Hood Canal Coordinating Council

Hood Canal & Eastern Strait of Juan de Fuca Summer Chum Salmon Recovery Plan

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Hood Canal Coordinating Council
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1. INTRODUCTION

1.1. Overview

A status review of all west coast salmon species initiated in 1994 by the National Marine Fisheries Service (Federal Register 1994) determined that summer chum salmon originating from Hood Canal and the eastern Strait of Juan de Fuca watersheds represented an Evolutionarily Significant Unit (ESU) (Johnson et al 1997). In March of 1999 the summer chum salmon ESU was considered to be at risk of extinction and listed as threatened under the Endangered Species Act (ESA) (16 U.S.C. Sec. 1531 et seq). The ultimate goal of the ESA is to recover threatened or endangered species. The ESA, in providing protection for a species at risk of extinction, also requires the development of a recovery plan for that species. Recovery is described as "the process by which the decline of a threatened or endangered species is arrested or reversed, and threats to its survival are neutralized, so that its long-term survival in nature can be ensured" (USFWS, 1992). Recovery planning under section 4 of the ESA can be keyed to habitat protection. A recovery plan is to include "site-specific management actions as may be necessary to achieve the plan's goal for the conservation and survival of the species" (§1533 (f) (1) (B)).

The Summer Chum Salmon Recovery Plan (the SRP) is ultimately intended to fulfill that ESA requirement and allow the appropriate Federal authorities to use the SRP in response to the ESA listing. Local and regional authorities within the Hood Canal and eastern Strait of Juan de Fuca watersheds desire to control and manage recovery in a manner that is compatible with their policies. They do not desire to form new processes or new organizations, but rather to provide an approach that takes advantage of existing processes, organization and political structures, and available data and information. Such an approach is intended to be responsive to the biological needs of the summer chum salmon in the context of local and regional political, economic, social, and legal realities.

In this context the Summer Chum Salmon Recovery Plan will provide a logic and rationale for recovery of summer chum salmon populations that can be understood by County Commissioners, Tribal governments, local and regional decision-makers and the public. The biology of the summer chum salmon and inherent biological productivity of the salmon habitats will provide the basis for the action alternatives that are described. The action alternatives will be driven by political feasibility, opportunity, ability, and willingness. The design of this SRP fosters participation and input from the appropriate land use and Tribal authorities. Development of the SRP engaged these authorities at multiple levels and provides them with guidance and direction in developing salmon recovery policies and regulations.

It is the intent of this SRP to be formally adopted by the three member Counties and the two member Tribes of the Hood Canal Coordinating Council. The

Counties will then be able to use this SRP to assist them in addressing regulatory aspects of habitat protection. Potential regulatory avenues for action might include Growth Management, Critical Areas Ordinances, and Shoreline Master Programs. However, the intent of this SRP is not to recommend sweeping regulatory solutions. The intent of this SRP is to craft specific 'packages' of solutions that may or may not include regulatory components, depending on each specific local habitat situation, the availability of alternative courses of action, and the political and economic feasibility of a regulatory solution.

Currently available technical work and information provides the basis for this SRP. On-going recovery actions and research will be incorporated as they become available within an adaptive management approach. Significant bodies of work have contributed to the development of this SRP, including the Summer Chum Salmon Conservation Initiative, Limiting Factors Assessments (WRIA's 14, 15, 16, 17 and 18), and refugia studies prepared for Jefferson and Kitsap Counties. The SRP proposes means by which the work being pursued by WRIA planning units under RCW 90.82 (the "2514 process") can be coordinated with the actions proposed for summer chum salmon recovery. Action recommendations are also coordinated with the HCCC's Lead Entity Salmon Habitat Recovery Strategy.

1.2. The Hood Canal Coordinating Council and its Role in Salmon Recovery Planning

The Hood Canal Coordinating Council (HCCC)[1] is a watershed based Council of Governments that was established in 1985 in response to concerns about water quality problems and related natural resource issues in the watershed. It was incorporated in 2000 as a 501(c)3, Public Benefit Corporation under RCW 24.03. It is made up of a Board of Directors of Regular Members (the County Commissioners from Jefferson, Kitsap and Mason Counties and elected Tribal Council Members from the Skokomish and Port Gamble S'Klallam Tribes.) It also has a slate of Ex-Officio Board Members (composed of representatives from State and Federal Agencies.) The Council also has Cooperating Partners who work with it on various projects and programs (volunteer groups, regional fisheries enhancement groups, conservation districts, land trusts, etc.). The HCCC's dual missions are:

> *"The Hood Canal Coordinating Council recognizes Hood Canal as a national treasure and will advocate and implement locally-appropriate actions to protect and enhance the Canal's special qualities."* (Adopted in 1992) and

[1] For more information about the Hood Canal Coordinating Council see http://www.wa.gov/hccc.

> *"To assure the existence of wild salmon in Hood Canal for the next 150 years, the Hood Canal Coordinating Council will: understand the causes of the decline of salmon in the Canal; identify the values and choices to be made in the natural, economic, legal, social, and cultural environments of salmon; develop and choose appropriate responses; and implement actions to maintain natural populations of salmon stocks at self-sustaining levels for ceremonial, subsistence, recreational and commercial fisheries."* (Adopted in 1996)

In 2002 the HCCC took the lead in the development of this Hood Canal/Eastern Strait of Juan de Fuca Summer Chum Salmon Recovery Plan. In 2005, the HCCC was statutorily designated as the regional recovery organization for Hood Canal Summer Chum.[2] This recovery work is part of the State of Washington's regional recovery planning effort for ESA listed species under the Governor's Plan, *Extinction is not an Option*.[3] It is funded through the Salmon Recovery Planning Grant Program. The Salmon Recovery Funding Board (SRFB)[4] established the Salmon Recovery Planning Grant Program. HCCC is also the designated Lead Entity for the Hood Canal watershed charged with the coordination of salmon recovery projects from counties, cities, conservation districts, tribes, environmental groups, business interests, landowners, citizens, volunteer groups, regional fish enhancement groups, and other habitat interests.

1.3. Geographic Description of the Summer Chum Salmon Recovery Planning Area

The Hood Canal Summer Run Chum Salmon ESU, as determined by the National Marine Fisheries Service (NMFS), includes summer-run chum salmon populations that naturally spawn in tributaries to Hood Canal and in Discovery Bay, Sequim Bay, and the Dungeness River on the Strait of Juan de Fuca (Johnson et al 1997). Figure 1 presents the entire ESU as determined by NMFS.

[2] See Engrossed Substitute House Bill 2097.
[3] For information see www.governor.wa.gov/gsro/strategy/longversion.htm.
[4] For information on the Salmon Recovery Funding Board see http://www.iac.wa.gov/srfb/.

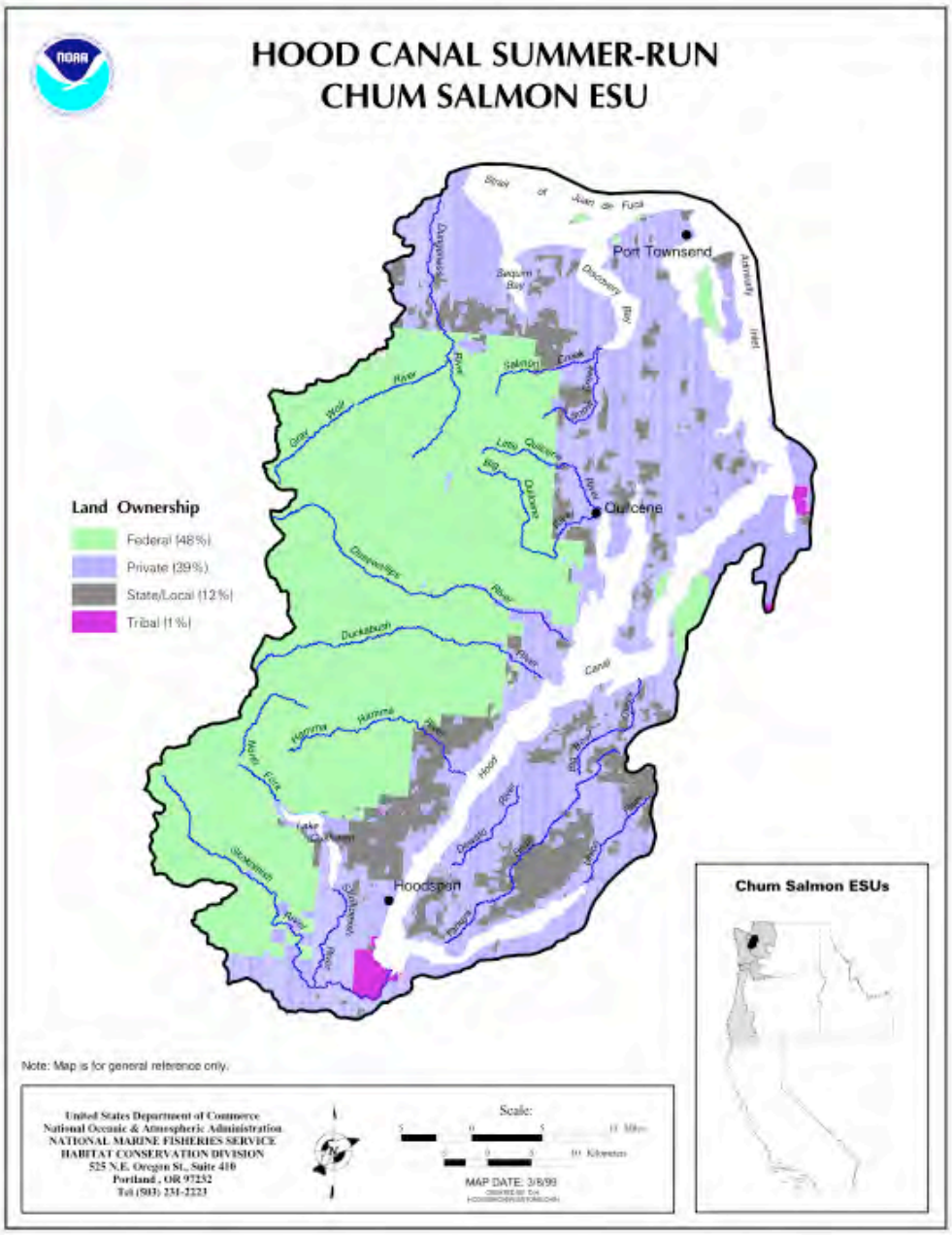


Figure 1. Hood Canal Summer-Run Chum Salmon ESU as determined by NMFS http://www.nwfsc.noaa.gov/trt/trt_puget.htm.

The Hood Canal/Eastern Strait of Juan de Fuca Summer Chum Salmon Recovery Planning area includes portions of Jefferson, Mason and Kitsap Counties, the eastern portion of Clallam County; the reservations of the Skokomish, Port Gamble S'Klallam and Jamestown S'Klallam Tribes; and portions of Water Resource Inventory Areas (WRIA) 14, 15, 16, 17, and 18. Figure 2 presents the Summer Chum Salmon Recovery Planning Area.

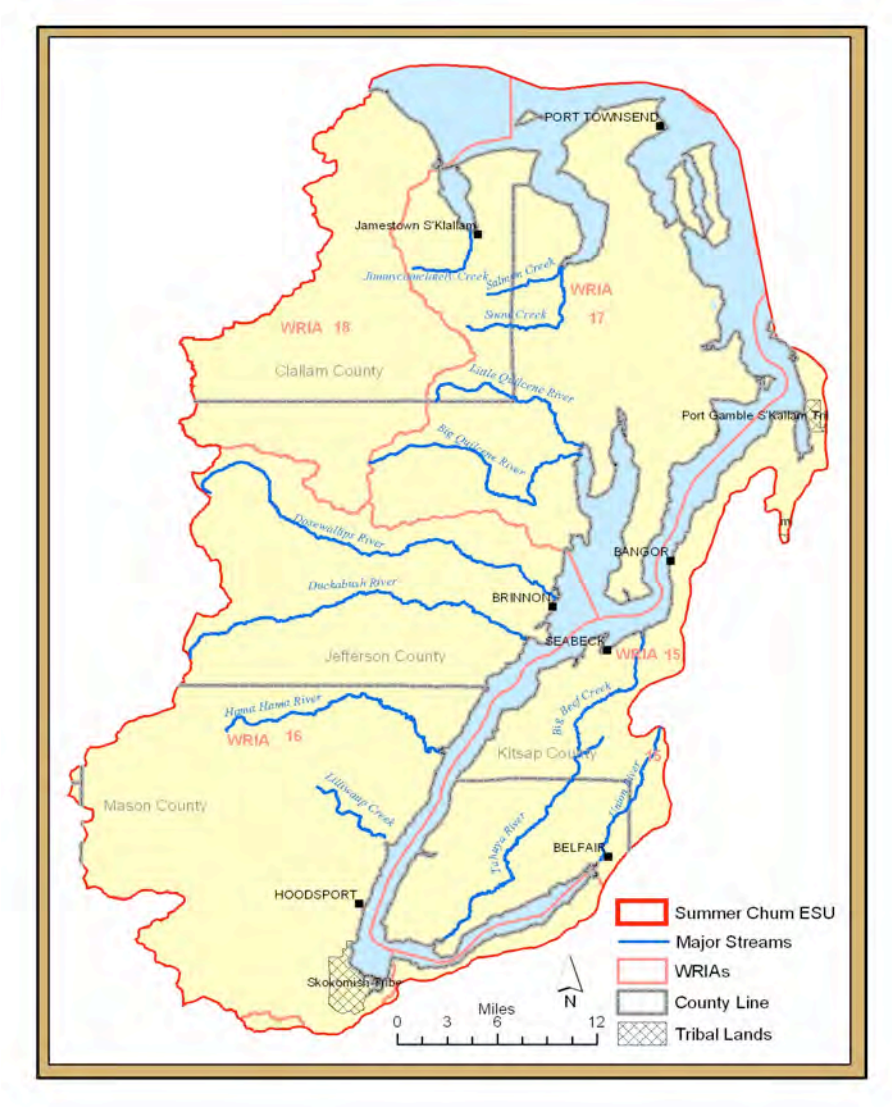


Figure 2. Hood Canal/Eastern Strait of Juan de Fuca Summer Chum Salmon Recovery Planning Area. Map developed by Gretchen Peterson, PetersonGIS.

1.4. The Audience of the Summer Chum Salmon Recovery Plan

Four counties comprise the Hood Canal/Eastern Strait of Juan de Fuca Summer Chum Salmon ESU: Mason, Jefferson, Kitsap, and Clallam. Under State law, counties have the land use authority that impacts summer chum salmon habitat. It is the intent of this SRP to provide the information so that the counties can manage their respective regulatory programs in a manner that is consistent with summer chum salmon recovery. The Summer Chum Salmon Recovery Plan provides analyses and action alternatives that are possible under the authorities of county policies and programs. County staffs have contributed to the development of the analyses provided and the action alternatives described. Each Board of County Commissioners will adopt the recommendations and action alternatives presented according to their respective policies and procedures. The Counties will also use the SRP as guidance in the development, modification and revisions of their respective regulatory programs related to the Growth Management Act and Shoreline Programs. Where applicable, public review processes will be undertaken by the Counties to allow the public to provide input and guidance for the Boards of County Commissioners as they deliberate the recommendations and develop regulatory policies and programs that support the recovery of summer chum salmon in Hood Canal and the Eastern Strait of Juan de Fuca.

The Skokomish and Port Gamble S'Klallam Tribes are voting members of the Hood Canal Coordinating Council and have Usual and Accustomed fishing areas within the boundaries that encompass the Hood Canal/Eastern Strait of Juan de Fuca ESU. Other Tribes with usual and accustomed fishing rights within the boundaries of that encompass the ESU include the Suquamish, Jamestown S'Klallam and Lower Elwha Klallam. Fisheries harvest and hatchery management for the Hood Canal and the eastern Strait of Juan de Fuca watersheds are the direct responsibility of these Tribes and the Washington State Department of Fish and Wildlife (WDFW). The Point No Point Treaty Tribes (Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, and Lower Elwha Klallam) and WDFW are the primary authors of the Summer Chum Salmon Conservation Initiative (SCSCI) and subsequent supplemental reports (WDFW and PNPTT 2000). The fishery co-managers, WDFW and PNPTT (hereafter as co-managers) have participated in the development of aspects of this SRP and it is designed to be supportive of and compliment the co-managers fisheries and interim salmon recovery goals and objectives.

The Federal government, in particular NMFS, is ultimately responsibility for the preparation of a recovery plan under the ESA. One of the primary intents of this SRP is for NMFS to adopt it as the recovery plan for the Hood Canal/Eastern Strait of Juan de Fuca Summer Chum ESU. This SRP contains the required elements for a recovery plan under the ESA (§ 1533 (f)(1)(B).) Those elements are: 1) objective, measurable criteria for determining when delisting is warranted; 2) a comprehensive list of site-specific management actions necessary to

achieve the SRP's goal for recovery of the species; and 3) an estimate of the cost and time required to carry out those actions. As a sanctioned recovery plan State and Federal agencies and departments can use it as guidance in developing programs that support summer chum salmon recovery. The State Legislature and Congress will have a vehicle to assess the efficacy of their mandated salmon recovery policies and provide for the necessary and appropriate funding to assure success.

1.5. Relationship to Other Salmon Recovery Planning Processes

A multitude of efforts and processes are in place that has some relationship to salmon recovery planning in Washington State.

1.5.1. The Salmon Recovery Lead Entity Process (RCW 77.85)

Chapter 77.85 RCW established an organizational framework to guide and implement salmon recovery through salmonid habitat restoration and protection. Chapter 77.85 RCW further authorizes counties, cities, and tribal governments to voluntarily join and designate a Lead Entity responsible for submitting habitat project lists to the Salmon Recovery Funding Board (SRFB) for their funding consideration. HCCC is the designated Lead Entity for the Hood Canal watershed charged with the coordination of salmon recovery projects from counties, cities, conservation districts, Tribes, environmental groups, business interests, landowners, citizens, volunteer groups, regional fish enhancement groups, and other habitat interests. As the Lead Entity, HCCC Staff, in conjunction with the various groups interested in salmon recovery for the Hood Canal watersheds, have developed a Lead Entity strategy (HCCC 2004) to guide the prioritization and selection of habitat restoration projects.[5] That Lead Entity strategy was recently revised to reflect new information and provide more specific guidance for restoration projects. The development of this Summer Chum Salmon Recovery Plan was done in conjunction with that Lead Entity strategy. Details of projects proposed for this SRP can be found in the Lead Entity strategy.

1.5.2. Co-managers Summer Chum Salmon Planning Process

As mentioned in section 1.4 above, the co-managers (in this case WDFW and the PNPTT) are the primary authors and participants in a related planning process known as the Summer Chum Salmon Conservation Initiative (SCSCI) (WDFW and PNPTT 2000). The SCSCI process, initiated in 2000 is an on-going planning forum and mechanism by which the co-managers are engaged in the development and implementation of harvest management regimes and supplementation programs. These regimes and programs are designed to

[5] For more information and a downloadable copy of the HCCC Lead Entity strategy see http://www.wa.gov/hccc/salmon.htm

provide opportunities for the recovery of summer chum salmon when integrated with aspects of habitat protection and restoration. The SCSCI process is iterative and evolves as new information is gathered and knowledge of summer chum salmon is enhanced. Annual reviews are documented in supplemental reports which describe and summarize the details of both the harvest management actions taken for the past fishing season and on-going supplementation programs. The co-managers interim recovery goals and thresholds (to be described in more detail in section 2 below) were developed as part of the SCSCI process. Five year annual reviews are scheduled which will look comprehensively at summer chum salmon recovery efforts. The first five-year review is scheduled to be published by the co-managers in late 2005.

The SRP should be considered an extension of the SCSCI, WDFW and PNPTT (2000) and subsequent supplemental reports, WDFW and PNPTT 2003 and PNPTT and WDFW 2003. These reports, developed as part of the SCSCI process, can be found at http://wdfw.wa.gov/fish/chum/chum.htm. The SCSCI provides extensive details regarding harvest management, hatchery supplementation programs, and interim recovery goals and thresholds. The SCSCI also considers habitat restoration and provides a basis for the development of the habitat projects and recovery actions presented in this SRP.

1.5.3. The Watershed Planning Process (RCW 90.82)

Chapter 90.82 RCW provides a process to plan and manage water resources in designated water resource inventory areas (WRIAs). Each WRIA under this process has established Planning Units, comprised of groups of governmental and non-governmental entities to perform two tasks: 1) determine the status of water resources in a watershed and 2) resolve the often conflicting demands for that water, including ensuring adequate supplies for salmon.[6] The WRIA Planning Units are to develop a watershed plan that accomplishes these tasks. RCW 90.82 further states that the watershed plan shall be coordinated or developed to protect or enhance fish habitat in the management area. Watershed plans are to be integrated with strategies, developed under other processes, to respond to potential and actual ESA listings of salmon and other fish species.

Watershed plans as part of the RCW 90.82 mandate are being developed in each of the WRIA's that encompass Hood Canal and the Eastern Strait of Juan de Fuca. WRIAs 15[7] and 16 are in the process of developing watershed plans and are near completion. WRIA 16, under a mutual agreement between WRIAs 14 and 16, includes the northern portion of WRIA 14 that drains into Hood

[6] See RCW 90.82.
[7] Information regarding the WRIA 15 watershed plan can be found at http://www.ecy.wa.gov/watershed/15.html

Canal.[8] The initial WRIA 17 watershed plan is complete[9]. Under an agreement with WRIA 18, planning for the Sequim Bay sub-basin will be done through the WRIA 18 process. As a result, the WRIA 18 recommendations for water quality, water quantity, instream flows, and habitat restoration and protection are presented in the WRIA 17 watershed plan for this sub-basin (WRIA 17 2003). The Dungeness-Quilcene Plan, completed in 1994, provides for watershed planning in the Eastern Strait of Juan de Fuca and the Clallam County portions of the summer chum ESU.[10]

The summer chum salmon recovery planning process has used information from the watershed planning processes of each of WRIAs 15, 16, 17 and 18. Analyses and recommendations that have resulted from the watershed planning processes have been referenced and incorporated as appropriate and relevant. It is also the intent of this Summer Chum Salmon Recovery Plan to allow the resulting analyses and recommendations regarding habitat restoration and management to be made available for use by the watershed planning processes.

1.5.4. Other ESA-listed Salmon Recovery Planning Efforts

Two other species that inhabit the Hood Canal and eastern Strait of Juan de Fuca environs are also listed under the ESA. Chinook salmon originating from two populations identified in the NMFS designated Hood Canal region are listed as threatened as part of the Puget Sound Chinook ESU (Federal Register 1999a). For the Hood Canal and eastern Strait of Juan de Fuca watersheds, the US Fish and Wildlife Service has identified two core bull trout populations. Those populations are located in the Dungeness and Skokomish River watersheds. They are also listed as threatened under the ESA. (Federal Register 1999b).

1.5.4.1. Relationship to Puget Sound Chinook Salmon Recovery Planning

Chinook salmon spawning in streams of Hood Canal are part of the Puget Sound Chinook ESU that has been listed as threatened under the ESA. The Puget Sound Technical Recovery Team (TRT) has described the Hood Canal Chinook geographic region as one of five geographic regions of diversity and risk. Evaluation of ESU-wide recovery scenarios will consider the Hood Canal geographic region. Two independent populations of chinook salmon have been tentatively delineated for the Hood Canal Geographic Region by the TRT. One of the recognized populations includes those that naturally reproduce in the Skokomish River watershed. The other independent population is a grouping of the stocks that spawn in the Hama Hama, Duckabush, and Dosewallips

[8] Information regarding the WRIA 16 watershed plan can be found at http://www.ecy.wa.gov/watershed/16.html
[9] Information regarding the WRIA 17 watershed planning can be found at http://wria17.co.jefferson.wa.us/.
[10] To download a copy of the Dungeness-Quilcene plan see http://www.ecy.wa.gov/biblio/94wrmp1718.html

watersheds with the Dosewallips River being the likely primary population or source for this grouped population.[11]

Hood Canal chinook salmon populations and their associated habitats, however, present unique and potentially challenging scenarios for recovery efforts and commitment. The status of chinook salmon stocks in Hood Canal is confounded by a long history of artificial introduction and production of stocks into Hood Canal systems, severely degraded habitat conditions, and an extremely complex hydroelectric relicensing process. The TRT recognizes the problems with available data in the determination of independent populations for the Hood Canal region. The TRT recommends that further investigations into the population structure of Hood Canal chinook be conducted (PSTRT 2001).

Some aspects of chinook salmon harvest relative to the incidental harvest of summer chum salmon are addressed in the Summer Chum Salmon Conservation Initiative (WDFW and PNPTT 2000). The analysis conducted by the co-managers is summarized in, section **4. HARVEST**, of this SRP. It is likely that recovery actions designed and implemented for summer chum salmon will also benefit chinook salmon in Hood Canal, especially work expected to occur in the lower watersheds and marine nearshores of Hood Canal. The Summer Chum Salmon Recovery Plan, however, will not provide an analysis of the benefits for Hood Canal chinook. Such benefits will be speculative until such an analysis can be performed.

1.5.4.2. Relationship to Bull Trout Recovery Planning

Within the Summer Chum Salmon Recovery Planning Area, the US Fish and Wildlife Service (USFWS) has identified core bull trout populations within the Skokomish River and Dungeness River systems (USFWS 2004). These core populations are part of the Olympic Peninsula Management Unit as designated by USFWS (USFWS 2004). USFWS has provided technical guidance to address recovery planning for bull trout populations (USFWS 2002 and USFWS 2004). It is also likely that recovery actions designed and implemented for summer chum salmon will also benefit bull trout in Hood Canal. The Summer Chum Salmon Recovery Plan, however, will not provide an analysis of the benefits for bull trout. Such benefits will also be speculative until such an analysis can be performed.

1.5.4.3. Shared Strategy for Puget Sound (SSPS)[12]

The main focus of SSPS is the development of a recovery plan for the Puget Sound chinook salmon ESU. Geographically, the summer chum salmon ESU is embedded within the Puget Sound chinook ESU area. ESA stipulates that a

[11] To download the current version of the document, "Independent Populations of Chinook Salmon in Puget Sound", please see http://www.nwfsc.noaa.gov/trt/trt_puget.htm.
[12] For more information on the SSPS process see http://www.sharedsalmonstrategy.org/

recovery plan be developed for each listed species. The Summer Chum Salmon Recovery Plan will focus on summer chum salmon. Recovery actions and strategies proposed will be expected to benefit other ESA-listed species (see section 1.5.4.1 for Hood Canal Chinook and section 1.5.4.2 for bull trout within Hood Canal). The intent of this SRP is to be a "stand-alone" plan that addresses issues related to Summer Chum Salmon Recovery Planning.

1.6. Organization of the Summer Chum Salmon Recovery Plan

The Summer Chum Salmon Recovery Plan will first describe its goals, drawing from the goals and objectives articulated by the co-managers in the Summer Chum Salmon Conservation Initiative (WDFW and PNPTT 2000) and the goals of the members of the HCCC. This section will also include guiding principles of conservation biology and the precautionary principle. Next, it will provide a description of the strategic approach and management strategy that is being used. This section will include a discussion of the viability analyses and population identification being considered by the TRT for summer chum salmon. Also included will be a summary of the co-managers' interim recovery goals and targets for summer chum salmon. The co-managers' interim goals provide the basis for analysis of those factors that contribute to the decline of summer chum salmon and the recovery actions that are needed. Sections summarizing both harvest and hatchery aspects of summer chum salmon are also provided. The SRP delineates six distinct geographic areas or "Conservation Units" to organize the analyses and for the development of recovery actions. The SRP then describes summer chum salmon recovery at the ESU-scale. A monitoring program to provide an evaluation of those recovery actions is articulated in this SRP. An adaptive management process that examines the integration of the H's (harvest, habitat, and hatcheries) is also discussed. A periodic review that utilizes the results of the monitoring and adaptive management processes is prescribed in this SRP. Finally, a section regarding aspects of implementation, including estimates of costs and desired commitment, is provided.

2. GOALS OF THE SUMMER CHUM SALMON RECOVERY PLAN

Recovery planning for summer chum salmon must include 1) political, economic, historical, and cultural values; 2) natural resource management concerns; 3) legal requirements (e.g., ESA, Treaties) and 4) biodiversity. The Summer Chum Salmon Recovery Plan (SRP) recognizes that the recovery goals and objectives must reflect a clear understanding of the concerns of the people living within the geographic boundaries of the summer chum salmon ESU. Many characteristics and ecological functions at the landscape scale, which influence summer chum salmon survival and persistence, are controlled by hydrologic and geomorphic conditions in the watersheds that encompass the summer chum salmon ESU. Changes in land use and development can influence these characteristics and functions. Current and future land use and development trends must be assessed and considered in the development of recovery actions. Though the focus of this SRP is the recovery of a single species, summer chum salmon, recovery planning must consider a diverse community, including humans.

2.1. Overall Goals

The overall goal of the Summer Chum Salmon Recovery Plan is to recover and obtain delisting of the summer-timed chum salmon populations in Hood Canal and the eastern Strait of Juan de Fuca watershed, including restoration of populations in watersheds where summer chum have been extirpated. This recovery plan adopts the overall goal presented in the Summer Chum Salmon Conservation Initiative (SCSCI). The SCSCI (WDFW and PNPTT 2000) states the goal as:

"To protect, restore and enhance the productivity, production and diversity of Hood Canal summer chum salmon and their ecosystems to provide surplus production sufficient to allow future directed and incidental harvests of summer chum salmon."

The Summer Chum Salmon Recovery Plan seeks to maintain current population structure and distribution of summer chum and restore distribution in previously occupied areas within the species native range.

The HCCC Board, in considering a recovery plan that can be implemented and meets the desires of the land-use (Counties) and Tribal authorities, further adds that a summer chum salmon recovery plan be designed to provide:

- the Counties with as much certainty as is possible regarding development, growth and land use,
- as much certainty as is possible for Tribal goals and objectives, and
- as much certainty as is possible for private landowners.

Certainty means that the SRP will strive to give the Counties, Tribes and public a clear understanding of salmon recovery, the actions that it will take to achieve recovery, and at what economic cost. It is not clear how much biological diversity, population structure, and abundance will be necessary for the long-term recovery of summer chum salmon. National Marine Fisheries Service (NMFS) scientists will ultimately recommend whether these biological and population structure elements will likely be met by the SRP. Recovery and long term sustainability of a threatened species require adequate reproduction for replacement of losses due to natural mortality factors (including disease and random events), sufficient genetic robustness to avoid inbreeding depression and allow adaptation, sufficient habitat (type, amount, and quality) for long-term population maintenance, and the elimination or control of threats (which may also include having adequate regulatory mechanisms in place).

Scientific studies and technical assessments can only provide a part of the answer. "Society must decide what degree of biological security would be desirable and affordable if it could be achieved, i.e., the desired probability of survival or extinction of natural populations, over what time and what area, and at what cost" (NRC 1996). The SRP will articulate the costs and develop actions that can be implemented in a reasonable timeframe.

The HCCC Board said that the SRP must also:

- Give credit for salmon recovery actions and measures that have been taken to date by the Counties and Tribes, and
- Show that the burden of salmon recovery goes beyond local governments (to State and Federal governments and associated entities).

The Counties, Tribes, and citizen groups have implemented many projects and regulatory measures that are aiding summer chum. The SRP will build on those efforts, support their continuation, and support the development of new efforts.

Summer chum salmon recovery will be expensive. Those expenses will include capital costs for new projects as well as operations and maintenance costs for existing projects. County and Tribal budgets are not sufficient alone to cover these costs. Solutions will be complex. They must be based on sound scientific information. They will also need consensus on the size of the investments, and commitments needed, and the allocation of costs. The solutions will have to be regionally based just as summer chum salmon restoration limits have regional variations. Significant financial, policy, and programmatic assistance from both the State of Washington and the Federal government will be necessary.

2.2. Summer Chum Salmon Recovery Goals

Recovery goals presented in this section are designed to provide numeric targets of summer chum salmon abundance and escapement for the purposes of recovery planning. The science that governs the development of the numeric goals is provisional and dynamic. The science depends on our current on-going and future ability to gather the appropriate data to measure recovery parameters, including abundance, productivity, and diversity. The initial numeric goals in this section will be used for the development of recovery actions. This SRP seeks to provide habitats that function at a level where summer chum salmon, as we currently understand their biology, can thrive and persist.

2.2.1. Puget Sound Technical Recovery Team Summer Chum Salmon Viability Analysis and Population Identification

The Puget Sound Technical Recovery Team (TRT) is the NMFS technical group charged with addressing the ESA objective of defining measurable criteria for determining when delisting is warranted. The TRT seeks to: (1) identify population and ESU de-listing goals; (2) characterize habitat/fish abundance relationships; (3) identify the factors for decline and limiting factors for each ESU; (4) identify the actions that are important for recovery; (5) identify research, evaluation, and monitoring needs; and (6) serve as science advisors to groups charged with developing measures to achieve recovery. The TRT is appointed by NMFS to be science advisors for recovery planning. The TRT has developed planning targets for most of the chinook populations identified for the Puget Sound Chinook ESU (PSTRT 2002). As of November 15, 2005, similar TRT viability goals and planning targets have not been completed for summer chum salmon. The TRT has not yet identified population abundance, diversity, spatial structure and productivity levels necessary for Hood Canal summer chum ESU viability. WDFW and the PNPTT developed interim recovery goals that that may be reviewed as interim viability parameters (PNPTT and WDFW 2003). These goals apply to abundance, escapement, productivity and diversity of the natural-origin component of the summer chum ESU. When realized, the recovery goals are expected to provide, on average, sufficient surplus abundance to allow for directed and incidental harvests of summer chum salmon. Due to a lack of adequate understanding of how habitat affects potential stock production, productivity, and diversity, habitat is not linked directly to the interim recovery goals. The PNPTT and WDFW (2003) interim recovery goals include: abundance and escapement recovery thresholds; a productivity recovery threshold; interim recovery goals' criteria for abundance, spawning escapement and productivity; and diversity interim recovery goals.

The TRT is considering the identification of two independent summer chum salmon populations that comprise the ESU with an associated viability analysis. The TRT has provisionally identified these two independent populations of Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon as: 1) Hood Canal

stock aggregations and 2) Strait of Juan de Fuca stock aggregations.[13] Stocks included in the Hood Canal aggregation are the extant stocks originating in Big Quilcene, Little Quilcene, Dosewallips, Duckabush, Hama Hama, Lilliwaup, and Union watersheds as well as those being supplemented in Big Beef Creek and the Tahuya River. Included in the Strait of Juan de Fuca aggregations are extant stocks originating in Salmon/Snow Creeks and Jimmycomelately Creek as well as stocks supplemented into Chimacum Creek. Any summer chum salmon that may be spawning in the Dungeness River are also included in the Strait of Juan de Fuca aggregation. In order for the ESU to be declared viable (and recovered), both populations need to achieve a low risk status.

The TRT's analysis is a work in progress and is expected to be available at a later date, but likely not in time for the initial development and completion of this SRP. The TRT will be describing the abundance and productivity associated with a low risk summer chum salmon population. Also discussed will be how spatial structure and diversity of the populations will be improved as stocks on both the eastern and western sides of Hood Canal are restored. Until the TRT analyses are available and have critical review it will be difficult to relate the general viability discussion with specific measures being recommended for the recovery of summer chum salmon. It is understood that the approach being taken in this SRP towards the recovery of summer chum salmon in the Hood Canal/Eastern Strait of Juan de Fuca ESU will need to be reviewed and analyzed by the TRT. It should be noted, however, that recovery planning according to the guidance of the TRT (PSTRT 2003) is problematic, absent definition by the TRT of the independent populations being considered, and the appropriate viability analyses being completed. Efforts to develop this SRP continue to be coordinated with the on-going analyses and deliberations of the TRT. Results from the TRT's efforts will be incorporated into this SRP as appropriate and feasible.

2.2.2. Co-manager (WDFW and PNPTT) Interim Summer Chum Salmon Recovery Goals

This SRP uses the interim targets established by the co-managers, in lieu of viability goals and targets from the TRT. Details of these targets are presented in the document, *Interim Summer Chum Salmon Recovery Goals* (PNPTT and WDFW 2003). These interim recovery goals are not viability goals similar to those developed for Puget Sound chinook by the PSTRT (2002). They are "tangible targets against which the success of recovery measures can be measured" (PNPTT and WDFW 2003). The *Summer Chum Salmon Conservation Initiative* (SCSCI), released in 2000 by the Washington Department

[13] A draft TRT report entitled*, Independent Populations of Summer Chum Salmon: Results of Genetic Analyses*, dated 29 January 2004, has limited distribution and review, but provides the basis for the identification of the populations.

of Fish and Wildlife and the Point No Point Treaty Tribes (WDFW and PNPTT 2000), provides some of the technical basis for the protection and recovery of summer chum salmon in Hood Canal and Eastern Strait of Juan de Fuca watersheds. The original SCSCI did not describe specific recovery goals. TRT viable salmonid population (VSP) parameters and targets for summer chum salmon are in development, as described in section 2.2.1 above. NMFS Staff participated in the development of the co-managers' interim recovery goals and the TRT is in the process of reviewing those goals and methods of development. As the TRT considers recovery goals for Hood Canal summer chum salmon it is expected they will take into account the interim recovery goals as presented in PNPTT and WDFW (2003). Until the TRT viability analysis for summer chum salmon is complete and available for critical review it will not be possible to determine whether the co-manager goals and the recommended actions described in this SRP will adequately address summer chum salmon recovery.

PNPTT and WDFW (2003) describes, *"interim natural-origin-recruit recovery goals for abundance, escapement, productivity and diversity."* Tables 2.1, 2.2, and 2.3 describe the co-managers' view of abundance, productivity, and spatial structure for the stocks that comprise the Hood Canal/Eastern Strait of Juan de Fuca ESU. Table 2.4 summarizes the co-managers' approach to the restoration and maintenance of population diversity.

The co-managers recognize that the recovery goals they developed are based on currently available, and limited, information with the expectation that they may be revised as additional information is generated. The co-managers, however, *"believe that these interim recovery goals provide effective initial targets to use in managing for recovery and that by meeting the goals, the risk of extinction will be reduced and the stocks will become more resilient while moving toward healthy abundance levels"* (PNPTT and WDFW 2003).

PNPTT and WDFW (2003) provided abundance and spawning escapement recovery thresholds for eight extant populations within the ESU that were estimated based on run sizes prior to population declines (Table 2.1). The status of the summer chum population in the Dungeness River is unknown due to a lack of historical or current population abundance data, and no thresholds were developed for this ninth extant population. A productivity recovery threshold of 1.6 recruits per spawner is proposed. This threshold is within a reasonable range of observed values and, when achieved, would accommodate liberalization of some restrictions on the harvest of salmon species commingled with summer chum salmon, while ensuring sustainability.

Table 2.1. Summary of the co-managers' abundance and escapement thresholds modified from the co-managers' Interim Summer chum salmon recovery goals (PNPTT and WDFW 2003).

Hood Canal aggregation

Stocks	Abundance	Escapement
Quilcene	4,570	2,860
Dosewallips	3,080	1,930
Duckabush	3,290	2,060
Hama Hama	6,060	3,790
Lilliwaup	3,310	1,960
Union	550	340

Strait of Juan de Fuca aggregation

Stocks	Abundance	Escapement
Salmon/Snow	1,560	970
Jimmycomelately[14]	520	330

Each recovery goal identified in Table 2.1 is linked to abundance, escapement and productivity criteria that must be met for the recovery goal to be achieved. Criteria were developed for the individual stocks as well as for the ESU. For each individual stock, all of the following criteria described in Table 2.2 must be met.

[14] Please note the following concern, from Crain (2003): "There is a concern that these interim targets for Jimmycomelately Creek summer chum may represent a moderate risk of extinction using the methods of Allendorf et. Al (1997), which specify that a population is at moderate risk of extinction if the total escapement population per generation is less than 2,500 or if the effective population size is less than 500. However, the Allendorf et. al assumptions were theoretical, and a population may be viable at sizes slightly below those the authors predicted. Additionally, these interim targets are based upon observed escapements during the 1970's and early 1980's. It is entirely possible that the population was already in decline by that time, as significant habitat alteration to the creek began in the late 1800's. Finally, it may be that the Jimmycomelately Creek stock is part of a larger population that included the Dungeness River and/or Discovery Bay stocks.

Table 2.2. Co-manager recovery criteria for each individual stock (PNPTT and WDFW 2003).

For each individual stock, all of the following criteria must be met:
▪ The mean natural origin abundance and mean natural origin spawning escapement of each stock shall meet or exceed the abundance and escapement thresholds described in Table 2.1, over a period of the most recent 12 years.
▪ The natural origin abundance and natural origin spawning escapement of each stock must be lower than the respective stock's critical thresholds (or, where applicable, minimum escapement flag)[15] in no more than 2 of the most recent 8 years and, additionally, in no more than 1 of the most recent 4 years.
▪ Natural recruits per spawner shall average at least 1.6 over the 8 most recent brood years for which estimates exist and no more than 2 of the 8 years shall fall below 1.2 recruits per spawner.

The required criterion for recovery at the ESU level which addresses spatial structure and diversity are summarized in Table 2.3.

Table 2.3. Co-managers' ESU-wide "natural" recovery criteria (PNPTT and WDFW 2003).

For the overall Hood Canal/Eastern Strait of Juan de Fuca ESU:
▪ No less than the extant 6 Hood Canal natural stocks and 2 Strait natural stocks must meet all the individual stock recovery criteria described in Tables 2.1 and 2.2. The corollary to this criterion is that, on average, the ESU-wide abundance must meet or exceed the sum of the individual stock thresholds and the ESU-wide "natural" escapement must meet or exceed the sum of individual stock escapement thresholds; also, on average, the ESU-wide "natural" productivity must meet or exceed 1.6 recruits per spawner.

Table 2.4 furtehr summarizes the co-managers' approach regarding population diversity.

[15] Critical abundance and escapement thresholds have been defined for all management units in the SCSCI that, except for the mainstem Hood Canal management unit, are currently equivalent to individual stocks. Minimum escapement flags have been described for individual stocks of the mainstem Hood Canal management unit. See Appendix 1.5 in WDFW and PNPTT (2003b) for a description of the critical thresholds, minimum escapement flags and their derivation.

Table 2.4. Co-managers' approach to the restoration and maintenance of population diversity for the Hood Canal/Eastern Strait of Juan de Fuca ESU (PNPTT and WDFW 2003).

Provisions intended to protect and restore diversity of the summer chum salmon populations in Hood Canal and the Strait of Juan de Fuca:
▪ Support planning and implementation of effective habitat protection and recovery actions by the agencies and local governments who have the jurisdiction.
▪ Rebuild by natural or artificial means, (under the guidelines of the SCSCI) the existing summer chum salmon stocks to meet their abundance and escapement recovery goals.
▪ Reestablish, by natural or artificial (i.e., reintroduction) means (under the guidelines of the SCSCI,) the selected extinct summer chum salmon stocks, where feasible.

The co-managers' interim recovery goals are consistent with the overall goal as stated in the WDFW and PNPTT (2000). That goal seeks to establish a level of production of summer chum salmon that is "sufficient to allow future directed and incidental harvests of summer chum salmon" (WDFW and PNPTT 2000). The interim measures are also consistent with the parameters of abundance, spatial distribution, productivity and diversity that are the general guidelines that identify viable salmonid populations (McElhany et al. 2000). They are consistent with the current technical approach being employed by the PSTRT. And, they provide for an appropriate initial approach with which to develop this SRP.[16]

2.3. Summer Chum Salmon Conservation Initiative Objectives

Part Four of the SCSCI describes its objectives (WDFW and PNPTT 2000). The Summer Chum Salmon Recovery Plan is designed to support these objectives, actions, and strategies for Artificial Production, Ecological Interactions, and Harvest Management.

[16] As of December 2004, it is not clear whether the Co-managers' interim recovery goals as established in SCSCI 2003 are within the ranges of abundance, productivity, diversity and spatial structure that are being envisioned by the TRT. After completion of this initial SRP, the TRT viability analysis may provide different targets and criteria that will define recovery. This SRP, lacking any viable alternatives, will use the co-managers' goals for recovery planning purposes with the understanding that these goals ultimately may not be descriptive of summer chum salmon viability as envisioned by the TRT. We believe, however, that achievement of these goals will be a tremendous accomplishment and will likely define recovery, or at least send summer chum salmon populations on a trajectory towards recovery.

2.3.1. Artificial Production

The SCSCI's Artificial Production program is designed to supplement populations identified as at moderate or high risk of extinction. The program also allows the reintroduction of summer chum salmon to watersheds where historical populations have been lost. The Artificial Production program is coordinated with other aspects of salmon recovery and is designed to minimize ecological and genetic risks. More details of the Artificial Production program for summer chum salmon are presented in section 5 of this SRP.

2.3.2. Ecological Interactions

The SCSCI assessed the ecological interactions between summer chum salmon and other species (WDFW and PNPTT 2000). The SCSCI concluded that there was little likelihood that the prescribed artificial production programs for summer chum salmon would substantially impact other species. The competitive interactions with other juvenile salmonids would be limited as the number of artificially produced summer chum salmon is relatively small. Since summer chum artificially produced are released at a small size, predation effects on other fishes are likely not a concern.

More important concerns are impacts on summer chum from other species, most notably other salmonids and marine mammals. Potential impacts from other salmonids include effects of hatchery operations, fish disease transfer, competition and predation. The SCSCI describes these region-wide factors for decline and offers descriptions of actions to address these impacts (WDFW and PNPTT 2000). Specifically, the SCSCI seeks to "eliminate and reduce the negative hatchery interactions with summer chum" salmon survival (WDFW PNPTT 2000). Included are recommendations to reduce the potential for interaction between hatchery juvenile salmon and summer chum juveniles in migration and feeding areas by delaying hatchery fish releases until most summer chum salmon have emigrated seaward. Also included is a recommendation to assess the impacts from fall chum spawning with in the same stream reaches in which summer chum spawn.

The SCSCI also attempts to "assess and respond to other potential negative species interactions with summer chum" (WDFW and PNPTT 2000). WDFW and the Washington Cooperative Fish and Wildlife Research Unit (WACFWRU) have been conducting research on Hood Canal salmon stocks and marine mammal predation since 1998. The result of their research is pending and will be incorporated, as appropriate, in this SRP when it becomes available. The research attempts to estimate seal predation rates on returning salmonids to certain Hood Canal streams between 1998-2001 (WDFW and WACFWRU 2004 in progress).

2.3.3. Harvest Management

The SCSCI has also developed harvest management provisions. The objective of these provisions is "to manage fisheries in a manner that will allow the rebuilding and maintenance of self-sustaining summer chum populations throughout Hood Canal and eastern Strait of Juan de Fuca, while maximizing harvest opportunities on co-mingled salmon species" (WDFW and PNPTT 2000). The basic harvest management strategy utilizes what the SCSCI considers a conservative four-way control mechanism: 1) a base set of conservative fishing regulations, 2) abundance and escapement thresholds that trigger adjustments to the fishing regime, 3) exploitation rate objectives that will result in changes to the harvest regime if not met, and 4) overall stock assessment criteria that will affect all plan provisions, including harvest, if not satisfactorily met at periodic plan reviews (WDFW and PNPTT 2000). More details of the harvest management approach being developed and implemented by the co-managers (WDFW and PNPTT) and can be found in section 4 of this SRP.

2.4. Summary

The Summer Chum Salmon Recovery Plan is designed to address 1) political, economic, historical, and cultural values; 2) natural resource management concerns; and 3) biodiversity goals and objectives. Because our knowledge is limited, there is some uncertainty regarding the goals and objectives that require active monitoring and adaptation as new knowledge of summer chum salmon habitats is gained. Section 3 of the SRP, *The Strategic Approach and Management Strategy to Achieve the Goals of the Summer Chum Salmon Recovery Plan*, provides the context for the co-manager recovery goals. It also describes the design for the achievement of these goals. Section 3 will also describe the Summer Chum Salmon Recovery Plan management strategy and categories of actions that are expected to achieve the goals set out in section 2 above. The management strategy will be the guidance for the identification, development, and prioritization of recovery actions and projects. Specific projects and site-specific actions are described in sections 7-12 of this SRP.

3. THE STRATEGIC APPROACH AND MANAGEMENT STRATEGY TO ACHIEVE THE GOALS OF THE SUMMER CHUM SALMON RECOVERY PLAN

In developing a strategy for the recovery of summer chum salmon, the National Research Council (1992) suggests the ideal would be restoration of Hood Canal and Eastern Strait of Juan de Fuca landscapes and ecosystems, *"to an approximation of its natural predisturbance condition."* However, such a goal is impractical, if not impossible, to achieve. To succeed, a strategy must incorporate an understanding, context, and perspective of both the fishes' needs and human needs. This starting point can insure that recovery efforts are consistent with the goals of abundance, productivity, diversity, and spatial structure, as well as practical in terms of cost and public acceptance.

Despite our knowledge about summer chum, a strategic approach must incorporate the existence of uncertainty. That uncertainty means that our knowledge is provisional and based on assumptions that may change over time. To address that dynamic, the Summer Chum Salmon Recovery Plan (SRP) stresses the monitoring of implemented actions, and adaptive approaches in the planning of new actions.

Finally, the SRP stresses that recovery is a long-term endeavor. Even when numerical targets that allow summer chum delisting are reached, mechanisms must be in place that will maintain the species over time. The SRP strives to suggest those mechanisms.

3.1. Recovery or Extinction

Summer chum salmon produced in the Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon ESU are in overall long-term decline. Taking no action insures that the population's decline will continue, and that eventual extinction likely will occur. Continuing current habitat restoration and protection projects without coordination will provide some improvement. However, this approach runs the risk that some critical ecological bottlenecks will be overlooked and remain unaddressed. The most likely result of that policy will be to continue in the "threatened with extinction" stage on the way to ultimate extinction.

A coordinated plan that addresses all aspects of recovery can provide the mechanism to bring together all the efforts that address summer chum salmon in the Hood Canal and eastern Strait of Juan de Fuca watersheds. A coordinated approach can focus the various projects and site-specific recovery actions. And, with monitoring and adaptive management, recovery actions can be adjusted as more information is gained.

An additional benefit of coordination and planning is that it can facilitate recovery at the necessary scale of an ESU. That means that not all geographic areas or fish populations are equal in their importance or their ability or opportunity for recovery. To address these differential properties, the SRP provides a range of options and alternatives for goal achievement with the overall focus on the recovery of the ESU as a whole.

3.2. Guiding Principles

Recovery actions developed and recommended in this SRP are based on their probable consequences for summer chum salmon, their habitats, and associated ecosystems. Even as we understand more about these ecosystems and habitats, it is important to appreciate that our knowledge will always be incomplete. And, that uncertainty can always be used as an excuse for inaction or delay. However, uncertainty can be addressed systematically and with the idea that we should act with the information we have now and seek the information that will give us an ability to modify our past actions to be more precise in the future. That systematic method has been referred to as the precautionary principle.

The precautionary principle involves acting to avoid serious or irreversible harm, despite a lack of scientific certainty as to the likelihood, magnitude or causation of that harm (Cooney 2003). It was developed through environmental risk management to address public health and pollution problems (Kriebel, et al 2001). At the international level, the precautionary principle has been applied in many arenas. It is an adopted principle in the European Union (Commission 2000). The 1992 Rio Conference on the Environment and Development adopted at the Rio Declaration in principle 15. That principle states, “in order to protect the environment, the precautionary principle approach shall be widely applied by States according to their capability. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.” Other institutions that apply the precautionary principle to their activities include the World Trade Organization (WTO) and the United Nations Convention on Biodiversity.

The precautionary principle provides tests for making decisions with uncertainty (Commission 2000). Those tests are:

- Proportionality – which means that any measures contemplated to address an issue should not be disproportionate to the desired level of protection. And that level of protection should not aim at zero risk. However, those measures must also address long-term threats and issues that have possible irreversible outcomes.

- Non-discrimination – which means that comparable situations must not be treated differently.

- Consistency – which means that measures should be congruous with those that have already been adopted in similar circumstances or those that use similar approaches.

- Examination of the benefits and costs of action or lack of action – which means that the actions contemplated, must produce an overall advantage in terms of reducing risk to an acceptable level. This is not just an economic cost-benefit analysis; it is wider in scope and should include non-economic considerations. It also requires an analysis of the efficacy of actions and their acceptability to the public.

- Examination of scientific developments – which means that measures taken to address an issue should be maintained as long as the scientific data are inadequate, imprecise or inconclusive. And that scientific research should be undertaken to obtain more advanced or complete assessments in order to reevaluate the necessity of maintaining those measures.

In addition to the precautionary principle, this SRP also attempts to apply specific guiding principles from conservation biology. Those principles suggest it is important to:

- Maintain stable or increasing trends in abundance of summer chum salmon throughout the ESU.
- Restore and maintain suitable habitat conditions for all summer chum salmon life stages and life histories and maintain functional corridors linking these habitats.
- Conserve genetic diversity and provide opportunity for genetic exchange.
- Protect and maintain existing quality habitats that function as refugia from which salmonid populations may expand.
- Emphasize self-sustaining, abundant, diverse, and widely distributed runs of naturally produced summer chum salmon when developing protection and restoration strategies.
- Identify, protect, and restore those areas that exhibit high existing summer chum salmon use, which have the greatest production potential or a high future conservation value for summer chum salmon.
- Maintain and restore watershed processes that create habitat characteristics favorable to summer chum salmon.
- Maintain connectivity between high quality habitats to allow for recolonization and population expansion as degraded systems recover.

3.3. The Recovery Management Strategy-prioritization of recovery actions

The strategy for recovery actions (projects or programmatic) is patterned after the framework as proposed by the Puget Sound Technical Recovery Team that is based upon work of the National Research Council (NRC 1992, 1996) and the aquatic diversity management concept of Moyle and Yoshiyama (1994). The PSTRT 2003 describes four strategy types; 1) protect, 2) restore, 3) rehabilitate, and 4) substitute. A fifth strategy type is also noted as status quo. It is also based on specific information from the limiting factors analyses for WRIAs 14/15, 16, 17, and 18; refugia studies for Jefferson and Kitsap Counties; the Summer Chum Salmon Conservation Initiative (WDFW and PNPTT 2000); the HCCC Lead Entity Salmon Habitat Restoration Strategy (HCCC 2004); as well as other relevant studies and assessments. The SRP also uses the summer chum salmon Ecosystem Diagnostic and Treatment (EDT) Model (see Appendices A and B).

3.3.1. Protect

The intent of the *protect* concept is the preservation of areas that are ecologically intact and healthy so that naturally regenerative processes can continue. This approach preserves the “natural capital” investment and allows for future recovery opportunities. Actions to implement that *protect* would be designed to prevent adverse impacts by protecting watersheds and areas with currently functioning natural processes. Such actions can allow for rebuilding or recolonization by summer chum salmon. The likelihood that this overall recovery strategy will succeed is enhanced due to this protection.

Table 3.1 adapted from the Puget Sound TRT Watershed Guidance document (PSTRT 2003) gives examples of the general habitat management strategies to protect habitat forming processes or specific aquatic habitat characteristics.

Table 3.1. Examples of the general habitat management strategies to protect habitat forming processes or specific aquatic habitat characteristics

Aquatic Habitat Characteristic	**Linked Physical Environmental Characteristics and Processes**	**<u>Protect</u> habitat strategy for development of recovery actions**
Channel Scour	Geomorphology Hydrology Sediment Transport	Maintain natural processes in watershed through education, conservation easements, or acquisition.
Water Temperature	Hydrology Succession	Maintain natural processes in watershed through education, conservation easements, or acquisition.
Fine Sediments	Geomorphology Hydrology Sediment Transport	Maintain natural processes in watershed through education, conservation easements, or acquisition.
Estuarine Acreage	Geomorphology Hydrology Sediment Transport	Maintain natural processes in watershed through education, conservation easements, or acquisition.

3.3.2. Restore

Where it is determined that recovery of natural processes is feasible a strategy of *restore* will be employed. The *restore* strategy, or restoration, is the "reestablishment of predisturbance aquatic functions and related physical, chemical, and biological characteristics" (NRC 1992). Restoration can occur with either an active or passive approach. The passive approach would remove the anthropogenic controls and allow the natural processes such as floods, natural revegetation, and erosion to restore the structures and functioning conditions. Active restoration removes the anthropogenic controls and supplements natural processes with artificial actions that are intended to accelerate the return to functioning conditions. Table 3.2, adapted from the Puget Sound TRT Watershed Guidance document (PSTRT 2003), gives examples of the general habitat management strategies to restore habitat forming processes or specific aquatic habitat characteristics.

Table 3.2. Examples of the general habitat management strategies to restore habitat forming processes or specific aquatic habitat characteristics.

Aquatic Habitat Characteristic	**Linked Physical Environmental Characteristics and Processes**	**Restore habitat strategy for development of recovery actions**
Channel Scour	Geomorphology Hydrology Sediment Transport	Remove dikes. Allow natural cycle of succession to occur throughout the watershed.
Water Temperature	Hydrology Succession	Allow natural cycle of succession to occur in all riparian areas of the watershed.
Fine Sediments	Geomorphology Hydrology Sediment Transport	Close roads in areas with steep slopes. Allow natural cycle of succession to occur throughout the watershed.
Estuarine Acreage	Geomorphology Hydrology Sediment Transport	Remove dikes.

3.3.3. Rehabilitate

The *rehabilitate* strategy is used when ecosystem processes or functions can be partially re-established. Continued anthropogenic intervention is required under a rehabilitation scheme because full restoration of the underlying ecosystem functions cannot occur. Basically the strategy is to rehabilitate watersheds where restoration is not feasible, but actions can be taken to improve aquatic habitats (PSTRT 2003). Rehabilitation acknowledges irreversible changes on the landscape such as urbanization, floodplain losses, and estuarine losses. Table 3.3, adapted from the Puget Sound TRT Watershed Guidance document (PSTRT 2003), gives examples of the general habitat management strategies to rehabilitate habitat forming processes or specific aquatic habitat characteristics.

Table 3.3. Examples of the general habitat management strategies to rehabilitate habitat forming processes or specific aquatic habitat characteristics.

Aquatic Habitat Characteristic	**Linked Physical Environmental Characteristics and Processes**	**Rehabilitate habitat strategy for development of recovery actions**
Channel Scour	Geomorphology Hydrology Sediment Transport	Move dikes back from channel. Institute land-use regulations that reduce the future expansion of impervious area within the watershed.
Water Temperature	Hydrology Succession	Revegetate riparian areas as needed to maintain water temperature. Institute instream flow regulations to maintain appropriate water temperature.
Fine Sediments	Geomorphology Hydrology Sediment Transport	Institute improved road maintenance procedures. Revegetate riparian areas as needed to minimize sediment inputs.
Estuarine Acreage	Geomorphology Hydrology Sediment Transport	Remove dikes blocking access to habitat likely to be usable. Institute land-use regulations prohibiting adverse modification of estuarine areas.

3.3.4. Substitute

Where rehabilitation is not possible on the landscape, the strategy of *substitute* will be used. Substitution is the creation of habitat features lost through degradation and can range from the creation of a spawning channel, adding logs to pools and building stormwater retention/detention systems. Substitution is the deliberate attempt to increase the abundance of selected habitat characteristics as desired. The modifications may be outside of the range of conditions that would occur naturally, but are found to be desirable and necessary in order to restore function. This strategy involves technological interventions that substitute artificial for natural habitat elements and characteristics (NRC 1996). The *substitute* strategy can involve either enhancement or mitigation. Enhancement might shift ecosystems to another state in which neither restoration nor rehabilitation can be achieved. Mitigation involves the extensive use of technological intervention and attempts to offset habitat loss in one area by replacement in another area. Table 3.4, adapted from the Puget Sound TRT Watershed Guidance document (PSTRT 2003), gives examples of the general habitat management strategies to substitute habitat forming processes or specific aquatic habitat characteristics.

Table 3.4. Examples of the general habitat management strategies to substitute habitat forming processes or specific aquatic habitat characteristics.

Aquatic Habitat Characteristic	**Linked Physical Environmental Characteristics and Processes**	**Substitute habitat strategy for development of recovery actions**
Channel Scour	Geomorphology Hydrology Sediment Transport	Install stormwater retention system. Construct off-site spawning channel.
Water Temperature	Hydrology Succession	Store and provide water as necessary to maintain appropriate water temperature.
Fine Sediments	Geomorphology Hydrology Sediment Transport	Install sediment traps. Construct off-site spawning channel.
Estuarine Acreage	Geomorphology Hydrology Sediment Transport	Create new estuarine habitat.

3.3.5. Status Quo

A final strategy category is designated as *status quo*. The *status quo* strategy is considered when existing or continuing loss of habitat and ecological functions due to human activities is accepted and will likely result in continued habitat degradation. The strategic approach in this case is to continue the present practices (i.e., land use patterns, habitat modifications, developments) and accept the continued loss of habitat and ecosystem function. Properly functioning conditions cannot be achieved everywhere throughout the ESU nor are they always necessary to recover summer chum salmon. Political feasibility and willingness, economic and technical limitations will determine the degree and extent to which habitat is classified in the status quo category. The level of degradation will determine if any of the other recovery management strategies are possible or if the degradation of the habitat is at a level and intensity beyond recovery.

3.4. Management Strategy Framework

It is anticipated that these five habitat management strategies will work in concert to provide for recovery of summer chum salmon in the Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon ESU. There are complex interactions between the habitat forming processes and the summer chum salmon populations that are targeted for recovery. Due to this complexity there is a decreased certainty of maintaining desired habitat conditions and achieving viable recovered populations as the habitat management strategies move from protect to status quo. Table 3.5 adopted from the TRT's watershed guidance documents (PSTRT 2003) graphically depicts this range (protect to substitute) of certainty.

Table 3.5. Framework for Development of the Summer Chum Salmon Recovery Plan Strategy as modified from PSTRT (2003)

Evaluation Criteria	Strategy Type
Increasing Uncertainty of Success in Achieving VSP Parameters Increasing Ongoing Resource Inputs to Achieve Viability Increasing Evaluation and Monitoring Required	**Protect**: Protect watersheds where the VSP parameters of the population are supported by fully functioning natural processes. Significant uncertainty exists in our ability to predict the effectiveness and temporal pattern of restoration, rehabilitation, and substitution actions. By protecting watersheds with functioning natural processes, we provide refuges for recolonization and maximize the likelihood that our strategy will contribute to achieving the VSP parameters of the population.
	Restore: Restore watersheds where habitat degradation has occurred but recovery of natural processes is feasible. Restoration is the "reestablishment of predisturbance aquatic functions and related physical, chemical, and biological characteristics" (NRC, 1992). Restoration can occur through either a passive or active approach: Passive. Anthropogenic controls are removed and natural processes, such as floods, natural revegetation, or erosion are allowed to restore the watershed to the predisturbance conditions. Active. Anthropogenic controls are removed and natural processes are supplemented by actions intended to accelerate the return to predisturbance conditions.
	Rehabilitate: Rehabilitate watersheds where restoration is not feasible, but actions can be taken to improve aquatic habitat and improve the VSP parameters of the population. Rehabilitation occurs when ecosystem processes or functions are partially re-established. Continual anthropogenic intervention will likely be required because restoration of the underlying ecosystem processes has not occurred.
	Substitute: Substitute habitat features in watersheds where rehabilitation is not possible. Substitution is the creation of habitat features lost through anthropogenic degradation. Substitution can range from the creation of a spawning channel to adding logs to create a pool.

In all cases the strategic priority of this summer chum salmon recovery plan will be to protect. It is recognized that habitats in the Hood Canal/Eastern Strait of Juan de Fuca are at various states of degradation and the ability to provide recovery for the targeted populations will require a mixture of habitat management strategies.

The prioritized order for the summer chum salmon recovery plan management strategies is:

1) Protect
2) Restore
3) Rehabilitate
4) Substitute
5) Status Quo

Each strategy type will be applied to projects and site-specific actions throughout the ESU. The intent of projects and actions will be to support the survival and persistence of the populations or stocks of concern.

3.5. Recovery Action Prioritization of Geographic Areas Within the ESU

To emphasize and promote the need to first recover currently known summer chum salmon populations to a viable status, and then to address other actions that would further benefit ESU viability, the SRP will prioritize recovery actions as follows:

1) The first priority level of recovery would focus on the eight extant populations' watersheds and associated marine areas (nearshore areas within one mile radius of the watershed's estuary).

2) The second priority level of recovery adds the eight extinct populations' watersheds and associated marine areas (nearshore areas within one mile radius of the watershed's estuary).

3) The third priority level of recovery provides for a focus on other watersheds in the ESU with recently documented observed summer chum salmon presence and associated marine areas (nearshore areas within one mile radius of these watersheds' estuaries).

4) The fourth priority level of recovery adds all remaining marine nearshore areas not previously addressed in priority levels 1, 2, and 3.

The specific watersheds and populations receiving this prioritization are described in each individual conservation unit section (section 7-12) of this SRP. Which geographic areas and populations that benefit from recovery actions based on this prioritization scheme will depend on available resources, political willingness, feasibility, and opportunity. Ideally all areas and populations should benefit from recovery actions and the SRP will strive to ensure that, ultimately, all four priority area levels are addressed. A core tenet of the management strategy for this SRP is the preservation of the "natural capital," or those populations and genetic material that still exist. Preserving the extant populations and associated supporting habitats will reverse the current downward trend towards extinction. It

will allow for the opportunity for physical, biological, and genetic material to be available. And it will preserve future opportunities for recovery as the mechanisms of implementation are developed.

Conservation and protection of populations and habitat within the ESU is a necessary first step to provide for the future recovery of summer chum salmon populations. Within the ESU these areas are examined to determine the relevance and appropriateness for implementation of management actions. Restoration is examined where habitat degradation has occurred and where recovery of natural processes appears to be feasible. Selected areas are delineated for specific management actions and project implementation. The assumption is that within any area, both fish distribution and habitat use will not be evenly distributed. And, habitat conditions (as indicated by fish habitat parameters such as pools and large woody debris) or watershed indicators (such as total impervious area, forest cover, wetland loss, and status of benthic invertebrates) may be unconstrained (functioning) or constrained (impaired or degraded). The combination of these two described situations, within each designated area, will provide indications of population productivity risks and opportunities.

Major production areas of the eight extant populations of summer chum salmon will be identified and described according to existing information and data. The SCSCI, refugia studies, and limiting factor analyses provide these initial delineations. Each area will analized according to its unique characteristics and associated recovery strategies. Table 3.6 provides the categories and a description of the general strategic approach for recovery of these areas and their associated summer chum salmon populations:

Table 3.6. General strategic approach for the recovery of summer chum salmon population production areas within each conservation unit.

Priority	Category	Production Area Actions
1	Unconstrained with current summer chum salmon production	Recovery actions and strategies will focus upon protection and passive restoration of watershed processes.
2	Constrained with current summer chum salmon production	Recovery actions and strategies will focus upon restoration, rehabilitation, and substitution approaches, likely artificial, to achieve the watershed processes.
3	Constrained, but with no current summer chum salmon production, but likely had historic production	Pending the reasons for the current lack of summer chum salmon production and change from historic, recovery actions could be limited. Recovery actions and strategies will focus upon restoration, rehabilitation, and substitution approaches. Such actions may require artificial supplementation programs coupled with restorative habitat measures. Recovery actions and strategies for these areas will be determined on a case-by-case basis.
4	Unconstrained, neither current nor historic summer chum salmon production. Determined to contribute to structure and function crucial to persistence and survival of the population of concern	Recovery actions and strategies will focus upon protection and passive restoration of watershed processes.
5	Constrained, neither current nor historic summer chum salmon production. With appropriate restoration and protection measures can contribute to function and structure to enhance persistence and survival of the population of concern	Recovery actions and strategies will focus upon restoration, rehabilitation, and substitution approaches. Such actions may require artificial supplementation programs coupled with restorative habitat measures. Recovery actions and strategies for these areas will be determined on a case-by-case basis.
6	Constrained, neither current nor historic summer chum salmon production. Determined does not and cannot contribute to structure and function critical for the persistence and survival of the population of concern	Status quo is likely maintained.

Protection and restoration of the major production areas is a necessary first step to provide for the future recovery of salmonid populations in Hood Canal. Conservation functions associated with specific geographic areas comprise the range necessary for reproduction, growth, and maturation. The Hood Canal Summer Chum Salmon Recovery Plan examines these areas to determine the relevance and appropriateness for implementation of management actions.

Based on the criteria described above, and the theoretical conservation function attributes, six *conservation units* have been designated for the Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon ESU. SRP sections 7-12 provide details for each conservation unit including the individual populations that are needed to be viable for ESU-wide recovery to be accomplished.

3.6. Conservation Units

The Summer Chum Salmon Recovery Plan designates conservation units that, in total, comprise the ESU. For the purposes of this SRP a conservation unit is a geographic grouping of the summer chum salmon populations that have been identified and targeted for recovery by the co-managers and the TRT. Populations that have initially been targeted for recovery are those described by the co-managers (PNPTT and WDFW 2003). Table 3.7 presents the six designated conservation units and their eight associated populations. Also presented are the eight extinct populations. Specific details for each conservation unit are presented in sections 7-12 of this SRP.

Table 3.7. Summer chum salmon populations associated with the designated conservation units.

CONSERVATION UNIT		POPULATIONS[17]	STATUS[18]
1	Lilliwaup-Skokomish	Lilliwaup	Extant-Supplemented
		Finch	Extinct
		Skokomish	Extinct
2	Hama Hama-Duckabush-Dosewallips	Hama Hama	Extant-Supplemented
		Duckabush	Extant
		Dosewallips	Extant
3	Eastern SJF	Dungeness	Extant?-Extinct?
		Jimmycomelately	Extant-Supplemented
		Snow/Salmon	Extant-(Supplemented in Salmon Creek only)
		Chimacum	Extinct-Reintroduced
4	Quilcene	Big/Little Quilcene	Extant-Supplemented
5	West Kitsap	Dewatto	Extinct
		Anderson	Extinct
		Big Beef	Extinct-Reintroduced
6	Union	Union	Extant-Supplemented
		Tahuya	Extinct-Reintroduced

The six conservation units for the Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon ESU are depicted in Figure 3.2.

[17] Shaded populations have identified interim recovery goals as developed by the co-managers (PNPTT and WDFW 2003). Each of these populations need to achieve a low-risk status. Extinct populations are described in WDFW and PNPTT 2000, and later in the respective conservation unit sections of this SRP.
[18] Supplementation and reintroduction programs are summarized below in Chapter 5 and described in detail in WDFW and PNPTT 2000 and subsequent supplemental reports.

Figure 3.2. Map showing the six conservation units designated for recovery planning within the summer chum salmon ESU. Rivers of natural origin populations, both extant and extinct, are noted in darker blue (map produced by Gretchen Peterson, PetersonGIS).

For each conservation unit, the SRP in section 7-12 describes:

- **Geographic boundaries and inclusive watersheds and marine nearshore areas.**

Each conservation unit section (sections 7-12) presents maps along with summary narrative descriptions for each conservation unit.

- **Status of the summer chum populations associated with each conservation unit**

Summer chum salmon populations have been identified and described in the Summer Chum Salmon Conservation Initiative (SCSCI 2000 and SCSCI 2003b). Each conservation unit chapter in this SRP provides a summary of these conclusions including interim recovery goals for these populations as developed by the co-managers.

- **Habitat overview and environmental conditions**

Each conservation unit chapter provides a description of the identified factors within the unit that contribute to the decline of the unit's associated population as well as the current land use development patterns.

- **Specific action recommendations**

Each conservation unit chapter describes specific actions (projects and programmatic) as appropriately designed to achieve the conservation functions needed for that particular conservation unit. These specific actions, within each unit, work in concert with actions developed for the other conservation units, to achieve overall ESU-wide recovery. Specific actions are based on an analysis of projects required to restore and enhance habitats within the conservation unit. Programmatic actions are derived from analyses and assessments developed by County staffs that 1) describe current land use and regulatory programs that are related to and impact summer chum salmon habitat, 2) determine projected build-out and development within the conservation units given those current land use and regulatory programs, 3) identify potential conflicts, both now and at build-out, with summer chum salmon habitat and 4) describe action alternatives and programmatic options that address the conflicts, as appropriate and feasible. Similar in rationale and logic to the designation of the Puget Sound chinook salmon geographic regions by the Puget Sound TRT (PSTRT 2001 and PSTRT 2002), the conservation units are regions that have correlated likelihood of catastrophic risks and similar ecological and political characteristics. Further characteristics of a conservation unit include:

- Similarities of geography/geomorphology, hydrogeography, biogeography and geology,
- The groupings of the summer chum salmon populations have likely evolved in common,
- Identified populations associated with each conservation unit seem to have similarities in response to environmental conditions, harvest regimes, and hatchery influence,
- Environments unique to each conservation unit affect life history strategies and the habitats that support and express those life histories of the summer chum salmon populations associated with the conservation unit,
- The factors that are suspected to contribute to the decline of the populations within the conservation unit are similar,
- Summer chum salmon populations and their supporting habitats associated within a conservation unit are subject to similar patterns of impacts and effects from:
    - Developmental and land-use characteristics,
    - Human growth development and pressures,
    - Land-use authorities and their approaches towards management and regulation of land use and growth, and
    - Political and biological opportunities to affect recovery within the conservation unit are similar.

Conservation units, for the purposes of this SRP, are envisioned as a means to provide organization of analyses and approaches for recovery of the targeted populations. The conservation units assist in focusing recovery efforts and prioritizing actions. These designations also allow community and volunteer groups, and citizens that are already organized in the ESU, to direct their efforts at specific recovery issues. Local land use authorities can then clearly see how their individual salmon recovery efforts fit in the comprehensive salmon recovery effort throughout the ESU.

Recovery of Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon ESU will be driven not only by the unique biology of the summer chum salmon, but also aspects of political feasibility, opportunity, ability, and willingness. The conservation unit construct provides an approach for salmon recovery that is responsive to the biological needs of the fish in the context of political, economic and social realities.

3.7. The Conservation Unit Construct and ESU-wide Recovery

A critical aspect of conservation units are their conservation function, or how they contribute to the survival and persistence of their associated summer chum populations. A conservation unit's conservation function derives its basis in metapopulation theory. Metapopulations are systems of local populations that are connected and supported by dispersing individuals (strays) between "core" and "satellite" groups (Hanski and Gilpin 1991). Habitat formation and disturbance regimes, on a watershed scale, are naturally and predictably variable, and result in a patchy distribution of habitat types and quality that are spatially and temporally dynamic. It is against this spatially and temporally dynamic template of habitat types and quality that native salmonid populations have adapted. Thus, naturally reproducing salmonid populations are not static in this dynamic environment (Hanski and Gilpin 1991). Local salmonid populations may become extirpated in some habitat patches, while other patches are occupied. And, unoccupied patches may be colonized by dispersal from adjacent populations (Martin 1999). There is a greater chance of recolonization of adjacent reaches if dispersing individuals are healthy and if the patches are well connected. This interaction of populations, which leads to the reestablishment of local populations, is the basis for metapopulation theory.

Within each conservation unit there are core areas or those areas that provide critical life history-habitat associations. These core areas are the production areas for each of the eight extant summer chum salmon populations. The critical life history-habitat associations support life-stage dependent survival, encompass assumed salmonid stock independence, and support those populations, which have been determined to be integral to the recovery of the ESU. Conservation units and associated population production areas are geographically specific and are the building blocks for summer chum salmon recovery planning. Conservation units are inextricably linked within the entire the Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon ESU. Fish spawning and rearing in one part of the ESU are necessarily dependent on other conservation units and core production areas for life history requirements of migration, feeding, protection, and physiological transitions.

Within each conservation unit, the habitats: 1) must be composed of patches that are well-connected, 2) have the structural complexity required for the life-history phases for which it is needed, 3) be large enough to support a viable population, and 4) contain persistent elements of the riverine and marine networks. In other words, the system of habitats that support sustainable life history patterns forms the core habitat (Martin 1999). Core areas can provide future opportunities on which to build the foundation for recovery. Core or production areas within the conservation units are instrumental during the initial phases of conservation and recovery implementation.

Many streams and marine nearshore areas within the Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon ESU conservation units, though not providing productive capacity for populations as do the production areas, do provide refuge and act as buffers in support of population productivity. These areas, sometimes called satellite areas, are also recognized as critical for overall population abundance, productivity, diversity, and distribution, and will be evaluated as part of the conservation function for each conservation unit and overall contribution to the ESU. Within the conservation units, there will also be habitats that occasionally fail to support a particular life phase. These areas become part of a population's habitat area and contribute to the population's abundance. This metapopulation structure is a critical component of habitat restoration and the summer chum salmon recovery strategy, because it requires suitable habitat patches be protected, maintained, restored, and connected to support populations in these satellite areas and straying individuals that may populate those areas. The production potential from satellite or straying individuals supports overall population abundance. However, if the progeny of straying individuals do not survive in currently marginal habitats, this production will not support population recovery. Patches in both the production areas, that are well connected and comprise a conservation unit, must also be well connected amongst each of the six conservation units identified for the summer chum salmon ESU.

3.8. Land Use and Development Potential Within the ESU

The summer chum salmon ESU encompasses four counties and three Indian Tribes with land use and regulatory jurisdiction. The designated conservation units cross these jurisdictional boundaries and cover multiple jurisdictions within a conservation unit (see Figure 3.2 above). The challenge for the SRP is to provide for a management strategy of recovery that is responsive to the biological and physical needs of the summer chum salmon while recognizing the multitude of political jurisdictions that are ultimately responsible for recovery. The SRP:

- will focus on specific solutions or packages of solutions to specific problems in each local area (i.e., conservation unit) and

- will not focus on broad-gauge, generic 'solutions' that have the potential to overreach in terms of proposing new regulations or requiring radical changes that have little chance of being effectively implemented.

While broader approaches cannot be completely ruled out, such approaches must be the only solution left that can address a problem, after localized, specific actions have been exhausted.

The SRP recognizes that land use and potential future development, must be addressed relative to summer chum salmon recovery. This must be done in coordination with the biological needs and physical conditions necessary for survival and persistence of the fish populations. Regulatory and land use programs designed and implemented by the land use authorities (primarily the Counties) must be coordinated with habitat restoration activities, harvest management and supplementation programs. Development of this SRP includes work with County staffs and Boards of County Commissioners within the ESU to:

- Describe current land use regulatory programs relative to summer chum salmon habitat,
- Describe build-out under current regulatory regimes and programs, and
- Identify specific areas and/or regulations that can be considered to address conflicts with summer chum habitat under both current and build-out conditions.

Most of the existing human population and projected development under current regulatory programs occurs in concentrated areas of the ESU outside of the watersheds where the major summer chum populations of concern originate. However, these factors are considered a threat to reintroductions of summer chum salmon into their historic habitats (i.e., west Kitsap County). Figure 3.3 shows the current human population density within the ESU.

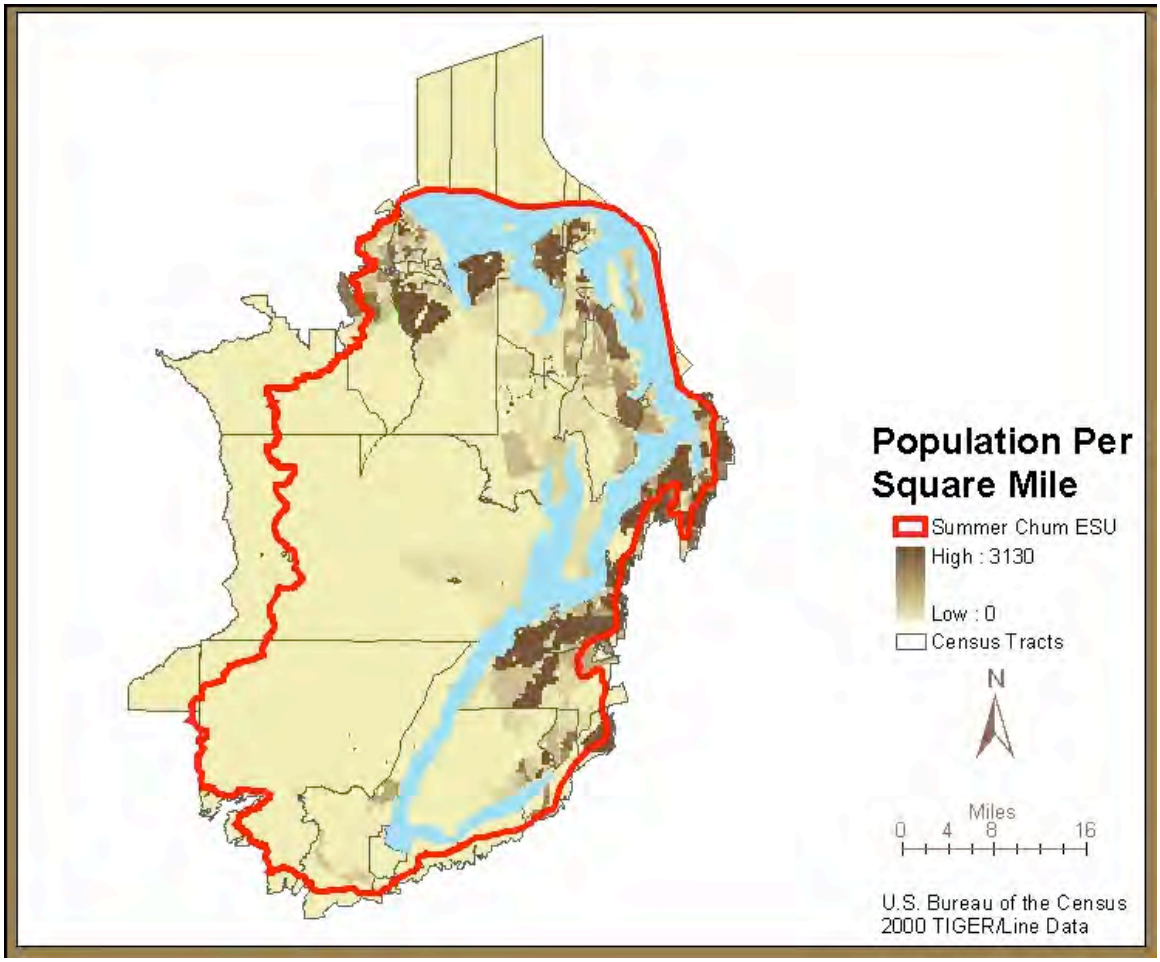


Figure 3.3. Human population per square mile within the summer chum salmon ESU. Map developed by Gretchen Peterson, PetersonGIS 2004.

Development patterns are projected to concentrate development adjacent to existing population concentrations.[19]

3.9. Development of the Policy Options and Management Strategy for Land-use and Regulatory Programs

A full range of policy options for acquiring, funneling and allocating resources for salmon habitat conservation was developed and presented to the members of the HCCC Board for review. That range of options was developed without advocating any particular set of choices. In offering this range of options, there are many that are not acceptable for a variety of reasons. However, that determination is for elected officials to make in combination with the other possible choices that are available to recover summer chum salmon.

[19] See Appendix C for County build-out scenarios and modeling methods.

Listed below is the "universe" of policy approaches that are available. Site-specific recommendations for recovery actions, drawn from the list below, as appropriate, will be presented in each conservation unit section (sections 7-12) to address that area's specific problems:

3.9.1. Potential Sources of Resources – this category describes various sources of funding that could be applied to salmon recovery problems or the underlying environmental conditions on which salmon depend.

3.9.1.1. Grants from Federal Agencies – there a variety of federal sources from which salmon recovery funding is available (US Fish & Wildlife Service, NMFS, NRCS, etc.)

3.9.1.2. Grants from State Agencies – Ecology, the Department of Fish and Wildlife, Puget Sound Water Quality Action Team, and others provide state funding for salmon recovery related projects.

3.9.1.3. General Fund Tax Revenue (local) – County tax revenue has been applied directly, in terms of County mitigation projects, and indirectly, in terms of matching funds for other funding sources to undertake salmon restoration projects.

3.9.1.4. Specific Tax Revenues – provisions in state law allow for locally approved taxing districts to be created to address local problems (local improvement districts, shellfish protection districts, etc.) Also, special purpose governments exist and can be created to address environmental concerns, such as a Public Utility District.

3.9.1.5. Fees – can be charged for use or services, such as day use fees at parks or boat or trailer pumpout charges. Those revenues can be applied to environmental improvement projects.

3.9.1.6. Special Charges - can be levied for degradation or pollution in permitted activity situations such as discharges from sewer plants, etc. Those revenues can be used for environmental remediation.

3.9.1.7. Fines - from regulatory enforcement have been imposed on law violators and can be used to address the causes of environmental degradation.

3.9.1.8. Creation of Markets - with environmental credits, tradable emissions permits and transferable development rights are examples of creating new "commodities" and systems in which those credits can be used to concentrate bad environmental effects in areas that have a greater potential to absorb them.

3.9.1.9. Voluntary Contributions - from memberships and contributions to national groups that undertake or sponsor local action, or contributions directly to local efforts, can aid environmental protection and restoration efforts.

3.9.2. Conduits for Resources – this category describes the administrative path that the resources described above can take to address salmon recovery problems.

3.9.2.1. Federal Government – can target appropriations or earmarks by Congress directly, or through federal agencies.
3.9.2.2. State Government – can target appropriations or earmarks by the Legislature directly, or through state agencies; or it can pass-thru spending from the federal government.
3.9.2.3. County Government – can direct spending, by county commissioners, either through county departments or outside them, using other entities.
3.9.2.4. Tribal Government – can direct spending, by Tribal Councils, through Tribal departments, or outside of them using other entities.
3.9.2.5. Special Purpose Districts – can direct spending through their own programs, or outside of them, using other entities.
3.9.2.6. Non-governmental Organizations (NGOs) – can direct spending through their own programs, or use outside entities.

3.9.3. Targets for Resources – this category describes the activities that could be undertaken with the resources described above, to address salmon recovery problems.

3.9.3.1. Voluntary Means – this category includes optional protection and restoration actions that are described below.
3.9.3.1.1. Protection of ecological functions – can include the provision of information (education & outreach); watershed/community level management; tax credits; long-term leases; acquisition of development rights or conservation easements; fee simple acquisition of whole property; covenants; green builder/developer certification; environmental 'safe harbor' agreements or negotiated regulatory relief; or risk-transfers (government insurance) through negotiated management or development practices (HCP or 4d rule inclusion, etc.)
3.9.3.1.2. Physical Restoration – can include matching or in-kind grant funded restoration projects; or fully funded restoration projects

3.9.3.2. In-Voluntary Means – this category includes protection and restoration actions that might be undertaken or required by any one of the various governments that have the appropriate ownership, jurisdiction or authority.

3.9.3.2.1. Protection – can include public lands management for conservation; strict enforcement of current regulations on private lands; development of new regulations for private lands; eminent domain acquisition; or negotiated development (contracts, permits, licenses, etc.)

3.9.3.2.2. Physical Restoration – can include facility construction on public lands; or eminent domain acquisition for facility construction.

In each conservation unit, specific programmatic choices, from the list above, have been included to address issues that could not otherwise be addressed by projects. Those programmatic choices have been selected based on their political, economic and biological appropriateness and based on their fit to the scale of the issue that they are being used to address.

In addition to the programmatic issues that are addressed within each conservation unit, an overall description of the programmatic decisions taken by the Counties, as the land use authorities in Hood Canal, is listed in Chapter 13 of this SRP, for those issues that are less locally specific and more general in nature, or that address an issue on a jurisdictional basis or at the ESU-wide scale.

4. HARVEST IMPACTS TO SUMMER CHUM SALMON

4.1. Introduction

This section summarizes the multitude of work and effort that is ongoing, by the co-managers involving the harvest management of summer chum salmon. Most of this section will be drawn from the Summer Chum Salmon Conservation Initiative (SCSCI) (Washington Department of Fish & Wildlife and Point No Point Treaty Tribes 2000) and subsequent supplemental reports of the SCSCI (WDFW and PNPTT 2003). Section 4 also describes harvest interactions with aspects of habitat conditions, and their implications, as currently understood, for summer chum salmon recovery. The SCSCI and supplemental reports can be found at the WDFW web site: http://wdfw.wa.gov/fish/chum/chum.htm.

WDFW and PNPTT (2000) provides both short and long-term goals to guide the harvest management regimes for summer chum salmon. Those goals are, "The short-term goal of the harvest strategies outlined in this section is to protect the summer chum populations within Hood Canal and Eastern Strait of Juan de Fuca (HC-SJF) from further decline by minimizing the effect of harvest as a major factor to that decline. The long-term goal of these strategies is to assist in the restoration and maintenance of self-sustaining summer chum populations throughout the Hood Canal/Strait of Juan de Fuca while maintaining harvest opportunities on commingled salmon of other species."

Harvest management regimes are being designed to limit mortality from fishing to a rate that allows the vast majority of summer chum salmon to return to their natal spawning grounds. To achieve these goals, the co-managers instituted harvest management regimes while the SCSCI was being developed, and have continued with the approach as described in the SCSCI to the present. Section 3.5 of the SCSCI provides specific details of these harvest regimes. The Salmon Recovery Plan will provide a summary of progress to date. To fully understand the harvest management regimes established for recovery of summer chum salmon, the reader is encouraged to explore the SCSCI (WDFW and PNPTT 2000), subsequent supplemental reports (WDFW and PNPTT 2003) and progress reports (Adicks, et. al. 2004 and 2005).

4.2. Summary of the SCSCI Conclusions

Harvest management provisions have been developed by the co-managers to manage fisheries in a manner that will allow the rebuilding and maintenance of self-sustaining summer chum populations throughout Hood Canal and eastern Strait of Juan de Fuca. This effort also attempts to maximize harvest opportunities on co-mingled salmon species (WDFW and PNPTT 2000). The harvest management strategy utilizes a conservative four-way control mechanism:

- A base set of conservative fishing regulations,
- Abundance and escapement thresholds that trigger adjustments to the fishing regime,
- Exploitation rate[20] objectives that will result in changes to the harvest regime if not met, and
- Overall stock assessment criteria that will affect all plan provisions, including harvest, if not satisfactorily met at periodic plan reviews.

These regimes were established to counter the historical impacts from fisheries prior to the year 2000. SCSCI sections 2.2.5 and 3.5.3 provide detailed descriptions of the history of summer chum salmon fisheries (WDFW and PNPTT 2000). WDFW and PNPTT (2000) conclude that increased exploitation rates on Hood Canal and the Strait of Juan de Fuca summer chum stocks corresponded with the stocks declined. In the case of Hood Canal summer chum salmon, the added impacts of indirect harvests[21] in the terminal area[22] fisheries (after 1974) combined with a relatively consistent level of pre-terminal[23] catch. These contributed substantially to the decline and subsequent continuing low escapement levels.

Two different types of harvest have contributed to the decline of summer chum salmon of the region: preterminal fisheries in the Strait of Juan de Fuca, and terminal fisheries in Hood Canal. For Hood Canal summer chum stocks, pre-terminal harvests occur annually, primarily in fisheries for pink and sockeye salmon in the Strait of Juan de Fuca. After 1974, an added level of fishery exploitation began to occur in the terminal area, resulting in high exploitation rates through the 1980s. Terminal harvest has been rated as a major impact on Hood Canal summer chum salmon. For Strait of Juan de Fuca summer chum stocks, historical pre-terminal harvests were rated as having a moderate impact. Exploitation rates have increased substantially in preterminal fisheries in the 1980's, corresponding with the 1989 drop in summer chum salmon escapements to the region's streams (WDFW and PNPTT 2000). Past terminal harvest was considered a low impact during the period of decline.

The fact that these summer chum salmon stocks are at the southern limit of summer spawning chum salmon (when compared with all summer spawning

[20] "Exploitation rate" is the proportion of the returning run or the total population of summer chum salmon that is taken (harvested) by fisheries. "Harvest rate" is the proportion of the available numbers of summer chum salmon that is taken by fisheries in a specific time period and location.
[21] "Indirect harvests" are harvest that occurs on summer chum salmon during the conduct of fisheries for other stocks such as Chinook or coho salmon fisheries.
[22] "Terminal area" fisheries are fisheries that occur in the close vicinity or area of where the salmon were produced. For example, the harvest inside Hood Canal would be considered a "terminal area" harvest. A fishery that occurs in Quilcene Bay and the Quilcene River would be considered an "extreme terminal area" harvest.
[23] "Pre-terminal" catch or harvest would be fisheries of Hood Canal summer chum salmon that occur outside of Hood Canal or the eastern Strait of Juan de Fuca such as in Canadian fisheries.

chum salmon from Alaska to Puget Sound) may mean that they have a naturally lower level of productivity, making them less able than wild fall chum stocks to be successful with past estimated levels of exploitation rates. Eastern Strait of Juan de Fuca summer chum salmon declined abruptly in 1989. That was the same year that the Canadian pre-terminal exploitation rate peaked at 43.1%. Canadian pre-terminal exploitation rates, in the following three years averaged 24.1%, ranging from 18.3% to 33.3%. These were substantially higher than average. These higher exploitation rates likely contributed to the lowered escapements of summer chum salmon in the streams of Discovery and Sequim Bays after 1988 (WDFW and PNPTT 2000). Estimated exploitation rates on the associated summer chum salmon populations are provided in Table 4.1.

Table 4.1. Mean observed exploitation rates (%) on the summer chum salmon stocks of concern during selected time periods (modified from WDFW and PNPTT 2003 and Adicks, et. al. 2004 and 2005).

Populations	1974-1979	1980-1991	2000-2004
Salmon/Snow	11.9	21.2	0.5
Jimmycomelately	9.4	21.2	0.5
Quilcene	29.7	89.8	17.5
Dosewallips	25.1	48	1.2
Duckabush	25.1	48	1.2
Hamma Hamma	25.1	48	1.2
Lilliwaup	25.1	48	1.2
Union	58.9	54.9	1.2

4.3. Connections to Habitat

Although harvest is thought to have been a factor, in the historical decline of summer chum in Hood Canal and the Strait of Juan de Fuca, it should not be viewed in isolation of the other factors for decline. The synergistic effects of a potentially (though unknown) dramatically reduced productivity, and high harvest rates, may have resulted in reduced abundance. That reduced abundance has been observed, and warranted a listing of “threatened” under the ESA.

Abundance declined beginning in 1979. That decline could have been a result of low productivity. That low productivity was caused, in part, by increased winter flows. Those flows affected incubating eggs. Additionally, increased exploitation rates, in both terminal and pre-terminal areas, began in 1977 (WDFW and PNPTT 2000). As productivity improved in the early 1980s, the sustained increase in harvest rates may have hindered the ability of the populations to rebuild. Productivity again declined, with the significant decrease in mean spawning flows (September-October), beginning in 1986. The decrease in the mean spawning flows at this time is attributed to changing climatic patterns. This

decline, beginning in 1986, corresponded with the period of highest total exploitation (harvest) rates and lowest abundances in the summer chum ESU region from1989 to 1992. Increases in exploitation rates during this time were primarily due to increased exploitation in Canadian fisheries. Both U.S. pre-terminal and terminal fishery exploitation rates had begun to decline from their peaks in the early to mid-1980s. The combined affects of high preterminal exploitation rates and unfavorable spawning conditions may have also impeded recovery (WDFW and PNPTT 2000).

Although there may be summer chum caught in fisheries targeted on fall chum salmon, the harvest is probably very low given that the difference in peak entry timing between summer and fall chum varies by a month or more. In addition, GSI sampling of commercial fall chum fisheries in Hood Canal and South Puget Sound indicates that Hood Canal summer chum are not present at detectable levels during fall chum fisheries (WDFW and PNPTT 2000). Another theory for a contributor to the decline of summer chum has been predation and competition from both fall chum and other species. Both the numbers and timing of wild and hatchery-produced chum fry entering Hood Canal in recent years, and the indirect effects of overlapping spawning areas between the two races, suggest the possibility of negative competitive impacts on summer chum salmon populations. Hatchery programs for other species of salmonids have, in some cases, been intensive. And, the potential for both competitive and predatory impacts on summer chum salmon juveniles has been identified (WDF et al. 1993, Johnson et al. 1997, Tynan 1998). Although the evidence is not conclusive, the recent improvements in summer chum abundance suggest that these have not been significant contributors to the decline of summer chum. However, what competitive and predation effects do exist may aggravate declines in freshwater productivity in those systems already impacted by the climatic regime shifts and habitat degradation (WDFW and PNPTT 2000).

The reduction of stream and estuarine productivity and capacity, caused by habitat degradation, is cumulative with the negative effects of climate and excessive fishery exploitation. The affects of habitat degradation likely contributed to the decline in productivity, in systems with summer chum impacted by the regime shifts in 1976 and 1986 (WDFW and PNPTT 2000). Some summer chum salmon populations appear to have responded positively from the reduction in harvest rates and added supplementation (see section 5). This Salmon Recovery Plan (SRP), however, suggests that improved habitat conditions, coupled with a variety of other management actions described herein, will be essential to the ability of summer chum to recover.

4.4. Progress to date

Given that there is a current lack of reliable information on which to base estimates of appropriate escapement ranges or exploitation rates, interim management objectives have been defined while extensive monitoring programs

have been implemented to gather the necessary data. These harvest management objectives seek to minimize incidental impacts to summer chum, during fisheries for other species. The harvest strategy is known as the Base Conservation Regime (BCR). Harvest activities, conducted in accordance with this regime, are expected limit fishing mortality to a rate that permits a high proportion of the summer chum run to escapement, contributing to the rebuilding of self-sustaining populations. Designing generic fishery regimes, for the harvest of target species (coho, chinook, pinks, fall chum), is based on both the biological requirements of summer chum, and the target species. This is expected to result in stable, reduced exploitation rates on co-mingled summer chum salmon, when fisheries for those target species occur. When additional fishery restrictions are implemented to protect those target species, it is expected to also result in further protection for summer chum by further reducing incidental mortalities (WDFW and PNPTT 2000).

According to WDFW and PNPTT (2000), the BCR[24] is comprised of a conservative four-way control mechanism:

- A base set of fishery-specific management actions for fisheries in pre-terminal (Canadian, U.S.), Washington terminal and Washington extreme terminal areas;

- Management unit and stock abundance and escapement thresholds that trigger review and possible adjustment of the management actions;

- Expected fishery-specific exploitation rate targets and ranges based on the application of the BCR on the summer chum management units; and

- Overall management performance standards are based on natural production against which to assess success of the regime and make necessary adjustments. The actions required depend both on the status of the management unit and the stocks within them, with the most conservative controls prevailing.

The intent of the BCR is to initiate rebuilding, by providing incremental increases in escapement over time, while providing a limited opportunity for fisheries conducted for the harvest of other species. The BCR has been constructed using a conservative approach. It will pass-through to spawning escapement, on average, in excess of 95% of the Hood Canal-Strait of Juan de Fuca summer chum abundance in U.S. waters. It will also pass-through nearly 90% of the total abundance of the run (Adicks, et. al. 2005). The BCR is based on a conservative integration of the existing data and management experience. However, the plan is designed to be responsive to feedback mechanisms, in order to provide for

[24] Details of the BCR and harvest management regimes are provided in WDFW and PNPTT (2000), section 3.5.6.1 of the SCSCI.

adaptive management towards meeting the goals of protection of summer chum, while maintaining harvest opportunities (WDFW and PNPTT 2000). It is further noted that there is a commitment from the co-managers to implement additional fishery restrictions should it be determined that critical thresholds are not being met (WDFW and PNPTT 2000). It is the intent of the co-managers to develop a harvest regime in addition to the BCR that would be implemented when the ESU is recovered. Such a regime would provide greater management flexibility and expanded fishing opportunities.

The co-managers delineated management units to facilitate accounting of harvest and escapement throughout the summer chum ESU geographic area. Management units are made up of one or more stocks. Those stocks are aggregated in recognition of practical and biological limitations to available data, and how fisheries can be effectively managed (Adicks, et. al. 2005).

Estimated exploitation rates, for fisheries in Canadian and U.S. waters (both pre-terminal and terminal fisheries) that impacted summer chum salmon during the years 2001-04 (since the implementation of the SCSCI), were well below the target exploitation rates, as determined by the co-managers as part of the BCR. The SRP concludes that the harvest management regime established for Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon is working according to expectations and contributes to recovery of the species.

4.5. Monitoring the harvest management regime

The co-managers have developed and implemented specific, integrated monitoring programs that are designed to assist in improving stock assessment methodologies as well as effectiveness of harvest management actions and objectives (WDFW and PNPTT 2000). These programs include:

- consistent escapement monitoring methods;
- identification and quantification of harvest contributions;
- assessment of survival rates to recruitment by age; and
- assessment of stock productivity and productive capacity.

Escapement and harvest monitoring form the core elements that are critical to implementation of the harvest management regimes, particularly during the initial phase. The third and fourth programs are necessary to provide information that allows managers to tailor harvest, supplementation, and habitat planning guidelines and actions, as necessary, to determine, with acceptable accuracy, the necessary steps, time horizon and likelihood of restoration. The fourth monitoring provision will also allow managers to better define survival parameters, thus allowing to better define recovery; what can be sustained over the long-term, and how to maximize benefits by stabilizing the summer chum salmon resource. This information will also be essential to the integration and effectiveness of habitat and harvest management strategies by keying production

to current estimates of habitat capacity and productivity. WDFW and PNPTT (2000) provides the details of the escapement and harvest-monitoring program in section 3.5.10 of the SCSCI. Tasks described in the SCSCI include spawning ground surveys, sampling of fisheries in Canada and the U.S., and genetic stock identification, sampling and analyses.

As more information is collected and becomes available, harvest management strategies will be coordinated with habitat and hatchery strategies. The intent is to incrementally increase abundance and spawning escapements above recovered levels. By maintaining high escapement rates, additional fish from supplemented or natural production can take advantage of additional capacity or improved habitat. This approach appears to be working given the increasing numbers of natural origin fish showing on the spawning grounds in recent years. More details of the monitoring and adaptive management aspects of the SRP can be found in section 14. Recovery goals for each stock were developed in 2003, and the co-managers are in the process of determining how to incorporate the recovery goals into the management structure. In addition, fishery performance criteria will be revised to include the new information as appropriate. As reintroduction programs are implemented, and become effective, fishery performance criteria will be expanded. They will include the additional management targets, if it is found that the current targets are insufficient to provide the necessary protection (WDFW and PNPTT 2000).

4.6. Conclusions

The National Marine Fisheries Service (NMFS) must review harvest management plans for consistency with the ESA 4(d) rule for limitation of take prohibitions. The 4(d) rule (July 10, 2000, 65 FR 42422) (Limit 6) states that fishery harvest or artificial propagation activities, described in a Resource Management Plan (RMP) developed under *U.S. v. Washington* or *U.S. v. Oregon,* are not subject to take prohibitions under Section 9 of the Endangered Species Act, provided that they are conducted in accordance with an RMP that meets the criteria of the 4(d) rule (see http://www.nwr.noaa.gov/4d/limit6/rmpfinal.htm). The Washington Department of Fish and Wildlife (WDFW) and Point-No-Point Treaty Tribes (Co-managers), pursuant to their authorities under U.S. v Washington, provided a joint Resource Management Plan (RMP) for salmon fisheries. That plan will affect listed Hood Canal summer chum salmon. The harvest component of the document titled "Summer Chum Salmon Conservation Initiative - An Implementation Plan to Recover Summer Chum Salmon in the Hood Canal and Strait of Juan de Fuca" (SCSCI) is the RMP. NMFS has determined that, “implementing and enforcing the RMP will not appreciably reduce the likelihood of survival and recovery of the Hood Canal summer-run chum salmon Evolutionarily Significant Unit (ESU).”

The stated goal of the summer chum salmon RMP is to "...protect, restore and enhance the productivity, production and diversity of Hood Canal summer chum

salmon and their ecosystem to provide surplus production sufficient to allow future directed and incidental harvest of summer chum salmon." On a regular basis, NMFS will evaluate the effectiveness of the RMP in protecting and achieving a level of productivity commensurate with conservation of the listed salmon. If the plan is not effective, NMFS will identify, to the jurisdiction, ways in which the joint plan needs to be altered or strengthened. If the responsible agency does not make changes to respond adequately to the new information, NMFS will publish notification in the Federal Register announcing its intention to withdraw the limit on activities associated with that joint plan. Such an announcement will provide for a comment period of no less than 30 days. After that, NMFS will make a final determination whether to withdraw the limit so that take prohibitions would then apply to the harvest activities described in the joint plan (Federal Register 2001b). More information regarding the RMP and NMFS determinations can be founds at:
http://www.nwr.noaa.gov/4d/limit6/qa_HCRMP.htm

This SRP concludes that the co-managers harvest management regimes are designed to protect and provide for the recovery of summer chum salmon. These regimes are well established and have been implemented since the year 2000. At this time, no further actions are necessary regarding summer chum salmon harvest management, except to continue the prescribed monitoring and in-season adjustments as described in the SCSCI (WDFW and PNPTT 2000), subsequent supplemental reports (WDFW and PNPTT 2003), and annual progress reports (Adicks, et. al. 2004 and 2005). The current SRP attempts to address habitat protection and restoration through the identification of the habitat factors responsible for the decline of summer chum salmon and the implementation of recovery actions that will address the limiting factors. The SRP provides the forum for all of he H's--habitat, harvest, and hatchery--to be discussed as a part of the recovery of Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon. As aspects of harvest management are analyzed and integrated with aspects of hatcheries/supplementation (see section 5) and habitat restoration and protection; adaptive management will allow the opportunity to address all aspects/programs that contribute to recovery (see section 14).

5. HATCHERIES' IMPACTS TO SUMMER CHUM SALMON

5.1. Introduction

Artificial production (hatcheries) techniques may be used to supplement depressed wild summer chum populations or to reintroduce summer chum back into streams where the original population no longer exists. The co-managers (Washington Department of Fish & Wildlife and the Point No Point Treaty Tribes) initiated supplementation programs for natural Hood Canal summer chum salmon populations during the 1992 brood year[25]. They did this, for example, in the Quilcene River using Quilcene summer chum stock. More recently, the co-managers have designed and implemented supplementation programs to reintroduce populations into streams where they had been extirpated.

Artificial Production Definitions (from WDFW and PNPTT 2000)

Supplementation: "The use of artificial propagation to maintain or increase natural production while maintaining the long term fitness of the target population, and keeping the ecological and genetic impacts to nontarget populations within specified biological limits."

Reintroduction: "The transfer and release of progeny from an appropriate broodstock into a watershed where the target species or race has been extirpated, for the purpose of reintroducing the species or race and creating a self-sustaining return."

Enhancement: "The use of artificial propagation to produce fish that are primarily intended to be caught in fisheries."

WDFW and PNPTT (2000) believe that artificial production and hatchery management, for summer chum salmon, should be directed at **only** those populations identified as **at risk of extinction**. They further believe that they should be directed at selected extirpated populations within the ESU geographic area. The goal of the co-managers for supplementation is (from WDFW and PNPTT 2000) to, "Restore naturally-producing, self-sustaining populations to their historic localities and levels of production, and minimize the risk of further declines, while conserving the genetic and ecological characteristics of the supplemented and reintroduced populations, and avoiding genetic and ecological impacts to other populations." An overarching premise assumed in implementing these conservation hatchery programs in the region is that summer chum salmon populations threatened with extinction cannot be recovered to viable population levels with harvest and hatchery measures alone. Commensurate, timely improvements in the condition of habitat critical for summer chum salmon survival are necessary to recover the listed populations to healthy levels.

[25] "Brood year" is the year adults return to their natal streams to spawn.

The intent of the supplementation efforts is to reduce the short-term extinction risk to existing wild populations, and to increase the likelihood of their recovery. This current emphasis is in response to the generally poor condition of the stocks of summer chum. In the future, as the stocks recover, consideration may also be given to enhancement of summer chum for fisheries benefit. However, specific conditions, criteria, and guidelines will need to be defined before artificial production would be pursued for that purpose. The current supplementation program, being implemented by the co-managers, addresses artificial production only as it applies to population recovery and reintroduction (WDFW and PNPTT 2000).

This section summarizes the co-managers' work on hatchery management and supplementation of summer chum salmon. It will be drawn primarily from the *Summer Chum Conservation Initiative* (SCSCI – WDFW and PNPTT 2000) and its supplemental reports (WDFW and PNPTT 2003). The National Marine Fisheries Service (NMFS) ESA section 7 biological opinion completed for Hood Canal summer chum salmon supplementation and other anadromous salmon hatchery programs in the region (NMFS 2002), and the Hatchery Scientific Review Group (HSRG) "Hatchery Reform Recommendations" addressing the summer chum hatchery programs (HSRG 2004) were also used as references. The listed reports describe the supplementation program for summer chum salmon in detail. They also describe the results from on-going monitoring and evaluation of the individual supplementation programs.

5.2. Summary of SCSCI Supplementation Programs

All summer chum salmon supplementation and reintroduction programs implemented in the region apply stringent operational criteria to reduce the risk of adverse impacts to target and non-target summer chum salmon populations. These conservation-directed measures are described in the individual Hatchery and Genetic Management Plans (HGMP) for the programs, and further detailed in the SCSCI (WDFW and PNPTT 2000). Overarching hatchery operational measures are included in the SCSCI to indicate when to supplement or reintroduce, when to modify or terminate a program, how to supplement or reintroduce. General and specific standards describing how supplementation and reintroduction programs will be conducted are applied to address risks to natural origin fish and to ensure the effectiveness of supplementation and reintroduction programs selected for implementation.

Key summer chum salmon hatchery conservation standards include: maintenance of unsupplemented natural populations that comprise a representative spectrum of existing diversity in the region; limitation of the duration of all hatchery programs to a maximum of three summer chum salmon generations (12 years) to minimize the likelihood for divergence between hatchery broodstocks and target natural stocks; propagation and release of only

the indigenous populations into each watershed; collection of broodstock so that they represent an unbiased sample of the naturally spawning donor population with respect to run timing, size, age, sex ratio, and any other traits identified as important for long term fitness; limitation of hatchery rearing to a maximum of 75 days to minimize the level of intervention into the natural chum life cycle, reducing domestication selection effects; and, limitation of annual juvenile fish release levels based on achieving historical spawner abundances in each watershed. Monitoring and evaluation standards and methods are also implemented in each program to collect information that will help determine the degree of success of each project; if a project is unsuccessful, why it was unsuccessful; what measures can be implemented to adjust a program that is not meeting objectives set forth for the project; and, when to stop the supplementation project. Monitoring and evaluation activities specifically address four elements: the estimated contribution of supplementation/reintroduction program-origin chum to the natural population during the recovery process; changes in the genetic, phenotypic, or ecological characteristics of populations (target and non-target) affected by the supplementation or reintroduction program; the need and methods for improvement of hatchery activities in order to meet program objectives, or the need to discontinue a program because of failure to meet objectives; and determination of when supplementation has succeeded and is no longer necessary for recovery.

As of June 2005, summer chum salmon supplementation programs continue at Lilliwaup Creek, Hama Hama River, and Jimmycomelately Creek. Summer chum salmon have been successfully re-introduced in two streams that were previously occupied by summer chum, Big Beef Creek and Chimacum Creek. A third reintroduction program is underway on the Tahuya River. Supplementation or reintroduction programs have been terminated on several streams, because they have met the individual projects' production level goals specified in the SCSCI (WDFW and PNPTT 2000). Projects that have been terminated include Big Quilcene River, Salmon Creek, Chimacum Creek, and the Union River. The last releases of fish from these programs occurred in 2004 (Brood Year 2003).

Following are summaries of the individual supplementation and reintroduction projects for Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon (modified from WDFW and PNPTT 2000, WDFW and PNPTT 2003, and Adicks, et. al. 2005):

LILLIWAUP CREEK

A supplementation program began on Lilliwaup Creek in 1992 as a cooperative project between Hood Canal Salmon Enhancement Group (HCSEG) and WDFW. In 1994, Long Live the Kings (LLTK) assumed the role of the primary project operator. Through 1997, there were difficulties in collecting adequate numbers of broodstock from Lilliwaup Creek. Attempts in this regard were complicated by the lack of a fish collection trap, low overall summer chum return

levels, and the presence (in odd-numbered years) of pink salmon in the same stream areas as summer chum. Beginning in 1998, WDFW was able to provide limited funding for this project, allowing for the installation of a trap in the lower creek, increased agency assistance during fish spawning, and increased monitoring and evaluation of the supplementation program.

Until 2001 and 2002, adult return levels had not improved since the program began. Program operational improvements begun in 1998 have apparently contributed to increased adult returns, with observed spawning escapements of 859 fish in 2002, 353 fish in 2003, and 1,017 fish in 2004 (WDFW and PNPTT 2005 data). The Co-managers will continue to monitor the adult returns. According to the standards set in the SCSCI and Hatchery and Genetic Management Plans (HGMP), the expected duration of the program is a maximum of 12 years (3 generations). The original program began in 1992, however, due to the lack of adequate broodstock collection until 1998, and only recent indications of population recovery, the Co-managers have established 1998 as the effective start-up year for the program. The 12 year maximum program duration criteria will therefore be based on 1998 as the program start-up date. The Lilliwaup supplementation project has generally addressed the program objectives described in section 3.2.3.4 of the SCSCI.

HAMA HAMA RIVER

The Hama Hama multi-species salmonid recovery project was developed by HCSEG with support from others. Out of this effort evolved the Hama Hama summer chum supplementation project on John Creek, a Hama Hama River tributary. A review of freshwater habitat conditions, summer chum escapements, potential causes for decline in escapement, and current restoration efforts in Hood Canal by the Co-managers and cooperators, led to the recommendation to initiate the summer chum supplementation project, beginning with brood year 1997.

It appears that the Hama Hama River summer chum supplementation program was generally successful in collecting a representative sample of broodstock from the natural Hama Hama River summer chum population. Consistent with the standards set in the SCSCI and HGMP, the expected duration of the program is a maximum of 12 years (3 generations) beginning with brood year 1997. It is too early in the program to assess the success of adult returns. Over 1,000 adults produced in the program returned to the Hama Hama River during 2002, but the number of program returns dropped to approximately 300 in 2003 and 2004 (WDFW and PNPTT 2005 data). The Co-managers are continuing to monitor the returns. The Hama Hama supplementation project has addressed the program objectives described in section 3.2.3.4 of the SCSCI.

JIMMYCOMELATELY CREEK

The Jimmycomelately (JCL) Creek supplementation project was completed with the 1999 brood year and is a cooperative effort between WDFW, North Olympic Salmon Coalition, and Wild Olympic Salmon. The SCSCI has noted that habitat impacts are high and may be contributing to the risk, and recommended that habitat protection and recovery measures should be addressed concurrent with supplementation project development. Habitat restoration projects have been prioritized, funded, and initiated in freshwater and estuarine areas of JCL Creek. In particular, restoration and improvement of lower creek and upper estuarine habitat in the watershed now provides improved access to spawning areas, and improved spawning and incubation conditions, for adult summer chum salmon returning as a result of the supplementation program. The integration of these habitat restoration actions with the supplementation program is designed to improve prospects for supporting a self-sustaining, viable natural summer chum salmon population in the watershed after the supplementation program terminates.

It appears that the JCL Creek summer chum supplementation program has been generally successful in collecting a representative sample of broodstock from the natural JCL Creek summer chum population, and increasing adult return levels above the post population decline (1988-91) average escapement of 88 fish. Supplementation program-origin fish comprised 85% of the total adult return of 446 fish in 2003, and 63% of the total adult return of 1,662 fish in 2004 (WDFW and PNPTT 2005 data). Consistent with the standards set in the SCSCI and HGMP, the expected duration of the program is a maximum of 12 years (3 generations) beginning with brood year 1999. The Co-managers will monitor the adult returns from fry released from the supplementation program. The Jimmycomelately Creek supplementation project has addressed the program objectives described in section 3.2.3.4 of the SCSCI.

BIG QUILCENE RIVER

A supplementation program on the Big Quilcene River was started in 1992, in response to the critical condition of the Quilcene stock, and to take advantage of a year expected to be relatively strong in the Hood Canal summer chum return cycle. The program is operated by the US Fish and Wildlife Service (USFWS) at the Quilcene National Fish Hatchery (QNFH). It is apparent that the Big Quilcene supplementation project has contributed to increased returns observed for this stock. The Quilcene program contributed eggs and fry to support the re-introduction program for summer chum at Big Beef Creek from 1996 through 2000.

High levels of adult returns appear to be associated with the supplementation program. In fact, escapement of the Big/Little Quilcene stock has exceeded the

escapement criterion for program reduction. The criterion is that the annual total of hatchery-origin and natural-origin escapement exceeds the mean 1974-1978 escapement for four consecutive years (see section 3.2.2.b of the SCSCI). The Big/Little Quilcene mean escapement for 1974 through 1978 is 2,607 spawners. Annual escapement exceeded that level every year, beginning in 1995, the first year of adult returns from the supplementation project. The Co-managers agreed to reduce the program production target to 300,000 fed fry for brood year 2002 and then to 250,000 fed fry for brood year 2003. Consistent with the standards set in the SCSCI and HGMP, the intended maximum duration of the program was 12 years (3 generations) beginning with brood year 1992. Accordingly, the program has been terminated and the last brood year of the Big Quilcene River program was 2003 (released in 2004, with last returns of supplementation program expected in 2006-08 as three, four and five year old adults).

BIG BEEF CREEK

The Big Beef Creek project began with brood year 1996 when eggs of Quilcene stock were transferred from Quilcene National Fish Hatchery (QNFH) to Big Beef Creek to initiate and support the reintroduction of a summer chum population there.

The Big Beef Creek summer chum reintroduction program has generally been successful in collecting a representative sample of brood stock from the Quilcene River summer chum population (1996-2000) and from Big Beef Creek returns (2001-2002). It is still early to judge the success of adult returns, but the numbers of summer chum adults that returned during 2001-2004 was encouraging, with from 730 to 1,742 fish escaping to spawn. The Co-managers will continue to monitor the adult returns. Consistent with the standards set in the SCSCI and HGMP, the expected duration of the program is a maximum of 12 years (3 generations) beginning with brood year 1996 (scheduled to end in 2008). The Big Beef reintroduction project has addressed the program objectives described in section 3.2.3.4 of the SCSCI during 1999 and 2000 (WDFW and PNPTT 2001) and again during 2001 and 2002. However, no study has been implemented to identify and compare wild and hatchery origin chum spawner productivity, and survival from out-migration to adult return. In compliance with planned research objectives for the program, NMFS, in cooperation with the co-managers, has initiated a study comparing the productivity of hatchery and natural-origin summer chum spawners using the Big Beef Creek spawning channel. This study includes a comparison of relative survival of the progeny of hatchery and natural-origin summer chum salmon to adult return to Big Beef Creek.

SALMON CREEK

The supplementation program, begun on Salmon Creek in 1992, was originally conceived with the objectives to rebuild and stabilize the Salmon Creek population, and to allow for the transfer of surplus eggs or fry to reintroduce summer chum to Chimacum Creek. The program reached its 12 year operational limit in 2003, and was terminated after summer chum fry releases from that brood year in Spring, 2004. When the program was initially implemented by Wild Olympic Salmon and WDFW, it was recognized that concurrent restoration of degraded natural habitat was required to accommodate enhanced adult returns, and to meet the goal of rebuilding a viable natural summer chum salmon population in the watershed that would remain self-sustaining after the supplementation program was terminated. An expansive habitat restoration project in the lower flood-plain re-established natural meander characteristics of the once-channelized lower creek in 2003, and natural and program-origin summer chum spawners used the restored area heavily for spawning in 2004. Redirection of a displaced upper tributary (Houck Creek) into its original channel in 2003 met the objective of substantially decreased sediment loads adversely affecting summer chum egg and fry survival in downstream spawning areas.

The Salmon Creek supplementation program has resulted in substantial increases in the total number of summer chum salmon adults returning to spawn in the watershed. The average escapement to the watershed has been increased from 283 fish for the four years prior to the commencement of the program (1989-92) to an annual average of 5,303 fish for the most recent four years (2001-2004). Natural-origin summer chum returns have also been increased, with escapements ranging from 1,570 to 2,025 fish, or an annual average of 65% of the total return over the last four years. Although it appears that impacts to natural processes in freshwater and/or estuarine habitats have likely limited natural summer chum production in the stream in some years, habitat restoration actions implemented in recent years are expected to improve survival and productivity conditions for natural fish. In addition to its substantial contribution to the summer chum adult return to Salmon Creek, the hatchery program also succeeded in providing seed stock for reintroduction of a summer chum return in Chimacum Creek. Adult returns to Chimacum Creek have been re-established to the point that transfers of Salmon Creek stock were no longer necessary beginning in 2004. The Salmon Creek supplementation project has addressed the program objectives described in section 3.2.3.4 of the SCSCI. Commensurate with the summer chum salmon reintroduction program, North Olympic Salmon Coalition, Wild Olympic Salmon, Jefferson County, and WDFW implemented habitat restoration projects designed to remedy major sediment input and lower channel degradation factors. These restoration actions were designed to improve prospects for the survival and productivity of naturally spawning summer chum salmon produced through the hatchery effort.

CHIMACUM CREEK

Chimacum Creek supported an indigenous summer chum population until the mid-1980s, when a combination of habitat degradation and poaching evidently led to its demise (WDFW and PNPTT 2000). In 1992, Wild Olympic Salmon initiated a project to boost the number of summer chum in the Salmon Creek stock so it could be used as a donor stock to reintroduce summer chum into Chimacum Creek. Beginning with brood year 1996, eyed eggs from the Salmon Creek broodstock were transferred to, and released from, Chimacum Creek hatchery facilities, to reintroduce summer chum to formerly occupied habitat.

It appears that the Chimacum Creek summer chum reintroduction program has generally been successful in collecting a representative sample of broodstock from the natural Salmon Creek summer chum population. It also appears successful in contributing to the return of adult summer chum to Chimacum Creek. Brood year 2001 and 2002 fry were successfully reared in the freshwater and saltwater facilities and released during March, April and May. Since 2000, the program generally met the production targets for number, size, and date of fry released. There has been no significant mortality to unknown causes. And, fish health condition of fry prior to release has been good. Total adult returns to Chimacum Creek from 2001 to 2004 ranged from 558 to 1,139 fish, and averaged 866 fish. Of the total spawner escapement over this period, an annual average of 383 fish, or 44% of the total, were natural-origin summer chum salmon established through the reintroduction program as returns to the creek. Consistent with the standards set in the SCSCI and HGMP for the program, the expected duration of the program is a maximum of 12 years (3 generations) beginning with brood year 1996. Substantial adult return levels to the creek, and data showing that the reintroduction program had led to the production, return, and spawning of natural-origin adult fish that were the progeny of naturally spawning hatchery fish, drove the decision to terminate the reintroduction program in 2004, well in advance of the 12 year duration limit. The Co-managers will continue to monitor annual adult returns to Chimacum Creek, including natural and hatchery-origin fish contribution levels. The Chimacum Creek reintroduction project has addressed the program objectives described in section 3.2.3.4 of the SCSCI.

UNION RIVER

The Union River supplementation program is a cooperative effort between the HCSEG and WDFW and was initiated in brood year 2000. The goal is to reintroduce and restore a healthy, natural, self-sustaining population of summer chum in the Tahuya River. The strategy is to boost the abundance of the Union River population to allow for transfers of surplus fish for a reintroduction of summer chum on the Tahuya River using Union River stock. The

supplementation program, its goal, objectives, and guidelines are consistent with the SCSCI. Based on an increased abundance of adult returns in recent years (2001-2004 average of 5,064 adults) relative to post population decline years (1988-91 average of 391 adults), and indications that the supplementation program had successfully bolstered total return levels (2003-04 average return of 3,183 hatchery adults), the decision was made to terminate supplementation program fry releases into the Union River beginning in 2004.

It appears that the Union River summer chum supplementation program was generally successful in collecting a representative sample of broodstock from the natural Union River summer chum population. The Union River supplementation project has addressed the program objectives described in section 3.2.3.4 of the SCSCI. The phase of the project to reintroduce summer chum into the Tahuya River began with brood year 2003 (releases to the Tahuya River started in 2004).

TAHUYA RIVER

Reintroduction of summer chum from the Union River into the Tahuya River began with brood year 2003 (releases to the Tahuya River started in 2004). Following is a summary of the Tahuya situation from WDFW and PNPTT (2000).

The current level of observed escapements in the Tahuya River are not indicative of the existence of a self-sustaining summer chum population. Production historically depended on wild spawners only, and no hatchery programs using summer chum were implemented in the watershed. The following are objectives for using supplementation to reintroduce summer chum to the Tahuya River in future years (beginning in 2004):

Objective 1: Transfer southern Hood Canal-origin (Union River) eyed eggs from an appropriate stock for incubation, rearing and release of fry into the historical habitat of the Tahuya River population. Monitor adult returns resulting from the initial releases and assess the natural spawning success of these adults, where success is measured by return of the naturally produced adult offspring.

Objective 2: Determine if a self-sustaining, viable population has been established through the reintroduction program. If return levels are below desired recovery levels after an indigenous population has been established, use it as broodstock to supplant transfers, fostering local adaptation. If a self-sustaining population is successfully established, the population will represent a range extension of the donor southern Hood Canal stock.

5.3. Summary of Hatchery and Genetic Management Plan Conclusions

WDFW and USFWS prepared HGMPs for each of the summer chum salmon supplementation and reintroduction programs in the eastern Strait of Juan de Fuca and Hood Canal areas (as per WDFW and PNPTT 2000). NMFS approved

the HGMPs in 2002 (NMFS 2002). Supported by information provided in the SCSCI, each HGMP provides a thorough description of each hatchery operation, including the facilities used, methods employed to propagate and release fish, measures of performance, status of ESA-listed stocks that may be affected by the program, anticipated listed fish take levels, and descriptions of risk minimization measures applied to safeguard listed fish. Much of the information in the HGMPs was derived from the SCSCI. The HGMPs were approved in 2002 by NMFS under Limit 5 of the ESA 4(d) Rule for a 12-year period (WDFW and PNPTT 2003). HGMPs for the summer chum salmon can be found at http://www.nwr.noaa.gov/1hgmp/approved/HC_QandA.htm, http://www.nwr.noaa.gov/1hgmp/HGMPAppr.htm, and more information can be found in Federal Register (2001a). Additional information regarding the ESU standing of the hatchery summer chum salmon populations propagated through the HGMPs and their impacts to ESU viability can be found on the NMFS Northwest region website at: http://www.nwr.noaa.gov/1srd/Prop_Determins/Inv_Effects_Rpt/index.html and in the Federal Register at: http://www.nwr.noaa.gov/reference/frn/2005/70FR37160.pdf"

5.4. Summary of NMFS Biological Opinion Conclusions

Addressing the ESA section 4(d) limit 5, NMFS, in a biological opinion (Consultation Number F/NWR/1999/01863) dated March 4, 2002, concluded that operation of the artificial propagation programs as described in the co-managers SCSCI (WDFW and PNPTT 2000) is not likely to:

(1) jeopardize the continued existence of threatened Hood Canal summer chum salmon or Puget Sound chinook salmon, or
(2) result in the destruction or adverse modification of these species' designated critical habitat, or
(3) adversely affect the designated essential fish habitat.

In arriving at these conclusions, NMFS considered the best available scientific and commercial information, as well as comments from the Northwest Fisheries Science Center - NMFS, and other Federal and non-Federal technical experts and resource managers in the Northwest Region (NMFS 2002).

5.5. Summary of Hatchery Scientific Review Group Conclusions

In 1999, in response to a request from Washington State's Congressional representatives, a group of leading scientists presented its recommendations to the US Congress in a report entitled *The Reform of Salmon and Steelhead Hatcheries in Puget Sound and Coastal Washington to Recover Natural Stocks While Providing Fisheries*. The report determined that the potential exists for hatcheries to provide benefits to the recovery of naturally spawning salmon. The report called for a comprehensive hatchery reform effort to conserve indigenous genetic resources; assist with the recovery of naturally spawning populations; provide for sustainable fisheries; conduct scientific research; and improve the quality and cost-effectiveness of hatchery programs. The effort was to be led by an independent panel of scientists called the Hatchery Scientific Review Group (HSRG). The role of independent science in the Hatchery Reform Project is to advise fishery managers, agency scientists, legislators, and the public about the benefits and risks of alternative actions that could be undertaken to meet goals for salmonid resources, including the consequences of inaction (HSRG 2004).

Recommendations and comments from the HSRG include:

- Continue the existing program consistent with the Summer Chum Salmon Conservation Initiative (SCSCI), including collecting and analyzing all data necessary to evaluate the program's success.

- The SCSCI is a well-designed, well-conducted program that appears to be achieving its goals. It is an example of a successful conservation program and partnership among state, tribal, private, and federal entities.

- The program, which may serve as a prototype for similar efforts in the future, has met the HSRG's first key principle of beginning with a solid goal setting process. Ensuring complete monitoring and evaluation of this program will be crucial to meeting the second and third principles—scientific defensibility and informed decision-making.

- Like all integrated hatchery programs, success will depend on good habitat being available to both the hatchery, and natural-origin, components of the integrated population (see HSRG system-wide recommendation about productive habitat).

The co-managers responded (from HSRG 2004) by saying, "The co-managers appreciate the HSRG comments in support of the SCSCI and support the recommendations of the HSRG. The co-managers agree that collecting and analyzing data is necessary to evaluate the program; however, additional funding will be needed to fully implement the monitoring and evaluation work described in the SCSCI. For example, critical objectives of the SCSCI include the monitoring and evaluation of the effects of reintroduction and supplementation on the natural summer chum populations and of the effectiveness of the programs in recovering summer chum. Monitoring and evaluation of the supplementation and reintroduction programs is ongoing by the co-managers and cooperators. However, dedicated funding is not currently available for the analysis of all otolith and DNA samples collected from summer chum adults returning to streams in the Hood Canal ESU. Some funding has been provided by the Regional Fish Enhancement Groups (HCSEG and NOSC), the Port Gamble S'Klallam and Skokomish tribes (BIA Salmon Recovery funds), and by WDFW (ESA Salmon Recovery funds). However, these sources of funds are not totally secure and additional funding is needed."

5.6. Adaptive Management Expectations

WDFW and PNPTT (2000) anticipate that as supplementation programs progress, and additional data and information is gathered, adjustments to the approach might be necessary. In particular, it is necessary to determine when to terminate the supplementation program or, at the least, institute major modifications. To that end, the co-managers developed an adaptive management approach, which is described in detail in SCSCI section 3.2.2.2. The following standards are applied to determine when a supplementation program is to be terminated or modified:

- The maximum duration of regional supplementation programs will be based on criteria that minimize the likelihood that potentially deleterious genetic changes occur in the wild population.

- If adult return targets are met before the three maximum generation limit is reached, then the program may be reconsidered, and may be reduced or terminated.

- Supplementation and reintroduction programs may be terminated if they are no longer believed to be necessary for timely recovery, for reasons other than the success of supplementation or reintroduction, including improvements in ocean survival or habitat condition.

- The supplementation program will be modified or terminated if appreciable genetic or ecological differences between hatchery and wild fish have emerged during the recovery program.

- The supplementation program will be modified or terminated if there is evidence that the program is impeding recovery.

- The supplementation and reintroduction programs will be modified or terminated if there is evidence that the program is negatively impacting a non-target ESA-listed population.

Monitoring and evaluating the effects of supplementation on the natural summer chum population, and the performance of the overall program in effecting the recovery of summer chum, are critical objectives of this SRP. The basic approach to monitoring and evaluation will be to collect information that will assist in determining: 1) the degree of success of each project; 2) if a project is unsuccessful, why it was unsuccessful; 3) what measures can be implemented to adjust a program that is not meeting objectives set forth for the project, and; 4) when to stop a supplementation project. SCSCI section 3.2.2.4 (WDFW and PNPTT 2000) describes the details of a monitoring program for the supplementation projects and is fully endorsed by this SRP.

5.7. Hatchery Program Integration with Harvest Management Actions

The Co-managers have been applying specific measures to protect natural and hatchery-origin Hood Canal summer chum salmon populations from significant fisheries harvest impacts since 1992. Following on this protective approach, beginning in 1999 and as described in the SCSCI, the Co-managers implemented a comprehensive harvest management regime, referred to as the Base Conservation Regime (BCR), designed to protect and rebuild summer chum salmon populations in the region. This approach is more fully described in Section 4 of the SCP. NMFS approved the BCR approach in 2003 under the ESA 4(d) Rule limit 6 (NMFS 2003b). Under the BCR, summer chum salmon may only be caught incidentally in salmon fisheries targeting other, more abundant and healthy populations. Most of these fisheries require the non-retention of summer chum salmon. This harvest management approach applies

to all salmon fisheries which impact listed Hood Canal summer chum salmon, including Canadian salmon fisheries.

The BCR is implemented to protect natural and hatchery-origin summer chum salmon, ensuring that the vast majority of these fish escape to spawn naturally, or return to broodstock collections locations for use in supplementation and reintroduction programs. The harvest approach is fully integrated with the supplementation and reintroduction strategy implemented in the region, as it is designed to deliver nearly all summer chum salmon adults produced naturally and by hatcheries to their watershed of origin, fully complementing the population preservation and restoration intent of the hatchery programs.

5.8. Summary of Hatchery Programs Producing Other Salmon Species

The Co-managers have also implemented conservation measures in state, tribal and federal hatchery operations producing other salmon species within the ESU geographic area. These measures, fully described in the SCSCI, are designed to reduce the risk of harm to summer chum salmon survival and productivity associated with the “non-summer chum” hatchery operations and resultant fish releases (WDFW and PNPTT 2000). Operation of these other salmon hatchery programs in the region will lead to the average annual liberation of approximately 6.7 million fall chinook salmon juveniles, 0.4 million early run chinook salmon, 1.8 million coho; 0.5 million pink salmon; 25.0 million fall chum salmon; and 1,700 steelhead. The programs producing the fish apply broodstock capture, fish culture, and juvenile fish release measures based on best management practices that reduce the risk of injury and mortality, and the risk of adverse ecological and genetic effects, to summer chum salmon. Important juvenile fish release measures include: the delay in releases of hatchery yearling salmon smolts until after April 15 each year to limit the risk of predation to March-emigrating summer chum fry in freshwater and estuarine areas; and, reduction of the risk of food resource competition effects to emigrating summer chum juveniles in estuarine and marine areas through a delay in annual releases of all fall chum and pink salmon fry from hatcheries in the region until after April 1. Monitoring and evaluation programs are conducted to assess potential ecological interactions with summer chum salmon juveniles and adults. Broodstock collection operations are evaluated annually to determine effects on summer chum salmon resulting from the removal of hatchery salmon adults.

6. HABITAT IMPACTS TO SUMMER CHUM SALMON

6.1. Introduction

This section provides a summary of the overall habitat conditions as they have been determined to affect summer chum salmon recovery. Details of specific habitat conditions will be found in the subsequent sections 7-12 of this Salmon Recovery Plan (SRP). Those sections are devoted to individual conservation units. Section 6 gives a brief overview of general habitat conditions throughout the ESU and discusses particular habitat issues that will need to be addressed to affect summer chum recovery.

Diversity of summer chum salmon is controlled by genetics and habitat. That diversity is manifested by variations in geographic distribution, behavior, morphology and other characteristics. It is reflected in the number and distribution of stocks, and in the expression of multiple life history pathways accommodated by habitat condition. The SRP contends that diversity has decreased, owing to the loss and reduced quality of habitat. Diversity has also been diminished by the recent population declines of summer chum salmon, primarily through the extinction of stocks (see Summer Chum Salmon Conservation Initiative {SCSCI} section 1.7.2), but also potentially by the reduced size of populations. Population size reduction, from historical levels, may have resulted in a decreased distribution within watersheds and nearshore areas. And, this reduction in the range of habitats used may have also decreased the currently available life history pathways. The risk of losing genetic diversity also increases with smaller population sizes.[26]

6.2. Conceptual Life History Of Hood Canal/Eastern Strait Of Juan De Fuca Summer Chum Salmon

Understanding habitat conditions, that are necessary for the persistence and survival of summer chum salmon, necessitates understanding the life history of summer chum salmon. Distribution of the fish, and the life history strategies for both the freshwater and marine phases, can allow a focus for habitat managers. They can determine effective recovery actions, both in terms of location of those recovery actions, and timing of when to effectively implement the actions. Much has been written regarding the life history of Pacific salmon in general, and chum salmon in particular. While much of the information is specific to summer chum salmon, some of the descriptive material is derived from investigations of fall-timed chum salmon. SCSCI section 1.3 (Washington Department of Fish and Wildlife and Point No Point Treaty Tribes 2000) provides a summary of the life history of summer chum salmon and the reader is encouraged to review the SCSCI. SCSCI Appendix Report 3.5 (see WDFW and PNPTT 2000) provides a description of the potential estuarine landscape impacts on summer chum

[26] See McElhany, et. al. (2000) for a more in-depth discussion of diversity.

salmon. Lestelle, et. al. (2005b) provides a more recent summary of the information, much of which was derived from the SCSCI.

Summer chum salmon of Hood Canal and the Eastern Strait of Juan de Fuca are defined as those chum salmon that have an average peak of spawning before November 1 (WDFW and PNPTT 2000).

The following overview, of chum salmon distribution, biology, and life history, is excerpted from Lestelle, et. al. (2005b)[27]. It states, "Throughout their distribution in North America and Asia, chum salmon commonly exhibit both an early and late timing pattern when returning to their natal streams (Salo 1991). Early timed runs are called summer chum, while the late runs are called fall chum. In Puget Sound, the late returning populations are further distinguished as being either fall or winter runs, based on peak return timing (Johnson et al. 1997). NOAA Fisheries has designated Hood Canal and Strait of Juan de Fuca summer chum as an ESU, based on distinctive life history and genetic traits (Johnson et al. 1997). In Hood Canal, eleven streams have been identified as recently having indigenous summer chum (Ames et al. 2000): Big Quilcene River, Little Quilcene River, Dosewallips River, Duckabush River, Hama Hama River, Lilliwaup River, Union River, Tahuya River, Dewatto River, Anderson Creek, and Big Beef Creek. They have also been observed in small numbers on occasion in the Skokomish River in Hood Canal. In the eastern Strait, summer chum populations are recognized in Snow and Salmon creeks in Discovery Bay and Jimmycomelately Creek in Sequim Bay. They have also been reported in Chimacum Creek in Admiralty Inlet and in the Dungeness River.

"Fall chum are distributed much more extensively throughout the Puget Sound region than summer chum. They are located in the same streams where summer chum are produced. The uniqueness of summer chum in Hood Canal and the eastern Strait is best characterized by their late summer arrival to natal streams and their late winter/early spring fry migration to the estuary. Tynan (1997) provides detailed information on return and spawn timing for each population. While spawning varies somewhat between some populations, it typically occurs from late August through late October. Fry emerge from the gravel between early February and May, with peak emergence being March 22 and April 4 for Hood Canal and Strait populations respectively (Ames, et. al. 2000). In contrast, Hood Canal fall chum spawn predominantly in November and December, and fry emerge approximately one month later than summer chum, between late April and mid-May (Koski 1975; Tynan 1997). Summer chum spawn soon after freshwater entry in the lower reaches of the mainstem streams. The use of lower reaches may be an adaptation to the low flow conditions present at arrival time; September is frequently the month of lowest flow in Hood Canal streams. In Big Beef Creek, Koski (1975) reported that the native summer

[27] To view the full document, the reader is encouraged to see Appendix B of this SRP. References cited in this excerpt may be found in the Lestelle et al (2005b) document.

chum salmon population (now extinct) spawned in the lower 0.8 km of the stream, while later timed chum extended their spawning to 6.4 km of stream. Similar spatial patterns of spawning occur in other Hood Canal and Strait streams. In contrast to summer chum, fall chum spawn in side channels, tributaries, and springs, as well as in mainstem creeks and rivers. Fall chum will use reaches or streams with strong groundwater influence, if available (Salo 1991).

"Emerging during the darkness of night, chum fry immediately move downstream, likely entering the stream mouth estuary the same night of emergence within Hood Canal streams (Simenstad 2000b). Transition from freshwater to brackish and saline waters within the estuary can therefore be very brief—less than 12 hours. Emergence and fry emigration to the estuary from a single watershed likely occurs over several weeks, similar to emergence patterns seen for other salmonids. Instream feeding during migration by chum in general is probably insignificant except in very large rivers where spawning migrations are extensive (Simenstad 2000b). Simenstad (2000b) reported that the residence time of chum fry within larger Hood Canal natal subestuaries is likely less than one week, suggesting that it is very brief in the smallest subestuaries. He suggests that fry may be held longer in the larger, more complex subestuaries than in the small or simplified subestuaries because of the better feeding conditions and lower water velocities associated with marshes and dendritic channels. Terrestrial drift insects are often prominent in the diet of chum fry in the inner portions of subestuary deltas and along the large margins of large deltas (Congleton 1979; Mason 1974; Simenstad 2000b). Small subestuaries and tidal marshes appear to be stopover sites for chum fry migrating along the nearshore corridor, moving in with the tide and utilizing both terrestrial and marine based food webs, before moving out again on the receding tide (Mason 1974; Hirschi, et. al. 2003). This pattern of utilization has been observed for chum salmon within Hood Canal (Hirschi, et. al. 2003).

"Upon departing the natal subestuary, chum fry inhabit shallow nearshore areas. For the first few weeks of estuarine life, they have been observed in the top 2-3 centimeters of surface waters and extremely close to shore. A description of early life in waters of Hood Canal is useful here. Ames, et. al. 2000, says that Chum fry arriving in the Hood Canal estuary are initially widely dispersed (Bax 1982), but form loose aggregations oriented to the shoreline within a few days (Schreiner 1977, Bax 1983, Whitmus, 1985). These aggregations occur in daylight hours only, and tend to break up after dark (Feller 1974), regrouping nearshore at dawn the following morning (Schreiner 1977, Bax 1983). Bax et al. (1978) report that chum fry at this initial stage of out-migration use areas predominantly close to shore. Early run chum fry in Hood Canal (defined as chum juveniles migrating during February and March) usually occupy sublittoral seagrass beds with residence time of about one week (Wissmar and Simenstad 1980). Schreiner (1977) reports that Hood Canal chum maintain a nearshore distribution until they reach a size of 45-50 mm, at which time they move to

deeper offshore areas. "Within the nearshore corridors, chum fry feed primarily on small crustaceans, such as harpacticoid copepods, and other epibenthic invertebrates, such as small gammarid amphipods (Kaczynski et al. 1973; Healey 1979; Simenstad et al. 1982). Simenstad (2000b) states that their diet is "surprisingly specific", targeting two or three species of harpacticoid copepods (i.e., Harpacticus uniremis and Tisbe sp.). He states that extremely high densities of these organisms often occur in eelgrass beds. This high selectivity for specific copepod species has been found within estuaries between Washington and Alaska (Salo 1991). The period of estuarine residence appears to be the most critical phase in the life history of chum salmon, having a major role in determining the size of the subsequent adult run (Johnson, et. al. 1997). Chum salmon are considered second only to Chinook salmon in dependence upon estuarine waters (Salo 1991). Upon reaching a threshold size, summer chum juveniles entering Hood Canal and Strait of Juan de Fuca estuarine waters appear to begin their migration seaward quite rapidly, with little delay (Tynan 1997). This rapid seaward movement may reflect either "active" migration in response to low food availability or predator avoidance, or "passive" migration, brought on by strong prevailing south/southwest weather systems that accelerate surface flows and move migrating fry northward (WDFW and PNPTT 2000). The southernmost Hood Canal summer chum emigrating fry population may exit the Canal in about two weeks after entering seawater. Summer chum salmon juveniles likely migrate in schools northward along the Hood Canal shoreline and then westward adjacent to the Strait of Juan de Fuca shoreline to reach Pacific Ocean rearing areas.[28]

Based on our understanding of summer chum salmon life history, the SRP will initially focus on those areas that most directly affect survival and persistence of the existing populations, the freshwater habitats (typically lower river spawning areas), and the immediate marine nearshore environs.[29]

6.3. Overview of Habitat Impacts

Three primary factors have combined to cause the decline of summer chum salmon in both Hood Canal and Strait of Juan de Fuca streams (WDFW and PNPTT 2000). They are: 1) climate related changes in stream flow patterns; 2) fishery exploitation, and 3) habitat loss. An unusual feature of the declines is that the summer chum salmon of the two regions (Hood Canal and Eastern Strait of Juan de Fuca) have been affected by similar factors; but the declines have occurred ten years apart (WDFW and PNPTT 2000). The summer chum salmon of both regions have experienced concurrent changes in critical stream flows and

[28] The SCSCI (WDFW and PNPTT 2000) provides a more detailed description of this life history behavior for summer chum salmon juveniles including references to various studies and researchers that have explored these topics. The reader is encouraged to review the SCSCI for more details.
[29] Section 3 of the SRP provides more specific information regarding the schemes the SRP is using to determine the sequence and prioritization for recovery and management actions.

increased fishery exploitation rates. While section 6.3 will focus on region-wide habitat impacts, individual stocks may have been differentially impacted by specific, identified factors for decline. More detailed assessments at the stock, watershed, and conservation unit level are presented in the SRP sections 7-12.

6.3.1. Climate Change and Fishery Exploitation

The long-term loss of habitat productivity and capacity will impact summer chum salmon by lowering survival rates (population resiliency) and reducing potential population size. When Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon began to experience the added pressures from climate change and new fishery exploitation, the populations collapsed. In 1979, summer chum run sizes and subsequent escapements were very low because of the effects of unfavorable stream flows on the 1975 and 1976 brood production (WDFW and PNPTT 2000). This poor performance was evident in chum salmon stocks statewide. The summer chum populations of Hood Canal (with the exception of Union River) were the only chum stocks that did not immediately recover from the low return levels of 1979 (WDFW and PNPTT 2000). WDFW and PNPTT (2000) discusses the potential impacts from climate change and particularly, the possible impacts to stream flows during spawning and incubation (see SCSCI section 2.2.2.4). The co-managers further conclude, however, that "[A]ny analysis of climate change in relation to stream flow and the decline of summer chum salmon populations cannot be isolated from human-caused habitat alterations."

Human induced changes and impacts to Hood Canal/Strait of Juan de Fuca stream ecosystems have potentially diminished the natural resiliency of summer chum salmon habitat, rendering populations more vulnerable to climate shifts. Climate shifts like those observed in the past 30 years, with their associated stream flow changes, likely have posed little threat to summer chum populations before the cumulative effects of habitat changes from human development became manifest. Summer chum salmon persisted long before significant human development.

Net fisheries in Hood Canal, when combined with pre-terminal harvests, began to impose high exploitation rates on summer chum salmon in 1980, contributing to low escapements through the 1980s (see SRP section 4). At the same time, oceanic climate changes influenced regional weather patterns, resulting in unfavorable stream flows during the summer chum salmon egg incubation seasons. Spawning flows also dropped substantially in 1986 (likely climate related), and contributed to the continuing poor status of these stocks. The current low production of Hood Canal summer chum salmon appears to be the result of the combined effects of lower survivals caused by habitat degradation, climate, increases in fishery exploitation rates, and the impacts associated with the releases of hatchery salmonids (WDFW and PNPTT 2000).

The pattern of decline of summer chum salmon in Strait of Juan de Fuca streams was similar to the Hood Canal experience, however, the drop in escapements occurred ten years later, in 1989 (WDFW and PNPTT 2000). The impact of habitat alteration likely had similar negative impacts on stock survivals and resiliency. Eastern Strait of Juan de Fuca summer chum stocks were also affected by a coincidental concurrence of changes in stream flows and exploitation rates. Regional stream flows during the spawning season dropped substantially in 1986, and likely contributed to lower returns beginning in 1989 (WDFW and PNPTT 2000). There were no terminal area harvests of summer chum salmon in this region, however, these fish were harvested in pre-terminal fisheries for other salmon species. In 1989, the pre-terminal exploitation rates increased substantially, reducing the numbers of summer chum salmon escaping to Strait of Juan de Fuca streams (WDFW and PNPTT 2000). The combined effects of reductions in habitat quality, stream flows, and fishery exploitation resulted in low summer chum salmon production in the region.

6.3.2. Habitat Loss and Degradation

Summer chum populations rely on a complex mix of different habitat types, in different seasons, during their various life stages. Spawning and egg incubation occur in freshwater; juveniles rear and find refuge in estuarine deltas and nearshore areas; feeding and growth of adults takes place in the open ocean. Ample, high quality habitat is critical to the recovery of summer chum salmon populations in the Hood Canal and Eastern Strait of Juan de Fuca. Recovery efforts and actions must consider habitat quality and quantity, the fishes' life history diversity, and its population resiliency. The approach of this SRP is to provide for the habitat requirements of each life stage (including adult migration, spawning, incubation and emergence, rearing, and juvenile migration), and for overall life history diversity, to ensure the survival and persistence of summer chum salmon throughout the ESU geographic area.

WDFW and PNPTT (2000) state that survival during the freshwater life history stages is linked to a number of habitat parameters. Those include water quantity (low and peak flows), water quality (primarily temperature), riparian forest conditions (width of riparian forest, age of trees, species composition), sediment conditions (aggradation, degradation, presence of fines), channel complexity (large woody debris quantities, channel condition, amount of side channel habitat), access to habitat, and presence of predators. Most factors are interrelated, as a change in one parameter typically manifests itself in changes to other parameters. For example, reduced channel complexity is closely correlated with high rates of sediment transport and deposition, as well as reduced channel interaction with the associated floodplain.

Survival during adult migration and spawning is largely a result of interactive processes between recruitment of suitable sized gravel, adequate stream flow, water temperature, and channel complexity such as the presence of large woody

debris to create holding pools and provide cover from predators. Conditions conducive to successful egg incubation and rearing include: 1) the presence of adequate large woody debris (LWD) to reduce scour of incubating eggs and moderate peak winter flow velocities; 2) the absence of excessive fines within spawning gravel; 3) stable channel configuration, and; 4) access to floodplain and offchannel areas. The excavation of redds by spawning adults may also contribute to streambed surface coarsening and sorting, and thereby reduce scour of incubating salmon embryos during winter high flow events. Processes within the freshwater environment can also influence the condition of subestuarine and nearshore environments. Hydrologic regimes, as well as transport and supply of LWD, sediment, and nutrients from watersheds, have a direct impact on both the quantity and quality of subestuarine and nearshore habitats used by summer chum (WDFW and PNPTT 2000).

Critical rearing and transition environments for summer chum salmon exist in the multitude of subestuary deltas of Hood Canal and the eastern Strait of Juan de Fuca. These areas support a diversity of habitats including tidal channels, mudflats, marshes and eelgrass beds. WDFW and PNPTT (2000) further states, "The importance of subestuaries for summer chum is linked to the placement of diverse, productive habitats in areas where summer chum fry are making dramatic transitions in physiology, feeding, and predator avoidance strategies. Diffuse networks of distributary channels allow fry migrating down rivers to access shallow-water wetlands such as tidal freshwater sloughs and salt marshes. In salt marshes, complex, branching networks of tidal channels serve as opportune feeding areas, as well as refugia from predators and migratory corridors linking the marsh to riverine and marine realms as well as other estuarine habitats. Juvenile chum salmon feed on invertebrate prey that depends on detritus. Marshes, mudflats, and riparian forests supply detritus to tidal channels, algal mats, and eelgrass meadows where summer chum and their invertebrate prey concentrate. Tidal channel and subtidal habitats provide resting and hiding places for summer chum, and expand salinity gradients to ease fish transition between fresh- and saltwater. The seasonal pulse in production of shallow-water invertebrate prey in subestuaries is thought to be an important resource for juvenile chum salmon entering marine waters and emigrating in April and May. Their use of subestuaries during the springtime period when productivity is increasing enables them to grow quickly and attain a large size to help them escape predation once they begin their migration through the open, deepwater of Hood Canal and Strait of Juan de Fuca. Earlier-migrating (February-March) summer chum salmon juveniles may benefit less from these areas, as available information indicates that their subestuary residence time, and growth accrued in those areas, is less than the residence time and growth observed for fall chum salmon juveniles (Tynan 1997)."

Understanding impacts to habitat requires an understanding of how summer chum salmon life history is linked to particular habitats and the ecological processes that sustain these habitats. SCSCI section 3.4.2 (WDFW and PNPTT

2000) provides more details regarding the ecological context of habitats and summer chum salmon survival and persistence. In general, the SRP focuses on the habitat factors that have been identified as contributing to the decline of summer chum salmon. These are listed in Table 6.1.

Table 6.1. Significant habitat factors that contribute to the decline of summer chum salmon in Hood Canal and the eastern Strait of Juan de Fuca (modified from WDFW and PNPTT 2000).

Habitat factors for decline	Life stage most affected	Impacts
Loss of channel complexity (large woody debris, channel condition, loss of side channel, channel instability)	Spawning and incubation	-Reduced holding pool quality and availability renders adults vulnerable to predation and harassment; reduced channel complexity increases frequency and severity of redd scour -Low levels may increase redd scour, contribute to channel instability, and limit availability of adult holding pools -Increased substrate mobility resulting in redd scour and entombment or de-watering of redds -In-channel structures obstruct or impede adult passage; tidegates and dikes limit juvenile access to subestuarine rearing and feeding habitats -Floodplain and wetland loss concentrates flood flows in main channel, increases peak flow volumes, and results in increased redd scour; loss of wetlands reduce summer low flow volumes -Limits adult holding areas, and confines spawning to main channel areas where redds are prone to scour
Altered sediment dynamics	Spawning and incubation	-Suffocation of developing embryos, entombment of fry in the gravel bed, compaction and cementing of spawning beds -Channel aggradation leading to egg/fry entombment, redd dislocation
Riparian degradation	Spawning and incubation	-Removal and modification of native riparian forests increases water temperatures, reduces stability of floodplain landforms, and reduces LWD recruitment to stream channels -lack of LWD Low levels may increase redd scour, contribute to channel instability, and limit availability of adult holding pools
Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)	Juvenile rearing and migration, adult migration	-Dikes, ditches, and road causeways eliminate marsh habitats, limit tidal circulation, and reduce estuarine productivity -Bulkheads eliminate natural sediment sources and contribute to coarsening of nearshore substrates, which reduces or eliminates eelgrass habitats used by chum fry

Table 6.2, taken from Lestelle, et. al. 2005b (see Appendix B), generally describes the conclusions about the primary issues affecting chum salmon performance in the marine waters of Puget Sound, with a particular focus on Hood Canal and the eastern Strait of Juan de Fuca.

Table 6.2. Conclusions regarding the most important issues affecting chum salmon performance in marine areas within the Puget Sound region with emphasis on Hood Canal (from Lestelle, et. al. 2005b).

Issue	Conclusions	Life stages affected
Estuarine/marine survival		
Relative survival between summer and fall chum	• Hood Canal summer chum survive on average at approximately 1/3 the rate of fall chum currently • Historically, difference in survival between the races in Hood Canal was less than seen in recent decades due to more productive forage areas within the shallow nearshore zone and in interspersed subestuaries	Small fry <60 mm
Forage availability		
Prey within subestuaries	• Both terrestrial and aquatic based prey are important within subestuaries • Subestuaries are important "stop-over" feeding areas for chum fry migrating along the nearshore shoreline • Prey availability within subestuaries is related to riparian conditions within the subestuary and the lower portion of the adjoining freshwater system and to adjacent wetlands, marshes, and mudflat • Relative amounts of detrital input to subestuary systems are important to overall system productivity • Land uses within and adjoining subestuaries that result in diking or disconnecting wetlands, sloughs, and secondary channels from main channels will reduce amounts of prey • Subestuaries that have high forage availability will hold fry longer and promote rapid growth and facilitate transition to salt water	Small fry <55-60 mm
Terrestrial based prey within shallow nearshore environment	• Riparian zone of the shoreline can be an important source of prey • Land uses that remove riparian vegetation will reduce inputs of prey to the nearshore environment	Small fry <55-60 mm

Epibenthic prey within shallow nearshore environment	• Epibenthic zooplankton, particularly some species of harpacticoids, are an especially important source of food to small fry • Within year pattern of abundance can vary but generally follows a predictable pattern, peaking prior to the neritic zooplankton peak • Abundance of preferred species varies by month and tends to peak prior to peak abundance of neritic zooplankton • Abundance of preferred species is subject to being heavily cropped by juvenile chum • Eelgrass meadows are major production areas of epibenthic prey for chum fry and provide important feeding areas • Epibenthic organisms are more abundant along beaches less exposed to wave action • Forage availability in bays and segments of Hood Canal and Puget Sound is related to detrital inputs from eelgrass, marsh, and adjoining watersheds; eelgrass is the major source of detritus in many areas of Hood Canal • Migration rate of chum fry is strongly influenced by forage availability; abundant prey slows migration rate for feeding, promoting rapid growth; scare prey accelerates migration in search of preferred prey • Shift to neritic life style (associated with deep water) is accelerated by abundant epibenthic prey; shift is slowed by scarce epibenthic prey • Summer chum are not as adapted to delaying finding good forage as fall chum because of less lipid reserves due to delayed emergence from spawning beds • Shoreline development that results in deepening of existing shallow water areas, coarsening of substrates from sand or mixed-sand to cobble, and docks and piers will reduce eelgrass abundance and associated epibenthic prey production	Small fry <55-60 mm
Neritic prey within deepwater areas of Puget Sound complex (including Hood Canal and Strait of Juan de Fuca)	• Neritic zooplankton are more abundant and uniform in distribution within the inland sea/estuarine complex of Puget Sound (including SJDF) than in the open ocean • Within year pattern of abundance can vary but generally follows a predictable pattern; interannual variability in abundance pattern can have a strong effect on interannual survival of chum fry • Peak abundance tends to follow peak abundance of inshore epibenthic prey • The PDO can have a strong influence on the abundance and timing of zooplankton within the SJDF but mechanisms are complex involving ecological interactions; generally, the recent regime shift has been favorable to early marine survival of chum	Large fry (subyearlings) >55-60 mm

Neritic prey within the coastal waters of North Pacific (outside Strait of Juan de Fuca)	• The PDO can have a strong influence on the abundance and timing of zooplankton within the zone but mechanisms are complex involving ecological interactions; generally, the recent regime shift has been favorable to early marine survival of chum	Large fry (subyearlings) >55-60 mm
Current outflow velocities		
Flow velocities within subestuaries	• High flows during fry outmigration from natal streams will tend to push fry through the subestuary unless suitable refuge or slow water areas exist • Accelerated emigration out of natal subestuary by high flows is disadvantageous to fry survival because it results in sudden, abrupt changes in habitat types experienced by newly emerged fry and exposes them to greater predation risk in deep water when pushed out beyond the delta face • Land uses that accelerate spring runoff or reduce refuge sites in subestuaries from high flows will result in faster emigration rates from natal subestuaries and reduced survival	Small fry <55-60 mm
Surface outflow velocities within the nearshore zone	• Small fry will be moved out of an area faster when relatively high surface outflow velocities occur compared to when low velocities predominate • Relatively rapid, passive movement from nearshore areas will generally be unfavorable to survival because it diminishes feeding opportunities on epibenthic prey, exposing fry to a greater array of predators per unit of time; summer chum have less lipid reserves than fall chum upon entry into the nearshore environment, making them less adapted to a forced, extensive migration from an area as Hood Canal • Shoreline development that results in reduced epibenthic prey abundance will exacerbate the effects of high surface outflows on fry survival because it would diminish opportunities for forage and growth upon arrival to the nearshore environment • Surface outflow velocities in Hood Canal and southern Puget Sound vary both intra- and interannually due to variability in runoff and wind; velocities tend to be greatest in late and early spring • The relative contribution of water surface outflow velocities to diminished marine survival of Hood Canal summer chum compared to fall chum is less than the contribution of poor forage availability (based on weight of evidence considering findings both in Hood Canal and Nanaimo estuary)	Small fry <55-60 mm

Cover and structure, habitat diversity		
Subestuaries—natal and non-natal	• Complexity of channels and structure within natal subestuaries provides refuge from high flows and predators; structure in non-natal estuaries provides refuge from predators • Interspersed subestuaries and tidal marshes along the nearshore shoreline provide "stop-over" feeding sites, predator refuge, and more effective transitioning from freshwater to saltwater conditions	Small fry <55-60 mm
Shallow nearshore	• Shallow beaches provide predator refuge for small fry migrating along shoreline • Eelgrass provides habitat structure for predator refuge for small and larger fry • Kelp forests provide habitat structure for predator refuge for small and larger fry • Areas of low wave exposure and calm water provide bioenergetically preferred feeding sites • Land uses and shoreline development that steepen beaches, coarsen substrates, eliminate or reduce eelgrass or kelp will reduce the quality of the nearshore environment for small fry	Small fry <55-60 mm
Ecological interactions		
Competition – interspecific competition with wild fish	• Potential for competition for food between summer and fall chum fry is small due to timing differences in outmigrations • Potential for competition for food between summer chum and Chinook, coho, steelhead, and cutthroat populations is small due to timing differences in outmigrations and differences in habitat utilization (potential is greatest with Chinook for species listed); potential for competition between fall chum and hatchery Chinook is somewhat greater than for summer chum • Potential for competition for food between both summer and fall chum and pink salmon is high during strong pink abundance years; chum fry behavior is changed when pink are abundant	All size classes of subyearlings
Competition –with hatchery fish[30]	• Potential for competition for food between summer chum and hatchery chum can be substantial due to the possibility for very large numbers of hatchery fish • Potential for competition for food between summer chum and hatchery Chinook, coho, and steelhead is small due to timing differences in outmigrations and differences in habitat utilization (potential is greatest with Chinook for species listed) • Potential for competition for food between both summer and fall chum and hatchery pink salmon is high where large numbers of the latter are released	All size classes of subyearlings

[30] It should be noted that measures are implemented in all regional hatchery operations to delay fish releases until after the majority of summer chum have emigrated seaward. This measure reduces the likelihood for interactions, and including competition for food resources and predation, that may adversely affect summer chum salmon.

Predation on chum fry	• Potential for predation effects on chum fry by wild cutthroat, steelhead, coho, and Chinook can be high when these populations of other species are abundant; cutthroat are known to be particularly effective predators on chum fry • Potential for predation effects on chum fry by hatchery cutthroat, steelhead, coho, and Chinook can be high when hatchery releases of these other species are large • Potential for predation by seabirds, marine fish, and marine mammals is generally relatively low, though unusual concentrations of seabirds and certain species of marine fish can cause high predation	All size classes of subyearlings
Predation on chum adults	• High concentrations of marine mammals (seals, sea lions, and orcas) can cause high predation losses on schooling adult chum	Adult fish
Obstructions to access within subestuaries		
Barriers to juvenile fish passage	• Tidal gates and other impediments to free movement by juvenile chum can block access to blind channels and off-channel sites within subestuaries	Small fry <55-60 mm

6.4. Low Dissolved Oxygen and Summer Chum Salmon

Low dissolved oxygen has been shown to negatively affect freshwater salmon egg incubation and fry emergence. In contrast, little is known regarding the potential impacts on summer chum salmon from incidents of low dissolved oxygen in marine waters. Over the past several years, the marine waters of Hood Canal have been experiencing hypoxia (oxygen concentrations less than 3 mg/l) and even anoxia (oxygen concentrations less than 1 mg/l) with increasing severity, duration and extent. In addition, there have been three extreme events in the last three years. During these extreme events, there has been mortality of marine organisms, including crabs, shrimp, other invertebrates and several species of fish. There has been no documentation of mortality to salmon, either juveniles or adults.

Despite the lack of evidence of direct salmon mortality, there is a great deal of concern for sub-lethal detrimental effects on salmonids from the low dissolved oxygen conditions in Hood Canal. The range of potential effects includes physiological or behavioral effects, negative impacts from aquatic ecosystem changes, and reduction of fitness. If there are some negative impacts from the low dissolved oxygen conditions on Hood Canal Summer Chum salmon, it could contribute to further population declines, or limit recovery potential.

The potential negative effects from the low dissolved oxygen conditions on Hood Canal Summer Chum salmon have not yet been tested or demonstrated. This is an important component of the Hood Canal Dissolved Oxygen Program Integrated Assessment and Modeling Program (HCDOP-IAM). The HCDOP-IAM is monitoring, modeling and testing hypotheses to determine the causes of the

low dissolved oxygen, the potential solutions, and the ecological impacts from the condition.

Until the HCDOP-IAM, and others, have fully assessed the impacts from low dissolved oxygen conditions on salmonids in Hood Canal, there can only be supposition about the range of possible effects. Some of those possible impacts could be:

For juvenile summer chum salmon:

- Not being able to find adequate food, as the aquatic invertebrate population may be reduced from low dissolved oxygen concentrations;
- Being exposed to oxygen conditions at levels that are lower than optimal. This could cause physiological stress and reduction in overall fish health;
- Behavioral modifications to reduce exposure to low dissolved oxygen conditions might also remove the juveniles from their preferred habitat and reduce growth and fitness;
- Reduced available habitat, because of the amount of water column containing low dissolved oxygen, could increase the likelihood of mortality from predation; and
- Potential for direct mortality of migrating summer chum salmon.

For returning adult summer chum salmon could include:

- Not being able to find adequate food, as the forage fish populations may be negatively impacted by low dissolved oxygen conditions;
- Being exposed to oxygen conditions which are lower than optimal. This could add physiological stress, reduced fitness and potentially reduced fecundity;
- Reduced habitat overall, increasing competition for available food; and
- Potential for direct mortality of migrating summer chum salmon.

At this time the SRP defers to the process of the HCDOP-IAM and the HCCC's Low Dissolved Oxygen Program to address the issue of low dissolved oxygen in the hood Canal watershed.[31]

6.5. Conclusions

As reported in SRP sections *4-Harvest Impacts to Summer Chum Salmon* and *5-Hatcheries' Impacts to Summer Chum Salmon*, initial remedies to stem the decline of summer chum salmon, and augment its recovery, have included adjustments to harvest management regimes and the institution of supplementation programs. The harvest management and hatchery

[31] More information regarding the efforts directed at the Hood Canal low dissolved oxygen situation can be found at: http://www.wa.gov/hccc/water.htm

supplementation actions implemented in the region have been integrated with commensurate habitat restoration and protection activities. These habitat restoration and protection actions have been implemented reserve critical spawning, incubation, migration, and rearing habitats for use by the summer chum salmon populations benefiting from harvest protection, and produced through the supplementation programs. At the southern terminus of the range of summer-run chum salmon, these populations represent a unique and significant component of regional biological diversity worthy of full protection and recovery (Johnson et al. 1997). The distinctiveness of these populations is tied, at least in part, to the ecological setting of the Hood Canal and eastern Strait of Juan de Fuca. Further work focused on these aspects of summer chum salmon habitat is the subject of this SRP and, in particular, the following sections 7-12.

7. Eastern Strait of Juan de Fuca Conservation Unit

7.1. Introduction

The Eastern Strait of Juan de Fuca Conservation Unit includes the entire Strait of Juan de Fuca summer chum salmon independent population aggregation as designated by the Puget Sound Technical Recovery Team (PSTRT). Estuaries, the lower riverine habitat of presumed summer chum presence, and the watershed processes that contribute to habitat formation in these areas, need primary consideration in the SRP. The main stocks targeted for recovery are those originating from the Salmon/Snow Creek and Jimmycomelately Creek watersheds. Chimacum Creek summer chum are considered as a satellite area extending the main production areas of Jimmycomelately and Salmon/Snow Creeks. Chimacum Creek summer chum salmon were extinct, but a supplementation program utilizing Salmon Creek stock is has been successful in reintroducing summer chum to the watershed. Information on Dungeness River summer chum salmon distribution is not well known. Summer chum have been observed (Washington Department of Fish & Wildlife and Point No Point Treaty Tribes 2003a) and adults have been recovered at the Dungeness Hatchery located at RM 10.8 (WDFW and PNPTT 2000).

WDFW and PNPTT (2000) report that summer chum salmon originating from the Eastern Strait of Juan de Fuca Conservation Unit are likely from the Salmon/Snow Creek and Jimmycomelately watersheds. The highest density of spawners in Salmon Creek is observed at approximately river mile (RM) 0.7 with the full extent of recently observed spawning up to RM 2.0. In Snow Creek the majority of spawning occurs below RM 1.5 with spawning extending up to RM 3.0. The current upper extent of spawning in Jimmycomelately Creek is likely at RM 1.5, but historic spawning may have occurred up to RM 1.9. Spawning in Chimacum Creek likely occurs in the lower river below RM 3.0. Surveys have observed spawning between the mouth and RM 1.0 (WDFW and PNPTT 2003). During 2004 adults were observed up to the Nesses Corners Road at approximately RM 2.0 (Al Latham, personal communication 2005).

Jimmycomelately and Salmon/Snow Creek summer chum salmon stocks are considered the “core” source for the Strait population aggregation. Restoring properly functioning conditions in both the Jimmycomelately and Salmon/Snow Creek watersheds would ensure the persistence and survival of the Strait population aggregation. Chimacum Creek functions as the “satellite” area for the Strait population aggregation. Restoration and maintenance of habitat that can support summer chum salmon in this watershed is critical. Estuarine and marine nearshore areas of Discovery Bay, Sequim Bay and the Eastern Strait of Juan de Fuca provide valuable juvenile rearing and migration habitats as well as production of food resources for juveniles and adults.

May and Peterson (2003) designated RM 0.0-2.0 on Salmon Creek, RM 0.0-6.5 on Snow Creek, and RM 0.0-2.0 on Chimacum Creek as Category B refugia, defined as "primary refugia with altered ecological integrity." Salmon Creek, from the mouth to RM 0.8 is the primary spawning habitat for summer chum salmon. Small pockets of intact, forested riparian and side-channel habitat remain in this segment. Protection of these intact habitats along with restoration of some of the degraded areas is a high priority for Salmon Creek. The primary summer chum spawning habitat is found from RM 0.0 to 1.0 in Snow Creek. Restoration of this potentially productive area is considered a high priority.

Current habitat conditions and situations were assessed using a variety of sources. Several sources were used to assess the summer chum salmon stocks in the Eastern Strait of Juan de Fuca conservation unit. This Salmon Recovery Plan (SRP) will not repeat the details of these assessments, but instead refers the reader to the cited documents. All material and documents referenced in this SRP should be considered part of, and integral to, the recovery of summer chum salmon. These sources provided the primary reference and knowledge base for development of these aspects of the SRP. Details of the EDT assessments for the Eastern Strait of Juan de Fuca stocks, including a summary of the baseline performance measures, and a summary of strategic priorities, are provided in Lestelle et al, (2005a) (see Appendix A). The EDT Method is a widely used tool to help prioritize habitat restoration and protection measures for salmon populations. It provides a systematic way of diagnosing habitat conditions that have contributed to the current state of populations, and it enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits to salmon populations of actions that might be taken to address habitat related issues impeding recovery. Other detailed assessments of habitat and environmental conditions are provided in the SCSCI (WDFW and PNPTT 2000), Correa (2002), and May and Peterson (2003).

Priority action recommendations developed in this Summer Chum Salmon Recovery Plan (SRP) will focus initially on the lower 1-2 miles of river and estuarine areas. Actions in the upstream areas of the watersheds will require assessments to determine impacts and limiting factors that contribute to degradation in the lower reaches. Protection, restoration and maintenance of the Jimmycomelately and Salmon/Snow Creek watersheds are of paramount importance. In both watersheds, the lower river sections (lower 1-2 miles) and the estuaries are targeted for restoration with several projects already implemented. These areas must be restored and protected to effect and ensure recovery of the Strait population aggregation. Habitat in the Chimacum watershed will need to be restored and maintained primarily through the utilization of engineered actions including stormwater controls and a variety of instream projects as appropriate.

The Jimmycomelately summer chum population shows a high loss in performance both in abundance and productivity when compared to historic levels. Under unfavorable ocean survival conditions the loss of performance is severe. The amount of potential increase in population abundance is greatest through restoration of freshwater reaches in the Jimmycomelately watershed. Within the lower freshwater reaches of Jimmycomelately Creek, habitat diversity, channel stability, and sediment load are seen as the most important factors to restore. For the Jimmycomelately population, full restoration of estuarine-marine waters offers somewhat higher benefits than those benefits associated with the natal subestuary.[32] Restoration of the Sequim Bay (Jimmycomelately Creek empties into the head of Sequim Bay) shore will provide the best way to restore the estuarine-marine waters for the Jimmycomelately population. Within the natal subestuary, several factors are approximately equal in importance for restoration, along with the amount of area available to be used for rearing. Within the estuarine-marine environment, the most important factor for restoration is food, associated with loss of eelgrass, shoreline development, and loss of riparian corridors.

The Salmon-Snow summer chum population shows a high loss in performance compared to historic levels both in abundance and productivity, particularly under unfavorable ocean survival conditions. Potential increase in the Salmon/Snow population abundance is greatest through restoration of freshwater reaches. Full restoration of estuarine-marine waters and the natal subestuary at the mouths of both Salmon and Snow Creeks appears to offer similar levels of benefit. The Snow Creek mainstem (upstream of the subestuary) provides the greatest potential for restoration benefits within the freshwater environment. Freshwater reaches in lower Salmon Creek have the greatest strategic priority for restoration for the Salmon/Snow population (Lestelle et al 2005). Within freshwater, habitat diversity and control of sediment load are seen as the most important factors to restore. Within the natal subestuary, food and habitat diversity appear to be equally important for restoration, along with the amount of area available to be used for rearing. Potential benefits of restoring estuarine-marine areas are diffused over many segments, but the Discovery Bay shore is ranked highest among these areas. Within the estuarine-marine environment, the most important factor for restoration is food, associated with loss of eelgrass, shoreline development, and loss of riparian corridors.

Summer chum salmon in the Dungeness River are infrequently observed and their status is currently unknown. Given the size and historic diversity of the

[32] The term *subestuary* refers to the estuarine portion of a stream beginning at the upper extent of tidal influence and extending downstream to the outer edge of the delta. The *natal subestuary* would be the subestuary on the natal spawning river of a salmon population. Those waters stretching beyond the subestuaries are referred to as the *estuarine-marine* areas (see Appendix B).

watershed, it is likely that summer chum salmon production occurred in the Dungeness River. Extensive work focused on Chinook salmon is underway by the Dungeness River Management Team (DRMT) and others. The DRMT was formed in 1988 to provide a forum to resolve watershed issues. Local citizens and governmental agencies meet monthly to coordinate salmonid recovery, water quality and quantity, and flood management activities in the watershed. DRMT has served as the planning and oversight body for major watershed plans and salmonid recovery activities for the area between Jimmycomelately Creek and Siebert Creeks in east Clallam County. Activities include restoration of the estuarine and delta areas, restoration of the lower river floodplain, and restoration of riparian corridors. It is expected that work being done to provide for the persistence and survival of Chinook salmon will also benefit summer chum salmon.

7.2. Geographic Description and Human Population Distribution

The Eastern Strait of Juan de Fuca Conservation Unit includes the Dungeness River, Jimmycomelately Creek, Salmon Creek, Snow Creek, and Chimacum Creek watersheds. Also included within this unit are the marine nearshore waters stretching from the Chimacum Creek estuary along the western shore of Admiralty Inlet, Discovery Bay, Sequim Bay and ending at the Dungeness River estuary. The marine offshore waters of Admiralty Inlet and the Eastern Strait of Juan de Fuca are also included in this Conservation Unit. The Eastern portion of this unit lies in Jefferson County and includes the City of Port Townsend. The western section is within Clallam County and includes the Jamestown S'Klallam Tribal Reservation. Figure 7.1 provides a generalized map of this Conservation Unit. Major watersheds of particular significance for summer chum salmon recovery planning include; Dungeness River, Jimmycomelately Creek, Salmon Creek, Snow Creek, and Chimacum Creek. The Dungeness River watershed in Clallam County drains 270 square miles and courses for over thirty-two miles before emptying into the Strait of Juan de Fuca. Jimmycomelately Creek encompasses an area of 19 square miles and has a stream length of approximately 20 miles. The Salmon Creek watershed is 19 square miles and flows for 9 miles into Discovery Bay. Snow Creek is approximately 10 miles long and also flows into Discovery Bay near the mouth of Salmon Creek. Chimacum Creek's watershed covers approximately 37 square miles with a combined stream length of 30 miles. More detailed descriptions of each of these watersheds can be found in SCSCI Appendix 3.6 (WDFW and PNPTT 2000), the WRIA 17 habitat limiting factors report (Correa 2002), and the WRIA 17 Watershed Management Plan (WRIA 17 Planning Unit 2003).

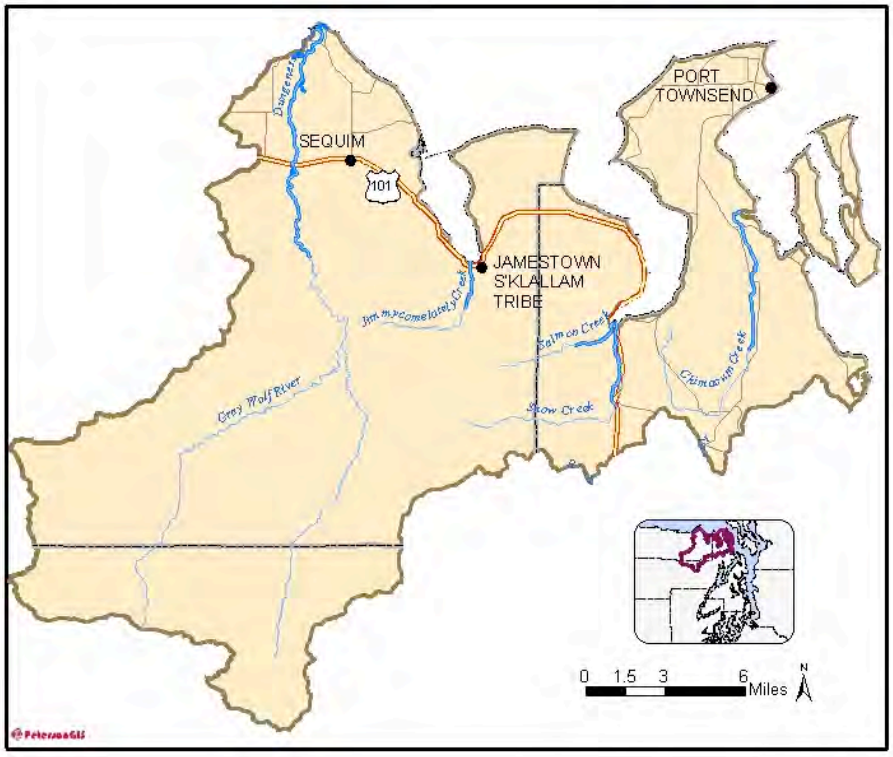


Figure 7.1. Eastern Strait of Juan de Fuca Conservation Unit. Watersheds of significant interest for summer chum salmon recovery are noted.

Human development and population centers are concentrated in the area of the Port Hadlock Urban Growth Area (lower Chimacum Creek), the City of Port Townsend, along the Eastern shore of Sequim Bay and into the Strait of Juan de Fuca and the City of Sequim in the lower Dungeness River watershed. Figure 7.2 shows the human population density within the Conservation Unit.

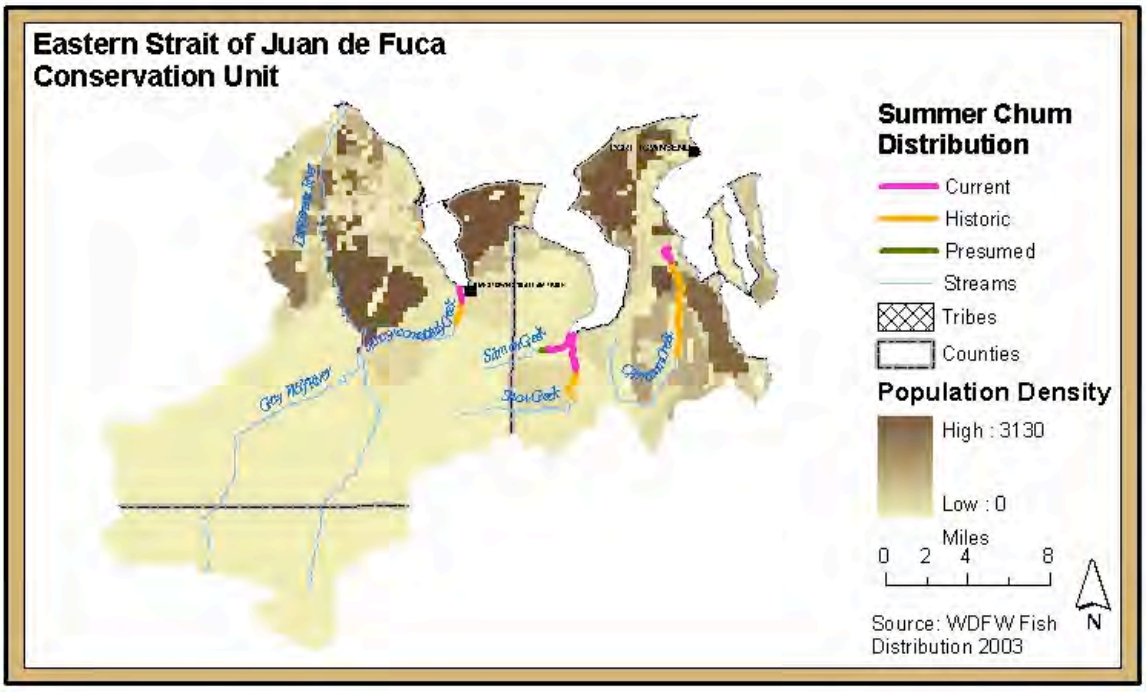


Figure 7.2. Human population density (people per square mile) and summer chum salmon freshwater distribution for the Eastern Strait of Juan de Fuca Conservation Unit.

The highest density of human population, relative to summer chum distribution, is found in lower Chimacum Creek and the lower Dungeness River. Other areas of high human population density include the marine nearshores of the northeast portions of Discovery Bay and Sequim Bay, and the area stretching south from the mouth of Chimacum Creek to Port Ludlow.

7.3. Summer Chum Salmon Stocks' Description and Distribution

The reader is urged to review the Summer Chum Salmon Conservation Initiative (WDFW and PNPTT 2000) and subsequent supplemental reports. Summer chum salmon in Hood Canal and the Eastern Strait of Juan de Fuca were also assessed based on the application of the Ecosystem Diagnostic and Treatment (EDT) Method (see Appendices A and B). The EDT Method is a widely used tool to assist in the prioritization of habitat restoration and protection measures for salmon populations. EDT provides a systematic way of diagnosing habitat conditions that have contributed to the current state of fish populations. It enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits of actions that might be taken to address salmon habitat problems (Lestelle et al 2005). The complete detailed EDT for summer chum salmon can be found at http://www.wa.gov/hccc/ and click on the Salmon Recovery Planning Activities link. Links to various documents and the EDT web site for summer

chum salmon can be found on that page. The web address for the EDT site: www.mobrand.com/edt/sponsors/show_sponsor.jsp?sponsor_id=11

Information regarding Dungeness River summer chum salmon distribution is not well known. Summer chum have been observed (WDFW and PNPTT 2003) and adults have been recovered at the Dungeness Hatchery located at RM 10.8 (WDFW and PNPTT 2000). At this time the SRP will rely on the on-going Dungeness River watershed recovery efforts for Chinook salmon. Further assessment of the status of summer chum salmon in the Dungeness watershed will be required and recommended for future efforts under this SRP.[33]

[33] More information regarding salmon recovery planning work in the Dungeness River watershed can be found in Crain (2003) and at the Dungeness River Management Team's web site: http://www.olympus.net/community/dungenesswc/index.htm.

7.3.1. Stocks' Status & Trends

Current, historic and presumed summer chum salmon distribution in the Eastern Strait of Juan de Fuca conservation unit is shown in Figure 7.3.

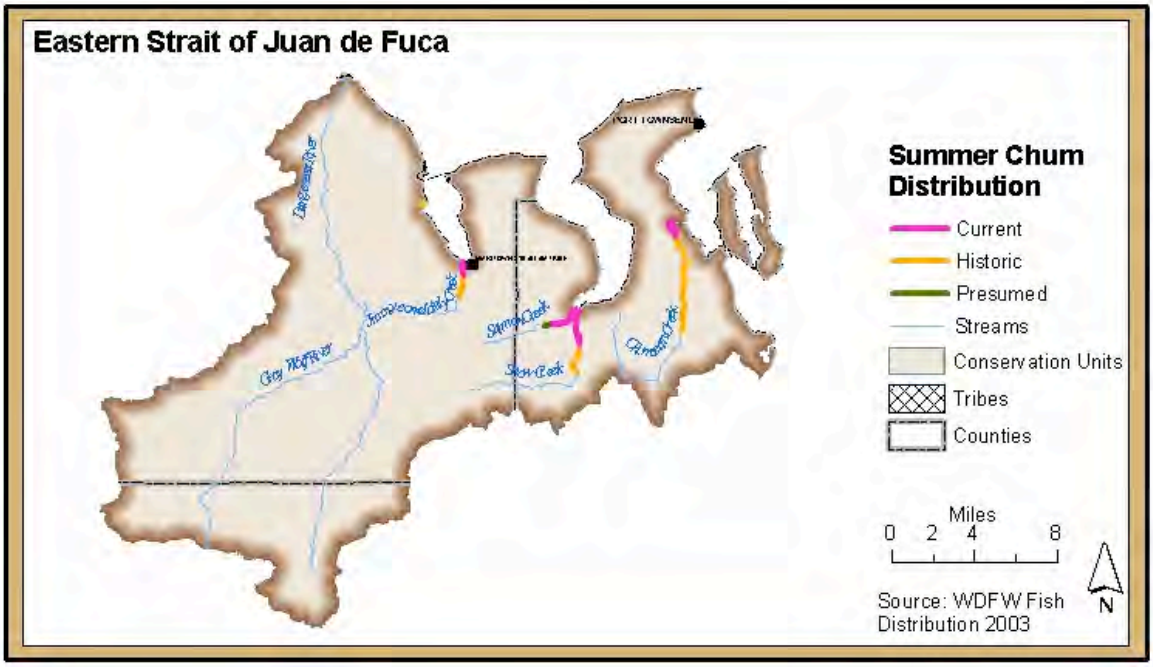


Figure 7.3. Map of the Eastern Strait of Juan de Fuca Conservation Unit showing current historic and presumed summer chum salmon distribution.

All summer chum salmon produced within the Eastern Strait of Juan de Fuca conservation unit comprise one of the two independent summer chum populations tentatively identified by the PSTRT (Currens 2004 Draft in progress). Currens (2004 Draft in progress) provides a detailed analysis of these conclusions. It speculates on the importance of the historical geographic distribution of summer chum salmon habitat and the overall "isolation-by-distance relationship" that seems to be observed in the summer chum salmon aggregations. More analyses of population identification and viability are expected from the PSTRT. At this time it is not expected that these analyses will affect the basic approach taken for recovery in this SRP.

The co-managers (WDFW and PNPTT) have identified two stocks to target for recovery in the Eastern Strait of Juan de Fuca Conservation Unit.[34] These stocks are the natural origin fish spawning in Salmon and Snow Creeks and Jimmycomelately Creek (PNPTT and WDFW 2003). The co-manager interim recovery goals for these stocks are:

[34] The co-managers have also targeted the reintroduction of the Chimacum Creek summer chum salmon as summarized in SRP section 5.

Table 7.1. Strait of Juan de Fuca aggregation: co-manager interim abundance and escapement recovery goals for the Salmon/Snow and Jimmycomelately natural origin spawning aggregations.

Stocks	Abundance	Escapement
Salmon/Snow	1,560	970
Jimmycomelately[35]	520	330

Abundance is defined as the size of the run or the number of recruits. Recruits are the number of fish (in this case summer chum salmon from the Hood Canal/Eastern Strait of Juan de Fuca ESU geographic area) available for all fisheries in any given year. Escapement is defined as the number of adults that return to the natal spawning grounds (they escaped all fisheries and are available to spawn). The co-managers did not provide a combined interim recovery threshold for the Strait of Juan de Fuca summer chum population. Simple addition of the thresholds for the Salmon/Snow and Jimmycomelately stocks provides the following interim thresholds for the combined spawning aggregations[36]:

Table 7.2. Strait of Juan de Fuca aggregation: interim abundance and escapement goals for Strait of Juan de Fuca natural origin summer chum salmon.

Stocks	Abundance	Escapement
Combined Jimmycomelately and Salmon/Snow	2,080	1,300

The interim escapement threshold (target) for the Strait of Juan de Fuca summer chum population is also shown in Figure 7.4.

PNPTT and WDFW (2003) also developed abundance and spawning escapement threshold criteria ro recovery. One of the criteria for recovery is that a summer chum stock (Jimmycomelately or Salmon/Snow) must, over a minimum of the recent twelve year period, have both a mean abundance, and mean escapement, of natural-origin recruits that meets or exceeds the defined thresholds. The following table (Table 7.3) provides a summary of escapement

[35] From Crain (2003): "There is a concern that these interim targets for Jimmycomelately Creek summer chum may represent a moderate risk of extinction using the methods of Allendorf et. al (1997), which specify that a population is at moderate risk of extinction if the total escapement population per generation is less than 2,500 or if the effective population size is less than 500. However, the Allendorf et. al assumptions were theoretical, and a population may be viable at sizes slightly below those the authors predicted. Additionally, these interim targets are based upon observed escapements during the 1970's and early 1980's. It is entirely possible that the population was already in decline by that time, as significant habitat alteration to the creek began in the late 1800's. Finally, it may be that the Jimmycomelately Creek stock is part of a larger population that included the Dungeness River and/or Discovery Bay stocks."

[36] It should be noted that the co-managers interim goals apply to the individual populations and threshold values of combined aggregations do not take precedence over the individual population targets.

for the recent twelve year period, 1993-2004, for the two stocks of concern in the Eastern Strait of Juan de Fuca conservation unit.

Table 7.3. Escapement thresholds for the Salmon/Snow and Jimmycomelately spawning aggregations based on PNPTT and WDFW (2003).

	ESCAPEMENT				
Summer chum population aggregation	**93-04 Average**	**target**	**% of target**	**# times below target 2001-2004 (≤1)**	**# times below target 1997-2004 (≤2)**
TOTAL SJF				0	4
Salmon/Snow	2159	970	223%	0	3
Jimmycomelately	231	330	70%	2	6

The Salmon/Snow summer chum population aggregation currently exceeds the escapement threshold as established by the co-managers. But this population is likely a combination of both hatchery and natural-origin recruits and the target applies only to natural origin recruits. Jimmycomelately, however, falls below the threshold over the recent twelve-year period. The Jimmycomelately Creek supplementation program began with the 1999 brood year, with the first adult returns noted in 2002. The intent of this program is to use 100% of the summer chum salmon returning to Jimmycomelately Creek as the donor broodstock (WDFW and PNPTT 2003).

Additional criteria require that the stocks do not fall below the target more than once in the recent four-year period, and no more than twice in the recent eight-year period. Salmon/Snow meets the criterion for the recent four-year period, but does not meet it for the recent eight-year period. Jimmycomelately does not meet either criterion. Overall, the combined Strait of Juan de Fuca population aggregations do not meet the criterion for the recent eight-year period, but do meet it for the recent four-year period[37]. Finally, it should be noted that the criteria fro productivity (for example, eight year average equal to or greater than 1.6 recruits per spawner) must be met for recovery. Data currently are insufficient to assess the productivity criteria, but are being collected

Summer chum salmon escapement (number of adults returning to spawn) for the Eastern Strait of Juan de Fuca Conservation Unit, from the years 1974-2004 is presented in Figure 7.4. Adult spawning escapement is presented for Salmon

[37] Note that both the four-year and eight-year criteria must be met for recovery. Also, it should be noted that the co-managers did not establish a threshold for the combined population aggregations. This was done by simple addition of the average from Salmon/Snow and Jimmycomelately.

Creek (Figure 7.5), Snow Creek (Figure 7.6), Salmon and Snow Creeks combined (Figure 7.7), and Jimmycomelately Creek (Figure 7.8).

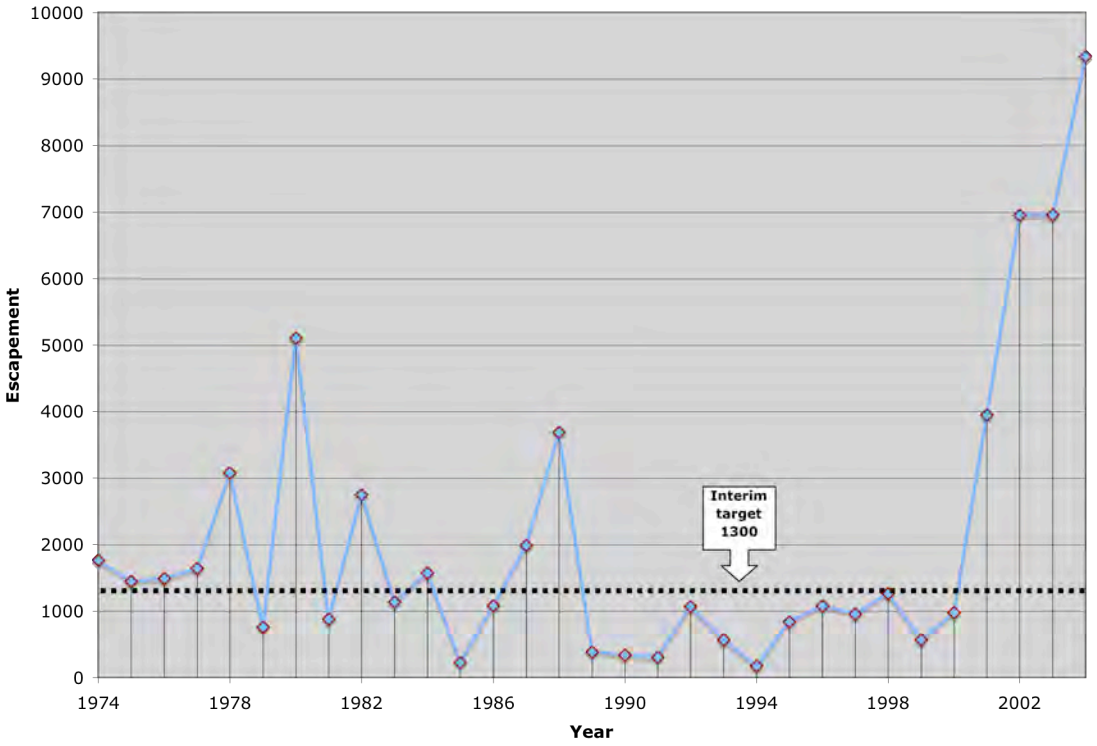


Figure 7.4. 1974-2004 summer chum salmon escapement for the Eastern Strait of Juan de Fuca Conservation Unit. (data source: WDFW and PNPTT 2003, 2004, and 2005)

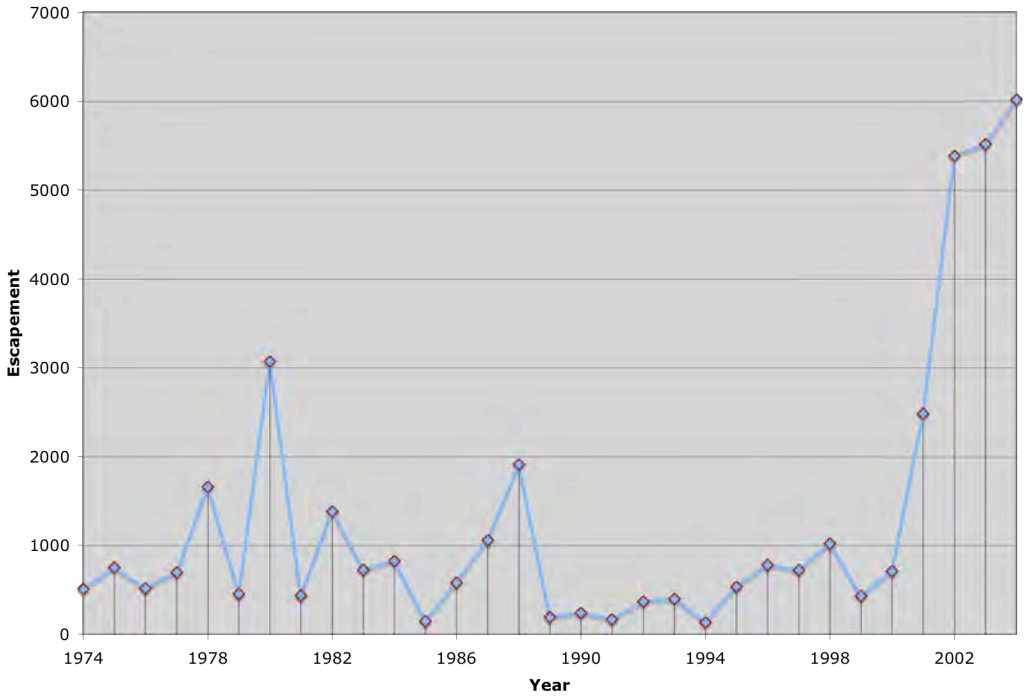


Figure 7.5. 1974-2004 summer chum salmon escapement for Salmon Creek (data source: WDFW and PNPTT 2003, 2004, and 2005).

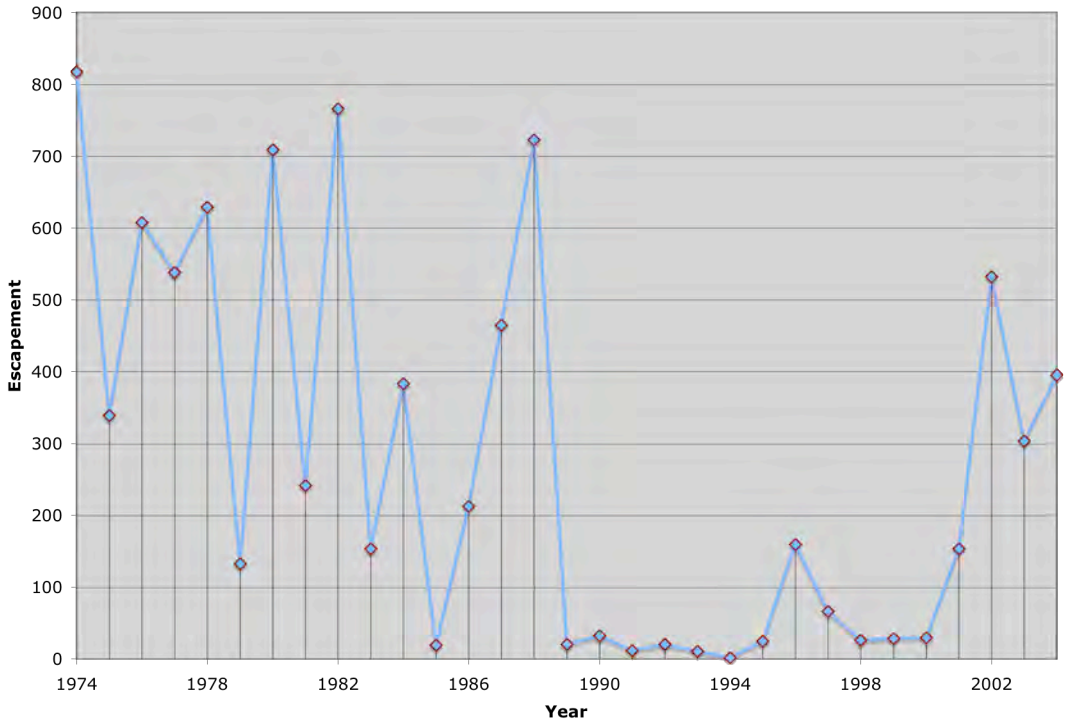


Figure 7.6. 1974-2004 summer chum salmon escapement for Snow Creek (data source: WDFW and PNPTT 2003, 2004, and 2005).

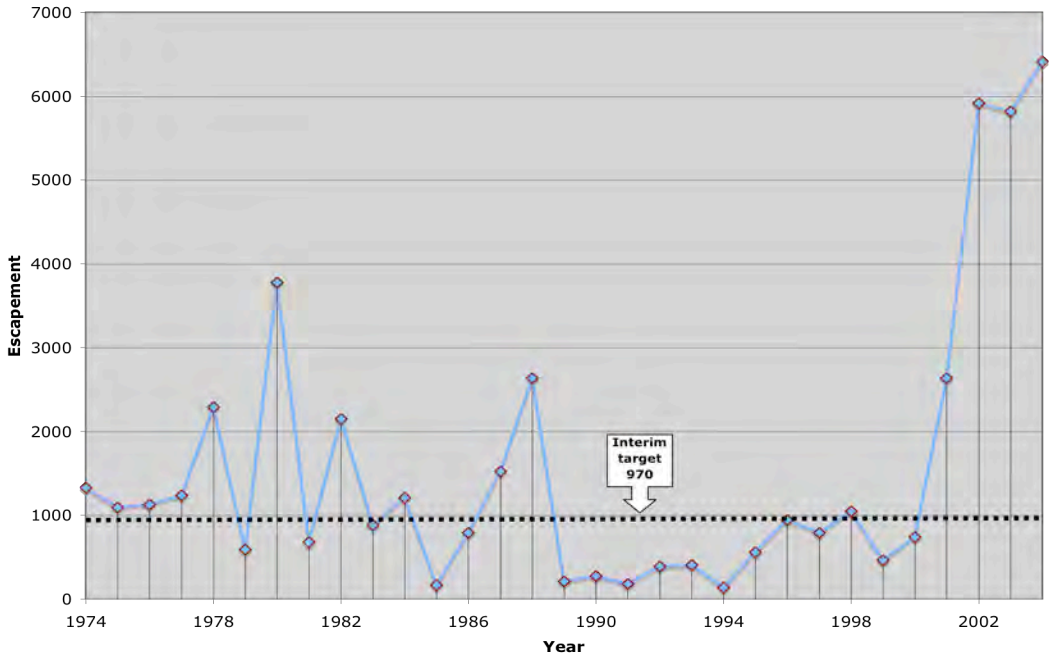


Figure 7.7. 1974-2004 summer chum salmon escapement for combined Salmon and Snow Creek

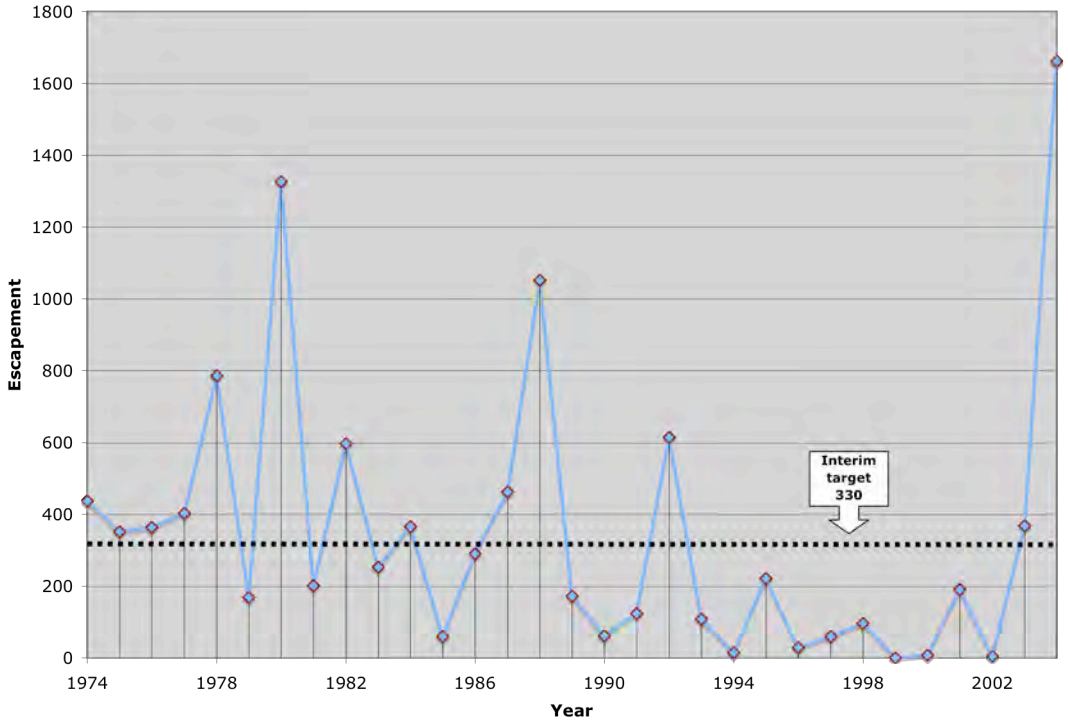


Figure 7.8. 1974-2004 summer chum salmon escapement for Jimmycomelately Creek (data source: WDFW and PNPTT 2003, 2004, and 2005).

The co-managers have assessed the extinction risk faced by individual summer chum salmon stocks, based on the methodology offered by Allendorf et al. (1997), and discussed it in detail in section 1.7.4 of the SCSCI (WDFW and PNPTT 2000). The extinction risk was assessed again in 2003 based on data available through 2002 (WDFW and PNPTT 2003).

A more recent assessment of extinction risk from the co-managers for the Jimmycomelately stock is found in WDFW and PNPTT 2003. It states that: "Escapements for Jimmycomelately Creek for the past four years annually averaged 91 spawners (range of 7 to 260). The effective population size (N_e) equals 66 fish for the 1999-02 return years, and total population size (N) is 328 for the same years. Because of the precipitous decline of this stock and population sizes meeting the high risk criteria (N_e < 500 or N < 2,500), the risk of extinction is judged to be high."[38]

A recent assessment of extinction risk from the co-managers for the Salmon/Snow stock also comes from WDFW and PNPTT 2003 and says that:

[38] It should be noted that, as of this writing, the co-managers' extinction rate assessment for Jimmycomelately has changed in a just updated assessment that includes the years 2003 and 2004. The update indicates the risk of extinction to now be moderate, owing primarily to the high escapements in 2003 and 2004 (WDFW and PNPTT In preparation).

"From 1999 through 2002, escapement estimates averaged 2,375 spawners (range of 528 to 6,049) for the Snow/Salmon stock. The effective population size (Ne) equals 1,710 fish for the 1999-02 return years, and total population size (N) is 8,550 for the same years. The recent return estimates were affected by returns to the existing supplementation project begun on Salmon Creek in 1992. Since the stock (with two streams combined) has experienced increasing overall escapements in recent years and average escapement exceeds the population size risk criteria, the current risk of extinction is judged to be low."[39]

A supplementation program was established for Chimacum Creek to reintroduce summer chum salmon. This was done using stock from the Salmon/Snow Creek system. A supplementation program for the Salmon Creek stock began in 1992 with the objective of rebuilding and stabilizing the natural population and to allow for a transfer of surplus eggs or fry to reintroduce summer chum to Chimacum Creek. Chimacum Creek summer chum salmon are considered extinct as the last documented observations occurred in the mid-1980's. Historic distribution of summer chum salmon in Chimacum Creek is documented (WDFW and PNPTT 2000). Returns to Chimacum Creek from the supplementation program, which was started in 1996, began in 1999 (WDFW and PNPTT 2003). Figure 7.9 provides adult spawning escapement for Chimacum Creek for the years 1999-2004.

[39] A just completed 2005 update of the extinction risk (including years 2003 and 2004) shows no change from the low risk rating for the Salmon/Snow stock (WDFW and PNPTT In preparation).

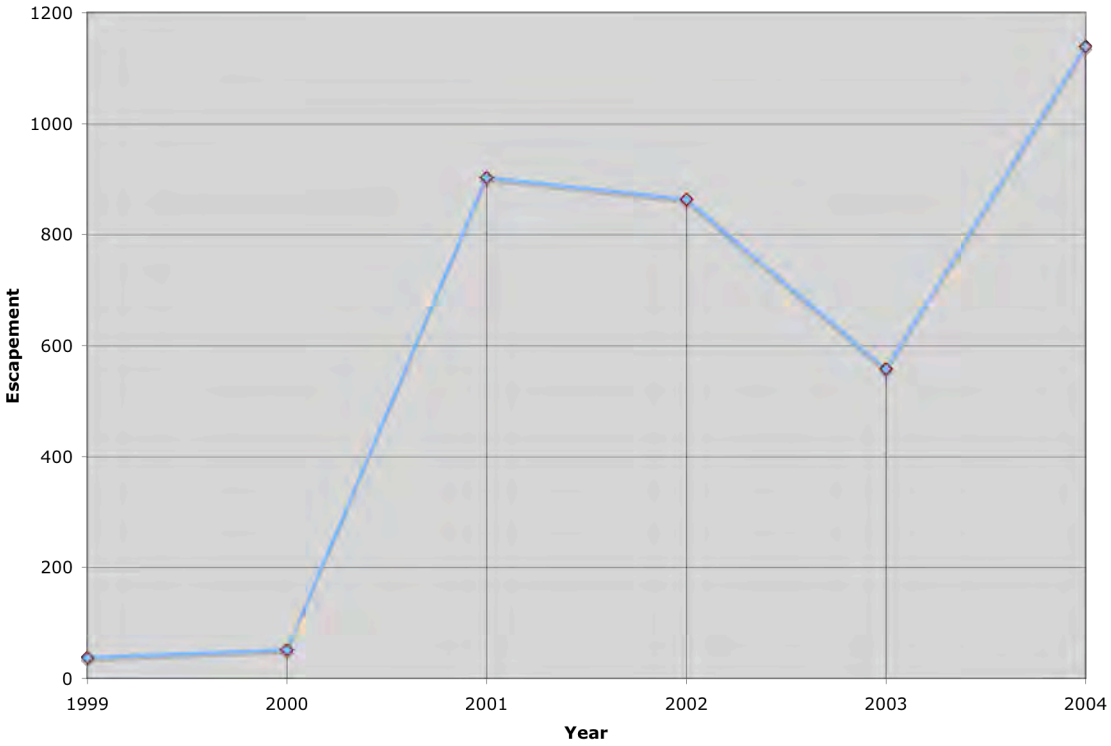


Figure 7.9. 1999-2004 summer chum salmon escapement for Chimacum Creek (data source: WDFW and PNPTT 2003, Adicks et al 2004 and 2005).

7.4. Habitat Overview and Environmental Conditions

7.4.1. Factors contributing to the decline of summer chum salmon

7.4.1.1. Jimmycomelately

The Jimmycomelately summer chum population shows a severe loss in performance, particularly in productivity. Under sustained, unfavorable ocean conditions, the population would be at a high risk of extinction (Lestelle et al, 2005a).

A summary of the EDT Conclusions for Jimmycomelately (from Lestelle et al, 2005a) suggests that:

- The Jimmycomelately population shows a high loss in performance compared to historic levels both in abundance and productivity, particularly under unfavorable ocean survival conditions.
- The amount of potential increase in population abundance is greatest through restoration of freshwater reaches; full restoration of estuarine-marine waters offers somewhat higher benefits than those associated with the natal subestuary.
- Protection of freshwater reaches is the highest priority.
- Potential benefits of restoring estuarine-marine areas are greatest by restoring the Sequim Bay shore.
- Within freshwater, habitat diversity, channel stability, and sediment load are seen as the most important factors to restore.
- Within the natal subestuary, the amount of area available to be used for rearing is important.
- Within the estuarine-marine environment, the most important factor for restoration is food, associated with loss of eelgrass, shoreline development, and loss of riparian corridors.

7.4.1.2. Salmon/Snow

According to the EDT assessment (Appendix A), the Salmon-Snow population shows a severe loss in performance, particularly in productivity. Under sustained, unfavorable ocean conditions, the population would be severely depressed and approaching a high-risk condition.

A summary of the EDT Conclusions for Salmon-Snow (from Lestelle et al 2005a) states that:

- The Salmon-Snow population shows a high loss in performance compared to historic levels both in abundance and productivity, particularly under unfavorable ocean survival conditions.

- The amount of potential increase in population abundance is greatest through restoration of freshwater reaches; full restoration of estuarine-marine waters and the natal subestuary appears to offer similar levels of benefit. Snow Creek mainstem (upstream of subestuary) provides the greatest potential for restoration benefits within the freshwater environment.
- Protection of freshwater reaches shows the highest priority with Salmon Creek having the greatest strategic priority.
- Potential benefits of restoring estuarine-marine areas are diffused over many segments but the Discovery Bay shore is ranked highest among these areas.
- Within freshwater, habitat diversity and sediment load are seen as the most important factors to restore.
- Within the natal subestuary, food and habitat diversity appear to be equally important for restoration, along with the amount of area available to be used for rearing.
- Within the estuarine-marine environment, the most important factor for restoration is food, associated with loss of eelgrass, shoreline development, and loss of riparian corridors.

The SCSCI (WDFW and PNPTT 2000), the "Limiting Factors Report for WRIA 17" prepared by the Washington Conservation Commission (Correa 2002), and May and Peterson (2003) provide details of the various habitat factors and environmental conditions affecting summer chum salmon in this conservation unit. In general, the findings from these reports are corroborated by the EDT assessment (Appendix A). These factors and conditions are summarized in the tables below for Jimmycomelately (Table 7.4), Salmon (Table 7.5), Snow (Table 7.6), and Chimacum Creeks (Table 7.7).

Table 7.4. Jimmycomelately Creek

Factors for decline	Life stage most affected	Remarks
Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)	Spawning and incubation	In lower reaches, riparian buffers have been reduced or eliminated, stable log jams are scarce, side channels and associated wetlands have been eliminated or cut-off from main channel, loss of LWD, bank hardening, aggradation, increased peak flows, increased bed scour
Sediment aggradation	Spawning, incubation, and adult migration	Rerouting of channel in lower reaches, loss of stream channel complexity, decrease in tidal energy, increased sedimentation, increased redd scour
Degraded riparian condition	Spawning and incubation	Degradation and loss of riparian habitat from mature forested area to a

		present day riparian mixture of young forest (34%), agriculture (12%), roads and dikes (9%), and residential land use (7%)
Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)	Juvenile rearing and migration	Delta area impacted by diking and intertidal fills associated with residential and commercial development along the Highway 101 corridor and railroad grade

Table 7.5. Salmon Creek

Factors for decline	Life stage most affected	Remarks
Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)	Spawning and incubation	Reduction of riparian buffers, LWD, side channels and associated wetlands
Increase in peak flows	Incubation	Reduction in LWD, and bank hardening, has exacerbated scour events during peak flows, confinement of channel has reduced side channels and wetlands
Degraded riparian condition	Spawning and incubation	Degradation and loss of riparian habitat, from mature forested area, to a present day riparian mixture of young forest (32%), agriculture (43%), low number of pools, forested buffer in lower reach is less than 66 feet in width
Estuarine habitat loss and degradation (diking and road causeways)	Juvenile rearing and migration	Delta area impacted by diking and intertidal fills associated with the Highway 101 corridor and railroad grade, ten roads or causeways cross or encompass the delta
Increased sedimentation (fines, aggradation)	Spawning and incubation	Fines present a moderate impact, but source of sedimentation is unclear

Table 7.6. Snow Creek

Factors for decline	Life stage most affected	Remarks
Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)	Spawning and incubation	Reduction of riparian buffers, LWD, side channels and associated wetlands, scarcity of pool habitat
Increased peak flow and low summer flows	Spawning and incubation	Extensive re-routing of Snow Creek out of Salmon Creek and Andrews Creek into Snow Creek and channelization have contributed to excessive sediment aggradation, increased peak flows contribute to bed and redd scour
Degraded riparian condition	Spawning and incubation	Degradation and loss of riparian habitat, from mature forested area, to a present day riparian mixture of young forest (64%), agriculture (43%), low number of pools, 76% of forested buffer in lower reach is less than 66 feet in width with 56% of that either absent or small immature trees
Estuarine habitat loss and degradation (diking and road causeways)	Juvenile rearing and migration	Delta area impacted by diking and intertidal fills associated with the Highway 101 corridor and railroad grade, two roads or causeways cross or encompass the delta, railroad grade located in center of emergent marsh rearing habitat, railroad grade mutes tidal circulation
Increased sedimentation (fines, aggradation)	Spawning and incubation	Re-routing of channel and loss of in-stream complexity have decreased channel's ability to route sediment through the system, increased aggradation which has increased scour, low flows as a result of aggradation may be impacting access to spawning areas

Table 7.7. Chimacum Creek

Factors for decline	Life stage most affected	Remarks
Increased fine sediments	Incubation	In-stream habitat has been severely degraded by a combination of upstream impacts. Siltation from de-forested and channelized stream segments has degraded spawning gravel conditions.
Increased peak flow, freshwater wetland loss, and channel instability	Incubation	Historic conversion of the lowland valleys from beaver pond wetlands and forested bogs to pasturelands may increase the duration and magnitude of peak flows. Areas around Chimacum, Port Hadlock, and Irondale are urbanizing, with an expected increase to the severity of winter floods from impervious surfaces.
Low flows	Spawning	Water withdrawal for irrigation and loss of wetlands in the Chimacum valley
Estuarine habitat loss	Juvenile rearing and migration	Tidal marshland fill of approximately 30 acres with road crossing

7.4.2. Human development and land use

Human population density in the Jimmycomelately Creek watershed is relatively low with the highest densities (34 persons per square mile) residing near the mouth and lower creek reaches in proximity to known summer chum salmon distribution. Figure 7.9 provides a map showing human population density throughout the watershed.

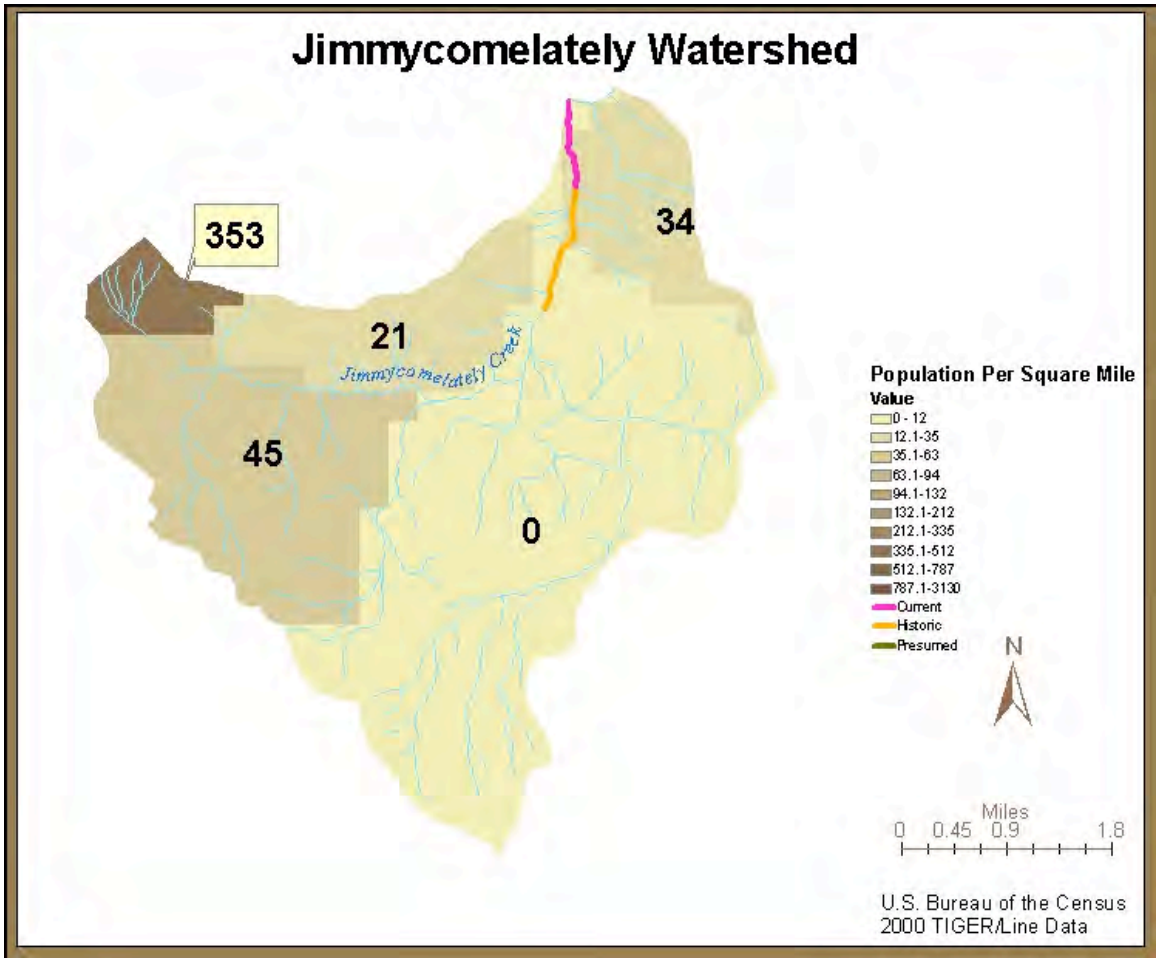


Figure 7.9. Human population density for the Jimmycomelately Creek watershed.

The lower portion (~RM 0.0-0.5) of the Jimmycomelately watershed is zoned as Rural Center (CEN) by Clallam County Zoning Code Title 33 code 33.15.040. Beyond that, Jimmycomelately flows through an area zoned as Rural Very Low. The purpose of Rural Very Low (R20) is “to conserve and enhance the forest resources of Clallam County by providing a transition between rural land uses and Commercial Forest zoning districts” (Clallam County Code 33.10.010). The upper reaches of Jimmycomelately Creek flow out of the Olympic National Forest

and State lands. Figure 7.10 provides a map modified from the Clallam County Parcel and Critical Areas Map (accessed April 30, 2005 at http://www.clallam.net/aimsxwebsite/CA_public_htmlcust/viewer.htm)

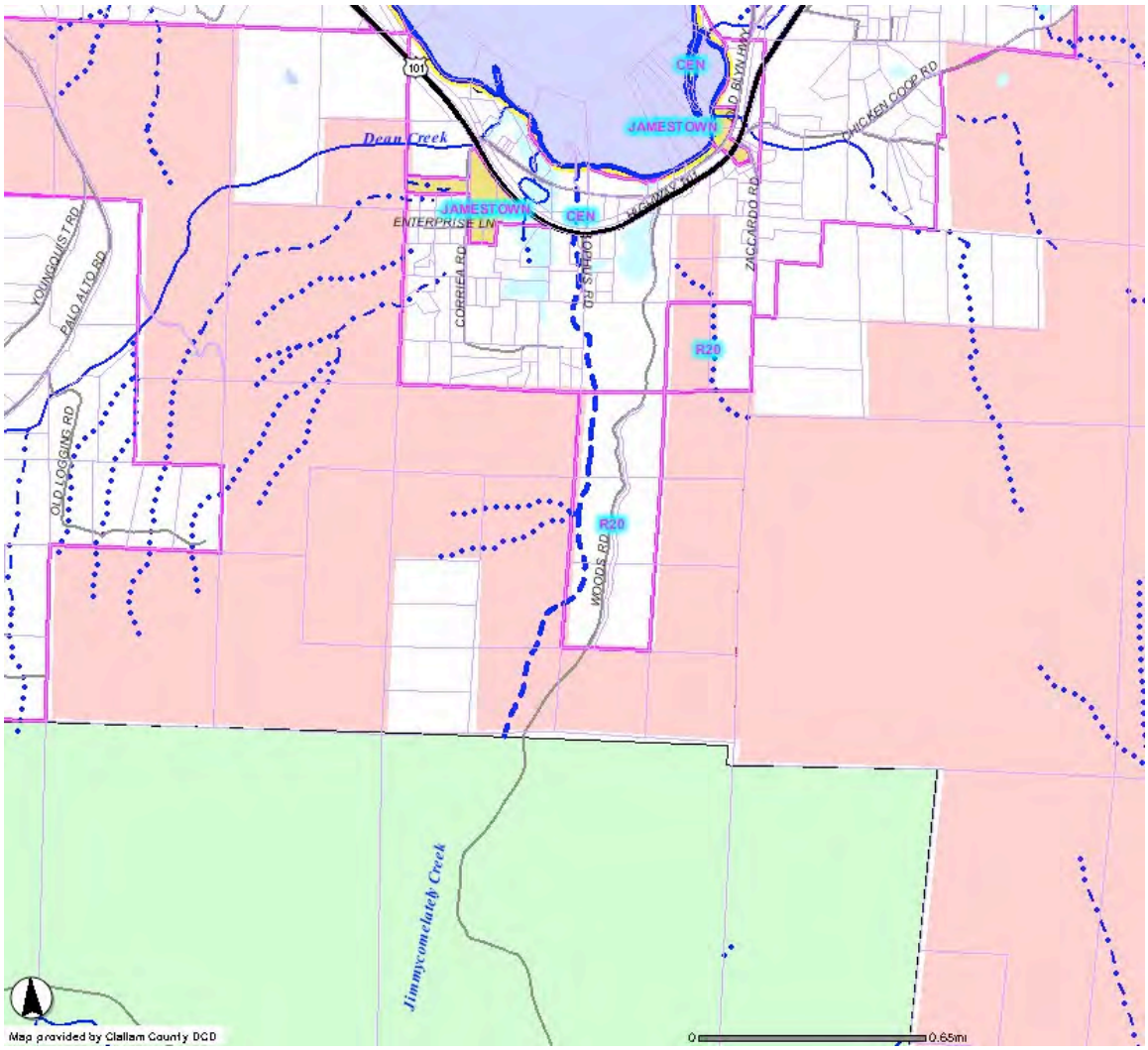


Figure 7.10. The lower Jimmycomelately Creek watershed showing zoning. R20 is Rural Very Low (Clallam Code 33.10.010) and CEN is Rural Center (Clallam County Code 33.15.045). State lands are noted in pink and Olympic National Forest lands are in green. (modified April 30, 2005 from: http://www.clallam.net/aimsxwebsite/CA_public_htmlcust/viewer.htm)

Figure 7.11 presents the zoning for the entire Jimmycomelately watershed.

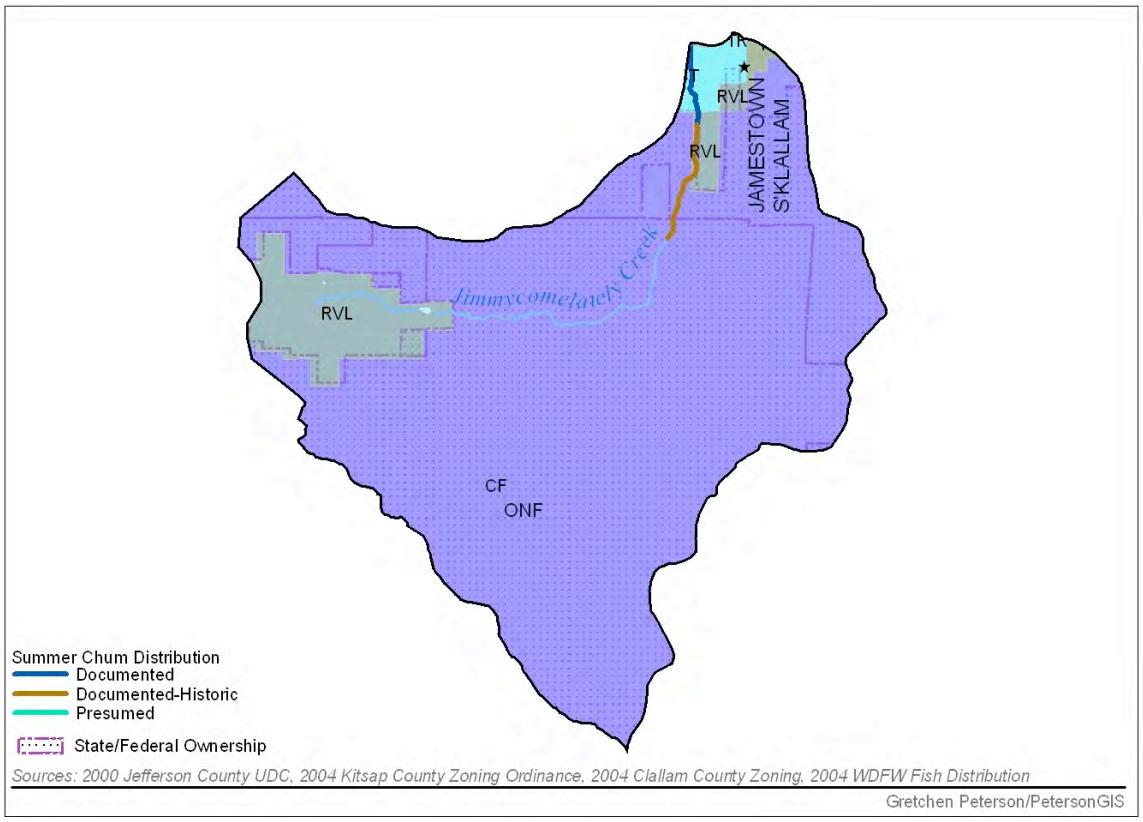


Figure 7.11. Clallam County zoning/land use for the Jimmycomelately watershed. RVL is Rural Very Low, CF is Commercial Forest. CT is the Rural Center.

Human population in both the Salmon and Snow Creek watersheds is low (under 150 total population in each watershed) and is expected to stay that way over the next 20 years (Christensen 2003). Chimacum Creek, however, flows through the Hadlock UGA with a population that is expected to almost double over the next 20 years from 4,669 to 8,674 (Christensen 2003). Table 7.8 presents a summary of current projected population growth in the Salmon, Snow and Chimacum Creek watersheds.

Table 7.8. Human population projections and growth rates for the Salmon Creek, Snow Creek and Chimacum Creek watersheds from (Christensen 2003).

Watershed	Human Population in 2000	20 Year Estimated Human Population Growth	2024 Estimated Human Population	Notes
Salmon Creek	118	23	141	Rural Growth Rate assumed 1.09%
Snow Creek	68	13	81	Rural Growth Rate assumed 1.09%
Chimacum Creek	4,669	4,005	8,674	Based on UGA population growth rate of 2.76% and rural growth rate of 1.09%*

*Note: Population projections are based on Resolution of Jefferson Board of County Commissioners and City of Port Townsend and analysis of trends in population growth (Memo dated April 16, 2003 from Cascadia Planning)

Human population density in the Salmon/Snow Creek watersheds is depicted in Figure 7.12. Densities are relatively low in the proximity of summer chum distribution with the highest being in the lower sections near the mouth and along the marine nearshore adjacent to the estuary.

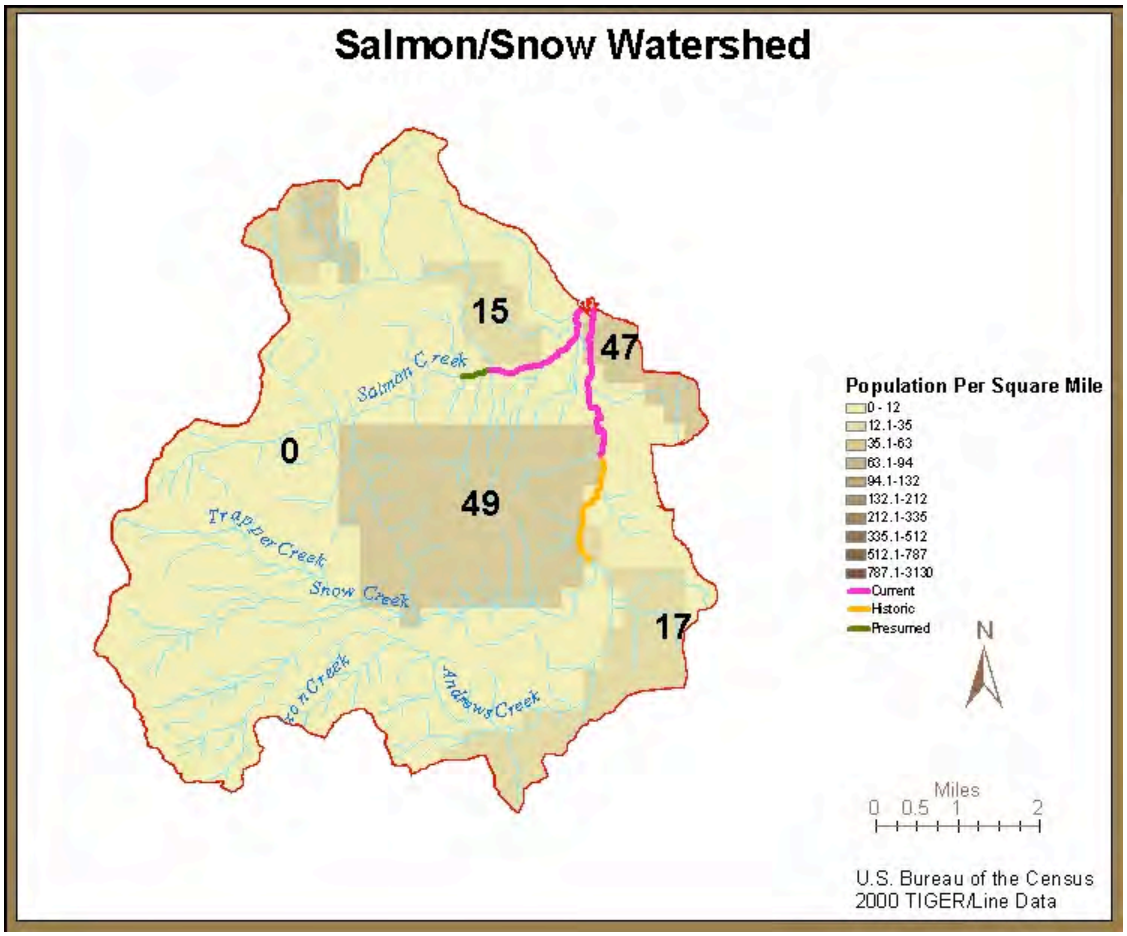


Figure 7.12. Human population density for the Salmon/Snow Creek watersheds (map produced by Gretchen Peterson, PetersonGIS).

Jefferson County zoning for the Salmon/Snow Creek watersheds are presented in Figure 13.

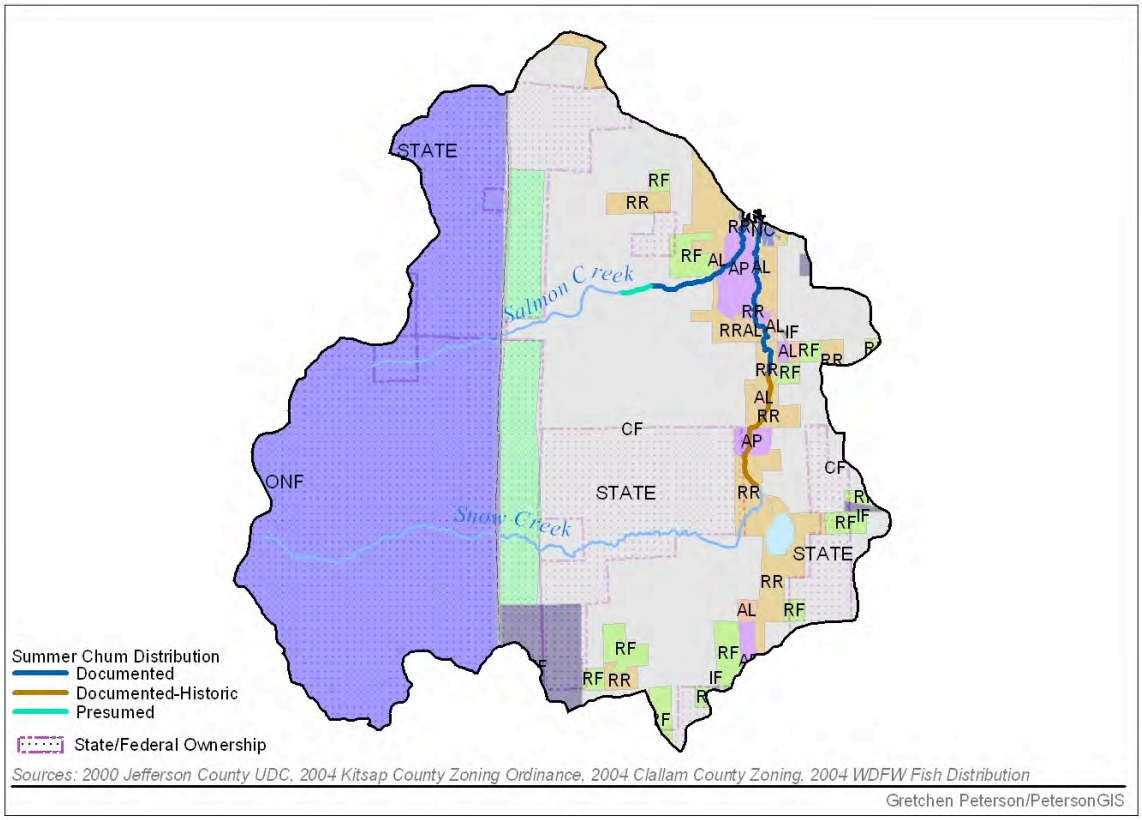


Figure 13. Jefferson County zoning for the Salmon/Snow Creek watersheds. RR is Rural residential, RF is Rural Forest, AL and AP are Agricultural Lands, CF is Commercial Forest. Map also depicts Federal and State ownership

Christensen (2003) reports that the lower reaches of Chimacum Creek lie within the Tri-Area Urban Growth Area. Based on the latest census information, the human population growth rate is estimated at 2.76% within the Tri-Area Urban Growth Area. Based on current development patterns, the Hadlock Urban Growth Area (Hadlock UGA) is one area where future development may conflict with summer chum recovery.

The extent of the Hadlock UGA is shown in Figure 7.14. Although the Hadlock UGA is considered within the Chimacum Creek watershed, only a portion of the land area actually drains toward Chimacum Creek. Instead, most of the area within the Hadlock UGA directly infiltrates into the excessively coarse soils, and drains directly to marine waters. Other areas of the UGA have formal stormwater collection, which also bypasses Chimacum Creek, draining into marine waters. Gray and Osborne are conducting a more detailed subwatershed-scale analysis as a part of the Tri-Area Stormwater Plan (Christensen 2003).

The summer chum spawning reach is generally below the Irondale Road Bridge, which is outside of the proposed UGA. However, the spawning reach is also downstream of the proposed UGA, so upstream hydrologic and water quality impacts originating in the UGA potentially could affect the spawning reach.

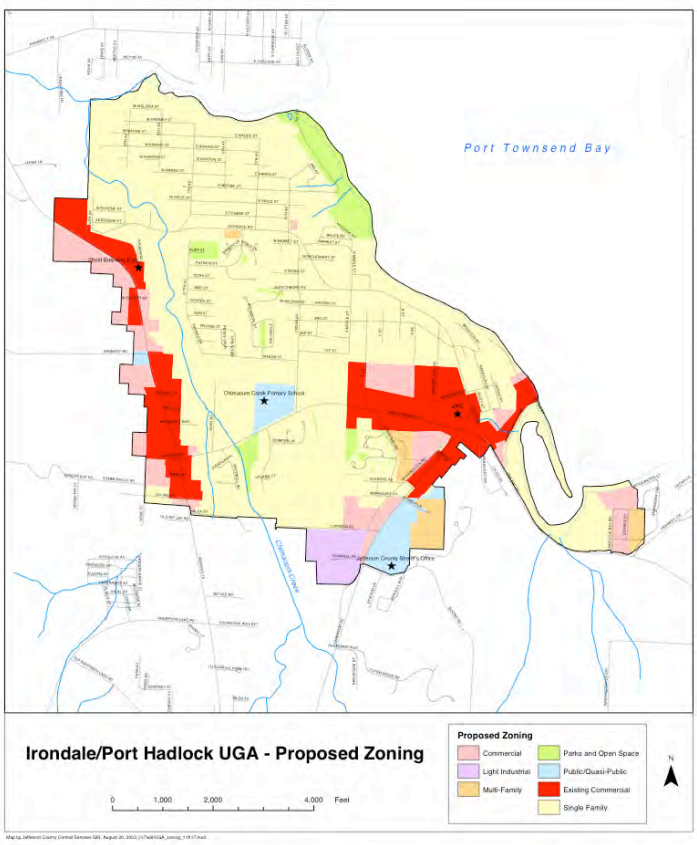


Figure 7.14. Irondale/Port Hadlock UGA.

Understanding future population growth, and its associated development, is critical to determine the potential future impacts to summer chum salmon habitat. A build-out analysis was conducted for the summer chum salmon ESU geographic area. This analysis used impervious surface area as a proxy for development. Based on existing land use designations (which are unique to each individual County), future impervious surface area was calculated and modeled. The amount of additional impervious surface area (relative to current) and where it can be expected to occur was determined for each County. Appendix C provides details of the methods used to conduct these build-out analyses.

Build-out was analyzed for the Jimmycomelately watershed in Clallam County and the Salmon, Snow, and Chimacum Creek watersheds in Jefferson County

(Appendix C). Riparian corridors were determined to be 200 feet on each side of the stream up to the point of presumed distribution of summer chum salmon. Impervious surface area (IP) was measured using 5-meter resolution satellite imagery (Peterson 2005). Current IP within this corridor on Jimmycomelately Creek is 2.1% of the total riparian area corridor. For Salmon Creek the current IP is 3.5% and for Snow Creek the current IP is 7.7%. Build-out IP looked at the potential to develop the land under current regulatory programs and land use codes for the respective Counties. Build-out IP for the Jimmycomelately riparian corridor examined is expected to be at 8.5%. Build-out in the Salmon Creek riparian corridor is modeled to be increased to only 3.6% of the total from a current IP of 3.5%, adding 0.1 acres of IP to the corridor. Build-out in the Snow Creek corridor is modeled to increase by 4.4 acres in the corridor to a value of 10.2% of the total corridor area. These results are summarized in the table below.

Table 7.9. Current impervious area and modeled build-out for the riparian corridors of the Eastern Strait of Juan de Fuca Conservation Unit.

Riparian Corridor	Corridor area acres	Current IP acres	Build-out IP acres	Added IP acres	Current IP%	Build-out IP%
Jimmycomelately Creek	97	2.1	8.2	6.1	2.1	8.5
Salmon Creek	100	3.5	3.6	0.1	3.5	3.6
Snow Creek	177	13.7	18.1	4.4	7.7	10.2

The uplands and nearshore within one mile of the Jimmycomelately and Salmon/Snow Creek subestuaries were also analyzed for projected build-out (Appendix C). Of the total area delineated in the subestuary zones, current IP for Jimmycomelately is 3.0% and for the Salmon/Snow estuary it is 2.1%. After build-out, the percent of the subestuary area analyzed for Jimmycomelately is estimated to be 8.6% and for Salmon/Snow 4.0%. These results are summarized in Table 7.10.

Table 7.10. Current impervious area and modeled build-out for the subestuaries of the Eastern Strait of Juan de Fuca Conservation Unit.

Estuary	Current IP%	Build-out IP%
Jimmycomelately	3.0	8.6
Salmon/Snow	2.1	4.0

Watershed and stream research, which typically looks at a watershed-wide perspective, generally indicates that certain zones of stream quality exist. Most notably, at about 10% impervious cover area, sensitive stream elements are lost from the system. A second threshold appears to exist at around 25 to 30%

impervious area, where most indicators of stream quality consistently shift to a poor condition (e.g., diminished aquatic diversity, water quality, and habitat scores).[40] More research is needed to determine if this research directly applies to the present analysis. It should be noted that similar research, however, has not been conducted for estuary and subestuary areas.

7.5. Specific Action Recommendations

This section presents specific recovery action recommendations for the Eastern Strait of Juan de Fuca conservation unit. Recommended actions are categorized as either Programmatic (section 7.5.1) or Project (section 7.5.2). Actions identified will be further delineated as actions to benefit the targeted spawning aggregation (in the case of the Eastern Strait of Juan de Fuca conservation unit, either the Jimmycomelately or Salmon/Snow aggregations). These specific action recommendations are also summarized and analyzed in the context of overall ESU-wide recovery (see section 13). All actions (previously implemented, on-going, and proposed) will become part of the Monitoring and Adaptive Management Program for the SRP as described in section 14.

7.5.1. Programmatic Actions

Programmatic recovery actions are those that are part of a policy, program, or process. They are generally of a regulatory or planning process nature. Programmatic actions could be part of a County's land use and regulatory program and structures, or watershed planning processes. Comprehensive plans, critical areas ordinances, shoreline management master programs, and zoning could all be considered programmatic actions in this context. Programmatic actions are non-project (i.e., habitat restoration projects--LWD placement, culvert repairs, etc.) in nature. Programmatic actions, however, can include projects when such projects are descriptive of a comprehensive or encompassing process (i.e., levee removal or set back as part of an estuary restoration plan). Watershed management plans often include projects to address identified factors of decline or specific habitat conditions. For the purposes of this SRP, the management plans or planning processes will be considered programmatic actions whereas the projects identified within the management plans will be categorized as projects.

[40] See The Center for Watershed Protection's (http://www.cwp.org) Stormwater Manager Resource Center at http://www.stormwatercenter.net for more extensive references on this subject. Table 1 at http://www.stormwatercenter.net/monitoring and assessment/imp cover/impercovr model.htm reviews the key findings of recent research regarding the impacts of urbanization on aquatic systems.

7.5.1.1. Jimmycomelately Spawning Aggregation

To most effectively address those factors that are likely affecting the performance of the Jimmycomelately spawning aggregation, the SRP recommends the following programmatic actions summarized in Table 7.11.

Table 7.11. SRP recommended programmatic actions for the Jimmycomelately spawning aggregation.

Recommended Programmatic Actions	Actions involved	Limiting factors to address
Jimmycomelately Creek-Lower Sequim Bay Estuary Restoration Project	-support the work in-progress and completion, assist in seeking more funding as appropriate, project can be used as template/example for other similar approaches recommended throughout the ESU (for a summary of this project see the brochure "The 'Undevelopment' of Jimmycomelately Creek and Estuary" written by Linda Newberry and produced by the Jamestown S'Klallam Tribe 2003)	-estuarine habitat loss and degradation -riparian condition -channel complexity
Clallam County zoning for the Jimmycomelately watershed	-support continuation of the present zoning for the upper watershed of Rural Very Low (R20) -monitor long-term effectiveness of the zoning code and enforcement	-riparian condition -sediment aggradation
Olympic National Forest and State lands	-continue to preserve these lands in current ownership -Forest Service road maintenance and road abandonment plans should be implemented including appropriate resources to effectively complete the projects	-sediment aggradation
Community Nearshore Restoration Program	-pursue application and implementation of a Community Nearshore Restoration program for Sequim Bay similar to that being conducted in south Hood Canal (see section 13)	-Estuarine and nearshore habitat loss and degradation
Jimmycomelately Creek Summer Chum Salmon Supplementation Project	-continue the supplementation project to fruition (through 2011) including monitoring	-see WDFW and PNPTT (2000) and (2003a) for complete details of this project, also section 5 of this SRP

7.5.1.2. Salmon/Snow Spawning Aggregation

To most effectively address those factors that are likely affecting the performance of the Salmon/Snow spawning aggregation the SRP recommends the following programmatic actions summarized in Table 7.12. Details of the programmatic actions approved and those being considered by the Jefferson County Board of County Commissioners can be found in section 13.

Table 7.12. SRP recommended programmatic actions for the Salmon/Snow spawning aggregation.

Recommended Programmatic Actions	Actions involved	Limiting factors to address
Snow/Salmon Watershed Fish and Wildlife Management Plan process	-support the work in-progress and completion, including continuation of land acquisition for conservation and protection -provide assistance in seeking more funding as appropriate.	-loss of channel complexity (LWD, channel condition, loss of side channel, channel instability) -estuarine habitat loss and degradation (diking and road causeways) -poor riparian condition -peak flow Remarks: this SRP is a work in progress resulting from the purchase and acquisition of lands in the lower reaches and subestuaries of Salmon/Snow Creeks
Jefferson County zoning for the Salmon/Snow watersheds	-support continuation of the present zoning for the upper watersheds -monitor long-term effectiveness of the zoning code and enforcement -support Staff on their efforts regarding the core habitats and corridors work including development within channel migration zones -adopt CMZ guidelines as proposed for the CAO update (see section 13- “Jefferson County Programmatic Actions” for more details)	-poor riparian condition -loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)

Tri-Area Stormwater Management Plan	-commitments from the Jefferson County Board of Commissioners to implement provisions of the storrmwater management plan. -consider adoption of a stormwater control to assist in the implementation of the key provisions	-increase in fine sediments -increase in peak flows, freshwater wetland loss, and channel instability Remarks: Jefferson County has adopted the State's "Stormwater Management Manual for Western Washington" as part of their County program (WDOE 2001).
Community Nearshore Restoration Program	-pursue application and implementation of a Community Nearshore Restoration program for Discovery Bay similar to that being conducted in south Hood Canal (see section 13)	-estuarine and nearshore habitat loss and degradation
Agricultural Best Management Practices programs	-pursue voluntary programs similar to that conducted for the Chimacum watershed by the Conservation District and local land-owners	-riparian degradation -Peak flow, freshwater wetland loss, and channel instability Remarks: a similar program to the Chimacum Creek watershed should be explored for the salmon/snow
Salmon Creek Summer Chum Salmon Supplementation Project	-continue with monitoring of the supplementation project to ensure long-term persistence of the stock	-see WDFW and PNPTT (2000) and (2003a) for complete details of this project, also section 5 of this SRP

7.5.2. Projects

Project recovery actions are generally physical modifications to the landscape designed to address specific habitat situations in specific and limited geographic areas. Projects in the summer chum salmon ESU have been in progress for many years by a variety of groups and entities. Section 7.5.2.1 provides an overview of existing projects related to summer chum salmon recovery planning. Many of the project proposals presented in this SRP are from the HCCC Lead Entity strategy (HCCC 2004). This SRP is designed to coordinate with and build on that strategy. Projects presented are categorized according to their benefit for the spawning aggregation of concern (for section 7 of this SRP either the

Jimmycomelately or Salmon/Snow spawning aggregations). All projects that are proposed or recommended in this SRP are strictly voluntary in nature. Those projects that would either take place on, or impact, private property will require the full cooperation and permission from the affected landowners before proceeding. If that landowner permission cannot be obtained, those projects will not proceed.

7.5.2.1. Existing Projects

Figure 7.15 provides a map of existing projects within the lower Jimmycomelately Creek watershed.

Figure 7.15. Jimmycomelately Creek lower watershed. Shaded areas represent protected lands.

Existing and completed projects for the Dungeness and Jimmycomelately watersheds are described below (project descriptions are derived from IAC Grant Projects at http://www.iac.wa.gov/maps/default.asp and click on the Grant Project Maps link, accessed on June 14, 2005):

99-1657 Dungeness/Jimmycomelately Riparian Land Project Description: Clallam County, the Jamestown S'Klallam Tribe and the Dungeness River Management Team have been working toward restoration of the riparian corridor along the Dungeness River and Jimmycomelately Creek for several years. Estuarine areas at the mouths of both streams have been identified by an interagency work group of fisheries biologists as critical habitat sites. Restoration

activities are precluded by private ownership of several parcels. Flood protection activities by private landowners have severely disrupted the river channels and destroyed habitat for threatened stocks of chinook and summer chum salmon. Land acquisition of key riparian parcels will allow restoration of the river corridors to proceed, especially in the river delta area. At least 55 acres of available riparian property is currently on the market. In the last three years, the North Olympic Land Trust has acquired approximately 80 acres of riparian land and another 150 acres in conservation easements along the Dungeness River. The Tribe and Rainshadow Natural Science Foundation acquired property at the Dungeness Railroad Bridge for development of an Audubon education center. The Tribe and WDFW have also acquired 9 acres of tidelands in Sequim Bay near the mouth of JCL Creek.

00-1045 Jimmycomelately Bridge Project Description:
This is for the construction of an 85' x40' bridge where one does not currently exist, in the historic location of Jimmycomelately Creek. This project is a component of a larger effort to restore the Creek. The lower reach was moved circa 1913, and routed on a terrace to the east. This change in alignment caused the loss of 8 feet of gradient and more than doubled the length of channel in this reach, resulting in a dramatic decrease in the amount of fluvial and tidal energy available to transport sediment in the channel. This energy loss has resulted in severely degraded habitat: * The perched, aggraded stream has lower flows and decreased habitat quality at low flow, which is important to the migratory, spawning, and egg incubation timing of Summer Chum. * The instability of the channel as it progrades into the Bay is so severe that partial or total blockages to fish passage occur at the point at which the Creek enters the Bay. * The Creek no longer has an "estuary", the marine/freshwater transition is abrupt. * Channel instability is chronic, redd scour/fill is severe. The overall project objectives are to restore the Creek to the estuary, restore the estuary by removal of fill and roads, specifically benefiting Summer Chum and waterfowl in the Sequim Bay Watershed, with benefits to other salmon species as well. This project will be implemented by WSDOT, Clallam County is the applicant at the request of the Jimmycomelately Work group.

00-1048 Jimmycomelately Restoration/Acquisition Project Description:
This project will acquire almost six acres of critical salmon habitat at the mouth of Jimmycomelately Creek at Sequim Bay. This effort is a component of a larger protection and restoration program for Jimmycomelately Creek, located in eastern Clallam County. Other funds will support relocating the creek to its historic channel and restoring portions of the estuary. The Creek channel alignment was altered in the early 1900's causing channel aggradation, severe habitat loss, low flows, channel instability, fish passage blockage, scour and fill of redds, and increased flood frequency and severity. Project partners include Clallam County, Clallam Conservation District, WDFW, US Environmental Protection Agency, US Fish & Wildlife Service and others.

Figure 7.16 provides a map of existing projects within the lower Salmon/Snow Creek(s) watershed.

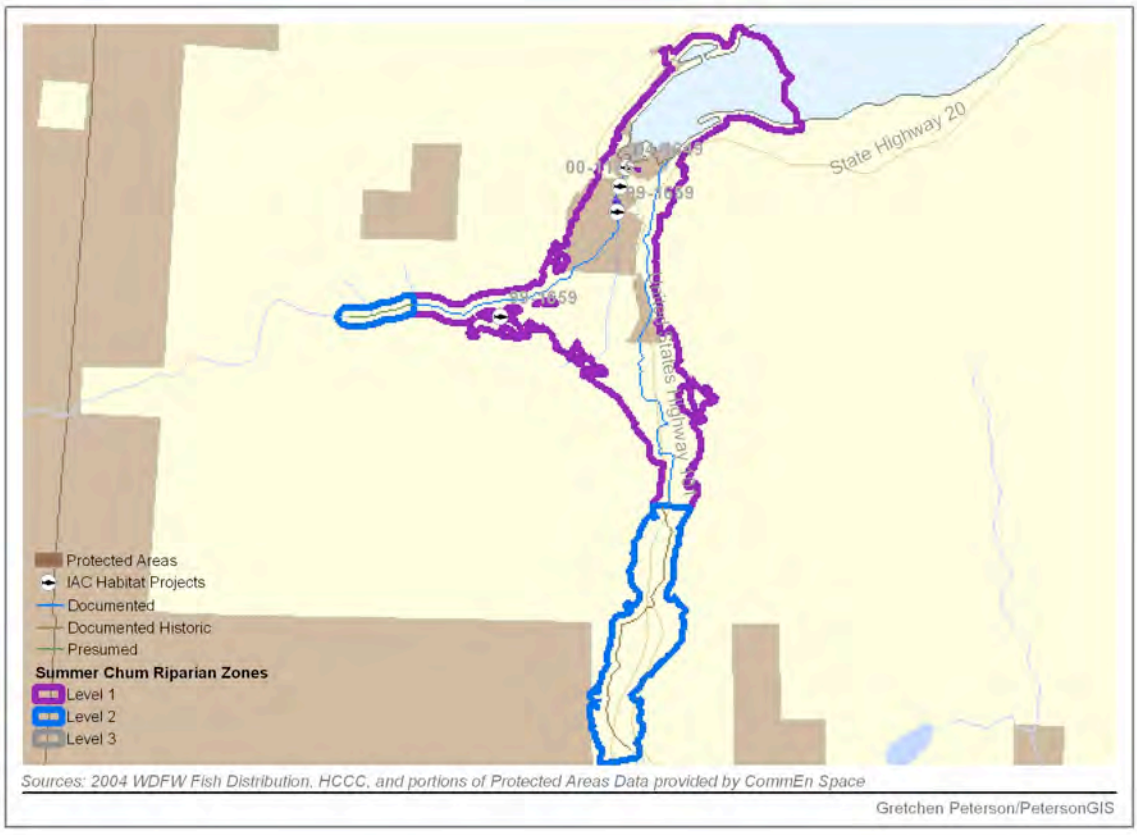


Figure 7.16. Salmon/Snow Creek(s) lower watershed. Shaded areas represent protected lands.

Existing and completed projects for the Salmon/Snow watershed are described below (project descriptions are derived from IAC Grant Projects at http://www.iac.wa.gov/maps/default.asp and click on the Grant Project Maps link, accessed on June 14, 2005):

99-1659 Chimacum and Salmon Creek Project Description:
Salmon and habitat in the Chimacum watershed have decreased dramatically both in quantity and quality in recent decades. The last summer chum was seen in Chimacum Creek in the mid-1980s. In 1992, the status of summer chum salmon in Salmon Creek was reported as critical in the Salmon and Steelhead Stock Inventory (SASSI) report. In response to these declines, Wild Olympic Salmon (WOS), a local non-profit organization, has worked with WDFW and tribal fisheries biologists to operate 2 salmon enhancement hatcheries, one on Salmon Creek and the other on a tributary to Chimacum Creek. The projects have been successful in the building and restoration of summer chum salmon

runs in the respective watersheds and therefore was terminated in 2004 to minimize potential hatchery domestication effects on the populations, consistent with artificial production guidelines in the Summer Chum Salmon Conservation Initiative (WDFW and PNPTT 2000).

00-1176 Salmon Creek Restoration Project Description:
Salmon Creek in Jefferson County is used by a stock of ESA-listed summer chum salmon. Poor habitat conditions limit the sustainability of this stock. This project's objective is to restore natural stream functions and improve salmon habitat in a 2,800-foot reach channelized many years ago for agriculture purposes. Project activities include restoring channel complexity through placing LWD, reducing aggradation, replacing a livestock ford with a bridge, and improving riparian conditions. Other fish species benefiting from this project include coho, cutthroat, steelhead, and sturgeon. Project supporters include private landowners, Wild Olympic Salmon, the North Olympic Salmon Coalition, and WDFW. This project complements the Wild Olympic Salmon/WDFW Salmon Creek/Chimacum Creek Summer Chum Stock Supplementation Project.

01-1346 Salmon and Snow Creek Estuary Project Description:
This is an acquisition and it will protect 4-8 of 33 targeted parcels. It will protect 3+ miles of stream and 300 acres of estuarine and riparian habitat for summer chum, other salmon species and wildlife. This fits with the Hood Canal Coordinating Council's Strategy for Salmon Recovery, which highlights estuary and nearshore habitats as the highest priority for acquisition. Critical habitat acquisition is at the top of the sequenced project lists for both Salmon and Snow Creek.

04-1649 Salmon/Snow Lower Watershed Restoration Project Description:
A partnership between WDFW, Jefferson Conservation District, and North Olympic Salmon Coalition will plant trees on 31 acres of riparian area along Lower Salmon and Snow Creeks and implement multiple estuary restoration projects covering between 5 and 12 acres on acquired land. The project objectives are: 1) Determine the final design for several high priority estuarine restoration actions, 2) Plan for future restoration actions including at least partial removal of railroad grade, 3) Determine the feasibility of reconnecting and restoring lower Salmon and Snow Creeks given historical reference conditions and contemporary constraints, 4) Implement actions including removal of fill from salt marsh and tidal channels, shoreline restoration and revegetation, and removal of abandoned buildings in the nearshore riparian and intertidal zone, 5) Extend riparian planting to 180' on each side of the new Salmon Creek channel, and 6) Extend Snow Creek planted riparian area to 180' from the existing channel. Wider forested riparian areas will address a limiting factor and benefit ESA listed summer chum in both streams, as well as coho, steelhead and cutthroat. Work will be directed by the local Chumsortium, a local restoration

consortium, and administered by the North Olympic Salmon Coalition as Phase IV of a decade of on-going recovery efforts.

Figure 7.17 provides a map of existing projects within the lower Chimacum Creek watershed.

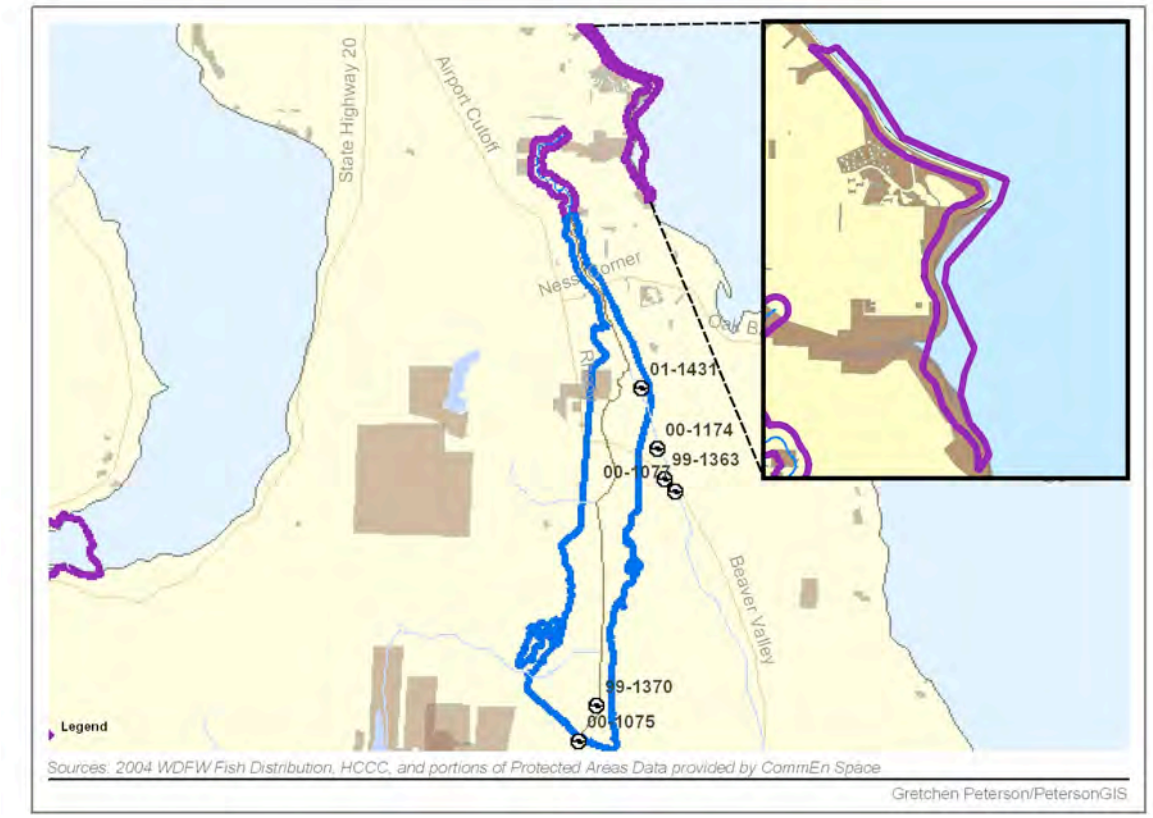


Figure 7.17. Chimacum Creek lower watershed. Shaded areas represent protected lands.

Existing and completed projects for the Chimacum watershed are described below (project descriptions are derived from IAC Grant Projects at http://www.iac.wa.gov/maps/default.asp and click on the Grant Project Maps link, accessed on June 14, 2005):

99-1370 Christian Property Chimacum Creek Habitat Project Description: Enhancement on the Christian property on Chimacum Creek will reconfigure an additional 250' with 50' riparian buffer adjacent to the 1998 reconfiguration of 650 ft. by the Department of Natural Resources. The area was channelized for agricultural purposes decades ago. Large amounts of Large Woody Debris will be added to the stream and forested riparian buffers replanted. Over 250 feet of channel will be excavated to create a flood plain bench 8-10 feet wide and then pulled back upslope to a 2:1 bank slope. Approximately every 65 feet, a scallop

in the shoreline will be constructed, with a log structure to create a pool, with the addition of LWD to create complexity and habitat. Large rock will be placed in/around spawning areas/riffles to improve fish habitat. The cut slope bench will be extensively planted with native shrubs with the area above the flood plain being planted with conifers. This project is a planned and permitted extension of the 1998 project providing additional complexity, improvements for summer and winter rearing for juvenile coho and cutthroat and enhanced spawning habitat for coho and steelhead. Plantings of trees and shrubs will help bring the summer water temperatures down in Chimacum Creek and provide cover and food sources. Spawning activity, species use and water quality will be monitored through local partnerships.

00-1075 West Fork Chimacum Creek Restoration Project Description:
This project reconfigured and naturalized a half-mile of ditched stream channel on Chimacum Creek, near Port Townsend. The project objective is long term improvement of overall stream conditions in the watershed, reducing sedimentation, increasing dissolved oxygen, and reducing nutrient loading. These improvements will assist summer chum spawning downstream while improving rearing and spawning habitat for coho, cutthroat and steelhead. Project elements include replacing a culvert with an inexpensive bridge; revegetating 15 acres of riparian zone to provide shade cover; and control of invasive weeds. The project will also excavate the stream bank; emplace LWD to create pools and riffles, deflect current and create back eddies; and create side channels to establish natural flow dynamics. Project partners include the Jefferson County Conservation District, Wild Olympic Salmon, Trout Unlimited and Chimacum Schools.

00-1077 East Chimacum Creek RM 1.2-2.3 Project Description:
This project will improve salmon habitat and water quality in a low-gradient, channelized, agricultural reach of East Chimacum Creek. This reach has very low dissolved oxygen levels during summer due to clogging with reed canary grass. In addition the riparian zone has little functional vegetation. Project elements include: removing reed canary grass from the channel, re-meandering the channel where possible, excavating bank margin pools, anchoring LWD in the pools and channel, and planting native trees and shrubs in the riparian zone. The Conservation District will also install livestock exclusion fencing and off-stream livestock watering systems. Anticipated outcomes are higher dissolved oxygen levels; lower fecal coliform and stream temperature levels; and improved channel structure, fish habitat and riparian function. This project will benefit coho, steelhead, cutthroat, and summer chum. Project partners include private landowners, Wild Olympic Salmon, and North Olympic Salmon Coalition.

00-1174 Lower East Fork Chimacum Creek Project Description:
This project will restore habitat in the Lower East Fork of Chimacum Creek. Project elements include reconfiguring and naturalizing 1,600 feet of ditched

stream channel and planting native riparian vegetation to establish shade cover and control invasive weeds on four acres of riparian buffer. This project complements previous restoration work on the Creek. The project will also excavate the stream bank and place large woody debris to create pools and riffles and help the channel establish a more natural flow dynamic. Other project elements include livestock exclusion fencing on both sides of the Creek. The project will reduce sedimentation, increase dissolved oxygen, and reduce nutrient loading that affects egg survival of summer chum. The project also improves rearing and spawning habitat for coho, cutthroat and steelhead. Project partners include the Jefferson County Conservation District, Wild Olympic Salmon, Trout Unlimited, and Chimacum Schools.

7.5.2.2. Project Proposals for the Jimmycomelately Spawning Aggregation

To most effectively address those factors that are likely affecting the performance of the Jimmycomelately spawning aggregation the SRP recommends the following projects. All projects that are proposed or recommended in this SRP are strictly voluntary in nature. Those projects that would either take place on, or impact, private property will require the full cooperation and permission from the affected landowners before proceeding. If that landowner permission cannot be obtained, those projects will not proceed. Estimated costs for these projects are presented in Appendix D.

Table 7.13. SRP recommended projects for the Jimmycomelately spawning aggregation.

Recommended Projects/Actions	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Jimmycomelately Creek-Lower Sequim Bay Estuary Restoration Project	-work in progress (for a summary of this project see the brochure "The 'Undevelopment' of Jimmycomelately Creek and Estuary" written by Linda Newberry and produced by the Jamestown S'Klallam Tribe 2003)	-lack of channel complexity (LWD, channel condition, loss of side channel, channel instability) -sediment aggradation -estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

7.5.2.3. Project Recommendations for the Salmon/Snow Spawning Aggregation

To most effectively address those factors that are likely affecting the performance of the Salmon/Snow spawning aggregation (and in this case, also including Chimacum Creek) the SRP recommends the following projects. All projects that are proposed or recommended in this SRP are strictly voluntary in nature. Those projects that would either take place on, or impact, private property will require

the full cooperation and permission from the affected landowners before proceeding. If that landowner permission cannot be obtained, those projects will not proceed.

Table 7.14. SRP recommended projects for the Salmon/Snow spawning aggregation. Presented in two subtables: Salmon/Snow Creek and Chimacum Creek

Salmon/Snow Creek

Recommended Projects/Actions	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Remove railroad grade, fill, and levees along estuary to restore salt marsh and tide flats	-a barrier to implementation is a water line and easement issue. One approach would be to vacate water line, put in well or move line around the perimeter area -need to focus on removing grade levee, fill, including the railroad causeway and creosote armoring	-estuarine habitat loss and degradation (diking and road causeways)
Remove part of the railroad grade to open up a salt marsh to tidal action for better access for fish	-would need to discuss feasibility of this project with private landowners -Olympic Discovery Trail public access -remove the RR grade	-estuarine habitat loss and degradation (diking and road causeways)
Remove railroad grade and road fill between ponds to open up tidal flow	-removing the grade/dirt -remove 3 overwater old sawmill structures	-estuarine habitat loss and degradation (diking and road causeways)
Control exotic vegetation	-clear and grub approximately 2 acres around the Snow Cr estuary	-poor riparian condition
Reconnect Snow Creek back into Salmon Creek above hwy 101.	-would need to discuss feasibility of this project with private landowners (agricultural businesses) located above Hwy 101	-increased sedimentation (fines, aggradation) -lack of channel complexity (LWD, channel condition, loss of side channel, channel instability) -Peak flow and low summer flows

Evaluate and abate effects of U.S. Highway 101 causeway to allow reconnection of floodplain	-could be a similar project to the Jimmycomelately restoration project	-estuarine habitat loss and degradation (diking and road causeways)
Restore sinuosity and natural channel configuration in artificially-confined reaches by removing riprap, road crossings, and ditching	-would need to discuss feasibility of this project with private landowners (agricultural business) -possibilities include riparian planting, soft armoring, buyout of house and land, place LWD structures	-loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)
Plant and maintain riparian areas on both public and private properties	-restore diversity quality and quantity on approximately 3.5 miles of Snow Creek and 1 mile of Salmon Creek	-poor riparian condition
Continue livestock exclusion fencing where appropriate	-Investigate possibility of implementing BMP similar to approach used for Chimacum Creek	-poor riparian condition -increased sedimentation (fines, aggradation)
Fee-simple purchase or conservation easement of: 1) remaining estuary parcels, 2) mainstem floodplain, and 3) sediment source abatement in parcels downstream of federal lands	-work with the Snow/Salmon Watershed Fish and Wildlife Management Plan proponents	-estuarine habitat loss and degradation (diking and road causeways) -increased sedimentation (fines, aggradation)
Decommission USFS roads	-assess sediment from other USFS roads -abating the sediment loading from the roads	-increased sedimentation (fines, aggradation)

Chimacum Creek

Recommended Projects/Actions	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Fee-simple purchase or conservation easement of: 1) remaining estuary parcels, 2) mainstem floodplain, and 3) sediment source abatement in parcels downstream of federal lands.	-work with landowners to determine feasibility of acquisition, purchase and easements	-estuarine habitat loss -increases in fine sediments

8. QUILCENE CONSERVATION UNIT

8.1. Introduction

The Quilcene Conservation Unit includes the Big Quilcene River and Little Quilcene River watersheds as well as the Tarboo and Thorndyke Creek watersheds. Also included in this unit are the marine nearshore waters and estuaries of the Dosewallips River, Quilcene Bay, Dabob Bay, and the Toandos Peninsula to the west side of Hood Canal and north through Port Ludlow.

In the conservation unit, a supplementation program, using indigenous spawners, was implemented at the Quilcene National Fish Hatchery (QNFH) beginning in 1992 (WDFW and PNPTT 2000). The program was recognized as a strategy for preventing extirpation of the Quilcene summer chum salmon stock. The decision to initiate the supplementation program was based on three problems. Those problems were: an observed severe downward trend in wild escapement levels, the low effective population size resulting from consecutively low escapements, and the occurrence of intercepting coho-directed fisheries in the terminal areas. At the same time complementary fisheries protection actions were taken in terminal area fisheries, and habitat management actions were developed to protect the summer chum population. These actions also contributed to the decision to implement a supplementation program. Lestelle, et. al. (2005a), surmise that Quilcene is one of five extant Hood Canal summer chum salmon populations (Quilcene, Lilliwaup, Hama Hama, Duckabush, Dosewallips) that had large escapements prior to about 1980. After 1980, severe drops in abundance occurred until the mid to late 1990s, when escapement began to increase again. The consistent pattern amongst these five stocks, including Quilcene, is attributed to (from Lestelle, et. al., 2005a):

- Favorable ocean conditions for marine survival until the mid 1970s, followed by a regime shift in the ocean that was unfavorable for survival until near the turn of the century when conditions switched again to favor marine survival;
- Low harvest rates prior to the mid 1970s, followed by steadily increasing rates on Hood Canal populations, sometimes exceeding 80% and averaging close to 60% in the 1980s; harvest rates fell sharply in the mid 1990s and were at very low levels again when ocean survival conditions turned favorable;
- Hatchery supplementation fish beginning to return to the Quilcene system in 1995 and several years later to the Hama Hama and Lilliwaup systems, roughly near or corresponding to the period of improving ocean conditions and low harvest rates; although no directed supplementation has occurred in the Dosewallips or Duckabush systems, some stray hatchery fish are suspected to have entered those streams in the late 1990s.

The Quilcene is one of six core stocks that make up the Hood Canal summer chum salmon population as identified by the Puget Sound Technical Recovery Team (PSTRT) (Currens 2004 Draft in progress). Dabob Bay and Tarboo Bay are thought to provide important rearing and migratory habitat for juveniles. Bahls (2004) reports that the Tarboo-Dabob estuary has an abundance of high quality habitat for juvenile salmonids. Much of the estuary is protected as state-owned, Natural Area Preserves, including the lower mile of Tarboo Creek and its coastal spits and adjoining upland forest. Juvenile salmonids, found widely distributed throughout the estuary during sampling from February-May 2003 and again in January 2004, were thought to be summer chum and from the Quilcene natural production areas (Bahls 2004).

Current habitat conditions and situations were assessed using a variety of sources. Several sources were used to assess the summer chum salmon stocks in the Eastern Strait of Juan de Fuca conservation unit. This Salmon Recovery Plan (SRP) will not repeat the details of these assessments, but instead refers the reader to the cited documents. All material and documents referenced in this SRP should be considered part of, and integral to, the recovery of summer chum salmon. These sources provided the primary reference and knowledge base for development of these aspects of the SRP. Details of the EDT assessments for the Eastern Strait of Juan de Fuca stocks, including a summary of the baseline performance measures, and a summary of strategic priorities, are provided in Lestelle et al, (2005a) (see Appendix A). The EDT Method is a widely used tool to help prioritize habitat restoration and protection measures for salmon populations. It provides a systematic way of diagnosing habitat conditions that have contributed to the current state of populations, and it enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits to salmon populations of actions that might be taken to address habitat related issues impeding recovery. Other detailed assessments of habitat and environmental conditions are provided in the SCSCI (WDFW and PNPTT 2000), Correa (2002), and May and Peterson (2003).

May and Peterson (2003) rated the lower portions of the Big Quilcene watershed as “secondary refugia with altered ecological integrity.” The lower Little Quilcene watershed was rated as a “primary refugia with altered ecological integrity.” The Quilcene Bay, Dabob Bay, and Thorndyke Creek estuaries, and the lower Tarboo and lower Thorndyke Creeks, were rated as “priority refugia with natural ecological integrity.” These ratings suggest that, at the least a semblance of properly functioning, natural ecosystems remains. Protection and active restoration of these areas is critical for the recovery of summer chum salmon.

Priority action recommendations developed in this Salmon Recovery Plan (SRP) will focus initially on the lower 1-2 miles of river and estuarine areas. Actions in the upstream areas of the watersheds will require assessments to determine the impacts and limiting factors that contribute to degradation in the lower reaches. Protection, restoration and maintenance of the Big and Little Quilcene watersheds is of paramount importance. In both watersheds, the lower river sections (lower 1-2 miles) and the estuaries are targeted for restoration. These areas must be restored and protected to effect and ensure recovery of the Hood Canal summer chum population aggregation.

The City of Port Townsend operates a water diversion structure at river mile (RM) 9 on the Big Quilcene and has rights to 30 cubic feet per second (CFS). The diverted water is used for the City's municipal needs and to supply water to the Port Townsend Paper Company. In 1994, the City of Port Townsend agreed to reduce or halt water withdrawal during low-flow periods to maintain a minimum of 25 CFS in the channel for fish. Prior to that, an informal arrangement between the dam operators and the Quilcene National Fish Hatchery (QNFH) ensured that enough water was maintained in the river to satisfy QNFH needs. Beginning in 1998, there was a cooperative effort to monitor stream flows for spawning availability, between the City of Port Townsend, QNFH, Port Townsend Paper Co., US Fish and Wildlife Service (USFWS), Jefferson Conservation District, and the Tribes. An Instream Flow Incremental Methodolgy(IFIM) study recently conducted by WDFW does not answer whether the given low-flow of 25 CFS is sufficient to provide for good spawning habitat for summer chum. The IFIM flow recommendations were well in excess of late-summer flows in the absence of withdrawal, and are likely better applied to fall chum. Data developed by the cooperative effort will be needed to assess the impacts of stream flow on spawning habitat (WDFW and PNPTT 2000). The City of Port Townsend and the Port Townsend Paper Company have managed their withdrawals of surface water from the Big Quilcene River, in recent years, to comply with a voluntary instream flow agreement. That agreement set minimum flows at 24 CFS between 1994 and 1997, and then at 27 CFS from 1997 onward. Between 1994 and 1999, flows in the Big Quilcene River, at the diversion, have averaged 50 CFS. But, those flows have been as low as 26 CFS in the summer-chum spawning season (WRIA 17 Planning Unit 2003).

8.2. Geographic Description & Human Population Distribution

The Quilcene Conservation Unit includes all of the Big Quilcene River and Little Quilcene River watersheds as well as the Tarboo Creek and Thorndyke Creek watersheds. Also included within this unit are the marine nearshore waters starting at the mouth and estuary of the Dosewallips River and moving north to include Quilcene Bay, Dabob Bay, and along the Toandos Peninsula, along the west side of Hood Canal, and north through Port Ludlow. The marine offshore

areas of north Hood Canal, up to Admiralty Inlet, are included in this conservation unit. The majority of this conservation unit is within eastern Jefferson County with the exception of a small portion of the upper Little Quilcene River watershed that lies within Clallam County.

Figure 8.1 provides a map of the Quilcene Conservation Unit. The Quilcene watersheds cover a combined area of 98 square miles. The Little Quilcene River flows for a total mainstem length of 12.2 miles. The total length of the Big Quilcene River mainstem is 19 miles. Detailed descriptions of each of these watersheds can be found in the Summer Chum Salmon Conservation Initiative (SCSCI) Appendix 3.6 (WDFW and PNPTT 2000), the Water Resource Inventory Area (WRIA) 17 habitat limiting factors report (Correa 2002), and the WRIA 17 Watershed Management Plan (WRIA 17 Planning Unit 2003).

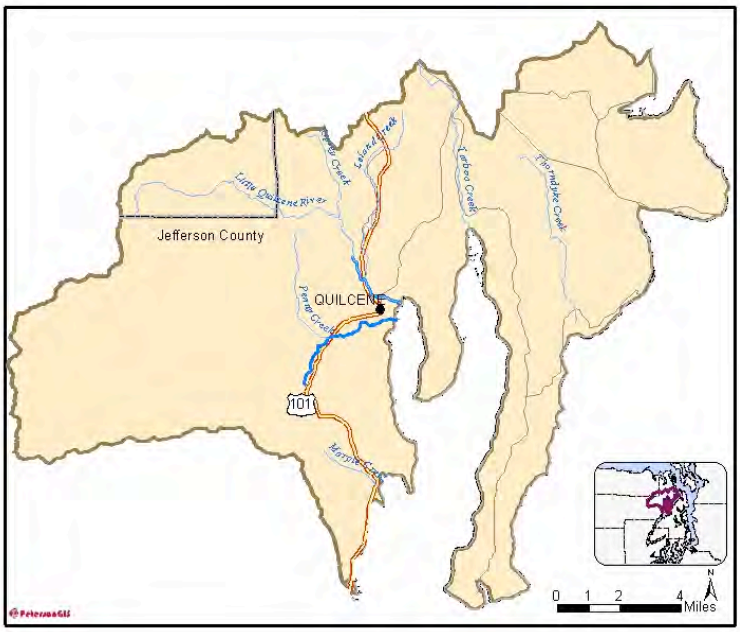


Figure 8.1. Quilcene Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

The town of Quilcene, located at the mouth of the Quilcene River, and the area around Port Ludlow, are the major concentrations of higher density human settlement in this conservation unit. Population density throughout the conservation unit is relatively low.

Figure 8.2 shows population density within the Quilcene conservation unit. Human population density, relative to summer chum salmon distribution, is low, with the possible exception of the Quilcene area (near the mouth of the Big and Little Quilcene Rivers).

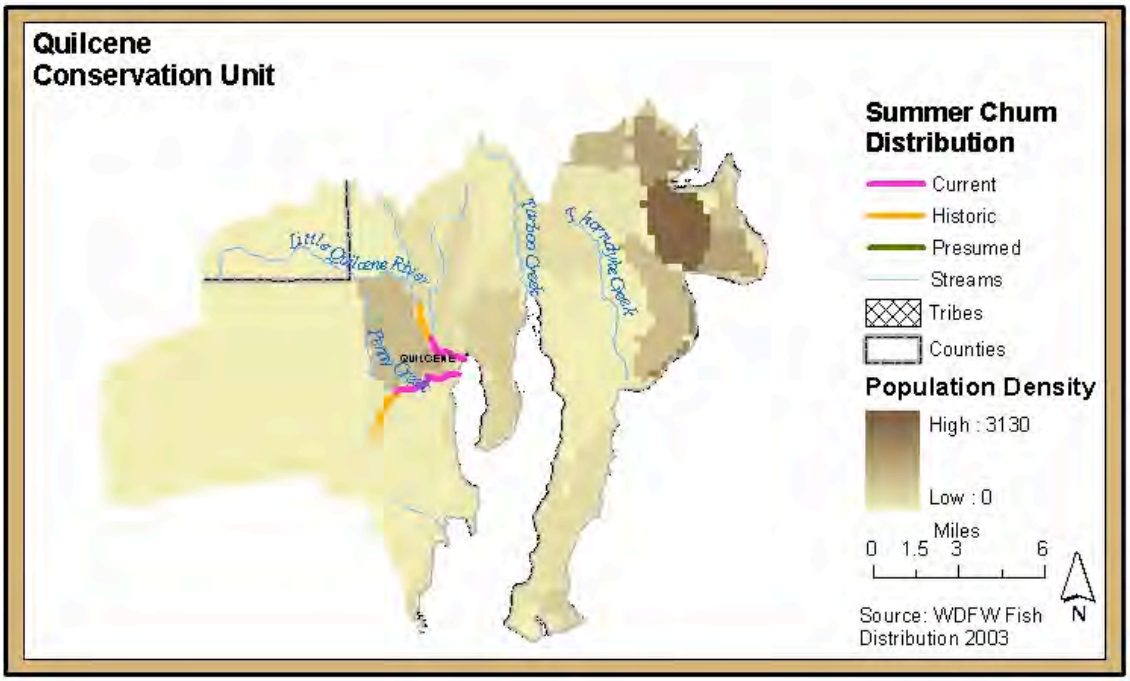


Figure 8.2. Human population density (people per square mile) for the Quilcene Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

8.3. Summer Chum Salmon Stocks' Description and Distribution

Several sources were used to assess the summer chum salmon stocks in the Quilcene conservation unit. This SRP will not repeat the details of these assessments, but instead refers the reader to the cited documents. All material and documents referenced to in this SRP should be considered part of, and integral to, the recovery of summer chum salmon. The reader is urged to review the Summer Chum Salmon Conservation Initiative (WDFW and PNPTT 2000) and subsequent supplemental reports. Summer chum salmon in Hood Canal and the Eastern Strait of Juan de Fuca were also assessed based on the application of the Ecosystem Diagnostic and Treatment (EDT) Method (see Appendices A and B). The EDT Method is a widely used tool to assist in the prioritization of habitat restoration and protection measures for salmon populations. EDT provides a systematic way of diagnosing habitat conditions that have contributed to the current state of fish populations. It enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits of actions that might be taken to address salmon habitat problems (Lestelle, et. al., 2005a).

The complete detailed EDT for summer chum salmon can be found at http://www.wa.gov/hccc/ and click on the Salmon Recovery Planning Activities link. On that page can be found links to various documents and the EDT web site for summer chum salmon. The web address for the EDT site: www.mobrand.com/edt/sponsors/show_sponsor.jsp?sponsor_id=11

8.3.1. Stocks' Status & Trends

Naturally produced summer chum salmon originating from the Quilcene Conservation Unit are likely from the Big and Little Quilcene watersheds (WDFW and PNPTT 2000). Summer chum spawn in the mainstem of the Big Quilcene up to RM 2.8, where the QNFH weir prevents further upstream access. Historically, summer chum may have spawned as far up as RM 5. Most spawning occurs below RM 1. Spawning in the Little Quilcene River stretches in the mainstem up to RM 3, with the majority spawning below RM 1.8. Current, historic and presumed summer chum salmon distribution in the Quilcene Conservation Unit is shown in Figure 8.3.

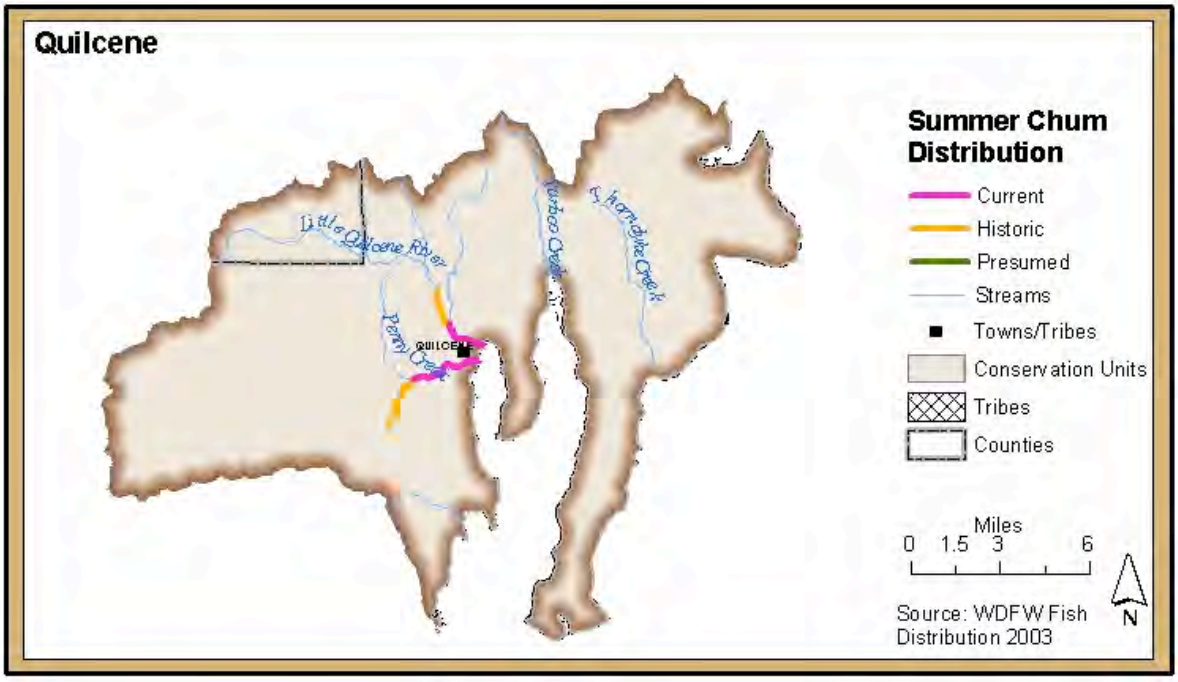


Figure 8.3. Map of the Quilcene Conservation Unit showing current, historic and presumed summer chum salmon distribution.

Summer chum salmon produced from both the Big Quilcene and Little Quilcene Rivers are part of the Hood Canal population targeted for recovery by the PSTRT. The Hood Canal population is one of two independent summer chum populations tentatively identified by the PSTRT (Currens 2004 Draft in progress).

Currens (2004 Draft in progress) provides a detailed analysis of these conclusions. It speculates on the importance of the historical geographic distribution of summer chum salmon habitat and the overall "isolation-by-distance relationship" that seems to be observed in the summer chum salmon aggregations. More analyses of population identification and viability are expected from the PSTRT. At this time it is not expected that these analyses will affect the basic approach taken for recovery in this SRP.

PNPTT and WDFW (2003) have identified as one stock the summer chum salmon that naturally produce in the Big Quilcene and Little Quilcene Rivers to to be targeted for recovery in the Quilcene Conservation Unit. The Quilcene stock is one of the six stocks that comprise the PSTRT designated Hood Canal aggregation. The co-manager interim recovery goals for this stock are presented in Table 8.1.

Table 8.1. Hood Canal aggregation: co-manager interim abundance and escapement recovery goals for the Quilcene spawning aggregation.

Stocks	Abundance	Escapement
Quilcene	4,570	2,860

Abundance is defined here as the size of the run or the number of recruits. Recruits are the number of fish (in this case summer chum salmon from the Hood Canal/Eastern Strait of Juan de Fuca ESU geographic area) available for all fisheries in any given year. Escapement is defined as the number of adults that return to the natal spawning grounds (they escaped all fisheries and are available to spawn). PNPTT and WDFW (2003) also developed abundance and spawning escapement threshold criteria. One of the criterion for recovery is that a summer chum stock (Quilcene) must, over a minimum of the most recent twelve year period, have both a mean abundance, and mean escapement, of natural-origin recruits, that meets or exceeds the defined thresholds. Table 8.2 provides a summary of escapement for the recent twelve year period, 1993-2004, for the Quilcene spawning aggregation.

Table 8.2. Escapement threshold for the Quilcene spawning aggregation based on PNPTT and WDFW (2003).

	ESCAPEMENT				
Population aggregation	**93-04 Average**	**Target**	**% of target**	**# times below target 2001-2004 (≤1)**	**# times below target 1997-2004 (≤2)**
Quilcene	8059	2860	282	0	0

The Quilcene aggregation currently exceeds the escapement threshold as established by the co-managers. But this population is likely a combination of

both hatchery and natural-origin recruits, and to meet the recovery goal 12-year criterion, only natural origin must be counted. The PNPTT, WDFW and USFWS initiated a 12-year brood stocking and supplementation program beginning in 1992 (WDFW and PNPTT 2000). The broodstocking program for the Quilcene River ended with the 2004 return year. Broodstock from the Quilcene population was used to reintroduce summer chum salmon back into Big Beef Creek during the 1996 and 1997 seasons.

Additional co-manager criteria require that the stocks do not fall below the target more than once in the recent four-year period and no more than twice in the recent eight-year period. The Quilcene aggregation does meet the criteria for the recent four-year period and for the recent eight-year period. It should also be noted that criteria for productivity (for example, eight year average equal to or greater than 1.6 recruits per spawner) must be met for recovery. Data currently are insufficient to assess the productivity criteria but are being collected (PNPTT and WDFW 2003).

Summer chum salmon escapement (number of adults returning to spawn) for the Quilcene Conservation Unit (combination of Big Quilcene and Little Quilcene) from the years 1974-2004 is presented in Figure 8.4.

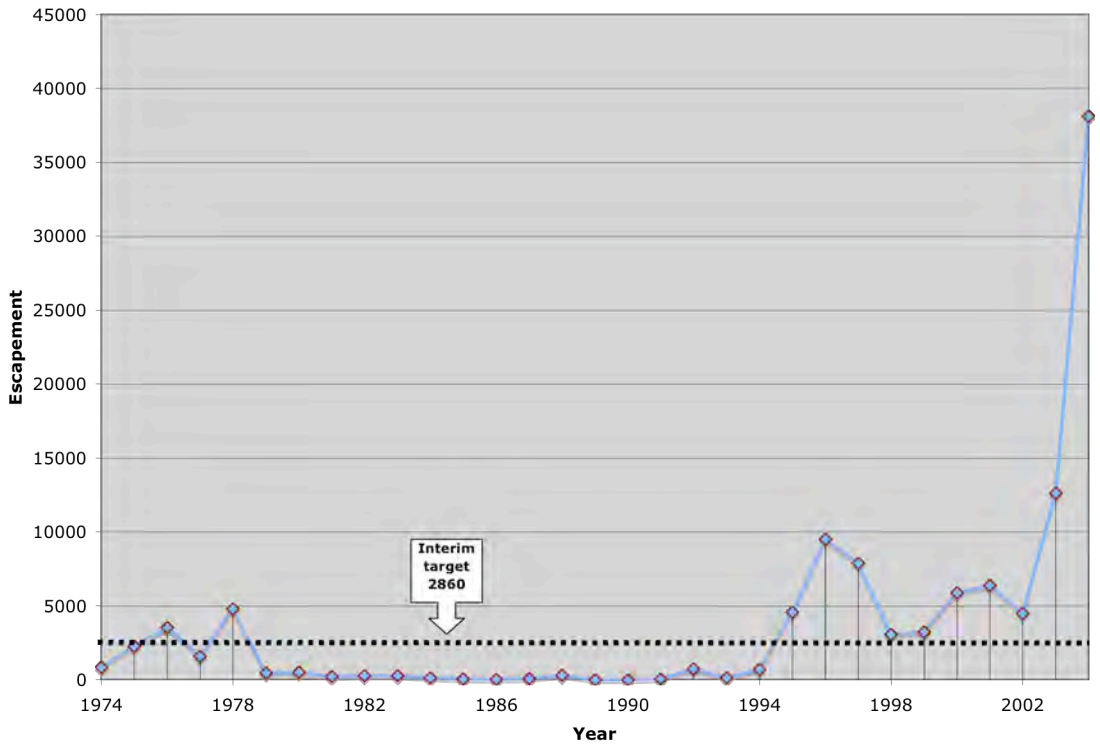


Figure 8.4. 1974-2004 summer chum salmon escapement for the Quilcene Conservation Unit, combined total for both the Big Quilcene and Little Quilcene Rivers (data source: WDFW and PNPTT 2003, 2004, and 2005).

The co-managers have assessed the extinction risk faced by individual summer chum salmon stocks, based on the methodology offered by Allendorf, et. al. (1997), and discussed in detail in section 1.7.4 of the SCSCI (WDFW and PNPTT 2000). The extinction risk was assessed again in 2003, based on data available through 2002 (WDFW and PNPTT 2003). A more recent assessment of extinction risk from the co-managers for the Quilcene stock stated, "Escapement estimates averaged 4,999 summer chum spawners (range of 3,237 to 6,373) for the Big/Little Quilcene summer chum stock for the 1999 through 2002 return years. The combined (including broodstock removals) total effective population size (Ne) equals 3,599 fish for the 1999-02 return years, and the total population size (N) is 17,996 for the same years. These recent returns likely were affected by the existing supplementation project begun in 1992. Based on a stable escapement trend and the large recent escapements, the current extinction risk for this stock is low."[41]

8.4. Habitat Overview and Environmental Conditions

Details of the EDT assessments for the Quilcene stock, including a summary of the baseline performance measures and a summary of strategic priorities, are provided in Lestelle, et. al. 2005 (see Appendix A). Other detailed assessments of habitat and environmental conditions are provided in the SCSCI (WDFW and PNPTT 2000), Correa (2002), and May and Peterson (2003).

8.4.1. Factors contributing to the decline of summer chum salmon

The Quilcene population shows a severe loss in performance, particularly in productivity. Under sustained, unfavorable, ocean conditions, the population would be at a high risk of extinction (Lestelle, et. al. 2005a).

In summary the EDT Conclusions for Quilcene (Lestelle et al 2005a) say that:

- The Quilcene population shows a high loss in performance compared to historic levels both in abundance and productivity, particularly under unfavorable ocean survival conditions.
- The amount of potential increase in population abundance is greatest through restoration of freshwater reaches; full restoration of estuarine-

[41] This assessment has just been updated by the co-managers and includes the years 2003 and 2004 (WDFW and PNPTT In preparation). The update indicates no change in the judgement of a low extinction risk.

marine waters offers a somewhat higher potential benefit than would occur for the natal subestuary. Restoration of the Big and Little Quilcene rivers offers similar levels of benefit.

- Protection of freshwater reaches shows the highest priority.
- Potential benefits of restoring estuarine-marine areas are diffused over many segments, but the Dabob Bay shore is ranked highest among these areas, followed by the Oak Bay segment. The reason for the high value of the Dabob Bay shore is due to its amount of change that has occurred in conjunction with its proximity to the Quilcene River. The reason for the high value of the Oak Bay segment is less clear. We believe this to be partly the result of how we expect migration to proceed. Fish from both shores of Hood Canal concentrate on the west side of Admiralty Inlet as they move to the Strait. The importance of the Oak Bay area is also partly due to the increasing amount of competition with hatchery fish, as summer chum move through Admiralty Inlet (being joined by fish from other areas in Puget Sound).
- Within freshwater, habitat diversity, channel stability, flow, and sediment load are seen as the most important factors to restore.
- Within the natal subestuary, food, and habitat diversity, appear to be equally important for restoration, along with the amount of area available for rearing.
- Within the estuarine-marine environment, the most important factor for restoration is food, associated with loss of eelgrass, shoreline development, and loss of riparian corridors.

The SCSCI (WDFW and PNPTT 2000), the "Limiting Factors Report for WRIA 17" prepared by the Washington Conservation Commission (Correa 2002), and May and Peterson (2003) provide details of the various habitat factors and environmental conditions affecting summer chum salmon in this conservation unit. In general, the findings from these reports are corroborated by the EDT assessment (see Appendices A and B). These factors and conditions are summarized in the tables below for Little Quilcene River (Table 8.3) and the Big Quilcene River (Table 8.4).

Table 8.3. Little Quilcene River

Factors for decline	Life stage most affected	Remarks
Low flow	Spawning	Mean annual flow is approximately 54 CFS with low flows of 5 to 13 CFS. Further assessment of the low flow situation is necessary to determine appropriate response and actions to ensure access for spawning.
Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)	Spawning and incubation	In lower reaches, channel habitat is highly degraded with 32% of the area as pools, 0.1 pieces of LWD/m and an average of 5.3 channel widths between pools, LWD removal occurs and the banks are hardened with riprap in places.
Sediment aggradation	Spawning and incubation	Channelized and diked area in the lower reaches has resulted in channel aggradation and avulsions leaving the main channel dry for several weeks
Loss of riparian forest	Spawning and incubation	70% of the forested buffer area consists of small trees (<12 in dbh), 51% is deciduous dominated with no riparian forest, 66% of the riparian area is <66 ft in width leaving the riparian area highly degraded from historic conditions
Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)	Juvenile rearing and migration	Estimated that 25% of the historic delta area (230 ac) is now diked. Road or causeway segments, totaling close to 0.5 miles in lineal extent, may constrict or prevent natural tidal inundation of adjoining wetlands.

Table 8.4. Big Quilcene River

Factors for decline	Life stage most affected	Remarks
Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability) and floodplain loss	Spawning and incubation	Historically (late 1950's) the channel was a narrow meandering single thread with good levels of LWD, pools and an intact riparian forest. Now it is wide, braided and in poor condition. No pool habitat in the lower 1.0 mile; so it is essentially one long riffle. Bank armoring, dredging, and dike construction has exacerbated flooding and channel scour.

Sediment aggradation	Spawning and incubation	Channelized and diked area in the lower reaches has resulted in channel aggradation. Forest Service logging roads built during the 1940's to 1960's contribute to the sediment problems.
Loss of riparian forest	Spawning and incubation	44% of the forested buffer area consists of small trees (<12 in dbh), 49% is deciduous dominated with no riparian forest, 45% of the riparian area is <66 ft in width leaving the riparian area highly degraded compared with historic conditions. Future LWD recruitment is considered from poor to moderate.

Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)	Juvenile rearing and migration	Estimated that 21% of the historic delta area (125 ac) is now diked. The dikes prohibit access to sloughs and side channels on the lower river and estuary. About 3% of the historic delta is now filled. Over the past 100 years the river mouth has been extended about 1,700 feet out into the bay due to dredging and diking. A very high density of roads (7.2 miles/square mile of watershed) occurs in the lower river.

8.4.2. Human development and land use

Population density in the Quilcene Conservation Unit is relatively low. Figure 8.5 Presents population density for the Quilcene conservation unit.

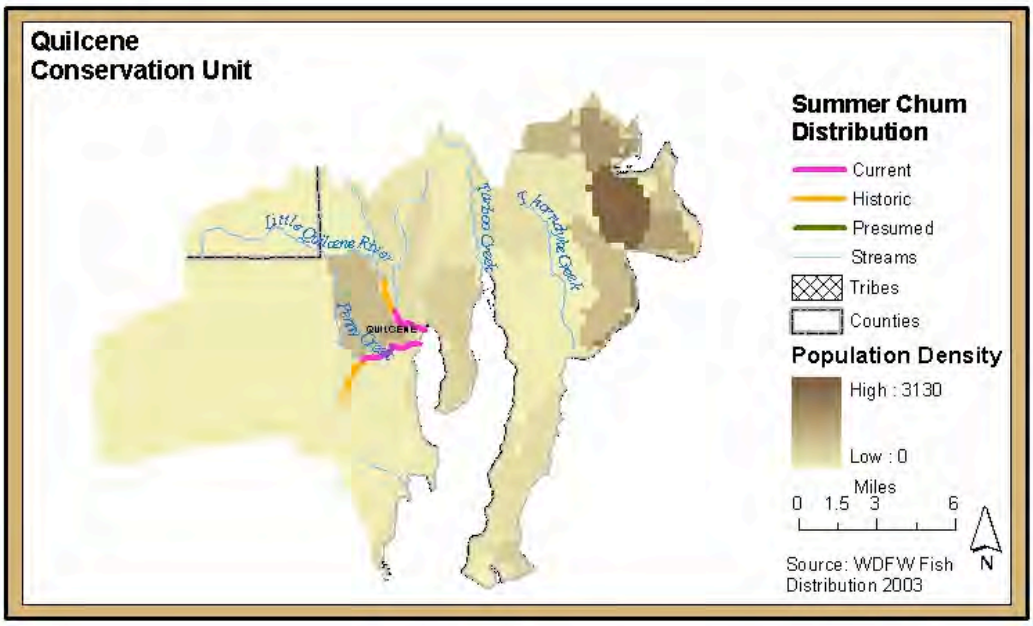


Figure 8.5. Human population density (people per square mile) for the Quilcene River conservation unit (map produced by Gretchen Peterson, Peterson GIS).

The highest density of human population currently exhibited in this conservation unit can be fund in the Port Ludlow area. Densities in the Quilcene watersheds are low to moderate, with the higher density of human population concentrated near the river mouths at the head of Quilcene Bay.

Christensen 2005 reports that an additional 179 people are expected over the next twenty years in the Big Quilcene and Little Quilcene watersheds combined. Table 8.5 presents the results of population projections and growth rates.

Table 8.5. Population projections and growth rates for the Quilcene watersheds (from Christensen 2005).

Watershed	Human Population in 2000	20 Year Estimated Human Population Growth	2024 Estimated Human Population	Notes
Little Quilcene River	353	69	422	Rural Growth Rate assumed 1.09%
Big Quilcene River	560	110	671	Rural Growth Rate assumed 1.09%

Jefferson County zoning indicates that 93 percent of the Big Quilcene watershed is in forestry (86% of which is within the Olympic National Forest with multiple use placing some acreage in wilderness areas), 4 percent is in rural residential

categories, 0.2% in agriculture and 0.1% in commercial use. The lower portions of both the Big Quilcene River and the Little Quilcene River flow through areas with land use coded by Jefferson County as Rural Residential (RR 1:5, RR1:10 or RR 1:20), Agricultural Resource Lands (AP 1:20 or AL 1:20), and Commercial Forest. Figure 8.6 provides the zoning delineations for the lower Quilcene watersheds. This map and the rest of Jefferson County's zoning can be found at (http://www.co.jefferson.wa.us/idms/mapserver.shtml).

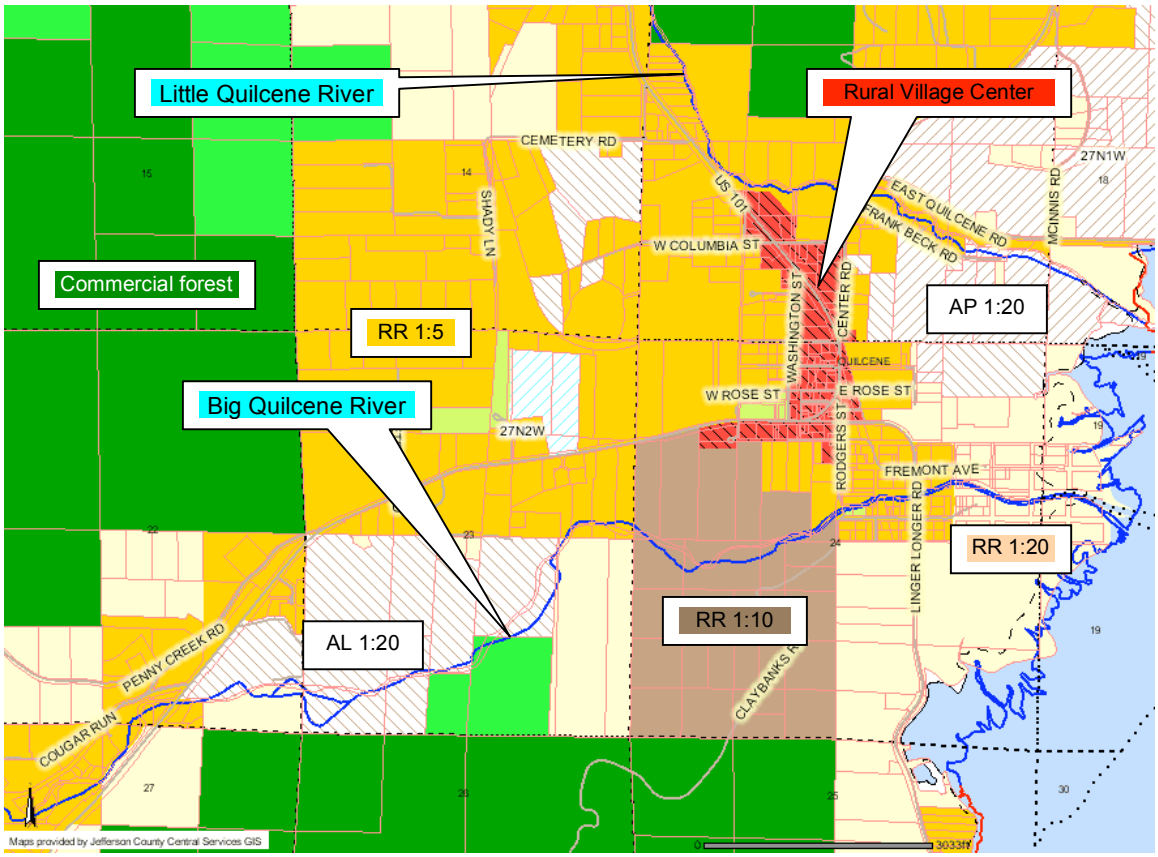


Figure 8.6. Zoning for the lower portions of the Big and Little Quilcene watersheds. (http://www.co.jefferson.wa.us/idms/mapserver.shtml)

The unincorporated town of Quilcene sits at the mouth of these rivers where it is zoned as a Rural Village Center (RVC). According to Jefferson County Unified Development Code, Title 18, Rural Village Centers "provide for most of the essential needs of the surrounding rural population and the traveling public. These areas supply a variety of basic goods and day-to-day services, while also providing a limited range of professional, public and social services. They are typically small, unincorporated commercial and residential community centers that provide rural levels of service and serve as a focal point for the local population. The boundaries of the rural village centers are predominantly defined

by the contained, built environment as it existed in 1990 or before, as required by RCW 36.70A.070(5)(d)." Designated rural village centers for Jefferson County include Quilcene and Brinnon. Rural Residential 1 Unit/5 Acres (RR 1:5) areas "allow for continued residential development in areas of Jefferson County consisting of relatively high density pre-existing patterns of development, along the county's coastal areas, and within areas within or adjacent to rural centers and rural crossroads. In addition, this district seeks to support and foster Jefferson County's existing rural residential landscape and character by restricting new land divisions to a base density of one unit per five acres." Rural Residential 1 Unit/10 Acres (RR 1:10) areas "provide a transitional area between the rural residential one per five acre district and the rural residential one unit per 20 acre district. Its intent is to preserve open space, protect critical areas, provide for the continuation of small-scale agricultural and forestry, and preserve and retain the rural landscape and character indigenous to Jefferson County.

Prime Agricultural Lands (AP-20) are designed to protect and preserve areas of prime agricultural soils for the continued production of commercial crops, livestock, or other agricultural products requiring relatively large tracts of agricultural land. It is intended to preserve and protect the land environment, economy and lifestyle of agriculture in Jefferson County. These lands must be protected as "agricultural lands of long-term commercial significance." Agricultural Lands of Local Importance (AL-20) are designed "to protect and preserve parcels of land which, while not necessarily consisting of prime agriculture soil or relatively large acreage, are still considered important to the local agricultural economy, lifestyle and environment." As such these lands deserve protection as "agricultural lands of long-term commercial significance."

Commercial Forest (CF-80) lands are designated to "ensure large tracts of forest lands of long-term significance are protected from incompatible uses thereby sustaining the ability of forest resource extraction activities to be maintained as a viable commercial activity."

The current upper extent of summer chum salmon distribution on the Big Quilcene River ends at the Quilcene National Fish Hatchery operated by USFWS. The Quilcene National Fish Hatchery, located at river mile 2.8, uses water from both the Big Quilcene and from nearby Penny Creek. Upstream passage is restricted on the Big Quilcene between September and December by an electric weir operated by the fish hatchery. A raised culvert and water intake structure permanently block access to Penny Creek, which has been identified as excellent refugia habitat (Correa 2002). The upper Quilcene watersheds flow out of a combination of Federal, State and commercial forest lands. The primary water source for the City of Port Townsend (30 CFS water-right) is diverted at river mile 9.4 on the Big Quilcene River.

The upper watershed of the Little Quilcene River is managed for public and private commercial forestry. A total of 52 percent of the watershed is zoned forestry, 17 percent rural residential and 0.8 percent agriculture. Sixty percent of the riparian zone below river mile 3 is developed with agriculture, roads/dikes, rural residences and forestry. The lower 0.8 miles contains dikes and bank armoring for residences in the floodplain. Dikes, roads and ditches impact the tidal delta. The City of Port Townsend diverts water (9.6 CFS water-right at the diversion, with a 6 CFS minimum instream flow requirement) on the Little Quilcene River, at river mile 7.1, to Lords Lake Reservoir on Howe Creek, which is removed from the watershed (Correa 2002).

Figure 8.7 shows the Jefferson County land use zoning for the Little Quilcene watersheds.

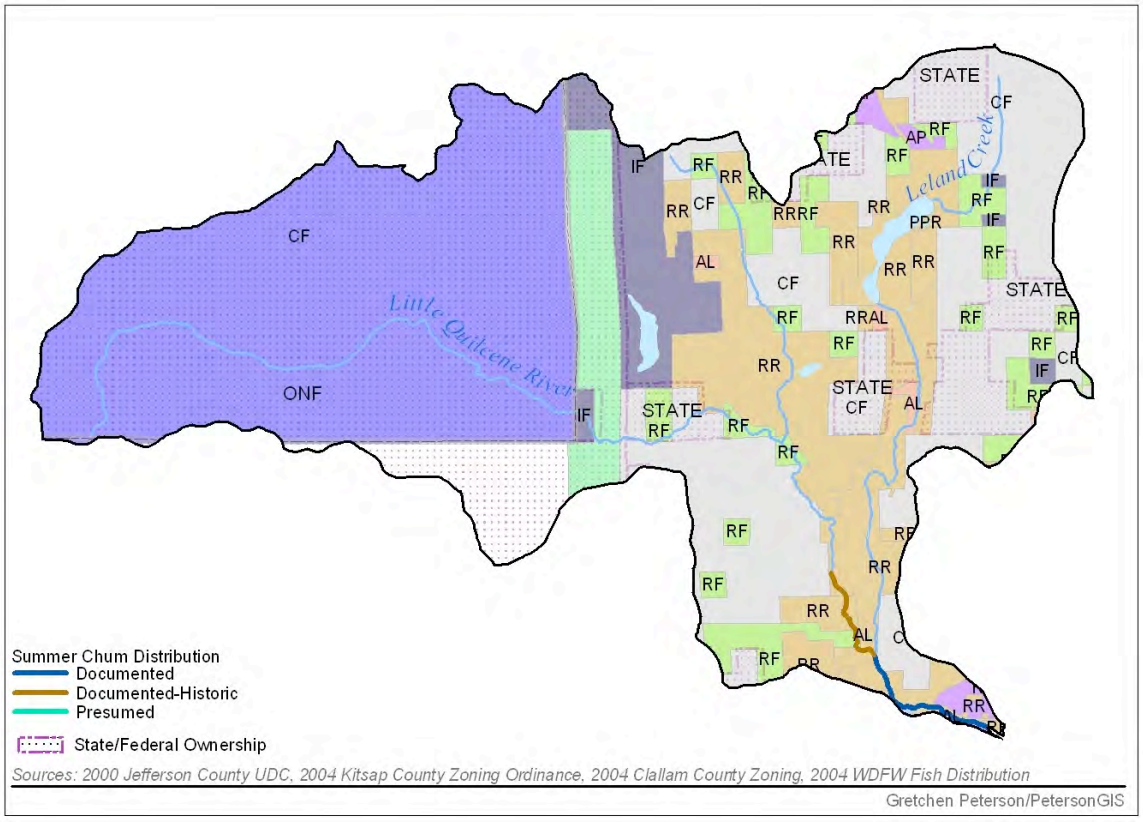


Figure 8.7. Jefferson County zoning for the Little Quilcene watershed.

Figure 8.8 presents Jefferson County zoning for the Big Quilcene watershed.

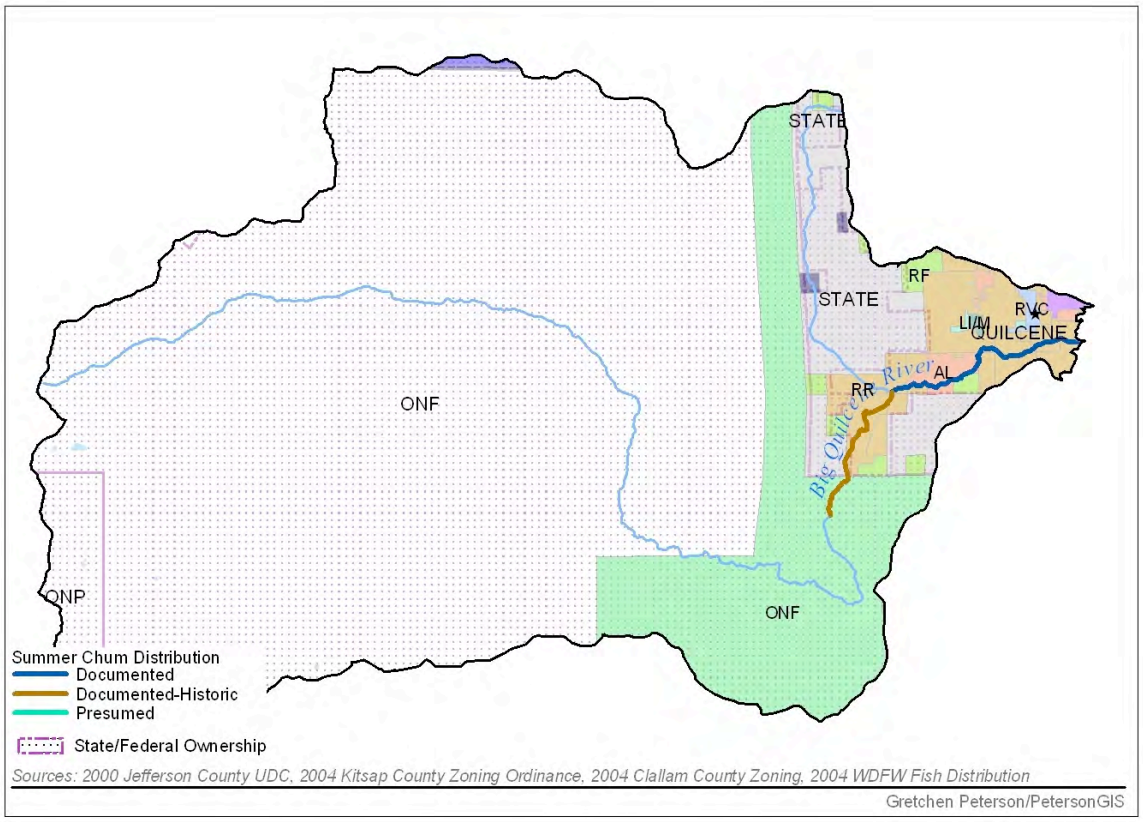


Figure 8.8. Jefferson County zoning for the Big Quilcene watershed.

Understanding future population growth, and its associated development, is critical to determine the potential future impacts to summer chum salmon habitat. A build-out analysis was conducted for the summer chum salmon ESU geographic area. This analysis used impervious surface area as a proxy for development. Based on existing land use designations (which are unique to each individual County), future impervious surface area was calculated and modeled. The amount of additional impervious surface area (relative to current) and where it can be expected to occur was determined for each County. Appendix C provides details of the methods used to conduct these build-out analyses.

Current and projected development in the Quilcene watersheds was analyzed (Peterson 2005 see Appendix C). Riparian corridors were delineated from 200 feet on either side of the river from the mouth upstream to the extent of presumed summer chum salmon distribution. Impervious surface area (IP) was measured using 5-meter resolution satellite imagery. Current IP within the Big Quilcene riparian corridor is 4.2% of the total riparian corridor area. For the Little Quilcene corridor, this value is 8.7%. Build-out looked at the potential to develop

the land under current regulatory programs and land use. Build-out for the Big Quilcene corridor is projected at 7.0% of the total area or an additional 6.6 acres of IP. For the Little Quilcene corridor, the additional acres of IP under build-out are projected to be 3.8, for a total of 11.6% of the corridor. These results are summarized in Table 8.6.

Table 8.6. Current impervious area (IP) and modeled build-out for the Big Quilcene and Little Quilcene riparian corridors.

Riparian Corridor	Corridor area acres	Current IP acres	Build-out IP acres	Added IP acres	Current IP%	Build-out IP%
Big Quilcene River	236	9.8	16.4	6.6	4.2	7.0
Little Quilcene River	130	11.3	15.1	3.8	8.7	11.6

The uplands, and nearshore within one mile of the Quilcene subestuaries, were also analyzed for projected build-out (Peterson 2005). Due to the close proximity of the mouths of both rivers, the estuary build-out analysis combined them. Of the total area delineated in the subestuary zone, current IP is at 1.6%. After build-out the IP climbs to 2.9%, for a total of 12.1 additional acres within the delineated subestuarine zone. The results of this analysis are summarized in Table 8.7.

Table 8.7. Current impervious area (IP) and modeled build-out for the subestuaries of the Big and Little Quilcene Rivers.

Estuary	Estuary Acres	Current IP acres	Build-out IP acres	Added IP acres	Current IP%	Build-out IP%
Quilcene	871	17.7	29.8	12.1	1.6	2.9

Watershed and stream research, which typically looks at a watershed-wide perspective, generally indicates that certain zones of stream quality exist. Most notably, at about 10% impervious cover area, sensitive stream elements are lost from the system. A second threshold appears to exist at around 25 to 30% impervious area, where most indicators of stream quality consistently shift to a poor condition (e.g., diminished aquatic diversity, water quality, and habitat scores).[42] More research is needed to determine if this research directly applies

[42] See The Center for Watershed Protection's (http://www.cwp.org) Stormwater Manager Resource Center at http://www.stormwatercenter.net for more extensive references on this subject. Table 1 at http://www.stormwatercenter.net/monitoring and assessment/imp cover/impercovr model.htm reviews the key findings of recent research regarding the impacts of urbanization on aquatic systems.

to the present analysis. It should be noted that similar research, however, has not been conducted for estuary and subestuary areas.

8.5. Specific Action Recommendations

This section presents specific recovery action recommendations for the Quilcene conservation unit. Recommended actions are categorized as either Programmatic (section 8.5.1) or Project (section 8.5.2). Actions identified will be further delineated as actions to benefit the targeted spawning aggregation (Quilcene). Specific action recommendations are also summarized and analyzed in the context of overall ESU-wide recovery (see section 13). All actions (previously implemented, on-going, and proposed) will become part of the Monitoring and Adaptive Management Program for the SRP as described in section 14.

8.5.1. Programmatic Actions

Programmatic recovery actions are those that are part of a policy, program, or process. They are generally of a regulatory or planning process nature. Programmatic actions could be part of a County's land use and regulatory program and structures, or watershed planning processes. Comprehensive plans, critical areas ordinances, shoreline management master programs, and zoning could all be considered programmatic actions in this context. Programmatic actions are non-project (i.e., habitat restoration projects--LWD placement, culvert repairs, etc.) in nature. Programmatic actions, however, can include projects when such projects are descriptive of a comprehensive or encompassing process (i.e., levee removal or set back as part of an estuary restoration plan). Watershed management plans often include projects to address identified factors of decline or specific habitat conditions. For the purposes of this SRP, the management plans or planning processes will be considered programmatic actions whereas the projects identified within the management plans will be categorized as projects.

To most effectively address those factors that are likely affecting the performance of the Quilcene spawning aggregation, the SRP recommends the following programmatic actions summarized in Table 8.8. Details of the programmatic actions approved and those being considered by the Jefferson Board of County Commissioners can be found in section 13.

Table 8.8. SRP recommended programmatic actions for the Quilcene spawning aggregation.

Recommended Programmatic Actions	Actions involved	Limiting factors to address
Jefferson County zoning for the Quilcene watersheds	-support continuation of the present zoning for the upper watersheds -monitor long-term effectiveness of the zoning code and enforcement -support Staff on their efforts regarding the core habitats and corridors work including development within channel migration zones -adopt CMZ guidelines as proposed for the CAO update (see section 13- "Jefferson County Programmatic Actions" for more details)	- poor riparian condition - loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)
Tri-Area UGA Stormwater Management Plan	-implement provisions of the Stormwater Management Plan -consider adoption of a stormwater control to assist in the implementation of the key provisions	- poor riparian condition - loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)
City of Port Townsend water supply	-support the recommendations of the WRIA 17 (WRIA 17 2003) watershed planning process regarding this issue -support City of Port Townsend's efforts and agreement to continue to ensure adequate spawning flow remains in the lower Big Quilcene during the months of August and September -consider formalization of the agreement to ensure adequacy in perpetuity	-low flow -inadequate future flows for spawning and outmigration
Olympic National Forest and State lands	-continue to preserve these lands in current ownership -Forest Service road maintenance and road abandonment plans should be implemented including appropriate resources to effectively complete the projects	-sediment aggradation
Community Nearshore Restoration Program	-pursue application and implementation of a Community Nearshore Restoration program similar to that being conducted in south Hood Canal (see section 13)	-estuarine and nearshore habitat loss and degradation

Quilcene River Summer Chum Salmon Supplementation Project	-ensure appropriate and properly funding monitoring occurs. -see section 14 of this SRP	-see WDFW and PNPTT (2000) and (2003a) for complete details of this project, also section 5 of this SRP

8.5.2. Projects

Project recovery actions are generally physical modifications to the landscape designed to address specific habitat situations in specific and limited geographic areas. Projects in the summer chum salmon ESU have been in progress for many years by a variety of groups and entities. Section 8.5.2.1 provides an overview of existing projects relative to summer chum salmon recovery planning. Many of the project recommendations presented in this SRP are from the HCCC Lead Entity strategy (HCCC 2004). This SRP is designed to coordinate with and build on that strategy. All projects that are proposed or recommended in this SRP are strictly voluntary in nature. Those projects that would either take place on, or impact, private property will require the full cooperation and permission from the affected landowners before proceeding. If that landowner permission cannot be obtained, those projects will not proceed. Estimated costs for these projects are presented in Appendix D.

8.5.3. Existing projects

Figure 8.7 provides a map of existing projects within the Quilcene conservation unit.

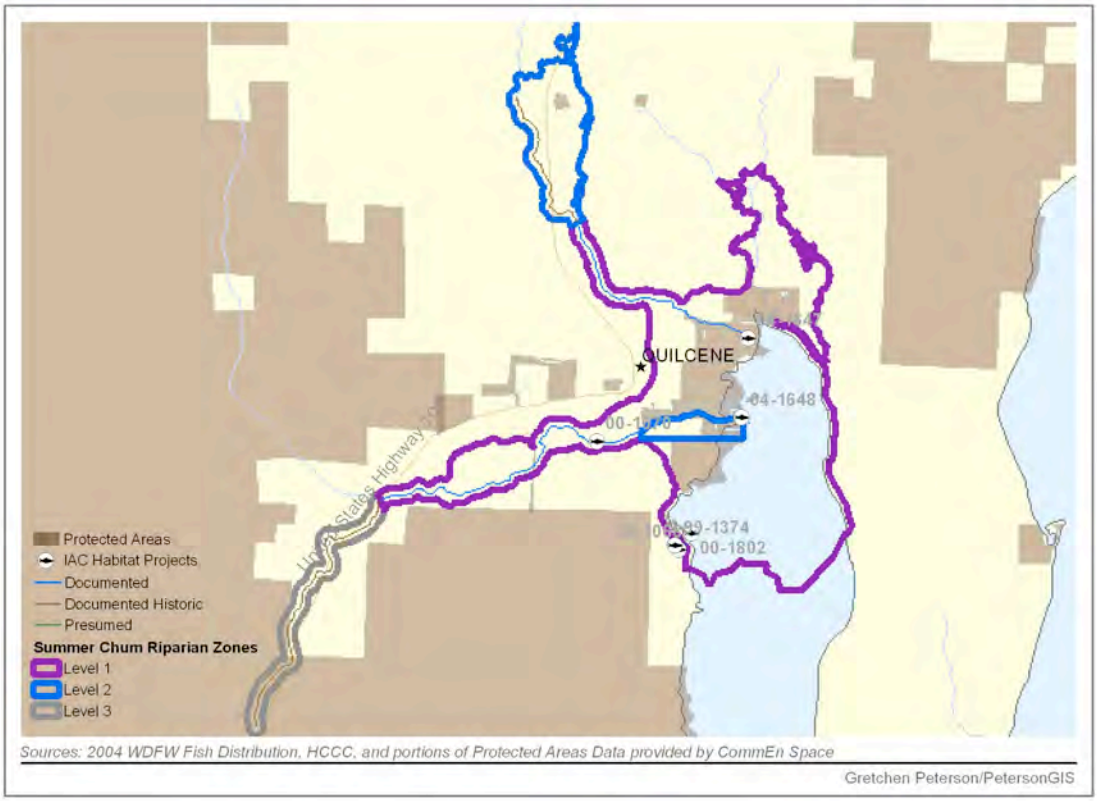


Figure 8.7. Existing summer chum salmon recovery projects located in the lower Quilcene watershed. Shaded areas represent protected lands.

Two of the existing and completed projects are described below (project descriptions are derived from IAC Grant Projects at http://www.iac.wa.gov/maps/default.asp and click on the Grant Project Maps link, accessed on June 14, 2005):

99-1374 Indian George Railroad Bridge Project Description:
This project is phase 1 of a 2-phase estuary restoration project. Phase 1 reconnected 2 slough segments in Quilcene Bay with a 60' Railroad Flat Car Bridge, connected Indian George Creek to the slough, and added scour logs to the lower creek to decrease water velocity. Reconnection of the 2 slough segments, removal of accumulated sediments, and the addition of slough-to-creek access will increase the quality and quantity of estuarine rearing habitat & remove an existing salmonid migration barrier. The southerly slough was cut off from a northerly slough by sediment aggradation caused by a failing culvert, which is also a fish barrier. This affects coho, steelhead, chum, and cutthroat migrating between the creek and the estuary. The culvert was removed and replaced with a 60' RR car bridge reconnecting both slough areas and the creek. This action will restore the southern slough habitat functions & increase the

quantity of rearing habitat and will increase salmonid access to a 10-acre tidal area, restoring circulation, nutrient distribution, and reduce water temperatures in the slough & nearshore area.

00-1802 Indian George Creek Estuary Restoration Project Description: Indian George Creek flows into the west side of Quilcene Bay, one mile south of the mouth of the Big Quilcene River. The 1.7 mile long stream was once associated with a significant estuary, 7 - 8 acres in size. Nearly 50 years ago the stream was channelized directly into Quilcene Bay and access roads were constructed across the upper part of the estuary and its outlet, which disconnected the stream from its estuary. The goal of the project was to restore estuary function and values by eliminating 250 lineal feet of parking lot fill and removing three derelict barges to restore the tidal prism and estuary habitat. This allows wave energy full access to the estuary to remobilize sediments from the fluvial into the marine system. Properly functioning estuaries have long been recognized as very productive aquatic environments. Summer chum and cutthroat also inhabit this system. The Hood Canal Salmon Enhancement Group is partnering with the WDFW to design, construct and manage this important project. Previously, the Jefferson Conservation District, Wild Olympic Salmon, and the Quilcene-Snow Restoration Team completed phase 1, the upstream habitat restoration portion.

8.5.3.1. Project recommendations

To most effectively address those factors that are likely affecting the performance of the Quilcene spawning aggregation, the SRP recommends the following projects for the Big Quilcene watershed (Table 8.10), the Little Quilcene watershed (Table 8.11) and Quilcene-Dabob Bay (Table 8.12). All projects that are proposed or recommended in this SRP are strictly voluntary in nature. Those projects that would either take place on, or impact, private property will require the full cooperation and permission from the affected landowners before proceeding. If that landowner permission cannot be obtained, those projects will not proceed.

Table 8.10. Big Quilcene River

Recommended Projects/Actions	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Restore sinuosity in the Big Quilcene River in the historical tidally influenced area	-primarily levee removal -LWD placement -other channel complexity actions	-loss of channel complexity (LWD, channel condition, loss of side channel, channel instability) -estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove dikes on WDFW property on the Big Quilcene River	-lower .5 mile on north shore	-estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove dikes south of the Big Quilcene River to restore salt marsh habitat	-would need to discuss feasibility of this project with private landowners -need to purchase land if landowner willing	-estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove artificially aggraded delta cone at mouth of Big Quilcene River	-excavation is required	-estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Fish passage at the QNFH weir	-hatchery provides coho fishery and is used for summer chum supplementation -additional habitat could be made available (see Zajac 2002)	-loss of channel complexity (LWD, channel condition, loss of side channel, channel instability) and floodplain loss -loss of habitat

Table 8.11. Little Quilcene River

Recommended Projects/Actions	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Restore sinuosity in the Little Quilcene River in the historical tidally influenced area	-primarily levee removal -LWD placement -other channel complexity actions	-loss of channel complexity (LWD, channel condition, loss of side channel, channel instability) and floodplain loss
Remove left bank dike along Little Quilcene River and nearshore	-already owned by county -right bank is private ownership and would need consent and discussions with land owner regarding feasibility	-loss of channel complexity (LWD, channel condition, loss of side channel, channel instability) and floodplain loss -estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Purchase conservation easement and set back right bank dike along the nearshore associated with the Little Quilcene River to restore salt marsh habitat	-currently in private ownership and would require discussion regarding project feasibility	-estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove artificially aggraded delta cone on Little Quilcene River	-excavation required	-estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

Table 8.12. Quilcene-Dabob Bay

Recommended Projects/Actions	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Remove landfill and bulkhead to restore historic saltmarsh and intertidal habitat between Boat Haven Marina and Indian George Creek.	-full residential development is in place and such a project would have to include a buyout the residences -work with landowners to discuss feasibility of project	-estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove abandoned creosoted RR pilings in Quilcene Bay south of Quilcene along W side of Bay		-estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

9. HAMA HAMA-DUCKABUSH-DOSEWALLIPS CONSERVATION UNIT

9.1. Introduction

The Hama Hama-Duckabush-Dosewallips Conservation Unit includes the Hama Hama, Duckabush, and Dosewallips River watersheds, their estuaries, the marine nearshore areas around these areas and the mid Hood Canal marine waters. In terms of the summer chum salmon stocks, "isolation by distance" best explains their genetic and population structure (Currens 2004 draft in progress).

As geographic distance increases between the spawning aggregations, fewer migrants are exchanged. Currens (2004) has determined that the greatest genetic exchange was between the spawning aggregations of central Hood Canal, which includes those occupying the Hama Hama, Duckabush, and Dosewallips Rivers (less than a 25 km spread between all three systems). Genetic analysis presented in Washington Department of Fish & Wildlife and Point No Point Treaty Tribes (2000) shows samples from native summer chum of the Hama Hama River to be significantly different from samples of other Hood Canal areas, except for Quilcene Bay/River. Due to the relatively large geographic distance between the Hama Hama River and Quilcene Bay (with both the Dosewallips and Duckabush rivers located in between) WDFW and PNPTT (2000) argues against the possibility of the Hama Hama and the Quilcene Bay populations being a single stock.

An examination of genetic information for the native Duckabush summer chum stock indicates it is significantly different from other Hood Canal summer chum populations, except for the Hama Hama (WDFW and PNPTT 2000). The finding of no significant difference does not necessarily mean these two populations are of the same stock. It is only an indication that they might be from the same population. In the case of Duckabush, geographic distance between the Duckabush and the Hama Hama, and between the Duckabush and other summer chum populations, appears sufficient to categorize Duckabush as a separate stock. The geographic differences between the Duckabush and other summer chum streams appear sufficient, when comparisons are made with geographic distances between other stocks identified as significantly different by genetic analysis (e.g., between the Dosewallips and the Big Quilcene/Little Quilcene stocks). More genetic analysis is in process for these stocks, but will not be available for inclusion in this Salmon Recovery Plan (SRP).

Lestelle et al (2005a), surmise that the Hama Hama, Duckabush, and Dosewallips are three of five extant Hood Canal summer chum salmon populations (Quilcene, Lilliwaup, Hama Hama, Duckabush, Dosewallips) that had large escapements prior to about 1980. That was followed by severe drops in abundance until the mid to late 1990s, when escapement began to climb again. The consistent pattern amongst these five stocks is attributed to (from Lestelle, et. al. 2005a):

- Favorable ocean conditions for marine survival until the mid 1970s, followed by a regime shift in the ocean that was unfavorable for survival until near the turn of the century, when conditions switched again to favor marine survival;
- Low harvest rates prior to the mid 1970s, followed by steadily increasing rates on Hood Canal populations, sometimes exceeding 80% and averaging close to 60% in the 1980s; harvest rates fell sharply in the mid 1990s and were at very low levels again when ocean survival conditions turned favorable;
- Hatchery supplementation fish beginning to return to the Quilcene system in 1995, and several years later to the Hama Hama and Lilliwaup systems, roughly near or corresponding to the period of improving ocean conditions and low harvest rates; although no directed supplementation has occurred in the Dosewallips or Duckabush systems, some stray hatchery fish are suspected to have entered those streams in the late 1990s.

Current habitat conditions and situations were assessed using a variety of sources. Several sources were used to assess the summer chum salmon stocks in the Eastern Strait of Juan de Fuca conservation unit. This Salmon Recovery Plan (SRP) will not repeat the details of these assessments, but instead refers the reader to the cited documents. All material and documents referenced in this SRP should be considered part of, and integral to, the recovery of summer chum salmon. These sources provided the primary reference and knowledge base for development of these aspects of the SRP. Details of the EDT assessments for the Eastern Strait of Juan de Fuca stocks, including a summary of the baseline performance measures, and a summary of strategic priorities, are provided in Lestelle et al, (2005a) (see Appendix A). The EDT Method is a widely used tool to help prioritize habitat restoration and protection measures for salmon populations. It provides a systematic way of diagnosing habitat conditions that have contributed to the current state of populations, and it enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits to salmon populations of actions that might be taken to address habitat related issues impeding recovery. Other detailed assessments of habitat and environmental conditions are provided in the SCSCI (WDFW and PNPTT 2000), Correa (2002), and May and Peterson (2003).

The Hama Hama, Duckabush, and Dosewallips are three of the six core stocks that comprise the Hood Canal summer chum salmon population, as identified by the Puget Sound Technical Recovery Team (PSTRT) (Currens 2004 Draft in progress). Low channel complexity, estuarine habitat loss and degradation, riparian degradation, and freshwater wetland loss, appear to be the principal factors associated with the decline of summer chum in the Hama Hama, Duckabush, and Dosewallips watersheds. Like other west Hood Canal watersheds, the Hama Hama, Duckabush and Dosewallips are remote from development pressures, and much of their headwaters are managed by public

agencies with mandates for the conservation of indigenous species. However, development pressures are highly concentrated in and around the lower river areas, where most summer chum use occurs. Nonetheless, compared to other Hood Canal and eastern Strait of Juan de Fuca watersheds, prospects for the recovery of summer chum are good. On the Hama Hama, one family owns most of the land in the lower reaches of the river, where summer chum spawn, which simplifies potential public-private conservation efforts. Although summer chum habitat in the Hama Hama is presently altered, compared to historic conditions, current conditions are not beyond recovery and past escapement estimates indicate the watershed has strong summer chum production potential.

May and Peterson (2003) have rated the lower Duckabush, the Duckabush estuary, the lower Dosewallips River and the north side of the Dosewallips estuary as "priority refugia with natural ecological integrity." The south side of the Dosewallips estuary is rated as "potential refugia with altered ecological integrity." The potential refugia rating means that the habitat has been highly modified by drainage modifications, channelization, and conversion for residential purposes. This area is determined to be a good candidate for restoration.

Priority action recommendations developed in this SRP will focus initially on the lower two miles of rivers, where spawning and rearing tend to occur, and the estuarine areas. Actions in the upstream areas of the watersheds will require assessments to determine impacts and limiting factors that contribute to degradation in the lower reaches. Protection, restoration and maintenance of the Hama Hama, Duckabush, and Dosewallips watersheds are of paramount importance. In these watersheds, the lower river sections and the estuaries are targeted for restoration. These areas must be restored and protected to effect and ensure recovery of the Hood Canal population aggregation.

9.2. Geographic Description & Human Population Distribution

The Hama Hama-Duckabush-Dosewallips Conservation Unit includes the Hama Hama, Duckabush, and Dosewallips River watersheds. The marine nearshore waters are also included. They start at the mouth and estuary of the Hama Hama River, and moving north along the west side of Hood Canal, encompass the Duckabush and Dosewallips River estuaries. Off shore areas of mid Hood Canal waters are also included in this conservation unit.

The upper two thirds of this conservation unit is within eastern Jefferson County and includes most of the Dosewallips and Duckabush watersheds. The lower third lies within Mason County and includes most of the Hama Hama watershed.

Figure 9.1 provides a map of the Hama Hama-Duckabush-Dosewallips Conservation Unit. The Hama Hama watershed covers an area of 85 square miles with 18 miles of mainstem river length. The Duckabush River flows for a total mainstem length of 25 miles and covers 75 square miles. The total length of the Dosewallips River mainstem is 28 miles with a watershed area of 112 square miles. Detailed descriptions of each of these watersheds can be found in the Summer Chum Salmon Conservation Initiative (SCSCI) Appendix 3.6 (WDFW and PNPTT 2000), and the WRIA 16 limiting factors report (Correa 2003).

Figure 9.1. Hama Hama-Duckabush-Dosewallips Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

The unincorporated town of Brinnon, located at the mouth of the Dosewallips River, is the major area of human settlement in this unit. Population density throughout this conservation unit is relatively low.

Figure 9.2 shows that population density. Human population density relative to summer chum salmon distribution is generally low in this conservation unit, with the exception of the Brinnon area.

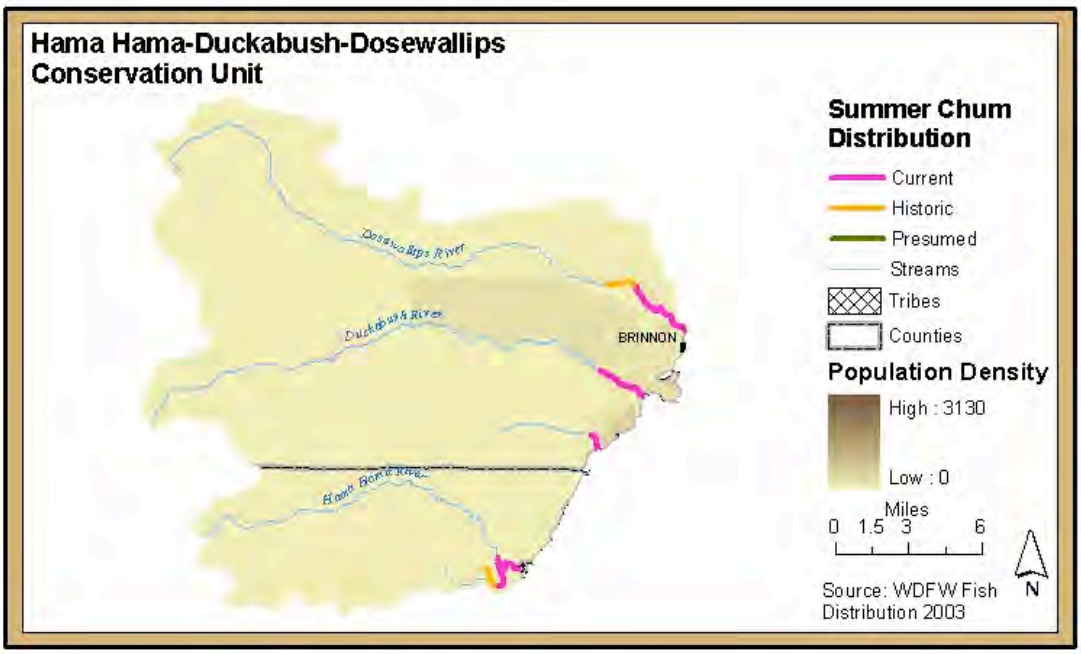


Figure 9.2. Human population density (people per square mile) for the Hama Hama-Duckabush-Dosewallips Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

9.3. Summer Chum Salmon Stocks' Description & Distribution

Several sources were used to assess the summer chum salmon stocks in the Hama Hama-Duckabush-Dosewallips conservation unit. This SRP will not repeat the details of these assessments, but instead refers the reader to the cited documents. All material and documents referenced in this SRP should be considered part of and integral to the recovery of summer chum salmon. The reader is urged to review the SCSCI (WDFW and PNPTT 2000) and subsequent supplemental reports. Summer chum salmon in Hood Canal and the Eastern Strait of Juan de Fuca were also assessed based on application of the Ecosystem Diagnostic and Treatment (EDT) Method. The EDT Method is a widely used tool to assist in the prioritization of habitat restoration and protection measures for salmon populations. EDT provides a systematic way of diagnosing habitat conditions that have contributed to the current state of fish populations. It enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits of actions that might be taken to address salmon habitat problems (Lestelle et al 2005). The complete detailed EDT for summer chum salmon can be found at http://www.wa.gov/hccc/ and click on the Salmon Recovery Planning Activities link. On that page can be found links to various documents and the

EDT web site for summer chum salmon. The web address for the EDT site: www.mobrand.com/edt/sponsors/show_sponsor.jsp?sponsor_id=11

9.3.1. Stocks' Status & Trends

Naturally produced summer chum salmon, originating from the Hama Hama-Duckabush-Dosewallips Conservation Unit, are likely produced in the Hama Hama, Duckabush and Dosewallips watersheds (WDFW and PNPTT 2000). Summer chum spawn in the mainstem of the Hama Hama River up to river mile (RM) 2 and in the lower 1.8 miles of John Creek (a tributary). Most spawning occurs below RM 1.8 in the Hama Hama and below RM 0.3 in John Creek. Spawning in the Duckabush River occurs in the mainstem up to RM 3.5 with the majority spawning below RM 2.2. Spawning in the Dosewallips is limited to the lower 4.3 miles with the majority of spawning occurring below RM 2.5

Current, historic and presumed summer chum salmon distribution in the Hama Hama-Duckabush-Dosewallips Conservation Unit is shown in Figure 9.3.

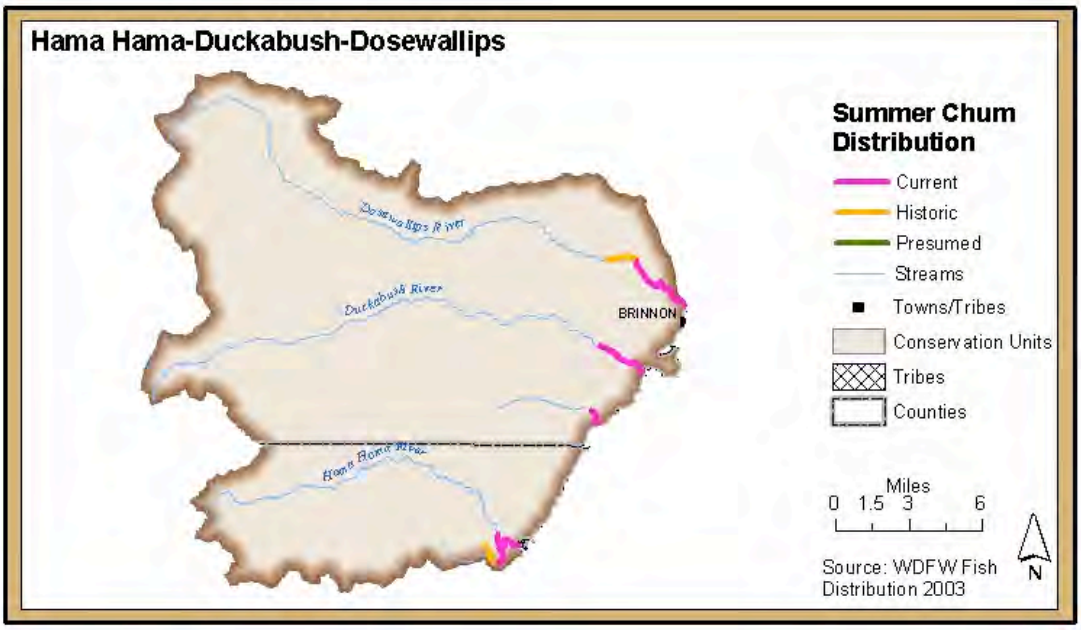


Figure 9.3. Map of the Hama Hama-Duckabush-Dosewallips Conservation Unit showing current, historic and presumed summer chum salmon distribution.

Summer chum salmon produced from the Hama Hama, Duckabush, and Dosewallips Rivers are part of the Hood Canal population targeted for recovery by the PSTRT. The Hood Canal population is one of two independent summer chum populations tentatively identified by the PSTRT (Currens 2004 Draft in progress). Currens (2004 Draft in progress) provides a detailed analysis of these conclusions. It speculates on the importance of the historical geographic distribution of summer chum salmon habitat and the overall "isolation-by-distance

relationship" that seems to be observed in the summer chum salmon aggregations. More analyses of population identification and viability are expected from the PSTRT. At this time it is not expected that this further analyses will affect the basic approach taken for recovery in this SRP. PNPTT and WDFW (2003) have identified the naturally produced stocks in the Hama Hama, Duckabush, and Dosewallips Rivers that should be targeted for recovery. The Hama Hama, Duckabush, and Dosewallips stocks are three of the six stocks that comprise the PSTRT designated Hood Canal aggregation. The co-manager interim recovery goals for these stocks are presented in Table 9.1.

Table 9.1. Hood Canal aggregation: co-manager interim abundance and escapement recovery goals for the Hama Hama, Duckabush, and Dosewallips spawning aggregations.

Stocks	Abundance	Escapement
Hama Hama	6,060	3,790
Duckabush	3,290	2,060
Dosewallips	3,080	1,930

PNPTT and WDFW (2003) also developed abundance and spawning escapement threshold criteria for recovery. Abundance is defined as the size of the run or the number of recruits. Recruits are the number of fish (in this case summer chum salmon from the Hood Canal/Eastern Strait of Juan de Fuca ESU geographic area) available for all fisheries in any given year. Escapement is defined as the number of adults that return to the natal spawning grounds (they escaped all fisheries and are available to spawn). One of the criterion for recovery is that each summer chum stock (Hama Hama, Duckabush, Dosewallips) must, over a minimum of the recent twelve year period, have both a mean abundance and mean escapement of natural-origin recruits that meets or exceeds the defined thresholds. Table 9.2 provides a summary of escapement for the recent twelve year period, 1993-2004, for the three stocks of concern in the Hama Hama-Duckabush-Dosewallips conservation unit.

Table 9.2. Escapement thresholds for the Hama Hama, Duckabush, and Dosewallips spawning aggregations based on PNPTT and WDFW (2003).

	ESCAPEMENT				
Population aggregation	**93-04 Average**	**target**	**% of target**	**# times below target 2001-2004 (≤1)**	**# times below target 1997-2004 (≤2)**
Hama Hama	792	3790	21%	4	8
Duckabush	1423	2060	69%	3	7
Dosewallips	2777	1930	144%	2	6

Of the three stocks from this conservation unit, only the Dosewallips currently exceeds the escapement threshold, as established by the co-managers; however, to meet the recovery goal 12-year criterion, only natural origin escapement must be counted. Additional criteria require that the stocks do not

fall below the target in more than once in the recent four-year period and no more than twice in the recent eight-year period. None of the three spawning aggregations meet the criteria for the recent four-year and eight-year periods. It should be noted that criteria for productivity (for example, most recent eight year average equal to or greater than 1.6 recruits per spawner) also must be met for recovery. Data currently are insufficient to assess the productivity criteria but are being collected (PNPTT and WDFW 2003).

Summer chum salmon escapement (number of adults returning to spawn) for the Hama Hama River from the years 1974-2004 is presented in Figures 9.4.

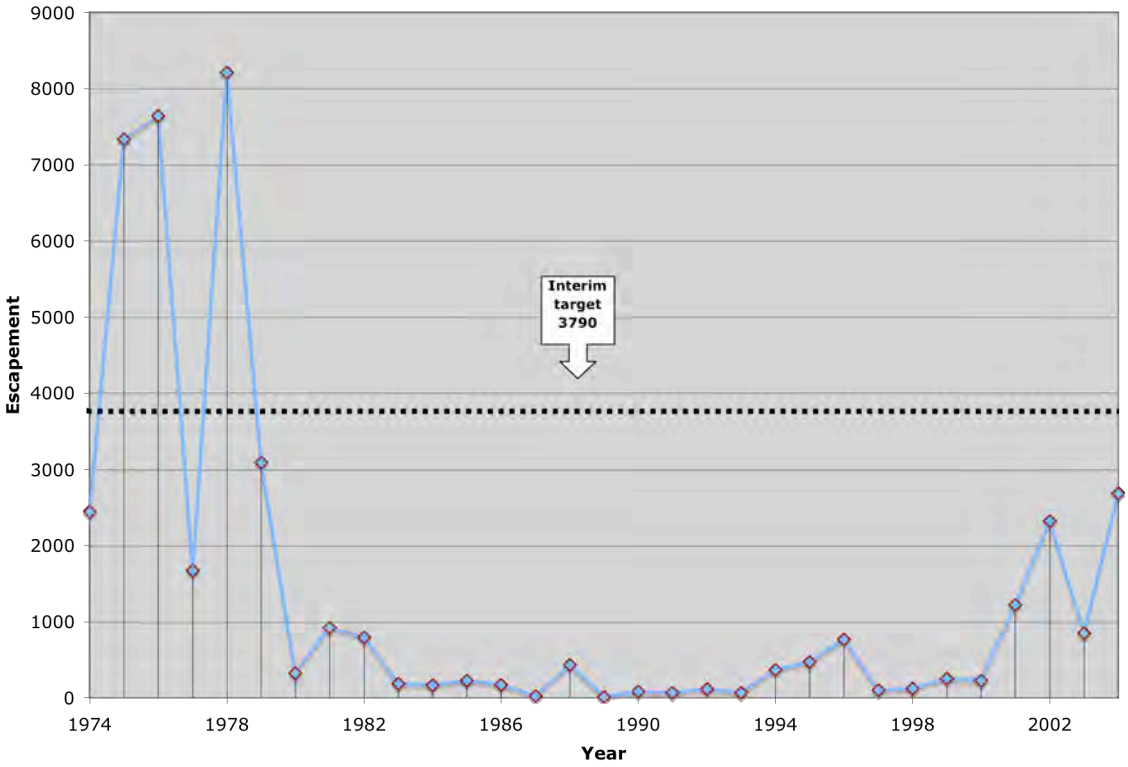


Figure 9.4. 1974-2003 summer chum salmon escapement for the Hama Hama River (data source: WDFW and PNPTT 2003, 2004, and 2005).

The co-managers have assessed the extinction risk faced by individual summer chum salmon stocks, based on the methodology offered by Allendorf, et. al. (1997) and discussed in detail in section 1.7.4 of the SCSCI (WDFW and PNPTT 2000). The extinction risk was assessed again in 2003, based on data available through 2002 (WDFW and PNPTT 2003). The most recent assessment of extinction risk from the co-managers for the Hama Hama stock states, “The annual average estimated Hama Hama system escapement over the past four years is 1,010 summer chum, ranging from 229 to 2,328 spawners. The effective population size (N_e) equals 727 fish for the 1999-02 return years, and total population size (N) is 3,636 for the same years. Because the population exceeds

the high risk abundance criterion (population size, N_e < 500 or N < 2,500) and is currently increasing relative to the low years from 1987-1993, the risk of extinction is judged to be low."[43]

Summer chum salmon escapement (number of adults returning to spawn) for the Duckabush River from the years 1974-2004 is presented in Figures 9.5.

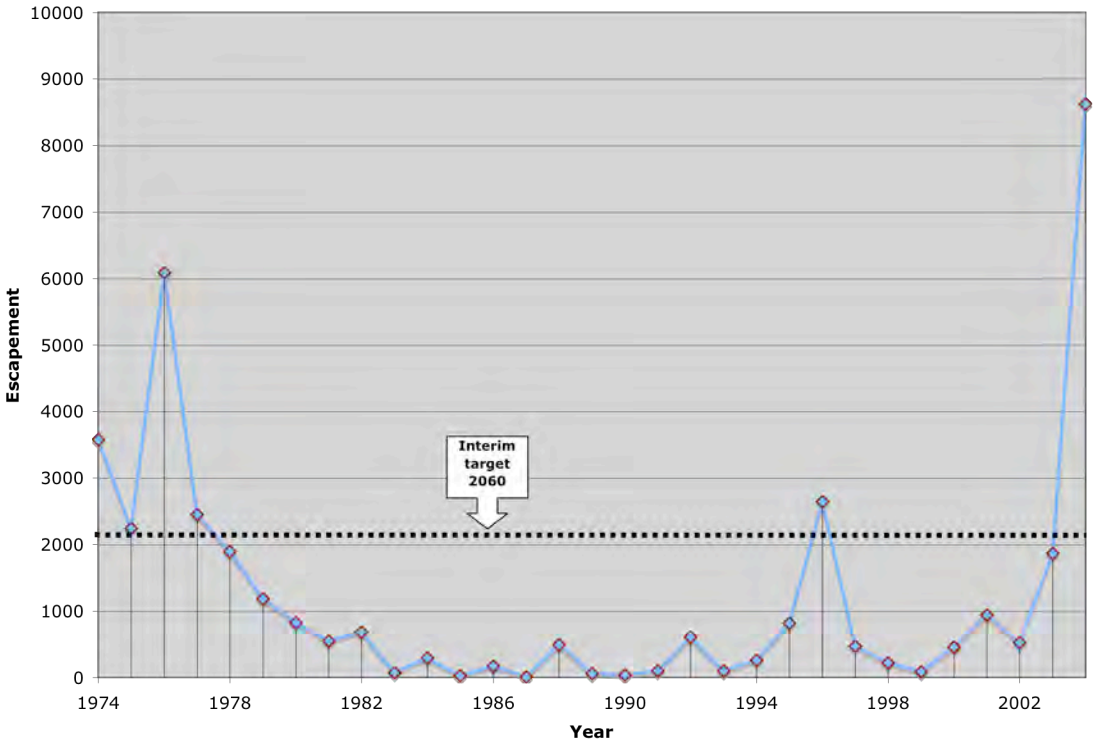


Figure 9.5. 1974-2003 summer chum salmon escapement for the Duckabush River (data source: WDFW and PNPTT 2003, 2004, and 2005).

The most recent assessment of extinction risk from the co-managers for the Duckabush stock says, "The estimated escapement to the Duckabush River ranges from 92 to 942 summer chum over the last four years, averaging 507 spawners. The effective population size (N_e) equals 365 fish for the 1999-02 return years, and total population size (N) is 1,825 for the same years. Though escapements have declined substantially since the 1970s, the current escapement levels are higher than the low levels experienced from 1984 through 1990. The recent population size for this stock (N_e < 500 or N < 2,500) indicates that the risk of extinction for Duckabush summer chum is moderate."[44]

[43] This assessment has just been updated by the co-managers and includes the years 2003 and 2004 (WDFW and PNPTT In preparation). The update indicates no change in the judgement of a low extinction risk for Hama Hama.
[44] It should be noted that the co-managers' extinction rate assessment for Duckabush has changed in a just updated assessment that includes the years 2003 and 2004. The update

Summer chum salmon escapement (number of adults returning to spawn) for the Dosewallips River from the years 1974-2004 is presented in Figures 9.6.

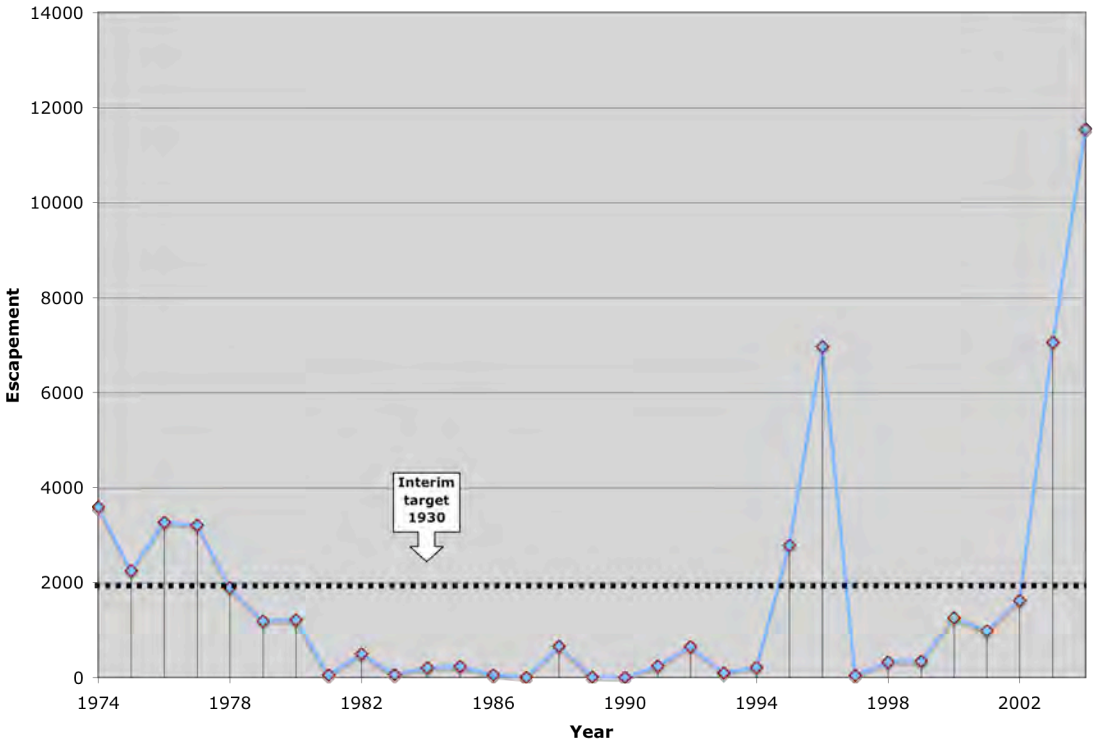


Figure 9.6. 1974-2003 summer chum salmon escapement for the Dosewallips River (data source: WDFW and PNPTT 2003, 2004, and 2005).

The most recent assessment of extinction risk from the co-managers for the Dosewallips stock states, "The 1999 through 2002 annual average escapement of summer chum salmon was 1,057 spawners, ranging from 47 to 1,260 fish. The effective population size (Ne) equals 761 fish for the 1999-02 return years, and total population size (N) is 3,805 for the same years. Escapements have increased substantially over the lows experienced in the 1980s and the recent population size for this stock exceeds the risk abundance criterion (Ne < 500 or N < 2,500), indicating that the current risk of extinction for Dosewallips summer chum is low."[45]

indicates the risk of extinction to now be low rather than moderate, owing primarily to the high escapements in 2003 and 2004 (WDFW and PNPTT In preparation).

[45] This assessment has been updated by the co-managers to include the years 2003 and 2004 (WDFW and PNPTT In preparation). The update indicates no change in the judgement of a low extinction risk for Dosewallips.

9.4. Habitat Overview & Environmental Conditions

Details of the EDT assessments for the Hama Hama-Duckabush-Dosewallips conservation unit stocks, including a summary of the baseline performance measures and a summary of strategic priorities, are provided in Appendix A. Other detailed assessments of habitat and environmental conditions are provided in the SCSCI (WDFW and PNPTT 2000), Correa (2003), and May and Peterson (2003).

9.4.1. Factors contributing to the decline of summer chum salmon

The populations in Hamma Hamma-Duckabush-Dosewallips conservation unit show a dramatic loss in performance, particularly in productivity. Under sustained, unfavorable ocean conditions, the population would be at a high risk of extinction (Lestelle et al 2005a). It should be noted that the results and conclusions of this EDT analysis for the Hamma Hamma watershed have not been fully reviewed by State, tribal and other biologists familiar with Hood Canal and the watershed. An understanding of the ecological importance of the connectivity of the lower river floodplain to the estuary and the effect of that connectivity on the function of the freshwater habitat in the lower river is critical for this type of assessment and will need to be further explored.

A summary of EDT conclusions for these populations (Lestelle, et. al., 2005a) states that:

• The populations shows a high loss in performance, compared to historic levels, both in abundance and productivity, particularly under unfavorable ocean survival conditions.

• The amount of potential increase in population abundance is greatest through restoration of freshwater reaches and connectivity with natal subestuary; full restoration of estuarine-marine waters and the natal subestuary appear to offer similar levels of benefit.

• Protection of freshwater reaches and a better understanding of the connectivity with the natal subestuary is the highest priority.

• Potential benefits of restoring estuarine-marine areas are diffused over many segments.

• Within freshwater, habitat diversity, channel stability, and sediment load are seen as the most important factors to restore.

• Within the natal subestuary, several factors appear to be equally important for restoration, along with the amount of area available to be used for rearing.

• Within the estuarine-marine environment, the most important factor for restoration is food, associated with loss of eelgrass, the installation of revetments, and loss of riparian corridors.

The SCSCI (WDFW and PNPTT 2000), the "Limiting Factors Report for WRIA 17" prepared by the Washington Conservation Commission (Correa 2003), and May and Peterson (2003) provide details of the various habitat factors and environmental conditions affecting summer chum salmon in this conservation unit. In general, the findings from these reports are corroborated by the EDT assessment (Appendix A). These factors and conditions are summarized in the tables below for the Hama Hama River (Table 9.3), for the Duckabush River (Table 9.4), and for the Dosewallips River (Table 9.5).

Table 9.3. Hama Hama River

Factors for decline	Life stage most affected	Remarks
Loss of channel complexity (large woody debris, channel condition, loss of side channel, channel instability)	Spawning and incubation	In lower mainstem, dredging and bank hardening along with removal of large woody debris has reduced overall channel complexity. Large woody debris is completely lacking in specifically identified areas.
Altered sediment dynamics	Spawning and incubation	Extensive sediment aggradation in lower John Creek has impeded spawning access in recent years. Subsurface flows can occur in summer during spawning migration periods, which robs spawners of needed flow.
Riparian degradation	Spawning and incubation	48% of the forested buffer area consists of small trees (<12 in dbh). In the lower 1.8 miles of John Creek, pools composed 51% of the total habitat area (rated fair), but large woody debris loading was extremely poor (0.06 large woody debris pieces/m). Most notably, large-sized large woody debris pieces, which are important habitat forming and stabilizing features of larger rivers, were completely absent from the Hama Hama mainstem, suggesting that streambed instability that may result in redd scour during peak flow events.
Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)	Juvenile rearing and migration	Over 13% of the estimated 368.5 acre historic delta is diked in three areas, accounting for a loss of summer chum rearing habitat. One filled area in the

		outer, southern corner of the delta accounts for a loss of 3.2 acres (1% of historic delta habitat). An estimated 2.4 acres (0.6% of historic delta area) of the mainstem distributary channel, where it crosses the outer intertidal area, has been dredged. At least seven areas of aquaculture or other modifications of the delta surface are apparent from contemporary aerial photographs that total 2.2 acres (0.6% of historic delta area).

Table 9.4. Duckabush River

Factors for decline	Life stage most affected	Remarks
Loss of channel complexity (large woody debris, channel condition, loss of side channel, channel instability) and floodplain loss	Spawning and incubation	The channel in the lower river appears to have been greatly simplified since the late 1800s by the scouring action of splash damming, large woody debris removal, and conversion of floodplain to pastureland and residential development. As a result, habitat diversity and complexity has been reduced (e.g. side channels, deep holding pools, and stable spawning gravels). A 1992 U.S. Fish and Wildlife Service survey from river mile 0.2 to 2.3 found 31% of habitat area in pools and sparse woody debris, which indicates degraded habitat conditions.
Sediment aggradation	Spawning and incubation	Channelized and diked area in the lower reaches has resulted in channel aggradation. Forest Service logging roads built during the 1940s to 1960s contribute to the sedimentation problems.

Loss of riparian forest	Spawning and incubation	Logging of old growth floodplain forest and conversion to pasture and residential areas has greatly reduced the potential for large woody debris recruitment to the channel. The forested buffer below river mile 3.0 is dominated by medium-sized (12-20 in dbh) trees (66%) and, to a lesser extent, small (<12 in dbh) trees (32%). Mixed conifer and deciduous forests predominate (57%) in the riparian zone, and 59% of the forested buffer is >132 ft in width (all percentages by length).
Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)	Juvenile rearing and migration	Two diked areas totaling 3.9 acres occupy 2.8% of the original 291.6 acres of estuarine delta habitat; these diked areas are located at the northern edge of the delta and are association with residential development adjacent to a small distributary channel. An estimated 0.2 acres (0.1%) of the historic delta area has been filled and two ditches or remnant dikes with a total length of 0.3 mi are evident in the delta. US Highway 101 is the most prominent of five roads that traverse the delta.

Table 9.5. Dosewallips River

Factors for decline	Life stage most affected	Remarks
Loss of channel complexity (large woody debris, channel condition, loss of side channel, channel instability) and floodplain loss	Spawning and incubation	Much of the lower river below river mile 3.0 has been simplified since the late 1800s by the placement of riprap, dike construction, large woody debris removal, the scouring action of splash dam operation, and conversion of floodplain to pastureland and residential development.
Sediment aggradation	Spawning and incubation	Channelized and diked area in the lower reaches has resulted in channel aggradation. Forest Service logging roads built during the 1940s to 1960s contribute to the sediment problems.
Loss of riparian forest	Spawning and incubation	Logging of old-growth floodplain forest areas along the lower 3.0 miles of the river has reduced both the original extent of riparian forests and the potential for large woody debris recruitment to the channel. Small trees (<12 in dbh) dominate 51% of the forested buffer below river mile 4.3. Forty one percent is deciduous dominated, but 52% is mixed conifer and deciduous forest and 58% of the forested buffer is greater than 132 ft wide (all percentages by length). An analysis of riparian large woody debris recruitment potential completed by the US Forest Service as part of the Dosewallips Watershed Analysis also identified fair (28%, by stream length) to poor (40%) riparian conditions predominating along the

		entire length of the river mainstem.
Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)	Juvenile rearing and migration	15.4% (68.5 ac) of the original summer chum rearing and migration habitat area in the Dosewallips estuary is diked. Four tidegates appear to regulate or prevent tidal inundation in these diked areas. One ditch or remnant dike, 0.4 mi long, attests to past attempts to further eliminate tidal inundation along the delta face. Ten road causeways, totaling 1.2 mi, bisect or fringe the delta. The Highway 101 crossing of the delta is the most deleterious. Construction of the highway, and the subsequent development that was facilitated by it, essentially cut off most of the secondary tidal channel connectivity across the delta. Two major distributary channels, that appear to have historically linked with the river higher in the delta, were isolated. Five identifiable fill areas associated with residential or agricultural development occupy 2.5 ac (0.6% of historical delta area). One aquaculture or similar modification to the delta surface covers 2.9 ac (0.6%), but it is not evident whether this poses a significant loss of estuarine habitat function. That loss depends to a large degree on the scale and frequency of disturbance to important habitat areas such as eelgrass.

9.4.2. Human development and land use

Population density in the Hama Hama-Duckabush-Dosewallips Conservation Unit is relatively low. Figure 9.7 Presents population density for the watersheds in the conservation unit.

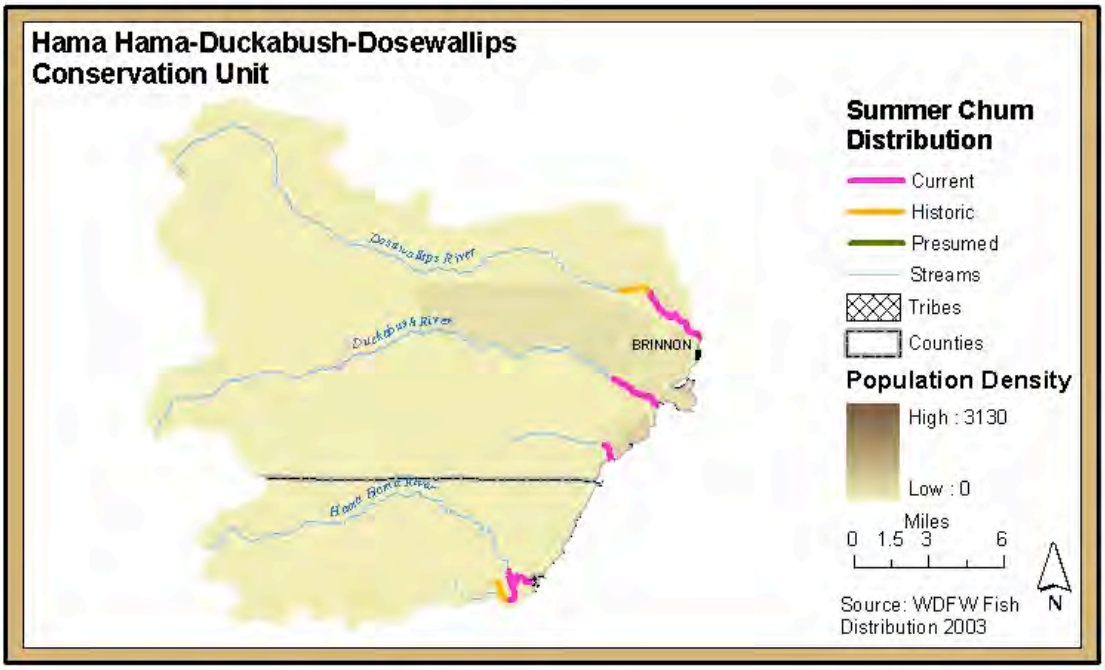


Figure 9.7. Human population density (people per square mile) for the Hama Hama, Duckabush, and Dosewallips River watersheds (map produced by Gretchen Peterson, Peterson GIS).

A total of an additional 125 people are expected in the Dosewallips and Duckabush watersheds over the next twenty years (Christensen 2003). Table 9.6 presents the results of population projections and growth rates.

Table 9.6. Population projections and growth rates for the Dosewallips and Duckabush watersheds (from Christensen 2003).

Watershed	Population in 2000	20 Year Estimated Population Growth	2024 Estimated Population	Notes
Dosewallips River	284	56	340	Rural Growth Rate assumed 1.09%
Duckabush River	350	69	419	Rural Growth Rate assumed 1.09%

The Hama Hama River originates on the rugged eastern slope of the Olympic Mountains within the Olympic National Park and enters Hood Canal in northern Mason County, south of the rural community of Eldon. Nearly 95% of the Hama Hama watershed is under public ownership; 60% is managed public forestland

and 34% is protected in National Park or designated wilderness. The remaining 5% is under private ownership and is located in the lower portions of the watershed. Most of the floodplain area along the lower 1.5 miles of the Hama Hama has been appropriated for agricultural and residential uses (WDFW and PNPTT 2000). The main channel today was a secondary channel historically. It has been straightened, channelized, diked and dredged. The freshwater flow has been routed away from present shellfish beds. The historic secondary channel, now the mainstem, was once an extended salt marsh with a spit crossing the mainstem. Pilings were placed on the spit itself to support a dike, which has now eroded away. A large bulkhead and fill now accommodates a shellfish facility at the base of the historic spit (Correa 2003).

Mason County has designated the lands in the lower Hama Hama as Agricultural Resource Lands or Rural Residential (RR5-one dwelling unit per 5 acres) according to Mason County Resource Ordinance 77-93, adopted January 2005 (Mason County Code 17.01). The Mason County Resource Ordinance is in effect while the Mason County Comprehensive Plan is being reviewed for revision according to the mandates of GMA. Figure 9.8 presents land ownership, and associated summer chum distribution, for the Hama Hama watershed.

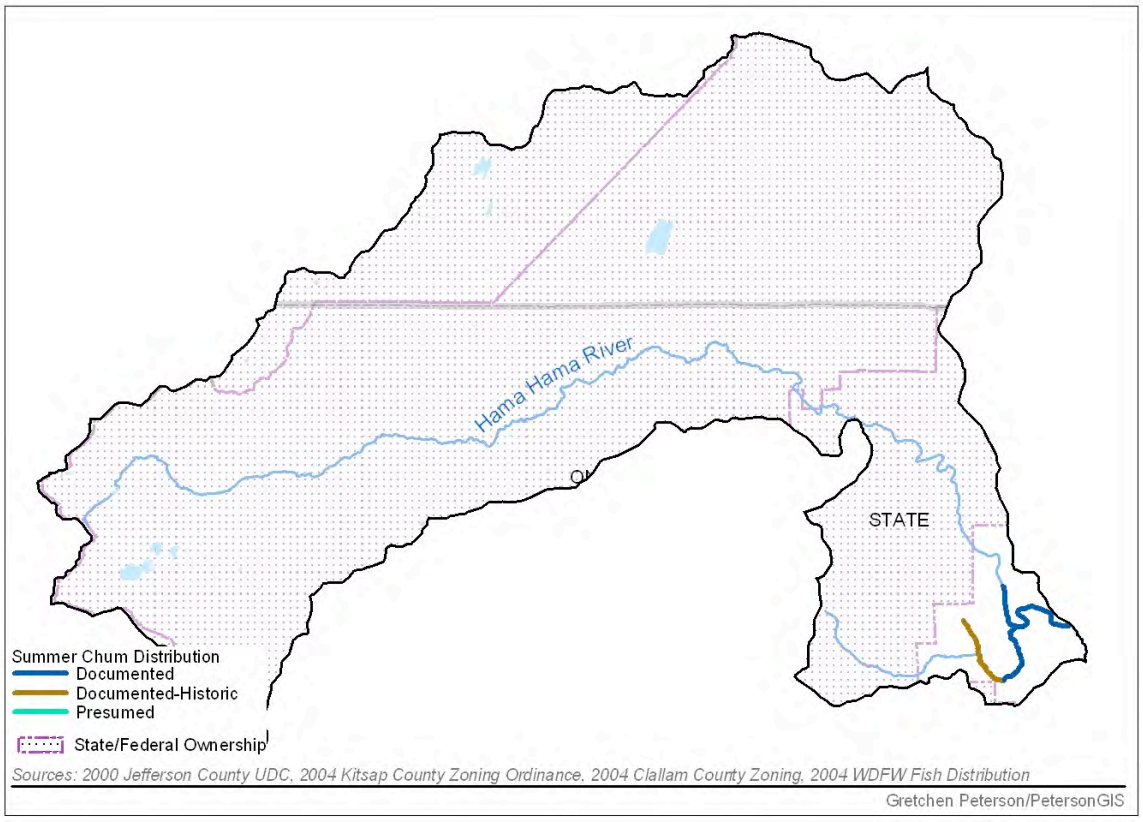


Figure 9.8. Land use and ownership for the Hama Hama watershed.

The upper 80% of the Duckabush River watershed is protected in Olympic National Park and the Brothers Wilderness in the Olympic National Forest. Nearly 25% of the riparian zone below river mile (RM) 3 is now developed (12% urban/commercial, 9% rural residences, and 3% roads/dikes). US Forest Service ownership begins at approximately RM 2.3 and extends upstream to approximately RM 11.5. Between the USFS lands and the mouth of the river, land use is predominantly managed for timber harvest, with some rural residential and urban commercial development in the lower 1.5 miles (Correa 2003). Figure 9.9 depicts land use for the Duckabush watershed according to the Jefferson County UDC Title 18.

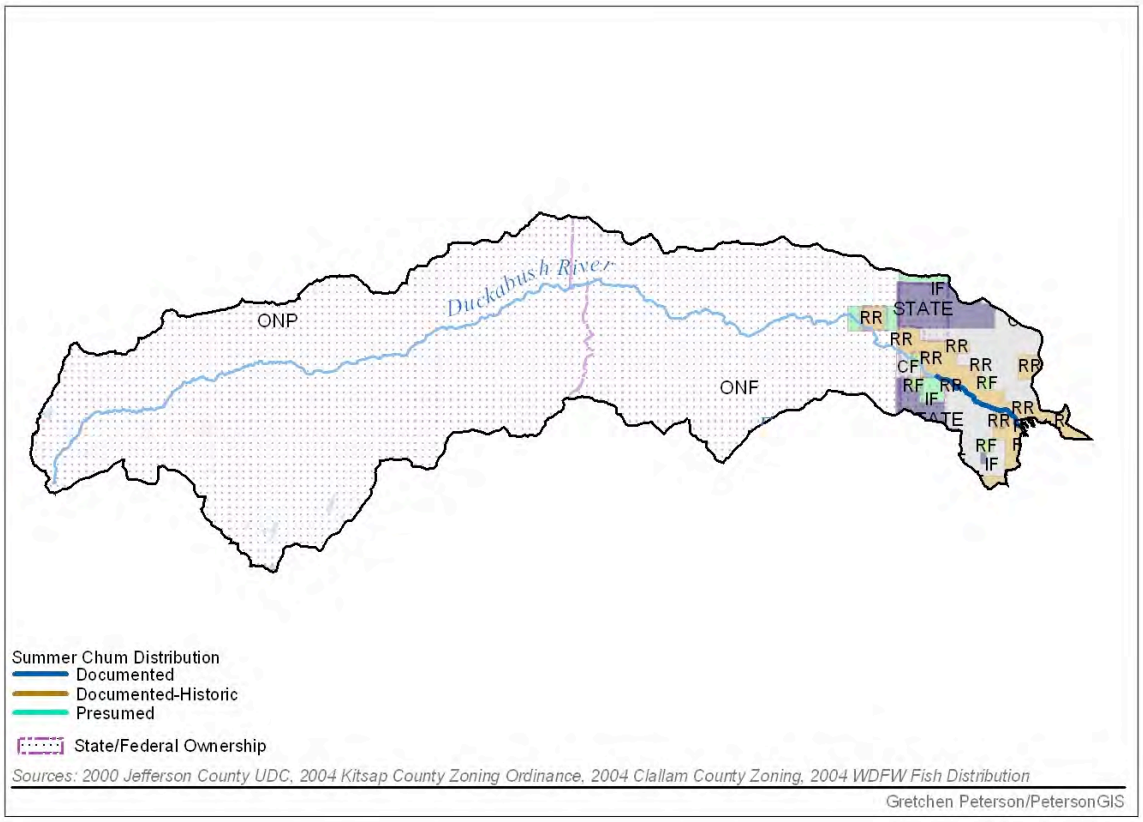


Figure 9.9. Land use for the Duckabush watershed from the Jefferson County UDC Title 18.

Downstream of the federal lands, the Duckabush flows through areas zoned as either Rural Residential (RR 1:5) or Commercial Forest (CF). Rural Residential 1 Unit/5 Acres (RR 1:5) areas "allow for continued residential development in areas of Jefferson County consisting of relatively high density pre-existing patterns of development, along the county's coastal areas, and within areas within or adjacent to rural centers and rural crossroads. In addition, this district seeks to support and foster Jefferson County's existing rural residential landscape and character by restricting new land divisions to a base density of one unit per five acres." Commercial Forest (CF) lands are designated to "ensure large tracts of

forest lands of long-term significance are protected from incompatible uses thereby sustaining the ability of forest resource extraction activities to be maintained as a viable commercial activity." Figure 9.10 shows the lower approximately 1 mile of the Duckabush and the designated land use.

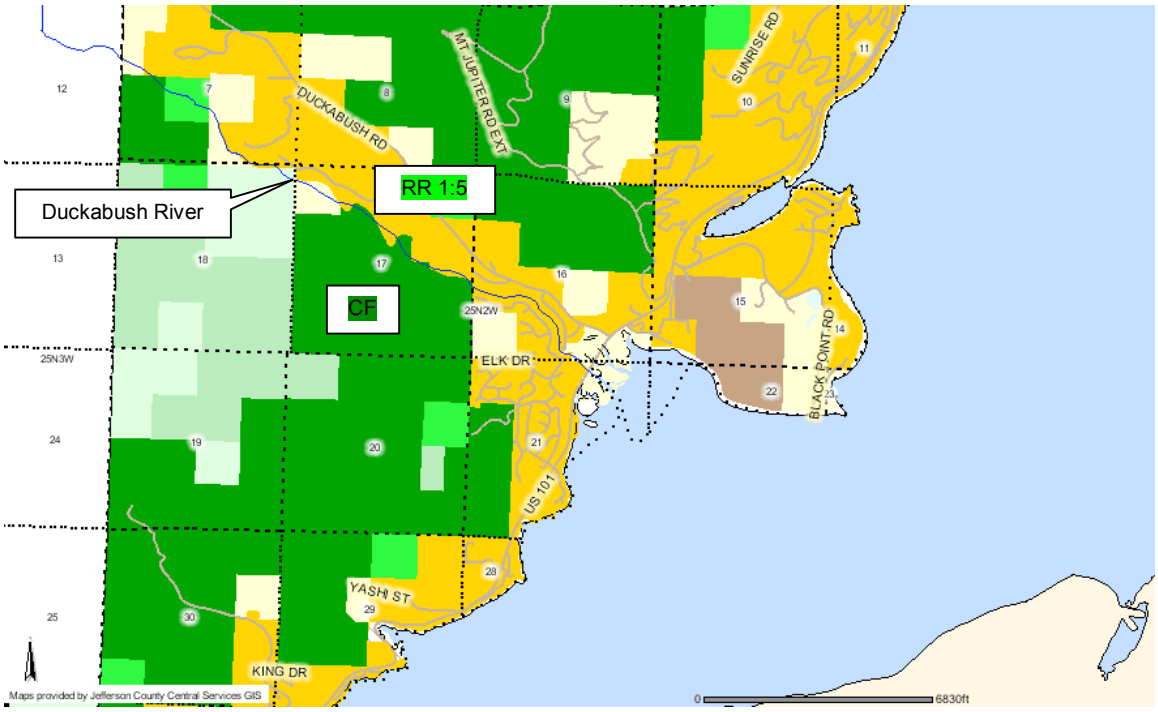


Figure 9.10. Land use designations for the lower portion of the Duckabush River (http://www.co.jefferson.wa.us/idms/mapserver.shtml).

The upper 60% of the Dosewallips watershed is undeveloped and protected within Olympic National Park, while the middle 30% of the basin is in the Olympic National Forest. As with other west Hood Canal watersheds, private land is concentrated along sensitive lower reaches of the river, where use is dominated by pastureland, residential development, and clearcut logging. Dosewallips State Park occupies land on the south side of the river near the mouth, and the town of Brinnon is located to the north, within the floodplain delta area (WDFW and PNPTT 2000). Outside of the Federal lands the river flows through land use designations of Rural Residential Agricultural Lands and Commercial Forest lands.

Figure 9.11 presents the land use for the Dosewallips watershed as designated by Jefferson County's UDC Title 18.

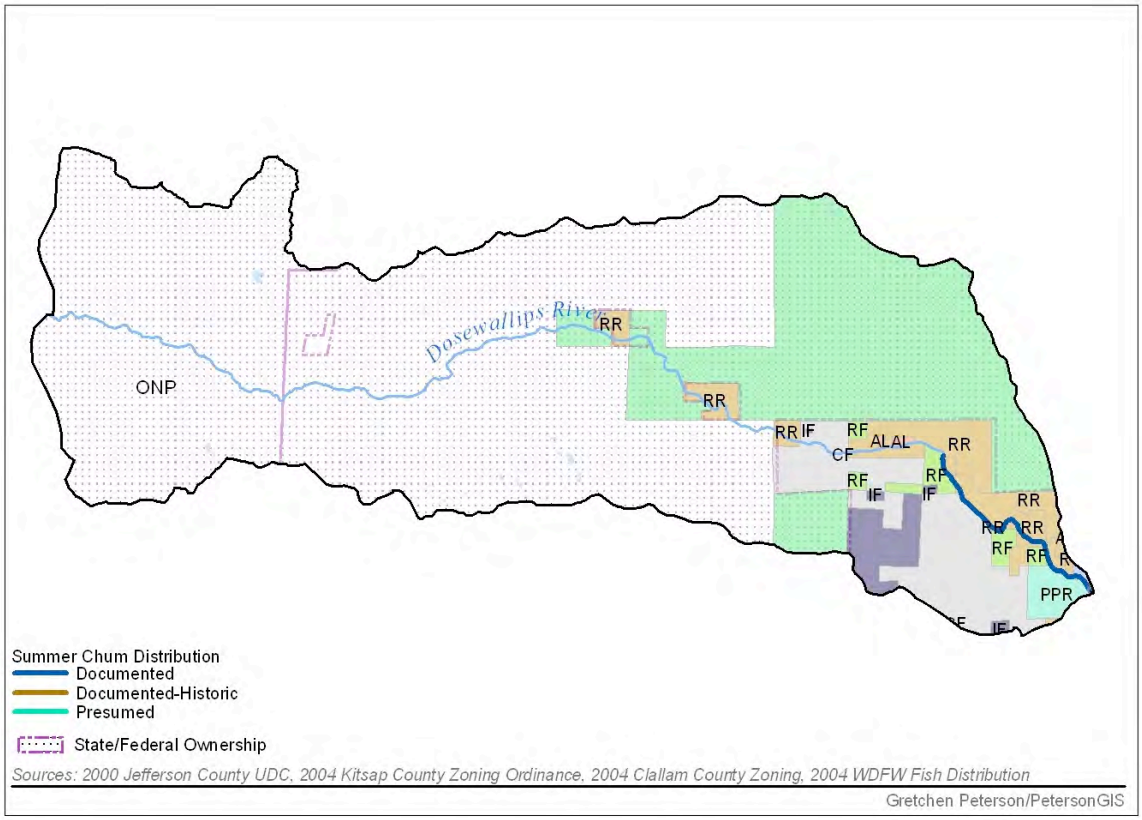


Figure 9.11. Land use designated for the Dosewallips River watershed from Jefferson County UDC title 18.

The town of Brinnon sits at the mouth of the Dosewallips River where it is zoned as a Rural Village Center (RVC). According to Jefferson County Unified Development Code Title 18, Rural Village Centers "provide for most of the essential needs of the surrounding rural population and the traveling public. These areas supply a variety of basic goods and day-to-day services, while also providing a limited range of professional, public and social services. They are typically small, unincorporated commercial and residential community centers that provide rural levels of service and serve as a focal point for the local population. The boundaries of the rural village centers are predominantly defined by the contained, built environment as it existed in 1990 or before, as required by RCW 36.70A.070(5)(d)." Designated rural village centers for Jefferson County include Quilcene and Brinnon. Also at the mouth of the Dosewallips River is a State Park.

Figure 9.12 presents the land use designations for the lower Dosewallips River basin.

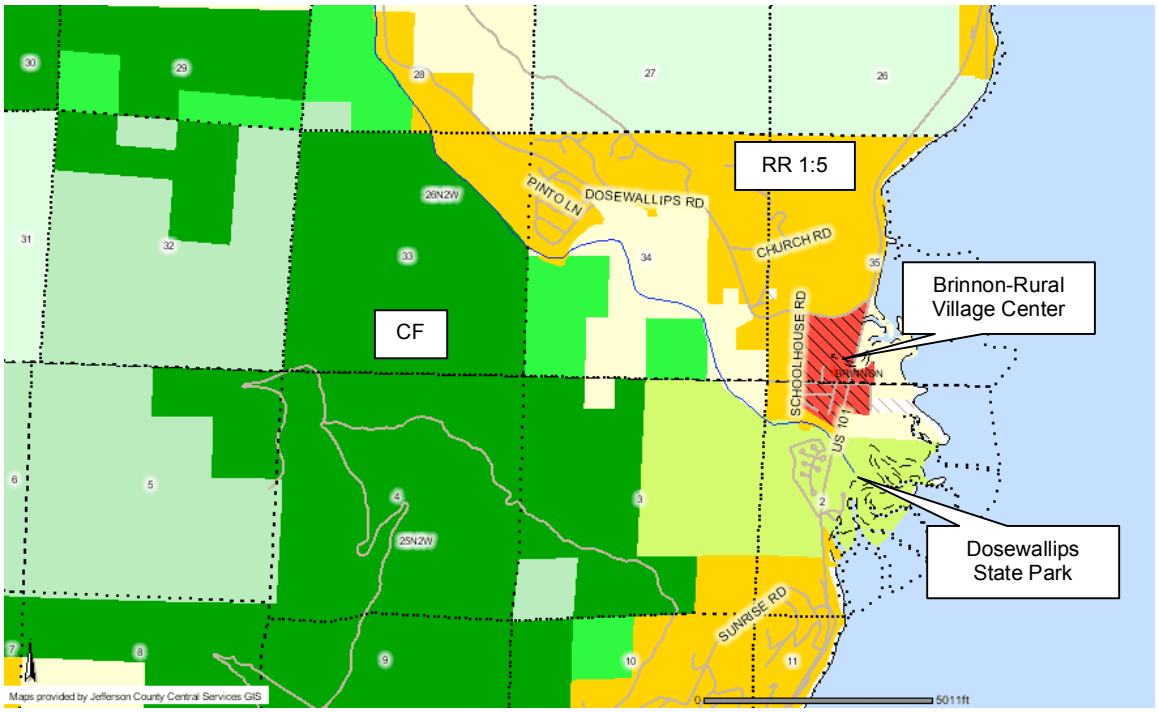


Figure 9.12. Land use and zoning for the lower Dosewallips River (http://www.co.jefferson.wa.us/idms/mapserver.shtml).

Rural Residential 1 Unit/5 Acres (RR 1:5) areas "allow for continued residential development in areas of Jefferson County consisting of relatively high density pre-existing patterns of development, along the county's coastal areas, and within areas within or adjacent to rural centers and rural crossroads. In addition, this district seeks to support and foster Jefferson County's existing rural residential landscape and character by restricting new land divisions to a base density of one unit per five acres." Commercial Forest (CF-80) lands are designated to "ensure large tracts of forest lands of long-term significance are protected from incompatible uses thereby sustaining the ability of forest resource extraction activities to be maintained as a viable commercial activity."

Understanding future population growth, and its associated development, is critical to determine the potential future impacts to summer chum salmon habitat. A build-out analysis was conducted for the summer chum salmon ESU geographic area. This analysis used impervious surface area as a proxy for development. Based on existing land use designations (which are unique to each individual County), future impervious surface area was calculated and modeled. The amount of additional impervious surface area (relative to current), and where it can be expected to occur, was determined for each County. Appendix C provides details of the methods used to conduct these build-out analyses.

Current and projected development, in the Duckabush and Dosewallips watersheds, was analyzed (Peterson 2005, see Appendix C). Riparian corridors were delineated from 200 feet on either side of the river from the mouth upstream to the extent of presumed summer chum salmon distribution. Impervious surface area (IP) was measured using 5-meter resolution satellite imagery. Current IP within the Duckabush riparian corridor is 5.8% of the total riparian corridor area. For the Dosewallips corridor this value is 4.9%. Build-out looked at the potential to develop the land under current regulatory programs and land use. Build-out for the Duckabush corridor is projected at 9.6% of the total area or an additional 4.4 acres of IP. For the Dosewallips corridor the additional acres of IP under build-out is projected to be 3.6 for a total of 7.0% of the corridor. These results are summarized in Table 9.7.

Table 9.7. Current impervious area (IP) and modeled build-out for the Duckabush and Dosewallips riparian corridors.

Riparian Corridor	Corridor area acres	Current IP acres	Build-out IP acres	Added IP acres	Current IP%	Build-out IP%
Duckabush River	114	6.5	10.9	4.4	5.8	9.6
Dosewallips River	166	8.1	11.7	3.6	4.9	7.0

The uplands and nearshore, within one mile of the Duckabush and Dosewallips subestuaries, were also analyzed for projected build-out (Peterson 2005). Of the total area delineated in the Duckabush subestuary zone, current IP is at 4.0%. After build-out the IP climbs to 5.3% for a total of 6.7 additional acres within the delineated subestuarine zone. For the Dosewallips subestuary, the total acres of current IP in the subestuary is 21. Under build-out, 3.5 acres of IP will be added to comprise 4.1% of the subestuarine area analyzed. The results of this analysis are summarized in Table 9.8.

Table 9.8. Current impervious area (IP) and modeled build-out for the subestuaries of the Duckabush and Dosewallips Rivers.

Estuary	Estuary Acres	Current IP acres	Build-out IP acres	Added IP acres	Current IP%	Build-out IP%
Duckabush	464	23.5	30.2	6.7	4.0	5.3
Dosewallips	620	20.8	24.3	3.5	2.9	4.1

Watershed and stream research, which typically looks at a watershed-wide perspective, generally indicates that certain zones of stream quality exist. Most notably, at about 10% impervious cover area, sensitive stream elements are lost from the system. A second threshold appears to exist at around 25 to 30% impervious area, where most indicators of stream quality consistently shift to a poor condition (e.g., diminished aquatic diversity, water quality, and habitat

scores).[46] More research is needed to determine if this research directly applies to the present analysis. It should be noted that similar research, however, has not been conducted for estuary and subestuary areas.

9.5. Specific action recommendations

Section 9.5 presents specific recovery action recommendations for the Hama Hama-Duckabush-Dosewallips conservation unit. Recommended actions are categorized as either Programmatic (section 9.5.1) or Project (section 9.5.2). Actions identified will be further delineated as actions to benefit the targeted spawning aggregations (Hama Hama, Duckabush, Dosewallips). Specific action recommendations are also summarized and analyzed in the context of overall ESU-wide recovery (see section 13). All actions (previously implemented, on-going, and proposed) will become part of the Monitoring and Adaptive Management Program for the SRP as described in section 14.

9.5.1. Programmatic recommendations

Programmatic recovery actions are those that are part of a policy, program, or process. They are generally of a regulatory or planning process nature. Programmatic actions could be part of a County's land use and regulatory program and structures or watershed planning processes. Comprehensive plans, critical areas ordinances, shoreline management master programs, and zoning could all be considered programmatic actions in this context. Programmatic actions are non-project (i.e., habitat restoration projects--LWD placement, culvert repairs, etc.) in nature. Programmatic actions, however, can include projects when such projects are descriptive of a comprehensive or encompassing process (i.e., levee removal or set back as part of an estuary restoration plan). Watershed management plans often include projects to address identified factors of decline or specific habitat conditions. For the purposes of this SRP, the management plans or planning processes will be considered programmatic actions whereas the projects identified within the management plans will be categorized as projects.

[46] See The Center for Watershed Protection's (http://www.cwp.org) Stormwater Manager Resource Center at http://www.stormwatercenter.net for more extensive references on this subject. Table 1 at http://www.stormwatercenter.net/monitoring and assessment/imp cover/impercovr model.htm reviews the key findings of recent research regarding the impacts of urbanization on aquatic systems.

To most effectively address those factors that are likely affecting the performance of the spawning aggregations in this conservation unit, the SRP recommends the programmatic actions summarized in Table 9.9. Details of the programmatic actions approved and those being considered by the Jefferson County and Mason County Boards of County Commissioners can be found in section 13.

Table 9.9. SRP recommended programmatic actions for the spawning aggregations in the Hama Hama-Duckabush-Dosewallips conservation unit.

Recommended Programmatic Actions	Actions involved	Limiting factors to address
Jefferson County zoning for the Duckabush and Dosewallips watersheds	-support continuation of the present zoning for the upper watersheds -monitor long-term effectiveness of the zoning code and enforcement -support Staff on their efforts regarding the core habitats and corridors work including development within channel migration zones -adopt CMZ guidelines as proposed for the CAO update (see section 13-"Jefferson County Programmatic Actions" for more details)	-poor riparian condition -loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)
Dosewallips River comprehensive floodplain management plan	-develop a comprehensive floodplain management plan consistent with summer chum salmon recovery involving the Brinnon community and Dosewallips State Park (see section 13-"Jefferson County Programmatic Actions" for more details)	-poor riparian condition -loss of channel complexity (LWD, channel condition, loss of side channel, channel
Olympic National Forest and State lands	-continue to preserve these lands in current ownership -Forest Service road maintenance and road abandonment plans should be implemented including appropriate resources to effectively complete the projects	-sediment aggradation
Community Nearshore Restoration Program	-pursue application and implementation of a Community Nearshore Restoration program similar to that being conducted in south Hood Canal (see section 13)	-estuarine and nearshore habitat loss and degradation

Comprehensive floodplain management and restoration plan for the Lower Hama Hama watershed	-a floodplain management and restoration plan would have to be developed with the current landowner to determine feasibility of protecting and restoring summer chum salmon habitat while maintain the economic viability of the current shellfish industry being conducted in the estuary. -the SRP recommends working with the landowners, Mason County, WSDOT, federal highway agencies, and co-managers in the development of the SRP and options to consider.	-poor riparian condition -loss of channel complexity (LWD, channel condition, loss of side channel, channel -estuarine and nearshore habitat loss and degradation
Hama Hama River Summer Chum Salmon Supplementation Project	-continue the supplementation project to ensure appropriate and properly funding monitoring occurs. -see section 14 of this SRP	-see WDFW and PNPTT (2000) and (2003a) for complete details of this project, also section 5 of this SRP

9.5.2. Project recommendations

Project recovery actions are generally physical modifications to the landscape designed to address specific habitat situations in specific and limited geographic areas. Projects in the summer chum salmon ESU have been in process for many years by a variety of groups and entities. Section 9.5.2.1 provides an overview of existing projects relative to summer chum salmon recovery planning. Many of the project recommendations presented in this SRP are from the HCCC Lead Entity strategy (HCCC 2004). This SRP is designed to coordinate with, and build on that strategy. Projects presented are categorized according to their benefit for the spawning aggregation of concern (Hama Hama, Duckabush, Dosewallips spawning aggregations). All projects that are proposed or recommended in this SRP are strictly voluntary in nature. Those projects that would either take place on, or impact, private property will require the full cooperation and permission from the affected landowners before proceeding. If that landowner permission cannot be obtained, those projects will not proceed.

9.5.2.1. Existing Projects

Figure 9.13 shows the lower Hama Hama watershed. Shading denotes protected lands.

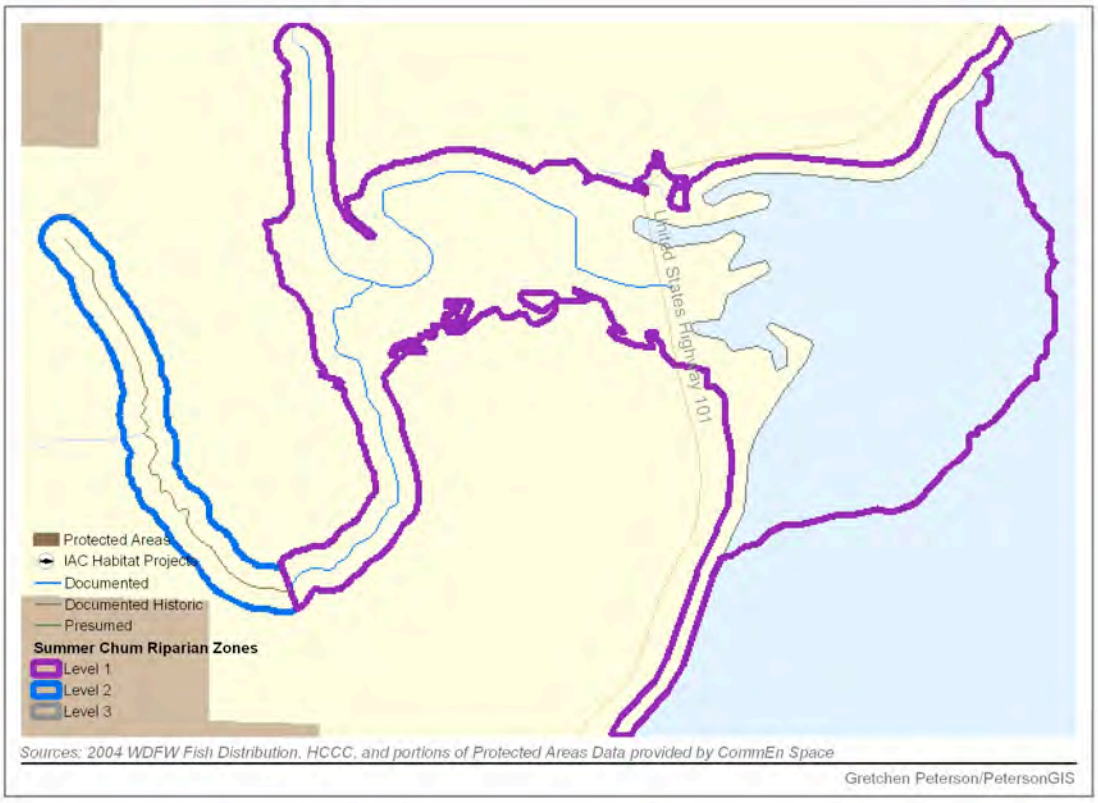


Figure 9.13. The lower Hama Hama watershed. Shaded areas on the map are protected areas near the lower Hama Hama watershed.

No existing summer chum salmon recovery projects are in process nor completed in the Hama Hama watershed. A supplementation program for summer chum salmon is underway and described in section 5 of the SRP.

Figure 9.14 shows the lower Duckabush watershed. Protected lands are denoted by shading. No existing summer chum salmon recovery projects are in process nor completed in the Duckabush watershed.

Figure 9.14. The lower Duckabush watershed showing protected areas (shaded areas on map).

Figure 9.15 shows the lower Dosewallips watershed. Protected lands are denoted by shading.

Figure 9.15. The lower Dosewallips watershed.

The existing summer chum salmon recovery project for the Dosewallips watershed is described below (project descriptions are derived from IAC Grant Projects at http://www.iac.wa.gov/maps/default.asp and click on the Grant Project Maps link, accessed on June 14, 2005):

02-1482 Dosewallips Estuary Restoration Phase 1, Project Description: This project will perform a variety of estuarine restoration measures at the Dosewallips estuary. Phase 1 work targets publicly owned lands held by WA State Parks and key privately owned lands, which constitute most of the tidally influenced environment of the lower river. The project will include project identification, prioritization, design, implementation, and monitoring measures. Phase 1 will include distributary slough and estuarine marsh restoration.

9.5.2.2. Project Recommendations for the Hama Hama, Duckabush, and Dosewallips Spawning Aggregations

To most effectively address those factors that are likely affecting the performance of the Hama Hama, Duckabush, and Dosewallips spawning aggregations, the SRP recommends the following projects. All projects that are proposed or recommended in this SRP are strictly voluntary in nature. Those projects that would either take place on, or impact, private property will require the full cooperation and permission from the affected landowners before proceeding. If that landowner permission cannot be obtained, those projects will not proceed. Estimated costs for these projects is presented in Appendix D.

Table 9.10. SRP recommended projects for the Hama Hama spawning aggregation.

Hama Hama

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Consider a lower channel subestuary plan working with landowner to restore mainstem channel complexity, tidal channels, and estuary function by potentially breaching or removing levees/dikes and armoring, particularly mainstem dike, the dike along the north side of the estuary, and other minor dikes	-an important shellfish industry currently exists at the mouth of the Hama Hama River. A restoration plan would have to be developed with the current landowner to determine feasibility (see programmatic recommendations above in Table 9.9)	-poor riparian condition -loss of channel complexity (LWD, channel condition, loss of side channel, channel -estuarine and nearshore habitat loss and degradation
Relocate US101 to the west, acquire historic estuarine properties, and restore Jorsted Creek estuary	-would need to be a part of the comprehensive floodplain management plan discussed in the item above. -would need to involve WSDOT and Federal highway agencies	-estuarine and nearshore habitat loss and degradation
Replace US101 causeway/bridge with an elevated structure across the entire delta	-would need to be a part of the comprehensive floodplain management plan discuss in the item above. -would need to involve WSDOT and Federal highway agencies	-poor riparian condition -loss of channel complexity (LWD, channel condition, loss of side channel, channel -Estuarine and nearshore habitat loss and degradation
Remove fill and relocate structures along north side of Wacketickeh estuary	-would need to be a part of the comprehensive floodplain management plan discuss in the item above. -would need to involve WSDOT and Federal highway agencies	-estuarine and nearshore habitat loss and degradation

Remove bulkhead and fill that forms an unused part of a parking lot to the north of shellfish facility to restore salt marsh habitat	-would need to be a part of the comprehensive floodplain management plan discuss in the item above. -would need to involve WSDOT and Federal highway agencies	-estuarine and nearshore habitat loss and degradation
Remove creosote pilings to the north of Jorsted Creek	-work with State to determine feasibility	-estuarine and nearshore habitat loss and degradation

To most effectively address those factors that are likely affecting the performance of the Duckabush spawning aggregation, the SRP recommends the projects summarized in Table 9.11.

Table 9.11. SRP recommended projects for the Duckabush spawning aggregation.

Duckabush River

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Elevate US101 across estuarine delta to restore tidal connectivity, reestablish native vegetation	-would require working with WSDOT and Federal highway agencies in the development and implementation	Loss of channel complexity (large woody debris, channel condition, loss of side channel, channel instability) and floodplain loss -Estuarine and nearshore habitat loss and degradation
Reconnect northern distributary channel with the Duckabush River	-should be done in conjunction with reconfiguration of the US101 intersection with Duckabush River Road	-loss of channel complexity (large woody debris, channel condition, loss of side channel, channel instability) and floodplain loss -Estuarine and nearshore habitat loss and degradation
Remove dike along north side of estuary along Robinson Road	-already WDFW ownership	-estuarine and nearshore habitat loss and degradation
Reconfigure intersection of US101 and Duckabush River Road to reconnect Pierce Creek Slough	-would require working with WSDOT and Federal highway agencies in the development and implementation	-loss of channel complexity (large woody debris, channel condition, loss of side channel, channel instability) and floodplain loss -estuarine and nearshore habitat loss and degradation
Remove levees and rip rap in lower river to restore sinuosity	-significant land purchase effort would be need to complete this project	-loss of channel complexity (large woody debris, channel condition, loss of side channel, channel instability) and floodplain loss
Restore native plants in estuary area	-would need to work with landowners to develop a program and gain access	-estuarine and nearshore habitat loss and degradation
Restore native vegetation in mainstem	-would need to work with landowners to develop a program and gain access	-riparian degradation

To most effectively address those factors that are likely affecting the performance of the Dosewallips spawning aggregation, the SRP recommends the following projects summarized in Table 9.12.

Table 9.12. SRP recommended projects for the Dosewallips spawning aggregation.

Dosewallips River

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Remove dikes in vicinity of mainstem Dosewallips River and estuary	-Remove levees on Dosewallips State Park lands -Brinnon levee an issue, but not much opportunity -Lazy C bank armoring -side channel should be reconnected on Bailey property -Rocky Brook confluence -Elkhorn campground and Steelhead camp Remove dike between Wolcott Slough and the Dosewallips mainstem on WA Parks ownership -could be part of a comprehensive floodplain management plan involving State Parks and the community of Brinnon	-estuarine habitat loss and degradation (diking, filling, log storage, road causeways) -loss of channel complexity (large woody debris, channel condition, loss of side channel, channel instability) and floodplain loss
Wolcott Slough: replace US 101 culvert at northern part of Wolcott Slough with a bridge, provide tidal channel connection with bridgeway over access road to east of US101, replace undersized culvert with bridge over slough to the south, remove dikes, connect upper tidal channel west of US101 with larger lagoon and with a bridge on the access road	-remove levees and dikes -replace culverts -remove US Highway 101 causeway -will need to involve planning with WSDOT and Federal highway agencies	-estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove barge at mouth of Walker Creek	-work with private landowner to develop feasibility plan	-estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Restore Sylopash slough tidal prism and riparian area	-work with private landowner to develop feasibility plan	-estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

Acquire lands to protect and allow restoration opportunity	-acquire powerlines reach -acquire land at Rocky Brook and areas downstream of USFS lands	-loss of channel complexity (large woody debris, channel condition, loss of side channel, channel instability) and floodplain loss -Sediment aggradation

10. LILLIWAUP CONSERVATION UNIT

10.1. Introduction

The Lilliwaup Conservation Unit includes the Lilliwaup River and Skokomish River watersheds, as well as the estuaries and nearshore up to the Hama Hama watershed. The native summer chum salmon of Lilliwaup Creek are shown to be significantly different from other summer chum populations in Hood Canal based on analysis of genetic samples. This genetic data, and the geographic separation from the other populations, lead to Lilliwaup being categorized as a separate stock (WDFW and PNPTT 2000). The Lilliwaup stock is one of the six core stocks that comprise the Hood Canal summer chum salmon population as identified by the PSTRT (Currens 2004 Draft in progress). A hatchery operated by Long Live the Kings (LLTK) is located on lower Lilliwaup Creek. It rears summer chum for release into the creek (summer chum salmon are the only species released into the stream). This program is part of the summer chum salmon supplementation program (WDFW and PNPTT 2000). This supplementation program began on Lilliwaup Creek in 1992 as a cooperative project between the Hood Canal Salmon Enhancement Group (HCSEG) and WDFW. In 1994, LLTK assumed the role of the primary project operator.

Current habitat conditions and situations were assessed using a variety of sources. Several sources were used to assess the summer chum salmon stocks in the Eastern Strait of Juan de Fuca conservation unit. This Salmon Recovery Plan (SRP) will not repeat the details of these assessments, but instead refers the reader to the cited documents. All material and documents referenced in this SRP should be considered part of, and integral to, the recovery of summer chum salmon. These sources provided the primary reference and knowledge base for development of these aspects of the SRP. Details of the EDT assessments for the Eastern Strait of Juan de Fuca stocks, including a summary of the baseline performance measures, and a summary of strategic priorities, are provided in Lestelle et al, (2005a) (see Appendix A). The EDT Method is a widely used tool to help prioritize habitat restoration and protection measures for salmon populations. It provides a systematic way of diagnosing habitat conditions that have contributed to the current state of populations, and it enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits to salmon populations of actions that might be taken to address habitat related issues impeding recovery. Other detailed assessments of habitat and environmental conditions are provided in the SCSCI (WDFW and PNPTT 2000), Correa (2002), and May and Peterson (2003).

Lestelle, et. al. (2005a) surmise that the Lilliwaup summer chum salmon population is one of five extant Hood Canal summer chum salmon populations (Quilcene, Lilliwaup, Hama Hama, Duckabush, Dosewallips) that had relatively large escapements prior to about 1980. That was followed by severe drops in

abundance until the mid to late 1990s. Then, escapement began to increase. The consistent pattern amongst these five stocks is attributed to (from Lestelle, et. al. 2005a):

- Favorable ocean conditions for marine survival until the mid 1970s, followed by a regime shift in the ocean that was unfavorable for survival until near the turn of the century when conditions switched again to favor marine survival;
- Low harvest rates prior to the mid 1970s, followed by steadily increasing rates on Hood Canal populations, sometimes exceeding 80% and averaging close to 60% in the 1980s; harvest rates fell sharply in the mid 1990s and were at very low levels again when ocean survival conditions turned favorable;
- Hatchery supplementation fish beginning to return to the Quilcene system in 1995 and several years later to the Hama Hama and Lilliwaup systems, roughly near or corresponding to the period of improving ocean conditions and low harvest rates; although no directed supplementation has occurred in the Dosewallips or Duckabush systems, some stray hatchery fish are suspected to have entered those streams in the late 1990s.

Managed public forestland accounts for 89% of the watershed area. Riparian degradation, estuarine habitat loss, and low channel complexity appear to be the principal habitat factors associated with the decline of summer chum in the Lilliwaup Creek watershed (WDFW and PNPTT 2000). WDFW and PNPTT (2000) further surmise that limited spawning habitat likely restricted the summer chum population in Lilliwaup Creek under natural conditions. And, human occupation and use of the Lilliwaup Creek floodplain and estuary has probably further diminished summer chum production potential.

The Skokomish River estuary and delta area provide for important rearing and migration habitats for summer chum juveniles in lower Hood Canal.

10.2. Geographic Description & Human Population Distribution

The Lilliwaup Conservation Unit includes the Lilliwaup River and Skokomish River watersheds. Also included within this unit are the marine nearshore waters starting at the mouth and estuary of the Skokomish River delta and moving north coursing the west side of Hood Canal through to the southern extent of the Hama Hama River estuary. The marine off shore areas of south Hood Canal are included in this conservation unit. This conservation unit lies almost entirely within Mason County and includes the Lilliwaup River watershed. The Lilliwaup watershed covers an area of almost 18 square miles with 6.9 miles of mainstem length. Lilliwaup Falls, at river mile (RM) 0.7, blocks anadromous passage upstream on Lilliwaup Creek. Spawning surveys indicate summer chum use the full extent of this anadromous zone in Lilliwaup Creek.

Figure 10.1 provides a map of the Lilliwaup Conservation Unit.

Figure 10.1. Lilliwaup Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

The Skokomish Indian Reservation is located at the mouth of the Skokomish River. Other human developments of significance continue north from the Skokomish Tribal Reservation through Potlatch and up into Hoodsport, along the western shore of southern Hood Canal. Another small settlement is located at Lilliwaup. Detailed descriptions of each of these watersheds can be found in SCSCI Appendix 3.6 (WDFW and PNPTT 2000) and the WRIA 16 habitat limiting factors report (Correa 2003).

10.3. Summer Chum Salmon Stocks' Description & Distribution

Several sources were used to assess the summer chum salmon stocks in the Lilliwaup conservation unit. This Salmon Recovery Plan (SRP) refers the reader to the appropriate documents that are cited in this section. All material and documents referenced in this SRP should be considered part of, and integral to, the recovery of summer chum salmon. The reader is urged to review the Summer Chum Salmon Conservation Initiative (SCSCI) (WDFW and PNPTT 2000) and subsequent supplemental reports. Summer chum salmon in Hood Canal and the Eastern Strait of Juan de Fuca were also assessed based on application of the Ecosystem Diagnostic and Treatment (EDT) Method. The complete detailed EDT for summer chum salmon can be found at http://www.wa.gov/hccc/ and click on the Salmon Recovery Planning Activities link. On that page can be found links to various documents and the EDT web

site for summer chum salmon. The web address for the EDT site: www.mobrand.com/edt/sponsors/show_sponsor.jsp?sponsor_id=11

Naturally produced summer chum salmon originating from the Lilliwaup Conservation Unit are likely from the Lilliwaup watershed (WDFW and PNPTT 2000). Summer chum spawn in the mainstem of Lilliwaup Creek up to RM 0.7 where a falls blocks any further passage.

10.3.1. Stocks' Status & Trends

Current, historic and presumed summer chum salmon distribution in the Lilliwaup Conservation Unit is shown in Figure 10.2.

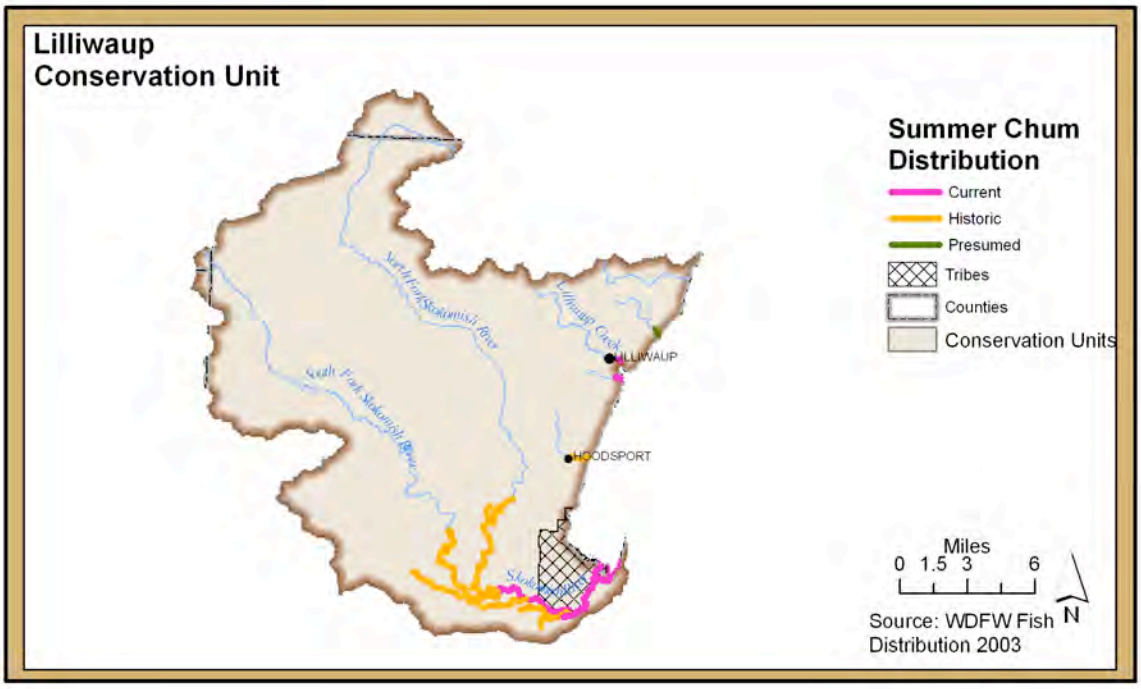


Figure 10.2. Map of the Lilliwaup Conservation Unit showing current, historic and presumed summer chum salmon distribution.

Summer chum salmon produced from Lilliwaup Creek are part of the Hood Canal population targeted for recovery by the PSTRT. The Hood Canal population is one of two independent summer chum populations tentatively identified by the PSTRT (Currens 2004 Draft in progress). Currens (2004 Draft in progress) provides a detailed analysis of these conclusions. He speculates on the importance of the historical geographic distribution of summer chum salmon habitat and the overall "isolation-by-distance relationship." That relationship seems to be observed in the summer chum salmon aggregations. More analyses of population identification and viability are expected from the PSTRT. At this time it is not expected that this further analyses will affect the basic approach taken for recovery in this SRP.

PNPTT and WDFW (2003) have identified the stock that is naturally produced in Lilliwaup Creek to target for recovery in the Conservation Unit. The Lilliwaup Creek stock is one of the six stocks that comprise the PSTRT designated Hood Canal aggregation. The co-manager interim recovery goals for these stocks are presented in Table 10.1.

Table 10.1. Hood Canal aggregation: co-manager interim abundance and escapement recovery goals for the Lilliwaup spawning aggregation.

Stocks	Abundance	Escapement
Lilliwaup	3,130	1,960

PNPTT and WDFW (2003) also developed abundance and spawning escapement threshold criteria. One of the criterion for recovery is that a summer chum stock (Lilliwaup) must, over a minimum of the recent twelve year period, have both a mean abundance and mean escapement of natural-origin recruits that meets or exceeds the defined thresholds. Table 10.2 provides a summary of escapement for the recent twelve year period, 1993-2004, for the Lilliwaup spawning aggregation.

Table 10.2. Escapement threshold for the Lilliwaup spawning aggregation based on PNPTT and WDFW (2003).

	ESCAPEMENT				
Population aggregation	**93-04 Average**	**target**	**% of target**	**# times below target 2001-2004 (≤1)**	**# times below target 1997-2004 (≤2)**
Lilliwaup	229	3130	12	4	8

The Lilliwaup aggregation currently falls well below the escapement threshold as established by the co-managers. This population is likely a combination of both hatchery and natural-origin recruits. A cooperative supplementation project between the HCSEG and WDFW was initiated in 1992. Starting in 1994 Long Live the Kings assumed primary project operator responsibilities. Broodstock, from naturally produced Lilliwaup stock, was used to supplement the summer chum salmon of Lilliwaup Creek.

Additional co-manager criteria require that the stocks do not fall below the target more than once in the recent four-year period and no more than twice in the recent eight-year period. Again, the Lilliwaup aggregation fails to meet the threshold for the recent four-year period and for the recent eight-year period. It should also be noted that criteria for productivity (for example, eight year average equal to or greater than 1.6 recruits per spawner) must be met for recovery. Data currently are insufficient to assess the productivity criteria but are being collected (PNPTT and WDFW 2003).

Summer chum salmon escapement (number of adults returning to spawn) for Lilliwaup Creek from the years 1974-2004 is presented in Figure 10.4.

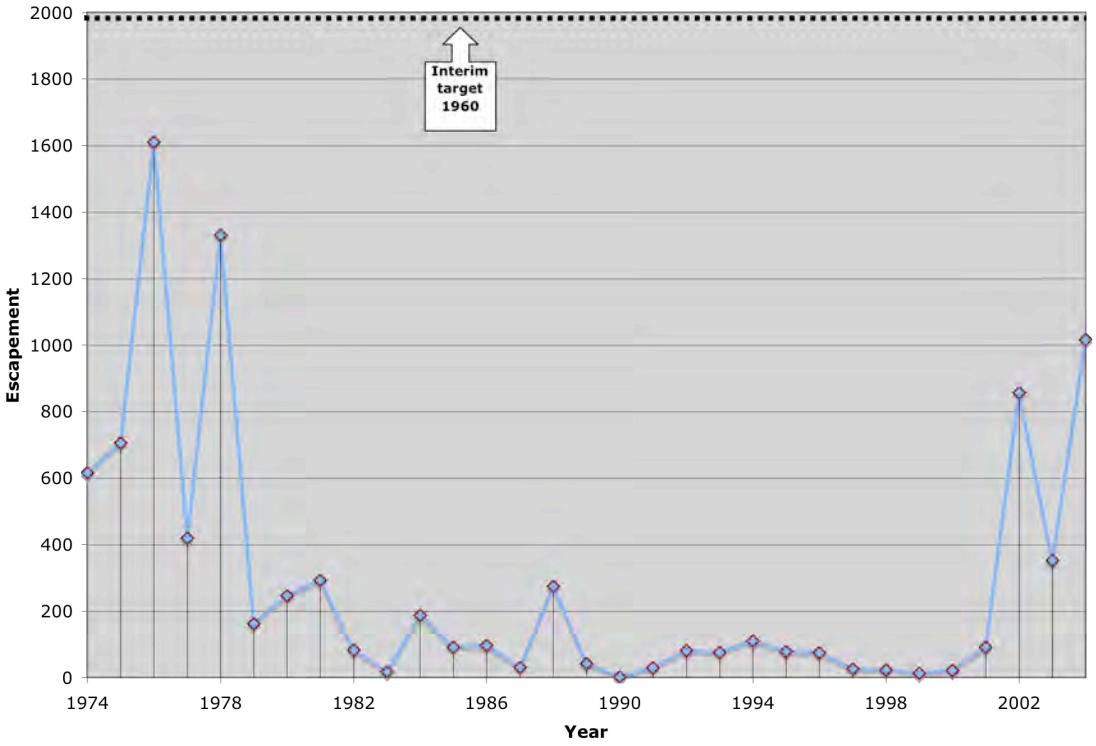


Figure 10.4. 1974-2004 summer chum salmon escapement for Lilliwaup Creek (data source: WDFW and PNPTT 2003, 2004, and 2005).

The co-managers have assessed the extinction risk faced by individual summer chum salmon stocks based on the methodology offered by Allendorf, et. al. (1997). This is also discussed in detail in section 1.7.4 of the SCSCI (WDFW and PNPTT 2000). The extinction risk was assessed again in 2003 based on data available through 2002 (WDFW and PNPTT 2003). This assessment by the co-managers for the Lilliwaup stock states, "Estimated escapements to Lilliwaup Creek range from 13 to 858 over the last four years, averaging 246 spawners. The effective population size (N_e) equals 77 fish for the 1999-02 return years, and total population size (N) is 887 for the same years. Because the population meets two high risk criteria (low population size, $N_e < 500$ or $N < 2,500$) and is in a chronic depression situation, the risk of extinction is judged to be high."[47]

[47] It should be noted that the co-managers' extinction rate assessment for Lilliwaup has changed in a more recently updated assessment that includes the years 2003 and 2004. The update indicates the risk of extinction to now be moderate rather than high, owing primarily to the high escapements in 2003 and 2004 (WDFW and PNPTT In preparation).

10.4. Habitat overview & environmental conditions

Details of the EDT assessments for the Lilliwaup stock, including a summary of the baseline performance measures and a summary of strategic priorities, are provided in Lestelle, et. al. 2005a (see Appendix A). The EDT Method is a widely used tool to help prioritize habitat restoration and protection measures for salmon populations. It provides a systematic way of diagnosing habitat conditions that have contributed to the current state of populations, and it enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits to salmon populations of actions that might be taken to address habitat related issues impeding recovery. Other detailed assessments of habitat and environmental conditions are provided in the SCSCI (WDFW and PNPTT 2000), and Correa (2003).

10.4.1. Factors contributing to the decline of summer chum salmon

According to WDFW and PNPTT (2000), recovery of summer chum in the Lilliwaup Creek watershed requires:

- Restriction of human activity in the lower floodplain to allow for the reestablishment of riparian forests and natural recruitment of LWD to the main channel.
- Restoration of a natural tidal distributary channel system across the waist of the estuarine delta through reduction of the impact from the Highway 101 road causeway.
- Protection of the Washington DNR-owned wetlands in upper Lilliwaup valley, which sustain summer flows in Lilliwaup Creek.

The Lilliwaup population shows a severe loss in performance, particularly in productivity. Under sustained, unfavorable ocean conditions, the population would be at a high risk of extinction (Lestelle, et. al. 2005a).

In summary, the EDT Conclusions for Lilliwaup (Lestelle, et. al. 2005a) suggest, that:

- The Lilliwaup population shows a high loss in performance compared to historic levels both in abundance and productivity, particularly under unfavorable ocean survival conditions.
- The amount of potential increase in population abundance is greatest through restoration of freshwater reaches; full restoration of estuarine-marine waters beyond the natal subestuary offers the next highest level of benefit, though much less than would be provided in freshwater.
- Protection of freshwater reaches shows the highest priority.

- Potential benefits of restoring estuarine-marine areas are diffused over many segments.
- Within freshwater, habitat diversity and sediment load are seen as the most important factors to restore.
- Within the natal subestuary, several factors appear to be equally important for restoration, along with the amount of area available to be used for rearing.
- Within the estuarine-marine environment, the most important factor for restoration is food, associated with loss of eelgrass, revetments, and loss of riparian corridors.

The Skokomish River delta and associated estuarine areas provide vital rearing habitats for juvenile summer chum salmon. Probably the largest long-term impact to this delta for juvenile salmon rearing, in addition to many other ecological functions, has been the steepening of the delta and the loss of approximately 17% of the delta's eelgrass habitat along the face of the delta. These impacts are primarily attributed to the loss of sediment transport through the delta due to water withdrawals out of the North Fork Skokomish by the Cushman hydroelectric project. Diversion of the North Fork has severely degraded estuarine habitat conditions for summer chum by disrupting sediment transport and natural salinity and nutrient regimes in the subestuary and intertidal delta, and by reducing the extent of tidal influence in the Skokomish River (WDFW and PNPTT 2000).

The SCSCI (WDFW and PNPTT 2000), and the "Limiting Factors Report for WRIA 16" prepared by the Washington Conservation Commission (Correa 2003), provide details of the various habitat factors and environmental conditions affecting summer chum salmon in this conservation unit. In general, the findings from these reports are corroborated by the EDT assessment (Appendix A). These factors and conditions are summarized in the Table 10.3 for Lilliwaup Creek and the Skokomish River estuary.

Table 10.3. Lilliwaup Creek and Skokomish River estuary

Factors for decline	Life stage most affected	Remarks
Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)	Spawning and incubation	Based on aerial photo interpretation and communication with local residents, approximately 600 feet of Lilliwaup Creek at RM 0.2 was straightened and dredged. The lack of LWD in both the creek and estuary also contributes to reduced channel complexity, and raises the potential for channel instability and redd scour during peak flow events.

Riparian degradation	Spawning and incubation	Agricultural and residential development along the lower reaches of Lilliwaup Creek has reduced the extent and altered the age and species composition of the riparian forest. Elimination of riparian forests has decreased LWD recruitment sources for both the creek and estuary. Seventy-nine percent of the forested buffer below RM 0.7 is dominated by medium-sized (12-20 in dbh) trees of mixed conifer and deciduous composition, and 21% lacks a buffer altogether. Fifty-two percent of the buffer is >132 ft in width, while 48% is <66 ft wide and/or sparse.
Lilliwaup estuarine habitat loss and degradation (diking, filling, log storage, road causeways)	Juvenile rearing and migration	Of the estimated 48.2 acres of historic delta, one diked area associated with a fish hatchery accounts for a loss of 1.5 acres (3.1% of historic delta area). Fill for residential development on the south side of Lilliwaup estuary accounts for a loss of 1.2 acres (2.6%), and a human-excavated pond at a fish hatchery represents a loss of 0.5 acres (1%). In addition, the 0.12 mi long Highway 101 causeway that bisects the delta has constrained the estuarine distributary channels of Lilliwaup Creek, eliminated habitat area, and likely altered overall estuarine function by altering tidal circulation. Although a relatively small percentage of the historic delta area has been impacted, the location of these habitat alterations has likely contributed to their disproportionately large effect on the overall functional value of Lilliwaup estuary as juvenile rearing and transition habitat for summer chum.

Skokomish Delta: Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)		Probably the largest long-term impact to the Skokomish River delta for juvenile salmon rearing, in addition to many other ecological functions, has been the steepening of the delta and loss of approximately 17% of the delta's eelgrass habitat along the face of the delta (Jay and Simenstad, 1996). This dramatic change is primarily attributed to the loss of sediment transport through the delta due to water withdrawals by the Cushman project. Diversion of the North Fork has severely degraded estuarine habitat conditions for summer chum by disrupting sediment transport abilities and natural salinity and nutrient regimes in the subestuary and intertidal delta, and by reducing extent of tidal influence in the Skokomish River. Of the original 2,175 acre delta (11.2 miles perimeter), 14.4% (313 acres) was diked for agriculture. A recent dike breach in the largest contiguous diked farm area in the delta (Nalley Farm, ~215 acres), has allowed tidal inundation of this area. Nine diked areas persist, totaling 99 acres (4.6% of original delta). Restoration of the Nalley Farm will contribute to increased juvenile summer chum rearing habitat although access is limited with the only dike breach located on the northern perimeter of the dike. Chum fry will have to migrate along existing dikes to the central portion of the delta before accessing the restoring wetland, and then predominantly at high tide. Dikes and several tidegates continue to keep wetlands isolated from the subestuary thereby cutting off the primary production in these once saltwater marshes. Two identifiable fill areas occupy approximately 5 acres (0.2% of historical delta area) of the delta and are thought to have a low impact. Thirteen roads or causeways cross or encompass the delta, the total length of which is 4.7 miles. Almost all of these roads are associated with dikes surrounding the original agricultural lands or service roads to electric line transmission towers. Even in the restoring Nalley Farm site, the dike

		roadways inhibit cross-delta movement of juvenile summer chum. Transmission tower service roads impact a long segment of the upper intertidal habitat, affecting tidal movement and fish foraging activity in the western portion of the delta. A debris dam and dilapidated concrete abutments are located at the junction of a major distributary channel in the delta that divides the Nalley Farm properties. The distributary once was a more prominent channel that provided access of migrating juvenile salmon to the central delta. Flow was intentionally reduced to this channel to reduce flooding potential, although some tidal flow persists.

10.4.2. Human development and land use

Population density throughout the conservation unit is relatively low. Figure 10.5 shows population density within the Lilliwaup conservation unit.

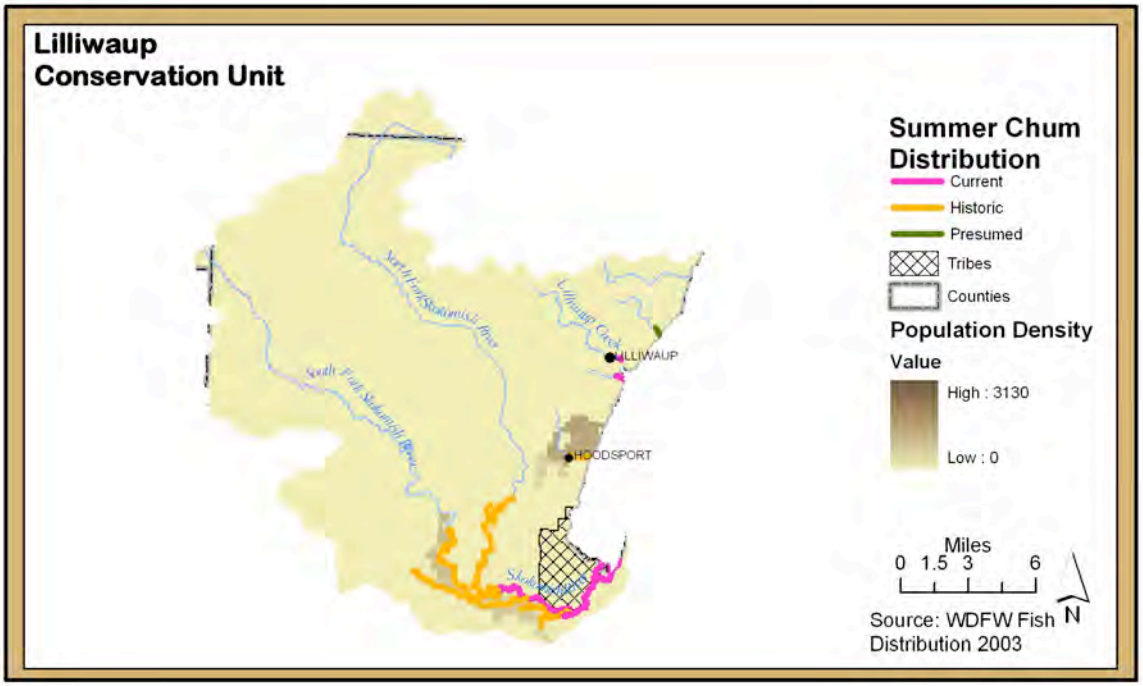


Figure 10.5. Human population density (people per square mile) for the Lilliwaup Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

The highest concentrations of human population are in the Hoodsport area and along the marine shoreline from Lilliwaup to Potlatch. WDFW and PNPTT (2000)

reports that the upper watershed is primarily forest lands with 89% in public ownership (2,189 acres or 19% of the total watershed acreage within Olympic National Forest and approximately 47% within WDNR ownership) and 7% in private ownership. By the early 1930s, the entire watershed was logged (WDFW and PNPTT 2000). Much of the lower floodplain has been converted to transportation and residential use.

Mason County has designated most of the lands in the lower Lilliwaup Creek watershed as conservancy. From the Mason County Code Title 7, "'Conservancy environment' means that environment in which the objective is to protect, conserve and manage existing natural resources and valuable historic and cultural areas in order to ensure a continuous flow of recreational benefits to the public and to achieve sustained resource utilization. The conservancy environment is for those areas that are intended to maintain their existing character. The preferred uses are those that are by nature non-consumptive of the physical and biological resources of the area. Non-consumptive uses are those uses that can utilize resources on a sustained yield basis while minimally reducing opportunities for other future uses of the resources in the area. Activities and uses of a nonpermanent nature, which do not substantially degrade the existing character of an area, are appropriate uses for a conservancy environment. Examples of uses that might be predominant in a conservancy environment include diffuse outdoor recreation activities, timber harvesting on a sustained yield basis, passive agricultural uses such as pasture and range lands and other related uses and activities. Compatible commercial uses are low intensity and low impact activities such as small camping or picnic facilities (less than ten spaces), aquacultural retail booths (less than six hundred square feet) and cottage industries when the operation is entirely contained within the primary residence excluding outbuildings, provided, such commercial activities must not alter the character of the conservancy environment. The designation of conservancy environments should seek to satisfy the needs of the community as to the present and future location of recreational areas proximate to concentrations of population, either existing or projected. The conservancy environment would also be the most suitable designation for those areas that present too severe biophysical limitations to be designated as rural or urban environments. Such limitations would include areas of steep slopes presenting erosion and slide hazards, areas prone to flooding, and areas which cannot provide adequate water supply or sewage disposal."

Mason County's Development Regulations, dated January 18, 2005, also designate the lands in the lower Lilliwaup watershed as Rural Residential. There are five types of Rural Residential districts. These districts primarily provide for low-density residential use, but also provide for some rural uses such as hobby farms. The hamlet of Lilliwaup is located in the lower sections at the mouth of Lilliwaup Creek. Hamlets are intended to provide a focal point and community identity for surrounding rural area, while they meet some of the immediate needs of rural residents, resource dependent industry, and visitors. Hoodsport is a

Rural Activity Center. Rural Activity Centers are concentrated settlements within Rural Lands that may include a variety of residential, small-scale commercial, resource-based and rural light industrial, recreation, and public uses. The majority of the marine shoreline in the Lilliwaup conservation unit is designated as Rural Residential (RR5).

The Skokomish Watershed is located in the northwest corner of the County and is largely occupied by Olympic National Park and Olympic National Forest. Although it is the largest watershed in the County, only 61,468 acres lie outside the National Park and National Forest boundaries. This watershed also includes Lake Cushman. The Skokomish Indian Tribe Reservation is located at the mouth of the Skokomish River. The Reservation area is approximately 5,000 acres. As of 1992, 525 enrolled tribal members lived on-reservation and 570 members lived off-reservation. Lands adjacent to the Skokomish Reservation in the lower Skokomish watershed are designated as Rural Residential. Long Term Commercial Forests represent the primary land use within the Skokomish watershed. This classification covers 28,704 acres and accounts for 46.7 percent of the watershed's land that lies outside of the National Park and National Forest lands.

Figure 10.6 shows the public ownership and distribution of summer chum salmon within the Lilliwaup conservation unit.

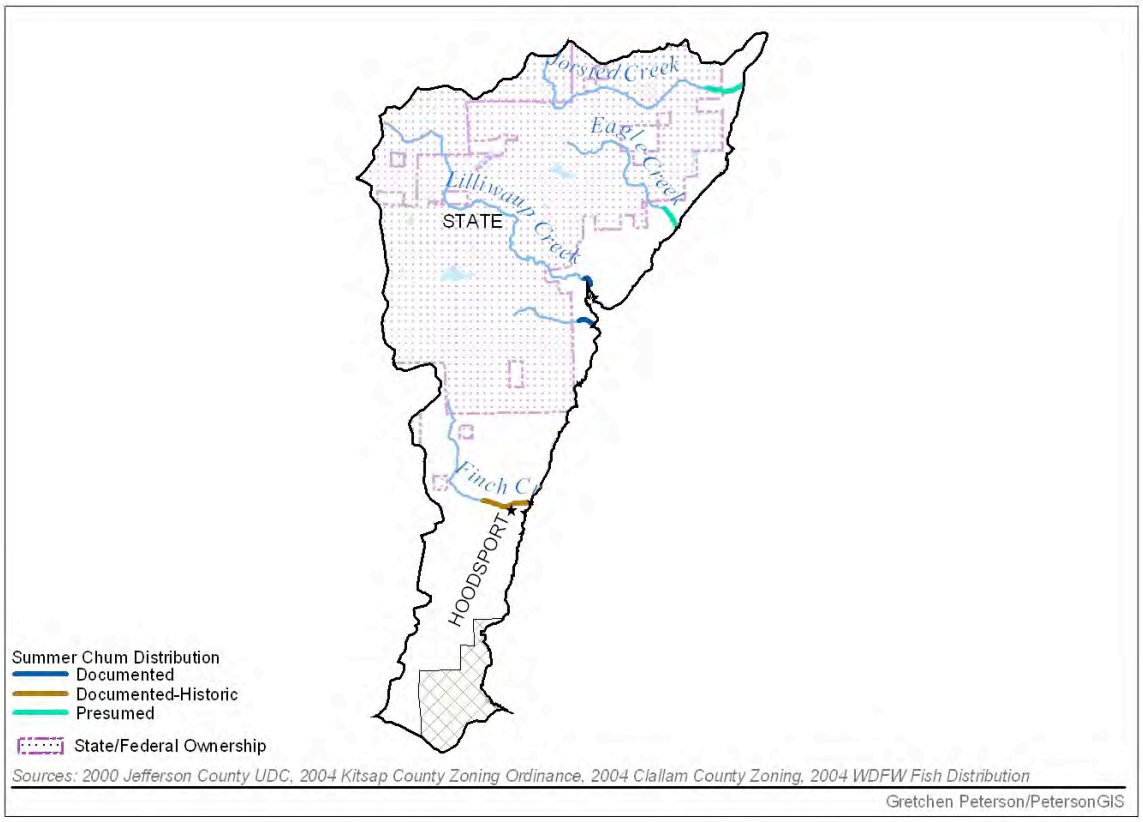


Figure 10.6. Land ownership and summer chum salmon distribution throughout the Lilliwaup conservation unit.

10.5. Specific action recommendations

Below are presented specific recovery action recommendations for the Lilliwaup conservation unit. Recommended actions are categorized as either Programmatic (section 10.5.1) or Project (section 10.5.2). Actions identified will be further delineated as actions to benefit the targeted Lilliwaup spawning aggregation. Specific action recommendations are summarized and analyzed in the context of overall ESU-wide recovery (see section 13). All actions (previously implemented, on-going, and proposed) would become part of the Monitoring and Adaptive Management Program for the SRP as described in section 14.

10.5.1. Programmatic recommendations

Programmatic recovery actions are those that are part of a policy, program, or process. They are generally of a regulatory or planning process nature. Programmatic actions could be part of a County's land use and regulatory program and structures or watershed planning processes. Comprehensive plans, critical areas ordinances, shoreline management master programs, and zoning could all be considered programmatic actions in this context.

Programmatic actions are non-project (i.e., habitat restoration projects--LWD placement, culvert repairs, etc.) in nature. Programmatic actions, however, can include projects when such projects are descriptive of a comprehensive or encompassing process (i.e., levee removal or set back as part of an estuary restoration plan). Watershed management plans often include projects to address identified factors of decline or specific habitat conditions. For the purposes of this SRP, the management plans or planning processes will be considered programmatic actions whereas the projects identified within the management plans will be categorized as projects.

To most effectively address those factors that are likely affecting the performance of the spawning aggregations in this conservation unit, the SRP recommends the following programmatic actions summarized in Table 10.4.

Table 10.4. SRP recommended programmatic actions for the spawning aggregations in the Lilliwaup conservation unit.

Recommended Programmatic Actions	Actions involved	Limiting factors to address
Mason County zoning and comprehensive plan/CAO updates	-support the update of Mason County CAO as per GMA requirements and development of the comprehensive plan -monitor long-term effectiveness of the zoning code and enforcement	-poor riparian condition -loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)
Stormwater management planning for Hoodsport and Skokomish areas	-support the efforts of Mason County and the Skokomish Indian Tribe to develop stormwater management practices and facilities.	-water quality and stream flow -see SRP section 13
Lilliwaup Creek Summer Chum Salmon Supplementation Project	-continue the supplementation project operated by LLTK to ensure appropriate and properly funding monitoring occurs. -see section 14 of this SRP	-see WDFW and PNPTT (2000) and (2003a) for complete details of this project, also section 5 of this SRP
Olympic National Forest and State lands	-continue to preserve these lands in current ownership -Forest Service road maintenance and road abandonment plans should be implemented including appropriate resources to effectively complete the projects	-sediment aggradation
Community Nearshore Restoration Program	-pursue application and implementation of a Community Nearshore Restoration program for mid to southern Hood Canal similar to that being conducted in south Hood Canal (see section 13)	-estuarine and nearshore habitat loss and degradation

10.5.2. Project recommendations

Project recovery actions are generally physical modifications to the landscape designed to address specific habitat situations in specific and limited geographic areas. Projects in the summer chum salmon ESU have been in process for many years by a variety of groups and entities. Section 10.5.2.1 provides an overview of existing projects relative to summer chum salmon recovery planning. Many of the project recommendations presented in this SRP are from the HCCC Lead Entity strategy (HCCC 2004). This SRP is designed to coordinate with and build on that strategy. Projects presented are categorized according to their benefit for the Lilliwaup spawning aggregation.

10.5.2.1. Existing Projects

Long Live the Kings operates a hatchery on Lilliwaup Creek a part of the co-managers summer chum salmon supplementation program (see section 5). Other existing projects have been implemented in the Skokomish System. Figure 10.7 shows the location of existing projects in the lower Skokomish watershed.

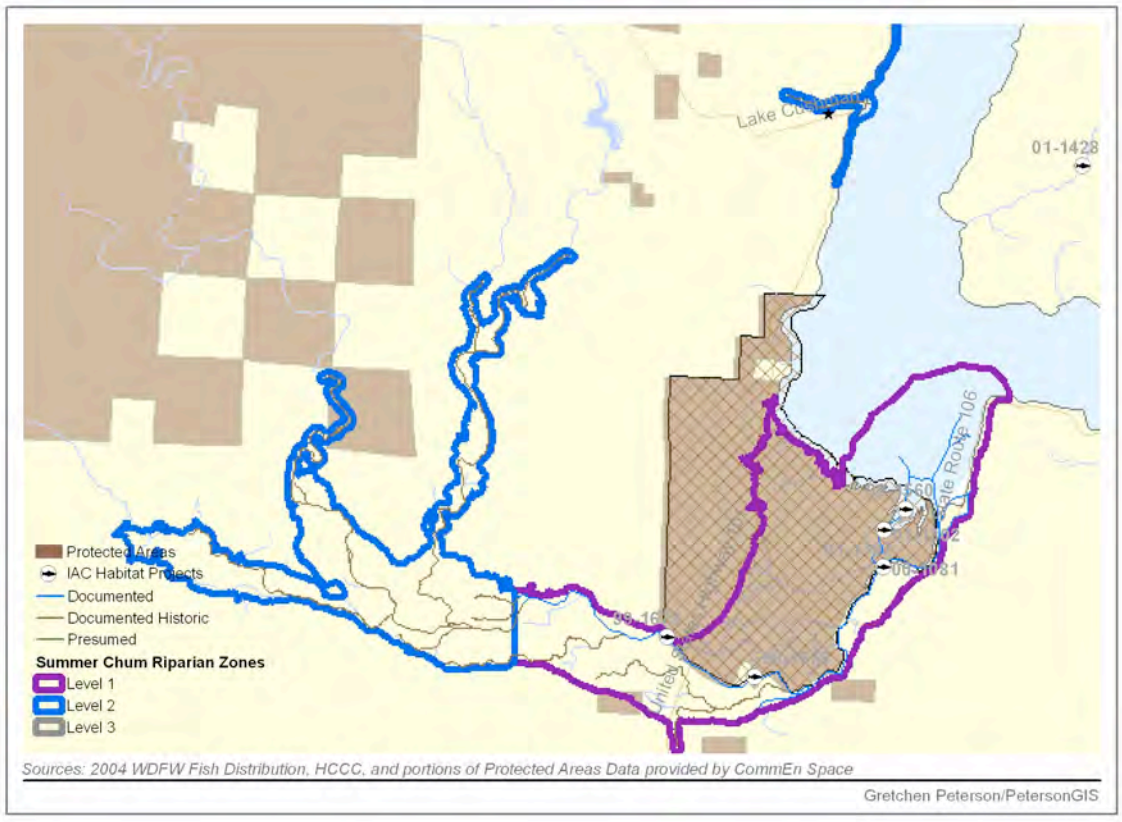


Figure 10.7 shows existing projects in the lower Skokomish watershed.

Projects located in the lower Skokomish River watershed that are likely to benefit summer chum salmon are described. The following existing project descriptions are derived from IAC Grant Projects at http://www.iac.wa.gov/maps/default.asp and click on the Grant Project Maps link, accessed on June 9, 2005:

Skokomish River, North Channel Oxbow, Project 99-1679 Description:
This project's objective was to increase and restore summer chum and Puget Sound Chinook habitat within the Skokomish Indian Reservation. Phase 1 removed impenetrable barriers to fish passage in a historic river meander bend, reconnected oxbow ponds to the Skokomish River, installed large organic debris, removed invasive plant species and revegetated with native plants. The expected result will be restoration of approximately 3/4 mile of spawning, overwintering, and summer rearing habitat for multiple salmon species. Phase 2 installed an engineered log jam at the head of the project.

Bourgault/North Channel Restoration phase 2, Project 00-1081 Description:
This project supports the restoration and maintenance of surface hydrologic connectivity between a historic river meander bend and the Skokomish River during all hydrologic flows throughout the system. The goals of the project are to increase salmon over-wintering and summer rearing habitats, as well as increase the available spawning area. The site is located within the Skokomish Indian Reservation boundaries. Project elements include bank stabilization, reconfiguring the channel, installing engineered log jams, removing exotic invasive vegetation, planting native species, installing sediment and livestock fencing, and salmon carcass placement. Displaced fishers and timber workers from economically distressed counties will work as Resource Technicians to provide labor for this project. Multiple salmon species and stocks are anticipated to make use of this restored area, including ESA listed threatened species Hood Canal summer chum and Puget Sound chinook salmon.

Skokomish River Tide Gate/Culvert, Project 01-1302 Description:
This project, sponsored by the Skokomish Indian Tribe, will remove tide gates, replace culverts, & breach dikes within a diked agricultural area that was formerly part of the estuary, near Skokomish River mouth, within the reservation. Other restoration will include removal of scotch broom, & planting sweetgrass. Tacoma Public Utilities owns other portions held in fee status. The project will implement recommendations of a 1995 Army Corps of Engineers study. This project will also initiate a long-term monitoring study that will provide information on estuary rehabilitation & adaptive management.

Skokomish River Nalley Island Levee Removal, Project 02-1560 Description:
This project, sponsored by the Skokomish Indian Tribe, represents Phase 2 of the SRFB funded Skokomish River Estuary restoration, removing agricultural dikes and a seawall on Nalley Island. The project will restore tidal influence to over 285 acres. ESA listed chinook, summer chum and bull trout are all found

within this area. Historic evidence suggests that ESA listed summer chum spawning may have extended into the floodplain from the river mouth upstream. This project will also benefit coho, winter steelhead, fall and winter chum, pinks, sea run cutthroat, and potentially sockeye.

10.5.2.2. Project Recommendations for the Lilliwaup Spawning Aggregation

To most effectively address those factors that are likely affecting the performance of the Lilliwaup spawning aggregation the SRP recommends the following projects:

Table 10.5. SRP recommended projects for the Lilliwaup spawning aggregation.

Lilliwaup Creek

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting Factors to Address
Extend SR101 bridge span and remove shoulders/fill	-would need to involve WSDOT and Federal highway agencies	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Restore sediment supply from feeder bluff	-would need to involve WSDOT and Federal highway agencies	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove bulkhead, fill, structures and groins at Lilliwaup Point to restore nearshore processes and juvenile migration corridor	-work with private landowners to implement softshore protections	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove fill and development seaward of southern bridge abutment of SR101 to reestablish salt marsh habitat	-would need to involve WSDOT and Federal highway agencies	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove trout pond diking, set back structures and roads and expand access road bridge	Work with landowners for property purchase and permission	-Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)
Daylight creek to falls on right bank of Lilliwaup estuary west of SR101 bridge	Work with landowners for property purchase and permission	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways) -Channel complexity (LWD, channel condition, loss of side channel, channel instability)
Restore channel complexity with LWD projects	0.8 miles of anadromous	-Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)

Riparian restoration with plantings		-Riparian degradation

Skokomish River estuary

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting Factors to Address
Remove left bank dikes/ levees, roads borrow ditches and tide gates. Install raised walkway to maintain access		-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove Nalley Island dikes/ levees, roads, borrow ditches and tide gates		-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove bulkheads and fill and restore 6 acres of salt marsh along the east side of the delta	Work with TPU and private landowner	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove TPU maintenance/access roads with the delta		-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Relocate TPU transmission towers to follow SR 106, and abandon access roads within salt marsh		-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Relocate access road to shellfish beds that extends into intertidal zone at the Skokomish Delta	-Possibly implemented with #2 above	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove fill to historic shoreline midway through parking lot at Cushman boat launch and revegetate with native species	-public outreach required for implementation	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Daylight lower Minerva Creek and restore estuary function	Property purchase required, then fill removal	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove fill and restore historic salt marsh and tidal channels at Potlatch State Park	Work with State Parks to remove fill, sediment source has been impacted, so restoring sediments will encourage salt marsh regeneration	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Reconstruct Enetai Hatchery trapping facility to allow better estuary function and tidal channel connectivity at		-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

Enetai Creek		
Pull pilings and fill from within the delta of old Potlatch Lagoon to restore intertidal wetland		-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

11. Union Conservation Unit

11.1. Introduction

The Union River enters Lynch Cove at the far end of the hook in south Hood Canal and is relatively far removed from the other known populations of summer chum. WDFW and PNPTT (2000) reports the results of genetic analysis show the Union River population is significantly different from the other populations. Also, the summer chum of Union River show earlier run timing, measured by appearance in spawner surveys, than summer chum of other streams in the region (WDFW and PNPTT 2000). For all these reasons, the Union River is categorized as a separate native summer chum stock.

According to Lestelle, et. al. (2005a), the Union population shows the least loss of performance of the eight summer chum salmon populations. WDFW and PNPTT (2000) further report that annual escapement estimates of 100 or fewer spawners during the 1970s. Since that time, the estimates have been considerably higher in most years. As of 2000, the Union River was the only non-supplemented summer chum population that has increased its returns since the 1970s. WDFW and PNPTT (2000) considered the Union River stock as 'healthy' and was eventually made part of the overall summer chum salmon supplementation program. The Union River supplementation program is now a cooperative effort between the Hood Canal Salmon Enhancement Group (HCSEG) and WDFW and was initiated in brood year 2000. The goal is to reintroduce and restore a healthy, natural, self-sustaining population of summer chum in the Tahuya River. The strategy is to boost the abundance of the Union River population to allow for transfers of surplus fish for a reintroduction of summer chum on the Tahuya River using that Union River stock (WDFW and PNPTT 2003).

Current habitat conditions and situations were assessed using a variety of sources. Several sources were used to assess the summer chum salmon stocks in the Eastern Strait of Juan de Fuca conservation unit. This Salmon Recovery Plan (SRP) will not repeat the details of these assessments, but instead refers the reader to the cited documents. All material and documents referenced in this SRP should be considered part of, and integral to, the recovery of summer chum salmon. These sources provided the primary reference and knowledge base for development of these aspects of the SRP. Details of the EDT assessments for the Eastern Strait of Juan de Fuca stocks, including a summary of the baseline performance measures, and a summary of strategic priorities, are provided in Lestelle et al, (2005a) (see Appendix A). The EDT Method is a widely used tool to help prioritize habitat restoration and protection measures for salmon populations. It provides a systematic way of diagnosing habitat conditions that have contributed to the current state of populations, and it enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits to salmon

populations of actions that might be taken to address habitat related issues impeding recovery. Other detailed assessments of habitat and environmental conditions are provided in the SCSCI (WDFW and PNPTT 2000), Correa (2003), Kuttel (2003) and May and Peterson (2003).

Although summer chum habitats in the Union River watershed have undergone changes from historic conditions, Lestelle, et. al. (2005a) believe they still provide relatively good nursery conditions for chum salmon fry. Extensive mudflat and wetlands exist at the mouth of the river. According to Lestelle, et. al. (2005a). the Union River population, produced in the southern terminus of Hood Canal, exhibits a pattern of spawner abundance distinctly different than the other seven populations. That pattern is its sudden and dramatic spawner abundance increase in the past several years. The pattern can be further characterized as:

- Low spawning escapements in the early years of the data record, at a time when escapements to the other rivers were large and when marine survival rates are believed to have been high and harvest rates on the other populations quite low;
- Spawning escapements tending to increase in the 1980s, then remaining relatively stable through the 1990s, with the notable exception of 1986 when it jumped markedly;
- Escapements beginning to increase again around the turn of the century and prior to the onset of returning hatchery fish, then jumping to record highs corresponding with the return of hatchery supplementation fish in 2003-04.

The dominant land use in the upper portions of the Union River, and its tributaries, is residential development, small farms, industrial forestry and water storage/diversion. The middle and lower reaches have moderately heavy residential development, as well as numerous small hobby farms and minor forestry operations. Belfair is located directly east of the river mouth and subestuary. Three County owned bridge crossings, and several privately owned bridges, exist. These prevent the river from migrating throughout its floodplain (WDFW and PNPTT 2000). The overall freshwater habitat is in fair condition, with the majority of the negative impacts occurring from encroachment by homes and farms in the floodplain. In addition, dikes and agricultural activities and modifications in the subestuary and intertidal areas are problems. The potential for further habitat degradation remains high due to the trends in growth, urban land use designations, and inadequate stream, riparian and shoreline protections.

11.2. Geographic Description & Human Population Distribution

The Union Conservation Unit includes the Union River and Tahuya River watersheds. Also included within this unit are the marine nearshore waters east of a line drawn from the town of Union near the mouth of the Skokomish River

north to Rendsland Creek. This conservation unit lies almost entirely within Mason County with small portions within Kitsap County. Figure 11.1 provides a map of the Union Conservation Unit. The Union River watershed covers an area of almost 24 square miles with 10 miles of mainstem length. The town of Belfair is located near the mouth of the Union River. Other human developments of significance in this conservation unit continue along the south and north shores of southern Hood Canal.

WDFW and PNPTT (2000) report that the Tahuya River is the largest stream draining the Kitsap Peninsula at 45.1 sq. miles. It is located east of Rendsland Creek and the Dewatto River, south of Big Beef Creek, and west of Big Mission Creek and the Union River. The headwaters are located in the Green Mountain on the plateau of the Kitsap peninsula and flow southwesterly, entering the east side of Hood Canal at the community of Tahuya. The Tahuya River has a total mainstem length of 21 miles and a combined tributary length of approximately 64.9 miles. Below Lake Tahuya, the Tahuya River flows through gently rolling hills with a low to moderate stream gradient. Below river mile (RM) 14, the river flows through a broad alluvial valley. A distinctive feature of the Tahuya River, and most of the streams draining the southwest Kitsap Peninsula, is the large wetland sections directly associated with the mainstem, as well as numerous tributary wetlands within the drainage. The geology of this watershed is dominated by glacial till. The moderate terrain and low elevation of the Tahuya River watershed results in a rain dominated hydrologic pattern where many of the smaller tributaries go dry early in the summer season, or during winter dry periods. The numerous wetlands within the watershed are critical to moderating peak winter flow and augmenting summer low flows (WDFW and PNPTT 2000).

Detailed descriptions of each of these watersheds can be found in SCSCI Appendix 3.6 (WDFW and PNPTT 2000) and the WRIA 14 North and 15 West habitat limiting factors report (Kuttel 2003).

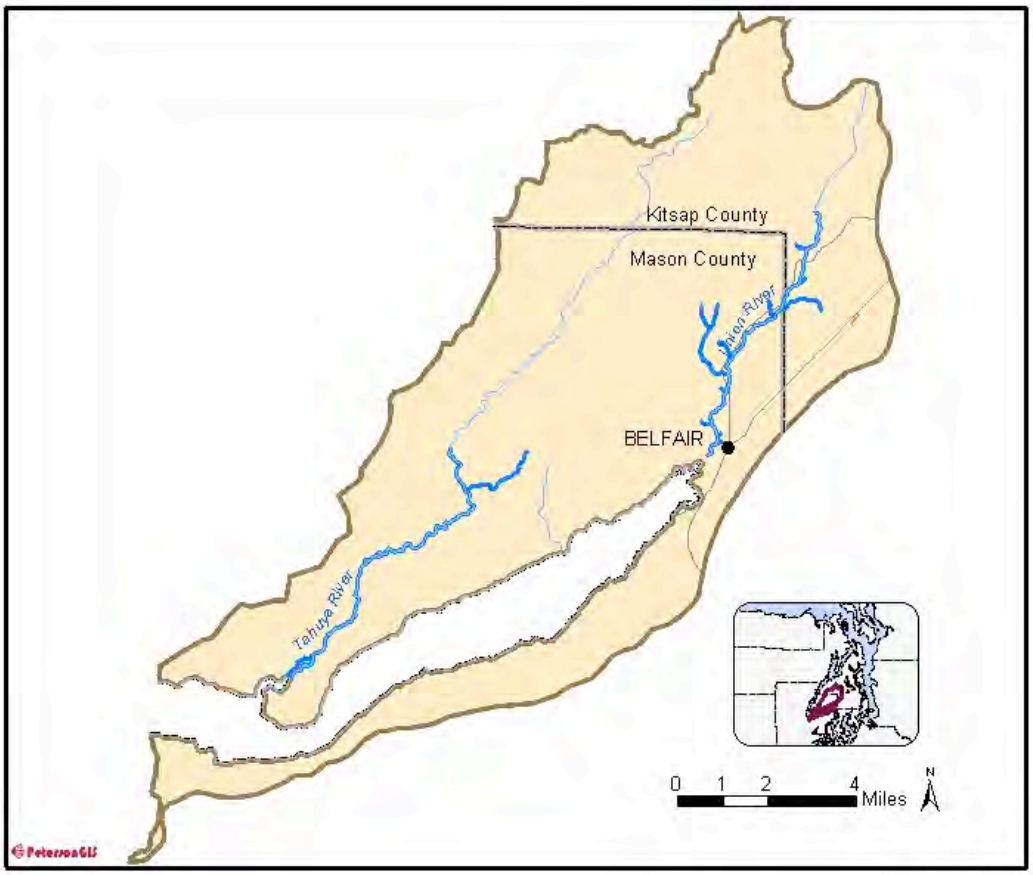


Figure 11.1. Union Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

11.3. Summer Chum Salmon Stocks' Description & Distribution

Several sources were used to assess the summer chum salmon stocks in the Union conservation unit. This SRP refers the reader to the appropriate documents cited in this section. All material and documents referenced in this SRP should be considered part of and integral to the recovery of summer chum salmon. The reader is urged to review the Summer Chum Salmon Conservation Initiative (SCSCI) (WDFW and PNPTT 2000) and subsequent supplemental reports. Summer chum salmon in Hood Canal and the Eastern Strait of Juan de Fuca were also assessed based on application of the Ecosystem Diagnostic and Treatment (EDT) Method (see Appendices A and B). The complete detailed EDT for summer chum salmon can be found at http://www.wa.gov/hccc/ and click on the Salmon Recovery Planning Activities link. On that page can be found links to various documents and the EDT web site for summer chum salmon. The web address for the EDT site:
www.mobrand.com/edt/sponsors/show_sponsor.jsp?sponsor_id=11

Naturally produced summer chum salmon originating from the Union Conservation Unit are likely from the Union River watershed (WDFW and PNPTT 2000). Summer chum spawn in the mainstem of the Union River is primarily limited to the first 2.5 miles of stream. Historical distribution is assumed to be as far as McKenna Falls (RM 6.7) under the historic flow regime. In the Tahuya River it is possible for summer chum to spawn as far up as RM 8.0, but surveys have only found the spawners as far as RM 3.0.

Current, historic and presumed summer chum salmon distribution in the Union Conservation Unit is shown in Figure 11.2.

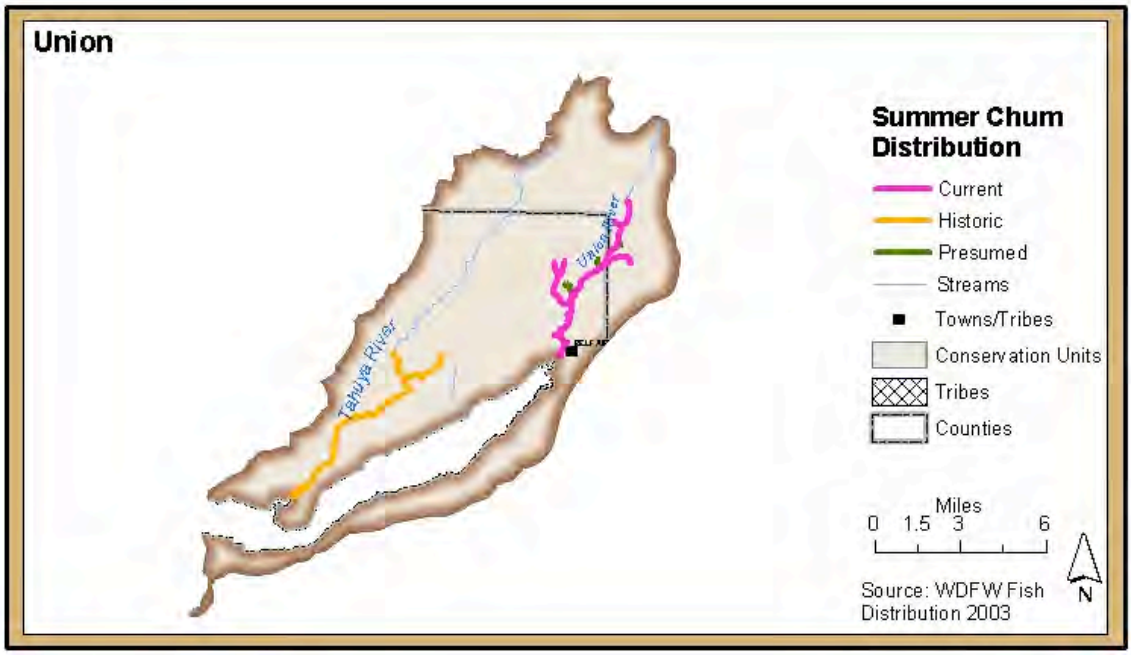


Figure 11.2. Map of the Union Conservation Unit showing current, historic and presumed summer chum salmon distribution.

Summer chum salmon produced from the Union River are part of the Hood Canal population targeted for recovery by the PSTRT. The Hood Canal population is one of two independent summer chum populations tentatively identified by the PSTRT (Currens 2004 Draft in progress). Currens (2004 Draft in progress) provides a detailed analysis of these conclusions and speculates on the importance of the historical geographic distribution of summer chum salmon habitat. He also speculates on the overall "isolation-by-distance relationship" that seems to be observed in the summer chum salmon aggregations. More analyses of population identification and viability are expected from the PSTRT. At this time it is not expected that this further analysis will affect the basic approach taken for recovery in this SRP.

PNPTT and WDFW (2003) have identified the stock that is naturally produced in the Union River to target for recovery in this conservation unit. The Union River

stock is one of the six stocks that comprise the PSTRT designated Hood Canal aggregation. The co-manager interim recovery goals for these stocks are presented in Table 11.1.

Table 11.1. Hood Canal aggregation: co-manager interim abundance and escapement recovery goals for the Union spawning aggregation.

Stocks	Abundance	Escapement
Union	550	340

PNPTT and WDFW (2003) also developed abundance and spawning escapement threshold criteria. One of the criterion for recovery is that a summer chum stock (Union) must, over a minimum of the recent twelve year period, have both a mean abundance and mean escapement of natural-origin recruits that meets or exceeds the defined thresholds. Table 11.2 provides a summary of escapement for the recent twelve year period, 1993-2004, for the Union spawning aggregation.

Table 11.2. Escapement threshold for the Union spawning aggregation based on PNPTT and WDFW (2003).

	ESCAPEMENT				
Population aggregation	**93-04 Average**	**target**	**% of target**	**# times below target 2001-2004 (≤1)**	**# times below target 1997-2004 (≤2)**
Union	2,000	340	588	0	2

The Union aggregation currently is meeting the escapement threshold as established by the co-managers. The recent years population abundance is likely a combination of both hatchery and natural-origin recruits and to meet the recovery goal 12-year criterion, only natural origin escapement must be counted. A cooperative supplementation project between the HCSEG and WDFW was initiated in 2000. The intent of the program is to boost the Union River stock to a level that can be used for the reintroduction of summer chum salmon into the Tahuya River. Broodstock from naturally produced Union stock is being used to rebuild summer chum salmon in the Union River and will be used for the Tahuya supplementation program. The Tahuya program was begum in 2004. Interim recovery goals have not been established for the Tahuya stock.

Additional co-manager criteria require that the stocks do not fall below the target in more than once in the recent four-year period and no more than twice in the recent eight-year period. Again, the Union aggregation meets the threshold for the recent four-year period and for the recent eight-year period though hatchery origin fish are part of the recent escapements. It should also be noted that criteria for productivity (for example, eight year average equal to or greater than 1.6 recruits per spawner) must be met for recovery. Data currently are insufficient to assess the productivity criteria but are being collected (PNPTT and WDFW 2003).

Summer chum salmon escapement (number of adults returning to spawn) for the Union River from the years 1974-2003 is presented in Figure 11.3.

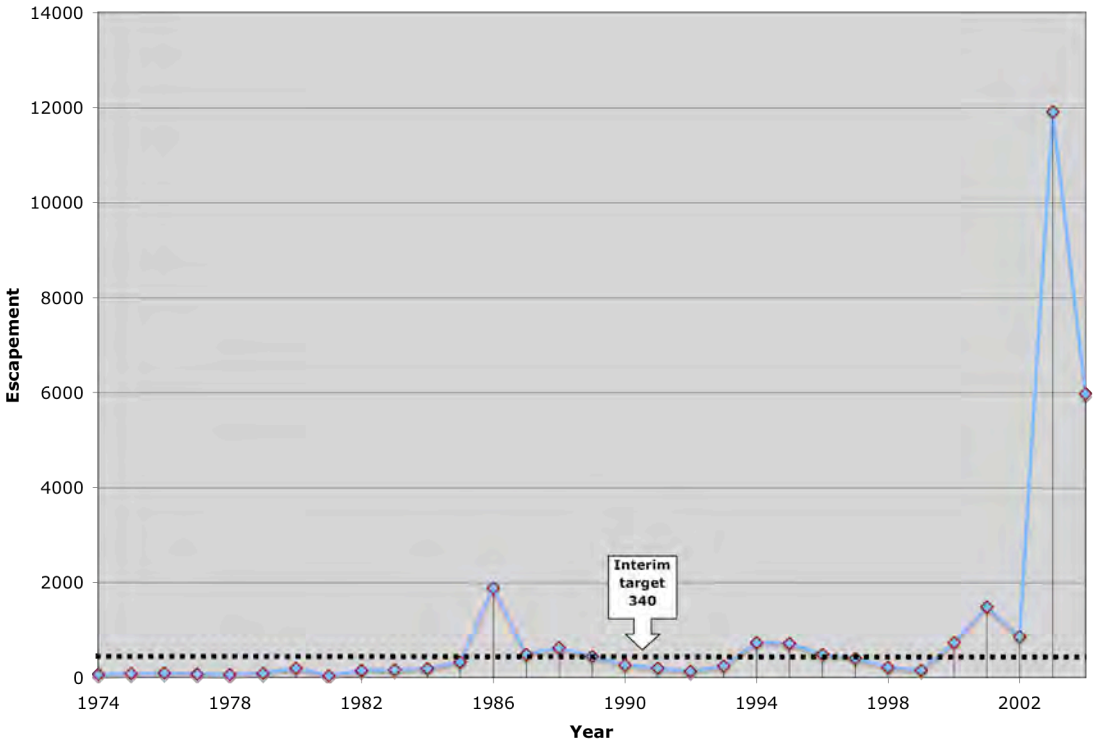


Figure 11.3. 1974-2003 summer chum salmon escapement for the Union River (data source: WDFW and PNPTT 2003, 2004, and 2005)

The co-managers have assessed the extinction risk faced by individual summer chum salmon stocks based on the methodology offered by Allendorf et al. (1997) and discussed in detail in section 1.7.4 of the SCSCI (WDFW and PNPTT 2000). The extinction risk was assessed again in 2003 based on data available through 2002 (WDFW and PNPTT 2003). The most recent assessment of extinction risk from the co-managers for the Union stock states, "Estimated escapements to the Union River show no declining trend over the period of record and, in fact, appear to have increased somewhat since the 1970s. Escapements over the last four years have ranged from 159 to 1,491, averaging 817 spawners. This stock has shown a recent increasing escapement trend, and its risk of extinction is now rated as low."[48]

[48] This assessment has just been updated by the co-managers and includes the years 2003 and 2004 (WDFW and PNPTT In preparation). The update indicates no change in the rating of low extinction risk.

11.4. Habitat overview & environmental conditions

Details of the EDT assessments for the Union stock, including a summary of the baseline performance measures and a summary of strategic priorities are provided in Lestelle, et. al. 2005a (see Appendix A). The EDT Method is a widely used tool to help prioritize habitat restoration and protection measures for salmon populations. It provides a systematic way of diagnosing habitat conditions that have contributed to the current state of populations, and it enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits to salmon populations of actions that might be taken to address habitat related issues impeding recovery. Other detailed assessments of habitat and environmental conditions are provided in the SCSCI (WDFW and PNPTT 2000), and Kuttel (2003).

11.4.1. Factors contributing to the decline of summer chum salmon

Lestelle, et. al. (2005a) conclude that, "[T]he Union population appears have relatively high productivity under both unfavorable and favorable ocean survival conditions and shows the least loss in performance of the eight populations."

In, summary the EDT conclusions for the Union (Lestelle, et. al. 2005a) are that:

- The amount of potential increase in population abundance is approximately equal between the Union River (freshwater), the natal subestuary, and the estuarine-marine waters beyond, if each area was able to be fully restored. Potential gain in productivity is highest for freshwater, followed by estuarine-marine waters.

- Protection of freshwater reaches shows the highest priority, followed closely by the natal subestuary.

- Potential benefits of restoring estuarine-marine areas are diffused over many segments but the Skokomish west shore is ranked highest among these areas, tied with the Oak Bay segment. The reason for the high value of the Skokomish west shore is due to its amount of change that has occurred in conjunction with its proximity to the Union River. The reason for the high value of the Oak Bay segment is less clear. We believe this to be partly the result of how we expect migration to proceed as fish from both shores of Hood Canal to be concentrated on the west side of Admiralty inlet as they move to the Strait. The importance of the Oak Bay area is also partly due to the increasing amount of competition with hatchery fish as summer chum move through Admiralty Inlet (picking up fish from other areas in Puget Sound).

- Within freshwater, sediment load and habitat diversity are seen as the most important factors to restore.

- Within the natal subestuary, several factors appear to be equally important for restoration, along with the amount of area available to be used for rearing.

- Within the estuarine-marine environment, the most important factor for restoration is food, associated with loss of eelgrass, revetments, and loss of riparian corridors.

May and Peterson (2002) rated floodplain conditions for the lower mile of the Union River as “fair” (25 to 50% lost connectivity and habitat) and “good” (≤ 25% lost connectivity and habitat) on the remainder of the mainstem. Fine sediment was rated “good” with a measure of 10% to 15% fines in the lower mainstem (May and Peterson 2002).

The SCSCI (WDFW and PNPTT 2000), the “Salmonid Habitat Limiting Factors Water resource Inventory Areas 15 (West), Kitsap Basin and 14 (North), Kennedy-Goldsborough Basin” prepared by the Washington Conservation Commission (Kuttel 2003), and May and Peterson (2002) provide details of the various habitat factors and environmental conditions affecting summer chum salmon in this conservation unit. In general, the findings from these reports are corroborated by the EDT assessment (Appendix A). These factors and conditions are summarized for the Union River (Table 11.3) and Tahuya River (Table 11.4) below.

Table 11.3 Union River

Factors for decline	Life stage most affected	Remarks
Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)	Spawning and incubation	The Union River still possesses a structurally diverse channel network with 63% pools. However pool frequency is poor at 5.9 channel widths between each pool. The stream contains low levels of large size LWD due to past stream clean-outs, riparian forest harvesting and natural transport downstream. Habitat surveys in 1993 found the Union River averaged 0.22 pieces of LWD/m from the mouth to McKenna Falls with nearly 42% of the wood being in the small size class [10-20 cm diameter]. The low levels of large size instream LWD may result in redd scour and channel instability. Much of the current instream LWD is western red cedar, which has long instream residency times due to its slow rate of decay. Stream clean-outs of LWD, particularly log jams and channelizations have been recorded back to the late 1800s but were more extensive during the late 1960s. For instance, in 1967 the WDF stream improvement division noted that five log jams were removed from the Union River and it was channelized for 5 miles. In a three year period in the late 1960s, numerous log jams were removed from the Union River and 2 of the larger tributaries, Courtney Creek and Bear Creek. In addition, rip rap was placed along 2 miles of Courtney Creek in 2 consecutive years in 1967 and 1968 and the lower two miles of Courtney Creek appears to have been moved sometime in the distant past.

Riparian degradation	Spawning and incubation	Most of the basin was completely logged of the original forests by the 1930s. Numerous farms, residential developments and associated bank armoring exist in the riparian corridor affecting the functional status of the riparian forest. Currently fifty two percent of the riparian area is forested of which 96% is dominated by deciduous trees. Sixty two percent of the total riparian length is sparsely vegetated or less than 66 feet wide. Rural residential development, agriculture, and roads cover 46% of the riparian area.
Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)	Juvenile rearing and migration	• For it's comparatively small size of 344.6 acres (6.1 miles perimeter), the estuarine delta of the Union River has been extensively diked and the tidal floodplain constrained as a result. Seven diked areas occupy 78.6 acres or 22.8% of the original summer chum rearing and migration habitat area. Some of these diked areas may be breached and now inundated by the tide but the extent of restoration to tidal circulation and the state of recovery cannot be verified without ground truthing. Several tidegates have been identified but their condition and impact on summer chum estuarine habitat is unknown (M. Schirato, WDFW, Olympia, WA pers. comm., Oct. 1995). Juvenile summer chum rearing opportunities are presently limited compared to the historic state of the subestuary. In particular, habitat extent and quality in the mesohaline reaches of the subestuary, which chum fry may volitionally occupy for up to 1-2 weeks, are very limited due to the diking. Much of the breaching of marshes appears to be in an early state of restoration. Fills for commercial or residential use include two areas totaling 3.6 acres, approximately 8.9% of the historical delta area. At least one of these fills is located on the outer edge of the historic

		subestuary, thus imposing an intertidal barrier to migrating summer chum fry. One small (0.9 acres) pond or other excavation is evident within the delta but its impact is thought to be minor. • Although much of the historically diked delta habitat in the Union River subestuary is now exposed to renewed tidal inundation, the associated ditching that accompanied diking and agricultural activities have heavily modified emergent marsh and other intertidal habitats. While these ditches and remnant dikes may not impose a direct impact, they likely inhibit restoration of natural drainage channel systems and delay long-term recovery of estuarine rearing habitat for summer chum. At least 19 ditch and remnant dikes are present, and extend over approximately 2 miles of delta habitat. Many of these are concentrated in a large dike-breach marsh in the lower extent of the delta, where chum fry would be expected to "stage" for migration into the Canal. Such ditching typically prevents or delays the formation of natural dendritic tidal channel systems, which in turn impacts foraging opportunities for juvenile salmon in the marshes. In addition, prey resources of the emergent marshes, which can be important to chum fry early in the estuarine migration, are likely progressing at a slower recovery rate than natural because of the ditching.

Table 11.4. Tahuya River

Factors for decline	Life stage most affected	Remarks
Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)	Spawning and incubation	Road building, diking, channelization, floodplain agriculture and residences, and bank armoring have constricted the floodplain and limited channel movement and the creation of new habitat. Agriculture land use found on the floodplain at RM 0.5 to 0.8 and RM 1.1 to 1.3 has eliminated or limited riparian forest development. From RM 1.6 to 2.0, a farm is located on a floodplain island bounded by the mainstem and a side-channel of the river. A roughly 800 foot long dike protects this site. Residential development at RM 2.5 to 2.7 is located in the floodplain on the west side of the river. Residential development at RM 4.5 to 6.0 is located in the floodplain on the north side of the river. Agriculture and residential developments also occur from RM 6.0 to 6.2. From RM 6.3 to 6.9 homes are placed directly on the river bank, and agricultural developments is cutting off old river meanders. Fill is used to protect residential development at RM 7.3 to 7.6. The residential and agricultural development in the floodplain and riparian forest of the river has resulted in the removal of riparian vegetation and bank armoring from river mile 7.5 downstream. From 1955 to 1970, the Washington Department of Fisheries Stream Improvement Division removed what was considered at that time as blockages to upstream salmon migration. Logjams, debris, and beaver dams were removed and many miles of mainstem and tributaries were channelized. The result was a loss of channel complexity and bed stability. From habitat survey data, the Tahuya River has 72% pools, 0.15 pieces of LWD/meter, and an average of 2.4 channel widths between each pool. This is a low impact for percent pool, a high impact for LWD and a moderate impact for pool spacing. The low density of LWD has not translated into a low percent pools,

		since LWD is not the only pool forming factor in low gradient, wetland dominated, channels such as the Tahuya. The combined ratings for channel complexity are rated as moderate, however conditions may decline for the next 50 to 100 years until the existing riparian forest matures and contributes increased LWD to the stream channel.
Riparian degradation	Spawning and incubation	By 1930 most of the old growth in the Tahuya River watershed had been harvested. Historical riparian forests were dominated by a mixture of old growth western red cedar, Douglas-fir, western hemlock, and areas of younger alder. Stumps remaining in the riparian forest adjacent to the stream channel network show that in most areas all the large conifer trees available for recruitment into the stream channel were removed with timber harvest. Presently, 7% of the riparian zone (by stream length) has no buffer, 24% averages <12 in. dbh and, 69% is 12 to 20 inches dbh (12-20 in dbh). Species composition of riparian forest is 52% deciduous dominated, and 37% mixed conifer and deciduous. Forty four percent of the riparian forest is greater than 132 feet in width, 27% 66 to 132 feet in width, and 29% less than 66 feet in width and/or sparsely vegetated. Riparian land use within the riparian buffer is 71% forested, 12% rural residential and 8% agriculture. Although 44% of the riparian forest greater than 132 feet in width and 71% of the riparian buffer forested, the small size of most of the trees and lack of conifer in the riparian forest combine for a moderate impact. The habitat is in recovery, however development of this watershed is expected to rapidly increase over the coming decades. Habitat surveys (between RM 4.0 and 9.0) of the Tahuya mainstem show low numbers of LWD at 0.15 pcs/m of channel length. Levels of LWD will continue to decline for the next 25 to 50 years until the existing riparian forest to matures and contributes large diameter LWD to the stream channel.

Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)	Juvenile rearing and migration	• Nearshore development including, bulkheads, filling of near shore areas, erosion onto beaches, installation of docks, and loss of shoreline vegetation, has reduced and eliminated nearshore habitat. Bulkheads increase the rate of beach erosion, modifying and eliminating suitable habitat. Bulkheads and docks force fish into deeper water where they are subjected to increased predation by birds and other fish species. Installation of bulkheads reduces available habitat for chum prey. Bulkheads and filling of nearshore habitat eliminates eelgrass beds and salt marsh, important rearing and feeding habitats. Removal of shoreline vegetation reduces shade, shoreline LWD, and increases erosion onto beaches, all important factors in the survival of summer chum and their prey. Shoreline vegetation is also an important source of terrestrial chum prey. Dock installation through filling, shading, and physical disturbance of the beach eliminates eelgrass beds, micro and macro algae, disrupts salmon migration, increases predation by forcing salmon into deep water, displaces prey species, and disrupts beach spawning of prey species. • Two areas of the delta, totaling >0.01 km (~1 ac; 1.4% of historical delta area), appear to have been filled, primarily for residential development. Three areas of roads or causeways have impacted the delta over 0.27 km (0.17 mi) and, in addition to the habitat directly lost in the footprint of the causeways, the effect of this has been to constrict estuarine exchange in the middle of the delta. For example, a bridge at RM 0.0 with a fill causeway, constricts the migration, development, and flushing of estuarine sloughs. The extent of change in tidal

		flooding circulation and the effect on migrating and rearing salmon is unknown.
Water quality, temperature	Adult spawning	High water temperatures into late September can negatively affect summer chum by preventing the entry of adults into the river, exposing them to predation. Temperature data shows that on some years water temperatures are 12 degrees Celsius or higher through the first half of September. Reductions in the extent of riparian forests, and the size of trees within the riparian forest increase stream temperatures through a loss of shade and transpiration. Within the lower 9 miles of the Tahuya River 29% of the riparian forest is less than 66 feet in width or sparsely vegetated.

11.4.2. Human development and land use

Population density in the Union Conservation Unit is relatively low, except in the area of Belfair, and portions of the Union River watershed and along the north and south shorelines. Figure 11.4 Presents population density for the Union conservation unit.

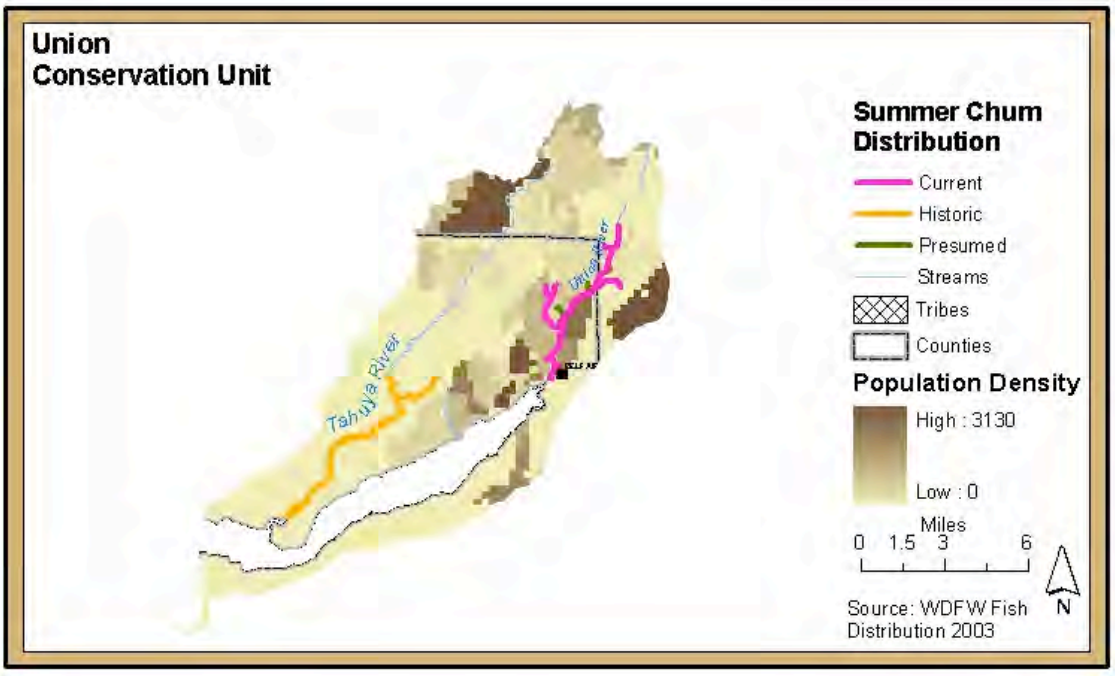


Figure 11.4. Human population density (people per square mile) for the Union Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

WDFW and PNPTT (2000) report that the Union River enters Lynch Cove in the eastern arm of Hood Canal**.** The watershed area is approximately 24 square miles with 10 miles of mainstem and 30 miles of tributary streams. The headwaters are in the Blue Hills near 1,500 ft. elevation. They flow through an undeveloped watershed before entering the Union River Reservoir that was constructed in 1955-57 as a municipal and industrial water supply. The project provides up to 5 million gallons per day for the City of Bremerton and the Puget Sound Naval Shipyard. The upper watershed contains moderate to steep side-slopes with a relatively low gradient stream channel downstream to McKenna Falls. That falls is located at river mile (RM) 6.7, immediately below the water supply dam (Cascade Dam) and reservoir. Below the falls, the gradient is also low, with the lower 5 miles being quite flat and flowing through a broad shrub-scrub floodplain. The Union River enters a subestuarine delta that has been heavily constrained by diking and filling, mainly for agriculture, flood control, and to protect residences located in the subestuary.

Mason County Development Regulations, dated January 18, 2005 have designated the lands in the lower watershed as part of the Belfair Urban Growth Area (UGA). UGAs have urban characteristics, but they currently lie outside of incorporated cities. In recognition of the availability of urban services and the proximity to urban areas, these areas are designated to accommodate the majority of the growth that is expected to occur within the County in the foreseeable future. The widest variety of uses, and the highest densities, will be allowed in Urban Growth Areas (Mason County Development Regulations section 1.02.020). The Belfair UGA is a ‘stand-alone’ area not affiliated with any incorporated city. Development regulations for this area are intended to accommodate existing land use patterns and densities, while planning for future growth. Mason County is in the process of developing a stormwater management plan for this UGA in conjunction with State Route 3 road improvements. The rest of the lower watershed is designated as Agricultural lands (at the mouth of the Union River) and Rural Residential (RR5-one dwelling unit per 5 acres and RR10-one dwelling unit per 10 acres).

Figure 11.5 presents the Union River watershed.

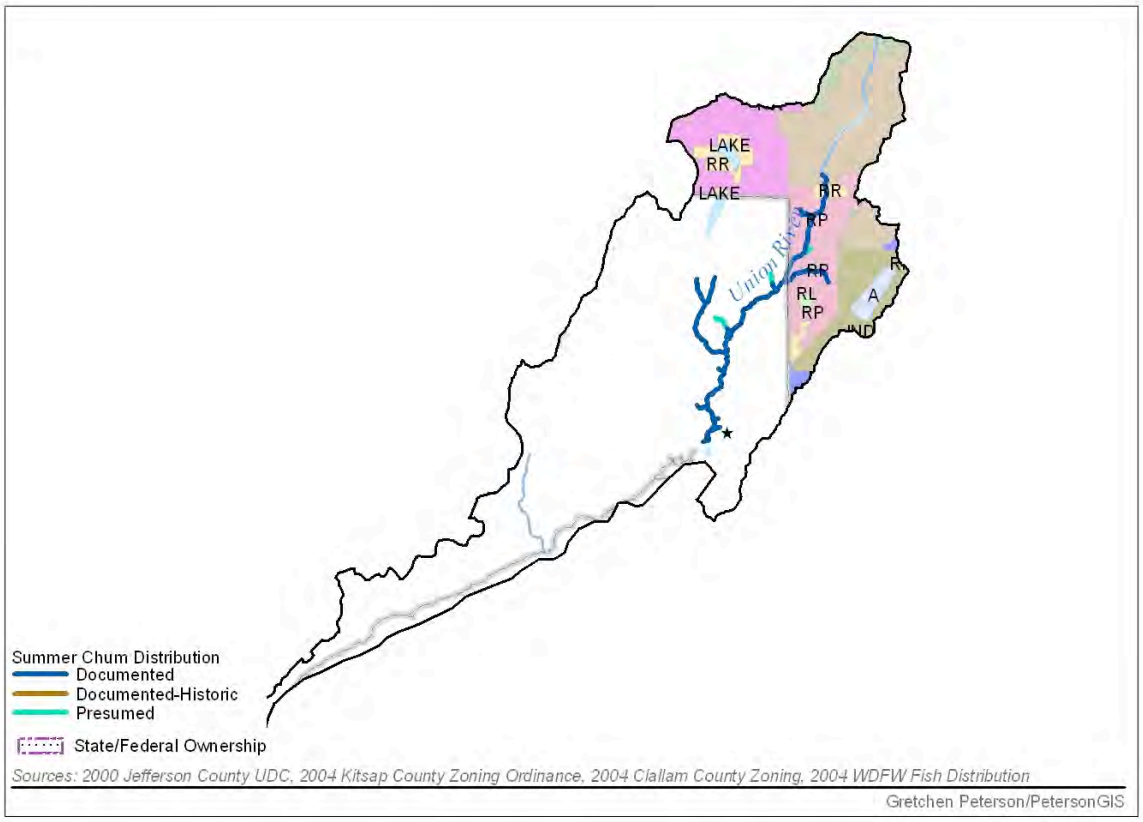


Figure 11.5. Land use in the Union River watershed. Note that the Mason County Development Areas Map is in progress. When completed the appropriate land use designations will be added to this map.

Zoning for this area is in development as part of Mason County's update of their comprehensive plan and critical areas ordinance under GMA provisions. The zoning shown in the upper watershed is from Kitsap County, which has designated these lands as rural lands per their Kitsap County Zoning Ordinance, 2004.

The primary historical land use in this watershed was timber harvest. A large portion of the watershed is still managed for timber in the Washington Department of Natural Resources, Tahuya State Forest, and on the lands of private timber companies. Seventy one percent of the riparian zone is fully forested, with another 6% clearcut. Agriculture accounts for 8% of the riparian zone, mainly in the form of Christmas tree farms and other small farms. Residential neighborhoods, within the 100-year floodplain, account for another 12% of the riparian zone. The immediate shoreline of Hood Canal is intensely developed. Many of the natural lakes, reservoirs, and wetlands in the Tahuya drainage are also intensely developed.

The lower Tahuya River watershed is designated by Mason County Development regulations as a mixture of Rural Residential (RR5, RR10 and RR20-one dwelling unit per 20 acres). Figure 11.6 shows some of the land use designations for the Tahuya watershed.

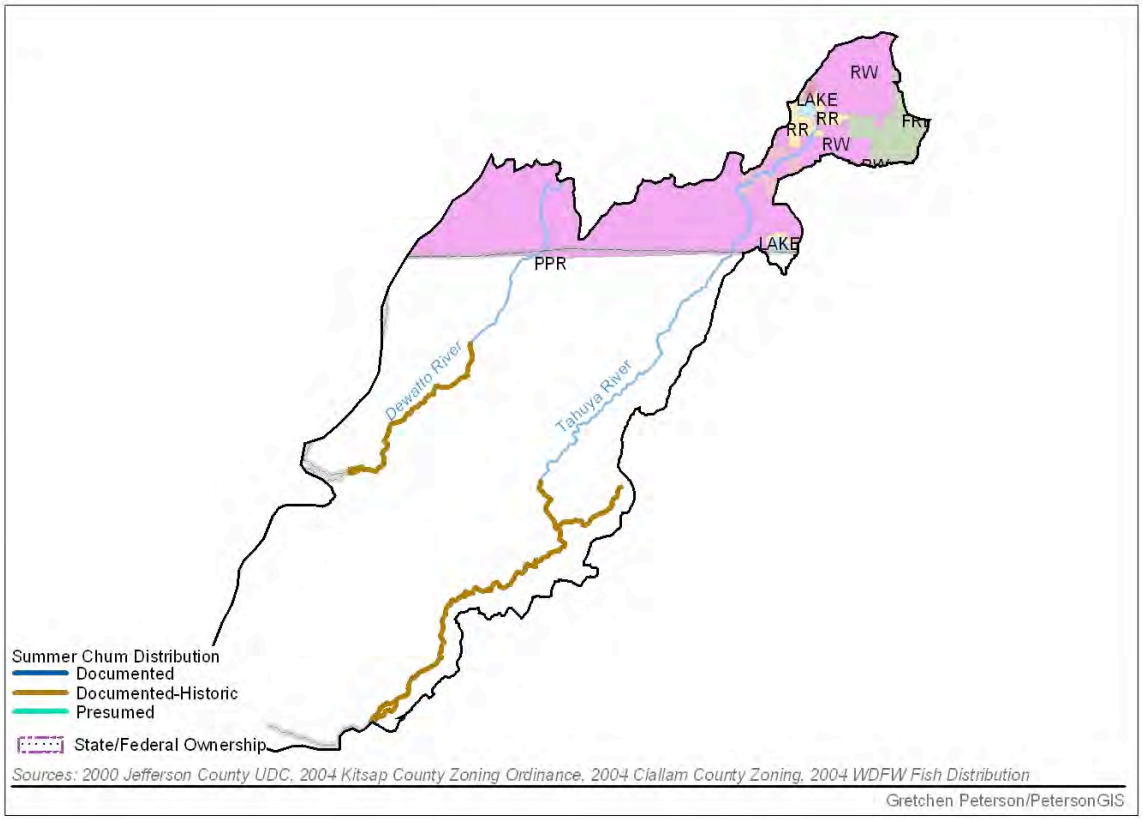


Figure 11.6. Land use in the Tahuya River watershed. Note that the Mason County Development Areas Map is in progress. When completed the appropriate land use designations will be added to this map.

Zoning for this area is in development as part of Mason County's update of their comprehensive plan and critical areas ordinance under GMA provisions. The zoning shown in the upper watershed is from Kitsap County, which has designated these lands as rural lands per their Kitsap County Zoning Ordinance, 2004.

11.5. Specific action recommendations

Section 11.5 presents specific recovery action recommendations for the Union conservation unit. Recommended actions are categorized as either Programmatic (section 11.5.1) or Project (section 9.5.2). Actions identified will be further delineated as actions to benefit the targeted Union spawning aggregation. Specific action recommendations are summarized and analyzed in the context of overall ESU-wide recovery (see section 13). All actions (previously

implemented, on-going, and proposed) would become part of the Monitoring and Adaptive Management Program for the SRP as described in section 14.

11.5.1. Programmatic recommendations

Programmatic recovery actions are those that are part of a policy, program, or process. They are generally of a regulatory or planning process nature. Programmatic actions could be part of a County's land use and regulatory program and structures or watershed planning processes. Comprehensive plans, critical areas ordinances, shoreline management master programs, and zoning could all be considered programmatic actions in this context. Programmatic actions are non-project (i.e., habitat restoration projects--LWD placement, culvert repairs, etc.) in nature. Programmatic actions, however, can include projects when such projects are descriptive of a comprehensive or encompassing process (i.e., levee removal or set back as part of an estuary restoration plan). Watershed management plans often include projects to address identified factors of decline or specific habitat conditions. For the purposes of this SRP, the management plans or planning processes will be considered programmatic actions whereas the projects identified within the management plans will be categorized as projects.

To most effectively address those factors that are likely affecting the performance of the spawning aggregations in this conservation unit, the SRP recommends the following programmatic actions summarized in Table 11.5.

Table 11.5. SRP recommended programmatic actions for the Union spawning aggregation in the Union conservation unit.

Recommended Programmatic Actions	Actions involved	Limiting factors to address
Mason County zoning and comprehensive plan/CAO updates	-support the update of Mason County CAO as per GMA requirements and development of the comprehensive plan -monitor long-term effectiveness of the zoning code and enforcement	-poor riparian condition -loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)
Stormwater management planning for Belfair area and Highway SR3 improvements	-support the efforts of Mason County to develop stormwater management practices and facilities.	-water quality and stream flow -see SRP section 13
Union River/Tahuya River Summer Chum Salmon Supplementation Project	-continue the supplementation project to ensure appropriate and properly funding monitoring occurs. -see section 14 of this SRP	-see WDFW and PNPTT (2000) and (2003a) for complete details of this project, also section 5 of this SRP

State forest lands (Tahuya watershed)	-continue to preserve these lands in current ownership -Forest Service road maintenance and road abandonment plans should be implemented including appropriate resources to effectively complete the projects	-sediment aggradation
Community Nearshore Restoration Program	-continue to pursue application and implementation of the Community Nearshore Restoration program (see section 13)	-estuarine and nearshore habitat loss and degradation

11.5.2. Project recommendations

Project recovery actions are generally physical modifications to the landscape designed to address specific habitat situations in specific and limited geographic areas. Projects in the summer chum salmon ESU have been in process for many years by a variety of groups and entities. Section 11.5.2.1 provides an overview of existing projects relative to summer chum salmon recovery planning. Many of the project recommendations presented in this SRP are from the HCCC Lead Entity strategy (HCCC 2004). This SRP is designed to coordinate with and build on that strategy. Projects presented are categorized according to their benefit for the Union spawning aggregation of concern.

11.5.2.1. Existing Projects

Figure 11.7 presents existing summer chum salmon projects in the Union River watershed.

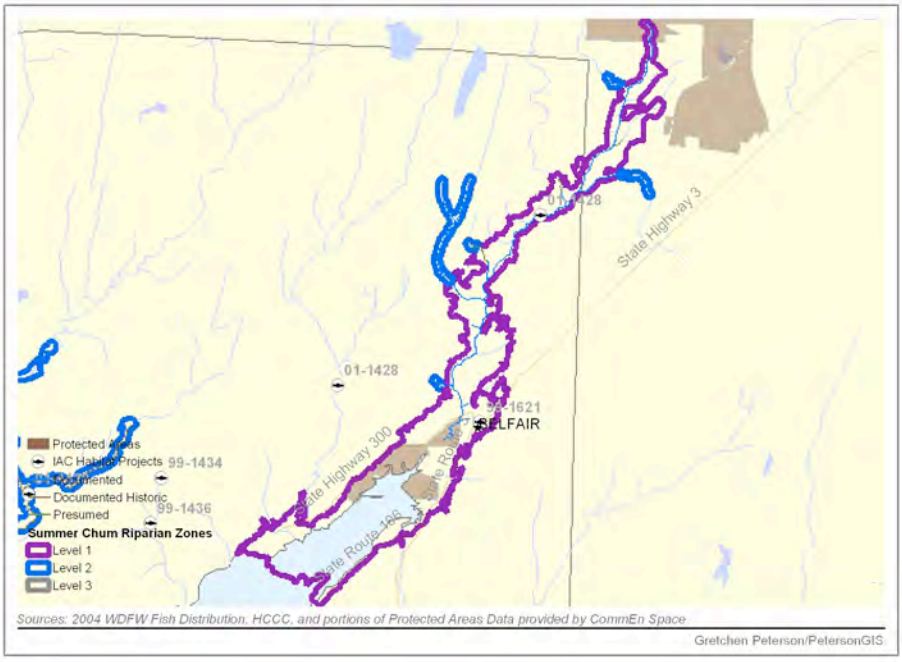


Figure 11.7. Existing summer chum salmon habitat restoration projects in the Union River watershed.

Projects located in the lower Union River watershed that are likely to benefit summer chum salmon are described. The following existing project descriptions are derived from IAC Grant Projects at http://www.iac.wa.gov/maps/default.asp and click on the Grant Project Maps link, accessed on June 12, 2005:

Bear Creek Fish Barrier removal Project 99-1621 Description:
Bear Creek is a tributary to the Union River, which has a low but stable population of summer chum. The culvert under Old Navy Yard Way poses upstream migration problems near the mouth of Bear Creek. The existing culvert is a 71"x 47" culvert with a pipe capacity of 140 CFS at velocities of >15 fps. The culvert has a 30" perch with rock and concrete rubble blocking a 3' plunge pool at the downstream end. The average stream width above and below the culvert is 11 feet, with a 100 year flood flow of 300 CFS. The culvert is undersized, is a velocity barrier during high flows, and is inaccessible to chum due to the perch at the downstream end. Replacing this culvert would open up approximately 0.75 miles of chum habitat and a total of 3.75 miles of good habitat for other salmonids, such as coho and steelhead. In addition, 3 acres of prime wetland habitat can be used by overwintering coho. Local citizens groups are working to rebuild the declining numbers of chinook in the system.

Identify/Restore Limiting Spawning/Rearing Project 01-1428 Description: This project will identify reaches within the Union, Mission, Tahuya, Rendsland, and Dewatto systems where LWD abundance and characteristics, pool surface area and depth is limited. Projects will be completed in areas most beneficial to salmon and that have support from the local communities and landowners. The systems are habitat for summer and fall chum, Chinook, coho, and steelhead.

11.5.2.2. Project Recommendations for the Union Spawning Aggregation

To most effectively address those factors that are likely affecting the performance of the Union spawning aggregation (including the Union and Tahuya watersheds), the SRP recommends the following projects summarized in Table 11.6:

Table 11.6. SRP recommended projects for the Union spawning aggregation.

Union River

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting Factors to Address
Remove the dike and tide gates at Belfair State Park	-Perform feasibility study with State Parks, and develop plan to have no net loss of public access	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Restore salt marsh and wetland habitats at the farm on the east bank of the mouth of the Union River	-working with private landowners is critical in a dialogue that can provide a long-term focus	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Monitor borrow ditches and remnant dikes on the salt marsh of Lynch Cove to ensure natural formation of dendritic tidal channels	-will require funding and stable resources to conduct the monitoring and evaluation over the long-term	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove fill at Belfair State Park and restore lost salt marsh habitat	-12 acres salt marsh lost to development, with about 3.5 recoverable -will to work with State Parks to determine feasibility and ensure public access that meets Park objectives	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove dikes and tide gates at the Klingel Wetlands and fill dike borrow pits	-Project underway with NRCS and Great Peninsula Conservancy -feasibility assessment in process	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

Remove levees, young alders, and aggraded delta cone on Little Mission Creek to allow more natural sediment routing in estuary	-local groups and state agencies working with Parks to implement early actions	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways) -Riparian degradation -Channel complexity (LWD, channel condition, loss of side channel, channel instability)
Remove fill at Snooze Junction and restore lost salt marsh habitat	-work with private landowner to implement property purchase and restoration	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove the private road east of Snooze Junction to restore tidal access to salt marsh west of the road	-work with private landowners (2) to implement skid road-fill removal	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Restore forested riparian buffers at Belfair State Park	-will be implemented when results of feasibility study implemented	-Riparian degradation -Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)
Remove fill, pool, and infrastructure to the east of the Klingel Wetlands and restore lost salt marsh habitat	-two landowners, currently working with both to proceed with purchase and restoration -possible mitigation project for Northshore road stabilization (Mason County) since fill could also be used for beach nourishment	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove the small concrete pool, boat ramp, fill, and bulkhead at Lynch Cove Community Park to restore lost salt marsh	-funded by WDFW -to be implemented 2004 by Hood Canal Community Nearshore Restoration Program	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

Tahuya River

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting Factors to Address
Evaluate the bridge span at the Northshore Road crossing of the Tahuya River for impaired tidal circulation and if necessary construct a longer span to improve tidal flow.	-long term focus to monitor impacts of road on estuary and work with County and PSNERP	-Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability) -Riparian degradation -Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove log structures in old log yard on western end of Tahuya bridge	-private landowner (Manke) has given permission to do project -shoreline restoration	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove intertidal fill in the vicinity of Caldervin Creek and restore lost mudflat and salt marsh habitats	-full residential development in place -would have to buyout at least one dozen residences	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove the helicopter landing pad on the left bank of the Tahuya River downstream from Northshore Road	-would need to work with private land-owners to determine feasibility	-Channel complexity (LWD, channel condition, loss of side channel, channel instability) -Riparian degradation

12. West Kitsap Conservation Unit

12.1. Introduction

The West Kitsap Conservation Unit includes Big Beef Creek, Big Anderson Creek, and the Dewatto River watersheds, their estuaries and associated marine nearshore areas. Historically, summer chum salmon were present in Big Beef Creek, Big Anderson Creek and the Dewatto River. Sporadic sightings of summer chum salmon have been noted in Stavis Creek. Seabeck Creek appears to have habitat conducive to summer chum suggesting that they may have been present historically. Currently, all summer chum in the West Kitsap conservation unit are considered extinct. A reintroduction program using Quilcene stock was initiated in Big Beef Creek in the mid-1990s (see SRP section 5 for a summary of this supplementation program). Salmon conservation and recovery in the West Kitsap conservation unit is a matter of addressing both the habitat needs of summer chum salmon and restoring the processes and habitat that sustain all species of salmon in the watershed and, particularly, in the adjacent marine nearshore areas of Hood Canal.

Current habitat conditions and situations were assessed using a variety of sources. Several sources were used to assess the summer chum salmon stocks in the Eastern Strait of Juan de Fuca conservation unit. This Salmon Recovery Plan (SRP) will not repeat the details of these assessments, but instead refers the reader to the cited documents. All material and documents referenced in this SRP should be considered part of, and integral to, the recovery of summer chum salmon. These sources provided the primary reference and knowledge base for development of these aspects of the SRP. Details of the EDT assessments for the Eastern Strait of Juan de Fuca stocks, including a summary of the baseline performance measures, and a summary of strategic priorities, are provided in Lestelle et al, (2005a) (see Appendix A). The EDT Method is a widely used tool to help prioritize habitat restoration and protection measures for salmon populations. It provides a systematic way of diagnosing habitat conditions that have contributed to the current state of populations, and it enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits to salmon populations of actions that might be taken to address habitat related issues impeding recovery. Other detailed assessments of habitat and environmental conditions are provided in the SCSCI (WDFW and PNPTT 2000), Kuttel (2003), and May and Peterson (2003).

May and Peterson (2003) in their report “Landscape Assessment and Conservation Prioritization of Freshwater and Nearshore Salmonid Habitat in Kitsap County” categorized various areas within the West Kitsap conservation unit as refugia. Refugia can be defined as “habitats or environmental factors that provide spatial and temporal resistance and/or resilience to aquatic communities impacted by natural and anthropogenic disturbances” (May and Peterson 2003).

Refugia areas are important for maintaining populations of salmon. Refugia act to "re-seed" nearby areas after natural or man-made disturbances.

The Stavis Creek and Dewatto River watersheds were given the highest rating of "priority refugia with natural ecological integrity." The nearshore areas along the West Kitsap conservation unit were also classified by May and Peterson (2003). The area stretching from Rendsland Creek north to Big Anderson Creek and the area near the enclave of Holly was rated as "secondary refugia with altered ecological integrity" or areas that are generally in a fair condition and able to provide some habitat for summer chum salmon. The nearshore area from Big Anderson Creek into Stavis Bay was rated as category 'A' refugia, "priority refugia with natural ecological integrity" and generally exhibits properly functioning conditions. Stavis Bay itself is considered in good condition, "primary refugia with altered ecological integrity." Seabeck area was rated as fair and the remainder of the nearshore heading north from Big Beef Creek to Foulweather bluff is considered to be in a "good" condition (May and Peterson 2003). The main conservation function and recovery action focus for the West Kitsap conservation unit will be the protection and restoration of the marine nearshore areas.

12.2. Geographic Description and Human Population Distribution

The West Kitsap Conservation Unit includes Big Beef Creek, Big Anderson Creek, and the Dewatto River watersheds. Also included within this unit are the marine nearshore waters starting at Rendsland Creek in Mason County, and traveling the east shoreline north to the mouth of Hood Canal, and the northern boundary of Kitsap County. Included along this nearshore north of Big Beef Creek is the Bangor Submarine Base. This conservation unit lies mostly within Kitsap County with a southern portion in Mason County. Figure 12.1 provides a map of the West Kitsap Conservation Unit.

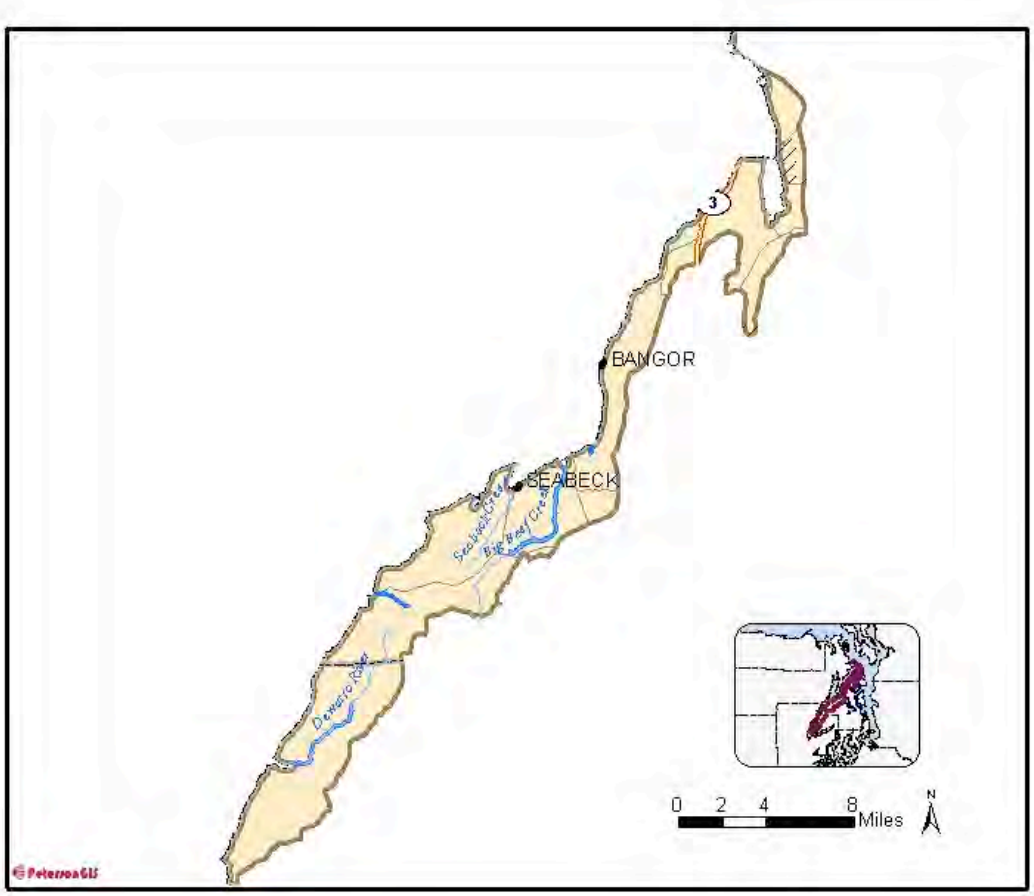


Figure 12.1. West Kitsap Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

The Big Beef Creek watershed covers an area of almost 14 square miles with 11 miles of mainstem stream length (WDFW and PNPTT 2000). Big Anderson Creek is located in southwestern Kitsap County. The stream enters Hood Canal approximately one-half mile north of the small community of Holly (WDFW and PNPTT 2000). The Dewatto River is located in the southwestern portion of Kitsap Peninsula, approximately 5.5 miles north of the Great Bend of Hood Canal, west of the Tahuya River, and south of Stavis and Big Beef creeks

(WDFW and PNPTT 2000). Originating on the plateau of the Kitsap peninsula, the Dewatto follows a glacial outwash channel as it flows southwesterly and parallel to Hood Canal for approximately 8 miles to saltwater. The headwaters originate in till and outwash sands and gravels. The narrowest portion of the valley is near the river mouth. The watershed area is approximately 23 square miles and there are approximately 30 miles of tributary streams. The Big Anderson Creek watershed is approximately 5 square miles in area, with 4 miles of mainstem and 13 miles of tributaries (WDFW and PNPTT 2000). Similar to other streams in the West Kitsap conservation unit, Big Anderson Creek originates in headwater wetlands and flows through a confined ravine before opening into a broad floodplain in the lower one-half mile. The small estuary includes a large intertidal delta.

The community of Seabeck, located just south of Big Beef Creek, is the area of the most significant human development. The Big Beef Creek watershed has a significant population density. Another area of high density human population is the town of Port Gamble at north end of the west side of Port Gamble Bay. Figure 12.2 shows population density within the West Kitsap conservation unit.

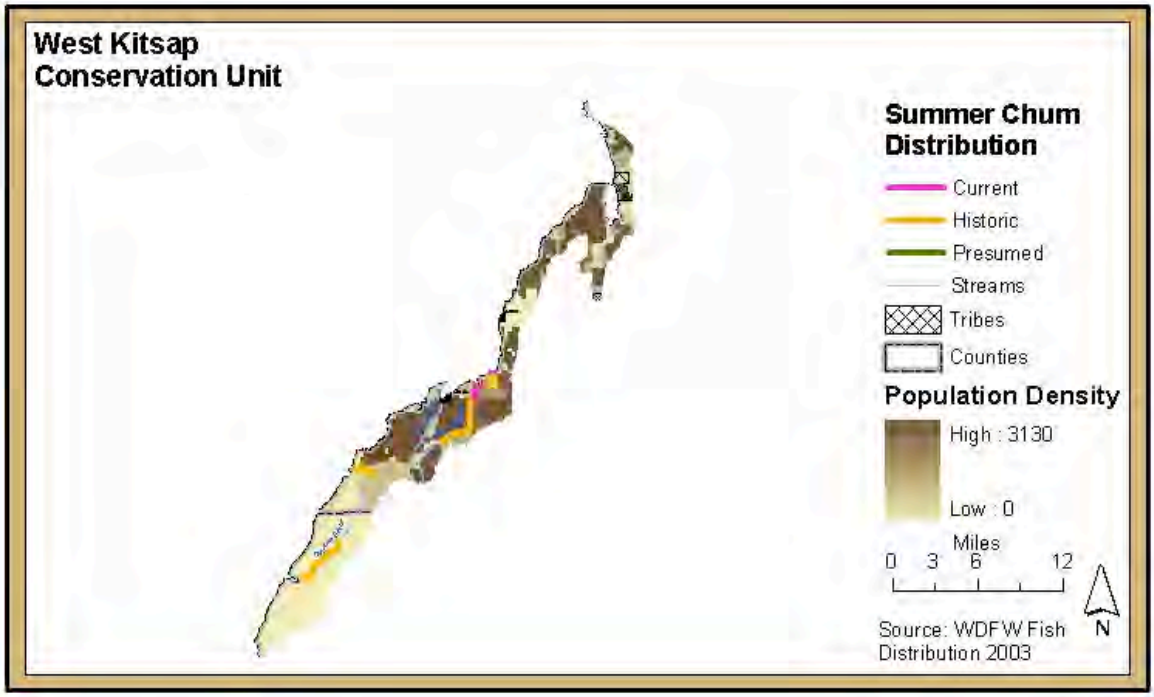


Figure 12.2. Human population density (people per square mile) for the West Kitsap Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

12.3. Summer Chum Salmon Stocks' Description & Distribution

Several sources were used to assess the summer chum salmon stocks in the West Kitsap conservation unit. This SRP refers the reader to the cited documents in this section. All material and documents referenced in this SRP should be considered part of and integral to the recovery of summer chum salmon. The reader is urged to review the Summer Chum Salmon Conservation Initiative (SCSCI) (WDFW and PNPTT 2000) and subsequent supplemental reports. Summer chum salmon in Hood Canal and the Eastern Strait of Juan de Fuca were also assessed based on application of the Ecosystem Diagnostic and Treatment (EDT) Method. The EDT Method is a widely used tool to assist in the prioritization of habitat restoration and protection measures for salmon populations. EDT provides a systematic way of diagnosing habitat conditions that have contributed to the current state of fish populations. It enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits of actions that might be taken to address salmon habitat problems (Lestelle, et. al. 2005a). The complete detailed EDT for summer chum salmon can be found at http://www.wa.gov/hccc/ and click on the Salmon Recovery Planning Activities link. On that page can be found links to various documents and the EDT web site for summer chum salmon. The web address for the EDT site: www.mobrand.com/edt/sponsors/show_sponsor.jsp?sponsor_id=11

Naturally produced summer chum salmon originating from the West Kitsap Conservation Unit are considered extinct (WDFW and PNPTT 2000). Summer chum from the Big Quilcene River stock have been reintroduced into Big Beef Creek. Spawning in the mainstem of Big Beef Creek is assumed to have occurred primarily in the lower reaches up to river mile (RM) 2.0. Historical distribution in Big Beef Creek is assumed to be as far as RM 6.0. The potential for historic summer chum salmon production is assumed for Stavis Creek, Seabeck Creek, Big Anderson Creek, and the Dewatto River.

Current, historic and presumed summer chum salmon distribution in the West Kitsap Conservation Unit is shown in Figure 12.3.

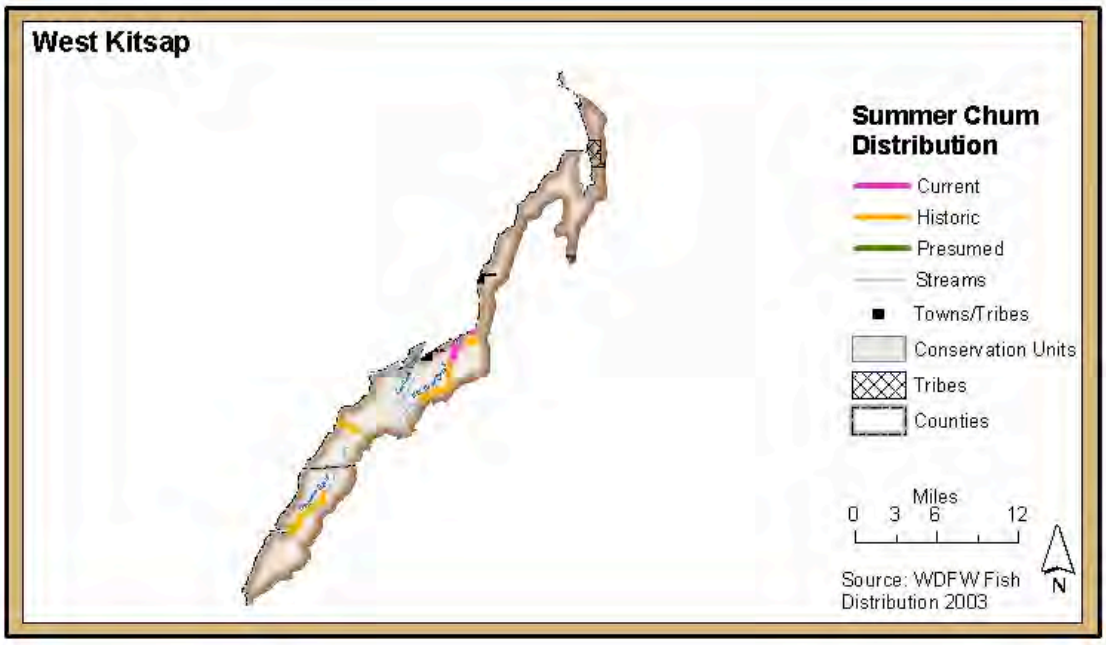


Figure 12.3. Map of the West Kitsap Conservation Unit showing current, historic and presumed summer chum salmon distribution (map produced by Gretchen Peterson, Peterson GIS).

Summer chum salmon escapement (number of adults returning to spawn) for Big Beef from the years 1974-2003 is presented in Figure 12.4.

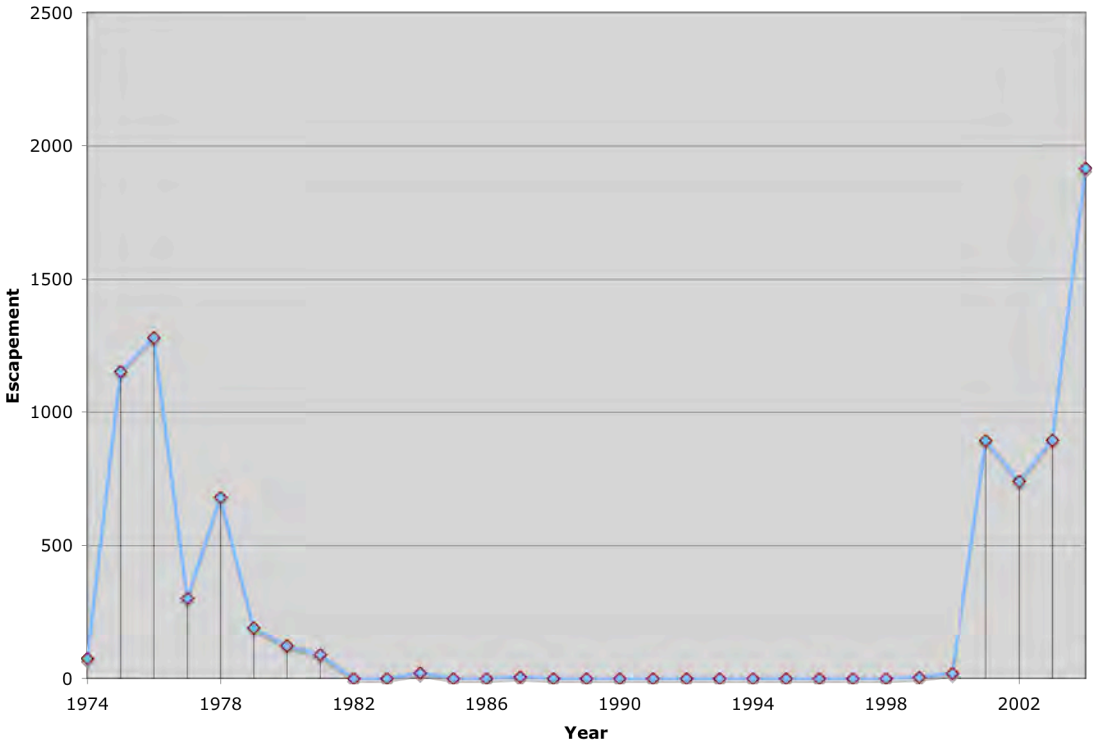


Figure 12.4. 1974-2003 summer chum salmon escapement for Big Beef Creek (data source: WDFW and PNPTT 2003, 2004, and 2005).

Escapement estimates exceed 1,000 fish in the years 1975 and 1976, although in the surrounding years (before and after) the escapement numbers were in the hundreds. With the exception of 22 in 1984, no summer chum has returned to Big Beef Creek (prior to the supplementation program) since 1982. Returns from the supplementation program began to show significant numbers beginning in 2001.

PNPTT and WDFW (2003) have not identified the stocks in the West Kitsap Conservation Unit to target for recovery. Big Beef Creek, by virtue of the current supplementation program (using Quilcene stock), is considered by the SRP as a stock to consider for restoration and protection. At this time it is not clear how the PSTRT or NMFS will view a supplemented stock, such as Big Beef Creek, relative to recovery. Since the stock is genetically similar to Quilcene, should Big Beef be included in the accounting as Quilcene or separately as Big Beef Creek? Should Big Beef Creek summer chum salmon be considered as part of the larger Hood Canal population? Do supplemented stocks contribute to and account for recovery? At what point in the supplementation program do supplemented stocks become considered as naturally produced (should they be determined successful)? These questions should be addressed in a viability analysis by the

PSTRT. Until that is completed, the SRP will assume that recovery of the ESU will need to consider abundant and well dispersed stocks throughout the ESU, including West Kitsap.

Other streams in the West Kitsap conservation unit have shown sporadic observations of summer chum adults. Most notably, fish have been observed in Big Anderson Creek and the Dewatto River (both of which had summer chum historically). Estimated escapements for Big Anderson Creek show a small population of just over 200 spawners occurring in the 1970s. That population does not appear to have been stable, with estimates of 0 and 16 adult spawners during 1974 and 1978 respectively. Estimated escapement drops to zero in the early 1980s (WDFW and PNPTT 2000). Estimated escapements for the Dewatto River show a gradual reduction of adult spawners over time, from escapements of more than a thousand in the early 1970s, to hundreds in the later 1970s, to less than 100 in the 1980s, and finally, to zero or near zero in the 1990s (WDFW and PNPTT 2000). Ten summer chum salmon were observed in the Dewatto River in 2002 (contributing to a 54 fish total from 1999-2002), suggesting that natural re-colonization is occurring (WDFW and PNPTT 2003).

12.4. Habitat overview & environmental conditions

12.4.1. Factors contributing to the decline of summer chum salmon

Detailed assessments of habitat and environmental conditions are provided in the SCSCI (WDFW and PNPTT 2000), Kuttel (2002), and May and Peterson (2003). May and Peterson (2003) summarized several common problems or factors that are likely contributing to the decline of salmonid in the West Kitsap conservation unit:

- Natural stream ecological processes have been significantly altered due to the cumulative effects of watershed land-use practices and human encroachment into the stream-riparian ecosystem.
- There has been a significant shift in the natural hydrologic regime of many watersheds, especially those undergoing urbanization. This is characterized by increases in peak flow frequency, duration, and magnitude due to increased stormwater runoff from lands that have been converted from native forest and wetlands to developed landscapes dominated by impervious surfaces.
- Streambed stability and spawning gravel quality have been degraded by high stormflow scour and fine sediment deposition. Major fine sediment sources include logging roads, construction sites, and agricultural fields.
- Stream channel morphological changes have resulted from direct alterations such as agricultural channelization or floodplain diking. In addition, streambank erosion has increased in frequency and extent due to higher stormflows, loss of natural vegetation cover, and subsequent streambank armoring.

- There is a general lack of adequate large woody debris (LWD) in streams, particularly large, stable coniferous “key” pieces that are critical to forming pools, providing cover for juvenile fish, retaining organic matter, and maintaining instream habitat complexity. In addition, there is a general lack of adequate, high quality rearing habitat (pools) for juvenile salmonids and the lack of deep “holding” pools for adult salmon migration.
- There has been a significant degradation and loss of natural floodplain processes in our rivers and larger stream systems, including the loss of functional off-channel wetland habitat. This is mainly due to dredging, bank armoring, and stream channelization. Past and current agricultural land-use has had a significant impact on floodplain and riparian processes in a number of lowland watersheds. In addition, development has also continued this process of stream channel manipulation.
- Almost all local streams have experienced a loss of natural riparian function due to removal or alteration of natural riparian forest vegetation. This degrades water quality, increases streambank erosion, reduces shade needed for water temperature regulation, and impacts instream habitat conditions through the decline in LWD recruitment.
- Stream-riparian corridor fragmentation is a major problem in many watersheds. This fragmentation has impacted the structure and function of our stream-riparian ecosystems. In addition, there are a significant number of culverts, diversion dams, and other fish passage barriers throughout these same watersheds.
- Estuarine and nearshore processes have been significantly impacted by physical alteration of nearshore ecological structure and function. These impacts include extensive shoreline bulkhead construction, loss of shoreline forest and large woody debris recruitment, loss of shoreline riparian cover and shade, and degraded water quality. In addition, natural sediment transport and beach nourishment processes have been disrupted as nearshore drift-cells have been altered by shoreline armoring, dock construction, and other human activities. All of these modifications have impacted salmonid habitat in the nearshore environment to some extent.

The majority of baseflow in Big Beef Creek is provided through hydrologic continuity with a shallow perched aquifer with indirect hydrologic continuity from a deeper aquifer known as the Seabeck Aquifer. The Seabeck Aquifer contributes baseflow predominantly at the mouth of Big Beef Creek. Minimum streamflow averages 3.1 CFS and maximum flows average around 200 CFS, with a maximum discharge of 1,500 CFS recorded in 1967 (WDFW and PNPTT 2000).

The SCSCI (WDFW and PNPTT 2000), the “Limiting Factors Report for WRIA North 14 and West 15” prepared by the Washington Conservation Commission (Kuttel 2003), and May and Peterson (2003) provide details of the various habitat factors and environmental conditions affecting summer chum salmon in this

conservation unit. The factors and conditions are summarized for Big Beef Creek in table 12.1.

Table 12.1. Big Beef Creek

Factors for decline	Life stage most affected	Remarks
Sediment aggradation, fines	Spawning, incubation, juvenile migration	The lower river channel, where historically most of the summer chum production occurred, has been impacted by upstream land use practices, with concurrent reductions in survival in all life history stages. Past logging and road building on steep unstable slopes in the lower Big Beef watershed have caused mass wasting, channel widening and bank instability, causing a 800% increase in sediment bedload over natural, undisturbed conditions. The majority of this coarse sediment has been deposited within the lower stream reaches, reducing available pool habitat and causing the channel to widen and become shallower. Channelization, along with the construction of the WDFW fish weir, has also increased aggradation by constricting the channel and forcing the bedload to be deposited upstream from the weir. The bridge causeway on the Seabeck Road has also restricted the freshwater-saltwater interface and reduced the potential flushing action of sediment associated with tidal action. During summer low flow periods, the aggraded and widened channel has been reported to impede upstream passage and reduce spawning success for adult summer chum due to increased predation associated with loss of stream cover. In 1969 and 1971, the entire summer chum run was moved into the UW Research Station spawning channel because of unstable conditions in the main channel and in anticipation of channelization activities. % loss of summer chum redds due to scour, fill, and channel displacement, with an average survival to emergence rate of 9.4%. In the same study, he noted 16.3% fine sediment (less than 0.8 mm in diameter) in spawning gravel, a rate at which permeability and intergravel survival would be substantially diminished.

Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)	Spawning and incubation	Channel alterations, in combination with sediment aggradation described above, have reduced complexity in lower Big Beef Creek, affecting all major life history stages. Monitoring data collected in 1993 and 1994 indicated 0.17 pieces of LWD per meter, rated as a high impact (Appendix Report 3.8). Pool habitat is rated as moderate impact (46% percent pools, pool spacing of 2.4) with the majority of pools being formed by the roots of standing trees or old growth stumps, and log jams anchored by remnant old growth LWD. In a recent field review of Big Beef Creek, Cederholm noted the loss of stable, deep pools present in the 1960s associated with the loss of LWD and sediment deposition in the lower river. Reduced LWD levels have been attributed to illegal cedar salvage, stream cleanout of log jams, channelization activities. At least three separate incidents of channel dredging, dike construction, wood removal, and channel relocation by private landowners have been documented in the lower river from the 1950s. In response to extreme channel aggradation and braiding in the lower river, and concerns for stranding and reduced survival of summer chum, the University of Washington channelized 1,968 feet of the lower river in 1969. At the same time, the U.W. constructed dikes consisting of excavated gravel on the southwest side of the river, further constricting the floodplain and creating a new sediment source for downstream areas. Channelization attempts were largely unsuccessful in dealing with sediment aggradation and channel instability in lower Big Beef Creek. Routine spot dredging upstream of the weir has occurred since the 1970s, with deposition of dredge spoils along the bridge causeway and a floodplain service road. Diking, construction of a road within the floodplain to service an artesian well for the Big Beef rearing facility operated by NMFS, and filling and alteration of side channel habitat associated with the construction and operation of the Big Beef Research Station, have also contributed to

		reduced channel complexity in the lower 2 miles of the river.
Riparian degradation	Spawning and incubation	Riparian zones which were historically a mixed forest of old growth cedar with limited areas of deciduous species associated with disturbance regimes (primarily windthrow and channel migration) are now predominantly composed of mixed conifer and deciduous (47%), deciduous species (48%) and 36% less than 12 inches in diameter. In comparison to adjoining watersheds, the riparian forest of lower Big Beef Creek is relatively intact (76% of the total riparian length having a buffer greater than 132 feet, low impact rating), with only minor areas of narrow riparian zone related to logging and limited residential developments (at RM 3.5 and below Lake Symington). Other land use impacts to the buffer include roads, dikes, and the UW Research facility in the lower river.
Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)	Juvenile rearing and migration	The research facility, road, bridge construction and sediment aggradation near the mouth of the stream have decreased the quality and amount of the subestuarine habitat that is most immediately available to emigrating summer chum fry. Three areas, totaling 0.64 ac or 1.4% of historic delta area have been filled; this filling, as with evacuation of one pond covering <0.72 acres or 1.5% of the historic delta area, is associated with the fish research and culture facilities of the Big Beef Research Station. A fish counting weir operated by WDFW, tends to act as a channel constriction and sediment trap, affecting upstream channel conditions and sediment transport processes into the estuary. Historically, timber from logging operations in the area was dumped from trucks into Big Beef Harbor upstream from the sandspit at the harbor's mouth where they were rafted to adjacent mills). The Seabeck Road bridge and its associated causeway crosses 0.03 mile of the middle reach of the delta, essentially narrowing the opening previously associated with a sandspit originating on the east side of the estuary. Aerial photographs from 1947, 1961, and 1997 show that extension and reinforcement

		of the bridge causeway has significantly constrained tidal interaction with the estuary, causing the estuary to infill with sediment, and reducing channel complexity. This observation is reinforced by historic accounts that at one time, small boats were able to navigate into the estuary and lower channel (S. Neuhaueser, personal communication). Adult intertidal spawning may also have also been impacted by these changes.
Flow (summer low and peak flows)	Spawning, incubation, juvenile migration	Summer low flows that occur during late August through the end of September, especially during natural drought cycles, have impacted adult migration and spawning success. Reports of adult stranding were recorded in the late 1960s and 1970s, mostly as a result of channel aggradation. Future withdrawals of water for domestic water supply, both from the shallow perched and deeper aquifer, have the potential to further compound the problem. The contribution from the Seabeck Aquifer to baseflows at the mouth of Big Beef Creek, is considered important, since the zone of influence overlap almost perfectly with the area of summer chum distribution. Winter flood flows have increased as a result of upstream urbanization effects, logging, road building and manipulation of flows at Lake Symington. As of 1993, 3.1% of the watershed was covered by impervious surfaces, approaching a rate at which changes to habitat quality are first noted. Changes in the duration and magnitude of peak flows with relatively minor precipitation have been observed since the late 1980s. This causes channel instability, including greater scouring and filling of sediments in the channel. Several incidences of scour in excess of 22 cm, the typical depth for egg deposition.

12.4.2. Human development and land use

Population density in the West Kitsap Conservation Unit is significant in select areas of the Big Beef Creek watershed and adjacent lands. Figure 12.5 Presents human population density for the Big Beef Creek watershed.

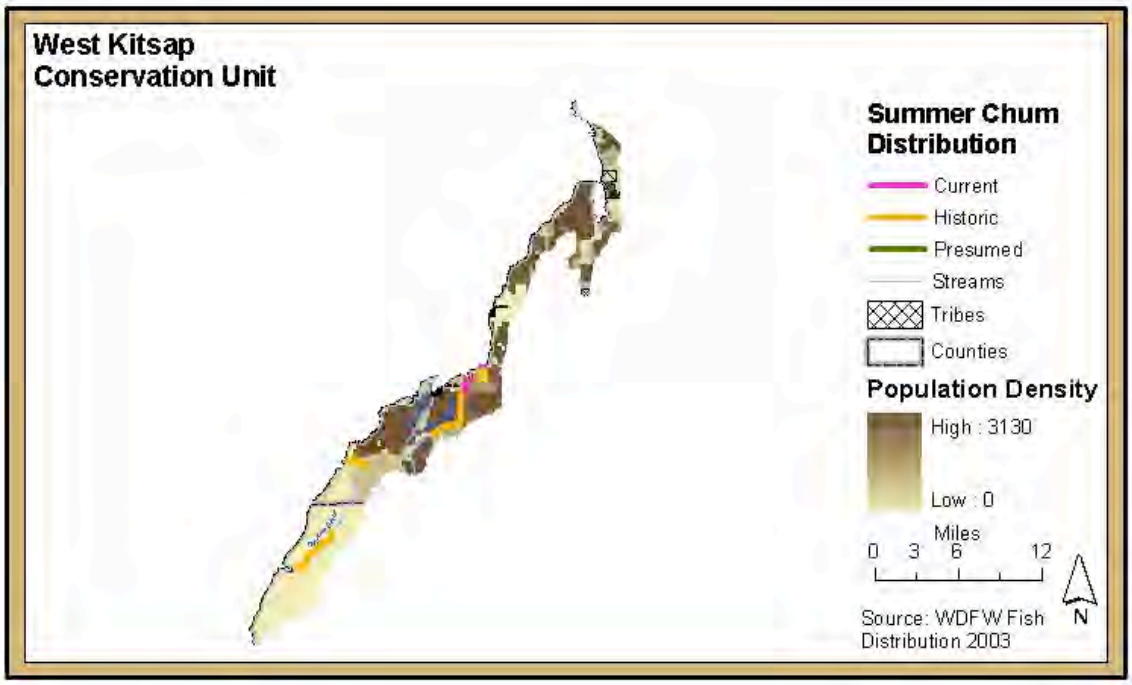


Figure 12.5. Human population density (people per square mile) for the West Kitsap Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

In the past, the prevailing land use in the upper watershed has been timber harvest; some lands are still managed for harvest of timber resources including several large blocks of land managed by the Department of Natural Resources. Historic logging activities began in earnest with the establishment of Camp Union in 1920, with the entire watershed above river mile (RM) 5.0 to the headwaters, logged by 1950. Agricultural developments exist at several locations along the upper stream reaches. Since 1970, residential development has proliferated, especially concentrated around and just downstream of Lake Symington. Lake Symington has had a primary impact on the lower system; lake levels and downstream flows were managed, for many years, to meet the needs of the lakeshore residents, with little regard for effects on downstream flows. WDFW has recently incorporated provisions in the lake's rules of operation to protect downstream flow requirements for fisheries resources. Below Lake Symington, there is limited residential development along the stream, with the majority occurring on the flat till plain above the river. The University of Washington's 320-acre fisheries research facility is located between RM 0.0 to 0.8. WDFW operates a weir at RM 0.1 to count upstream and downstream coho salmon migrants. The Hood Canal Salmon Sanctuary program has actively been

purchasing key riparian habitat upstream of the U.W. research facility (WDFW and PNPTT 2000).

Land-use in the Big Anderson Creek watershed is primarily industrial forestry operations conducted by several large landowners and the Department of Natural Resources. Logging in the Big Anderson most likely began in 1920s, with the establishment of the Camp Union logging camp. Between the 1920s and 1944, the headwaters were entirely denuded, with erosion observed in steep tributaries. At that time, most of the remaining basin was logged. As the habitat recovered in the following decades, logging was again observed in 1984 aerial photos and continues to the present. Three private residences and a small farm are located along the lower mile of the stream. A road bisects the floodplain near the mouth, and another road is adjacent to the river, and within the 100-year floodplain, from RM 0.5 to the mouth. Forty-five percent of the riparian zone is occupied by roads (36%) and agriculture (9%) (WDFW and PNPTT 2000).

Historically, the prevailing land use in the sparsely developed Dewatto River watershed has been timber harvest, with a large portion of the watershed still managed for timber. Several Christmas tree farms are the only agricultural developments. Rural residences are scattered throughout the drainage. The riparian zone is 87% forested, the highest percentage of all 20 watersheds. Rural homes account for 4% and agriculture 2% of riparian land uses (WDFW and PNPTT 2000). Figure 12.6 shows the current land use designations for the Kitsap County portion of the West Kitsap conservation unit.

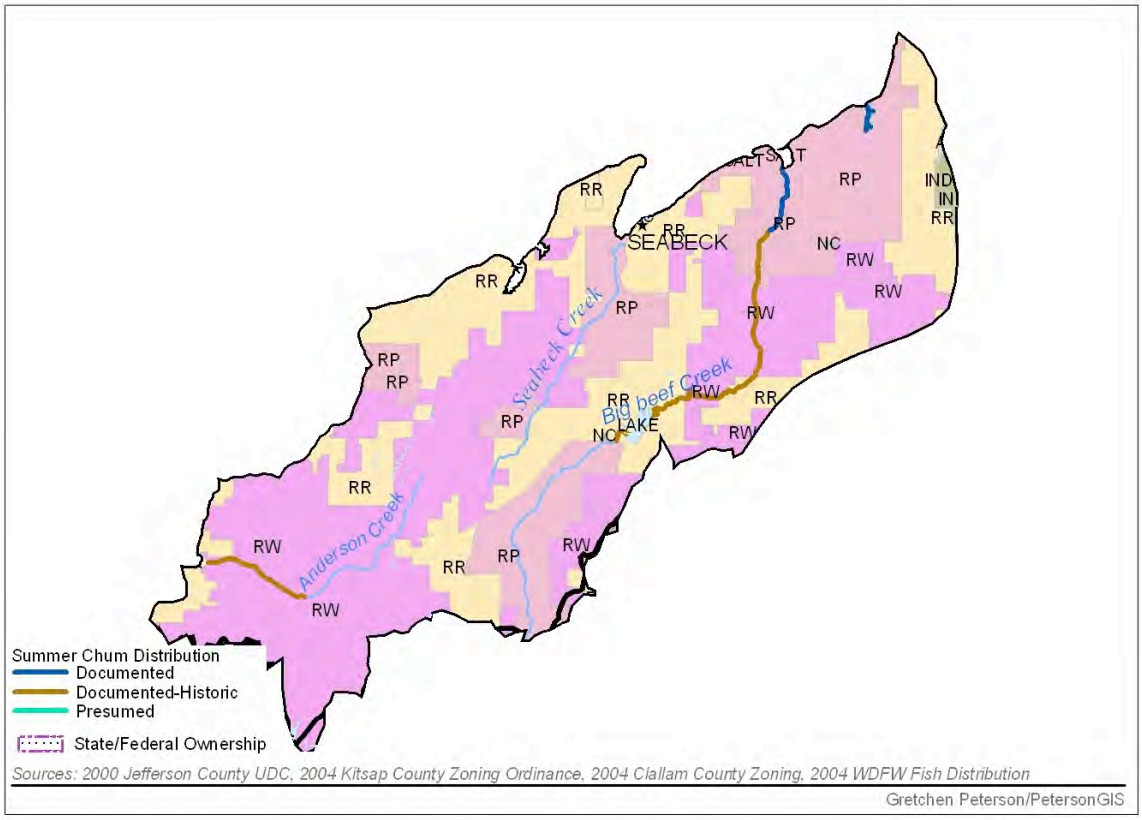


Figure 12.6. Zoning for the Kitsap County portion Big Anderson Creek, Seabeck Creek and Big Beef Creek watersheds) of the West Kitsap conservation unit.

Kitsap County (Kitsap County Code Title 17 Zoning) has designated the lower Big Beef Creek watershed as mostly Rural Protection (RP) zone. This zone is intended to protect and maintain the rural residential character and environment of Kitsap County and to provide for home sites with acreage. This zone is applied to areas without many public services at housing densities consistent with the physical characteristics of the area included in this zone. Big Anderson Creek watershed is zoned as Rural Wooded (RW) with a density of one dwelling unit per 20 acres. The RW zone is designated to encourage the preservation of forest uses, retain an area's rural character, and conserve the natural resources while providing for some rural residential use. The mouth of Dewatto River is designated by Mason County, Resource Ordinance 77-93, adopted January 2005 (Mason County Code 17.01), as Rural Residential, RR5, (1 dwelling unit per 5 acres). The remainder of the lower Dewatto River watershed is designated as Rural Residential, RR20, (1 dwelling unit per 20 acres). The northern portion of the West Kitsap conservation unit is dominated by naval submarine base Bangor.

Understanding future population growth, and its associated development, is critical to determine the potential future impacts to summer chum salmon habitat. A build-out analysis was conducted for the summer chum salmon ESU geographic area. This analysis used impervious surface area as a proxy for development. Based on existing land use designations (which are unique to each individual County), future impervious surface area was calculated and modeled. The amount of additional impervious surface area (relative to current), and where it can be expected to occur, was determined for each County. Appendix C provides details of the methods used to conduct these build-out analyses.

Build-out was also analyzed for the West Kitsap conservation unit as per the methods described in Appendix C. Figure 12.7 shows current impervious area compared with the impervious area expected after build-out.

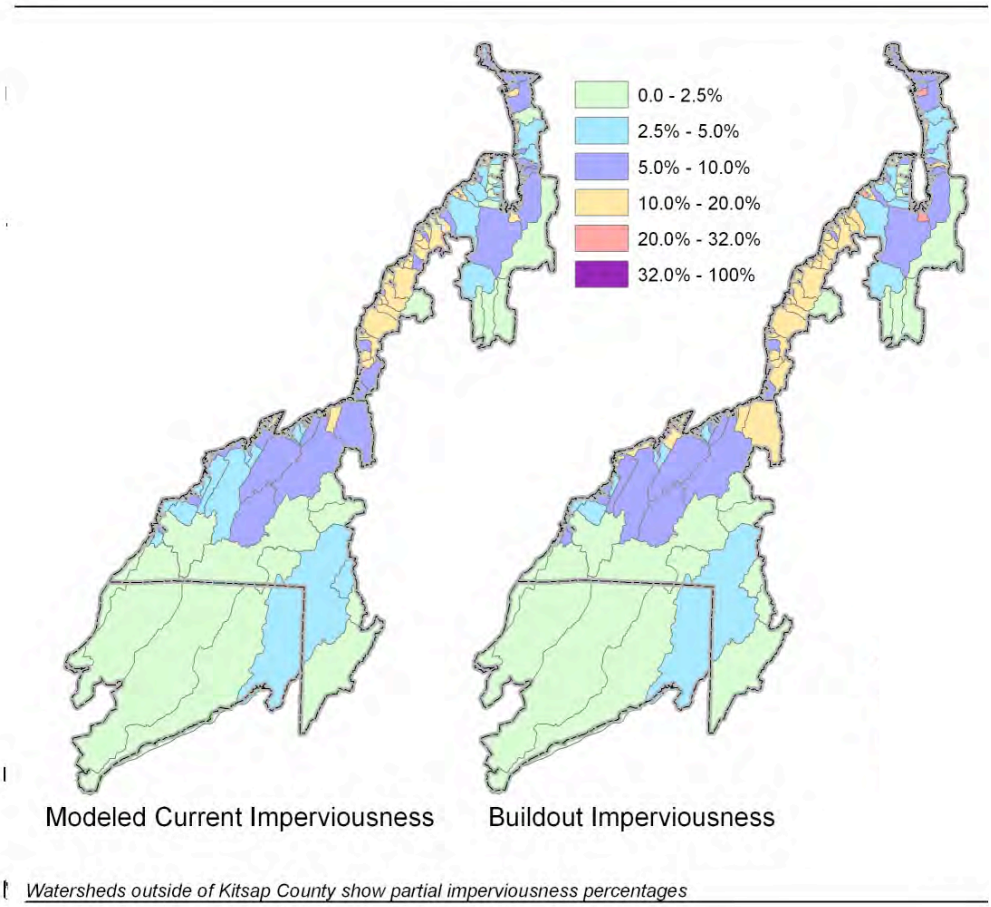


Figure 12.7. Modeled current impervious area compared with the impervious area expected after build-out (map and build-out analysis prepared by Gretchen Peterson, PetersonGIS).

Current and projected development, in the Big Beef Creek and Big Anderson Creek watersheds, was analyzed (Peterson 2005, see Appendix C). Riparian corridors were delineated from 200 feet on either side of the river from the mouth upstream to the extent of presumed summer chum salmon distribution. Impervious surface area (IP) was measured using 5-meter resolution satellite imagery. Table 12.2 summarizes the current impervious area and impervious area expected after build-out.

Table 12.2. Current impervious area (IP) and modeled build-out for the riparian corridors of the lower Big Beef Creek and Big Anderson Creek watersheds.

Riparian Corridor	Corridor area acres	Current IP acres	Build-out IP acres	Added IP acres	Current IP%	Build-out IP%
Big Beef Creek	308	19.5	23.2	3.7	6.3	7.5
Big Anderson Creek	83.1	1.6	1.8	0.2	1.9	2.2

The uplands and nearshore, within one mile of the Big Beef Creek and Big Anderson Creek subestuaries, were also analyzed for projected build-out (Peterson 2005). The results of this analysis are summarized in Table 12.3.

Table 12.3. Current impervious area (IP) and modeled build-out for the subestuaries of Big Beef and Big Anderson Creeks.

Estuary	Current IP%	Build-out IP%
Big Beef Creek	3.7	9.1
Big Anderson Creek	7.0	8.7

The largest impacts from future growth are expected to be in the lower Big Beef Creek and lower Seabeck Creek watersheds. Watershed and stream research, which typically looks at a watershed-wide perspective, generally indicates that certain zones of stream quality exist. Most notably, at about 10% impervious cover area, sensitive stream elements are lost from the system. A second threshold appears to exist at around 25 to 30% impervious area, where most indicators of stream quality consistently shift to a poor condition (e.g., diminished aquatic diversity, water quality, and habitat scores).[49] More research is needed to determine if this research directly applies to the present analysis. It should be noted that similar research, however, has not been conducted for estuary and subestuary areas.

The remainder of the West Kitsap conservation unit is not expected to change significantly from current land use conditions. It is assuming the current land use

[49] See The Center for Watershed Protection's (http://www.cwp.org) Stormwater Manager Resource Center at http://www.stormwatercenter.net for more extensive references on this subject. Table 1 at http://www.stormwatercenter.net/monitoring and assessment/imp cover/impercovr model.htm reviews the key findings of recent research regarding the impacts of urbanization on aquatic systems.

regulations will remain in effect through the duration of the recovery of summer chum salmon.

12.5. Specific action recommendations

Section 12.5 presents specific recovery action recommendations for the West Kitsap conservation unit. Recommended actions are categorized as either Programmatic (section 12.5.1) or Project (section 12.5.2). Actions identified will be further delineated as actions to benefit the summer chum salmon ESU. Specific action recommendations are also summarized and analyzed in the context of overall ESU-wide recovery (see section 13). All actions (previously implemented, on-going, and proposed) will become part of the Monitoring and Adaptive Management Program for the SRP as described in section 14.

12.5.1. Programmatic recommendations

Programmatic recovery actions are those that are part of a policy, program, or process. They are generally of a regulatory or planning process nature. Programmatic actions could be part of a County's land use and regulatory program and structures or watershed planning processes. Comprehensive plans, critical areas ordinances, shoreline management master programs, and zoning could all be considered programmatic actions in this context. Programmatic actions are non-project (i.e., habitat restoration projects--LWD placement, culvert repairs, etc.) in nature. Programmatic actions, however, can include projects when such projects are descriptive of a comprehensive or encompassing process (i.e., levee removal or set back as part of an estuary restoration plan). Watershed management plans often include projects to address identified factors of decline or specific habitat conditions. For the purposes of this SRP, the management plans or planning processes will be considered programmatic actions whereas the projects identified within the management plans will be categorized as projects.

To most effectively address those factors that are likely affecting the performance of the spawning aggregations in this conservation unit, the SRP recommends the programmatic actions summarized in Table 12.4. Details of the programmatic actions approved and those being considered by the Kitsap County and Mason County Boards of County Commissioners can be found in section 13.

Table 12.4. SRP recommended programmatic actions for the West Kitsap conservation unit.

Recommended Programmatic Actions	Actions involved	Limiting factors to address
Update Kitsap County's Shoreline Master Plan in 2011 and the current update of the County's CAOs (see SRP section 13 for more details regarding Kitsap County's programmatic actions)	-An evaluation of the criteria for allowing docks and piers that considers the protection of herring habitat. -Identification of herring habitat spawning areas as habitats of local importance requiring habitat management plans. -Consideration of cumulative effects from overwater structures in updating the SMP (for example, build out scenarios with overwater structures), taking into account processes that control functions. -The gathering of information from studies that will be used to inform land use planners and managers to best manage natural resources. -Development of incentive programs to encourage community docks vs. single-family docks. Instead of the use of site-by-site overwater structure permits, use long range planning tools to address potential impacts to eelgrass areas. -Actively seek funding to support protection and restoration of existing forage fish spawning areas. -Adopt proposed revisions to the Critical Areas Ordinance, including extending buffers for shorelines designated as "Conservancy" to 50 ft. and adopting Ecology's wetland rating system and recommended flexible buffers options. -monitor long-term effectiveness of the zoning codes and enforcement	-poor riparian condition -loss of channel complexity (LWD, channel condition, loss of side channel, channel instability) -Flow (summer low and peak flows) -Sediment aggradation, fines -Riparian degradation -Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Conduct a Nearshore Assessment (to be completed in April 2007).	- The nearshore assessment will 1) conduct a baseline characterization of the County's nearshore environment and assess its ecological health and function, 2) identify restoration and preservation opportunities and develop a strategy for ranking and prioritizing those opportunities, and 3) develop a management framework based on functions and processes of nearshore ecology. The assessment will provide a baseline from which results of nearshore protection/restoration actions may be evaluated allowing an adaptive management approach to future nearshore activities.	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Adopt the Kitsap County	- includes dual designations for some	-Estuarine habitat

Draft Shoreline Environmental Designations (subject to the required public review and adoption process)	areas that include important habitat types for forage fish spawning. Dual designations provide one designation for the above the ordinary high water (OHW) line to reflect current and surrounding land uses and a more restrictive designation for nearshore areas below the OHW line.	loss and degradation (diking, filling, log storage, road causeways)
Community Nearshore Restoration Program	-pursue application and implementation of a Community Nearshore Restoration program similar to that being conducted in south Hood Canal (see section 13)	-estuarine and nearshore habitat loss and degradation

12.5.2. Project recommendations

Project recovery actions are generally physical modifications to the landscape designed to address specific habitat situations in specific and limited geographic areas. Projects in the summer chum salmon ESU have been in process for many years by a variety of groups and entities. Section 12.5.2.1 provides an overview of existing projects relative to summer chum salmon recovery planning. Many of the project recommendations presented in this SRP are from the HCCC Lead Entity strategy (HCCC 2004). This SRP is designed to coordinate with, and build on that strategy. Projects presented are categorized according to their benefit for the waterhsed of concern. All projects that are proposed or recommended in this SRP are strictly voluntary in nature. Those projects that would either take place on, or impact, private property will require the full cooperation and permission from the affected landowners before proceeding. If that landowner permission cannot be obtained, those projects will not proceed.

12.5.2.1. Existing projects

Figure 12.8 shows the existing projects for Big Beef Creek.

Figure 12.8. Existing projects located in the Lower Big Beef watershed (map produced by Gretchen Peterson-PetersonGIS with a portion of the Protected Area Data provided by CommEn Space and the HCCC LE Strategy-Richard Brocksmith).

The existing summer chum salmon recovery project for Big Beef Creek are described below (project descriptions are derived from IAC Grant Projects at http://www.iac.wa.gov/maps/default.asp and click on the Grant Project Maps link, accessed on June 14, 2005):

99-1372 UW Research Station Wetlands Restoration Project Description: A multi-disciplinary team from Point No Point Treaty Council, UW, WDFW, USFWS, NMFS, Kitsap County & the Hood Canal Salmon Enhancement Group developed the Hood Canal Summer Chum Habitat Recovery Plan to restore Big Beef Creek habitat for threatened summer chum. Phase 1 of this project re-established a spawning channel & gathered hydrology data on the lower basin, which will be used to guide future large-scale restoration efforts. Phase II will relocate a well enabling the reconnection of a 30-acre wetland with the mainstem of Big Beef Creek and line the spawning channel with boulders. This will directly address the primary limiting factor to natural production of summer chum in Big Beef: sediment aggradation/deficient channel complexity in the lower reaches. The road separating the wetland from the mainstem protects a waterline from a

high capacity well that provides water for NMFS' and UW's research projects. Rerouting the waterline is not economically or technically feasible at this time; the best alternative is well relocation closer to the main Research Station. DOE has approved the water rights transfer.

99-1672 Big Beef Creek Summer Chum Recovery Project Description:
The goal of this multi-phase project is to re-establish self-sustaining wild summer chum salmon in Big Beef Creek. The early stages of the effort will involve reintroducing the extirpated stock to the watershed in a means that produces sufficient numbers of spawners to reproduce in natural and artificial settings. Inherent in this stage will be careful monitoring of the success rates of each production type. Subsequent stages will involve restoring sufficient habitat and channel stability to support wild self-sustaining runs, restoring estuarine habitat, and preserving key elements of the watershed to maintain adequate riparian function and hydrology. In this phase of the project we will re-establish a spawning channel to create the capacity to produce summer chum using various production types. University and agency scientists will analyze success rates of each production type. We will also, to the extent funds allow, restore habitat by reconnecting a 30-acre wetland and the mainstem of Big Beef Creek. Big Beef Creek, a tributary of Hood Canal, is an extremely important salmon stream. Scientists from WDFW, NMFS, UW, USFWS, and Point No Point Treaty developed this proposal jointly. The Hood Canal Salmon Enhancement Group managed the project, with oversight provided jointly by the other cooperators.

00-1181 Big Beef Creek Preservation Project Description:
The University of Washington Fisheries Research Station at Big Beef Creek, on Hood Canal's east side, has been the site of a three-phase effort to improve fish habitat. Funding will help to preserve the 30-acre wetland on the west side of Big Beef Creek just upstream of the research facility by removing an existing water utility road access. The road has altered the natural functions of the wetland, and with minor adjustments to the utility lines the wetland will be reconnected to the creek and restored it to its natural state. The project will also line 200 feet of the spawning channel with large cobble to prevent erosion.

To most effectively address those factors that are likely affecting the performance of the summer chum salmon in the West Kitsap conservation unit, the SRP recommends the following projects. All projects that are proposed or recommended in this SRP are strictly voluntary in nature. Those projects that would either take place on, or impact, private property will require the full cooperation and permission from the affected landowners before proceeding. If that landowner permission cannot be obtained, those projects will not proceed.

Table 12.5. SRP recommended projects for the West Kitsap conservation unit.

Big Beef Creek-

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Restore natural tidal influence and sediment transport in the Big Beef Creek subestuary by addressing causeway and hatchery weir.	-County Road (300 meter raised causeway if removing 4 to 5 residences, or 250 meter with houses remaining) and UW weir	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Restore tidal processes and lost salt marsh habitat at the mouth of Johnson Creek	-need to work with landowners to determine feasibility and design	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Address causeway impacts to restore estuary and floodplain	-need to work with Kitsap County and landowners to determine feasibility and design	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove UW service road and associated fill	-Work with UW to implement	
Restore natural tidal influence and sediment transport in the Big Beef Creek subestuary by addressing causeway and hatchery weir.	-County Road (300 meter raised causeway if removing 4 to 5 residences, or 250 meter with houses remaining) and UW weir -will need to work with County, UW, and private landowner/residents to determine design and feasibility	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

Big Anderson Creek

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Restore historic salt marsh and lagoon habitats at the community of Holly.	-working with private landowners is critical	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove the county road along the north shore of Anderson Cove (traffic could be rerouted to the road immediately to the north) and revegetate the riparian zone with native plants.	-work with Kitsap County to develop feasibility, design and costs	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove old railroad grade and pilings from the head of Anderson Cove.	-will need to work with landowner to determine feasibility and design	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

Dewatto River

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Remove abandoned dikes on the salt marsh at the head of Dewatto Bay	-will need to work with landowner to determine feasibility and design	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove fill and restore lost mudflat habitat at the Oyster House and artificial boat basin on the south shore of Dewatto Bay.	-will need to work with landowner to determine feasibility and design	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Restore tidal processes and salt marsh habitat at the unnamed stream about one mile north of the mouth of Dewatto Bay.	-working with private landowners is critical to removing landfill	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

Seabeck Creek

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Remove railroad fill to restore estuary and nearshore	-will need to work with landowner to determine feasibility and design	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

13. ESU-WIDE RECOVERY

13.1. Summer Chum Salmon Populations Recovery Goals

Sixteen historic stocks of summer chum salmon have been identified that comprise the Hood Canal Summer Chum Salmon Evolutionarily Significant Unit (ESU). Of these sixteen stocks, eight currently exist (called extant stocks). Those eight are spatially distributed throughout the geographic area of Hood Canal and the eastern Strait of Juan de Fuca. Consistent with the co-managers (Washington Department of Fish and Wildlife and the Point No Point Treaty Tribes) approach (PNPTT and WDFW 2003), this Salmon Recovery Plan (SRP) is designed to identify recovery actions that will provide the basis for recovery of all eight extant stocks. The SRP encourages the co-managers to reintroduce stocks where appropriate, and according to the guidelines established by the co-managers (WDFW and PNPTT 2000), and approved by National Marine Fisheries Service (NMFS 2002).

Summer chum salmon in Hood Canal and the eastern Strait of Juan de Fuca are most likely "a single metapopulation held together historically by a stepping stone pattern of demographic exchange" (Currens 2004 draft in progress). The "stepping stone" population structure is influenced by geography, life history of the fish, and habitat stability. Summer chum salmon, which return to spawn in the lower reaches of natal streams rather than in their headwaters, accentuates the linear, geographic pattern of genetic exchange that seems to be exhibited amongst summer chum salmon populations (Currens 2004 draft in progress).

Habitat stability influences how strong and quickly the "stepping stone" patterns of genetic differentiation may form. The importance of this pattern of "isolation-by-distance" in summer chum salmon has important implications for prioritizing recovery actions and reintroduction strategies (i.e., supplementation). This genetic pattern further supports the recovery approach being taken by this SRP. It attempts to preserve all remaining populations and their spatial diversity. It also attempts to provide opportunities for future recovery actions. The SRP endeavors to preserve the remaining extant stocks of summer chum salmon throughout the Hood Canal and Eastern Strait of Juan de Fuca. Preservation of this natural capital will allow a stronger basis to build on, and provide for future recovery opportunities. The SRP is designed, and will be implemented, to recover all eight remaining summer chum salmon stocks. When implemented, the SRP will help ensure that habitat critical for natural summer chum salmon population survival and productivity is retained or restored.

The recovery goals, as determined by the co-managers (PNPTT and WDFW 2003), apply to abundance, escapement, productivity and diversity of natural origin summer chum. These ESU-wide recovery goals account for the composite of summer chum stocks in addressing conditions for recovery. The goals set standards by which progress toward, and attainment of, recovery can be

measured. The Hood Canal summer chum interim recovery goals presented by PNPTT and WDFW (2003) address the parameters of annual abundance, spawning escapement, productivity, and diversity. NMFS has identified four parameters for use in evaluating the status of natural salmonid populations. These are the basis for its general guidelines identifying viable salmonid populations (McElhany et al. 2000). The NMFS parameters are abundance, productivity, diversity and population spatial structure. They are essentially the same parameters being used by the co-managers for the summer chum salmon ESU . As of June 2005, NMFS and the Puget Sound Technical Recovery Team had not established recovery goals or completed a viability analysis of Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon.[50]

The co-managers' interim recovery goals (from PNPTT and WDFW 2003) include the following criteria. They state, "No less than the extant 6 Hood Canal natural stocks and 2 Strait natural stocks must meet all the individual stock recovery criteria. The corollary to this criterion is that, on average, the ESU-wide abundance must meet or exceed the sum of all these individual stock thresholds and the ESU-wide spawning escapement must meet or exceed the sum of all these individual stock escapement thresholds; also, on average, the ESU-wide productivity must meet or exceed 1.6 recruits per spawner."

"Ideally, recovery goals should be developed based on knowledge and assessment of the habitat and of how the habitat affects potential production, productivity and diversity of the stocks. Currently no such assessment exists that is adequate to tie the habitat directly to recovery goals. Studies should be undertaken in the future to develop quantitative relationships between habitat conditions and summer chum salmon performance within the watersheds and estuaries that then could provide knowledge for improving the recovery goals.

"For each stock, all of the following criteria must be met:

- The mean natural origin abundance and mean natural origin spawning escapement of each stock shall meet or exceed the above-described abundance and spawning escapement thresholds, over a period of the most recent 12 years.
- The natural origin abundance and natural origin spawning escapement of each stock shall be lower than the stock's respective critical thresholds (or, where applicable, minimum escapement flag) in no more than 2 of the most recent 8 years and, additionally, in no more than 1 of the most recent 4 years.
- Natural recruits per spawner shall average at least 1.6 over the 8 most recent brood years for which estimates exist and no more than 2 of the 8 years shall fall below 1.2 recruits per spawner."

[50] See SRP section 2.2.1 for more discussion about the TRT viability analysis.

The Puget Sound Technical Recovery Team (TRT), organized under the auspices of NMFS to address recovery planning, of listed salmon species for the Puget Sound area, has adopted the aforementioned NMFS parameters as a basis for development of recovery goals for the Puget Sound Chinook salmon ESU. The TRT has coordinated with WDFW and the western Washington Treaty Tribes in developing Chinook recovery goals. As the TRT considers recovery goals for the Hood Canal Summer Chum ESU, the SRP anticipates a similar coordinated effort that will take into account the interim recovery goals presented by the co-managers.

According to PNPTT and WDFW (2003), "Diversity is reflected in the number of life history pathways of a population, in its biological characteristics and genetic traits, in the population's spatial distribution, and in the number and distribution of all populations across the landscape. Diversity within and between stocks incorporates differences in geographic distribution, morphology, behavior, physiology and other characteristics that are controlled by genetics and habitat. Diversity can be difficult to define specifically and quantitatively by stock. However, conceptually, there is an understanding of risks associated with reduced diversity and of actions that can be taken to decrease risk of its loss."

Summer chum salmon in the ESU would be expected to be more diverse, with more and larger populations, and a greater spatial distribution. PNPTT and WDFW (2003) further state that, "Diversity reduces the risk of catastrophic impact, short-term environmental effects, and long-term effects of climatic cycles or regime shifts on individual populations and the species as a whole. It also enhances a population's ability to take advantage of a wider range of habitats." The protection and restoration of good quality habitat, across a wide range of environments, coupled with effective management of artificial production and harvest regimes, can foster diversity. Given that effective artificial production and harvest management regimes are in place, the SRP serves an integrating function by providing for the protection and restoration of good quality habitat. It seeks to ensure diversity, as envisioned by the co-managers as part of their interim recovery goals, for summer chum salmon (PNPTT and WDFW 2003).

The Summer Chum Salmon Conservation Initiative (SCSCI) includes provisions intended to protect and restore diversity of the summer chum salmon (PNPTT and WDFW 2003). These provisions include programs to reintroduce summer chum salmon into watersheds, where the stocks have become extinct, and to supplement critically low populations (see SRP section 5). Criteria and procedures for selecting and operating reintroduction and supplementation projects have been identified and are being implemented (Section 3.2 of SCSCI). These criteria, and procedures, are intended to minimize the risks of reducing diversity within and between stocks. A qualitative assessment of summer chum salmon habitat has also been completed in the watersheds and nearshore areas of Hood Canal and the Eastern Strait of Juan de Fuca. Recommendations have been made for restoring watershed functions and increasing habitat complexity;

to improve habitat conditions supportive of population diversity (section 3.4 of SCSCI and SRP sections 7-12). Finally, the Co-managers have developed a Base Conservation Regime to control harvest, and help rebuild the summer chum salmon populations and their diversity (Section 3.5 of SCSCI and SRP section 4).

In addition to the above ESU-wide interim recovery goal provision, that all currently extant stocks meet individual stock recovery criteria, the Co-managers have agreed upon the following goals to protect and increase population diversity of the summer chum salmon (from PNPTT and WDFW 2003):

1) Support planning and implementation of effective habitat protection and recovery actions by the agencies and local governments who have the jurisdiction;
2) Rebuild the existing summer chum salmon stocks to meet their abundance and escapement recovery goals, by natural or artificial (i.e., supplementation) means, under the guidelines, criteria and provisions of the SCSCI, and;
3) Reestablish the majority of the identified extinct summer chum salmon stocks, where feasible, by natural or artificial (i.e., recolonization or reintroduction) means, and under the guidelines, criteria and provisions of the SCSCI.

13.2. Project actions

Project actions can be defined as physical modifications to the landscape designed to address specific habitat situations in specific and limited geographic areas. The Hood Canal Coordinating Council (HCCC) is the designated "Lead Entity" for the Hood Canal watershed under RCW 77.85. It is charged with the coordination of salmon recovery projects from counties, cities, conservation districts, tribes, environmental groups, business interests, landowners, citizens, volunteer groups, regional fish enhancement groups, and other habitat interests. As the Lead Entity, HCCC Staff, in conjunction with the various groups interested in salmon recovery for the Hood Canal watersheds, have developed a Lead Entity strategy (HCCC 2004) to guide the prioritization and selection of habitat restoration projects.[51]

The SRP will defer to the LE process to select, design and develop details of projects, and determine landowner cooperation and feasibility. Many of those projects are described in this SRP. Sections 7-12 list the projects, excerpted from the Lead Entity Strategy, that are crucial for summer chum salmon recovery. Estimated costs for those projects can be found in Appendix D.

[51] For more information and a downloadable copy of the HCCC Lead Entity strategy see http://www.wa.gov/hccc/salmon.htm

All projects that are proposed or recommended in this SRP are strictly voluntary in nature. Those projects that would either take place on, or impact, private property will require the full cooperation and permission from the affected landowners before proceeding. If that landowner permission cannot be obtained, those projects will not proceed.

13.3. County Programmatic actions

Programmatic actions are those that are part of a policy, program, or process. They are generally of a regulatory or planning process nature. Programmatic actions could be part of a County's land use and regulatory program and structures, or watershed planning processes. Comprehensive plans, critical areas ordinances, shoreline management master programs, and zoning could all be considered programmatic actions in this context. Programmatic actions are non-project (i.e., habitat restoration projects--LWD placement, culvert repairs, etc.) in nature. Programmatic actions, however, can include projects when such projects are descriptive of a comprehensive or encompassing process (i.e., levee removal or set back as part of an estuary restoration plan). Watershed management plans often include projects to address identified factors of decline or specific habitat conditions. For the purposes of this SRP, the management plans or planning processes will be considered programmatic actions, whereas the projects identified within the management plans will be categorized as projects.

Specific programmatic actions are described in sections 7-12. Each County that lies within the geographic boundaries of the ESU, also has a suite of programmatic actions that they have agreed to undertake now or consider in the future. These County specific programmatic actions are listed below. These Counties' actions will contribute significantly to the recovery of summer chum salmon, when combined with the projects and other programmatic actions included in this SRP.

13.3.1. Clallam County

The SRP supports the continuation of the present zoning and land use provisions being used by Clallam County. It is anticipated that growth in the Jimmycomelately watershed will be minimal and have relatively little impact on summer chum salmon habitat. Projects currently in progress and planned, such as the *Jimmycomelately Creek-Lower Sequim Bay Estuary Restoration Project*, are anticipated to provide the protection and restoration necessary for the recovery of summer chum salmon in that system. Other work in the Dungeness River watershed will address programmatic issues for Clallam County.

Clallam County has developed a draft report entitled *Towards Recovery*[52], which captures the land use strategies adopted by the County, which will protect salmonid habitat from further degradation and facilitate the recovery of habitat over the long term (Clallam County 2000). In addition, land use planning is an adaptive process and changes in policy are to be expected over time. These changes may be critical to the success or failure of salmon recovery in eastern Clallam County. For Clallam County, the vehicle for incorporating policy changes in land use planning is the Clallam County Comprehensive Plan (CCC 31.02). Following are programmatic actions being considered by Clallam County as reported in "Towards Recovery":

13.3.1.1. Update Clallam County Shoreline master Program and Shoreline code for conformance with the Critical Areas Code and ESA

13.3.1.2. Critical Areas GIS Mapping and Updates

13.3.1.3. Completion of Clallam County acquisition policy

13.3.1.4. Promulgation of clearing and grading code

13.3.1.5. Aquatic Habitat Conservation Area and Wetland Buffers, variance requirements to maintain watershed hydrology and stormwater recommendations

13.3.1.6. Adoption of County-wide stormwater standards

13.3.1.7. Rural Road Design Standards to minimize impervious surface

13.3.1.8. Prepare Clallam County Erosion Control and further integrate Comprehensive Planning Stormwater Brochure and Standards for small parcels

13.3.1.9. FCAAP Funded Channel Meander Zone Mapping &Information Project

13.3.1.10. EPA-funded Wetland function Educational Project

13.3.1.11. Cooperation with City of Sequim in Stormwater Planning for Bell Creek Basin

[52] See Appendix E for the Clallam County document, *Towards Receovery*. The Clallam County programmatic actions listed are excerpted from this report.

13.3.1.12. Change SEPA checklist to encourage reduced impervious surfaces, retention/planting of native vegetation

13.3.1.13. Change SEPA checklist to minimize stormwater impacts from residential development

13.3.1.14. Rural Road Design Standards to minimize impervious surface

13.3.1.15. Complete Forest Practices (conversion) MOU with DNR

13.3.1.16. Further integrate Comprehensive Planning with Watershed Planning to minimize stormwater impacts

13.3.1.17. Addition of 2 Code Compliance Officers to Clallam County Department of Community Development

13.3.2. Jefferson County[53]

At their June 13, 2005, Jefferson Board of County Commissioners meeting, their Board unanimously approved the following programmatic issues to be included in the SRP:

13.3.2.1. Analyses, including EDT, suggest that freshwater factors and environmental conditions are the most important factors affecting summer chum salmon survival. Restoration and protection in the freshwater environments of Jefferson County would provide the greatest benefit. Next in importance is nearshore work in chum natal subestuaries. Specific attention to channel migration zones (CMZs) in the lower elevation areas of rivers, and marine shoreline bulkheading, would be beneficial for summer chum salmon habitat.

13.3.2.1.1. Recommendations from the "Review of Best Available Science for 2004 Comprehensive Plan and Development Regulations Update" (Sept 2004), coupled with recommended and on-going projects, could meet these needs. The SRP recommends that Jefferson County protect the CMZ to at least the extent as described in that September 2004 review document.

[53] A review of Jefferson County's land use regulations and policies relative to summer chum salmon habitat and recovery is presented in Appendix F.

13.3.2.1.2. The SRP recognizes that Jefferson County has been funded to pursue an update of the Shoreline Master Program (SMP). A key provision of an updated SMP is addressing the restoration element. The target date for completion of the revised SMP is mid-2007. The SRP supports Jefferson County's efforts to update the SMP and recommends the following:

13.3.2.1.2.1. The current Unified Development Code (UDC) provides for guidance regarding bulkheads and armoring along the nearshore areas of Jefferson County. The SRP suggests the County continue the current guidelines into the future.

13.3.2.1.2.2. The SRP also recommends, that during the SMP update process, the County consider guidance that discourages hard armoring of the nearshore. That could be a stated preference for soft-bank armoring and incentives to help property owners with those techniques. When repair of bulkheads is required the County should not decrease protections in its current regulations.

13.3.2.1.2.3. Jefferson County's codes for development of bulkheads along marine shorelines are as restrictive as State law currently allows. The SRP will provide an analysis of current State law regarding marine shoreline bulkheading and suggest ways that the law can be revised to allow Counties to be more conservative in their approaches.[54]

13.3.2.2. Summer chum salmon protection for the Dosewallips population would be enhanced by a Jefferson County commitment to develop a comprehensive floodplain management plan consistent with summer chum salmon recovery. This type of planning should involve the Brinnon community and representatives of Dosewallips State Park. The SRP supports such a comprehensive management approach for the lower Dosewallips

[54] See SRP section 13.3.6 for this analysis.

watershed and the HCCC would seek to assist the County in these planning efforts as desired.

13.3.2.3. The Tri-Area Stormwater Management Plan has been adopted by Jefferson County. It is designed, in part, to minimize deleterious impacts to salmon habitat. The SRP commends the County for this effort and recommends that the County commit to implement provisions of the stormwater management plan for the UGA. Some of these provisions include on going monitoring, and encouragement of development that minimizes the amount of impervious area closest to the stream corridor. Restoration and protection projects in the lower watershed (downstream of the UGA) will benefit from these stormwater management plan measures. The SRP encourages the County to consider adopting a stormwater control fee (RCW 36.89) to fund stormwater management capital facilities and program activities (public education, water quality monitoring, stream gauges, etc.) in the UGA.

13.3.2.4. The SRP recommends the application of the revised 2004 Dept. of Ecology wetland rating system on a case-by-case basis as proposed by County staff. The SRP and HCCC could assist the County in the development of appropriate management measures to protect and restore summer chum salmon habitat.

13.3.2.5. Land use and regulatory actions taken by the County for salmon recovery may also satisfy GMA, SMP, and other State requirements and conditions. Likewise, actions taken by the County to comply with GMA and SMA may also benefit salmon recovery. The State should recognize the synergy between GMA, SMP and salmon recovery planning. The County may agree to provide salmon recovery protection provisions if credit for those actions was acknowledged. The SRP will pursue “credit” for County programs relative to appropriate State requirements under GMA and SMA.

13.3.2.6. Jefferson County has been involved in the acquisition of “refugia” (last best habitat areas), mainly along the Dosewallips and Duckabush Rivers. The SRP acknowledges the County’s efforts towards the protection of summer chum salmon habitat and supports the continuation of these programs as appropriate. The SRP

is in the process of describing the involvement by the County in this matter.

13.3.2.7. The SRP acknowledges that the County has adopted the latest "Stormwater Management Manual for Western Washington (dated August 2001, revised in 2005, from Dept. of Ecology) as the set of stormwater management standards for development and re-development in Jefferson County.

13.3.2.8. The SRP supports County staff in their efforts to look at ordinances and regulations to seek flexibility to allow low impact development and implement those practices in areas needing protection for summer chum salmon habitat.

13.3.2.9. Current land use and regulatory programs under the authority of the County are assumed to be adequate to allow for the protection and restoration of summer chum salmon populations. Funding and resources are necessary for the County to pursue enforcement of current regulations and site-specific biological reviews. The SRP recommends the following:

13.3.2.9.1. The SRP will support and help pursue adequate resources for the County to enforce and implement the current Jefferson County regulatory program.

13.3.2.9.2. Endangered Species Act (ESA) mandated exemption from litigation might be possible if the County was able to take the necessary and appropriate actions to enforce current programs and complete the necessary biological reviews. The SRP will assist in pursuing such an exemption under appropriate provisions of the (ESA).

13.3.2.10. The SRP supports the County staff efforts in the development of a process to provide a "stakeholder convention" for the prioritization of conservation and salmon recovery actions. As the County pursues acquisitions and conservation futures type programs, the SRP can assist in facilitating prioritization of the proposed actions.

13.3.2.11. The SRP recommends that Jefferson County pursue consideration of the State's Community, Trade, and Economic Development (CTED) model clearing and grading guidance as part of its analysis of low impact development rules. Since the County will be responsible by law for assuming sole jurisdiction over Class IV General forest practices, these clearing and grading guidelines could be incorporated.

13.3.2.12. Loss of forest cover is a potential future issue that could impact salmon habitat in the County. The SRP recommends that the County pursue a public education/outreach program that can address loss of valuable forest cover in the future and protect summer chum salmon habitat. The HCCC can provide assistance to the County for these efforts.

13.3.2.13. The SRP supports the continuation of the voluntary BMPs approach for agricultural lands, on a watershed-by-watershed basis and building on the Chimacum example. Jefferson County has a good record of accomplishment in this area.

13.3.2.14. One of the goals of the SRP is to show that the burden of salmon recovery extends beyond the Counties to the State and Federal level. The County would likely pursue many other actions listed in the SRP if funding and staff resources were available. The SRP supports and will pursue additional resources for the County to pursue recovery actions as appropriate. Resources for the County will be necessary for enforcement, monitoring, public outreach/education, and adaptive management.

13.3.2.15. The HCCC can assist the County with resources and technical review, in considering a variety of innovative and creative measures to address protection and restoration of habitat. Such measures or tasks might include various compensatory mitigation measures (i.e., transfer of development rights programs, implementing existing UDC provisions), revisions of the Unified Development Code, land banks, wetland mitigation banks, etc.

13.3.3. Kitsap County

On November 8, 2005, the Kitsap Board of County Commissioners affirmed the following programmatic issues that Kitsap County[55] has implemented, or will implement will implement if funding and staff are available, and that these issues can be included in the SRP:

13.3.3.1. Seek funding to conduct a West Kitsap Nearshore Assessment (to supplement earlier work by Point No Point Treaty Council). The nearshore assessment will 1) conduct a baseline characterization of the County's nearshore environment and assess its ecological health and function, 2) identify restoration and preservation opportunities and develop a strategy for ranking and prioritizing those opportunities, and 3) develop a management framework based on functions and processes of nearshore ecology. The assessment will provide a baseline from which results of nearshore protection/restoration actions may be evaluated allowing an adaptive management approach to future nearshore activities. The methodology to be used will likely be the same as that used by East Kitsap County and the City of Bainbridge Island.

13.3.3.2. Consider adoption in 2007 of the Kitsap County Draft Shoreline Environmental Designations (subject to the required public review and adoption process), which includes dual designations for some areas that include important habitat types for forage fish spawning. Dual designations provide one designation for the above the ordinary high water mark (OHWM) to reflect current and surrounding land uses and a more restrictive designation for nearshore areas below the OHWM.

13.3.3.3. Update Kitsap County's Shoreline Master Plan in 2011. The update will include:

13.3.3.3.1. An evaluation of the criteria for allowing docks and piers that considers the protection of herring habitat.

13.3.3.3.2. Identification of herring habitat spawning areas as habitats of local importance with the possible requirement for habitat management plans.

13.3.3.3.3. Consideration of cumulative effects from overwater structures in updating the SMP (for example, build out

[3] A summary review of Kitsap County's policies and regulations relative to summer chum salmon habitat and recovery planning are described in SRP Appendix G.

scenarios with overwater structures), taking into account processes that control functions.

13.3.3.3.4. The gathering of information from studies that will be used to inform land use planners and managers to best manage natural resources

13.3.3.3.5. Development of incentive programs to encourage community docks vs. single-family docks.

13.3.3.3.6. Instead of the use of site-by-site overwater structure permits, use long range planning tools to address potential impacts to eelgrass areas.

13.3.3.4. Consider adoption of proposed revisions to the Critical Areas Ordinance, including extending buffers for shorelines designated as "Conservancy" to 50 ft. and adopting Ecology's wetland rating system and recommended flexible buffers options.

13.3.3.5. Develop Volunteer Anchor Free Zones modeled after Jefferson County. Provide designated moorage buoys at all public facilities and install marker buoys showing boaters where eelgrass is located so they can avoid anchoring there.

13.3.3.6. Seek resources to fully fund Kitsap County/Kitsap Health District Pollution Identification and Correction (PIC) program. Expand the PIC program to look at nutrient loading.

13.3.3.7. Develop incentive programs to encourage removing unnecessary shoreline armoring and the use of soft bank protection (*e.g.* using the Public Benefit Rating System).

13.3.3.8. Achieve compliance with NPDES Phase II requirements pending review by Ecology.

13.3.3.9. The Kitsap County Public Works has adopted the ESA 4(d)-compliant regional road maintenance guidelines and will continue to operate according to those principles.

13.3.3.10. Kitsap County encourages the use of low impact development (LID) techniques, which conserve natural areas and minimize development impacts. The County is currently reviewing its development ordinance relative to LID issues under a contract with the Puget Sound Action Team.

13.3.3.11. Seek funding to conduct a comprehensive forage fish spawning survey to update documentation maps, especially for sand lance. Seek funding to support protection and restoration of existing forage fish spawning areas.

13.3.3.12. Seek funding to develop a beach nourishment program to restore lost sediment supply to beaches and restore/maintain spawning area substrate.

13.3.3.13. Develop methods to quantify cumulative effects from overwater structures.

13.3.3.14. Develop a method of identifying, and develop long range planning tools to manage, cumulative impacts of shoreline development, armoring and stormwater on herring, surf smelt and sand lance spawning areas.

13.3.3.15. Actively seek funding to support protection and restoration of marine riparian areas.

13.3.3.16. Revegetate public lands wherever possible.

13.3.3.17. Protect existing riparian habitat through acquisitions and conservation easements wherever possible.

13.3.3.18. Seek resources to fund more enforcement activities.

13.3.3.19. Support development of native vegetation workshops for local shoreline owners and master gardeners (using the Mason County model).

13.3.3.20. Develop education and outreach programs, which may include:

13.3.3.20.1. Funding an Education/Outreach position,

13.3.3.20.2. Implementing a shoreline stewardship program,

13.3.3.20.3. Conducting shoreline educational workshops,

13.3.3.20.4. Developing a video on how salmon are using Kitsap and what citizens can do to protect and improve conditions, and

13.3.3.20.5. Offer the Sound Boater Program to educate recreational boaters on boating best management practices.

13.3.3.21. The SRP will provide an analysis of current State law regarding marine shoreline bulkheading and suggest ways that the law can be revised to allow Counties to be more conservative in their approaches.

13.3.3.22. The SRP further supports continued and additional resources, including funding and staff, for the County to pursue and engage in forums, implementation, and enforcement of County programs, ordinances, and regulations.

13.3.3.23. Land use and regulatory actions that may be taken by the County for salmon recovery may also satisfy GMA, SMP, and other State requirements and conditions. Likewise, actions taken

by the County to comply with GMA and SMA may also benefit salmon recovery. The State should recognize the synergy between GMA, SMP and salmon recovery planning. The County may agree to provide salmon recovery protection provisions if credit for those actions was acknowledged. The SRP will pursue "credit" for County programs relative to appropriate State requirements under GMA and SMA.

13.3.3.24. One of the goals of the SRP is to show that the burden of salmon recovery extends beyond the Counties to the State and Federal level. The County would likely pursue many other actions listed in the SRP if funding and staff resources were available. The SRP supports and will pursue additional resources for the County to pursue recovery actions as appropriate. Resources for the County will be necessary for enforcement, monitoring, public outreach/education, and adaptive management.

13.3.3.25. The HCCC can assist the County with resources and technical review, in considering a variety of innovative and creative measures to address protection and restoration of habitat. HCCC can work with County staff in the interpretation of databases, technical input, and assistance.

13.3.4. Mason County

On June 29, 2005, the Mason Board of County Commissioners affirmed the following programmatic issues that Mason County has implemented, or will implement, within funding constraints, and that these issues can be included in the SRP[56]:

13.3.4.1. To support summer chum salmon recovery and protection the Hood Canal Coordinating Council's Summer Chum Salmon Recovery Plan (SRP) recognizes and supports that Mason County has already implemented or is in the process of implementing the following provisions:

13.3.4.1.1. Stormwater management planning is underway for the Hoodsport and Skokomish areas and the County is in the process of adopting a stormwater management ordinance. Stormwater management planning is also occurring for the Belfair area as part of the water, sewer, and road improvements associated with Highway SR 3.

[56] An initial Mason County Salmon Receovery program review was done by County staff and is included in Appendix H. It was consulted in preparation of this section of the SRP.

13.3.4.1.2. Mason County has adopted a policy to encourage use of "soft-bank" armoring for developments that occur in freshwater channel migration zones and along marine shorelines.

13.3.4.1.3. Mason County Conservation District has been awarded a manure control grant and is in the process of the design, development, and implementation of manure control best management practices (BMPs) that affect the waters of Mason County.

13.3.4.2. The SRP is recommending the following actions be considered and endorsed by the Mason County Board of Commissioners:

13.3.4.2.1. The SRP recognizes that Mason County will need to pursue an update of the Shoreline Master Program (SMP). A key provision of an updated SMP is addressing the restoration element. The SRP supports Mason County's efforts to update the SMP. The SRP recommends that during the SMP update process, the County consider guidance that discourages hard armoring of the nearshore. That could be a stated preference for soft-bank armoring, and incentives to help property owners with those techniques. When repair of bulkheads is required the County should not decrease protections in their current regulations.

13.3.4.2.2. The SRP recommends the application of the revised 2004 Dept. of Ecology wetland rating system.

13.3.4.2.3. The SRP supports County staff in their efforts to look at ordinances and regulations to seek flexibility to allow low impact development and implement those practices in areas needing protection for summer chum salmon habitat.

13.3.4.2.4. The SRP supports the adoption of incentive-based programs that provide density bonuses and other incentives that encourage residential clustering and more intensive land uses in rural areas to be offset by larger blocks of open space.

13.3.4.3. Other issues Mason County may consider include:

13.3.4.3.1. Adoption of the Department of Ecology's "Stormwater Management Manual for Western Washington" (revised 2005).

13.3.4.3.2. Development of a regional approach (Hood Canal wide) to public education and outreach regarding SRP issues and actions.

13.3.4.3.3. Floodplain/watershed management planning efforts in select watersheds (i.e., Hama Hama, Lilliwaup, Union, Skokomish) with discussions that will consider summer chum salmon habitat conditions and recovery actions.

13.3.4.3.4. The SRP recommends that Mason County consider clearing and grading guidelines that are compatible with summer chum salmon habitat restoration and protection.

13.3.4.3.5. Loss of forest cover in residential and commercial areas is a potential future issue that could impact salmon habitat in the County. The County may pursue a public education/outreach program that can address loss of valuable forest cover in the future and protect summer chum salmon habitat. The HCCC can provide assistance to the County for these efforts.

13.3.4.4. The SRP further supports continued and additional resources, including funding and staff, for the County to pursue and engage in forums, implementation, and enforcement of County programs, ordinances, and regulations.

13.3.4.4.1. Land use and regulatory actions taken by the County for salmon recovery may also satisfy GMA, SMP, and other State requirements and conditions. Likewise, actions taken by the County to comply with GMA and SMA may also benefit salmon recovery. The State should recognize the synergy between GMA, SMP and salmon recovery planning, and work towards flexibility and support for innovative approaches and actions taken on the part of the County. The SRP will pursue State and Federal acknowledgement and support of innovative models and strategies that are incorporated into County land use and regulatory programs relative to appropriate State requirements under GMA and SMA.

13.3.4.4.2. One of the goals of the SRP is to show that the burden of salmon recovery extends beyond the Counties to

the State and Federal level. The County would likely pursue many other actions listed in the SRP if funding and staff resources were available. The SRP supports and will pursue additional resources for the County to pursue recovery actions as appropriate. Resources for the County will be necessary for enforcement, monitoring, public outreach/education, and adaptive management.

13.3.4.4.3. The HCCC can assist the County with resources and technical review, in considering a variety of innovative and creative measures to address protection and restoration of habitat. HCCC can work with County staff in the interpretation of databases, technical input, and assistance.

13.4. Other programmatic actions

13.4.1. Harvest and Hatcheries

As discussed in SRP sections 4 and 5, it is recommended to continue the co-manager designed and implemented harvest management regimes and supplementation programs as described in the SCSCI (WDFW and PNPTT 2000). These activities, combined with the other project and programmatic actions described in this SRP, will provide the opportunity for the recovery of the Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon ESU.

13.4.2. Regional Problems

Within the Hood Canal and the Eastern Strait of Juan de Fuca there are some problems that are 'regional' in nature and must be addressed through a larger scale approach. These problems span watershed, County and WRIA boundaries. They pose special challenges because they are physically large, very costly and complicated to address. Two such problems are described below.

13.4.3. US Highway 101 Causeways

The problem with Highway 101 is that it creates physical blockage, destruction of habitat, and functional degradation of estuaries and along-shore processes. It does this by the existence of the earthen fill causeways that support it. This problem exists along the west side of Hood Canal and along the eastern Strait of Juan de Fuca. It impacts, to different degrees, five of the major west-side Hood Canal drainages (Skokomish, Lilliwaup, Hama Hama, Duckabush, and Dosewallips Rivers) as well as Salmon, Snow, and Jimmycomelately Creeks along the Eastern Strait of Juan de Fuca. To address this problem with spanning of the estuaries and river mouths, the Washington State Department of Transportation (WSDOT) will need political support locally, because of the

disruptions to the public and local landowners that any realignment or reconstruction work would entail. WSDOT will also need political support and substantial amounts of funding from the State Legislature and the US Congress, because of the high costs of the various projects that would be required to address this issue, and because of the lower funding priority of Highway 101 relative to other major roadways and highways in the state.

13.4.4. Logging Roads in the Olympic National Forest

Sediment delivery to many major rivers and streams, from erosion and mass wasting on US Forest Service (USFS) roads, is a large problem. This problem impacts streams all along the west side of Hood Canal and in the eastern Strait of Juan de Fuca. To address this problem the USFS will need local political support to close many of the failing roads that are no longer used for logging access, and to upgrade and stabilize roads still used for resource protection and management, or for recreation. The USFS will also need political support and substantial amounts of funding from the US Congress because of the high cost of this program. An adequate and stable budget for road maintenance is also needed to reduce the risks of sedimentation from inadequately maintained roads in the future. The USFS Access and Travel Management Plan (2003) has laid out a comprehensive and prioritized approach to managing their road networks, now it must be funded.

13.4.5. Community Nearshore Restoration Program

The Hood Canal Coordinating Council currently runs a program called the Community Nearshore Restoration Program (CNRP). It focuses efforts on the part of the watershed that has the most potential for affecting water quality—marine waterfront property owners. The approach is two-fold. It works directly with marine waterfront property owners to provide incentives for voluntary restoration actions on private property. It also engages those individuals, and their neighbors and community, in an education program specifically on and about their property and beaches. This helps improve public awareness, galvanize a sense of community around watershed and nearshore processes, and improve public support for environmental protections.

The HCCC has been successful with the CNRP in the two “piloted” areas of Hood Canal. Those were the Northshore and Dewatto communities in Mason County. In those programs, the HCCC has worked directly with and educated more than 235 shoreline landowners. We are in the process of completing more than 20 shoreline restoration projects with those property owners, and we have achieved two critical estuary protection projects through the purchase of conservation easements. To date, this program has been funded by the US Fish & Wildlife Service in the Northshore Community, and by the Puget Sound Action Team in the Dewatto Community.

The site locations chosen are based on recommendations from the Lead Entity Strategy, the SRP, and ongoing HCCC assessments. Within the marine shoreline, certain areas are more critical for restoration because of their ecological importance. Pocket estuaries, eelgrass beds, forage fish spawning beaches and estuarine wetlands enhance water quality and act as nurseries for fish. These highly sensitive areas will be the areas of focus for additional iterations of the CNRP. The CNRP also focuses on communities with known onsite sewage problems. The following locations along Hood Canal meet the first criterion of biological importance:

- Communities found adjacent to, or on, river estuaries: the Big and Little Quilcene, Dosewallips, Duckabush, Hama Hama, Skokomish, Union, Tahuya rivers, and Tarboo, Lilliwaup, Big Anderson and Big Beef creeks.

- Added to these are the communities that have documented onsite sewage problems: Potlach, Hoodsport and along the southeastern shoreline of Hood Canal.

The CNRP fosters a local community of waterfront owners that is informed and educated about their specific marine nearshore and estuary ecosystem functions and how those functions are affected by human development. Public resources are leveraged by “training the trainer”, which is a model that has been proven to be successful elsewhere. The end result is that we build capacity among the citizenry, and political will for future regulatory actions. All three counties in the Hood Canal are scheduled, in upcoming years, to develop new regulations for shoreline areas through the State of Washington’s Shoreline Management Act. Having an involved, informed citizenry will decrease the animosity, improve understanding and foster a more productive dialog during the development of those regulations.

The projects already developed implement Priority 1 restoration projects from the Lead Entity Strategy (HCCC 2004) for marine nearshore areas. The group of restoration actions to implement previous CNRP iterations is described below.

Project #1A is a levee removal in the intertidal zone of the Union River Estuary, reconnecting 13 acres of isolated salt marsh rearing habitat for ESA-listed summer chum and chinook salmon, improving nutrient processing and providing for more natural stormwater retention.

Project #1B will result in removal of fill and debris left from historical logging and shipping, followed by replanting riparian vegetation within the Tahuya River Estuary, and project monitoring (described below). Implementation of this project will result in improved salmon migration of a shallow-water corridor, improve bank conditions, and improved marine riparian conditions, which will assist in water quality improvements.

Project #1C, in the Dewatto River Estuary, will remove artificial fill that is a remnant from an abandoned artificial boat basin/marina. This project will restore lower riverine and upper salt marsh habitats by restoring the linkage between freshwater and saltwater habitat forming processes. This will increase natural nutrient and organic material processing and reduce anthropogenic water quality impacts to Hood Canal.

Project #1D will result in four demonstration gardens on four individual residential properties. The four properties span the range of ecologic and anthropogenic conditions, from pristine freshwater wetlands to saltwater marsh, gravel shorelines with and without concrete bulkheads, and a highly developed estuary. The rain garden installation will re-establish a native vegetated buffer, improving the quality of salmon habitats and increase pollution and nutrient remediation.

Project 2 is the expanded implementation of the CNRP. We will conduct a 'community assessment' within each of the 'biologically-targeted' communities on the Hood Canal shoreline that was identified through previous assessments. The community assessment determines if there are sufficient community resources to organize into a functioning workgroup. The community assessment also identifies key property owners and recruits them as "ambassadors" to help communicate with the others in their neighborhood and function as an advisory group. Those areas that meet the criteria for both the biological and community assessment will receive repeated, targeted outreach over a period of six to nine months followed up with beach/property walks. Scientists participating in the beach walks will lead discussions about the specific ecological communities, processes and functions of each landowner's shoreline. Finally, after the beach walks, HCCC staff will provide technical assistance and coordinate the planning, design and implementation of the restoration and/or protection project.

Project 3 will be the set of specific actions developed through the proposed expansion of the CNRP throughout Hood Canal. The following demonstration projects are targeted.

- At least one shoreline landowner will remove their bulkhead and install soft-bank armoring. This increases habitat, reduces sediment scour on adjacent landowner property and improves shoreline ecosystem functions for nutrient and organic material cycling.
- At least one shoreline landowner will re-develop their property using low impact development techniques (re-vegetation, stormwater management).
- At least 30 shoreline landowners will re-vegetate their shoreline with native vegetation.
- At least 20 shoreline landowners will remove their old, outdated onsite sewage systems, and either connect to a publicly-managed community sewage system or will install an onsite sewage system that reduces nitrogen output to groundwater/marine waters by at least 50%.

This SRP proposes increasing the frequency of the CNRP process to include the entire ESU geographic area. However, additional resources are needed to proceed with this effort.

13.5. Bank armoring (bulkheading) and shoreline modifications

13.5.1. Overview

Hood Canal summer chum salmon, listed as 'Threatened' under the Endangered Species Act, spend several weeks as juveniles feeding in the productive nearshore waters of Hood Canal. They do that in preparation for their ocean migration. Juvenile summer chum salmon use the nearshore areas, including estuaries, eelgrass beds and nearshore woody debris, for foraging and protection from predation. Many reaches of Hood Canal's shorelines are in a semi-modified state, yet retain substantial functions supporting salmonid migration, rearing, refuge, and osmoregulatory adjustment. Forage fish species also use the Hood Canal shoreline, including Pacific herring, sand lance, and surf smelt. For these reasons, the marine shoreline of this area plays a critical role in the recovery of threatened salmon populations.

Marine shorelines have been altered in Hood Canal by historical and ongoing land uses, primarily through the cumulative impacts of single-family residential development, road building, and agricultural activities. Impacts include changes to vegetation, hydrology, woody debris and construction of bank protection in the form of bulkheads. This section reviews the state laws and regulations that affect construction of marine shoreline armoring (bulkheads), to identify specific changes that might be necessary to better protect and restore nearshore marine habitat.

Although there are several laws that indirectly affect marine shoreline armoring, there are two laws that directly address it: the Shoreline Management Act (Chapter 90.58 RCW) and Construction Projects in State Waters (Chapter 77.55 RCW). Each contains provisions to guide agencies in their regulation of shoreline armoring, to protect marine shoreline property from erosion. The laws contain provisions for the protection of private property rights, and also contain provisions intended to protect environmental features and habitat values of the marine shoreline.

13.5.2. Private Property Protection

Both laws are clear in their intent to allow certain activities, especially bulkheading of marine shoreline property to protect a single-family residence. RCW 77.55.200 (2) states, "The department [WDFW] **shall** issue a hydraulic permit with or without conditions within forty-five days of receipt of a complete and accurate application which authorizes commencement of construction, replacement, or repair of a marine beach front protective bulkhead or rockwall for

single-family type residences or property," with conditions that are detailed in the law [emphasis added].

There are several activities listed in the Shoreline Management Act, Chapter 90.58.030(3) RCW, which are exempt from shoreline permitting. Those include:

- Construction of the normal protective bulkhead common to single-family residences;
- Construction on shorelands by an owner, lessee, or contract purchaser of a single-family residence for his own use or for the use of his or her family
- Construction of a dock, including a community dock, designed for pleasure craft only, for the private noncommercial use of the owner, lessee, or contract purchaser of single and multiple family residences (within a set value limit).

13.5.3. Shoreline Habitat Protection

The Shoreline Management Act also contains provisions that may provide local governments with tools to protect nearshore marine habitat from degradation:

Chapter 90.58.100(6) RCW states, "Each master program shall contain standards governing the protection of single family residences and appurtenant structures against damage or loss due to shoreline erosion. The standards shall govern the issuance of substantial development permits for shoreline protection, including structural methods such as construction of bulkheads, and nonstructural methods of protection. The standards shall provide for methods that achieve effective and timely protection against loss or damage to single family residences and appurtenant structures due to shoreline erosion. The standards shall provide a preference for permit issuance for measures to protect single family residences occupied prior to January 1, 1992, where the proposed measure is designed to minimize harm to the shoreline natural environment."

Construction Projects in State Waters, Chapter 77.55.200 (c) RCW states, "Construction of a new bulkhead or rockwall, or replacement or repair of an existing bulkhead or rockwall waterward of the existing structure shall not result in the permanent loss of critical food fish or shellfish habitats;"

The laws seem to direct local governments and state agencies to:

a) Allow individuals to build single family residences on the shoreline, and to protect their structure once it is built; and,
b) Restrict the construction of residences, bulkheads and other structures to prevent any further loss or degradation of nearshore habitat."

13.5.4. Analysis

The negative impacts to nearshore habitat from the current regulatory structure include the following:

- Bulkheads and docks can impact habitat and alter natural shoreline processes, often affecting adjacent landowners that necessitates similar action for those property owners to protect their shoreline from erosion.
- Bulkheads are often installed to ease beach access and prevent potential erosion, not necessarily to protect a structure that is in danger because of erosion.
- While some Counties limit bulkhead construction and encourage "soft-bank" or bioengineered bank protection, there is no State mandate to do so. In fact, to completely prohibit the installation of bulkheads to protect existing residences would be contrary to state law.
- Since both the construction of a home and the construction of a bulkhead are exempt from shoreline permitting, new homes are being constructed which either require bank protection at the time of construction, or soon after construction.
- State agencies do not have the same review and approval authority for exempt activities that they have for permitted activities. This includes review of permit variances and conditional approvals, which have to have Department of Ecology approval to assure that adequate protections are being implemented (Chapter 90.58.140(10) RCW).

Complicating the issue further, there appears to be a direct statutory conflict within the Shoreline Management Act. It is not totally clear that Counties can adopt standards that govern the issuance of substantial development permits for shoreline protection (Chapter 90.58.100(6) RCW). This is because, "Construction of the normal protective bulkhead common to single-family residences… shall not be considered substantial developments for the purpose of this chapter" (Chapter 90.58.030(3)(e) RCW). So, local governments face conflicting interpretations with regard to this statute.

The Shoreline Management Act also refers to shoreline permitting requirements "for the construction of a bulkhead or other measures to protect a single-family residence and its appurtenant structures from shoreline erosion" (Chapter 90.58.140(11) RCW). That statute then provides a detail of procedures required to issue such permits.

It is clear that the legislative intent must be clarified for the permitting of bulkheads and other measures to protect a single-family residence. Without legislative clarification, local jurisdictions are likely to avoid potential legal battles that would follow a more conservative regulatory approach that would provide greater environmental protection. The current ambiguous situation will lead to continued increases in armored marine shorelines, continued habitat degradation, and risks to the recovery of summer chum salmon.

13.6. Conclusions

Summer chum salmon returns and escapements to Hood Canal and Strait of Juan de Fuca streams have improved in recent years. Those returns have been enhanced by exceptionally strong returns to various supplementation programs. Adicks, et. al. (2005) suggests that these returns, combined with the high percentage of natural origin recruits (number of fish entering the fisheries) in recent years, provide a substantial reduction of the extinction risk for this Evolutionarily Significant Unit. While all of the above events are very positive results for the summer chum salmon recovery effort, they do not yet constitute full recovery. Ocean conditions have been favorable in the recent past, but can be expected to be unfavorable again sometime in the near future. The co-managers have developed interim recovery goals for summer chum salmon (PNPTT and WDFW 2003b). Those goals require strong production performance of natural origin recruits over three generations (12 years). But, the recent large returns do not yet meet those recovery goals and the diversity is not yet restored to all of Hood Canal where summer chum historically inhabited. The co-managers are just now beginning the development of a 5-year review of the Summer Chum Salmon Conservation Initiative results, and that document (due by the end of 2005) will contain a detailed discussion of progress towards full recovery.

True recovery cannot be defined until the viability analysis is completed and a tool (such as EDT[57] or Shiraz) is developed to measure the efficacy of recovery actions relative to the viable salmonid population (VSP) parameters. The SRP is proceeding with the co-manager developed recovery goals and threshold criteria. This SRP will work in coordination with the co-managers' 5-year review process to determine the status of recovery progress. Should the SRP be implemented, as described in section 15 below, tremendous progress will be made towards recovery of the Hood Canal/Eastern Strait of summer chum salmon ESU.

[57] At this time the EDT developed only provides an assessment of the baseline conditions that impact summer chum salmon. Recovery actions can be inferred from this analysis, but an actual model or tool to do that analysis has yet to be completed. More resources are necessary to conduct this type of analysis and model development.

14. MONITORING AND ADAPTIVE MANAGEMENT

14.1. Introduction

In the development of the Salmon Recovery Plan (SRP) several key biological and political assumptions have been made. For example, land use and regulatory programs that are currently in place are assumed to continue without major changes. Harvest and hatchery regimes operating today were developed and being implemented under the assumption that commensurate habitat restoration actions were needed to sustain the targeted summer chum populations naturally after the hatchery programs are terminated. The harvest and hatchery programs are being implemented with knowledge that interaction with on-going and new habitat restoration and protection actions is required and that harvest regimes and hatchery production acting alone will not lead to ESU recovery. The harvest and hatchery regimes in progress today are expected to continue well into the future. The assumptions on which the SRP were developed are based on our current knowledge and understanding of salmon eceolgy. Only with its implementation over time, will we be able to gauge the correctness of those assumptions and adapt plan implementation activities to address changes. Human population growth and the accompanying development may exceed our current projections. Political changes may reshape existing regulatory programs. Environmental conditions may also change in ways that are unexpected.

SRP sections 1-13 provide the context for recovery of the Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon ESU. They also provide the details of the actions that we believe are needed to recover summer chum. Section 15 spells out how this set of SRP actions can be implemented. This section, 14, describes the framework to:

- Evaluate the efficacy of the prescribed SRP actions addressing summer chum salmon habitat,
- Monitor the results and effects of those implemented actions, and
- Respond to those results by making changes to planned future actions.

Salmon recovery is an on-going process. Once the stated goals of recovery are reached, monitoring will need to continue to ensure that recovery is maintained and stable in the future. This monitoring and adaptive management requires a commitment for the future that translates to dedicated funding and/or staffing. Section 14 describes the types of monitoring that will be developed and pursued along with select, specific monitoring programs for all aspects of the SRP including habitat, harvest and hatcheries. A framework from which to develop the specific monitoring program is constructed in this section. As resources, forums, and mechanisms are identified during the implementation phases of the

SRP a more detailed monitoring and adaptive management program will be described.

14.2. Implementation Monitoring

Implementation monitoring is conducted to determine if a habitat action or suite of habitat actions was performed and/or completed as planned[58]. This type of monitoring will result in a yes or no answer, though lessons for adaptive management are also inherent in this category of monitoring. Within the context of salmon recovery planning, three functions fall under this category, including habitat actions, regulatory actions, and recovery plan progress. Table 14.1 provides a summary of the types of monitoring (beginning with implementation monitoring), funding needs and the next steps in the development of the monitoring program.

[58] Extensive monitoring and evaluation requirements and reports for harvest and hatchery actions have been implemented by the co-managers, and previously approved by NMFS under ESA 4(d) rule in 2002 and 2003. More details can be found in sections 4 and 5 of the SRP.

Table 14.1. Summary of SRP monitoring program items, funding needs and proposed next steps.

TYPE OF MONITORING	RECOMMENDED MONITORING	CURRENT FUNDING	PROJECTED FUNDING NEEDS	NEXT STEPS
Implementation • Were habitat actions implemented as designed? • Were regulatory program requirements met? • Is the recovery plan being implemented in a manner appropriate to reach milestones?	• Document implementation successes and failures and why, with LE and project sponsor producing one report per action. • Document regulatory program successes and failures and why, with periodic reporting. • Roll-up project reports to assess recovery plan implementation.	• SRFB currently funds project managers to perform this task, although only to meet contractual obligations. • County, state, and federal programs currently have compliance programs that would meet regulatory program needs. • WDFW currently funds LE coordinators to assess LE Strategy implementation.	• Limited funding needs for individual habitat action reports, although funds needed to develop templates for action types. • Consistent and comprehensive review of regulatory compliance would need improved enforcement and reporting mechanisms. • Fund reporting and adaptive management for recovery plan implementation.	• Develop standardized templates. • Develop coordinated approach to incorporate habitat actions by all funding sources (USFS, CREP, NRCS, etc.) • Discuss relevant programs and appropriate reporting and analysis mechanism • Continue to develop adaptive management framework to assess milestones.
Direct Effectiveness for Habitat • Did the habitat action(s) achieve the desired habitat condition? • Did the land use/management action(s) achieve the desired habitat condition?	• Adopt SRFB protocols and extend project monitoring beyond randomly selected samples to include all restoration actions by stakeholders. • Work with local jurisdictions to implement standardized monitoring protocols with individual actions such as stormwater facility installation.	• SRFB currently funds a subset of projects with TetraTech/Foster Wheeler contract, and allows project sponsors to apply for funds to monitor for maintenance of remaining projects. • It is currently unexplored as to how local jurisdictions monitor land use or management actions for habitat improvements relevant to salmon recovery.	• Fund remaining project monitoring. Monitoring costs could be assumed at 15% of project costs. • Fund development and implementation of protocols, QA/QC, data collection, analysis, and regional coordination for both habitat actions and land use/management actions.	• Work with project sponsors to fund and implement SRFB protocols on remaining habitat restoration actions. Also, work with Governor's Forum on Monitoring to continue to improve adaptive management through direct effectiveness mon'g. • Work with local jurisdictions to determine current efforts and future implementation approaches.

TYPE OF MONITORING	RECOMMENDED MONITORING	CURRENT FUNDING	PROJECTED FUNDING NEEDS	NEXT STEPS
Cumulative Effectiveness for ESA salmon • Abundance • Productivity • Spatial Diversity • Genetic Diversity	• Co-manager, USFWS, and volunteer spawner surveys and sampling in core and satellite watersheds. • Surveys of juvenile distribution and timing in estuary. • Documentation of spawner distribution. • Improved enumeration of out-migrant juveniles • Description of genetic and biological characteristics over time. • Estimation of hatchery straying. • Estimation of productivity (recruits per spawner). • Improved understanding of estuarine life history.	• Co-managers and USFWS fund survey and sampling staff in core watersheds while coordinating with volunteers for satellite populations • Co-managers fund rotary screw trap on Hama Hama River • WDFW and UW fund weir trap on Big Beef Creek • WDFW funds weir trap on Snow Creek • Co-managers analyze data and report results.	• Fund effort to improve survey coordination and GIS documentation. • Fund effort to assess efficacy of existing screw trap and opportunities for additional needs such as snorkeling or sonar. Depending on results, fund recommendations	• Improve survey coverage and GIS documentation. • Co-manager discussion on additional tools to assess productivity and estuarine juvenile surveys.
Cumulative Effectiveness for Habitat, or Habitat Trends • Did implementation of habitat actions and management plans achieve anticipated improvements in ambient habitat conditions?	• Implement long-term channel condition monitoring building upon existing geodatabase. Data is collected with TFW or modified-TFW protocols and extend back to 1992. • Implement nearshore monitoring of estuaries, drift cells, and submerged aquatic vegetation. • Implement watershed	• Complete coverage of summer chum basins (within the wadeable domain) were completed in the 1990s while HCSEG and HCCC have begun to re-inventory basins for habitat improvements. SRFB grant to HCCC developed early version of geodatabase. High resolution remote sensing done in	• Finalize geodatabase and queries. Develop QA/QC protocols for cooperating partners. Fund new surveys to determine trends in wadeable streams. Fund remote sensing and assessment for non-wadeable domain. • Develop and implement protocols for trend detection in estuaries and drift cells. Repeat	• Conduct regional discussions on status & trends monitoring programs' needs and existing capacities. • Implement gap analysis

TYPE OF MONITORING	RECOMMENDED MONITORING	CURRENT FUNDING	PROJECTED FUNDING NEEDS	NEXT STEPS
	trend detection program building on existing efforts for forest cover, type and age; total and effective impervious area; and freshwater and marine riparian quality and quantity. • Improve water quantity (peak flow, low flow, and flashiness) monitoring coverage • Long-term commitment to water quantity monitoring through conrtinuous funding of stream gauges • Coordinate and improve existing water quality monitoring coverage for parameters documented as limiting production for ESA salmon.	Dosewallips to establish baseline for non-wadeable. • Ecology conducted Shorezone Inventory, with hyperspectral imaging and historic vs. contemporary assessment of nearshore habitat complexes. • Several jurisdictions and programs utilize remote sensing for land cover and riparian conditions, although it is currently unknown as to repeatability and on-going commitments. • Flow gauging is well developed in the HCCC region for most ESA basins, though funds are sunsetting. • Several jurisdictions and programs do focus on random sampling for water quality, although few maintain long-term fixed or random sampling stations for trend detection. Water quality parameters are not well defined by reach or basin for salmon habitat limiting factors.	hyperspectral analysis of submerged aquatic vegetation given adequate funding. • Funding of the gap analysis • Needed funds unknown for watershed trend detection program until a gap analysis can be conducted. • Needed funds unknown for water quantity until a gap analysis can be conducted. • Needed funds unknown for water quality until parameters of concern are developed and a gap analysis can be conducted. • Funding of stream gauges	

TYPE OF MONITORING	RECOMMENDED MONITORING	CURRENT FUNDING	PROJECTED FUNDING NEEDS	NEXT STEPS
Validation • Is our understanding and assumptions of summer chum salmon life valid? • Did our habitat actions meet the cause and affect assumptions of improving salmon productivity in Intensively Monitored Watersheds?	• Track juveniles through the freshwater and marine systems to understand timing and habitat preferences • Verify that habitat restoration and enhancement can improve summer chum salmon productivity in Big Beef Creek.	• IMW program has been funded by SRFB and WA State to develop IMWs and monitoring regimes in those basins. Granting agencies has funded some habitat actions. HCCC and cooperating partners are currently querying watershed landowners for high benefit projects in the watershed.	• Additional funds will be needed to administer and manage the local portion of the program to work with landowners and implement habitat actions. Additional funds may be needed to continue programmatic monitoring by State agencies for next 12 years minimum.	• Work with partners and landowners to develop suites of habitat actions and submit to SRFB and other funding agencies.

The first key question is whether habitat actions and projects were implemented as designed to meet key salmon recovery issues. Documenting the reasons for project implementation success or failure is a component of adaptive management, and should be performed on all recovery actions. A standardized template should be developed and the appropriate parties should collaborate to produce a single report per action, for all current and future projects implemented within the ESU. The SRP proposes a standardized template be developed. It could determine if the implemented project met the intentions and objectives described in the salmon recovery plan, what lessons were learned, and what further steps are needed. Additionally, improved communication and coordination among SRFB and GSRO staff, HCCC staff, project sponsors, and project partners, will facilitate this effort.

The second question is whether programmatic actions, including land use regulations were implemented according to their intent. Documenting the reasons for the success or failure of programmatic actions is also an inherent component of adaptive management, and should be performed on a periodic basis. The HCCC is working on a matrix of actions committed to in the SRP and will use that to track progress on programmatic activities as well as projects. Specifically, with regard to land use and development regulations, the HCCC is working on a querying system of local jurisdictions' permit tracking systems. This querying system will help assess how development is progressing in relation to current land use regulations, which the SRP asserts are adequate to aid summer chum salmon recovery. This querying system is described more fully later in this section (14.6.)

The third question within implementation monitoring is whether the salmon recovery plan is being implemented as agreed by our various partners who made commitments within the plan. This question will also be addressed by our tracking of actions within our matrix. Reporting mechanisms will include coordinating individual reports, working with our various partners, HCCC reporting of programmatic actions through the use of our tracking matrix, and the reporting of trends at the ESU scale. All of these reporting actions will be developed on established timelines that meet the adaptive management framework and objectives of the SRP.

14.3. Direct Effectiveness Monitoring of Habitat Projects

Direct effectiveness monitoring tracks how well an implemented action or regulatory program met its objectives. An example of this is the SRFB's effectiveness monitoring program. Each project type (levee removal, large woody debris replacement, riparian plantings, etc.) has its own particular objectives and protocols that measure parameters of interest. This program samples a portion of the total number of projects implemented statewide. It uses random sampling to make statistical inference to projects statewide. Though

sampling is sufficient to say that any particular project type is effective, it is not sufficient to say that every project was directly effective at meeting its objectives.

Since each of the actions must be effective to recover salmon within the summer chum salmon ESU, the SRP recommends extending this project monitoring program to all projects except feasibility studies, using SRFB's protocols for each project type. The SRP also recommends that monitoring be implemented by the HCCC at the regional level and that it be coordinated with the SRFB effectiveness program managers and project sponsors to implement protocols under an established quality assurance progam (QAP). This coordinated regional monitoring effort should meet both sponsor requirements for maintenance monitoring and SRP requirements for effectiveness monitoring. This effort should also coordinate with other effectiveness programs, data management in conjunction with Washington State, local efforts, and should coordinate reporting. The HCCC will work collaboratively with the Governor's Forum on Monitoring to continue to refine an approach to adaptive management of projects through this program. Funding will be needed to extend effectiveness monitoring beyond the current SRFB sampling program, though opportunities may exist for leveraging local efforts.

14.4. Cumulative Effectiveness Monitoring of Salmon Recovery

Perhaps the most important parameter for monitoring the effectiveness of our actions towards the goal of salmon recovery is the species of concern itself. NMFS defines salmon recovery in terms of viable salmon population characteristics, including abundance, productivity, diversity, and capacity (McElhany et al 2000). For summer chum salmon, there is a strong program for enumerating abundance through fish escapement (spawning ground surveys) and harvest (fishing mortality.) Table 14.2 lists summer chum stocks by watershed and summarizes responsibility and methods.

Table 14.2. Summary of spawning ground survey programs necessary to evaluate performance and presence of each summer chum salmon throughout the ESU.

Type	Watershed	Organization	Method
Extant	Jimmycomelately	WDFW	Weir
Extant	Snow/Salmon	WDFW/NOSC	Weirs
Extant	Big Quilcene	USFWS/WDFW	Survey/Weir
Extant	Little Quilcene	WDFW	Survey
Extant	Dosewallips	WDFW	Survey
Extant	Duckabush	WDFW	Survey
Extant	Hama Hama	WDFW/HCSEG	Survey
Extant	Lilliwaup	LLTK/HCSEG	Weir/Survey
Extant	Union	HCSEG/WDFW	Weir/Survey
Reintroduced	Chimacum	NOSC	Survey
Reintroduced	Tahuya	HCSEG/WDFW	Survey
Reintroduced	Big Beef	WDFW/UW	Weir/Survey
Extinct/Extant?	Dungeness	DRMT	Survey
Extinct	Finch	WDFW	Weir
Extinct	Skokomish	Skokomish Tribe	Survey
Extinct	Dewatto	HCSEG	Survey
Extinct	Big Anderson	WDFW	Survey
Recently Observed	Fulton	HCCC	Survey
Recently Observed	Little Lilliwaup	Skokomish/HCCC	Survey
Recently Observed	Little Anderson	Stream Team/WDFW	Survey
Observed	Eagle	Skokomish Tribe	Survey
Observed	Stavis	Stream Team/WDFW	Survey
Potential	Tarboo	NW Watershed Inst.	Survey
Potential	Seabeck	Stream Team/WDFW	Survey

Table 14.2 describes each summer chum salmon stock as extant, re-introduced, or extinct. The table also notes whether summer chum have been observed (historically or recently). It should be noted that this list is derived, in part, from historic spawner observations in the WDFW spawner survey database and does not necessarily suggest historic occurrence of an independently stable population.[59] Table 14.2 also lists agencies, Tribes, and organizations that have had and will continue to have the primary responsibility for conducting summer chum salmon spawner surveys. Although these responsibilities may change over time as various programs evolve, implementation of the SRP by the HCCC

[59] Populations have been identified for recovery by WDFW and PNPTT (2000) and tentatively described by Currens (2004 draft in progress). These are described in SRP section 2.2.1 and 2.2.2. A table (Table 3.7) of populations/stocks being initially considered by the SRP can be found in SRP section 3.6.

and its salmon recovery partners will ensure that the populations of concerned are surveyed.

Productivity is another important parameter in measuring salmon recovery. It is a measurement of the number of adult salmon that are ultimately produced by each year's spawning escapement. Since the summer chum salmon from a given year's spawner population (brood year) return as 2, 3, 4, and 5-year old fish, it is necessary to have reliable age composition data for each annual return. The total return for each brood year is divided by the number of parent spawners to arrive at the brood year production rate, typically expressed as recruits per spawner (R/S). The Summer Chum Salmon Conservation Initiative (WDFW and PNPTT 2000) performance standards included a minimum value for mean natural-origin R/S rates that would contribute to stability and recovery of summer chum, and the SCSCI interim recovery goals included a natural-origin R/S threshold that would represent recovery. Increased scale and mark-recovery (otolith and adipose-clip) data collection in recent years have made it possible to distinguish between hatchery-origin and natural-origin spawners and recruits and to begin estimating productivity in terms of natural-origin recruits per spawner for a limited number of broods. Productivity estimates are presented in the Co-managers SCSCI 5-year review report (WDFW and PNPTT 2005 draft) for the Hood Canal summer chum ESU as a whole, for the Hood Canal and Strait of Juan de Fuca regions, for each management unit, and for each summer chum stock. GSI, sex, age and length data are being collected to assess trends over time.

"Diversity is reflected in the number of life history pathways of a population, in its biological characteristics and genetic traits, in the population's spatial distribution, and in the number and distribution of all populations across the landscape" (PNPTT and WDFW 2003b.) The Co-manager interim recovery goals include provisions to protect and increase summer chum population diversity (see Table 2.4 of the SRP). Monitoring for diversity must then be accomplished in several ways. As discussed above, spawner surveys across watersheds with summer chum categorized as extant, extinct, re-introduced, observed, and/or potential will be important in tracking changes in spatial diversity. Also, tracking distribution of spawners throughout a watershed will provide information relevant to summer chum diversity. For example, as the population of summer chum salmon has increased in Chimacum Creek due to supplementation and natural spawning, the upstream distribution of spawners has increased. GPS tracking of spawning locations would facilitate documentation and understanding of this aspect of diversity. Monitoring for changes in genetic diversity will also be important as populations evolve and potentially expand into satellite populations. WDFW has taken the lead on genetic analyses (WDFW and PNPTT 2003). Finally, documenting and understanding diversity of life history pathways in the marine nearshore environment is important in recovery planning. As populations increase in abundance and distribution, diversity of marine nearshore life

histories may also increase. Adjusting restoration and protection strategies to these various marine nearshore life history patterns is an important component of adaptive management.

The co-managers have developed productivity estimates (recruits/spawner) for the past five brood years of naturally spawning summer chum salmon populations. The estimates are based on analyses of escapement abundances, marked supplementation adult fish returns and age class data for both hatchery and natural origin adult returns to estimate brood year contributions. Recruit per spawner information can indicate how, where, and under what conditions habitat used by summer chum salmon may be affecting productivity. Deposited egg to emigrating fry survival information is still needed to focus productivity analyses specifically on freshwater habitat conditions.

14.5. Cumulative Effectiveness Monitoring of Actions and Ambient Monitoring of Habitat Conditions

Ambient habitat conditions should also be monitored to determine long-term trends in condition, a type of monitoring which is often referred to as status and trends. In the context of salmon recovery, did implementation of the entire array of both habitat actions and land use/management plans achieve anticipated improvements in ambient habitat conditions? Are our anticipated actions resulting in improving conditions across watersheds, or at least maintenance of existing conditions? Habitat listing factors from the Federal Register notice include summer chum watershed, floodplain, and channel conditions, riparian conditions, flow conditions, water quality, and marine nearshore/estuarine conditions (NOAA, March 10, 1998).

The HCCC and its salmon recovery partners have worked to develop a geodatabase[60] as a permanent repository and assessment tool for channel and riparian conditions (HCCC, in prep 2005). Data collected using Timber, Fish, and Wildlife (TFW) protocols from 1992 to present have been entered into a database, with stream segments assigned a latitude/longitude identification number. This approach allows for queries that produce results displayed on maps for any parameter of interest. Data include bankfull width and depth; canopy density; pool quality, quantity, and forming factors; habitat units; bank conditions; and woody debris surveys which measure size, position, function, type, and condition. All of the summer chum core population watersheds have had at least their mainstem covered, where wadeable conditions exist. Non-wadeable rivers such as the Dosewallips and Skokomish present conditions that are less readily described by TFW protocols and require a modified approach.

[60] "Geodatabase" is a spatially referenced database or a database that is organized according to the geographic area of concern. Such databases are commonly used in Geogrpahic Information Systems (GIS) applications.

One example of a modified TFW methodology that can be applied to non-wadeable streams by utilizing a combination of remote sensing and ground surveys was recently produced by the Port Gamble S'Klallam Tribe (Labbe et al, 2005). A similar methodology should be applied to the remaining non-wadeable streams to establish baseline data for trend detection and to provide data for design of habitat actions such as woody debris addition. The HCCC is currently examining how the geodatabase may be able to incorporate remote sensing data from these larger summer chum and chinook salmon watersheds.

The Washington State Comprehensive Monitoring Strategy and Governor's Forum on Monitoring recommended a status and trends monitoring program be implemented at the WRIA, salmon recovery region, and state scales to track freshwater habitat and water quality. This statewide monitoring framework is currently developing recommended protocols and a randomized sampling design. Though this approach is not the most comprehensive method for addressing status and trends of specific habitat listing factors for summer chum or chinook salmon as described in the Federal Register notice (NOAA, March 10, 1998), implementing some aspect of this approach could be an efficient complement to our existing watershed census. The HCCC will continue to work with Washington State to leverage monitoring partnerships such as this where appropriate. Future steps include determining an appropriate funding source for cumulative effectiveness monitoring.

The HCCC and its partners in salmon recovery are currently participating in a series of parallel habitat surveys being coordinated through the Pacific Northwest Aquatic Monitoring Partnership in the John Day watershed in Oregon. The objectives of these surveys are to compare commonly used habitat survey protocols across federal, state, and Tribal jurisdictions to determine the most descriptive, effective, and efficient protocols for use by the Partnership and will eventually be adopted by Washington State's Governor's Forum on Monitoring for use in the statewide monitoring framework.

Inherent in cumulative effectiveness monitoring and assessment is an understanding of watershed conditions that have led to changes in channel and riparian conditions. Forest age, type, and cover, road network and drainage intersection, as well as impervious areas and streamside development may all affect channel and riparian conditions. Many of these parameters have been quantified for each watershed and riparian corridor in county assessments, Salmon Refugia Studies, this SRP, and the US Forest Service, among others, though future efforts for trend detection and relation to in-channel habitat have not yet been established. The HCCC will continue to work with each jurisdiction to establish an appropriate adaptive management and monitoring plan using existing efforts where possible for remote sensing of watershed conditions.

Significant listing factors that will need long-term monitoring include water quantity and quality. Evidence suggests decreasing trends in certain summer chum watersheds, a fact that may be exacerbated by climate change. All summer chum watersheds except the Dosewallips River currently have flow gauges. State agencies, counties, PUDs, and non-governmental organizations should be supported in efforts to maintain these gauges, to make data accessible to interested parties, and to participate in future analysis with regards to summer chum salmon recovery and adaptive management of this resource. Additionally, we should coordinate and improve existing water quality monitoring coverage for parameters documented as limiting production for ESA salmon (temp., DO, turbidity, etc.). Most of these parameters are measured where problems are known to exist, but an additional randomized sampling framework and implementation strategy such as that being developed by Washington State currently would increase our coverage for monitoring these listing factors.

Another area of importance for cumulative effectiveness monitoring of habitat actions and programs is the marine nearshore. The U.S. Coastal Geodetic and Land Survey categorized and mapped certain physical conditions in the marine nearshore habitats of Hood Canal and the eastern Strait of Juan de Fuca during early European settlement in the late 1800s, documenting baseline habitat conditions to which we can make comparisons for trends detection today. The Point No Point Treaty Council has taken the lead in this effort by the inventorying of shoreline modifications (PNPTC, 2003) and documenting changes in estuarine and alongshore habitat complexes, with a specific focus on impacts to geomorphic processes (PNPTC, in prep 2005). These efforts have established both status and trends in physical shoreline conditions, and will be critical in determining the effectiveness of restoration, protection, and regulatory programs, when taken in conjunction with future remote sensing over decadal time periods.

Status, or baseline conditions of marine riparian and intertidal vegetation has been well documented, though trend detection in most parameters of interest is coarse and insufficient to address most local management questions and concerns. Projects such as the Washington State Department of Natural Resources' Shorezone Inventory documented percentage of overhanging vegetation and qualitative coverage of eelgrass meadows and kelp beds along marine shorelines of the state. Washington State Department of Ecology has documented shoreline conditions (including marine riparian) in the 1970's, 1990's, and 2000's with oblique aerial photos. Ecology also maintains a trend detection program for eelgrass beds throughout Hood Canal and Puget Sound using underwater photography. Although not determinative to date, there has been an effort to research functional linkages between shoreline development and the health of eelgrass beds in Hood Canal (as mapped using hyperspectral imagery), which could prove important as adaptive management of these critical juvenile salmon habitats moves forward in the future (PNPTC, 2002; PNPTC, In prep 2005).

14.6. Land Use, Development, and Regulatory Programs

14.6.1. Land Use Regulatory Monitoring Program

In previous sections, the SRP describes the harvest and hatchery programs that are in place that affect summer chum salmon. Those sections also describe the tracking systems that are associated with those harvest and hatchery programs. Also, in previous sections of the SRP, programmatic actions that affect summer chum salmon, including regulatory regimes, are described. This section addresses the need for an equivalent tracking system for those programmatic actions, particularly for the regulation of land use and development.

The development of a querying system for land use permits must have several characteristics to be useful for tracking impacts to summer chum salmon. It must be able to gather information from each jurisdiction that is at an equivalent level of detail and is comparable. It must be able to sum up that information and those trends at the ESU scale. It must also be able to assess significant departures from current land use regulations through variances, conditional uses and other waivers of those regulations.

Each local land use jurisdiction promulgates development regulations and issues permits under those regulations. Each of those jurisdictions also records and tracks those development permits with some sort of permit tracking system. However, those systems are all different from each other. The HCCC is currently assessing the magnitude of those differences and ways to overcome them. Also, there is no current system in place that can aggregate data and assess trends at the ESU scale. This is critical because the SRP analysis of regulatory programs concludes that current land use regulatory regimes are adequate to aid summer chum salmon recovery. But, this is the case only if those regimes are maintained. If significant relaxation of those current regulations takes place, then that assumption of adequacy may be undermined. To address this issue, the design and implementation of a land use and development permit querying system is needed.

The HCCC is working with each of our local jurisdictions, and other interested parties, to develop this permit querying system. That querying system will focus on permits and other development authorizations that might be detrimental to summer chum salmon habitat. HCCC staff, in conjunction with local governments' staffs and others, is inventorying the types of permits and procedures that are most likely to affect summer chum salmon habitat. The inventory will examine permits such as SEPA threshold determinations, building permits, variances, conditional use permits, conversions to non-forest use, floodplain development permits, shoreline conditional permits, shoreline permit variances, critical areas-related permits and other development authorizations.

The intent of this information system is to analyze trends and patterns of development and their consistency with current regulations. It is being designed with local government staffs to address information needs that they may have, as well as for salmon recovery purposes. This information will be provided back to the appropriate jurisdiction for their use in assessing their land use regulations and permit processing practices in an adaptive management fashion.

14.6.2. Impacts and Effectiveness of Regulatory Programs

Effectiveness monitoring of recovery actions has been described previously. Tools or models to evaluate programmatic actions, such as regulatory programs, are needed to assess the impact and effectiveness of regulatory programs and programmatic actions that are being considered by the Counties as part of this SRP (see section 13.3). The Ecosystem Diagnostic and Treatment (EDT) Method is a widely used tool to assist in the prioritization of habitat restoration and protection measures for salmon populations. EDT provides a systematic way of diagnosing habitat conditions that have contributed to the current state of fish populations. It enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits of actions that might be taken to address salmon habitat problems (Lestelle et al 2005). The SRP proposes to explore the further development of EDT as such a tool to address programmatic actions relative to summer chum salmon habitat and eventual recovery of the species.

14.7. Plan Integration and Adaptive Management

The SRP is intended to be an integrated plan. Each element in it contributes in concert with all of the other elements and on-going, related, summer chum salmon recovery processes. SCSCI section 3 describes the individual elements of habitat, harvest, artificial production, and ecological interactions[61] (WDFW and PNPTT 2000). The habitat element describes what conditions will allow the populations of summer chum to be productive. The harvest element reduces harvest impacts to very low levels that clearly will not impede recovery, and will be maintained at these levels that are consistent with the productivity of the populations. Given properly functioning habitat conditions, carefully controlled and extensively monitored artificial propagation programs can successfully supplement populations at moderate and high risk of extinction, and reintroduce naturally spawning populations where native summer chum stocks are extinct. The ecological interactions element is designed to further examine the complex

[61] Ecological interactions as described in the SCSCI are impacts on summer chum from other species, most notably other salmonids and marine mammals. Potential impacts from other salmonids include effects of hatchery operations, fish disease transfer, competition and predation. SRP section 2.3.2 also provides some details of ecological interactions.

relationships between summer chum salmon and other species, which share the same habitats. That element is also designed to reduce or control those interactions that may be limiting recovery (WDFW and PNPTT 2000). Together these four elements can provide the conditions necessary for the diverse set of summer chum salmon populations to recover. Integration of these elements can only occur as a result of assessing the outcomes of plan implementation and modifying the SRP through adaptive management approaches.

The SRP adopts the evaluation and review process as described in SCSCI section 3. The SRP will work with and augment the work of the co-managers as they develop annual reports (SCSCI section 3.6.2) and the five-year review report (SCSCI section 3.6.3). The HCCC will work with the co-managers by bringing to the evaluation and review processes the elements of habitat (programmatic and project actions) as addressed in the SRP. In particular, the review of the SRP will include the following steps (modified from WDFW and PNPTT 2000):

1. Review and describe performance of each element of the plan in meeting their specific compliance and effectiveness standards, as provided in previous sections of the SRP (and SCSCI sections 3.2 - 3.5), by management unit and stock, since the last review period and since adoption of the plan.

2. Evaluate management unit and stock performance relative to the standards provided in the SRP (and SCSCI section 3.6.4).

3. Determine which strategies and actions and conservation objectives were most effective and least effective and which management unit and stock did or did not see the desired improvement. Document the findings by management unit and stock and at the region-wide level, i.e., were successes concentrated geographically or were certain units chronically falling short of objectives.

4. Identify causes of successes and failures and categorize them according to type:

   - *Compliance/Implementation*: Actions were not implemented correctly or had a significant degree of noncompliance by user groups or governments.
   - *Effectiveness*: Actions were implemented correctly and had high degrees of compliance but did not have the intended effect(s).
   - *Assumptions*: Assessment methods or parameters were accurately or inaccurately estimated and applied.

5. Make adjustments to plan elements as provided in the SRP (and SCSCI sections 3.2 - 3.5). The HCCC and the co-managers will incorporate new

information from monitoring, evaluation and research studies in making adjustments as prescribed.

6. Make recommendations for plan changes or amendments. This information should be as specific as possible, including the watersheds, river systems, estuaries, management units, stocks, programs or projects, and fisheries affected, the type of suggested change and the time frame over which it should be implemented.

Results of these reviews will then be analyzed and become part of the discussion and dialogue in forums that will consider appropriate changes and adaptations to the on-going and prescribed recovery and management actions.

15. IMPLEMENTATION

15.1. Overview

This section describes the implementation of the Salmon Recovery Plan (SRP). It describes the recommendations to be done to recover Hood Canal summer chum salmon, how to go about doing it, and how to fund it. This section relies on and references many other sections within the SRP and cannot be understood without referring back to those appropriate sections and appendices.

15.2. Actions for summer chum recovery

The actions that are required for the recovery of Hood Canal summer chum salmon have been described in various other parts of the SRP. They consist of projects and programmatic activities. Some are regional in nature and others are site specific. They are topically related to the different "Hs" that are addressed by this SRP (harvest, hatcheries and habitat.)

The harvest actions that are recommended are specifically described in section 4, Harvest, in this SRP. Those interested in that topic should refer to that section, and the Summer Chum Salmon Conservation Initiative (SCSCI), and its associated updates as prepared by the co-managers. Harvest management, as it fits into overall recovery, is also described in section 13, the section on ESU-Wide considerations.

Similarly, hatchery management actions that are recommended in this SRP are listed in detail in section 5, Hatcheries. Again, for those issues, it is recommended that the SCSCI and section 5 of this SRP be consulted. Hatcheries are also described in terms of their overall contribution to summer chum recovery in section 13, ESU-Wide considerations. Supplementation and reintroduction programs implemented since 1992 have benefited total ESU abundance, and the abundance of natural-origin summer chum salmon returning to spawn in regional watersheds. The programs have helped preserve existing diversity in the ESU, and have led to range extensions of several populations by creating genetic reserves, reducing the risk of further genetic diversity reduction. Population spatial structure has also benefited through the reintroduction of naturally spawning, and now natural-origin spawning populations in two watersheds where native populations were extirpated (Big Beef Creek and Chimacum Creek), with a third watershed in the initial stages of reintroduction (Tahuya River). It is unknown whether the hatchery programs have affected ESU productivity, but recent recruit per spawner data for naturally spawning populations enhanced through the programs suggests that productivity is not being adversely affected (WDFW and PNPTT data from 5 year report in progress, 2005).

Habitat is addressed in this SRP both in terms of recommended project actions and programmatic actions. Project recommendations that are site specific are listed and described in each conservation unit (sections 7-12), and their cost estimates are listed in Appendix D. Projects that are 'regional' in nature are described in section 13, ESU-Wide considerations. This is also true of programmatic actions that are not tied to individual conservation units. Counties, as land use regulators, exercise jurisdiction only within their legal boundaries. Those boundaries cross conservation unit boundaries. As such, the programmatic actions that are recommended by the SRP for each County are listed and described in section 13, ESU-Wide considerations, unless they pertain exclusively to an area within a conservation unit. In those cases, those programmatic actions are listed and described in the appropriate conservation units.

This SRP includes an extensive list of projects and programs that need to be undertaken and enacted to recover Hood Canal summer chum. Attempts to chart a timeline of actions are fraught with huge amounts of uncertainty. That uncertainty stems from the fact that all actions are contingent on the availability of resources to carry out the actions, that current elected officials cannot legally bind different elected officials in the future with the commitments that they make today, and that many of the actions that are needed, both project and programmatic, must take place on private property which requires consent, either individually, or collectively at the ballot box.

In section 3, Management Actions, this SRP states the criteria that must be applied, in selecting actions to undertake for the recovery of the ESU. Specifically, in 3.5, Recovery Action Prioritization of Geographic Areas within the ESU, criterion 1 states that recovery actions must be prioritized first 'on the eight extant populations' watersheds and associated marine areas (nearshore areas within one mile radius of the watershed's estuary). Those areas are the lower two miles of the Lilliwaup, Hama Hama, Duckabush, Dosewallips, Jimmycomelately, Snow/Salmon, Big/Little Quilcene and Union Rivers; the estuaries of those rivers; and the marine nearshore areas roughly within a one mile radius of those river mouths.

The possible additions to the criterion 1 list are the summer chum populations in Big Beef and Chimacum creeks, and (likely) in the Tahuya river. All three of these watersheds have reintroduced summer chum runs, that when established as self-sustaining, could also be vital for summer chum recovery. The addition of these populations is not presently supported by the co-manager recovery goals, which thus far address extant populations in their native watersheds. However, in view of the apparent success in re-establishing natural-origin returns, the co-managers are discussing development of specific recovery goals for the reintroduced populations. Furthermore, inclusion of the populations in recovery

criteria may be supported by the PSTRT through their yet to be completed viability analysis for the ESU.

The reintroduced populations will continue to be considered lower in priority relative to identified extant populations until co-manager and PSTRT assessments identifying their standing in ESU recovery considerations are completed. If the co-managers and PSTRT conclude that the populations warrant recovery goals, and are needed to achieve ESU viability, the populations and the watersheds they inhabit will be elevated into a priority status equivalent to the criterion 1 areas for extant populations listed previously in the SRP.

This SRP recommends that efforts be concentrated on those criterion 1 areas, until such time as the co-manager's (or future PSTRT) de-listing criteria are met for those extant stocks. The current co-manager recovery criteria for those eight extant stocks are described in detail in section 2, Goals of the Plan, 2.2.2, Co-manager (WDFW and PNPTT) Interim Summer Chum Salmon Recovery Goals. At such time when those recovery criteria are met for the eight extant stocks, then efforts in the second, third and fourth prioritized areas, described in section 3.5 should be addressed in their order of precedence.

There will be circumstances under which work in other areas, beyond those of criterion 1 and with reintroduced runs, makes sense. That could be based on the development of new information, such as a PSTRT viability analysis and new recovery goals, new opportunities that arise which cannot be foreseen at this time, or funding or policy choices that constrain actions recommended in this SRP. However, it must be said that with the limited availability of funding, time, and other resources, efforts and actions must be constrained by the fact that if recovery efforts are diffused over too much area and over too much time, our efforts could result in failure. The goal must remain focused on the de-listing of Hood Canal summer chum salmon. That is the purpose of this SRP.

This SRP contends that all of the project actions listed in each conservation unit, in sections 7-12, must be addressed. Additionally, the programmatic actions that are offered by each County in section 13, ESU-Wide considerations, must also be addressed. The completion of all the projects listed in all the conservation units without undertaking the programmatic actions listed in section 13, particularly the County actions, will not achieve recovery and de-listing. Similarly, taking programmatic actions without completing the projects will also fail to achieve full recovery. Both sets of actions are needed and must be pursued to effect the recovery and de-listing of Hood Canal summer chum. Results must be achieved in both arenas.

The implementation of project actions will proceed in the future, as it has in the past, through the HCCC's Lead Entity process. We have a very efficient process that has the involvement of numerous groups throughout the Hood Canal

watershed. Those groups have been working together in that process since 1998. That process will have to evolve to address only ESA listed species, as we are now directed to do by the Salmon Recovery Funding Board (SRFB) and NMFS, through their project funding restrictions. It will also have to evolve with the evolution of future SRFB funding of Regional Recovery Boards (the HCCC, in this case) and recovery plans like this SRP. Those funding mechanisms might include block grants for plan implementation or for projects. While the future funding structures and amounts of resources are uncertain, the HCCC intends to use our current Lead Entity structure to its fullest extent to address project implementation to fulfill this SRP. Other structures and entities, as depicted in Figure 15.1, will be needed to implement programmatic actions and prioritize those actions over time.

Sections 7-12 (the conservation units) as well as section 13 (the ESU-Wide considerations) delineate all of the projects and programmatic actions that must be undertaken to ensure the recovery and de-listing of Hood Canal summer chum salmon. Appendix D estimates funding of all of those project and programmatic actions. To achieve more specificity in terms of what actions should be done, in what order, and when, funding amounts and the timing of that funding must be made clearer with State and Federal commitments. Until those funding commitments are made, the HCCC will proceed with project selection out of this SRP through our Lead Entity process. We will proceed with the programmatic actions, particularly with the Counties, on a suasion and technical assistance basis. We will continue to work with County staffs, to support their current efforts to implement the actions committed to, or being considered by, each Board of County Commissioners as outlined in section 13 of this SRP.

15.3. Structure and mechanisms for summer chum recovery

There are a limited number of methods that can be used to implement any plan. Those methods rely either on the exercise of government authority (regulation) or through voluntary consent. Unless a federal or state agency forces the implementation of this SRP through regulatory means, which is highly unlikely, not to mention infeasible; or authority is delegated or transferred to a more local entity or government, which is also very unlikely and probably just as infeasible, then the voluntary consent method will be assumed for the implementation of this SRP.

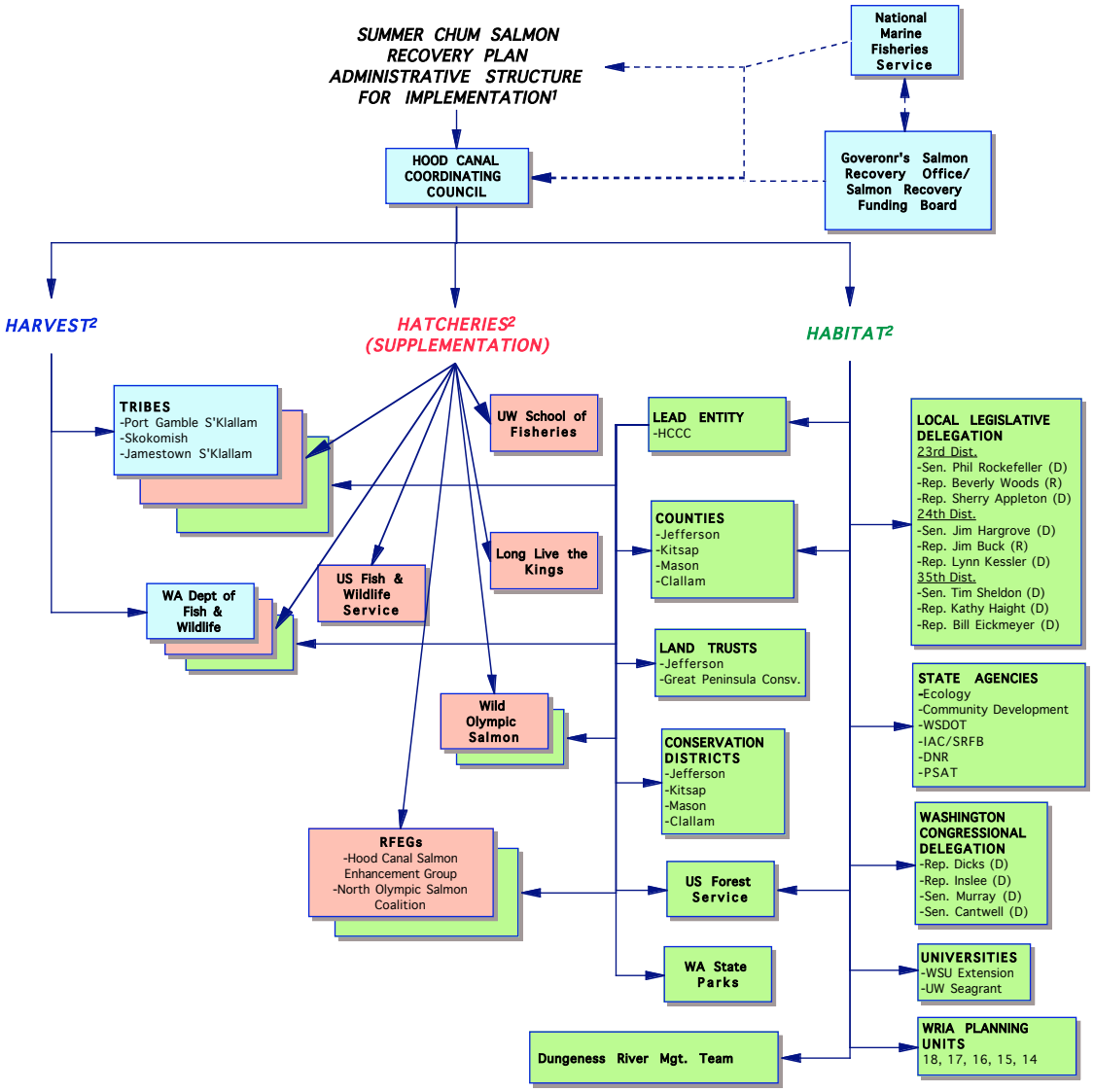
The additional assumption that is made in this SRP is that the Hood Canal Coordinating Council (HCCC) will be the focal point for its implementation. If that assumption also holds true, then the only method that can be exercised by the HCCC is the use of voluntary consent. This can be achieved by suasion; providing information through education and outreach, and providing technical assistance. It can also be gained through the provision of funding to various local groups and entities with associated contractual obligations. The former can accomplish much, but will not be enough to achieve summer chum recovery. It probably can only play a supporting role. The latter may be able to achieve the majority of what is recommended in this SRP, both for projects and programmatic actions.

15.3.1. Contractual model for implementation

If adequate funding is made available (see Appendix D regarding costs for both projects and programmatic actions) a contractual model for implementation of this SRP could be accomplished. To develop that contractual model, the currently identified actors, and their roles with regard to the various 'Hs', must be delineated. Figure 15.1 depicts a network of actors, grouped under their appropriate 'Hs', by activity, jurisdiction and function. This depiction is intended to be the 'universe' of actors that are currently identified as needed to implement all aspects of the SRP. None of these entities are required to participate in the implementation of this SRP. It is hoped that they will, through the advancement of their own agendas and missions, or through funding and contractual agreements. If some entities choose not to participate, others may be able to fill their void. Whether to participate in the implementation or not will be strictly up to each entity or organization. As the implementation process moves forward, the HCCC will be attempting to formalize relationships with these entities as their desire is determined and as our ability to offer support through funding and contracts becomes clearer.

Figure 15.1 below is a description of each of those actors. And, in Appendix D, estimated costs for many of those actors are estimated.

Figure 15.1. Network diagram of the entities/agencies needed as an implementation structure for SRP activities.



[62]This 'administrative structure' does not imply that HCCC has current authority over any of the agencies within it, nor is it meant to imply that any blanket authority should be given. It represents the 'network' of entities that, to a greater or lesser degree, have a part to play in summer chum recovery in the ESU. It does imply that some relationship needs to be developed that coordinates information about the activities of each agency that impact summer chum recovery. This structure can be developed with MOAs or other specific arrangements. HCCC currently has some MOAs or other arrangements with some of the agencies listed.

[63] This diagram groups agencies under topical areas. It is not intended to confer authority, but is merely used to show which agencies are involved in what areas of activity. All authorities exist as a matter of law and are not affected by this depiction.

In reviewing Figure 15.1, it is important to note that the HCCC has current relationships with many of the entities listed. Those relationships vary from formal MOAs to informal working relationships to very limited relationships. However, a more formal overall structure is anticipated and this network diagram and its associated descriptions are intended to form the initial basis for that structure.

While many entities are depicted and described in this section, it must be recognized that the level of effort and involvement needed from each entity for summer chum recovery varies greatly. Some entities are critical while others are more peripheral or may have a very narrow and limited role, as well as a desire to participate.

Below, each entity/agency is listed under a category or as a unique group. Each category or unique group has a description of 1) the names of the entities or groups; 2) the role they have in summer chum recovery; 3) the current relationship they have with the HCCC; and 4) what new relationship might be needed with the HCCC to implement the SRP. The order of the agencies roughly corresponds to the topical areas of habitat, harvest and hatcheries, not the level of importance or authority of that agency or group.

Lead Entity

The HCCC is the Lead Entity for the SRFB funding process for the vast majority of the summer chum ESU under RCW 77.85. The HCCC's role here is to develop and implement a strategy for habitat preservation and restoration for summer chum and other listed salmonidae within the Hood Canal watershed. We implement that strategy through the vetting of proposals for acquisition of habitat (for protection) and the restoration of habitat (through physical construction and rehabilitation projects.) Those vetted projects are then submitted to the SRFB for funding. This process forms the foundation for the suite of summer chum recovery project actions. Through this process we have an institutional relationship with our group of "cooperating partners." Those partners include: Jefferson Co. Public Works, Jefferson Co. Natural Resources, Kitsap Co. SSWM, Kitsap Co. Public Works, Mason Co. Public Works, Port Gamble S'Klallam Tribe, Skokomish Tribe, Jefferson Conservation District, Mason Conservation District, Kitsap Conservation District, North Olympic Salmon Coalition, Hood Canal Salmon Enhancement Group, Jefferson Land Trust, Great Peninsula Conservancy, Washington Department of Fish & Wildlife, US Forest Service, WA State Parks, and others. While this relationship is institutionalized, it could be strengthened with regard to summer chum recovery if we were given more control and flexibility over the funding for projects and acquisitions by the SRFB, possibly through block-granting. That increased control over funding could increase our efficiency with regard to summer chum recovery by allowing us to implement our Strategy and the SRP.

Counties

The Counties that have an impact on summer chum recovery are Jefferson, Kitsap, Mason, and Clallam. These Counties' role in summer chum recovery revolves around their control of land use in areas that constitute or affect summer chum habitat. Land uses that have the ability to most directly affect summer chum habitat tend to occur in the lower two miles of streams and rivers that empty into Hood Canal, estuaries of those streams, and marine shorelines along the Canal and eastern Strait of Juan de Fuca. The Boards of Commissioners from Jefferson, Kitsap and Mason Counties make up a significant portion of the HCCC's Board of Directors. These counties (along with the two Tribes in Hood Canal) directly govern the activities of the HCCC. In addition to this governing role of the three counties, the HCCC also has roles with the Counties through our Lead Entity process (they are also some of our "cooperating partners" - see Lead Entity section) and the Counties are subcontractors (through MOAs) in the salmon recovery planning process (with land use regulatory and GIS analyses.) While Clallam County is not a formal part of the HCCC, we have an informal arrangement with County Staff to use their completed analysis and restoration plans in the summer chum recovery plan as is appropriate. While these relationships form a significant cornerstone of summer chum recovery, we believe that an even more comprehensive and long-term relationship must be formalized to implement summer chum recovery. That would take place in the form of revised MOAs with accepted tasks and appropriate levels of funding to the Counties to address those tasks.

Land Trusts

There are two land trusts that cover the Hood Canal Watershed. They are the Jefferson Land Trust, based in Chimacum, for the eastern portion of Jefferson County, and the Great Peninsula Conservancy, based in Bremerton, for Mason and Kitsap Counties. These land trusts play a vital role in land acquisitions for preservation of habitat for summer chum. The HCCC currently has relationships with them through their participation in our Lead Entity process. They are part of our group of "cooperating partners." We believe, however, that this relationship should grow and become more formalized, as we see a larger role for their acquisition activities for summer chum habitat preservation in the future. (see Lead Entity section.)

Conservation Districts

There are three conservation districts (CDs) that cover the Hood Canal watershed. They are the Jefferson Conservation District, the Kitsap Conservation District, and the Mason Conservation District; and the Clallam Conservation District. The CDs undertake physical restoration projects that can aid summer chum. The HCCC currently has relationships with them (excluding Clallam CD) through their participation in our Lead Entity process. They are part of our group of "cooperating partners." We believe that this relationship could be

strengthened through reform of the Lead Entity process (see Lead Entity section above.)

US Forest Service

The US Forest Service (USFS) area that is in the Hood Canal watershed is managed by the Hood Canal Ranger District from the Quilcene Ranger Station. USFS lands cover a significant portion of the watershed on the west side of Hood Canal and on the south side of the Eastern Strait of Juan de Fuca. The HCCC has identified an overarching issue with regard to USFS lands in its Lead Entity Strategy and in section 13 of this SRP. That issue is the need for regular maintenance of current, and decommissioning of older, USFS roads throughout the watershed. These unmaintained roads contribute significant amounts of sediment to streams through mass-wasting events. Mass-wasting causes problems for summer chum by filling-in spawning gravels with silt in streams on the west side of Hood Canal and the south side of the Eastern Strait of Juan de Fuca. The HCCC has a current relationship with USFS as one of our "cooperating partners" in the Lead Entity process (see Lead Entity section above.) They are also an ex-officio member of the HCCC and we have had a long-standing relationship with them when we were housed in their Quilcene facility. While our formal relationship is limited, we are interested in helping USFS obtain funding to address their road maintenance problems and will work with them and the Congressional Delegation to further that effort in the future.

Washington State Parks

There are a number of State Parks in the Hood Canal summer chum ESU. They are: Belfair, Twanoh, Potlatch, Triton Cover, Scenic Beach, Dosewallips, Kitsap Memorial, Shine Tidelands, Anderson Lake, Mystery Bay, Fort Flagler, Fort Worden, and Old Fort Townsend. State Parks undertake physical restoration projects on their lands that can aid summer chum. The HCCC currently has relationships with some of these parks through their participation in our Lead Entity process. They are part of our group of "cooperating partners." We believe that this relationship could be strengthened through reform of the Lead Entity process (see Lead Entity section above.)

Dungeness River Management Team

The Dungeness River Management Team (DRMT) was formed in 1988 by Clallam County as a partnership for individuals and stakeholders to work together to develop and implement locally based, long-term solutions to watershed management issues. The Dungeness River watershed is included in the summer chum salmon ESU, but the current and historic status of summer chum in the Dungeness River is unclear. The DRMT is developing a recovery plan for Chinook in the watershed and it is likely that any resulting habitat restoration and protection will also benefit summer chum. Though not a member of DRMT, the HCCC indirectly works with some of its members, including Clallam County, the Jamestown S'Klallam Tribe, and WDFW. We are using information and analyses

developed by DRMT for the SRP. It may be desirable, in the future, to establish a formal relationship with DRMT to exchange information and to coordinate efforts.

Local Legislative Delegation

The local Washington State Legislative Districts include District 23 with Senator Phil Rockefeller (D), Representative Beverly Woods (R), and Representative Sherry Appleton (D); District 24 with Senator Jim Hargrove (D), Representative Jim Buck (R), and Representative Lynn Kessler (D); and District 35 with Senator Tim Sheldon (D) (who also chairs the HCCC as one of the Mason County Commissioners), Representative Kathy Haight (D), and Representative Bill Eickmeyer (D). These local members of the Legislature have two roles in salmon recovery. They have a stake in funding for Hood Canal summer chum salmon recovery as well as legislation that might facilitate that recovery. While the HCCC has not worked closely with them in the past, we intend to build our ties with them and keep them briefed on summer chum recovery efforts in the future.

State Agencies

The State agencies, aside from WDFW, that are primarily needed to support summer chum recovery, are the Department of Ecology (Ecology), the Department of Transportation (WSDOT), the Department of Natural Resources (DNR), the Department of Community, Trade and Economic Development (CTED), and the Puget Sound Action Team (PSAT).

Ecology has two roles that are important to summer chum. The first relates to setting instream flows. They are currently supporting WRIA planning processes to do this (see WRIA Planning Units section), however, if these processes do not accomplished their mission, Ecology is the entity that is ultimately responsible for setting instream flows. Ecology also is involved in the development of local shoreline master programs (SMPs). Summer chum are highly dependent on intact shoreline habitat in the rearing phase of their life history. Support from Ecology with regard to protecting shorelines through these SMPs is critical.

WSDOT is the owner and responsible party for the highway 101 causeways and bridges along the west side of Hood Canal and the south side of the Eastern Strait of Juan de Fuca. These earthen-fill causeways have severely constrained the ecological functions of each of the major, and many minor, estuaries that they cross. Addressing these impacts is critical for summer chum recovery.

DNR is developing an HCP for their aquatic lands throughout the State. These lands include summer chum habitat in estuaries and marine nearshore areas throughout Hood Canal and the eastern Strait of Juan de Fuca. It is critical that this HCP includes high levels of protection for these areas, particularly in the nearshore.

CTED's role in supporting summer chum habitat relates to their participation in the development of local critical areas ordinances. As we have said, with regard to summer chum, we are focusing on the lower two miles of

streams throughout Hood Canal and the Eastern Strait of Juan de Fuca as the primary habitat needed by summer chum. As CAOs can help protect that habitat, CTED can help in that arena.

PSAT's role with regard to summer chum is similar to the Universities' and the Conservation Districts' roles (see the Universities and Conservation Districts sections.) PSAT has no regulatory authority and is primarily an education, outreach and technical support provider.

Each of these state agencies is an ex-officio member of the HCCC. Their participation on the HCCC Board has varied over time based on their interest in the issues that the HCCC has addressed. We believe that state agency involvement with the HCCC needs to be reinvigorated to help address some of the problems we have identified for summer chum in each of their respective areas.

Local Congressional Delegation

The local Congressional delegation consists of Congressman Norm Dicks, Congressman Jay Inslee, Senator Patty Murray and Senator Maria Cantwell. Their role in summer chum salmon recovery is twofold. They have a role in Congressional funding of recovery efforts as well as encouraging federal agencies to work with local groups, agencies and governments in recovery efforts. As with the Washington State Legislative delegation, the HCCC has not worked closely with our Congressional representatives in the past, but we are intent on building our ties with them and keeping them briefed on summer chum recovery efforts in the future.

Universities

There are two University entities involved in environmental issues in Hood Canal. They are the University of Washington SeaGrant and Washington State Extension programs. SeaGrant has offices in Kitsap and Mason Counties and Extension has an office in Jefferson County and an office in Thurston County that covers the south end of Hood Canal. SeaGrant is focused on the marine and nearshore areas of the Canal and Extension looks upland to terrestrial areas that impact Hood Canal. Both entities have field agents that work closely with local groups, agencies and governments on environmental outreach, information, education and technical assistance. That role aids summer chum salmon recovery in general. The HCCC has informal relationships with both entities and has participated in joint education and outreach ventures with them at various times. We believe that this connection should be strengthened and that the abilities of both entities could be brought more directly to bear on assisting with summer chum recovery.

WRIA Planning Units

There are portions of five Water Resource Inventory Areas (WRIA) that are within the Hood Canal summer chum ESU. They are: WRIA 18 Dungeness, WRIA 17 East Jefferson, WRIA 16 Skokomish-Doeswallips, WRIA 15 West Kitsap, and

WRIA 14 Kennedy-Goldsborough. Each WRIA has established a Planning Unit under the Watershed Planning Act (RCW 90.81.) The primary issue that the WRIA groups address, that could have an impact to summer chum recovery, is in-stream flow. The most immediate flow issue for summer chum is in the Quilcene River in WRIA 17. The HCCC is monitoring WRIA 17 progress on setting in-stream flows, as well as other WRIA groups' in-stream flow setting activities, and will interact with those Planning Units at the appropriate time. We have no formal relationships established with the WRIA Planning Units at this time because they are not making significant progress on setting in-stream flows. If that situation changes, the HCCC may need to establish a more formal link with the appropriate WRIA Planning Units. However, while WRIA planning is important for other matters and for other species, it will probably not have an overall impact on the recovery of summer chum unless flows are not protected from significant new withdrawals.

Tribes

There are five Tribes that have fishing rights in the Point No Point Treaty area (of which the Hood Canal is a part.) The Port Gamble S'Klallam and Skokomish Tribes have reservations in the Hood Canal watershed; they also have harvest and hatchery/supplementation authority over summer chum as part of the co-management authority they share with WDFW. Three other Tribes (Suquamish, Lower Elwha Klallam and Jamestown S'Klallam) are also involved in the development of harvest and hatchery management regimes for fish originating in the Hood Canal watershed.

The Port Gamble S'Klallam and Skokomish Tribes (along with the three Counties in Hood Canal) are on the HCCC Board of Directors and directly govern the activities of the HCCC. Those two Tribes are also involved in our Lead Entity process and undertake physical restoration and acquisition projects for summer chum habitat (they are part of our "cooperating partners" group - see Lead Entity section).

The Jamestown S'Klallam Tribe is directly involved in the restoration of Jimmycomelately Creek, which supports a targeted stock of summer chum salmon in the eastern Strait of Juan de Fuca. Currently HCCC does not have any formal relationship with the Tribes outside of Skokomish and Port Gamble S'Klallam as described above. Informally HCCC staff has discussed the Jimmycomelately restoration project with the Jamestown S'Klallam Tribe and has exchanged information. HCCC does not anticipate needing to alter the current informal relationship with the Jamestown S'Klallam Tribe in order to implement the SRP. HCCC also does not have formal relationships with the Lower Elwha Klallam or Suquamish Tribes and does not anticipate a change to that situation. The Point No Point Treaty Council provides fishery management support to the Port Gamble S"Klallam and Jamestown S'Klallam Tribes. The support involves harvest and hatchery management issues as well as habitat-related research.

Treaty Council staff was major contributors to the SCSCI and continue to provide support to the co-managers summer chum management efforts. The HCCC does not have a formal relationship with the Treaty Council and does not anticipate a change to that situation.

The primary issue for summer chum recovery involves harvest and hatchery management. In general, all western Washington Tribes are involved in the development of these management regimes with the lead given to those Tribes that are most directly impacted by those management provisions. The Skokomish and Port Gamble S'Klallam are those primary Tribes in Hood Canal. In the eastern Strait of Juan de Fuca, those Tribes are the Port Gamble S'Klallam, Jamestown S'Klallam and the Lower Elwha Klallam.

HCCC will continue to work closely with the Skokomish and Port Gamble S'Klallam Tribes and does not anticipate a need to alter that current relationship in order to implement summer chum recovery. HCCC will need to coordinate and exchange information with the co-managers (WDFW, Skokomish, Port Gamble S'Klallam) relative to harvest and hatchery impacts and interactions with summer chum production and habitat. All of the 'Hs' will need to be addressed in summer chum recovery.

WDFW

The Washington Department of Fish and Wildlife (WDFW) is a co-manager with the Point No Point Treaty Tribes (primarily the Port Gamble S'Klallam and Skokomish Tribes – see the Tribes section.) WDFW's Region 6 Fish Management Program is the administrative unit and is that agency's lead in the Hood Canal and the eastern Strait of Juan de Fuca. They also have various science staff, based in Olympia, that are involved in activities in Hood Canal. WDFW (as a co-manager) has responsibility and authority for the development of harvest and hatchery management regimes that directly impact summer chum salmon. WDFW also has a primary responsibility with regard to the development of restoration projects, habitat assessments and issuance of HPAs that impact summer chum. Finally, WDFW has an on-going role in the analyses, monitoring and adaptive management of their activities. WDFW is currently an ex-officio member of the HCCC and participates in our Lead Entity process to gain funding for some of its projects. We will need to strengthen those bonds and continue to coordinate and exchange information with WDFW relative to summer chum recovery.

UW School of Fisheries

UW School of Fisheries has a hatchery facility on Big Beef Creek that is used by WDFW, in cooperation with the HCSEG, to incubate, rear, and release summer chum juveniles. Summer chum produced at the UW site are collected as progeny from reintroduced adult returns trapped in WDFW's weir at the mouth of Big Beef Creek. UW also owns a spawning channel adjacent to the creek that is

currently being used by NMFS staff to study the relative spawning success and productivity of hatchery and natural-origin summer chum salmon. Although the HCCC has no formal relationship with the UW School of Fisheries, WDFW, as the primary operator of the program at the location, will serve as the logical contact for information regarding the status of the reintroduction program, and research findings that may be of assistance in recovery planning.

Long Live the Kings

Long Live the Kings (LLTK) has a hatchery facility on Lilliwaup Creek. That hatchery raises summer chum for release as broodstock for supplementation in the Lilliwaup watershed. HCCC will need data about that supplementation program, but we anticipate obtaining the information from WDFW and NOAA Fisheries as needed for summer chum recovery planning and monitoring. At a larger scale, LLTK is the third party facilitator and project manager for the Puget Sound and Coastal Hatchery Reform Project underway in partnership with the co-managers. That project involves changes to hatchery programs throughout western Washington. The Hatchery Scientific Review Group (coordinated by LLTK) has developed recommendations for hatcheries in Hood Canal and the eastern Strait of Juan de Fuca. The implementation of those recommendations is subject to review and approval by the co-managers and USFWS, who have management authority for hatchery programs in the region. The summer chum salmon supplementation and reintroduction approach, including attendant monitoring and evaluation actions, was endorsed through the review conducted by the hatchery reform group. HCCC will need information about this activity but we also anticipate this will largely be obtained from the co-managers. The HCCC has no current formal relationship with Long Live the Kings, however, this may change in the future if beneficial for overall hatchery reform in Hood Canal.

US Fish & Wildlife Service

The US Fish & Wildlife Service has a hatchery facility on the Big Quilcene River. The federal hatchery supplemented the native Quilcene summer chum salmon population through releases into the Big Quilcene River from 1992-2003. The program was terminated in brood year 2003 after twelve years of operation, consistent with criteria set forth in the SCSCI. The HCCC has no formal relationship with the US Fish & Wildlife Service and we do not see a need for a change in that situation. We will need data about supplementation. However, we can obtain supplementation data from WDFW and NMFS as needed for summer chum recovery planning and monitoring.

Regional Fisheries Enhancement Groups

There are two RFEGs operating in Hood Canal. One is the Hood Canal Salmon Enhancement Group (HCSEG), which operates from the Hood Canal Bridge southward. The other, North Olympic Salmon Coalition (NOSC), operates from the Hood Canal Bridge northward. The RFEGs have two roles in summer chum recovery. They are substantial participants in the HCCC's Lead Entity process

and sponsor many habitat restoration projects in each SRFB funding cycle. They are also sponsors of summer chum supplementation projects. NOSC participates in supplementation in Jimmycomelately Creek. HCSEG participates in supplementation in the Union River, Lilliwaup Creek, Tahuya River and the Hama Hama River. The HCCC has a relationship with both RFEGs through our Lead Entity process. We do not have a relationship with them in their supplementation activities. We do not see a need for a change in our current relationship with the RFEGs (see Lead Entity section.) We will continue to interact with them in the Lead Entity process and encourage them to pursue summer chum projects and projects for the other listed species in Hood Canal. We will need data about supplementation, however, we can obtain that data from WDFW and NOAA Fisheries as needed for summer chum recovery planning and monitoring.

Wild Olympic Salmon

This group is a volunteer community environmental group that has been instrumental in salmon restoration and protection projects in the Salmon Creek Chimacum Creek watersheds. They have been partners in our Lead Entity process in the past. We anticipate that they will remain as a participant in that process in the future. We do not anticipate a change in that relationship.

Other Processes and Forums

There are other forums, groups, agencies and processes that either have jurisdiction over, or an impact on, Hood Canal summer chum salmon recovery. There are federal, bilateral and international management regimes and treaties that address these fish when they are in waters of the United States, Canadian waters and international waters. Thoroughly addressing those treaties and management regimes is beyond the scope of this SRP and would be redundant. Also, most of those processes are beyond the ability of any local implementing entity to participate in or to affect.

15.3.2. Regional governance

In the 2005 State Legislative session, ESHB 2097, the Hood Canal Management bill was passed. That bill statutorily recognized the Hood Canal Coordinating Council as the local 'management board' for aquatic rehabilitation zone one (Hood Canal) to address the low dissolved oxygen problem. It also recognized the HCCC, in statute, as the Lead Entity and Regional Recovery Organization for salmon, in Hood Canal, as well as the Inter-WRIA Coordination entity in Hood Canal. Each of these new authorities conferred in statute affirms the Hood Canal Coordinating Council's central place with regard to environmental issues in the Canal. The Lead Entity and Regional Recovery Organization language also cements the HCCC's role in salmon recovery, in particular with regard to summer chum.

Additionally, ESHB 2097 required the HCCC to assess regional governance options by the end of 2007 to present to the HCCC Board of Directors for their decision making. The structure and functions of the HCCC could change, even drastically, in this governance assessment process. And, while the ultimate outcome of that process is unknown at this time, the possibility that this assessment process could address salmon recovery implementation more directly and formally is conceivable.

15.4. Funding summer chum recovery

15.4.1. Funding Needs

This SRP combines a variety of different types of actions into a coordinated program to protect and improve salmon stocks in the basin. Each type of action – habitat restoration, hatchery improvements, and many others – comes at a price. One of the most important aspects of the SRP is the financing strategy to ensure that funding is available where and when it is needed to support the recommendations in the SRP. This section describes a fundraising strategy to support the needs of the SRP.

The SRP is particularly strong on the identification of habitat restoration needs for summer chum salmon. A total of 107 projects have been proposed for implementation. Cost estimates were prepared for the majority of proposed projects[64], and the total estimated cost of the 78 habitat projects that estimates were prepared for is $101 million[65]. Several projects proposed in the SRP were not estimated due to their high individual cost and complexity. The costs of these projects could add 30% to 40% to this estimate.

[64] This work was done by Evergreen Funding Consultants in late 2004.
[65] See Appendix D for further information on costs.

In addition, the cost of various non-capital needs has been estimated using a spreadsheet model. The model estimates costs associated with staffing that is directly associated with implementation of the SRP, including design, permitting, and management of capital projects, interagency coordination, and some monitoring activities. The total cost of these actions has been estimated at an average of $314 thousand per year or $3.1 million for an initial ten-year implementation period. Of this, the portion unmet by current funding sources is estimated at $146 thousand per year or $1.5 million total for an initial ten years of SRP implementation.

A third category of costs was not estimated. These are related to activities that support salmon recovery but are not exclusive elements to a recovery strategy. Examples include actions to prepare land use plans, enforce regulations, and address water quality and stormwater capital needs. While important to successful implementation of the SRP, these actions have much wider objectives and benefits than salmon recovery and it is impractical to estimate the costs attributable to the SRP at this time. As implementation of the SRP begins, the HCCC will be working with those local governments to assess their costs, more specifically, and attempt to help with those costs as is feasible under the constraints of the funding sources we are able to access.

Finally, there are several elements in addition to this SRP that are currently uncertain. Recovery actions for chinook and bull trout may fall to the HCCC. And costing for those actions has not been included in this SRP.

In summary, the costs of the initial ten-year implementation of the Hood Canal salmon recovery strategy are estimated as follows:

Summer chum habitat projects (estimated in detail)	= $101 million
Other summer chum projects (rough estimate)	= $ 30 million
Non-capital costs (estimated in detail)	= $ 3.1 million
Continuing agency/organization costs (rough estimate)	= $ 2 million
TOTAL APPROXIMATE COSTS	= $136.1 million

15.4.2. Current Availability of Funding

Funding is currently provided to salmon recovery actions through a variety of federal, state, local, tribal, and private funding sources. The following information estimates annual spending in recent years by funding source.

Federal: The principal source of federal funding for salmon recovery in the Hood Canal basin in recent years has been the Salmon Recovery Funding Board grant program. This program, financed through annual appropriations to NOAA/NMFS, has provided an average of $1.6 million per year for Hood Canal projects in the

period 1999 to 2004. Other federal grant programs have provided some additional funding, but funding from these sources has been sporadic.

State: The SRFB funding cited previously includes a state share that averages approximately one-third of total SRFB awards. In addition, the state has funded several projects through the Washington Wildlife and Recreation and Department of Ecology grants programs. Annual funding from state grant sources is on the order of $1.5 to 2 million.

Local: Local funding for salmon recovery is supplied by a variety of programs and resources, most notably Conservation Futures Taxes, surface and storm water utility assessments, Conservation District Assessments, and specified county funds. A total of approximately $3 million per year is currently spent on salmon-related projects and activities in counties within the HCCC operating area. Some local funding sources are guaranteed for perpetuity with opportunities to change rates, while others are subject to local, state, and federal budgets and are not guaranteed long-term options.

Tribal: Spending by local tribes on salmon recovery is both variable and unquantified at this time. Activities range from assessments and riparian plantings to large-scale capital projects. While no capital costs have been identified, it appears that most recovery projects fall within a range of $300,000 to $1M, with several projects planned annually by local tribes. Total tribal spending is estimated at $1.5 million per year.

Private: Spending by private entities, including homeowners, conservation organizations, other businesses, and private industry, has been grossly estimated at $2.5 million annually. Actions that are supported privately include land protection, mitigation for private development actions, voluntary conservation actions, and compliance with regulatory requirements.

Total Annual Spending: Total spending from these sources is estimated as shown in Figure 15.2 below.

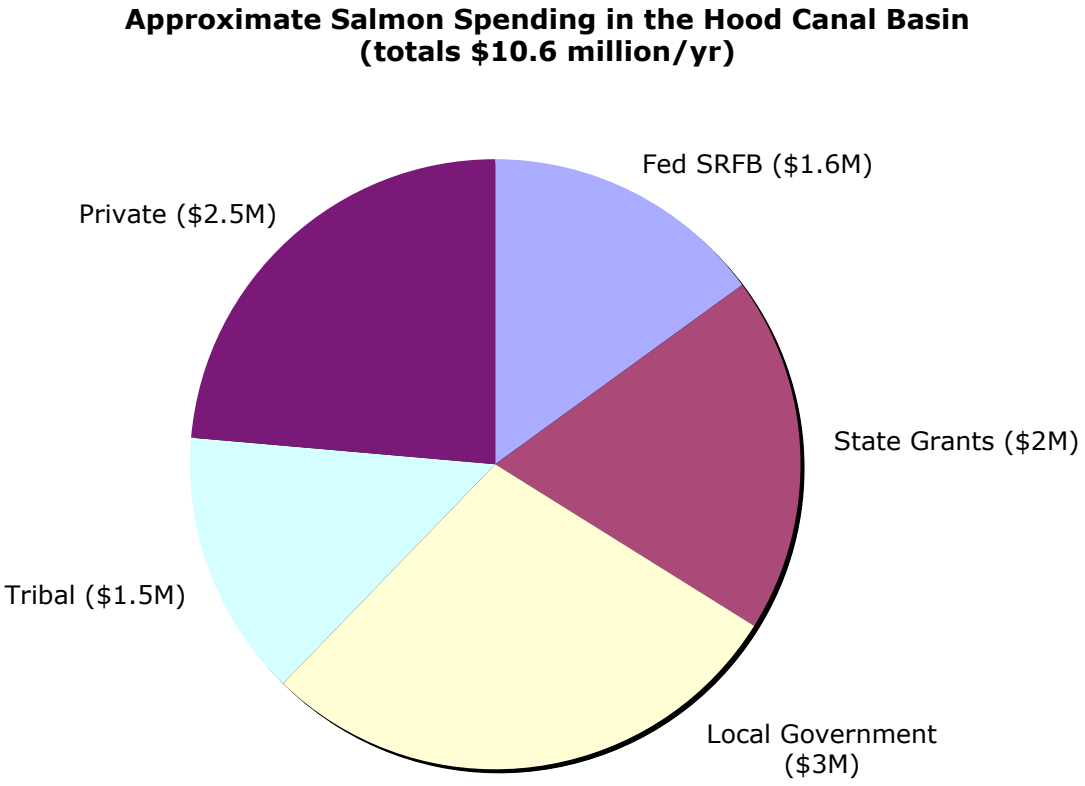


Figure 15.2. Spending on salmon in Hood Canal.

Sustainable Annual Spending: Recent spending patterns may not be sustainable over time. Since the ESA listings, spending has climbed to levels that are considerably higher than historic spending levels. The majority of this funding has been provided through annual budget appropriations by the federal, state, and local governments rather than dedicated funding sources. As a consequence, recent levels of funding may be difficult to sustain in coming years. While it is unlikely that all current sources would disappear in coming years, it is probably prudent to assume that the baseline funding level - the total sustainable funding level from the suite of sources that are currently used – is 60 to 75% of recent high levels, or $6.4 to 8.0 million per year.

15.4.3. Fundraising Options and Proposed Strategy

As the forgoing discussion demonstrates, funding needs associated with full implementation of the SRP (at approximately $161 million total or an average of $16.1 million per year) exceed the expected availability of funding at the baseline funding level (at $6.4 to 8.0 million per year).

Solutions to this shortfall include raising additional funding, reducing the number of actions to be implemented, or a combination of the two. For the purposes of this chapter, it is assumed that the partners to the SRP would prefer to attempt to raise sufficient funding to fully implement the SRP, and this is the goal proposed for the fundraising strategy.

15.4.3.1. Context for the fundraising strategy

The Puget Sound Shared Strategy group, a coalition of agencies, organizations, tribes, and business interests that are developing a recovery plan for Puget Sound Chinook salmon, has been developing a fundraising strategy for the Puget Sound chinook recovery plan that provides a useful context for the Hood Canal fundraising strategy. The Shared Strategy proposal assumes the following:

a. That each watershed will use a combination of chinook regional, watershed, and local funding to address watershed needs and priorities.
b. That chinook regional funding will be raised from state and federal grant sources – particularly SRFB funding – and distributed per PSTRT criteria.
c. That watershed funding will be raised from redirection of mitigation and settlement sources and from basin-specific federal appropriations.
d. That local funding will be raised from general funds, utility revenues, and special assessments from the local governments within each watershed.
e. That the combination of chinook regional, summer chum regional, and watershed funding will fall short of full funding of this SRP.

<u>Options for the fundraising strategy</u>

Several options exist for how to raise additional funding for the implementation of the SRP. Those options are summarized below.

a. Directed salmon appropriations from federal and state sources

Directed appropriations to the SRFB have been crucial to early habitat work in the Hood Canal watershed and throughout Washington State. Since 1999, the federal government has contributed more than $140 million to salmon recovery projects in Washington and the state has provided $71 in match. SRFB funding has been provided through the four- and now five-state Pacific Coastal Salmon Recovery Fund, an annually appropriated special fund in the NOAA Fisheries budget. It has been available largely due to the political clout of the Alaska and Washington Congressional delegations.

The Pacific Salmon program has not been without controversy in Congress. It is the largest program of its kind in the NOAA budget and members of Congress from other states have become increasingly concerned about continuing a

program of that size. Key members of the Washington delegation suggest that maintaining the fund will be much harder in future sessions and further growth in funding levels should not be expected.

There are other sources of federal appropriations that may be brought to bear for this SRP. Recent interest in low dissolved oxygen issues in the Hood Canal watershed could present an opportunity for new water quality sources through the EPA and other federal agencies. It remains to be seen whether there is sufficient linkage between the SRP and the solution to the hypoxia problem to allow implementation of SRP actions with this funding. The Shared Strategy is investigating federal appropriations for on-farm conservation actions, which might be a promising source for the small number of farms within the Hood Canal watershed.

Directed state appropriations have been a smaller contributor to salmon recovery funding in recent years, averaging $6 to $10 million annually in funding to the SRFB. In addition, the state has provided funding for the lead entity functions, for the regional fisheries enhancement groups, and for state staff support with various aspects of recovery planning, particularly the development of hatchery and harvest elements.

As the state economy shows signs of improving and the 2005 legislative session ends on a promising note for salmon programs, it seems reasonable to consider additional state appropriations in a more favorable light than in recent years. These appropriations would likely come through the SRFB budget, although there also seems to be a growing interest in new Puget Sound initiatives in the Governor's office and this may open new conduits for state funding of salmon recovery efforts.

In all likelihood, state funding would be made available at a statewide or regional basis and participants in the Hood Canal, as now recognized as a regional recovery organization in ESHB 2097, would need to compete for a share of that money. Additionally, given that Hood Canal and the Strait of Juan de Fuca are considered two of the five important subregions for chinook recovery in Puget Sound, and that the subregions together comprise the complete ESU for federally listed summer chum, jurisdictions in the SRP region should be in a good position to compete successfully for funding.

Highway 101 culvert replacement projects look feasible for funding from the USFWS Fish Passage grant program. Causeway removal, bridge span extensions, road elevation, fill removal, and road relocation projects may be best funded through appropriations, given the large price tag and limited transportation funding options. Transportation enhancement (TE) money can be used to fund projects falling into targeted categories, one of which includes environmental mitigation of runoff pollution and provision of wildlife connectivity.

The WA state TE program requires a 13.5% match for projects that strengthen the cultural, aesthetic, and environmental aspects of the transportation system. Approximately $42M has been available for all of Washington from 2004-2006. In summary, prospects for continuation of federal SRFB appropriations are fair to good, for directed water quality appropriations to Hood Canal. Prospects for increased state funding of the SRFB are very good to excellent. The Hood Canal region has very good prospects for competing successfully for SRFB funding. Prospects for directed transportation dollars are fair to good.

a. Other federal and state grants

A variety of other federal and state grant programs have some promise for use in implementing this SRP. On the federal side, the US Fish and Wildlife Service offers a number of well-funded programs aimed at restoration of fish and wildlife species other than salmonids. Most notably of those is the Cooperative Endangered Species Account grant program. Some SRP projects could be eligible if reframed. The Corps of Engineers also offers a number of restoration programs on a cost-shared basis. While not grant programs in the strictest sense, the Ecosystem Restoration Continuing Authority Programs (better known as the 1135 and 206 programs) and the Puget Sound and Adjacent Waters restoration program have potential, particularly for the larger and more complex projects in the SRP. Finally, a variety of EPA grant programs may be appropriate for water quality issues in the region and there may be opportunities for combined water quality and habitat projects.

With regard to state grant programs, there are several good options. For habitat restoration, the Washington Wildlife and Recreation Program is one of the best funded grant programs in the state. The Aquatic Lands Enhancement Program and Family Forest Fish Passage programs may also be promising, although their smaller size will increase competition and decrease awards. On the water quality side, the section 319 and State Revolving Fund programs are also possibilities.

In summary, prospects for federal and state grants from the USFWS and WWRP programs are very good to excellent. Prospects for other grant sources are fair to good.

b. Mitigation

One promising but largely untapped source is mitigation funding. Public and private development projects that result in impacts to wetlands, streams, and other environmental features are routinely required by regulators to replace or restore similar features on the project site or nearby, and this practice is known as mitigation. Since federal guidelines were released in 1990, the most common practice has been to mitigate impacts through on-site actions, but a growing body of evidence suggests that pooling mitigation funds and applying them to larger,

more promising locations is likely to result in improved environmental performance at a reduced cost.

This approach has some promise in the Hood Canal watershed. A variety of public agencies plan capital improvements in the watershed that are likely to trigger mitigation requirements. State and federal agencies have a number of highway projects proposed within the watershed, including significant repaving and reconstruction work on US 101, SR 104, SR 3, and numerous other roads (for further information on upcoming projects in the Hood Canal basin, see the WSDOT website at http://www.wsdot.wa.gov/projects/cipp/). In addition, local governments within the basin intend to construct or upgrade a variety of capital facilities in Hood Canal in coming years.

The redirection of mitigation funding from local capital improvement projects is assumed to be the responsibility of local governments, while mitigation funds from state and federal sources will be pursued by at a regional level in partnership with local jurisdictions. A rule of thumb in common use is that mitigation funding averages ten percent of the overall cost of capital projects that have on-the-ground impacts[66]. It is reasonable to estimate that between five and ten percent of mitigation funding, or one-half to one percent of total capital costs, could be reallocated to actions recommended in the Hood Canal salmon SRP.

In summary of prospects for redirection of mitigation funding from local, state and federal sources are fair to good.

c. Local appropriations

There are nine local general-purpose governments in the Hood Canal basin, including Jefferson, Kitsap, and Mason Counties, as well as many special-purpose districts developed for fire protection, drainage system development and maintenance, and many other purposes. Many local agencies have provided some funding to salmon recovery actions in recent years, with Kitsap and Jefferson Counties being especially active in cosponsoring projects through the SRFB and other grant sources.

The most commonly used funding sources employed by Hood Canal local governments are Conservation Futures Taxes and surface/storm water utility assessments. Other sources that have been used less routinely are conservation district assessments, general fund revenues, Title III money, and other utility fees.

[66] Capital programs may include items such as transit vehicles that have no on-the-ground impacts and should be excluded from consideration.

It is likely that additional funding will need to be raised to achieve full implementation of the SRP. Additional federal and state project funding will typically require local match of between 15 and 35% of total project costs and it is likely that state and federal fundraising will fall short of targets given the constraints already discussed.

If necessary, local governments could raise additional funds through a variety of sources. Most common are the conservation district assessments, real estate excise taxes, and conservation futures taxes. The final local source that is widely used for salmon recovery is utility fees, with stormwater utilities frequently used as a local funding source for salmon projects. A table describing sources in common use by Hood Canal governments follows.

Table 15.1. Currently used local funding sources for salmon activities.

Local Entity	Current Funding Sources
Jefferson County	Conservation Futures Program; Natural Resources Fund; Secure Rural Schools & Community Self Determination Act of 2000
Kitsap County	Conservation Futures Fund; Surface/Storm Water Management Fund; Kitsap Public Utilities District Assessment
Mason County	Conservation District Assessment

In summary, prospects for continued use of existing local government funding sources are good to very good. Prospects for increased funding from existing sources and use of untapped local authorities are fair.

d. New multi-jurisdictional sources

One of the constraining factors in the use of local funding to support some of the costs of salmon recovery actions is that local sources are rarely transferable across jurisdictional boundaries. Local governments that have many proposed projects may not have the local tax base to support them, and others may have more funding available than is needed to support projects within their jurisdictions.

It seems likely that there will be mismatch between project location and funding availability in the Hood Canal watershed. The majority of local funding is raised and spent in Kitsap County while the recommended projects appear to be concentrated on the west side of the Canal.

If needed to increase the "portability" of funding or to raise additional funds[67], the Hood Canal partners may need to investigate options for collecting funding across their jurisdictions. Among options that are actively being discussed elsewhere in the Puget Sound region are interlocal agreements and special watershed districts to collect and distribute funding among local jurisdictions. Current prospects for public enactment of new local tax-based sources are considered poor to fair.

15.4.3.2. Proposed fundraising strategy

Fundraising is an inexact science. Funding sources come and go, allocation criteria change, and funding levels rise and fall. The fundraising strategy must be flexible and adaptable, and revised as needed to address the inevitable changes in funding sources. The following strategy is intended as an initial proposal based on funding circumstances as they exist at this time. Recommendations on its evolution are also described.

The following table 15.2 identifies annual funding goals by source for the eight sources incorporated into this funding strategy.

Table 15.2. Summary of annual funding goals.

Source	Current	Goal	Activity Supported
Salmon Recovery Funding Board	$1.6	$4.1	Habitat projects
Fed and State Appropriations	$0.0	$1.5	Hwy 101 retrofits, habitat projects
Other State and Fed Grants	$2.0	$2.0	Habitat projects
Mitigation	$0.0	$1.0	Habitat projects
Local Appropriations	$3.0	$3.0	Non-capital responsibilities, habitat project match
New Multi-Jurisdictional Sources	$0.0	$0.0	N/A
Tribal	$1.5	$2.0	Hatchery capital and operating, fisheries regulation
Private	$2.5	$2.5	Land acquisition, habitat project match
TOTAL	$10.6	$16.1	

[67] In some circumstances, a unified campaign for a new multi-jurisdictional source may be more politically palatable and fruitful than having each local government pursue additional funding independently.

15.4.4. Roles and responsibilities in Executing the Fundraising Strategy

The execution of the fundraising strategy for the Hood Canal SRP will require actions at the regional level, the watershed level, and within each participating jurisdiction and organization. The following discussion identifies the principal responsibilities at each level as well as the coordination among them to execute the fundraising strategy.

15.4.4.1. Actions at the Puget Sound chinook ESU level

The Hood Canal watershed is one of fourteen that comprise the Puget Sound chinook ESU. Action at this level will be needed for chinook that will help Hood Canal chinook, as well as summer chum.

The principal regional roles for both Hood Canal chinook and summer chum in fundraising are:

a. To coordinate support for state and federal funding;
b. To help access mitigation funding from state and federal projects; and
c. To undertake some grant writing responsibilities.

The strategy for state and federal funding relies in large part on annual appropriations in the state legislature and Congress. The three essential characteristics that are needed to make these efforts a success are (a) services to provide information to lawmakers in Olympia and Washington DC, (b) a strong coordination effort within the region to keep partners on a common track and message, and (c) a communications program to broaden public and political constituencies. Some of this effort will take place for chinook, and the Hood Canal region will benefit from that effort. Some of that effort may need to be undertaken by the HCCC and its member governments directly.

Just as it is likely to be more efficient to provide lobbying efforts at a regional scale, the major policy and political work needed to open mitigation funding for use in salmon recovery will require a regional campaign. The principal challenges to be addressed are the hesitancy of regulatory agencies, the complexities of identifying priority areas for transferred mitigation actions, and the need for broker/banker functions to put “sellers” and “buyers” of mitigation actions together. Again, some of this effort will take place for chinook, and some for summer chum. The Hood Canal region will benefit from both efforts.

The final regional function of crucial importance to the Hood Canal SRP is grant-writing. There are several circumstances in which grant-writing for chinook recovery could be helpful to the Hood Canal. These circumstances include where the grant proceeds are to be distributed across the chinook region, where

grant procedures are unusually complex, and where there is less capacity at more local levels.

The functions of importance in the regional role are strong research capabilities, familiarity with a variety of public and private grant sources, and excellent grant-writing skills. It would be desirable if these functions were available to recovery agencies in the Hood Canal watershed on an "on-call" basis.

15.4.4.2. Actions at the Hood Canal summer chum ESU level

There are several elements of the fundraising strategy that would benefit from continuing coordination among agencies, tribes, and organizations at the Hood Canal scale:

a. Seeking Hood Canal-specific appropriations;
b. Developing proposals for Hood Canal-specific grants;
c. Assistance with chinook ESU scale lobbying strategies; and
d. Coordination of local government fundraising efforts to sustain watershed capacity.

There will be a need to seek state and federal appropriations and grants specifically for the implementation of this SRP. That will entail briefings with delegation members and staff, development of information materials on Hood Canal needs, and contact with delegation members during budget processes. While this function could be fulfilled by individual jurisdictions, it would be useful and efficient to staff this effort at the Hood Canal regional level. Staffing for these needs could be provided through the Hood Canal Coordinating Council or by an individual agency or organization acting on behalf of the basin as a whole.

There may be actions that the Hood Canal SRP partners wish to sustain at the joint expense of participating agencies, tribes, and organizations. For instance, continued studies, planning, and/or monitoring may require capacity at the Hood Canal regional scale. While the Hood Canal partners have been successful at securing state and federal funding for these activities in the past, it may be necessary to consider interlocal agreements or other joint fundraising vehicles to sustain these functions into the future.

<u>Actions at the individual agency, tribe, or organization level</u>

While fundraising strategies at the chinook and summer chum ESU scales are expected to raise a major portion of total funding needs to implement the SRP, some responsibilities will fall to individual agencies, tribes, and organizations, including:

a. Providing matching funds for habitat projects;
b. Supporting growth management, enforcement of local regulations, and some monitoring functions;

c. Participating in local, and summer chum and chinook regional-scale recovery efforts; and
d. Tracking and reporting on progress to funders.

Most state and federal funding sources will require a match of 15% to 50% percent of total costs and these matching funds have typically been the responsibility of the local jurisdiction in which the project is located. As previously noted, it is possible that there may not be sufficient funding to support all projects within a jurisdiction and some cost-sharing strategy among local jurisdictions would be required.

Several activities of local governments, tribes, and organizations are assumed in this SRP to continue into the future, including land use and growth management planning, enforcement of local regulations, and development-related stream monitoring. There is a limited amount of funding for non-capital costs of activities such as this in the tally of watershed costs, but not enough to support them fully. As the Hood Canal partners shift from planning to the implementation of the SRP, it will be important to determine which activities are supported as common expenses and which are assumed to be the responsibility of the individual participants.

The costs of participating in regional recovery activities, like the development of the SRP, are likely to diminish but not disappear as implementation begins. Several actions in the SRP, particularly large-scale projects such as the retrofitting of Highway 101 stream crossings, are in the conceptual stages and will require further development and consultation among partners in the SRP. In addition, the effectiveness of implemented actions will need to be evaluated and some projects and programs may need to be revised. It seems likely that ongoing coordination on SRP implementation will be through the existing Hood Canal Coordinating Council.

The final significant local responsibility is tracking and reporting on progress on SRP implementation. It is vital that state and federal funders receive timely information on successes in order to maintain political interest in the recovery effort. The HCCC, local governments and other sponsors bear the responsibility to report on the on-the-ground results of funded projects.

15.4.5. Fundraising strategy evolution

The success of this fundraising strategy is contingent on annual successes in federal, state, and local budget processes, in annual grant rounds, and in securing mitigation dollars. It is unlikely that this strategy will unfold exactly as described here. Ideally, better-than-expected results with some funding sources will compensate for the inevitable shortfalls in others. However, it is possible that

many sources will under- or even over-perform and more substantial changes to the fundraising strategy will be needed.

It is recommended that the proposed fundraising strategy be revisited annually for the first three years, and then every two years thereafter. The reviews should probably occur in the late spring following the conclusion of local and state budget processes, although this will be slightly out of sync with the federal budget schedule. Milestones for these reviews are suggested below.

- Following year one, agreement among regional, watershed, and local entities on responsibilities, initial grant-writing priorities and prospects identified, communications strategy developed and begun, local funding budgeted

- Following year two, coordinated state and federal lobbying strategy established, initial grants written, initial mitigation transfers occur, local funding budgeted

- Following year three, all federal, state, and local sources budgeted, fully functioning grant-writing program, full functioning reporting/communications strategy, first formal review of approach and results and revisions if needed

- Following years five, seven, and nine, all sources maintained, reporting/communications strategy continues, biannual formal review of approach, results, and revisions

It is recommended that the Hood Canal Coordinating Council oversee these reviews.

15.4.6. Tasks for Redirecting Mitigation Funding

Unlike other areas of the United States, notably California and southeastern states, the Pacific Northwest has been slow to embrace alternative mitigation strategies such as mitigation and conservation banking. One often cited reason is unfamiliarity and hesitancy among regulatory agencies, with NMFS perhaps most hesitant of all. As a result, none of the 19 mitigation banks currently in operation in Washington State address compensation for impacts to salmon or other NMFS-administered endangered species[68]. It is hoped that improvements to their receptivity to mitigation and conservation banking can be made through discussions at the chinook and summer chum regional levels.

[68] Assessment by Gail Terzi, Seattle District, Corps of Engineers.

It will also be a challenge to identify sites for transferred mitigation actions. While the Hood Canal SRP and other plans will be helpful, an additional level of detail may be needed to prioritize sites for mitigation-funded restoration work. A major part of this work will be to categorize sites according to their principal "products", such as riparian wetlands, salmon spawning habitat, or cedar forests, in accordance with the description of features disturbed on development sites. While much of this work will need to be done at the local level, it is important that it be consistent across watersheds and undertaken with a regional model.

A final challenge to more widespread use of mitigation as a salmon recovery funding source is the difficulty of matching "buyers", entities who are developing property and require off-site mitigation actions to compensate for on-site impacts, and "sellers", who take on the task of constructing and maintaining the off-site mitigation actions. Buyer and seller are the same entity in the simplest mitigation strategies, in which an agency undertakes off-site mitigation actions to compensate for anticipated impacts of their own development actions. Not every public or private developer will want to become their own mitigation banker, however, and limiting alternative mitigation strategies to single-party transactions will unduly limit use of these strategies. In order to realize the full potential of mitigation as a salmon recovery funding source, it will be necessary to establish bankers or brokers as intermediaries between buyers and sellers, contracting the development of mitigation "credits", holding credits if needed to address time lags, and marketing credits to buyers. This banking or brokering function may be fulfilled at the chinook or summer chum ESU level.

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