Multi-Species Salmon Recovery Plan Update

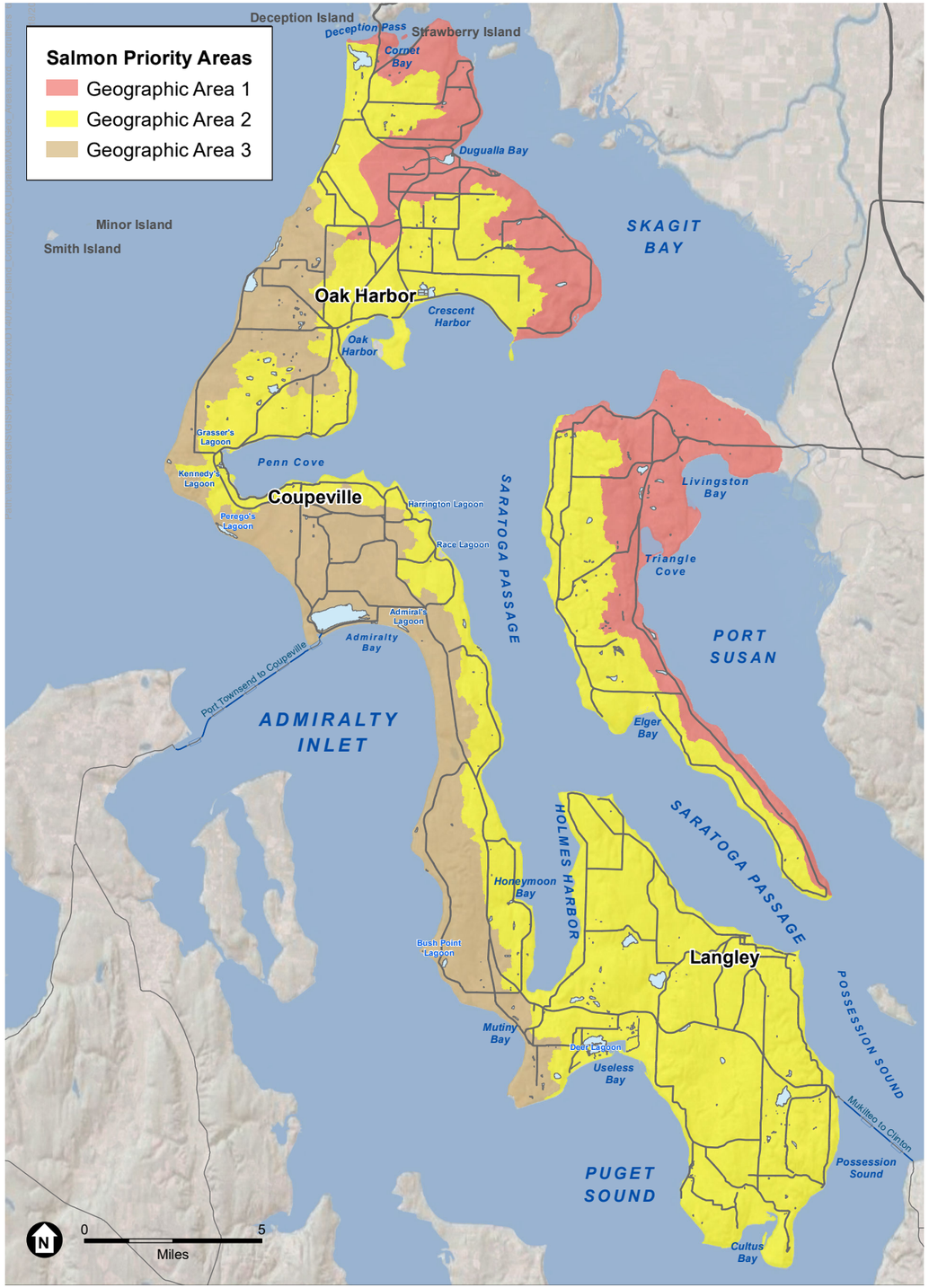
WRIA 6

(Whidbey and Camano Islands)

June 2019

Contents

WRIA6(WhidbeyandCamanoIslands)Multi-SpeciesSalmonRecoveryPlanUpdate|June2019



WRIA 6, Whidbey and Camano Islands

Overview

This document updates the WRIA 6 (Watershed Resource Inventory Area) (Whidbey and Camano Islands) Multi-Species Salmon Recovery Plan originally produced in 2005 (2005 SRP). Since that time, WRIA 6 partners have developed a more thorough understanding of the watershed, nearshore processes and habitats, and species using the watershed and have used this new knowledge to update various components of the 2005 Salmon Recovery Plan. This document presents the progress that WRIA 6 partners have made towards achieving the goals outlined in the 2005 Salmon Recovery Plan, summarizes changes made to the mission, goals, and strategies of the Island County Lead Entity, updates the pressures and limitations facing salmon recovery, institutes an adaptive management strategy, and outlines the future of salmon recovery actions in WRIA 6. This document is an addendum to the 2005 Salmon Recovery Plan.

To date, WRIA 6 partners, have partially or fully implemented nearly every action identified in the 2005 Salmon Recovery Plan. While many of the pressures facing salmon remain the same, the new information learned through implementing the 2005 actions has elevated the importance of healthy nearshore ecosystems and habitat for salmon in the watershed and the region. New research has revealed the role the nearshore plays in providing nursery habitat for salmonids and forage fish, as well as that of pocket estuaries that provide necessary habitat for juvenile Chinook. In response, the Island County Lead Entity Salmon Recovery Technical and Citizen Committee have updated the 2005 Salmon Recovery Plan to reflect a renewed commitment of restoring and preserving feeder bluffs, pocket estuaries, and lagoons.

New vision statements have been added to address the importance of restoring and conserving habitat to protect not only salmonids, but also the food web they depend upon. Additionally, the recovery strategies have been improved and realigned to be more consistent with salmon recovery efforts throughout the Puget Sound region. Considerations regarding the impacts of climate change and sea level rise have been incorporated into the recovery strategies to encourage responsible actions leading to resilient habitats.

Within the Puget Sound Chinook Recovery Plan, approved by NOAA in 2007 and adaptively managed by the Puget Sound Partnership, the WRIA 6 plan is one chapter or appendix of 16 local watershed plans that identify the most relevant issues and actions to take locally in order to reach overall recovery of the Puget Sound Chinook Evolutionarily Significant Unit (ESU).

WRIA 6 Exceptional Feeder Bluff

Maylor Point Site Visit

Introduction

Plan Context

This document updates the WRIA 6 (Watershed Resource Inventory Area) (Whidbey and Camano Islands) Multi-Species Salmon Recovery Plan originally produced in 2005. Since that time, WRIA 6 partners have made significant progress towards accomplishing actions and achieving goals originally outlined in the 2005 Salmon Recovery Plan. The Island County Lead Entity Salmon Recovery Technical and Citizen Committee (SRTCC) was formed from members of the original Technical Advisory Group (TAG) and some members from the Water Resources Advisory Committee (WRAC), which streamlined the number of committees involved in WRIA 6 salmon recovery. Since 2005, new monitoring data has been collected, lessons have been learned, and new science has emerged to help inform the salmon recovery approach in Island County. The Lead Entity has ensured this information has been included in other Island County planning efforts as appropriate, including the Shoreline Master Program. Lead Entity staff and SRTCC have used this information to update various components of the 2005 Salmon Recovery Plan—all of which will result in a more effective and accelerated ability to make progress toward goals, implement projects, and take actions to assist the recovery of salmon in WRIA 6. The purpose of this document is to capture all of the updates to the Lead Entity's plan for salmon recovery. This document also presents the progress made by WRIA 6 partners and communicates where WRIA 6 salmon recovery actions are headed.

The WRIA 6 plan is one chapter of 16 watershed plans or strategies in the Puget Sound that identify the most relevant issues and actions to take locally for overall recovery of the Puget Sound Chinook and other salmonids. While WRIA 6 is not included as critical habitat for Puget Sound steelhead, the protection and restoration of nearshore habitat throughout Puget Sound, including WRIA 6, highlights the importance of a functional marine food web which includes forage fish recovery as a strategy for steelhead survival during their outmigration through Puget Sound (NMFS, 2018).

WRIA 6 will continue to strive to restore juvenile rearing habitat wherever possible. However, salmon and steelhead recovery also relies on the successful production of juveniles out of the freshwater streams and big river deltas. The recovery of Puget Sound salmon and steelhead will depend on all the watersheds working together into the future.

10-year Implementation Plan Status

The following table summarizes the goals, objectives, and actions originally outlined in the 2005 Salmon Recovery Plan and lists the status of those actions at the time of this update. The Island County Lead Entity maintains a detailed list of references addressing the Done, Partially Done and In Effect actions.

Table 1: The status of actions identified in the 2005 10-year Implementation Plan.

Goal 1: Over the long term, achieve a net increase in salmon habitat through protection, enhancement, and restoration of naturally-functioning ecosystems that support self-sustaining salmon populations and the species that depend on salmon.

Objectives	Action	Status
Objective 1: Inventory and prioritize WRIA 6 nearshore and fresh-water habitats for protection and restoration activities	Action 1.1.1 - Use the NW Straits Nearshore Habitat Evaluation (Anchor Environmental 2002) to create and prioritize an initial ecosystem processes and habitats priority list	Done
	Action 1.1.2 - Develop a historical (pre-1870) shoreline inventory to determine the distribution of salmon habitats in WRIA 6	Done
	Action 1.1.3 - Utilize data collected by the Marine Resources Committee (MRC) to update the ecosystem processes and habitats priority list	Done
	Action 1.1.4 - Inventory freshwater habitats that have been identified as being important for nearshore processes, nearshore water quality, potential fish habitat, and/or riparian condition	Partially Done
	Action 1.1.5 - Develop project feasibility criteria addressing community issues and a cost-benefit analysis	Done
	Action 1.1.6 - Evaluate habitat inventory and fish distribution to set quantitative protection and restoration goals and link actions to Viable Salmonid Population parameters	Done
Objective 2: Protect existing high-quality nearshore and stream habitats	Action 1.2.1 - Assess potential for additional process/habitat degradation (inventory areas where open space and natural habitats may be subject to land use conversion and assess protection opportunities)	Done/In Effect
	Action 1.2.2 - Develop and promote a private lands salmon habitats protection strategy ensuring protection of naturally functioning nearshore processes by 2015 (integrate stewardship and conservation programs such as: Shore Stewards, Public Benefits Rating System, and conservation easements)	Done/In Effect
	Action 1.2.3 - Develop and promote a public lands salmon habitats protection strategy ensuring protection of naturally functioning nearshore processes by 2015	Done/In Effect
	Action 1.2.4 - Promote pollution prevention strategies that will help maintain freshwater and marine water quality (update as new methodologies and technologies are developed)	Done/In Effect
	Action 1.2.5 - Provide technical comments to Island County Planning during review of Critical Areas Ordinance and Shoreline Master Program updates	Done/In Effect
	Action 1.2.6 - Support successful enforcement strategies for regulations that protect salmon habitats	Not started*
Objective 3: Restore/enhance critical rearing habitats for forage fish and juvenile salmon	Action 1.3.1 - Work with willing landowners to achieve enhancement and restoration projects in priority geographic areas (minimum of 5 by 2015)	Done/In Effect
	Action 1.3.2 - Support *Spartina anglica* control programs	Partially Done
	Action 1.3.3 - Promote best management practices that will help to decrease pollution impacts on freshwater and marine water quality	Done/In Effect

Table 1 cont'd: The status of actions identified in the 2005 10-year Implementation Plan.

Goal 2: Develop understanding of habitat functions and the distribution of forage fish species, salmonids, and marine mammals in WRIA 6		
Objectives	Action	Status
Objective 1: Fill key ecosystem science data gaps	Action 2.1.1 - Assess marine salmonid distribution (species/stocks/life history stages) to identify habitat utilization throughout Island County	Done
	Action 2.1.2 - Assess freshwater salmonid distribution	Partially Done
	Action 2.1.3 - Collaborate with neighboring watershed groups (particularly Skagit, Stillaguamish, and Snohomish) to determine which habitats are most important for their populations	Done/In Effect
	Action 2.1.4 - Cooperate with state and federal agencies to develop tools that relate nearshore habitat conditions to Viable Salmon Population characteristics	Done/In Effect
Objective 2: Assess and regularly update aquatic habitat attributes	Action 2.2.1 - Assessment of feeder bluff connectivity (longshore drift functionality)	Done
	Action 2.2.2 - Eelgrass survey	Done/In Effect
	Action 2.2.3 - Forage fish spawning beaches survey	Done/In Effect
	Action 2.2.4 - Shoreline hardening survey	Done
	Action 2.2.5 - Pocket estuary survey and habitat evaluation	Done
	Action 2.2.6 - Mapping of tide gates and stormwater outfalls	Partially Done
	Action 2.2.7 - Survey of private outfalls	Partially Done
	Action 2.2.8 - Survey of marine debris hotspots and develop clean-up plan	Done/In Effect
	Action 2.2.9 - Survey interactions between commercial shellfish operations and nearshore habitat forming and productivity processes	Done/In Effect
	Action 2.2.10 - Develop and implement a shoreline community water quality monitoring program to assess basic water quality parameters and aquatic invertebrate communities in areas of concentrated salmon utilization	Done/In Effect
	Action 2.2.11 - Develop and implement a water quality monitoring program to assess basic water quality parameters and aquatic invertebrate communities	Partially Done
	Action 2.2.12 - Implement streamflow monitoring program	Done/In Effect
	Action 2.2.13 - County culvert inventory	Done/In Effect
	Action 2.2.14 - Physical and biological habitat surveys – in-stream habitat inventory, riparian assessment, and culvert passage assessments	Done/In Effect
Objective 3: Quantify and evaluate impacts of predation by marine mammals and other wildlife on salmonid and forage fish populations (e.g. Orca, Sea Lion, Harbor Seal, Heron, Cormorants, Mergansers, Humans, etc.)	Action 2.3.1 - Encourage the state and federal agencies to determine if it would be appropriate for NOAA Fisheries to transfer management oversight of pinnipeds to the WA Department of Fish and Wildlife	Not Started*
	Action 2.3.2 - Assist a study of predation (seals, sea lions, and other wildlife) in WRIA 6 on salmonids and forage fish (by species/stock) and collaborate with neighboring watershed groups on projects specific to their stocks	Not Started*
	Action 2.3.3 - Assist with WDFW to identify realistic levels of predation on salmon and forage fish	Not Started*
	Action 2.3.4 - Collaborate with WDFW to identify sustainable predator population levels and methods to achieve these levels	Not Started*
	Action 2.3.5 - Compare the impacts on salmon caused by predation versus the impacts caused by habitat loss/degradation	Not Started*

Table 1 cont'd: The status of actions identified in the 2005 10-year Implementation Plan.

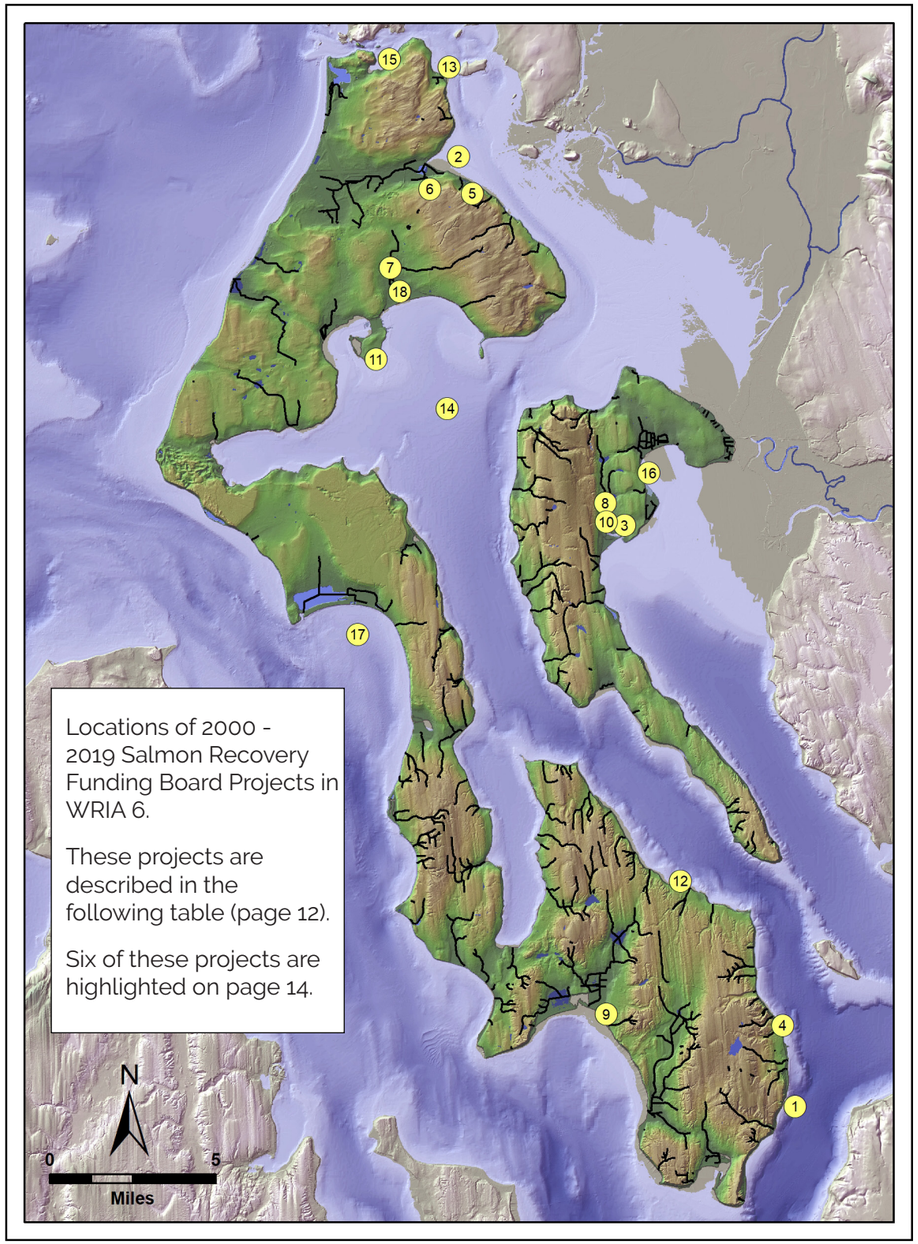
Goal 3: Engage an informed community in identifying, protecting, enhancing, and restoring salmon supporting ecosystem processes and habitats		
Objectives	Action	Status
Objective 1: Educate the community about juvenile and adult salmon distribution, ecosystem processes, habitats, and challenges through information, education, and communication activities	Action 3.1.1 - Develop and implement a public involvement/outreach strategy and action plan	Done/In Effect
	Action 3.1.2 - Develop and present watershed/salmon recovery lessons for school groups in WRIA 6	Done/In Effect
	Action 3.1.3 - Coordinate educational nearshore tours/cruises (minimum 1/year)	Done
	Action 3.1.4 - Coordinate and facilitate stakeholder focus groups to encourage participation in the development of problem definitions and solutions	Done
	Action 3.1.5 - Coordinate and facilitate community forums for in-depth discussions of salmon recovery issues (sharing of experiences and lessons learned)	Done
	Action 3.1.6 - Coordinate landowner education programs	Done/In Effect
	Action 3.1.7 - Survey the views of Whidbey and Camano residents regarding salmon recovery practices and track changes in thinking	Done/In Effect
Objective 2: Develop and implement a comprehensive communication strategy for internal and external communication	Action 3.2.1 - Partner with local organizations to disseminate information through established programs	Done/In Effect
	Action 3.2.2 - Expand network of salmon recovery partners and coordinate regular exchange of information (email/newsletter/list-serve)	Done/In Effect
	Action 3.2.3 - Develop a standard reporting format for salmon recovery projects	Partially Done
Objective 3: Increase community participation in, and commitment to, salmon recovery activities	Action 3.3.1 - Research, identify and encourage behavioral changes that WRIA 6 residents and visitors can make to support salmon recovery	Done/In Effect
	Action 3.3.2 - Develop targeted messages about salmon needs, ecosystem processes and habitat goals for key stakeholder audiences	Done/In Effect
	Action 3.3.3 - Encourage community participation in salmon and habitat assessments and protection, enhancement, and restoration activities	Done/In Effect
	Action 3.3.4 - Participate on key local and regional watershed/water resources committees as advocates for salmon recovery	Done/In Effect
	Action 3.3.5 - Promote integration of salmon recovery in WRIA 6 water resources discussions and encourage integrated planning, resource sharing, and collaborative activities within local and regional organizations	Done/In Effect
	Action 3.3.6 - Compile research data, survey results, community information, and project implementation progress in a standardized database	Done/In Effect

Table 1 cont'd: The status of actions identified in the 2005 10-year Implementation Plan.

Goal 4: Cultivate a supportive environment for salmon recovery by supporting policies that protect salmon habitats; advocating for adequate program staffing; encouraging cross-sector and public-private partnerships; pursuing adequate, reliable funding; and implementing effective project and program evaluations

Objectives	Action	Status
Objective 1: Establish salmon recovery program policies that will cultivate public support for salmon recovery and adequate program staffing	Action 4.1.1 - Organize semi-annual discussions with the Board of Island County Commissioners and other elected officials	Done/In Effect
	Action 4.1.2 - Encourage interdisciplinary and interdepartmental participation in salmon recovery efforts	Done/In Effect
	Action 4.1.3 - Mentor community sponsored projects by providing technical assistance and networking support	Done/In Effect
	Action 4.1.4 - Encourage local projects that are cost-effective and include volunteer opportunities	Done/In Effect
	Action 4.1.5 - Conduct roundtables with all Salmon TAG affiliated organizations to identify ways in which each group's programs support salmon recovery and request commitments to salmon recovery activities	Done/In Effect
Objective 2: Obtain adequate, reliable funding through a variety of public and private sources and use these resources cost-effectively	Action 4.2.1 - Develop and implement a biannual salmon recovery workplan and budget	Done/In Effect
	Action 4.2.2 - Identify and promote applications to a variety of grant organizations, including the Salmon Recovery Funding Board	Done/In Effect
	Action 4.2.3 - Identify and pursue non-grant funding opportunities	Partially Done
	Action 4.2.4 - Engage private sector partners in WRIA 6 salmon recovery efforts	Done/In Effect
	Action 4.2.5 - Promote regional actions that help to avoid duplication, maximizing limited resources	Done/In Effect
Objective 3: Develop and implement a salmon recovery adaptive management program	Action 4.3.1 - Identify a set of ecosystem process and habitat indicators	Done
	Action 4.3.2 - Develop and implement a local monitoring program that evaluates ecosystem process and habitat indicator trends	Partially Done
	Action 4.3.3 - Encourage project sponsors to include an adequate monitoring and evaluation component in their project	Done/In Effect
	Action 4.3.4 - Produce an annual program summary	Done/In Effect
	Action 4.3.5 - Review project and program progress on a biennial basis and make adjustments to workplan where needed	Done/In Effect

(*) These actions were identified in the 2005 Salmon Recovery Plan. However, since then have been detmerined to fall outside of local control and should be implemented at the regional level by entities like the Puget Sound Partnership, NOAA, and other co-managers.



Map of Project Locations

Table 2: Projects funded through the WRIA 6 Lead Entity by Project Type.

2000-2019 Salmon Recovery Funding Board Projects funded by WRIA 6 Allocations			
Number on map	Name	Year funded	Description
Protection Projects			
1	Pearson Shoreline Protection	2018	Protection of 54 acres of feeder bluff, including 2820 feet of shoreline.
2	Dugualla Tidelands Acquisition	2017	Protection of 83 acres of tidelands and nearshore.
3	Barnum Point Protection	2016	Protection of 37 acres of feeder bluff and tidelands, removal of 2 houses. Part of a 167 acre protection project that created Barnum Point Park.
4	Waterman Nearshore Acquisition	2014	Protection of 59 acres of feeder bluff and 2000 feet of shoreline. Removal of a creosote bulkhead by DNR creosote program.
5	Shorecrest Lagoon Protection	2007	Protection of 32 acres of a lagoon that used to be a pocket estuary but is disconnected by a barrier culvert.
6	Skagit Bay Nearshore Protection	2007	Protection of 84 acres of relic salt marsh and tidelands in Dugualla Bay.
Restoration Projects			
7	Crescent Creek Design and Restoration	2016 & 2018	Construct 1400 feet of natural stream channel replacing current 1000 foot incised channel.
8	East Camano Drive Culvert Design and Replacement	2018	Design to replace two barriers and remove a third. Construction supported with Fish Barrier Removal Board funds.
9	Sunlight Shores Armor Removal	2017	Removal of armor along 350 feet of beach.
10	Kristoferson Barrier Correction	2015	Replaced four concrete blocking culverts with a 14-foot box culvert. Replaced a 48 inch broken culvert with a 10-foot culvert.
11	Maylor Point Armor Removal	2016	Removal of different types of shore armor along 1500 feet of shoreline in front of a feeder bluff.
12	Seahorse Siesta Armor Removal	2016	Removal of a 98 foot by 136 foot stretch of armor and fill off a beach and intertidal area.
13	Ala Spit Restoration Phase 1- 4	2005-14	Removal of over 600 feet of armor and riprap material, removal of rock groin, nourishment of spit neck with 6000 cubic yards of sediment.
14	Derelict Gear Removal	2011	32 nets removed from up to 105 foot deep marine areas.
15	Cornet Bay Restoration Phase 1 and 2	2010-13	Restoration of 1600 feet of beach, removal of fill, regrading and nourishment, reconnection of small pocket estuary and plantings.
16	Livingston Bay Pocket Estuary Acquisition and Restoration	2005-09	Acquisition of 20 acres and restoration of 10 acre pocket estuaries on the west side of Port Susan.
17	West Whidbey Derelict Fishing Gear Removal	2007	Removal of derelict nets from 7.5 acres of subtidal habitat.
18	Crescent Marsh Restoration	2001 & 2004	Restoration of tidal inundation to 300 acres of pocket estuary.

Table 2 cont'd: Projects funded through the WRIA 6 Lead Entity by Project Type.

2000-2019 Salmon Recovery Funding Board Projects funded by WRIA 6 Allocations		
Name	Year funded	Description
WRIA 6 Regional Planning and Assessments		
Greenbank Marsh Restoration Planning	2015-19	Community engagement, engineering studies and designs to inform the restoration of a pocket estuary.
Camano Country Club Tidegate Feasibility	2018	Feasibility of the removal or alternate placement of tidegates to restore a pocket estuary.
Oak Harbor Marina Feasibility	2018	Feasibility to remove shore armor, improve stormwater runoff, reconfigure a boat ramp, remove creosote piles and overwater boat housing.
Nearshore Acquisition Strategy	2017	A plan to assist in ranking protection project proposals.
Iverson Stakeholder Integration	2015	Feasibility and stakeholder engagement around solutions to flooding, drainage and habitat in an 130 acre tidal marsh.
Camano State Park Feasibility	2015	Feasibility of tidal inundation of a relic pocket estuary.
Whidbey Basin Pocket Estuary	2015	Study to assess status and trends of pocket estuaries in Whidbey Basin.
Culvert Assessment Area 1	2014	Inventory and assessment of publicly-maintained culverts in Priority Area 1.
Swan Lake Engineering Feasibility Assessment	2011	Assess feasibility of opening lagoon to tidal inundation.
Deer Lagoon Restoration Assessment	2009	Assess feasibility of restoring tidal inundation to Deer Lagoon.
Skagit Bay Nearshore Restoration Assessment	2009	Assess feasibility of tidal inundation into a pocket estuary in Dugualla Bay.
Origin of Juvenile Chinook	2007	Study of Chinook genetics in Whidbey Basin.
Strawberry Point Protection Assessment	2006	Assess need and develop a plan for protection of resources on Strawberry Point.
West Whidbey Nearshore Use	2004 & 2005	Assessment of juvenile Chinook use of nearshore along West Whidbey.
Island County Assessment and Coordination	2000 & 2001	MRC's project to help establish Shore Stewards, eelgrass monitoring, seining, forage fish monitoring and feeder bluff mapping.
Salmon Supporting Creek Assessments	2000	Habitat surveys and culvert replacement designs for Maxwelton, Chapman and Glendale.
Maxwelton Fish Passage Study	2000	Assess current condition and tidegate on salmon.

Selected Project Snapshots

CORNET BAY

This project restored 1600 feet of the beach to its natural condition by removing a cresotoe bulkhead and fill, placing beach sediment, expanding marsh habitat, and planting native plant species.

"It's been wonderful watching the beach come back. People interact with the beach differently now"

~Jack Hartt, Deception Pass Park Manager

ALA SPIT

A 250 foot riprap revetment, a 430 foot cement bulkhead and 75 foot rock groin were removed, resulting in increased habitat area, restored physical processes, and protected habitat function for Chinook and forage fish species while maintaining the current use of Ala Spit County Park by the public.

"Daily walks of exploring on this little strip of movable land and the beach it creates brings me peace, happiness and solitude while recharging my soul"

~Dawn Glavick, Neighbor

MAYLOR POINT

This project involved the removal of 1,500 feet of varied shoreline armor treatments including 185 treated posts, 165 planks, 1,300 tires, 10,000 square feet of concrete bags, and over 16,000 square feet of angular rock. The removal of this armor has improved forage fish spawning substrate and nearshore fish habitat.

"In the 1970s, the Corps was promoting low-cost methods of erosion control. At Maylor Point, they tried several, most of which immediately failed. In hindsight, the lowest cost approach would have been to do nothing at all. But at least now we have the chance to clean up the mess"

~Hugh Shipman, Dept. of Ecology

KRISTOFERSON CREEK

Five culverts under two roads, that prevented fish passage, were removed and replaced with two larger culverts to improve fish passage for juvenile Chinook and other salmonids, providing access to an additional 1.6 miles of stream habitat.

"It can take years, or decades even, to complete some of these restoration projects. The success of these projects has and will continue to take a village of dedicated partners and especially community members and property owners to achieve salmon recovery."

~Kristin Marshall, Snohomish Conservation District

SUNLIGHT SHORES

This project removed a 3,600 square foot bulkhead and converted the area back to naturalized upper intertidal and backshore habitat along 350 feet of shoreline, providing better habitat for juvenile Chinook and access to the beach for the community that owns the property.

"You could not really walk down to the edge of the bulkhead and so most people just chose not to go down there...People felt like the determination to do this project was for the benefit of the community..."

~ Vivian Stembridge, Sunlight Shores Resident

Photo credit: Benjamin Drummond

BARNUM POINT

This project protected 167 acres in total, including 37 acres of tidelands and exceptional feeder bluff. It allowed for the recycling of 2 houses off the property. This project was funded with 8 grants, 2 of which were salmon-related, and 620 individual private donations.

"The ability to make over a mile of shoreline available to the public with one project is incredibly rare. And the importance of the property for wildlife and coastal habitats extends well beyond the property boundary."

~Ryan Elting, Land Trust Conservation Director

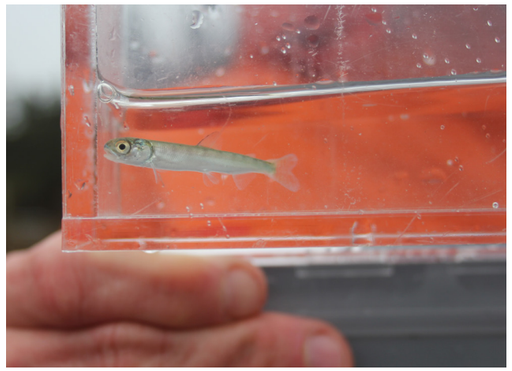
Cornet Bay Beach Seining

Recovery Context

Since the development of the 2005 WRIA 6 Salmon Recovery Plan, numerous scientific studies have investigated salmon ecology in nearshore marine environments of the Whidbey Basin. In order to capture this new knowledge and use it to inform the development of this update, the SRTCC commissioned a literature review of scientific research conducted in WRIA 6 regarding salmonids and other species listed under the Endangered Species Act as well as nearshore habitats throughout Whidbey and Camano Islands (Cramer Fish Sciences, 2017).

Saratoga Pass

It is well known that during the lifetime of salmon, the highest mortality often occurs when they are juveniles. Of major concern is that stage when they are transitioning from their home rivers and estuaries to feed and grow in the ocean (Quinn 2005). The watersheds of WRIA 6 in Island County are comprised of streams that are too small to support much salmon spawning. This means that the marine nearshore habitats, pocket estuaries, and the small streams themselves provide vital transition habitat for out-migrating juveniles from the large rivers draining to the Whidbey Basin (Zackey et al. 2015). Because changes in the nearshore marine environment are implicated in the status of imperiled fish populations, the WRIA 6 salmon recovery strategies are focused on protecting the diverse marine nearshore and estuarine habitats near three major rivers - the Skagit, Stillaguamish and Snohomish.



Juvenile Salmonid

The central location of WRIA 6 in the Salish Sea, at the junction of Puget Sound, the Strait of Juan de Fuca and Georgia Strait, places it on the migration corridors used by most Puget Sound juvenile and adult salmon and trout populations. As these fish move to and from their respective natal streams and rivers, nearshore and coastal estuaries in WRIA 6 provide critical feeding areas and/or shelter from wave energy and predators. Many spawning beaches and eelgrass beds are used by forage fish – surf smelt, sand lance and herring – which salmonids feed on or rely on as a buffer prey for predators. Eelgrass beds provide refuge to juvenile salmonids from both predators and high-energy marine environments. Sheltered beaches, bays, and lagoons also provide resting areas for adult salmonids. In addition to marine habitats, freshwater and tidally-influenced streams in WRIA 6 provide valuable stream habitat for juvenile fish to rest in during their early marine outmigrations. They adapt to salt water after rearing in freshwater in these coastal streams (Beamer et al. 2013; Zackey et al. 2015).

Several important studies during the last decade have measured juvenile salmon use of nearshore and estuary habitats (lagoons and pocket estuaries) across multiple years to determine how physical habitat structures, connectivity, and food supply, can interact to inform protection and restoration of these areas. This idea first came to light in a study by the Skagit River System Cooperative (Beamer et al. 2003) that identified the dramatic decrease in estuarine habitat in the Skagit estuary as being potentially limiting for Chinook salmon *(Oncorhynchus tschawytcha)* populations. Their findings indicated that when Chinook smolt outmigration levels exceeded 2.5 million fish, the lack of productive rearing habitat in the estuary caused fish to recruit to Skagit Bay. Similar findings about the extent of estuarine loss has been documented in the Stillaguamish (Griffith 2005) and Snohomish watersheds (Rice et al. 2013).

Based on Beamer et al. (2003), researchers investigated the importance of lagoons and pocket estuaries for fish in the Whidbey Basin. Studies were completed in Harrington Lagoon (Kagley et al. 2007a), Elger Bay (Kagley et al. 2007b), Race Lagoon (Henderson et al. 2007), Cornet Bay (Keystone Ecological 2009; Schmidt 2010; Schmidt 2012), and Dugualla Heights Lagoon (Beamer et al. 2011; Beamer et al. 2012).

In general, these studies found that temperatures were slightly warmer in the lagoon sites compared to the nearshore sites and salinity was generally lower in the lagoon sites. In all studies, salmonid fishes made up substantial proportions of total fish encountered (Table 1 in Appendix A). Salmonid species found to be utilizing these habitats included Chinook (age 0 and age 1), coho (ages reported as "All"), chum (age 0), pink (*Oncorhynchus gorbuscha*; age 0), and cutthroat trout (age unknown). Numerous other marine fish species were encountered during these surveys including shiner perch *(Cymatogaster aggregata)*, staghorn sculpin *(Leptocottus armatus)*, starry flounder *(Platichthis stellatus)*, and stickleback *(Gasterosteus aculeatus)*. All of the non-salmonid fish encountered in these surveys are important

Measuring Fish Samples

constituents of the nearshore environment in Puget Sound. They can be prey, competitors, or predators on salmonids (Levings 2016).

Additional pocket estuary studies were undertaken around the same time as those mentioned above and covered a broader geographic range within the Whidbey Basin but did not cover such a long time span. Beamer et al. (2003) evaluated 12 different pocket estuaries in the Skagit River Delta, and compared both nearshore and offshore habitats that were associated with the pocket estuaries. This investigation looked at juvenile Chinook use of these various habitats during their outmigration and potential restoration actions for Chinook during their first year of life. Their findings indicated that pocket estuaries provide important rearing habitat for juvenile Chinook and should be restored where possible. However, restoration of pocket estuaries will not mitigate for the habitat losses, which requires more protection and restoration, as called for in other local and regional plans (Skagit Chinook Recovery Plan, 2005; Griffith and Fuller 2012, Rice et al 2013). Therefore, efforts to protect and restore nearshore habitats in WRIA 6 must be coupled with projects that protect and restore the large estuaries of the Skagit, Stillaguamish and Snohomish Rivers.

Overall, this new scientific information learned since the 2005 Salmon Recovery Plan reinforces the existing WRIA 6 salmon recovery strategies that are centered on prioritizing the protection of functional lower stream mouths and their pocket estuaries that are critical to resting, feeding, and refuge for migrating salmon. In addition, given the information learned about how salmon use the nearshore marine environment, WRIA 6 partners have placed a high priority on protecting natural beaches throughout the watershed. Further, the WRIA's high geographic priority on protecting the pocket estuaries and nearshore beaches with proximity to the large rivers draining into the east side of the Whidbey Basin is consistent with research indicating that juvenile salmonids using these habitats derive from these large rivers.

Juvenile Chinook Salmon

Apart from the scientific context of salmon recovery, Tribes throughout the Puget Sound Region have weighed in on progress of recovery and implications for their Treaty Rights. The 2016 State of Our Watersheds report produced by the Northwest Indian Fisheries Commission (NWIFC 2016) states that more than twice as much new armoring was added as was removed in Puget Sound and that forage fish indicators are declining. In addition, riparian forests are largely at risk or not properly functioning and fish passage remains a critical issue. The Swinomish Tribe estimates that over two-thirds of historic pocket estuaries have been lost in the Whidbey Basin that are within a day's swim of Skagit Chinook smolts, which includes the northern end of WRIA 6. Additional work is needed to meet the goal of increasing smolt production. The Tulalip Tribes point out that 31% of the erosional drift cell habitat needed for forage fish in the Whidbey basin is already modified or armored. Work is needed to protect functional drift cells and restore areas that have been modified (NWIFC 2016).

A relatively new consideration when developing and implementing recovery strategies has been how the affects of climate change need to be addressed. In WRIA 6, climate change effects are exhibited primarily by coastal flooding (sea level rise and exaggerated storm surge events) and potentially altered hydrology (higher temperatures and flashier stream flows). To address the altered hydrology, in-stream projects are expected to follow the WA Department of Fish and Wildlife's guidance for incorporating climate change into the design of water crossing structures. To address the coastal flood risk, projects are expected to be designed taking sea level rise and storm surge into account. In 2017, WRIA 6 contracted with the University of Washington's Sea Grant Program to develop probabilistic tables that calculate the amount of sea level rise or annual potential storm surge level based on time into the future and certainty (Miller et al. 2016). Strategies and projects that support resiliency (landward habitat migration and prevention of reactionary, unnecessary armoring) in salmonid habitat are encouraged and high priority.

Oak Harbor

Teaching the next generation

Vision Statements

The 2005 Salmon Recovery Plan included three vision statements that reflected the understanding at the time of juvenile salmonid use of nearshore habitats. However, after reviewing the information that has emerged since 2005, the Salmon Recovery Technical and Citizen Committee members agreed that, while still valid, the original three vision statements did not adequately capture their new understanding of nearshore processes in WRIA 6. In response, the SRTCC developed three new vision statements, listed below, that more adequately reflected the importance of forage fish, chinook-supporting systems, sustainability, water quality, climate change, and coastal resiliency.

Table 3. List of original and new vision statements.

We, the citizen volunteers and staff of the WRIA 6 Salmon Recovery Lead Entity, envision...	
Original 2005 SRP Vision Statements	Abundant salmon using nearshore and coastal stream habitats in WRIA 6 Diverse, viable populations of salmon coexisting with the human population and supporting harvest Strong community and government support for ecosystem protection and restoration
Additional Vision Statements (new)	Functioning habitat forming processes that support salmon and the food web upon which they depend Resilient and connected functioning habitats that support all salmon life stages, now and into the future Water quality and quantity sufficient to support salmon habitats and all salmon life stages

Limiting Factors and Pressures

The limiting factors and the pressures from the 2005 Salmon Recovery Plan were updated by the SRTCC using information learned during the Island County Local Integrating Organization (ILIO) planning process in 2014. The ILIO is an organization made up of watershed partners focused on ecosystem recovery throughout Island County. Many of the pressures identified in the 2014 ILIO process related directly to those in the 2005 Salmon Recovery Plan, but were organized into broader categories. Some of the 2005 pressures were combined into one pressure. Additionally, the nearshore literature review commissioned by the SRTCC (Cramer Fish Sciences, 2017) highlighted new pressures facing salmon in WRIA 6 including habitat connectivity and water quality. SRTCC removed Hatchery Fish as a pressure because WRIA 6 has no involvement with hatchery management nor any literature indicating hatchery fish are a pressure that can be addressed with nearshore strategies. The SRTCC came up with a final list of nine pressures.

Useless Bay

Inventorying Culverts

Table 4. List of pressures identified in 2019 and how they align with the pressures from the 2005 Salmon Recovery Plan and the 2014 ILIO pressures that relate to salmonids.

2019 Salmon Recovery Plan Update	2005 Salmon Recovery Plan	2014 ILIO Salmon-Related Pressures
Shoreline Armoring and Fill	Shoreline Armoring & Shoreline Fill	Marine Shoreline Infrastructure
Shoreline and Overwater Structures	Shoreline and Overwater Structures	Marine Water Levees and Tidegates
(Tidal) Wetland Modifications	Wetland Modifications	
Riparian/Shoreline Modifications	Riparian Removal	
Connectivity Modifications	Streamflow Modifications	Culverts
Stormwater and Non-point Runoff	Wastewater and Stormwater Discharge & Nonpoint Runoff	Runoff from Built Environment
Invasive Species	Invasive Plants	Invasive Species & Genes
Oil and Hazardous Spills	Toxic/Oil Spill	Oil Spills
Marine Debris	Marine Debris	
Warm temperatures		Freshwater Levees & Tidegates

Updated Strategies

To update the plan strategies, SRTCC members reviewed each strategy from the 2005 Salmon Recovery Plan in light of best available science, the updated vision statements, and updated pressures and targets. SRTCC members also reviewed the strategies outlined in the WRIA 8 (Lake Washington/ Cedar/Sammamish Watershed) 10-year plan update as it was conducted as a Region-supported pilot for chapter updates. In order to be consistent with future regional salmon recovery efforts, SRTCC members adjusted the strategies in the 2005 Salmon Recovery Plan using the WRIA 8 strategies that best aligned with the habitats and species found in WRIA 6. The SRTCC also removed strategies from the 2005 Salmon Recovery Plan related to law enforcement and predator control since these fell outside of the direct control of the Lead Entity. Additionally, the group removed the program development strategy because the formation and establishment of the Lead Entity was completed and is currently securely maintained.

The SRTCC came up with a final list of ten strategies. These ten strategies were then prioritized into two tiers based on their potential impact to juvenile salmon survival. There is a scoring advantage for projects that address Tier One strategies.

Table 5. List of recovery strategies identified in 2019 and their priority related to one another.

Strategy	Tier
Remove fish passage barriers to benefit anadromous fish	1
Protect and restore functional riparian vegetation	1
Reconnect creek mouths, backshore areas, and estuaries	1
Protect and restore natural marine shorelines and processes	1
Integrate salmon recovery priorities into local and regional planning, regulations, and permitting	1
Continue existing and conduct new research, monitoring and adaptive management on key issues	1
Provide adequate streamflow	2
Protect and restore natural marine offshore habitats	2
Protect and restore freshwater and marine water quality	2
Increase awareness of and support for salmon recovery	2

Ala Spit De-Construction

Juvenile Pink Salmon

Table 6. This table explains how the original strategies in the 2005 Salmon Recovery Plan relate to the updated strategies included in this update.

2005 Salmon Recovery Plan	2019 Salmon Recovery Plan Update
Habitat	
*New based on best available science	Protect and restore freshwater and marine water quality
*New based on best available science	Protect and restore natural marine offshore habitats
Beach Restoration	Protect and restore natural marine shorelines and processes Protect and restore natural marine offshore habitats
Pocket Estuary Restoration	Reconnect creek mouths, backshore areas, and estuaries
Stream Restoration	Remove fish passage barriers Provide adequate streamflow Protect and restore functional riparian vegetation
Stream Protection Strategy	Rolled into other 2019 strategies
Public Land Strategy	Rolled into other 2019 strategies
Private Land Protection Strategy	Rolled into other 2019 strategies
Research and Assessments	Continue existing and conduct new research, monitoring and adaptive management on key issues
Public Land Strategy	
Regulations and best available science	Integrate salmon recovery priorities into local and regional planning, regulations, and permitting
Enforcement Support	Removed, not within our ability to affect. Relying on region and state to support enforcement.
Law Enforcement support	Removed, not within our ability to affect. Relying on region and state to support enforcement.
Permit Compliance support	Removed, not within our ability to affect. Relying on region and state to support compliance enforcement.
Program Development	
Communication for Public Support	Increase awareness of and support for salmon recovery
Voluntary Compliance outreach and support	Rolled into other 2019 strategies
Enable Communication Strategy	Rolled into other 2019 strategies
Program Development	No strategy. Part of Lead Entity scope of work
Salmon MAM phase I development	Completed
Salmon Recovery Organizational Strategy	No strategy. Part of Lead Entity scope of work
Salmon Recovery Program Policies	No strategy. Part of Lead Entity scope of work
Funding	No strategy. Part of Lead Entity scope of work

Goals and Targets

During the process of updating the 2005 Salmon Recovery Plan, the SRTCC used the Puget Sound Partnership's Puget Sound Common Indicators as a starting point for creating new habitat recovery goals and targets. The SRTCC reviewed how the vision statements connected with the nine pressures to identify the most appropriate Common Indicators for the WRIA 6 watershed. The Common Indicators were mapped to Habitat Goals, as indicated in the table below.

Table 7. This table explains how the Habitat Goals, Strategies and the Common Indicators are aligned.

Habitat Goals	2019 Strategies	Common Indicator
Drift cell continuity	Protect and restore natural marine offshore habitats	% sediment source intact by drift cell
Intact feeder bluff Intact shoreline Intact marine riparian vegetation	Protect and restore natural marine shorelines and processes	Extent of shoreline armoring Proportion of current shoreline that is vegetated
Pocket estuary connectivity	Reconnect creek mouths, backshore areas, and estuaries	Pocket estuarine habitat area that is accessible Pocket estuary count Extent of connected tidal wetlands Extent of functional tidal channels
Longitudinal connectivity/access	Remove fish passage barriers Provide adequate streamflow Protect and restore functional riparian vegetation	Number of fish passage barriers replaced (This Common Indicator is unique to WRIA 6. The Regional Common Indicator targets adult Chinook.)
Water quality	Protect and restore freshwater and marine water quality	Marine Water Quality Index

Quantifiable targets were developed for the habitat goals Intact Shoreline, Longitudinal Connectivity and Access and Pocket Estuary Connectivity (table 8). The targets for Intact Marine Riparian Vegetation, Drift Cell Continuity and Water Quality will be set once regional protocols have been developed for those Common Indicators.

These targets aim to define the trajectory of recovery efforts in WRIA 6 and encourage a pace deemed necessary to fulfill WRIA 6's role in regional salmon recovery efforts. SRTCC partners agreed to set long term (50-year) and interim (10-year) targets for each of the selected habitat goals. The SRTCC has approved implementation targets for beach armor removal, feeder bluff armor removal, barrier replacement, and are currently in the process of setting targets for marine riparian vegetation, drift cells, pocket estuary habitat, in addition to implementation goals for stormwater projects.

Table 8. Targets for habitat goals.

WRIA 6 Long-term (50-year) Goals and Short-term (10-year) Targets				
Habitat Goals	Historic Amount	Current Conditions (2017)	50-year Habitat Goal	10-year Implementation Target
Intact Shoreline *Remove armor*	217 miles of intact shoreline 122 non-feeder bluff miles 94 miles of accretion & transport beaches	173 miles of total shoreline is unarmored 54 miles of armor exist now 29 miles of removable armor total 13 miles of armor in Area 1	80% of shoreline unarmored Can have 44 miles of armor and still meet PFC* Need to remove 10 miles of armor to meet PFC	2 miles armor removed (net) Priorities are on Area 1, low elevation armor and documented forage fish spawning beaches
Longitudinal Connectivity and Access *Repair barrier culverts*	No barriers present	19 public culverts, ~60 private culverts in Area 1 *Area 2 metrics will be included after inventory is completed, ~ 2022*	100% of freshwater streams containing juvenile anadromous rearing habitat are accessible (not natural barriers)	16 barriers (public/ private) made passable in Area 1 *Area 2 targets will be included after inventory is completed, ~ 2022*
Pocket Estuary Connectivity *Reconnect pocket estuaries*	4,485 acres tidally inundated and accessible	1,819 acres currently have some amount of fish access 2,666 historical acres inaccessible (2014)	80% of total historic acreage connected to tidal inundation and accessible by juvenile salmonids Can have 897 acres unaccessible and still meet PFC Need to restore 1,769 acres	400 acres of estuarine habitat opened to tidal inundation
Intact Marine Riparian Vegetation	Waiting on regional protocols	2020		
Drift Cell Continuity	Waiting on regional protocols	2021		
Water Quality	Waiting on regional protocols	2022		

PFC = Properly Functioning Condition

Monitoring and Adaptive Management

Salmon recovery is a long-term process that has many variables, and is constantly evolving as new information emerges. Regular monitoring and evaluation provides objective data that ensures shared understanding and assumptions, allows for flexibility and adaptive decision making, and helps to direct funding to meaningful, cost-effective and priority recovery activities.

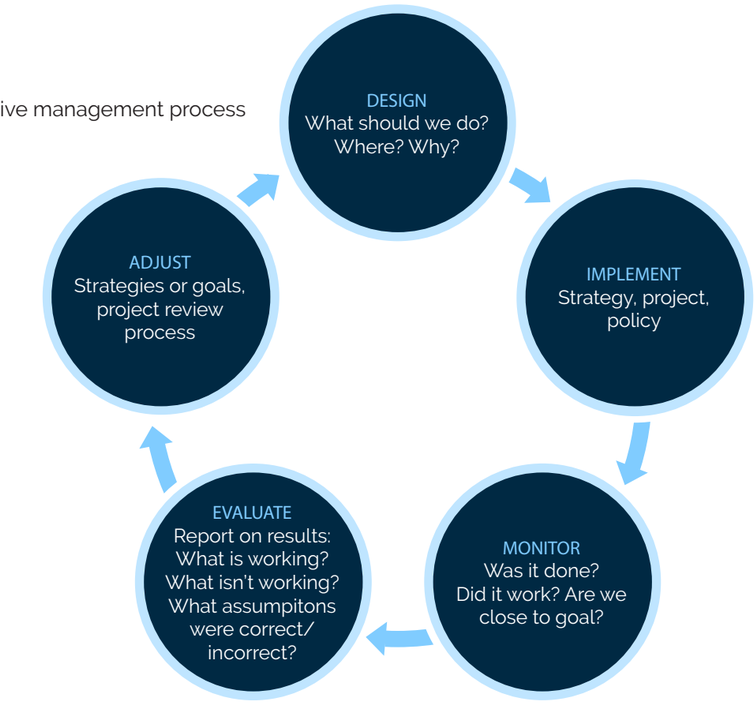
Evaluation of the local indicators and Regional Common Indicators, identified by the Puget Sound Partnership, track the progress towards targets and will inform the Lead Entity if and when changes to strategies need to be considered. Common Indicators are oriented to overall habitat function and extent and can be rolled up for regional reporting. Additional local indicators are important for determining progress toward implementation goals and the types and locations of projects being completed. Discussing lessons learned at the close of each project will inform the Lead Entity if and when changes to project guidance, scoring and ranking need to be implemented. Similarly, learning new information through best available science as it is published will inform the Lead Entity if strategies and actions are still effectively contributing to ecosystem recovery goals. As new information is learned and situations change through time, gaps in our knowledge can become apparent. Addressing those data gaps is important to informing the implementation or adjustment of recovery efforts.

This section provides the framework for development of monitoring and evaluation indicators as well as the process for implementing lessons learned, utilizing best available science and identifying data gaps.

What is Adaptive Management?

Adaptive management is an on-going process of learning and adjusting approaches to recovery based on new information. Whether evaluating a metric against a target (i.e. number of acres of estuary restored) or learning a new piece of knowledge that informs our strategies (i.e. small coastal streams are as important as pocket estuaries to Chinook smolts), the adaptive management process is similar (Figure 1):

A typical adaptive management process



Barnum Point Site Visit

Fish Species Identification During Cornet Sampling

Beach Seining

Past Adaptive Management

The 2005 Salmon Recovery Plan included an adaptive management concept within the Implementation Plan. However, no formal process, nor targets and triggers, were identified in 2005. Though adaptive management of strategies has not occurred as a result of monitoring efforts, some actions of the Lead Entity have been adapted in response to lessons learned and new, emerging science. The Lead Entity adjusted weighting of scores for project evaluation, questions asked of project sponsors regarding their project design, and community outreach strategies to communities with potential interest in proposed projects.

Revised Adaptive Management

The goal of the revised Adaptive Management Plan is to allow the Lead Entity to respond to monitoring results, lessons learned, emerging science and data gaps in a nimble and efficient way. Upon adoption of this 2019 Salmon Recovery Plan addendum, WRIA 6 Lead Entity recovery partners agreed that the Salmon Recovery Plan can and will be adaptively managed according to this framework. Any adjustments to vision or mission statements or goals will be reviewed and approved by the Board of Island County Commissioners (BICC) every 10 years. Workplan items, policies, strategies and scoring criteria may be adjusted as needed and approved by the SRTCC. These will be reported to the BICC every 5 years or upon request.

Identifying and Using Targets for Decision-Making

In 2013, the Lead Entity participated in a Puget Sound-wide effort, led by the Puget Sound Partnership, to select several key metrics to measure status and trends as a way to monitor progress towards habitat protection and restoration in each watershed and across Puget Sound. These have been termed the Common Indicators.

The SRTCC used regional guidance and best available science to set quantifiable targets for the Common Indicators identified as relevant to WRIA 6 and which have measuring protocols developed. Targets will be developed as protocols for the remaining WRIA 6-applicable Common Indicators are approved (table 8). A companion document, Adaptive Management Goals and Targets Support Refrences, that details the data sources and how the targets were developed, is available from the Lead Entity staff.

The expectation moving forward is that the SRTCC will monitor the progress towards the targets every three years. The SRTCC will determine what actions need to be taken based on progress towards each target (table 9). Adaptive actions have been predetermined and are grouped into three bins (ranges of progress). Ranges for each target have been established with corresponding responses that will be triggered. The SRTCC will determine if a metric met the target (green bin) or failed to meet the target (yellow or red bins) and discuss the cause of each. The assessments and bins stipulate what adaptive actions need to be implemented (e.g. a study of why the target is not being met or recommendations of changes to funding priorities) and what adjustments to the Salmon Recovery Plan, if any, should be taken (e.g. change scoring criteria; new strategy or policy). The SRTCC will work with local government and non-governmental partners to review the recommended adjustments to the Plan. The triggers and actions have been decided ahead of time and partners are expected to adhere to these decisions in the future (e.g. approving changes to scoring criteria or changing strategies). Adaptive management of the triggers, bins and actions may occur based on lessons learned or emerging science.

Table 9. Target bins and triggered actions

At 3 year intervals		
Green Bin	Yellow Bin	Red Bin
On trajectory to meet 90-100% of 10 year target by 2029	On trajectory to meet 40-90% of 10 year target by 2029	On trajectory to meet <40% of 10 year target by 2029
Approved and funded projects count. Do not necessarily have to be constructed or fully permitted yet.	Approved and funded projects count. Do not necessarily have to be constructed or fully pemitted yet.	Approved and funded projects count. Do not necessarily have to be constructed or fully pemitted yet.
Action: Celebrate	**Action**: 1. Determine barriers 2.. Decide corrective actions 3. Consider implementing corrective actions (may include adjustment of strategies and scoring criteria)	**Action**: 1. Determine barriers 2.. Decide corrective actions 3. Implement corrective actions (may include adjustment of strategies and scoring criteria)

Identifying and Using Lessons Learned for Lead Entity Decision-Making

The Salmon Recovery Plan will be adapted based on lessons learned from project implementation and outcomes. The SRTCC will regularly review the lessons learned after the completion of each project. These lessons learned may include, but are not limited to, how recovery efforts are communicated with communities, what is expected from project sponsors, how to manage the project list and how to support sponsors with development. The SRTCC will adjust actions based on these lessons learned as appropriate. The SRTCC will communicate these adjustments with partners and/or will adjust the SRTCC strategies. Policies, work plan items, indicator triggers, bins and actions may be adapted based on lessons learned.

Identifying and Using Emerging Science and Information for Decision-Making

Emerging science and new information, such as climate change information or new regulatory direction, will be assessed locally by the SRTCC and regional subject matter experts for local applicability. When appropriate, these groups will recommend adaptations to the Salmon Recovery Plan that may affect limiting factors, goals, priorities, scoring criteria, work plans, strategies and indicator triggers, bins and actions. When the issues are best addressed at the regional level, the SRTCC will make a statement about regional actions necessary to meet local recovery goals.

Identifying and Addressing Data Gaps

Data gaps occur when it becomes apparent that information is missing that would benefit recovery efforts, increase efficiencies or inform the understanding of the ecology and habitats being recovered. The SRTCC will regularly review if there are gaps and, when identified, develop adaptive actions to address the missing information or data gaps.

Summary

Since 2005, when the original WRIA 6 Salmon Recovery Plan was written, much has changed and, at the same time, much is the same. Puget Sound Chinook are still an ESA listed species. Since 2005, steelhead have been added to the threatened list. Many of the same pressures on salmonids and their food web remain a concern - water quality, loss of habitat, and predation. And since 2005, climate change, rapid population growth and increasing water temperatures can be added to the list of challenges to salmon recovery.

However, since 2005, much has been learned about the use of the nearshore and small coastal streams by out-migrating juvenile salmon. Many protection and restoration projects have been funded and implemented. Citizens are more aware of the importance of the nearshore to salmon and have been motivated to action to a greater degree.

One of the most important components to salmon recovery in WRIA 6 that remains still, and is getting stronger, is the network of volunteers and partners. The SRTCC, made up of citizen volunteers and subject matter experts continues to work together to review, improvise and adapt what is done in an effort to restore salmon and their habitats. They work with a network of capable and undaunted restoration professionals to develop responsible, complex and effective projects.

The network will apply these newly revisioned strategies and work towards the newly declared targets and maintain the commitment that WRIA 6 will continue to work, and do our part, until the salmon populations are recovered and stable.

References

Beamer, E., B. Brown, and K. Wolf. 2011. Juvenile salmon and nearshore fish use in shallow intertidal habitat associated with Dugualla Heights Lagoon, 2011. Skagit River System Cooperative Research Program, LaConner, WA.

Beamer, E., B. Brown, and K. Wolf. 2012. Juvenile salmon and nearshore fish use in shallow intertidal habitat associated with Dugualla Heights Lagoon, 2012. Skagit River System Cooperative Research Program, LaConner, WA.

Beamer, E., A. McBride, R. Henderson, and K. Wolf. 2003. The importance of non-natal pocket estuaries in Skagit Bay to wild Chinook salmon: An emerging prirority for restoration. Skagit River System Cooperative Reseearch Program, LaConner, WA.

Beamer, E., 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.

Cramer Fish Sciences. 2017. WRIA 6 Marine Nearshore Literature Review and Response to Questions. Prepared for Salmon Recovery Lead Entity, Island County Department of Natural Resources. Letter dated February 17, 2017. Issaquah, WA.

Griffith, J.N. 2005. Mapping Nearshore and Delta Habitat in Port Susan, Final Report. Stillaguamish Tribe Natural Resources Department, Stillaguamish, WA.

Henderson, R., A. Kagley, K. Fresh, E. Beamer, A. McBride, and K. Wolf. 2007. Juvenile salmon and nearshore fish use in shallow intertidal habitat associated with Race Lagoon, 2006 and 2007. Skagit River System Cooperative, NOAA Fisheries, LaConner, WA.

Kagley, A., J. Marcell, K. Fresh, and E. Beamer. 2007a. Juvenile salmon and nearshore fish use in shallow intertidal habitat associated with Harrington Lagoon, 2006. NOAA Fisheries, Island County Planning & Community Development, Skagit River System Cooperative, LaConner, WA.

Kagley, A., T. Zackey, K. Fresh, and E. Beamer. 2007b. Juvenile salmon and nearshore fish use in shoreline and lagoon habitat associated with Elger Bay, 2005-2006. NOAA Fisheries, Tulalip Tribes, Skagit River System Cooperative.

Keystone Ecological. 2009. Juvenile salmon and nearshore fish use in shallow intertidal habitat associated with Cornet Bay, 2009. Island County Beach Watchers, NOAA Fisheries, Keystone Ecological, Yelm, WA.

Miller, I., S. Peterson, D. Spilsbury Pucci, L. Clark, B. Wood. 2016. Island County Coastal Flood Risk Assessment. A report by UW Sea Grant for Island County, Coupeville, WA.

NMFS (National Marine Fisheries Service). 2018. Proposed Recovery Plan for the Puget Sound Steelhead Distinct Population Segment (Oncorhynchus mykiss). National Marine Fisheries Service. Seattle, WA

Northwest Indian Fisheries Commission. 2016. 2016 State of our Watersheds: A report by the Treaty Tribes in Western Washington. Northwest Indian Fisheries Commission. Olympia, WA.

Quinn, T. P. 2005. The Behavior and Ecology of Pacific Salmon and Trout. American Fisheries Society, Bethesda, Maryland in association with the University of Washington Press, Seattle, Washington.

Rice, C., J. Chamberlin, J. Hall, T. Zackey, J. Schilling, J. Kubo, M. Rustay, F. Leonetti, G. Guntenspergen. 2013. Monitoring ecosystem response to restoration and climate change in the Snohomish River estuary. A report to the Tulalip Tribes, Marysville, WA.

Salmon Recovery Plan (SRP) Technical Advisory Group: WRIA 6. 2005. WRIA 6 (Whidbey and Camano Islands) Multi-Species Salmon Recovery Plan. Adopted by the Island County Water Resources Advisory Committee and Board of Island County Commissioners.

Schmidt, S. 2010. Juvenile salmon and nearshore fish use in shallow intertidal habitat associated with Cornet Bay, 2010. Keystone Ecological, Coupeville, WA.

Schmidt, S. 2012. Juvenile salmon and nearshore fish use in shallow intertidal habitat associated with Cornet Bay, 2011, Coupeville, WA.

Shared Strategy Development Committee. 2007. Puget Sound Salmon Recovery Plan: Volume 1. Shared Strategy for Puget Sound, Seattle, WA.

Skagit Chinook Recovery Plan. 2005. Authored by the Skagit River System Cooperative and the Washington Department of Fish and Wildlife.

Zackey, T., E.M. Beamer, T. Waldo, L. Dailey, and M. Totman. 2015. Applicaton of a Predictive Model to Identify Coastal Streams in the Whidbey Basin with Juvenile Chinook Presence. Tulalip Tribes, Skagit River System Cooperative, Northwest Indian Fish Commission.

Juvenile Chinook

Photo credits (unless otherwise noted): Dawn Spilsbury Pucci, Island County Lead Entity, Washington State Department of Ecology.

Appendix A

Table A1. Salmon diversity in WRIA 6: Numbers of juvenile salmon encountered in the Whidbey Basin from 2006 to 2011 in non-natal lagoon and nearshore marine habitats (Cramer Fish Sciences, 2017).

"Unk" indicates unknown age. Reference indicates data source.

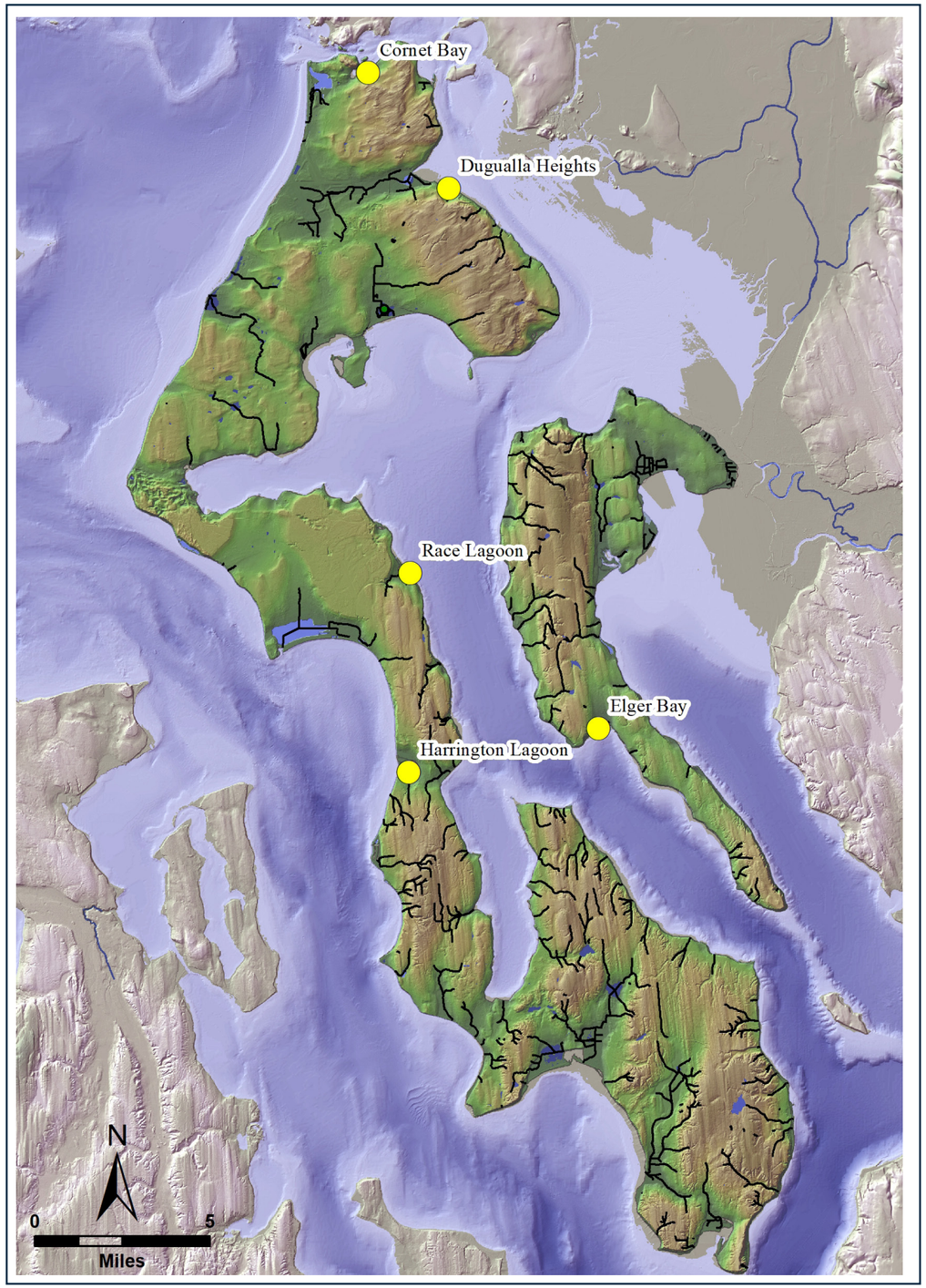
Site	Year	Total Number		Species	Age	Reference
		Lagoon	Nearshore			
Harrington Lagoon	2006	46	2	Chinook	0	Kagley et al. 2007a
	2006	62	12	Chum	0	Kagley et al. 2007a
	2006	127	47	Pink	0	Kagley et al. 2007a
Elger Bay	2005	66	10	Chinook	0	Kagley et al. 2007b
	2005	0	1	Chinook	1	Kagley et al. 2007b
	2005	0	1	Coho	All	Kagley et al. 2007b
	2005	7	26	Pink	0	Kagley et al. 2007b
	2005	193	768	Chum	0	Kagley et al. 2007b
	2006	23	1	Chinook	0	Kagley et al. 2007b
	2006	11	4	Coho	All	Kagley et al. 2007b
	2006	240	3689	Pink	0	Kagley et al. 2007b
	2006	98	198	Chum	0	Kagley et al. 2007b
	2007	5	0	Chinook	0	Kagley et al. 2007b
	2007	0	1	Chinook	1	Kagley et al. 2007b
	2007	0	9	Coho	All	Kagley et al. 2007b
	2007	227	2892	Chum	0	Kagley et al. 2007b
	2007	0	1	Cutthroat	Unk	Kagley et al. 2007b
Race Lagoon	2006	58	0	Chinook	0	Henderson et al. 2007
	2006	408	79	Chum	0	Henderson et al. 2007
	2006	1087	297	Pink	0	Henderson et al. 2007
	2007	2	0	Chinook	0	Henderson et al. 2007
	2007	1586	438	Chum	0	Henderson et al. 2007
	2007	1	0	Pink	0	Henderson et al. 2007
Cornet Bay	2009	0	2	Chinook	0	Keystone Ecological 2009
	2009	0	5058	Chum	0	Keystone Ecological 2009
	2010	0	102	Chinook	0	Schmidt 2010
	2010	0	396	Chum	0	Schmidt 2010
	2010	0	15,893	Pink	0	Schmidt 2010
	2011	0	31	Chinook	0	Schmidt et al. 2012
	2011	0	7,625	Chum	0	Schmidt et al. 2012
Dugualla Heights Lagoon	2011	0	71	Chinook	0	Beamer et al. 2011
	2011	0	61	Chum	0	Beamer et al. 2011
	2011	0	1	Bull Trout	Unk	Beamer et al. 2011
	2012	0	50	Chinook	0	Beamer et al. 2012
	2012	0	4	Chinook	1	Beamer et al. 2012
	2012	0	51	Chum	0	Beamer et al. 2012
	2012	0	6	Coho	1	Beamer et al. 2012
	2012	0	1,744	Pink	0	Beamer et al. 2012
	2012	1	0	Cutthroat	Unk	Beamer et al. 2012

Appendix A

Table A1. Salmon diversity in WRIA 6: Numbers of juvenile salmon encountered in the Whidbey Basin from 2006 to 2011 in non-natal lagoon and nearshore marine habitats (Cramer Fish Sciences, 2017).

"Unk" indicates unknown age. Reference indicates data source.

Site	Year	Total Number		Species	Age	Reference
		Lagoon	Nearshore			
Harrington Lagoon	2006	46	2	Chinook	0	Kagley et al. 2007a
	2006	62	12	Chum	0	Kagley et al. 2007a
	2006	127	47	Pink	0	Kagley et al. 2007a
Elger Bay	2005	66	10	Chinook	0	Kagley et al. 2007b
	2005	0	1	Chinook	1	Kagley et al. 2007b
	2005	0	1	Coho	All	Kagley et al. 2007b
	2005	7	26	Pink	0	Kagley et al. 2007b
	2005	193	768	Chum	0	Kagley et al. 2007b
	2006	23	1	Chinook	0	Kagley et al. 2007b
	2006	11	4	Coho	All	Kagley et al. 2007b
	2006	240	3689	Pink	0	Kagley et al. 2007b
	2006	98	198	Chum	0	Kagley et al. 2007b
	2007	5	0	Chinook	0	Kagley et al. 2007b
	2007	0	1	Chinook	1	Kagley et al. 2007b
	2007	0	9	Coho	All	Kagley et al. 2007b
	2007	227	2892	Chum	0	Kagley et al. 2007b
	2007	0	1	Cutthroat	Unk	Kagley et al. 2007b
Race Lagoon	2006	58	0	Chinook	0	Henderson et al. 2007
	2006	408	79	Chum	0	Henderson et al. 2007
	2006	1087	297	Pink	0	Henderson et al. 2007
	2007	2	0	Chinook	0	Henderson et al. 2007
	2007	1586	438	Chum	0	Henderson et al. 2007
	2007	1	0	Pink	0	Henderson et al. 2007
Cornet Bay	2009	0	2	Chinook	0	Keystone Ecological 2009
	2009	0	5058	Chum	0	Keystone Ecological 2009
	2010	0	102	Chinook	0	Schmidt 2010
	2010	0	396	Chum	0	Schmidt 2010
	2010	0	15,893	Pink	0	Schmidt 2010
	2011	0	31	Chinook	0	Schmidt et al. 2012
	2011	0	7,625	Chum	0	Schmidt et al. 2012
Dugualla Heights Lagoon	2011	0	71	Chinook	0	Beamer et al. 2011
	2011	0	61	Chum	0	Beamer et al. 2011
	2011	0	1	Bull Trout	Unk	Beamer et al. 2011
	2012	0	50	Chinook	0	Beamer et al. 2012
	2012	0	4	Chinook	1	Beamer et al. 2012
	2012	0	51	Chum	0	Beamer et al. 2012
	2012	0	6	Coho	1	Beamer et al. 2012
	2012	0	1,744	Pink	0	Beamer et al. 2012
	2012	1	0	Cutthroat	Unk	Beamer et al. 2012



Map of Seining Locations discussed in Appendix A

Dawn Spilsbury Pucci
WRIA 6 Salmon Recovery Lead Entity Coordinator
Island County Public Works

PO Box 5000
Coupeville, WA 98239
Email: d.pucci@co.island.wa.us
360.678.7916