PugetSoundPartnership
our sound, our community, our chance

Ecosystem Recovery Target: Swimming Beaches

A functioning, resilient ecosystem requires:

- Water quality at swimming beaches that protects human health

This measure provides an indication of:

- Water quality at marine swimming beaches from May through September

Why this measure:

- Water quality at swimming beaches that protects human health is one indicator that a healthy human population is supported by a healthy Puget Sound. (Revised Code of Washington 90.71.300(1)(a))
- Water quality at swimming beaches that protects human health is one indicator that waters and sediments are of sufficient quality so that waters in the region are safe for drinking, swimming, shellfish harvest and consumption, and other human uses and enjoyment. (Revised Code of Washington 90.71.300(1)(f))

Current conditions:

- From 2004 to 2010, 48 percent of routinely monitored (50-70 core) beaches consistently met standards every year; 35 percent met standards except for one or two years; and 17 percent failed to meet standards almost every year.
- In any year from 2004 to 2010, 7 to 15 beaches failed to meet the marine water quality standard for enterococcus (a type of fecal bacteria).

Conditions that might affect what can be achieved by 2020:

- Drier summers with reduced rainfall might improve water quality at swimming beaches that are most affected by wet weather runoff.
- Storm water and wastewater infrastructure near swimming beaches
- Growing human population, and extent and pattern of land development may affect pollution levels.

Target

- By 2020, all monitored Puget Sound beaches meet enterococcus standard.

Next Steps

- The Partnership will work with the steering committee of the coordinated ecosystem monitoring and assessment program to develop a robust system of monitoring and indicators to protect recreational uses of surface waters at swimming beaches and other locations where contact recreation (e.g., SCUBA diving, wind surfing, kayaking) occur.

PugetSoundPartnership
our sound, our community, our chance

Ecosystem Recovery Target: Summer Stream Flows

A functioning, resilient ecosystem requires:

- Summer stream flows that support salmon habitat needs, other ecosystem needs, and provide water for people.

This measure provides an indication of:

- Summer stream flows to support salmon habitat needs, measured via the lowest 30-day average flow observed from June through October.

Why this measure:

- Summer stream flows provide a key indication that river and stream flow levels are sufficient to sustain people, fish, and wildlife, and the natural functions of the environment (Revised Code of Washington 90.71.300(1)(e)).
- Summer stream flows that support salmon habitat needs, other ecosystem needs, and provide water for people provide a key indication that Puget Sound's freshwater, estuary, nearshore, marine, and upland habitats are protected, restored, and sustained (Revised Code of Washington 90.71.300(1)(d)).

Current conditions:

For 13 rivers, representing 68 percent of Puget Sound's watershed area, monitored from 1975 to 2010:

- Three rivers show increasing trends in summer low flows – Cedar (strong evidence), Nisqually and Skokomish (weak evidence)
- Six rivers show no trend – Dungeness, Elwha, Green, Nooksack, Puyallup, and Skagit
- Four rivers show declining trends in low summer flows – Snohomish (weak evidence), Deschutes, North Fork Stillaquamish, and Issaquah Creek (all with strong evidence)

Conditions that might affect what can be achieved by 2020:

- Expected climate changes will result in decreased summer low flows (related to decreased snow pack and loss of glaciers combined with warmer temperatures). Increased glacial melt may temporarily increase summer low flows in glacially-fed rivers.
- Surface water withdrawals for consumptive uses, flow management by dams, ground water withdrawals, and increase in impervious land cover can all affect summer stream flows.
- Flow restoration goals may not be achievable by 2020 given: the trend, the amount of work needed to increase flows to change recent trends, and the funding and legal tools available to accomplish implementation.

Target

1. By 2020, meet the following river-specific targets:
    a. Maintain stable or increasing flows in highly regulated rivers: Nisqually, Cedar, Skokomish, Skagit, Green

b. Monitor low flow in the Elwha River after dam removal

c. Maintain stable flows in unregulated rivers that currently are stable: Puyallup, Dungeness, Nooksack

d. Restore low flows to bring the Snohomish River from a weakly decreasing trend to no trend

e. Restore low flows to bring the Deschutes River, North Fork Stillaguamish River, and Issaquah Creek from a strongly decreasing trend to a weakly decreasing trend

Next steps

The Partnership will work collaboratively with the steering committee of the coordinated ecosystem monitoring and assessment program to explore and develop a robust system of indicators that more effectively address diverse aspects of stream flow and water availability. This work might consider: using 7-day low flows rather 30-day low flows as an indication of critical summer flow conditions; including more gauges; addressing concerns about use of the 1975 to current time period; using a two-way indicator that includes the adequacy of flow levels (both status and trend); and developing an hydrologic index that captures “environmental flows.”

PugetSoundPartnership
our sound, our community, our chance

Ecosystem Recovery Target: Water Insects in Freshwater

A functioning, resilient ecosystem requires:

- Lowland streams that support the salmonids and water insects native to this region

This measure provides an indication of:

- Biological health of wadeable, lowland streams as reflected by communities of water insects (benthic invertebrates)

Why this measure:

- Runoff from developed lands and clearing of trees along waterways can harm the health of small streams that support salmon, other aquatic life, and wildlife. Water insects in small streams are an effective way to measure stream health.

Current conditions:

- Sound-wide results have not been reported, but King County data show that about 37 percent of sites are rated “good” or “excellent” with the remaining 63 percent rated “fair” or “poor.”

Conditions that might affect what can be achieved by 2020:

- Improvement in rating (benthic invertebrates B-IBI) scores lags behind improvements to flow and water quality
- Resources committed to redevelopment and storm water retrofit projects to improve storm water management and stream health
- Development practices may degrade stream health in urbanizing areas
- Economic conditions between 2011 and 2020

Target

- By 2020, 100 percent of Puget Sound lowland stream drainage areas monitored with baseline B-IBI scores of 42-46 or better retain these “excellent” scores and mean B-IBI scores of 30 Puget Sound lowland drainage areas improve from “fair” to “good.”

Next steps

The Partnership will work collaboratively with partners to develop a robust system of monitoring and indicators to describe the condition of water bodies that are affected by storm water runoff, especially measures of the incidence of pre-spawn mortality among salmon returning to Puget Sound lowland streams.

PugetSoundPartnership
our sound, our community, our chance

Ecosystem Recovery Target: Dissolved Oxygen in Marine Waters

A functioning, resilient ecosystem requires:

- Dissolved oxygen concentrations in marine waters to support Puget Sound species, communities, and food webs.

This measure provides an indication of:

- Human-related contributions to depressed dissolved oxygen concentrations in Puget Sound marine waters. A measureable (i.e., 0.2 mg/L) decrease in dissolved oxygen concentrations related to human-related causes is a violation of Washington State water quality standards.

Why this measure:

- Dissolved oxygen in marine water provides a key indication that waters in the region are not harmful to the native marine mammals, fish, birds, and shellfish of the region (Revised Code of Washington 90.71.300(1)(f))
- Dissolved oxygen in marine water provides a key indication that freshwater, estuary, nearshore, marine, and upland habitats are protected, restored, and sustained (Revised Code of Washington 90.71.300(d))

Current conditions:

- Hood Canal, south Puget Sound, and perhaps the Whidbey basin are nutrient sensitive areas of Puget Sound. Modeling will be complete in early 2012 to identify areas that may experience 0.2 mg/L reductions in dissolved oxygen from human-related causes. Some areas of south Puget Sound and lower Hood Canal may not meet the water quality standard related to dissolved oxygen reductions from human-related causes.

Conditions that might affect what can be achieved by 2020:

- Time lag of 1 to 2 years in environmental response to reduced loadings
- Permitting schedules and wastewater facilities planning schedules
- Resources (from utility fees, grants, or loans) for improved wastewater treatment infrastructure
- Limited availability of affordable, reliable, sufficiently demonstrated nitrogen removing technologies for on-site sewage systems at single-home applications.
- Financial and technical assistance to control non-point source pollution

Target

- By 2020, human-related contributions of nitrogen do not result in more than 0.2 mg/L reductions in dissolved oxygen levels anywhere in Puget Sound.

Next Steps

The Partnership will work collaboratively with partners to develop a robust system of monitoring and indicators to describe the condition of the region's marine water quality, including the marine water quality composite index that has been adopted by the Partnership as a dashboard ecosystem indicator.

Ecosystem Recovery Target: Toxics in Fish

A functioning, resilient ecosystem requires:

- Fish populations not harmed by toxic contaminants and fish safe for consumption by predators and humans.

This measure provides an indication of:

- Exposure of marine fish to toxic chemicals relative to levels that might harm the health of fish populations throughout the food web and pose health risks to human consumers of fish.

Why this measure:

- Toxics in fish provide a key indication that fresh and marine waters and sediments are of a sufficient quality so that the waters in the region are safe for drinking, swimming, shellfish harvest and consumption, and other human uses and enjoyment, and are not harmful to the native marine mammals, fish, birds, and shellfish of the region" (Revised Code of Washington 90.71.300(1)(f)).
- Toxics in fish provide a key indication that freshwater, estuary, nearshore, marine, and upland habitats are protected, restored, and sustained (Revised Code of Washington 90.71.300(d)).
- Toxics in fish provide a key indication that a healthy human population is supported by a healthy Puget Sound (Revised Code of Washington 90.71.300(a)).

Current conditions:

- Polychlorinated biphenyls (PCBs), a class of industrial chemicals that is toxic to fish, marine mammals, and other animals, in Puget Sound bottomfish and salmon have declined since the 1970s. PCBs remain relatively high in bottomfish from urban bays and in "resident " Chinook salmon. The Washington Department of Health has issued consumption advisories for English sole from 8 of 17 areas in Puget Sound and for Chinook salmon Puget Sound-wide because of high PCB levels. High PCBs levels in Pacific herring and Pacific hake illustrate the degree to which Puget Sound's food web is contaminated. These species along with Pacific salmon represent a large component of the food web that supports Puget Sound's apex predators including harbor seals and orca whales.
- A similar pattern exists for polybrominated diphenyl ethers (PBDEs), a class of chemicals used as flame retardants, in these species, but long-term trends are less clear.
- Liver disease in English sole caused by exposure to polynuclear aromatic hydrocarbons (PAHs), a by-product of combustion and a minor component of the hydrocarbons in fossil fuels, has been tracked in some Puget Sound locations for more than 20 years.

Conditions that might affect what can be achieved by 2020:

- Reservoirs of some toxic contaminants persist in the Puget Sound ecosystem long after sources are controlled; measurable reductions in persistent, biaccumulative compounds may not occur in the 2020 timeframe.
- Natural recovery of contaminated sediments depends on incoming load of clean sediment.

- Time needed to find safe substitutes of chemicals currently in use and to change behaviors
- Resources available for storm water retrofit, improved wastewater treatment, and site clean up
- Individuals' preferences and behaviors with regard to (1) use and disposal of pharmaceutical, personal care products, and other consumer products and (2) generation of toxic chemicals from residential heating, transportation, etc.

Target

- By 2020, toxics in fish are below threshold levels. Target is achieved if each of the following conditions is observed in monitoring results from 2019 or 2020:
    - Bioaccumulative toxics – 95 percent of samples meet the following thresholds:
        - Concentrations of PCBs and PBDEs in Puget Sound herring, English sole, salmon and steelhead are below adverse effects thresholds (e.g., 2,400 ng PCB/g lipid and 1,400 ng PBDE/g lipid)
        - Concentrations of PCBs and other biocumulative toxics in Puget Sound herring, English sole, salmon, and steelhead are below human-health screening levels (e.g., Department of Health screening levels for recreational or subsistence consumption rates, currently 33 ng PCB/g and 10 ng PCB/g fish tissue, respectively for a non-cancer endpoint).
    - PAHs and endocrine disrupting compounds, including chemicals that affect animals' hormone production and function and can cause reproductive harm – all samples meet the following thresholds:
        - English sole in Puget Sound exhibit no PAH-related liver disease
        - English sole in Puget Sound exhibit no toxics-related reproductive impairment
        - PAHs in herring are below an effects threshold.

Next Steps

The Partnership will work collaboratively with partners to develop a robust system of monitoring and indicators to describe the exposure and harm from toxic contaminants in fish, including freshwater fish.

Ecosystem Recovery Target: Freshwater Water Quality

A functioning, resilient ecosystem requires:

- Freshwater water quality that protects aquatic life and other uses of the state's waters.

This measure provides an indication of:

- Quality of flowing freshwaters compared to (a) water quality criteria for conventional pollutants and (b) "better" conditions of sediment and nutrient concentrations as observed during a benchmark period; parameters are combined into an index where a score of 80 indicates that water quality criteria are met and conditions compare favorably to benchmark conditions for sediments and nutrients.

Why this measure:

- Freshwater water quality provides a key indication that waters in the region are safe for drinking, swimming, shellfish harvest and consumption, and other human uses and enjoyment, and are not harmful to the native marine mammals, fish, birds, and shellfish of the region (Revised Code of Washington 90.71.300(1)(f))
- Freshwater water quality provides a key indication that freshwater, estuary, nearshore, marine, and upland habitats are protected, restored, and sustained (Revised Code of Washington 90.71.300(d)).

Current conditions:

- Current Freshwater Quality Index scores for major rivers in Puget Sound are in the mid 70s, an improvement of about 0.4 units a year since 1995 when the index began. Scores have improved most strongly in the Nisqually and Deschutes systems. No Puget Sound basins have had significantly declining scores.
- Projecting current trends into the future suggests that average index scores will reach 80 by 2025 (if no flow adjustment is included) or by 2060 (using flow adjusted scores)

Conditions that might affect what can be achieved by 2020:

- Expected climate changes likely would worsen index scores for temperature, oxygen, and pH, and winter scores for nutrients and sediment. Climate changes likely would improve summer index scores for nutrients and sediment.
- Adoption of management practices to control non-point sources of sediment, nutrients, and fecal coliform bacteria.
- Extent and pattern of land development can affect stream hydrology and pollutant loads.

Target

- By 2020, at least 50 percent of all monitoring stations with suitable data have Freshwater Water Quality Index scores of 80 or higher, and
- By 2020, achieve a decrease in the number of impaired waters (303(d) list) in Puget Sound freshwaters.

Next steps

The Partnership will work collaboratively with the steering committee of the coordinated ecosystem monitoring and assessment program to develop a robust system of monitoring and indicators to describe the condition of the region's freshwater water quality.

PugetSoundPartnership
our sound, our community, our chance

Ecosystem Recovery Target: Estuaries

A functioning, resilient ecosystem requires:

- Tidally-influenced wetland habitats at the estuaries of Puget Sound's major rivers to provide ecosystem functions, goods, and services

This measure provides an indication of:

- Extent to which wetlands at 16 large river mouth estuaries support salmon recovery and provide other ecosystem functions, goods, and services. (Wetland extent is only one of five key ecological attributes needed for functioning river deltas.)

Why this measure:

- The extent of river mouth estuary wetlands provides a key indication that freshwater, estuary, nearshore, marine, and upland habitats are protected, restored, and sustained (Revised Code of Washington 90.71.300(d)).
- The extent of river mouth estuary wetlands can affect how quality of human life is sustained by a functioning Puget Sound ecosystem (Revised Code of Washington 90.71.300(b)).

Current conditions:

- Wetlands are only 17-19 percent of their historic extent in Puget Sound. At 16 large river mouth estuaries, they are 45 percent of their historic extent but as little as 1-3 percent in the most high developed areas (Duwamish and Puyallup).

Conditions that might affect what can be achieved by 2020:

- Rising sea level may reduce extent of wetlands at Puget Sound's river mouth estuaries.
- Areas of historic wetlands have been converted to other uses and these transformed landscapes provide other valued services (e.g., ports, farms, utility and transportation infrastructure).
- Restoration projects depend on financial resources (total cost not yet known) and social buy-in, which has proven difficult; rate of restoration envisioned in 2005 has not been accomplished in the past 6 years

Target

- By 2020, all Chinook natal river deltas meet 10-year salmon recovery goals (or 10 percent of restoration need as proxy for river deltas lacking quantitative acreage goals in salmon recovery plans) and 7,380 quality acres are restored basin-wide, which is 20 percent of restoration need.

Next steps

The Partnership will work collaboratively with the steering committee of the coordinated ecosystem monitoring and assessment program to develop a robust system of monitoring and indicators to effectively describe the condition of river mouth estuaries and their delivery of ecosystem functions and services.

PugetSoundPartnership
our sound, our community, our chance

Ecosystem Recovery Target: Marine Sediment Quality

A functioning, resilient ecosystem requires:

- Sediment quality that supports functioning, healthy communities of sediment-dwelling invertebrates.

This measure provides an indication of:

- Quality of marine sediments based on levels of chemical contamination, toxicity testing, and benthic invertebrate communities. This indicator assesses conditions based on findings of an established status and trends monitoring program that evaluates conditions in individual regions of Puget Sound and in urban bays.

Why this measure:

- Marine sediment quality provides a key indication that fresh and marine waters and sediments are of a sufficient quality so that the waters in the region are not harmful to the native marine mammals, fish, birds, and shellfish of the region (Revised Code of Washington 90.71.300(1)(f)).
- Marine sediment quality provides a key indication that freshwater, estuary, nearshore, marine, and upland habitats are protected, restored, and sustained (Revised Code of Washington 90.71.300(d)).

Current conditions:

- All eight regions of Puget Sound monitored from 1997-2009 demonstrated minimum exposure to toxic chemicals in sediment. Four of eight regions demonstrated unimpacted benthic invertebrate communities. The other four regions demonstrated likely impacted communities.
- Two of four Puget Sound urban bays monitored from 1998-2010 demonstrated minimum exposure to toxic chemicals in sediment. The other two urban bays that have been monitored showed improving chemistry index scores but low levels of exposure. Benthic community results are available for only three urban bays: One appears unimpacted, one has likely impacted communities, and the third is on the border of unimpacted-likely impacted.

Conditions that might affect what can be achieved by 2020:

- Reservoirs of some toxic contaminants persist in the Puget Sound ecosystem long after sources are controlled; measurable reductions in persistent compounds may not occur in the 2020 timeframe.
- Natural recovery of contaminated sediments depends on incoming load of clean sediment.
- Time needed to find safe substitutes of chemicals currently in use and to change behaviors.
- Resources available for storm water retrofit, improved wastewater treatment, and site clean up.
- Individuals' preferences and behaviors with regard to (1) use and disposal of pharmaceutical, personal care products, and other consumer products and (2) generation of toxic chemicals from residential heating, transportation, etc.

Target

- By 2020, all Puget Sound regions and bays achieve the following: Chemistry measures reflect "minimum exposure" (i.e., mSQS is <0.1 and the SCI is >93.3), Sediment Quality Triad Index (SQTI) scores reflect "unimpacted" conditions (i.e., SQTI values >83), and no measurements exceed the Sediment Quality Standards chemical criteria set in the Washington State sediment management standards.

Next steps

The Partnership will work collaboratively with the steering committee of the coordinated ecosystem monitoring and assessment program to develop a robust system of monitoring and indicators to describe the condition of the region's marine sediment quality, including the development of a marine benthic index and new understandings of thresholds protective of marine ecosystem health and human health.

Ecosystem Recovery Target: Floodplains

A functioning, resilient ecosystem requires:

- Freshwater floodplains that support natural processes and deliver ecological services to keep people and property safe during flood flows, support fisheries production, and provide water filtration and ground water recharge.

This measure provides an indication of:

- Extent, connectivity, and function of tidal and non-tidal, freshwater floodplains associated with large rivers and their major tributaries.

Why this measure:

- The extent and condition of freshwater floodplains provides a key indication that freshwater, estuary, nearshore, marine, and upland habitats are protected, restored, and sustained (Revised Code of Washington 90.71.300(d))
- The extent and condition of freshwater floodplains can affect how quality of human life is sustained by a functioning Puget Sound ecosystem (Revised Code of Washington 90.71.300(b)).

Current conditions:

- Extensive loss of floodplain wetlands and forests has occurred through shoreline armoring, construction of levees, and agricultural, residential, commercial, and industrial development. The National Oceanic and Atmospheric Administration estimates that 73 percent of Puget Sound wetlands have been lost, most of which occurred in floodplains.

Conditions that might affect what can be achieved by 2020:

- Hydrologic shifts and variability related to a changing climate likely will alter the interactions between rivers and their floodplains.
- Floodplain recovery objectives and actions need to recognize the significant social and economic values of floodplains. Objectives and actions that advance human safety and protect economic activities are more likely to succeed than those advance solely on ecological merits.

Target

- By 2020, 15 percent of degraded floodplain areas are restored or floodplain projects to achieve that outcome are underway across Puget Sound and there is no additional loss of floodplain function in any Puget Sound watershed relative to a 2011 baseline.

Next steps

The Partnership will work collaboratively with partners during the next two years, to develop and refine indicators addressing floodplain extent and condition (connectivity, condition, and flood storage capacity). This work will include identification of the most important floodplain areas on which to focus recovery and protection efforts (e.g.. the entire 100-year floodplain or a narrower, more dynamic and ecologically critical portion of the floodplain). The two-year work plan would include completion of the Department of Ecology's current Sound-wide mapping of channel migration zones and modifications to

river-floodplain interactions due to shoreline alteration (to be completed 2013) as well as development of a land cover-based measure of riparian and floodplain condition.

PugetSoundPartnership
our sound, our community, our chance

Ecosystem Recovery Target: Wild Chinook Salmon

A functioning, resilient ecosystem requires:

- A spatially and genetically diverse collection of viable Chinook salmon populations.

This measure provides an indication of:

- The status of this evolutionarily significant unit, currently listed as threatened under the federal Endangered Species Act. To achieve 95-99 percent probability that Puget Sound Chinook salmon can persist on their own for 100 years would require an abundance of 60,580 to 271,640 wild Puget Sound Chinook salmon, depending on the productivity of the Chinook populations.

Why this measure:

- The viability of Chinook salmon populations provides a key indication of healthy and sustaining populations of native species in Puget Sound, including a robust food web (Revised Code of Washington 90.71.300(d)).

Current conditions:

- Abundance data back to 1986 indicate an overall decline during the past 25 years.
- On average about 55,000 Puget Sound Chinook return for each year combined across harvest, spawning, or capture for hatchery brood stock

Conditions that might affect what can be achieved by 2020:

- Chinook salmon may respond to actions that directly affect their survival (e.g., improving passage, restricting harvest) over decades or less. Responses to other actions (e.g., improving hatchery practices, improving habitat quality) may take much longer.
- Spatial distribution of populations is a key ecological attribute of Chinook salmon viability and the recovery plan suggests that at least two populations in each of five biogeographic regions should reach their recovery goals for Puget Sound Chinook to achieve a low risk of extinction.
- Level of effort in implementing habitat, harvest, and hatchery contributions to salmon recovery.
- Effectiveness of regulatory and non-regulatory efforts to protect Chinook salmon habitat.

Target

- By 2020, we stop the overall decline and start seeing improvements in wild Chinook abundance in two to four populations in each biogeographic region.

Next steps

The Partnership will work collaboratively with the steering committee of the coordinated ecosystem monitoring and assessment program to develop a robust system of monitoring and indicators of all aspects of Puget Sound Chinook population viability, including population productivity, spatial distribution, and diversity.

PugetSoundPartnership
our sound, our community, our chance

Ecosystem Recovery Target: Shoreline Armoring

A functioning, resilient ecosystem requires:

- Dynamic shorelines maintained by coastal processes such as shoreline erosion and ecological exchange between terrestrial and aquatic systems.

This measure provides an indication of:

- Extent of armoring of marine shorelines.

Current conditions:

- About 27 percent (666 miles)of Puget Sound's marine shoreline is armored. Extent of armoring is continuing to grow in recent years at a rate of about 1 mile a year from 2005-2010 (new + replacement – removals).

Why this measure:

- Patterns and rates of change of shoreline armoring provide a key indication that freshwater, estuary, nearshore, marine, and upland habitats are protected, restored, and sustained (Revised Code of Washington 90.71.300(d)).
- Patterns and rates of change in shoreline armoring can affect how quality of human life is sustained by a functioning Puget Sound ecosystem (Revised Code of Washington 90.71.300(b)).

Conditions that might affect what can be achieved by 2020:

- Rising sea level and shifts in precipitation and runoff patterns may alter coastal erosion processes.
- Shoreline armoring is used to protect interests in shoreline properties.
- The extent of shoreline armoring has increased during the past 6 years with recent placements concentrated in a few counties.
- Population growth and development of shoreline properties likely will result in continued armoring.

Target

- From 2011 to 2020, the total amount of armoring removed is greater than the total amount of new armoring in Puget Sound (total miles removed> total miles added); feeder bluffs receive strategic attention for removal of existing armoring and avoidance of new armoring; and soft shore techniques are used for all new and replacement armoring unless it is demonstrably infeasible.

Next steps

The Partnership will work collaboratively with the steering committee of the coordinated ecosystem monitoring and assessment program to develop a robust system of monitoring and indicators of the condition of beach systems; the extent, pattern, and rate of shoreline armoring of marine and freshwater shorelines; and pressures on the ecosystem from other types of shoreline alteration of marine and freshwater shorelines.

The Partnership encourages partners to conduct assessments to project the extent of drift cell improvements needed for a functioning, resilient ecosystem, including support for increases in the Sound-wide extent of eelgrass and viable populations of forage fish and salmon.

PugetSoundPartnership
our sound, our community, our chance

Ecosystem Recovery Target: Management of On-Site Sewage Systems

A functioning, resilient ecosystem requires:

- Management of wastewater in a manner that protects aquatic resources and human health.

This measure provides an indication of:

- Proper operation and maintenance of on-site sewage systems.

Why this measure:

- Management of on-site sewage systems provides a key indication that a healthy human population is supported by a healthy Puget Sound (Revised Code of Washington 90.71.300(a)).
- Management of on-site sewage systems provides a key indication that waters in the region are safe for drinking, swimming, shellfish harvest and consumption, and other human uses and enjoyment, and are not harmful to the native marine mammals, fish, birds, and shellfish of the region (Revised Code of Washington 90.71.300(1)(f)).

Conditions that might affect what can be achieved by 2020:

- Funding and design of on-site sewage systems' operation and maintenance programs at 12 local health jurisdictions, including their approaches to inventorying systems, notifying homeowners, inspecting systems, and reporting results.
- Local health jurisdictions' designation of marine recovery areas and other areas with equivalent enhanced operation and maintenance programs.
- Resources available to property owners for on-site sewage systems repair.

Target

- By 2020, all on-site sewage systems in marine recovery areas and other areas with equivalent enhanced operation and maintenance programs are inventoried, 95 percent are current with inspections, and all failed systems are fixed.
- By 2020 expand designations of marine recovery areas or designation of other areas with equivalent enhanced operation and maintenance to 90 percent of marine shorelines not primarily served by sewers.

Next steps

- The Partnership will work collaboratively with local health jurisdictions, Department of Health, and other partners to (a) develop shared expectations about reasonable timeframes for fixing failed on-site sewage systems (i.e., how long after inspection identifies a problem will a system be fixed?) and (b) identify legislative options to increase homeowners responsibility for on-site sewage systems' operation and maintenance.
- The Partnership will work collaboratively with the steering committee of the coordinated ecosystem monitoring and assessment program to develop a robust system of monitoring and indicators to describe to the condition of fresh and marine waters that are affected by on-site sewage systems.

PugetSoundPartnership
our sound, our community, our chance

Ecosystem Recovery Target: Orcas

A functioning, resilient ecosystem requires:

- A viable population of southern resident killer whales.

This measure provides an indication of:

- The status of this population segment, currently listed as endangered under the federal Endangered Species Act. The Act protections will no longer be needed if the population grows at an annual rate of 2.3 percent over a 28-year period, if population characteristics are indicative of a stable or increasing population, and if threats to the population segment have been addressed.

Why this measure:

- The viability of Orcas provides a key indication of healthy and sustaining populations of native species in Puget Sound, including a robust food web (Revised Code of Washington 90.71.300(d)).

Current conditions:

- The 2010 end of year census identifies 86 southern resident killer whales. The population has grown slowly in recent years with an annual growth rate of about 0.66 percent.

Conditions that might affect what can be achieved by 2020:

- Although this population segment currently includes 25 females of reproductive age, only 17 or 18 are reproductively active. At a 5-year calving interval, a population with 17 or 18 reproductively active females will produce 3-4 calves a year. Accounting for calf mortality and other mortality in the population, a 2.3 percent annual growth rate does not appear to be achievable in the near-term.
- Levels of ocean harvest and hatchery production of Chinook salmon from Puget Sound and Georgia Basin rivers affect the availability of prey for southern resident killer whales.
- Level of effort to address the threats to southern resident killer whale recovery might affect the rate of population recovery

Target

- By 2020, achieve an end of year census of southern resident killer whales of 95 individuals, which would represent a 1 percent annual average growth rate from 2010 to 2020.

Next steps

The Partnership will work collaboratively with the steering committee of the coordinated ecosystem monitoring and assessment program to develop a robust system of monitoring and indicators of killer whale recovery and reduction in threats to recovery.

PugetSoundPartnership
our sound, our community, our chance

Ecosystem Recovery Target: Pacific Herring

A functioning, resilient ecosystem requires:

- Herring to satisfy predators' consumption requirements, meet bait and other fishery needs, and assure sufficient herring for successful spawning and recruitment.

This measure provides an indication of:

- Biomass of herring in each genetic stock.

Why this measure:

- The viability of Pacific herring provides a key indication of healthy and sustaining populations of native species in Puget Sound, including a robust food web (Revised Code of Washington 90.71.300(d))

Current conditions:

- Overall, herring spawning abundance has declined in Puget Sound since the 1970s and the condition is depressed. Much of the decline is attributed to the decrease of the Cherry Point stock.

Conditions that might affect what can be achieved by 2020:

- Food web modeling suggests that predators in central Puget Sound need 8,170 mt of juvenile and 2,540 mt of adult herring annually.
- Age composition of Cherry Point and other herring stocks has been skewed to younger ages over time; this shift may reduce reproductive capacity and impair the capacity of the population to recover.
- Human population growth and associated land development may reduce the amount or quality of spawning habitat for herring.
- Management of herring commercial harvest.

Target

- By 2020, achieve increased spawning biomass for each genetic grouping to a minimum of:
    - 5,000 tons for Cherry Point stock.
    - 880 tons for Squaxin Pass stock.
    - 13,500 tons for all other stocks combined.

Next steps

The Partnership will work collaboratively with the steering committee of the coordinated ecosystem monitoring and assessment program to develop a robust system of monitoring and indicators of all aspects of Pacific herring population viability (including acoustic-trawl survey), food web support, and provisioning for fisheries.

The Partnership encourages partners to develop thresholds for herring biomass based on needs for herring viability, fishery needs, and/or ecosystem needs.