2023-2024 DELTA SOUND CONNECTIONS

NATURAL HISTORY AND SCIENCE NEWS FROM PRINCE WILLIAM SOUND AND THE COPPER RIVER BIOREGION

# INNOVATION IS ENERGIZING

Copepods such as this tiny (1.5 mm) egg-bearing female Pseudocalanus spp. are important unseen members of ocean ecosystems. Filled with fat, they provide energy to fishes, whales, and seabirds. This specimen was collected from the Prince William Sound and photographed through a microscope at the Prince William Sound Science Center using an innovative technique called focus stacking. Photo credit Caitlin McKinstry.



**SAILING INTO** 

Alaska's Push to

Green the Seas

**THE FUTURE** 

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**ADF&G LAUNCHES PWS** 

Herring Spawn Map

**HERRING PORTAL** 

An Interactive

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**ALEUTIAN TERNS** Investigating the

a Rare Seabird



**KELP THE SOUND!** Annual Workshop Suspected Decline of about Kelp Farming in PWS

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## INNOVATION Is energizing

If you know many coastal Alaska residents, you might begin to suspect that innovation is in their DNA. My father-in-law, who was born in the 1930s, was the first person in the commercial fishing fleet in Cordova to install hydraulics on his fishing vessel. He ordered the parts from a Montgomery Ward catalogue, and some people thought he was wasting his money. You'd be hard pressed to find a commercial fishing vessel anywhere in Alaska without hydraulics today. It makes you wonder: what innovations are coming down the pike that will be broadly adopted that are still far off on the horizon, or not even in view? Time will tell, but the Prince William Sound Science Center has been working on some innovations - both independently and with partners - that are beginning to become a reality.

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**KATRINA HOFFMAN** President & CEO Prince William Sound Science Center

For starters, PWSSC's new seawater system will be up and running before the year is out. This system will allow the Prince William Sound Science Center to be home to the first running seawater-supported kelp hatchery on Prince William Sound—a region with more than a quarter of the pending kelp farm permits in the state, but to date, no local kelp hatchery. Through this innovation, we'll be able to better support a growing industry. We have also applied for grants that, if successful, will allow us to test out kelp drying facilities using waste heat already generated by other local facilities—another innovation.

Our new campus will be the third location in Alaska to be primarily heated by energy from the ocean with the installation of a seawater heat pump. This has multiple benefits, such as: it allows us to keep money circulating in the community because we'll be buying power to run the seawater pumps from our local electric cooperative, which keeps folks employed locally; it uses an energy resource (ocean heat) that is locally available and sustainable; and it's part of a lower carbon emissions operating scenario. Our new campus is poised to accommodate a charging station for electric vehicles, which our community will likely see more of in the not-too-distant future. And we built additional conduit into the building that can allow us to "plug and play" alternative energy technologies over time—some of which may be temporary pilot projects, and some that may be longer term solutions to energy needs. These are just a few of the many ideas that are "on deck".

Cordova is an ideal place to develop, demonstrate, and leverage approaches to building resilience in our changing world. There's a demand for resilience innovation afoot in Cordova that is best described as "organic collective impact." Cordovans are compelled to innovate in the face of climate change and a changing economy. An historic spirit of innovation and partnership courses through our community, and the practical outcomes that result can be embraced and repeated in coastal communities anywhere. In our unique "corner" of the globe, we're connecting with leaders of key organizations and working to prioritize the development and implementation of technological, social, and programmatic approaches to resilience, deploy those efforts with support from funders and partners, evaluate what works, adjust accordingly, share successes, and inspire those successes to be drivers of innovation elsewhere. We welcome additional support and partnerships-innovation is energizing, and there's lots of room to grow.

#### **DELTA SOUND CONNECTIONS** 2023-'24

#### DELTA SOUND CONNECTIONS

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#### **BIRD AND WILDLIFE CHECKLIST**

**RECOMMENDED BIRD/MAMMAL GUIDE:** Sibley's Field Guide to Birds of Western North America by David Allen Sibley and the Guide to Marine Mammals of Alaska by Kate Wynne. List compiled by the Prince William Sound chapter of the Audubon Society. Steller's Jay
Hermit Thrush
Varied Thrush
American Robin
Wilson's Warbler
Orange-crowned Warbler

#### U = UNCOMMON • S = SEASONAL

#### LOONS AND GREBES

Common Loon
Red-throated Loon
Pacific loon (s)
Yellow-billed Loon (s,u)
Horned Grebe
Red-necked Grebe

#### SHEARWATERS AND PETRELS Grok-tailed Storm-Petrel Sooty Shearwater (u)

#### CORMORANTS

Pelagic CormorantDouble-crested Cormorant

HERONS
Great Blue Heron

# WATERFOWL Surf Scoter White-winged Scoter Long-tailed Duck Barrow's Goldeneye Common Goldeneye Bufflehead Harlequin Duck Mallard Dusky Canada Goose Common Merganser Red-breasted Merganser

#### SHOREBIRDS

Black Oystercatcher
Semipalmated Plover
Least Sandpiper
Yellowlegs (Lesser and Greater)
Red-necked Phalarope (s)
Surfbird (s)
Black Turnstone (s)
Dunlin (s)
Western Sandpiper (s)

GULLS/TERNS

Glaucous-winged Gull

Herring Gull

Gull Mew Gull

Bonaparte's Gull (s)

Black-legged Kittiwake

Parasitic Jaeger

Pomarine Jaeger

Arctic Tern (s)Aleutian Tern (s,u)

#### SEABIRDS

Tufted Puffin (s)
 Horned Puffin (s)
 Marbled Murrelet
 Kittlitz's Murrelet (u)
 Parakeet Auklet (u)
 Pigeon Guillemot
 Common Murre

RAPTORS
Bald Eagle
Peregrine Falcon

HUMMINGBIRDS

KINGFISHERS Belted Kingfisher

#### PASSERINES

Tree Swallow
Violet Green Swallow
Bank Swallow
Chestnut-backed Chickadee
Winter Wren
Common Raven
Northwestern Crow
Black-billed Magpie

Song Sparrow Generation Fox Sparrow Savannah Sparrow MAMMALS Humpback whale □ Minke whale Dall's porpoise Black bear Land otter □ Marmot **Mink** U Weasel □ Killer whale □ Steller sea lion Sea otter Harbor seal Harbor porpoise Sitka black-tailed deer Brown bear Mountain goat Beaver Moose

#### **OCEANS**

#### PRINCE WILLIAM SOUND SCIENCE CENTER PWSSC.ORG



# **INTO THE FUTURE**

Residents and visitors alike rely on the Alaska Marine Highway System for business and personal endeavors. The gorgeous scenery is an added bonus. Photo credit AMHS.



#### Alaska's Push to Green the Seas

#### LINDSEY HAMMER

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Electric ferries are gaining traction worldwide: Norway operates over 50, Canada recently introduced its first two, and the State of Washington has committed, by executive order, to a zeroemission fleet by 2040.

Alaska is no exception. A strong maritime industry and culture make ferries a necessary part of our local economies, but their reliance on fossil fuels significantly contributes to pollution. However, recent federal funding initiatives are pushing hybrid vessels as a key component of our state's future ferry system. For the 35 communities along the Alaska Marine Highway System (AMHS), electric ferries offer lower diesel consumption and carbon emissions, and improved air and water quality.

This January, the US Department of Transportation awarded \$285 million to modernize Alaska's ferry system, including developing hybrid designs and replacing the 58-year-old M/V Tustumena with a hybrid diesel-electric vessel. By adding electric power, captains can use one of their two diesel engines at a time, reducing the current 150 gallons per hour fuel consumption by 1%.

There is a significant futureproofing benefit to investing in these improvements. Introducing battery power to AMHS vessels now will familiarize the state in preparation for future projects, and represents a significant step towards a sustainable, environmentally conscious transportation system.

Extreme Close Up! **Counting Plankton** with Cameras



**ROB CAMPBELL** 

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Plankton form the base of the marine food web. Tiny single-celled plant plankton (aka phytoplankton) grow and are consumed by animal plankton (aka zooplankton) grazers; zooplankton are food for larger animals like fish, birds, and whales. The amount and type of plankton present changes within and among years and measuring them is not easy. Innovative technologies like underwater cameras offer new ways to estimate plankton abundance.

Prince William Sound Science Center researchers have developed an underwater plankton camera and attached it to an autonomous robotic profiler that is deployed from spring to autumn in central Prince William Sound as part of the Gulf Watch Alaska project. In 2022, the profiler completed 338 separate profiles from 60 meters depth to the surface and collected almost a half million individual plankton images.

Most of the images show plankton near the surface, particularly during spring months, where productivity is mostly near-surface. Later in the summer, plankton are found in thinner bands further down where there is a balance between sunlight from above and nutrients from below.



ABOVE: A depth-specific time series of plankton images collected by the plankton camera during the 2022 deployment. Hotter colors indicate more plankton and cooler colors indicate less. Depth is shown on the left axis, with the surface at the top.

LEFT: A Neocalanus copepod image collected by the plankton camera. Neocalanus are a marine crustacean called a copepod, which are the most common type of zooplankton. The image shows a wealth of detail: all around the copepod, single-celled phytoplankton (the copepod's food) can be seen. Copepods have transparent carapaces, and the dark line visible within this copepod is its gut, which is full of phytoplankton it has consumed.

#### OCEANS

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Flatfish catch from a single 10-minute tow conducted at low tide near the mouth of the Copper River. *Photo credit Dylan Kiene.* 

#### Resilience of Subarctic Estuaries

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The Copper River Delta, Alaska is the largest contiguous coastal wetland system along the West Coast of North America. Sediments carried by the suspended load of the Copper River form vast expanses of tidal mudflats that are teeming with life. Fueled by the rich abundance of benthic invertebrates residing in the sediment, a diverse assemblage of crabs, fishes, birds, and marine mammals occupy the tidal sloughs.

Monthly benthic trawl surveys conducted from April to October of 2002-2006 quantified the demersal species composition and found it to be vital nursery habitat dominated by flatfish. Health and diversity of flatfish communities in the Copper River Delta could serve as a proxy for ecosystem resilience since flatfish species occupying very high or very low latitudes tend to have narrower temperature ranges in which they can thrive making them particularly susceptible to climate change. A re-evaluation of the benthic community composition is currently underway through an interdisciplinary collaboration between the University of South Alabama and the PWSSC that may shed light on the impacts of significant climate perturbations such as the Northeast Pacific Marine Heatwave and predicted changes in warming of ocean waters on the resilience of subarctic estuaries.



PWSRCAC staff and engineers from contractor Glosten deploy the PLT Multi, one of the line-throwing devices evaluated in the study and practical trial. *Photo credit Alan Sorum/PWSRCAC*.

#### Trials at Sea Lead to New Recommended Device

#### DANIELLE VERNA &

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To establish a tow between a rescue tug and a vessel in distress, the first step is to pass a light weight "messenger line," making the critical first connection between the vessels prior to deploying towing gear. Messenger lines may be passed by hand, heaved aboard, projected by mechanical means, or picked out of the water. Establishing this connection can be difficult and dangerous in the rough weather often encountered in Prince William Sound. The Prince William Sound Regional Citizens' Advisory Council (PWSRCAC) recently sponsored an innovative project to evaluate commercially available devices for deploying messenger lines.

Surprisingly, given the importance of this equipment to safely arrest a disabled tanker and prevent oil spills, best use practices and device recommendations have been largely overlooked. The devices were evaluated on eight scoring criteria including effectiveness, availability, environmental impacts, and cost. The devices were then tested in practical, real-world conditions on the water. The recommendation of the study is to use a reusable, compressed air device along with a surface float line. A video summarizing the line throwing trial and complete study results can be found on the PWSRCAC's website, www. tinyurl.com/LineThrowingVideo.



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A close-up look at the surface float line device evaluated and recommended by the PWSRCAC's study. *Photo credit Alan Sorum/PWSRCAC.* 



#### THE YELLOW TORPEDO

Herring detected by the glider. The glider detected 14 shed tags, e.g., tags redetected in the same location. There were eight undetermined herring tags, with four outside of the Montague Strait receivers which were recently detected by the OTN and likely alive. One herring moved 14.8 km within eastern PWS while the other moved 59.5 km between eastern PWS and Montague Strait. This second movement suggests herring use the western side of Montague Strait for migration. Overall, the glider detected 12 herring likely to be alive in a 240 mi<sup>2</sup> area over the course of an 86-day deployment.

#### THAT COULD

#### **ALYSHA CYPHER**

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The Prince William Sound Science Center tracks fish movement in Prince William Sound (PWS). How do we do it? With acoustic receivers – tubular pieces of plastic with hydrophones – positioned across Hinchinbrook Entrance, Montague Strait, and the southwest passages. This "Ocean Tracking Network" listens for fish fit with acoustic tags that emit pings every 60-90 seconds. When they pass a receiver, it records when they entered or exited PWS. Because the receivers are at fixed locations, they don't tell us much about how fish move inside PWS. We partnered with University of Alaska Fairbanks to mount a receiver on a glider, aptly named Shackleton.

In early 2021, the glider swam throughout Port Gravina and Orca Inlet before journeying through Montague Strait to Seward for pickup. During this time, it detected 30 Pacific herring tags implanted in 2020. We learned that nearly half of these herring expelled their tags, as the glider re-detected them in the same location. We found 12 live herring, most of which were detected by spawning grounds. One herring moved from spawning grounds to Montague Strait, a 60 km distance. The glider detected four herring outside of our receiver arrays in Montague Strait. Turns out gliders are pretty good at finding herring in PWS! PRINCE WILLIAM SOUND SCIENCE CENTER PWSSC.ORG

Introducing the GULF WATCH ALASKA LONG-TERM RESEARCH AND MONITORING PROGRAM



#### NEARSHORE ECOSYSTEMS







ROB SURYAN NOAA Auke Bay Laboratory rob.suryan@noaa.gov

Gulf Watch Alaska and the Herring Research and Monitoring programs were established a decade ago to identify factors limiting the recovery of species still listed as injured from the 1989 *Exxon Valdez* oil spill. In 2022, the two were combined to form the Gulf Watch Alaska Long-Term Research and Monitoring program, and now consist of five components:

1. Environmental Drivers (physical and biological oceanography),

#### ENVIRONMENTAL DRIVERS

EXCHAN

#### PELAGIC ECOSYSTEMS, INCLUDING HERRING



2014 and 2019. In the eight years since the onset of the first heatwave, some species have returned to or exceeded preheatwave levels, but others have not.

The four species that remain injured

#### A Herring's Dilemma: Should I Stay or Should I Go?

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#### MARY ANNE BISHOP

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Pacific herring in Prince William Sound are partial migrants, meaning while some herring are year-round residents, others migrate out into the Gulf of Alaska. To determine if there were differences between the "stay" and "go" herring, during four spring spawning seasons we implanted small acoustic tags into herring. When a tagged herring swims within the detection range of an acoustic receiver, the individual identification code and a time/ date stamp is recorded. Using detections obtained from the Ocean Tracking Network, a series of underwater receivers located at the major passageways into the Gulf of Alaska, we were able track herring movements for up to two years. After spawning, most herring moved to the mouths of Hinchinbrook Entrance or Montague Strait. After foraging there, fish that were smaller and lighter tended to remain in Prince William Sound while the longer, heavier (and hence, older) herring tended to migrate into the Gulf of Alaska. Herring remained in the Gulf anywhere from relatively short periods (14 days) to over 300 days before returning. In other words, the Gulf of Alaska is not just a summer foraging area, but also serves as wintering grounds for herring.



Dr. Alysha Cypher and Kirsti Jurica deploying an acoustic receiver during the annual cruise to service the Ocean Tracking Network, arrays of receivers that listen for tagged fish entering and exiting Prince William Sound. *Photo credit Anni Siebenmorgen*.

- 2. Nearshore Ecosystems (subtidal and intertidal systems),
- 3. Pelagic Ecosystems (prey and upper trophic-level predators),
- 4. Herring Research and Monitoring, and
- 5. Science Synthesis.

Many individual projects remained unchanged so as not to disrupt the critical long-term time series of data and a few projects were replaced by new ones, including studies of herring predators (walleye pollock) and competitors (pink salmon). Science synthesis has most recently focused on understanding how the Prince William Sound and Gulf of Alaska ecosystems responded to extensive marine heatwaves between

and not recovered after over 30 years since the oil spill - Pacific herring (a commercially and ecology important forage fish), killer whales (iconic top predators and a highlight of whale watchers), pigeon guillemots and marbled murrelets (ecologically unique marine birds) - are in similar or worse states of recovery after the heatwaves. Luckily, multiple indicators suggest recovery is still possible, despite the setbacks, but expected timelines must be adjusted. Programs like Gulf Watch Alaska demonstrate that it is possible to distinguish natural from human-caused changes in the environment and longterm research and monitoring programs are critical in doing so.

#### Herring Harvest Rules

#### **JOSH ZAHNER & TREVOR BRANCH**

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Herring have been fished in Prince William Sound for over a century. However, following a large decline in population size in the mid-1990s, the commercial herring fishery was closed to allow the population time to naturally rebuild. Thirty years later, the population has only recently begun to show signs of rebuilding to a level where a fishery can be reopened. But how many fish can a commercial fishery sustainably harvest?

We have developed computer simulations to test the impact of different catch rules on future population levels, while accounting for natural variations in abundance from strong and poor age classes. These kinds of simulations allow for quick exploration of many possible ways to sustainably manage Prince William Sound herring. Early results demonstrate that the current catch-setting rule does a good job of balancing annual catch levels and total population size compared to many alternatives. However, how well any potential catch-setting rules perform is highly dependent on a rebound in natural reproduction in the population, which has been highly variable over the last decade.

#### **GULF WATCH ALASKA**

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**DELTA SOUND CONNECTIONS 2023-'24** 

# ADF&G LAUNCHES PWS HERRING PORTAL

Herring spawn at Cedar Bay in 2022. Photo credit ADF&G

#### JENNI MORELLA

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In the spring, Pacific herring gather to spawn in large numbers. This provides an opportunity to obtain information on the biomass and age composition of the spawning fish. Aerial surveys are used to measure the miles of spawn, estimate biomass, and map congregations of birds and mammals. The Alaska Department of Fish and Game (ADF&G) has conducted spring aerial surveys of herring spawn in Prince William Sound since 1973. During aerial surveys, information is recorded on electronic tablets, and photographs are taken from the air to document and quantify the distribution of spawn. This information is critical to monitoring the herring population in Prince William Sound and feeds into a model used to estimate the biomass.

ADF&G is launching an interactive web map that will be updated after each aerial survey so you can follow along throughout the spawning season. The web map will include observed mile-days of milt, survey routes, and observations. Photos from the survey can be viewed by clicking on the individual features in the map. The map contains historic spawn observations for each year since 1973.

#### CHECK OUT THE PRINCE WILLIAM SOUND HERRING SPAWN INTERACTIVE WEB MAP ON THE ADF&G WEB SITE AT:

https://www.adfg.alaska.gov/index. cfm?adfg=commercialbyareapws.herring#maps



Screenshot of the interactive web map.



a two-part life cycle: a planktonic microscopic stage (larva) that are free-floating within the water column and a benthic stage that lives on the bottom. The benthic stages are generally better studied. Adult populations of animals (e.g., mussels, barnacles, and sea stars) are known to be affected by competition, predation, and physical stressors, such as heatwaves. However, the supply of larvae also may influence local population dynamics; after all, any population needs new animals to replace those that die. The number of larvae that arrive at a particular location can be influenced by water movement, the amount of time larvae are in the plankton phase, and seasonal patterns in species production of larvae.

For three groups of common intertidal animals, numbers of juveniles or adults in the intertidal was not strongly related to numbers of larvae in Prince William Sound. At one intertidal site, there was an increase in numbers of small mussels that coincided with a peak in bivalve (mussels, clams, and scallops) larvae, but there was no relationship at the other four sites. There was no apparent relationship between barnacle



Numbers of larvae in Prince William Sound (top row) and juveniles and adults in the rocky intertidal (bottom row) for mussels, barnacles, and sea stars.

percent cover and barnacle larvae or between sea stars and sea star larvae. Bivalve larvae and barnacle larvae were abundant in most years, while sea star larvae were rarely observed. Mussels and barnacles in the intertidal may not be limited by supply of larvae and processes that occur in the intertidal after they settle may be more important.

#### **GULF WATCH ALASKA**

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### **NEW SUPPORT** For Ship-based Ocean Acidification Monitoring in the Gulf of Alaska

#### ADDIE NORGAARD & CLAUDINE HAURI University of Alaska Fairbanks

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The ocean is becoming more acidic due to the absorption of human-generated carbon dioxide. Globally, ocean acidification (OA) is increasing as human emissions increase. In the Gulf of Alaska, additional factors such as high seasonal productivity, increasing freshwater input, and varying circulation can influence when and where harmful ocean acidification conditions emerge. The impacts are not fully understood, but OA could affect entire ecosystems. To understand impacts to the Gulf of Alaska region, we need a robust set of observational tools to measure carbon dioxide in

seawater over space and time. Hydrographic data has been collected by oceanographers along the Seward Line (see page 12) since the 1970s, and ocean acidification measurements have been collected since 2008. New funding from the *Exxon Valdez* Oil Spill Trustee Council ensures the continuation of these OA measurements every May, July, and September.

Moored sensors and a regional biogeochemical model round out this toolset to give a picture of the change occurring in the Gulf of Alaska. Together they allow us to understand the long-term OA trend, as well as the underlying chemical dynamics that control OA conditions. With this knowledge, we can anticipate and respond to future changes.

This photo was taken in April of 2022 on the R/V Sikuliaq in Icy Bay near Chenega Glacier in PWS as the water sampling rosette is deployed. Photo credit Addie Norgaard.

#### What Happened to the Humpback Whales of Prince William Sound?

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#### JOHN MORAN

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In 2020 we reported a drop in whale numbers that occurred during the North Pacific Marine Heatwave (NPMHW). The decline in whales corresponded to a drop in the biomass of Prince William Sound herring seen in 2015, the primary food of humpbacks in the Sound. We also saw fewer calves and "skinny" whales which points to a nutritional issue. In 2022, whale numbers remained low, including few calves, although herring have been increasing since 2018. This is shown in figure 1 with whales represented in bars and herring as a line. The predator-prey relationship is complex, but it appears that whale predation kept herring numbers in a decline until 2016 when the NPMHW occurred, and herring numbers could not sustain the number of feeding whales. We speculate that once ocean conditions improved for herring, the lack of this large predator made it possible for herring to rebuild.

We still have not found the missing whales. They may return but most have not been sighted on any breeding ground—an indicator they perished. We have not given up hope and will continue to monitor humpback whales in Prince William Sound and search for the missing whales elsewhere in the North Pacific.



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Figure 1. Annual herring biomass estimates (Trochta et al. 2022) and whale encounter rate represented as the number of whales sighted per nautical mile during surveys in Prince William Sound, 2006-2022.

References: Trochta, J.T., J.A. Zahner, and T. A. Branch et al. 2022. 2021 Bayesian Age-structure Stock Assessment (BASA) Results for Prince William Sound (PWS) herring. Annual Report to EVOSTC.

#### SALMON

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Copper River sockeye salmon scale seen at 50x magnification. Scale age is estimated visually by counting winter growth zones, or regions of the scale where the dark growth lines are narrow and tightly spaced, indicative of the slower growth rate of a fish in winter. Photo credit Rachel Ertz/ADF&G.

#### Age Doesn't Matter... Unless You're a Fish

**RACHEL ERTZ** Alaska Department of Fish and Game

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Alaska's salmon are getting smaller. Many Alaskans have observed these declines firsthand. For younger generations, knowledge of these declines exists in stories and in the comparisons of salmon caught today with those in old family photos. Family photos show relatives holding up the proverbial sea monsters of yesteryear; fish that by today's standards are the stuff of legends. Such observed declines in fish size can be a result of both declines in the average size of fish at an age, as well as changes to age at maturity as fish mature and spawn at younger ages. In some species, like Chinook salmon, scientists have documented a decline in both the size of Chinook salmon for their age, as well as a decline in their age at maturity, with more Chinook salmon spending fewer years feeding at sea before returning as adults to spawn. Documenting and tracking these trends in age at maturity and size at age are important tools for fisheries scientists to characterize population health and run sizes over time. Salmon are aged from seasonal patterns in growth that are visible on bony structures in the fish. Commonly, salmon are aged by counting annual growth zones on their scales, like counting the rings of a tree. The Alaska Department of Fish and Game (ADF&G) has been collecting, storing, and aging salmon scales since the 1960s. These scale age archives represent an impressive record of fish age information and span the entire management history of the department. Advancements in computer processing power coupled with high-speed imaging are allowing scientists to analyze these archives in novel ways. Scientists at the Prince William Sound Science Center and ADF&G are leveraging the existing scale archive in Cordova to investigate the application of neural networks, a form of artificial intelligence to age salmon scales.

# SALMON HATCHERY RESEARCH AND



Benjamin

**BENJAMIN AMERICUS** Alaska Fisheries Development Foundation bamericus@afdf.org

In 2013, I landed my first job out of high school as a field technician for the Prince William Sound Science Center (PWSSC). I joined a small crew aboard the *R/V Cathy G* in Prince William Sound for the first sampling season of the Alaska Hatchery Research Program (AHRP). I returned to this job for five summers. Each year we became more regimented in our pursuit of salmon carcasses. In eight seasons, field teams from PWSSC collected samples from over 250,000 pink salmon. The project is in its final years of analysis, and the Alaska Department of Fish and Game has published two papers using samples and data collected by PWSSC. In July 2022, I joined the Alaska Fisheries Development Foundation as an Alaska Sea Grant Fellow to summarize the AHRP for the Marine Stewardship Council (MSC) and Responsible Fisheries Management (RFM). MSC and RFM are third-party sustainability auditors; MSC is responsible for the blue checkmark on seafood packages. I summarized the results to date in a document available here: afdf.org/sustainability-certification/msc-alaska-salmon. Like all projects, the AHRP has raised more questions than it answered, and the Prince William Sound Science Center is in an ideal posi-

tion to tackle these questions.



#### SALMON

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# Designing the Next 50+ Years for the

ASHLEY TAYLOR Copper River Watershed Project ashley@copperriver.org

In 1972, a weir was installed at the outlet of Eyak Lake in Cordova, Alaska to reestablish the water surface to pre-1964 earthquake levels and keep nearshore sockeye spawning beds submerged. However, the weir is on its last legs, or more accurately, its last sheet piles. It's currently a barrier to the movement of fish up and downstream, especially smaller juvenile stages of species like coho and sockeye salmon, cutthroat trout, and Dolly Varden. It is also starting to bulge, gradually lowering lake levels as it "tips over." During the next two years, the Copper River Watershed Project (CRWP) will work with a diverse partnership to install a new outlet structure that improves fish passage.

Engineers and partners will have their work cut out for them. Not only is Eyak Lake a large salmon spawning lake, but it also provides key habitat for eight other fish species, is the City's secondary drinking water supply, and is a beloved recreational area. While the cultural and recreational aspects are invaluable, it is considered a multi-million-dollar lake when looking at the ex-vessel value of commercial harvest of sockeye and coho salmon returns to Eyak Lake.

It will take creativity and innovation to have one structure tick all the necessary boxes outlined for this project: improve fish passage; maintain water levels to protect important nearshore spawning; maintain property lines and drinking



Image of Eyak Lake weir at sunset during preliminary investigations. Photo credit DOWL.

water infrastructure; improve safety around the structure; continue current level of boat passage and fishing access; and expand fisheries monitoring.

CRWP has hired design engineers from DOWL to tackle this challenge and is drawing on the collective expertise of our 14 partners to come up with a solution. We've deployed remote monitoring devices, we're running advanced modeling scenarios, and we are confident that our team will help improve habitat quantity and connectivity to sustain Eyak Lake salmon into the future.

Funding by *Exxon Valdez* Oil Spill Trustee Council.



Project locator map shows the Eyak Lake weir at the outlet of Eyak Lake in Cordova, Alaska.

#### An Innovative Way to Identify and Count Passing Salmon

ROB CAMPBELL Prince William Sound Science Center



rcampbell@pwssc.org

The State of Alaska uses fish passage estimates to manage numerous fisheries throughout the state. An important management goal is a certain amount of "escapement" – fish that have left the ocean into spawning streams and have "escaped" the fishermen. For many fisheries, escapement is estimated by setting up a barricade in the stream (called a weir) and counting fish as they pass through.

Weirs require several technicians to run safely and effectively, and cost tens of thousands of dollars per year to run. Several weirs have been unfunded in recent years due to budget cuts by the State.

In 2021, we began developing an in-water camera system with an onboard computer that we are training to count and identify salmon as they pass, as a potential lower cost alternative to a full weir deployment. The camera was deployed in Eshamy Creek, Prince William Sound, to collect video of salmon passage in 2021 and 2022. We are now using the collected video to train computers to identify the salmon from the videos.

Preliminary results show that the computer is quite good at distinguishing between the sockeye salmon (which are large and tend to be shiny) and pink salmon (which are smaller and darker colored) that are most common in Eshamy Creek. Development of algorithms to count the salmon as they pass in and out of frame is ongoing.

A video frame from the deployment in Eshamy Creek with computer tracking and identification boxes superimposed. The type of fish is labeled in the box. The computer is remarkably successful at discriminating pink salmon from sockeye salmon.







#### **AOOS:** Your source for ocean data in Alaska

#### Page 12

#### YOUR SOURCE FOR OCEAN DATA IN ALASKA

The Alaska Ocean Observing System monitors Alaska's marine and coastal environments, shares information, and provides tools to better understand ecosystem changes, inform decision-making, and support the ocean economy.

#### SUSTAINING OCEAN OBSERVATIONS

#### **THE SEWARD LINE**

The Seward Line is a series of oceanographic monitoring stations that extend 150 miles from Resurrection Bay into the Gulf of Alaska. This area of the ocean is incredibly productive; the plankton at the base of the food web support many of Alaska's iconic fish, crabs, seabirds, and marine mammals.

Measurements along the Seward Line began in 1974 and represent the longest and most comprehensive monitoring program along the coastal Gulf of Alaska. These data have been fundamental to understanding the region's physical, chemical, and biological processes and how the ecosystem is responding to climate change.

#### GAK-1

The GAK-1 mooring is co-located with the first sampling station of the Seward Line. Scientists have been collecting ship-based measurements at GAK-1 since 1970 and year-round moored measurements since 1998. This time series supports fisheries research and management by providing a consistently collected time series that documents the magnitude of environmental changes in the coastal Gulf of Alaska.

In May 2022, researchers



The GAK-1 mooring is assembled on the deck of R/V Sikuliaq prior to deployment. Photo credit Seth Danielson.

recovered the GAK-1 mooring and replaced it with a fresh suite of instruments. The mooring logs temperature and salinity at six locations throughout the water column from the surface to the seafloor (800 feet deep), and measures carbon dioxide, chlorophyll, and light.





A glider prepared for deployment in the Gulf of Alaska. Photo credit Hank Statscewich.

#### **GLIDERS: PILOTING INNOVATIVE TECHNOLOGY**

AOOS and its partners at the University of Alaska Fairbanks recently expanded their operations of underwater gliders in support of an ecosystem-based approach to fisheries management. Gliders are underwater, unmanned vehicles that transmit data back to shore in near-real-time, saving the expense of conducting the work with large research vessels.

In spring of 2022, the glider named Gretel completed a 60-day mission in the Gulf of Alaska where it helped map ocean conditions and the winter distribution of Pacific salmon as part of the International Year of the Salmon project. It also measured the spring phytoplankton bloom that salmon and their prey feed on. In summer of 2022, the glider named Shackleton was deployed near Kodiak to track 35 acoustically tagged Tanner crabs. A follow-up crab survey is planned for 2023 in the Bering Sea.

### AOOS Alaska Ocean Observing System

#### **COORDINATING MONITORING EFFORTS**

AOOS brings scientists and ocean users together to better understand and mitigate how changes to Alaska's marine ecosystems impact coastal communities. Each of the following networks have websites with more information



#### ALASKA OCEAN ACIDIFICATION NETWORK

AOOS hosts the OA Network, which engages with researchers and stakeholders to expand the understanding of ocean acidification processes and consequences in Alaska, as well as potential adapta tion and mitigation strategies.



ALASKA HARMFUL ALGAL BLOOM NETWORK



ABOVE: Ivy Patton from the Native Village of Eyak takes a water sample to provide baseline data on ocean acidification. Photo credit Teal Hetrick. RIGHT: Alexandrium cells. Photo by Karie Holtermann.



AOOS coordinates the AHAB network, which provides a platform to address human and wildlife health risks from toxic algal blooms in Alaska through improved awareness, research, monitoring, and response. Most harmful algal blooms in Alaska are caused by Alexandrium, a phytoplankton that can produce paralytic shellfish toxins.





#### THE ALASKA WATER LEVEL WATCH

AOOS hosts the Alaska Water Level Watch, which strives to improve the quality, coverage, and accessibility to water level observations in Alaska's coastal zone. Accurate water level observations are a fundamental data requirement for flood forecasting, informed emergency response, ecosystem management, safe navigation, efficient mapping and charting, and scientific research in support of these activities. It is governed by a steering committee, and its members include state and federal agencies, local governing entities, non-profits, private businesses, and community members.

#### **AOOS:** Your source for ocean data in Alaska

#### PRINCE WILLIAM SOUND SCIENCE CENTER PWSSC.ORG



AOOS's Ocean Data Explorer is a public web portal that houses and visualizes the largest collection of ocean information in Alaska showcasing the biological, chemical, and physical characteristics of Alaska waters.

#### DATA PORTAL HIGHLIGHT: SEABIRD MORTALITY TRENDS

The data portal presents datasets generated through several biological monitoring programs. An established community monitoring program known as the Coastal Observation and Seabird Survey Team documents seabird mortality in Alaska. Researchers look at trends in seabird health as a valuable indicator of marine ecosystem health. Carcass per km COASST Beached Bird Manitoring Data



TOP: A map on the data portal shows where at least one seabird carcass was found (indicated by a yellow dot).

LEFT: When visualized as a histogram, data shows that common murres experienced a mortality event in this region in 2015 and 2016.

#### DATA PORTAL HIGHLIGHT: MARINER'S DASHBOARDS

me 🗉 Catalog 🛛 Map 🚺 - 🖈 Data vlevs 💵 - 🕲 Downloads 🚺 🔍 Settlings - 🔶 Share 🛛 Holp - 🚿

The data portal offers three dashboards of maritime conditions so that users can easily access real-time conditions for

Page 13

Parameters Stations and Marine Speecest 000 14

AOOS Mariner's Dashboard: Prince William Sound

#### Click on the Bit below to see istest data.

Air Jamp B Press Tobe Predictions Water Lavel Water Lavel Water Height and Onection Waters Height and Onection Waters Maximum Height Waters Seet Period

Wind Wind Oust



Prince William Sound, Cook Inlet, and Kodiak.

The data are from multiple sources, such as the National Weather Service and the Marine Exchange of Alaska, and includes tide predictions, temperature, barometric pressure, water levels, wind speed and gusts, and wave height and direction. AOOS plans to add dashboards for additional regions and improve the mobile experience.

A screenshot of the Mariner's Dashboard shows air temperature in Prince William Sound.

#### **BIRDS**

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#### **Plastics** Pollution and Migrating Shorebirds on the Copper **River Delta**

**MARY ANNE BISHOP & ANNE SCHAEFER** Prince William Sound Science Center mbishop@pwssc.org, aschaefer@pwssc.org

Plastic pollution is a worldwide problem and can negatively impact wildlife through ingestion or entanglement. Shorebirds have a high likelihood to be exposed to and ingest plastics because many migrate long distances and concentrate seasonally around shorelines, coastal areas, and estuaries that have elevated levels of plastics pollution.

From mid-April through May, the Copper River Delta along southcentral Alaska serves as one of the Western Hemisphere's most important shorebird stopover areas. Numbering in the millions, shorebirds who wintered anywhere from South America to southern Canada will stop to rest and forage on the delta before continuing to their breeding grounds in western Alaska.

Thanks to funding from the Hurtigruten Foundation, in spring 2023 the Prince William Sound Science Center will investigate if shorebirds stopping on the Copper River Delta have ingested microplastics. An easy, non-lethal way to determine if shorebirds have consumed plastics is to sample their fecal droppings. We will mistnet the shorebirds, briefly place them in a cardboard box to collect their droppings, then will measure, weigh, band, and release the birds to continue their migration. Our project is part of a larger, Pacific Coast sampling effort that includes sites in Mexico, Canada, and USA.



A least sandpiper is gently extracted from a mistnet by PWSSC researchers. Photo credit Anne Schaefer.



During summer 2023, researchers in southcentral Alaska will survey the coastline looking for breeding colonies of Aleutian terns, a rare and potentially declining seabird. Photo credit Nate Catterson/USFS.

#### Investigating the Suspected Decline of a



**ANNE SCHAEFER** Prince William Sound Science Center aschaefer@pwssc.org

SUSAN OEHLERS U.S. Forest Service, Tongass National Forest susan.oehlers@usda.gov

Aleutian terns are small seabirds that nest in dispersed colonies along the coastline in Alaska and eastern Russia. Alaskan populations at known breeding colonies have decreased dramatically in recent decades.

To further assess the population status of the species, a group of agencies, nongovernmental organizations, and university researchers has been developing a plan to estimate Aleutian tern abundance in Alaska. The surveys will use planes to cover the large swaths of potential nesting habitat along Alaska's coastlines. Aleutian terns frequently

nest with Arctic terns, and differentiating between the two species from a plane is difficult. As such, biologists will conduct ground-based surveys at potential colonies detected from the air.

**DELTA SOUND CONNECTIONS** 2023-'24

This summer (2023), the group plans to survey the eastern Gulf of Alaska coastline, extending from Prince William Sound to Glacier Bay National Park. The successful completion of a statewide survey will be an important first step for assessing the conservation status of this species.

We need your help! If you see an Aleutian tern colony, please submit your observations to susan.oehlers@usda.gov. Include location of colony (preferably GPS coordinates), estimated number of terns, whether Arctic terns are present, and a photo.

#### **Examining Interactions** between Marine Birds and Mariculture Development

#### ANNE SCHAEFER

Prince William Sound Science Center aschaefer@pwssc.org

As kelp and oyster farming (mariculture) expands along coastal Alaska, researchers at the Prince William Sound Science Center are working with the Mariculture Research and Restoration Consortium to understand if and how farm development and operation affect marine bird distribution and community composition. Mariculture farms tend to be in protected bays, which are also the preferred foraging habitat during winter for over 30 species of marine birds in this region.

Mariculture development could have positive, negative, or neutral impacts to marine bird populations.

Marine birds may be attracted to farms by the creation of novel habitat. For example, above-water farm infrastructure (e.g., buoys, platforms) can provide protected roosting habitat and act as elevated perches to search for prey below the surface. Additionally, the below-water infrastructure and farmed crops (kelp, oysters) may create novel habitats for forage fish and invertebrates on which marine birds prey. Conversely, mariculture operations could repel birds through disturbance.

Understanding how mariculture farms impact marine bird habitat use is needed for both the mariculture industry and state/federal managers to inform sustainable expansion of mariculture development along coastal Alaska, and to evaluate the restoration potential of mariculture.



kelp may create novel underwater habitat for forage fish that could attract birds. Photo credit Caitlin McKinstry.

#### PRINCE WILLIAM SOUND SCIENCE CENTER PWSSC.ORG

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PWS-based farmer Skye Steritz, Noble Ocean Farms, and Caitlin McKinstry, Native Village of Eyak, identifying kelp in Orca Inlet. *Photo credit Alysha Cypher*.

#### ALYSHA CYPHER Prince William Sound Science Center acypher@pwssc.org

Did you know that 26% of the permitted and pending Alaskan kelp farms are in Prince William Sound? We have the interest, but can we stay on top of this budding industry? The PWSSC is pitching in to keep Prince William Sound on the map for mariculture by providing workshops and starting a research and commercial kelp nursery.

On March 4, 2023, we held our first "Kelp the Sound" workshop where participants learned how to start and operate a kelp farm. The workshop featured 14 speakers including PWSand Kodiak-based farmers and stakeholders, including ADF&G and Cordova District Fishermen United. This workshop will be held annually in March and is free for residents of Prince William Sound.

The PWSSC kelp nursery will open this summer and address farmer-inspired questions about when and where to obtain seed stock. We can also provide farmers with commercial kelp for the season. Each season, kelp farmers obtain 50 adult plants with fertile tissue and send it to a nursery. To date, the most accessible nursery was Alutiiq Pride Marine Institute in Seward. While they are very adept at growing kelp, shipping costs are prohibitive for PWS farmers. By providing local capacity, we strive to keep PWS farmers at the forefront of this budding industry.

#### The CORaL Network

CRISTINA REO Prince William Sound Science Center Creo@pwssc.org

Established in 2022, the Community **Organized Restoration** and Learning (CORaL) Network aims to create and maintain a framework that builds the capacity of existing resources within the Exxon Valdez oil spill impacted region. The CORaL Network is comprised of the following partners: Alaska SeaLife Center, Alaska Sea Grant, Alutiiq Museum and Archaeological Repository, Center for Alaskan Coastal Studies, Chugach **Regional Resources** Commission, and **Prince William Sound** Science Center.

The CORaL Network will ensure that science outreach is relevant, co-created, and culturally responsive to our regional communities. Goals with the CORaL Network are to increase public knowledge related to the Exxon Valdez oil spill; increase participation of youth in community-based science; integrate the EVOSTC-funded long-term research and monitoring, mariculture, and restoration projects with community identified needs; and increase understanding of Alaska Native knowledge relations, cultural competency, and collaborative community.

#### Meet the Mar ReCon!

#### ANNE SCHAEFER, ALYSHA CYPHER

Prince William Sound Science Center aschaefer@pwssc.org, acypher@pwssc.org

The Mariculture Research and Restoration Consortium (Mar ReCon) is a new project funded by the *Exxon Valdez* Oil Spill Trustee Council that will support habitat restoration and economic development in Alaska, focusing on Prince William Sound, Kodiak Island, and Kachemak Bay. Researchers with AD-F&G, NOAA, Native Village of Eyak, PWSSC, Alaska Sea Grant, and University of Alaska Fairbanks are partnering with the Alaska Fisheries Development Foundation and nine farms across the regions.

Together, researchers and farmers will

monitor the impact of farms on ocean biogeochemistry and marine communities. This information will determine if farms affect the ecosystem and how to responsibly grow this budding industry.

Mar ReCon will also address immediate issues for the mariculture industry, including assessing environmental limits to kelp and oyster growth, performance of diploid (fertile) versus triploid (infertile) oysters, and kelp growth with varying grow line density. We will also evaluate the economic viability of producing oyster seed in Alaska. Finally, we will develop and test products to boost market demand for kelp and oysters farmed in Alaska. Importantly, we will work with the CORaL Network to disseminate all that we learn to farmers and interested stakeholders.



Mar ReCon will evaluate the impact of mariculture (seaweed and oysters) on the physical environment (water biogeochemistry and nutrients) and marine communities (plankton, benthic species, pelagic fish, marine birds, marine mammals). This project will also support farm production, evaluate economic feasibility of producing oyster seed in Alaska, and develop and test products.

#### COMMUNITY

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**DELTA SOUND CONNECTIONS** 2023-'24

# Innovative Programs Merge

CRISTINA REO Prince William Sound Science Center creo@pwssc.org

The Prince William Sound Science Center is proud to offer fun, new adult programming. We now offer nature yoga, biweekly on Sundays from 7-8pm. We dive into learning about the surrounding ecosystems and how we can reflect on nature's lessons to lead richer lives. We host a monthly trivia night, from 7-8pm. You don't have to be an expert to put your knowledge to the test about birds, plankton, fish, and more. We also created Science Charcuterie Game Night where folks come to the Science Center with their most creative charcuterie boards and compete against friends in science-themed games.

After a three-year hiatus, due to the pandemic, Tuesday Night Talks are back! These talks are a series of lectures organized for experts from the state of Alaska and the world to share their research and findings with the community of Cordova and beyond. They occur every Tuesday from 7-8pm and can be live-streamed using GoToMeeting or viewed afterwards on our YouTube channel.

LASTLY, WE HAVE THE NEW ASK A SCIENTIST COLUMN ON OUR WEBSITE. Do you have a question about why salmon jump or if jellyfish have regenerative capabilities? Email your questions to CREO@PWSSC.ORG to have it answered!



The "Sknow Birds," were the winning team at the first ever Science Charcuterie Game Night on March 16. *Photo credit Cristina Reo.* 



#### Rethinking



Big lettuce growing in the second-grade classroom at Mt. Eccles Elementary School in Cordova. *Photo credit PWSSC*.

# in the Classroom and Beyond

LAUREN BIEN

Prince William Sound Science Center Ibien@pwssc.org

When you live in a cold, wet place with sandy soil and little natural light, it is difficult to grow vegetables ... the traditional way, that is. So, the Prince William Sound Science Center (PWSSC) has turned to an innovative solution. Since 2019, the education team has been incorporating hydroponics into their classroom and community education programs. The local second graders host deep water culture systems in their classrooms and learn how plants in a hydroponic system photosynthesize with artificial light and get the nutrients they need to survive through liquid nutrients added to the circulating water. Students plant the seeds, monitor the pH of the water, and observe the growth of their lettuce to help them understand more about plants, nutrition, and where we get our food. It is a great way to demonstrate the life cycle of plants while presenting an innovative, local solution to a global issue. It's tasty, too! Second graders said the lettuce they grew was "the best thing they've ever eaten!"

The PWSSC atrium also hosts a hydroponic tower, where we are currently growing herbs and lettuce. The tower decreases the footprint of the system while maximizing vertical growing space. Though not small, it is a mini version of PWSSC's recently acquired hydroponics farm, formerly run locally as Kale N' Thyme. This farm, when operating, supplies our community with fresh greens and herbs – grown right here. We are excited to get this farm up and running, both as a teaching tool and as a producer of delicious, healthy foods.

#### COMMUNITY

#### PRINCE WILLIAM SOUND SCIENCE CENTER PWSSC.ORG



### lights, Camera, Glaciers:

#### Glacial Archaeology in the Chugach Mountains

#### **CHRISTY MOG & JAKE RAMSAY**

U.S. Forest Service, Chugach National Forest christy.mog@usda.gov, william.ramsay@usda.gov

At first glance, glaciers may appear as a barren wasteland, untouched by humans since the last ice age. However, recent discoveries tell a different story. In 2022, a roll of 16mm film was discovered on the surface of a glacier high in the Chugach Mountains. Sixteen-millimeter film was first produced in 1923 and quickly became the industry standard for filming motion pictures. The film sustained significant damage due to impacts from glacial movement and exposure to the extreme environment. The owner of the film and the story behind this 100-year-old production remains a mystery. Archaeological investigations may provide a detailed future narrative. Who were these early explorers or film crews? What struggles did the crews endure to reach such an environment and why did they choose to film on these glaciers?

The goal of U.S. Forest Service archaeologists is to understand the dynamic relationship between humans and the environment over past centuries. This discovery is an example of how Chugach National Forest archaeological research is investigating human and environmental systems in Southcentral Alaska. This research assesses the critical factors that affect cultural resource vulnerability and resilience to environmental change in the Chugach Mountains and Prince William Sound.



While the film artifact has been preserved in the cryosphere for 100 years, studying glacier mass balance records (change in the mass of a glacier over time) will help interpret the glacier's long-term behavior and the probability of discovering additional fragile cultural resources. The 16mm film is located at the bottom center of the photo. *Photo credit USFS.* 

#### Prince William Sound Natural History Symposium

#### PRINCE WILLIAM SOUND NATURAL HISTORY SYMPOSIUM

Tuesday, May 16, 2023 Whittier and Online CHARLA HUGHES Prince William Sound Stewardship Foundation

The Prince William Sound Stewardship Foundation is delighted to announce the fifth annual PWS Natural History Symposium. The Symposium will be held on Tuesday, May 16, 2023. We invite you to join us in Whittier or online for the latest in news and research from around PWS. Last year marked our first ever hybrid symposium, an innovative approach to our annual event that brought together our largest audience ever, and we are building on that momentum as we launch this year's event!

The theme for this year is "Resilience: Perseverance and Tenacity in Prince William Sound." The Symposium's schedule includes a mix of returning speakers offering updates on staple topics such as landslides, glaciers, and land management news; and first-time presenters focusing on cultural history, sea otters, and predator/prey ecology. We look forward to hearing from speakers from Chugach Alaska Corporation, Chugach Regional Resources Commission, Chugach National Forest, the Alaska SeaLife Center, U.S. Geological Survey, PWS Science Center, PWS Regional Citizens' Advisory Council, the Alaska Department of Environmental Conservation, and more.

This year, we're adding a half day of pre-symposium activities on Monday, May 15, including a tour to Blackstone Bay, designed as an immersive experience for guides and outdoor educators new to PWS or those looking to brush up on their knowledge in preparation for summer.

The fifth annual PWS Natural History Symposium is made possible through the generosity of the *Exxon Valdez* Oil Spill Trustee Council and the PWS Regional Citizens' Advisory Council, as well as the support of generous corporate and individual sponsors.

Register for the Symposium and discover more opportunities to get involved with the Prince William Sound Stewardship Foundation at princewilliamsound.org. If you can't join us on May 16, visit our website in June; videos of all sessions will be posted, adding to the recordings of the three previous years as a free online community resource.

Photo: Paul Twardock

### **KIDS' CORNER**

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#### **RECYCLED NOTEBOOK:**

Cut scrap paper in half, then fold each piece in half again (used side facing inwards.) Stack the folded paper, which should measure 4.25" x 5.5" Cut a plastic cover approximately 8 5/8" x 5 1/2". Fold in half. Insert stack of paper, folded edges facing away from the center of the cover. Secure with clips. Stitch or sew along the spine to hold it all together.



**DELTA SOUND CONNECTIONS** 2023-'24

Hole punches, yarn, and a button keep this pouch secure for your belongings. Get creative with the stitching patterns!



#### LAMINATED BOOKMARK:

With clear plastic, you can laminate your favorite pictures and turn them into bookmarks. No stitching required. Tip: laminate the front and back pieces separately before sandwiching the paper in between. Be sure to press the edges together around the outside of the paper to create a good seal. Trim with about 1/8" edge.

#### YOUR CREATIONS CAN BE USED TO EXPLORE OUTSIDE.

### INNOVATIVE IDEAS FOR REUSING PLASTIC

Refusing a plastic bag at the store is a good first step to reduce your plastic intake. Despite our best efforts, we may still end up with some single-use plastic bags in our homes. Bags are often made from #2 and #4 plastics. With a bit of creativity (and help from an adult), these single-use plastic bags can have a second life and stay out of the landfill.

Fusing sheets of plastic together with a warm iron creates a durable "fabric" that can be used in many different applications. See below for instructions and ideas.

#### **SUPPLIES**

- #2 (HDPE) and #4 (LDPE) plastic bags (excluding thin bags, such as produce bags, and bags made with compostable materials)
- Iron and ironing board
- Parchment paper • Scissors, ruler, cutting board

#### OPTIONAL

- Duct tape
- Hole punch
- Yarn, embroidery floss

- DIRECTIONS
- This activity requires adult supervision Cut larger bags into single layer
- rectangular sheets; trim off handles Colorful bags and bags with designs can be cut into smaller bits for decorative purposes
- Heat iron to medium, no steam
  - Layer 4-7 large plastic sheets, depending on the thickness of the plastic and your preference for the thickness of the final product.
  - Sandwich these layers between two sheets of parchment paper on the





**BOOKSI FEVE** 

• For a smaller

version,

search

online for

booklet, measuring 2

<sup>3</sup>/<sub>4</sub>" × 4 <sup>1</sup>/<sub>4</sub>".

POUCH:

- · Needle and thimble
- Sewing machine
- Scrap paper (8.5x11, blank on one side)
- Binder clips
- Buttons



ironing board. Make sure the paper extends beyond all edges of the plastic.

- Keep the iron moving at all times over the surface of the parchment paper. Depending on the size and number of layers, it may take up to one minute to fuse. Flip everything over and repeat on the back side.
- Lay a cutting board or large book on top while the plastic cools slightly. This ensures it won't curl around the edges.
- Check the layers. If there are air bubbles or sections that aren't fused, repeat steps 6 and 7.
- Once fused and cool, cut your new fabric into desired sizes and shapes; sew, tape, make your creation! Some ideas are listed below.



Protect your book or tablet when you're on the go. This sample was stitched together using a sewing machine.



#### **EYEGLASSES CASE:**

Duct taped edges are fast and easy. Overlay colorful bits of plastic for a fun design.

A notebook is perfect for nature journaling.

#### **PWSSC HAS LOTS OF RESOURCES HERE:**

pwssc.org/education/nature-journaling

#### WHAT ELSE CAN YOU CREATE?

We'd love to see your ideas. Email photos to SBAUMANN@PWSSC.ORG so we can share on our social media channels and newsletter.

### **KIDS' CORNER**

#### PRINCE WILLIAM SOUND SCIENCE CENTER PWSSC.ORG



One easy way to refuse a plastic bag at the store is to be sure you have a reusable bag with you. Not only does this save on plastic, but you can make your own bag using items you already have at home!



#### **SUPPLIES**

- Old t-shirts
- Scissors

#### **OPTIONAL**

- Needle + thread
- Sewing machine
- Fusible bonding web, iron, and ironing board

#### **HOW TO**

· Cut off the sleeves and collar of the t-shirt

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#### FOR THE FRINGE METHOD:

- Cut the bottom hem of the t-shirt in 3⁄4" intervals, about 3" long.
- Knot the fringe together: a front piece of fringe to a back piece of fringe.
- Turn the t-shirt inside out. • Sew the bottom edges together with a 1/2" hem • Fusible bonding web is

G

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for the no-sew/no-fringe method folks. Found at craft and fabric stores, following directions on the package to fuse the bottom hem.



#### FOR SEWING BY HAND OR WITH A SEWING MACHINE:









TNLAWWRZWJIKELP EQNUULCXSAULCF ()V V R Y O B B U C O O I L U Ν HALEKEHICNVV Ρ ΖW SKRGBBLZ Ε F R L ΙK Q YLSMJYSRHVJA L ΥE РЈСΖ ENKNTMHWSO 0 S ENCEDECB Ι Τ С Ι Q 0 YHGLAC IERCRML M D ERRYESRDTWDMF ΕF

below, inspired by the content of this publication.

1. Ferry

2. Glacier

3. Herring

4. Innovation

5. Kelp

6. Plankton

7. Salmon

8 Science

9. Shorebird

10. Weir

11. Whale



A crowd gathers at the Prince William Sound Science Center's ribbon-cutting ceremony, June 4, 2022. Photo credit: Hamish Laird.

#### The Prince William Sound Science Center has successfully launched its next

# ERA OF IMPACT

Our new 5-acre waterfront campus (with advanced laboratories, a forthcoming running seawater system, and plans for a science residence and dormitory) is a once-in-a-generation opportunity that is relevant to all of Alaska and beyond. The 20,000 sq. ft. facility will make the Science Center and Alaska more competitive for national-level research funding, support high-wage jobs, generate new STE(A)M education opportunities, and advance industries such as mariculture, aquaculture, and commercial fishing.

This is a time of great change in the world that is driving unpredictable outcomes for the things that matter to all of us. With our new facilities, we can grow capacity, programs, and partnerships that will help ensure our region is a stronghold of resilience for the decades to come. We're taking the long view, because we're deeply invested in this place—it's one of the last, best places on earth. Let's keep it that way. Let's make it better. We are so grateful to have you all with us.

# DONATE NOW

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