

# Puget Sound Nearshore Chinook Salmon Strategies

**Making connections between local actions and regional strategies**



There are two regional policy documents that guide Chinook recovery efforts: the 2005 Regional Chinook Recovery Plan and the 2016 Chinook Implementation Strategy. These regional plans are supported by ongoing work locally. This summary report will:

- **Demonstrate linkages** between local and regional recovery strategies.
- **Highlight local actions** that can collectively advance priority regional strategies.
- **Establish how regional support** can advance watershed efforts.
- **Present new nearshore information** (since 2005); including new science and lessons learned from implementation that support watershed and adaptive management efforts.

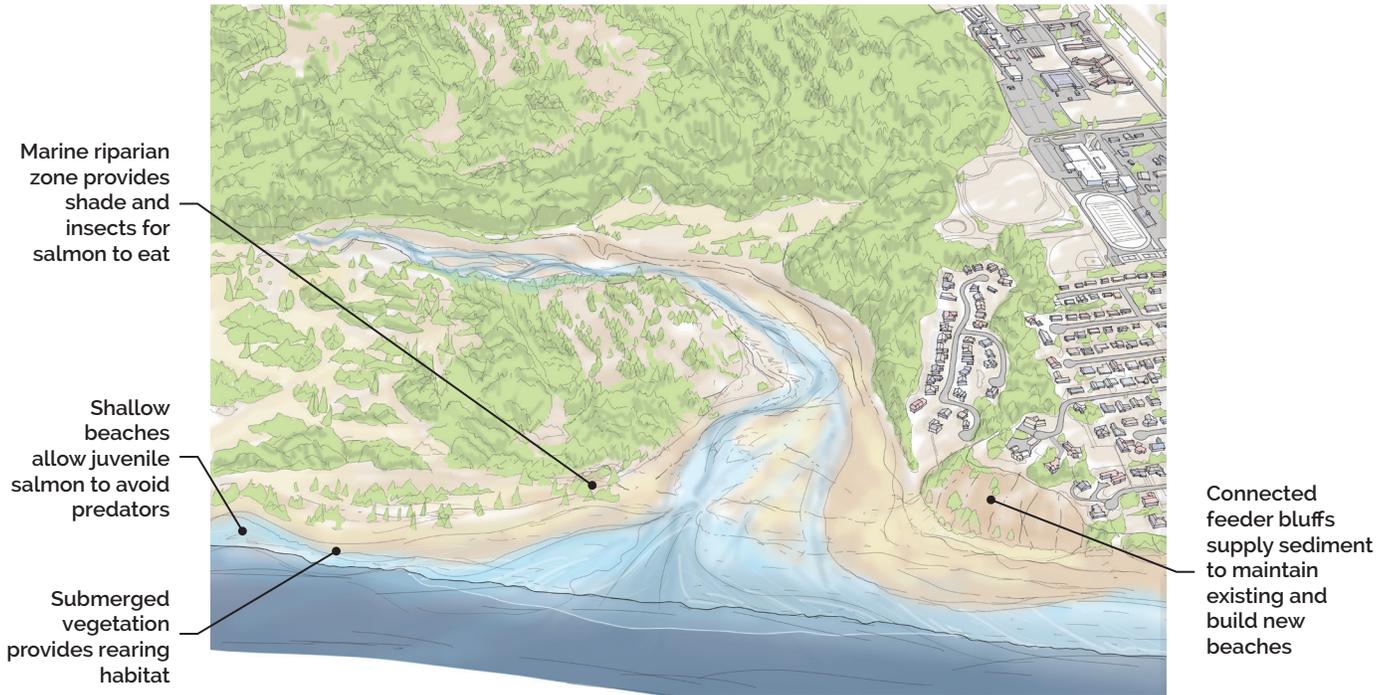
## Importance of Nearshore for Chinook Salmon

Puget Sound Chinook salmon spawn in freshwater and feed, grow and mature in marine waters. During their transition from freshwater to saltwater, juvenile salmon use nearshore ecosystems in Puget Sound. The use of the word "nearshore" generally includes large natal estuaries. For the purpose of this fact sheet, the focus on describing strategies will be on beach features and inputs from natal estuaries. Research has suggested that because rearing is limited in river and estuary systems due to habitat loss, juvenile Chinook salmon are pushed out to the marine environment and are more dependent on nearshore habitats than previously realized.

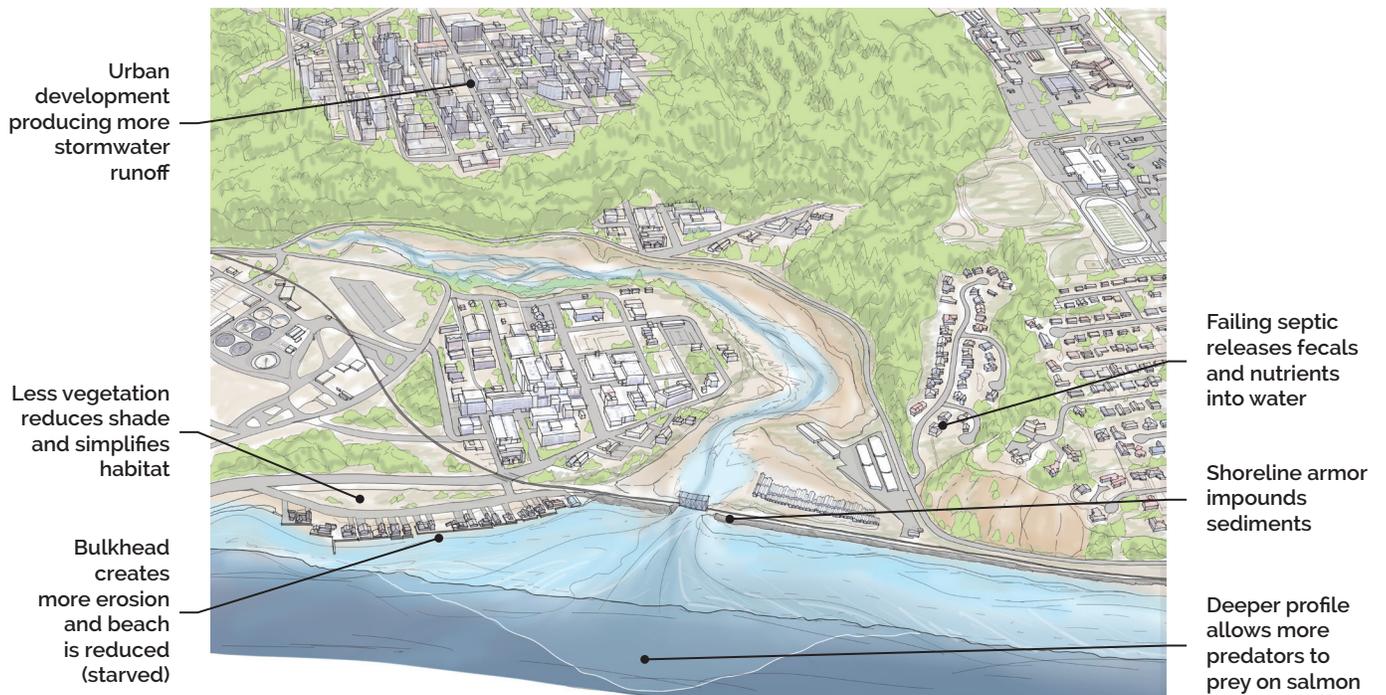
# Changes along a Conceptual Puget Sound Nearshore

Active research will help improve understanding of function and process of nearshore habitats

## CONCEPTUAL LOW DEVELOPED NEARSHORE



## CONCEPTUAL DEVELOPED NEARSHORE



## **Top threats to nearshore and how they affect habitat and fish**

Over a century of human development in Puget Sound has led to altered nearshore processes and conditions. Chinook salmon recovery efforts are addressing the top threats that limit their ability to survive and thrive as they move out of freshwater rivers and migrate to the ocean. Some of the top conceptual threats to healthy nearshore environments that researchers are actively pursuing to better inform our understanding include:

### **SHORELINE ARMORING & FILL (ROADS, BUILDINGS, RAILROADS)**

Unlike other parts of the world where beaches are fed by river sediment, the unique glacial history here created feeder bluffs that supply sediment to build and maintain beaches. When these bluffs are disconnected from the beaches below them by armor or roads and railroads, beaches tend to become "starved" and shrink. Because of the placement of armor and loss of sediment source, there is less shallow water and vegetation such as eelgrass for young fish to feed and hide from predators.

Shoreline armoring also affects Puget Sound's beach habitat, the tiny insects and other invertebrates that make up the base of the food web. Tiny creatures are found in the logs and other organic debris that wash up on shore on a natural beach. They provide an important food source to juvenile Chinook salmon and other marine animals.

### **CLEARING OF VEGETATION**

People who live on the beach sometimes clear vegetation to improve views and access to the shoreline. Marine riparian vegetation provides important functions that affect water quality and erosion control. The trees and brush also provide shade, woody debris that improves beach habitat, and detritus and nutrients to support the food web. Finally, the vegetation provides area for fish and wildlife habitat.

### **POLLUTED INPUTS**

Runoff during storm events has been identified as a major source of contamination entering Puget Sound and is contributing to the degradation of nearshore habitats, fish and animals. Metals, organic chemicals, and other pollutants are known to accumulate in beach sediments and juvenile salmon. In addition to chemical contaminants, small plastic particles (known as microplastics), found in marine waters of Puget Sound and suspected of being in aquatic sediments, are a concern because they can be ingested by animals and transported through the food web.

### **WASTE WATER**

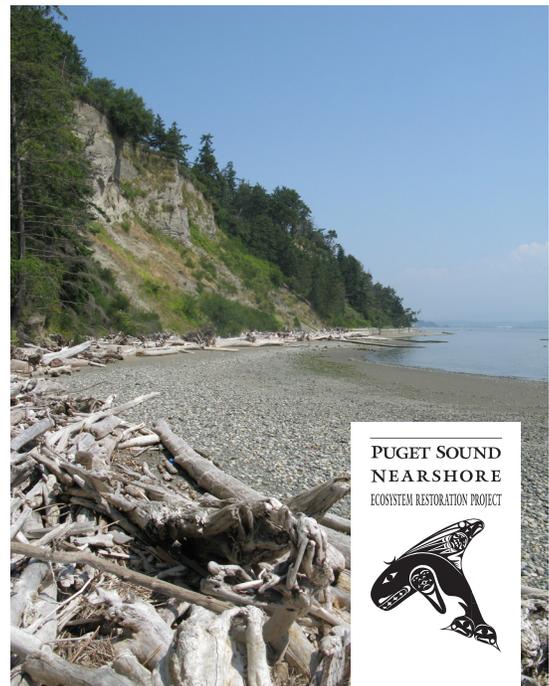
Wastewater treatment plant outfalls are a major source of chemicals of emerging concern. On-site septic systems that store sewage for homes need regular inspection and maintenance to ensure they are working properly. When on-site septic systems fail and leak into our rivers and marine waters, sewage disrupts the food web by delivering excess nitrogen and phosphorus into the waters, contributing to low-oxygen conditions that can kill fish. Waste water and failed septic systems also release contaminants into the nearshore including pharmaceutical and personal care products that are known to reduce health of juvenile salmon.

## Notable Examples of New Science and Information since 2005

It was widely recognized in 2005 that there were significant gaps in the understanding of how salmon used the nearshore and the natural processes that supported high quality habitat. Following the approval of the **Puget Sound Salmon Recovery Plan**, partners worked to implement the research strategies to refine recovery hypotheses. Additionally, several new technical programs created guidance or project lists that local recovery partners are now taking into consideration. Below are some of the notable achievements and findings since 2005 that have influenced nearshore Chinook salmon recovery.

The **Puget Sound Nearshore Ecosystem Restoration Project** (PSNERP) began in 2001 and is one of the largest habitat restoration and preservation programs ever undertaken in the United States. PSNERP is an effort similar in scale to others in the Chesapeake Bay and Everglades. PSNERP is an U.S. Army Corps of Engineers General Investigation study in partnership with the Washington Department of Fish and Wildlife that includes many other partners. In 2016 the feasibility phase of this study was completed. The Corps' recognition of the Puget Sound nearshore zone being nationally significant and authorization by Congress in 2018 allows federal Corps funding to be directed towards Washington State to design and implement eligible nearshore habitat projects. PSNERP explored the following questions:

- How has the shoreline of Puget Sound changed?
- Where are the most problematic changes and why?
- What can we do to protect and manage the nearshore?
- What actions should we take and where?



Barnum Point. SOURCE: WDFW.

PSNERP feasibility work guided by the Nearshore Science Team produced over 20 peer-reviewed technical publications<sup>1</sup> and greatly advanced the state of science for the nearshore, including synthesizing information, notably around juvenile salmon use of specific nearshore habitat types and an historical change analysis to understand regional degradation from late 1800s to 2000. The work used the process-structure-function approach as the basis for process-based restoration for Puget Sound nearshore habitats.

In 2013, Beamer et al.,<sup>2</sup> published the results of a six-year study on the use of small coastal streams in the Whidbey basin by juvenile Chinook salmon. Streams of this size had not been considered Chinook salmon habitat because many flow seasonally and did not provide habitat for spawning salmon. However,

1 [http://www.pugetsoundnearshore.org/technical\\_reports.html](http://www.pugetsoundnearshore.org/technical_reports.html)

2 Beamer, E.M., W.T. Zackey, D. Marks, D. Teel, D. Kuligowski, and R. Henderson. 2013. Juvenile Chinook salmon rearing in small non-natal streams draining into the Whidbey Basin. Skagit River System Cooperative, LaConner, WA.

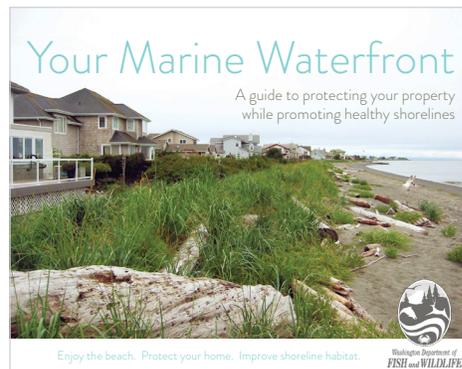
research showed that small streams entering the Whidbey Basin did provide rearing habitat for fry migrant Chinook salmon originating from the three nearby rivers (Skagit, Snohomish, and Stillaguamish). In general, small streams are not well mapped and most have inadequate regulatory protections as fish habitat.

In 2014, **The Marine Shoreline Design Guidelines**<sup>3</sup> (MSDG) were developed by WDFW to provide a comprehensive framework for site assessment and alternatives analysis to determine the need for shore protection and identify the technique that best suits the conditions at a given site. These techniques include the use of best management practices, structure relocation, and implementation of "soft shore protection" project designs, all specific to unique conditions and processes in Puget Sound.

Since 2014, over 150 scientists and technicians from federal, state, tribal, academic, and nonprofit institutions have been contributing to the **Salish Sea Marine Survival Project** (<http://marinesurvivalproject.com>) and assessing the condition of juvenile Chinook salmon, coho and steelhead and their marine environment. Preliminary results suggest that abundant food, such as forage fish, is key to help juveniles survive as they grow quickly in the Puget Sound offshore environment. Supporting increased forage fish production will also help Chinook by reducing predation by harbor seals. It is believed that harbor seals are preying more heavily on juvenile salmon due to reduced numbers of forage fish available.

In 2018, Miller et al.<sup>4</sup> released an updated set of absolute and relative sea level rise (SLR) projections out to 2150 for Washington State. This report incorporates the latest science, provides community-scale projections, and is designed for direct application to risk management and planning. As part of a broader project that created these SLR projections, Raymond et al. 2018 provides considerations for nearshore restoration that take these new SLR projections into account. This report provides information to evaluate the extent to which nearshore restoration projects are likely to be resilient to the impacts of SLR. The intended purpose is to assist restoration practitioners with identifying SLR impacts relevant for specific restoration actions.

For further examples of peer-reviewed nearshore literature, see the 2016 Chinook Nearshore Literature Review, assembled by Cramer Fish Sciences for the Puget Sound Partnership (<https://app.box.com/file/111704575613>).



Harbor Seal. SOURCE: WDFW.

3 Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. Barnard, R. Carman, and H. Shipman. 2014. Marine Shoreline Design Guidelines. Washington Department of Fish and Wildlife, Olympia, Washington. <https://wdfw.wa.gov/publications/01583/>.

4 Miller, I.M., Morgan, H., Mauger, G., Newton, T., Weldon, R., Schmidt, D., Welch, M., Grossman, E. 2018. Projected Sea Level Rise for Washington State – A 2018 Assessment. A collaboration of Washington Sea Grant, University of Washington Climate Impacts Group, Oregon State University, University of Washington, and US Geological Survey. Prepared for the Washington Coastal Resilience Project. <http://www.wacoastalnetwork.com/washington-coastal-resilience-project.html>

## Recovery Plans in the Nearshore

When the regional Chinook salmon recovery plan was approved in 2005, little was known about the importance of nearshore habitats and areas. The Habitat Strategies in the Nearshore Chapter called for the following high-level strategies:

- Protect functioning habitat and high water quality
- Improve nearshore habitat function by restoration, rehabilitation, or substitution
- Research, monitor, evaluate/refine hypotheses, goals and strategies related to nearshore habitat recovery

In 2008, the Washington State Legislature created the **Puget Sound Partnership** (PSP), a new state agency to oversee ecosystem recovery in the Puget Sound through the National Estuary Program (NEP). The agency created regional strategies and associated local plans, many of which focus on nearshore habitat health. As the lead for implementation of the NEP, PSP has a unique backbone role in catalyzing funding and support for partners engaged in nearshore work.

## Regional Partners

The following table shows the elements of the NEP and Puget Sound Chinook Recovery.

	PUGET SOUND NATIONAL ESTUARY PROGRAM		PUGET SOUND CHINOOK RECOVERY	
RESPONSIBLE AGENCY	Puget Sound Partnership		NOAA Co-managers (WDFW + Tribes) Puget Sound Partnership (Regional Organization)	
RESEARCH AND MONITORING	State agencies Local governments Tribes	Puget Sound Institute Academia	NOAA WDFW Local governments	Tribes Academia
REGIONAL PLANS	Action Agenda Shoreline Armoring Implementation Strategy Chinook Implementation Strategy Eelgrass Implementation Strategy		Regional Chinook Recovery Plan Nearshore Chapter PSNERP Strategy	
LOCAL IMPLEMENTERS	Local Integrating Organizations + partners		Lead Entities + local government, conservation district, non-profit organization partners Marine Resources Committees Tribes	

## Funding of Implementation in the Nearshore

Several programs fund aspects of the salmon recovery effort. For on-the-ground restoration and protection projects, there are several funders, including the Puget Sound Acquisition and Restoration Fund, the Salmon Recovery Funding Board, and the Estuary and Salmon Restoration Program. Other programs are not dedicated funding sources for salmon, but they have a strong nexus to the salmon recovery effort. For example, NEP Geographic Funds support near-term actions prioritized in the Puget Sound Action Agenda, which includes a broad set of recovery goals.

# Lessons Learned in Chinook Recovery Implementation

## SINGLE FAMILY DEVELOPMENT

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- Single family homes are a major driver of shoreline armoring and represent two-thirds of permit applications from the State.
- Education, incentives, examples of softshore project successes, and technical assistance are essential to overcoming the barriers for homeowners in deciding whether to install or remove shoreline armoring.
- Landowners need to be able to access local contractors who have a technical understanding of how to remove armoring, and design softshore alternatives to protect property and the nearshore.

## PERMITTING

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- Local jurisdiction staff need training or access to technical experts to ensure permits are implemented correctly to protect beaches.
- Additional capacity is needed for local jurisdiction permitting staff.
- Permitting processes are lengthy and complicated, involving several different regulatory authorities with overlapping jurisdictions.
- Emergency permitting processes are being over-used and are not as protective as non-emergency permits.
- Streamlined permitting is beneficial as an incentive for restoration projects.

## ENFORCEMENT

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- A lack of staff is dedicated to enforcement of shoreline regulations.
- Enforcement actions are largely complaint-driven.
- There is a lack of political will to enforce regulations.
- There is limited access to information and data.
- Prosecution is difficult for both WDFW and local governments.

## FEAR OF CLIMATE IMPACTS

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- Homeowners fear erosion before verifying if that fear is warranted or not.
- Homeowners misunderstand the role of shore armor in reducing resiliency to climate change impacts.
- Jurisdictions tend to protect infrastructure instead of moving it.
- Guidance is needed to project proponents in applying climate impacts to the siting, design, and maintenance of projects.

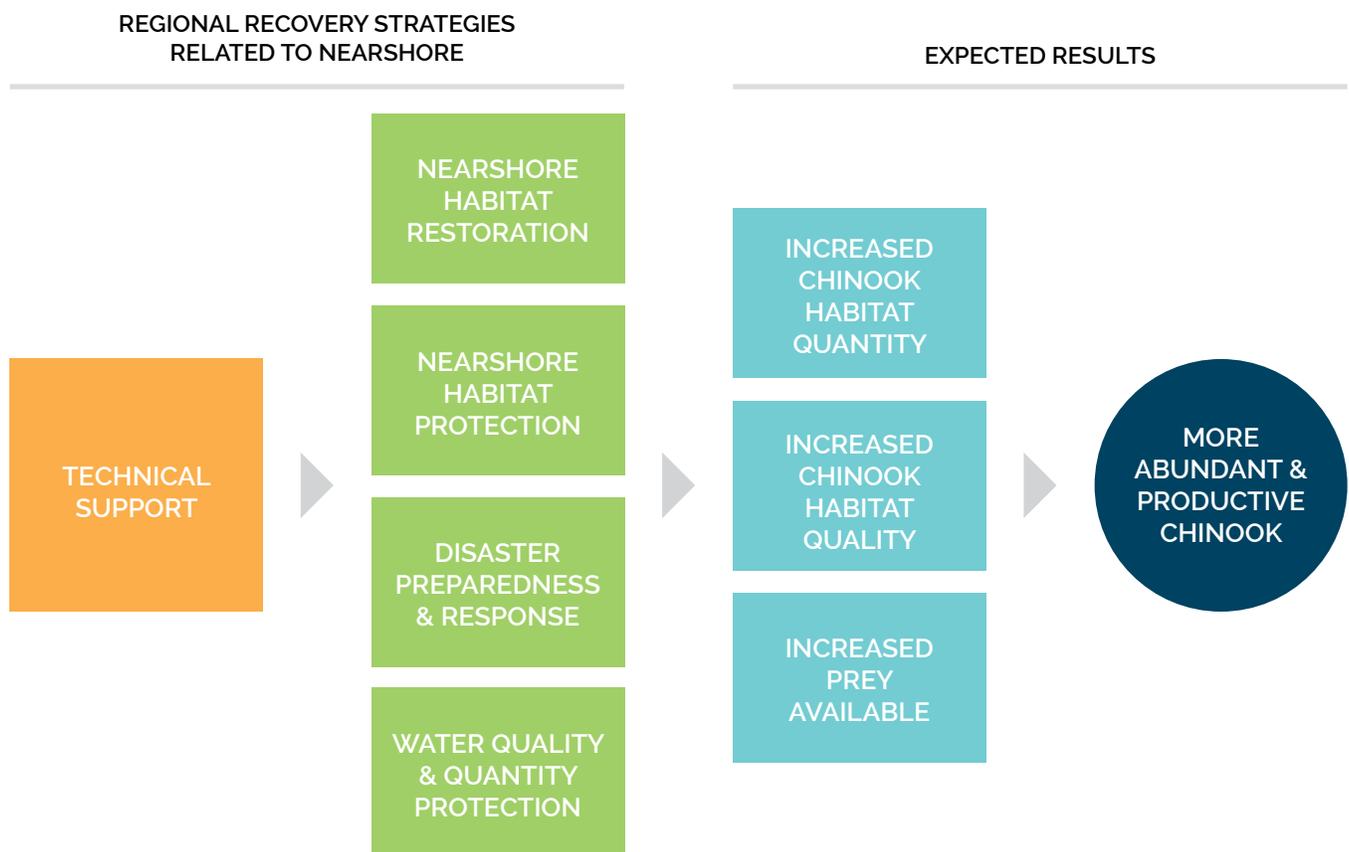
## RESTORATION AND ACQUISITION FUNDING

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- Government acquisition funding is unable to respond quickly to opportunities for purchase of property. New programs are needed to allow for rapid funding response to priority acquisitions.
- Projects are often extremely expensive because of coastal land values. And there is the need to protect landward infrastructure or property.
- Existing nearshore programs are chronically underfunded.
- It is often difficult to measure how individual armor removal projects benefit the Puget Sound ecosystem. These projects are often considered lower priority compared to larger estuary or shoreline projects during funding deliberations.
- There is a lack of funding for ecosystem monitoring activities.
- Large restoration projects need to be conducted in phases in order to match development time to life-span of state funding (4 years), thereby increasing uncertainty of funding for future phases.

# 2018 Regional Chinook Salmon Recovery Approach

The graphic below shows the primary regional strategies associated with increasing the quantity and quality of nearshore habitat for Chinook salmon in the Puget Sound. Activities, programs and projects at the watershed-scale directly support the success of each of these regional approaches, although implementation of the strategies may vary in different geographies. Regional funding and regional technical support is essential to supporting watersheds as they implement locally. The recovery categories below will be described in greater detail in the following pages.

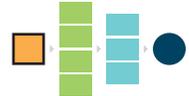


## Watershed Activities and Desired Outcomes

The following sections outline examples of watershed activities that support regional outcomes. These sections can help watershed partners better understand how their work contributes to Puget Sound-scale recovery.



## Technical Support



With shifting conditions and new impacts to Chinook salmon in Puget Sound, ongoing technical support is needed to help local implementers prioritize where to put their nearshore efforts. The issues below have been identified at the regional level, however specific threats or context may warrant additional technical information at the local level.

EXAMPLE ACTIVITIES	REGIONAL OUTCOMES
<ul style="list-style-type: none"> <li>• Research the following issues related to Chinook salmon:                             <ul style="list-style-type: none"> <li>— Point and non-point pollution</li> <li>— Food web dynamics</li> <li>— Climate impacts</li> <li>— Marine survival</li> <li>— Fish genetics and fitness</li> <li>— Effects of stormwater and wastewater</li> <li>— Predation dynamics</li> </ul> </li> <li>• Provide guidance on prioritization for specific nearshore geographies and shoreline features and habitats that support the 22 Puget Sound Chinook salmon populations</li> <li>• Provide engineering design guidance on tidal restoration (e.g., tidal channel geometry)</li> </ul>	<p style="text-align: center;"><b>Technical information and guidance that allows watersheds to restore the most important shoreline habitats and protect against emerging issues.</b></p>

### EXAMPLE PROJECT

#### Toxic Contaminants in Juvenile Chinook

Recent research has shown that a significant portion of Puget Sound Chinook salmon are at risk of impaired health due to contaminant exposure from rivers and nearshore habitats. Studies linking stormwater and legacy contaminants to juvenile Chinook health have highlighted the necessity to consider other contributing impacts beyond a lack of accessible habitats. Some suggested strategies to consider in the future are sediment remediation in estuaries and the nearshore and better controls of contaminants that reach river systems.

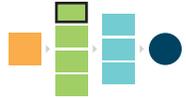
**Toxic contaminants in juvenile Chinook salmon (*Oncorhynchus tshawytscha*) migrating through estuary, nearshore and offshore habitats of Puget Sound**

October 2015

Sandra M. O'Neill, Andrea J. Carey, Jennifer A. Lanksbury, Laurie A. Niewolny, Gina Yittalo, Lyndal Johnson, and James E. West




Washington Department of FISH and WILDLIFE  
Report FPT 16-02



## Nearshore Habitat Restoration

Nearshore restoration helps create and enhance habitat that provides increased feeding and resting opportunities for salmon, which has contributed to the success of out-migrating juveniles and returning adults. Additionally, nearshore habitats provide spawning opportunities for forage fish. Activities can include removing impediments to natural processes that support the creation of beaches and other shallow water habitat. Restoration can also focus on the marine vegetation zone which cools water and increases food sources for juveniles.

EXAMPLE ACTIVITIES	REGIONAL OUTCOMES
<ul style="list-style-type: none"> <li>• Improve the function of marine shorelines, particularly embayments, eelgrass beds, and other shallow, low velocity, fine substrate estuary-adjacent habitats .</li> <li>• Improve sediment delivery from sources such as feeder bluffs, river and creek discharges, and sediment transport processes to support habitat formation and function.</li> <li>• Improve stream mouth estuary habitats.</li> <li>• Implement riparian functions related to water quality, food production and refuge.</li> <li>• Remove hard armor or replace with soft shore protection when necessary.</li> </ul>	<p>Improved quality and quantity of nearshore habitat</p>

### EXAMPLE PROJECT

#### The Shore Friendly Program

The Shore Friendly Program has a public information website for waterfront homeowners who care about the health of Puget Sound. The program offers incentives to make protecting property and the Puget Sound easier. Local programs around the Puget Sound offer free workshops and site evaluations for waterfront homeowners. Shore Friendly helps landowners evaluate alternatives to hard armor for their shoreline. Good soft shore protection techniques mimic nature while protecting your property. These techniques generally include some combination of native plantings, anchored drift logs, gravel berms, sand replenishment, and site recontouring.

[www.shorefriendly.org](http://www.shorefriendly.org)



Seahurst Park (Burien, WA) **TOP:** before soft shore protection (2005); **BOTTOM:** after soft shore protection (2014)



## Nearshore Habitat Protection

The most certain recovery approach to supporting Chinook salmon in the nearshore is to protect the intact, good quality habitat that already exists. This is difficult however as landowners want to protect their assets from potential flooding and erosion, clear shoreline vegetation for views, and nearshore habitats receive polluted inputs from upland landscapes.

EXAMPLE ACTIVITIES	REGIONAL OUTCOMES
<ul style="list-style-type: none"> <li>• Acquire high value nearshore habitat.</li> <li>• Provide incentives to nearshore landowners to protect habitat by using softshore approaches when considering armoring and moving at-risk infrastructure that is threatened by erosion.</li> <li>• Create incentives to nearshore landowners to protect non-armored beaches.</li> <li>• Improve shoreline regulations, implementation and enforcement.</li> <li>• Educate the public on how to steward the nearshore, maintain and restore native marine riparian vegetation.</li> <li>• Enforce regulations on non-compliant or illegal armoring.</li> </ul>	<p><b>Permanently protected habitat and associated processes</b></p> <p><b>Nearshore stewarded for improved Chinook salmon use</b></p>

### EXAMPLE PROJECT

#### Kelly’s Point (Guemes Island)

In 2018, Skagit Land Trust, supported by over 450 families, business and organizations, as well as many grants, raised funds to purchase 27 acres and 3,000 linear feet of feeder bluff on the southern edge of Guemes Island. The sediment from the bluff sustains local habitat, including the nearby Peach Preserve Wildlife Area owned by the San Juan Preservation Trust, and barrier beaches found in front of local homes. The sediment also anchors marine eelgrass beds used by forage fish that are essential to juvenile salmon.

<http://www.skagitlandtrust.org/properties/kellyspoint.aspx>



## Disaster Preparedness & Response



Oil and other toxic contaminants affect juvenile Chinook salmon survival through limiting growth, lessening disease resistance and altering hormones which affect future reproduction. Reducing the chances for spills and developing processes for rapid clean-up are key to limit exposure. Natural disasters can often put shoreline infrastructure at risk that is currently limiting habitat. By planning responses that move shoreline infrastructure away from nearshore habitats, the assets and habitats will be more resilient.

EXAMPLE ACTIVITIES	REGIONAL OUTCOMES
<ul style="list-style-type: none"> <li>• Develop information on spill risk and response plan.</li> <li>• Train and equip local responders.</li> <li>• Develop information on natural disasters (sea level rise, storm surge) and infrastructure at risk.</li> <li>• Work with jurisdictions to develop plans to minimize risk to infrastructure and restore shoreline.</li> </ul>	<p>Oil spills prevented and/or impacts minimized</p> <p>Shoreline infrastructure moved or replaced after failure with a more ecosystem resilient approach</p>

### EXAMPLE PROJECT

#### Washington Coastal Resiliency Project

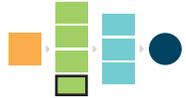
Washington's Coastal Resilience Project is a three-year effort to rapidly increase the state's capacity to prepare for natural events that threaten the coast. The project will improve risk projections, provide better guidance for land use planners and strengthen capital investment programs for coastal restoration and infrastructure. These are the tools that coastal communities need to become more resilient to disasters.

Through a smart combination of activities — investing in new science, coordinating existing programs and applying and sharing what is learned from three community models — our state can efficiently expand its capacity to "weather" future coastal hazards.

<http://www.wacoastalnetwork.com/washington-coastal-resilience-project.html>



Storm waves on Lummi Island, WA, 2015. Photo by Pete Granger. Courtesy of Washington Sea Grant.



## Water Quality & Quantity Protection

Many of the pollutants that run off of the landscape into the nearshore are poorly metabolized by salmon, persist in the environment and bioaccumulate and biomagnify in the food web. These toxics can reduce salmon survival by making them more susceptible to disease. Human sewage and pet waste can result in poorly oxygenated conditions for nearshore species, including Chinook salmon. Elevated nearshore temperatures, resulting from lack of marine riparian zones, modified shorelines and reduced freshwater flows, can lower growth rates in young Chinook salmon.

EXAMPLE ACTIVITIES	REGIONAL OUTCOMES
<ul style="list-style-type: none"> <li>• Work with jurisdictions, private developers, and landowners to adopt best stormwater practices.</li> <li>• Work to identify and reduce contaminants and pollution from sources other than stormwater (e.g., Pollution Identification Control programs, prescription take-backs, pet waste reduction).</li> <li>• Analyze water and sediment quality issues in impaired areas and implement cleanup activities – focused on control or elimination of sources or restoration of natural hydrology.</li> <li>• Address impaired water quality standards with site appropriate measures and support implementation.</li> <li>• Work with region to ensure water rights appropriations protect Chinook salmon and instream flow rules are enforced.</li> <li>• Implement nutrient source reduction programs.</li> </ul>	<p><b>Regulations and best management practices support improved water quality in the nearshore</b></p> <p><b>Flows to the nearshore support Chinook habitat</b></p>

### EXAMPLE PROJECT

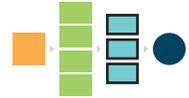
#### Hood Canal Regional Stormwater Retrofit Plan

The Hood Canal Regional Stormwater Retrofit Plan is designed to coordinate stormwater and low impact development (LID) retrofit efforts on a watershed scale using shared prioritization and planning strategies to maximize benefits, find efficiencies, and encourage consistency. The plan seeks to provide important environmental and public health benefits, limit runoff and pollution of surface waters and increase infiltration of rainwater in the Hood Canal watershed. It prioritizes retrofits in locations that are most important to the protection or restoration of watershed processes and achieve the following:

- Establishes regional collaboration and coordination between Mason County, Kitsap County, Jefferson County, the Skokomish Tribe, and the Port Gamble S'Klallam Tribe
- Determines regional retrofit goals, priority areas, and retrofit criteria
- Assesses feasibility of stormwater retrofits opportunities
- Develops conceptual designs, pre-design reports, and funding plans for retrofit pilot projects

<http://hccc.wa.gov/content/hood-canal-regional-stormwater-retrofit-plan>

## Expected Results & Monitoring



Since 2005, an impressive body of knowledge of the nearshore ecology of Puget Sound related to Chinook salmon has been accumulated. Despite that, there is no integrated and systematic Puget Sound-wide monitoring program for marine habitats. Most studies and monitoring programs are undertaken at local scales and it is challenging to assess local conditions within or across regions in Puget Sound. Despite the variation in data, there are still several Puget Sound-wide programs that will continue to give limited results.

### NOAA Status Review

The Endangered Species Act directs the National Oceanic and Atmospheric Administration (NOAA) to review the listing classification of threatened and endangered species at least once every five years. The last review was in 2016. After completing this review, NOAA must determine if any species should be: (1) removed from the list; (2) have its status changed from threatened to endangered; or (3) have its status changed from endangered to threatened. NOAA tracks several metrics associated with nearshore habitats.

### Common Indicators

Each local area has its own specific needs for monitoring status and trends. However, for the Puget Sound region to report on Chinook salmon recovery at a regional level, it is essential to have a common set of indicators across all watersheds that can be used both to measure progress for each watershed as well as rolled up to report on progress across the region. Watersheds will continue monitoring additional indicators as needed to support local decisions. In 2014, many watersheds identified the need for regional guidance on a standardized or common set of indicators. Developed in 2016, this set of common set of indicators will enable the region to understand how successful each watershed is in implementing its recovery chapter and also tell a clear regional story about recovery that is directly tied to evaluating the success of the recovery plan. The current common indicators<sup>1</sup> related to the nearshore are:

- Percent sediment source intact by drift cell
- Extent of armored shoreline
- Proportion of current shoreline that is vegetated

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<sup>1</sup> Protocols are currently in development through work at the Puget Sound Partnership.

## Puget Sound Ecosystem Monitoring Program

The Puget Sound Ecosystem Monitoring Program is a collaboration of state, federal, tribal and local government agencies, non-governmental organizations, watershed groups, business, academic researchers, local integrating organizations, and other private and volunteer groups and organizations – all who are dedicated to monitoring environmental conditions in Puget Sound. The objective of PSEMP is to create and support a collaborative, inclusive, and transparent approach to regional monitoring and assessment that builds upon and facilitates communication among the many monitoring programs and efforts operating in Puget Sound by PSEMP partners. PSEMP's fundamental goal is to assess progress toward the recovery of the health of Puget Sound.

## Vital Signs and Implementation Strategies

To track progress toward recovery goals for Puget Sound, the Puget Sound Partnership chose a specific set of measures called the Vital Signs (<https://www.psp.wa.gov/vitalsigns/index.php>). Tracking and reporting of Vital Signs is the foundation of the shared measurement system the Partnership relies on to show collective progress. The data and information for the Puget Sound Vital Signs are compiled from a variety of monitoring programs and funding organizations in Puget Sound, including state and federal agencies, tribes, local jurisdictions, and non-governmental organizations. Technical and scientific experts from these organizations provide the data and oversee the interpretation of the results.

Three Vital Signs related to the nearshore—**Chinook**, **Shoreline Armoring**, and **Eelgrass** will continue to have information collected, compiled, and reported on to give the best understanding of how these species and habitats are responding to recovery efforts.



## Gains and Losses in Nearshore Habitats

Significant work has been done with respect to nearshore restoration, regulatory updates that better protect shorelines, conservation easements which limit development, acquisition of high value parcels, and outreach and education to landowners to improve stewardship. However, this progress has been coupled with a growing Puget Sound human population, increases in upland and shoreline development and concerns about possible impacts due to climate change, such as sea level rise and storm surge.

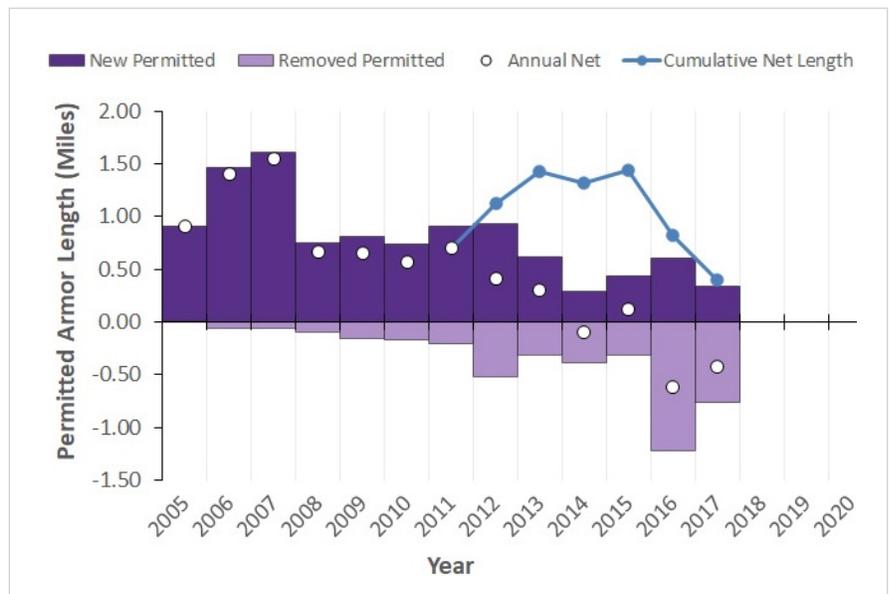
Two primary indicators that are related to nearshore health have data at the Puget Sound scale – the length of shoreline armoring (such as bulkheads) and the area of eelgrass. Each have an associated target developed in the Action Agenda:

- From 2011 to 2020, the total amount of armor removed should be greater than the total amount of new armor installed in Puget Sound
- From 2011 to 2020, there should be a 20% increase of eelgrass area, relative to the 2000 - 2008 baseline

### MONITORING RESULTS

Because the rate of new permitted armor has slowed and more armor was permitted for removal than added in 2014, 2016, and 2017, this indicator appears to make progress toward the 2020 target.

- More permitted armor was gained than lost cumulatively since 2011, resulting in a net cumulative length of 0.4 miles (2112 feet) of new armor. In three of the last four years (2014, 2016, 2017), more permitted armor was removed than was added, a ratio that aligns well with the 2020 target.
- New armor continues to be permitted for construction at an average pace of 0.58 miles (3,062 feet) per year (2011 – 2017), but the pace has slowed progressively since 2013.
- In contrast, during the same time period, removal of shoreline armor was permitted at an average rate of 0.53 miles (2798 feet) per year— not enough to balance out new permitted armor.



New, removed, annual net, and cumulative net permit armor change in Puget Sound. SOURCE: Puget Sound Partnership. [www.psp.wa.gov/vitalsigns/shoreline\\_armoring.php](http://www.psp.wa.gov/vitalsigns/shoreline_armoring.php)

As of 2017, Department of Natural Resource's annual estimate of sound-wide eelgrass area show:

- Overall sound-wide stability between 2000 and 2017, with a majority of sites either stable or increasing.
- Losses observed in enclosed embayments (Quartermaster Harbor, Westcott Bay, Port Gamble Bay) and some sub-regions (south Central Puget Sound and the San Juan Islands).

It is unlikely that the 2020 target of a 20% increase in eelgrass area will be met.

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## For More Information

Everyone that lives in the Puget Sound region has a role to play in protecting and restoring nearshore habitats and Chinook habitats. For more information, please visit the **WDFW Estuary and Salmon Restoration Program** at <http://pugetsoundnearshore.org/esrp/index.html> or the **Puget Sound Partnership** at <https://www.psp.wa.gov/salmon-recovery-overview.php>.

This project has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement PC-01J22301 through the Washington Department of Fish and Wildlife. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency or the Washington Department of Fish and Wildlife, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.