATION ACTIVITIES: 1996 AND 1997 FUNDING	Columbia River Inter-Tribal Fish Commission	$500,000					$500,000
5504900	FISH MEDICINE FIELD STUDIES	Western Regional INAD Project	$60,000	$65,000	$70,000			$195,000
5507600	COLUMBIA RIVER BASIN TRIBUTARY ADULT FISH PASSAGE	CBFWF	$0	$1,000,000	$1,500,000	$500,000		$3,000,000
9306600	OREGON FISH SCREENS PROJECT	ODFW	$420,000	$426,000	$432,000	$440,000	$500,000	$2,218,000
	SUBTOTAL		$3,280,294	$4,071,703	$4,689,638	$3,646,670	$3,297,004	$18,985,309
	Clearwater Subbasin							
5520700	CAPTIVE BROODSTOCK ARTIFICIAL PROPAGATION	Nez Perce Tribe	$0	$97,000	$100,000	$105,000	$110,000	$412,000
8909803	SALMON SUPPLEMENTATION STUDIES IN ID RIVERS - SHOSHONE-BANNOCK TRIBES	Shoshone-Bannock Tribes	$172,000	$181,000	$190,000	$200,000	$210,000	$953,000
9303600	HAYSFORK GLORY HOLE, NEWSOME CREEK PLACER MINE SILT TRAP - NEZ PERCE TRIBE	Nez Perce Tribe	$30,000	$15,000	$15,000	$15,000		$75,000

			FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
8335000	NEZ PERCE TRIBAL HATCHERY	Nez Perce Tribe	$6,660,000	$4,325,000	$2,215,000	$1,920,000	$2,000,000	$17,120,000
9604300	JOHNSON CREEK ARTIFICIAL PROPAGATION ENHANCEMENT	Nez Perce Tribe	$792,793	$425,000	$375,000	$375,000	$375,000	$2,342,793
	SUBTOTAL		$7,654,793	$5,043,000	$2,895,000	$2,615,000	$2,695,000	$20,902,793
	Deschutes Subbasin							
9303000	BUCK HOLLOW WATERSHED ENHANCEMENT (SWCD)	Wasco Co SWCD	$110,000	$110,000	$110,000	$110,000	$55,000	$495,000
9304500	BUCK HOLLOW WATERSHED ENHANCEMENT (ODFW)	ODFW	$75,000	$75,000	$75,000	$75,000	$75,000	$375,000
9404200	TROUT CREEK OPERATION & MAINTENANCE	ODFW	$250,000	$250,000	$250,000	$250,000	$250,000	$1,250,000
8902900	HOOD RIVER PRODUCTION PROGRAM - PELTON LADDER - HATCHERY	ODFW	$142,000	$146,000	$150,000	$155,000	$160,000	$753,000
9500700	HOOD RIVER PRODUCTION PROGRAM - PGE O&M	PGE	$56,000	$57,000	$58,000	$59,000	$60,000	$290,000
	SUBTOTAL		$633,000	$638,000	$643,000	$649,000	$600,000	$3,163,000
	Fifteenmile Subbasin							
9304000	FIFTEENMILE CREEK HABITAT IMPROVEMENT	ODFW	$325,000	$300,000	$200,000	$200,000	$200,000	$1,225,000
	Grande Ronde Subbasin							
5506000	MONITORING FINE SEDIMENT LEVELS IN SUBSTRATE AND OVERWINTER SEDIMENTATION IN CLEANED GRAVELS IN PORTIONS OF THE GRANDE RONDE AND JOHN DAY RIVERS	Columbia River Inter-Tribal Fish Commission	$30,000	$30,000	$30,000	$30,000	$30,000	$150,000
5519100	MEADOW CREEK INSTREAM STRUCTURE AND RIPARIAN EVALUATION	USFS	$60,000	$60,000	$65,000	$65,000	$65,000	$315,000
9202604	SPRING CHINOOK SALMON EARLY LIFE HISTORY	ODFW	$526,000	$267,000	$283,000	$300,000	$318,000	$1,694,000
9604400	GRANDE RONDE BASIN SPRING CHINOOK CAPTIVE BROODSTOCK PROGRAM	ODFW	$2,212,400	$380,000	$403,000	$427,000	$453,000	$3,875,400
5507000	GRANDE RONDE SUBBASIN WATERSHED RESTORATION	CTUIR	$150,000	$200,000	$215,000	$230,000	$245,000	$1,040,000
5520900	WALLOWA COUNTY/NEZ PERCE TRIBE SALMON HABITAT RECOVERY PLAN IMPLEMENTATION	Nez Perce Tribe	$50,000	$50,000	$50,000	$50,000	$50,000	$250,000
8402500	GRANDE RONDE HABITAT ENHANCEMENT	ODFW	$250,000					$250,000
9402700	GRANDE RONDE MODEL WATERSHED HABITAT PROJECTS	Grande Ronde Model Watershed Program (Blue Mtns.)	$1,439,000	$2,205,000	$650,000	$650,000	$650,000	$5,594,000
9202601	GRANDE RONDE MODEL WATERSHED - ADMIN/IMPL./RESEARCH	USFS	$305,000	$295,000	$295,000	$295,000	$295,000	$1,485,000
9403900	WALLOWA BASIN PROJECT PLANNING - G. R. MODEL	Nez Perce Tribe	$50,494	$53,152	$55,950	$58,894	$61,994	$280,484

			FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
	WATERSHED							
8805301	NORTHEAST OREGON OUTPLANTING FACILITIES MASTER PLAN - NEZ PERCE TRIBE	Nez Perce Tribe	$1,200,000	$3,000,000	$4,000,000	$3,000,000	$2,000,000	$13,200,000
8805302	NE OREGON HATCHERY - GRAND RONDE SATELLITE FACILITIES	CTUIR	$1,400,000	$1,200,000	$200,000	$200,000	$200,000	$3,200,000
	SUBTOTAL		$7,672,894	$7,740,152	$6,246,950	$5,305,894	$4,367,994	$31,333,884
	Hood Subbasin							
8805303	HOOD RIVER PRODUCTION PROGRAM - CTWS - M&E	Warm Springs Tribe	$515,000	$535,000	$555,000	$580,000	$605,000	$2,790,000
8805304	HOOD RIVER PRODUCTION PROGRAM - ODFW - M&E	ODFW	$425,000	$450,000	$475,000	$500,000	$525,000	$2,375,000
9301900	HOOD RIVER PRODUCTION PROGRAM (PARKDALE DESIGN & CONSTRUCTION)	ODFW	$2,570,000					$2,570,000
9500700	HOOD RIVER PRODUCTION PROGRAM - PGE O&M	PGE	$56,000	$57,000	$58,000	$59,000	$60,000	$290,000
	SUBTOTAL		$3,566,000	$1,042,000	$1,088,000	$1,139,000	$1,190,000	$8,025,000
	John Day Subbasin							
5506000	MONITORING FINE SEDIMENT LEVELS IN SUBSTRATE AND OVERWINTER SEDIMENTATION IN CLEANED GRAVELS IN PORTIONS OF THE GRANDE RONDE AND JOHN DAY RIVERS	Columbia River Inter-Tribal Fish Commission	$30,000	$30,000	$30,000	$30,000	$30,000	$150,000
8400800	NORTH FORK JOHN DAY HABITAT IMPROVEMENT	USFS	$30,000	$30,000	$30,000	$30,000	$30,000	$150,000
8402100	MAINSTEM, MIDDLE FORK, AND N. FORK JOHN DAY RIVER	ODFW	$350,000	$365,000	$380,000	$395,000	$410,000	$1,900,000
9303800	NORTH FORK JOHN DAY AREA RIPARIAN FENCING	USFS	$80,000	$80,000	$80,000	$75,000	$75,000	$390,000
9605300	NORTH FORK JOHN DAY RIVER DREDGE TAILINGS RESTORATION PROJECT	USFS	$100,000	$100,000	$100,000	$20,000	$20,000	$340,000
	SUBTOTAL		$590,000	$605,000	$620,000	$550,000	$565,000	$2,930,000
	Klickitat Subbasin							
8903000	EFFECTS OF ACCLIMATION ON THE SURVIVAL OF SPRING CHINOOK SALMON AKA: EVAL OF PRE-REL TEMP ACCLIMATION AT KLICKITAT HTCH	WDFW	$36,121	$37,204				$73,325
5512600	UPPER KLICKITAT MEADOWS RIPARIAN RESTORATION	Yakama Indian Nation	$32,292	$55,890				$88,182
5512700	KLICKITAT BASIN CULVERT REHABILITATION	Yakama Indian Nation	$35,000	$95,800				$130,800
5512800	LOWER KLICKITAT RIVER RIPARIAN AND IN-CHANNEL HABITAT ENHANCEMENT PROJECT	Yakama Indian Nation	$665,280	$631,680	$631,680	$631,680	$33,600	$2,593,920

			FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
9506800	KLICKITAT PASSAGE/HABITAT PRELIMINARY DESIGN	Yakama Indian Nation	$776,511	$823,048	$924,775	$924,775	$924,775	$4,373,884
	SUBTOTAL		$1,545,204	$1,643,622	$1,556,455	$1,556,455	$958,375	$7,260,111
	Lower Columbia Mainstem Subbasin							
5505900	PREDATION BY FISH-EATING BIRDS ON JUVENILE SALMONIDS IN THE COLUMBIA RIVER BASIN	Oregon State University/CRITFC	$125,000	$250,000	$350,000	$300,000	$250,000	$1,275,000
8200300	SELECTIVE PREDATION/DEVELOPMENT OF PREY PROTECTION	National Biological Service	$470,798	$474,246	$447,919			$1,392,963
8331901	ESSENTIAL M&E INFRASTRUCTURE - PIT TAG MONITOR PROCUREMENT AND INSTALLATION	NMFS	$2,500,000	$3,000,000	$1,300,000	$700,000	$500,000	$8,000,000
8401400	SMOLT MONITORING AT FEDERAL DAMS	PSMFC	$800,000	$810,000	$900,000	$1,000,000	$1,000,000	$4,510,000
8712700	SMOLT MONITORING BY NON-FEDERAL ENTITIES	PSMFC	$1,212,704	$1,268,120	$1,333,250	$1,407,281	$1,480,241	$6,701,596
8740100	TRAVEL TIME AND SURVIVAL SMOLT PHYSIOLOGY	National Biological Service	$469,000	$480,000	$492,000	$504,000	$517,000	$2,462,000
9204101	EVALUATION OF ADULT SALMON AND STEELHEAD MIGRATION PAST DAMS AND THROUGH RESERVOIRS IN THE LOWER COLUMBIA RIVER AND INTO TRIBUTARIES	the Corps	$350,000	$200,000	$375,000	$375,000		$1,300,000
9300802	SYMPTOMS OF GAS BUBBLE TRAUMA INDUCED IN SALMON BY TOTAL DISSOLVED GAS PRESSURE SUPERSATURATION IN THE SNAKE AND COLUMBIA RIVERS	Columbia River Inter-Tribal Fish Commission	$900,000	$900,000	$900,000			$2,700,000
9306000	COLUMBIA RIVER TERMINAL FISHERIES RESEARCH PROJECT	ODFW	$900,000	$900,000	$900,000	$900,000	$900,000	$4,500,000
9402600	PACIFIC LAMPREY RESEARCH AND RESTORATION PROJECT	CTUIR	$352,000	$380,000	$388,000	$408,000	$430,000	$1,958,000
9602100	GAS BUBBLE DISEASE MONITORING AND RESEARCH OF JUVENILE SALMONIDS	National Biological Service	$750,000	$586,000	$609,000	$432,000	$450,000	$2,827,000
9602400	CHANGES IN GAS BUBBLE DISEASE SIGNS AND SURVIVAL OF MIGRATING JUVENILE SALMONIDS EXPERIMENTALLY EXPOSED TO SUPERSATURATED GASES	NMFS	$228,000					$228,000
5507300	HARDY CREEK CHUM SALMON SPAWNING HABITAT IMPROVEMENT PROJECT	USFWS	$83,790	$127,880	$92,169	$101,386		$405,225
8612400	INSP SERV FOR LITTLE FALL CREEK PASS RE:86-090	ODFW	$2,000					$2,000
	SUBTOTAL		$9,143,292	$9,376,246	$8,087,338	$6,127,667	$5,527,241	$38,261,784

			FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
	Lower Mid-Columbia Mainstem Subbasin							
5503800	1996-97 EVALUATION OF JUVENILE FALL CHINOOK STRANDING ON THE HANFORD REACH	WDFW	$200,000	$10,000	$5,000	$5,000	$5,000	$225,000
9603201	HANFORD K-BASIN FALL CHINOOK ACCLIMATION AND MASTER PLAN DEVELOPMENT	Yakama Indian Nation	$358,400	$394,240	$421,120	$446,880	$477,120	$2,097,760
	SUBTOTAL		$558,400	$404,240	$426,120	$451,880	$482,120	$2,322,760
	Lower Snake Mainstem Subbasin							
5521200	MONITORING AND EVALUATION OF LYONS FERRY HATCHERY FALL CHINOOK ABOVE LOWER GRANITE DAM	Nez Perce Tribe	$0	$135,000	$140,000	$145,000	$150,000	$570,000
8332300	SMOLT CONDITION & ARRIVAL TIMING AT LWR GRANITE	IDFG	$342,000	$359,000	$377,000	$396,000	$415,000	$1,889,000
9102800	MONITORING THE SMOLT MIGRATIONS OF WILD SNAKE RIVER SPRING/SUMMER CHINOOK SALMON	NMFS	$303,800	$167,500	$348,800	$184,800	$196,000	$1,200,900
9102900	LIFE HISTORY OF FALL CHIN IN COL RIVER BASIN	National Biological Service	$1,000,000	$900,000	$900,000	$900,000		$3,700,000
5504200	1996 PITTSBURG LANDING O&M AND M&E FUNDING	USFWS	$0					$0
5521300	BIG CANYON CREEK PORTABLE ACCLIMATION/RELEASE FACILITY	Nez Perce Tribe	$0	$245,000	$253,000	$261,000	$269,000	$1,028,000
5521400	PITTSBURG LANDING PORTABLE ACCLIMATION/RELEASE FACILITY	Nez Perce Tribe	$0	$253,000	$261,000	$269,000	$277,000	$1,060,000
5521500	ROGERSBURG (ABOVE MOUTH OF GRANDE RONDE RIVER) PORTABLE ACCLIMATION/RELEASE FACILITY	Nez Perce Tribe	$0	$245,000	$253,000	$261,000	$269,000	$1,028,000
9202602	EASTERN WA MODEL WATERSHED COORDINATORS	Washington State Conservation Commission	$162,000	$168,000	$173,000	$179,000	$186,000	$868,000
9401800	WASHINGTON MODEL WATERSHED HABITAT PROJECTS	Conservation Districts	$600,000	$650,000	$700,000	$700,000	$750,000	$3,400,000
	SUBTOTAL		$2,407,800	$3,122,500	$3,405,800	$3,295,800	$2,512,000	$14,743,900
	Methow Subbasin							
5509900	METHOW BASIN SIDE CHANNEL HABITAT CONSTRUCTION	Yakama Indian Nation	$527,850	$434,700	$434,700			$1,397,250
9604000	WENATCHEE AND METHOW RIVER COHO RESTORATION	Yakama Indian Nation	$324,800	$340,480	$364,000	$380,800	$399,840	$1,809,920
9603401	METHOW VALLEY IRRIGATION DISTRICT CONVERSION	Yakama Indian Nation	$861,000					$861,000

			FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
	SUBTOTAL		$1,713,650	$775,180	$798,700	$380,800	$399,840	$4,068,170
	Okanogan Subbasin							
9502100	OKANOGAN WATERSHED PLANNING	Colville Confederated Tribes	$125,000	$125,000	$150,000	$150,000		$550,000
	Salmon Subbasin							
9107200	REDFISH LAKE SOCKEYE SALMON CAPTIVE	IDFG	$663,000	$700,000	$700,000	$500,000	$500,000	$3,063,000
9204000	REDFISH LAKE SOCKEYE SALMON CAPTIVE BROODSTOCK REARING AND RESEARCH	NMFS	$500,000	$500,000	$500,000	$500,000	$500,000	$2,500,000
9700100	CAPTIVE REARING INITIATIVE FOR SALMON RIVER CHINOOK SALMON	IDFG	$731,532	$689,604	$484,604	$484,604	$484,604	$2,874,948
5520100	O'HARA WATERSHED RESTORATION	USFS	$35,000	$5,000	$5,000			$45,000
9107100	SNAKE RIVER SOCKEYE SALMON HABITAT	Shoshone-Bannock Tribes	$600,000	$700,000	$700,000	$700,000	$700,000	$3,400,000
9303501	LOWER RED RIVER MEADOW RESTORATION PROJECT	Pocket Water Inc/River Master Engineering	$729,000	$500,000	$500,000	$500,000	$500,000	$2,729,000
9401700	IDAHO MODEL WATERSHED HABITAT PROJECTS	Lemhi and Custer Soil and Water Conservation Districts	$200,000	$100,000	$100,000	$150,000		$550,000
9405000	SALMON RIVER HABITAT O&M/MONITORING & EVALUATION	Shoshone-Bannock Tribes	$268,000	$281,000	$295,000	$310,000	$325,000	$1,479,000
9607700	MEADOW CREEK RESTORATION	USFS	$69,000	$39,000	$37,000	$14,500	$2,000	$161,500
9202603	IDAHO MODEL WATERSHEDS ADMIN/IMPL. SUPPORT	ID Soil Conservation Commission	$196,900	$202,700	$208,800	$217,900	$224,400	$1,050,700
5514000	SALMON RIVER PRODUCTION PROGRAM	Shoshone-Bannock Tribes	$50,000	$975,000	$475,000	$200,000	$200,000	$1,900,000
9306200	SALMON RIVER ANADROMOUS FISH PASSAGE ENHANCEMENT, IDAHO	Lemhi and Custer Soil and Water Conservation Districts	$100,000	$100,000	$100,000			$300,000
9401500	IDAHO FISH SCREENING IMPROVEMENT (SEE NEW NPPC)	IDFG	$1,000,000	$2,000,000	$2,000,000	$2,000,000		$7,000,000
9600700	UPPER SALMON RIVER DIVERSION CONSOLIDATION	Shoshone-Bannock	$645,000	$1,547,500	$250,000	$37,500	$250,000	$2,730,000

			FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
	PROGRAM	Tribes						
	SUBTOTAL		$5,787,432	$8,339,804	$6,355,404	$5,614,504	$3,686,004	$29,783,148
	Tucannon Subbasin							
9202602	EASTERN WA MODEL WATERSHED COORDINATORS	Washington State Conservation Commission	$162,000	$168,000	$173,000	$179,000	$186,000	$868,000
9401800	WASHINGTON MODEL WATERSHED HABITAT PROJECTS	Conservation Districts	$600,000	$650,000	$700,000	$700,000	$750,000	$3,400,000
	SUBTOTAL		$762,000	$818,000	$873,000	$879,000	$936,000	$4,268,000
	Umatilla Subbasin							
8710001	UMATILLA RIVER BASIN ANADROMOUS FISH HABITAT ENHANCEMENT	CTUIR	$275,000	$285,000	$295,000	$305,000	$315,000	$1,475,000
8710002	UMATILLA HABITAT IMPROVEMENT / ODFW	ODFW	$235,000	$250,000	$265,000	$280,000	$295,000	$1,325,000
9506000	UMATILLA RIVER RIPARIAN CORRIDORS: SQUAW CREEK WATERSHED PROJECT (ANADROMOUS PORTION)	CTUIR	$1,300,000	$2,700,000	$200,000	$200,000	$200,000	$4,600,000
9608500	COORDINATION OF WATERSHED PROJECTS IN UMATILLA RIVER BASIN	Umatilla Basin Watershed Council	$65,000	$68,000	$72,000	$75,000	$79,000	$359,000
8343600	UMATILLA PASSAGE O&M	US BOR	$421,200	$454,896	$491,288	$530,591	$573,038	$2,471,013
8802200	UMATILLA RIVER BASIN TRAP AND HAUL PROGRAM	CTUIR	$430,000	$450,000	$475,000	$500,000	$500,000	$2,355,000
8902700	POWER/REPAY O&M FOR USBR CPR PUMPING PROJ	PPL/UECA	$750,000	$750,000	$750,000	$750,000	$750,000	$3,750,000
8343500	UMATILLA HATCHERY SATELLITE FACILITIES OPERATION AND MAINTENANCE	CTUIR	$425,000	$450,000	$475,000	$500,000		$1,850,000
8903500	UMATILLA HATCHERY OPERATIONS AND MAINTENANCE	ODFW	$1,250,000	$1,313,000	$1,378,000	$1,447,000	$1,519,000	$6,907,000
9000500	UMATILLA HATCHERY - MONITORING/EVAL PROJECTS	ODFW	$545,000	$577,700	$612,362	$649,104	$688,050	$3,072,216
9101400	UMATILLA HATCHERY SATELLITE FACILITIES - PLANNING, SITING, DESIGN, AND CONSTRUCTION	CTUIR	$2,000,000					$2,000,000
	SUBTOTAL		$7,696,200	$7,298,596	$5,013,650	$5,236,695	$4,919,088	$30,164,229
	Walla Walla Subbasin							
9604600	RIPARIAN AND FISH HABITAT ANALYSIS, PROTECTION AND ENHANCEMENT TO INCREASE NATURAL PRODUCTION OF STEELHEAD AND SPRING CHINOOK IN THE WALLA WALLA RIVER BASIN	CTUIR	$200,000	$215,000	$230,000	$245,000	$260,000	$1,150,000
9606400	WALLA WALLA COUNTY COOPERATIVE WATERSHED PLAN (DEVELOPMENT AND IMPLEMENTATION)	Walla Walla County Conservation	$100,000	$100,000	$75,000	$50,000	$50,000	$375,000

			FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
		District						
9601100	JUVENILE FISH SCREENS AND SMOLT TRAPS AT IRRIGATION DIVERSION DAMS ON THE WALLA WALLA AND TOUCHET RIVERS IN OREGON AND WASHINGTON	CTUIR	$600,000	$1,500,000	$200,000	$200,000	$200,000	$2,700,000
9601200	ADULT ANADROMOUS FISH PASSAGE IMPROVEMENT AT IRRIGATION DIVERSION DAMS ON THE WALLA WALLA RIVER	CTUIR	$350,000	$650,000	$150,000	$150,000	$150,000	$1,450,000
	SUBTOTAL		$1,250,000	$2,465,000	$655,000	$645,000	$660,000	$5,675,000
	Wenatchee Subbasin							
9604000	WENATCHEE AND METHOW RIVER COHO RESTORATION	Yakama Indian Nation	$324,800	$340,480	$364,000	$380,800	$399,840	$1,809,920
	Yakima Subbasin							
5510200	YAKIMA RIVER BASIN SIDE CHANNEL SURVEY AND REHABILITATION	Yakama Indian Nation	$474,880					$474,880
5510500	CABIN CREEK HABITAT ENHANCEMENT PROJECT	Yakama Indian Nation	$162,400	$280,000	$280,000	$151,200	$33,600	$907,200
5510900	TEANAWAY RIVER INSTREAM FLOW RESTORATION	Yakama Indian Nation	$1,680,000	$1,680,000				$3,360,000
5511300	LITTLE NACHES RIVER RIPARIAN AND IN-CHANNEL HABITAT ENHANCEMENT PROJECT	Yakama Indian Nation	$89,600	$72,800	$72,800	$72,800	$16,800	$324,800
5511600	YAKIMA BASIN SIDE CHANNELS	Yakama Indian Nation	$1,005,760	$972,160	$972,160	$972,160	$33,600	$3,955,840
5511700	YAKIMA RIVER REARING HABITAT ENHANCEMENT, BETWEEN SELAH AND UNION GAPS	Yakama Indian Nation	$246,400	$56,000	$10,080			$312,480
5512000	TOPPENISH/SIMCOE INSTREAM FLOW RESTORATION	Yakama Indian Nation	$308,000	$350,000	$510,000	$44,000	$44,000	$1,256,000
9603501	SATUS WATERSHED RESTORATION	Yakama Indian Nation	$200,000	$218,368	$218,368	$218,368	$218,368	$1,073,472
5510800	UPPER YAKIMA TRIBUTARY IRRIGATION IMPROVEMENT	Yakama Indian Nation	$246,400	$560,000	$10,080			$816,480
9105700	YAKIMA PHASE 2 SCREEN FABRICATION	WDFW	$300,000	$300,000	$300,000	$300,000	$150,000	$1,350,000
9107500	YAKIMA PHASE II SCREENS - CONSTRUCTION	US BOR	$1,500,000	$1,500,000	$1,000,000	$1,000,000		$5,000,000
9200900	YAKIMA SCREENS - PHASE II - O & M	WDFW	$85,000	$100,000	$100,000	$100,000	$100,000	$485,000
9503300	O&M OF YAKIMA FISH PROTECTION, MITIGATION & ENHANCEMENT FACILITIES	US BOR	$200,000	$210,000	$220,000	$230,000	$240,000	$1,100,000

			FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
8811500	YAKIMA HATCHERY - CONSTRUCTION	BPA	$8,300,000	$3,700,000	$800,000	$500,000	$500,000	$13,800,000
8811500	YAKIMA HATCHERY - CONSTRUCTION	BPA	$8,300,000	$3,700,000	$800,000	$500,000	$500,000	$13,800,000
8812001	YAKIMA/KLICKITAT FISHERIES PROJECT MANAGEMENT	Yakama Indian Nation	$763,000	$799,000	$799,000	$799,000	$799,000	$3,959,000
8812004	HATCHERY TRAINING AND EDUCATION	Yakama Indian Nation	$231,202	$79,078				$310,280
9006900	YAKIMA HATCHERY - FINAL DESIGN	CH2M Hill	$900,000	$70,000	$30,000			$1,000,000
9603301	YAKIMA RIVER FALL CHINOOK SUPPLEMENTATION	Yakama Indian Nation	$660,800	$694,400	$739,200	$790,720	$838,880	$3,724,000
9603302	YAKIMA RIVER COHO RESTORATION	Yakama Indian Nation	$143,360	$151,200	$157,920	$164,640	$171,360	$788,480
	SUBTOTAL		$25,796,802	$15,493,006	$7,019,608	$5,842,888	$3,645,608	$57,797,912

9603301 YAKIMA RIVER FALL CHINOOK SUPPLEMENTATION

Supplement the populations of naturally spawning fall chinook in the Yakima River basin by trapping adult fall chinook at Prosser Dam and Marion Drain and utilizing the Prosser Hatchery for adult holding, spawning, egg incubation, and early rearing, then acclimating and releasing smolts at selected sites in Marion Drain and the lower Yakima River.

9603302 YAKIMA RIVER COHO RESTORATION

Restore the population of naturally spawning coho in the Yakima River basin by transferring adult and/or juvenile coho from appropriate lower river hatcheries to selected habitats or acclimation ponds.

5.10.2 USDA Forest Service Watershed Restoration Funding for FY 1997

In late fiscal year 1996, the USDA Forest Service received a supplemental appropriation directed at watershed and channel restoration in systems damaged by the February 1996 floods. Damage was confined primarily to the west side of the Cascades, in Oregon and Washington. Approximately $29 million anticipated to be expended through FY99 will be allocated to National Forest lands in the Columbia River Basin to address road-related activities ($18 million) and in-channel, riparian, and slope stabilization work ($11 million). This appropriation creates two opportunities for consideration in the development of the Fish and Wildlife Managers' Multi-Year Implementation Plan, both of which would complement FS funded projects.

The first opportunity is to direct NPPC funds to lands within the selected basins so that a "whole watershed" approach to restoration may be accomplished. Work would focus on both public (National Forest) and private lands. Though there is little opportunity to redirect these FS funds, the Council can consider funding complementary projects throughout the watershed or basin to accomplish restoration activities at this larger scale.

The second opportunity takes advantage of the FS funds that can be redirected in FY97. The flood damage appropriation replaces regular program funding that would have been expended by those forests. The regular program funding can now be allocated to the Columbia River forests that did not experience flood damage. Like the situation in the opportunity identified above, FS funds can augment NPPC funds to accomplish more cost-efficient work across the watershed. Time frames are tight: the USFS must allocate these funds by the first of the year, so agreement with the Council on priority actions and locations is required no later than the first of the year. Approximately $100M of Forest Service funding is available for leveraging.

Table 5.10-3 identifies the amount of flood repair funds allocated for public lands within the Council's subregions and subbasins. This funding will be available for work activities by January 1997, and is anticipated to be expended over the next three years. Planning and design will occur this year, with most of the construction work accomplished in 1998.

5.10.3 Spirit of the Salmon Plan Production Facility and Equipment Costs

Production facility and equipment costs for implementation of the Spirit of the Salmon plan are provided in Table 5.10-4.

Table 5.10- 3 U.S. Forest Service flood repair funding for FY 1997 by subregion in the Columbia River Basin

			CNES ($M)	NFES ($M)	TOTAL ($M)
Lower Snake Subregion					
17060103	Asotin Subbasin		0	167	167
17060104/6	Grande Ronde Subbasin		320	100	420
17060107	Tucannon Subbasin		95	78	173
17060102	Imnaha		127	100	227
17060105	Lower Snake (Wallowa)		174	13	187
		Total	**716**	**458**	**1174**
Lower Columbia River Subregion					
17080001	Sandy		1077	635	1712
17080001	Lower Mid-Columbia Mainstem		385	210	595
17080002	Lewis Subbasin		1902	2027	3929
17080004	Cowlitz		6131	2596	8727
17090001	MF Willamette		888	1111	1999
17090011	Clackamas		2605	1234	3839
17090004	McKenzie Subbasin		540	545	1085
17090005/6	Santiam and Calapooia Rivers		1105	204	1309
		Total	**14633**	**8562**	**23195**
Lower Mid-Columbia River Subregion					
17070105	Wind/Big White Salmon/15 mile/Hood		1599	1821	3420
17070301-7	Deschutes		405	90	495
17070202	John Day Subbasin		0	9	9
17090002	Coast Fork and Long Tom		17	25	42
		Total	**2021**	**1945**	**3966**
Upper Mid-Columbia River Subregion					
17020008	Methow Subbasin		189	0	189
17020011	Wenatchee River		221	80	301
17030001/2	Yakima Subbasin		354	28	382

Total	**764**	**108**	**872**
Grand Total	**18134**	**11073**	**29207**

Table 5.10- 4 FY 1997-2001 project costs of proposed Columbia Basin production and habitat projects

	Proposal Source	FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
Lower Columbia Mainstem Production Program For All Species	S of S						
Tanker Trucks 3500 gallon		$250,000					$250,000
Double Axle Flatbed Truck		$120,000					$120,000
Single Axle Flatbed Truck		$66,000					$66,000
Stainless Steel Tanks 400 gallon		$15,000	$15,000				$30,000
Marking Trailer		$150,000					$150,000
Net Pen		$50,000	$2,000	$2,000	$2,000	$2,000	$58,000
Annual Operation (incl. marking & transport)		$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
SUBTOTAL		$661,000	$27,000	$12,000	$12,000	$12,000	$724,000
Wind River Production Program For All Species	S of S						
Acclimation/Final Rearing Facility		$250,000	$118,000	$118,000			$486,000
Adult Trap		$150,000	$150,000	$150,000			$450,000
Annual Operation (incl. marking & transport)			$79,000	$107,000	$157,000	$158,000	$501,000
SUBTOTAL		$400,000	$347,000	$375,000	$157,000	$158,000	$1,437,000
Little White Salmon River Production Program For All Species	S of S						
Acclimation/Final			$258,000				$258,000
Annual Operation (incl. marking & transport)				$10,000	$10,000	$10,000	$30,000
SUBTOTAL			$258,000	$10,000	$10,000	$10,000	$288,000
Big White Salmon River Production Program For All Species	S of S						
Acclimation/Final Rearing Facility				$118,000	$250,000		$368,000
Adult Trap				$150,000			$150,000
Annual Operation (incl. marking & transport)				$51,000	$104,000	$105,000	$260,000
SUBTOTAL				$319,000	$354,000	$105,000	$778,000
Hood River Produciton Program For All Species	S of S						
Complete the Hood River Production Project							
Klickitat River Production Program For All Species	S of S						
Acclimation/Final Rearing Facility		$250,000	$118,000	$118,000			$486,000
Adult Trap		$150,000	$150,000				$300,000
Annual Operation (incl. marking & transport)			$51,000	$104,000	$158,000	$158,000	$471,000

	Proposal Source	FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
SUBTOTAL		$400,000	$319,000	$222,000	$158,000	$158,000	$1,257,000
Deschutes River Production Program For All Species	S of S						
Acclimation/Final Rearing Facility		$118,000					$118,000
Adult Trap		$150,000					$150,000
Annual Operation (incl. marking & transport)			$11,000	$11,000	$11,000	$11,000	$44,000
SUBTOTAL		$268,000	$11,000	$11,000	$11,000	$11,000	$312,000
Umatilla River Production Program For All Species	S of S						
Acclimation/Final		$118,000					$118,000
Annual Operation (incl. marking & transport)			$11,000	$11,000	$11,000	$11,000	$44,000
SUBTOTAL		$118,000	$11,000	$11,000	$11,000	$11,000	$162,000
Walla Walla River Production Program For All Species	S of S						
Acclimation/Final Rearing Facility		$250,000	$118,000	$118,000			$486,000
Adult Trap		$136,000		$136,000			$272,000
Annual Operation (incl. marking & transport)			$58,000	$104,000	$158,000	$158,000	$478,000
SUBTOTAL		$386,000	$176,000	$358,000	$158,000	$158,000	$1,236,000
Mainstem mid-Columbia Production Program For All Species	S of S						
Tanker Truck 3500 gallon		$250,000					$250,000
Yakima River Production Program For All Species	S of S						
Implement Yakima/Klickitat Fisheries Project							
Wenatchee River Production Program For All Species	S of S						
Acclimation/Final Rearing Facility		$368,000	$368,000	$250,000			$986,000
Adult Trap		$150,000	$150,000				$300,000
Annual Operation (incl. marking & transport)			$102,000	$109,000	$161,000	$161,000	$533,000
SUBTOTAL		$518,000	$620,000	$359,000	$161,000	$161,000	$1,819,000
Entiat River Production Program For All Species	S of S						
Acclimation/Final Rearing Facility		$250,000	$118,000	$250,000			$618,000
Adult Trap		$150,000	$150,000				$300,000
Annual Operation (incl. marking & transport)			$51,000	$55,000	$109,000	$109,000	$324,000
SUBTOTAL		$400,000	$319,000	$305,000	$109,000	$109,000	$1,242,000

	Proposal Source	FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
Methow River Production Program For All Species	S of S						
Acclimation/Final Rearing Facility		$250,000	$118,000				$368,000
Adult Trap		$150,000	$150,000				$300,000
Annual Operation (incl. marking & transport)			$50,000	$54,000	$105,000	$106,000	$315,000
SUBTOTAL		$400,000	$318,000	$54,000	$105,000	$106,000	$983,000
Okanogan River Production Program For All Species	S of S						
Acclimation/Final Rearing Facility		$250,000	$118,000				$368,000
Adult Trap		$150,000	$150,000				$300,000
Annual Operation (incl. marking & transport)			$54,000	$54,000	$105,000	$105,000	$318,000
SUBTOTAL		$400,000	$322,000	$54,000	$105,000	$105,000	$986,000
Mainstem Snake Production Program For All Species	S of S						
Tanker Trucks 3500 gallon		$250,000	$250,000				$500,000
Double Axle Flatbed Truck		$120,000					$120,000
Single Axle Flatbed Truck		$66,000					$66,000
Stainless Steel Tanks 400 gallon		$15,000	$15,000				$30,000
Marking Trailer		$150,000					$150,000
Acclimation/Final Rearing Facility		$500,000	$250,000	$118,000			$868,000
Adult Trap				$150,000			$150,000
Annual Operation (incl. marking & transport)		$50,000	$110,000	$111,000	$164,000	$164,000	$599,000
SUBTOTAL		$1,151,000	$625,000	$379,000	$164,000	$164,000	$2,483,000
Tucannon Production Program For All Species	S of S						
Acclimation/Final Rearing Facility		$250,000					$250,000
Adult Trap		$150,000					$150,000
Annual Operation (incl. marking & transport)			$25,000	$29,000	$54,000	$54,000	$162,000
SUBTOTAL		$400,000	$25,000	$29,000	$54,000	$54,000	$562,000
Clearwater Production Program For All Species	S of S						
Complete construction of the Nez Perce Production Project							
Annual Operation (incl. marking & transport)		$314,000	$314,000	$314,000	$314,000	$314,000	$1,570,000
Grande Ronde Production Program For All Species	S of S						
Acclimation/Final Rearing Facility		$368,000	$368,000				$736,000

	Proposal Source	FY 97	FY 98	FY 99	FY 00	FY 01	TOTAL
Adult Trap		$150,000	$150,000				$300,000
Annual Operation (incl. marking & transport)			$101,000	$104,000	$155,000	$158,000	$518,000
SUBTOTAL		$518,000	$619,000	$104,000	$155,000	$158,000	$1,554,000
Salmon River Production Program For All Species	S of S						
Acclimation/Final Rearing Facility		$736,000	$736,000	$486,000	$368,000	$368,000	$2,694,000
AdultTrap		$300,000	$300,000	$300,000	$300,000	$300,000	$1,500,000
AnnualOperation(incl.marking&transport)		$1,005,000	$1,110,000	$1,160,000	$1,215,000	$540,000	$5,030,000
SUBTOTAL		$2,041,000	$2,146,000	$1,946,000	$1,883,000	$1,208,000	$9,224,000
ImnahaProductionProgramForAllSpecies	S of S						
Acclimation/FinalRearingFacility		$250,000					$250,000
AdultTrap		$150,000					$150,000
AnnualOperation(incl.marking&transport)			$21,000	$34,000	$55,000	$55,000	$165,000
SUBTOTAL		$400,000	$21,000	$34,000	$55,000	$55,000	$565,000
GRAND TOTAL		**$9,025,000**	**$6,478,000**	**$4,896,000**	**$3,976,000**	**$3,057,000**	**$27,432,000**

5.11 Basinwide Activities

5.11.1 Approach

This section collects and describes activities that do not as a group have common objectives, but have significant importance because they represent basinwide efforts to coordinate actions, collect data, or inform the public and/or decision-making processes. As such, these activities and projects are vital to comprehensive program coordination, management, and implementation and require participation by and coordination among many management entities. The section is organized into three major subsections: Coordination, Information, and Special Projects.

The Coordination subsection (5.11.2) provides descriptions of the roles and functions of the principal entities involved in the planning and implementation of fish and wildlife measures. Some receive funding directly from BPA through the "Direct" portion of the total fish and wildlife budget. Funds approved for FY97 and funds estimated to be needed through 2001 are listed as appropriate at the end of each entity's description. The Information subsection (5.11.3) describes activities and associated costs of collection, maintenance, and distribution of information believed necessary to allow researchers, managers, the public, and/or others to have access to data for review, analysis, or information purposes. Again, appropriate project costs are provided. The final section, Special Projects (5.11.4), contains projects that are generally basinwide efforts involving more than one management entity. Substantial costs are associated with two of these projects, and therefore these two have been the object of a great deal of scrutiny as well as some criticism. They are presented here individually and in moderate detail to facilitate further review and discussion.

5.11.2 Coordination

Many organizations and entities are involved in the planning, coordination, and implementation of Columbia River fish and wildlife programs. There are 19 entities with management authority over the Columbia River Basin's fish and wildlife resources. Numerous other agencies and organizations manage or have an impact on the quantity and quality of habitat needed by these resources. The scope, complexity, and cost of measures needed to recover anadromous fish populations and to mitigate losses of resident fish and wildlife in the basin demands the highest level of coordination among resource managers, hydro facility operators, state and local governments, and public and private interests affected by the plans. The role of some of the more significantly involved organizations in accomplishing this coordination is set out below.

In general, each organization assumes the cost of its staff time and travel expenses to participate in the various forums. In instances where organizations were founded to provide a specific coordination or technical service to the fish and wildlife effort, the costs of that organization may be funded through BPA monies allocated to the Columbia River Basin Fish and Wildlife Program, other sources, or a combination.

5.11.2.1 Columbia Basin Fish and Wildlife Authority

Continuing declines in many salmonid stocks, current and proposed ESA listings, establishment of a BPA funding cap, the emergence of additional Columbia Basin plans, and other recent events mandate greater biological and fiscal management oversight of Columbia River Fish and Wildlife Program implementation activities than ever before. The Columbia Basin Fish and Wildlife Authority (CBFWA) provides the forum and structure through which that oversight can occur in a coordinated and comprehensive manner.

The CBFWA is a body consisting of the directors of the two federal and four state fish and wildlife agencies, and the chairs of the 13 Indian tribes in the basin. It provides a forum for discussion, debate, and coordination regarding the management of the basin's fish and wildlife resources. The organization has adopted a consensus type of operation. The Executive Director and a small clerical and technical support staff are located in the Oregon Department of Fish and Wildlife building in Portland. The organization is funded through contributions by its member agencies and through contracts for services provided by its members.

The CBFWA members have agreed to use a "caucus" approach to accomplish more effective coordination and implementation of anadromous fish, resident fish, and wildlife activities. Each caucus consists of senior program managers from among the agencies and tribes having management responsibilities in one of the three areas. Each caucus is chaired by an elected member of the caucus. Time and travel costs associated with participation in the CBFWA forum are usually borne by the participant’s employer.

Each caucus is responsible for the coordination of activities within its area as well as the integration of those activities with the other two caucuses. The caucuses convene at least monthly to review implementation progress, resolve issues, and coordinate activities. Once a year each caucus convenes over an extended time to determine budget allocations and priority activities for the upcoming fiscal year. When approved by the CBFWA membership, these recommendations are forwarded to the Northwest Power Planning Council for public comment and Council consideration.

The Anadromous Fish Caucus is one of three caucuses that together comprise the programmatic body of the Columbia Basin Fish and Wildlife Authority. Its membership consists of senior program managers from among the fish and wildlife agencies and Indian tribes having management authority over anadromous fish. The caucus operates semi-autonomously with respect to its responsibilities in implementing anadromous fish restoration and recovery activities. Where those activities overlap or affect the responsibilities of the resident fish or wildlife caucuses, the anadromous fish caucus must coordinate with those groups or with the full CBFWA membership. Caucus business ranges from making policy recommendations to the CBFWA membership, to grappling with research issues and individual project priorities. The

work of the caucus ultimately results in coordinated program recommendations for anadromous fish mitigation, enhancement, and recovery measures. The recommendations result in a regional annual implementation plan that is consistent with state and tribal policies and plans, the NPPC's Fish and Wildlife Program, NMFS' biological opinion, and the Spirit of the Salmon plan of the Nez Perce, Umatilla, Warm Springs, and Yakama tribes.

Project: PREPARE DRAFT ANNUAL IMPLEMENTATION WORK PLAN (8906200)
This project involves coordinating and facilitating the fish and wildlife managers' development of an annual plan for implementing the NPPC Fish and Wildlife Program, use of BPA's fish and wildlife budget, and monitoring the implementation of the current year's budget.

FY97	FY98	FY99	FY2000	FY01
$800,000	$837,000	$863,000	$888,000	$915,000

Project: ESA RECOVERY IMPLEMENTATION COORDINATION (5513200)
The project is intended to assist with the planning, coordination, and facilitation of the implementation of the Proposed Recovery Plan for Snake River Salmon. An essential component is the coordination among the fisheries co-managers and the operating agencies with respect to reservoir operations and the hatchery and other fish and wildlife mitigation programs.

FY97	FY98	FY99	FY2000	FY01
$200,000	$443,000	$456,000	$470,000	$484,000

5.11.2.2 Fish Passage Center

Approach The evolution of the Fish Passage Center (FPC) began with the Power Planning Council's Fish and Wildlife Program in 1982. The FPC evolved from the concept of the Council's water budget. The Council maintained that a water budget approach at Priest Rapids and Lower Granite dams would significantly increase the number of Columbia Basin fish without seriously affecting the provision of an adequate, efficient, economical and reliable power supply. The Council agreed with the fish and wildlife agencies and tribes that creating fish/power coordinating positions would allow the fish managers an opportunity to develop the skills necessary to participate in the power system decision process that affected fish. In 1982, the Council proposed the need for two water budget managers, one assigned to the state and federal fish and wildlife agencies and the other to the Columbia River Basin tribes.

Ecological Objective The objective is to maintain data and migration characteristics and environmental factors affecting migration throughout the Snake and Columbia basin. The three types of passage management recommendations developed within the Smolt Monitoring Program (SMP) include spill, flow, and fish facilities operations throughout the Columbia and

Snake River Basins. All of the data used to develop an operational request fall into two categories, historical and current. The SMP is designed to provide current site-specific information regarding fish passage, as well as to maintain long-term consistent and continuous data for historical reference.

Recent regional discussions propose to include a broader ecological scope of data and analysis to the FPC, specifically, listed and nonlisted resident species requirements relative to the hydrosystem operation.

Effort Required The FPC supports an extraordinary amount of experience and expertise. The FPC is composed of two clerical and nine professional staff, with knowledge in computer science, data base management, biostatistics, hydrology, fish passage, biology, hydrosystem operations and management, data analysis, and research design. Two-thirds of the staff have worked at the FPC from 8 to 12 years. Because of this longevity, the staff members have expanded and enhanced their collective expertise, which is essential to the region's understanding of complex anadromous fish issues.

The FPC, as described in its current contract with BPA, has numerous responsibilities. The Council Fish and Wildlife Program establishes the FPC as the manager of the mitigation measures described in the Program, representing the fish agencies and tribes. The annual Smolt Monitoring Program (SMP) requires developing and analyzing information to implement flow and spill passage measures, and documenting migrational characteristics of all stocks (listed and unlisted) of salmon and steelhead in the Columbia Basin. With the advent of listed stocks in the basin, the FPC has provided additional analysis, data collection, reporting and distribution to the National Marine Fisheries Service for Endangered Species Act (ESA) activities and the ESA implementation process. The FPC also deals with the Section 10 "taking" permits as part of ESA regulations.

Summary of Activities Gas bubble monitoring is an important segment of the SMP. The SMP is designed to have continuity and consistency in the data generated from year to year, to assess passage decisions against an historical data base. The historical reference is extremely meaningful for making passage recommendations. The specific type of data include: (1) mark recaptures on specific groups of fish; (2) site-specific passage indices; (3) condition of each specific group and the group at large; (4) hydrologic data, flow forecasts, flows, spill, dissolved gas, and water temperature; and (5) hatchery release information.

The FPC has served a major regional role in the distribution of data and information throughout the region. This includes distribution of over 450 weekly reports mailed to private and public agencies and private citizens upon request. In addition, the FPC responds to hundreds of individual formal data requests annually. The FPC also maintains daily updates to the FPC Internet page.

From the technical viewpoint, the FPC is the major source of in-season and historical data that are used to make recommendations for operating the hydropower system to accommodate anadromous fish and the implementation of Biological Opinion measures. The FPC sustains the pulse of data and analysis support, not only for the CBFWA members including NMFS, but for the Council, BPA, private and public utilities, and others. The FPC has the personnel, knowledge, expertise, hardware, software, and general overall experience to meet the informational needs of anadromous fish in the Columbia Basin.

Project: FISH PASSAGE CENTER (9403300)
Provide regional resource to successfully interface between fishery agencies, Tribes, and FCRPS operators. Analyze and report smolt monitoring data and recommend operations for fish passage.

FY97	FY98	FY99	FY2000	FY01
$1,082,500	$1,043,000	$1,108,000	$1,177,000	$1,235,850

5.11.2.3 National Marine Fisheries Service of the National Oceanic and Atmospheric Administration, including the Executive Committee and Implementation Team structure.

Responsibilities in the Columbia River Basin The National Oceanic and Atmospheric Administration (NOAA Fisheries) is delegated a major role in managing activities that affect Columbia Basin environmental health and residing salmon and steelhead populations.

The Secretary of Commerce, through NOAA Fisheries, has regulatory responsibility for the conservation and management of fisheries resources within the 200-mile limits of the U.S. Exclusive Economic Zone (EEZ). Columbia River salmon and steelhead spend much of their lives within this area and are thus subject to NOAA Fisheries jurisdiction. The Magnuson Fishery Conservation and Management Act, under which fisheries within the EEZ are regulated, established Regional Fishery Management Councils, which prepare fishery management plans for the nation's fishery resources. Members of these councils are appointed by the Secretary of Commerce based on recommendations from the governors of the states in each region. The states of Idaho, Washington, Oregon, and California have members appointed to the Pacific Fishery Management Council. NOAA Fisheries plays an advisory role in the protection and management of fish populations in coastal areas under state authority, and in riverine areas also under state control for anadromous fishes. Management and conservation plans are developed through extensive partnerships with state, tribal, and other federal agencies, fishermen, processors, marketers, public interest groups, universities, and the general public, and through partnerships with science and management organizations.

Columbia River In the Columbia River, NOAA Fisheries conducts important research that improves existing knowledge of the biology and life-history requirements of salmon and steelhead, evaluates the efficacy of various conservation measures, and supports improved salmon and steelhead husbandry. Basic research and scientific monitoring and evaluation conducted in the Columbia River Basin are primarily funded by different federal agencies under direction provided by NOAA Fisheries and other co-managers of Columbia River salmon and steelhead.

Mitchell Act Hatcheries NOAA Fisheries also plays a role in the conservation and restoration of habitats vital to living marine resources and anadromous fishes. Various statutes including the Fish and Wildlife Coordination Act and the Federal Power Act call on NOAA Fisheries to review proposed federal actions that may affect habitat vital to living marine resources and anadromous fishes and make recommendations for the adequate conservation of those resources. In the Columbia River Basin, NOAA Fisheries also administers the Columbia River Fisheries Development Program (CRFDP). The CRFDP was authorized by Congress under the Mitchell Act of 1938 with emphasis placed on the conservation of salmon and steelhead populations, and support for sport, commercial and Indian fisheries affected by development in the basin. The CRFDP under NOAA Fisheries Administration has supported construction and operation of 25 salmon hatcheries producing in excess of 100 million juvenile salmon and steelhead annually, the construction of fishways restoring important spawning and rearing areas, and the screening of more than 700 irrigation diversions. Annual funding provided by NOAA Fisheries to Idaho, Washington, Oregon and the U.S. Fish and Wildlife Service to support these activities ranged from 13 to 17 million dollars between 1990 and 1995, with 14.4 million dollars allocated for 1997.

Endangered Species Act The inadequacy of existing management and regulatory mechanisms is often a reason why species are threatened or endangered with extinction. Under the Endangered Species Act (ESA), NOAA Fisheries is accountable to conserve and restore plant and animal species for the benefit of all citizens and the nation's fish and wildlife heritage. Responsibility under the ESA for anadromous fishes was delegated to NOAA Fisheries by an August 1974 memorandum of understanding between the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. Through consultation and recovery planning under the ESA, NOAA Fisheries incorporates habitat preservation and restoration actions into water and land development projects, and seeks external funding for environmental restoration activities from other organizations such as the U.S. Army Corps of Engineers, the Bonneville Power Administration, the Bureau of Reclamation, the Bureau of Land Management, and the U.S. Forest Service. In the case of Columbia River salmon and steelhead, federal agencies are investing between $126 and $166 million dollars annually (NMFS 1995) to implement measures called for in the formal recovery plan for Snake River salmon required under the ESA.

Executive Committee and the Implementation Team In 1996 the NMFS established a committee structure to plan, discuss, and resolve Lower Snake River and Mainstem Columbia hydro operations issues relative to implementation of the 1995 Biological Opinion. An Executive Committee, chaired by the NMFS Regional Director, consists of senior policy representatives from each of the regional sovereigns, NMFS and the USFWS, and the federal operating agencies (the Corps, BR, BPA). Others participate as *ex officio* members of the Executive Committee. An Implementation Team (IT) is made up of senior program level representatives from the fish and wildlife agencies, Indian tribes, and federal hydro operators. The IT works under the direction of the Executive Committee and provides a forum for discussion and resolution of operational issues that may be elevated from the several technical committees - the Technical Management Team (TMT), the System Configuration Team (SCT), and the Dissolved Gas Team (DGT). These teams are made up of experienced technical representatives from the fish and wildlife agencies, tribes, and operators. During the migration season the TMT meets weekly to review and plan hydro operations (See Section 4, Mainstem Operations). When consensus is not achieved at the technical team level, the issue may be elevated to the IT for consideration at its monthly meeting, or sooner by conference call when circumstances warrant. The committees are currently in the process of formalizing participation and rules and procedures. None of the members or participants abrogate their decision-making authority through participation in the committee structure.

5.11.2.4 Columbia River Inter-Tribal Fish Commission (CRITFC)

Roles and Responsibilities. CRITFC is a coordinating and technical arm of the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation of Oregon, and the Confederated Tribes of the Yakama Indian Nation. Based on inherent sovereignty and affirmed in *US v Oregon*, *US v Washington*, and other rulings, these four tribes have fish and related resource management responsibilities in the Columbia Basin. (There are nine other federally recognized Indian tribes with rights and responsibilities for nonanadromous fish and wildlife in the Columbia River Basin who are not members of the CRITFC.)

CRITFC, whose governing body is composed of the fish and wildlife committees of the four tribal governments, is charged with the role of assisting the tribes in perserving tribal treaty rights and protecting and rebuilding anadromous fish populations. To carry out that responsibility, CRITFC and the tribes' on-reservation fisheries departments developed a restoration plan, *Wy-Kan-Ush-Mi Wa-Kish-Wit* -- Spirit of the Salmon, for anadromous fish above Bonneville Dam.

Authorities. The relevant treaties are the following: Treaty with the Middle Tribes of Oregon, 1855; Treaty with the Yakamas, 1855; Treaty with the Cayuse, Umatilla, and Walla Walla, 1855; Treaty with the Nez Perce. Each tribe has numerous authorizing resolutions by its governing bodies that direct fish and wildlife activities.

Some of the applicable federal statutes are the Fish and Wildlife Coordination Act, the Pacific Northwest Electric Power Planning and Conservation Act, and the Pacific Salmon Treaty.

Applicable federal legal opinions and orders include the Columbia River Fish Management Plan, *US v Oregon* and its conservation requirements, *US v Washington,* and Federal Energy Regulatory Commission orders in .....

Activities. The tribes are involved in fish production, fisheries regulation and enforcement, land and water planning and management, and watershed restoration on their reservations and off-reservation in ceded lands and wherever fish destined for "usual and accustomed fishing places" migrate.

The tribes have delegated the following responsibilities to their individual fisheries departments and/or to CRITFC: 1) to provide the scientific analyses of and recommended actions needed for fish restoration; 2) to provide the institutional analyses of and recommended actions needed for restoration; 3) to enforce tribal fishing regulations at usual and accustomed fishing places and to protect tribal members exercising their treaty-reserved fishing rights; 4) to inform and educate tribal members and the general public about the tribes' treaty rights and responsibilities and about their efforts to rebuild anadromous fish populations.

River Operations. CRITFC hydrologists and biologists participate in the Technical Management Team (TMT), the System Configuration Team (SCT), and the Dissolved Gas Team (DGT), technical committees that review, plan, and evaluate mainstem Columbia and Snake river hydro operations. State and federal fish agencies and the tribes provide oversight and sponsor the Fish Passage Center, which collects and distributes fish migration and passage data -- for example, flow and spill at mainstem dams, daily fish passage indices by species at each dam, and hatchery release data.

Watershed Habitat. The tribes, in conjunction with their public and private-sector neighbors, are rehabilitating fish and wildlife habitat as a part of an Early Implementation Watershed Restoration Program and as part of other initiatives and agreements. The early implementation program is coordinated by CRITFC.

Watershed Production. Anadromous fish production in the Columbia Basin comes under the purview of the Production Advisory Committee under *US v Oregon*. The PAC is an important forum for planning future artificial production measures that meet state and federal obligations under the tribes' treaty reserved rights. All species review...

Tribally operated production and related facilities include:

Umatilla-Juvenile acclimation and release facilities are Bonifer, Minthorn, Thornhollow, Amaches-C-Mimikim. Adult holding and spawning facilities are located at Three-Mile Dam, South Fork Walla Walla, and Minthorn Springs. Co-managed facilities are those producing fish

for tribal ceded and "usual and accustomed" fishing areas, including the Umatilla Hatchery and the Lookingglass Hatchery.

Yakama-Production facilities operated by the tribe are the Hanford K Pond Fish Facility, Prosser Hatchery, Marion Drain Hatchery, and Cle Elum Hatchery. The acclimation facilities are Marion Drain, Wapato Net Pens, Granger Pond, and Rosa Waste Way. Co-managed facilities include the Eastbank/Methow Spring Chinook Facility and other state and federal facilities in tribal ceded and usual and accustomed fishing areas.

Nez Perce- Construction will begin on the Nez Perce Hatchery in 1997. The tribe has acclimation and related facilities at various locations at Sweetwater Springs and on the Snake River. Co-managed facilties include those federal and state hatcheries either on-reservation, in ceded lands, or in usual and accustomed fishing areas.

Warm Springs The tribe operates production facilities at Pelton Dam and the Hood River Hatchery Complex and co-manages the Warm Springs National Fish Hatchery.

Harvest Management and Stock Assessment. Numerous activities related to Pacific salmon stock harvest and harvest assessment under the auspices of the Pacific Salmon Treaty, the annual ocean-inriver agreements, and the *US v Oregon* Columbia River Fish Management Plan are coordinated by CRITFC. Commissioners serve on several policy committees and panels, including the Pacific Salmon Commission and Southern Chinook Panel; tribal and CRITFC staff serve on technical committees, including the Chinook Technical Committee and the *US v Oregon* Technical Advisory Committee to the Oregon-Washington Columbia River Compact.

Law Enforcement. Through the Columbia River Inter-Tribal Fisheries Enforcement Program, the four tribes enforce tribal fishing regulations on the mainstem Columbia, principally between Bonneville and McNary dams. The inter-tribal enforcement program, headquartered in Hood River, Oregon, participates in the Columbia Basin Law Enforcement Council.

The tribes also intend to expand their efforts to include the enforcement of habitat laws in the basin's important watershed habitats.

5.11.2.5 Northwest Power Planning Council Fish and Wildlife Division

Role The Council's continuing role in fish and wildlife rehabilitation is supported by its fish and wildlife division. Primary activities include: 1) preparing for future program planning and amendments; 2) facilitating, monitoring, and evaluating program implementation and funding; and 3) continued evaluation and assessment of mainstem, harvest, production and habitat improvements. Additional emphasis is being placed on resident fish and wildlife activities as reflected in the Council's program amendments adopted in September 1995.

Activities Fish and wildlife division efforts focus on three major activities: 1) rule makings related to salmon, resident fish, and wildlife mitigation; 2) monitoring and facilitating implementation of the program; and 3) evaluation and analysis of fish and wildlife measures. Additional emphasis will be required for evaluation and accountability to ensure that program measures and projects are vigorously and effectively implemented, produce benefits, are cost effective, minimize harm to other species and are modified or terminated if results are not as expected.

Costs: The costs for the Council's central staff fish and wildlife division are estimated below. These costs are for personnel services, travel, contracted services, and the other operating expenses for the Council's fish and wildlife division only.

FY97	FY98	FY99 (est)	FY2000 (est)	FY01 (est)
$1,097,000	$1,027,000	$1,027,000	$1,027,000	$1,027,000

A portion of the total Council costs are included in the Bonneville budget agreement because the Council is funded from Bonneville power sale revenues. For the purposes of developing the budget agreement, one half of the Council's total budget was assumed to be related to its fish and wildlife functions. This would incorporate costs beyond the Council's central office fish and wildlife staff and include half of Council member compensation and travel, costs of the Council's state offices and staff, the Council's administrative costs, public involvement and information functions, and legal assistance (see Northwest Power Planning Council Fiscal Year 1998 Budget and Fiscal Year 1997 Revisions; Document 96-12; August 15, 1996). The table below summarizes one half of the Council budget projected through 2001:

FY97	FY98	FY99 (est)	FY2000 (est)	FY01 (est)
$3,993,000	$3,960,000	$4,000,000	$4,000,000	$4,000,000

5.11.2.6 Independent Scientific Advisory Board

For several years, the Council has impaneled a group of experts to advise the region on scientific aspects of program implementation. In 1996, this group's efforts were focused on the review of science described above. With the National Marine Fisheries Service's draft recovery plan for Snake River salmon calling for similar scientific guidance, the Council and NMFS agreed in 1996 to utilize the same panel for the twin purposes of the Council program and the recovery plan.

The existing Independent Scientific Group was expanded from nine members to 11 to provide more expertise in needed areas and constituted to be jointly used by the Council and NMFS.was renamed the Independent Scientific Advisory Board. Members of the Board were nominated by an ad hoc committee of scientists (Dr. John Magnuson, National Research

Council; Dr. Donald Bevan, former chair of the Snake River Salmon Recovery Team; and Dr. Lyle Calvin, past chair of the Scientific Review Group).

The Independent Scientific Advisory Board may serve additional functions beginning in 1997 to implement provisions of the 1997 Energy and Water Appropriations Act. The Act required the Council to incorporate scientific peer review into the prioritization process for allocating Bonneville's fish and wildlife budget. The participants in this review will be selected by the Council based on nominations by the National Research Council. The Act anticipated that the members of the ISAB could serve this function.

Project: INDEPENDENT SCIENTIFIC GROUP SUPPORT (8907201)
Provides funding for one member of the Independent Scientific Group through a contract with DOE.

FY97	FY98	FY99	FY2000	FY01
$100,000	$100,000	$100,000	$100,000	$100,000

Project: OPERATION OF THE INDEPENDENT SCIENTIFIC ADVISORY BOARD (9600500)
This project provides the administrative and fiscal support to the ISAB established by the NPPC and NMFS. It also includes the funds to reimburse the ISAB members for time and expenses.

FY97	FY98	FY99	FY2000	FY01
$620,000	$639,000	$658,000	$677,000	$700,000

5.11.2.7 U.S. Fish and Wildlife Service

Mission The U.S. Fish and Wildlife Service's (FWS) mission is "To conserve, protect, and enhance the Nation's fish and wildlife and their habitats for the continuing benefit of people." The primary goal of the FWS in the Columbia River Basin is to prevent species decline, expedite recovery of candidate, threatened, and endangered species, and preclude future listings by conserving and restoring a diversity of native fish, wildlife, and plant species and their habitats.

Authorities The FWS is mandated by many federal laws and regulations, court decisions, and international treaties, and by its federal trust responsibility to Native Americans, to provide for mitigation and restoration of fish and wildlife resources. These legal mandates include the Endangered Species Act, Migratory Bird Treaty Act, Fish and Wildlife Coordination Act, National Wildlife Refuge System Administration Act, National Environmental Policy Act, Federal Water Pollution Control Act, Pacific Northwest Electric Power Planning and

Conservation Act, Pacific Salmon Treaty Act, Magnuson Fishery Conservation and Management Act, Water Resources Development Act of 1976, and *US v Oregon*.

Role The FWS's focus is on its trust resources, lands, legal mandates, and responsibilities with the recognition that protecting ecosystem health and the full array of biological diversity is fundamental to its mission and goals. The FWS has adopted an ecosystem approach to fulfilling its responsibilities, which means restoring the function, structure, and species composition of an ecosystem while providing for its sustainable socioeconomic use. The FWS does not control or manage entire ecosystems, therefore its success in achieving ecosystem health is dependent upon coordinated efforts of many public agencies, Indian tribes, communities, private organizations, corporate and private landowners, and private citizens. In the Columbia River Basin the FWS is an active participant in a wide variety of interagency forums and working groups and is actively developing partnerships with all stakeholders involved in fish and wildlife management and restoration.

Endangered Species The FWS and the National Marine Fisheries Service share responsibility for administration of the Endangered Species Act. Generally, the National Marine Fisheries Service deals with those species occurring in marine environments and anadromous fish, while the FWS is responsible for terrestrial and freshwater species and migratory birds. The two agencies work closely together and through various basin forums to ensure that the listing, consultation, habitat conservation planning, and recovery planning of all proposed and listed species are addressed in a coordinated and comprehensive manner.

Hatcheries The FWS funds or operates 34 hatchery and other fish production facilities in the Columbia River Basin. These facilities are funded by direct appropriations to the FWS, from funding from the National Marine Fisheries Service through the Mitchell Act, and by the Corps of Engineers, Bureau of Reclamation, and the FWS for the Lower Snake River Compensation Program, through reimbursable funds from the Bonneville Power Administration. The key forums for coordinating anadromous fish hatchery operations and management of production in the Columbia River Basin include the Production Advisory Committee under *US v Oregon*, the Integrated Hatchery Operations Team established under the Northwest Power Planning Council's Fish and Wildlife Program, the Pacific Northwest Fish Health Protection Committee, and the Columbia Basin Fish and Wildlife Authority. The FWS, with assistance from the National Marine Fisheries Service and the Bonneville Power Administration, is conducting a Comprehensive Environmental Review of all of the state, tribal, and federal hatchery operations for anadromous fish in the basin. This EIS will help determine the future role of artificial production in the basin by identifying the impacts of artificial production on natural production and defining areas where artificial and natural production are compatible or not compatible.

Salmon Harvest and Stock Assessment The FWS is the Department of the Interior's representative for numerous activities related to Pacific salmon stock and harvest assessment within the purview of the Pacific Salmon Treaty, Magnuson Fishery Conservation and Management Act, and *US v Oregon*. The FWS serves on various technical committees under

the Pacific Salmon Treaty, including the chinook, coho and chum technical committees, and works closely with the National Marine Fisheries Service and the State Department which represent the United States on the Pacific Salmon Commission and Panels. The FWS is a non-voting member of the Pacific Fishery Management Council (PFMC) and a member of the PFMC's Salmon Technical Team. The FWS participates in all technical and policy level decisions related to harvest management under the Columbia River Fish Management Plan and *US v Oregon* through its membership on the Technical Advisory Committee for stock and harvest assessment and the Policy Committee. In addition, the FWS coordinates the development of the biological assessments for harvest in the Columbia River basin with the affected states and tribes and submits the assessments to the National Marine Fisheries Service.

Wildlife The FWS operates nine National Wildlife Refuges and 12 satellites throughout the Columbia River basin. The refuges are managed for a variety of purposes including mitigation for impacts from hydropower and other development, protection and restoration of native fish, wildlife, and plant species and their habitats, and for various public uses including wildlife observation and hunting and fishing. The FWS participates on the CBFWA Wildlife Committee, which coordinates the planning, development, and implementation of wildlife mitigation projects in the Columbia River basin.

Law Enforcement The FWS has seven Law Enforcement offices in the Columbia River basin that are funded by direct appropriations through the FWS. The FWS is a member of the Columbia Basin Law Enforcement Council and administers the BPA funding for law enforcement in the Columbia River basin through its Federal Aid Program and Division of Law Enforcement. The FWS in 1996 administered the funding for the states of Washington, Oregon, Idaho, and Montana and the Columbia River Inter-Tribal Fish Commission at no cost in overhead. Budgets are being prepared for Fiscal Year 1997 that will also include law enforcement funding for the Shoshone-Bannock, Umatilla, and Nez Perce tribes.

5.11.2.8 Bonneville Power Administration Fish and Wildlife Division

> *The BPA Administrator shall use the Bonneville Power Administration fund and the authorities available to the Administrator under this Act and other laws administered by the Administrator to protect, mitigate and enhance fish and wildlife to the extent affected by the development and operation of any hydroelectric project of the Columbia River and its tributaries in a manner consistent with the plan...*
>
> *Pacific Northwest Electric Power Planning and Conservation Act of 1980*

The Bonneville Power Administration Division of Fish and Wildlife was created in 1982 to administer the portion of the BPA fund dedicated to implementing the measures contained in the Council's Columbia River Basin Fish and Wildlife Program. Later, the Division's role was

expanded to implement projects pursuant to Endangered Species Act requirements. In concert with expertise internal and external to Bonneville, the organization reviews and analyzes proposed policies and programs, and then develops standards, criteria, and policies necessary to fulfill Bonneville's fish and wildlife obligations. The Division coordinates regional fish and wildlife efforts with other involved parties, including the Northwest Power Planning Council, U.S. Army Corps of Engineers, National Marine Fisheries Service, Bureau of Reclamation, U.S. Fish and Wildlife Service, Columbia Basin Fish and Wildlife Authority, Columbia River Inter-Tribal Fish Commission, individual tribes, utilities, and others. The Division is organized around three functions: Planning, Resident Fish, and Wildlife; Anadromous Fish Implementation; and Hydro Integration.

Planning, Resident Fish, and Wildlife: This group plans, develops, integrates, and coordinates BPA fish and wildlife policy and scientific efforts related to the Council's Fish and Wildlife Program, Endangered Species Act, other legislative and legal mandates, and ecosystem management. It also implements resident fish, anadromous fish habitat, watershed, and wildlife mitigation projects outlined in the Program. Projects cover a wide spectrum, including resident fish substitution and mitigation; resident fish culture facilities; anadromous fish and wildlife habitat protection and enhancement; wildlife mitigation agreements; ecosystem coordination; and model watershed program participation. BPA contracts with a variety of state and federal fish and wildlife agencies, Indian Tribes, and private consultants across many subbasins. This group also maintains a database of project descriptions for the Council's Fish and Wildlife Program and coordinates in regional development of annual and multi-year work plans.

Anadromous Fish Implementation: This group implements anadromous fish mitigation projects outlined in the Council's Fish and Wildlife Program for both ESA-listed and other salmon and steelhead stocks in the Columbia River Basin. Projects cover a broad spectrum including anadromous fish hatcheries; anadromous fish passage and screen projects in subbasins and tributaries; steelhead supplementation research in Idaho; captive broodstock research for Stanley Basin sockeye; fish marking programs; and law enforcement. This group also provides technical expertise where necessary for ESA, NEPA and other consultations for anadromous fish. This group contracts with regional fish and wildlife agencies, Indian tribes, and the private sector.

Hydro Integration: The hydro integration group coordinates, analyzes, and implements activities related to the integration of fish passage and hydrosystem operations. Areas of focus include juvenile and adult mainstem passage downstream passage and life-cycle modeling, and Endangered Species Act consultations and compliance related to hydrosystem operations. The group also evaluates current and proposed dam and reservoir operations, systemwide operations, and facilities modifications to determine the effects on salmon and sturgeon survival. With information from these evaluations the group participates in both long-term and real-time power marketing and operations decisions. Issues of particular interest include flows, spills, bypass facilities, transportation, and predation.

5.11.2.9 Corps of Engineers

Organization: The US Army Corps of Engineers, North Pacific Division office, and its Walla Walla, Portland and Seattle Districts are involved in efforts to mitigate for and improve salmon passage at its projects on the Columbia and Snake Rivers. The district offices are responsible for carrying out planning, engineering, construction, and project operations. The North Pacific Division office coordinates operation of the Federal Columbia River Power System (FCRPS) through its Reservoir Control Center. The Division office also provides regional coordination through its Pacific Salmon Coordination Office.

Mission: The Corps' fish mitigation and protection activities are carried out under project authorities for the Corps-operated dams in the Columbia/Snake system and under other specific authorities, such as the Lower Snake River Fish and Wildlife Compensation Plan, as provided by Congress. Some specific mission activities related to or involving the salmon recovery efforts include operating the FCRPS, planning for and implementing structural fish protection improvements at its dams, operating and maintaining the project facilities, funding mitigation hatcheries, and fish passage research, monitoring, and evaluation activities. The Corps is also engaged in other facets of water resource development that may affect salmon, such as the current study to investigate deepening the Columbia River channel for navigation purposes. Other mission areas include small projects for flood control, navigation, and environmental restoration. The Corps also has a regulatory role in reviewing and approving public and private activities that may affect wetlands.

Scope: The Corps operates twelve mainstem Columbia River projects for multiple purposes: flood control, power generation, fish and wildlife, recreation, navigation, irrigation and water supply uses. The four lower Columbia River dams are Bonneville, The Dalles, John Day, and McNary. The four lower Snake River dams are Ice Harbor, Lower Monumental, Little Goose, and Lower Granite. The remaining four dams are Chief Joseph on the mid-Columbia River; Dworshak Dam on the north fork of the Clearwater River; Libby Dam on the Kootenai River; and Albeni Falls Dam on the Pend Oreille River. The Corps also operates a complex of dams and reservoirs in the Willamette River basin for flood control and other purposes.

The Corps' eight Lower Columbia and Snake Rivers dams, through which salmon migrate on their way to and from upstream spawning/rearing areas and the ocean, include adult fishways and juvenile bypasses to aid salmon passage. The agency continues to construct new fish facilities and improve existing systems as well as evaluate long-term options for further salmon passage improvements at the dams. These activities are primarily funded with Congressional appropriations through the Columbia River Fish Mitigation Project. The Corps also operates two upstream storage dams used in flow augmentation for migrating juvenile salmon: Dworshak Dam in Idaho and Libby Dam in Montana. The Corps has constructed fish hatcheries as directed by Congress as mitigation measures for the construction of some of the dams. The project and hatchery facilities are maintained and operated through Congressional appropriations.

5.11.3 Information Gathering and Dissemination

5.11.3.1 Stream Net

Approach StreamNet, the Northwest Aquatic Resource Information Network, consolidates data compilation and management activities that were historically conducted through the Coordinated Information System (CIS), the Northwest Environmental Data Base (NED), and the Pacific Northwest Hydropower Data Base and Analysis System (NWHS). These projects were created by the Northwest Power Planning Council to provide information necessary for implementation of its Fish and Wildlife Program; CIS for anadromous fish productivity and management, NED regarding Protected Areas and stream-based environmental factors, and NWHS for dam impacts and energy analysis (See CRBFWP Measures 3.3A-3.3E and 12.2). The rationale for their consolidation was to provide the region with one comprehensive, high-quality package of fish and wildlife data products and services to address emerging regional fish and wildlife data demands and to realize cost savings. The fundamental building block for this project is interagency cooperation in the collection, compilation, and dissemination of critical fish and wildlife information. The means for achieving this are 1) establishing agreement on the critical data needs, 2) developing regionally consistent data exchange formats, 3) establishing effective communication links, and 4) use of common data distribution mechanisms.

Biological Need Virtually every analysis of the Pacific Northwest fish issue calls for the preparation of regionally consistent and easily accessible data. The overall goal of StreamNet is to compile, maintain, and enhance a high-quality, regionally consistent set of fish and wildlife data that are directly applicable to regional policy, planning, and management, and to provide that data to users' desk tops. Specific emphasis continues to be placed on tailoring the project to meet specific Fish and Wildlife Program monitoring and evaluation needs.

StreamNet seeks to fill this need by providing essential baseline data on fish distribution, production, habitat, and management that are useful at policy, planning, and management levels. The project is the only source for regionally consistent fish and wildlife information and, as such, will play a critical role in evaluating the success of the various Fish and Wildlife Program activities. The project will also aid in the tracking of these activities. This project provides support for a variety of policy, planning, management, and research initiatives. It does not, in and of itself, produce specific biological results.

Description At its core, StreamNet consists of a series of data sets and reference materials concerning anadromous fish, resident fish, and factors related to the management of aquatic resources. Included are data on 1) anadromous fish productivity, both natural and hatchery, 2) species distribution, range, and life history, 3) the condition of anadromous (and some resident) fish populations and their environments, 4) dams and diversions, 5) Protected Areas, 6) other

river-related environmental variables, 7) references to source materials, and 8) stream flow and hydrology. Tabular data are accessed through custom interfaces, including the Distributed System (DS) and each state's Rivers Information System, the NWHS (or Hydro Site Data Base) system, and regional summary data currently available through a menu access system on the Council's VAX computer. Most of these data are available in Geographic Information System (GIS) format, and Internet access capability is being developed. Source materials are available through a reference library housed at the Columbia River Inter-Tribal Fish Commission in Portland, Oregon.

Brief Schedule of Activities Regularly scheduled progress reports are prepared by the contractor and sub-contractors. An annual Columbia River Basin Salmon and Steelhead Report is produced that graphically portrays salmon and steelhead production trends and other summary data of interest to managers and decision-makers. An anadromous fish production data system (DS), including documentation and a user's guide, is updated biannually. Tabular and graphic information is produced on fish distribution, life stages, barriers, and other topics applicable to natural resource management. Other products include a strategic plan for future data enhancement, data exchange format documentation, stock summary reports, an Internet home page, various topic-specific reports and map atlases, and white papers that identify opportunities for interagency cooperation in data compilation.

Listed below are a few of the more significant tasks StreamNet will accomplish during FY 97:

1. Incorporate 1996 and 1997 data concerning anadromous fish productivity.
2. Enhance the current anadromous fish data system by adding improved data on stocks, genetic management units as defined by others, ocean conditions, and other factors.
3. Initiate compilation of biological data on resident fish.
4. Collect regionally consistent information on aquatic habitat, aquatic management, land uses applicable to aquatic management, and flow.
5. Compile data on diversions and other instream factors that affect fish productivity.
6. Create data exchange formats and the infrastructure necessary for facilitating subbasin planning and other watershed planning activities regionwide.
7. Prepare a detailed strategy for using StreamNet for Fish and Wildlife Program monitoring and evaluation.

StreamNet will provide the framework for development of Fish and Wildlife Program-wide monitoring and evaluation activities. Baseline biological and management data are available, including the location of BPA-funded mitigation projects, and technologies are now in place to begin to compile data generated through individual on-the-ground Program projects and to analyze their effectiveness. Compilation of information on other mitigation, watershed planning, and ecosystem management activities will begin in FY 97. The annual Columbia River Basin Salmon and Steelhead Report provides a summary means to determine trends in meeting Program objectives. With regard to monitoring the effectiveness of the StreamNet project, participants will regularly solicit input from managers and decision-makers on 1) the effectiveness of data currently in the system in meeting regional needs; 2) the need for

modifications and/or enhancements to the information; and 3) the effectiveness of data delivery systems.

Project: STREAMNET (formerly CIS and NED) (8810804)
StreamNet compiles, maintains, and disseminates regionally standardized graphic and tabular data critical to the implementation of the Program and other compatible regional efforts.

FY97	FY98	FY99	FY2000	FY01
$2,000,000	$2,050,000	$1,800,000	$1,700,000	$1,700,000

5.11.3.2 PIT Tags

Approach "Passive Integrated Transponder" or "PIT" tags have emerged as a primary tool in the monitoring and evaluation and research of NPPC Fish and Wildlife Program measures and Biological Opinion measures. A regional approach to utilization, data management, and access to PIT tag data was adopted from the advent of use of the tag.

The use of PIT tags in a standardized regional data base provides a means of basinwide data collection, monitoring, and analysis. The approach required to develop this system should incorporate a consensus of the salmon managers utilizing these tools to evaluate mitigation measures. The PIT tag data base is maintained by the Pacific States Marine Fisheries Commission (PSMFC) through the Pit Tag Information System (PITAGIS) project. The data base management as well as technical aspects of the tag development and research is reviewed by a technical oversight committee, the PIT Tag Technical Committee. The regional approach to collection, management, and use of PIT tag information and installation and maintenance of detection equipment is being pursued, although this overall objective is not completely accomplished.

Ecological Objective The ecological objective of the maintenance and development of the Pit Tag information system is to provide a tool and data management that allows the systemwide evaluation of combinations of mitigation measures and their impacts on salmon recovery. The regional system of standardization of data collection and management is required by the broad range of migratory habitats and conditions encountered by any single group of listed and nonlisted anadromous fish.

Effort Required Both the Council's Fish and Wildlife Program and the Biological Opinion include measures that require the maintenance of a regional PIT Tag data system and a coordinated standardized system of tag use and detection. Maintenance of a regional data base to collect and store data and maintain open access to those data...[incomplete sentence] Continued development of adult return detection, detection facilities have a long-term role in evaluation of mitigation measures in both the NPPC Fish and Wildlife Program and the Biological Opinion. Several major studies are underway that depend upon the Regional PIT tag

information system, including the hatchery PIT tag study, survival studies, and smolt monitoring program implementation.

Summary of Current Activities The PITAGIS data system is operated and maintained under contract with Pacific States Marine Fisheries Commission. The maintenance and operation of PIT tag detection systems at mainstem dams is conducted under the auspices of a Memorandum of Agreement between BPA and the Corps. Development, maintenance, and operation of the data system and the tag system to maintain the regional objectives of the system is overseen by the PIT Tag Technical Committee.

Project: COLUMBIA BASIN PIT-TAG INFORMATION SYSTEM (9008000)
Develop, operate, maintain, and enhance a long-term Columbia River Basin database on PIT Tag information.

FY97	FY98	FY99	FY2000	FY01
$1,550,000	$1,575,000	$1,250,000	$1,275,000	$1,300,000

5.11.3.3 Plan for Analyzing and Testing Hypotheses (PATH) and Regional Analytical Coordination

Approach. During the period from 1990 to 1994, the BPA, the NPPC, NMFS, and various state and tribal resource agencies worked together to compare and enhance the models used to evaluate management options intended to enhance recovery of depleted Columbia River Basin salmon stocks. In 1994, a Scientific Review Panel (SRP) completed an interim report in which it concluded that there were three major differences between the modeling systems: 1) the distribution of survival over the life span; 2) the effect of flow on survival; and 3) the benefit of transportation. The panel felt that as long as these differences exist the models were going to give different answers in a fairly predictable fashion, rendering further analysis of the details of model behavior a relatively unproductive activity. The panel concluded that it would be more fruitful to focus on describing and attempting to resolve the fundamental issues, through hypothesis formulation and testing. This was the genesis of the Plan for Analyzing and Testing Hypotheses (PATH).

The NMFS 1995 Biological Opinion on the Federal Columbia River Power System (page 124, Recommendation 17) stated that "The BPA shall participate with NMFS in activities to coordinate the regional passage and life cycle models and to test the hypotheses underlying those models." NMFS noted that the emphasis should shift to analyses that test the different assumptions and hypotheses underlying the models, rather than refining our understanding of how the models are different. NMFS concurred with the recommendation of the SRP to conduct an analysis of alternative hypotheses. While PATH was designed to respond to the NMFS 1995 Biological Opinion, it also meets specific needs of the NPPC Fish and Wildlife

Program.11 In 1997, the NPPC will be reopening the Fish and Wildlife Program for review. This provides an opportunity to further meld PATH's objectives with those of the NPPC.

Though initiated by written directives (i.e. the SRP, NMFS and NPPC), the direction of PATH responds to periodic meetings with senior management and policy personnel in NMFS, BPA, the Corps, NPPC, Washington Dept. of Fisheries (WDF), Oregon Dept. of Fish and Wildlife (ODFW), Idaho Dept. of Fish and Game (IDFG), and the CRITFC. The policy group currently directing PATH is a Subcommittee of the Recovery Plan Implementation Team (IT).

Objectives. PATH's primary objectives were originally defined as the following:

1. Determine the overall level of support for key alternative hypotheses based on existing information, providing guidance to management agencies. Propose other hypotheses and/or model improvements that are more consistent with the data.

2. Assess the ability to distinguish among competing hypotheses from future information. Advise various institutions (NMFS, NPPC, BPA, USFW,ODFW,WDFW, IDFG, and Columbia River Treaty Tribes) on research, monitoring and adaptive management experiments that would maximize the rate of learning and clarify decisions.12

PATH is an iterative process of defining and testing a logical framework of hypotheses relating to the Columbia River anadromous salmon ecosystem, while moving towards stock recovery and rebuilding. Iteration within the PATH process occurs as this logical framework is revised over time in response to improvements in both information and analytical methods. The framework is intended to:

- Bound the anadromous salmon ecosystem components under consideration in the Columbia River Basin

- Lay out alternative hypotheses for the functioning of these ecosystem components, their response to management actions, and their ultimate impact on salmonid production

- Compile and analyze information to assess the level of support for alternative hypotheses relevant to key management decisions, identifying knowledge and data gaps that could be filled through management experiments, research, and monitoring

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11 Section 3.2 (adaptive management; integration of monitoring, evaluation and research into a unified framework to assist decision makers); Section 4.2A (system-wide analysis of major uncertainties); and Section 5.0A (specific hypotheses).

12 Barnthouse, L.W. and D. Marmorek; April 5, 1995. A new direction for Columbia River Basin Salmonid Model Evaluation and Use.

- Provide guidance to the development of regional programs that would stabilize, ensure persistence, and eventually restore depressed salmon stocks to self-sustaining levels

- Provide a structure for an adaptive learning approach to development and implementation of a regional salmonid recovery program

The logical framework developed in PATH is driven by the management questions of interest, the alternative hypotheses relevant to these questions, and the data available to test these hypotheses. The purpose of this exercise is not to simply compare the existing belief systems embodied in the various models, although modeling plays a role. Instead, the hope is to lay out a framework without reference to existing models with the expectation that this will provide a novel foundation for learning, decision-making, and action. This has already started to develop improved analytical tools.

Effort Required. Procedurally, PATH consists of a series of workshops, technical meetings, intense analytical activities, and reporting/review steps. The workshops and reports compel participants to complete tasks, and provide for fruitful exchange, feedback, and internal peer review. Both a core set of 25 PATH participants (composed of regional technical experts and outside technical experts) and an extended set of 15 - 20 occasional participants provide input to analytical activities. Progress toward specific tasks is directed and coordinated by a PATH Planning Group, consisting of five representatives of each of the major institutional groups (NMFS, States, Tribes, NWPPC, power system operating agencies), and the PATH facilitator. Cooperative development of assessment tools are encouraged and strived for as a goal of the PATH process.

Summary of FY 97 Activities

For FY 97, PATH has five goals concerned with retrospective analyses:

R1. Publish the results of retrospective analyses on spring/summer chinook completed in FY 96 in the peer-reviewed literature.

R2. Complete a conclusions document describing the main conclusions of the FY 96 retrospective analyses and the implied research and monitoring priorities.

R3. Followup retrospective analyses for hydrosystem, hatchery, habitat, and harvest impacts, so as to better define quantitatively the impact each of these have had on spring/summer chinook stock indicators.

R4. Complete data acquisition and run reconstructions for fall chinook within the

Columbia River Basin, as well as spring/summer stocks outside of the Basin (e.g. Alaska, Canada).

R5. Design and complete retrospective analyses for fall chinook stocks.

R6. Complete data reconnaissance and scoping for steelhead stocks.

PATH's FY 97 goals for prospective analyses are as follows:

P1. Estimate the improvement in life cycle survival required to reach various salmon objectives (survival, recovery, rebuilding) and the uncertainty associated with these estimates.

P2. Develop a formal decision analysis framework, which provides a common framework for incorporating alternative management action packages, alternative passage models (with their respective posterior probabilities based on retrospective analyses), and a variety of performance measures.

P3. Use of the decision analysis approach and other methods to assess the rate of learning associated with alternative sets of management actions, research and monitoring activities, and adaptive management experiments.

This set of goals obviously will mean concurrent efforts on retrospective and prospective analyses, and concerted efforts at integration and coordination. The reopening of the NPPC Fish and Wildlife Program in 1997 could affect the PATH group's progress on these goals.

Projects

The following projects fall under the PATH and Regional Analyctical Activities (Modeling):

Project: PATH - FACILITATION, TECH ASSISTANCE & PEER REVIEW (9600600)

PATH (Plan for Analyzing and Testing Hypotheses): an iterative process of defining and testing hypotheses underlying key salmon management decisions in the Columbia River Basin with scientists/managers from BPA, NPPC, NMFS, state and tribal agencies, as well as independent peer reviewers.

FY97	FY98	FY99	FY2000	FY01
$450,000	$450,000	$450,000	$450,000	

Project: PATH - PARTICIPATION BY STATE AND TRIBAL AGENCIES (9600800)

PATH (Plan for Analyzing and Testing Hypotheses): an iterative process of defining and testing hypotheses underlying key salmon management decisions in the Columbia River Basin with scientists/managers from BPA, NPPC, NMFS, Idaho Department of Fish and Game (IDFG), Oregon Department of Fish and Wildlife (ODFW), Washington Department of Fish and Wildlife (WDFW), and the Columbia River Inter-Tribal Fish Commission (CRITFC) and its member tribes, as well as independent peer reviewers.

FY97	FY98	FY99	FY2000	FY01
$716,200	$534,300	$553,000	$572,400	

Project: MONITORING AND EVALUATION MODELING SUPPORT (8910800)

Provides analytical tools and databases required to evaluate the effectiveness of hydrosystem operations and other mitigation measures for improved fish survival as required to meet obligations of the ESA, NEPA, and NW Power Act.

FY97	FY98	FY99	FY2000	FY01
$200,000	$900,000	$900,000	$900,000	$0

Project: LIFE-CYCLE MODEL DEVELOPMENT AND APPLICATION TO SYSTEM AND SUBBASIN PLANNING IN SNAKE RIVER (9203200)

Improve decision-support tools for (1) assessing overall program effectiveness, and more specifically (2) assessing the impacts of land-use activities on resident and anadromous salmonids.

FY97	FY98	FY99	FY2000	FY01
$65,000	$68,000	$30,000		

Project: TECHNICAL ASSISTANCE WITH THE LIFE CYCLE MODEL (9303701)

Evaluation of biological impacts of hydro operations through life cycle modeling.

FY97	FY98	FY99	FY2000	FY01
$60,000	$150,000	$175,000	$200,000	

Project 6: Technical Support (9601700)

5.11.3.4 Clearing Up

Project: FISH.NET POLICY ACCESS NETWORK WITH NW FISHLETTER (9601500)

A Fish.NET web page project on Internet which gathers and organizes policy and scientific information and publishes NW Fishletter periodical with news supported by hyperlinked documents.

FY97	FY98	FY99	FY2000	FY01
$93,262	$97,925	$102,821		

5.11.3.5 Fish Passage Center Home Page

Approach The Fish Passage Center Home Page is developed as a means to provide the data that the FPC has collected and summarized regionwide over the past years through the Internet. Data collected through the Smolt Monitoring Program and data used in the ESA in-season management process are provided daily on the Internet page. The page provides fish migration data as collected by the FPC throughout the Columbia Basin. The page is maintained as a component of the normal data distribution activity of the FPC and not as a separately funded project.

Ecological Objective The objective is to provide broad access through the Internet to all of the systemwide data used by the FPC, the salmon mangers, and the hydrosystem managers in implementation of Biological Opinion measures and the NPPC Fish and Wildlife program measures.

Effort Required The NPPC measures related to the Fish Passage Center require the collection and distribution of migration-characteristic data and weekly and annual reporting of those data. The Biological Opinion implementation requires the collection and distribution of migration data for the implementation process. Maintenance of the FPC project encompasses the maintenance of the home page activity as well as the traditional facsimile and mail distribution of data.

Summary of Current Activities At present the Fish Passage Center Home page includes the following information, updated daily and weekly as appropriate.

- daily passage indices for all mainstem sites by species
- cumulative passage indices
- dissolved gas and symptoms by site
- summary passage indices by week
- hatchery and freeze brand release data

- annual hatchery release data
- hatchery release information for the next two weeks and the previous two weeks
- historical previous years hatchery release data (1979-1995)
- smolt transportation summary tables
- adult salmon and steelhead cumulative passage (ladder) counts
- project flow and spill volume tables for mainstem dams
- dissolved gas saturation tables for mainstem dams and in river sites
- current versus historic water temperature profiles for Bonneville, McNary, Priest Rapids, Ice Har
- system operation requests
- weekly report

5.11.4 Special Projects

5.11.4.1 Enhanced Columbia Basin Law Enforcement Program

Objective and Approach The objective of this systemwide law enforcement program is to reduce illegal take of Columbia River Basin salmonids and native resident fish, and thereby help to rebuild of all endemic fish populations within the basin. The approach being taken is threefold. First, to substantially increase and maintain the levels of harvest and habitat law enforcement throughout the Columbia Basin -- to more than double pre-program (1991) baseline conditions for all state and tribal enforcement agencies. Second, to enhance the efficiency of this increased harvest and habitat enforcement effort by promoting cooperation and assistance from appropriate federal, state, tribal, regional, and local entities. Third, to educate the public on the plight of specific fish stocks that are in danger of extinction and the need to protect their critical habitats, and to make the public aware of the importance to society of conserving the cultural values and diversity of anadromous salmonid species and resident fish for future generations. Specific goals and objectives of the tribal fisheries enforcement projects are consistent with this overall goal.

Scope The conceptual scope of the overall program is the entire life cycle of the target fish species, i.e., "gravel to gravel." The geographical scope of the BPA-funded program is the entire Columbia River Basin, including near-shore ocean, estuary, mainstem, and tributaries. Illegal take includes illegal harvest of adults and juveniles, harassment of spawners attending redds, destruction of eggs or fry within redds, direct mortality of juveniles caused by various human activities (e.g., water diversion), and degradation of critical habitat. With the cooperation and support of the NMFS and U.S. Coast Guard, the geographic scope of enhanced law enforcement extends from the near-shore ocean to the high seas. The targeted fish stocks are depleted anadromous salmonids and resident fish species -- especially species petitioned or listed under the ESA. It is expected that enhanced protection will also extend to all other endemic fish populations in the Columbia Basin (e.g., steelhead, and white sturgeon); this enhancement "spin-off" is considered by all participants to be beneficial to fishery resources of the entire region.

Background and History of the Law Enforcement Program The enhanced law enforcement program was conceived by regional consensus during the 1990-1991 Salmon Summit and resulted from agreement between the Bonneville Power Administration, the Executive Director of the Columbia River Inter-Tribal Fish Commission, and the fishery agency directors from Oregon, Washington, and Idaho. The original 1992-1994 implementation plan for "*Increased Levels of Fishery Harvest Law Enforcement and Public Awareness for Anadromous Salmonids in the Columbia River Basin*" was an integration of four individual statements of work provided by the law enforcement managers of the participating enforcement entities. In August 1993, the National Marine Fisheries Service, Northwest Law Enforcement Division joined the BPA-enhanced law enforcement program to provide coordination for inter-agency task forces. In 1994, the Montana Department of Fish, Wildlife and Parks (MFWP*) enforcement division initially received funding from a BPA-funded habitat project. Subsequently, in 1995 the MFWP resident fish component was incorporated into Project 92-024. In 1995, the statement of work was revised to incorporate basinwide habitat enforcement and resident fish enforcement in Montana.

The enhanced fishery law enforcement was initially designed as a three-year (1992-1994) demonstration project -- to determine the cost and biological effectiveness of this conservation method. Preliminary analyses and evaluation by the cooperating enforcement agencies, BPA, and the NMFS Snake River Recovery Team indicated that the program was successful in providing additional protection to depleted Columbia Basin fish stocks and their critical habitats during the initial phase of program implementation. The directors of ODFW, CRITFC, IDFG, WDFW, NMFS, and USFWS all recommended continued funding for fiscal year 1995. In June 1995 the results from the 1992-1994 Columbia Basin fisheries and habitat law enforcement demonstration project, in terms of implementation and potential biological benefits, were published in a BPA final report. At the same time the directors of state, federal, and intertribal fishery agencies within the Columbia Basin again instanced their unanimous support for the continued BPA funding of the enhanced fishery and habitat law enforcement program for FY 1996. Table 5.11-1 shows the history of BPA funding for this program from 1991 to 1996.

Table 5.11- 1 Increased levels of fisheries harvest law enforcement personnel (FTE) in the Columbia and Snake river basins derived from BPA funding, 1992-1996

AGENCY	1991 BASELINE FTE	BPA FUNDED FTE FOR 1992	BPA FUNDED FTE FOR 1993	BPA FUNDED FTE FOR 1994	BPA FUNDED FTE FOR 1995	BPA FUNDED FTE FOR 1996
CRITFE	**14**	**5**	**8**	**8.5**	**9.0**	**8.25**
OSP	**5**	**6**	**7.5**	**7.5**	**7.5**	**6.0**
WDFW	**5**	**7**	**10.5**	**10.5**	**10.5**	**9.5**
IDFG	**2**	**5**	**5.75**	**7**	**7.0**	**5.0**
MDFWP	**--**	**0**	**0**	**0**	**1.0**	**3.0**
Total	**26**	**23**	**31.75**	**33.5**	**35.0**	**31.75**

In September, 1997 CBLEC allocated the $4.457 million available funds for project 92-014, as depicted in Table 5.11-2.

Table 5.11- 2 Budget allocation for FY 1997 BPA funding of the enhanced law enforcement program

Component	FY 1997
92-024-01 CRITFC	$891,827
92-024-02 OSP	$760,266
92-024-03 WDFW	$765,000
92-024-04 IDFG	$820,459
92-024-05 NMFS	$0
92-024-06 MDFWP	$262,709
92-024-07 Evaluation	$70,000
92-024-08 Nez Perce	$311,549
92-024-09 Umatilla	$271,734
92-024-07 Shoshone Bannock	238,456
Discretionary (e.g., pump survey)	$65,000
TOTAL	**$4,457,000**

The Columbia Basin Law Enforcement Council (CBLEC) In 1978, the National Marine Fisheries Service, U. S. Fish and Wildlife Service, Oregon State Police, Washington Department of Fish and Wildlife, and Idaho Department of Fish and Game formed the Columbia Basin Law Enforcement Council[13] (CBLEC). CBLEC is composed of LE chiefs or their delegates from state, federal, and tribal fish and wildlife entities throughout the Columbia

13 Formerly called the Columbia River Law Enforcement Committee (CRLEC).

Basin. CBLEC was formed so that the regional fisheries enforcement agencies would have a forum in which to coordinate fisheries enforcement on the Columbia River. CBLEC membership consisted of command personnel from each of the participating agencies. In 1983, the Columbia River Inter-Tribal Fish Commission's Enforcement Department (CRITFE) joined CBLEC. CRITFE represented the four Columbia River Treaty Tribes on mainstem Zone 6 fishery issues. From 1978 until the fall of 1991, coordination and levels of enforcement were severely restricted because of a shortage of enforcement resources.

Since 1992, CBLEC has taken on the task of coordinating the ongoing Columbia Basin law enforcement program, which is funded by BPA and administered through the U.S. Fish and Wildlife Service. CBLEC has been recognized by regional planning and funding entities (e.g., CBFWA, NPPC, and BPA) as the appropriate entity to plan and coordinate inter-agency fisheries and habitat law enforcement operations throughout the Columbia Basin. Furthermore, BPA desires that any new LE projects be integrated with the ongoing LE Program -- via CBLEC coordination -- using adaptive management principles. Current membership of the Columbia Basin Law Enforcement Council (CBLEC) is presented in Table 5.11-3.

Table 5.11- 3 Membership of the Columbia Basin Law Enforcement Council (CBLEC), 1996

Entity	Initial Year of Membership
U.S. Fish & Wildlife Service, Region 1 Division of Law Enforcement	1978
National Marine Fisheries Service, Northwest Region, Office of Enforcement,	1978
Oregon State Police, Division of Fish & Wildlife	1978
Washington Department of Fish & Wildlife, Fisheries Patrol	1978
Idaho Department of Fish & Game, Bureau of Enforcement	1978
Montana Department of Fish, Wildlife & Parks, Enforcement Division	1995
Columbia River Inter-Tribal Fish Commission, Fisheries Enforcement Department[14]	1983
The Nez Perce Tribe, Fish & Wildlife Department	1996
The Confederated Tribes of the Umatilla Indian Reservation, Fish & Wildlife Enforcement	1996
The Shoshone-Bannock Tribes, Fish & Game Enforcement	1995
The U.S. Coast Guard	Ex Officio, 1994

Relationship to Treaty Rights, *US v Oregon*, the Columbia River Management Plan
Authority for tribal fisheries law enforcement is derived from treaties with the U.S. Government. It has consistently been held that treaties were grants of rights from tribes to the United States

14 CRITFC represents the four Columbia River Treaty Tribes -- Nez Perce, Yakama, Umatilla, and Warm Springs -- on matters pertaining to mainstem Zone 6 fisheries.

and that anything not expressly granted was reserved. It is fundamental that a federal treaty guaranteeing certain rights to the subjects of a signatory nation is self-executing and supersedes state law, *US v Washington*, and that a state may enact no statute or regulation in conflict with a treaty between the United States and an Indian tribe.

Relationship to the Northwest Power Planning Council's Fish and Wildlife Program
The ESA listings described in Section D (below) provided an impetus to implement additional measures that could provide immediate protection of depleted salmonid stocks in the Columbia Basin under the auspices of the Northwest Power Act -- one such measure was enhanced law enforcement. The NPPC Program was amended in 1991 to provide for increased levels of harvest law enforcement throughout the Columbia River Basin, and to heighten the public's awareness of the importance of protection of various depleted stocks from over harvest, incidental catches, and illegal harvest in ocean and river mixed-stock fisheries. The increased law enforcement measure was included as a measure in the Council's Strategy for Salmon published in 1992). This measure included two parts: (1) Use all available authorities to put a rapid end to all high seas driftnet fisheries; and (2) Develop, implement, and evaluate an expanded enforcement and public education program to provide additional protection to Columbia River salmonids and weak stocks throughout their life cycle.

Relationship to the Endangered Species Act (ESA) and Federal Recovery Plans The impetus for initiating the enhanced law enforcement program was to provide additional protection for critically depleted stocks that are listed or proposed for listing under the federal Endangered Species Act of 1973. Under Section 7(a)(1) of the ESA, federal agencies are mandated *"... to utilize their authorities, in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act."* The ESA specifically lists law enforcement as one of the conservation measures to be used to rebuild threatened or endangered species to achieve de-listing (Section 3(3)). The National Marine Fisheries Service is the federal agency responsible for conducting the ESA process for anadromous salmonids in the Columbia Basin. In contrast, the parallel ESA process for resident fish is conducted by the U.S. Fish and Wildlife Service.

Numerous Columbia Basin anadromous salmonid stocks and resident fish species are severely depleted and have been petitioned, proposed, or listed as threatened or endangered species under the authority of the ESA. The first Columbia Basin salmonid stocks to be listed as threatened or endangered pursuant to the ESA were the Snake River (Redfish Lake) sockeye salmon, in 1991, and two Snake River stocks of chinook salmon (the spring/summer chinook, and the fall chinook) in 1992. The Kootenai River population of white sturgeon was listed by the USFWS as "endangered" under the ESA in September 1994. Bull trout were petitioned for listing in October 1992; USFWS conducted a status review and determined a listing was "warranted but precluded" because of planned enhancement measures. Other depleted resident fish species in the Columbia Basin that may benefit from enhanced enforcement protection

include burbot, kokanee, redband trout, westslope cutthroat trout, Arctic grayling, and Lahontan cutthroat trout.

NMFS also recommended continuation of a vigorous fishery law enforcement program. NMFS released the proposed Salmon Recovery Plan for Snake River sockeye salmon, fall chinook salmon and spring/summer chinook salmon (Schmitten et al. 1995). The USFWS has assembled a Recovery Team for Kootenai River white sturgeon and issued a draft Recovery Plan in December 1995.

Enforcement Jurisdictions and Coordination among Cooperators The cornerstone of this interagency law enforcement program is coordination among the tribal, state, and federal entities with fisheries law enforcement jurisdictions within the Columbia River Basin -- through the Columbia Basin Law Enforcement Council. The primary state or tribal jurisdiction of different segments of the Columbia and Snake rivers varies according to the geographic boundaries; however, law enforcement agencies work together throughout the region. Memoranda of Understanding (MOU's) exist to cross-deputize law officers across state, tribal, and federal jurisdictions and facilitate interagency task forces. federal agencies have the responsibility to protect listed stocks and enforce violations of the ESA, i.e., NMFS for anadromous salmonids and USFWS for resident fish. The states of Washington and Oregon have jurisdictions in the Columbia River estuary and the near-shore ocean. The U.S. Coast Guard, in conjunction with NMFS, has enforcement jurisdiction over salmon protection in the high seas. Specific state and tribal jurisdictions are described in more detail by Vigg (1991, 1994). Various administrative rules, state laws, treaties, and federal laws exist that give the enforcement arms of the fish and wildlife agencies and tribes the authority to enforce rules and laws.

Project: COLUMBIA BASIN LAW ENFORCEMENT PROGRAM (9202400)
An interagency fisheries and habitat law enforcement program to reduce illegal take of anadromous salmonids and resident fish and protect their critical habitats throughout the Columbia Basin. USFWS is currently administering BPA funds to CRITFC, OSP, WDFW, IDFG, and MDFWP to implement the LE Program.

FY97	FY98	FY99	FY2000	FY01
$4,457,000	$4,000,000	$4,000,000	$4,000,000	$4,000,000

Project: CTUIR TRIBUTARY ENFORCEMENT (5505500)
The CTUIR will develop a coordinated enhancement for a fish and wildlife enforcement program, which will support continued interagency cooperation with tribal, state, and federal agencies in the "gravel-to-gravel" management philosophy adopted for protecting Columbia River salmonids, salmon listed by ESA, and all other anadromous fish.

FY97	FY98	FY99	FY2000	FY01
$0.00	$219,740	$227,890	$236,345	$245,145

5.11.4.2 Predator Control

Approach The Squawfish Management Program (Program) is supported by the Northwest Power Planning Council's Fish and Wildlife Program (Measure 5.7B) and is listed as a "reasonable and prudent alternative" in the National Marine Fisheries Service's 1995 Biological Opinion. The Program was begun in 1990 with test fisheries, using a sport-reward fishery and a commercial-longline fishery in John Day Pool. This project is based upon the results of BPA-funded predation studies conducted during 1982-88 in John Day Reservoir by the U.S. Fish and Wildlife Service and the Oregon Department of Fish and Wildlife. These studies determined that predation was the principal cause of mortality for juvenile salmonids in John Day Reservoir and that 80 percent of these losses are from predation by northern squawfish. When data from these studies were modeled, the results predicted that sustained fisheries on northern squawfish 11 inches and over would reduce northern squawfish consumption of juvenile salmonids by up to 50 percent. Many methods of catching northern squawfish were tested, including the use of angling, trapping, electrofishing, gill-netting, and long-lining, with angling found to be the most effective method. Based on the success of these limited efforts, systemwide fisheries were implemented in 1991 and are continuing.

Ecological Objective The ecological objective is to reduce mortality from northern squawfish predation on outmigrating stocks of salmon and steelhead by controlling squawfish numbers. Construction of mainstem dams has made juvenile salmonids more vulnerable to predation by northern squawfish. The objective of the Northern Squawfish Management Program is to test the hypothesis that a 10-20 percent harvest rate on northern squawfish is sustainable, and that it will result in a 50 percent reduction in northern squawfish predation on juvenile salmonids. The harvest rate on northern squawfish has averaged 12.3 percent for 1991-96. Predation by northern squawfish on juvenile salmonids in 1997 is estimated to be reduced by 34 to 59 percent from pre-Program levels as a direct result of Program activities to date.

Effort Required The Program is currently being implemented by the Washington Department of Fish and Wildlife (sport-reward fishery), the Nez Perce, Umatilla, Warm Springs, and Yakama tribes (dam-angling and gillnet-fisheries), the Columbia River Intertribal Fish Commission (coordination and reporting for tribal fisheries), the Pacific States Marine Fisheries Commission (fiscal administration and sport-reward and derby payments), and the Columbia Basin Fish and Wildlife Authority (technical administration). Program evaluation is being carried out by the Oregon Department of Fish and Wildlife

Current Activities and Future Plans. Activities in 1997 will focus on increasing participation in the sport-reward fishery by increased promotional activities (radio and newspaper advertising, derbies, and fishing clinics) focused earlier in the season in the area below Bonneville Dam. Preliminary data from evaluations conducted by the Oregon Department of Fish and Wildlife (ODFW) indicate that the Program is successfully accomplishing its initial

purpose, as indicated by a reduction in the average size and number of northern squawfish. ODFW is presently preparing a final report on its 1990-96 evaluation. The ODFW plans to restrict its future evaluation efforts to monitoring the harvest rate on squawfish. More intensive evaluation activities are planned for every third year to assure that key assumptions have not changed. Under the assumption that the final report by ODFW will reflect its preliminary findings of success, the Program is expected to continue in an operational mode for at least the next five years, with continuous monitoring and more intensive evaluation every three years.

Project: EFFECTIVENESS OF SQUAWFISH MANAGEMENT (5516600)

The evaluation of the effectiveness of squawfish management is an integral component of the ongoing program. Changes in northern squawfish age and size distributions and consumption rate of juvenile salmonids are being assessed by ODFW through biological sampling; computer modeling is the primary basis for estimating survival benefits to juvenile salmonids, including inter- and intra-specific compensation. NBS is also conducting bioenergetics modeling as an alternative, corroborating evaluation method. This project simply serves to enhance the ongoing evaluations, if necessary, to ensure rigorous and timely assessment of this program.

FY97	FY98	FY99	FY2000	FY01
$3,700,000				

Project: SELECTIVE PREDATION/DEVELOPMENT OF PREY PROTECTION (8200300)

Objectives are to assess the relative vulnerability of juvenile salmonids of varying condition to predation and to develop measures that will protect outmigrating juvenile salmonids from resident fish predators, particularly northern squawfish.

FY97	FY98	FY99	FY2000	FY01
$470,798	$474,246	$447,919		