

Watershed Profile:

# Mid Hood Canal Chinook

*This plan focuses on the Mid Hood Canal Chinook population. State and tribal co-managers are in the process of writing a separate plan for the Skokomish Chinook population. The Hood Canal Coordinating Council is preparing a separate recovery plan for the Hood Canal summer chum Evolutionarily Significant Unit (ESU).*

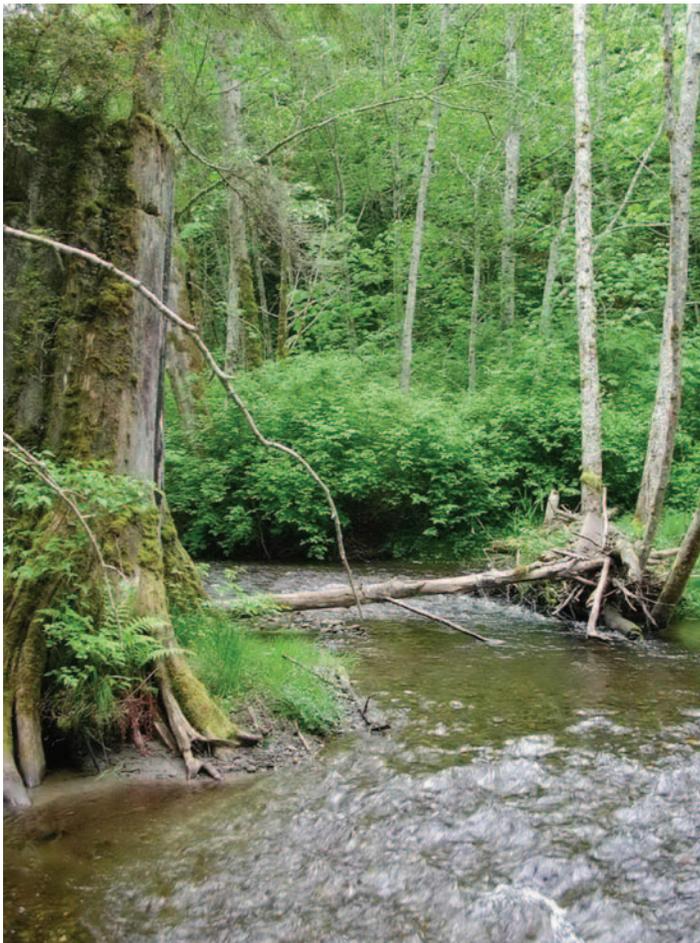


Photo courtesy the Washington State Salmon Recovery Funding Board

## **The Place and the People**

Located in western Washington, Hood Canal is not really a canal at all but rather a picturesque glacial fjord that sits in the shape of a backwards checkmark or a fish hook between Puget Sound and the Olympic Peninsula. Five major rivers with upper reaches protected inside Olympic National Park flow east into Hood Canal. The Dosewallips, Duckabush, Hamma Hamma, Skokomish, and Big Quilcene rivers mix in the Canal with the waters of countless smaller streams and creeks that flow west from the Kitsap Peninsula. Endowed with an abundance of biologically-rich estuaries, Hood Canal produces Pacific oysters, known world-wide for their unique flavor, as well as a smorgasbord of other shellfish, crab and shrimp.

The retreat of the huge and heavy ice sheets of ancient glaciers carved the inland waterways of Puget Sound, including those along east Jefferson County and Hood Canal. As the ice retreated northwards and

approached the Strait, an isolated drainage route was created connecting Dabob Bay with Discovery Bay via the Leland-Snow Creek valleys. This glacial history had important consequences for the evolution of stream drainages, headwater wetland formation, and fish colonization/movement among basins.

The Hood Canal watershed lies predominantly in the rainshadow of the Olympic Mountains, which intercept much of the precipitation from the Pacific Ocean. Due to this rainshadow effect, Hood Canal has been called the driest coastal region north of southern California (SCSWAT 1996). The southern part of the watershed experiences increased precipitation to as much as 70 to 80 inches per year along the foothills of the eastern Olympic Mountains (Parametrix, Inc. et al 2000). Eighty-five percent of the rainfall occurs in the winter. Many streams are naturally flow-limited and some dry during the summer months. This condition renders streams particularly vulnerable to habitat impacts such as elevated water temperatures or channel de-watering stemming from human removal of riparian vegetation and water extraction.

The Skokomish Tribe, along with the Lower Elwha S'Klallam Tribe, Jamestown S'Klallam Tribe, Port Gamble S'Klallam Tribe, and the Suquamish Tribe, have adjudicated usual and accustomed fishing areas in Hood Canal. The Hood Canal watershed currently includes a variety of land uses including forestry, agriculture, urban development, rural residential, light industry, and recreation.

Much of Jefferson County is in public ownership given its position within the Olympic National Park, Olympic National Forest, and state trust lands. The upper two thirds of the planning area is within eastern Jefferson County. The lower third lies within Mason County. Only 11% of the entire county is in private land ownership, with a higher percentage of private lands in east Jefferson County. Significantly, most of the anadromous fish habitat is on private land. The forestry and agricultural practices have contributed to habitat impacts throughout the plan-

### Key Facts:

Land ownership in the watershed is 48% federal and includes portions of Olympic National Park and Olympic National Forest, 39% private, 12% state and local, and 1% Tribal trust lands.



Hood Canal is 62 miles long by boat with a total of about 358 miles of shoreline. This is about 15% of the total inland marine shoreline, or 25% of Puget Sound proper.



Mid Hood Canal Chinook watersheds are in Jefferson and Mason counties.



Projected population growth for Jefferson County is 43% between 2000 and 2020 and 41% and 54% for Mason and Kitsap Counties respectively.



The planning area for Mid Hood Canal Chinook includes parts of Watershed Resource Inventory Area (WRIA) 16 and the nearshore of Hood Canal.

ning area through channelization (straightening a stream or river and preventing it from meandering), riparian loss and removal of instream structures such as large woody debris. Rural residential development has added to these impacts.

Jefferson County is now one of the fastest growing (per capita) counties in Washington. In 1996, the population was approximately 24,792 and future projections estimate that by 2016 the population will reach 38,392 — a net increase of 13,600. About 40 percent of the population increase is expected to occur in the urban growth area of Port Townsend and another 20 percent of the increase is projected for the Port Ludlow

Master Planned Resort. The remaining portions of east Jefferson County are expected to increase by a total of about 5,200 people between now and 2016 (Parametrix, Inc. et al 2000). Population pressure increases demand for water and developed residential properties, particularly with views, which can increase impacts to fish habitat through stormwater runoff, riparian degradation and surface and ground water withdrawal. Washington State’s Growth Management Act is designed to minimize, but not eliminate, many of these impacts to fish habitat productivity.

The staffs of Mason, Jefferson and Kitsap counties are currently working collaboratively with the tribes and the Hood Canal Coordinating Council, which is composed of representatives of Tribes and local governments, to ensure that Hood Canal is a place where both people and fish thrive.

**Mid Hood Canal Chinook Salmon**

The Mid Hood Canal Chinook Population, comprised of the Dosewallips, Duckabush and Hamma Hamma sub-populations, is one of the two genetically distinct Chinook populations that historically and currently exist within the Hood Canal area of the Puget Sound Chinook salmon ESU, the other being the Skokomish Chinook population. Early reports on salmonid use of Hood Canal streams documented early-returning Chinook life histories in the Skokomish, Dosewallips, Duckabush and Hamma Hamma rivers, but more recently, only late-returning Mid Hood Canal Chinook are present. The Skokomish River is the largest river system in the Hood Canal basin, and historically produced the region’s largest runs of salmon and steelhead. The Skokomish Chinook population is being addressed in a separate plan under development by the co-managers.

Chinook spawn in the lower reaches of all three of the Mid Hood Canal rivers. In the Hamma Hamma River mainstem, spawning occurs up to RM 2.5, where a barrier falls prevents higher access. When water flows are high enough to permit

access, spawning can also occur in John Creek. A series of falls and cascades typically block access to the upper Duckabush at RM 7, and to the upper Dosewallips River at RM14, though spawning may also occur in Rocky Brook Creek, a tributary to the Dosewallips. Because most tributaries to the three rivers are inaccessible, high gradient streams, the mainstems are vital in terms of production potential.

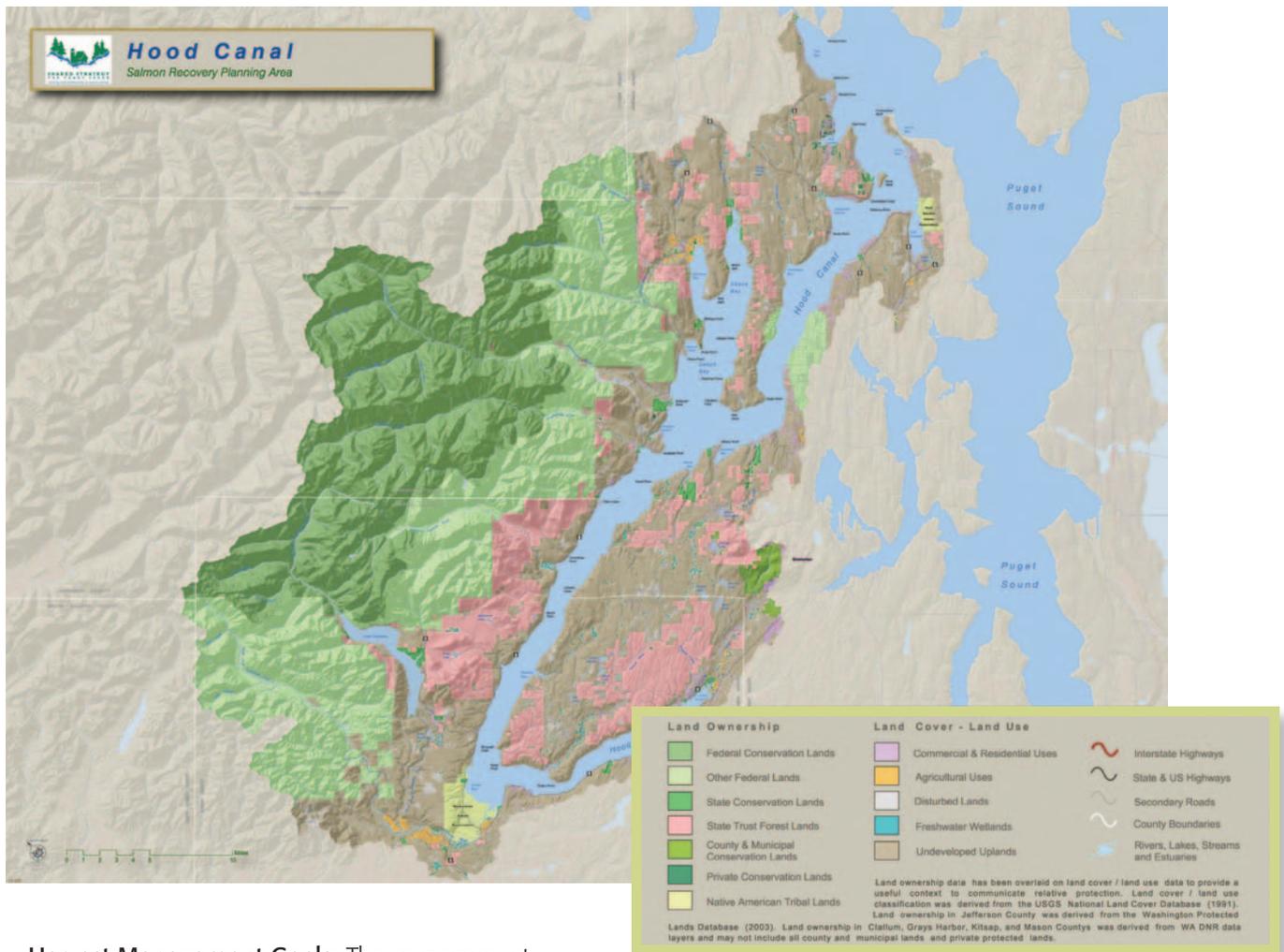
**Mid Hood Canal Chinook Sub-Population Goals**

Planning targets for abundance and productivity are provided in the table below. Escapement is the number of salmon allowed to “escape” a fishery to spawn and is a common measure used to determine abundance. Two combinations of abundance/productivity numbers are given because a more productive population with fewer spawners has the same risk level as a less productive population with more spawners returning. Another way of putting this is that if each pair of parents produces more surviving offspring (e.g., 3 surviving offspring per parent means they have higher productivity), fewer parents are needed to sustain a population, compared to one in which each set of parents produces only 1 surviving offspring. The plan notes, and the table reflects, that the lower escapement target for each sub-population is substantially higher than the average escapement from 1993 to 2004.

<b>Chinook Sub-population</b>	<b>Escapement planning targets</b> (productivity in parentheses, expressed as adults produced per spawner)		<b>Mean escapement</b> (1993-2004)
Hamma Hamma R.	1000 (1.0)	250 (3.0)	152
Duckabush R.	1200 (1.0)	325 (3.0)	31
Dosewallips R.	3000 (1.0)	750 (3.0)	84

Source: Mid Hood Canal Chinook Recovery Chapter, p. 17

Co-managers anticipate that the combination of harvest and hatchery management strategies, along with habitat protection and implementation of restoration projects, will improve Chinook population diversity and spatial structure (see page 18 of the Mid Hood Canal Chinook Recovery chapter).



**Harvest Management Goals:** The management objective for the Mid Hood Canal Management Unit is to maintain and restore sustainable, locally adapted, natural-origin Chinook sub-populations. Harvest Management practices constrain harvest to the extent necessary to enable rebuilding of natural Chinook populations to occur, assuming the implementation of management actions to protect and restore habitat needed to achieve recovery. The ultimate goal is to rebuild natural productivity so that natural Chinook populations will be sufficiently abundant to provide ecological functions, ensure that cultural values to society are not lost, and sustain commercial, recreational, ceremonial and subsistence harvest.

**Hatchery Management Goals:** There are three goals of the hatchery Chinook salmon programs in Hood Canal:

- Produce fish for subsistence, ceremonial, commercial and recreational harvest.
- Aid in recovery and reestablishment of natural populations.
- Provide mitigation for reduced natural production in the Skokomish River system, primarily caused by hydroelectric dams on the North Fork Skokomish.

Co-managers have developed and implemented conservation hatchery programs and harvest hatchery programs for Chinook in Hood Canal.



Photo by Eileen Palmer for the Hood Canal Salmon Enhancement Group.

The Hamma Hamma Chinook supplementation program is a conservation hatchery program that is being managed to reduce the risk of extinction for the Chinook population and to help rebuild the population to sustainable levels. The Hoodsport and George Adams hatcheries and Long Live the Kings Rick's Pond are examples of harvest hatchery programs. These hatchery programs are managed so as not to impede the recovery of natural populations.

### **What is the current status of the threatened Chinook populations?**

Levels of abundance of the three Mid Hood Canal sub-populations are low. In 2002, the stock status was rated as critical, primarily because of chronically low spawning escapements. The average escapement abundance over the 1991-2002 period did not meet the established low escapement threshold of 400 Chinook.

### **What key factors currently affect the populations?**

#### **Supporting Factors**

The largest landowners in the Dosewallips River watershed are the Olympic National Park and the

Olympic National Forest. Together, they comprise 93% of the watershed, and a significant portion of the national forest land is protected as wilderness area. The remaining 7% is divided between privately held forestlands, rural residential, parkland and commercial uses. Commercial zoning is concentrated in the lower reaches. The predominant residential zoning in the watershed is one resident per 20 acres.

The Riparian Reserve Program adopted by the US Forest Service (USFS) has the potential to improve riparian conditions, including temperature control, large woody

debris recruitment, streambank and migratory corridor stability, and riverine functions downstream.

Habitat protection and restoration actions developed by the Hood Canal Coordinating Council as part of the Hood Canal Summer Chum recovery plan are expected to benefit Mid Hood Canal Chinook sub-populations.

Population projections and growth rates for the Dosewallips and Duckabush watersheds reflect an assumed estimated rural growth rate of 1.09%. Boundaries drawn by Jefferson County for designated rural village centers which provide for the needs of rural populations and travelers are largely defined by the built environment as it existed in 1990 or earlier. If impervious cover areas can be maintained at or within the 10% threshold, the lower population growth rate projections, along with protection and restoration measures, are expected to result in improved conditions for fish.

The co-managers have prepared a harvest management plan describing the harvest management guidelines for the Chinook of Puget Sound, including Hood Canal, for the 2004-2009 management years. The intent of the harvest management plan is to constrain harvest to the extent necessary to enable rebuilding of natural Chinook populations

of Puget Sound, provided that habitat capacity and productivity are protected and restored. It includes explicit measures to conserve and rebuild abundance and to preserve diversity among all the Chinook populations. NOAA Fisheries has recently approved the co-manager harvest management plan.

The co-managers have prepared Resource Management Plans for hatchery operations affecting Puget Sound Chinook, including Hood Canal. The plans describe how hatchery programs are managed to help control potential hatchery impacts to natural Chinook populations and/or to recover the natural Chinook populations.

### **Significant Factors Limiting the Mid Hood Canal Chinook**

The lower river and estuary are the most impacted by development and past logging practices in each of the three rivers inhabited by the Mid Hood Canal Chinook. Attributes related to habitat diversity, channel stability, key habitat quantities, flow, and sediment load emerged as the most important limiting factors per co-managers' ratings and the Ecosystem Diagnosis and Treatment (EDT) analysis. Habitat conditions related to successful egg incubation, fry colonization and, in some areas, pre-spawning holding were also identified as important limiting factors.

Significant habitat limiting factors which have prevented increased productivity of Chinook include the following:

Estuarine habitat loss and degradation associated with loss of eelgrass, bulkheads and revetments, and impaired riparian corridors have reduced the amount of rearing habitat in the estuarine and near-shore area as well as limited the amount of food for migrating juveniles.

Channel complexity and overall channel conditions have been impacted by dredging, removal of large woody debris (LWD) and lack of LWD recruitment. Logging has modified native riparian forests and has resulted in reduced LWD recruitment,

increased water temperatures, reduced bank and floodplain stability, and impaired channel conditions, resulting in the loss of juvenile rearing and spawning habitat.

High water flows in the winter months cause scouring of salmon redds and, in association with unnatural man-made sediment sources (e.g. owing to forest practices), transport sediment loads downstream, potentially burying redds and reducing habitat quality. Summer low flows prevent or delay upstream passage and also reduce available spawning habitat.

Floodplain modifications and loss of freshwater wetlands that occurred largely due to the conversion of floodplains to pastureland and residential development have reduced the quantity and quality of habitat available for spawning and rearing and changes in instream flows.

Logging roads in the upper watersheds, as well as diking and channelization in the lower reaches has resulted in sediment aggradation, reducing spawning habitat and affecting incubation.

In addition to habitat limiting factors, there is evidence that harvest and hatchery activities have been limiting to Mid Hood Canal Chinook salmon. Mid Hood Canal natural Chinook were not protected from mixed stock fisheries within Hood Canal during the 1980s when these fisheries were at their peak. Also, fisheries outside Hood Canal would have been a factor. From 1990 through the present, fishing effects on the Chinook survival continue, primarily owing to pre-terminal (predominantly Canadian) fisheries. In recent years, the State and Tribes have severely reduced fisheries and their potential impact in Hood Canal and Washington State.

Hood Canal hatchery programs also have potentially impacted Mid Hood Canal natural Chinook. At one time, hatchery Chinook juveniles were planted in Mid Hood Canal streams, with possible negative effects on the natural populations; that practice was terminated in 1991. Today, there is still concern about hatchery released fish of Hood Canal affecting the abundance, productivity and diversity of



Photo courtesy the Hood Canal Salmon Enhancement Group.

natural Chinook. However, the potential risks have been addressed by eliminating programs, reducing production, and timing hatchery releases to minimize interactions with the natural Chinook.

### Future Threats

Climate change, ocean, estuarine, and freshwater effects (such as flows) and shifts related to human caused impacts that may negatively affect summer chum are also believed to affect Mid Hood Canal Chinook.

Dissolved oxygen levels are at historic low levels in the marine waters of Hood Canal. The problem is being addressed by the Hood Canal Coordinating Council and the Puget Sound Action Team through the Preliminary Assessment and Corrective Actions Plan and other programs.

### Overall Approach to Recovery

Both Mid Hood Canal Chinook and summer chum salmon share the mid Hood Canal rivers and nearshore environment of Hood Canal. The Duckabush, Dosewallips, and Hamma Hamma river systems represent one of the six conservation units addressed in the summer chum recovery plan. For this reason, the Mid Hood Canal Chinook recovery strategy relies in part on close coordination and collaboration with the Hood Canal Summer Chum recovery planning processes and activities occurring

under the auspices of the Hood Canal Coordinating Council. Habitat actions that will improve conditions for Chinook will also address limiting factors for summer chum in the Mid Hood canal watersheds.

Currently, this chapter does not address Skokomish Chinook recovery.

The completion of the Skokomish recovery chapter will require continued work on all Hs-Habitat, Hydropower, Hatchery, Har-

vest. Co-managers are working together to develop a Skokomish Chinook recovery plan that could potentially be completed by December 2005.

The habitat protection and restoration strategy is to work cooperatively with current landowners on habitat stewardship and restoration projects. Acquisition will be pursued when no other practical alternatives exist to achieve some habitat goals. The existing regulatory protection tools are viewed as adequate for recovery "if watershed development occurs as expected and current regulations are maintained or improved and adequately implemented."

The Hood Canal Coordinating Council is the Lead Entity under HB2496 for the Hood Canal watershed. The Council's multi-species salmon habitat recovery strategy places Chinook and summer chum habitat in the Dosewallips, Duckabush and Hamma Hamma, and Skokomish rivers and their nearshore areas in the highest prioritization categories. The Lead Entity strategy is based on ecosystem restoration principles.

### Key Strategies and Actions supporting the overall approach to recovery

Restoration actions in the Mid Hood Canal Chinook plan are organized by limiting factors. Examples are provided at right.

Ecosystem Diagnosis and Treatment (EDT) modeling results indicate that target recovery values would be close to being achieved for the Dosewallips River within 25 years, assuming that projects are implemented within the 10 year time frame if:

- Habitat protection and restoration projects of equal or better habitat value of the entire *High Implementation Potential* list are successfully implemented;

- Current development regulations are implemented and enforced;
- Habitat conditions do not degrade any more than is predicted for modeled potential build-out; and
- The assumptions and attribute ratings for EDT are correct.

Achieving target recovery goals in the Duckabush and Hamma Hamma watersheds requires intensive

Hamma Hamma River	
Factors limiting recovery	Sample Actions within the next ten years
<ul style="list-style-type: none"> <li>• Loss of channel complexity and in-channel wood in lower river due to dredging, bank hardening and channelization</li> <li>• Bed instability and sedimentation (lower Johns Creek) at least partially as a result of landslides associated with road failures and clear cutting</li> <li>• Impaired connectivity and loss of tidal prism in the estuary from dredging and dikes</li> <li>• Restricted tidal action caused by the Highway 101 causeway, isolation of estuarine marsh</li> </ul>	<ul style="list-style-type: none"> <li>• Estuary: 34.5 km road decommissioning; 9.2 km road conversion to trail</li> <li>• Mainstem/Floodplain Restoration: Silviculture treatment of upland problem areas, with emphasis on Jefferson and Cabin Creek watersheds to increase hydrologic maturity</li> <li>• Assess, conserve and restore riparian conditions in anadromous zone and above anadromous zone as recommended in Watershed Analysis, and in lake riparian areas damaged by recreation</li> </ul>

Duckabush River	
Factors limiting recovery	Sample Actions within the next ten years
<ul style="list-style-type: none"> <li>• Loss of estuarine complexity and connectivity through highway construction</li> <li>• Loss of floodplain and side channel access due to development in lower river reaches</li> <li>• Loss of riparian vegetation in lower river; loss of in-channel wood; sedimentation</li> </ul>	<ul style="list-style-type: none"> <li>• North estuary restoration: remove dikes, improve tidal connectivity of two creeks</li> <li>• Evaluate SR101 across estuarine delta to restore tidal connectivity and native vegetation</li> <li>• Remove dike south side of estuary and upstream of SR101</li> <li>• Reconnect northern distributary channel with the Duckabush River</li> <li>• USFS road decommissioning: 13 km of road decommissioning; 1.2 km of road conversion to trail</li> <li>• Plant and maintain riparian areas on public and private properties in lower mainstem in Murhut and Cliff sub-watersheds</li> <li>• Restore stream channel habitat complexity through key LWD and log jam addition in mainstem and through LWD addition in Murhut and Cliff sub-watersheds</li> <li>• Conserve remaining high quality riparian and floodplain habitat</li> </ul>

Dosewallips River	
Factors limiting recovery	Sample Actions within the next ten years
<ul style="list-style-type: none"> <li>• Loss of channel complexity, side channels, and floodway from levee construction, bank hardening, and splash dam</li> <li>• Loss of in-channel wood</li> <li>• Estuarine marsh affected by levees and filling</li> </ul>	<ul style="list-style-type: none"> <li>• Acquire 17 acres,</li> <li>• Placement of key wood or engineered log jams (ELJs) to improve channel and floodplain complexity</li> <li>• Mainstem – restore channel complexity below 6 Mile Bridge with full scale wood ELJ restoration; conifer under plantings</li> <li>• Restore channel complexity at Steelhead Campground through addition of key wood pieces, removal of sediment plug at top of enhancement pond, road bed and 200 meters of low riprap</li> <li>• Restore channel and floodplain complexity below washout with full scale wood/ELJ restoration</li> <li>• Restore riparian conditions RM 6 to RM 12 on USFS land</li> <li>• Remove low berms, dredge spoils, riprap, culverts, and restore vegetation in estuary</li> <li>• Remove bank protection/riprap below SR101 on lower river</li> <li>• Slough conservation: acquire 3 acres and restore vegetation</li> <li>• USFS 8 km road decommissioning</li> <li>• USFS 2.6 km road conversion to trail</li> </ul>



Photo courtesy the Washington State Salmon Recovery Funding Board

habitat protection and restoration actions. The EDT analysis indicates that, unlike the Dosewallips, implementation of projects within ten years would not result in the achievement of target recovery values in 25 years in the Duckabush and Hamma Hamma watersheds, though significant progress would be possible.

**The following issues and associated programs affect the entire watershed:**

**Instream Flows**

Water Resource Inventory Areas within the Hood Canal watershed are in the process of developing Watershed Plans. The plans are expected to address Instream flow needs for fish.

**Water Quality**

The Hood Canal Coordinating Council is addressing water quality, including dissolved oxygen in marine areas, in concert with the Puget Sound Action Team.

**Harvest Management Strategy**

The management objective is to maintain and restore sustainable, locally adapted, natural-origin Chinook sub-populations. Fisheries are being restricted to accommodate the escapement objectives. Management strategies include the following (see Mid Hood Canal Recovery Plan, Chapter 39)

- Fisheries in southern U.S. areas, outside Hood Canal, are managed to achieve a pre-terminal rate of exploitation of no more than 15%.
- No fisheries specifically directed at Mid Hood Canal Chinook will occur until recovery is sufficient to support them.
- Fisheries on species other than Chinook are managed by limiting exploitation rates, using harvest time and area closures, to remove or minimize negative effects on Chinook salmon

productivity, abundance, diversity and spatial distribution.

The co-managers' Chinook harvest management plan (PSIT and WDFW 2004) notes that performance of Chinook fishery management will be evaluated annually to assess whether management objectives were met and to identify factors affecting success or failure. The Mid Hood Canal Chinook recovery plan includes a table which describes harvest adaptive management assessments/tasks, rationale, monitoring tools required, time frames for implementation, and comments concerning funding. Tasks include assessing distribution of Mid Hood Canal Chinook throughout the watersheds, improving estimates of exploitation rates, and estimating a rebuilding exploitation rate (RER). Monitoring tools include coded wire tagging and sampling, spawner surveys, and modeling efforts (See Table 6.2, p. 49-52 of the Mid Hood Canal Recovery Plan chapter). A detailed description of Chinook harvest management practices is in Appendix F of the Mid Hood Canal Recovery Plan.

## Hatchery Management Strategy

The co-managers studied HSRG recommendations for hatchery reform operations and implemented changes to Chinook programs, including:

- Termination of the Big Beef Creek Chinook program
- Reduction in size of several programs associated with the Hoodport Hatchery program
- Modifications to hatchery facilities

(See Mid Hood Canal Chinook Recovery Plan chapter, P. 61-64)

The George Adams, Hoodport and Rick's Pond Hatchery programs are operated to provide Chinook for harvest while minimizing adverse effects on ESA-listed fish. The Hamma Hamma River fall Chinook supplementation program is being

managed to restore a healthy, natural, self-sustaining population to the Hamma Hamma River.

Hatchery programs supporting other species in Hood Canal are managed to minimize negative impacts on Chinook or summer chum salmon populations. The coho and steelhead programs include delaying release time until after April 15 to reduce potential predation on Chinook and summer chum. The fall chum and pink salmon programs also delay release to reduce competition and behavioral modifications to natural summer chum (Mid Hood Canal Chinook Recovery Plan chapter, p. 60).

The Mid Hood Canal Chinook Recovery Plan includes a table that describes hatchery adaptive management assessments/tasks, rationale, monitoring tools required, time frames for implementation, and comments concerning funding (See Table 7-2, p. 49-52). Tasks include assessing genetic, demographic and ecological characteristics of the Chinook population, evaluating non-Chinook hatchery program interactions with Chinook, assessing distribution of Mid Hood Canal Chinook throughout the watersheds, and measuring progress toward recovery goals. Monitoring tools include coded wire tagging and sampling, spawner surveys, juvenile trapping and snorkeling surveys.

## H-Integration:

In addition to describing the application of the All-H Analyzer (AHA) model to the Hamma Hamma, the plan addresses several questions concerning the integration of habitat, harvest and hatcheries, including:

- Consistency of harvest rates with population productivity
- Consistency of harvest rates with providing necessary spatial structure
- Whether hatcheries are used effectively to reintroduce and maintain populations where habitat is degraded

- Whether hatchery structures are blocking access to important habitat
- Whether harvest augmentation programs are operated consistent with recovery of the ESU
- Whether production from hatchery harvest augmentation programs can be caught without excessive harvest of natural fish

## Results

*The watershed plan for the Mid Hood Canal Chinook population was reviewed by the Puget Sound Technical Recovery Team (TRT: a group of seven scientists) and an interagency committee facilitated by the Shared Strategy staff. The TRT reviewed the plan to determine the degree of certainty that the plan can achieve recovery goals. The conclusions of this analysis are below. For the most part, the issues identified below by the analysis are discussed in the watershed plan to some extent, but the reviewers felt they merited particular attention or additional effort to increase the certainty of achieving plan outcomes. Where the analysis identified key uncertainties, proposals are included for consideration. If implemented along with the watershed plan's other actions, these proposals would increase the certainty of results and achieve the requirements for a recovery plan under the Endangered Species Act.*

According to the TRT's ESU recovery criteria, the two Hood Canal Chinook populations (Mid Hood Canal and Skokomish) will need to achieve low risk status over time for Puget Sound ESU recovery. Since there was no plan submitted for the Skokomish population at the time of the review, there is no way to assess the certainty of achieving this outcome. The reviewers understand that the state and tribal co-managers are in the process of developing a plan for the Skokomish population that is expected to be available later in 2005.

*The certainty of achieving this plan's outcomes*

*and the resulting contribution to overall ESU recovery will increase if the following issues receive focused attention as described below.*

The reviewers understand there is currently a lawsuit related to Cushman Dam in the Skokomish River basin that, until resolved, will limit the ability to develop specific recovery strategies and actions. In the meantime, it will be critical to preserve future options for the Skokomish Chinook populations and their habitat.

Several uncertainties exist surrounding the plan's hypotheses for what factors are most limiting recovery of the Mid Hood Canal Chinook population. The plan does not provide clear statements of the life stage-specific factors limiting overall population recovery and the likely habitat, hatchery or harvest factors contributing to these limitations. The EDT model results could be used to provide a basis for stating the hypotheses for where in the life cycle do bottlenecks occur for each stock, and how abundance, productivity, and diversity may be impaired relative to a low-risk condition. In addition, the plan considers the potential responses of the 3 Mid Hood Canal streams independently – how are their collective responses predicted to affect the risk status of the population (which includes Chinook in all 3 streams)?

Since this plan has some provisions that overlap with the Summer Chum Recovery Plan, it will be important to reconcile these two plans early in the first phase of implementation. It will be especially important to identify the specific protection and restoration strategies from the summer chum plan that are expected to help Chinook and link these to the four VSP parameters.

This plan largely relies upon existing land use regulatory and voluntary protection mechanisms. As such, it will be important to assess the biological results for fish that can be expected from these protection measures.

The TRT recommends using the adaptive management and monitoring program to assess the potential effects of competition among hatchery fish of all species in the Canal's nearshore. In addition,



Photo by Eileen Palmer for the Hood Canal Salmon Enhancement Group.

the certainty of the plan will be increased if the authors clarify the EDT model predictions regarding the Hamma Hamma hatchery program. With the information provided, it is uncertain whether that program is necessary for population recovery, what its objective is, and whether the size of the program is consistent with what the habitat can support. There is a potential conflict between the objectives for the Hamma Hamma hatchery program: is it designed to be used as an indicator stock for estimating harvest rates, or a supplementation program for population recovery, or both? How the program will be managed to be consistent with harvest objectives and the capacity of the habitat to support fish over time is not clear.

In general, it will be important to assess the ecological effects of hatchery-wild interactions on VSP, for Chinook and other species (especially the steelhead and Coho hatcheries). This issue is most

pressing if the goal is to develop a strategy for an “integrated” hatchery program that accounts for ecological interactions.

The harvest management strategy aims to make more population-specific estimates of harvest rates for the Skokomish and Mid Hood Canal Chinook populations, but this approach is still in the planning stages. In the early years of recovery plan implementation, it will be important to better integrate harvest objectives with hatchery and habitat objectives, consistent with recovery goals, and to begin implementing management actions accordingly.

This plan has a good start on developing strategies and using the AHA model to integrate habitat, harvest, and hatchery strategies. The AHA model does not cover ecological effects or the spatial context of hatchery effects and should therefore be only one of the tools used to strengthen the H-Integration strategies over time. In particular,



Photo by Eileen Palmer for the Hood Canal Salmon Enhancement Group.

since the EDT modeling to date does not include the effects of hatchery or harvest management on Chinook population responses, the model results for specific abundance and productivities expected to occur in the 3 streams within 25 years are highly uncertain. The TRT encourages the planners to use the adaptive management and monitoring program to move H-Integration further down the integration continuum.

The review process also identified a number of issues and uncertainties that are common to many Puget Sound watersheds. Strategies to address these issues that are contained in this local watershed chapter are a good approach, based on the current state of scientific understanding. Nevertheless, because (1) these issues are very important to the success of watershed approaches to recovery and (2) the effects of some of these strategies on salmon populations at watershed scales are

relatively untested, these issues deserve particular attention. Reducing the uncertainties in the issues below could come through local and/or regional inclusion in adaptive management and monitoring programs, regional or local pilot studies to explicitly test their effects, or through additional implementation actions. The complexities associated with these issues are discussed in the regional strategy section of this document or in the regional adaptive management and monitoring program. The “cross-watershed” issues identified are:

- The importance of habitat protection strategies and the need to assess the results for fish from the combination of protection tools available,
- The need to develop H-Integration strategies or, where they are included, to move them further along the integration continuum over time,

- The need to reconcile local nearshore strategies and actions with the regional nearshore chapter,
- The need to address water resources, both water quality and water quantity,
- The need to better link the effects of land use to habitat-forming processes and to habitat conditions. In turn, the effects of these changes in habitat, processes and landscapes on salmon populations need to be estimated,
- The need to develop or complete a robust adaptive management and monitoring program.

If the above uncertainties are addressed, the Hood Canal watershed will have the opportunity of making a significant contribution to overall Puget Sound Chinook ESU recovery.