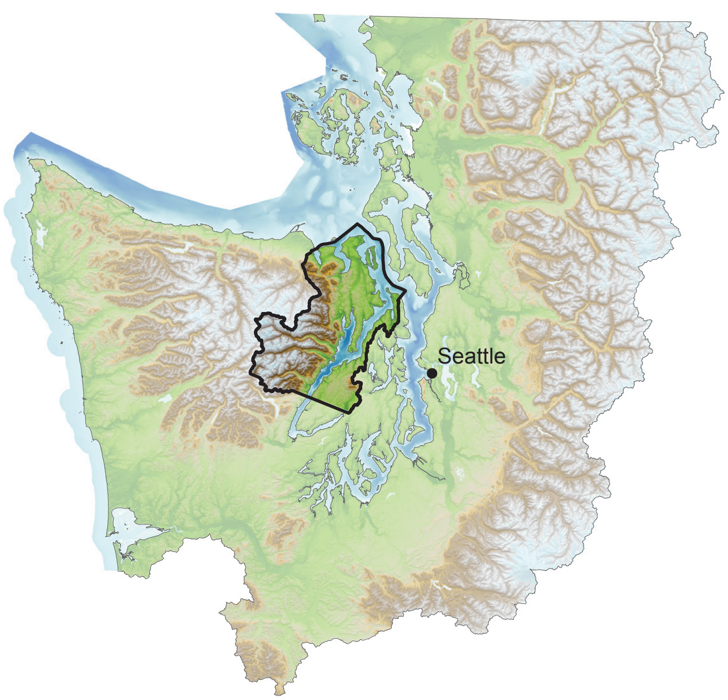
2016 State of Our Watersheds Report
Olympic & Kitsap Peninsulas

We are in the middle of challenging times. Our natural resources are facing many threats – a multitude of ESA listings and decreasing populations for subsistence and commercial salmon species, and increasing shoreline development and human population growth. In addition, we're dealing with new threats, such as climate change and ocean acidification. We are struggling to manage, conserve, enhance and protect our declining and threatened salmon populations. Restoration and recovery efforts are more important than ever before as we realize the realities we face of new threats and a critical need for immediate action.

– Paul McCollum
Natural Resources Director



Port Gamble S'Klallam Tribe

The Port Gamble S'Klallam Tribe is part of the Klallam Band of Indians that has resided throughout the Strait of Juan de Fuca, Hood Canal and Port Gamble Bay for generations. The northern Hood Canal and WRIA 17 watersheds have remained largely rural and forested with a natural resources-based economy focused on shellfish harvesting, commercial forestry, commercial fisheries, tourism and agriculture. Major land-use impacts on salmon habitat have occurred from floodplain and shoreline development, road construction and past logging practices. This report will focus on the WRIA 17 basin and surrounding marine waters, which is only a portion of the area where the Port Gamble S'Klallam Tribe works and manages.

Degradation of WRIA 17 and Northern Hood Canal

The Port Gamble S'Klallam Tribe's Focus Area for this report encompasses the northeast corner of the Olympic Peninsula in the rain shadow of the Olympic Mountains, and south to the Hamma Hamma watershed. The area includes many smaller watersheds that drain the low elevation terrain of the Kitsap Peninsula and the steep eastern slopes of the Olympic Mountains into the Hood Canal, Admiralty Inlet and the Strait of Juan de Fuca.

The Hood Canal and eastern Strait of Juan de Fuca are home to salmonids and shellfish, which are culturally and economically important resources to the Port Gamble S'Klallam Tribe. With the signing of the Point No Point Treaty of 1855, the S'Klallam Tribes retained the right to fish, hunt and gather in their Usual and Accustomed areas. These treaty-reserved rights were affirmed by Judge Boldt in the *U.S. v. Washington* ruling (the Boldt decision), in the 1994 ruling by Judge Rafeedie affirming tribal shellfish harvest, and several other court cases. Although considerable portions of the Tribe's Focus Area are contained within Olympic National Park or U.S. Forest Service wilderness, much of the upland, shoreline and floodplain areas are heavily impacted by land use, development, roads and historic logging.

Technical analyses have identified the significant habitat limiting factors for decline of the region's salmonid populations as:

- Estuarine habitat loss and degradation;
- Loss of channel complexity from loss and recruitment of large woody debris;
- Scouring from high water flows in the winter months and low flows in the summer months;
- Floodplain modifications and loss of wetlands; and
- Sediment aggradation.[1]

Landowners Critical to Recovery Efforts

The recovery strategy pursued for the Focus Area has been the protection and restoration of shoreline and estuary habitat. Landowner involvement and incentives for good stewardship were seen as critical components of this effort as most of the land adjacent to these critical areas is privately owned.

The existing regulatory protection tools have been viewed as adequate for recovery "if watershed development occurs as expected and current regulations are maintained or improved and adequately implemented."[2] Development pressure is testing this assumption.

Washington Coastal Atlas, 2006

An example of modified shoreline in northern Hood Canal.

Recovery Efforts Lagging

At the 10-year mark of the Puget Sound Salmon Recovery Plan, a review of key environmental indicators for the WRIA 17 and northern Hood Canal area shows degrading water quantity and quality, increasing impervious surface areas and degrading marine shoreline habitat conditions remain priority issues, while some improvements are occurring with restoration efforts. In general, there is a shortage of staff at all levels (e.g., federal, state, tribal, county) needed to address the issues and implement actions to restore and protect habitat and to monitor and enforce compliance of existing regulations. In addition, funding shortfalls for large-scale projects contribute to the slow pace of progress.

Review of the status of these key environmental indicators since the 2012 State of Our Watersheds report shows a steady loss in habitat but improvement in restoration efforts:

Tribal Indicator	Status	Trend Since SOW 2012 Report
Water Quality	Fish kill event was observed in 2015, as fatally low dissolved oxygen levels affected Hood Canal.	Declining
Shoreline Modifications/Forage Fish Impacts	2004-2014 saw an increase of new armoring in all four counties in this region. About 45% of shoreline has been modified or armored. Survey data from 1970 to 2012 shows about 41% of inventoried sand lance and surf smelt spawning habitat has been modified and of that 11% has been armored. From 1970 to 2012, Port Gamble Bay herring stocks decreased from a status of healthy to depressed, showing potential relationships between fish decline and shoreline armoring and climate change. By 2014, about 50% of the herring spawning areas inventoried were either modified or armored.	Declining
Water Wells	Water well logs increased nearly 185% in the Focus Area between 1980 and 2014. From 2011-2014, an increase of 164 wells, over 50 (30%) were installed in watersheds that are closed to new withdrawals.	Declining
Impervious Surface	From 2006-2011, impervious surface increased by 1%. 36 of 328 sub-watersheds had impacted (7-12% impervious surface) habitat conditions in 2011. Over 140 subwatersheds had increases in impervious surfaces.	Declining
Restoration	Long-awaited cleanup and restoration of Port Gamble Bay commenced in the fall of 2015. The project will remove 70,000 cubic yards of contaminated sediment and wood waste and over 6,000 creosote pilings.	Improving

The Tribe continues to work toward the protection and restoration of healthy and functional nearshore, estuarine and river habitat, restoring those areas that are degraded, and conducting research to understand the organisms and the habitats they occupy.

Looking Ahead

The Port Gamble Tribe's priorities center around the protection of Hood Canal and Port Gamble Bay and the resources they provide for current and future generations. Many of their future efforts are intended to enhance and protect existing resources, such as beach seeding and enhancement through a shellfish nursery floating upweller system in Port Gamble Bay and protecting the Hood Canal from impacts of stormwater pollution.

Greater focus and effort is required in conservation measures and restoration activities to offset negative habitat trends. Enhancement and restoration efforts in the Focus Area are not on pace to achieve the identified 10-year goals due to the lack of funding, staff capacity and landowner expectations.[3] Additionally, upgrading the regulatory framework that serves to protect salmon habitat must occur if the underlying assumption to meet all the recovery goals is to be realized – that existing habitat will be protected from loss.[4] Obviously, the 1999 recovery goals of keeping impervious covered areas maintained at or within the 10% threshold and rural growth rate of 1.08% have not been realized. A monitoring program on habitat status and trends should be implemented in conjunction with this regulatory reform to determine if observable differences can be detected as a result of implementation of new land-use regulations.

Climate change is emerging as a key priority for the Port Gamble S'Klallam Tribe. More science is needed to better determine the potential impacts of climate change including sea level change, ocean acidification and changes in temperature. Understanding the potential impacts is important, but it must be followed by actions. The Tribe plans to determine what the environment may look like in three generations and address the management challenges it presents to ensure that fishable and harvestable resources are sustained.

The Port Gamble S'Klallam Tribe is trying to secure healthy and sustainable salmon populations, as well as access to them, for future generations with very limited resources. Another concern is with the population and availability of cockles, which are an important subsistence fishery for the Tribe.

The Tribe has placed much of its energy into nearshore work, including acoustic, beach seine, and tow-netting studies to better understand the early marine life history of juvenile salmon. The Tribe is looking at associated limiting and/or constraining factors with juvenile salmon and forage fish relating to their nearshore habitat use, dependence and impacts from the large areas of altered shorelines.

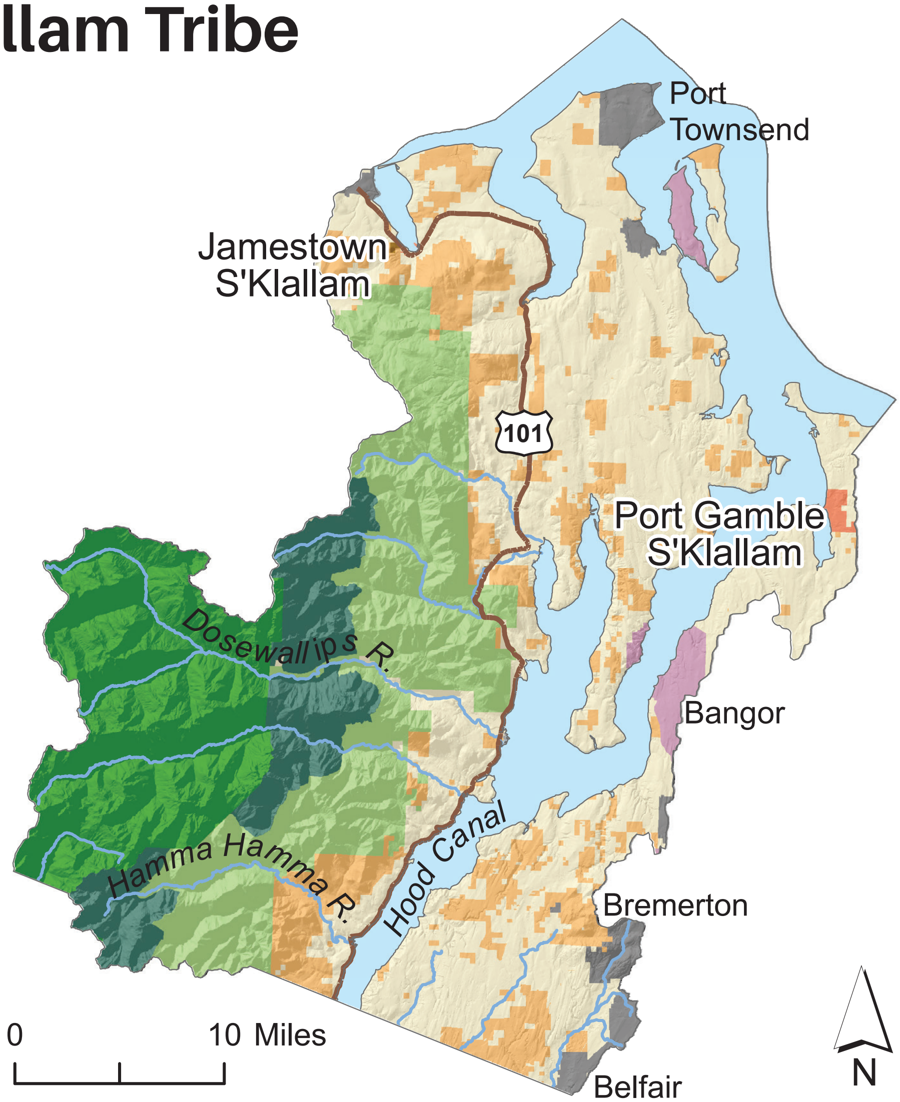
The Port Gamble S'Klallam Tribe is involved in many projects to further understand and protect the resources within their Focus Area. The Tribe is one of many partners working to determine how the Hood Canal Bridge impacts salmon and steelhead migration. The anthropogenic impacts on the water quality of the Hood Canal and Port Gamble Bay are of great concern to the Tribe. The cleanup efforts of Port Gamble Bay remain a priority for the Tribe as is the Pollution Identification and Correction program, which they would like to see expanded.

Tiffany Royal, NWIFC

Habitat biologist Hans Daubenberger prepares the hydroacoustic equipment for launch in Port Gamble Bay.

Further research on using DNA to identify source pollution has also emerged as a priority for the Tribe. Other emerging concerns include the contaminants found in fish that is consumed and any associated effects on human health.

Port Gamble S'Klallam Tribe



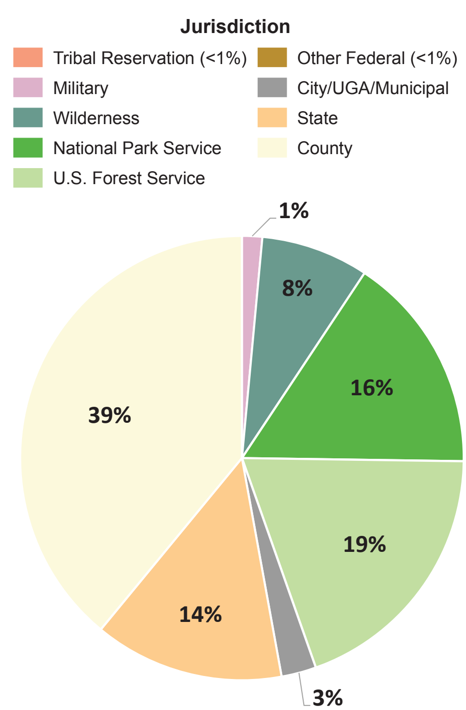
The Focus Area for the Port Gamble S'Klallam Tribe encompasses the northeast corner of the Olympic Peninsula in the rain shadow of the Olympic Mountains, south to the Hamma Hamma watershed. The area includes many smaller watersheds that drain the low elevation terrain of the Kitsap Peninsula and the steep eastern slopes of the Olympic Mountains into Hood Canal, Admiralty Inlet and the Strait of Juan de Fuca. The Focus Area is made up of portions of four counties: Kitsap, Jefferson, Clallam and Mason.

Geologic features in the landscape were created from a combination of seismic uplift, glaciation and fluvial processes. These past and current forces have had important consequences for the evolution of coastal shoreline features, stream drainages and headwater wetlands, many of which provide important spawning and rearing habitats in the nearshore for forage fish species and salmonids, including Hood Canal/Eastern Strait summer chum and Puget Sound Chinook, both listed as threatened under the Endangered Species Act.

Many streams in the Focus Area have natural periods of low flows and may go dry during the summer months when precipitation is sparse. This tendency renders streams particularly vulnerable to human impacts on the habitat, such as riparian vegetation removal and water extractions. While these streams may not flow year-round, they provide important spawning habitat for fish populations, including coho and fall chum.

Native American people in the Hood Canal and Eastern Strait region had villages and fishing camps along the shorelines and near the mouths of major streams where they could take advantage of plentiful fish and shellfish resources. After the Point No Point Treaty of 1855, the Skokomish (traditionally the Twana) and S'Klallam tribes ceded their lands to the U.S. government and several Indian reservations were established. Euro-Americans had begun settlements around sawmills in the region to continue logging the old-growth timber that dominated the landscape.

Today the area is largely rural and forested, with communities relying on logging, fishing and recreation. Sizable portions of Water Resource Inventory Areas (WRIAs) 16 and 17 are contained within Olympic National Park or U.S. Forest Service (USFS) Wilderness Areas, and are protected from major habitat alterations. Major land-use impacts on salmon habitat include floodplain and shoreline development, roads and logging (especially in steep forested terrain). Today the vegetation is primarily early to mid-seral forest, though semi-rural residential and urban development encompasses an increasing portion of the landscape.

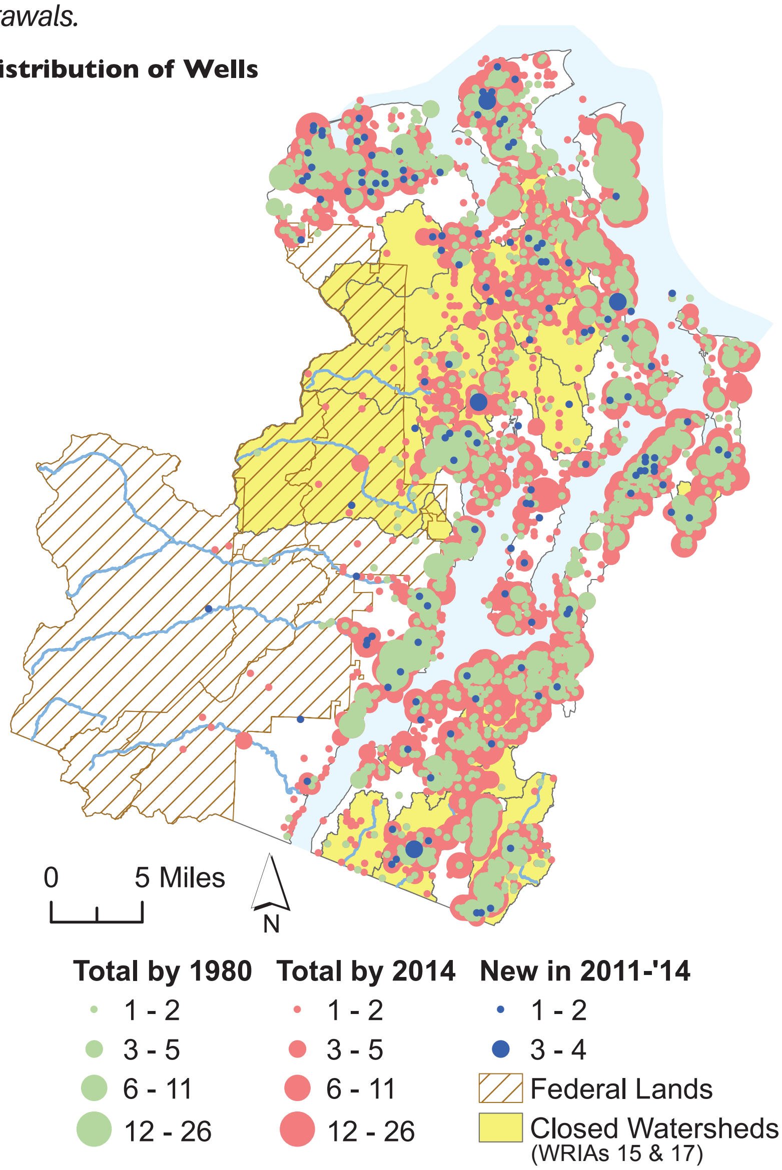


Data Sources: SSHIAP 2004,[1] USFWS 2014,[2] WADNR 2014a,[3] WADNR 2014b,[4] WADNR 2014c,[5] WADOT 2013,[6] WAECY 1994,[7] WAECY 2011a,[8] WAECY 2013[9]

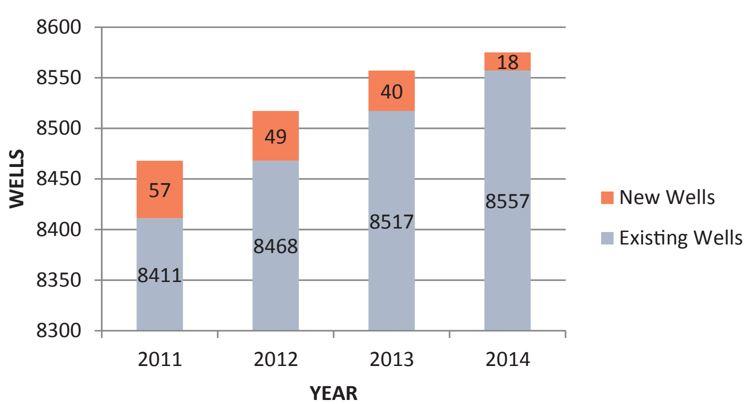
Water Extractions Impact Surface Flow and Fish Usage

The number of well logs has increased by 185% in the Focus Area from 1980 to 2014; 164 new wells were added in 2011-2014 alone. Of those 164 wells, over 50 were installed in watersheds that are closed to new water withdrawals.

Distribution of Wells



New Wells in the Focus Area



New wells were added each year from 2011 to 2014, and more may be added as the economy improves and population increases.

The watersheds within the Focus Area receive 15-100 inches of precipitation per year, primarily in the winter months.[1,2,3] Little precipitation falls during the dry summer months when water needs are greatest, causing streams to draw on groundwater sources. "Groundwater and surface water are one resource": changes to one will impact the other.[4]

Salmonid species, including summer chum and steelhead, require adequate streamflows to access suitable spawning habitats and to maintain appropriate water temperatures and stream substrate.[5] The summer low flow period is expected to get longer and stream temperatures to increase due to climate change,[6] amplifying the effects of groundwater extractions on freshwater salmon habitats. The Focus Area experienced periods of extreme drought during the summer of 2015,[7] resulting in record low streamflows.[8]

Well logs within the Focus Area increased 185% from 1980 to 2014, with 164 new wells in 2011-2014 alone. Seventeen of the streams within WRIAs 15 and 17 are closed to new surface and groundwater uses at least part of the year.[9,10] However, over 50 of the 164 new wells since 2011 were installed in watersheds closed to new water withdrawals. The number of new wells will likely increase with the upturn of the economy and the resulting development.

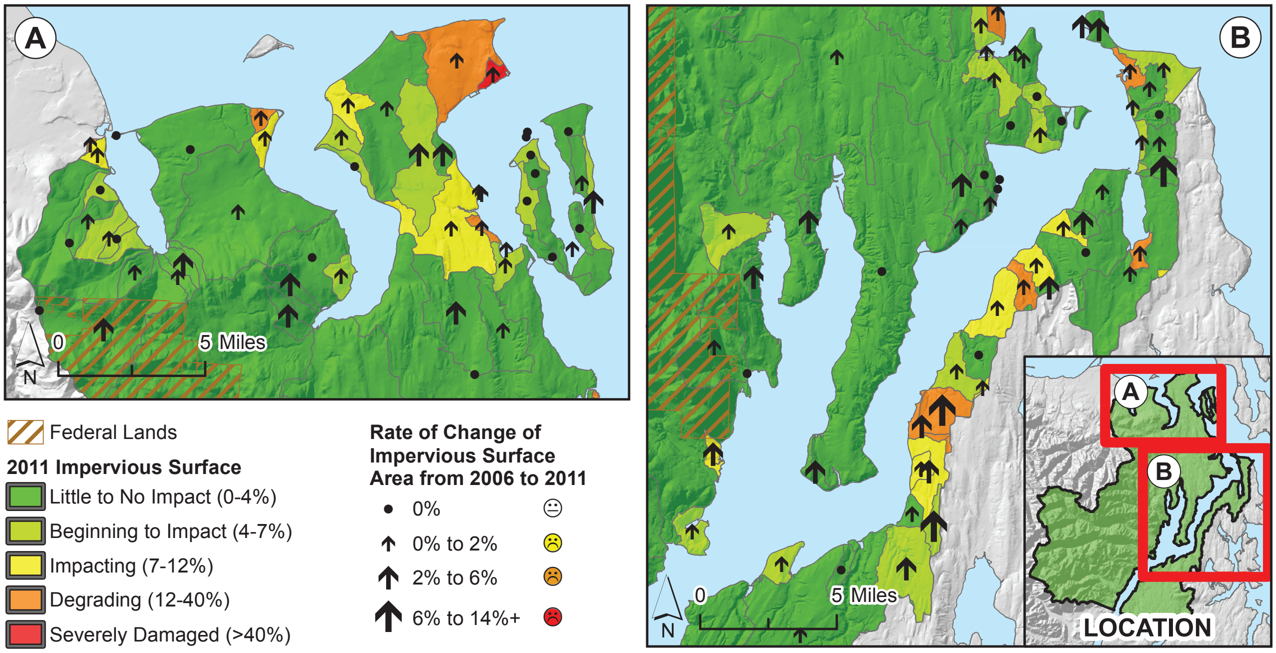
The Department of Ecology's instream flow rules are designed to protect instream resources by mandating minimum water levels for streams.[11] However, many of the instream flow rules are inadequate for protecting salmonid species and ensuring their ability to produce in the wild, a primary goal in the evaluation of instream flow rules.[12] Tribes have attempted to update instream flow rules for important salmon-bearing streams through the Department of Ecology with little success, occasionally resorting to legal action.[13]

Conservation of freshwater resources for instream and human uses is one of the five primary objectives in Puget Sound Partnership's Action Agenda.[14] Water withdrawals and diversions are listed as one of the high pressures on the local ecosystem within the Hood Canal Action Area.[15]

Data Sources: SSHIAP 2008,[16] WADNR 2014c,[17] WAECY 1994,[18] WAECY 2011a,[19] WAECY 2015[20]

Population Density and Impervious Surface Impact Water Quality

The total impervious surface area increased by 1% from 2006 to 2011. Thirty-six of the 328 sub-watersheds had impacted habitat conditions from impervious surfaces in 2011 and over 140 had increases of impervious surface area from 2006 to 2011. The areas with the highest population densities had the most impervious surfaces.

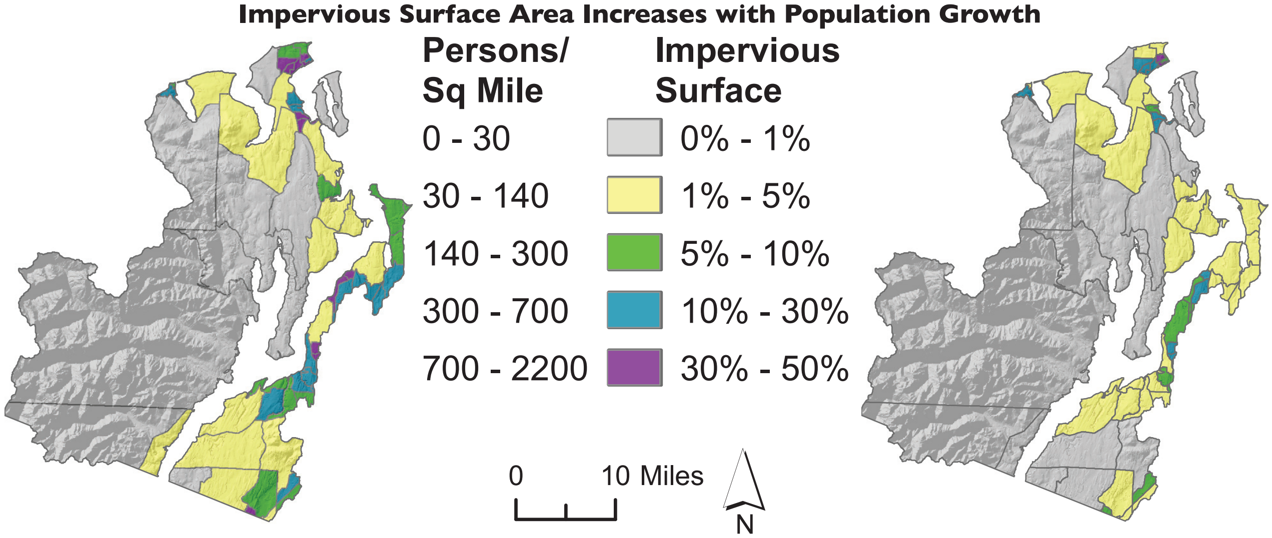


Any level of human disturbance has an impact on watershed processes. Impervious surface area is well documented as a coarse measure of human impact on watershed-scale hydrology and biology.[1,2,3] The Hood Canal and Strait of Juan de Fuca Summer Chum Recovery Plan describes thresholds of 10% impervious surface area in a watershed at which sensitive stream habitat elements are lost, while 25% to 30% impervious surface area results in poor water quality.[4] Each watershed will have a different reaction to a given amount of impervious surface area; thresholds serve only to generalize the continuum of degradation that accrues as impervious surface area increases and forest cover is lost.[5] Many species within the watersheds show signs of stress and population decline well before the 10% impervious surface area threshold is reached.[6]

Impervious surface area causes increases in stream temperatures, decreases in stream biodiversity, and contributes to pollutants in point and nonpoint sources of stormwater runoff, which can contaminate local aquatic systems[7] and lead to shellfish area closures. Aquatic and marine organisms respond immediately to these changing habitat elements, resulting in fatalities,[8] impaired physiological functions, or migration to more hospitable areas.[9]

Areas with high population densities also have large amounts of impervious surfaces. Clallam, Jefferson, Kitsap and Mason counties are projected to have a total increase in population of nearly 100,000 people between the years of 2015 and 2040; over half of those people are projected to be in Kitsap County.[10]

Impervious Surface Area Increases with Population Growth



Data Sources: NLCD 2006,[11] NLCD 2011,[12] SSHIAP 2004,[13] WADNR 2014c,[14] WAECY 1994,[15] WAECY 2011b,[16] WAOFM 2014[17]

High Juvenile Fish Densities Found Within Port Gamble Bay

Port Gamble Bay had the highest estimated fish densities in Hood Canal during the survey seasons of 2011 and 2012, likely linked to its ideal environment for eelgrass and high densities of larval forage fish.

The Port Gamble S'Klallam Tribe conducted hydroacoustic surveys, surface trawls and beach seining during the summers of 2011-2014 in nearshore habitats of Hood Canal and Eastern Strait of Juan de Fuca.

"Single targets" (individual non-schooling fish) were extracted from the hydroacoustic data for analysis. Pairing the hydroacoustic surveys with surface trawls and beach seining allowed for species composition of the single targets to be determined based on size class distribution.

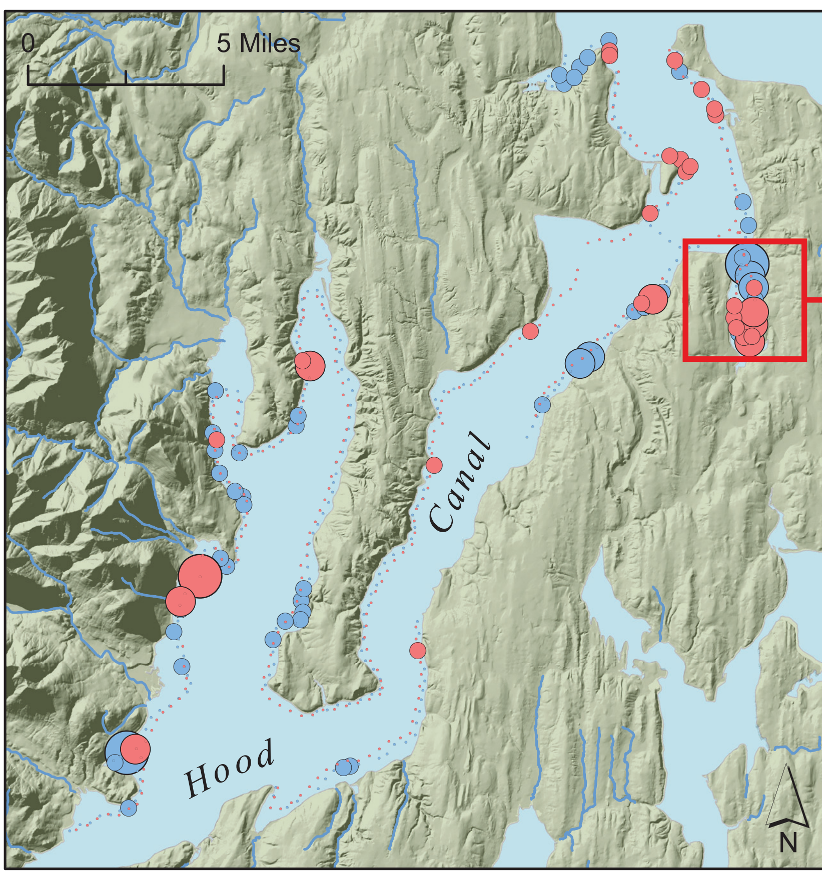
Port Gamble Bay had the highest estimated fish density rankings in 2011 and 2012.[1] Port Gamble Bay is a spawning area for forage fish including herring, surf smelt and sand lance. The larval forage fish are prey for juvenile Chinook and may explain the high densities of single target detections. The unique geomorphology of Port Gamble Bay within Hood Canal may also be a factor of the high densities: the relatively shallow bay creates a productive aquatic environment ideal for eelgrass and attached macroalgae.

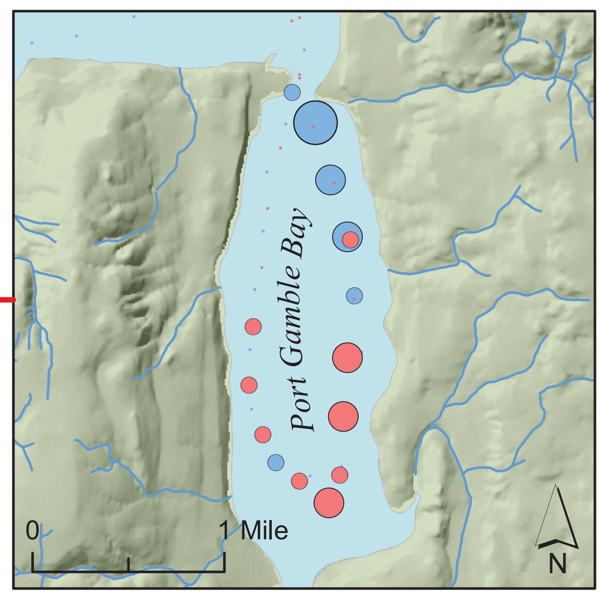
The Dosewallips and the Duckabush River deltas did not have high densities of single target detections. These results were surprising considering the rivers' large populations of salmonid species, including Chinook, fall chum and summer chum. This may be attributed to the rivers' large, shallow alluvial fans that are dewatered during low tide events.

Results of this study will inform the Hood Canal Coordinating Council's Salmon Habitat Recovery Strategy to help prioritize and rank restoration and conservation actions within the marine nearshore environment.[2]

H. Daubenberger (2)

Left: Juvenile Chinook caught in a surface trawl. Above: PGST research crew members Janet Aubin and Julianna Sullivan record measurements of fish caught during a surface trawl.





Fish Density, per 10,000 cubic meters

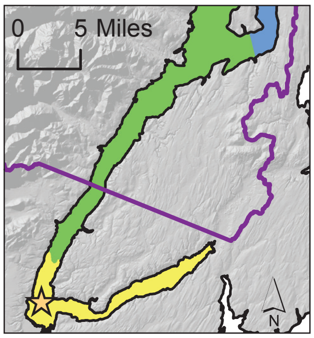
	August 2011	August 2012
0 - 12		
13 - 40		
41 - 134		
135 - 325		

Data Sources: PGST 2013,[3] SSHIAP 2004,[4] WAECY 1994[5]

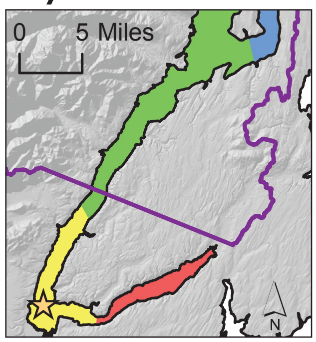
Low Dissolved Oxygen Causes Fish Kills in Hood Canal

Four fish kill events were observed between 2006 and 2015 as fatally low dissolved oxygen levels affected large portions of the water column in Hood Canal. Dissolved oxygen levels continue to be a key planning issue for the Mid-Hood Canal Chinook Recovery Plan.[1]

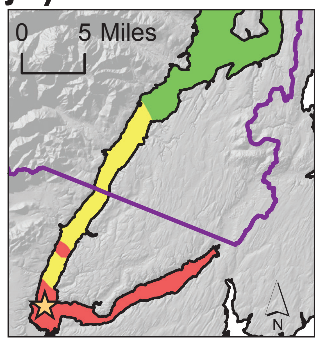
March 2006



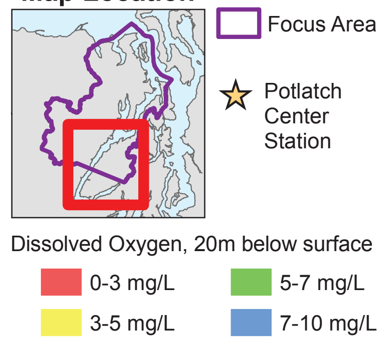
May 2006



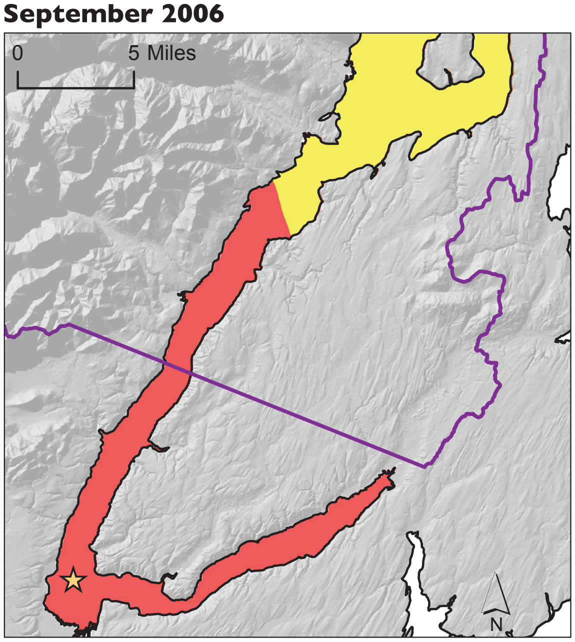
July 2006



Map Location



September 2006



This map series models the levels of DO at 20 meters below the water surface throughout Hood Canal that led up to the fish kill event of September 2006.

Hypoxia as a result of chronic low dissolved oxygen (DO) has a detrimental impact on marine species, changing their usual activity patterns and species distribution. Predation may increase as the fish leave the hypoxic waters for areas with more oxygen where they may be vulnerable to new predators, including birds and mammals that are not affected by hypoxia.[2]

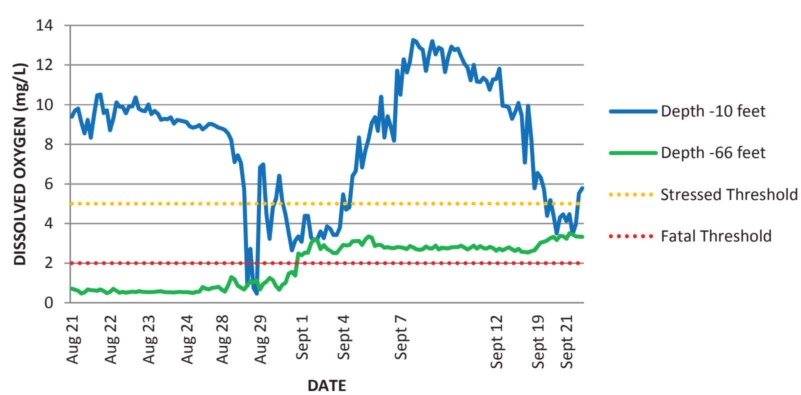
Many fish species experience stress at DO concentrations below 3-5 milligrams per liter (mg/L) and may be severely stressed and die at concentrations of 1-2 mg/L.[3] There were 17 days in 2011 that had DO levels of 5 mg/L or less at 20 meters below the surface in Hood Canal, nine of which had DO levels of 3 mg/L or less.[4] As a consequence of low DO, salmonids in Hood Canal may not be able to find food and quality habitat, resulting in reduced growth and increased mortalities.[5]

It is estimated that humans are responsible for less than 1% of the nitrogen input into Hood Canal. The natural fluctuations of DO have been linked to climate, but they may increase in severity as development increases. A review of Hood Canal best available science recommends a series of actions to improve the estimates of human influence on DO levels within Hood Canal, including modeling and continued monitoring.[6]

August 2015 Hood Canal Fish Kill

A fish kill occurred in lower Hood Canal in late August 2015 when southerly winds brought hypoxic water to the surface. The low oxygen levels associated with this fish kill are the worst conditions that have been measured. However, the fish kill events from 2003, 2006 and 2010 were worse than the 2015 event.[7] Hood Canal is a system that is very susceptible to periodic fish kills; additional oxygen depressions from human nitrogen loading increase that risk.[8]

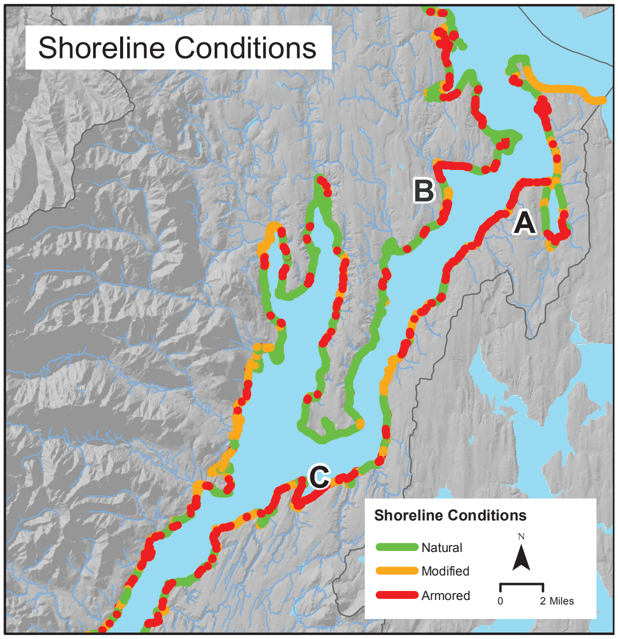
Hoodsport Buoy Dissolved Oxygen Levels
August 21, 2015 – September 21, 2015



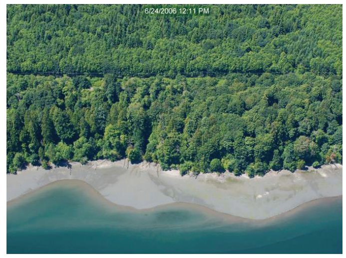
Data Sources: HCDOP 2006,[9] NANOOS 2015,[10] SSHIAP 2004,[11] WAECY 1994[12]

Nearshore Habitat Loss in Hood Canal and Strait of Juan de Fuca

About 45% of the marine shoreline in the Port Gamble S'Klallam Tribe's Focus Area has been modified or armored. A closer look at Port Gamble Bay's shoreline shows about 74% being altered through anthropogenic means. From 2004 to 2014, there was a net increase of 19,663 feet in armoring in all four counties in this region.[1]



A. Natural Shoreline



No portion of Hood Canal has been altered more than southern Hood Canal. In contrast, Point Julia, home to the Port Gamble S'Klallam Tribe, has the most frequently used and most heavily accessed spit complex on Hood Canal and maintains natural functions and values.[2]

B. Modified Shoreline

C. Armored Shoreline

Washington Coastal Atlas, 2006 (3)

The Action Agenda has identified habitat alteration as a priority threat in the Puget Sound region.[3] Shoreline alterations such as jetties and rockwalls interrupt the flow of sand on beaches. Docks and bulkheads cover beaches so that plant life and fish species are not productive in these areas.[4] Data collected on shoreline conditions in the Port Gamble Tribe's Focus Area shows that 55% is natural, 32% is modified and 13% is armored (Figure 1). However, when focusing on the area around Port Gamble Bay, a known productive area for salmonids and forage fish, it is noted that 74% of the area is either modified or armored (Figure 2). 2008 PSNERP data was used to calculate this area, but funding has been cut to continue this type of essential monitoring. The Port Gamble Bay area and surrounding shoreline has a significant amount of forested area upland of the bay that is not developed. Sediment source beaches make up 50% of this area, of which 70% is either modified or armored.[5] Shorelines in the reservation section of the drift cell are little changed and have significant wooded bluffs contributing sediment supply to the spit at Point Julia as well as providing large wood structure in the nearshore and overhanging shade for out-migrating salmon.[6] This regional Focus Area is made up of four different county jurisdictions: Clallam, Jefferson, Mason and Kitsap. Data available from the Hydraulic Project Approval (HPA) database shows that shoreline armoring is increasing for each of these counties.[7] From 2005 to 2014, there has been a net increase of 3.7 miles (19,663 feet) in shoreline armoring in Clallam, Jefferson, Kitsap and Mason counties (Figure 3).[8]

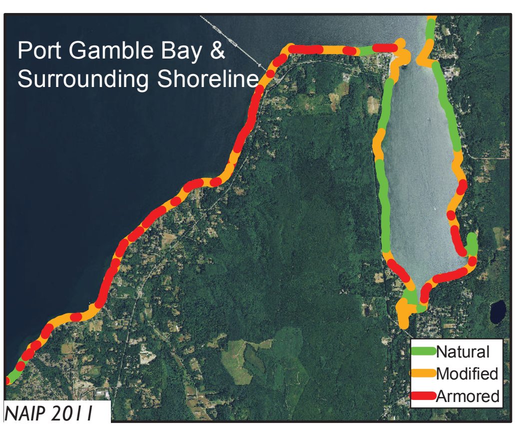


Figure 1

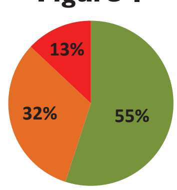


Figure 2

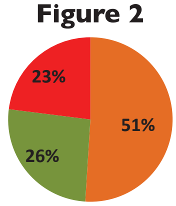
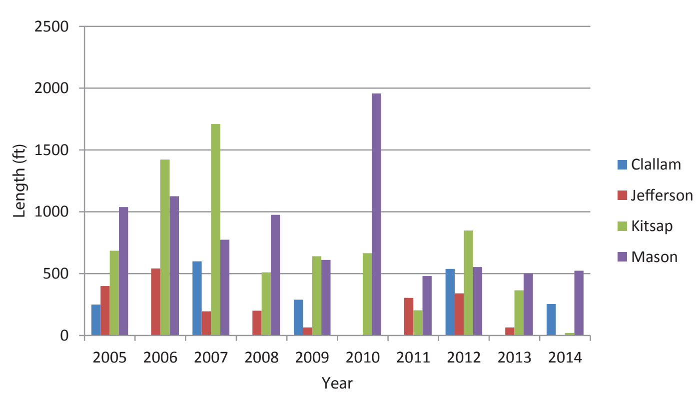


Figure 3: New Shoreline Permits by County



There is an unknown amount of unpermitted armoring that is not included in graph above.

Data Sources: Carmen et al. 2015,[9] NAIP 2011,[10] PSNERP 2008,[11] SSHIAP 2004,[12] SSHIAP 2012,[13] USGS 2014[14]

Sand Lance and Surf Smelt Spawning Habitat Conditions

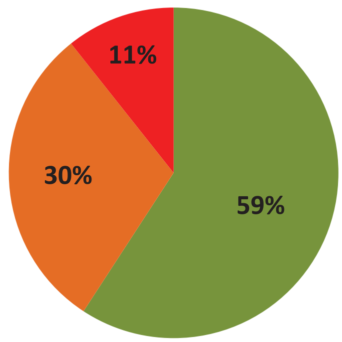
Survey data from 1970 to 2012 shows that approximately 41% of inventoried sand lance and surf smelt spawning habitat in the Port Gamble Tribe Focus Area has been modified, and of that 11% has been armored. Armoring and modification interrupts the movement of gravel and sand to these beaches and could negatively affect spawning habitat as a consequence. Climate change could exacerbate these conditions.

Surf smelt and Pacific sand lance are key part of the Puget Sound food web.[1] These forage fishes are small schooling fishes that are key prey items for larger predatory fish and wildlife, such as salmonids.[2] Sand lance is recognized as being one of the key elements of a juvenile Chinook's nearshore diet.[3] A very large portion of the shoreline in this Focus Area has been altered in various ways by human activities, to the possible detriment of the species. Sand lance and surf smelt spawn on upper intertidal beaches consisting of sand and gravel. Shoreline modification and development can negatively affect spawning sites.[4] Additionally, sea level is expected to rise substantially in this century, which will likely profoundly affect the structure and function of the Puget Sound ecosystem.[5] Maintaining abundant surf smelt and sand lance in Puget Sound is a conservation imperative, but current regulations do not consider cumulative or off-site impacts of armoring, cannot prohibit armoring in most cases,[6] and do not address likely future conditions such as climate change.[7] Cumulative distribution functions of catch per unit effort indicate that historically dominant forage fishes (Pacific herring and surf smelt) have declined in Central and South Puget Sound.[8] The results of this study suggest that some Puget Sound sub-basins have reduced capacity to support forage fish that were highly abundant historically, and these patterns are consistent with other historic studies.[9,10] The studies referenced above suggest the possible linkage between anthropogenic activities and development, as well as changing climate conditions on the abundance of forage fish in Puget Sound.

PNPTC, 2014

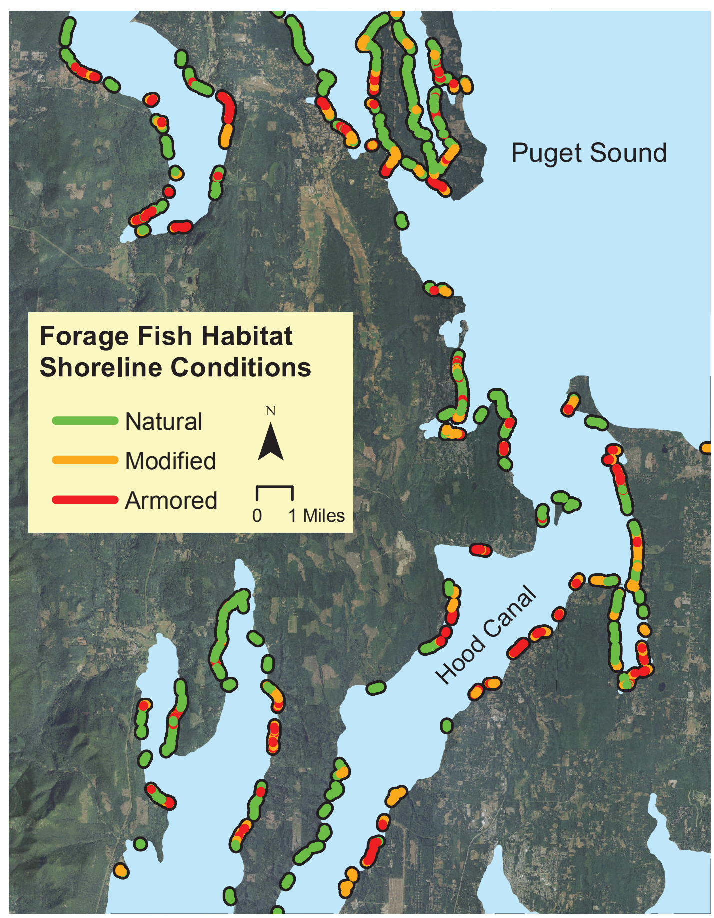
Armoring and modification impacts nearshore spawning habitats for forage fish in Hood Canal.

Pacific Sand Lance and Surf Smelt Habitat Shoreline Conditions



WADFW

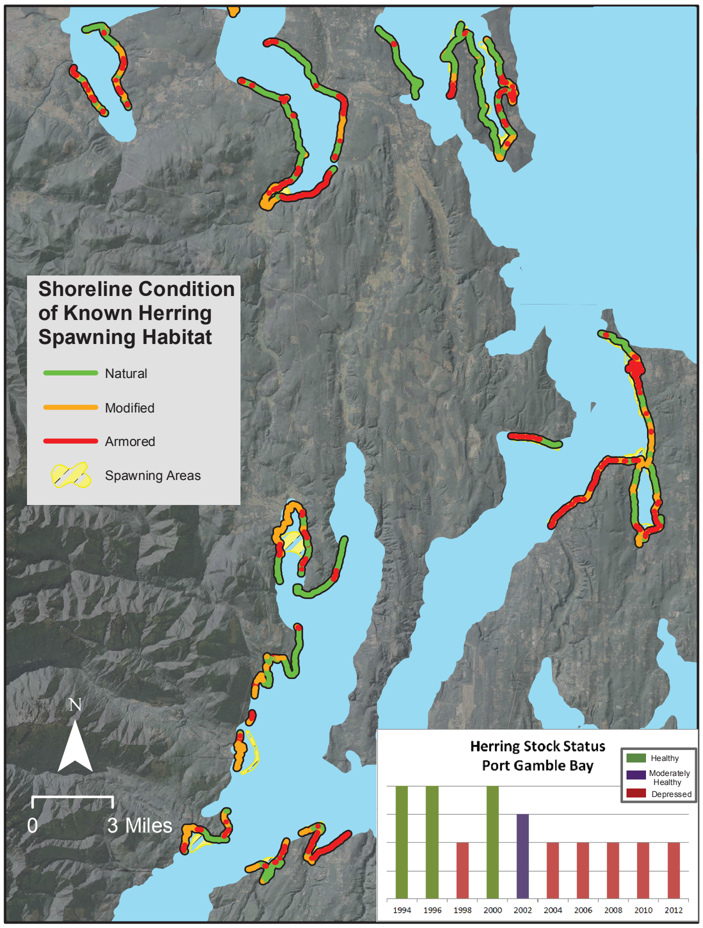
This pie chart reveals the proportion of armoring and modification in known forage fish spawning areas along shorelines, which can affect the natural sediment dynamics of spawning beaches and potentially impact the habitat for these fish. Of note, not all beaches were surveyed for forage fish.

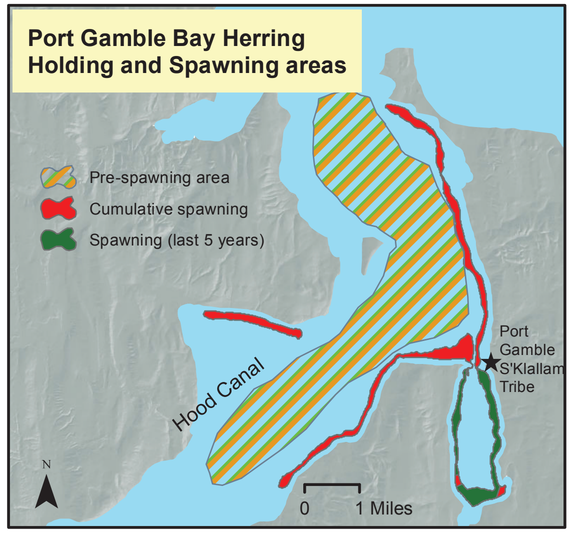


Data Sources: NAIP 2011,[11] PSNERP 2008,[12] SSHIAP 2008,[13] WADFW 2010[14]

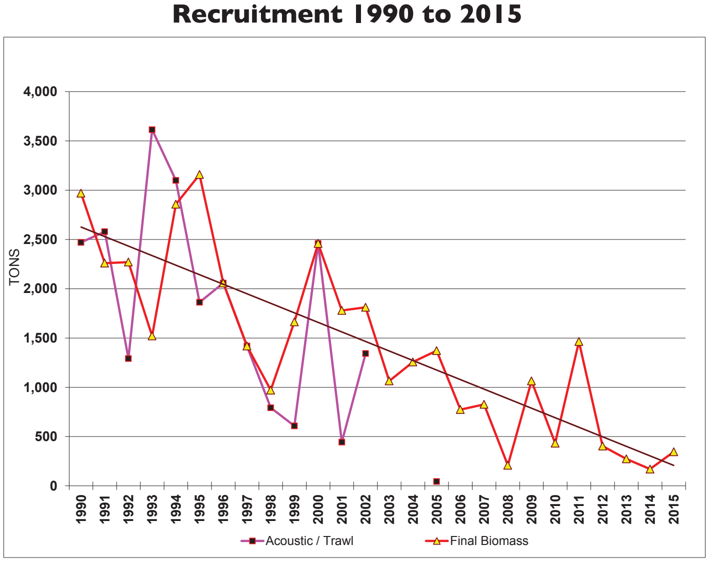
Pacific Herring Spawning Habitat Conditions: Regionally and in Port Gamble Bay

From 1970 to 2012, Port Gamble Bay herring stocks have decreased from a status of healthy to depressed, showing potential relationships between fish decline, shoreline armoring and climate change.[1] By 2014, approximately 50% of the herring spawning areas inventoried were either modified or armored. Historical evidence shows Port Gamble Bay having one of the largest Pacific herring stocks in Puget Sound. However, considerable spawning habitat has been lost due to shoreline alterations.[2]





Port Gamble Herring Stock, Spawning & Recruitment 1990 to 2015



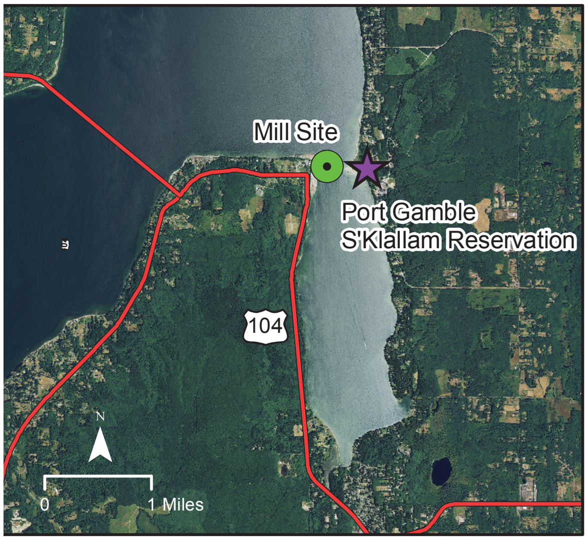
The Port Gamble herring stock has been considered one of the larger stocks in Puget Sound since quantitative survey effort began in the late 1970s.[3] Pacific herring, a vital forage fish of the marine ecosystem, are an indicator of the overall health of the marine environment. Herring were included in the 1974 Boldt decision, which defined Native American fishing rights. Herring are generally known for preferring nearshore areas containing vegetation and bay inlets. Inventoried known spawning areas along the shoreline show that 49% of the shoreline remains natural, 35% is modified, and 16% is armored. Research indicates that priority habitat for herring lies in sheltered bays.[4]

Approximately 10% of shorelines in the Puget Sound are selected by herring in sheltered bays, such as Port Gamble and Quilcene Bays.[5] The Spawning and Recruitment graph shows stock decline levels from 1990 to 2015 in Port Gamble Bay. The WDFW Port Gamble stock status has declined from healthy to depressed.[6] The concern is that development and other anthropogenic impacts within these bays will continue to remove healthy habitat for herring, especially with the unknown consequences of climate change.[7] Also, because of high contaminant levels from the old mill site on Port Gamble Bay, a recent study shows that Pacific herring embryos survived significantly better outside the Port Gamble Bay than inside.[8] The Port Gamble Tribe is hopeful that the Port Gamble Cleanup and Restoration, including removal of creosote piles, will help restore the herring population.[9]

Data Sources: NAIP 2011,[10] PSNERP 2008,[11] SSHIAP 2004,[12] SSHIAP 2008,[13] Stick et al. 2014,[14] WADFW 2010[15]

Port Gamble Bay: Long-Awaited Cleanup and Restoration

Port Gamble Bay



S'Klallam Blessing at Mill Site - July 2015

PNPTC

The Port Gamble S'Klallam performed a blessing ceremony of Port Gamble Bay and the old Port Gamble mill site in July 2015, as work started to remove thousands of creosote pilings and overwater structures from the former industrial site. Approximately 70,000 cubic yards of contaminated sediment and wood waste will be removed.

Pope Resources entered into a consent decree with the Washington Department of Ecology to clean up Port Gamble Bay from contamination from the former saw mill site. The cleanup area will include removing 70,000 cubic yards of contaminated sediment and wood waste and over 6,000 creosote pilings. Port Gamble Bay is an ancestral home and very important fishing area for the Port Gamble S'Klallam Tribe. Area tribes have been supporting this long-awaited action. Port Gamble Bay is home to ESA-listed Puget Sound Chinook, Puget Sound steelhead, Hood Canal summer chum and bull trout,[1] and other species such as coho, fall chum, herring and other forage fish, oysters, crabs and clams.[2] Port Gamble Bay is an abundant shellfish, crab and finfish harvest area, containing approximately 28% of the approved commercial harvest area within Kitsap County.[3] But historic and current uses of the Bay and watershed – including the former saw mill, the town of Port Gamble, and other developments – have taken their toll.

Port Gamble Bay is part of the Tribe's ancestral history, with archeology from Point Julia indicating that people have been using and living along the bay's shore for well over 1,000 years. With the signing of the Point No Point Treaty of 1855,[4] the S'Klallam Tribes retained the right to fish, hunt and gather in their Usual and Accustomed areas.[5] These treaty-reserved rights were affirmed by Judge Boldt in the *U.S. v. Washington* ruling (the Boldt decision), in the 1994 ruling by Judge Rafeedie affirming tribal shellfish harvest, and several other court cases. The cleanup and restoration of the Bay is essential for tribes to exercise their treaty-reserved rights.

Just 470 feet across the bay from the Port Gamble Reservation, the Port Gamble saw mill operated from 1853 to 1995. During that time, pollutants from wood waste and creosote pilings were released into the bay. These pollutants include cadmium, petroleum hydrocarbons, carcinogenic polycyclic aromatic hydrocarbons (cPAHs) and dioxins/furans. The mill closed in 1995 and has since been used for log sorting/chipping, materials handling and as a marine research facility. The bay cleanup will take about two years, with the first year focusing on the southern portion of the former mill. The second year will focus on creosote piling removal and cleanup on the area north of the mill site. Substantial improvement to the bay will result once this cleanup is complete. As a broader effort, the Port Gamble S'Klallam Tribe has been working on a cleanup of debris and removal of derelict gear and vessels on the bay next to their reservation. In 2015, the Washington Department of Ecology and the Port Gamble S'Klallam Tribe removed and disposed of an old pier, pilings and a boat launch.[6] The Tribe is looking into more restoration opportunities to protect the bay from development.[7]

For the tribe, Port Gamble Bay is not just a bay; it is the home of the tribe's ancestral village. They eat shellfish and salmon collected in the bay. Gathering goods there is very important to tribal identity and livelihood. After many years of work between the Department of Ecology and Pope Resources, with the support of local tribes, the cleanup of the bay and mill site is scheduled, starting in the fall of 2015, to remove approximately 70,000 cubic yards of contaminated sediment and wood waste, a derelict vessel, and 6000 creosote pilings along with overwater structures.[8] It will be the biggest creosote piling removal in Washington state history.[9]

Data sources: NAIP 2013,[10] WADNR 2014b[11]

Former Mill Site at Port Gamble

Washington Department of Ecology

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