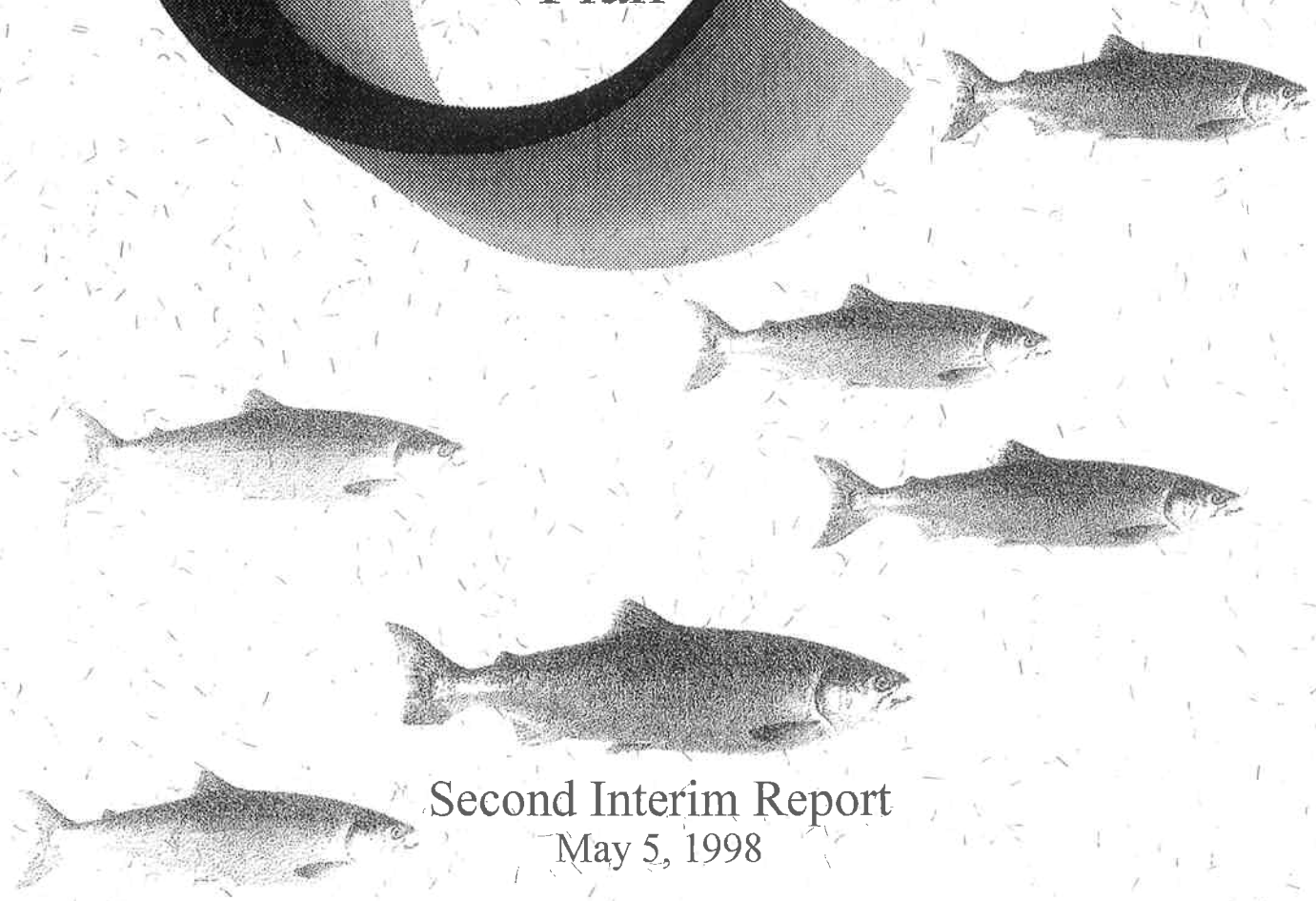
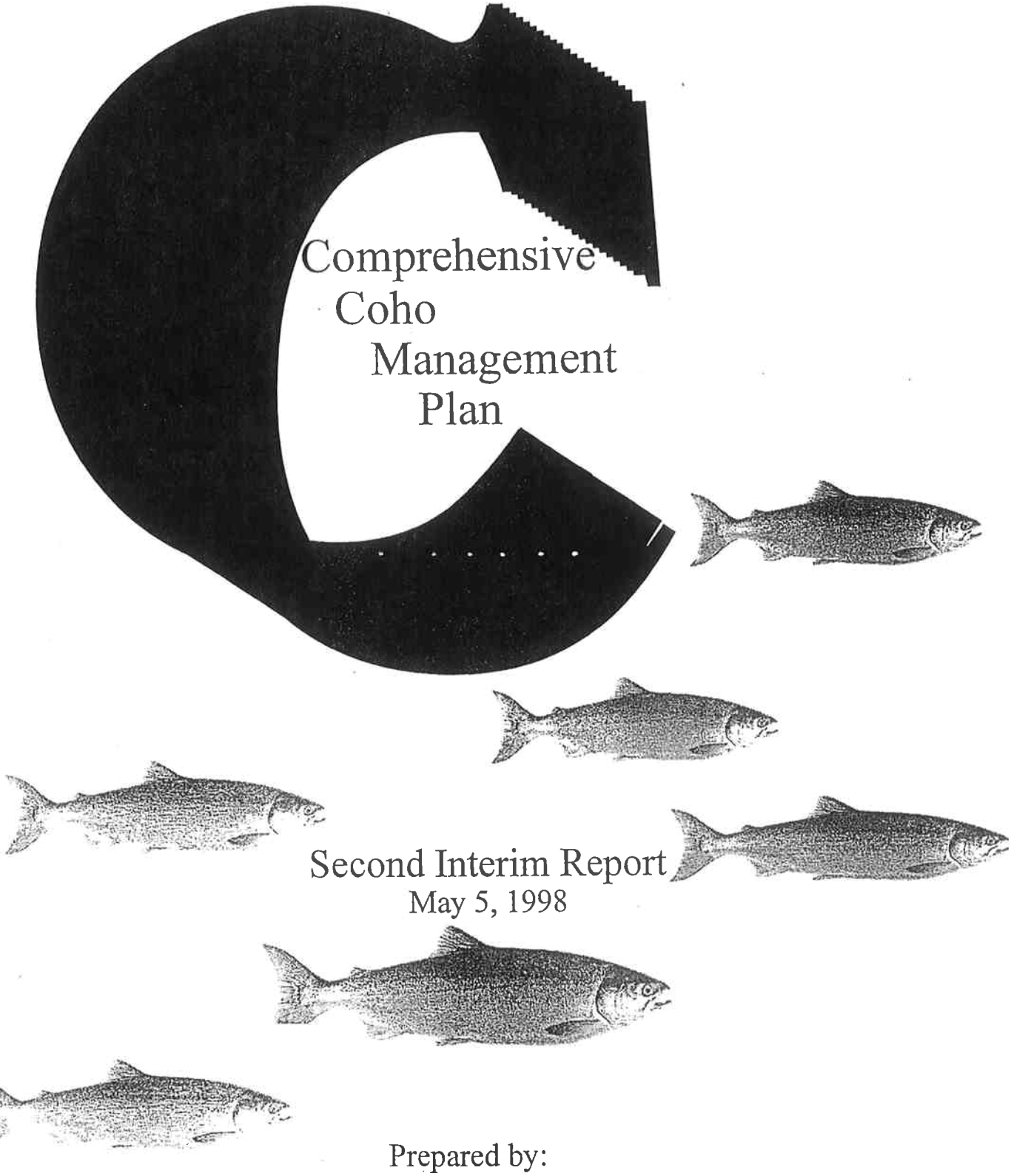
Comprehensive Coho Management Plan



Second Interim Report
May 5, 1998

Comprehensive Coho Workgroup

Comprehensive Coho Management Plan



Second Interim Report

May 5, 1998

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Puget Sound Treaty Tribes
Washington Department of Fish and Wildlife

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List of Acronyms

CCMP	Comprehensive Coho Management Plan
CCW	Comprehensive Coho Workgroup
CWT	Coded-wire-tag
ESU	Evolutionary Significant Unit
MSH	Maximum Sustainable Harvest
NMFS	National Marine Fisheries Service
PSSMP	Puget Sound Salmon Management Plan
PSSSRG	Puget Sound Salmon Stock Review Group
SASSI	Salmon and Steelhead Stock Inventory
SSHIAP	Salmon and Steelhead Habitat Inventory and Assessment Project
WDFW	Washington Department of Fish and Wildlife
WRIP	Watershed Restoration Diversity Report

1.0 Introduction

At the Cooperative Management meeting in April of 1993, an outline of a proposed process for developing a Comprehensive Coho Management Plan (CCMP) was presented for consideration by the State and Tribes (Cooney et al. 1993). The outline was presented in response to a perceived need to: 1) improve the management of coho salmon in the face of decreased abundance and habitat loss (PSSSRG 1992); 2) address intertribal and treaty/nontreaty allocation disputes; 3) complement watershed and Pacific Salmon Commission planning activities; and 4) prevent the depletion of wild stocks and the potential for the subsequent listing of evolutionary significant units (ESUs) as threatened or endangered (58 FR 57770). By directly addressing the needs of wild stocks, the CCMP provides a management framework for the Wild Stock Restoration Initiative for coho salmon, an initiative of the co-managers to "Maintain and restore healthy wild salmon and steelhead stocks and their habitats in order to support the region's fisheries, economies, and other societal values" (WDF et al. 1993).

The identified goal of the Comprehensive Coho process is to:

Goal of Comprehensive Coho Management Plan

Develop and implement improved coho management approaches that support the maintenance and restoration of wild stocks in a manner that reflects the region's fisheries objectives (resource protection, allocation, and harvest stabilization), production constraints, and production opportunities.

Specific objectives identified were as follows.

Resource Protection. The approach must protect the production base and provide incentives for increased production.

Allocation. The approach must meet legal obligations, including the preservation of Treaty Indian fishing rights and sharing of the resource among the tribes.

Harvest Stabilization. Year-to-year stability is an important objective in many fisheries. Stability should be achieved in a manner consistent with allocation and resource protection objectives.

Management Process. The approach should be consistent with technical capabilities, promote management efficiency by establishing pre-determined management actions for specific resource conditions, and reduce annual management conflicts. Implementation of the plan should result in a shift in emphasis from pre-season fishery planning to inseason and post-season stock assessment, management system evaluation, and stock restoration.

Evaluation Incentives. Development and implementation of the approach should help identify and assign information and research needs. The approach should readily incorporate new information.

Consistent with the Puget Sound Salmon Management Plan (PSSMP), the resource use policy of maximum sustainable harvest (MSH) has guided the development of the CCMP.

1.1 Historical Development

Acting upon the 1993 proposal to develop the CCMP, the State and Tribes established a Comprehensive Coho Workgroup (CCW) comprised of technical staff representing the State and western Washington tribes to prepare a 'strawhorse' coho management plan. The CCW was given the task (May 21, 1993 letter of Gary Graves to Case Area Fisheries Managers) of developing a plan for review and elaboration by state and tribal policy representatives with: 1) predetermined management actions for specified fisheries under specific stock conditions; 2) a multi-year approach to allocation; and 3) specification of which stocks drive which fisheries under which conditions, taking into account proper application of harvest management, and the need to react to extreme conditions.

Initial efforts of the CCW were focused upon reviewing the range of alternatives that might be implemented. This review, completed in September of 1993, resulted in a recommendation that base fishery levels be set to achieve target exploitation rates that are specific to a management unit. Policy approval to pursue appropriate alternatives was provided at the Mid-Term Cooperative Management meeting in October of 1993. Subsequent progress on the framework for the CCMP was presented in an interim report in June of 1994 (CCW 1994).

Two reports of the Puget Sound Salmon Stock Review Group (PSSSRG) provided similar recommendations for an escapement policy for several wild stocks in Puget Sound. In 1992 (for the Hood Canal and Skagit wild management units) and in 1997 (for the Strait of Juan de Fuca Tributaries management units) the PSSSRG's review of factors leading to escapement failures recommended a management approach that reduced dependence on preseason forecasts and fixed escapement goals and established stock-specific target exploitation rates (PSSSRG 1992; PSSSRG 1997). The 1997 report also noted that these recommendations had not yet been implemented.

The commitment to develop the CCMP was reinforced by the April 1997 stipulation regarding Mass Marking and Selective Fisheries (the Stipulation). The parties recommitted to completing a comprehensive plan that would include, among other things, consideration of selective fisheries for mass-marked coho salmon. The Stipulation included a work plan with a defined schedule of tasks leading to full implementation of all elements of the CCMP with the planning of the 1999 season.

1.2 Characteristics

The inextricable links between coho salmon habitat, natural and artificial production, and harvest have been the driving forces in the development of the CCMP. Recognition of these links, and the development of integrated management strategies, is a critical step toward maintaining and restoring the productivity, diversity, and capacity of the resource. Only through the integrated management of the resource can the objectives of this plan be achieved.

The inextricable links between coho salmon habitat, production, and harvest are the driving forces in the development of the CCMP.

The CCW believes that an integrated management plan entails more than simply recognition of the primary factors affecting coho salmon production. The plan must also identify complementary habitat, artificial production, and harvest management actions appropriate for the status of the resource. In the CCMP, integration of these management actions is achieved by keying all management actions to the same measures of productivity and production capacity of the resource.

Maintenance and restoration of coho salmon habitat is a critically important objective of the CCMP. Viable, sustainable fishing opportunities cannot be provided in the absence of viable habitat; preservation of relicts of disjointed habitat remnants will inevitably result in the preservation of mere remnants of natural production. The harvest management actions provided in this plan will provide short-term protection for wild stocks when survival rates decline temporarily due to non-anthropogenic sources. However, only a comprehensive approach that also includes protecting productive habitat and restoring degraded habitat will result in the long-term health of wild stocks and sustainable fisheries.

Maintenance and restoration of coho salmon habitat is a critically important objective of the CCMP. Viable, sustainable fishing opportunities cannot be provided in the absence of viable habitat...

1.3 Current Status

During the last year, the CCW has made substantial progress on the development of the CCMP, particularly the tasks identified by the Stipulation for discussion in 1997. This report provides a summary of progress on those tasks, including recommended exploitation rates for some wild stocks, escapement thresholds that trigger management actions, and monitoring requirements. Components of the plan that will be developed in 1998 are also noted in the report.

The strawhorse plan described in this report is applicable to Puget Sound stocks. Coastal stocks of coho salmon, which are not included in this plan, are the subject of the *Hoh v. Baldrige* Framework Management Plan. Following completion of the preliminary framework for Puget Sound stocks, the Washington Department of Fish and Wildlife (WDFW) is interested in applying the concepts

of the plan to coho salmon of the lower Columbia River, Willapa Bay and, through the *Hoh v. Baldrige* process, evaluating management options for coho salmon stocks in the North Washington Coast. Integration of these plans would be required for coastwide implementation of the CCMP.

2.0 Technical Basis

One objective of the CCMP is to provide a management framework that is consistent with our technical capabilities. Given this objective, the CCW sought to identify the technical information that is available and the constraints that this information might place upon the plan. These constraints are discussed below for each of the primary components of the CCMP.

2.1 Habitat and Natural Production

Harvest management and habitat management are closely linked. In order to provide a quantity of production sufficient for both spawning escapement and harvest, habitat must be protected to a greater extent than would be necessary to simply maintain a minimal level of production.

A review of the information available on the relation between fish habitat and production indicated that:

1) Under constant habitat and survival conditions, the exploitation rate associated with the maximum sustainable harvest (MSH exploitation rate) would be the same in each year. However, the quality and quantity of fish habitat in western Washington is dynamic and variable. Long-term trends, and annual variation, affect the MSH exploitation rate and harvest levels.

   The inextricable links between coho salmon habitat, production, and harvest are the driving forces in the development of the CCMP. Throughout this management plan, the CCW has sought to identify management actions that complement, rather than subordinate, these links.

2) Research has identified the habitat factors that typically affect the production of coho salmon.

   Exhaustive reviews of the habitat factors affecting the production of coho salmon have been provided by the NRC (1996), Spence et al. (1996) and, for western Washington, by Lestelle et al. (1993) and the PSSSRG (1997). These reviews can be used to define prescriptive standards, or habitat conditions, required to maintain the production of coho salmon. These reviews and other literature were used to define policy goals, performance measures, and actions strategies in the Joint Tribal-State Wild Salmonid Policy (WSP). The WSP was adopted by the Washington State Fish and Wildlife Commission on December 5, 1997. This Policy is being reviewed by tribal governments and may be amended as necessary on a government-to-government basis between the Tribes and Commission.

3) The complex relationship among habitat factors has made it difficult to provide quantitative predictions of the effects of habitat changes upon coho salmon production. At the present time, only limited tools exist to provide quantitative predictions of the effect of habitat changes on coho salmon production.

   The development of quantitative predictive models discussed in this plan will facilitate analyses of how land use activities can be conducted without compromising coho salmon production. However, in the short-term, prescriptive standards will remain the primary tool used to assure the maintenance of coho salmon habitat.

4) Extensive data on habitat conditions exist, but sample design and analytical methods have often been inconsistent. Efforts to compile all relevant data into a single, linked, and easily accessed database have only recently been initiated.

   The Salmon and Steelhead Habitat Inventory and Assessment Project (SSHIAP), the Resource Inventory Project, and Watershed Analysis will soon provide a comprehensive description of the habitat conditions within a watershed, but prioritization of protective and restoration actions is required

2.2 Artificial Production

Hatchery production can have immediate profound effects on total harvest levels and harvests of wild fish and potentially long-term effects on genetic diversity and productivity. The CCW review indicated that:

1) Artificial production currently account for approximately 60% of the total abundance of Puget Sound coho salmon. Hatchery programs realize a variety of intended benefits. Uses of hatchery production range from fishery augmentation and replacement of lost natural production to reintroduction of fish into environments where they have become extinct.

2) As discussed in Section 2.1, we currently have a limited capability to estimate the effects of habitat loss and degradation upon the production potential of streams in western Washington. However, Weitkamp et al. (1995) have estimated that the total abundance of coho salmon originating from Puget Sound remains near historical levels, despite the significant increase in the contributions of fish originating from hatchery programs.

3) With the benefits of artificial production come a variety of genetic and ecological risks, including potential loss of genetic diversity within populations, loss of genetic diversity among populations, domestication (or loss of fitness in the wild), and extinction. These are expected to vary depending on the intent of the program, status of the habitat, status of natural populations, and the effectiveness of the programs (Steward and Bjornn 1990;

Busack and Currens 1995). The National Marine Fisheries Service identified the risks associated with hatchery production as a significant concern in Puget Sound (Weitkamp et al. 1995). Our ability to assess these risks is generally limited and varies between individual risk factors and stocks:

a) The conditions necessary for loss of fitness associated with hatchery production have been well documented. Only a few studies, however, have attempted to measure loss of fitness or productivity from genetic and ecological impacts of hatchery production (reviewed by Campton 1995).

b) No quantitative models are currently available to accurately predict on a case-by-case basis the loss of fitness or productivity associated with artificial production. These are unlikely to be developed soon, because fitness and productivity depend on complex interactions of genes and environment that are not well understood.

c) Managing for genetic diversity, which is more easily measured and predicted than fitness, is one method of addressing genetic risks. The most commonly used techniques for measuring genetic diversity (protein eletrophoresis, DNA) do not directly measure traits associated with fitness, however.

2.3 Fishery Management

An extensive review of the information available on the productivity of wild stocks of coho salmon in the northwest indicated:

1) Accurate estimates of the escapement and subsequent production (smolts or adult recruits) are available for only a limited number of stocks and generally only for a component of a management unit (e.g., the South Fork Skykomish River component of the Snohomish River wild management unit).

2) Due to the large effect of the environment on productivity and production capacity, most data sets had an insufficient period of record to predict production over the range of observed and likely escapements.

As a result, the data for all wild management units is currently not sufficient to reliably predict the production that would result from different harvest strategies or to develop a complex management system that would rely upon those predictions.

In addition, the review examined the relative advantages of a fixed escapement management policy versus policies based upon harvest rates. This review indicated that:

3) A great deal of uncertainty exists in the current estimates of the escapement level that will produce the MSH under average environmental conditions and additional uncertainty results from environmental variability and changes in habitat.

   Variability in the estimates of escapement and recruits can introduce significant bias into estimates of the MSH escapement obtained from spawner-recruit analyses (Walters and Ludwig 1981; Walters 1985).

4) Estimates of the MSH exploitation rate are likely to have less bias than estimates of the MSH escapement level.

   Simulation studies have indicated that estimates of the MSH exploitation rate obtained from a stock-recruit function are likely to have less bias than estimates of the MSH escapement (Hilborn and Starr 1984).

5) The MSH exploitation rate, rather than the MSH escapement objective, is more likely to be consistent over a range of management units within a region.

   Estimates of the MSH exploitation rate depend only upon the number of recruits per spawner (which is relatively constant within a geographic region), while estimates of the MSH escapement also depend upon the number of recruits produced from the system. The number of recruits produced obviously varies substantially between watersheds.

6) When survival rates are correlated between years, a fixed harvest rate policy may provide greater long-term catches than a fixed escapement policy while minimizing interannual variability in fishing seasons, thus providing fishery stability.

   ...a fixed harvest rate policy may provide greater long-term catches than a fixed escapement policy while minimizing interannual variability in fishing seasons...

   Dynamic programming analyses have shown that a fixed harvest rate policy can allow the escapement to track interannual variation in survival rates - additional escapement occurs during periods that are conducive to increased stock productivity and abundance. Walters and Parma (1996) reported that long-term harvests with a fixed harvest rate policy "are very close (within 15%) to the theoretical optimum that could be achieved if all future climatic variations were known in advance".

7) Postseason estimates of exploitation rates are likely to have greater precision and accuracy than postseason estimates of the escapement of wild management units.

   Exploitation rates may be estimated from coded-wire-tag (CWT) recoveries obtained from exploitation rate indicator stocks. An accurate estimate of escapement, often obtained at a weir or hatchery, was one criterion identified to select indicator stocks (Morishima 1986). Estimates of the escapement of wild

management units are difficult to obtain and often include a significant error (Flint 1984).

8) Exploitation rate management is generally more responsive to variation in population size and errors in forecasting, when compared to fixed long-term catch quotas.

2.4 Plan Characteristics

The review of current knowledge of coho salmon and technical capabilities suggested the CCMP should have the following characteristics.

Flexible and Adaptive. The management system should be designed to increase our understanding of the factors affecting the production and exploitation of coho salmon and flexible enough to incorporate additional information as it becomes available.

Prescriptive. Although the plan must be flexible in the long-term, it should provide short-term prescriptive measures to streamline management and assure maintenance of coho production. The prescriptions should be based upon the best available science, but recognize the limitations of our current data and technical capabilities. Examples of prescriptions include standards for supplementation and other artificial production, habitat maintenance, and exploitation rates on wild stocks.

Exploitation Rate Driven. The allowable catch of the wild units managed for production objectives should be controlled under most abundance levels by estimates of MSH exploitation rates rather than estimates of the MSH escapement.

Integrated. The plan should recognize the links between habitat, hatchery, and harvest management actions.

Assessment Oriented. Performance of the management system should be monitored annually, including the effectiveness of supplementation and other artificial production, and trends in the quality and quantity of habitat. Escapement estimates for wild stocks will still be necessary to monitor stock status, but postseason assessment of the management system should rely upon estimates of exploitation as well as escapement.

3.0 Plan Components

To achieve the identified policy objectives while remaining within the technical constraints identified in Section 2.0, the CCW recommends an approach with the following six major components.

1) **Controlling Management Units.** The controlling management units are a set of management units for which predefined management actions will be undertaken under specified abundance conditions. The controlling units include wild management units managed for production objectives (***key wild management units***), wild and hatchery management units managed to meet or exceed a minimum escapement (***auxiliary management units***), and wild and hatchery management units passively managed in mixed stock fisheries (***secondary management units***).

2) **Abundance Breakpoints.** The abundance breakpoints provide a systematic method for categorizing the abundance of the controlling management units into categories (typically ***normal, low, or critical***). Complementary habitat, artificial production, and fishery management actions are prescribed by the plan in response to the abundance of the management units relative to these breakpoints.

3) **Habitat Management.** The habitat component of the plan provides a means to maintain and restore the production of coho salmon.

   Performance Measures and Action Strategies. Performance measures have been identified for the biological and physical processes affecting salmonids. The CCMP identifies action strategies to implement these performance measures, and identifies those agencies that will take the lead or participate in the implementation of general habitat action strategies.

   Inventory and Assessment. This section of the plan describes ongoing programs to inventory and assess watershed habitat

   Watershed Recovery Plans. It is expected that a number of watershed recovery, landscape, and conservation plans will be developed cooperatively between state, federal, tribal, local governments, and the general public. The CCMP describes necessary attributes of these watershed recovery plans.

   Simulation Model. A model relating coho production to habitat and harvest is a key component of the development of an integrated management plan for coho salmon. This report provides an initial description of the model and how it will be used.

4) **Artificial Production Management.** Appropriate artificial production is an essential component of the plan for rebuilding wild management units and sustainable fisheries.

> ***Guidelines.*** The guidelines identify the factors to consider when evaluating artificial production programs and the complementary role of artificial production in the restoration of wild stocks. They help to shape artificial production programs to minimize negative effects while maximizing benefits to natural production and fisheries.
>
> ***Equilibrium Production Levels.*** Maintenance of the equilibrium production levels is essential if the objectives of this plan are to be achieved. This plan identifies those levels.

5) **Fishery Management.** The fishery management component of the plan is consistent with current technical capabilities while promoting management efficiency by establishing pre-determined management actions for specific resource conditions.

> ***Target Exploitation Rates and a Tolerance Range.*** The target exploitation rate and tolerance range is used to compute the maximum allowable harvest for each controlling management unit at any abundance level. The computations for the key wild management units incorporate a tolerance range around the target exploitation rate.
>
> ***Fishing Regimes.*** Three base fishing regimes (critical, low, and normal) would typically be established for each fishery actively managed for the key wild management units. The regime implemented in any year would depend upon the abundance of the management units considered in the management of the fishery. The levels in the regimes may be identified in terms of catch numbers, seasons, exploitation rates, gear/area limitations, or other controls.
>
> ***Switching Rules.*** Switching rules specify what management actions will be undertaken under which conditions of abundance. Examples of potential rules include, a) which management units are considered when determining the management actions for a fishery, b) the conditions under which the base normal fishing regime will be adjusted, and c) the procedure used to adjust the base normal fishing regime if the predicted exploitation rate is outside the tolerance range.

6) **Evaluation and Monitoring.** The plan provides defined procedures for a) evaluation of the performance of the plan with respect to the identified goals and b) modification of the plan to incorporate information gained during implementation of the plan.

4.0 Management Units

A management unit is defined by the PSSMP as "a stock or group of stocks which are aggregated for the purpose of achieving a desired spawning escapement objective". The CCMP categorizes all management units within Puget Sound by the types of management actions that will be undertaken under specified abundance conditions. The categories include wild management units managed for production objectives (***key wild management units***), wild and hatchery management units managed to meet or exceed a minimum escapement (***auxiliary management units***), and wild and hatchery management units passively managed in mixed stock fisheries (***secondary management units***).

The PSSMP identifies two types of management units, primary and secondary, each of which may include fish of hatchery and wild origin:

> Primary Management Unit. A stock or group of stocks for which a specific spawning escapement goal is established with the intention of managing all impacting fisheries to meet that goal. For primary natural units returning to natural spawning areas, the escapement goal shall be the maximum sustained harvest escapement level.
>
> Secondary Management Unit. A stock or group of stocks for which escapement is that which occurs primarily as a result of not being caught in fisheries directed at commingled primary units.

The CCW is considering an expansion of this system that classifies the management units into three types:

Key Wild Management Units. The key wild management units are distinguished by: 1) a management objective to maintain abundance within the range of MSH and 2) a management plan that identifies management actions throughout the migratory range of the unit. The five key wild management units currently are the Skagit, Stillaguamish, Snohomish, Hood Canal, and the western Strait of Juan de Fuca Tributaries. Designation of the eastern Strait of Juan de Fuca Tributaries as a key wild unit is also under consideration.

Auxiliary Wild and Hatchery Management Units. The management objective for an auxiliary management unit is to maintain escapements greater than a level related to either production objectives or to the desire to maintain an acceptable level of within-unit diversity.

Secondary Wild and Hatchery Management Units. The secondary management units are passively managed in mixed stock fisheries. The escapement of a secondary management unit is the result of 1) active management in mixed stock fisheries for the key units and auxiliary units (or stocks) and 2) the absence of directed

fisheries (unless a harvestable surplus exists) after separation of the unit from commingled key and auxiliary units.

While requiring a revision in our fishery management and terminology, the new system for classifying management units has the following advantages.

1) The system recognizes that more flexibility is required than can be provided by simply classifying a unit as primary or secondary. At some abundance levels, a unit which was not previously considered in management decisions may become important.

2) The system provides a management framework to implement the identified policy goal of the maintenance and restoration of wild stocks in a manner consistent with fishery objectives.

3) The use of a revised system prevents the confusion that might result if the terms primary and secondary were used with different meanings than were previously defined.

The CCW is evaluating the expanded system to determine if it will assist managers in achieving the objectives of this plan. The current and proposed classification of each management unit is provided in Table 1.

Significant uncertainty exists in the status and productivity of many of the units that may be classified as auxiliary. To address these information needs, the final CCMP may identify a process for reviewing management unit status, stock productivity, and implementing new management regimes.

Table 1. Classification of Puget Sound management units.

Production Region: Nooksack/Samish

Management Unit	Production Type	Classification	
		Current	CCMP
Area 7/7A Independents	Wild	Secondary	Secondary or Auxiliary 1/
	Hatchery	Secondary	Secondary
Nooksack River	Wild	Secondary	Secondary or Auxiliary 1/
	Hatchery	Primary	Auxiliary
Samish River	Wild	Secondary	Secondary or Auxiliary 1/

1/ Classification is under review.

Production Region: Skagit

Management Unit	Production Type	Classification	
		Current	CCMP
Skagit River	Wild	Primary	Key Wild
	Hatchery	Secondary	Auxiliary
Swinomish Channel	Hatchery	Secondary	Secondary
Baker River	Hatchery	Secondary	Auxiliary
Oak Harbor Pens	Hatchery	Secondary	Secondary

Production Region: Stillaguamish/Snohomish

Management Unit	Production Type	Classification	
		Current	CCMP
Stillaguamish River	Wild	Primary	Key Wild
	Off-Station	Secondary	Secondary
Snohomish River	Wild	Primary	Key Wild
	Hatchery	Secondary	Auxiliary
Tulalip Hatchery	Hatchery	Secondary	Secondary

Production Region: Mid Puget Sound

Management Unit	Production Type	Classification	
		Current	CCMP
Lake Washington	Wild	Secondary	Secondary or Auxiliary 1/
	Hatchery	Primary	Auxiliary
Green/Duwamish River	Wild	Secondary	Secondary or Auxiliary 1/
	Hatchery	Primary	Auxiliary
Elliot Bay	Net Pens	Secondary	Secondary
Seattle Aquarium	Hatchery	Secondary	Secondary
Area 10, 11	Wild	Secondary	Secondary or Auxiliary 1/
Area 10E	Wild	Secondary	Secondary or Auxiliary 1/
	Hatchery	Secondary	Secondary
Area 11	Net Pens	Secondary	Secondary
Puyallup River	Wild	Secondary	Secondary or Auxiliary 1/
	Hatchery	Primary	Auxiliary

1/ Classification is under review.

Production Region: South Puget Sound

Management Unit	Production Type	Classification	
		Current	CCMP
Area 13, 13C	Wild	Secondary	Secondary or Auxiliary 1/
Sequalitchew	Hatchery	Primary	Secondary
Nisqually River	Wild	Secondary	Secondary or Auxiliary 1/
	Hatchery	Primary	Auxiliary
Area 13A	Wild	Secondary	Secondary or Auxiliary 1/
	Hatchery	Primary	Auxiliary
Misc. Area 13D-K	Wild	Secondary	Secondary or Auxiliary 1/
SPS Net Pens	Net Pens	Primary	Secondary
Area 13F	Wild	Secondary	Secondary or Auxiliary

1/ Classification is under review.

Production Region: Hood Canal

Management Unit	Production Type	Classification	
		Current	CCMP
Area 9A 1/	Aggregate	Secondary	Auxiliary
Area 12A 2/	Aggregate	Secondary	Auxiliary
Mainstem Hood Canal	Wild	Primary	Key Wild
George Adams Hatchery	Hatchery	Secondary	Auxiliary

1/ Includes Port Gamble Net Pens and Area 9A Wild
2/ Includes Area 12A Wild, Quilcene National Fish Hatchery, and Quilcene Bay Pens. Classification is under review.

Production Region: Strait of Juan de Fuca Tributaries

Management Unit	Production Type	Classification	
		Current	CCMP
Eastern SJF 1/	Wild	Primary	Key Wild or Auxiliary
Dungeness River	Aggregate	Primary/Secondary	Auxiliary
Elwha River 2/	Aggregate	Primary/Secondary	Auxiliary
Western SJF 3/	Wild	Primary	Key Wild

1/ Includes Area 9 Independents and Eastern Strait of Juan de Fuca miscellaneous tributaries.
2/ Management approach will be reviewed when the Elwha River dams are removed.
3/ Includes Lyre River, East and West Twin Rivers, Pysht River, Clallam River, Hoko River, and Sekiu River.

5.0 Abundance Breakpoints

The abundance breakpoints provide a systematic method for categorizing the abundance of the controlling management units into ranges (high, normal, low, or critical), depending on whether abundance is greater or less than a particular breakpoint. Complementary habitat, artificial production, and fishery management actions are prescribed by the plan in response to the abundance of the management units relative to these breakpoints.

Complementary habitat, artificial production, and fishery management actions are prescribed by the plan in response to the abundance of the management units relative to the abundance breakpoints.

5.1 Key Wild Management Units

Although the current information is not sufficient to quantify the MSH escapement levels for all key wild management units with sufficient precision and accuracy (see Section 2.3), it is sufficient to define broad regions of escapement in which differing management actions are applicable. One to three breakpoints may be defined for a management unit (Table 2), depending upon the characteristics of the unit, the precision of the management regime, and the specific management objectives for the unit.

Critical/Low Breakpoint. The objective of defining the critical/low breakpoint is to identify the escapement level below which an unacceptable risk exists (resulting from population instability, unpredictability, or productivity) that the abundance will be less than the low/normal breakpoint in one to three cycles. The risk to the unit can be evaluated in many ways, including historical escapements, observations from other units (or even species), and from estimates of stock productivity. From this technical information, a policy decision must be made regarding the acceptable level of risk, or "How much risk am I willing to take that the abundance of this unit will not be at a specified level in a specified period of time?"

For a management unit with multiple stocks, a critical level may be established for an individual stock rather than the management unit in order to assure preservation of the unique characteristics of the stock. In this case, the critical/low breakpoint represents an escapement level that will result in escapements that will safely perpetuate the stock; lower abundance levels represent a heightened risk to the stock. Abundance levels above the breakpoint should pose no risk to their continued existence, although they may not be large enough to produce significant harvest benefits.

Provisional critical/low breakpoints have been identified for the Skagit, Snohomish, and Stillaguamish management units, and two alternative critical/low breakpoints are under discussion for Hood Canal (Table 2).

Low/Normal Breakpoint. This breakpoint identifies an abundance below which the benefits of current harvest are small relative to the risk that future production will be less than the MSH level. The breakpoint reflects considerations regarding both current and future harvest and the risk that a low escapement might substantially reduce future production.

1) Production - At abundance levels below the breakpoint, the management unit is unlikely to provide sufficient recruits to achieve the estimated MSH escapement in the subsequent cycle.

2) Risk - At abundance levels below the breakpoint, small deviations from the predicted escapement resulting from management uncertainty begin to exert a substantial influence on future production.

As discussed in Section 2.3, the escapement that will produce the MSH in the subsequent cycle varies annually in response to environmental conditions. If, for example, conditions in the marine environment deteriorate and survival rates decline, the MSH escapement level will be reduced relative to the long-term average. The relationship between the MSH escapement and survival rates, in conjunction with historical records of freshwater and marine survival, can be used to estimate the probability that a given escapement will not result in the MSH. The risk that the escapement will be insufficient to achieve MSH can then be balanced against the harvest opportunities provided by reducing the escapement in the current cycle.

Based upon analyses of spawner-recruit relationships for wild stocks (Appendix 1, to be included in final report), the CCW recommends providing a 90% probability that the MSH escapement level will be equal to or greater than the low/normal escapement breakpoint. Therefore, the low/normal breakpoint is defined as the estimated MSH escapement under low survival conditions, where low survival is the survival rate expected to be exceeded 90% of the time. Provisional low/normal breakpoints have been identified for the Skagit, Snohomish, and Stillaguamish management units, and two alternative low/normal breakpoints are under discussion for Hood Canal (Table 2).

Although the low/normal breakpoint is initially computed in terms of escapement, conversion to other units (e.g., cohort size, post-WCVI troll fishery cohort) is possible using the associated target exploitation rate and tolerance range. Breakpoints based on abundance prior to fishing are advantageous in that the error introduced by simulating fishery catches can be isolated from the computation of the fishing regime. Conversely, simply using cohort sizes could result in a CCMP in which the allowable catch in some U.S. fisheries was not responsive to annual variations in the exploitation rates in Canadian fisheries. Initial analyses of the CCW will attempt to gain some of the benefits of each type of breakpoint by subtracting from the cohort abundance the anticipated catch in the WCVI troll fishery (referred to as the post-WCVI cohort). For simplicity, the breakpoints in Table 2 are presented in terms of escapement.

Normal/High Breakpoint. A normal/high breakpoint is also under consideration for the Hood Canal key wild management unit. Conceptually similar to the low/normal breakpoint, it defines the escapement level that the MSH escapement exceeds 10% of the time. The breakpoint would provide for additional harvest within the terminal area if an inseason estimate of abundance

indicated that the escapement would exceed the breakpoint in the absence of an increased harvest rate in the terminal area.

Specific methods to compute the breakpoints for the key wild stocks are provided in Appendix 1 (to be included in the final report).

5.2 Auxiliary Management Units

Auxiliary Wild Management Units. The critical/low breakpoint for the auxiliary wild management units identifies a minimum acceptable level of escapement. The objectives associated with the breakpoint may be the same as discussed previously for the key wild management units, or related to desired production levels.

Auxiliary Hatchery Management Units. Management actions for auxiliary hatchery units are determined by the abundance relative to either 1) a production based escapement goal or 2) a critical/low breakpoint related to maintenance of broodstock (i.e., the long-term viability of the broodstock is threatened). For the latter case, management actions may include fishery restrictions, a broodstock collection program, or improvements to the facility.

5.3 Secondary Management Units (Wild and Hatchery)

No breakpoints are established for secondary management units since mixed stock fisheries are actively managed for the key wild and auxiliary units. Directed harvest of secondary units will occur subsequent to separation from the key and auxiliary units only if abundance is identified to be greater than the escapement goal.

Table 2. Provisional escapement breakpoints, target exploitation rates, and tolerance ranges for the key wild management units.

Management Unit	Unit Status			
	Critical	Low	Normal	High
Skagit				
Escapement Breakpoints		9,000	18,900	
Target Exploitation Rate	1/	0.47	0.64	
Tolerance Range		0.45 - 0.49	0.61- 0.67	
Stillaguamish				
Escapement Breakpoints		6,000	11,800	
Target Exploitation Rate	1/	0.47	0.64	
Tolerance Range		0.45 - 0.49	0.61- 0.67	
Snohomish				
Escapement Breakpoints		14,000	27,400	
Target Exploitation Rate	1/	0.47	0.64	
Tolerance Range		0.45 - 0.49	0.61- 0.67	
Hood Canal Option 1				
Escapement Breakpoints		4,000	14,350	
Target Exploitation Rate	1/	0.50	0.70	
Tolerance Range		0.47 - 0.53	0.67 - 0.70	
Hood Canal Option 2				
Escapement Breakpoints		13,000	14,350	27,150
Target Exploitation Rate	1/	0.50	0.70	variable
Tolerance Range		0.47 - 0.50	0.67 - 0.70	
Western SJF Tributaries				
Escapement Breakpoints		Analysis not completed.		
Target Exploitation Rate	1/			
Tolerance Range				
Eastern SJF Tributaries				
Escapement Breakpoints		Analysis not completed.		
Target Exploitation Rate	1/			
Tolerance Range				

1/ When the abundance of a key wild management unit is in the critical category, the intent of the plan is to prevent the escapement from falling below the critical/low breakpoint. The CCW recognizes that identification of the critical fishing regime required to achieve this objective will require difficult policy decisions. We recommend that exploitation rates in the critical regime fall between the maximum possible reduction (no mortality in U.S. fisheries) and the lowest rate previously achieved (predicted to have been approximately 10% of the age 3 cohort for the Strait of Juan de Fuca management unit in 1997).

6.0 Habitat Management

Degraded freshwater and marine habitat, declines in ocean survival rates, species and genetic interactions, and excessive harvest rates have all contributed to the reduced abundance of some coho salmon stocks (PSSSRG 1993; PSSSRG 1997, Spence et al. 1996 (hereinafter the ManTech report); WDFW 1997a (hereinafter the WSP EIS), 1997b (hereinafter the WSP)). Of these mortality sources, habitat and harvest can be directly affected by management actions, and each must be a component of a comprehensive management plan if depressed stocks are to be restored to their productive potential. The effects of habitat degradation have been accumulating for over a century, and stock recovery will require a long-term commitment to the task of protecting productive habitat and restoring degraded habitat.

A complete discussion of the habitat factors causing this decline is provided in the ManTech report, Appendix C of the WSP EIS, and pages 13-43 of the WSP. The WSP also establishes goals and performance measures for the nine salmonid life history parameters identified in Section 6.1 below.

...habitat and harvest can be directly affected by management actions, and each must be a component of a comprehensive management plan if depressed stocks are to be restored to their productive potential.

The habitat component of the CCMP has four elements: (1) recommended action strategies, based on identified factors of decline, to protect and restore coho salmon production; (2) incorporation by reference of an ongoing program to inventory and assess watershed habitat; (3) a description of the attributes necessary for watershed recovery plans; and (4) the use of new technology to develop a model that links habitat quality and quantity to coho salmon production.

Our intent is to provide a source document that is useful to not only tribal and state natural resource managers, but also local land use planners, parties developing conservation plans (e.g. Habitat Conservation Plans, Landscape Management Plans, etc.), and watershed groups working to restore salmon runs. Conservation and other watershed recovery plans are likely to become increasingly prevalent in response to listings or proposed listings of chinook, sockeye, steelhead, chum, and coho salmon, and cutthroat and bull trout. Although the CCMP does not create new regulatory authorities, it will help focus existing authorities and identify where additional restoration and protection efforts should occur.

The Governor's Joint Cabinet on Natural Resources (Joint Cabinet) and Salmon Team, in cooperation with the Tribes and National Marine Fisheries Service (NMFS), will provide coordination and oversight for the implementation of the habitat component of the CCMP. The Joint Cabinet and Salmon Team will prioritize and coordinate state and local activities necessary to

implement the action strategies, develop work plans for each action strategy, coordinate budgets, funding, and ensure compliance and consistency with the WSP and recovery of the fisheries resources. Implementation will be closely coordinated with local governments and watershed councils. The Joint Cabinet, Salmon Team, and Tribes will identify legislation or administrative rules that impede full implementation of the WSP. In addition, these parties will also develop any new legislative initiatives necessary for the full implementation of the WSP. Full implementation will occur within ten years. Work plans and measurable milestones will be developed on a biennial basis for purposes of budget planning and to ensure adequate implementation.

6.1 Habitat Policies, Performance Measures, and Action Strategies

The first element, definition of habitat policies, performance measures, and action strategies that will guide the CCMP, has been identified in the Joint Tribal-State WSP as adopted on December 5, 1997, or otherwise amended in government-to-government processes between the Tribes and Fish and Wildlife Commission. The CCMP is built upon co-management principles between the state and tribes and is intended to be consistent with and implement the WSP. For purposes of the CCMP, this report will focus on taking the next steps of implementing the WSP by identifying those agencies that will take the lead or participate in the implementation of general habitat action strategies.

Habitat protection requires a high degree of specificity and guidance about what fish need. The WSP defines narrative and numeric performance measures that reflect the best available science to evaluate biological and physical processes for salmonids. These performance measures will be used to direct policy decision making and adaptive management, ensure compliance and accountability, and measure adequacy of implementation. Achieving the performance measures will also ensure consistency in achieving the goals of the WSP and CCMP. The WSP intends that the habitat performance measures will have a level of force and accountability comparable to that provided by other elements of the Policy over which the co-managers have direct control. The WSP and CCMP encourages local watershed planning for specific implementation consistent with these policies and performance measures. In the absence of adequate local implementation, the obligation will rest with state and tribal entities to implement these policies and action strategies.

The habitat action strategies are organized by along salmonid life history needs. These components include:

1) Habitat Protection and Management
2) Basin Hydrology and Stream Flow
3) Water and Sediment Quality and Sediment Transport
4) Stream Channel Complexity
5) Riparian Areas and Wetlands
6) Lakes
7) Marine Areas
8) Fish Passage and Access
9) Habitat Restoration

Summarized below are action strategies and implementing agencies that are recommended to be successful in meeting the habitat policies, performance measures, and ultimately the overall goal of the WSP. This initial list is intended to provide the basis for implementation actions and recovery plans.

Each action strategy listed below has been given a code to assist in identifying the responsible agencies and organizations who will develop work plans, implementation strategies, and budgets for those items.

State

AGR- Washington Department of Agriculture
CRE- Columbia River Estuary Program
CTE- Washington Department of Community, Trade, and Economic Development
CCO- Washington Conservation Commission
DNR- Washington Department of Natural Resources
DOT- Washington Department of Transportation
ECY- Washington Department of Ecology
DFW- Washington Department of Fish and Wildlife
IAC- Interagency Committee for Outdoor Recreation
LEG- Legislature

Local

LGT- Local Governments
WSC- Watershed Councils
RFEG- Regional Fisheries Enhancement Groups

Federal

USFS- United States Department of Agriculture, Forest Service
EPA- United States Environmental Protection Agency
NMFS- United States Department of Commerce, National Marine Fisheries Service
FWS- United States Department of Interior, Fish and Wildlife Service
COE- United States Department of Defense, Corps. of Engineers
NRCS- United States Department of Agriculture, Natural Resource Conservation Service
FEMA- Federal Emergency Management Agency

Tribal

TRB- Affected Tribal Governments

6.1.1 Action Strategies for Habitat Protection and Management

Habitat protection and management first require an overarching goal and philosophy to guide the

policy implementation. They also require a number of institutional, housekeeping details to ensure efficiency of staff and budget for those involved or affected by this effort. This includes coordination of regulatory and proprietary efforts, up-to-date comprehensive information to guide habitat decisions, and sharing, interpretation and application of that information to habitat issues. Acquisition of key parcels or easements adjacent to salmonid habitat will be an effective way of partially protecting and restoring salmonid populations as well and will be a part of the overall habitat approach. For full benefit and success, however, it will be necessary for state and local planning and implementation groups to adopt and embrace these action strategies.

With this approach and framework in place, the habitat policy as defined in the WSP addresses the issues of maintaining and restoring the physical and chemical processes necessary to meet salmonid life requirements, protecting and restoring key habitats and providing adequate migratory pathways between habitat types.

The following are action strategies that are intended to achieve the performance measures and goals as defined in the Joint Tribal-State WSP:

A) Seek full restoration, where feasible, or monetary compensation from responsible parties for direct loss of salmonids or adverse impacts to salmonid habitat, particularly in situations resulting from actions taken contrary to Department or Tribal recommendations in areas designated as high risk by watershed analysis. Compensate for the impact by replacing or providing substitute resources or habitats. Monetary compensation shall be usually reserved for fish kills or habitat damage where restoration is impossible. This hierarchy will be applied to all planning activities and permit reviews and is recommended for other agencies and private citizens as an approach to protecting salmonid habitat. Avoidance is the most preferred and should be the most commonly used form of protection. Mitigation will be used only when no practicable or feasible alternative exists. [DFW, ECY, LGT]

B) Conduct a coordinated, comprehensive inventory and assessment of freshwater/marine salmonid habitat, including aquatic biointegrity, with periodic updates [DFW, ECY, TRB, LGT, RFEG]:

1) Include all habitats necessary for maintaining life history stages of existing and historical salmonid populations, incorporating both physical habitat elements and biological monitoring parameters such as water chemistry and prey-base assemblages and densities. [DFW, ECY, TRB]

2) Use the inventory to establish and evaluate watershed protection and restoration strategies. [DFW, TRB, ECY, DNR, LGT, Watershed Councils, RFEG]

3) Create a system to keep cumulative track of approved and pending state and local environmental permits, accessible to the tribes, state and local agencies, and the general public. [DFW, ECY, DNR, LGT]

C) Define and improve quantitative relationships between habitat forming processes and the creation and maintenance of physical habitat. Establish habitat performance measures based

directly on salmonid production/productivity. [DFW, TRB]

D) Routinely review and update physical habitat performance measures in the policy to reflect the best available science and data. [DFW, TRB]

E) Develop a process to coordinate local, state, tribal, and federal regulatory and proprietary authority that ensures opportunities for public review and input and that ensures that all components of the habitat policy are adequately and efficiently implemented. This coordination process should include regularly reviewing and recommending revisions to regulations and/or reviewing and revising typical permit conditions as appropriate to protect salmonid habitat. [JNRC, TRB]

F) Develop a statewide, unified natural resource damage assessment and restoration strategy that will fully compensate the public for unauthorized activities that injure salmonids. [DFW, TRB]

G) Develop regulations and enforcement mechanisms to bring assurance of salmonid habitat protection. [DFW, ECY, DNR, LGT, LEG, TRB]

H) Encourage voluntary compliance with state and local habitat protection laws, consistent with this policy. [DFW, TRB, ECY, DNR, CTE, Agriculture, Conservation Districts, LGT, Joint Cabinet]

I) Rigorously enforce current regulations to protect salmonid habitat where voluntary efforts are not underway or are unsuccessful.

1) Prioritize enforcement of salmon habitat protection measures.

2) Increase accountability of governments for enforcement of state and local habitat protection laws.

3) Establish public and private partnerships in enforcing laws needed to protect salmon habitat. [DFW, ECY, DNR, CTE, LGT, LEG]

J) In collaboration with affected parties and in other forums addressing these issues, develop and propose rule changes or legislative changes to improve wild salmonid protection in four major areas: (1) forest practices (including Department representation on the Forest Practices Board); (2) growth management (addressing minimum standards for zoning, platting, and protection of critical areas); (3) water allocation (addressing water rights and permitting, stream flows beneficial to wild salmonids, exemptions, water conservation); and (4) agriculture. The Department and the Tribal Parties should work closely with the Joint Cabinet for Natural Resources, the Washington State Natural Resources Council, the Joint Legislative Task Force on Salmon Recovery, and local watershed groups to accomplish this objective. Additional new forums may also be necessary. [DFW, TRB, ECY, DNR, CTE, Agriculture, Joint Cabinet, Natural Resources Council, Joint Legislative Task Force on Salmon Recovery, Local Watershed Groups, LGT, LEG]

K) Support a uniform state water-type classification system for use in protecting salmonid habitats. Efforts should be made to verify correct water typing prior to any land or water use decision or plan. [DFW, TRB, ECY, DNR, LGT]

L) Provide public access to the wild salmonid habitat information to maximize the effectiveness of habitat protection and restoration efforts. [DFW, TRB, SSHIAP, DNR]

M) Identify key parcels of wild salmonid habitat as a priority for state-funded land acquisition programs.

1) Support a dedicated funding source for securing wild salmonid habitat.

2) Acquire key wild salmonid habitats using watershed inventories and analyses as a basis for identifying critical habitats. Acquisition priorities should be consistent with restoration priorities.

3) Increase efforts to seek opportunities for acquisition of easements or land trades that secure wild salmonid habitat. [DFW, TRB, LGT, RFEG]

N) Develop an improved version of watershed analysis or equivalent procedure to meet both Endangered Species Act and Clean Water Act requirements, and that will address all watershed land uses. Watershed analysis is recommended as a tool to assess watershed processes and condition and develop management and restoration strategies. [DFW, TRB, TFW Stakeholders, Agriculture Stakeholders, LGT]

O) Identify and discourage the use of federal, state, and local subsidies that directly or indirectly detrimentally affect salmonid habitat. [NMF, FWS, DFW, TRB, LGT]

P) Develop strategies and conduct analysis of cumulative effects resulting from past and currently approved activities before further habitat impacts occur. [DFW, TRB, LGT, ECY, DNR]

Q) In the event that any population fails to meet its prescribed spawning abundance levels, make an assessment of habitat, harvest management, and hatchery issues affecting escapement and make harvest and hatchery production adjustments as needed to meet the spawner abundance goal for the wild fish population. In addition, whenever failure to meet the prescribed spawner objectives is attributable, at least in part, to habitat degradation or loss, make an assessment to determine if the performance standards for the respective habitat components are being met, and make adjustments accordingly. [DFW, TRB]

6.1.2 Action Strategies for Basin Hydrology and Stream Flows

The basic life need for all living organisms is water and, obviously, a fish out of water is in trouble. The amount and quality of the water, and its pattern of flow are among the key factors of critical importance to salmonids.

Action strategies to meet the performance measures for basin hydrology and stream flows include:

A) Develop and integrate water conservation guidelines and standards into regional and watershed-based water resource planning and implementation. Savings from conservation programs should, as needed, be used to restore optimum stream flows. Continue development and use of water rights as a means to achieve water conservation to benefit stream flows. If needed, request funding for development of statewide water conservation standards. [ECY, DFW, TRB, LGT, Watershed Councils]

B) Ensure that maintenance or restoration of the hydrologic regimes necessary to protect or restore salmonid habitats and life history needs are an integral part of upland management plans and practices, growth management planning, and stored water management plans.

1) Develop strategies to maintain, restore, or emulate natural processes and land features that allow river basins to intercept, store, transfer, and release water so that stream flows are maintained and natural hydrologic regimes are attained.

2) Develop means (including incentives, zoning, re-aggregation of small parcels, clustering) to retain forest, agricultural, and rural lands in order to protect the extent and functions of aquifer recharge and discharge areas, wetlands, riparian zones, and frequently flooded areas.

3) Develop mechanisms that limit the total effective impervious surface in a watershed subbasin to, or below, a threshold that prevents loss of habitat quality, habitat quantity, juvenile salmonids, and salmonid diversity. In watershed subbasins currently exceeding this threshold, employ best available technology to manage existing or anticipated stormwater runoff. These efforts can be coordinated with development and implementation of a statewide stormwater management strategy that recognizes and avoids impacts to salmonids that manifest at smaller discharge events than do damage to the channel.

4) Develop mechanisms that limit increases in the duration or frequency of flow events in a subbasin below a threshold that juvenile salmon may use for overwintering habitat. In subbasins currently exceeding this threshold, increase habitat complexity to provide areas of low velocity for juvenile salmon to utilize as refuge during high flow events.

5) Coordinate water resource planning for stream and potable uses with Growth Management Act (GMA) planning. Determine adequate water supplies in a manner that accounts for the protection and restoration of stream flows.

   i) Identify and map known or potential aquifer recharge areas that provide base flows to streams, lakes, and wetlands.

   ii) Protect and restore groundwater recharge and discharge areas that are important for wild salmonids. [DFW, TRB, ECY, DNR, CTE, LGT]

C) Protect (and restore where feasible) floodplain habitat of value for wild salmonids.

1) Employ low-density and low-intensity zoning and regulation.

2) Utilize floodplain management measures that provide retention or reclamation of flood plain function and extent.

3) Require that new roads constructed in floodplains avoid increasing water surface levels and minimize the channeling effects that convert sheet flow to directed flow points (bridges, culverts) during flood events. Correct, to the extent possible, existing roads that function as dikes to reduce or eliminate their adverse hydrologic impacts.

4) Forest harvest planning should include harvest scheduling - including rotation ages that will prevent damaging changes in stream hydrology from rain-on-snow events, reduction in large woody debris recruitment, increases in the frequency and duration of flows above those suitable for juvenile salmonid overwintering, and other hydrologic effects. Forest-road densities should be limited to thresholds which avoid damaging changes in stream hydrology and direct impacts to rearing salmonids. [DFW, TRB, ECY, DNR, FEMA, COE, LGT]

D) Establish and revise, as necessary, stream flow rules before any additional out-of-stream uses are permitted. Establish and maintain stream flows (minimum low flows, channel-forming and maintenance flows) that optimize habitat conditions for migration, spawning, incubation, and rearing for wild salmonids and their prey base. [ECY, DFW, TRB]

E) Maintain stream flows by modifying stored water release strategies and addressing interbasin transfers of water. [ECY]

F) Protect stream flows from impairment by groundwater withdrawals where groundwater is in hydraulic continuity with surface water. This protection includes minimizing the effects of exempt wells on stream flows. [ECY]

G) Promote the use of best available irrigation practices that emphasize water and wild salmonid habitat conservation. State funding for new installation and upgrades of water delivery systems should be provided only where best available technology is used. [ECY, Agriculture, Conservation Districts]

H) Where voluntary efforts have not been successful, attain and maintain instream flows through (1) increased enforcement of existing instream-flow regulations, (2) active pursuit of relinquishments and abandonments, (3) reduction of waste, (4) increased water-use efficiency, (5) dedication of water from federal projects, (6) pursuit of water rights, and (7) denial of new consumptive water rights. Increased storage may also be investigated, where feasible, as an option to gain additional flows. [ECY]

I) Institute specific wild-salmonid habitat protection criteria as part of the analysis to determine which flood control projects will be funded. These criteria will include channel-forming

functions and values, bed character and quality, and overwintering habitat areas. [ECY, LEG, DFW, TRB]

6.1.3 Action Strategies for Water Quality and Sediment Quality Delivery and Transport

Salmonids are dependent on abundant, clean, cool water for their survival. Several water quality components are important to, or regulate, salmonid habitat and resources: water temperature, dissolved oxygen, pH, total suspended solids (TSS), and specific toxic materials. The quality, delivery and transport of sediments throughout stream channels, lakes, and marine areas plays a significant role in salmonid survival and production.

Action strategies to meet the performance measures for water quality and sediment quality, delivery and transport include:

A) Ensure surface water runoff, water discharge, water conveyance systems and irrigation return flows meet applicable water quality standards for a receiving water body. [ECY, LEG, Conservation Districts]

B) Establish spawning and rearing habitat criteria (e.g., percent fine sediment) through the state water quality standards triennial review process. [ECY, DFW, TRB]

C) Develop and implement a statewide stormwater management strategy that uses the best science and data to develop land use options that avoid significant changes in basin hydrology and non-point source point pollution that affect salmonid rearing, spawning, and migration. [ECY]

D) Develop a statewide, unified aquatic-sediments strategy to prioritize clean-up of contaminated-sediment sites associated with salmonid production. [ECY, DNR, DFW/TRB]

E) Continue to support a statewide, unified natural resource damage incident response, clean-up and assessment and restoration strategy to fully compensate the public for damages incurred due to releases of toxic substances. [ECY, DFW/TRB]

F) Organize a forum to promote understanding and communication between the fish and wildlife management community and the agricultural community on issues of salmonid production and the production of agricultural crops and products. This could be modeled on the Timber, Fish and Wildlife Agreement that was used to address the interactions of timber management activities and fish. Develop an improved regulatory framework, including best management practices, that assures agricultural activities will comply with federal and state water quality requirements. [Joint Cabinet]

G) Rigorously enforce compliance with the Clean Water Act, including the development and prioritization of total maximum daily loading (TMDL) allocations for water bodies, and those parameters that could adversely affect salmonids. [ECY]

H) Ensure that water quality standards recognize the value of salmonid carcasses up to historical

levels as a source of nutrients. [ECY, DFW/TRB]

I) Develop interim approaches, including best management practices, for impaired water bodies or watersheds for which a TMDL has not been developed. [ECY]

J) Deny, defer, or condition activities or permits that will adversely affect salmonid habitat or state waters to ensure that no further degradation would occur. [ECY, LGT, DFW, DNR]

K) Employ and promote land-use practices that prevent significant changes in the delivery and transport of sediments. Priority consideration will be given to high-risk areas where potential for adverse impacts is greatest, such as highly erodible areas. [LGT, DNR, LEG]

L) Employ and promote sediment control measures for activities that can introduce unnaturally high levels of fine sediments into streams and estuaries such as gravel or rock crushing/washing, gravel/dirt road use in wet weather, and land clearing on erodible soils. [LGT, DOT, LEG]

M) Employ and promote sediment control measures that protect all waters, including small non-fish bearing streams especially in areas with steep headwall slopes, unstable slopes, and high mass-wasting potential likely to result in sedimentation and pool filling, and to protect the integrity of downstream salmonid-bearing waters. [DNR, LGT, LEG]

N) Manage watersheds to ensure that gravel and sediment delivery to streams approximates the natural disturbance regime. {LGT, Conservation Districts, DNR]

O) Design and operate dams and water diversion structures to facilitate the normal downstream transport of sediments. Require spawning gravel supplementation to mitigate spawning gravel supply depletion. [ECY, DFW]

P) Ensure that gravel removal and dredging operations are evaluated, conditioned, and limited to protect incubating salmonid eggs and salmonid habitat, including instream, riparian, wetland, and marine resources. Evaluations should include appropriate alternatives analysis. [DNR, ECY, DFW, COE, LGT]

6.1.4. Action Strategies for Stream Channel Complexity

Salmonids have evolved and adapted to a stream's natural disturbance regime that provides a variety of in-channel features important to their survival, growth, migration, and reproduction. These features include pools, riffles and intermediate areas such as glides, cascades and waterfalls. Other features include substrate size and distribution (silt, sand, gravel boulders, etc.), sediment delivery and transport processes, water depth and velocity, undercut banks, side channels and instream large woody debris. These features collectively define the complexity - or simplicity - of a stream channel. Typically, complex channels are more productive for salmonids than simple channels.

Action strategies for maintaining or restoring stream channel complexity include:

A) Allow river and stream channels to maintain or restore their natural meander patterns, channel complexity and flood plain connectivity. Where feasible, restore these features. [LGT, NRCS, DOT, DNR, DFW]

B) Maintain or provide functional riparian corridors. See also action strategies under riparian areas and wetlands (next component). [LGT, DNR, Conservation Districts, NRCS]

C) Avoid or minimize channel relocations or encroachments. Where channel relocations are absolutely necessary, ensure that new channel design and construction will not result in a net loss of function or value. Where altered channels are being rebuilt or restored, the reconstruction design should conform to the performance measures identified in the policy. [DNR, LGT, Conservation Districts, Diking Districts, NRCS, DFW]

D) Restrict large woody debris (LWD) removal from stream channels and floodways. Where LWD removal is warranted because of damage to public or private capital improvements, relocate LWD to other areas within the channel. Discourage LWD removal for other purposes. [DFW, LGT, NRCS, FEMA]

E) Develop performance measures, including channel complexity and sinuosity, for historically non-forested areas and intertidal lands of rivers and streams. [DFW/TRB]

6.1.5 Action Strategies for Riparian Areas and Wetlands

Riparian areas and associated wetlands perform a variety of functions, all of which have a direct or indirect effect on salmonid production.

Action strategies to protect and restore these areas include:

A) Develop wetland protection standards specific to the needs of wild salmonids. [DFW/TRB, ECY]

B) Support a mechanism for wetlands inventory, tracking, and characterization. [ECY, Joint Cabinet]

C) Develop integrated strategies to include regulatory and non-regulatory approaches (e.g., incentives such as current-use taxation, conservation easements, awards/recognition, or land trusts or other forms of acquisition) to improve stewardship of riparian and wetland areas and buffers supporting wild salmonid habitat. [Joint Cabinet, LEG, LGT]

D) Ensure that land-use plans avoid the loss or degradation of riparian and wetland areas, fundamentally through land use allocation, and secondarily through application of mitigation techniques. [LGT, DNR, NRCS, Conservation Districts, ECY]

E) Where wetlands alterations are unavoidable, support wetlands permitting programs to achieve

no net loss of wetland acreage and function.

1) Provide for a mechanism to assess the effectiveness of wetlands mitigation to replicate wetlands functions and extent.

2) While avoidance of wetland impacts is preferable, there may be times when off-site mitigation is more practical, affordable and effective. A state mitigation banking protocol should be followed when site specific wetland impacts are unavoidable and mitigation should occur within the same affected subbasin. The protocol should ensure the needs of wild salmonids are met, including criteria for success and monitoring strategies. [ECY, LGT, DFW]

F) Over the long term, seek to gain an increase in wetland base and functional characteristics. [Joint Cabinet, LGT]

G) Oppose new road construction or other encroachments in riparian areas and wetlands. Where construction, reconstruction, or upgrades are unavoidable, minimize encroachments in riparian areas and wetlands and mitigate for adverse impacts. [LGT, DOT, DNR]

6.1.6 Action Strategies for Lakes and Reservoirs

Lakes and reservoirs are significant and ever-changing features of the landscape of Washington. The over 8,000 lakes identified in the state vary widely in age and successional stage, origin, elevation, productivity, shape, hydrology and water quality, and in shoreline configuration and level of human development. Some are nearly pristine and virtually unchanged physically. Others, typically low-elevation lakes such the Lake Washington/Sammamish system, have been extensively altered and developed with wholesale changes in inlet and outlet drainage systems. Many lakes have been manipulated in some fashion; usually for lake-level maintenance, flood control or hydroelectric power generation, and they are often equipped with control structures at their outlets.

The state also abounds with human-built reservoirs. Most have been converted from previously free-flowing stream reaches. They range from small impoundments to single large dam/reservoir structures up to entire river system impoundments such as the Columbia River system of hydroelectric dams. Some are designed to allow fish passage, while others completely obstruct passage or the passage facilities are inefficient or ineffective.

Action Strategies for Lakes and Reservoirs include:

A) Ensure that land-use plans and regulations take into account the particular sensitivity of lake habitats as identified in the lakes introduction. [LGT, LEG]

B) Ensure that lake level manipulation operations plans protect salmonid habitat. [ECY, COE, LGT]

C) In areas of significant nearshore use by wild salmonids, minimize the size and numbers of docks, floats, ramps, and bulkheads, and seek appropriate mitigation. Use community or shared/common structures where possible. Avoid the use of treated wood or other materials that release toxic substances in these structures. Where use of treated wood is proposed, the Department shall review and condition permits to protect salmonids and their habitats. [LGT, ECY, DFW]

D) Develop strategies to address aquatic plant introduction and control issues. [DFW, ECY, DNR, LGT]

E) Ensure that existing lake outlets afford free and unobstructed passage as necessary for anadromous and resident fish species. Avoid further installations and where feasible, remove these structures. [DFW, LGT]

6.1.7 Action Strategies for Marine Areas

Washington State has approximately 100 diverse estuaries within 14 regions, exhibiting structural, hydrological and biological diversity. As with freshwater habitat, salmonid life histories have evolved in response to estuarine conditions. Estuaries are critical transition areas where seaward-migrating smolts adapt to seawater and returning adults prepare to enter spawning streams.

Action strategies for marine areas include:

A) Standards for basin hydrology and stream flows, water quality, stream channel complexity, and riparian areas and wetlands should be reviewed and modified to recognize and manage for functions necessary to maintain productive estuarine and nearshore marine habitats. [DFW/TRB, ECY]

B) Ensure that maintenance or restoration of the natural marine shoreline processes necessary to sustain productive nearshore salmonid habitat are an integral part of upland and aquatic land-use planning. [LGT, LEG]

C) Promote land-use planning that allows natural marine bluff and riverine erosion, sediment, nutrient, and large woody debris transport processes to create and maintain the productive estuarine and marine habitats that salmonids depend upon. [ECY, LGT, Port Districts, LEG]

D) Support mitigation sequencing (similar to habitat protection hierarchy) to fully mitigate for the potential impacts of proposed in-water or overwater structures on salmonid migratory pathways. [LGT, ECY, DFW, Port Districts]

E) Include in watershed plans a program to restore diked, filled, and covered estuarine and tidally influenced habitats. Develop, promote, and seek funding for estuarine and tidally influenced habitat restoration. [Port Districts, ECY, LGT, Joint Cabinet, LEG]

F) Develop standards for aquatic lands to facilitate local planning to ensure salmonid productivity

will be maintained or increased. [DFW/TRB, ECY, DNR]

G) Develop a marine protected-areas strategy to include reserves for herring spawning habitat. [Joint Cabinet, DFW/TRB]

H) Develop integrated strategies to use regulatory and non-regulatory approaches to improve stewardship of estuarine wetlands through protection and restoration efforts. [Joint Cabinet, LGT, ECY, DFW/TRB]

I) Recognize the value of sediment transport to deltas and marine areas, and evaluate, condition, and limit dredging and filling operations to protect nearshore marine, estuarine, and intertidal habitats and functions that wild salmonids depend upon. [DFW, ECY, DNR, LGT]

J) Promote oil and hazardous substance spill prevention, contingency, and response planning to reduce risk, minimize exposures, remediate contaminated areas, and restore lost resource functions and services. [ECY, DFW]

6.1.8 Action Strategies for Fish Access and Passage

Physical barriers interrupt adult and juvenile salmonid migrations in many parts of the state. Persistent blockages deny access to critical spawning and rearing habitat. Loss of access to habitat reduces overall salmonid productivity and may result in loss of salmonid populations. Fish passage is affected by and related to all the previous habitat components. Basin hydrology and stream flow are obvious fish passage parameters. Less obvious are the attributes of water quality and sediment delivery and transport, riparian areas, and lakes and marine shorelines. Fish passage, in the sense of the presence of adult salmonids, especially spawners, also affects water quality, aquatic productivity, riparian vegetation, and spawning gravel quality.

Action strategies to meet the performance measures for fish access and passage include:

A) Within three years, develop criteria, implementation processes, and compliance processes to identify, correct or remove existing human-caused fish passage problems in freshwater, floodplain and estuarine habitats. Prioritize and correct known human-caused fish passage barriers. [DFW, DOT, LGT]

B) Develop recommendations and coordinate with the U.S. Army Corps of Engineers, the Federal Energy Regulatory Commission, and federally licensed dam operators to implement, monitor, and evaluate controlled spill programs at dams, including dissolved gas abatement and other fish passage options, to maximize effectiveness for juvenile and adult salmonid passage. [DFW/TRB, ECY]

C) Establish procedures for evaluating, adopting and implementing new fish passage technologies, including:

1) Automation of spillway operational facilities.

2) Development, testing and construction of surface attraction flow collectors.

3) Construction of gas abatement structures and operation strategies to control gas supersaturation.

Expedite these and other activities to reach the goal of safe and effective in-river fish passage.[DFW/TRB, COE, NMFS]

D) Promote land-use plans that prevent the impacts of road construction on fish passage. Associated components include:

1) Reduce needs for new highways and streets via land use planning and transportation planning including such things as light rail, ride-sharing, etc.

2) Reduce the number of individual private roads for individual residences.

3) Limit most new growth to urban areas while retaining large blocks of habitat in rural areas. [LGT, DOT, CTE, ECY, DFW/TRB]

E) Incorporate consistent state-wide criteria and guidelines for fish passage and screening into future design, construction, or alteration of instream structures, roads, and facilities. [DFW, DOT, DNR, LGT]

F) Develop and expand programs to educate people regarding fish passage issues, and when stream crossings are unavoidable, assist them in the design and construction of instream structures which facilitate free passage. [DFW/TRB, DOT, LGT]

G) Develop an equitable long-term funding mechanism and other incentives to share costs of passage restoration. [Joint Cabinet, LEG]

H) Develop and implement effective monitoring and maintenance programs, and compliance processes that assure fish passage and screening structures are safe and efficient. [DFW, DOT, LGT]

6.1.9 Action Strategies for Habitat Restoration

Any strategy designed to maintain or recover salmonid populations should have as a basic underpinning meaningful protection of existing habitat. Continual restoration of unmitigated impacts to wild salmonid habitat is undesirable, often ineffective and the most costly means to achieving salmonid population recovery; in the long run salmonid populations are best protected by ensuring habitat protection.

Action strategies to meet the performance measures for habitat restoration include:

A) It is the legislature's intent to minimize expense and delay due to obtaining required permits for projects that preserve or restore native fish habitat (Chapter 378, Washington Laws). The law defines watershed restoration projects and provides that projects that have been reviewed under the State Environmental Policy Act shall be processed without charge and permit decisions shall be issued within 45 days of filing a completed application. The state agencies with permitting responsibilities relevant to watershed restoration should fully implement Chapter 378. They should continue to examine opportunities to increase their efficiency in processing project permits and to enhance the design and effectiveness of restoration projects. [DFW, ECY, DNR, LGT]

B) Apply best available science and adaptive management to restoration strategies and activities:

1) Where possible, use some form of watershed analysis that identifies the physical, chemical and biological processes that may affect the success of the restoration strategy.

2) Employ watershed restoration mechanisms and technology to restore and maintain habitats to optimum conditions for salmonid spawning, rearing, and migration.

3) Use qualified experts to analyze, design, and construct specific projects and to evaluate the success of the strategy.

4) Ensure that monitoring and contingency planning is included in project design.[All]

C) Prioritize restoration activities. Considerations for prioritization include:

1) Salmonid stock status, if available

2) Harvest management plan

3) Population vulnerability

4) Possible positive or negative risks or consequences to wildlife or capital improvements

5) Community/landowner acceptance and/or support

6) Feasibility and probability of long-term success

7) Compliments existing completed restoration projects

8) Level of funding, opportunity for partnerships

9) Ability to obtain permits in a timely, affordable basis

10) Length of time before expected positive salmonid stock response

11) Amount of habitat to be made available or improved [All]

D) Plan habitat restoration at multiple scales (subbasin, basin, watershed, state, region) to ensure efforts are consistent, coordinated, and effective. [All]

E) Coordinate salmonid habitat recovery plans with other planning processes such as GMA, watershed planning, flood control planning, etc. [All]

F) Support stable funding source(s) for salmonid habitat restoration in capitol budgets in order to provide time and predictability for planning, development, implementation and monitoring. [Joint Cabinet, LEG]

G) Establish criteria for salmonid habitat restoration to be incorporated into appropriate state grant funding program selection processes. [DFW/TRB, Joint Cabinet, ECY]

H) Where recovery of habitat is possible, pursue restoration measures to allow wild salmonids to recolonize areas they historically occupied. [All]

I) Develop an education outreach program to local communities to foster environmental stewardship. [Joint Cabinet]

J) Work with local governments to assure the availability to landowners of incentive programs, such as current-use taxation, and to advocate land stewardship and recognition programs. [Joint Cabinet, LEG, LGT]

K) Develop a coordinated, statewide geographic information system (including mapped and tabular data) among federal, state and local governments for cataloging habitat extent, condition, and restoration needs. Data should be organized and accessed according to watershed and made available to all entities who are conducting watershed protection and restoration projects. [Joint Cabinet]

L) Use a variety of methods, including water conservation, additional storage where feasible, and water purchases to restore stream flows, consistent with this policy. This should include budget authorization to purchase water, water rights, or relinquished or abandoned water rights and transfer them to the trust water rights program. [ECY, LEG]

M) Pursue federal and state flood-control funds for restoration of wild salmonid habitat that has been damaged by flooding or flood-control activities. This could include non-structural solutions to flood damage reduction such as relocation of structures; removal of dikes and levees; and re-connection of sloughs, former side channels, oxbows and wetlands. [Joint Cabinet, LGT, ECY]

N) Provide technical support (engineering, biological assessments) to landowners and watershed groups. [DFW, TRB, ECY]

O) Develop dedicated funding and establish criteria for decommissioning of dams. [LEG, Joint Cabinet, COE, FERC]

P) Develop new methods and approaches for repairing, rehabilitating, or restoring salmonid habitat. [All]

6.2 Watershed Inventory and Assessment

Development of the second element of the habitat component of the CCMP will occur at the regional scale to address basin variability. Species concerns, limiting factors, and specific action strategies were originally defined in the WSP. However, this same type of information will also be developed on a watershed-by-watershed basis. There are a number of available processes that describe and evaluate habitat condition which may be useful in the development of protection and restoration strategies, including elements of the state watershed analysis (WAC 222-22), WDFW/DOT culvert inventory, and assessment projects funded by state and federal landowners.

In addition, the CCMP will rely heavily on the work-product from the SSHIAP database and reports. SSHIAP is not in itself a formal watershed/recovery planning process, but is intended to be complementary to such processes as they may occur as described in Section 6.4. The SSHIAP watershed database and reports are dynamic and will change over time as new information is gathered and processed.

In 1995, the tribes and WDFW initiated an inventory and assessment of salmon and steelhead habitat as part of an overall Wild Stock Restoration Initiative. Completion of a data inventory and initial habitat loss and degradation analyses for all streams within these areas is expected to be completed by August 1998. This will include documentation on the location, amount and current condition of freshwater habitats used at various life history stages of SASSI (Salmon and Steelhead Stock Inventory) salmon and steelhead stocks; habitat loss in relation to an historical base; and natural and human factors contributing to habitat loss and degradation.

To date, methodologies have been developed and tested on a number of pilot basins and database and analysis tools are being refined and completed. Most available information has been identified and gathered and work continues on compilation and analysis of this data. Most streams within the SSHIAP area of coverage (Water Resource Inventory Areas 1-23, or most of western Washington) have been segmented by gradient, confinement and stream type and the databases built. The project must be considered as a work in progress that will continually be updated as new information, i.e. through monitoring, is added.

Several planned and ongoing efforts aimed at heading off potential listings of salmonid stocks under the Endangered Species Act are planning to utilize SSHIAP information. These include the WDFW Watershed Restoration Inventory Project (WRIP), State and Federal Watershed Analysis, local salmon restoration efforts, and Tribal-State management and resource protection efforts (e.g. Comprehensive Coho and Comprehensive Chinook). Database and GIS assessment tools designed for SSHIAP have been proposed as the basis of a statewide habitat monitoring proposal.

SSHIAP will ultimately result in a framework for building joint Tribal/State cooperative assessment of the role of habitat loss and degradation in the status of salmon and steelhead stocks

and to develop stock or watershed specific habitat protection and restoration strategies and plans for their implementation.

6.3 Watershed, Landscape, Recovery, and Conservation Plans

In addition to implemenation of the WSP and SSHIAP, it is expected a number of watershed recovery, landscape, and conservation plans will be developed cooperatively between state, federal, tribal, local governments, and the general public. These plans are also to be consistent with the WSP and co-management plans of the tribes and WDFW.

The complexity of the habitat characteristics affecting coho salmon, and the extended duration and likely prevalence of watershed and other conservation plans, speak to the need for consistent goals, objectives, performance measures, and criteria for planning. Plan development will be guided by the WSP. Any HCP or other watershed plans affecting coho salmon must at a minimum incorporate the following.

Habitat Performance Measures. Habitat performance measures included in the plans should be no less stringent than the WSP, unless watershed specific information demonstrates that less stringent measures developed cooperatively with the WDFW and affected tribes will provide at least an equal level of resource protection

Measurable Biological Goals. Although habitat performance measures should be relied upon as the primary conservation measure, the WSP identifies the ultimate performance measure for habitat as "a level of productivity and production that will sustain robust fisheries, while maintaining healthy adult spawning populations." Similarly, the ESA requires that HCPs must "not appreciably reduce the likelihood of the survival and recovery of the species".

To successfully implement adaptive management and guide monitoring programs, each plan must identify measurable biological objectives tailored to the application. For example:

1) A plan covering a dam with fish passage facilities should provide a biological objective identifying the anticipated survival rate through the dam for both smolts and returning adults .

2) A watershed plan that includes fish bearing streams should include as biological objecives: (a) the anticipated level of coho salmon smolt production (from the fish bearing streams and tributaries) against which the effectiveness of the adaptive management strategies will be evaluated; and (b) a threshold value for smolt production equivalent to the critical/low breakpoint. If smolt production drops below this threshold, predetermined assessment procedures and decision process should be triggered (see Section 11.1).

Adaptive Management. Significant uncertainty exists in our ability to predict the effectiveness of conservation strategies in maintaining and restoring coho salmon populations. Adaptive management provides a method for testing through monitoring and research the viability of

alternative methods for meeting measurable biological goals, then adjusting future conservation management actions according to what has been learned.

Each plan must incorporate an adaptive management plan that identifies measurable biological goals, a monitoring program to determine if the objectives have been achieved, and a procedure for modifying conservation strategies.

Monitoring. A carefully designed and fully specified monitoring program is essential to the success of operating conservation programs that incorporate adaptive management into the strategy designed to conserve the covered species. Three types of monitoring should be included in each plan: (a) compliance monitoring to ensure that the plan is implemented, (b) effectiveness monitoring to ensure biological, chemical, or physical performance measures are achieved and to evaluate alternative adaptive management strategies, and (b) validation monitoring to evaluate the causal relationship between actions and habitat conditions.

An example of effectiveness monitoring programs corresponding to the previously described biological objectives are provided below:

1) The effectiveness monitoring program should determine whether the biological objectives for smolt and adult survival are being achieved, utilizing appropriate methodologies that provide the necessary level of precision and accuracy.

2) The monitoring program should determine whether the anticipated level of coho salmon smolt production from the watershed are being achieved and if the management actions are responsive to the resource objectives, utilizing appropriate methodologies that provide the necessary level of precision and accuracy.

6.4 Coho Salmon Habitat and Production Model

The intent of this element of the habitat component of the CCMP is to develop a model that will be consistently used by federal, state, tribal, and local agencies to quantify the effects of proposed land use activities on the production of coho salmon. By institutionalizing the use of the model, the intent of the CCMP is to refocus discussions from "How will land use activities affect coho salmon production?" to "How can land use activities be conducted without compromising coho salmon production objectives?" The habitat-to-production algorithms might initially be relatively simplistic; however, the model will be "technology forcing" in that it will direct research toward the types of data and studies that are necessary to resolve identified gaps in the quantification of the relationship between habitat and coho salmon production.

The model will be a key tool in the implementation of an integrated management plan for coho salmon. For example, the model should provide an analytic tool that addresses questions such as "What are the most effective artificial production and harvest management strategies to address short-term degradation of habitat? Are different strategies required if habitat degradation is expected to persist?" The model will quantify how a particular habitat action or suite of actions would change the productivity and capacity of a management unit, and the effect of modifications

or alternatives to those actions. From this information, the managers can determine how each alternative would change the breakpoints and target exploitation rates for that unit, and quantify the likely effect on future production and harvests. Land use planners would use this information, in evaluating proposed land use actions, along with the prescriptive standards described in Section 6.1.

7.0 Artificial Production

This chapter guides the appropriate use of artificial propagation of coho salmon under the CCCMP. It includes:

- definitions and description of the major categories of artificial production,
- the relationship of artificial production guidelines to guidelines for other areas of coho salmon management (harvest, habitat, genetic conservation and ecological interactions),
- description of the process for planning and implementing artificial production programs,
- general standards and guidelines for each of the major categories of artificial production, and
- a description of the standard mode of operation for existing facilities.

7.1 Definitions

Artificial production refers to the whole range of human activities that substitute for the voluntary behavior of fish in a natural stream in order to increase survival, growth, abundance, and distribution. Consequently, it includes everything from captive rearing (rearing of fish captured from the wild for subsequent release) to captive brood stocking (rearing of fish captured from the wild for brood stock to produce fish that will be reintroduced into the wild in later generations) to production of fish for harvest.

Although artificial production encompasses a wide range of activities, most can be divided by their potential benefits into two main categories. A common understanding of definitions is important to appropriately identify program objectives and adequately assess risks and benefits. For the purposes of this document:

> ***Enhancement*** or ***fishery augmentation*** is the production of fish that are never intended to spawn in the wild but are intended to be caught in fisheries.
>
> ***Supplementation*** is the production of fish to maintain or increase natural production while maintaining the long term fitness of the target population and keeping ecological and genetic impacts on non-target populations within specified biological limits (RASP 1992).

Artificial production programs may also be classified by two different reproductive strategies depending on whether they are intended to spawn with natural spawners:

> ***Integrated production*** is where artificially propagated fish are intended to spawn in the wild and become fully integrated into the wild population. Where natural habitat is available, recovery programs use this type of production. Some programs may provide for harvest opportunity in combination with an objective of natural production by

artificially produced fish. Supplementation programs are based on integrated production by definition.

Isolated production is artificially produced fish that are not intended to interact with natural spawners. Typically, these are fishery augmentation programs designed to replace lost or provide additional fishing opportunity. Some endangered species and research programs may also fall under this category.

7.2 Categories of Artificial Production

The result of these classifications is a matrix of four categories of artificial production (Table 3). These four categories provide the organizational basis for the rest of this chapter. Planning and implementing an artificial production program is based on choosing an appropriate category. Risk and benefits of each artificial production program can be assessed according to its category. Each category has different guidelines and standards. Additional guidelines provide direction on how and when programs would change categories.

Table 3 . Four major categories of artificial production programs. Shaded category indicates primary benefit of progam is supplementation.

Strategy	Management Objective	
	Recovery	Harvest
Integrated	Recovery/restoration Reintroduction Research	Harvest during or after recovery
Isolated	Gene Banking Research	Fishery augmentation Mitigation Allocation Research

{This section to be completed by May of 1998 with a description of the risks and benefits of each category.}

7.3 Relationship to Other Components of CCMP

Because this is a comprehensive plan, program objectives and decisions must be compatible with the harvest, habitat, and genetic conservation and ecological interactions objectives detailed elsewhere in the CCMP. Figure 1 illustrates the interacting influences of different parts of the CCMP on different components of coho salmon production.

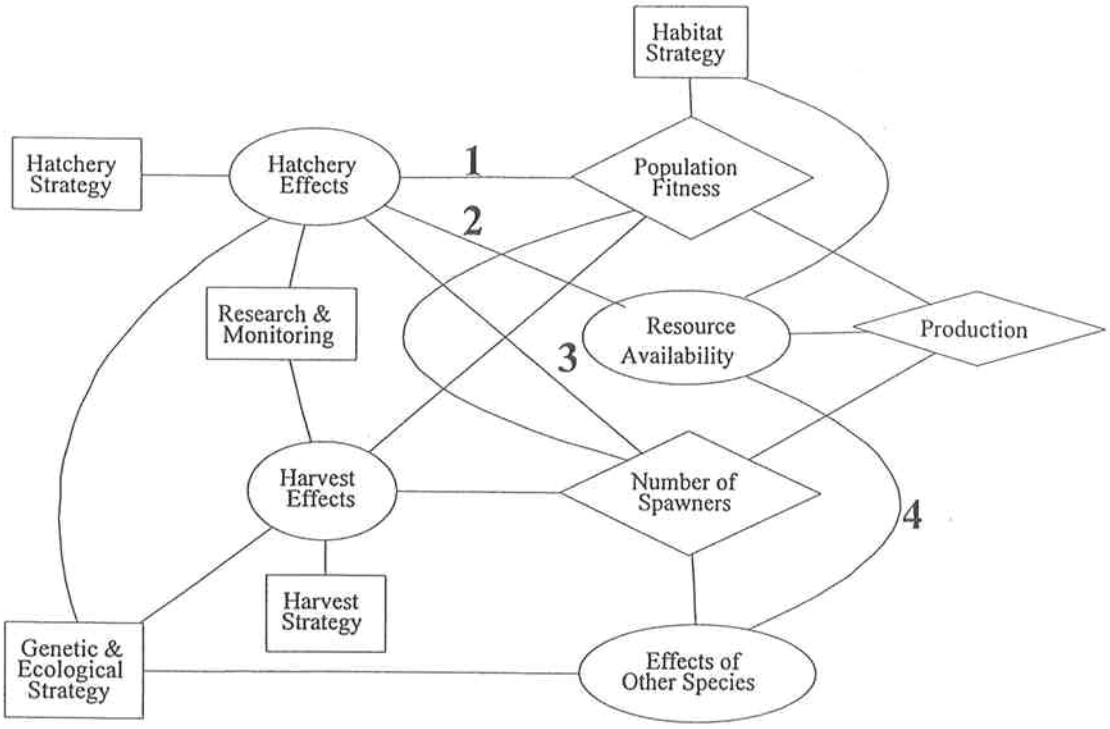

Figure 1. Influence diagram for coho salmon production.

Explanation of figure. Management decisions (major components of CCMP) are represented by rectangular nodes. Important influences related to artificial production (hatcheries) are indicated by numbers 1-4:

1. **genetic factors (domestication, inbreeding depression, outbreeding depression, extinction) and non-genetic factors (fish health, release strategy, mating success that affect population fitness;**
2. **intraspecific competition;**
3. **scale effects (size and duration of program);**
4. **interspecific competition, predation, parasitism, and nutrient enrichment.**

7.2 Equilibrium Production Levels

The equilibrium brood production levels provided in Appendix 4 describe the standard mode of operation for existing facilities. Maintenance of these production levels is necessary to support the fisheries described in this plan.

8.0 Exploitation Rates

The biology of coho salmon, current stock assessment capabilities, and management objectives indicate that the fishery management of the key wild management units should be controlled under most abundance levels by estimates of the MSH exploitation rates rather than estimates of the MSH escapement. Escapement safeguards are provided by reducing exploitation rates when the abundance drops to low (key wild units) or critical levels (key and auxiliary wild units).

Exploitation rates for auxiliary hatchery units will generally depend upon abundance relative to production-based escapement goals and fishing schedules.

The biology of coho salmon, current stock assessment capabilities, and management objectives indicate that the fishery management of the key wild management units should be controlled under most abundance levels by estimates of the MSH exploitation rates...

8.1 Key Wild Management Units

Target Exploitation Rates. The plan establishes a minimum of 3 target exploitation rates for each of the key wild management units (Table 2):

1) a **normal exploitation rate,** applicable when the abundance is within the normal range;

2) a **low exploitation rate,** applicable when the abundance is within the low range; and

3) a **critical exploitation rate,** applicable when the abundance is within the critical range.

The normal exploitation rate is an estimate of the exploitation rate that provides the MSH under average environmental conditions. This rate will be the target rate for the management unit unless: 1) the abundance for that unit is projected to be less than the low/normal breakpoint or 2) the escapement of an auxiliary stock that is a component of that management unit is projected to be below the critical/low breakpoint. This rate will be reviewed periodically and recalculated if data indicate that the productivity of the unit has changed (primarily due to long-term change in marine or freshwater habitat—see Section 6.3 above), or better estimates of the productivity of the management unit become available.

The low target exploitation rate is the exploitation rate that provides the MSH under low survival conditions, where low survival is the survival rate expected to be exceeded 90% of the time. This rate will be the target rate when the abundance of the management unit is categorized as low, unless the escapement of an auxiliary stock that is a component of the unit is projected to be below the critical/low breakpoint.

When the abundance of a key wild management unit, or a component auxiliary stock, is in the critical category, the intent of the plan is to prevent the escapement from falling below the critical/low breakpoint. The CCW recognizes that identification of the critical fishing regime required to achieve this objective will necessitate difficult policy decisions. We recommend that exploitation rates in the critical regime fall between the maximum possible reduction (no mortality in U.S. fisheries) and the lowest rate previously achieved (predicted to be approximately 10% of the age 3 cohort for the Strait of Juan de Fuca management unit in 1997).

Tolerance Ranges. The predicted exploitation rate for a key wild unit resulting from the application of a management regime must fall within a predefined tolerance range defined by a lower and an upper bound for the exploitation rate. The inclusion of a tolerance range both increases the flexibility of the plan and explicitly recognizes the uncertainty in the estimates of the target rates. Flexibility is required since 1) all units may not have the same target exploitation rate and 2) the allowable catch in some fisheries may be controlled by a catch quota. In the latter case, harvest rates in the quota fishery may be expected to vary with abundance. In the absence of a tolerance range, the quota would require annual adjustment to exactly achieve the target exploitation rate.

The value for the lower bound of the tolerance range will depend upon the frequency of adjustment desired for the mixed stock fisheries. As the lower bound for the tolerance range decreases, the relative frequency at which the normal regime occurs will increase. However, the increased stability in the normal regime may come at the cost of reduced harvest in mixed stock fisheries. Initial modelling of the harvest regime will use a lower bound for the tolerance range that is 95% of the target exploitation rate. A simulation model will then be used to assess the effect of the value of lower bound on the stability of the fishing regimes.

Flexibility in the plan must be balanced against the risk of the loss of future production and harvest given the variability in environmental conditions. Large positive deviations from the target rate could result in a substantial loss of production in the subsequent cycle and reduced harvest. The extent of the production loss will depend upon the abundance of the stock and the environmental factors affecting the productivity in the subsequent cycle. To reduce the likelihood of reduced future production, and recognize the uncertainty inherent in the target exploitation rates, the CCW recommends an upper bound for the tolerance range that would result in no more than a 1% reduction in future harvest under equilibrium conditions (constant exploitation rates and environmental conditions). Alternatively, the upper bound might be set at the exploitation rate that, given the uncertainty in the estimate of the MSH exploitation rate, results in a chosen probability that the long-term surplus production will be less than the surplus production at the target exploitation rate. This alternative is still under development and consideration by the CCW.

The relationship between exploitation rates, escapements, catches, and management unit abundance, are shown for a theoretical example in Figure 2. The values used in this example are provided below:

Canadian Fishery Exploitation Rates

WCVI Troll:	0.15

Other Canadian Fisheries:	0.05

Breakpoints	
Critical/Low (escapement):	9,000
Low/Normal (post-WCVI cohort):	48,980

U.S. Fishery Exploitation Rates	
Critical:	0.10
Low:	0.32
Normal:	0.49

Exploitation Rate Tolerance Range:
Upper: $3E\text{-}07X^3\text{-}9E\text{-}05X^2 + 0.0092X + 0.3541$
Lower: $-2E\text{-}05X^2 + .0058X + 0.2045$
where X is the abundance in 1000s.

8.2 Auxiliary Management Units

Auxiliary Wild Management Units. The management actions undertaken for the key wild management units will also generally act to control the harvest of the auxiliary units. However, if the abundance of an auxiliary unit falls below the low/critical breakpoint, additional management actions will be triggered. Management actions may include the reduction of the exploitation rate to the rate necessary to achieve the minimum acceptable escapement level, enhancement, and/or habitat protection measures (see Section 6.0).

Auxiliary Hatchery Management Units. The CCW anticipates that the maximum allowable harvest on the key hatchery management units will remain dependent upon the escapement goal. Hence, in fisheries controlled by the abundance of these units, the allowable catch of these units will be computed by subtracting the escapement goal from the abundance.

8.3 Secondary Management Units

Target exploitation rates will typically not be defined for the secondary management units. If defined, the rates define the harvestable surplus after separation from commingled key and auxiliary units.

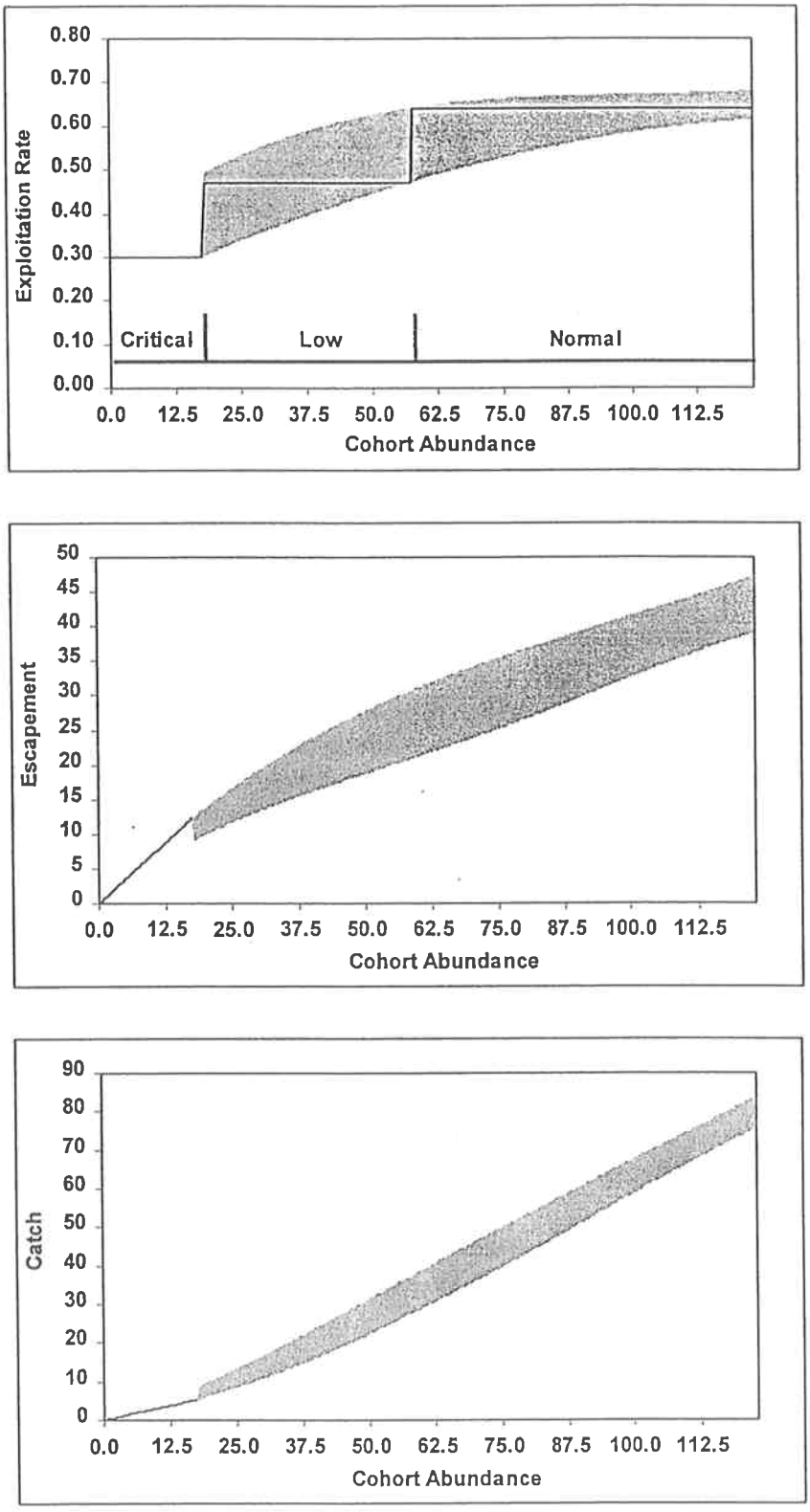

Figure 2. Example of target exploitation rates, tolerance range (shaded area), and the resulting range in escapement and catch for a key wild management unit.

9.0 Fishery Regimes

One objective of the CCMP is to promote management efficiency by establishing pre-determined management actions for specific resource conditions. The fishery management component of the CCMP promotes management efficiency by identifying base fishing levels and the conditions under which each level will be implemented. Efficiency is achieved in the CCMP by reducing uncertainty in annual fishery management planning and the associated management conflicts; reduced uncertainty in fishery management results in a concomitant incentive to increase production.

Efficiency is achieved in the CCMP by reducing uncertainty in annual fishery management planning and the associated management conflicts...

9.1 Switching Rules and Active Management

Switching rules specify what management actions will be undertaken under which conditions of abundance. Examples of potential rules include: 1) which management units are considered when determining the management actions for a fishery, 2) the conditions under which the base normal fishing regime will be adjusted, and 3) the procedure used to adjust the base normal fishing regime if the predicted exploitation rate is outside the tolerance range.

The same management units (or objectives) may not be used to control the harvest in each fishery. For example, the catch or effort level in an Area 4 sport fishery might be set based upon the abundance of the key wild management units, the catch in Skagit Bay by the Skagit wild unit, and the catch in Area 11 by the abundance of auxiliary South Sound management units. Decisions regarding the management actions that will be undertaken in each year in response to the abundance of the controlling stocks are collectively referred to as switching rules. A fishery is said to be actively managed for a management unit if the status of the unit is checked prior to determining the fishing regime. The CCW anticipates that it will be developing the switching rules in consultation with policy representatives.

9.2 Base Fishing Regimes

For each fishery actively managed for the key wild management units, three base fishing regimes (critical, low, and normal) will be defined in terms of catch numbers, seasons, exploitation rates, gear/area limitations, or other controls. The fishing regimes are termed 'base' since adjustments may be made if the preseason prediction for the exploitation rate resulting from the appropriate regime is outside of the tolerance range. The base normal regime will be identical for all management units, but the low and critical base regimes may be unit specific. Unit specific regimes may be necessary to reflect the difference in the catch distribution of the management units or differing allocation objectives.

While the abundance of the key and auxiliary management units determines the total allowable catch, the distribution of the catch among fisheries will be defined by policy level allocation decisions. The CCW anticipates that it will work in conjunction with policy representatives to develop the base fishing regimes.

9.3 Annual Application of Fishing Regimes

Fishery regimes will be established annually based upon the status of the key wild and auxiliary units and a predefined procedure for determining fishing levels. Although the CCW will be working with the policy representatives to develop the specifics, the following general procedures for preseason planning are anticipated:

1) Predict the cohort size of each management unit.

2) Predict the exploitation rate in the WCVI sport and troll fishery.

3) Compute the post-WCVI cohort size by multiplying the initial cohort size by the escapement rate from the WCVI sport and troll fishery.

4) Compute the status of each of the key wild management units by comparing the post-WCVI cohort size with the abundance breakpoints.

5) Set each actively managed fishery to the base-fishing regime that matches the status of the lowest actively managed key unit in that fishery.

6) Use a simulation model to predict the escapement of the key and auxiliary wild management units that would result from the predicted abundance, expected catches or exploitation rates in Canadian and South of Cape Falcon fisheries, and the base fishing regimes set in Step 5.

7) The fishing regime identified in Step 5 would be implemented except under the following conditions:

    a) If the predicted exploitation rate for a key wild management unit was below the tolerance range, exploitation rates in a specified set of fisheries actively managed for that unit would be increased until the exploitation rate was predicted to fall within the tolerance range. The rules governing this adjustment shall be developed prior to completion of the CCMP by policy representatives with assistance from the CCW.

    b) If the predicted exploitation rate for any key wild management unit was above the tolerance range, the exploitation rates in a specified set of fisheries actively managed for that unit would be reduced until the exploitation rate was predicted to fall within the tolerance range. The rules governing this adjustment shall be

developed prior to completion of the CCMP by policy representatives with assistance from the CCW.

c) If the predicted escapement for any key wild or auxiliary management unit was less than the critical/low breakpoint, all fisheries actively managed for that unit would be switched to the low regime. If the predicted escapement remains less than the critical/low breakpoint, the critical regime would be implemented.

The primary task of the CCW in 1998 will be to develop the fishing regimes for review and elaboration by policy representatives.

9.4 Inseason Adjustment

{This section to be completed by August 31, 1998.}

10.0 Monitoring and Research

Resource monitoring and research is essential for an adaptive management system, and is an integral component of the CCMP.

10.1 Monitoring Programs

The tribes and WDFW will maintain ongoing programs to monitor fisheries, the status of the coho salmon resource, the condition of natural habitats important for coho salmon production, and the interaction of hatchery and wild coho. Fishery monitoring will include monitoring of harvest and effort for all fisheries by area and time; sampling of harvest for CWTs and other methods of assessing stock composition; and monitoring of encounter rates, mark recognition, and regulation compliance for all fisheries where catch and release is allowed or required. Resource monitoring will include annual estimation of escapement and spawning numbers for all hatchery stocks and annual estimation of spawning escapement numbers and the abundance and distribution of hatchery strays in natural spawning areas for all key wild and auxiliary management units and as many secondary units as possible.

The state and tribes will also carry out an indicator stock program, based on CWTs, adequate to estimate exploitation rates, survivals, and other key elements of this plan. Annual assessment of coho salmon smolt migration numbers for wild management units is also a desirable monitoring program, but cannot be implemented until a funding source for this work is found. All monitoring data will be stored on databases jointly maintained by the tribes and WDFW.

Commitments for fishery and resource monitoring by the tribes and WDFW are outlined in Appendix 2.

10.2 Research and Data Needs

The success of the CCMP depends upon application of the best current data and data analysis to the management of the coho salmon resource. The CCMP includes a list of Research and Data Needs (Appendix 3) which will list and concisely summarize information and analysis necessary for effective implementation of the CCMP. The tribes and WDFW will include these projects in their fishery management programs to the extent possible and will seek necessary funding for those projects that cannot be included within the managers' basic programs.

Given limited funding it will not be possible to complete even the necessary work right away. The Research and Data Needs will be revised as part of each six-year plan review.

11.0 Implementation

11.1 Annual Stock Status Review

The escapement and exploitation rates of the key wild and auxiliary units will be monitored on an annual basis to identify units for which production objectives have not been achieved. A review of stock status and the CCMP will be initiated if for any unit:

1) escapement is less than the value identified in Table 4 in any year;

2) exploitation rates exceed the upper end of the tolerance range in two consecutive years or in three years within a six year period;

3) a nine year average of exploitation rates exceeds the target exploitation rate (or ceiling, if defined) by more than 3%.

All exploitation rate criteria are computed relative to the target rate given the postseason estimate of abundance. Criterion 3 is computed relative to the exploitation rate targets in each of the nine years. For example, if the normal and low targets for a management unit were 70% and 50%, respectively, and the abundance of the unit was normal 67% of the time, the exploitation rate criterion would be set to (1.03)((0.33)(50%)+(0.67)(70%))=65.3%.

Failure to achieve the production objectives may result from reductions in the quality or quantity of habitat and/or excessive fishing mortality.

Failure to achieve the production objectives may result from reductions in the quality or quantity of habitat and/or excessive fishing mortality. Two hypotheses will be used to provide a framework for the analysis of stock status: a) the recruitment to U.S. fisheries was less than the escapement trigger point identified in Table 4; or b) the structure of the CCMP, or errors in management or assessment models, resulted in excessive fishing mortality. If recruitment was insufficient, then subsequent analyses of the status review will attempt to discern why the unit was depressed. For example, did habitat degradation reduce the productivity of the stock, or was the escapement in the previous cycle insufficient? Conversely, if the review was triggered by criteria 2) or 3), or escapement was less than the value in Table 4 despite adequate recruitment, the focus of the analysis will be the management tools and CCMP fishing regimes. Was the preseason forecast in error, were fisheries not managed as expected, or were model predictions of fishery impacts in error?

In addition to these analyses, the status review will provide either a recommended rebuilding program (required for criterion 1) and/or modifications to management tools (required for criteria 2 and 3). The rebuilding program will identify specific habitat, fishing, and production actions predicted to provide an escapement greater than the low/normal breakpoint within three cycles for the key wild units, and greater than the critical/low breakpoint for auxiliary units.

Table 4. Escapements and exploitation rates for the key wild stocks that trigger a stock status review. Criterion 3 is not included because the trigger values will depend upon the target exploitation rates in each of the nine years comprising the review period.

Management Unit	Criterion 1 Escapement	Criterion 2 Exploitation Rate	
		Low	Normal
Skagit	9,000	0.49	0.67
Stillaguamish	14,000	0.49	0.67
Snohomish	4,000	0.49	0.67
Hood Canal	4,000	0.50 or 0.53	0.70
Western SJF Tributaries	Analysis not completed.		
Eastern SJF Tributaries	Analysis not completed.		

11.2 Annual Plan Review

The key statistics required to evaluate the CCMP will be provided in an annual report by February of the second year after escapement occurs (e.g., age 3 escapement for the 1996 brood will occur in 1999; the report providing key statistics for the 1996 brood would be completed by February of 2001). These statistics will include:

1) preseason predicted cohort abundance and postseason estimated abundance for the key wild and auxiliary management units;

2) preseason predicted status and postseason estimated status of key wild and auxiliary management units;

3) preseason target and predicted exploitation rates, postseason target and estimated exploitation rates for the key wild management units;

4) preseason predicted escapement and postseason estimated escapement for key wild and auxiliary management units;

5) treaty/nontreaty and intertribal allocation by relevant management or allocation unit;

6) preseason predicted catch and postseason estimated catch by fishery; and

7) estimated marine survival rates for the key wild management units.

11.3 Six Year Plan Review

Every six years the tribes and WDFW will prepare a report reviewing the management of the coho salmon resource under the CCMP. The review will conclude with a set of recommended plan revisions developed as a result of the review. The first six-year review will be completed by August 1, 2005, and cover management for the 1999 through 2004 seasons. The revised CCMP will be in effect beginning with the season following the review (2006 for the first six-year plan review).

In addition to the statistics presented in the annual report, the six-year plan review will also include:

1) a reassessment of the productivity of the stocks, including stock-recruit parameters, freshwater survival, and marine survival. Revised estimates of stock productivity may require modification of the target exploitation rates, tolerance ranges, and breakpoints;

2) the range of escapements and exploitation rates estimated postseason for the key and auxiliary management units, and the predicted values for these statistics. Deviations from the predicted values may indicate that the preseason prediction models are biased;

3) the frequency that each key wild and auxiliary management unit was in each status category. A greater than anticipated frequency of critical and low status may indicate that survival rates were worse than anticipated, habitat degradation has occurred, or that exploitation rates were excessive;

4) the frequency of each fishing regime for each fishery. A greater than anticipated frequency of low or critical fishing regimes could result from the same factors identified in 3);

5) a revised list of research and data needs; and

6) plan revisions recommended as a result of the six-year review.

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Appendix 1. Methods for computing abundance breakpoints and target exploitation rates.

{This section to be include in final report.}

Appendix 2. Ongoing Fishery Research and Resource Monitoring

Monitoring programs will provide the basic information necessary to carry out the annual and six-year reviews of this plan's performance. These programs must be designed such that key parameters for the evaluations (overall exploitation rates for key wild units, spawning escapement numbers, etc.) can be estimated at or above the desired level of precision. The desired level of precision will be determined prior to the completion of the final report; initial suggestions are noted by italic statements enclosed by brackets.

Harvest Monitoring

1) Where possible, all retained harvest of coho salmon will be recorded on fish tickets. At a minimum, the date, catch area, gear type, number of fish, and weight of fish caught will be recorded.

2) Where recording of data on fish tickets is not possible, the appropriate management agency will develop a procedure for estimation of the number and size distribution of coho salmon harvested by month, area, and gear type. These programs will be designed such that the number of coho salmon harvest within each time-area stratum can be estimated with a [*90% probability of being at a precision of +/- 20% of the true value, exact level of precision will depend upon the level of precision established for exploitation rate and the other parameters which for the basis of the plan reviews.*].

3) If it is not possible to implement a harvest estimation program meeting the above standards for a fishery, then the appropriate management agency will develop a program for estimating an upper bound on the retained harvest of coho salmon such that the estimate for each time-area stratum has a probability of [*95%*] of exceeding the true value of the number harvested. Such a program will also include a component for estimating the size distribution of coho salmon harvested.

Monitoring of Gear-Related Mortality

1) The state and tribal co-managers will develop and implement agreed procedures, and the necessary level of monitoring, for estimating non-harvest mortality for each gear type that causes mortality to coho salmon (to be provided in an appendix in the final report). Examples of parameters to be estimated or monitored include: coho salmon encounter rates in hook-and-release or selective fisheries, rates of mis-identification of marked fish in selective fisheries, drop-off mortalities by gear type, rates of noncompliance with release regulations for each gear type.

Monitoring for Stock Composition in Fisheries

1) The state and the tribes will maintain a viable CWT release and recovery program for coho salmon. The state and tribal management agencies will sample each time-area stratum of each fishery at a rate of at least [*20%, or some other level to be determined based on the precision requirements for the evaluation parameters*] for CWTs. For treaty and non-treaty

commercial net and troll fisheries the time-area strata will be statistical week by catch area. For all other fisheries, the time-area strata will be statistical month by catch area.

2) Whenever significant numbers of hatchery fish are mass-marked (for example, with adipose finclips), fishery monitoring will include estimates of marked-to-unmarked ratios in coho fisheries, stratified by time and area.

3) Monitoring of CWTs in the spawning escapement is critical for indicator stock programs to be effective. All escapements of hatchery-produced coho salmon involved in indicator stock programs will be sampled for CWTs at a rate as close to 100% as possible.

Monitoring of Natural Production Habitats

{This section to be included in final report.}

Monitoring of Resource Status

1) Annual estimates of coho salmon spawning escapement will be made for all key wild and auxiliary management units and as many secondary units as possible.

2) Coho salmon will be sampled for CWTs in natural spawning areas.

3) There will be a monitoring program designed for each key wild and auxiliary unit (*secondary units too?*) to estimate the number and distribution of hatchery-produced fish in natural spawning areas.

4) The size of coho salmon in spawning populations and fisheries (all gears) will be monitored with the objective of tracking any changes in size over time and any size-selectivity of fishery removals (both direct retention on non-retention mortalities).

5) Development of genetic baselines and genetic monitoring of key spawning populations will be conducted according to a plan designed to assure the genetic integrity of individual coho salmon stocks.

6) Monitoring of smolt outmigration will be continued per currently ongoing projects or added as needed and defined as a result of research projects.

Coded-Wire Tagging

1) The state and tribal managers will CWT an agreed set of indicator stocks as part of maintaining a viable CWT program. Double-index tagging will be used where appropriate and necessary. *[The final plan should include a list of coho indicator stocks cross-referenced to the stocks represented by each indicator stock.]*

Appendix 3. Research and Data Needs

Productivity and Capacity Estimates

The breakpoints and exploitation rates that form the basis for wild stock management in this plan critically depend on estimates of productivity and production capacity. The current estimates of these parameters for the key management units are based on data from test streams and may or may not apply to each key management unit. Research programs should be developed to estimate current productivity and production capacity for coho salmon. The research should be designed so that the new estimates will be available at the time of the first six-year plan review.

Improvement of Escapement Estimates

The annual assessment of the number of fish that escape fisheries to spawn naturally is the most important means of evaluating the performance of this CCMP. Therefore, a critical area of research will be to review, and revise where necessary, the escapement estimation methodologies for each key management unit. As a second priority, escapement estimation methodologies should be reviewed and/or developed for each auxiliary management unit.

Another critical component of the spawning escapement estimate is to determine what portion of the spawning escapement was naturally produced and what portion was derived from hatchery production. Programs to accomplish the above will be designed for each key wild management unit and for as many auxiliary management units as possible. Once these programs are designed data collection aspects of them may become part of the regular annual monitoring program.

Improvement of Run Size Forecasting

The fishing regimes called for in this CCMP depend upon the availability of accurate forecasts of the return of adult coho salmon for each key, auxiliary, and hatchery management unit. Annual run size forecasts should be computed with a probability of 90% of being within +/- 20% of the true value. Usually the forecast is computed as juvenile outmigration times ocean survival. Therefore, this research will have two components. These components should be designed to provide estimates with sufficient precision such that the ultimate run size forecasts will achieve the precision goal stated above:

> Improvement of Juvenile Outmigration Estimates. For each key wild management unit a program will be designed to obtain annual estimates of smolt outmigration. As soon as the optimal monitoring program is determined, it will become part of normal annual monitoring (appendix to be included in the final report). As far as possible similar programs will be designed and implemented for auxiliary management units.
>
> Improvement of Marine Survival Estimates. Research should be undertaken to determine the best method of annually predicting marine survival for Puget Sound coho salmon.

Expanded Run Reconstruction Database - Evaluation of CWT System

There is currently available a new run reconstruction database for 1986 through 1991 constructed using analysis of CWT returns. This database should be extended as far as possible, both backwards and forwards in time. This work should also include an evaluation of the CWT marking and recovery system with an assessment of the optimal 1) set of tagged indicator stocks and 2) tagging and sampling strategies to adequately determine the survival and distribution of at least each key wild management unit (*quantifiable criteria should be included here*). Once this work is completed then the revised tagging and recovery program will be provided in an appendix table.

Non-harvest Mortality

Research should be conducted to improve estimates of the non-harvest mortality of coho salmon as a mortality rate per fish encountered such that the rate for each gear type is estimated with sufficient precision to meet the overall goals for precision of exploitation rate estimates. [*A list of the parameters to be estimated will be included here.*] In some cases there may be different estimates for a single gear type. For example hook-and-release mortality rates may be different for marine waters, estuaries, and freshwater. The estimates obtained from these studies will be used in annual harvest modeling as well as in cohort analysis and other assessments of survival and run strength.

Habitat

The coho-habitat production model will be used to identify critical uncertainties in our understanding of the factors affecting coho salmon production. These factors should be the subject of subsequent research.

Hatchery/Wild Interactions

In order to fully evaluate the costs and benefits of coho salmon hatchery production it will be necessary to investigate ecological effects of hatchery-produced coho, including competition and predation. This includes interactions of hatchery coho with wild coho salmon as well as with other salmon and other non-salmon species.

Research should be carried out to document potential cross-breeding of hatchery and wild coho salmon. This has three parts: 1) determination the extent and distribution of hatchery-produced coho in natural spawning areas, 2) in cases where hatchery coho are present in natural spawning areas, determining the extent to which gene flow is occurring from hatchery to wild populations and 3) where gene flow is occurring, determining if this gene flow has a potential detrimental effect on the natural population.

Fishery Selectivity

Research should be carried to determine the extent to which each kind of fishery (examples, net fishery, hook-and-line recreational fishery, hook-and-line recreational fishery with selective retention regulations, etc.) exerts a size-selective mortality on wild and hatchery coho salmon.

Appendix 4. Equilibrium Brood Production Levels

Region: Nooksack/Samish

Facility/Production Unit	Activity	Number	Type	Size	Destination	Preferred Stock	Timing	Comments
Skookum Creek Hatchery	egg take goal	4,000,000-6,300,000	eggs					
	on-station release goal	2,000,000	fish	18-23/lb	Skookum Cr.	Local	May-June	
	off-station release goal	400,000	fish	800/lb	Nooksack/Samish Region			For fry plants in Region 1(surplus to priority objectives)
	transfer goal	2,000,000	eyed eggs		Skookum Cr. Hatchery	Lummi Bay Sea Ponds		transfer from Lummi Bay Sea Ponds
	transfer goal	2,000,000	fish	40/lb	Lummi Bay Sea Ponds		April	transfer to Lummi Bay Sea Ponds
	transfer goal	800,000	fish	40/lb	Fairhaven Net Pens	Lummi Bay Sea Ponds	April	
Lummi Bay Sea Ponds	egg take goal	2,000,000	eggs		Lummi Bay	Lummi Bay Sea Ponds		
	on-station release goal	2,000,000	fish	15-20/lb	Lummi Bay	Lummi Bay Sea Ponds	May-June	
	transfer goal	2,000,000	eyed eggs		to Skookum Cr. Hatchery	Lummi Bay Sea Ponds	January	
	transfer goal	2,000,000	fish	40/lb	Lummi Bay	Lummi Bay Sea Ponds	April	
Kendall Creek Hatchery	egg take goal	5,300,000	eggs			Nooksack Coho		
	on-station release goal	1,300,000	fish	17/lb	Nooksack River	Nooksack Coho	May	On-station release goals will be achieved prior to other needs
	off-station release goal	2,000,000	fish	600/lb	Nooksack R. tributaries	Nooksack Coho	April	Off-station releases, if available
	transfer goal	250,000	eyed eggs		Blaine High School (Haynie Cr.)			
	transfer goal	20,000	eyed eggs		Ferndale High School (Deer Cr.)			
	transfer goal	100,000	eyed eggs		Lyd-Christion High School			
	transfer goal	5,600	eyed eggs		Region 4 Coops.			
	transfer goal	10,000	eyed eggs		Nooksack/Samish fry plants			
Whatcom Creek Hatchery	egg take goal	590,000	eggs					Goal rarely met. Usual transfer of 480K from Kendall Cr.
	transfer in	175,000	fish	25/lb		Marblemount Hatchery		
	planting goal	175,000	fish	10/lb	Squalicum Harbor			
	planting goal	10,000	eyed eggs		RSI project			
	planting goal	50,000	eyed eggs		Baker Cr. RSI project			

Appendix 4. Equilibrium Brood Production Levels (continued)

Region: Skagit

Facility/Production Unit	Activity	Number	Type	Size	Destination	Preferred Stock	Timing	Comments
Marblemount Hatchery	egg take goal	885,000	eggs					
	on-station release goal	250,000	fish	17/lb	Skagit River		June	
	off-station release goal	100,000	fish	30/lb	Indian Slough		March	
	transfer in	1,500,000	green eggs			Wallace River Hatchery	November	
	transfer goal	1,400,000	fish	200/lb	Skookumchuck Rearing	Wallace River Hatchery	May	
	transfer goal	30,000	fish	25/lb	Lacbugten Wharf Net Pens		March	
	transfer goal	30,000	fish	25/lb	Oak Harbor Net Pens		March	
	transfer goal	150,000	fish	30/lb	Fidalgo Bay Net Pens			
	transfer goal	4,000	eyed eggs		Region 4 Ed. Coops.			
Baker Spawning Beach	transfer in	300,000	eyed eggs			Baker Trap		Primarily a Puget Power operation. CWT returns.
	transfer goal	50,000	fish	600/lb	Lake Shannon Net Pens	Baker Trap	May	
	transfer goal	80,000 (+, -)	fish	1,000/lb	Lake Shannon	Baker Trap	April	Target 80,000; actual amount depends on survival rate.
Lake Shannon Net Pens	transfer in	50,000	fish	600/lb		Baker Trap	May	Transferred from Baker Spawning Beach
	planting goal	25,000	fish	15/lb	Baker River	Baker Trap	April-June	
	planting goal	15,000	fish	15/lb	Baker Lake	Baker Trap	April	Gulper efficiency test
Skagit System Coop.	transfer in	100,000	fish	25/lb	Indian Slough	Marblemount Hatchery	March	Direct plant into Indian Slough
Samish Hatchery-Friday Creek	transfer in	100,000	eyed eggs			Samish Hatchery		
	planting goal	10,000	fish	1500/lb	Prairie Ln. Springs RSI project		March	only approved for 96-98 broodyears
	planting goal	25,000	fish	1500/lb	Bob Smith Creek		March	Fidalgo Flyfishers project
	planting goal	45,000	fish	1500/lb	Cain Lake			
	planting goal	20,000	fish	1500/lb	Mud Creek			

Appendix 4. Equilibrium Brood Production Levels (continued)

Region: Stillaguamish/Snohomish

Facility/Production Unit	Activity	Number	Type	Size	Destination	Preferred Stock	Timing	Comments
Stillaguamish Hatchery	egg take goal	250,000	eggs			Stillaguamish River		
	planting goal	3,000	fish	200/lb	Eagle Creek		May	Arlington Schools Coop.
	planting goal	50,000	fish	18/lb	NF Stillaguamish River		May	
	planting goal	5,000	fish	35/lb	SF Stillaguamish River		September	Everett School Camp Coop.
	planting goal	50,000	fish	500/lb	Stillaguamish Tribs.		March	
	transfer goal	100,000	fish	500/lb	Brenner Creek Hatchery	Stillaguamish River	March	
Brenner Hatchery	transfer in	100,000	fish	500/lb		Stillaguamish River	March	
	planting goal	100,000	fish	30/lb	SF Stillaguamish River	Stillaguamish River	April	
Tulalip Hatchery	transfer in	1,300,000	green eggs			Wallace River Hatchery		
	planting goal	1,000,000	fish	18/lb	Tulalip Bay		June	
Tokul Creek Hatchery	transfer in	1,300,000	fish	1000/lb		Wallace River Hatchery	March	For South Sound Net Pen program
	transfer goal	1,100,000	fish	250/lb	Skookumchuck Rearing	Wallace River Hatchery	May	For South Sound Net Pen program
Wallace River Hatchery	egg take goal	6,400,000	eggs					
	transfer goal	135,000	fish	25/lb	Coop. Net Pen Support		February	Net pen support including backfill of SSNP
	transfer goal	30,000	fish	25/lb	Ballard Salmon Club			
	transfer goal	26,000	eyed eggs		Everett School District			
	transfer goal	50,000	eyed eggs		Flowing Creek			
	transfer goal	50,000	fish	25/lb	Fox Island Net Pens		February	
	transfer goal	150,000	fish	25/lb	Manchester Fuel Dock Pens			
	transfer goal	1,500,000	green eggs		Marblemount Hatchery		November	
	transfer goal	50,000	fish	25/lb	Quartermaster Harbor Pens		February	Puyallup Tribal progam
	transfer goal	50,600	eyed eggs		Reg. 3 Still/Snoh.			50K for Maxwelton Creek project; 600 for Kulman Cr. project
	transfer goal	20,000	fish	25/lb	Possession Point Net Pens		March	
	transfer goal	25,200	eyed eggs		Region 4 Ed. Coops			
	transfer goal	10,000	eyed eggs		Sky Valley School			
	transfer goal	24,000	fish	1,000/lb	Snohomish Sportsmen		March	
	transfer goal	1,300,000	fish	1,000/lb	Tokul Hatchery		March	
	transfer goal	1,300,000	green eggs		Tulalip Hatchery			
	transfer goal	135,000	eyed eggs		WA Trollers Association			
	transfer goal	15,000	fish	25/lb	WA Trollers Association		February	
	planting goal	300,000	fish	17/lb	Skykomish River			

Appendix 4. Equilibrium Brood Production Levels (continued)

Region: Hood Canal

Facility/Production Unit	Activity	Number	Type	Size	Destination	Preferred Stock	Timing	Comments
George Adams Hatchery	egg take goal	590,000	eggs					
	fish planting goal	500,000	smolts	17/lb	Purdy Creek		May	on station release
	egg transfer goal	450,000	eggs					FROM Quilcene NFH
	fish transfer goal	400,000	smolts	25/lb	Port Gamble Net Pens		January	TO PNPTC Port Gamble Bay Pens
Quilcene NFH	egg take goal	1,400,000	eggs					
	egg transfer goal	450,000	eggs					TO George Adams Hatchery for Port Gamble Pens
	fish transfer goal	300,000	smolts	25/lb	Quilcene Bay Net Pens		January	TO PNPTC Quilcene Bay Pens
	fish planting goal	450,000	smolts	18/lb	Quilcene River		May	on station release
	fish planting goal	24,000	fry	450-480/lb	Quilcene River		Feb, March	up-river outplant
Quilcene Bay Net Pens	fish transfer goal	300,000	smolts	25/lb			January	FROM Quilcene NFH
	fish planting goal	300,000	smolts	15/lb	Quilcene Bay		May, June	on-station release
Port Gamble Bay Net Pens	fish transfer goal	400,000	smolts	25/lb			January	From George Adams Hatchery (Quilcene NFH brood)
	fish planting goal	400,000	smolts	10/lb	Port Gamble Bay		May, June	on-station release

Appendix 4. Equilibrium Brood Production Levels (continued)

Region: Mid Puget Sound

Facility/Production Unit	Activity	Number	Type	Size	Destination	Preferred Stock	Timing	Comments
Portage Bay Hatchery	transfer goal	20,000	eyed eggs		classroom community			
	transfer goal	33,050	eyed eggs		Region 4 Ed. Coops.			
	transfer goal	6,750	green eggs		Region 4 Ed. Coops.			
	planting goal	80,000	fish	30/lb	Portage Bay/Ship Canal		May	
Issaquah Hatchery	egg take goal	3,300,000	eggs					
	transfer goal	25,000	eyed eggs		Bridgehaven Assoc.			
	transfer goal	30,000	eyed eggs		City of Bellevue			
	transfer goal	50,000	eyed eggs		Cross Project			
	transfer goal	50,000	eyed eggs		Everett School Dist.			
	transfer goal	80,000	eyed eggs		Halls Lake Project			
	transfer goal	1,000	eyed eggs		Kent School Dist.			
	transfer goal	20,000	eyed eggs		Lynnwood High School			
	transfer goal	10,000	eyed eggs		Nelson Project			
	transfer goal	125,000	eyed eggs		NWSCC-Laebugten			Swamp Creek Project
	transfer goal	450,000	eyed eggs		Region 4 Mid Puget Sound			Ten Million Salmon Project
	transfer goal	144,900	eyed eggs		Region 4 Ed. Coops.			
	transfer goal	4,850	green eggs		Region 4 Ed. Coops.			
	transfer goal	3,000	eyed eggs		Renton School			
	transfer goal	30,000	eyed eggs		Scriber Creek			
	transfer goal	300,000	eyed eggs		Steps			
	planting goal	1,000,000	fish	600/lb	Local Streams as needed		May	
	planting goal	450,000	fish	17/lb	Issaquah Creek		April	
Soos Creek Hatchery	egg take goal	2,825,000	eggs					
	transfer goal	600,000	fish		Crisp Creek Hatchery		August	
	transfer goal	550,000	fish	1500/lb	Keta Creek Hatchery		March	
	transfer goal	1,000	eyed eggs		Kent School District			
	transfer goal	230,000	eyed eggs		NWSSC - DesMoines			
	transfer goal	17,450	eyed eggs		Region 4 Ed. Coops.			
	transfer goal	500	fish		Region 4 Ed. Coops.		April	
	transfer goal	4,650	green eggs		Region 4 Ed. Coops.			
	transfer goal	10,000	eyed eggs		Salmon Creek Community			
	transfer goal	25,000	fish	25/lb	Seattle Aquarium		February	
	transfer goal	7,000	eyed eggs		Shoreline Comm. College			
	transfer goal	40,000	eyed eggs		City of Tukwila			Approved only for 96-98 broods. Will be evaluated.
	transfer goal	2,000	eyed eggs		Twin Lakes CC			
	transfer goal	30,000	fish	500/lb	Vashon Sportsmen		April	
	transfer goal	1,000	fish	1500/lb	Wordan Project		March	
	planting goal	600,000	fish	17/lb	Big Soos Creek		April	
	planting goal	350,000	fish	600/lb	Green River		May	
Crisp Creek Hatchery	transfer in	600,000	fish			Soos Creek Hatchery	August	
	transfer goal	400,000	fish	25/lb	Elliot Bay Net Pens		March	
	planting goal	200,000	fish	15/lb	Crisp Creek		May	

Appendix 4. Equilibrium Brood Production Levels (continued)

Region: Mid Puget Sound (continued)

Facility/Production Unit	Activity	Number	Type	Size	Destination	Preferred Stock	Timing	Comments
Keta Creek Hatchery	transfer in	550,000	fish	1500/lb		Soos Creek Hatchery	March	
	planting goal	500,000	fish	400/lb	Green River		May	
Puyallup Hatchery	transfer in	200,000	fish	30/lb		Voights Creek Hatchery	February	
	planting goal	200,000	fish	10/lb	Lake Kaposin Net Pens	Voights Creek Hatchery		
Voights Creek Hatchery	egg take goal	1,700,000	eggs					
	transfer goal	50,000	eyed eggs		Orting Coop.			
	transfer goal	100,000	fish	18/lb	Rushing Water Creek	Voights Creek Hatchery	May	Electron Dam Project
	transfer goal	200,000	fish	30/lb	Puyallup Hatchery			
	transfer goal	500	eyed eggs		Region 4 Ed. Coop.			
	transfer goal	28,500	eyed eggs		Region 7 Ed. Coop.			
	transfer goal	10,000	eyed eggs		Surprise Lake Project			
	planting goal	500,000	fish	500/lb	Local Streams		April	
	planting goal	1,180,000	fish	17/lb	Voight Creek		May	
Agate Pass Pens	transfer in	600,000	fish	25/lb		Coulter Creek	February	
	planting goal	60,000	fish	17/lb	Agate Pass		June	
Quartermaster Harbor Pens	transfer in	50,000	fish	25/lb		Wallace River Hatchery	February	
	planting goal	50,000	fish	10/lb	Quartermaster Harbor			

Appendix 4. Equilibrium Brood Production Levels (continued)

Region: South Puget Sound

Facility/Production Unit	Activity	Number	Type	Size	Destination	Preferred Stock	Timing	Comments
Clear Creek Hatchery	egg take goal	1,100,000	eggs					excess up to 2 million may be used for fry/fingerling plant in lower river.
	transfer goal	10,000	eyed eggs		Region 5			
	transfer goal	1,500	eyed eggs		Region 7 Ed. Coop.			
	planting goal	250,000	eyed eggs		Nisqually River Tribs.		March	
	planting goal	630,000	fish	17/lb	Clear Creek		May	
	planting goal	150,000	fish	650/lb	Nisqually River Tribs.		April	questionable info?
Kalama Creek Hatchery	egg take goal	80,000						
	transfer goal	120,000	eyed eggs		Eatonville Eagles			
	planting goal	175,000	fish	250/lb	Beaver Creek		March	
	planting goal	400,000	fish	17/lb	Kalama Cr.		April	
	planting goal	150,000	fish	650/lb	Nisqually River Tribs.		April	questionable info?
Garrison Springs Hatchery	transfer in	88,000	eyed eggs			Minter Creek Hatchery		
	transfer goal	5,000	eyed eggs		Clover Creek Project			
	transfer goal	20,000	eyed eggs		Kupper Project			
	transfer goal	13,500	eyed eggs		Region 7 Ed. Coop.			
	transfer goal	51,000	eyed eggs		Stadium High School			
Lake Sequalitchew Hatchery	transfer in	350,000	fish	35/lb		Coulter Creek Hatchery	November	
	planting goal	300,000	fish	17/lb	Lake Sequalitchew			
Coulter Creek Hatchery	transfer in	1,200,000	fish	1500/lb		Minter Creek Hatchery	March	
	transfer goal	600,000	fish	25/lb	Agate Pass Net Pens			
	transfer goal	350,000	fish	35/lb	Lake Sequalitchew Hatchery			
Minter Creek Hatchery	egg take goal	5,136,000	eggs					
	transfer goal	8,000	eyed eggs		Boy Scout troop 112			
	transfer goal	1,200,000	fish	1500/lb	Coulter Creek Hatchery		March	
	transfer goal	5,000	fish	600/lb	Cove Trout Farm		April	
	transfer goal	5,000	eyed eggs		Dobbs Cr. Project			
	transfer goal	1,500	fish	50/lb	Donald Kelly Project		October	
	transfer goal	88,000	eyed eggs		Garrison Springs Hatchery			for local Coop. projects
	transfer goal	5,000	fish	500/lb	Gilmer Project		April	
	transfer goal	10,000	eyed eggs		Hartstene Island Project			
	transfer goal	4,000	fish	500/lb	Kitsap Conservation		April	
	transfer goal	20,000	eyed eggs		Nelaly Creek Project			
	transfer goal	20,000	fish	25/lb	NWSSC - Desmoines		March	
	transfer goal	25,000	eyed eggs		NWSSC - Mason County			
	transfer goal	50,000	eyed eggs		Olympia Salmon Club			
	transfer goal	15,000	eyed eggs		Port Orchard Rotary			
	transfer goal	60,000	eyed eggs		R&R Monohon Project			
	transfer goal	70,000	eyed eggs		Region 5			
	transfer goal	47,800	eyed eggs		Region 7 Ed. Coops			
	transfer goal	25,000	eyed eggs		Sherwood Creek Project			
	transfer goal	60,000	eyed eggs		SOS			

Appendix 4. Equilibrium Brood Production Levels (continued)

Region: South Puget Sound (continued)

Facility/Production Unit	Activity	Number	Type	Size	Destination	Preferred Stock	Timing	Comments
Minter Creek (continued)	transfer goal	50,000	green eggs		Suquamish Tribe			
	transfer goal	10,000	eyed eggs		Woodland Creek #2			
	transfer goal	2,000	eyed eggs		Wurner Project			
	planting goal	1,000,000	fish	500/lb	Local Streams		May	
	planting goal	1,500,000	fish	17/lb	Minter Creek		May	
Squaxin Island Pens	transfer in	1,000,000	fish	25lb		Skookumchuck Hatchery	January	
	planting goal	1,000,000	fish	10/lb	Peale Passage @ SS Pens		June	
South Sound Pens	transfer in	1,200,000	fish	20/lb		Skookumchuck Hatchery	April	
	planting goal	1,200,000	fish	10/lb	Peale Passage @ SS Pens		June	
Fox Island Pens	transfer in	50,000	fish	24/lb		Wallace River Hatchery	February	
	planting goal	40,000	fish	10/lb	Fox Island @ Pens			
	planting goal	10,000	fish	1/lb	Fox Island @ Pens			

Appendix 4. Equilibrium Brood Production Levels (continued)

Region: Strait of Juan de Fuca Tributaries

Facility/Production Unit	Activity	Number	Type	Size	Destination	Preferred Stock	Timing	Comments
Dungeness Hatchery	egg take goal	1,000,000	eggs					
	egg transfer goal	6,500	green eggs					TO Hurd Creek Hatchery
	fish planting goal	350,000	smolts	17/lb	Dungeness River		June	on-station release
	fish planting goal	450,000	smolts	17/lb	Dungeness River		June	on-station release, Jamestown Tribe program
Hurd Creek Hatchery	egg transfer goal	6,500	green eggs					FROM Dungeness Hatchery
	egg transfer goal	6,500	eyed eggs					TO Region 6 educational coop. projects
Region 6 Ed. Coop. Projects	egg transfer goal	6,500	eyed eggs					FROM Hurd Creek Hatchery
	fish planting goal	6,500	fry	500/lb	various SJDF streams		March	production divided among school projects
Elwha Hatchery	egg take goal	1,100,000	eggs					
	egg transfer goal	3,000	eyed eggs					TO Peninsula College
	fish planting goal	750,000	smolts	15/lb	Elwha River		May	on-station release
Peninsula College	egg transfer goal	3,000	green eggs					FROM Elwha Hatchery
	fish planting goal	3,000	fry	500/lb	Ennis Creek		March	educational project