



Inclusive Understanding of Novel Changes in North Pacific Social-Ecological-Environmental Systems



leonetwork.org

Thomas A. Okey^{1,2}, Michael Y. Brubaker^{3,4} and Michael J. Brook^{3,4}

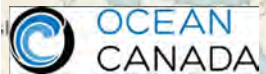
¹University of Victoria, British Columbia, Canada. E-mail: Thomas.Okey@gmail.com

²Ocean Integrity Research, Victoria, British Columbia, Canada

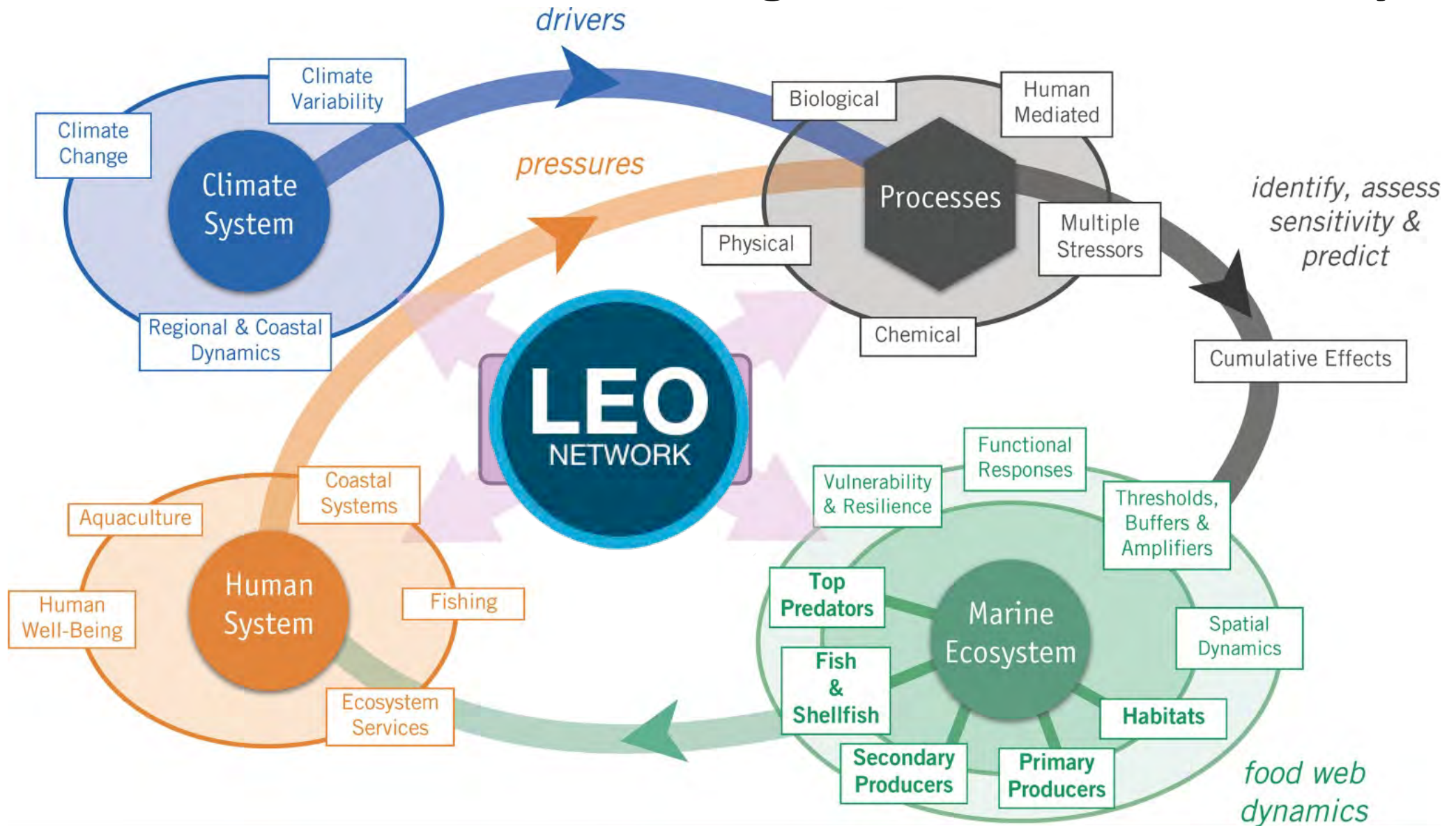
³Alaska Pacific University, Anchorage, AK, USA

⁴Alaska Native Tribal Health Consortium, Anchorage, AK, USA

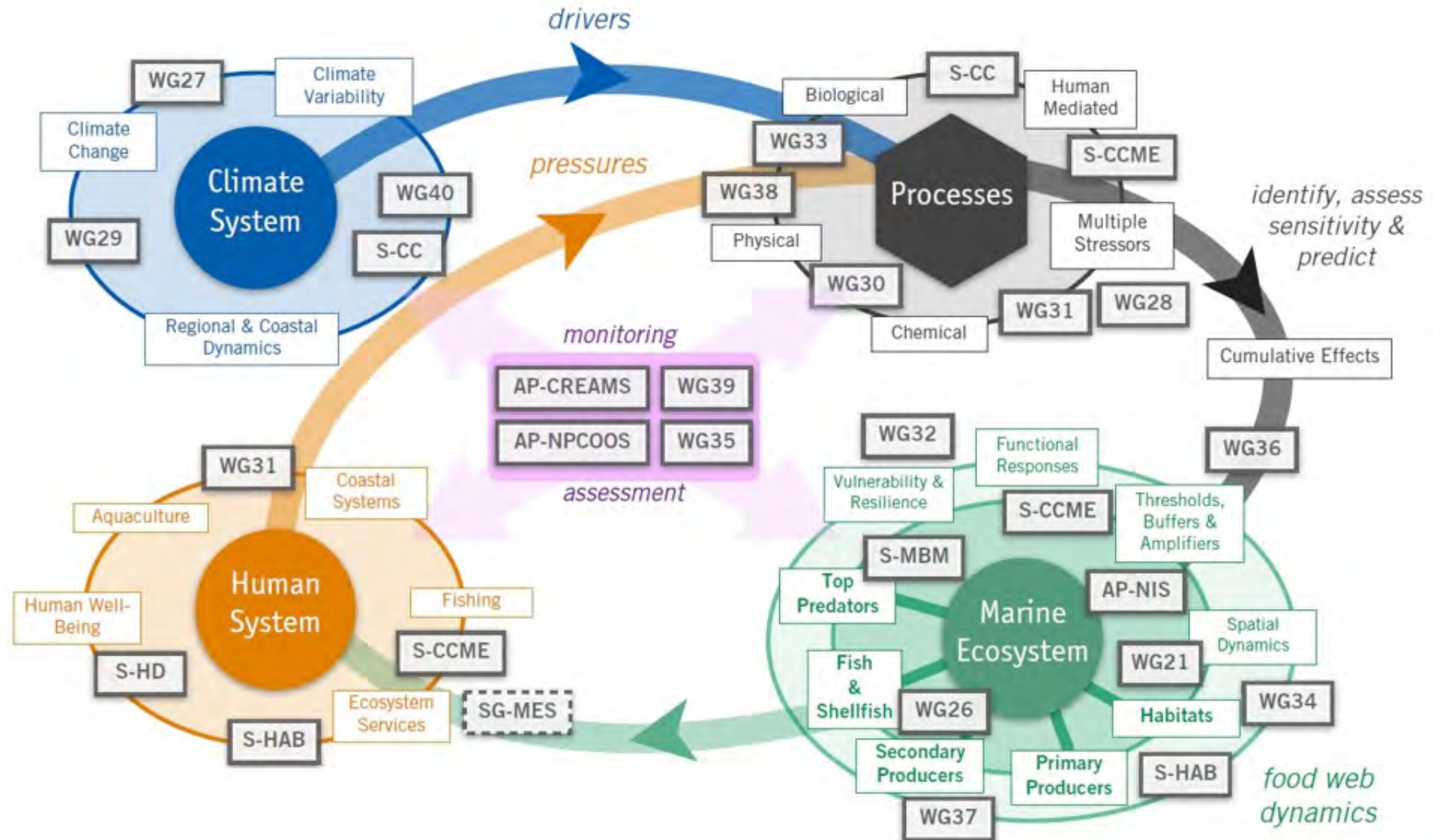
PICES Annual Meeting 2019, Victoria, BC, Canada, 15-26 October 2019



The North Pacific Social–Ecological–Environmental System



LEO and the Elements of the FUTURE Science Program



A Network of People

- Over 3,300 members
- Over 1,000 affiliations
- LEO is like a talking circle



The screenshot shows the LEO Network MEMBERS page. At the top, there is a search bar with the text "enter a person's name, community, or organization" and buttons for "Search" and "Show all". Below the search bar are icons for "List", "Map", and "Stats". The page displays a list of members, each with a profile picture, name, and affiliation. The members listed are:

- Stephanie Poole**: Lutsel K'e, NT Canada; Lutsel K'e / Kache Dene First Nation
- Derek Sikes**: Fairbanks Alaska United States; Curator of Insects University of Alaska Museum - Entomology UAF, University of Alaska Fairbanks
- Richard L Thoman Jr**: Fairbanks Alaska United States; Alaska Region Climate Science and Services Manager National Weather Service (NWS) Forecast Office : Anchorage, AK
- Mike Brubaker**: Anchorage Alaska United States; Department Director Community Environment & Health ANTHC
- Kendra Lee**: Teller Alaska United States; IGAP Coordinator Native Village of Teller
- John Henry**: Unalakleet Alaska United States; IGAP Coordinator Environment Dept Native Village of Unalakleet
- Lindsey Markoff**: Togiak Alaska United States

On the right side of the page, there are two filter sections:

- Basis of Knowledge**: Local Knowledge (1841), Scientific Knowledge (1584), Indigenous Knowledge (707)
- Community**: Anchorage, Alaska, United States (361), Fairbanks, Alaska, United States (97), Victoria, British Columbia, Canada (69), Juneau, Alaska, United States (43), Vancouver, British Columbia, Canada (38), Ensenada, Baja California, Mexico (34), Seattle, Washington, United States (34), Homer, Alaska, United States (31), Bellingham, Washington, United States (24), Nome, Alaska, United States (24). Showing top 10.
- Primary Organization**: Royal Roads University (75), ANTHC (68), UAF, University of Alaska Fairbanks (51), Grupo de Ecología y Conservación de (39), First Nations Health Authority (FNHA) (35), Environmental Protection Agency - EF (28), University of Alaska, Anchorage (28), Alaska Department of Fish and Game (28), Northwest Indian College (NWIC) (26), Government of Northwest Territories (19).

Growing Global Distribution of Communities



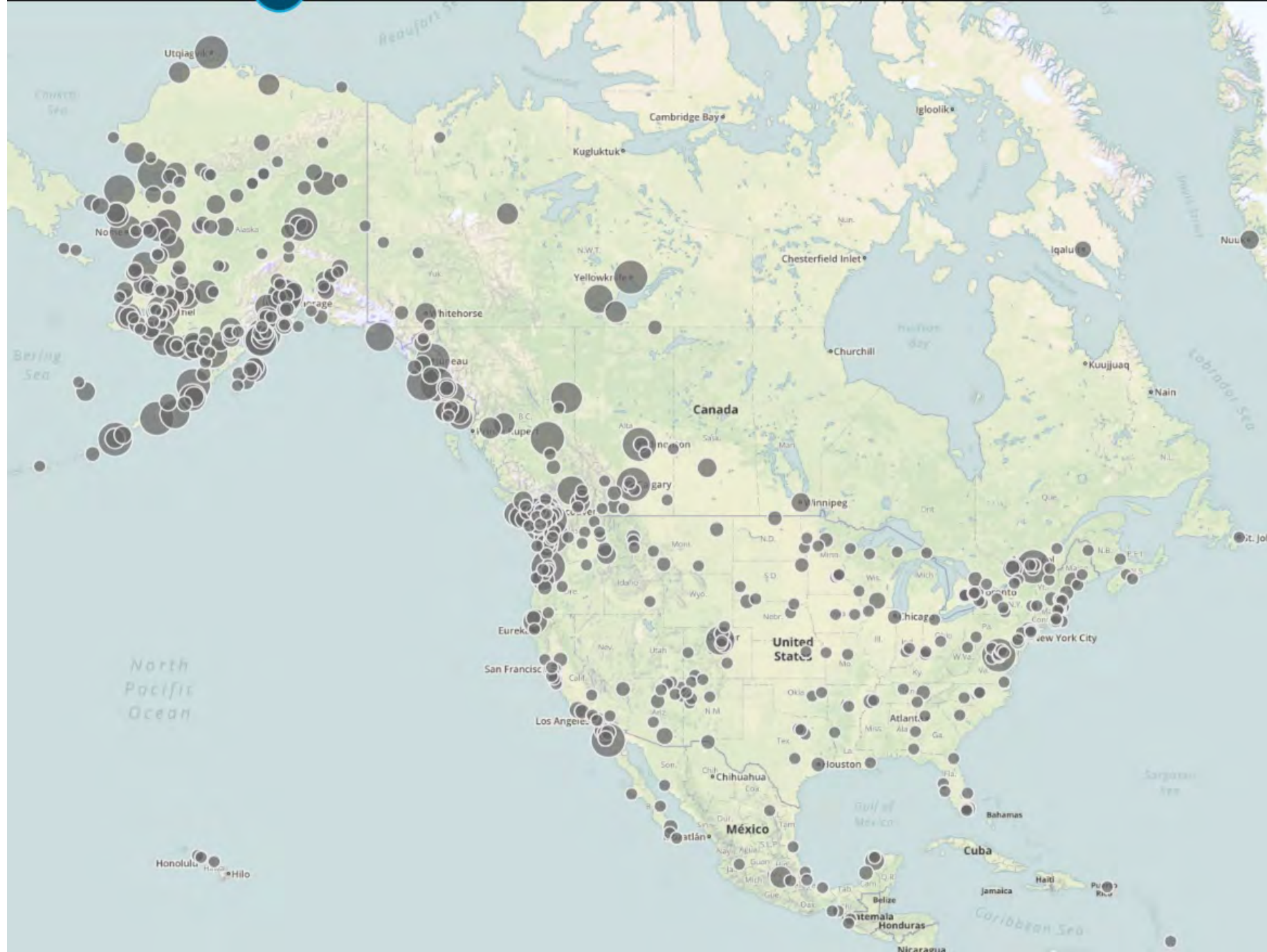
Nearly
800
communities





Communities

- Surveillance across whole landscapes
- Along coastlines





LEO Local Environmental Observer Network

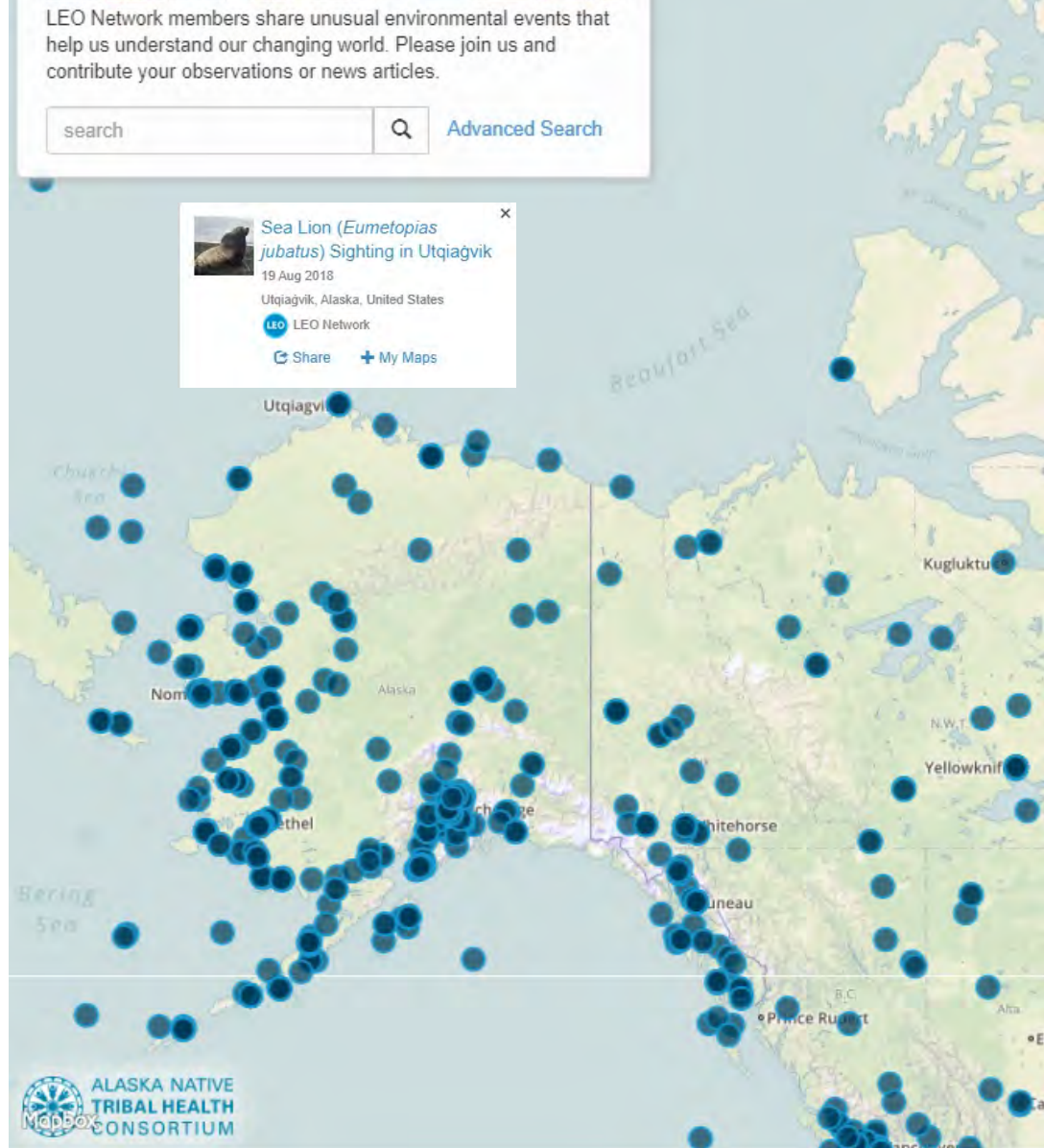


LEO Network members share unusual environmental events that help us understand our changing world. Please join us and contribute your observations or news articles.

search [Advanced Search](#)



Sea Lion (*Eumetopias jubatus*) Sighting in Utqiagvik
 19 Aug 2018
 Utqiagvik, Alaska, United States
 LEO Network
[Share](#) [+ My Maps](#)



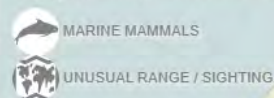
Accessible Stories of Change



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AUGUST 19, 2018
Sea Lion (*Eumetopias jubatus*) Sighting in Utqiagvik

Utqiagvik, Alaska, United States **Utqiagvik**



Unusual Stellar sea lion (Eumetopias jubatus) sighting in Utqiagvik.

Observation by **Jonas M. Ahsoak Sr.** by **Jimmy Evak**:

I did not sight this but I saw a Facebook post with photographs of a sea lion near Utqiagvik (Barrow), Alaska sighted by Jonas M. Ahsoak Sr., of Utqiagvik (Barrow) August 19, 2018 by Wiley Post/Will Rodgers Memorial site. This is unusual because sea lion sightings so far north are rare, much less seeing one on the beach. *With permission from Jonas M. Ahsoak*

Comments from LEO Editors:

This observation has been forwarded to the North Slope Borough Wildlife Department

The [Alaska Department of Fish and Game](#) documents the southern Chukchi Sea/Northern Bering Sea as the northernmost part of the Stellar Sea Lion (*Eumetopias jubatus*) species range. However, as conditions in the Arctic continue to change, normal species distributions may also change. A recent article published in the [Nome Nugget](#) describes changes in water temperatures that is affecting some species distributions. In a recent trawl survey conducted by NOAA Fisheries scientists found that the thermal barrier separating northern and

Contributing Members



Jimmy Evak Observer
 Kotzebue Alaska, United States
[Send Message](#)

See Also



First Elephant Seal Born at Race Rocks
 Race Rocks Ecological Reserve- Marine mammals, seabirds
 Race Rocks Ecological Reserve, British Columbia, Canada
 JAN 31, 2009 [+ My Maps](#)

[W Barrow, Alaska](#)

[W Steller sea lion](#)

Latitude 71.1553996365256
 Longitude -157.056427001953

[Nearby](#)

Evak, Jimmy. 2018. Sea Lion (*Eumetopias jubatus*) Sighting in Utqiagvik . *LEO Network* (leonetwork.org). Accessed 15 October 2019.

A Stellar Sea Lion (*Eumetopias jubatus*) in a new region



sighting and photo by Jonas M Ahsoak, Sr. of sea lion near Utqiagvik (Barrow), August 19, 2018

Photo courtesy of Jonas M Ahsoak, Sr. via Jimmy Evak



Stellar Sea Lion Range

Alaska Department of Fish and Game

Each post is indexed – consistent with SEES components

Natural Environment



Weather



Seasons



Ocean / Sea



Surface Waters



Groundwater



Ice and Snow



Land



Air



Plants / Kelp



Fish



Marine Mammals



Land Mammals



Birds



Invertebrates



Insects



Arachnids



Reptiles



Amphibians



Fungi



Microbes

Unusual or Unexpected Event



Extreme Temperature



Extreme Precipitation



Extreme Wind



Death / Die-off / Decline



Deformity / Disease



Unusual Range / Sighting



Unusual Abundance



Infestation



Seasonal Timing



Unusual Animal Behavior



Flood



Wildfires



Erosion



Landslide / Avalanche



Drought



Algal Bloom



Cyclone / Hurricane



Thunderstorm



Storm Surge



Earthquake



Volcano



Sea/Land Level Change



Permafrost Change



Pathogen

Impact on Human Environment



Health



Infrastructure



Transportation



Energy



Sanitation



Economic Impact



Cultural Impact



Recreation



Food Security



Water Security



Air Quality



Pollution



Harvest Failure



Agriculture



Aquaculture



Livestock



Pets



Displacement



Forestry



Burial Site



Fisheries

AUGUST 27, 2015

Pink Salmon (*Oncorhynchus gorbuscha*) Die-off Jakolof Creek

Tutka Bay Lagoon, Alaska, United States

FISH HEALTH

500 km 300 mi Mapbox

Observation: About 8 air miles to the east northeast of Seldovia, up the head of Jakolof Bay is the mouth of Jakolof/Kingfisher Creek. With low and no water flow going down the streams because of no snow pack and no amounts of rain, the stream system is drying out. 2000 or more salmon and dolly varden have died in the struggle to get up stream and spawn. These salmon have become an even more important resource with no coho salmon being stocked in Seldovia Lake, located to the southeast, about 7.5 air miles. With an aging population that can more easily access this site and its resources, people rely on this creek to help fill the drying racks, jars, freezers, or smokehouses. Mike Opheim, LEO - Seldovia Native Tribe

Alaska Department of Fish & Game Consult: "We have had a record return of pink salmon (*Oncorhynchus gorbuscha*) in lower Cook Inlet in 2015. Most of our major streams either are in the upper end of their escapement goals or are higher. Many of the smaller systems also have significantly more fish than they normally do. This combined with low snowfall last winter, and modest amounts of rain this summer have made it difficult (or impossible) for some of the smaller returns to reach spawning areas that might be accessible in years of adequate rainfall or greater snow pack. During years of low water flow, pink salmon have the ability to spawn in gravel in the inter-tidal areas. Additionally, wild pink salmon are known to stray to neighboring streams. This may allow fish to return to Jakolof Creek from other returns and repopulate it if this year's return does not put any eggs into Jakolof Creek itself. Lastly, pink salmon within a diverse population have different run timings. Some fish will migrate into the streams earlier in the season to spawn, and others will migrate later. When streams dry up as the result of

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Contributing Members

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Anchorage Alaska, United States
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Service High School

Stephen Payton Observer
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Fisheries Technician
Seldovia Village Tribe

Kris Holdreid Consultant
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Glenn Hollowell Consultant
Homer Alaska, United States
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Alaska Department of Fish and Game
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Michael Opheim Consultant
Seldovia Alaska, United States
Environmental Coordinator
Seldovia Village Tribe
[Send Message](#)

See Also

Late Run of Abundant Pink Salmon (*Oncorhynchus gorbuscha*)
Nanwalek, Alaska, United States
SEP 19, 2017

+ My Maps

Parasites on Pink Salmon (*Oncorhynchus gorbuscha*)
Whipple Creek, Alaska, United States
SEP 3, 2017

+ My Maps



Salmon Die-Offs
AUG 27, 2015
5 Observations

Changing Salmon (*Oncorhynchus*) runs in the Northeast Pacific
Northeast Pacific and Bering Sea
APR 4, 2017
31 Observations

The Blob - A Marine Heat Wave in Alaska, 2013-2016
OCT 1, 2013
131 Observations



View southeast - creek bed (Photo by Stephen Payton)

Videos

Photos

MAY 14, 2019

Shiner surfperch (*Cymatogaster aggregata*) in Southcentral Alaska


Tatitlek, Alaska, United States

FISH

UNUSUAL RANGE / SIGHTING

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Contributing Members



Ricky Kompkoff Observer
Tatitlek Alaska, United States
IGAP Coordinator
Native Village of Tatitlek
✉ Send Message



Tom Okey Consultant
Victoria British Columbia, Canada
Principal
Ocean Integrity Research
✉ Send Message

See Also



Brown Booby (*Sula leucogaster*) North of Usual Range
Sitka, Alaska, United States
NOV 3, 2018 + My Maps



Ocean Sunfish (*Mola mola*) off Masset, Haida Gwaii
near Masset, Haida Gwaii
AUG 1, 2017 + My Maps



Blue Sail (*Veleva*) Jellyfish
Seldovia, Alaska, United States
OCT 9, 2015 + My Maps



Leatherback (*Dermochelys coriacea*) Sighted
Southeast Region, Alaska, United States
AUG 24, 2015 + My Maps



A new arrival!
Ricky Kompkoff

This catch in a Tatitlek herring net places a school of shiner surfperch about 700 km north of their normal range.

Observation by **Ricky Komkoff**:

This fish was caught in a school of herring and there seems to be quite a few of them. We have never seen this fish around our community waters before.

Tom Okey, with Ocean Integrity Research, writes:

That, my friend, is a shiner surfperch (*Cymatogaster aggregata*). This observation is way north of the species' estimated native range, which doesn't extend north of Glacier Bay. This means that this nearshore demersal fish, which I used to commonly see while diving in Monterey Bay, is about 700 km up the outer Alaskan coast from the northernmost extent of its native range (measured with Google Earth). The [Aquamaps](#) projected year 2100 native range places them as far north as Prince William Sound – but this ain't 2100, so that fish is there a few decades early. That's the thing about science. though: we need real data to 'round truth'



Native Range of Shiner Perch
<https://www.fishbase.se/summary/3626>



Juveniles and sub adults live and migrate in open water at shallow to moderate depths. They move to the bottom as adults when they settle around sea mounts in the North Pacific.

Observation by **Edgar Smith**:

This fish was caught in a purse seine at Jack Point near Chignik Alaska. The markings appear to be tropical.

Andrés López, Curator of Fish with the University of Alaska Museum, writes:

I am thinking it is a slender armorhead (*Pentaceros wheeleri*) subadult. See Figure 1B in the attached article. It makes sense based on location of the observation and the color pattern. P.S. Any chance the fish is still in somebody's freezer? 9-18-19

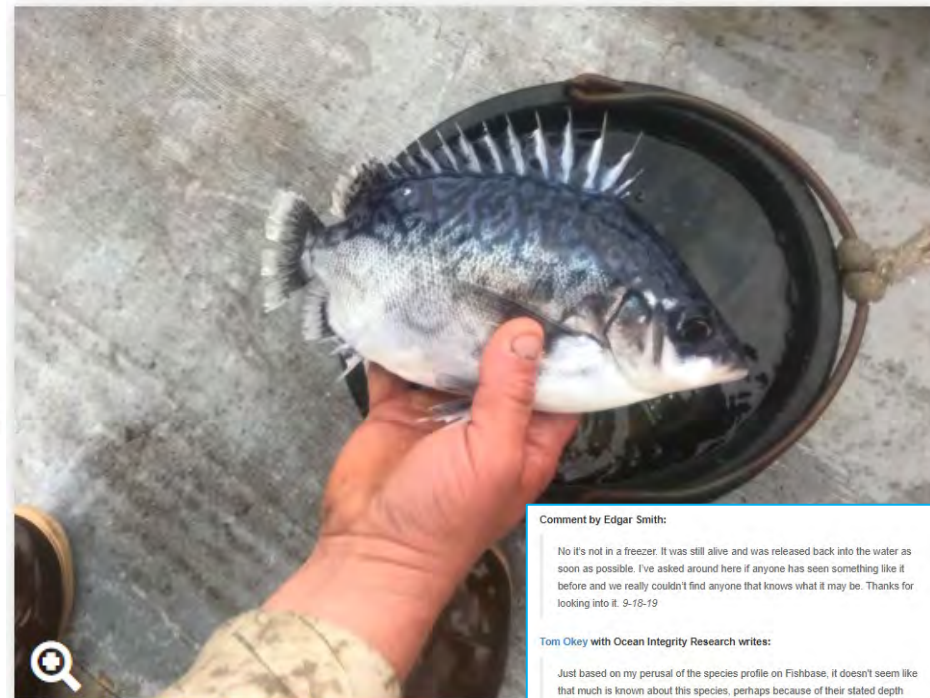
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Contributing Members

Edgar Smith Observer
Chignik Lagoon Alaska, United States
✉ Send Message

Andrés López Consultant
Fairbanks Alaska, United States
Curator of Fishes **Ichthyology and Fisheries UAF, University of Alaska Fairbanks**
✉ Send Message

Tom Okey Consultant
Victoria British Columbia, Canada
Principal
Ocean Integrity Research
✉ Send Message



A fish unknown to Chignik Lake
Edgar Smith

Comment by Edgar Smith:

No it's not in a freezer. It was still alive and was released back into the water as soon as possible. I've asked around here if anyone has seen something like it before and we really couldn't find anyone that knows what it may be. Thanks for looking into it. 9-18-19

Tom Okey with Ocean Integrity Research writes:

Just based on my perusal of the species profile on Fishbase, it doesn't seem like that much is known about this species, perhaps because of their stated depth range (146-800 m)(Fadeev 2005), which is a heck of a lot deeper than a purse-seine net. However, Andres indicated it is a sub-adult, and so more epipelagic (the photosynthetic zone). Still, it would be good to get more info on how unusual this species is for different fishing gear types to encounter. One way to check would be for a post on the Facebook group 'Unusual Marine Life of Alaska'. Another would be for a NMFS insider to query the fishery observer database, which might well contain some pretty interesting information about this species. 9-18-19

Fadeev, N.S., 2005. Guide to biology and fisheries of fishes of the North Pacific Ocean. Vladivostok, TINRO-Center. 366 p.

Andrés López writes:

According to the article attached, the juveniles and subadults live and migrate in open water at shallow to moderate depths. They only move to the bottom as adults when they settle around sea mounts in the North Pacific. Below is the full citation for that article. It includes quite a bit of what is known about the biology of the species. This observation was a great motivator to learn about a fish I knew nothing about prior! 9-19-19

Kiyota, Masashi, Kazuya Nishida, Chisato Murakami, and Shiroh Yonezaki. 2016. "History, Biology, and Conservation of Pacific Endemics 2. The North Pacific Armorhead, *Pentaceros wheeleri* (Hardy, 1983) (Perciformes, Pentacerotidae)." *Pacific Science* 70 (1): 1–20.

Comment from LEO Editors:

This is the first report on a Slender Armorhead received in LEO Network. An unusual fish for Chignik Lake for sure but within its general range, which according to FishBase is "Gulf of Alaska to North Pacific Ocean off central California and south of Japan, with center of abundance at the seamounts of the southern Emperor-northern Hawaiian Ridge." See a species profile here at FishBase. *Mike Brubaker*

See Also

W [Pentaceros](#)

Smith, Edgar, Andrés López and T.A. Okey. 2019. Slender armorhead (*Pentaceros wheeleri*) caught in purse seine. *LEO Network* (leonetwork.org). Accessed 15 October 2019.

Documents

[70.1.1.pdf](#)

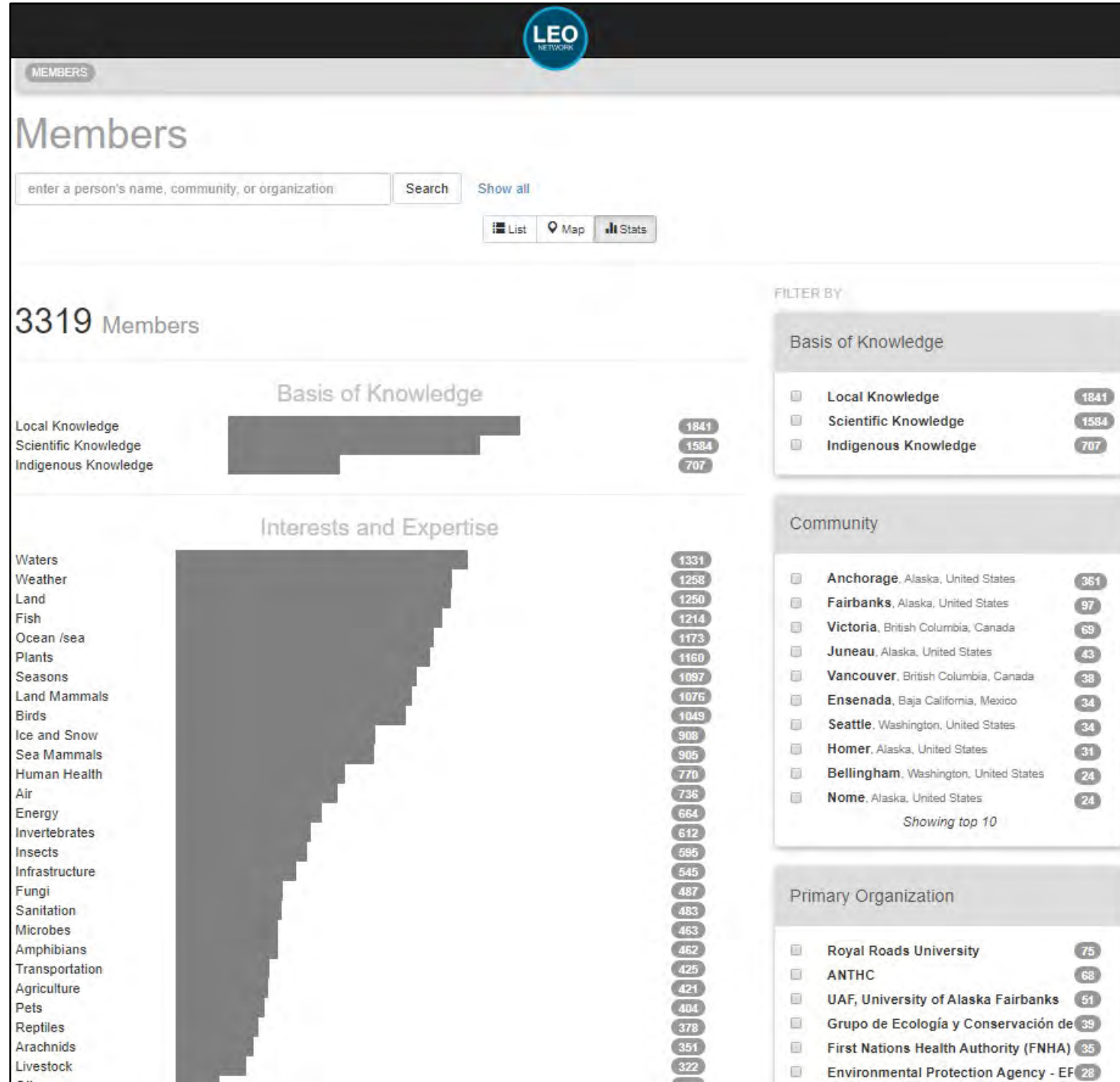
Dimensions of Knowledge

- Three Knowledge Dimensions
- Distribution of Interests and Expertise

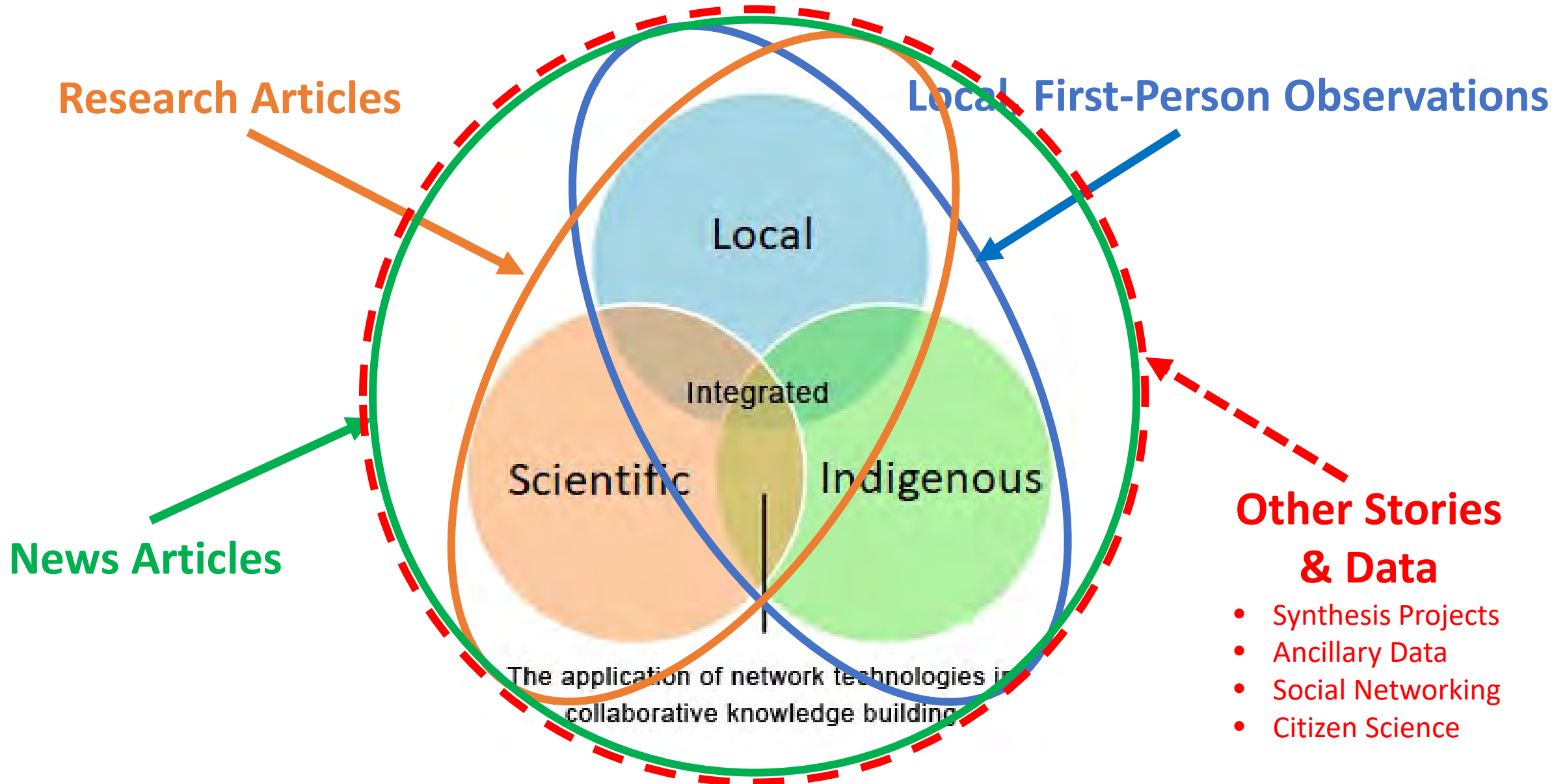


The application of network technologies in collaborative knowledge building

Figure modified from Calvani et al 2008 Models and Instruments for Assessing Digital Competence at School, *Journal of e-Learning and Knowledge Society* - Vol. 4, n. 3, September 2008 (pp. 183 - 193)



LEO Data Layers by Knowledge Dimensions



Observations that Matter Locally

- First Person Observations of Unusual Changes in Ecosystems
- A Distribution of Topics

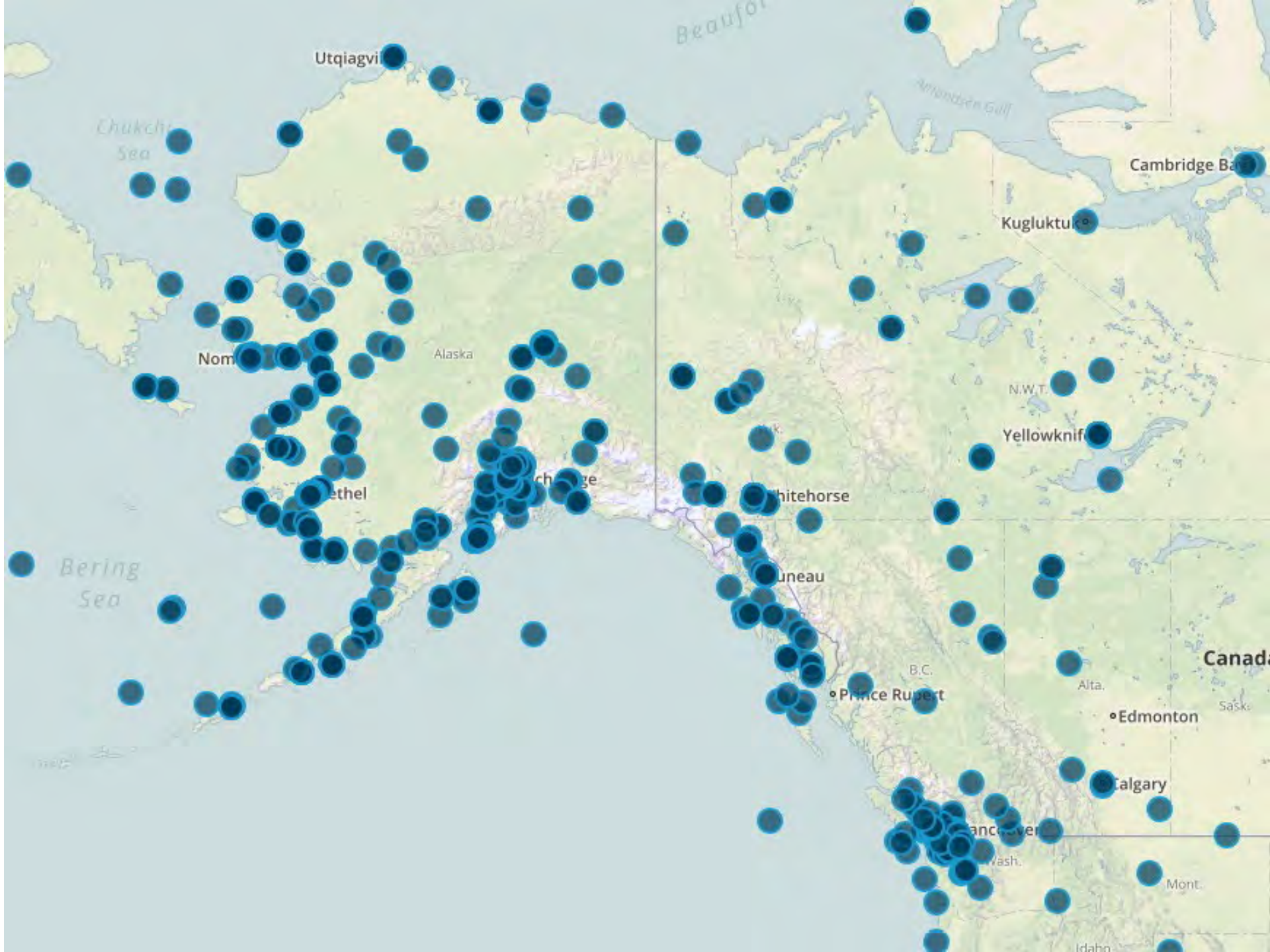
Identifying health effects of climate change in Alaska





**Observations
Distributed
Along
Coastlines**

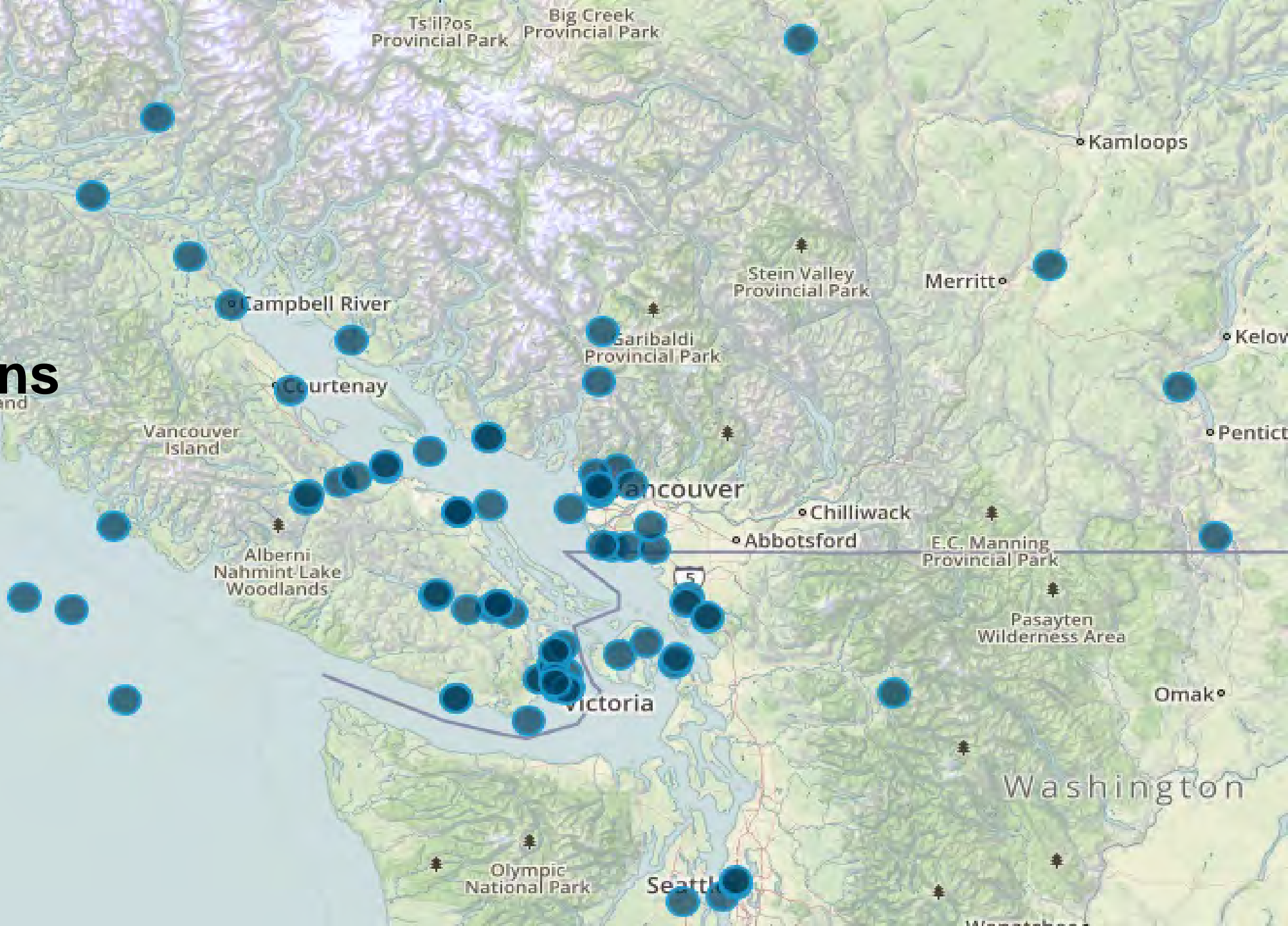
(Recent observations shown)



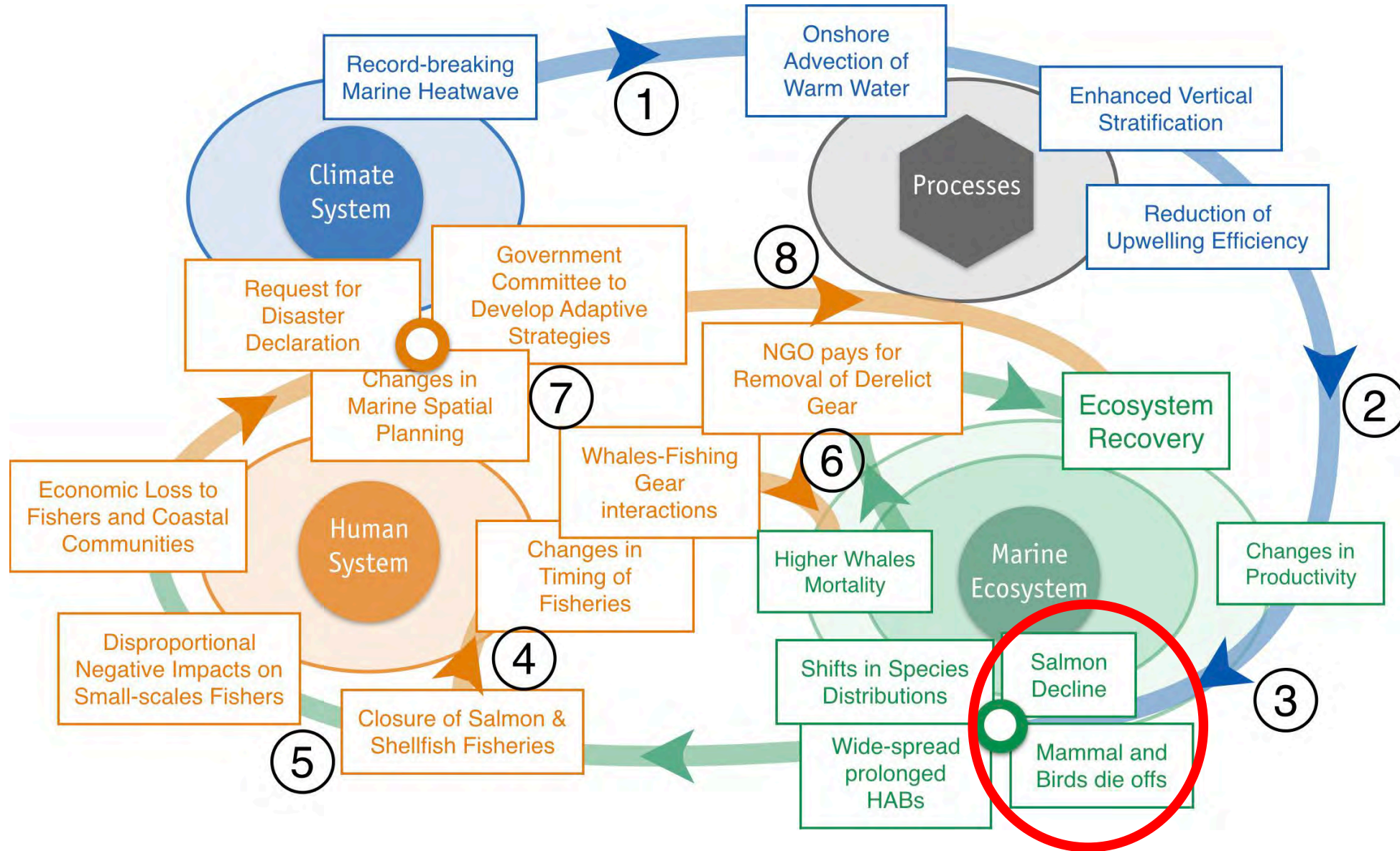


**Observations
Distributed
Along
Coastlines**

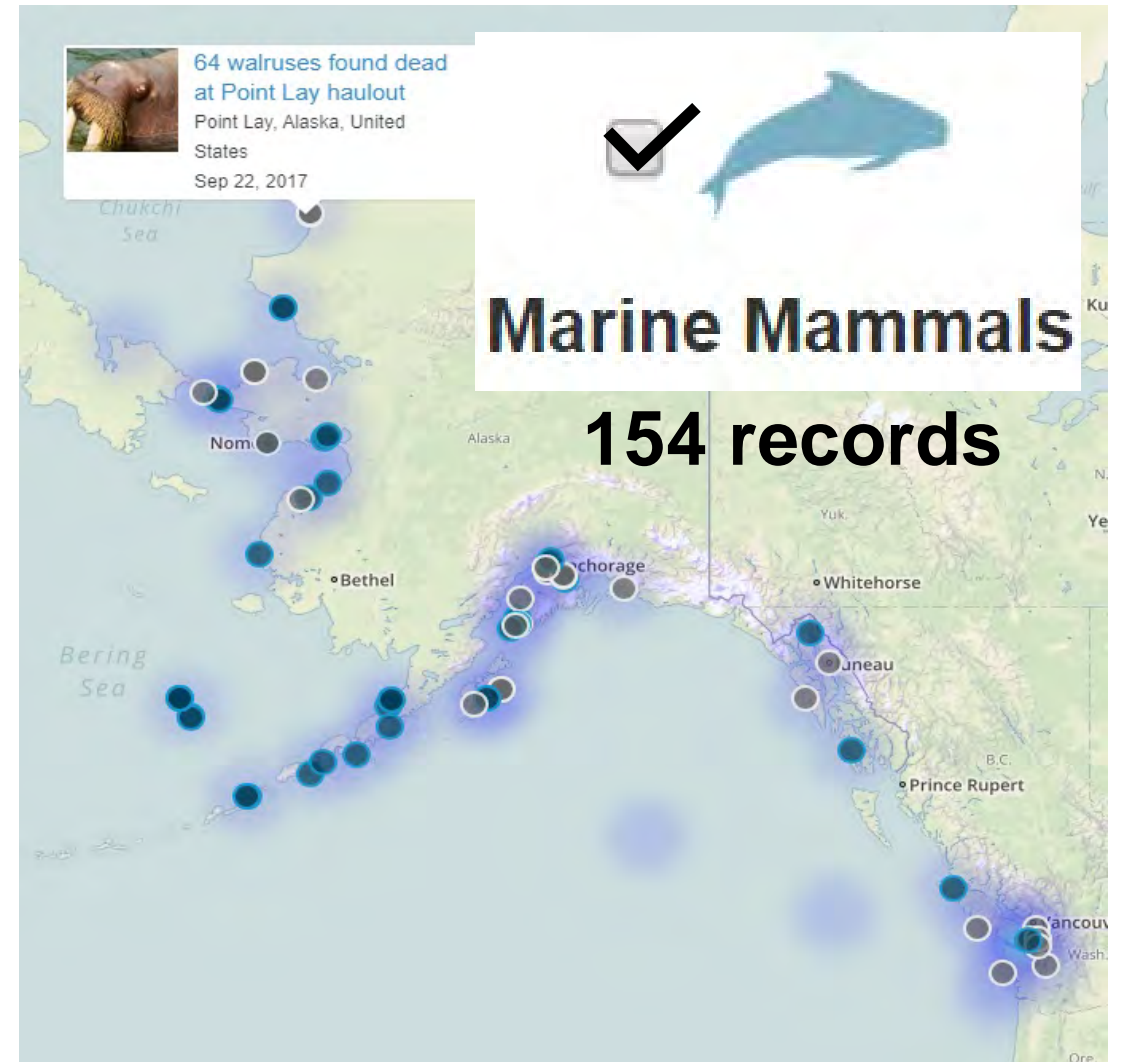
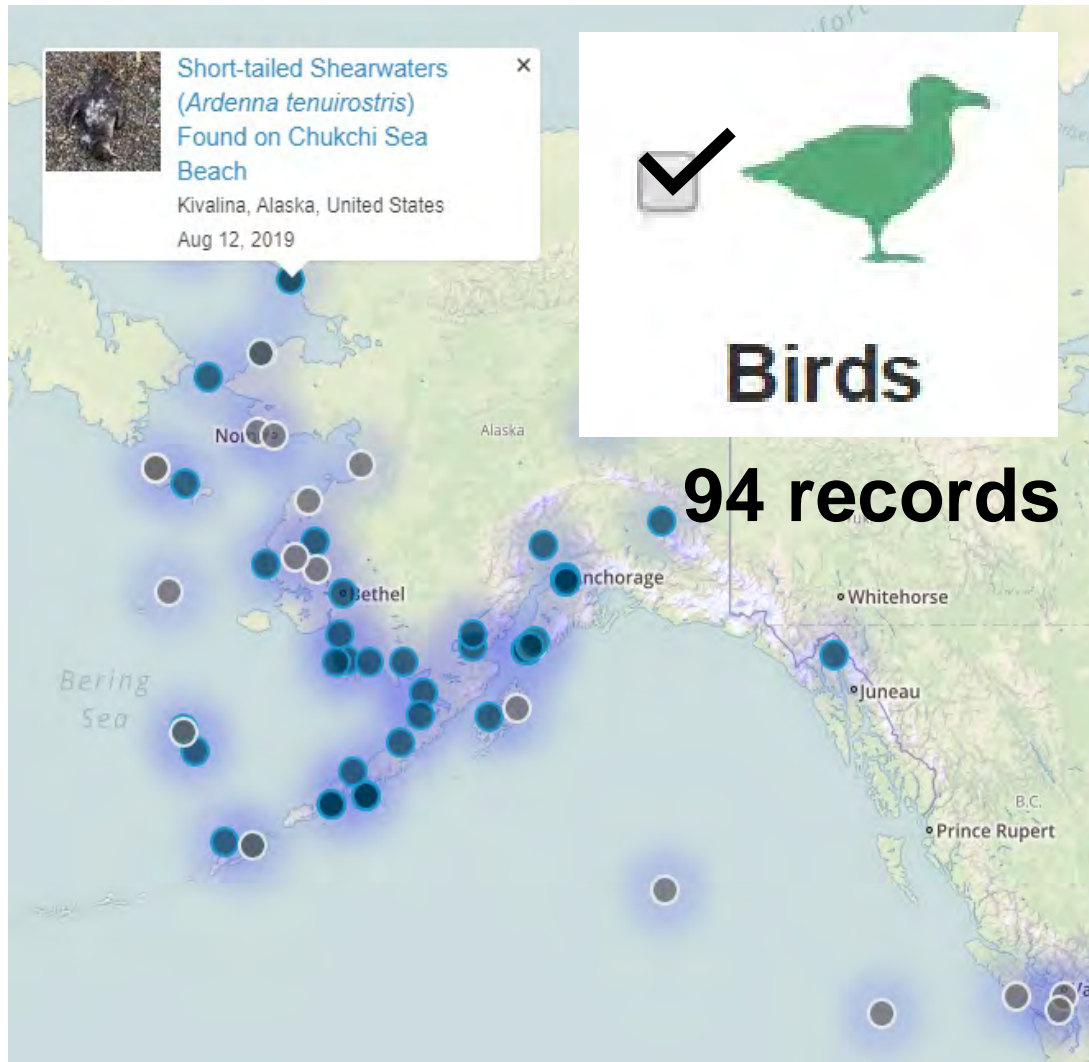
(Recent observations shown)



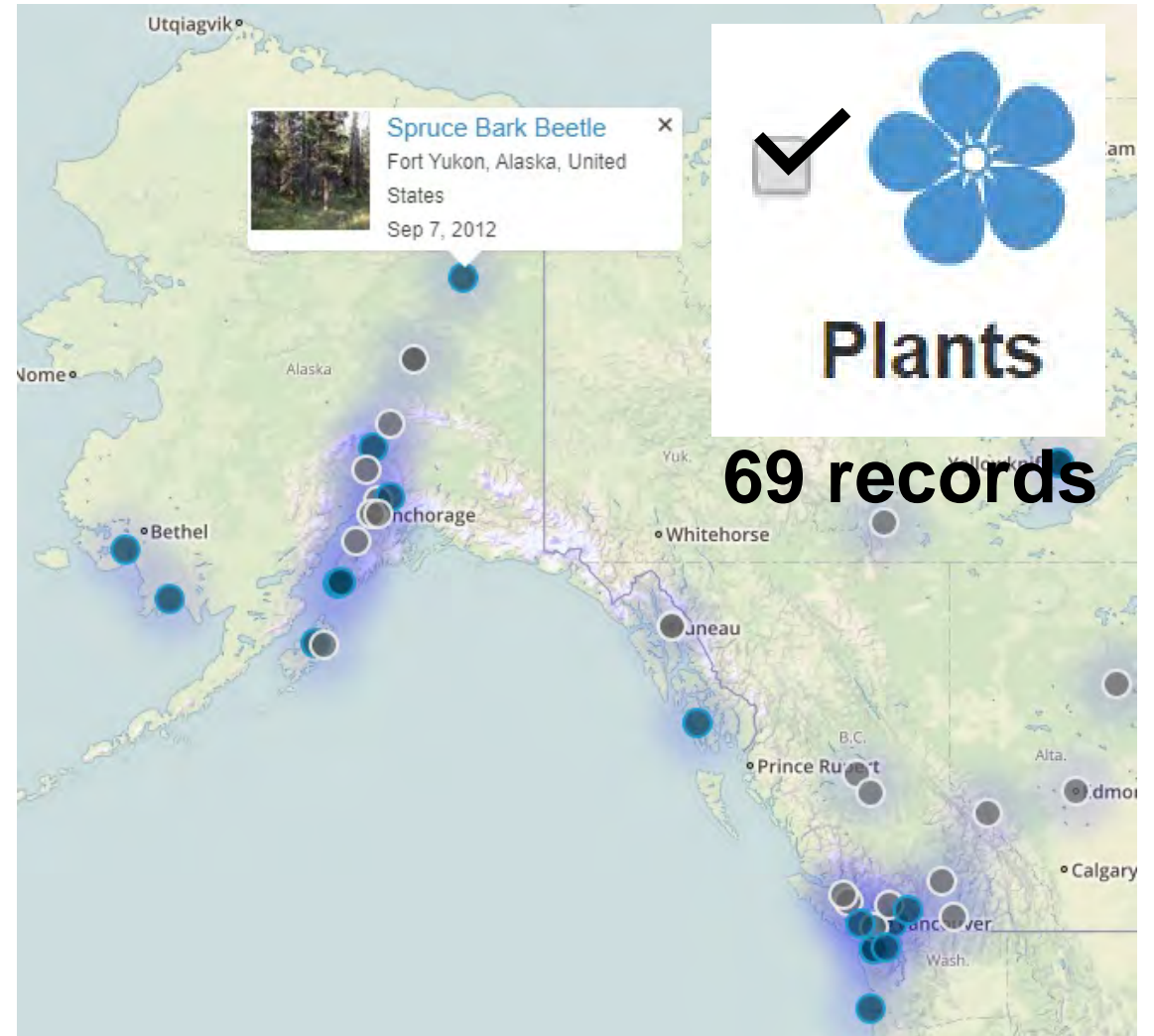
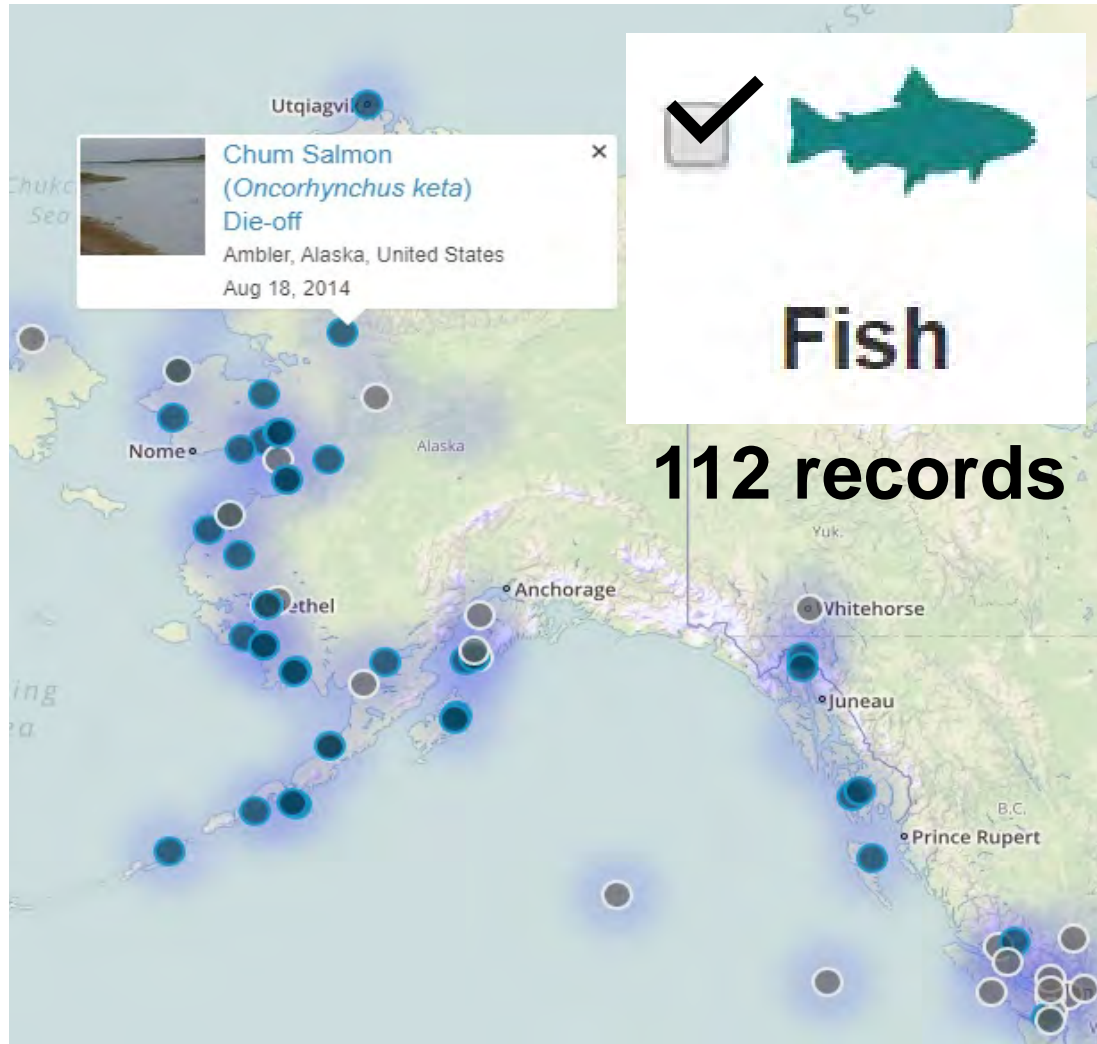
FUTURE SEES case study 2: Ecosystem impact of a marine heat wave in the eastern Pacific



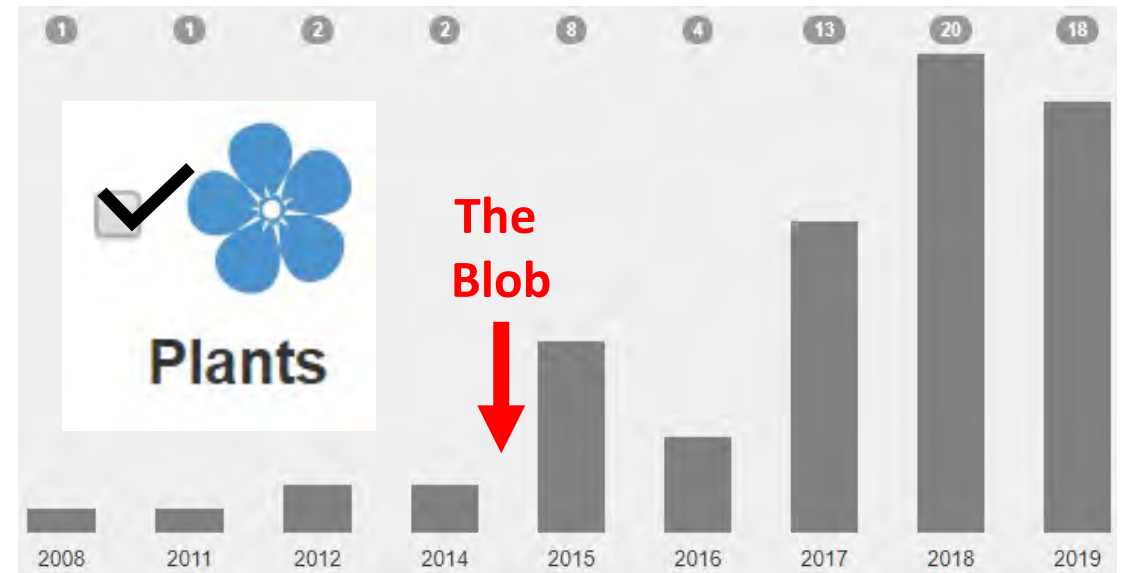
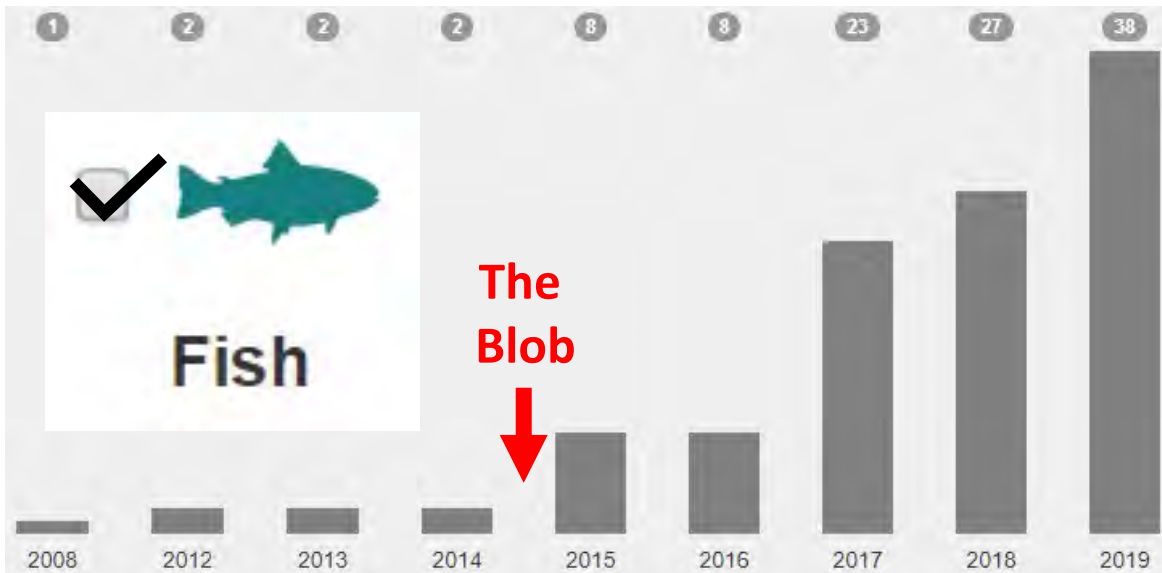
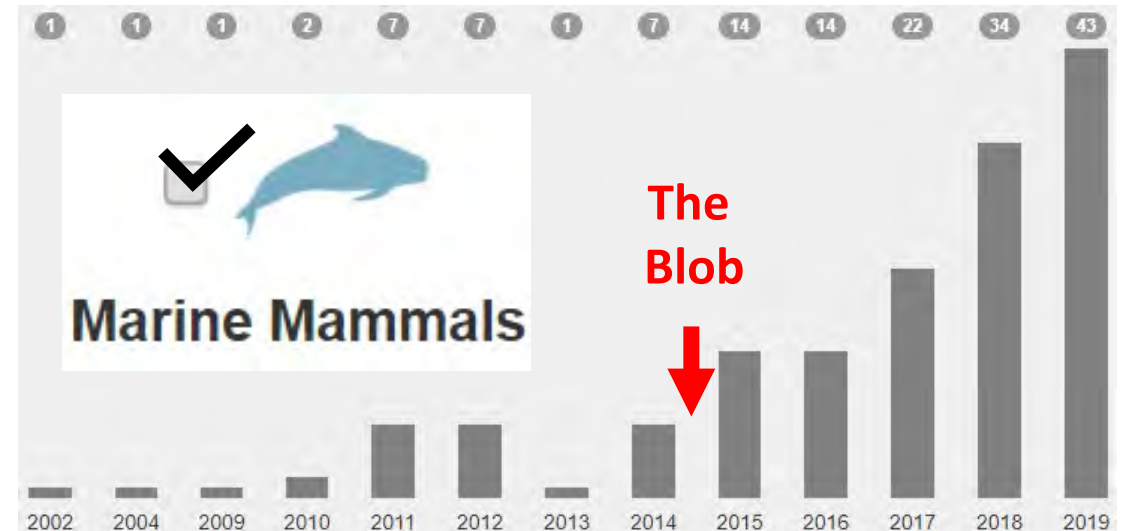
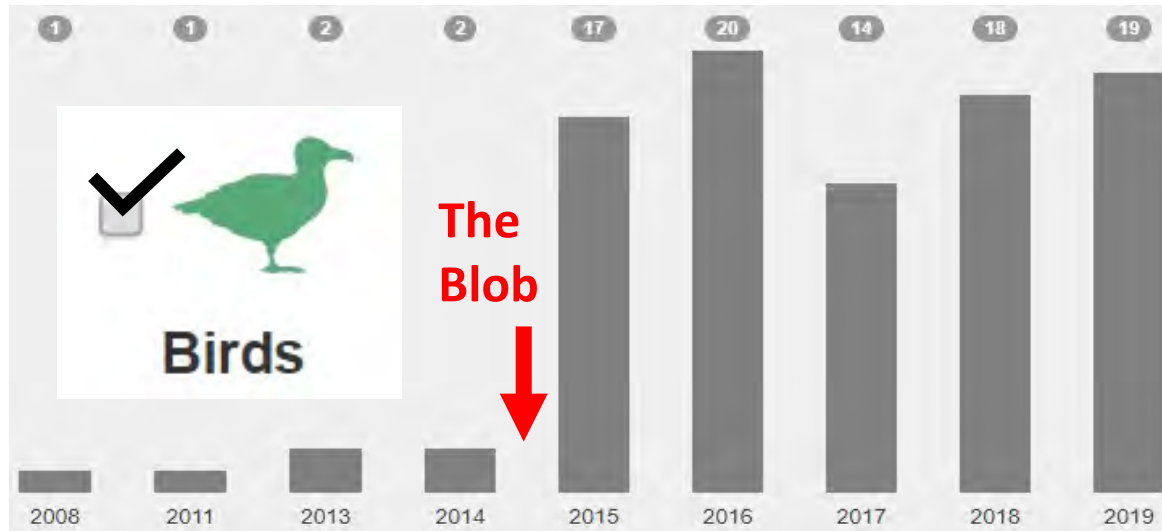
Example LEO Search: “Die | Dead”



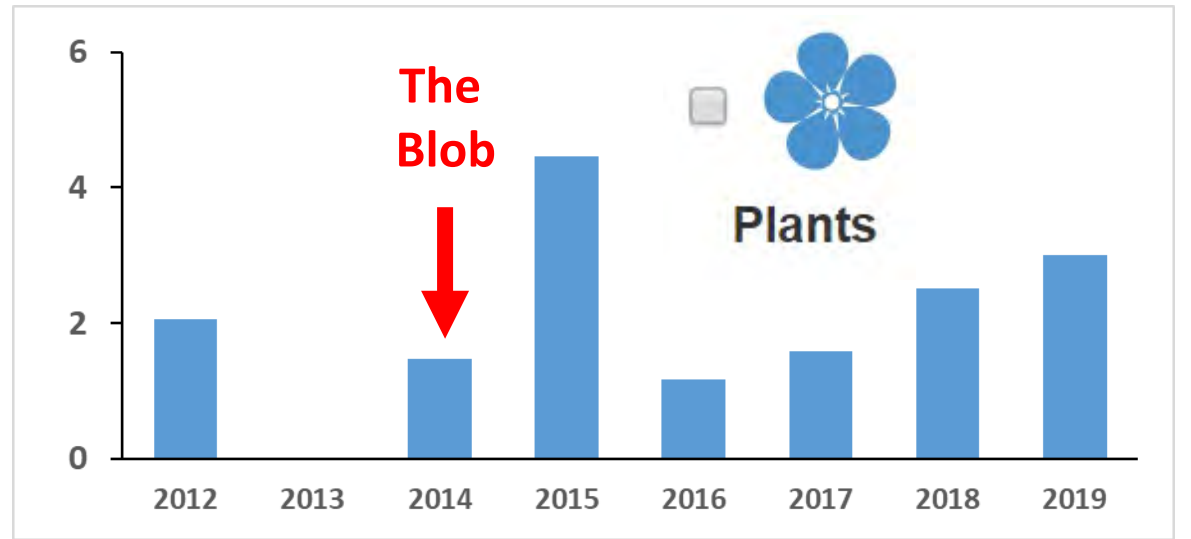
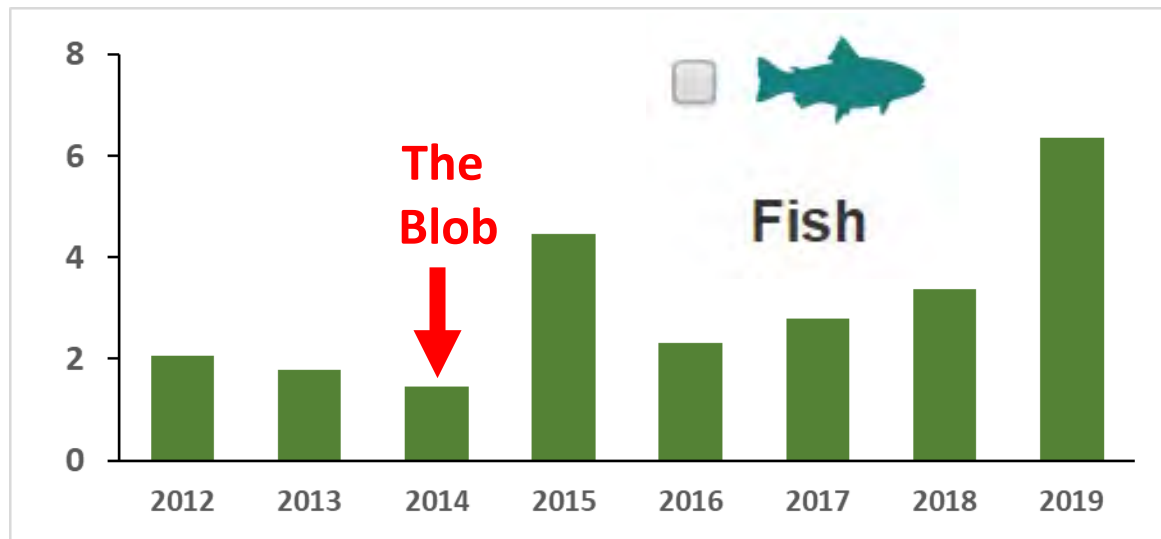
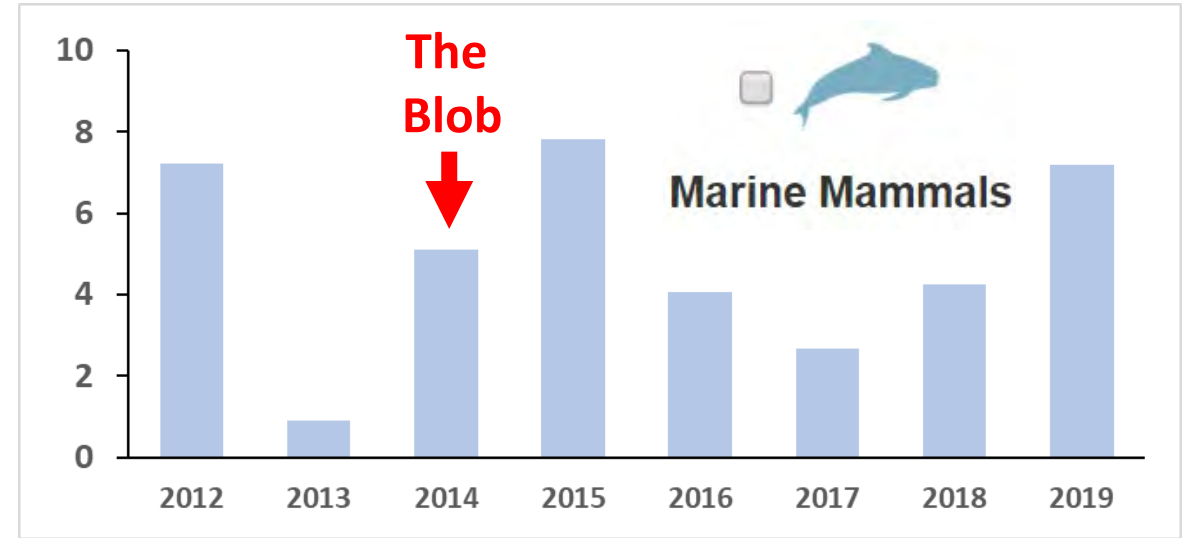
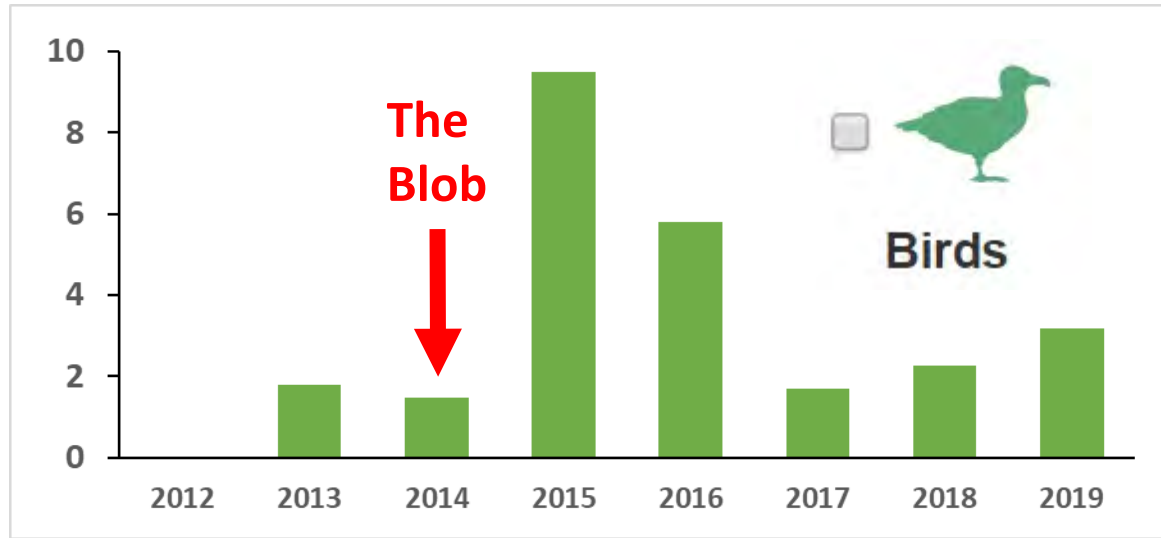
Example LEO Search: “Die | Dead”



Example LEO Search: “Die | Dead”

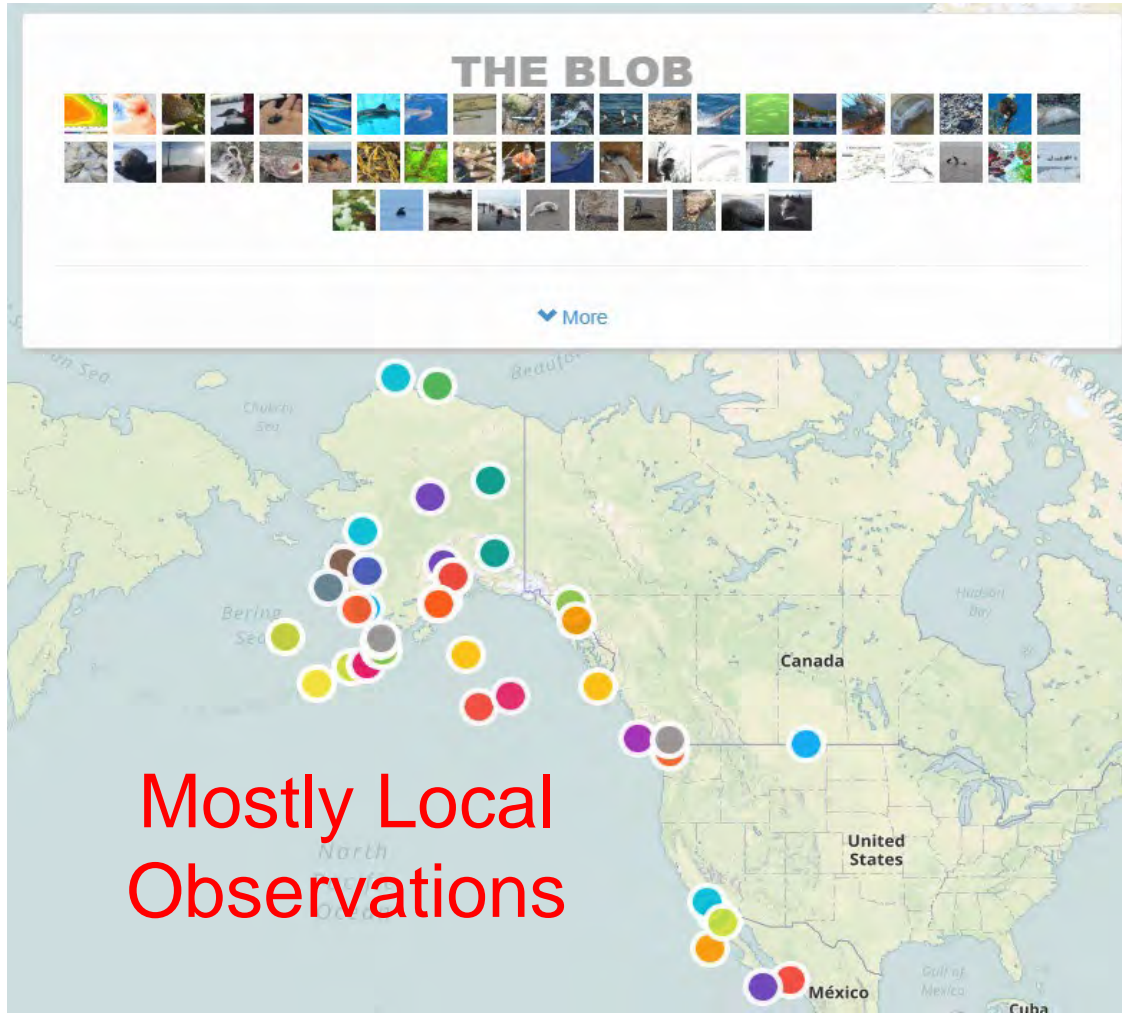


Percentage of annual LEO Posts with terms “Die | Dead”



Example LEO 'Project Maps'

The Blob



Sargassum in Caribbean



Example LEO 'Project Maps'

The screenshot displays a web interface for a LEO Network project map. At the top, navigation links include 'Explore', 'Contribute', 'Members', and 'About'. The LEO Network logo is centered, and the user 'Tom Okey' is logged in. The main map area shows the Northeast Pacific region with various colored circular markers indicating data points or research locations. A sidebar on the left provides details for the project, including a title, share options, and a list of articles. Two article snippets are visible: one about scallop mortality near Qualicum Beach and another about ocean acidification effects in Puget Sound. A central text overlay reads 'Ocean Acidification' and 'Mostly Research Articles'.

Explore ▾ Contribute ▾ Members ▾ About ▾ ?

LEO NETWORK

Tom Okey 1 English 🔍

NE Pacific Ocean Acidification

Share Settings Search/Filter Stats

Thumbnails People

A growing collection of literature on ocean acidification in the Northeast Pacific. First Person Observations and News Articles on the topic can be added, in addition to a more complete sampling of the OA scientific literature.

Ocean acidity wipes out 10 million scallops near Qualicum Beach

Island Scallops Ltd., Vancouver Island, Canada
26 FEB 2014

Ten million scallops that have died in the waters near Qualicum Beach due to rising ocean acidity are the latest victims in a series of marine die-offs that have plagued the West Coast for 10 years. ...

Times Colonist

Related Posts + My Maps

The combined effects of ocean acidification, mixing, and respiration on pH and carbonate saturation in an urbanized estuary

Puget Sound, United States
1 AUG 2010

Puget Sound is a large estuary complex in the U.S. Pacific Northwest that is home to a diverse and economically important ecosystem threatened by anthropogenic impacts associated with climate change, urbanization, and ocean acidification. While ocean acidification has been studied in oceanic waters, little is known regarding its status in estuaries. Anthropogenically acidified coastal waters upwelling along the western North American continental margin can enter Puget Sound through the Strait of Juan de Fuca. In order to study

Ocean Acidification

Mostly Research Articles

Mapbox


© Mapbox © OpenStreetMap Improve this map

Projects

- Harnessing the LEO Network
- Changing Salmon Runs
- The Blob – Marine Heat Wave

LEO

PROJECTS
CHANGING SALMON (*Oncorhynchus*) RUNS IN THE NORTHEAST PACIFIC



Changing Salmon (*Oncorhynchus*) runs in the Northeast Pacific

Northwest Pacific and Bering Sea

Location: Canada's Pacific marine areas and surrounding coastal areas of the northeast Pacific Ocean and Bering Sea

Description: The purpose of this project is to track observations of unusual trends, patterns, and events related to Pacific salmon in Canada's Pacific Marine Ecosystems and the northeast Pacific generally.

Background: The observed and predicted responses of Pacific salmon species to climate change and non-climate related stressors were reviewed by Okey et al. (2014). The literature summarized in this review indicated multiple issues: (1) Canada's Pacific salmon are influenced by changes in climate and oceanography across the whole North Pacific; (2) Changes in climate and oceanography influence biological productivity; (3) Salmon are responsive to changes and variations in biological production; Salmon ranges and distributions are contracting and shifting northward due to changes in climate, oceanography, and productivity; (4) A variety of non-climate stressors affect salmon including overfishing and habitat degradation, increased aquaculture, possible changes in degradation, and even increased hatchery production; (5) The Pacific Decadal Oscillation (PDO) corresponds to dramatic shifts in salmon productivity regimes with higher catches of chum, pink, coho, and sockeye in Canada's Pacific and Alaska; (6) The survival of pink, chum, and sockeye salmon decreased with increasing ocean temperatures in Pacific Canada and Washington State while increasing with increasing temperatures in Alaska—showing opposite effects in Northern and Southern areas; (7) Rivers and lakes will warm faster than the ocean, and this may strongly affect salmon reproduction and survival in Canada's Pacific region; (8) High uncertainty of climate effects on Pacific salmon relates to the multidimensionality of climate impacts on them and the range of sensitivities by life stage and habitat.

Local observations of changing hydrological flows on the west coast of Vancouver Island, British Columbia, Canada, suggest off-channel river habitats are staying dry for significantly longer time periods and may be contributing to delayed salmon run migrations. During a Clayoquot Salmon Roundtable (CSR) Chinook Risk Assessment Workshop, held in April, 2014, local fishermen and field biologists identified a number of habitat changes, related to changing climate conditions, that could be limiting salmon population migration patterns and population size.

Funding: Open Invitation

Partners: Pending

Observing Guidance: Observers are asked to report any notable or unusual changes in salmon runs or populations in the northeast Pacific. Detailed photos are encouraged in addition to information about the precise location and dates of the observations. Data summaries from point locations are also requested.

Source Data: Posts on the LEO Network, or from other sources.

Outputs: Contributed data will be added to LEO regional map and to timeline trends. Contributed data will potentially be used in published reports or papers.


Project Updates: Project updates may be provided in forthcoming LEO BC newsletters, regional ocean health reports, and through direct collaboration with project contributors.

Resources: Clayoquot Biosphere Trust
Clayoquot Salmon Round Table Stakeholder Risk Assessment Matrix.
Pacific Salmon on the Encyclopedia of Life


Follow My Maps Share Add Comment Edit

Lead Organization
clayoquot Biosphere Trust

Project Contributors All Contributing Members




Laura Loucks Lead
Ishmael British Columbia, Canada
Research Coordinator
Clayoquot Biosphere Trust
[Send Message](#)




Tom Okey Editor
Victoria British Columbia, Canada
Principal
Ocean Integrity Research
[Send Message](#)

All



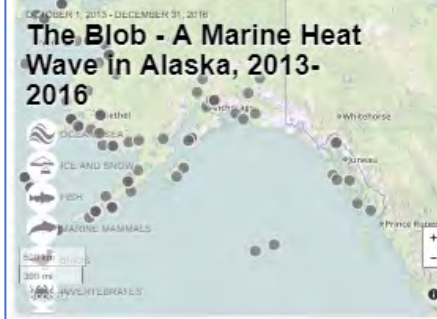
Bald Eagle (*Haliaeetus leucocephalus*) Targeting Forage Fish in Open Water
Island View Beach, British Columbia, Canada
JUN 21, 2018 My Maps



Small red salmon (*Oncorhynchus nerka*) return and fish size
Ostuskie, Alaska, United States
JUN 20, 2018 My Maps

LEO

PROJECTS
THE BLOB - A MARINE HEAT WAVE IN ALASKA, 2013-2016



The Blob - A Marine Heat Wave in Alaska, 2013-2016

Location: Alaska ocean waters south of the Bering Strait.

Description: This project includes observations from the LEO Network which may be associated (directly or indirectly) with the event known as the The Blob.

Local Observations - Insights on Community Impacts

Local observations are indicators of the impacts being experienced in communities across Alaska. Over 100 observations were posted to the LEO Network between October 2013 and December 2016 that could potentially be attributed to the Blob. The observations describe a variety of unusual events related to seasonality, weather, ocean conditions, plants and wildlife. Re-occurring themes include the changes and challenges for people engaged in subsistence activities, and increased variability and uncertainty for hunters, from failures one year to bumper harvests the next. The lack of winter sea ice in Western Alaska delayed or prevented ice-based harvesting of fish, crab, seal and whale. Low snow resulted in stream drying and mass mortalities of pink salmon in south central Alaska. Meanwhile bumper pink runs were documented in Aleutian communities. Low snow pack and high air temperatures were attributed to wild berry harvest failures across the State in 2015. While in 2016, an exceptionally early spring and moderate rainfall resulted in early berries and an exceptional harvest across species and across the State. For shellfish harvests, the warm waters translated into persistent high levels of harmful algae in Southern Alaska, and concerns about emerging food safety challenges as far North as the Bering Strait. Through these local observations new perspectives were presented about changes in the acclimations, preservation, quality and quantity of wild foods.


This project contributed to the study published December of 2017 in the Journal of the American Meteorological Society entitled: *The High Latitude Marine Heat Wave of 2016 And its Impacts on Alaska* by John Walsh et al. The paper in a pdf format is attached.

References:
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Krueger, Kelly. "Low Waters For Fish in Kodiak." LEO Network (leonetwork.org). Observed 25 September 2015. Accessed 24 February 2017.
Osterback, David. "So Many Pinks (*Oncorhynchus gorbuscha*)!" LEO Network (leonetwork.org). Observed 15 July 2015. Accessed 24 February 2017.
John, Anna R. "Early and Abundant Salmonberries (*Rubus chamaemorus*)."
LEO Network (leonetwork.org). Observed 10 July 2016. Accessed 24 February 2017.
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Porcincula, Karis. "High PSP in Clams." LEO Network (leonetwork.org). Observed 15 February 2015. Accessed 24 February 2017.


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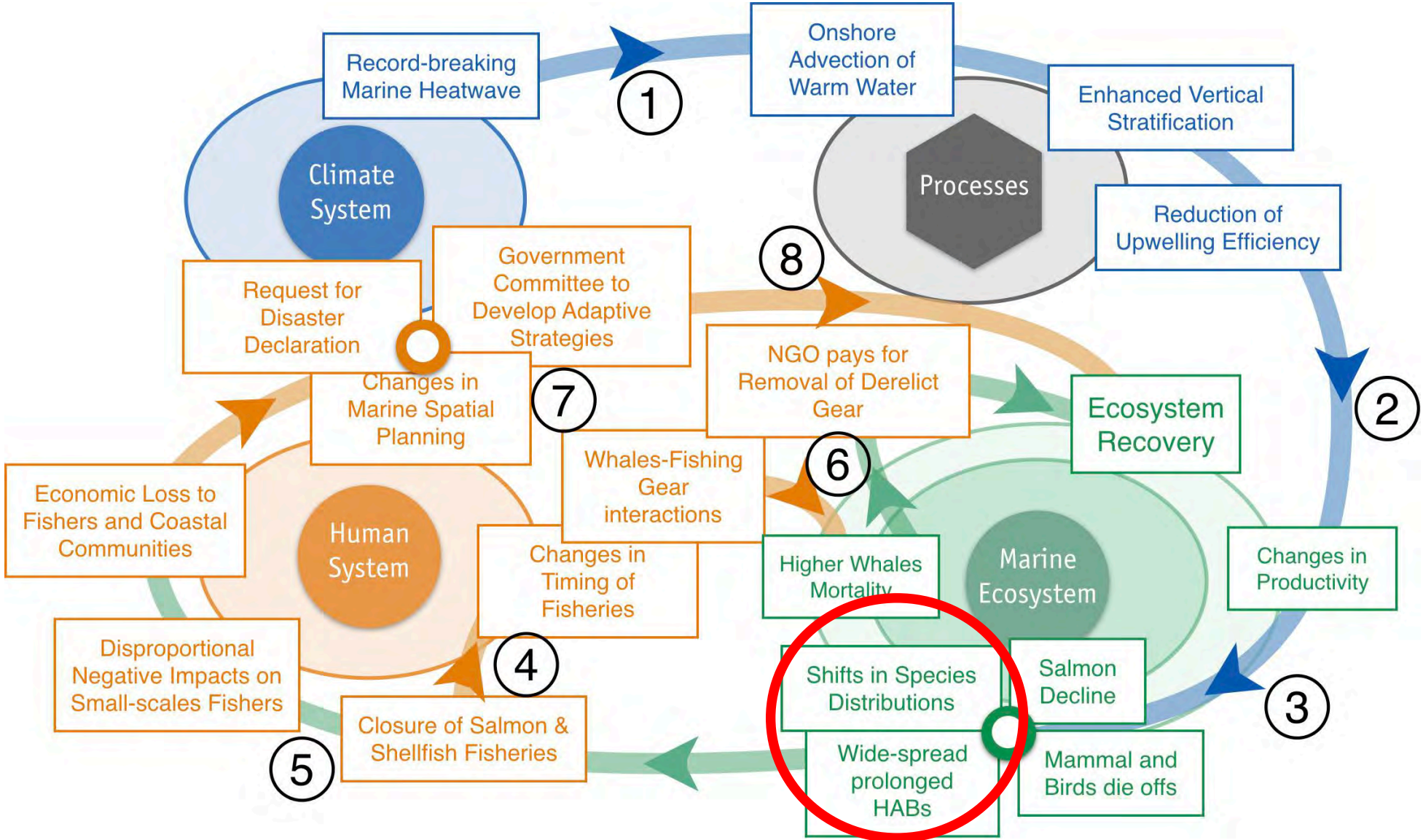


Bald Eagle (*Haliaeetus leucocephalus*) Targeting Forage Fish in Open Water
Island View Beach, British Columbia, Canada
JUN 21, 2018 My Maps



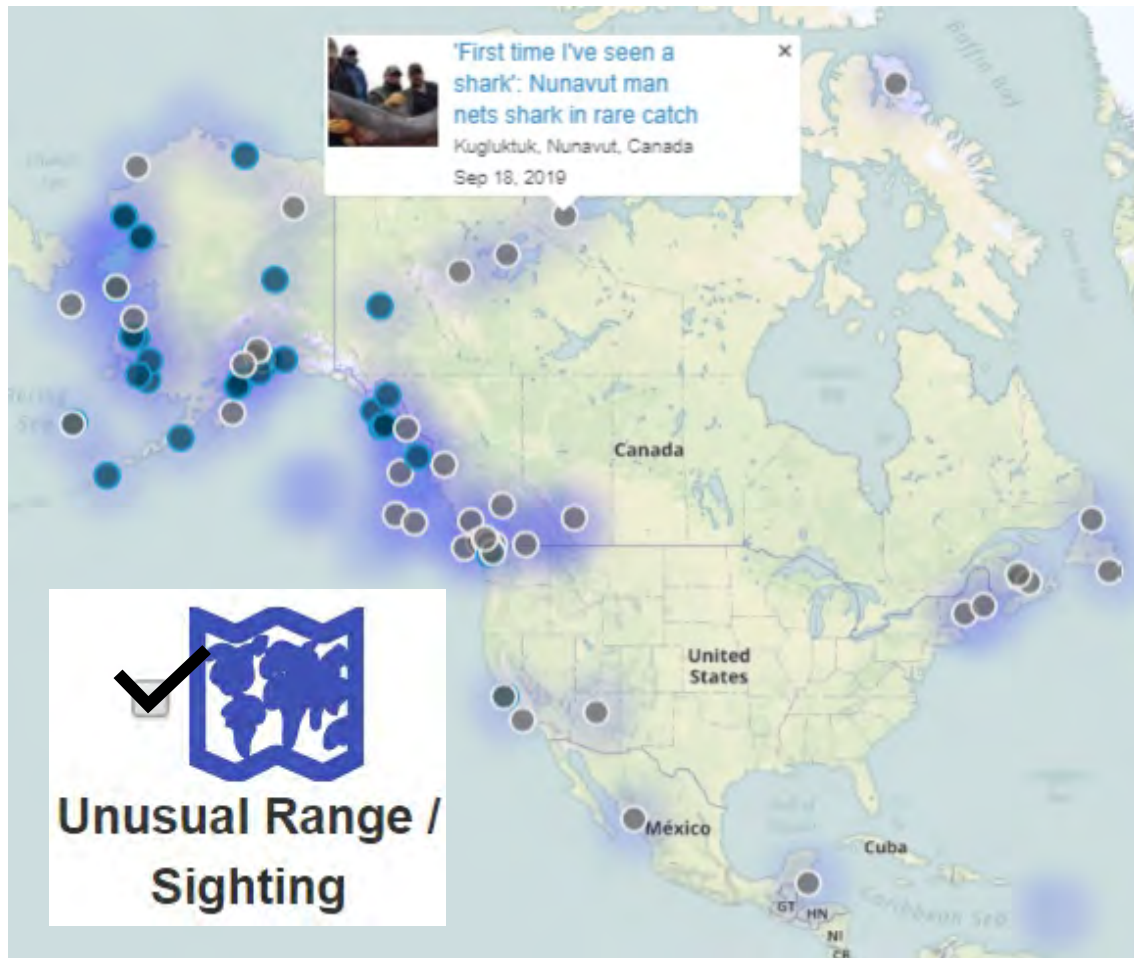
"Glowing" Tomcod (*Microgadus proximus*) in the dark - plankton?
Chevak, Alaska, United States
OCT 4, 2017 My Maps

FUTURE SEES case study 2: Ecosystem impact of a marine heat wave in the eastern Pacific

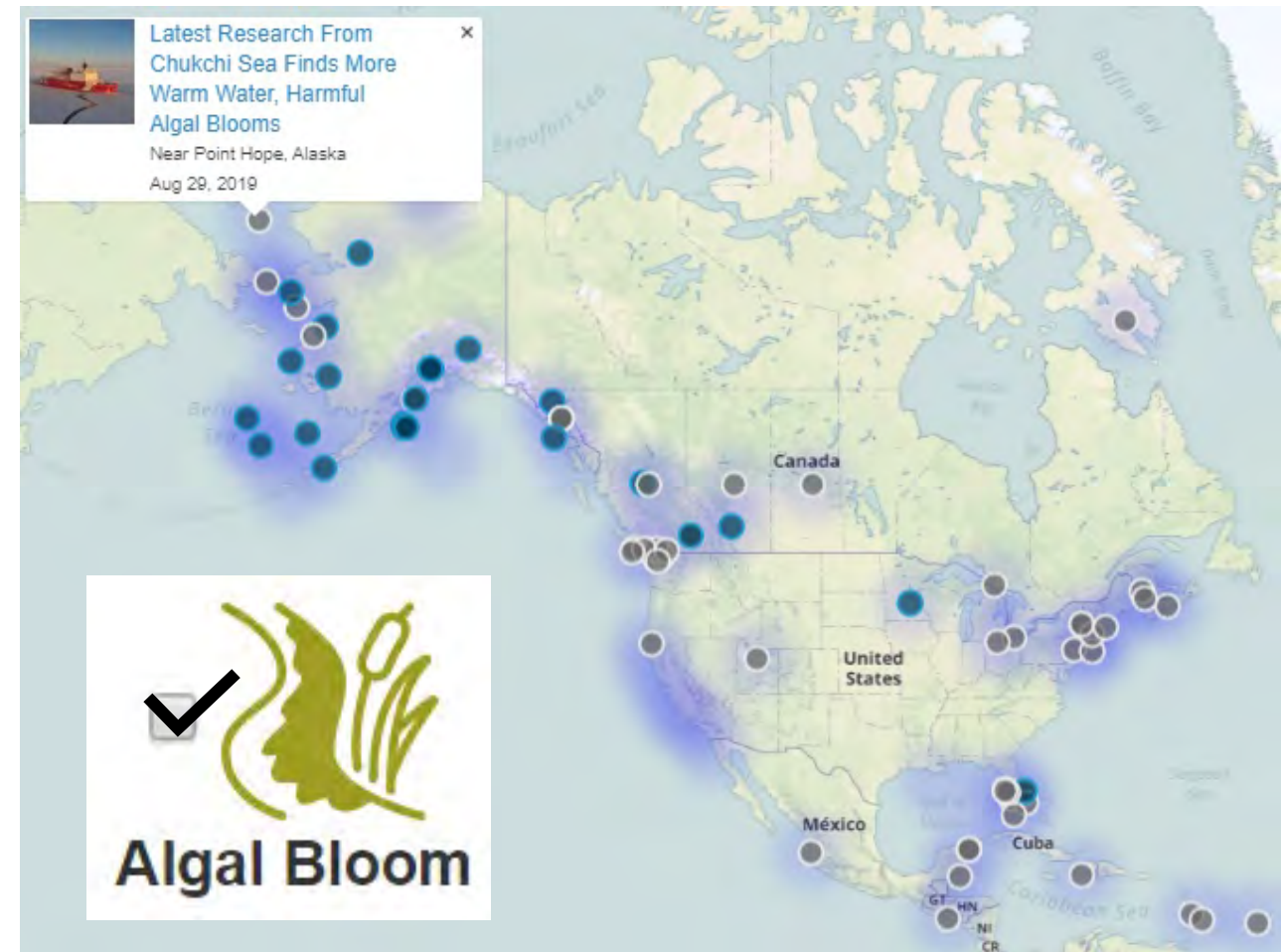


Example LEO Categories

Range shifts



Harmful Algae Blooms





Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Progress in Oceanography

journal homepage: www.elsevier.com/locate/pocean



Projecting future changes in distributions of pelagic fish species of Northeast Pacific shelf seas

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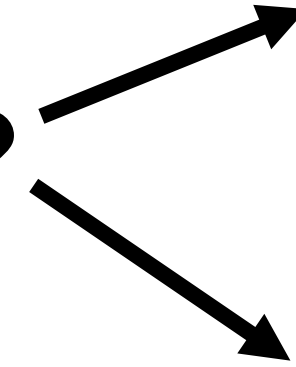
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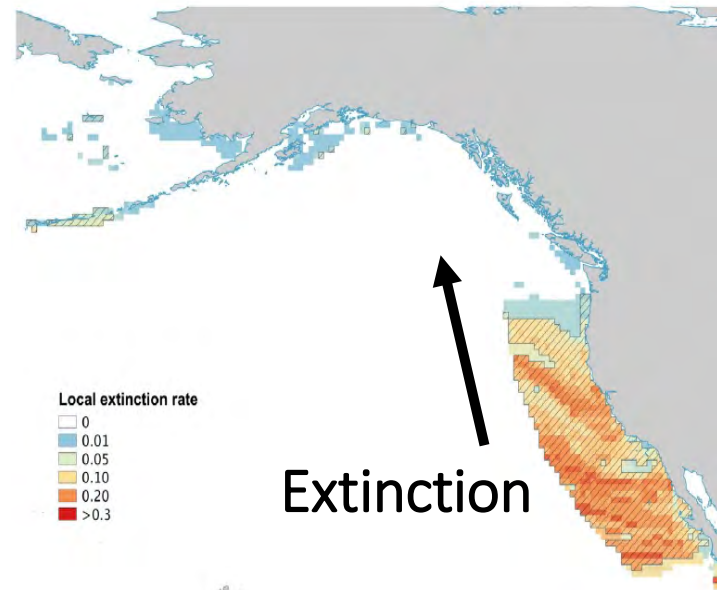
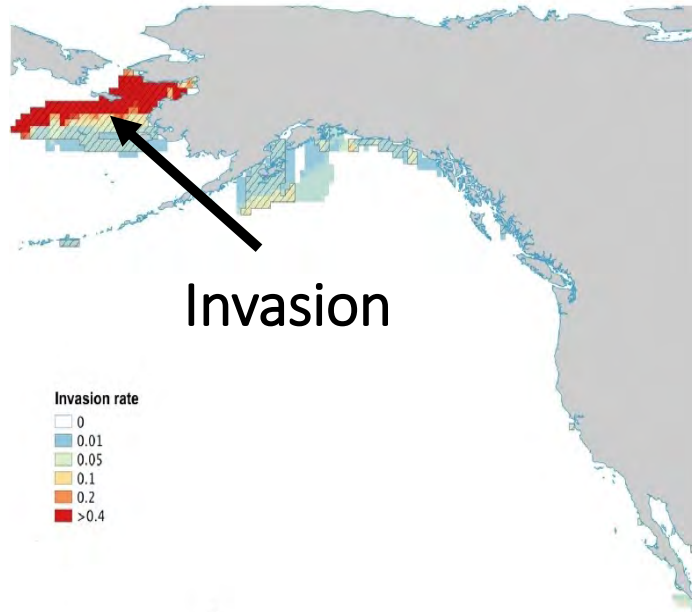
Tom Okey



Ric Brodeur



William Cheung



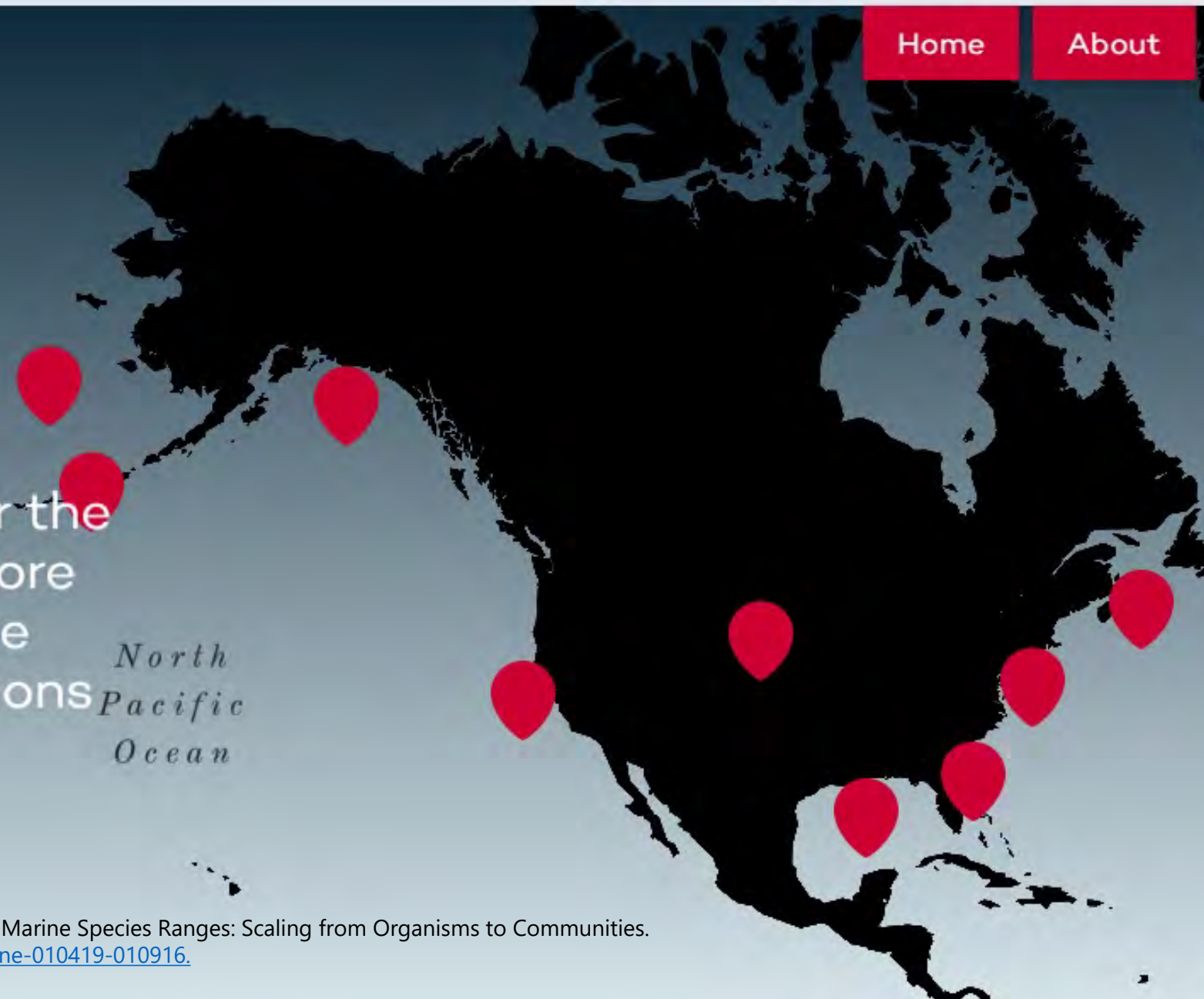
Daniel Pauly

Ocean Adapt

Welcome!
Select a region or the
continent to explore
changes in marine
species distributions

 [Download Data](#)

*North
Pacific
Ocean*

A dark blue map of the North Pacific Ocean region, showing the coastline of North America and Alaska. Several red teardrop-shaped markers are placed on the map, indicating specific locations of interest. The markers are located in the Gulf of Alaska, the Bering Sea, the North Pacific, the California Current, and the Eastern North Pacific.

Interfacing with Other Data and Platforms

- Direct links to other platforms
- Co-locating data points
- Understanding relationships

LEO for BC Students Map Search Add Your Observation Help

OCEAN WISE POLLUTIONTRACKER STATIONS

Share Settings Search/Filter Stats
Thumbnails People

This map shows [PollutionTracker](#) sampling stations along with related LEO posts from the same areas.
Visit the [PollutionTracker](#) website to learn more about the project.

"Total devastation": Dozens of fish killed in North, West Vancouver streams
West Vancouver, British Columbia, Canada
7 MAY 2018
CBC News

Stage 3 Water Restrictions in Shawnigan Lake, BC
Shawnigan Lake, BC
20 APR 2016
LEO Network

King-of-the-salmon (*Trachipterus ativelis*) stranded on beach
Victoria, British Columbia, Canada
26 SEP 2017

Port Neville
Sampled November 2, 2016
data for: [sediment](#) | [mussels](#)

**We can include all knowledge of change that
is accessible or shared in the North Pacific**



Our understanding is incomplete without local observations

LEO NETWORK

OBSERVATIONS STORM RELATED EROSION

FEBRUARY 26, 2018

Storm Related Erosion

Port Heiden, Alaska, United States

OCEAN / SEA
LAND
TRANSPORTATION

1000 km
500 mi
Mapbox

★ Follow + My Maps Share Add Comment

Port Heiden Alaska, United States
Massriq (Alutiiq)
Port Heiden is a community of 102 residents on the Alaska peninsula.

29 Nearby Posts 12 LEO Members W

Contributing Members

Scott Anderson Observer
Port Heiden Alaska, United States
Environmental Director
Native Village of Port Heiden
Send Message

Erica Lujan Editor
Anchorage Alaska, United States
LEO Network Coordinator Community Environment & Health
ANTHC
Send Message

See Also

Erosion Could Drain Lake at Anytime
Port Heiden, Alaska, United States
MAY 29, 2017 + My Maps

Coastal Erosion Damaging Boat Launch
Port Heiden, Alaska, United States
DEC 30, 2016 + My Maps

Scott Anderson writes:

We've already lost access to our Safe harbor and if the lake washes out will lose access to the old village. A 12-hour storm happened on February 26th. It was a good thing we built another road right alongside the lake because the original one is now gone.

Erica Mitchell writes:

The geology around Port Heiden is largely composed of unconsolidated volcanic deposit, much of it pumice. This makes the bluff vulnerable to erosion, especially during significant storm events. In the absence of sea ice that can prevent waves and shore ice that armors and protects the land, erosion can be greatly accelerated. Historically, the coast around Port Heiden was protected by a series



Port Heiden Coast, 2017
Alaska Division of Geological and Geophysical Surveys, via Google Earth



The Eyes, Ears, and Voice Our Changing Environment

**Understanding environmental changes should be
accessible by everyone**



For more about LEO:

leonetwork.org



First Nations Health Authority
Health through wellness

Contact:

Thomas.Okey@gmail.com

