



Eyes Over Puget Sound

Summary

Art & Critters

Climate & streams

Marine water

Aerial photos

Data

Surface Conditions Report: March-June 2022



The Catworm

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



Artists corner

Artists corner, [p. 3](#)

Showcasing the natural beauty of Puget Sound through photography.



Tyler Burks,

Climate & streams, [p. 8](#)

Low air temperatures, rain, and late season snow accumulation have pushed back the discharge of meltwater to Puget Sound later in the season.



Field team, Natalie Coleman,
Holly Young

Water quality, [p. 12](#)

Mostly expected conditions with regional cooler and more oxygenated conditions in May.



Dr. Christopher Krembs

Aerial photography, [p. 13](#)

Months of clouds have made flying for aerial photography challenging. In June, we were amazed by the number of fish, unusually low tides, the build up of macroalgae on beaches, and large internal waves in Central Basin.

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Artists corner

Showcasing the natural beauty of Puget Sound through photography from engaged artists in our communities and from unique vantage points.



Image by John Storbeck 8/19/2021:

“The footprint of the whale”: Whale surfacing through a turbid Stillaguamish freshwater plume

Summary

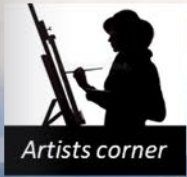
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"A splatter of clouds and sediment matter": Skagit Bay looking towards Penn Cove (Whidbey Basin)

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Artists corner



"An outpost in a sea of colors": Smith Island

Summary

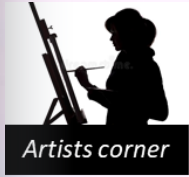
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“A carpet of shades of the sea”: Experienced by Pilot Gary Lanthrum and his plane over Hood Canal in February

Critter of the Month – The Catworm



Dany Burgess
Marine Sediment
Monitoring Team

Family Nephtyidae

Well, look what the cat dragged in! It's the catworms, a family of paw-some polychaetes, or marine segmented worms. These worms have real "cattitude," prowling the mud of Puget Sound like the fantastic felines they are named for.

Fun Catworm Facts

- They are amazing burrowers, swimmers, and hunters
- Their "tongues" are eerily similar to actual cat's tongues
- Some species can live up to seven years

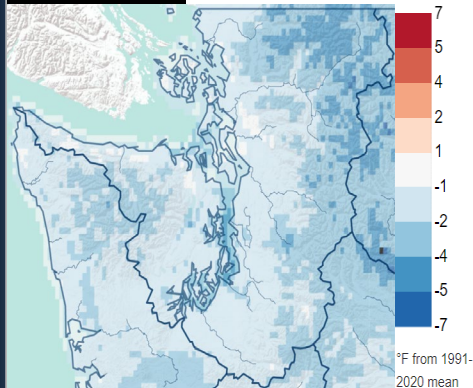




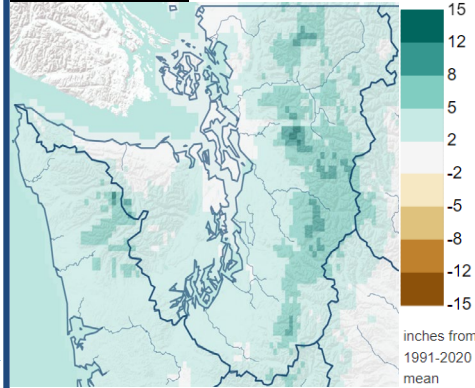
In late spring, Puget Sound air temperatures were below normal, while precipitation was above normal (A). Snowpack has begun to melt, but due to continued cool conditions and late season accumulation, more snow than normal currently remains (B) to feed rivers this summer. Despite current robust values, not all locations reached their median peak volumes, so air temperature and precipitation trends should still be monitored closely.

A. Northwest Climate Toolbox

Temperature



Precipitation



Temperature Anomaly

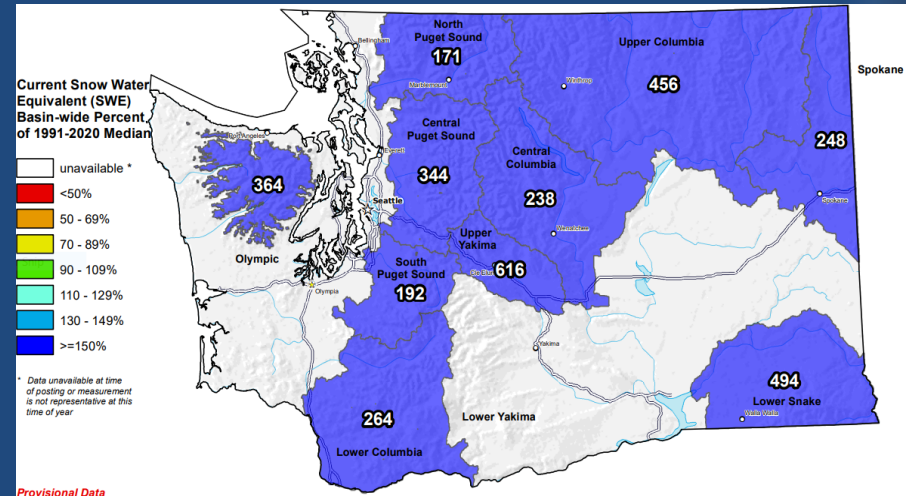
from historical mean daily ranged from 0 to -7 °F in the Puget Sound region during the past 30 days.

Precipitation Anomaly

from historical mean ranged from 0 to +15 inches in the Puget Sound region during the past 30 days.

B. Washington SNOTEL, USDA/NRCS

June 16th, 2022



Snow water equivalents

present in watersheds draining to Puget Sound are above normal. High values this time of year are indicative of the persistence of snowpack rather than significant further accumulation, in most cases. Snowpack typically reaches its peak around April 1st.

How much water currently flows into Puget Sound?

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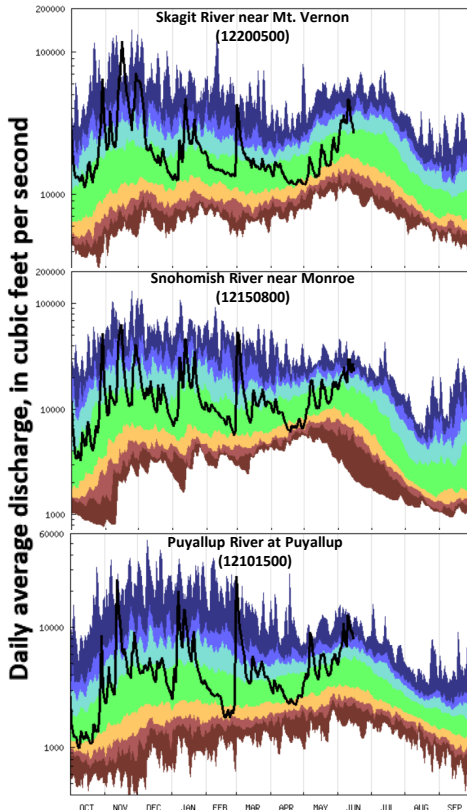
Data

Temporal: Due to a wet spring and the late onset of spring snowmelt, freshwater inputs from major rivers to Puget Sound (trend charts, left) are normal to above-normal.

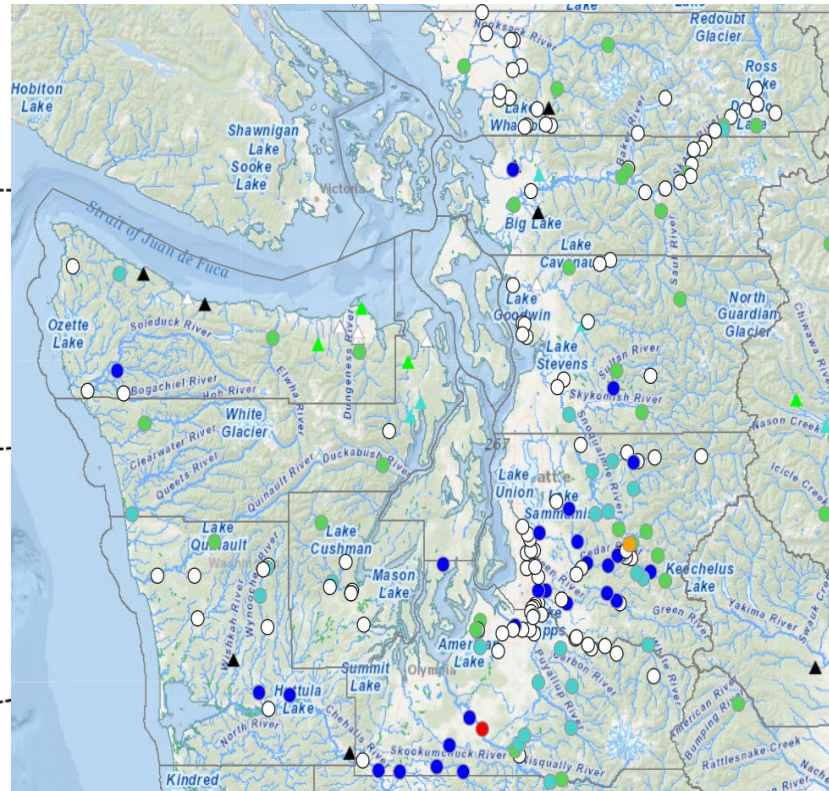
Spatial: Variation in streamflow (map, right) is caused by the distribution and timing of precipitation events, and whether streamflow is primarily dominated by snowmelt or rainfall.

Select Puget Sound Streamflow Trends

Current Streamflow Conditions as of 06/16/2022



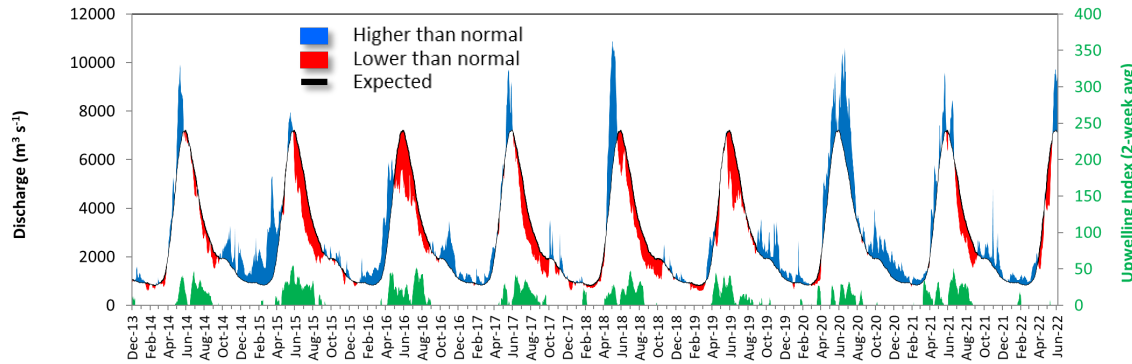
USGS WaterWatch: [CLICK HERE!](#)



Current conditions: [CLICK HERE!](#)

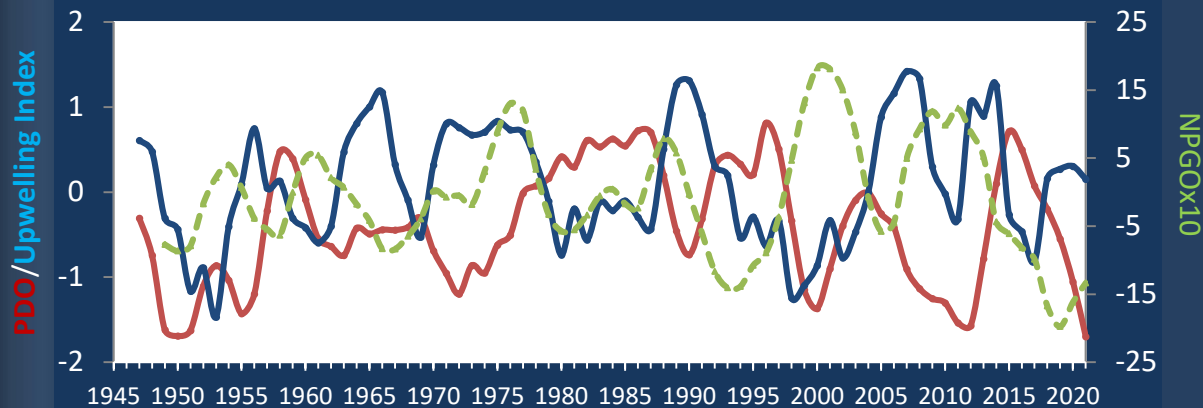
Historically, the peaks of coastal upwelling and the [freshet](#) are in sync.

Fraser River (at midnight)



The Fraser River is the major driver of [estuarine circulation](#) and water exchange between the Salish Sea and the ocean. Fraser River flows are currently higher than normal. Upwelling off the coast, however, is yet not coinciding with the freshet.

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



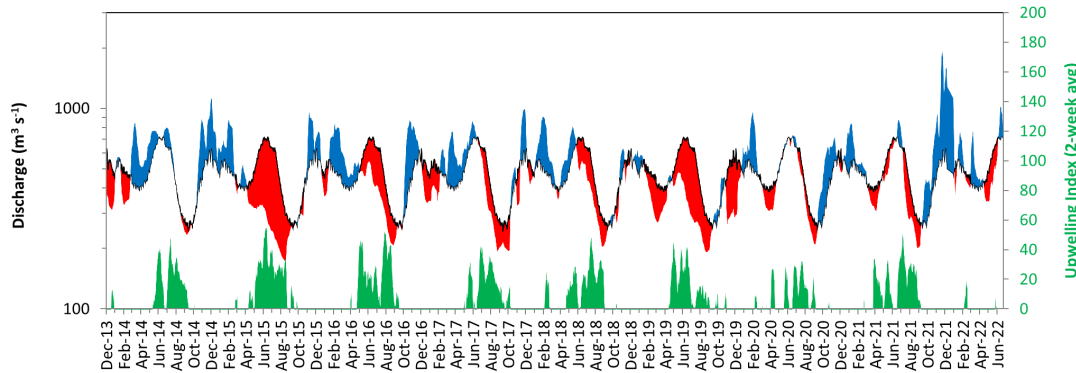
How do ocean boundary conditions affect the quality of water the Salish Sea exchanges with the ocean? Water has cooled (PDO). Upwelling (Upwelling Index [anomaly](#)) is at expected level. Productivity in the eastern Pacific is lower (NPGO; last updated Jan 2022).

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



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

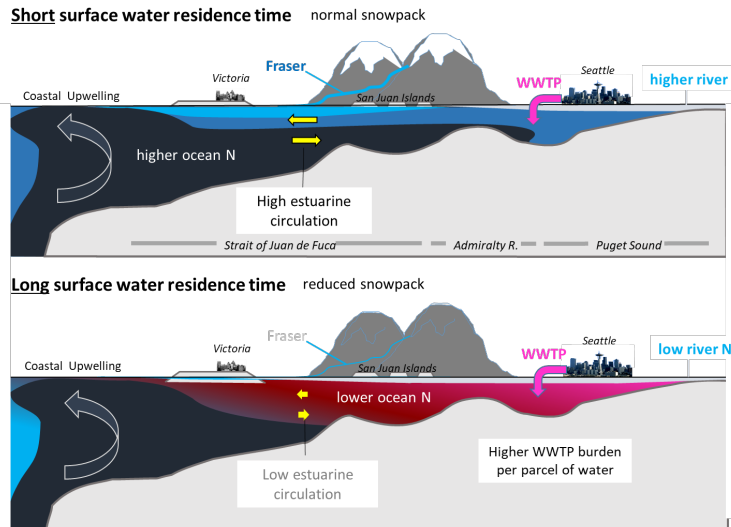
Skagit River (at midnight USGS)



The Skagit River freshet is no longer clearly pronounced because the river is a regulated system for hydroelectric power generation. However, drought years and low flows can be seen in the river's discharge data. In 2022, flows were near normal. Upwelling, to date, is weak.

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.



Field team, Natalie Coleman,
Holly Young

Marine Water Conditions: 2022 temperature, salinity, and dissolved oxygen

Coastal Bays

T: *Expected*

S: *Lower*

DO: *Variable*

Salish Sea

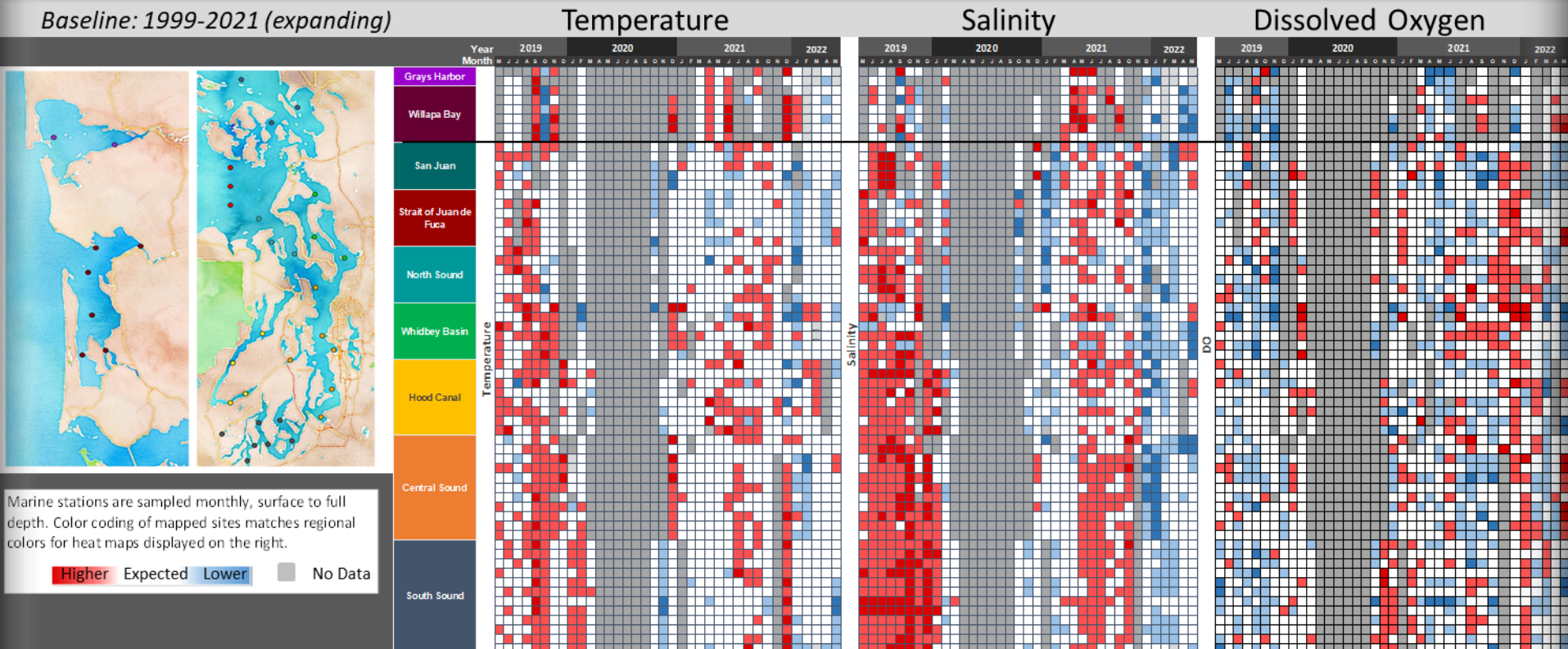
T: Expected, South Sound cooler

S: Mostly expected

DO: Higher in Central Sound


The year 2022 is shaping up to be relatively normal for temperature, lower in salinity reflecting a lot of rain, and normal to slightly lower in oxygen concentration. In contrast 2019 and 21 were saltier.

Baseline: 1999-2021 (expanding)



Marine stations are sampled monthly, surface to full depth. Color coding of mapped sites matches regional colors for heat maps displayed on the right.

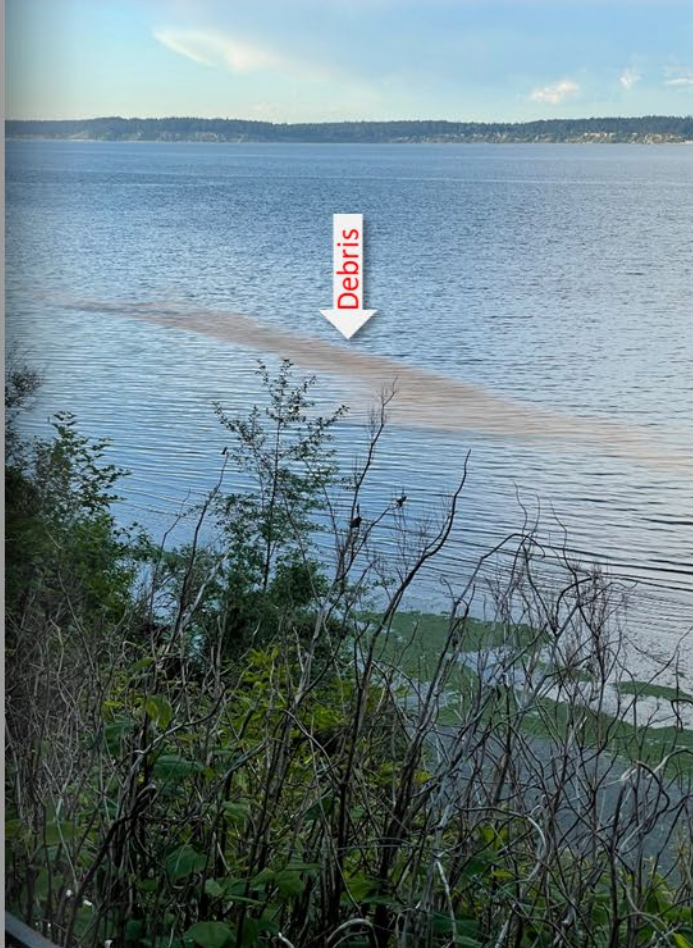
Higher Expected Lower No Data

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Months of clouds have made flying for aerial photography challenging. In June, we were amazed by the number of fish, unusually low tides exposing underwater regions, the build up of macroalgae on beaches, and large internal waves in Central Basin.

[Start here](#)

Observation by Andrew S. Write 5/21 at 7:25 pm, Whidbey Basin, Saratoga passage, north of Langley



Mixing and fronts:

Fronts visible in several places by discolored water from sediments and bloom. Internal waves in Central Sound.



Jellyfish and fish:

Large numbers of schooling fish in Case inlet and Holmes Harbor. Occasional jellyfish patches in Budd Inlet and Eld Inlet in May. Spawning herring in East Sound in March.



Suspended sediment:

Very low tides expose mudflats with sediment washing into the adjacent waters. High concentrations of sediment in Port Susan and wave-exposed beaches on Lopez Island. Sediment plume in Bellingham and Samish Bay.



Visible blooms:

Red-brown blooms in Case Inlet, Port Townsend. Green-brown bloom in Port Susan, Similk Bay, Central Basin. Noctiluca off Crescent Beach and East Sound earlier in May.



Debris:

Lage patches of debris in Lynch Cove in May. In June, accumulating at fronts in Bellingham Bay and Port Susan.



DEPARTMENT OF
ECOLOGY
State of Washington

Aerial navigation guide

Date: 6-14-2022

Click on numbers



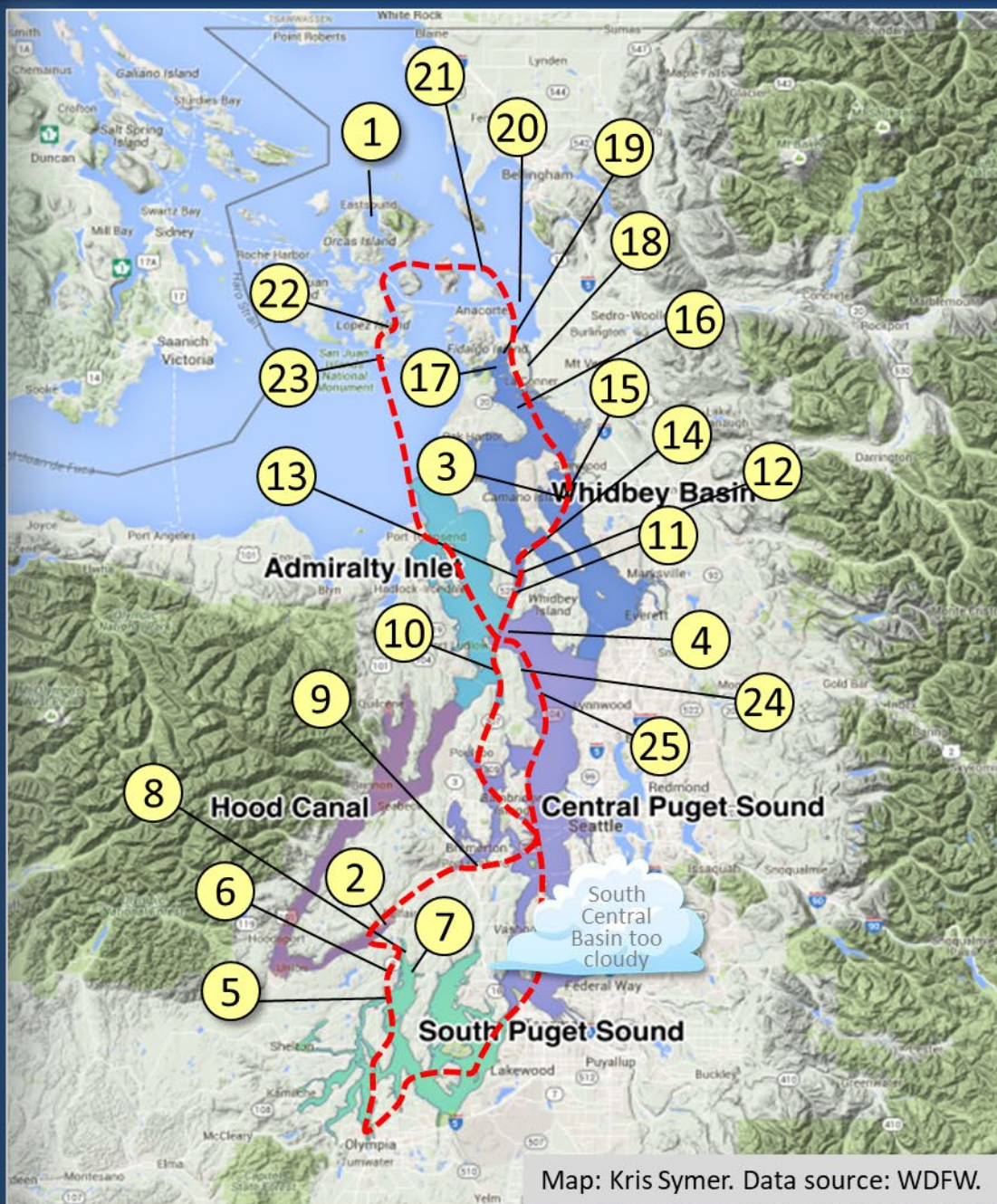
26

Flight Observations

Intermediate visibility, Central
Sound very cloudy

Tide data from 6-14-2022 (Seattle):

Time	Pred	High/Low
04:01 AM	11.64	H
11:22 AM	-3.97	L
06:58 PM	12.08	H





Connecting 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 [Hoodsport](#)
- 4 [Hansville](#)
- 5 [Point Wells](#)
- 6 [Twanoh](#)

Salish Sea

- 7 [Bellingham Bay](#)
- 8 [Friday Harbor](#)



Thayne Yazzie, NWIC,
Robert Daniels, UW/APL



Summary

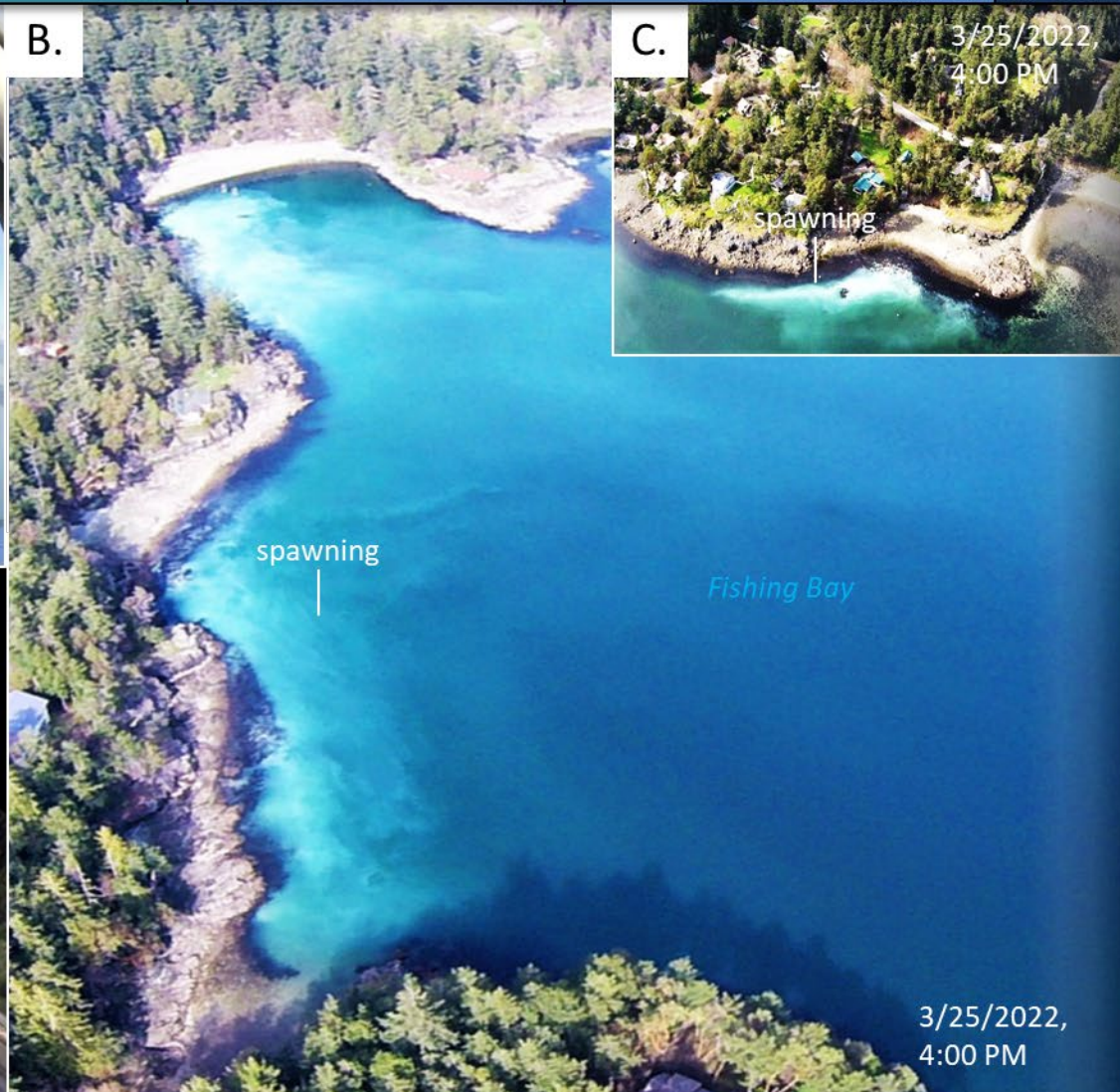
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A. Pilot Mike MacKay monitoring regions around the San Juan Islands. B-C. Spawning herring in East Sound. D. *Noctiluca* bloom, Crescent Beach. Location: B-C. Orcas Island, D. Strait of Juan de Fuca (North Sound), 11:32 AM



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*Organic material floating at surface. A. Looking west, B. looking south.
Location: Lynch Cove (Hood Canal), 2:13 PM*



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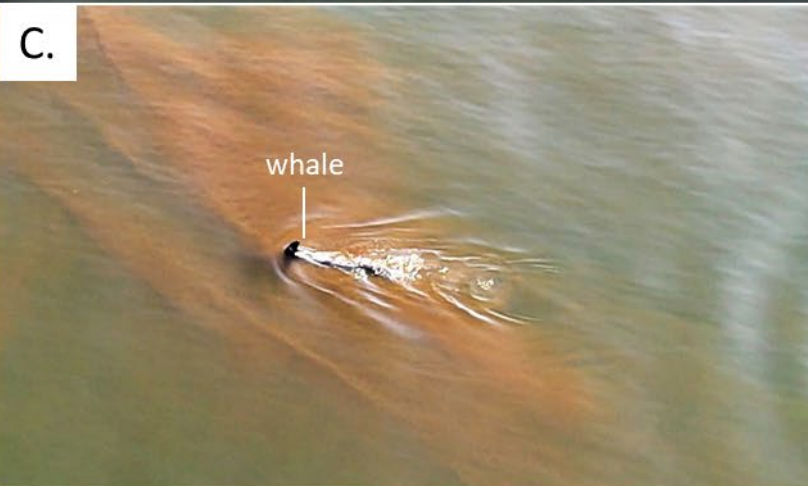
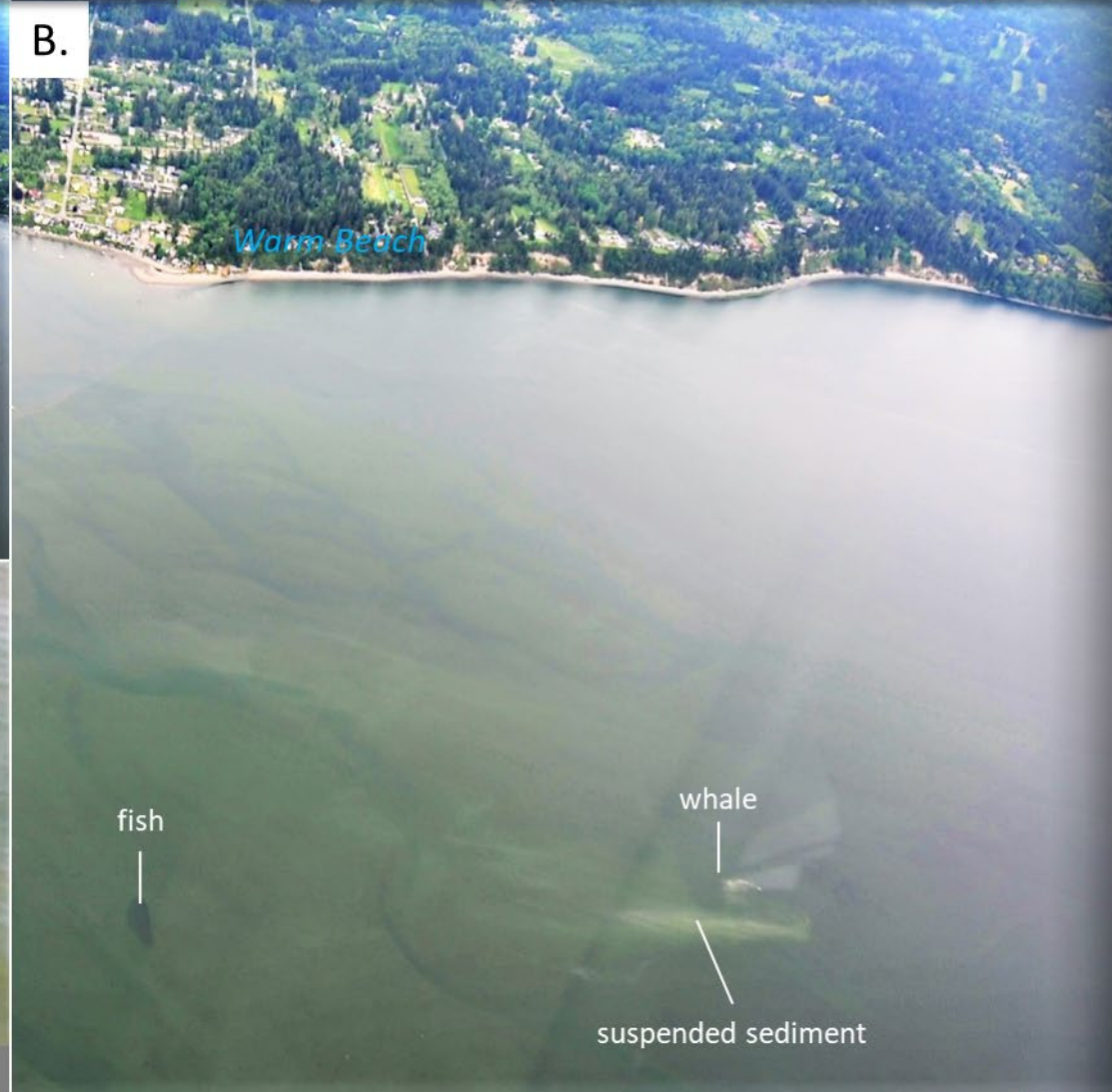


Image by John Storbeck 8/19/2021:

A. Stillaguamish River estuary. B. Whale scooping up sediment near a school of fish. C. Whale swimming through a bloom in 2021 at nearby location. Location: Port Susan (Whidbey Basin), 3:00 PM



Summary

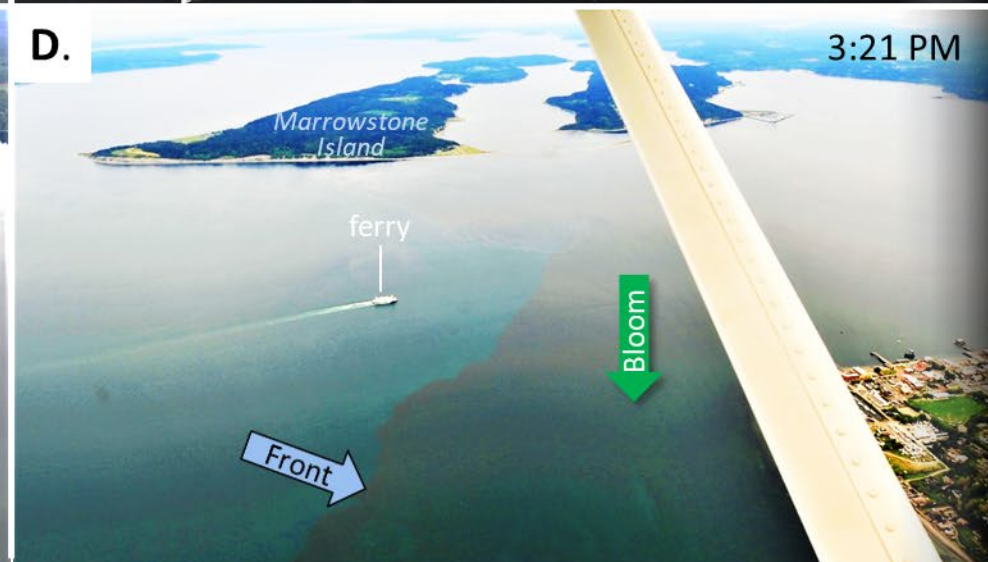
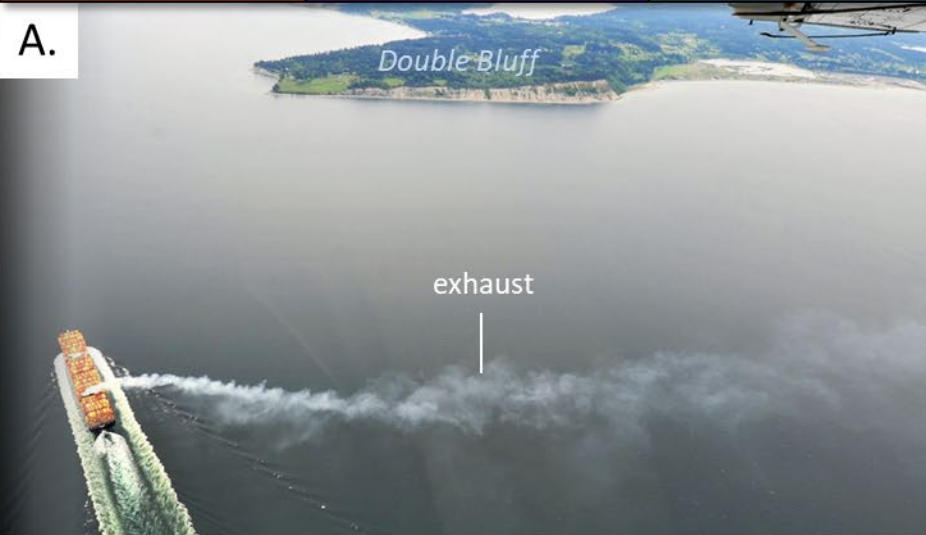
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A-B. Exhaust from container ship visible for 5 miles. C-D. Blooms and fronts in bays.
 Location: A-B. Admiralty Reach, C. Nisqually Reach, D. Port Townsend (Central and South Sound).



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A. Front and B. tidal eddy at the entrance to Case Inlet made visible by discoloration from algal bloom.
Location: Northern tip of Harstine Island (South Sound), 12:03 PM



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High number of schooling fish. On the image, we count more than 85 schools (marked with white vertical lines).

Location: Case Inlet (South Sound), 12:05 PM



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High number of schooling fish. On the image, we count more than 25 schools (marked with white vertical lines).

Location: Case Inlet (South Sound), 12:05 PM



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Extremely low tide exposes much of the sediment in North Bay.

Location: Case Inlet (South Sound Basin), 12:06 PM



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Suspended sediment in Sinclair Inlet at a very low tide. Many macroalgae growing in Blackjack River estuary.
Location: Sinclair Inlet (Central Sound), 12:18 PM



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Macroalgae growing on Foulweather Bluff beaches.
Location: Entrance to Hood Canal (Hood Canal), 12:35 PM



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High number of schooling fish. We count more than 13 schools on this image (marked with white vertical lines).

Location: Holmes Harbor (Whidbey Basin), 12:39 PM



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High number of schooling fish. We count more than 17 schools on this image (marked with white vertical lines).

Location: Holmes Harbor (Whidbey Basin), 12:40 PM



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High number of schooling fish. We count more than 13 schools on this image (marked with white vertical lines).

Location: Holmes Harbor (Whidbey Basin), 12:40 PM



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*Macroalgae growing in thick layers on eastern shores of Holmes Harbor.
Location: Baby Island Heights, (Whidbey Basin), 12:43 PM*



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Strong discoloration of water in Port Susan by bloom and sediment. Fronts surrounding the Stillaguamish River plume. Location: Port Susan (Whidbey Basin), 12:46 PM



Summary

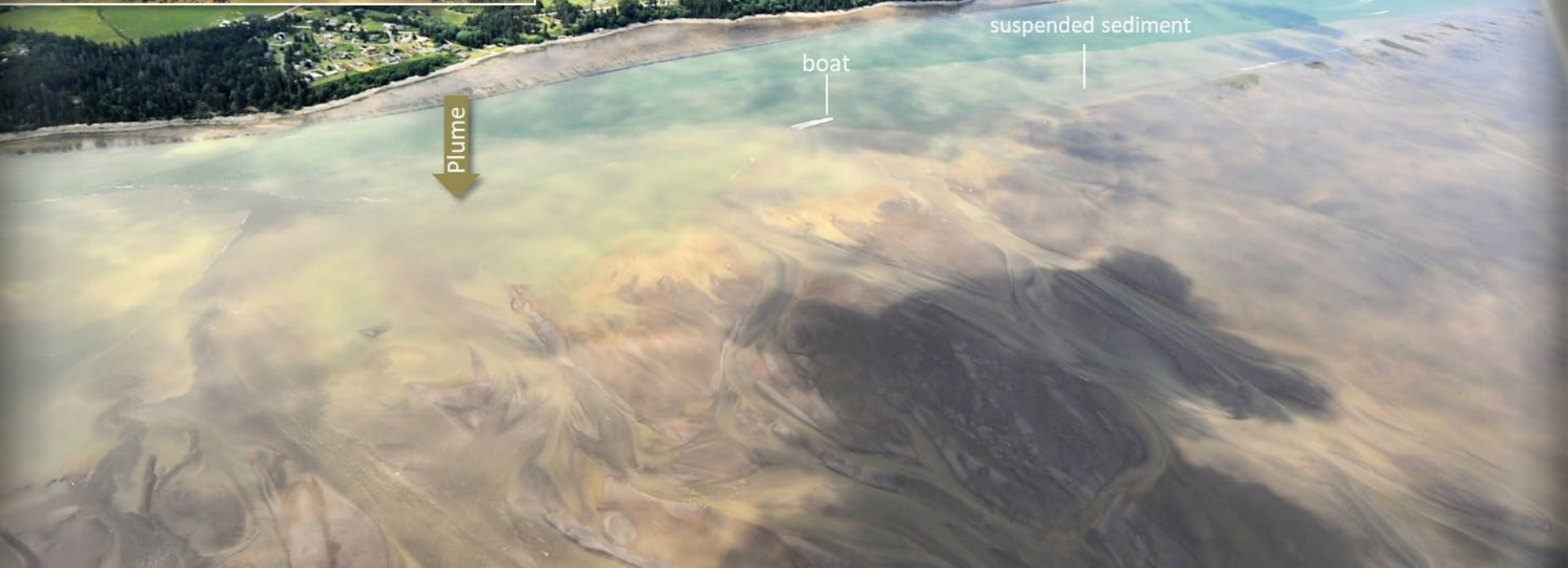
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*A. Very low tide exposes large areas of the mudflats and vegetation. B. Little water remains in the bay.
 Location: Skagit Bay (Whidbey Basin), 12:52 PM*



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*Very low tide exposes large areas of the mudflats collecting sunlight, while little water remains in the bay.
Location: Skagit Bay (Whidbey Basin), 12:55 PM*



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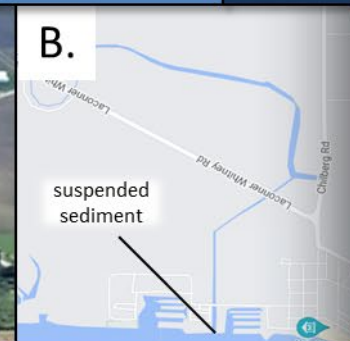
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A.



B.



*A. Very brown water entering the Swinomish Channel from a B. drainage channel next to La Conner Marina.
Location: Whidbey Basin (North Sound), 12:55 PM*



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*Green bloom mixed with nearshore suspended sediment.
Location: Similk Bay (Whidbey Basin), 12:56 PM*



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Very low tide exposing large areas of the Padilla Bay eelgrass beds to warm summer temperatures.
Location: Padilla Bay (North Sound), 1:00 PM



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Sediment-laden water creates a mosaic of different surface conditions separated by fronts.

Location: Off Guemes Island (North Sound), 1:01 PM



Summary

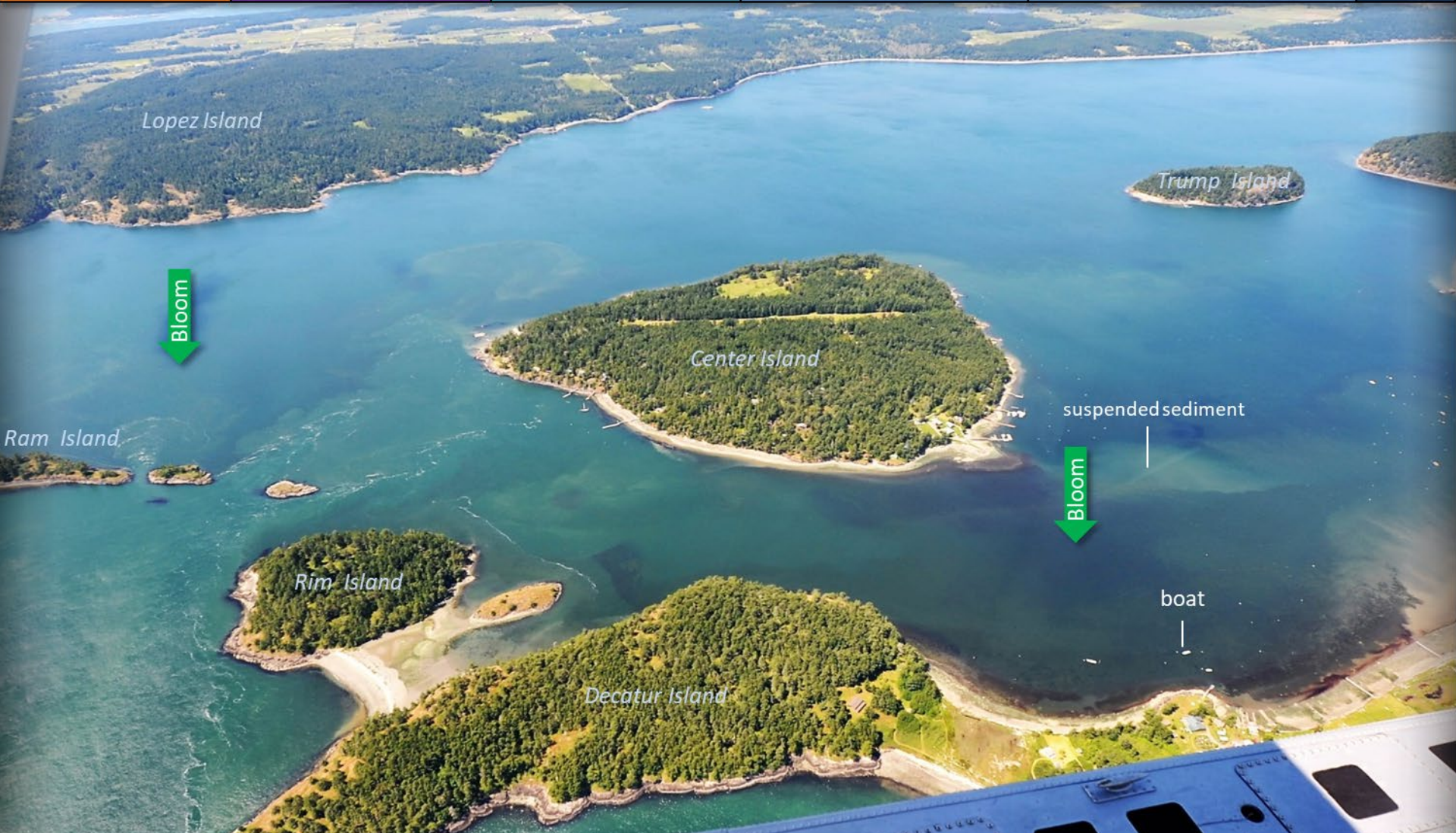
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Localized brown bloom in Reeds Bay, Decatur Island.
Location: Lopez Sound (San Juan Islands), 1:10 PM



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Eddy and suspended sediment in Outer Bay. Greener water in Inner Bay.

Location: Lopez Sound (San Juan Islands), 1:13 PM



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*Front separating water discolored by a strong bloom in Central Basin from clearer water to the north.
Location: Point No Point (Central Sound), 1:35 PM*



Summary

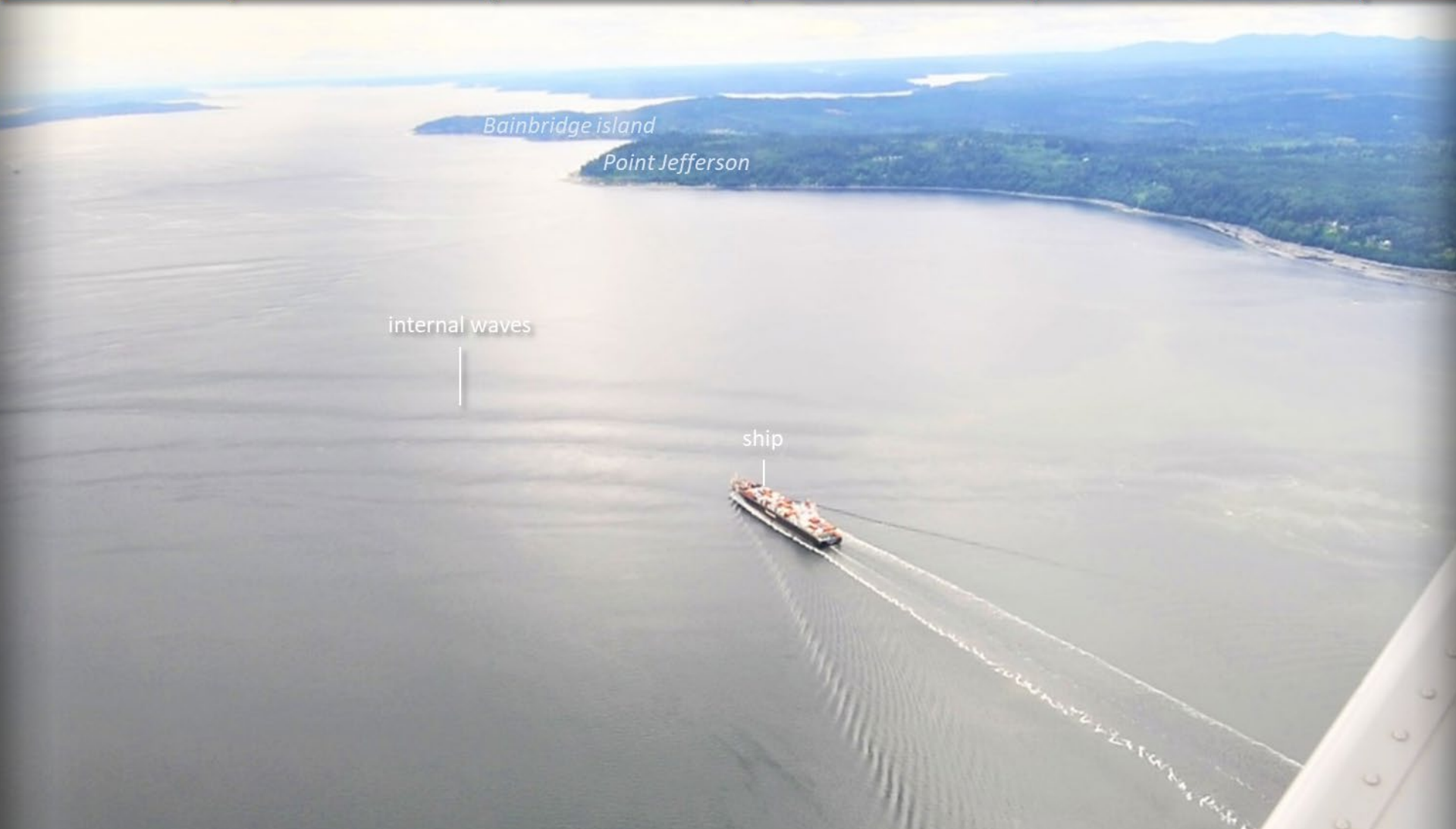
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Large internal waves interacting with the water surface. The container ship surface waves appear small in comparison. Location: Kingston (Central Sound), 1:37 PM



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We add your observations to EOPS because we believe they matter.

- In the following pages you will find water quality issues that engaged and concerned citizens submitted to us.
- We feel that your observations should be shared side-by-side with aerial photo records.
- We encourage you to share your observations with us. Together we can document more.



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Art & Critters

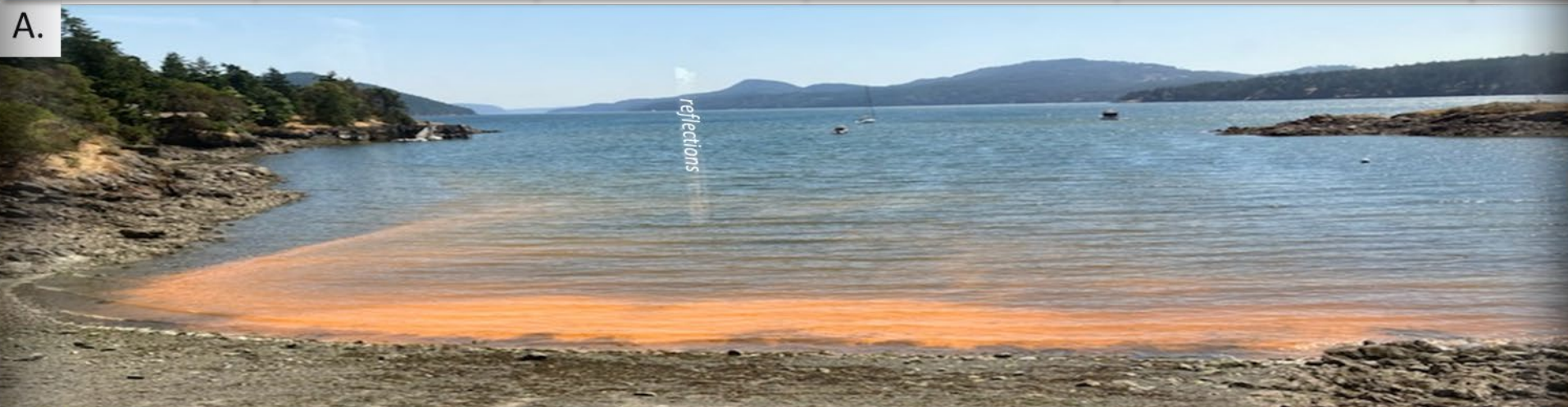
Climate & streams

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A.



B.

Tomato soup on the waterfront (Russel Barsh for KWIAHT, May 11, 2022)
theorcasonian.com/tomato-soup-on-the-waterfront/



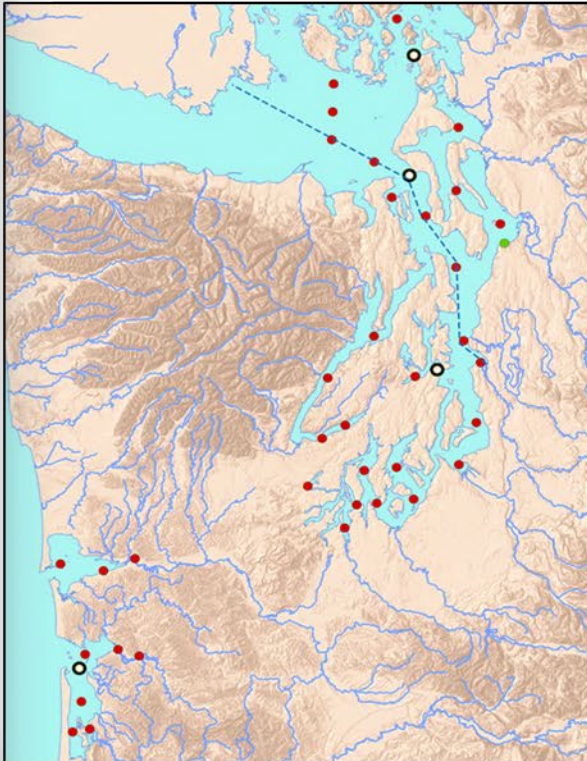
Photo courtesy of Anita Holliday

A repeating observation of *Noctiluca* blooms in East Sound, Orcas Island.

A. Mya Keyzers, 7/14/2021. B. Anita Holliday, 5/11/2022.

Long-term monitoring data from Puget Sound and coastal bays

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



Natalie and Holly embrace our new Research Vessel

Get your data

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We have published 97 editions!

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>.



Contact:

Dr. Christopher Krembs
Christopher.Krembs@ecy.wa.gov
Marine Monitoring Unit
Environmental Assessment Program
Washington State
Department of Ecology

If you want to be added to our
mailing list please e-mail
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June_14_2022
[Publication No. 22-03-072](#)



February_25_2022
[Publication No. 22-03-071](#)



January_7_2022
[Publication No. 22-03-070](#)



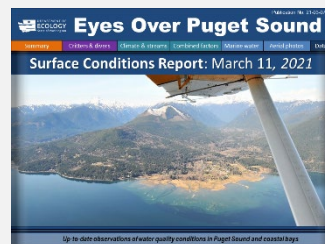
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[Publication No. 21-03-075](#)



June_17_2021
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April_1_2021
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March_11_2021
[Publication No. 21-03-072](#)



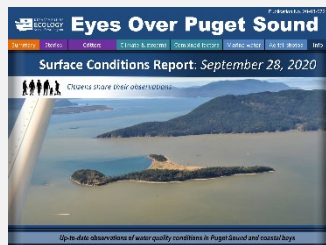
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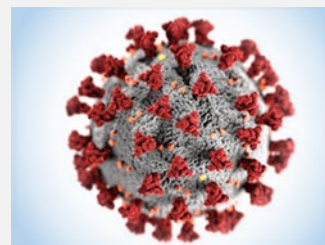
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October_26_2020
[Publication No. 20-03-073](#)



September_28_2020
[Publication No. 20-03-072](#)



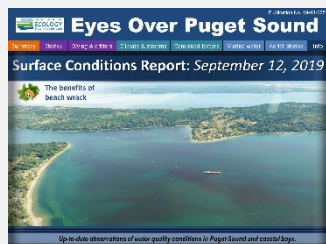
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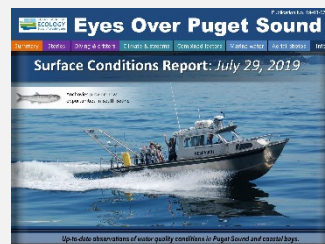
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October_30_2019
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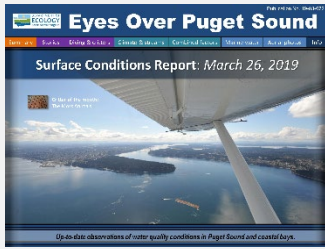
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March_26_2019
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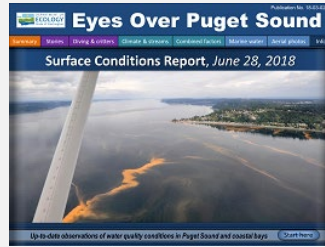
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September_17_2018,
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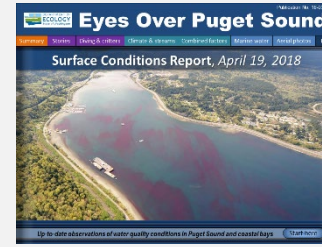
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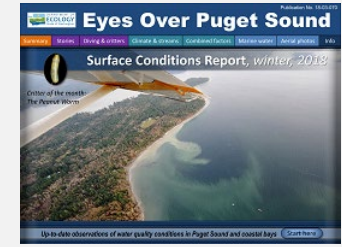
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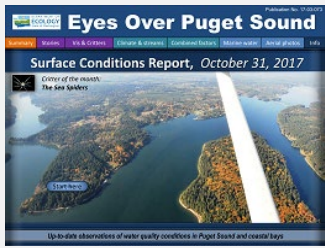
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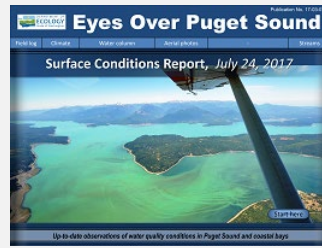
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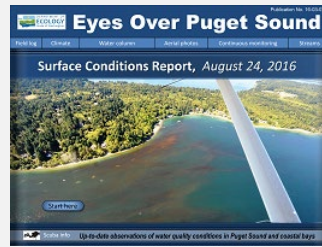
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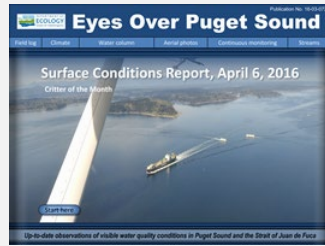
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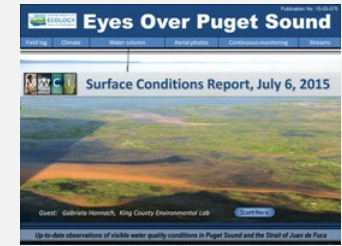
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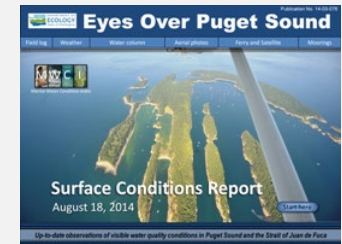
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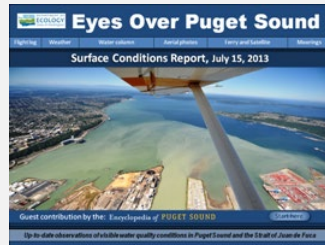
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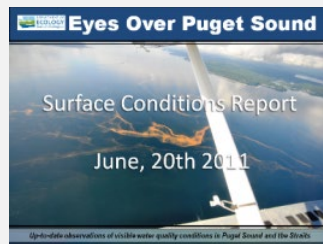
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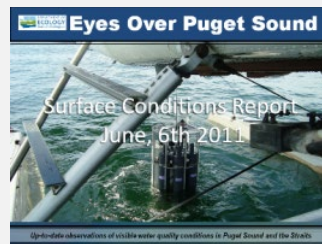
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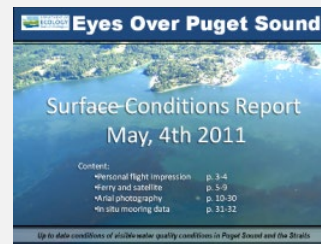
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