The economics of our ecosystem

If you look simply at the value of commercial fisheries, the Northern Gulf of Alaska and Bering Sea are among the world’s richest waters. They are certainly the most productive waters in North America. Alaska leads all states in both volume and value of fisheries. According to the National Marine Fisheries Service, in 2011 Alaska fishermen landed 5.35 billion pounds of seafood, worth $1.9 billion. This exceeds the combined value of all 15 east coast states, and is more than half of the volume and value landed by all states combined. If Alaska was a nation it would be ranked about 14th among seafood-producing countries.

The Prince William Sound (PWS)/Copper River corner of the Gulf of Alaska supports incredibly diverse fisheries including halibut, crab, cod, sablefish, shrimp, and Alaska’s iconic fish: the Pacific salmon. Poets serving the region include Cordova, Valdez, Whittier, Seward, Homer, Kena, Anchorage and Yakutat. In 2010 the communities landed 278 million pounds of seafood valued at almost $260 million; half that value was from salmon harvested on the Copper River and in PWS. Fish drive our economy, social structure and ecology.

Without healthy ecosystems that support sustainable fisheries, communities would fail and thousands of families would be without work. Not just fishing families; cannery workers, longshoremens, warehouse workers, box makers, electricians, store clerks, wholesalers, restaurant and hotel workers all depend on our fisheries. The seafood industry generates 38,000 jobs, making it the largest employment sector in coastal Alaska. There is no backup economy. In partnership with the National Aeronautics and Space Administration and United States Geological Survey, the Prince William Sound Science Center (PWSSC) is looking at the terrestrial and marine connections that affect productivity in the ocean environment, which ultimately affects fish populations through the food web.

Since statehood, Alaskans have looked after their fish and the environment that these fish depend on. In 1974, after extensive salmon run failures, fishermen joined together with the Alaska Department of Fish and Game (ADF&G) and developed regional aquaculture programs to help enhance depressed salmon returns. Today, on average, the nonprofit hatcheries in PWS produce 1 in every 4 of Alaska’s commercially caught pink salmon. There have been recurring questions about the potential impacts from the hatchery programs on wild fish. ADFG recently contracted the PWSSC to collect data for a multi-year research program in PWS and Southeast Alaska to better understand wild and hatchery salmon interactions.

In 1989, just after the Exxon Valdez oil spill, fishermen again organized and joined with local community leaders to launch the PWSSC. People were fearful of long term impacts from the oil and wanted to learn from and apply the research being done by visiting scientists. Their fears were justified; after the spill, herring populations crashed and have not recovered. To date this has cost fishermen over $230 million in lost income. The PWSSC’s integrated herring research looks at links between disease, predation, food availability, ocean currents and depressed herring populations. The new Gulf Watch Alaska program is monitoring ecosystem functions to provide the long-term datasets needed to inform future managers.

The region’s economy depends on its ecosystems. Inside this issue of Delta Sound Connections, discover how agencies, universities, and independent scientists are working to better understand this incomparable place.

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LEAVE FEEDBACK
Let us know what you think of this publication by scanning this QR code with your phone, or visit:
www.pwssc.org

Our circumference of home

Three years ago an acquaintance of mine, Kurt Hoelting, wrote a book called The Circumference of Home about the year he spent only traveling within 100 kilometers of his house. The concept “circumference of home” resonates with me day to day as we consider what lies within 100 kilometers of my home in Cordova, Alaska. One hundred kilometers is roughly 62 miles. If you draw a circle with that radius on a map with Cordova at the center, it will encompass some of the most dramatic scenery and compelling ecosystems anywhere in North America. Here lie some of the northernmost temperate rainforests on earth. This is the home of the Copper River, whose watershed drains around 25,000 square miles of land and whose delta forms the largest contiguous wetlands on the Pacific coast of North America. It is here that over one million shorebirds have been observed at a time using the delta as a stopover on their annual migration to their breeding grounds. Here one can find all five species of Pacific salmon, returning by the millions to their natal streams and filling nets in one of the most notable fisheries in the country.

The spectacular Chugach Mountains are the local hills in our circumference of home, and native villages and traditional subsistence areas dot our shorelines and uplands. Traveling past rocky shorelines, herring spawning grounds and the reef one upon which the Exxon Valdez ran aground, you can find icebergs calving into the ocean from the Columbia Glacier, one of the fastest moving glaciers on earth. Travel down the oil tanker shipping lanes towards Hinchinbrook Entrance, passing the protected bay at Nushagak, before entering the northern Gulf of Alaska—one of the most productive ecosystems on Earth.

Go far enough past the barrier islands at the mouth of the Copper River and you’ll eventually come upon the ghost town of Katala, where the first commercially viable oil was discovered in all of Alaska. Within these places are the ecosystems that support the economies of our region. This is our circumference of home.

Katrina Hoffman
President & CEO
PWS Science Center
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People have lived and worked in the Prince William Sound (PWS) for centuries, but it remains a relatively understudied place. Although the marine realm of PWS is very important to local residents, as a means of travel and communication as well as commercial and subsistence resources, the oceanography of the area is not well known. Limited surveys were done in the 1970s, but it was not until after the Exxon Valdez oil spill in 1989 that the area received significant study. With support from the Exxon Valdez Oil Spill Trustee Council and the Oil Spill Recovery Institute, Prince William Sound Science Center researchers have been working to collect and archive oceanographic data collected in the region to see how it has changed over time. This data includes measurements taken at multiple depths to assess temperature and salinity.

Preliminary analysis of data from the central PWS region for the period between 1975 and present day shows a warming trend across all depths, with relatively less warming at the surface (as might be expected from contributions from melting ice sheets) with a maximum warming of slightly more than a half of a degree Fahrenheit per decade at depth.

\[ \text{Temperature change (degrees F per decade at depth) = 0.5°F} \]

People and technology together provide marine safety net

The nonprofit Marine Exchange of Alaska (MEA) was founded in 2006 to develop and implement a comprehensive vessel tracking system with shared access that is accomplished with Alaska’s mariners’ willingness to provide funding and sites to install Automatic Identification System (AIS) vessel tracking. The initially new AIS technology required to be installed on many commercial vessels transmits information on a vessel’s location, speed and other information several times a minute that is received by other vessels and shore receiving stations. This data is accumulated and graphically displayed on a Marine Exchange system accessed by the Coast Guard, State agencies, maritime operators, ports, and other stakeholders to aid the coordination of vessel activities, validation and compliance with safety and environmental protection measures and assist in emergency response. The Marine Exchange was built and operates over 50 AIS stations in Alaska, including five in Prince William Sound (PWS) that are hosted by the Prince William Sound Aquaculture Corp., Alaska Marine Lines, Shoreline Petroleum, the Port of Valdez, and the Tatitlek Village IRA Council. The nonprofit Marine Exchange of Alaska, www.mekalaska.org

Life between the tides

Someday, one might say, “the only constant in nature is change,” and that applies to life between the tides in Prince William Sound (PWS). During the summer of 2012, a group of volunteers photographed several shoreline sites in western Prince William Sound. Some of the observations had been collected in 1994 and 2006. They were then compared to PWS/NOAA to understand the various changes. These observational efforts, conducted at different depths, seek to test ocean circulation models, provide information on how benthic larvae might go, and understand the local processes. We found that during the summer there is a fairly strong spring- and summer-clockwise circulation in PWS. Surface drifters traveled north around Knight Island and exited PWS via Montague Strait. During the winter those drifters tended to travel south and often left through Hinchinbrook Entrance. Drifters that left PWS would take me to four weeks to reach Cook Inlet. Observations make it all the way to the Bering Sea before it would appear on the Alaska coastline.

The most unusual drifters involved a drifter dropped at seven meters (23 feet) from the Gulf of Alaska to the Aleutian Islands to test ocean circulation models, provide information on how benthic larvae might go, and understand the local processes. There is always one that has to go against the flow.

Drifting around

Edited by
 Marine Exchange of Alaska edpage@mekalaska.org

The non-profit Marine Exchange of Alaska is an organization established to provide information, communications, and services to aid safe, secure, efficient, and environmentally sound maritime operations. One key tool for attaining these goals is development of a comprehensive vessel tracking system with shared access that is accomplished with Alaska’s mariners’ willingness to provide funding and sites to install Automatic Identification System (AIS) vessel tracking. The initially new AIS technology required to be installed on many commercial vessels transmits information on a vessel’s location, speed and other information several times a minute that is received by other vessels and shore receiving stations. This data is accumulated and graphically displayed on a Marine Exchange system accessed by the Coast Guard, State agencies, maritime operators, ports, and other stakeholders to aid the coordination of vessel activities, validation and compliance with safety and environmental protection measures and assist in emergency response. The Marine Exchange was built and operates over 50 AIS stations in Alaska, including five in Prince William Sound (PWS) that are hosted by the Prince William Sound Aquaculture Corp., Alaska Marine Lines, Shoreline Petroleum, the Port of Valdez, and the Tatitlek Village IRA Council. The Marine Exchange of Alaska, www.mekalaska.org

How do we know what we know?

The basis of our understanding of nature begins with the scientific method. This is how our knowledge has grown of Southeast Alaska’s coast and how the scientific information from the following articles was determined. First, through observation, a question is formed along with a guess to answer this question that can be tested through some measurements or an experiment. Nobel laureate Richard Feynman said that: “If [the guess] disagrees with experiment, it is wrong. In that simple statement is the key to science. It does not make any difference whether you have guessed or not in...how smart you are, who made the guess, or what your name is, if it disagrees with experiment, it is wrong. That is all there is to it.”

This principle is best exemplified by ongoing studies of Asian desert dust storms, offshore Prince William Sound (PWS) in 2011. Dust storms from the Asian desert transport large amounts of soluble iron in the dust. In that simple statement is the key to science. It does not make any difference whether you have guessed or not in how smart you are, who made the guess, or what your name is, if it disagrees with experiment, it is wrong. That is all there is to it.

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Sampling herring—no school please!

Jeannine herring swims outside the water with the greatest of ease. But how research just calls for a study rather than a school? That is the challenge we face when we sample jeannine herring each November in Prince William Sound. Our collection samples for the purposes of herring abundance, populations, disease, and movements. The program is part of a long-term research and monitoring study sponsored by the Exxon Valley Oil Spill Trustee Council that has a goal to answer why Prince William Sound herring have not recovered. Jeannine herring can be tricky to catch—they spend light hours on the ocean surface only Occasionally if a stimulus or another predator disturbs them. To be dealt with, they rise toward the surface to gulp air for their swim bladder and to find food for the population. For our sampling work, we use three fishing techniques: a mid-water trawl, gillnets, and cast nets. The mid-water trawl allows us to fish over distant and target depth layers within the water column, while sampling a larger range of fish sizes and finfish species associated with schools of jeannine herring. We use the mid-water trawl to validate the age-structure, species composition, and size of fish stocks observed during acoustic surveys. We use gillnets of various mesh sizes, lengths, and sizes to more specifically target either age-0 and age-1 herring for energetics and movement studies, respectively, while reducing by-catch of non-target species or age classes. And holly, cast nets are used when at anchor when the boat’s lights are on to attract young herring to the surface. This is the preferred method of sampling for any projects which require live individuals, or fish in good body condition.

The human dimension of sustainability

Prince William Sound Aquaculture Corporation (PWSAC) operates five hatcheries in the Prince William Sound (PWS) and Copper River regions to supplement our salmon fisheries for long-term sustainability. These operations result in the return of millions of wild salmon. Fish are harvested for sport, commercial, and subsistence use for an economic purpose—high quality protein for human consumption. Sustainability is the cornerstone of Alaska’s longstanding commitment to responsible fisheries management. In times of plenty or scarcity, PWSAC’s contributions are critical in stabilizing wild salmon stocks so people can continue to enjoy the significant nutritional and economic benefits they provide.

The economic impact of PWSAC extends far beyond the fishing community of Cordova. A recent study analysis by the MDowell Group found that PWSAC hatcheries yielded a 271% to 312% return-on-investment since the program’s inception. The report also revealed that significant economic impacts extended to Anchorage and Fairbanks.

From 2007-2011, PWSAC salmon created an annual average of $451 million in labor income for an average of 2,495 workers. Commercial fishers earned a gross income for an average of $51 million in labor income on-investment since the program’s inception. The program’s success is beyond the fishing community of Cordova. A multitude of jeannine herring enjoy the significant nutritional and economic benefits associated with this decision. In times of plenty or scarcity, our commitment to responsible fisheries management provides a sustainable yield for Alaska.

THE LIFE CYCLE OF HATCHERY BORN, OCEAN-RAISED WILD ALASKAN SALMON

The University of Alaska Southeast (UAS) Fisheries Technology Program and Prince William Sound Community College (PWSCC) have teamed up to create a new bachelor’s degree program in fisheries science. Each course within the fisheries course titled “Fisheries of the Pacific Northwest” is being delivered to students online. This is a lower level undergraduate course available through UAS and PWSCC that introduces students to some of the basic principles, concepts and techniques of fisheries management, enhancement and rehabilitation in the Pacific Northwest. Board issues are reviewed in the context of the region’s, ecological, economic, political and social framework. One topic includes a history of the region’s fisheries, commercial and non-commercial fisheries of importance to the region, enhancement of the region’s fisheries, the impact of various types used, and management of the waters they inhabit.

An ounce of prevention: Expanding long-term salmon monitoring on the Copper River

Growing evidence indicates the health of a salmon fishery is highly correlated with the “passive-effects” of multiple, consistent, small finely-tuned data collection systems. For example, the Copper River Salmon Management Plan is actually composed of populations from various Copper River tributaries (e.g. Chitina, Knik, Gulkana). Current monitoring efforts of these populations are largely focused on detecting short-term changes in individual salmon stocks that may be negatively impacted by a variety of factors, including a parasite known as Ceratidinium.”

A new study examines the Native Village of Eyak (NVE) assesses the feasibility of using remote Radio Frequency Identification (RFID) streambed readers on Copper River tributaries in lieu of salmon tagged with Passive Integrated Transponder (PIT) tags. Since 2001, NVE’s Chinook Escapement Monitoring program annually PIT tags up to 5% of Chinook on the mainstem Copper River at Bear, Canyon. In lieu of tags, the streambed readers directly track salmon and recent information

New fisheries course

Tommy Sheridan
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Currently, USFS specialists are redesignated Wilderness Study Area. the western sound’s congressionally-established 24 lichen plots in Prince wilderness areas. Chugach National Forests, mostly in monitoring air quality on the Tongass and temperature and humidity. Deer. Lichens also regulate forest for birds and nutrition for goats and coastal forests. Over 500 species grow air quality. Using lichen to monitor Semipalmated plovers: seen on mudflats and on barrier island to the Copper River Delta, they can be found in open habitats and is therefore plover is one of those birds. And, the Semipalmated Like small children, some birds are impacts, and education and emphasizes its wild character. The plan includes forest health. affect recreation, fishing, tourism, and be underway. Lichen biomonitoring but research indicates change may also helped determine critical loads for change. Samples are analyzed for sulfur, based on evolving understandings and visiting plots and establishing new ones community surveys can detect changes occurring in species composition. In the Pacific Northwest, lichens have also helped determine critical loads for nitrogen in coastal forest ecosystems. Alaska’s air is perceived as clean, but research indicates change may be underway. Lichens biomonitoring informs PW’s communities about air quality and climatic changes that may affect recreation, fishing, tourism, and forest health. The work stems from the USFS’s stewardship plan for the Wilderness Study Area, which aims to protect its wild character. The plan includes work on invasive weeds, recreation impacts, and education and emphasizes connecting people to the area’s values.

One of nine marine invertebrates to make the list of “The World’s 100 Worst Invasive Species”, European Green Crabs have had major economic and ecological impacts on ecosystems around the world as they prey on and compete with crabs, crabs, shrimp, and many other invertebrates. Exceptional travelers, the crabs have expanded from their native range into the European Coast to six major regions of the world. Great crabs first appeared in the eastern United States in 1877, were transported to the West Coast in the 1960s and by 2010 they were 200 miles from the Alaskan border, so the current status of their expansion Research by the Smithsonian Environmental Research Center (SERC) and other scientists in this area are at risk of invasion.

To prepare for this, in 2000 SERC began training green crab monitors in Alaska. The first citizen-based monitoring effort began in 2004 at the Kachemak Bay Research Station and has expanded to sites in Prince William Sound and Southeast Alaska. Monitors include summer visitors, tribal environmental technicians, naturalists, biologists and teachers. Some teachers have incorporated the monitoring effort into their classrooms, with kids as young as 9 participating in trapping. Volunteers trap throughout the summer months, counting crabs data in a statewide database that serves as an early warning system for green crabs. So for far, green crabs have been found, and with luck, their proactive efforts will keep it that way.

In addition to reporting a green crab sighting, visit http://www.eelab.si.edu

Citizens help defend Alaska’s coastal waters.
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Using lichen to monitor air quality
Tim Lyndon
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Lichens are critical to Alaska’s coastal forests. Over 500 species grow here, hanging like long beards from branches, clinging to trees in leafy clusters, or grow atop the forest floor. They provide nutrient material for birds and nutrition for grizzly and deer. Lichens also regulate forest temperature and humidity. Because lichens absorb airborne moisture and elements, they are also air quality indicators. The United States Forest Service (USFS) uses lichens as a cost-effective way to bio-monitor air quality on the Tongass and Chugach National Forests, mostly in wilderness areas.

In the early 1990s, the USFS established 24 lichen plots in Prince William Sound (PWS), mostly within the western sound’s congressionally-designated Wilderness Study Area. This established baseline, for airborne contaminants and nutrients accumulating in target species. Currently, USFS specialists are re-visiting plots and establishing new ones based on evolving understandings and concerns about pollution and climate change. Samples are analyzed for sulfur, nitrogen and 26 other contaminants, including mercury, and the lichen community surveys can detect changes occurring in species composition. In the Pacific Northwest, lichens have also helped determine critical loads for nitrogen in coastal forest ecosystems. Alaska’s air is perceived as clean, but research indicates change may be underway. Lichens biomonitoring informs PW’s communities about air quality and climatic changes that may affect recreation, fishing, tourism, and forest health. The work stems from the USFS’s stewardship plan for the Wilderness Study Area, which aims to protect its wild character. The plan includes work on invasive weeds, recreation impacts, and education and emphasizes connecting people to the area’s values.

For both the pre-European contact Native cultures and the current communities in Prince William Sound, the five salmon species have been key to long-term survival and maintenance of livelihoods. While many are not aware of is that there is another culture dependent on abundant populations of salmon. These are the “resident” killer whales, the type of killer whale that shows maternal care and feeds while its offspring, primarily salmon during the spring, summer, and fall months. While salmon fishing boats tend to bug the shorelines, catching fish concentrated along shallow beaches, resident killer whales plying the deeper waters some distance off the shoreline, diving for several minutes at a time and using echolocation to find salmon, especially king and silver salmon, the manner of their diet. Until recently we had not realized just those whales were diving

This has changed with the remote attachment of small satellite-mounted tags to the fins of some killer whales. These tags not only relay the location of the whale to the satellite, but send data on depth and duration of dives. We had thought that resident killer whales fed near the surface, but last year we discovered that they regularly dive to depths of 300m (over 980 feet) and in some cases repeatedly dive to about 500m (over 1600 feet). We don’t know for sure that we are feeding on salmon during the deepest dive, but we do know from tagging studies in British Columbia that salmon often swim at considerable depths. Our view of resident killer whale feeding behavior is changing as we continue to examine their salmon-related community and its traditions.

The connection between whales and humans
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Getting to know and love our local mushrooms
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Most old growth forests are a common landscape feature across Prince William Sound (PWS). These forests, comprised mainly of Sitka spruce and hemlock, provide the perfect environment for the flourishing of mushrooms every fall.

While many delight in the sight of these colorful mushrooms and harvesting edible species, most do not realize that coastal Alaska forests depend on them for normal growth, survival and decay. Fungi are the only organisms able to break down lignin, the primary component in wood. They are also responsible for recycling nutrients from decaying plant matter to new growth.

Every fall the communities of Cordova and Girdwood celebrate these organisms through fungi festivals. These events are aimed at educating the public on the important ecosystem services that fungi provide as well as offer information on edible species and those used in arts and crafts such as fabric dye.

Mushroom experts (mycologists) have been visiting for years to present at these events and help identify and document the species that occur here. As a result, over 270 species of mushrooms have been identified from the area – the list keeps growing.

Hit off the press for this year is a new Forest Service publication Mushrooms of the National Forests of Alaska, which features 51 species, many of which in the PWS region. If you happen to be in the area during mushroom season, you will want to pick up a free copy at any United States Forest Service Ranger Station.

Is biomass a feasible energy source?
Casey Native Village of Eyak
page@eyakt.gov

Energy is an important subject to all Alaskans, especially among communities in Prince William Sound (PWS) where the high costs of energy remain a constant burden on families and often impede economic development in those areas. In Cordova, finding usable and low cost sources of energy is of great interest as it can have a profound effect on improving the local economy and boosting community resilience. The Native Village of Eyak (NVE), with support from the Alaska Energy Authority, has recently completed an evaluation of biomass resources on the Copper River Delta and waste “fuel wood” resources in Cordova.

Forest productivity on Eyak Corporation lands near the airport measured an annual (net) growth of 4,593 cords per year, equivalent to nearly 80,000 gallons of diesel. An additional 1,652 cords were estimated to be available from alder overgrowth on old logging roads. At a delivered cost of $225/ cord (for trees in areas with <15° slope), net growth harvest could offset diesel usage at a rate of $2,107 per gallon, presenting an attractive argument for a local sustainable harvest program (i.e. thinning, brush clearing, sailfield removal, etc) in Cordova.

The results of the study help summarize current heating footprints (loads) and unused waste streams (resources) in Cordova. NVE is hopeful that these waste streams can be eliminated in the near future by incorporating them into a thermal heating project using local biomass to supply heat instead of heating fuel.

Is biomass a feasible energy source?

Using lichen to monitor air quality

Semipalmated plouvers: Barrier island breeders
Like small children, some birds are just plain cute. And, the Semipalmated plover is one of those birds.

Although relatively scarce, this shorebird is found in open habitats and is therefore easy to observe. In May, when the plouvers first return to the Copper River Delta, they can be found on mudflats and on barrier island beaches. As visual predators, they run several steps, stop, scan, and pick. Sometimes they stop to cause prey to move. Egg Island, one of the Copper River Delta’s largest barrier islands, has been the site of a long-term breeding study by scientists at the Prince William Sound Science Center. At Egg Island the plouvers build ground nests behind the primary sand dunes, an area full of logs and other debris blown or washed in by waves during powerful winter storms.

Birds that have color-marked often return to breed within a few months and with the same mate from the previous year. Both birds incubate, but females often migrate south shortly after the nests hatch. Males stay with the chicks, usually until the chicks fledge after which they also head south. From mid-July through mid-August it is the chicks that are found on the beaches, after which they fly to land.

But where do the Copper River Delta plouvers winter – on the Pacific or the Atlantic Ocean? Our hope is that networking of plouvers color-banded at Egg Island will help answer that question.

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Taking the long view

Many resources and ecosystem processes were affected by the 1989 Exxon Valdez oil spill; the extent of those impacts is still not fully understood and ecosystem recovery is not complete. Climate change is also affecting the marine environment and resources. Scientists are utilizing three-year, five-year, and longer-term ecosystem monitoring programs called Gulf Watch Alaska.

The Gulf Watch Alaska program is funded by the Exxon Valdez Oil Spill Trustee Council and includes long-term monitoring of marine conditions, animal movements, and food web changes. The program will provide near-shore and open ocean monitoring data in the spill-affected area to resource managers, researchers and the public. The team will also compile and combine current and historical data to improve our understanding of the ecosystem as a whole.

Where are all the herring?

Herring was an important fishery in Prince William Sound (PWS), but collapsed in the 1970s, and has yet to recover. The herring population is still recovering and in the early 1990s the Prince William Sound Oil Spill Trustee Council (Trustee Council) began research into determining the factors that may be limiting recovery. From 2006-2012 is a program called the PWS Herring Survey program that included 11 different projects. Herring were monitored in the PWS, and the results have been published in the peer-reviewed literature. Projects looked at the herring population dynamics and the underlying oceanographic conditions.

The PWS Herring Survey program was initiated in 2006 and continued to provide data through 2012. The survey included several projects that studied the herring population dynamics and the underlying oceanographic conditions. The surveys were conducted in the Gulf of Alaska and Prince William Sound, and the results have been published in the peer-reviewed literature. The surveys included several projects that studied the herring population dynamics and the underlying oceanographic conditions.
**The eye on Alaska’s coasts and oceans**

Advancing sentinel monitoring, informing and improving weather and marine forecasts, and serving data and products in Prince William Sound and across Alaska to meet stakeholder needs.

**What is the Alaska Ocean Observing System (AOOS)?**

AOOS is the regional coastal ocean observing system for Alaska. A partnership of federal and state agencies, research entities, and private industry, AOOS provides observations, model forecasts, and data products to meet stakeholder needs.

**Tracking climate change**

Using Webcams You Can

**KNOW BEFORE YOU GO**

http://data.aoos.org/maps/pws_webcams.php

Fourteen webcams bring the Sound’s water, coastline, and mountains directly to you. Check conditions with a click of the mouse before you leave home.

**SEWARD LINE TRANSECT OBSERVATIONS**

AOOS contributes to a consortium led by the University of Alaska to support sampling along the Seward Line and at stations throughout the Sound:

- The longest multidisciplinary time series in Alaska.
- Provides critical long-term data series on oceanographic conditions in the GOA and how the region may be changing with climate impacts.
- Sampled continuously since October 1997, with some measurements going back to late 1970s.
- Funds support two cruises a year (May and September) and sample processing and data analysis.
- Measurements include ocean conditions and phytoplankton and zooplankton distribution and abundance.

**OCEAN ACIDIFICATION MONITORING**

AOOS is partnering with the new University of Alaska Ocean Acidification Center, the Alliance of Coastal Technology, and NOAA to support the fledgling statewide OA research and monitoring program to:

- Collect samples of dissolved inorganic carbon, total alkalinity, partial pressure of CO2, pH, carbonate mineral saturation states, particulate organic carbon, dissolved organic carbon, and oxygen isotope twice a year during the Seward line cruises.
- Combine OA data with observations of specific pelagic and benthic calcifying organisms to monitor how key-tonnage species in food web are responding to increased intrusion of atmospheric CO2.
- Support year-round OA sampling at a mooring in Resurrection Bay, just outside the Sound.

**Stream the real-time data and forecasting the future**

Through the AOOS Model Explorer, you can:

- Check out ocean circulation and wind current conditions and forecasts in the Sound.
- Drop a virtual sensor anywhere in the region and get simulated observations for that location.
- Scroll backwards and forwards through time-steps in the models.
- Download data into a spreadsheet.

Through the AOOS Real-Time Sensor Map, you can:

- Access 4000 real-time sensors throughout the state.
- Find real-time information for temperature, precipitation, waves, webcams and more.
- Simultaneously view the latest observations from multiple sensors housed on a single station.
- Bookmark a specific view with sensors of your choice to return to or send to a friend.
- View wind vectors, showing wind direction and magnitude across a region.

Click on one of the real-time sensors and get the latest information as well as historical data. www.aoos.org

**Informed improving weather and marine nowcasts and forecasts**

AOOS stations support NWS forecasts

AOOS is funding operations and maintenance of eight Snotel stations in the Sound to provide real-time weather and precipitation information. In the coming year, AOOS and its partner, the PWS Oil Spill Recovery Institute, will be assessing the current use and effectiveness of these stations and may shift their locations to optimize data flow to meet stakeholder needs.

**What do stakeholders care about?**

**Marine Operations**
Safe shipping and energy development; improved spill response and search and rescue operations.

**Coastal Hazards**
Improved ability to forecast and plan for changing storm conditions and their impacts on coastal communities.

**Ecosystems, Fisheries and Water Quality**
Better science to manage fisheries; sustained sentinel monitoring of key biological, chemical and physical variables.

**Climate Variability and Change**
Tracking ocean condition changes over time, especially ocean acidification, sea level rise, temperature, and salinity.
Connecting kids with wetlands

Jillian Jablonski
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WetlandsLIVE is a series of three wetlands ecology webcasts, broadcast over the course of the 2012-2013 school year. Sponsored by the United States Forest Service, WetlandsLIVE features programs in English and Spanish from Canada, Panama and the Copper River Delta. Through live and interactive programs, classes of grades 4-8 from around the world are able to watch and interact online with wetlands specialists, learn about the important role that wetlands play in our ecosystems, and share their own stories about what they are doing in wetlands.

Future environmental stewards

Linda Robinson
PWS Regional Citizen’s Advisory Committee
robinson@pwssc.org

In 2009 the Prince William Sound Regional Citizens’ Advisory Council was looking for ways to teach our region’s youth about safe oil transportation, the effects of the Exxon Valdez oil spill, marine science, fisheries and other important aspects of our neighborhood. By working with Alaska Geographic, Prince William Sound Science Center, the Chugach School District, and many others, the council has been involved in over 17 projects supporting youth and encouraging them to be stewards of their region.

Exxon Valdez oil spill

On March 24, 1989, the oil tanker Exxon Valdez left the Valdez Marine Terminal at 9:12 pm, bound for California with a load of approximately 33 million gallons of North Slope crude oil. The tanker Captain, Joe Hazelwood, was granted permission to change course to avoid icebergs from nearby Columbia Glacier. He gave orders to the Third Mate to maneuver the tanker to the new course and then retired to his quarters. For reasons that remain unclear, the tanker was never returned to its proper course.

Just after midnight on March 24, the Exxon Valdez oil tanker grounded on Bligh Reef, spilling at least 11 million gallons of oil into Prince William Sound, the largest oil spill in U.S. history. The initial response to the oil spill was slow, uncoordinated, and ineffective. Soaps and skimmers were called for three days, but almost no response equipment was available.

On March 27, a storm blew in with winds up to 65 mph, spreading the oil spill to the southwest along at least 1,400 miles of shoreline.

More information on the immediate and long-term impacts of the spill, as well as links to other oil spill resources can be obtained from the legacy organizations established after the spill including:

The Exxon Valdez Oil Spill Trustee Council oversees the 1991, $900 million settlement agreement between the federal government, the State of Alaska, and the Prince William Sound Communities Oil Spill Trustee Council. The council includes a Natural Resource Damage Assessment and Restoration Trustee Council, a Marine Mammal Damage Assessment and Restoration Trustee Council, and a Marine Bird Damage Assessment and Restoration Trustee Council.

The Prince William Sound Natural Resource Damage Assessment and Restoration Trustee Council was established by Congress in 1990 to focus on improved methodology and ecological research related to oil pollution in the marine environment of the Prince William Sound region.

The Prince William Sound Oil Spill Recovery Institute is an independent non-profit organization whose mission is to improve environmental safety applicable to Alaska’s Petroleum Valdez Marine Terminal and associated oil tankers. (www.pwsorc.org)
Cape St. Elias: A bright future

Cape St. Elias, one of Alaska’s most recognized yet least visited vistas, has some very distinguishable features. The majestic cliffs and rocky pinnacle rock have adorned famous oil paintings and photographs. Although it is only about 100 years, Yeti Kayak is less populated now than when Vitus Bering named the point in 1741. The lighthouse Cape St. Elias was constructed in 1913 and first lit in 1916. It contained state of the art signaling equipment that had been displayed at San Francisco’s Panama-Pacific International Exposition before it was shipped by Kayak Island. This was a “inpropriate navigational aid along the shipping lanes from the contiguous American states and Southeastern Alaska to Cordova, Valdez, Seward, and Anchorage” and was continuously manned until it was automated in 1974. In 1975 the Cape St. Elias Lighthouse was added to the National Register of Historic Places and in 1997 the property was leased by the USCG to the Cape St. Elias Lighthouse’s Association, a non-profit organization dedicated to preserving, maintaining and sharing the lighthouse. Tony and John Boccio, along with Steve Ramny, formed the Association because they wanted to make sure that the entity that took over the care and restoration of the historic property had a vested local interest in the heritage of the site.

Some of the main uses for the site since it became automated have been as a research facility for biologists, a site for vessel tracking, and a camp for beach debris clean-up. The property is currently in the process of being permanently transferred to the Cape St. Elias Lighthouse’s Association and under the watchful eye of the Boccio’s, the Association hopes to complete a major upgrade project this spring by baking up and repairing the house for new living quarters. Previous projects undertaken by the Association have included replacing the roof on the Main Keeper’s Quarters and sponsors a beach debris clean-up project that was an Eagle Scout project by Kris Ramny.

The future plans for Cape St. Elias include securing funding for a complete restoration of the famed lighthouse cupola and maintaining the facility as a valuable research and visitor destination. For more information about the Cape St. Elias Lighthouse’s Association check our website at lighthousecanada.org or email info@ kayaking.org.

Photo: (below) Cape St. Elias Lighthouse

Kuyuak – locally known as baidarkis – were, and are, expertly adapted to navigating the capricious waters of the Copper River Delta. Early European explorers admired their dynamic qualities and often traded for them. Even after motorized boats and planes arrived hunters appreciated their ability to quietly sneak up on prey. By the 1940s Chenega was the last village in the Sound still using the traditional sea lion baidarkis.

In recent years Native people around the Delta have been, and are, superbly adapted to living and working below deck. The old man knows the People of the Land-the Atina. He is one. He comes from the Headwaters People. This is his land. Not because he owns it, but because it is him. The old man looks at the river. He thinks about it every day. He knows the river in the summer, when the water is high under the hot sun. He knows when the fish come.

The salmon nation! He knows each group. Each tribe that makes this way up the Copper River, to ancestral streams. He too is from a tribe, where his story runs deep.

The old man knows the People of the Land-the Atina. He is one. He comes from the Headwaters People. This is his land. Not because he owns it, but because it is him.

The old man looks at the river. He thinks about it every day. He knows the river in the dark and cold time, when the snow grows white and the stars are bright.

He remembers other times, when the storms came in and his dogs surrounded him. They kept him alive through the night. The old man knows this land. The land knows him.

The future plans for Cape St. Elias include securing funding for a complete restoration of the famed lighthouse cupola and maintaining the facility as a valuable research and visitor destination. For more information about the Cape St. Elias Lighthouse’s Association check our website at lighthousecanada.org or email info@kayaking.org.
ACROSS
3. Iron is carried into the Copper River by this
5. Alaska’s tattooed friend
6. The second largest Pacific Salmon species
12. The acronym for the regional coastal ocean observing system for Alaska
14. A key species that collapsed after the Exxon Valdez oil spill
16. The lake where Cordova’s fourth graders monitor water quality
17. The PWSSC specializes in this area
19. A Prince William Sound shorebird
22. Herring food
24. A mushroom expert
26. The number of years it takes for a tin can to biodegrade
28. The Prince William Sound region’s economy depends on a healthy

DOWN
1. A pint in the Exxon Valdez spill-affected region
2. The acronym for an Alaska natural resource management agency
4. Killer whale
6. A natural air-quality indicator
7. The number of ports that serve Prince William Sound
8. A river in Prince William Sound
9. A large Alaskan animal
10. Future leaders
11. A community that annually celebrates fungi
13. The European Green Crab is one of these
15. A key event in the hatchery salmon life cycle
18. Potted commercial harvest-salmon species
20. The local Native name for “kayak” in Prince William Sound
21. One of the measurements available through the AOOS Real-Time Sensor Map
23. The acronym for the producer of Delta Sound Connections
25. A tool used to describe scenery in Prince William Sound
27. You can connect with us here
29. The total mass of organisms in a given area or volume

Biodegredation timeline

Test your knowledge
1. When was the light at the Cape St. Elias lighthouse first lit? ________________
2. What year did the Exxon Valdez oil tanker run aground on Bligh Reef? ________
3. How many salmon hatcheries are there in Prince William Sound? ______________
4. How many webcams does AOOS have placed around Prince William Sound? ____

Spot the invader
Read the article on page 6 titled, “Citizens help defend Alaska’s coastal waters”, then try and find a pesky invasive species hidden somewhere in this publication.

Antarctica is an icecap formed by the freezing of seawater from the bottom of the Indian Ocean, about 200 million years ago. The Antarctic ice cap, the largest ice mass on Earth, extends from the South Pole towards the other tropical regions.

Test your learning power
Find clues within our articles

Answers are available at: pwssc.org/delta-sound-connections

You may be surprised to discover just how long some things take to break down in the environment. Do the right thing by appropriately discarding your waste...and help us keep Prince William Sound and the Gulf of Alaska pristine!

WIN!
For a chance to win one of three cool Prince William Sound Science Center prize packages, draw a picture of a way that you think people are connected to their surroundings.

Mail your completed drawing to:
PWSC
P.O. Box 705
Cordova, AK 99574

Entries must be received by 10/01/13.

FIRST NAME:  .................................................................................................................
LAST NAME:   .................................................................................................................
ADDRESS:   .................................................................................................................
.................................................................................................................
.................................................................................................................
BEST CONTACT # or EMAIL: .................................................................................................

DESCRIBE YOUR DRAWING:
Our Bioregion

Bird and wildlife checklist


Loons and Grebes
- Common loon (nlukul)
- Red-throated loon
- Pacific loon (s)
- Yellow-billed loon (s)
- Horned grebe
- Red-necked grebe

Shearwaters and Petrels
- Fork-tailed storm-petrel
- Sooty shearwater (u)

Cormorants (ayagyuq)
- Pelagic cormorant
- Double-crested cormorant

Shorebirds
- Great blue heron

Waterfowl
- Surf scoter (unnalirrut saqulet)
- White-winged scoter
- Long-tailed duck
- Barrow’s goldeneye
- Common goldeneye (qatert’ snat)
- Bufflehead
- Harlequin duck
- Mallard (ungusaq)
- Canada goose (temngiaq)

Passerines
- Tree swallow
- Violet green swallow
- Hank swallow
- Chestnut-backed chickadee
- Winter wren
- Common raven
- Northwestern crow
- Black-billed magpie
- Steller’s jay
- Hermit thrush
- Varied thrush

Gulls/Terms (sea gull = naruyaq)
- Glaucous-winged gull
- Herring gull
- Mew gull
- Bonaparte’s gull (s)
- Black-legged kittiwake
- Parasitic jaeger
- Pomarine jaeger
- Arctic tern (s) (nerusicaluq)
- Aleutian tern (s,sa)

Seabirds
- Tufted puffin (s) (ngaqugaq)
- Horned puffin (s) (ngaqugaq)
- Marbled murrelet
- Kittlitz’s murrelet (u)
- Parakeet auklet (s)
- Pigeon guillemot
- Common murre

Heron
- Bald eagle (lukuluk)

Raptors
- Peregrine falcon

Hummingbirds
- Rufous hummingbird (s)

Kingfishers
- Belted kingfisher

Gulls/Terns (sea gull = naruyaq)
- American robin
- Wilson’s warbler
- Orange-crowned warbler
- Song sparrow
- Fox sparrow
- Savannah sparrow

Mammals
- Humpback whale (qadauq)
- Minke whale (qadauq)
- Dall’s porpoise (munagoon)
- Black bear
- Land otter (kep’arkan)
- Marmot
- Mink

Marine
- Harlequin duck
- Common goldeneye
- Black-billed magpie
- Steller’s jay
- Hermit thrush
- Varied thrush
- American robin
- Wilson’s warbler
- Orange-crowned warbler
- Song sparrow
- Fox sparrow
- Savannah sparrow

Can you spot the BIG 10?

- Killer whale (arluk)
- Steller sea lion (witnaq)
- Sea otter (xiqamauq)
- Harbor seal (qiyXiq)
- Harbor porpoise (munagoon)
- Siski black-tailed deer (pekauq)
- Brown bear (luk-qaq)
- Mountain goat (sepaauq)
- Beaver (shniq)
- Moose

Get involved. Support local science.

We need your help to continue planning, developing and delivering our education and research programs. Consider joining the PWS Science Center as a member and start making a difference today. YES! I want to become a member at the following level:

- Up to $50
- $51-$99
- $100-$249
- $250-$499
- $500-$999
- $1000-$4,999
- $5000-$9,999
- $10,000+

The PWSSC is a 501(c)(3) nonprofit research and education organization based in Cordova, AK.