

# Eyes Over Puget Sound

[Summary](#)[Critters & divers](#)[Climate & streams](#)[Combined factors](#)[Marine water](#)[Aerial photos](#)[Data](#)

## Surface Conditions Report: *February 3, 2021*



*Critter of the month: the heart crab*



*Up-to-date observations of water quality conditions in Puget Sound and coastal bays*

Summary

Critters & divers

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Picture by: Jesse Miller

LONG-TERM MARINE MONITORING UNIT



*Dany Burgess*

## The heart crab, [p. 3](#)

Get ready to fall in love with the heart crab – a shy critter that wears its heart on its shell.



*Tyler Burks, Skip Albertson*

## Climate & streams, [p. 6-10](#)

It has been warmer and wetter. Rivers are flowing higher than normal. Despite warmer than expected air temperatures, water temperatures are continuing to drop through winter and already exclude Northern Pacific anchovies in North Sound.



*Thank you to many*

## People send their observations, [p. 4, 40, 41](#)

Underwater the beauty is in the details. Puget Sound has many species worth showcasing.



*Dr. Christopher Krembs*

## The Aerial photography, [p. 13-39](#)

From patches of jellyfish and snow geese to sediment and early blooms. There is more happening in the winter than you might expect.

## Critter of the Month – The Heart Crab



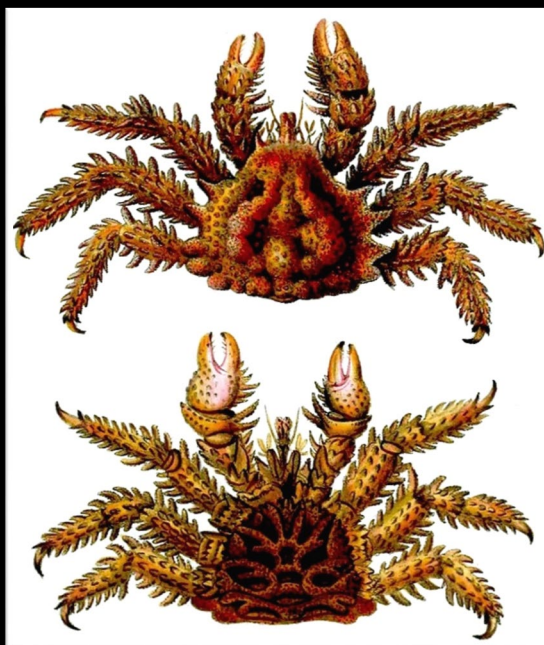
### *Phyllolithodes papillosus*

Get ready to fall in love with the heart crab – a shy critter that wears its heart on its shell. Although it occurs in Puget Sound, we've never collected one in over 30 years of sediment sampling!

Dany Burgess  
*Marine Sediment Monitoring Team*



Photo by  
*Erin McKittrick*



### Fun Heart Crab Facts

- They have a lot in common with hermit crabs
- They like to hide under stinging anemones
- One of their family members is a reality show star



Photo by  
*Erin McKittrick*



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*Elisa Rauschl is reaching out to our diving community*

White-lined dirona, Redondo  
By Pieter Booth



Blob top jellyfish, Hood Canal  
By Kerry Edwards

*SCUBA divers in Puget Sound often encounter amazing creatures that few of us get to enjoy. Some divers shared their photos with us.*



Pacific spiny lumpsucker, Redondo  
By Jesse Miller



Juvenile PS king crab, Port Townsend  
By Jessica Alexanderson



Hooded nudibranchs, Port Hardy BC  
By Eric Askilsrud

Email [erau461@ecy.wa.gov](mailto:erau461@ecy.wa.gov)  
if you'd like to contribute dive photos



## What was the water visibility like for divers?

Only best visibility shown for December, in form of a small diver



Best and worst horizontal visibility at corresponding vertical depth

Location	Best Visibility		Worst Visibility	
	Horizontal Distance (ft.)	Vertical Depth (ft.)	Horizontal Distance (ft.)	Vertical Depth (ft.)
1	12	18	10	2
2	18	3	17	97
3	25	36	10	11
4	19	59	18	10
5	25	92	4	10
6	19	46	4	2
7	65	61	34	8
8	60	36	16	7
9	24	36	11	49
10	97	38	36	5
11	58	49	3	10
12	47	98	4	3

Find depths with high/low visibility



- **Best visibility** occurred in Central Puget Sound near Three Tree Point and Dash Point (Location 10).
- **Poor visibility (no diver icon)** occurred in the top ten feet in several locations (Locations 5, 6, 11, and 12), also in Central Sound... so get down below 40 ft!



This is a feature we are soliciting feedback on ([skip.albertson@ecy.wa.gov](mailto:skip.albertson@ecy.wa.gov)).



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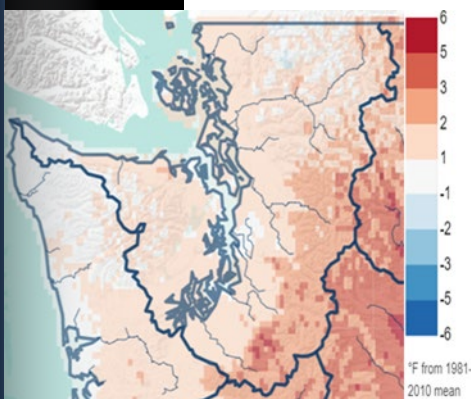
Data



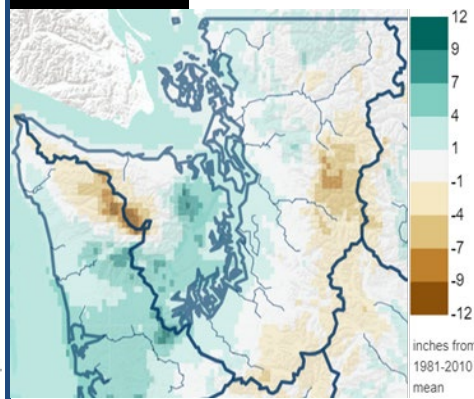
In January, Puget Sound air temperatures and precipitation were generally above normal, with some spatial variation. (A) With two months of snowpack accumulation remaining, watersheds that drain to Puget Sound hold above-normal volumes. (B) Monitoring snowpack and temperature trends will be critical as we transition to spring.

## A. Northwest Climate Toolbox

### Temperature



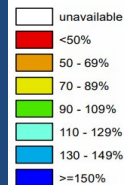
### Precipitation



## B. Washington SNOTEL, USDA/NRCS

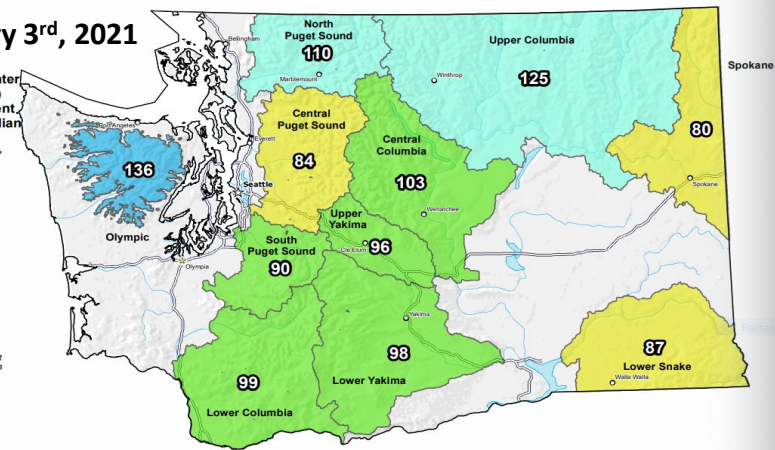
February 3<sup>rd</sup>, 2021

Current Snow Water Equivalent (SWE) Basin-wide Percent of 1981-2010 Median



\* Data unavailable at time of posting or measurement is not representative at this time of year

Provisional Data



### Temperature Anomaly

from historical mean daily ranged from -2 to +6 °F in the Puget Sound region during the past 30 days.

### Precipitation Anomaly

from historical mean ranged from -9 to +9 inches in the Puget Sound region during the past 30 days.

### Snow water equivalent

percent of median for watersheds draining to Puget Sound are just above normal. As we move toward the typical peak of seasonal snowpack accumulation, April 1<sup>st</sup>, snow water equivalents are at 105% of the historical median.

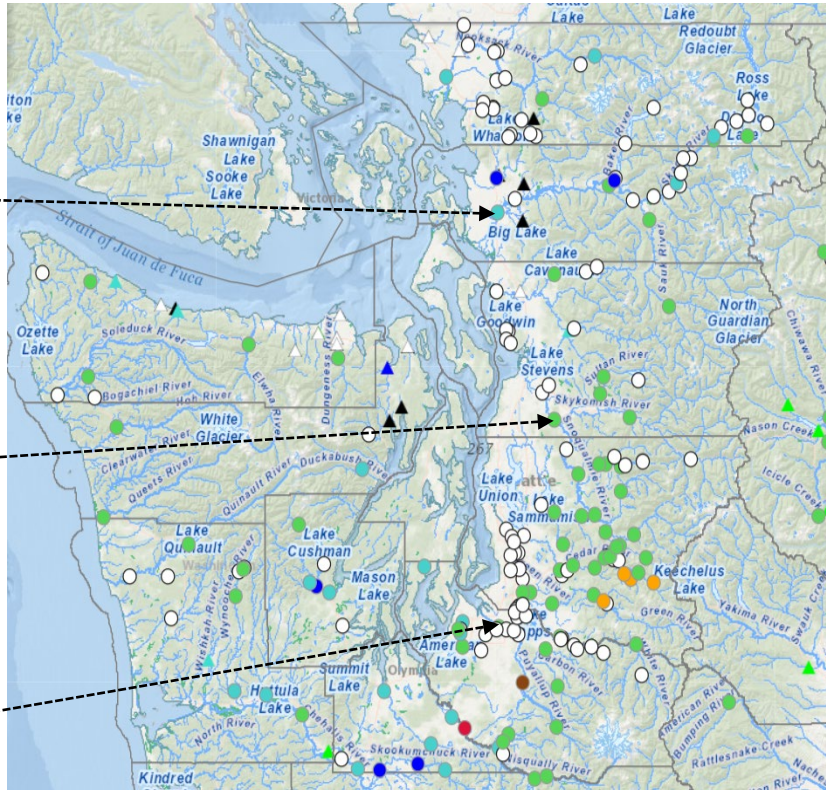
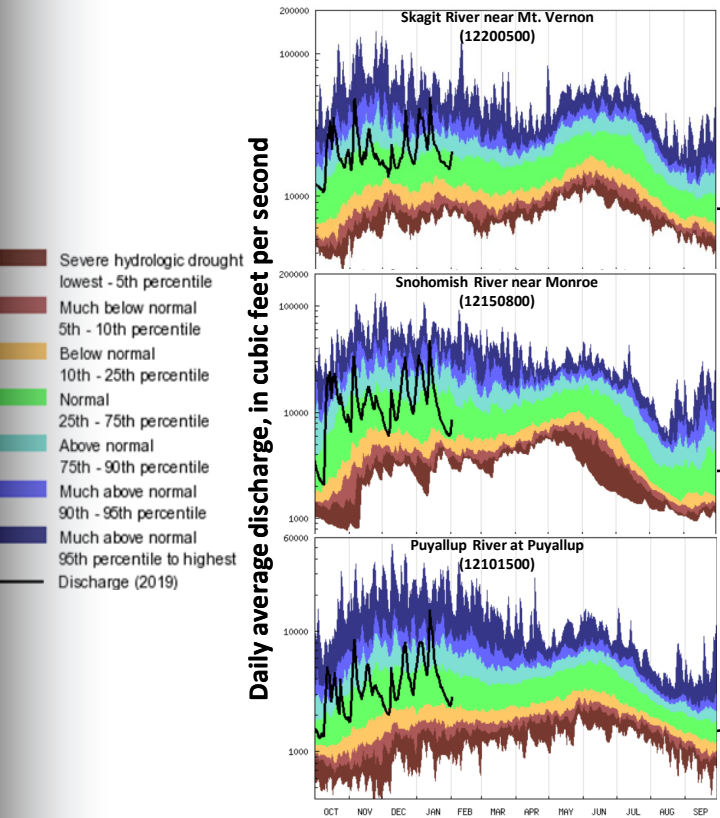


**Temporal:** Following a series of notable precipitation events, a brief drying period resulted in a return to normal freshwater inputs from major Puget Sound rivers to Puget Sound (trend charts, left).

**Spatial:** Geographic variation in streamflow (map, right) is dependent on the distribution and dominant form of precipitation falling in the watershed, leading to normal and above normal conditions.

### Select Puget Sound Streamflow Trends

### Current Streamflow Conditions as of 02/03/2021



#### USGS Real Time Streamflow Values

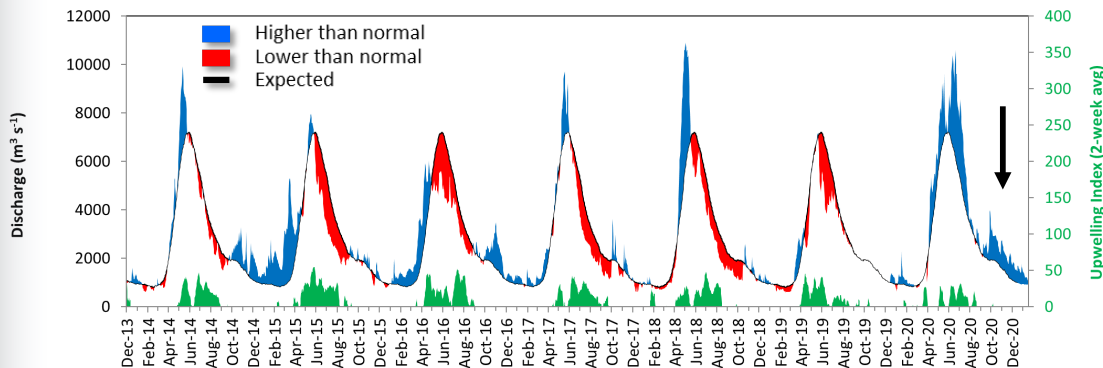
- Much above normal (>90%)
- Above normal (76-90%)
- Normal (25-75%)
- Below normal (10-24%)
- Much below normal (5-10%)
- Far below normal (>5%)
- Lowest recorded
- Not Ranked

#### Ecology Daily Streamflow

- Daily Streamflow
- ▲ Highest recorded
  - ▲ Much above normal (>90%)
  - ▲ Above normal (76-90%)
  - ▲ Normal (25-75%)
  - ▲ Below normal (10-24%)
  - ▲ Much below normal (<10%)
  - ▲ Lowest recorded
  - △ Not ranked

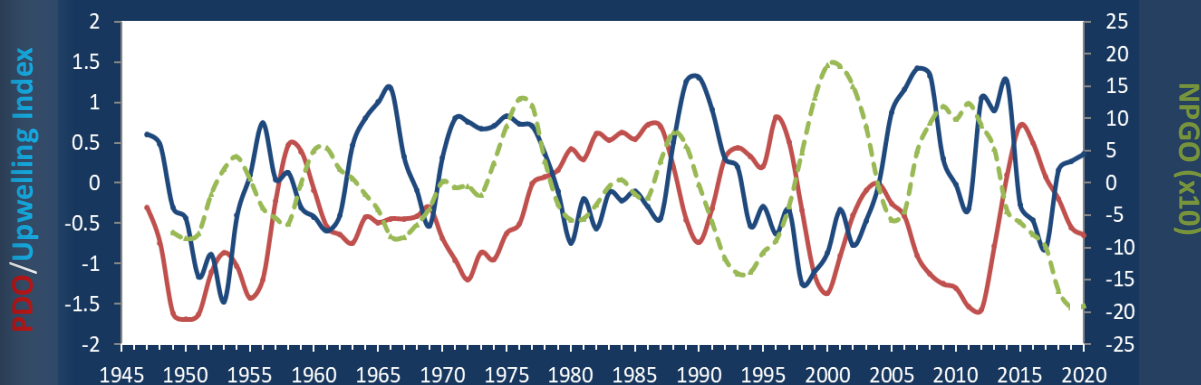
Historically, the peaks of coastal upwelling and the [freshet](#) are in sync..

Fraser River (at midnight)



The Fraser River is the major driver of [estuarine circulation](#) and water exchange between the Salish Sea and the ocean. The Fraser River continues to flow consistently higher in 2020 even into winter 2021.

Three-year running average of PDO, Upwelling, and NPGO Indices



How do ocean boundary conditions affect the quality of water we exchange with the ocean?

Recent years' warm water is mostly gone (PDO). Upwelling (Upwelling Index anomaly) is relatively expected. NPGO, which reflects the surface productivity along the coast, has fallen to one of its lowest numbers (note updated past 7/2020).

Pacific Decadal Oscillation Index (**PDO**, **temperature**, [explanation](#)). Upwelling Index (anomalies) (**Upwelling**, **low oxygen**, [explanation](#)). North Pacific Gyre Oscillation Index (**NPGO**, **productivity**, [explanation](#)).





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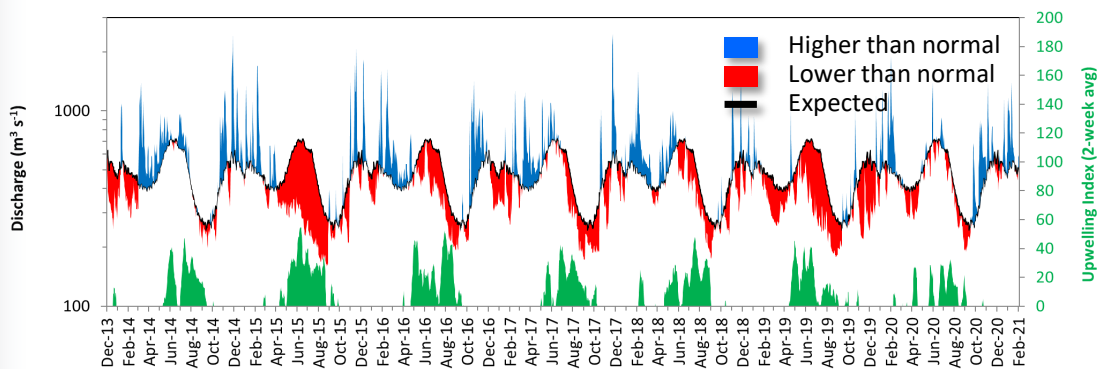
Marine water

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The Skagit River is the largest freshwater source for Puget Sound. It is a river that is regulated.

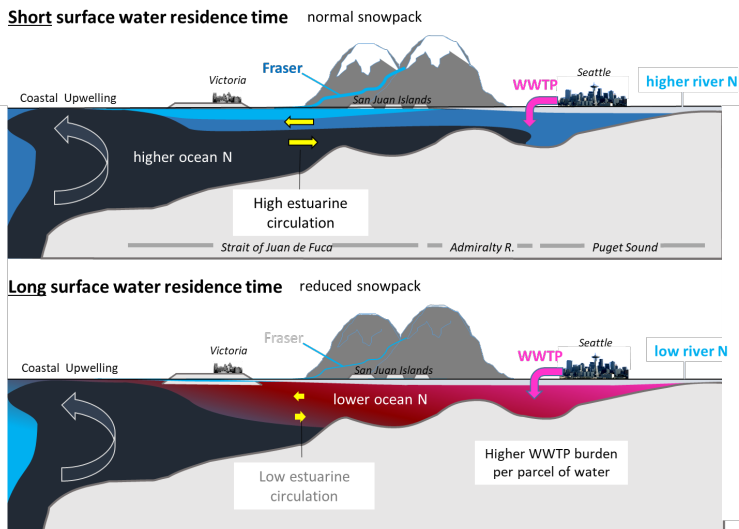
**Skagit River (at midnight USGS)**



The Skagit River freshet is no longer clearly pronounced, because it is a regulated system for hydroelectric power generation. However, drought years and low flows can be seen in the river's discharge data. In the last year flows of the Skagit appear more normal than the Fraser River.

Normal river flows drive **“natural”** nutrient inputs and keep the **water cool**.

Low river flows change the **nutrient balance** and make **water warmer**.



Rivers strengthen estuarine circulation in the Salish Sea. This is important in the summer.

Upwelled ocean water provides cool, nutrient-rich water.

For that to happen, we need northerly winds and good river flows (a good snowpack) during periods of water exchange through Admiralty Reach (neap tides).

River flows and upwelling in the summer influence our water quality.



In the anomaly plot, we want to connect different factors influencing water quality in the context of space and time. We do this with a heat map and anomalies by month for selected regions from north to south. For recent river and stream inflow, [see page 6](#).

## Conditions leading up to February:

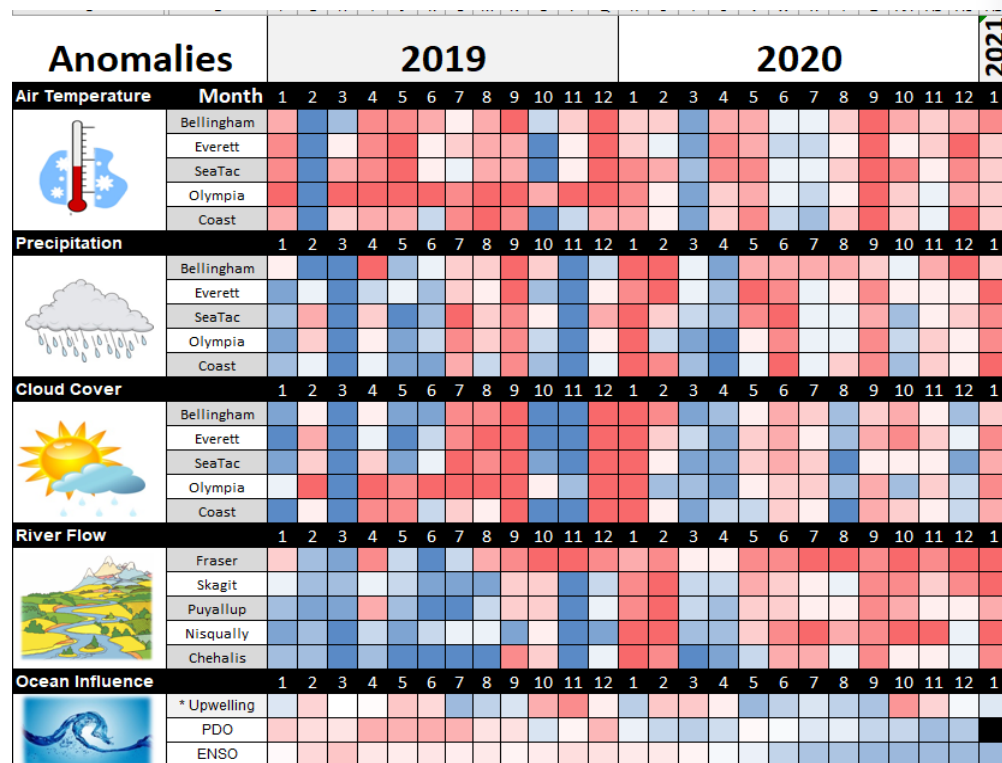
**Air temperatures** were generally warmer this winter through January.

**Precipitation** was above normal after October.

**Cloud cover** levels were slightly above normal, generally being closer to normal than in 2019.

**River flows** were higher than normal through January. Flows in 2020 were generally higher than in 2019.

**Upwelling** was weaker. PDO is lower and La Niña is gaining strength. Downwelling is less pronounced than normal.

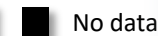


All data are from public sources: UW GRAYSKIES; river flows from USGS and Environment Canada; indices from NOAA & UW (PDO).

\*Upwelling/downwelling Anomalies (PFEL)

PDO = Pacific Decadal Oscillation

ENSO = El Niño Southern Oscillation





Summary

Critters & divers

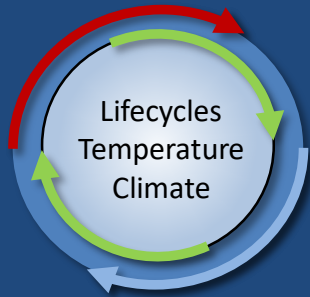
Climate & streams

Combined factors

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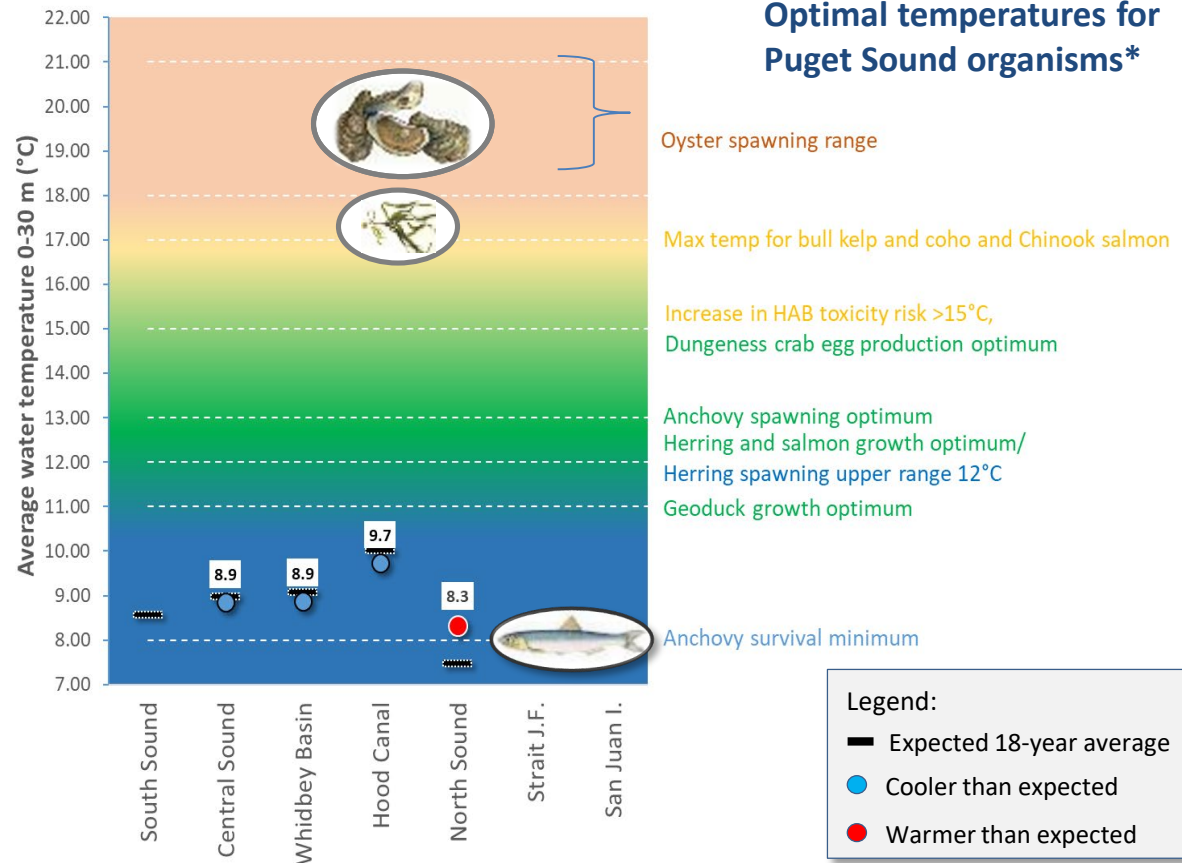
## Can organisms thrive and survive?

The life cycles of organisms respond to temperature. To be successful, the timing of early life stages must line up with good growth conditions.

Temperature is important for growth, but also dictates if certain organisms can overwinter in Puget Sound (e.g., northern anchovy).

\* Help us get these right. We scoured the literature for temperatures important to the success and survival of marine organisms.

**In January**, average surface water (0 – 30 m) temperatures were slightly below expected across many regions. Water temperatures were in ranges for spawning for herring, but were approaching the minimum survival temperature for anchovies of about 8.2 °C. Coldest water temperatures in North Sound are approaching 8.2 °C. Temperatures are expected to further drop until the end of March.





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## Stay up-to-date on unfolding stories relevant to our region



The **Marine Waters Work Group** (PSEMP) releases a summary of its bimonthly **Marine Condition Update**, covering the Puget Sound region, coastal waters, and the North Pacific.

To participate in the webinar every other month, join our email list by emailing Iris Kemp ([ikemp@ltk.org](mailto:ikemp@ltk.org)) or the Marine Waters Work Group ([marinewaters@psemp.org](mailto:marinewaters@psemp.org)).

Stay plumbed into the the information stream...

## What's the story so far?

Go to the [webpage](#) and read detailed discussion summaries.



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Southern Hood Canal is blooming at the beginning of February. Many nearshore environments show significant amounts of suspended sediment, including sloughs in Skagit County. Jellyfish are present in Sinclair Inlet, and large flocks of snow geese are drifting at the surface of Padilla and Skagit Bays.

Start here

1/20/2021, Possession Sound. Rendezvous with ORCA students and research vessel



Flying in winter for EOPS. Weather is always a challenge.



### Mixing and fronts:

Tidal eddies around Vashon Island and Holmes Harbor; distinct fronts in the Strait of Juan de Fuca with woody debris.



### Jellyfish and fish:

Jellyfish abundant in Sinclair Inlet.



### Suspended sediment:

Many places with suspended sediment in the nearshore. Nooksack River and Stillaguamish River both carrying very brown, sediment-rich water into adjacent bays.



### Visible blooms:

Visible brown-red bloom in southern Hood Canal.



### Debris:

Large woody debris in Port Susan and in the Straits.



# Aerial navigation guide

Date: 2/3/2021

Click on numbers

## Flight Observations

South Sound: low clouds; north of Tacoma: broken ceiling, sunny.

## Contributed observations

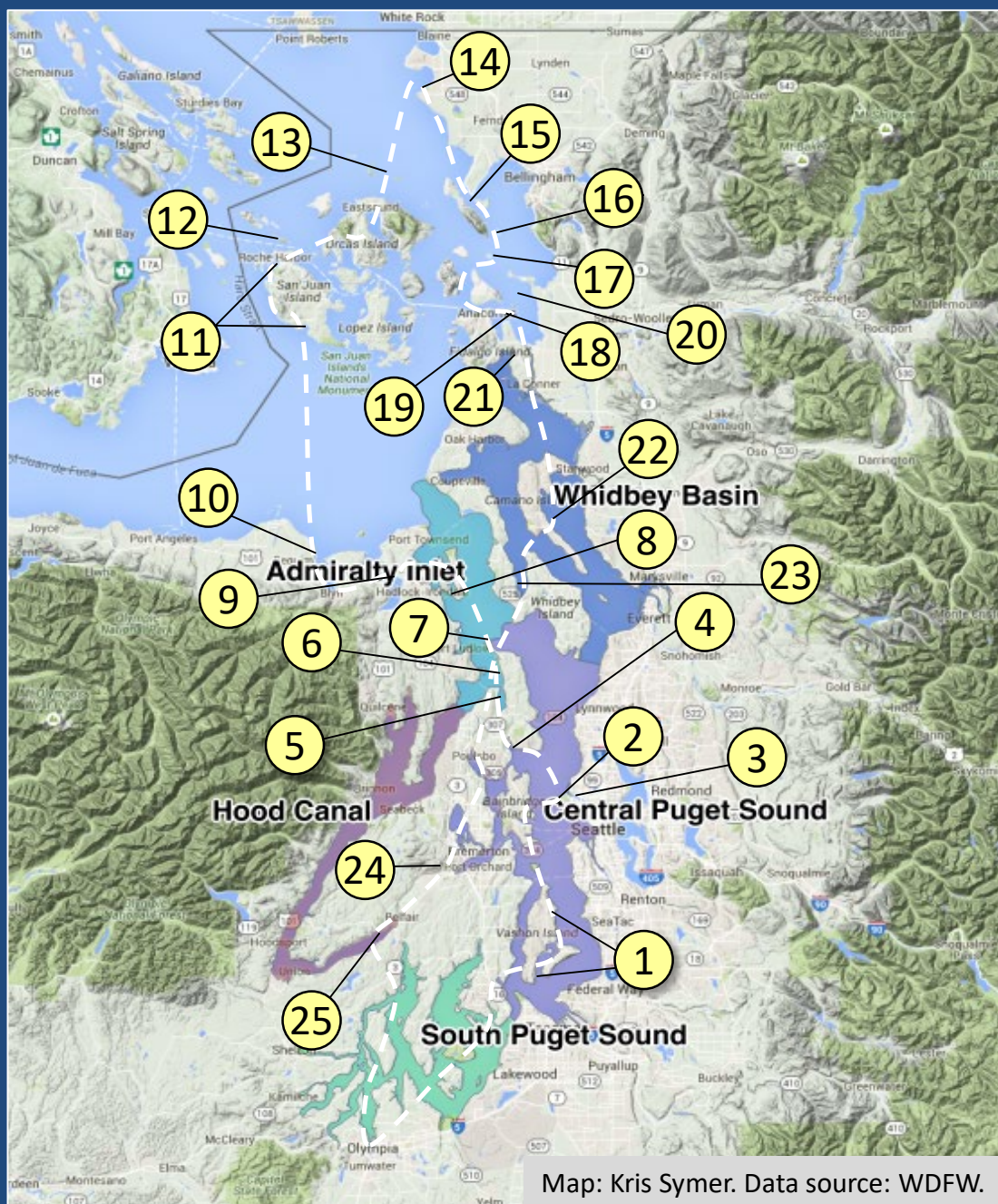


26

27

Tide data from 2-3-2021 (Seattle):

Time	Pred (ft)	High/Low
01:47 AM	8.03	H
07:52 AM	1.92	L
03:10 PM	11.25	H
09:39 PM	3.82	L



Map: Kris Symer. Data source: WDFW.



Summary

Critters &amp; divers

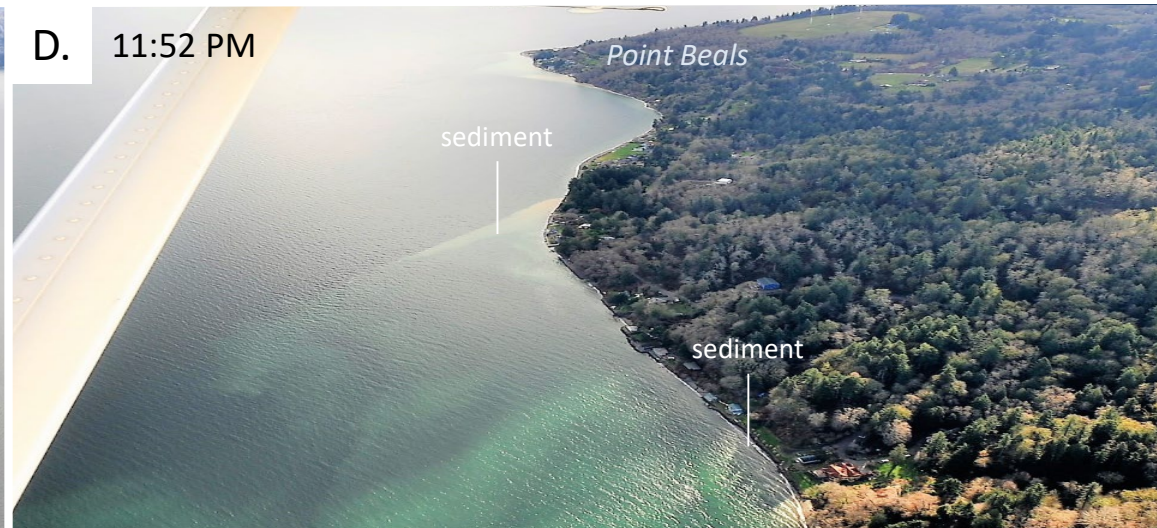
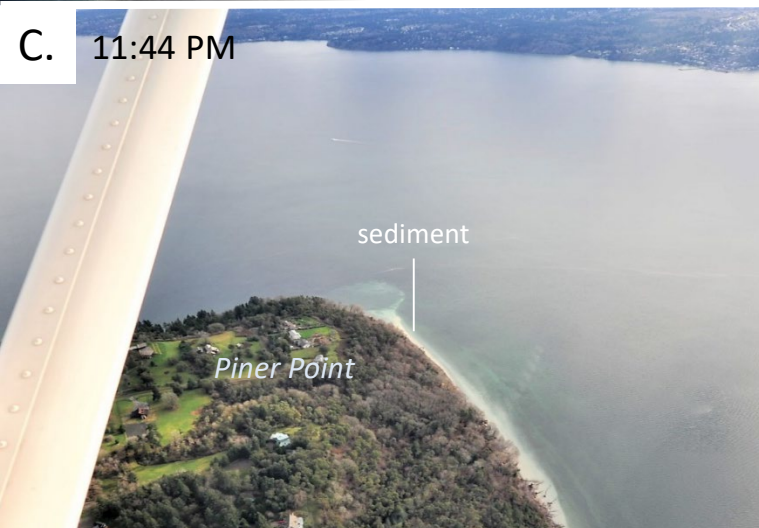
Climate &amp; streams

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*Suspended sediment near the shoreline in many places around Vashon Island.*  
 Location: A. Neil Point, B. near Northeast Vashon Park, C. Piner Point, D. north of Point Beals.



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*Bainbridge Island*

sediment

*West Point*

sediment

sediment

*Suspended sediment near the shoreline extending into Central Sound.*

Location: West Point (Central Sound), 12:01 PM





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*Salmon Bay is an urban waterway. On 1/19/2021 large amounts of foam were seen past the Ballard Locks.  
Location: Salmon Bay Seattle (Central Sound), 12:01 PM*



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*Brown boggy water, likely from a nearby creek of the same color.*  
Location: Indianola (Central Sound), 12:07 PM



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A. River plume with brown boggy water. B. Suspended sediment near the shoreline in many places.

Location: Port Gamble (Hood Canal), 12:11 PM



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*Front with organic material and suspended sediment near the shoreline.  
Location: Across from Hood Canal Bridge (Hood Canal), 12:14 PM*



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*Suspended sediment near the shoreline extending into Admiralty Reach.*  
Location: Twin Spits, northern end of Kitsap Peninsula (Central Sound), 12:17 PM



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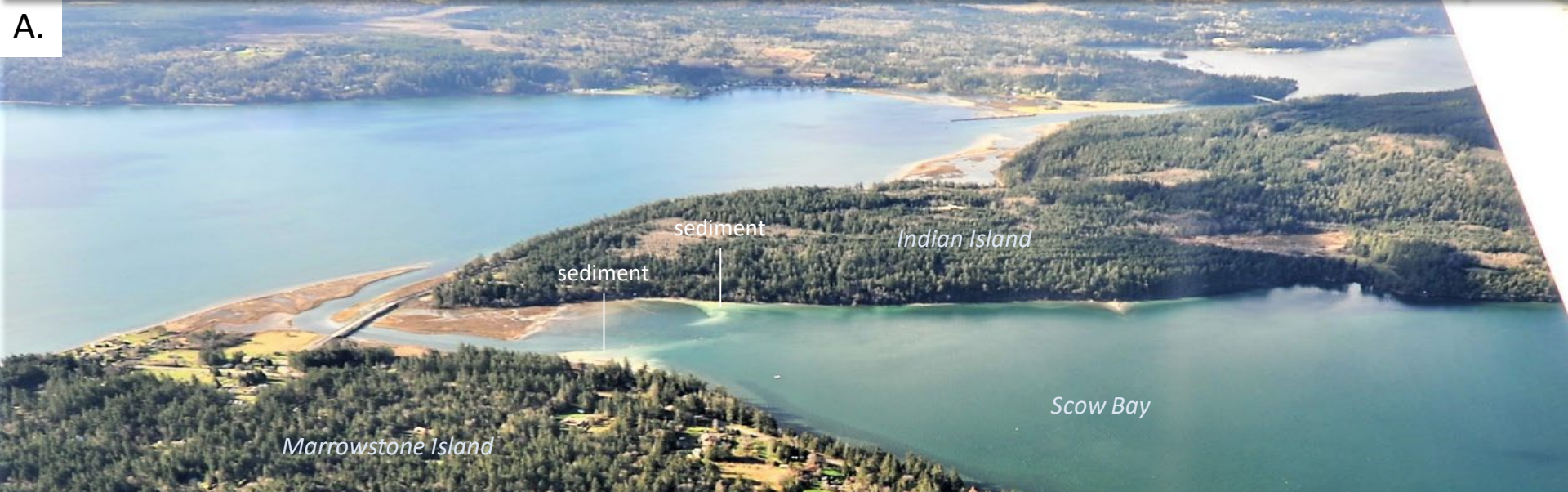
Combined factors

Marine water

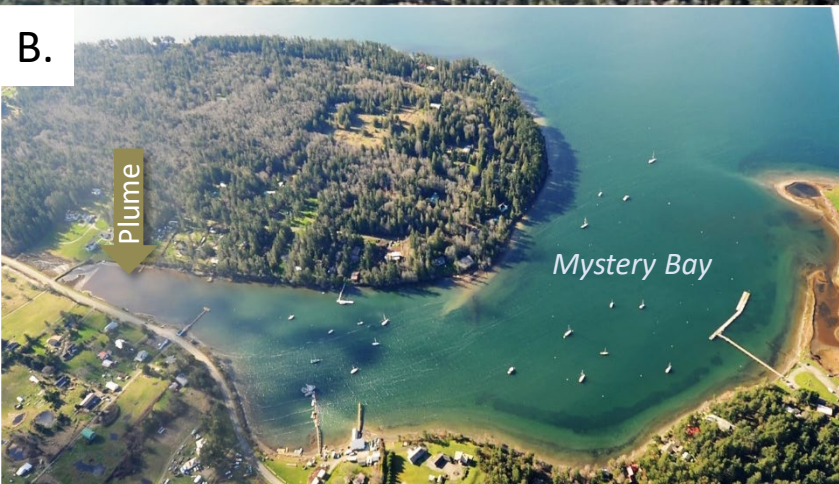
Aerial photos

Data

A.



B.



A. Two tidal eddies visible by suspended sediment coming from shore. B. A plume of boggy creek water.

Location: Marrowstone Island (Central Sound), 12:21 PM



Summary

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*Suspended sediment near the shoreline extending into Discovery Bay.*

Location: Discovery Bay (North Sound), 12:29 PM



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*Entrance to Sequim Bay during outgoing tide. No blooming activity.*  
Location: Sequim Bay (North Sound), 12:35 PM





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 A. 12:55 PM
 

False Bay

Plume


 B. 12:55 PM
 

Telegraph Ln

 C. 12:59 PM
 

Roche Harbor

Nelson Bay

 D. 12:59 PM
 

Mosquito Pass

Exploring new flight route over Friday Harbor. A. False Bay with B. creek. C-D. Roche Harbor.  
 Location: Friday Harbor (North Sound).



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*Exploring new flight route over Spieden Island.*  
Location: Spieden Island (North Sound), 1:03 PM



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*Strong currents between Sucia and Matia Islands visible by different water masses.*

Location: San Juan Islands (North Sound), 1:14 PM



Summary

Critters & divers

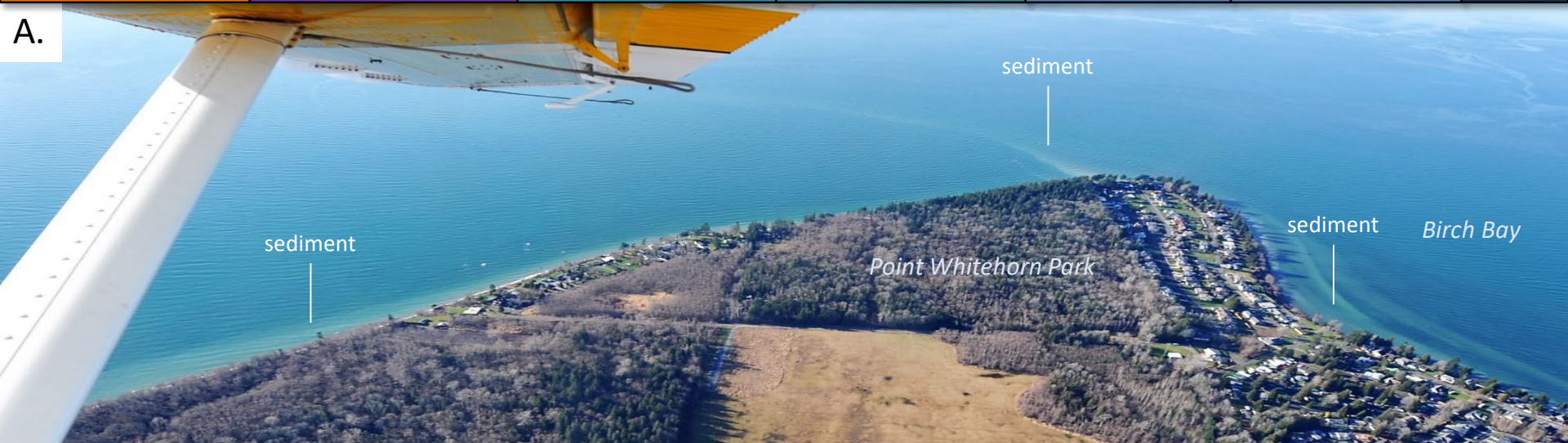
Climate & streams

Combined factors

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*Suspended sediment near the shoreline in many places near Point Whitehorn.*

Location: A. Birch Bay, B. Cherry Point Aquatic Reserve, C. Point Whitehorn (North Sound), 1:20 PM



Summary

Critters & divers

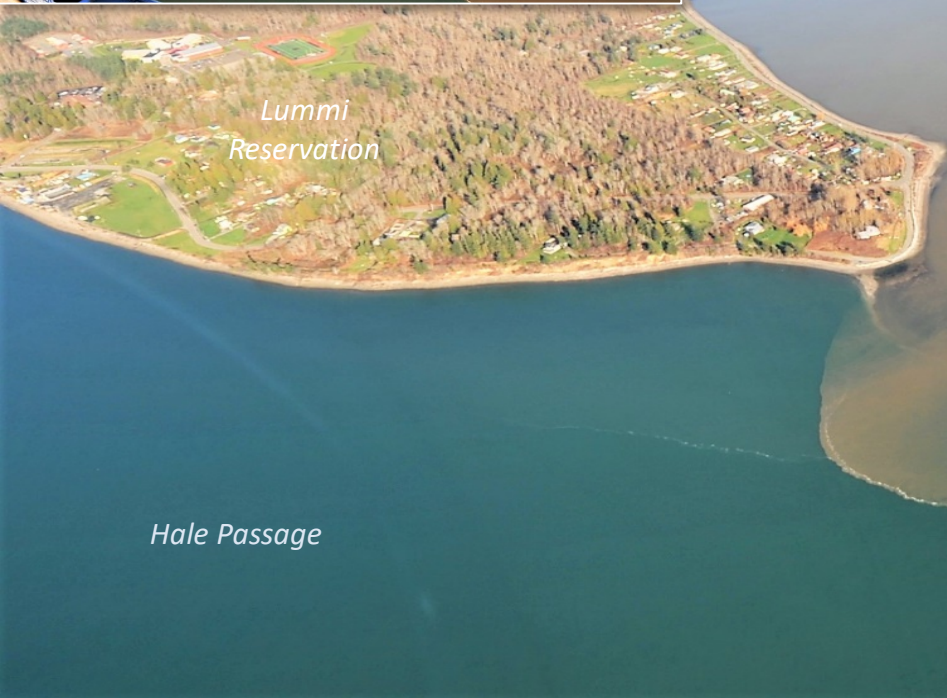
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*Nooksack River plume carrying lots of brown sediment across the portage.  
Location: Portage Bay (North Sound), 1:28 PM*



Summary

Crittters &amp; divers

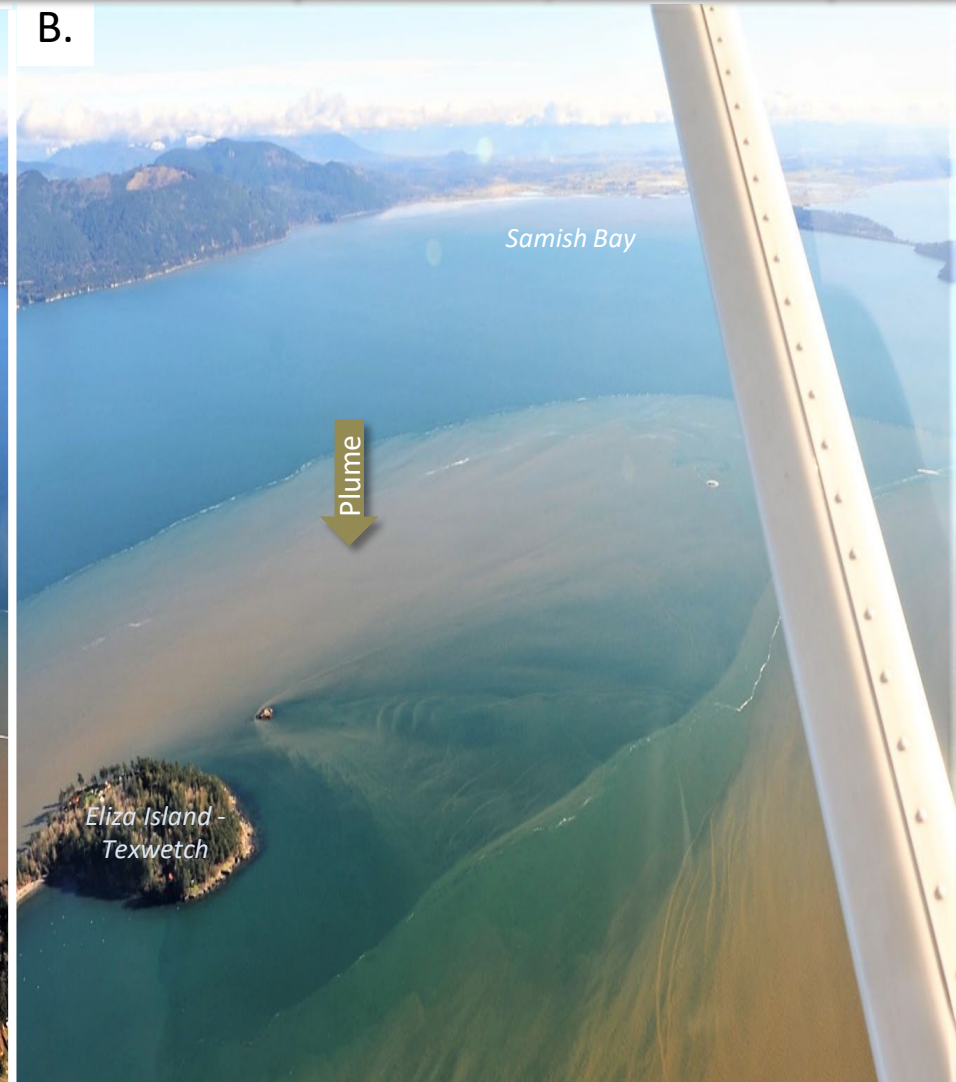
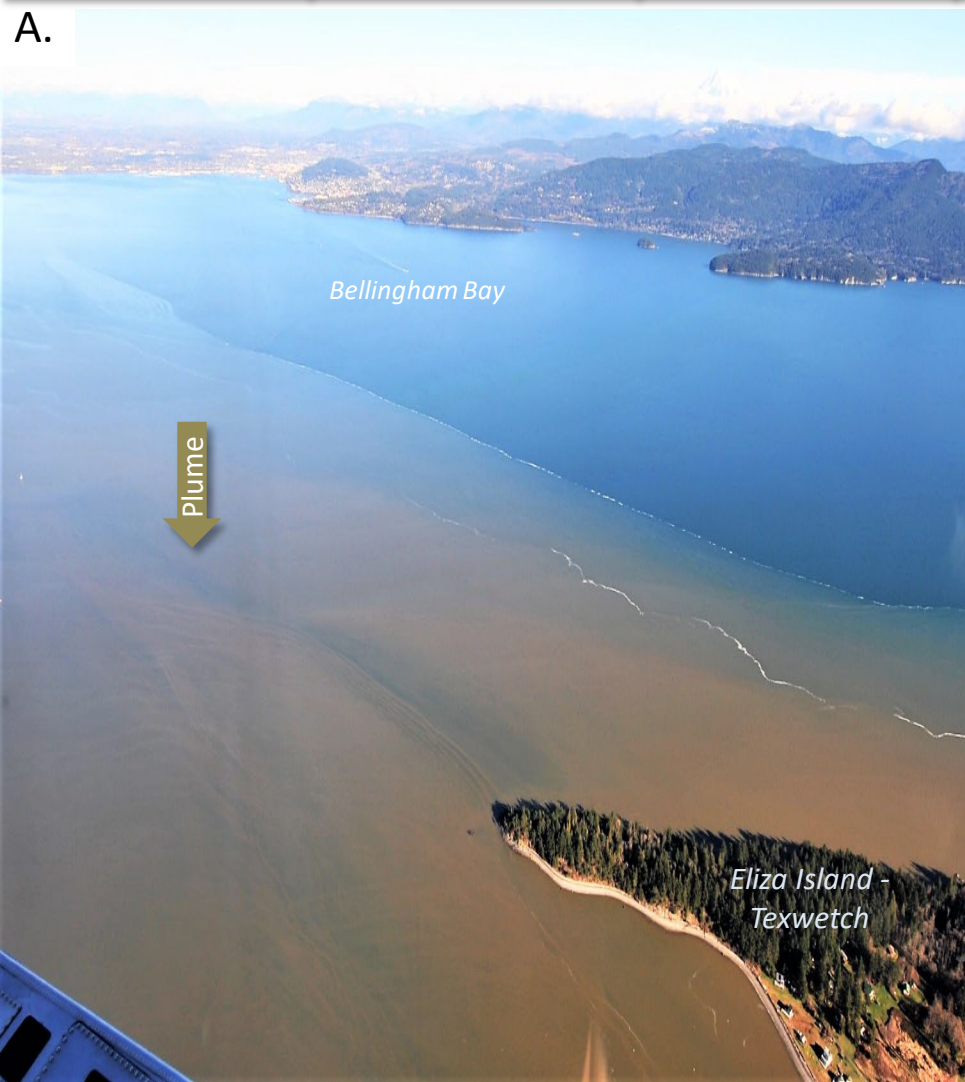
Climate &amp; streams

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*Nooksack River plume carrying lots of brown sediment across Bellingham Bay. A. looking north, B. looking south.  
Location: Eliza Island – Texwetch (North Sound), 1:30 PM*



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*Nooksack River Plume carrying lots of brown sediment south past Vendovi Island.*

Location: Vendovi Island (North Sound), 1:32 PM



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A.



B.



A. Sediment-rich water of Telegraph Slough entering Padilla Bay. B. Sediment-rich water extending into Padilla Bay.  
 Location: A. Padilla Bay, B. Fidalgo Bay (North Sound), 1:35 PM





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*A long band of sediment-rich water originating from Padilla Bay and extending into Guemes Channel.  
Location: Padilla Bay (North Sound), 1:35 PM*



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A.



A. Large flock of geese floating in open water. B. Geese landing in formation in open water. Read more [here](#)

Location: A. Padilla Bay, B. Skagit Bay (North Sound), 1:35 PM



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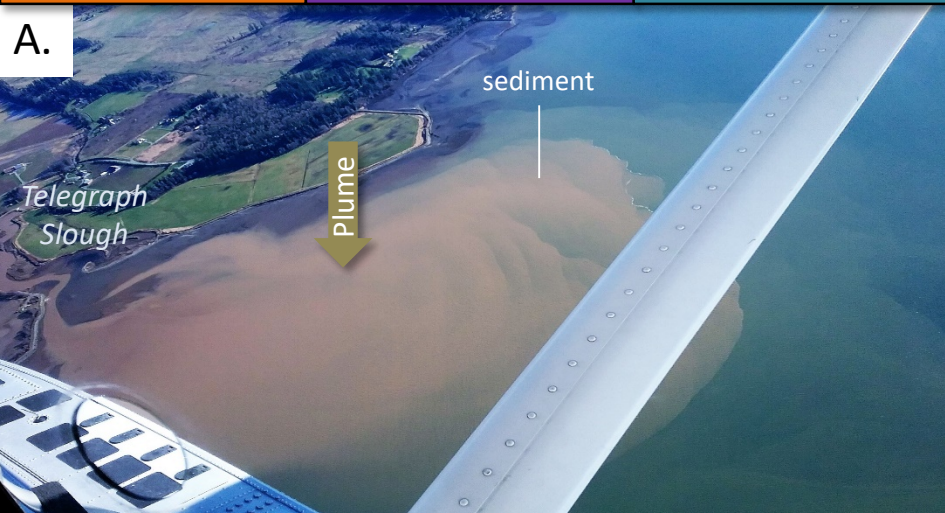
Combined factors

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A.



B.



C.



D.



*Sediment-rich water from sloughs enter A. Padilla Bay, B-C. the Swinomish Channel, and D. the Skagit River.  
 Location: North and south of La Conner (North Sound), 1:38 PM*



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*Sediment-rich water of the Stillaguamish River plume carrying wood debris and logs.*  
 Location: Port Susan, Camano Island (Whidbey Basin) 1:48 PM



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*Suspended sediment near the shoreline and tidal eddies.* Location: Holmes Harbor (Whidbey Basin), 1:53 PM



*Jellyfish aggregations and early signs of phytoplankton growth. Location: Sinclair Inlet (Central Sound), 2:12 PM*



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Critters &amp; divers

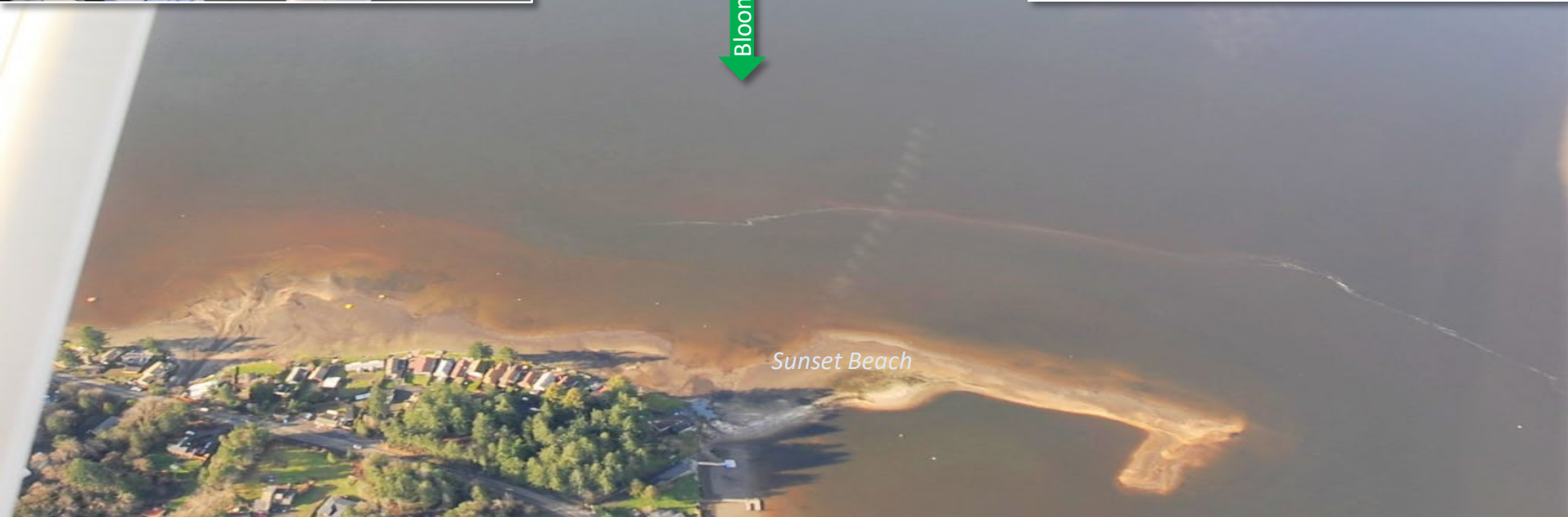
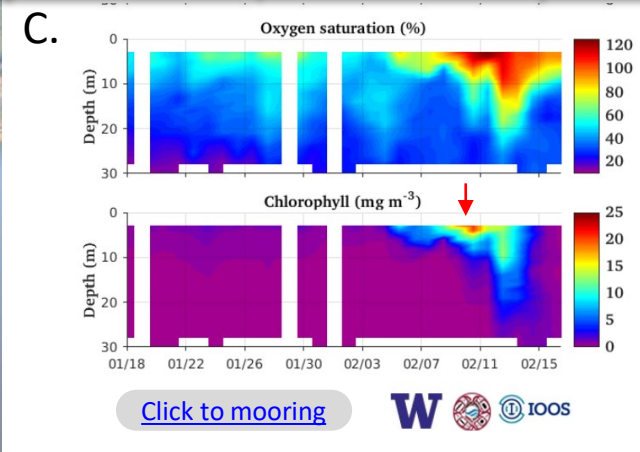
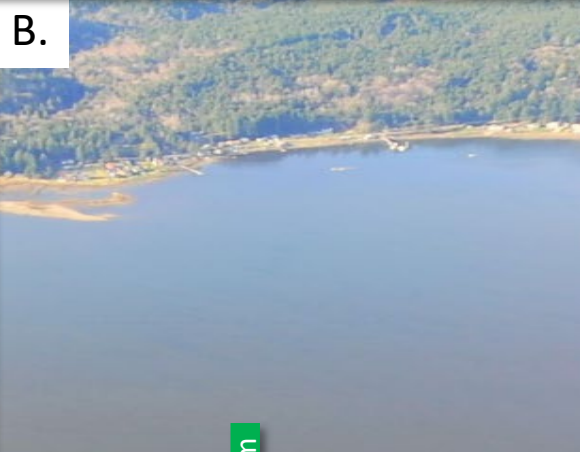
Climate &amp; streams

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A-B. Strong red-brown bloom between Twanoh and Belfair State Parks C. ORCA Twanoh mooring confirming bloom with high oxygen saturation and high Chlorophyll. Location: Sunset Beach (Hood Canal), 3:23 PM



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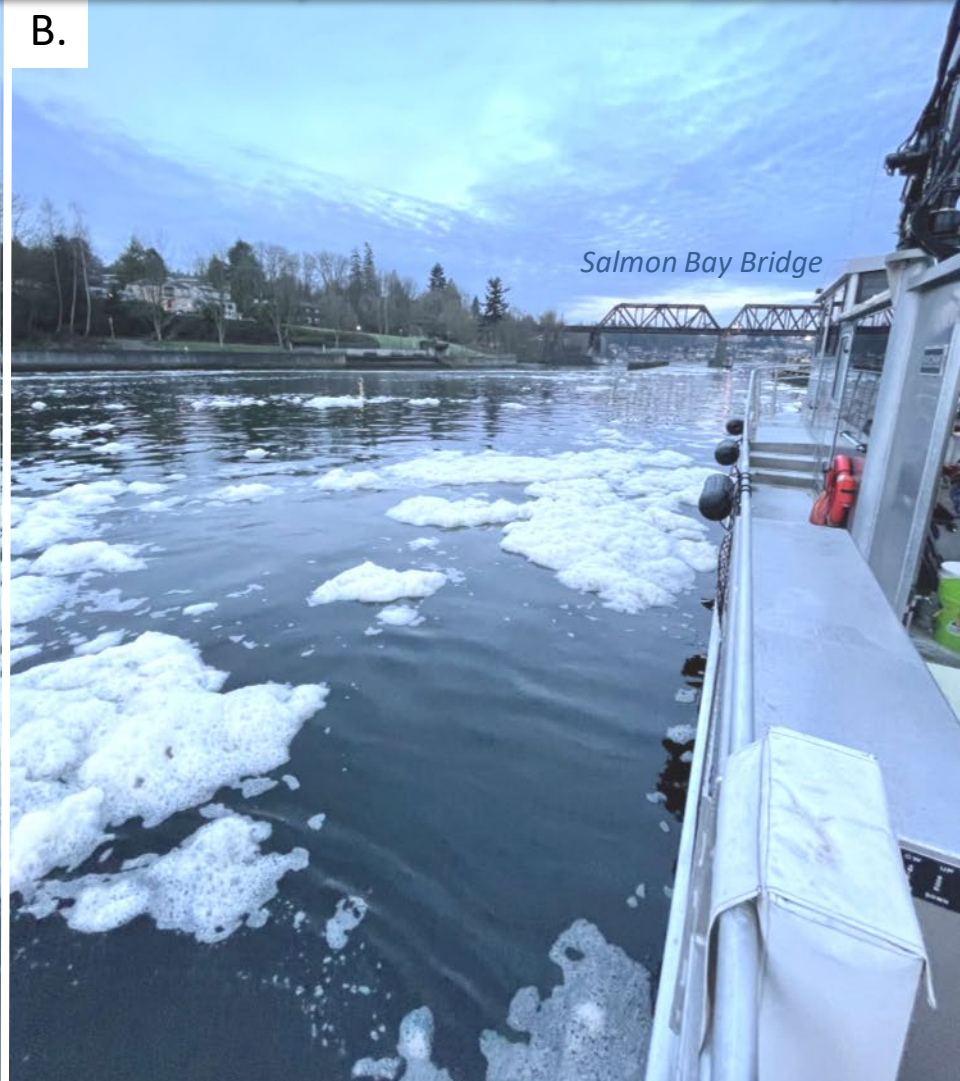
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A.



B.



1/19/2021, King County Boat crew inspecting foam past the Ballard locks. A. looking east, B. looking west.





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1/9/2021, Scott Steltzner, downtown Olympia with thousands of moon jellies.

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**Find all previous Eyes Over Puget Sound editions at the end of this document.**

**Recommended Citation (example for September 2018 edition):**

Washington State Department of Ecology. 2018. Eyes Over Puget Sound: Surface Conditions Report, September 17, 2018. Publication No. 18-03-075. Olympia, WA.  
<https://fortress.wa.gov/ecy/publications/documents/1803075.pdf>.

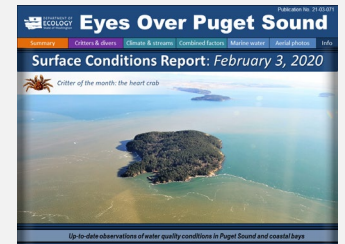


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Shannon Point Marine Lab (WWU), Swantown  
Marina, and Kenmore Air.

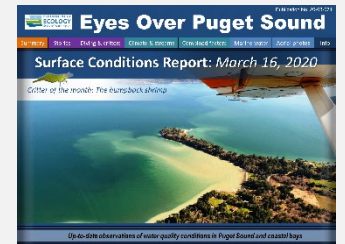
**Contact:**

Dr. Christopher Krembs  
[Christopher.Krembs@ecy.wa.gov](mailto:Christopher.Krembs@ecy.wa.gov)  
Marine Monitoring Unit  
Environmental Assessment Program  
Washington State  
Department of Ecology

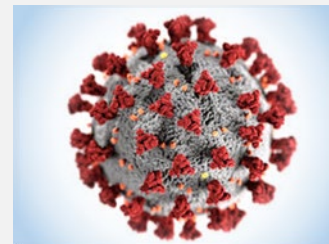
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No coverage due to COVID-19  
pandemic from April-September



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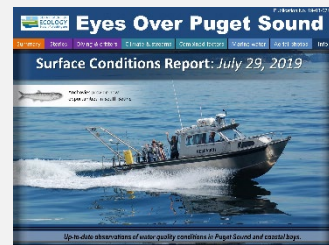
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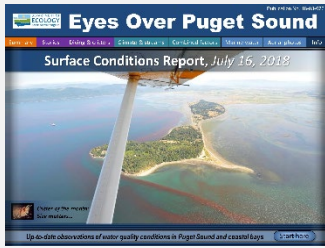
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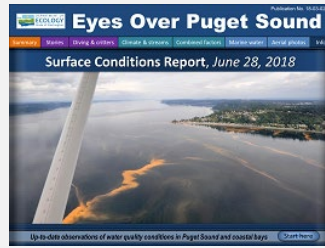
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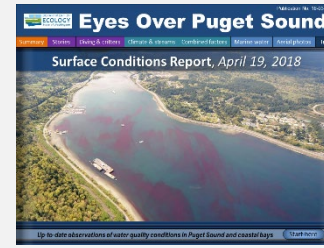
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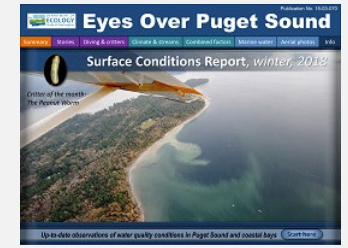
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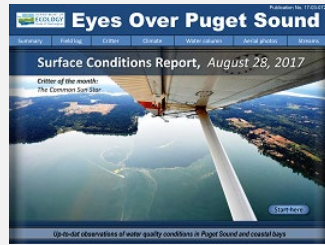
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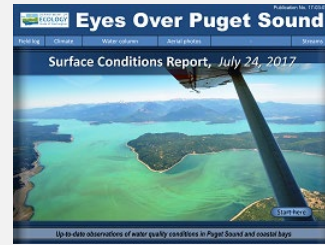
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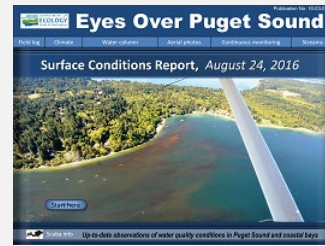
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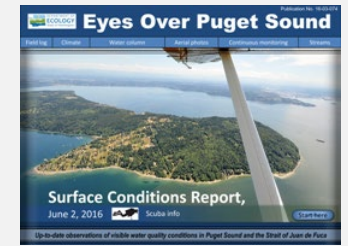
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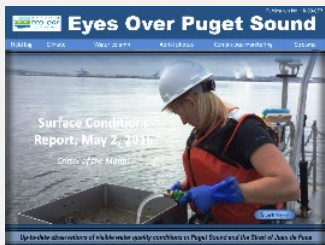
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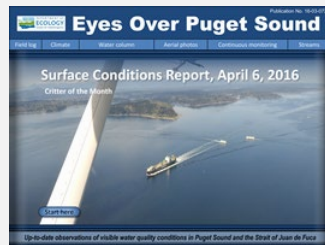
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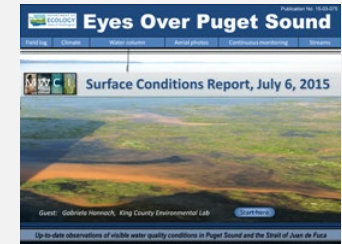
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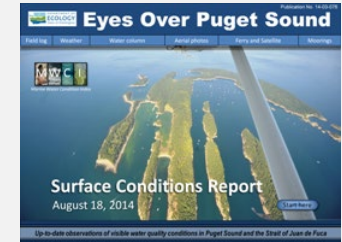
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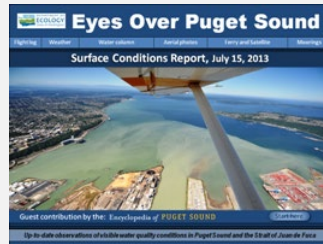
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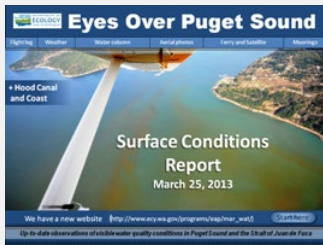
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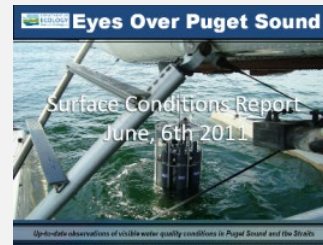
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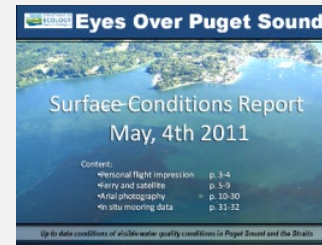
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