



Eyes Over Puget Sound

Summary

Herring & planes

Climate & streams

Combined factors

Marine water

Aerial photos

Data

Surface Conditions Report: April 1, 2021



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

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LONG-TERM MARINE MONITORING UNIT



Mike MacKay

Herring & planes, [p. 3-4](#)

Capturing these events from a plane provides valuable information.



Skip Albertson

Climate & streams, [p. 5-7](#)

After a wet winter, spring has been noticeably drier, warmer, and sunnier, and river flows are near normal levels.



Julia Bos

Water quality, [p. 8-9](#)

Salinity in coastal bays and Puget Sound is higher, especially in areas with rain-fed river sources.



Dr. Christopher Krembs

Aerial photography, [p. 10-38](#)

The spring bloom is developing, though not very pronounced, but *Noctiluca* is already visibly present in Hood Canal." Suspended sediment frequently seen near rivers and creeks, failing bluffs, and human activities. Oil sheen in Salmon Bay.



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Mike MacKay uses his airplane to support the documentation of herring spawning events in North Sound. For more information about his work contact: Mike MacKay, starsailor@fidalgo.net.



Explore aerial observations of herring spawn events in Whatcom County 2015 – 2021 by Mike MacKay



Summary

Herring & planes

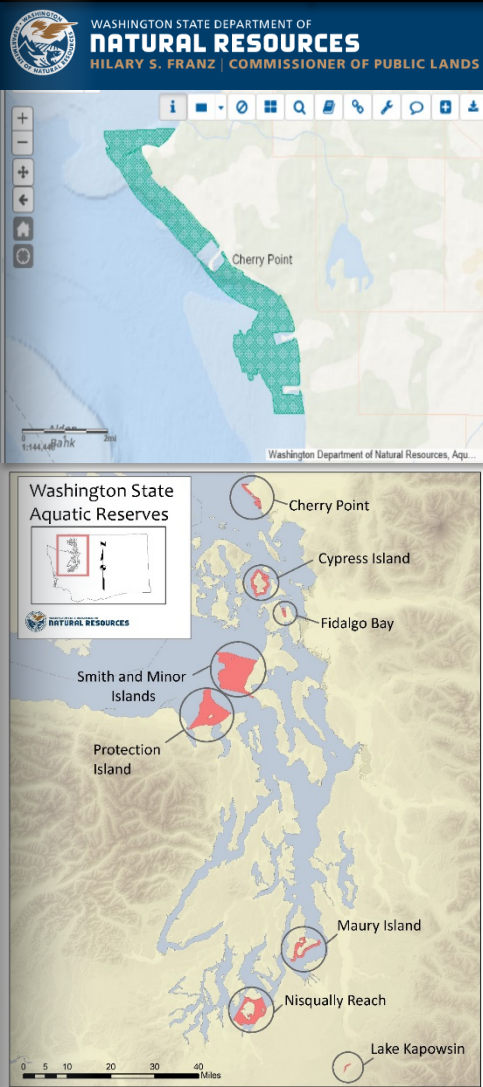
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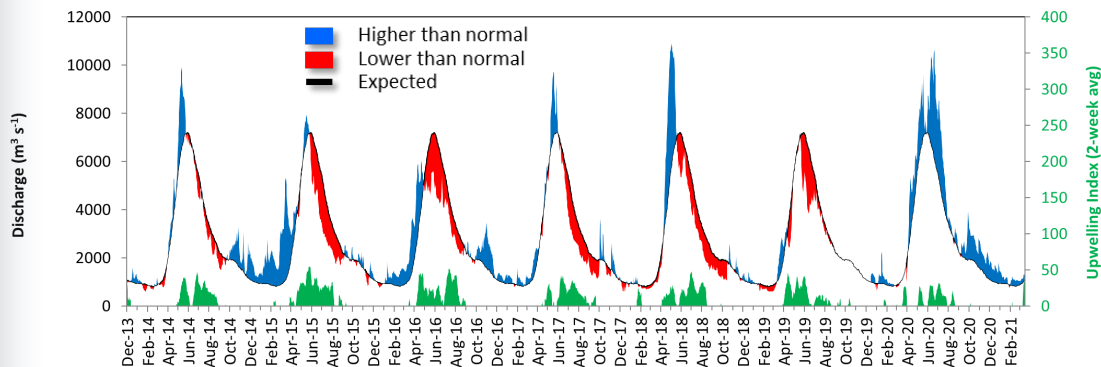
Data



In 2000, the state Department of Natural Resources created the Cherry Point Aquatic Reserve to “protect the significant environmental resource” of the area — including herring.

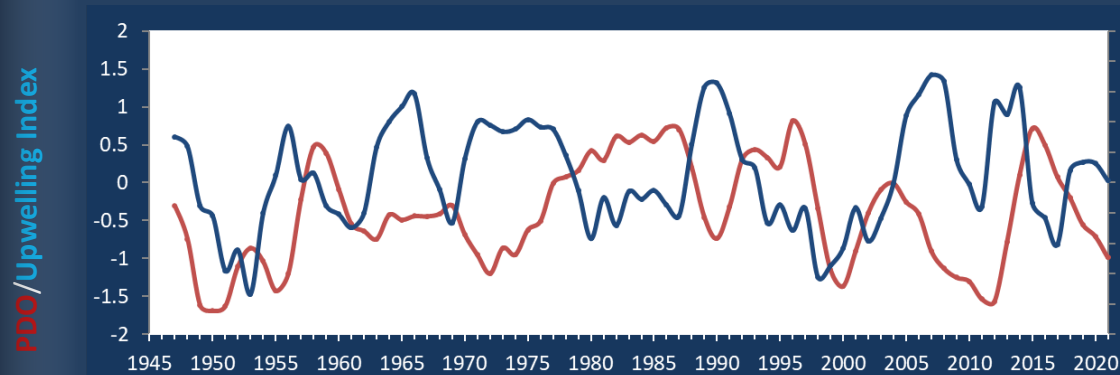
Historically, the peaks of coastal upwelling and the [freshet](#) are in sync.

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 flows normalize after high flows in 2020 and winter 2021.

Three-year running average of PDO and Upwelling Indices



How do ocean boundary conditions affect the quality of water the Salish Sea exchanges with the ocean?
 Water has gradually cooled (PDO).
 Upwelling (Upwelling Index anomaly) is at expected level.

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



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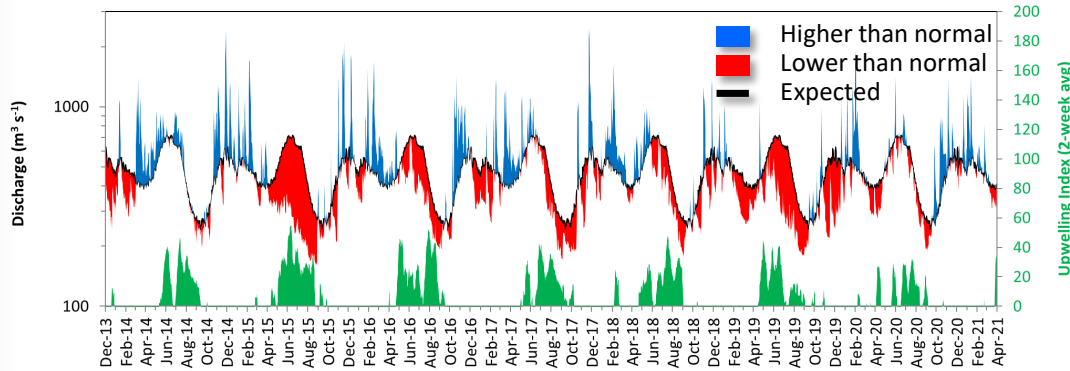
Marine water

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

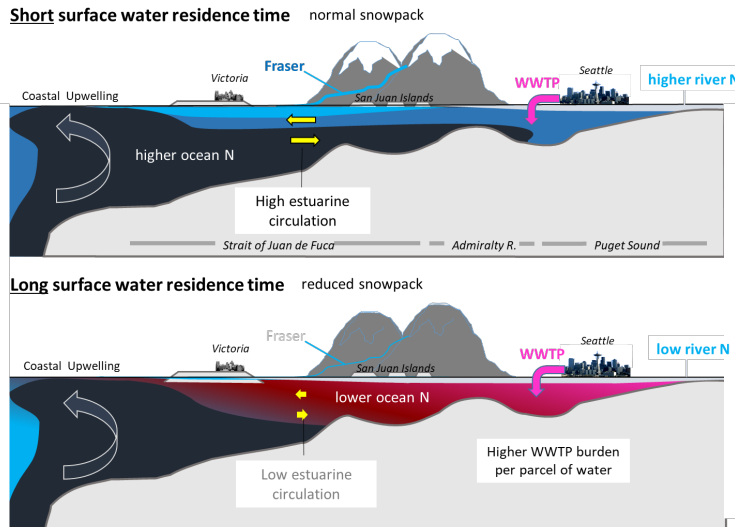
Skagit River (at midnight USGS)



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.

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.

Conditions leading up to April:

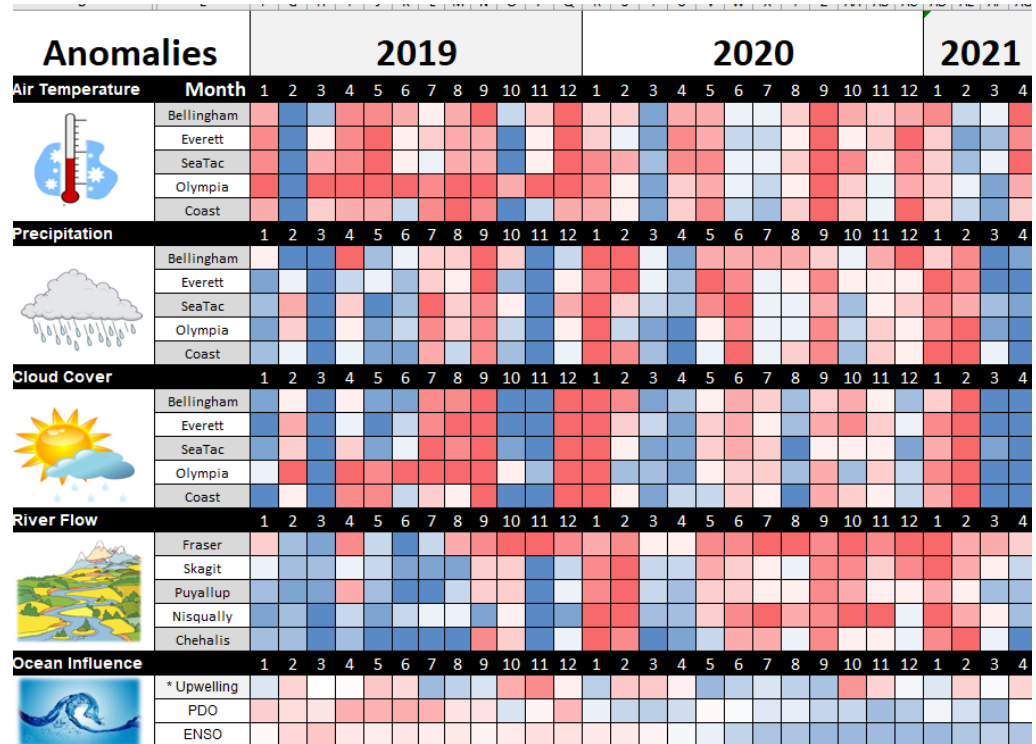
Air temperatures were generally warmer this winter, but February and March were cold.

Precipitation has been below normal in March and April, an abrupt change from January and February.

Cloud cover has been low in March and April.

River flows have been higher than normal but are returning to normal.

Downwelling was less pronounced in February. PDO is lower and La Niña remains.



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

higher expected lower

No data



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Marine water conditions: 2021 temperature, salinity, and dissolved oxygen

Coastal Bays

T: Warmer

S: **Max Salinity**

DO: Lower

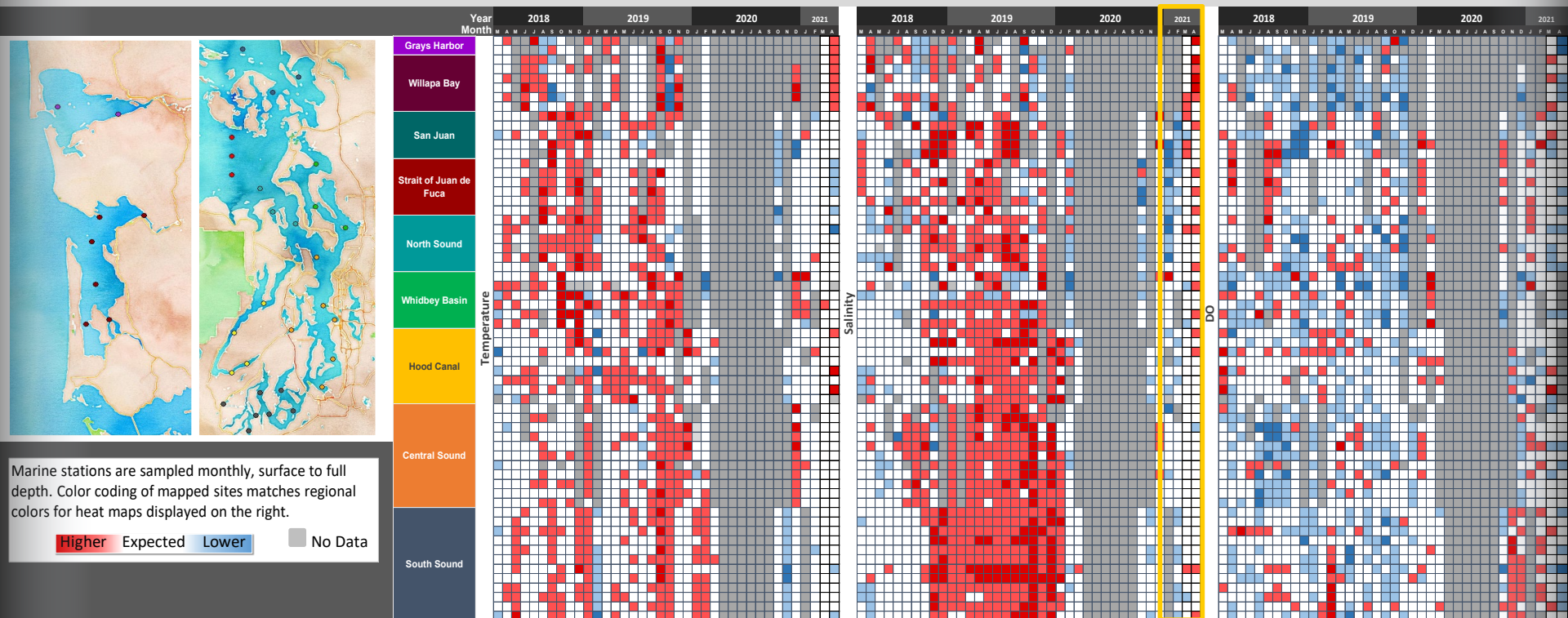
Salish Sea

T: Expected temps

S: Saltier at depth, especially Strait of JdF/San Juans

DO: Variable. April mostly expected with S. Sound lows

Record highs in January and February for both precipitation and river discharge switched to record lows in March and April. This impacted salinity in coastal bays and Puget Sound, especially areas that have rain-fed river sources.





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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) or the Marine Waters Work Group (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.



The spring bloom is developing, though not very pronounced, but *Noctiluca* is already visibly present in Hood Canal. Suspended sediment frequently seen near rivers and creeks, failing bluffs, and human activities. Oil sheen in Salmon Bay.

Start here

Wave-exposed Sunlight Beach, Whidbey Island



Restoration Point, Bainbridge I.; Geologically interesting



Mixing and fronts:

Internal waves in Saratoga Passage, mixing near Sucia and Matia Islands.



Jellyfish and fish:

Small but numerous patches of jellyfish in Budd Inlet, some patches in Eld Inlet and Sinclair Inlet.



Suspended sediment:

Nearshore in Port Madison, Whidbey Island, Port Susan, Swinomish Canal, Joe Leary Slough, Nooksack River delta, Sucia and Matia Islands, Hood Canal, Squaxin Island.



Visible blooms:

Noctiluca blooming in southern Hood Canal. Many places with phytoplankton discoloration. A small red-brown bloom in Budd Inlet.



Debris:

Organic debris not very abundant.



Aerial navigation guide

Date: 4-1-2021

Click on numbers

Flight Observations

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

Contribute observations

iNaturalist



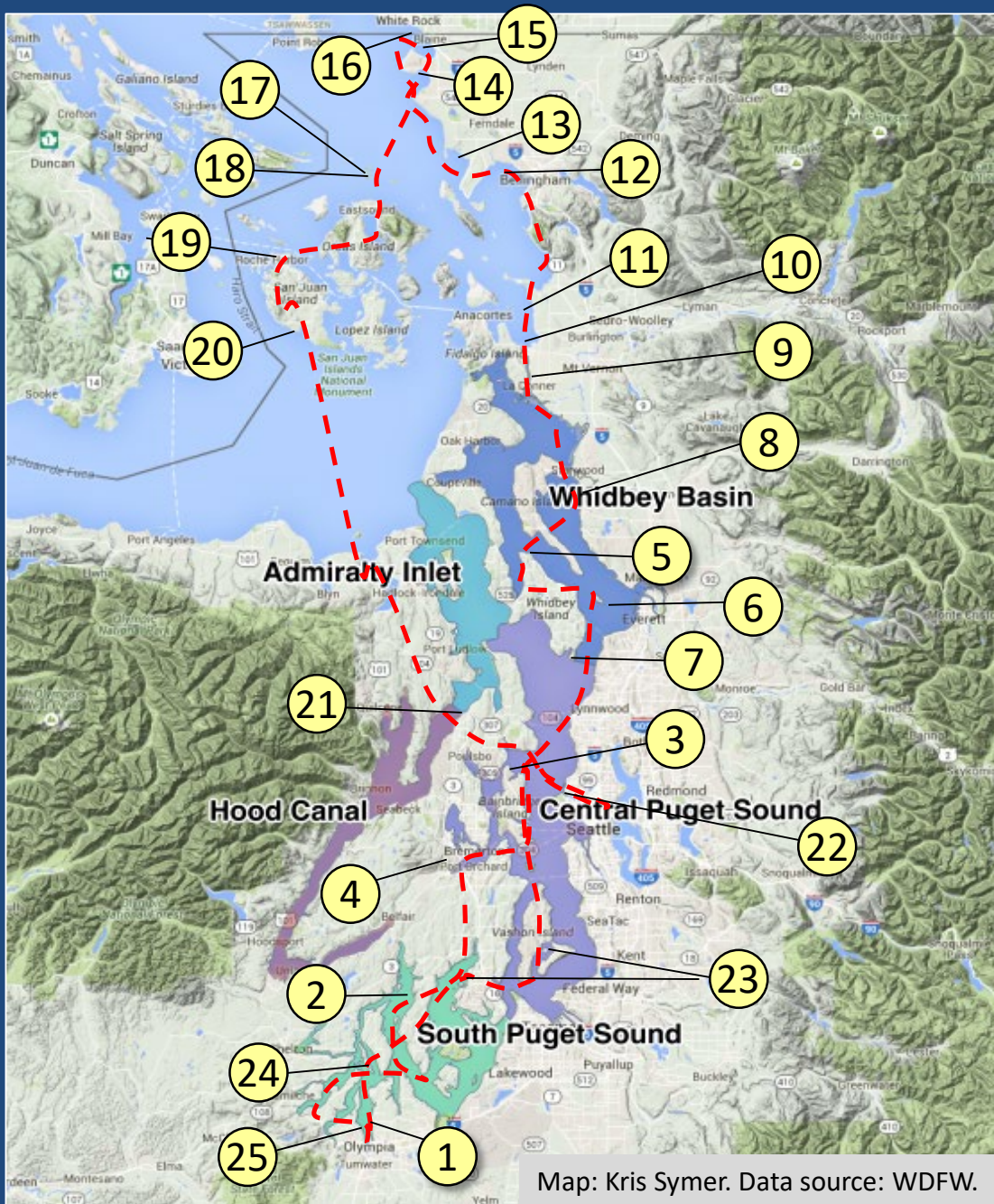
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SCIENCES



NATIONAL
GEOGRAPHIC

Tide data from 4-1-2021 (Seattle):

| Time | Pred (ft) | High/Low |
|----------|-----------|----------|
| 02:02 AM | 4.73 | L |
| 07:43 AM | 11.71 | H |
| 02:33 PM | -1.39 | L |
| 09:28 PM | 11.07 | H |





Connect aerial observation with data from ORCA moorings



Nick Michel-Hart,
John Mickett, UW/APL.



[NANOOS NVS Data Explorer](#)

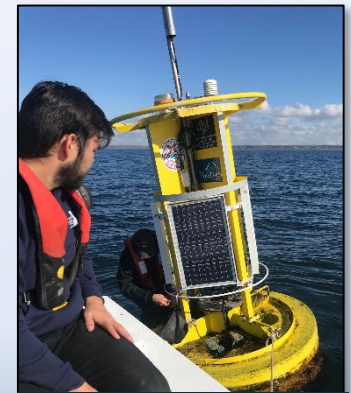
View products by mooring

Puget Sound

- ① [Carr Inlet](#)
- ② [Dabob Bay](#)
- ③ [Hoodspout](#)
- ④ [Hansville](#)
- ⑤ [Point Wells](#)
- ⑥ [Twanoh](#)

Salish Sea

- ⑦ [Bellingham Bay](#)



Thayne Yazzie, NWIC,
Robert Daniels, UW/APL

Summary

Herring & planes

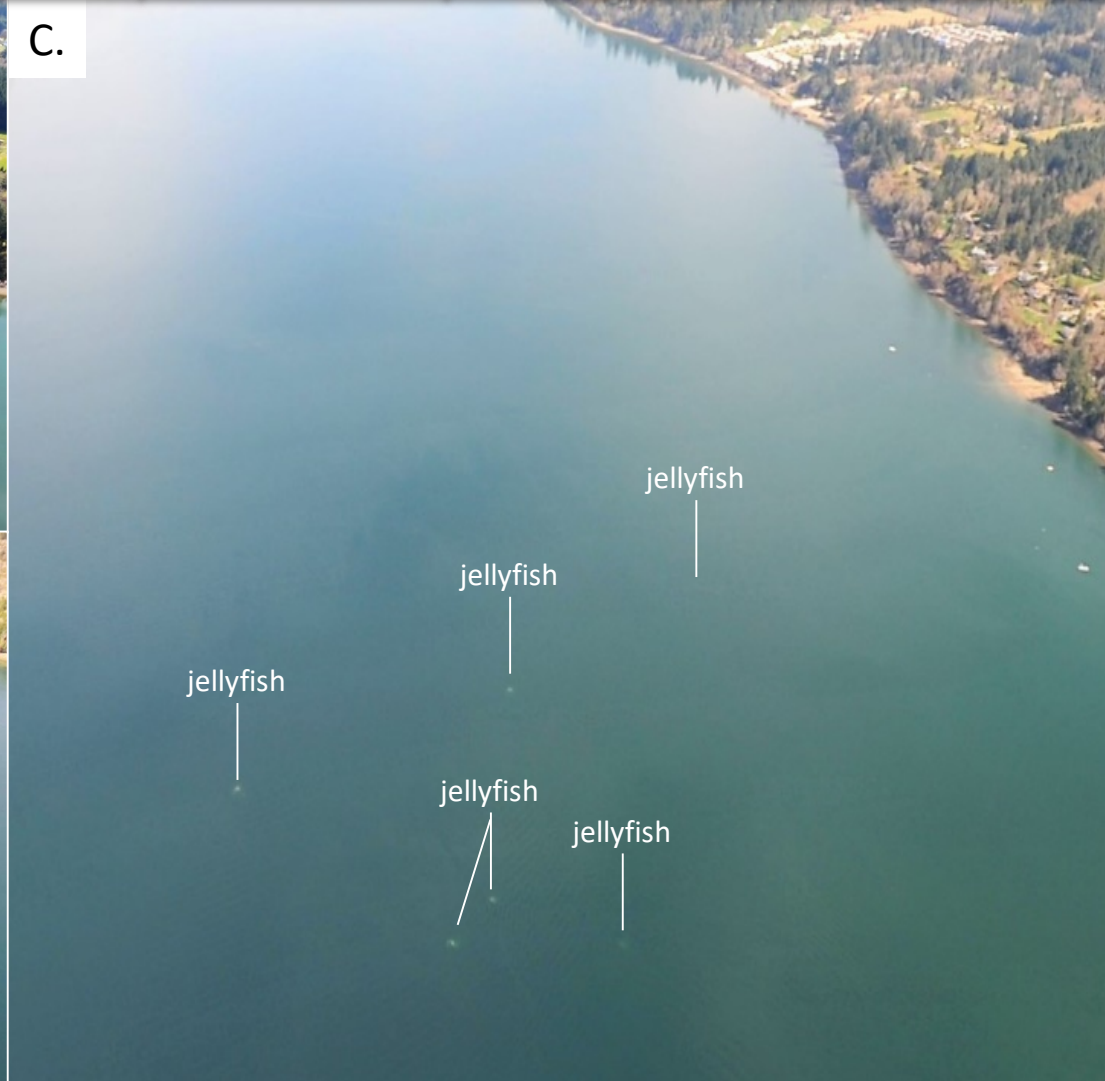
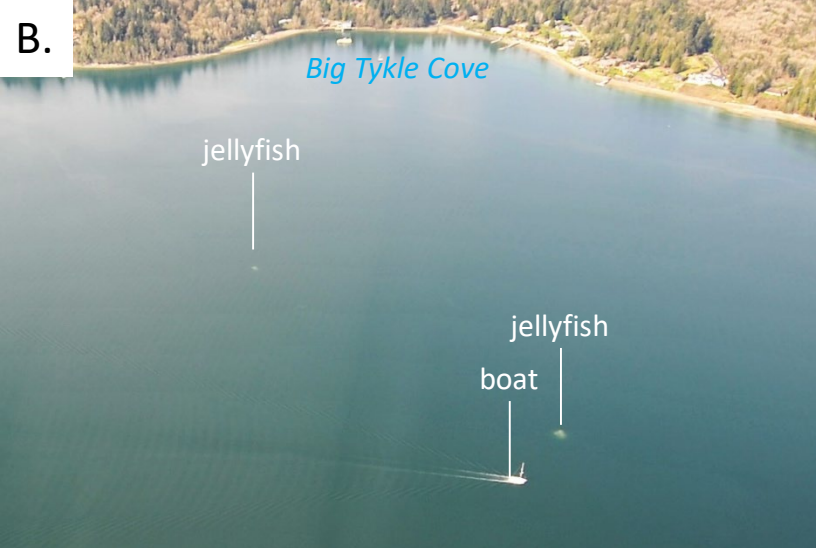
Climate & streams

Combined factors

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A. Organic material patch. B and C. small but numerous patches of jellyfish on west (B) and east side of Inlet.
Location: Budd Inlet (South Sound), 11:57 AM



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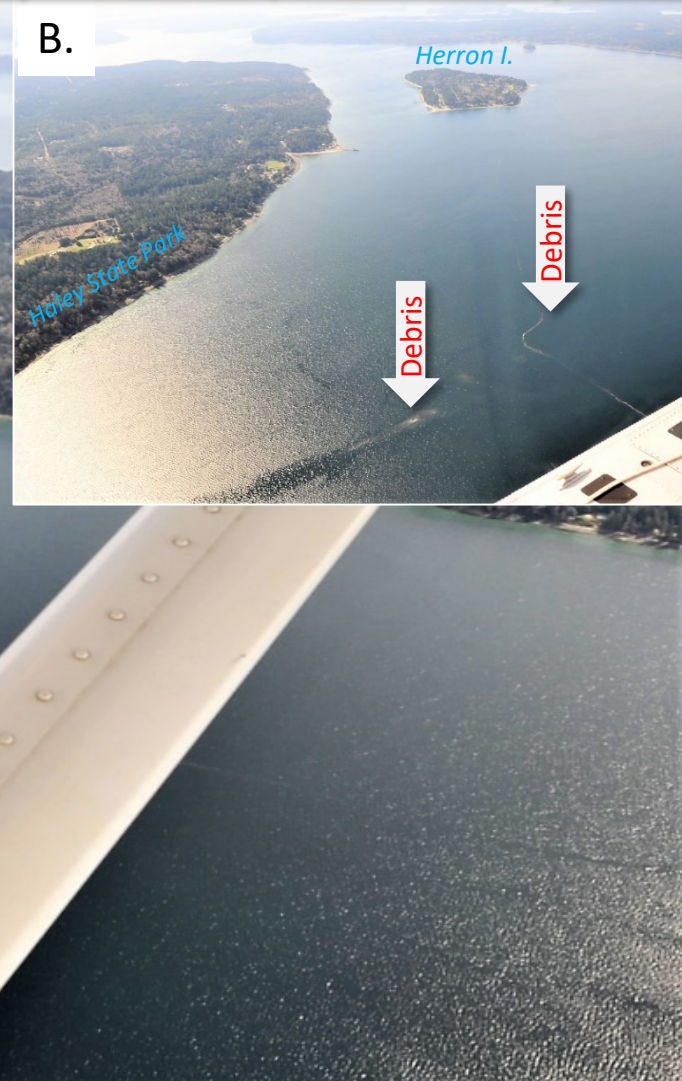
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A.



B.



*Front with organic debris accumulations and big patch of organic material.
Location: Off Haley State Park, Case Inlet (South Sound), 12:25 PM*



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Suspended sediment nearshore.

Location: West Port Madison Nature Reserve, Port Madison (Central Sound), 12:47 PM



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Patches of jellyfish. Location: Sinclair Inlet (Central Sound), 12:35 PM



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Internal waves running northward (right) in Saratoga Passage. The interaction with the surface makes them visible.
Location: Near Anderson Cave (Whidbey Basin), 1:11 PM



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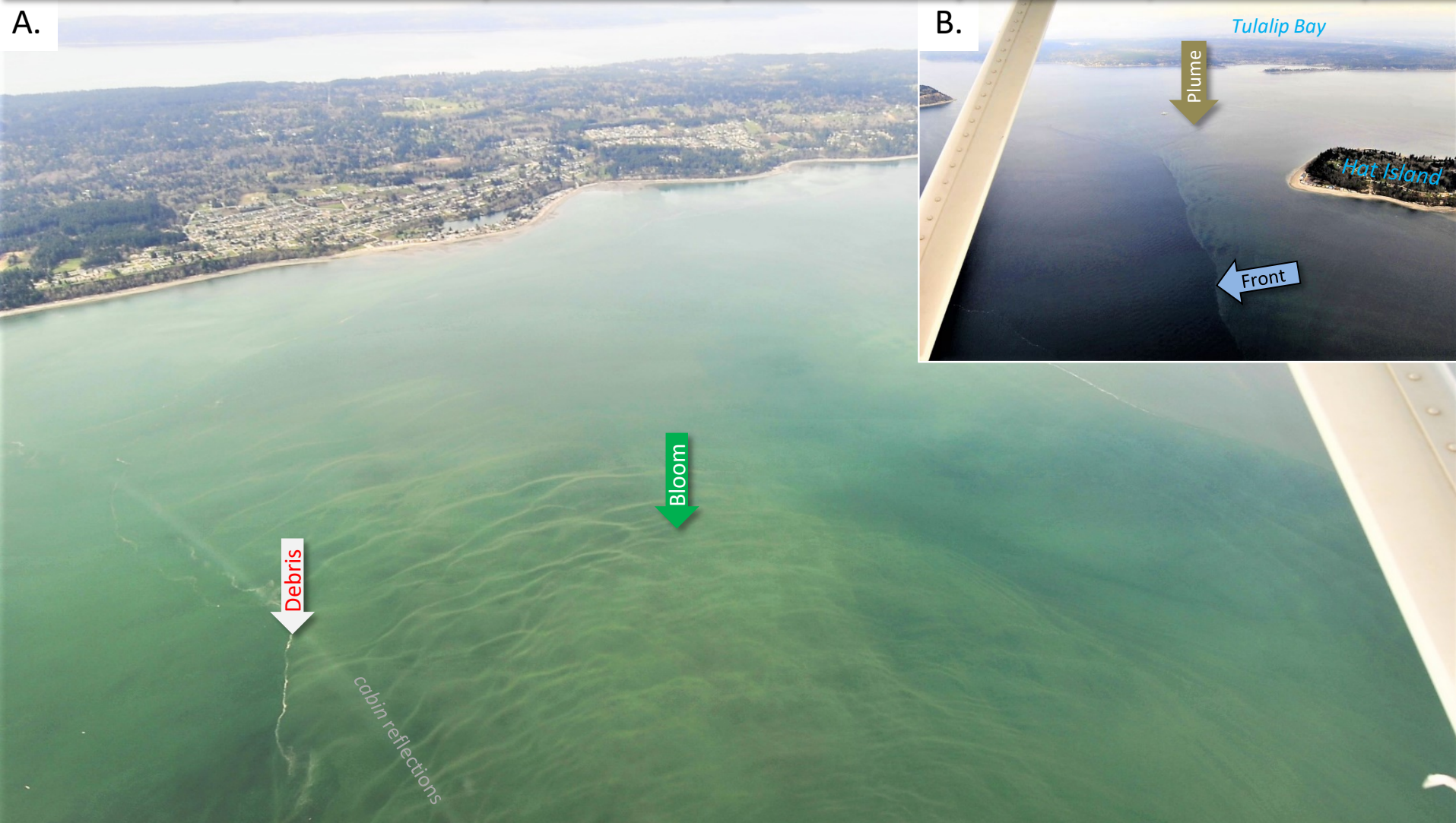
Climate & streams

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A. Stillaguamish River plume with bloom of phytoplankton. B. Water with sediment and bloom flowing from Port Susan into Possession Sound. Location: A. Saratoga Passage, B. Hat Island (Whidbey Basin), 1:02 PM



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WHIDBEY ISLAND, Wash. -- A large mudslide took out part of a steep hill on the southeastern shore of Whidbey Island on January 15, 2021. The slide was reported just north of the end of Possession Beach Walk and just missed a row of homes perched on the shoreline.

[Watch video](#) (KOMONEWS) [Watch video](#) (King5 News)



Remnants of the mudslide in January are still visible and leave a trail of sediment during the incoming tide.

Location: Whidbey Island (Central Sound), 12:58 PM



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Sediment-rich water of the Stillaguamish River flowing both into A. & B. Port Susan and C. & D. Skagit Bay.
 Location: Camano Island (Whidbey Basin), 1:16 PM



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B.



A. Rain and flooded fields carry much sediment into local drainage channels that B. enter Swinomish Channel.
 Location: La Conner (Swinomish Reservation), 1:23 PM



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Dense gold-olive green-colored diatom mats form in the shallows of the southern reaches of Padilla Bay.
Location: Padilla Bay (North Sound), 1:26 PM

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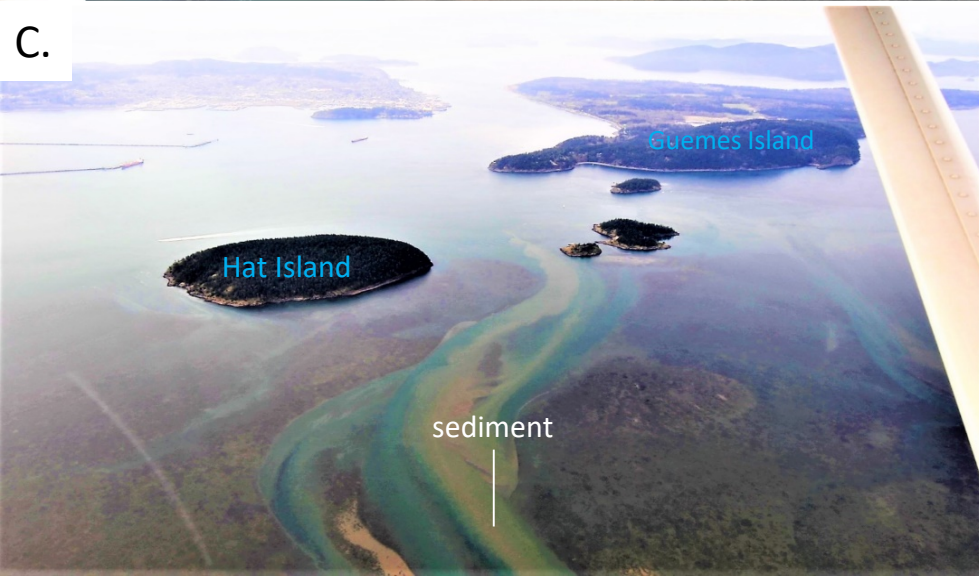
Climate & streams

Combined factors

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Eelgrass beds of Padilla Bay. A. Tidal gully carrying whitish material (likely not sediment). B. Joe Leary Slough with sediment C. traveling past Hat Island. D. Patches devoid of eelgrass. Location: Padilla Bay (North Sound), 1:27 PM



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Nooksack River plume with suspended sediment. A. From a distance. B. Close-up showing fine structure of sediment entering the bay. Location: Bellingham Bay (North Sound), 1:36 PM



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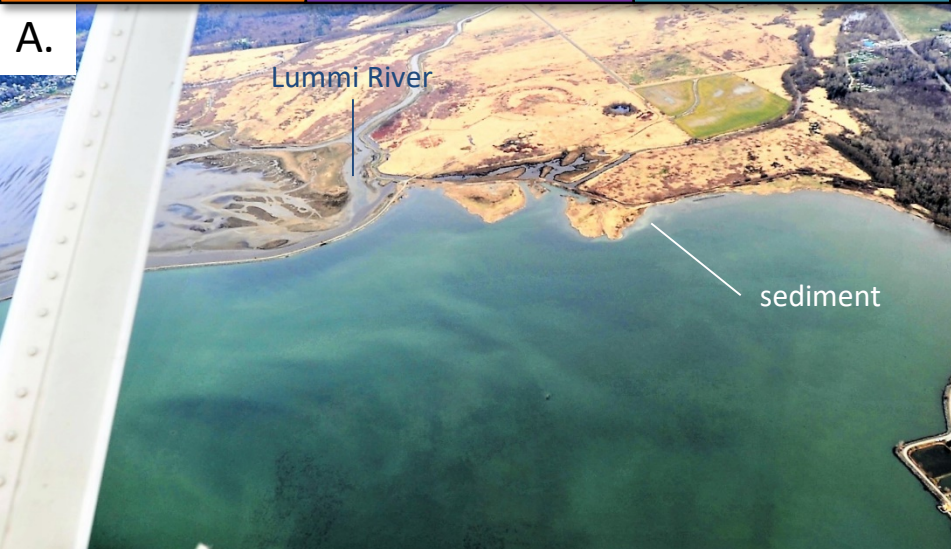
Combined factors

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A.



B.



C.



D.



A. Lummi Bay with Lummi River delta, B. diked aquatic enclosure, and C. marina. D. near-shore suspended sediment.
 Location: A.-C. Lummi Bay, D. Cherry Point (North Sound), 1:39 PM



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Birch Bay with A. suspended sediment forming over the shallows on low tide, B. front separating different water masses, C. Terrel Creek discharging brown water. Location: Birch Bay (North Sound), 1:46 PM



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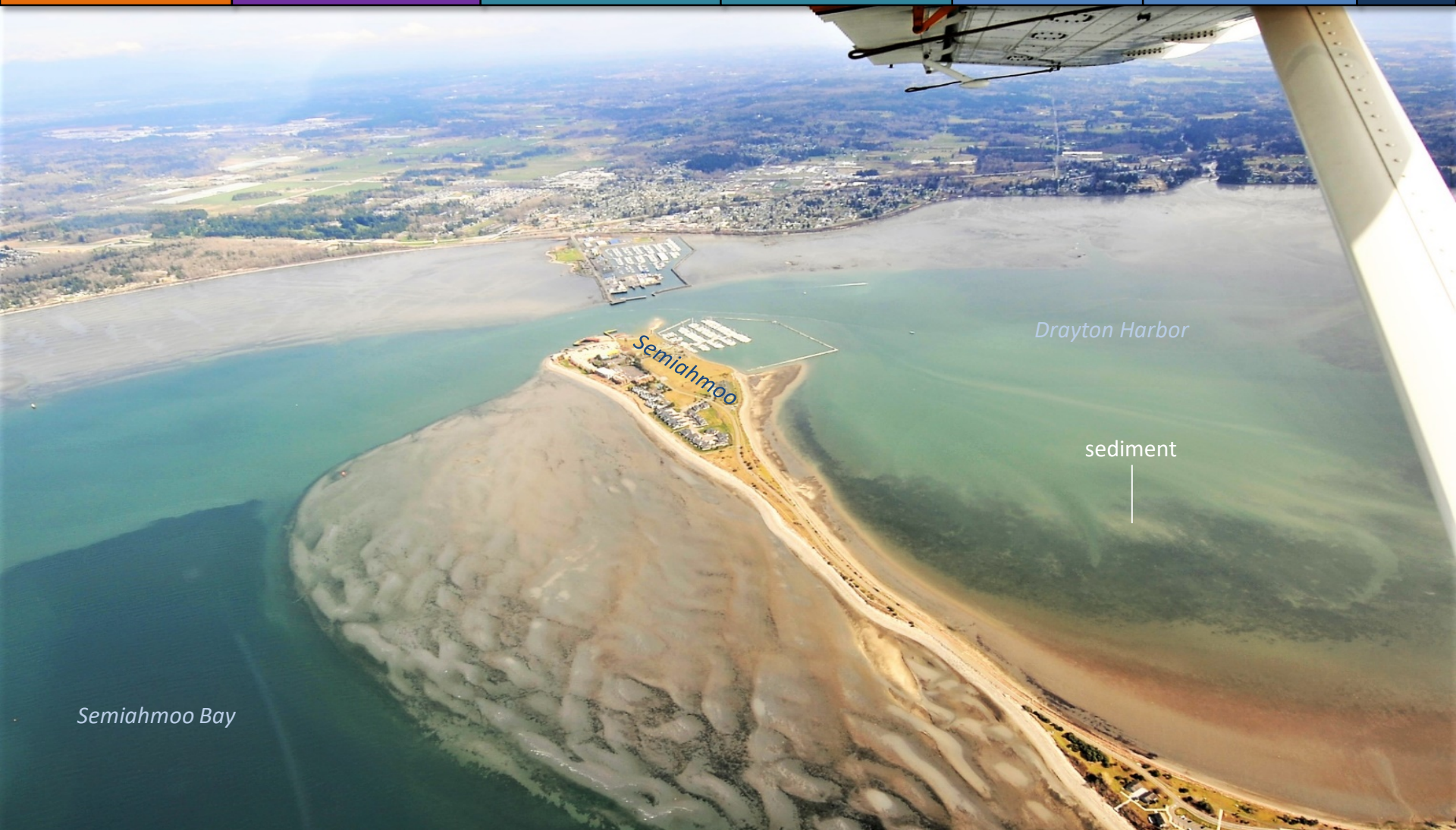
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*Seagrass in Semiahmoo Bay and suspended sediment forming in Drayton Harbor on low tide.
Location: Birch Bay (North Sound), 1:49 PM*



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Blaine Harbor at low tide.

Location: Drayton Harbor (North Sound), 1:48 PM



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*Echo Bay*

Sediment shows circulation pattern of sediment-rich water through Echo Bay.

Location: Sucia Island (San Juan Islands), 1:58 PM



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cabin reflections

Sediment shows circulation pattern of sediment-rich water mixing south of Matia Island.

Location: Matia Island (San Juan Islands), 1:58 PM



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*Beginning of a spring bloom in Westcott Bay.
Location: Westcott Bay, Roche Harbor (San Juan Island), 2:09 PM*



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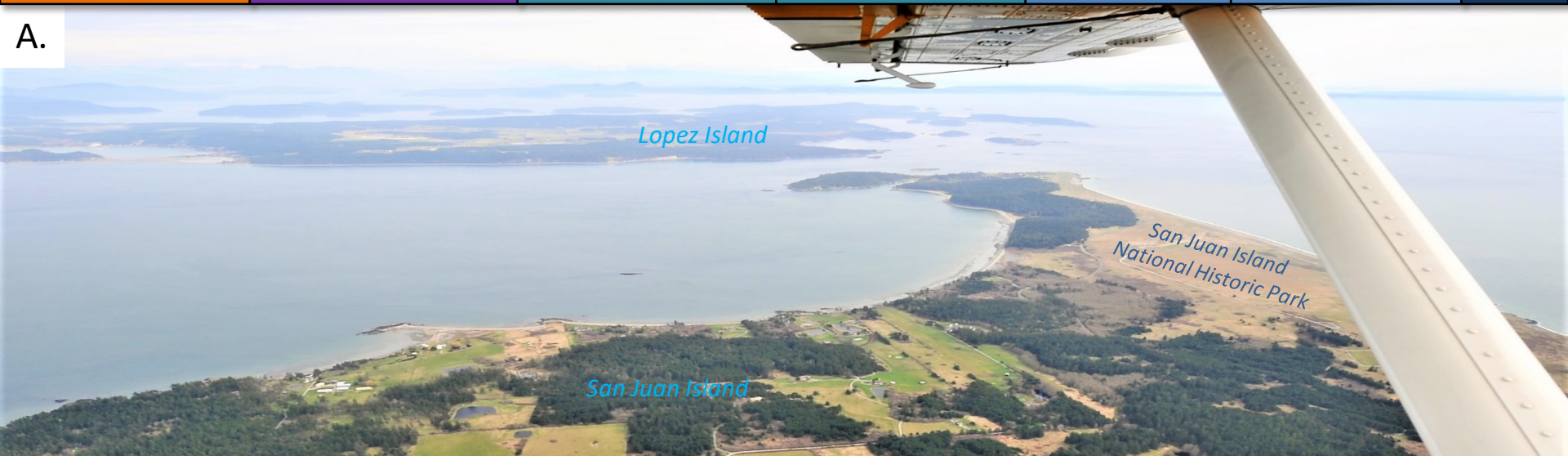
Combined factors

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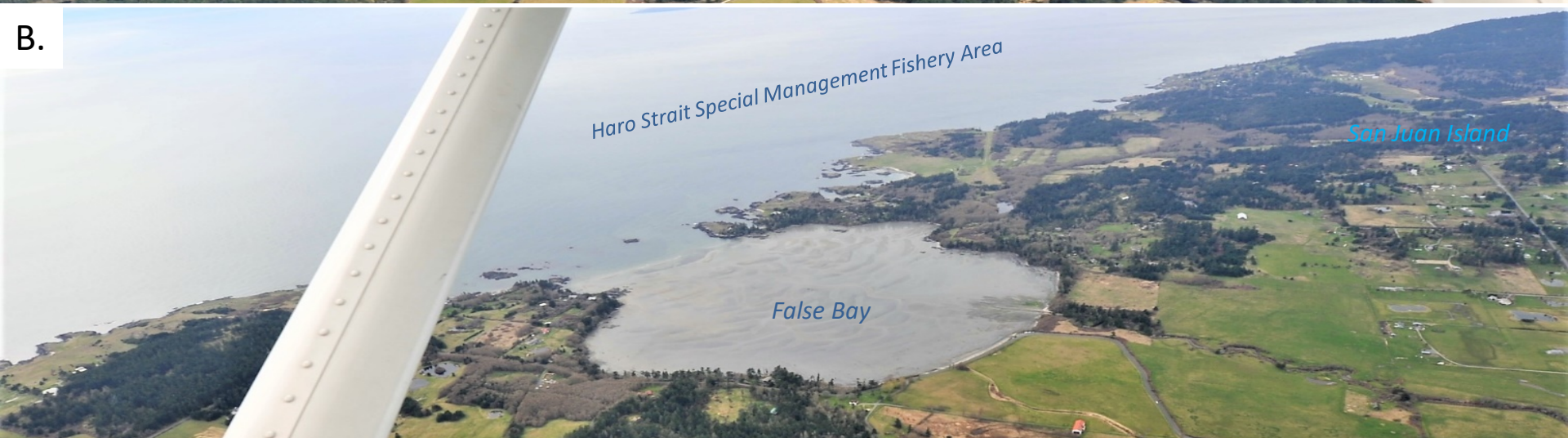
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A.



B.



A. View of San Juan Island and Lopez Island. B. View of False Bay and Haro Strait, San Juan Island.

Location: San Juan Island (San Juan Islands), 2:14 PM



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Sediment-rich water with bloom showing current pattern and mixing.

Location: Northern Hood Canal (Hood Canal), 2:42 PM



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A. Suspended sediment east of Ballard bridge. B. Oil Sheen amongst boats of North West Dock.
Location: Salmon Bay, Seattle (Central Sound) 2:51 PM



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Populated bays do not show strong blooming activity. A. Rosendale, B. Horsehead Bay, C. Gig Harbor, D. Quartermaster Harbor. Location: Southern Kitsap Peninsula and Vashon Island (South and Central Sound), 3:32 PM

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Suspended sediment nearshore, likely in association with human activity.

Location: Squaxin Island (South Sound), 3:42 PM



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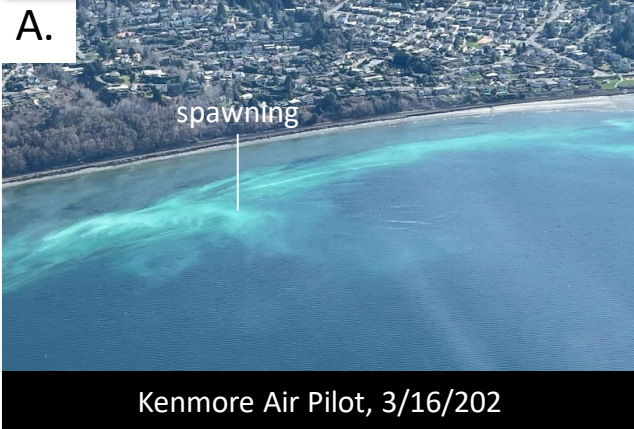
Data



Red-brown bloom and suspended sediment.
Location: Budd Inlet (South Sound), 3:48 PM


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Tony Melchior, 4/20/2021



A. Spawning herring, off Carkeek Park, Seattle. B. Nearshore *Noctiluca* bloom and macroalgae, NE between Belfair and Union.



Help us cover important events in Puget Sound



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Help us to document important environmental events and places on Puget Sound's waters and beaches.



Jellyfish



click

Algal blooms



click

Noctiluca blooms



click

Macro-algae



click

Click on the images above what you want to report

[A Community for Naturalists,](#) [Eyes Over Puget Sound](#)

Start reporting observations and share them with with us.

How It Works



1

Record your observations



2

Share with fellow naturalists

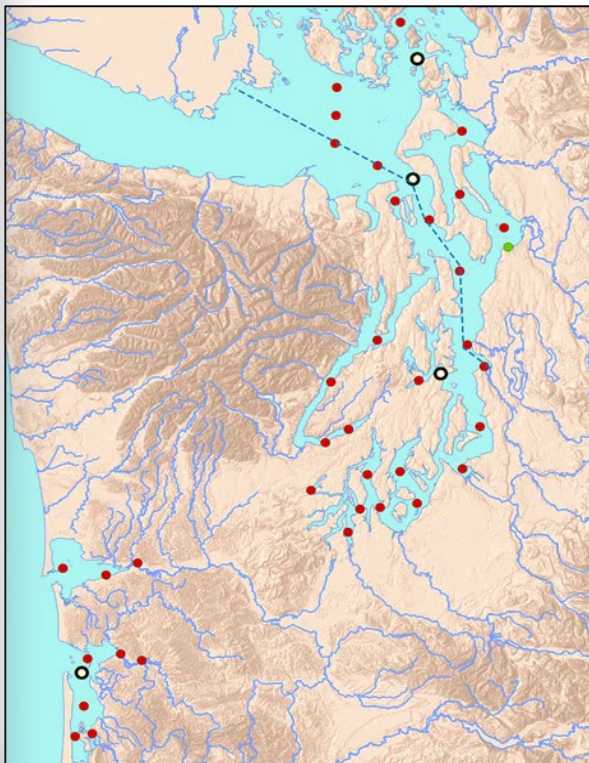


3

Discuss your findings

Long-term monitoring data from Puget Sound and Coastal Bays

- 39 stations sampled monthly
- 16 physical, chemical, biogeochemical parameters
- data from 1999-present



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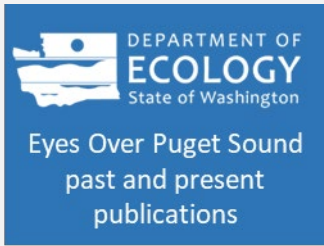
Washington State Department of Ecology. 2018. Eyes Over Puget Sound: Surface Conditions Report, September 17, 2018. Publication No. 18-03-075. Olympia, WA.
<https://fortress.wa.gov/ecy/publications/documents/1803075.pdf>.



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Environmental Assessment Program
Washington State
Department of Ecology

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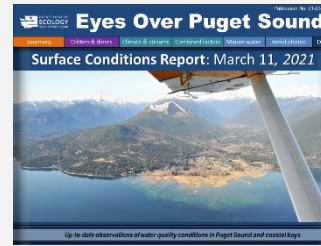
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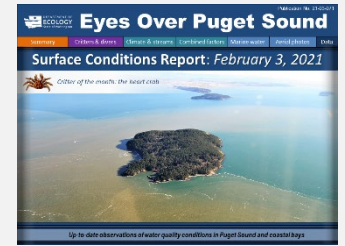
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April_1_2021
[Publication No. 21-03-073](#)



March_11_2021
[Publication No. 21-03-072](#)



February_3_2021
[Publication No. 21-03-071](#)



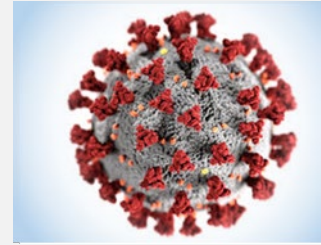
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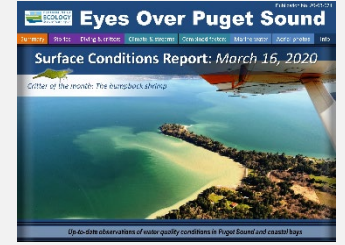
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September_28_2020,
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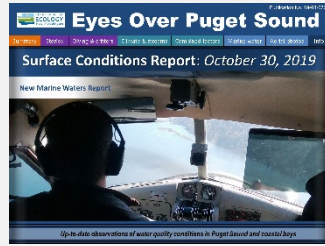
No coverage due to COVID-19
pandemic from April-September



March_16_2020,
[Publication No. 20-03-071](#)



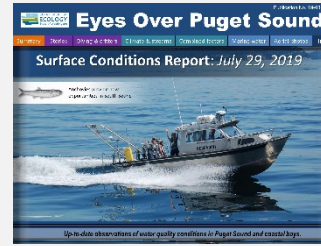
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October_30_2019,
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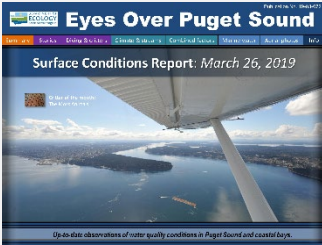
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June_4_2019
[Publication No. 19-03-073](#)



March_26_2019
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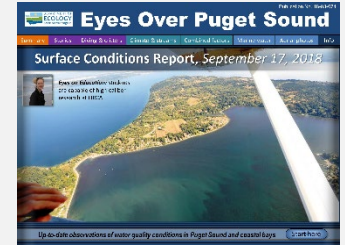
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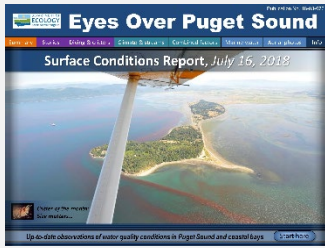
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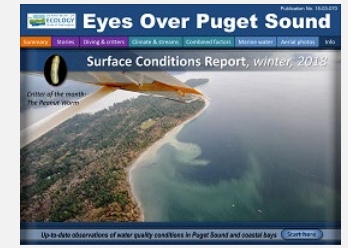
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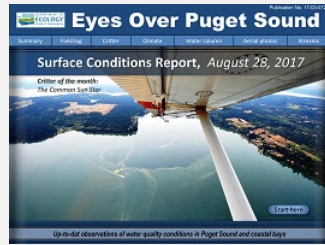
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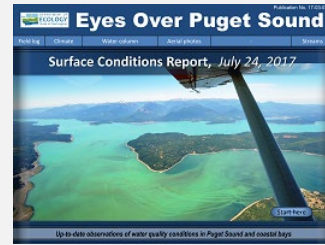
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[Publication No. 17-03-072](#)



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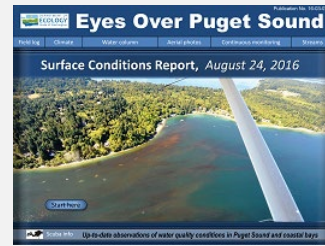
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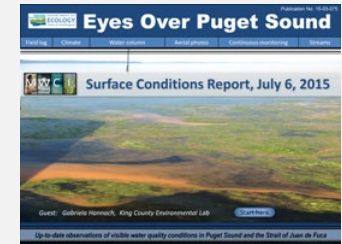
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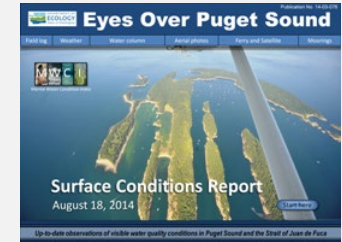
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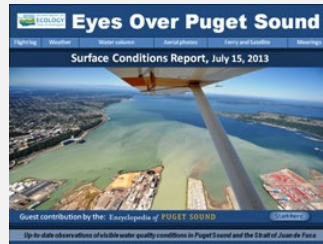
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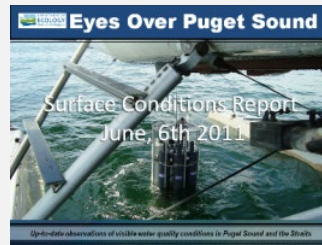
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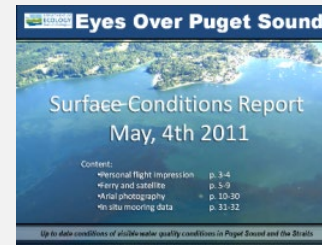
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