Publication No. 22-03-070

DEPARTMENT OF ECOLOGY
State of Washington

Eyes Over Puget Sound

Overview | Art & Critters | Awesome people | New tools | Combined factors | Aerial photos | Data

Surface Conditions Report: 2021 in review

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

Overview of conditions for the year 2021

LONG-TERM MARINE MONITORING UNIT

Photo by Grace McKenney

Dany Burgess

Karin Bumbaco, Skip Albertson

Dr. Christopher Krembs

Artists corner, p. 3

Art is a way to reflect on Puget Sound's water quality with different eyes.

Eyes Under Puget Sound, p. 4

A story map is bringing the critters living in the mud of Puget Sound to a wider audience.

Photos sent in by you, p. 5

A wonderful community like you helped us cover the large scope of visible water quality issues in the Puget Sound region.

Boundary conditions in 2021, p. 7

The past year was generally warmer and drier than normal and with higher river flows following mainly a wet cloudy fall.

Aerial photography, p. 10

We hope that our pictures continue to inspire, educate, and motivate our community.

Editor: Dr. Christopher Krembs; editorial assistance: Holly Young, Valerie Partridge.

DEPARTMENT OF ECOLOGY
State of Washington

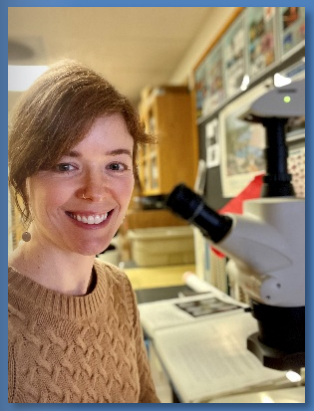
Puget Sound is beautiful and inspiring

Showcasing the natural beauty of Puget Sound through photography


Skagit river

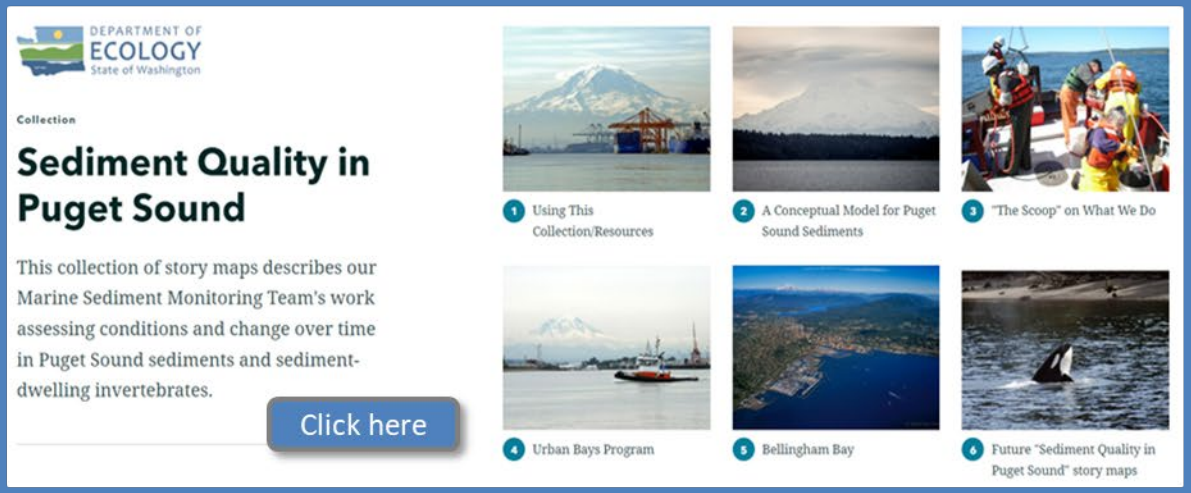
"We will continue to share the beauty of Puget Sound's waters in the future year. A place worth protecting."

Eyes Under Puget Sound – A Year in Review



Dany Burgess
Marine Sediment Team

2021 was a busy year for the sediment team, as we resumed our field work in Puget Sound, published a new set of **online story maps** to bring the benthos to a wider audience, and featured a colorful compilation of critters, from the cute to the downright creepy! Click on the photos below to link to each article.



Learn more about our program, including benthic critters and how we identify them on our website

People contributing their own observations in 2021

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

Thank you for all the wonderful documentation of blooms, spills, macroalgae, and other noteworthy water quality issues that you saw during the year 2021.

A special thank you this year to:

Tony Melchiors, Mya Keyzers, Mary Jean Ryan, Maria Mason, Kenmore Air Pilot, Josephine Strauss, Jim Baker, Jacquelyn Stenman, Michael Dawson, Hugh Matheson, Grace McKenney, Glenn Briskin, Eryn Craig, Elisa Dawson, Tim Ellis, Alex Pittman, Danita Delimont, Catherine Drews, Alysha Dotson, Mike MacKay, Department of Fish and Wildlife , Scott Steltzner, King County Boat crew, and Julia Bos.

Explore the new Puget Sound Metrics Dashboard

Click here

- Estuarine Flow
- Temperature Changes from Surface Heat Fluxes
- Salinity Changes from Rivers and Rain
- Water Column Dissolved Oxygen (O_2)
- Ocean Boundary Conditions

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Applied Physics Laboratory
University of Washington

Nick Bond
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University of Washington

Beth Curry
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University of Washington

Jan Newton
Applied Physics Laboratory
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NANOOS

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 using selected regions displayed from north to south.
Year 2021 was generally warmer than normal and with higher river flows following mainly a wet cloudy fall.

Conditions of 2021 in recent context

Air temperatures were variable in 2021, but generally summer was warmer and winter was colder than normal.

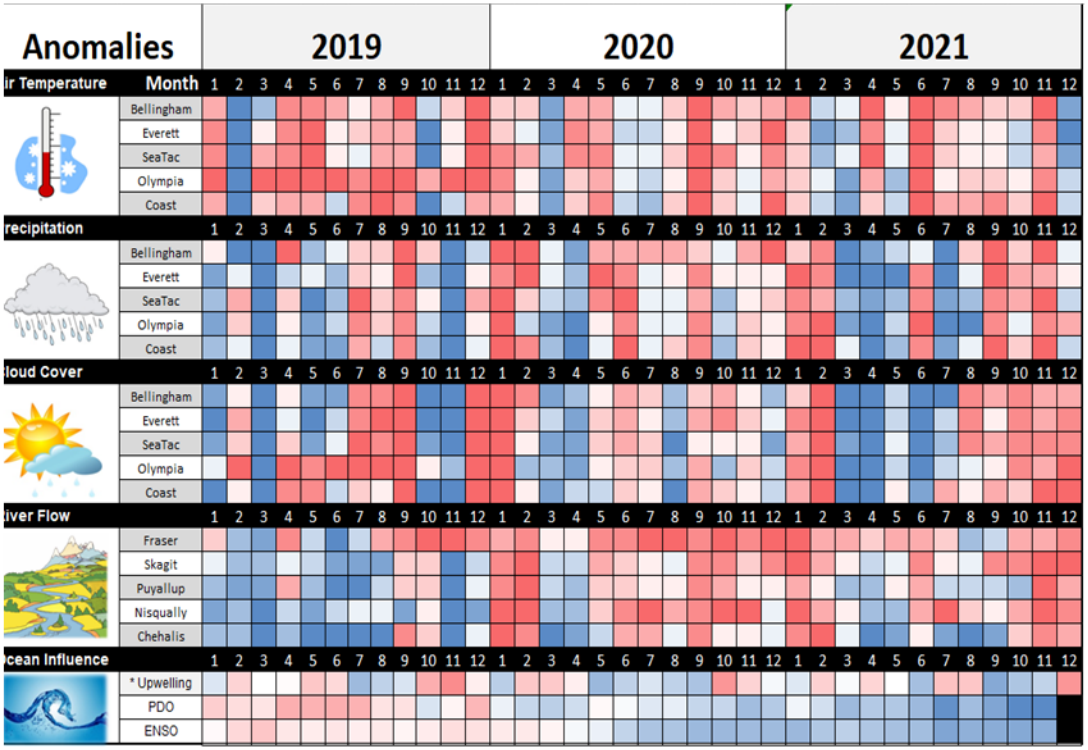
Precipitation was mostly above normal, except in the spring and early summer.

Sunshine (opposite of cloud cover) levels followed precipitation.

River flows were higher than normal only in the last several months.

Upwelling and Downwelling were variable. La Nina is present.

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

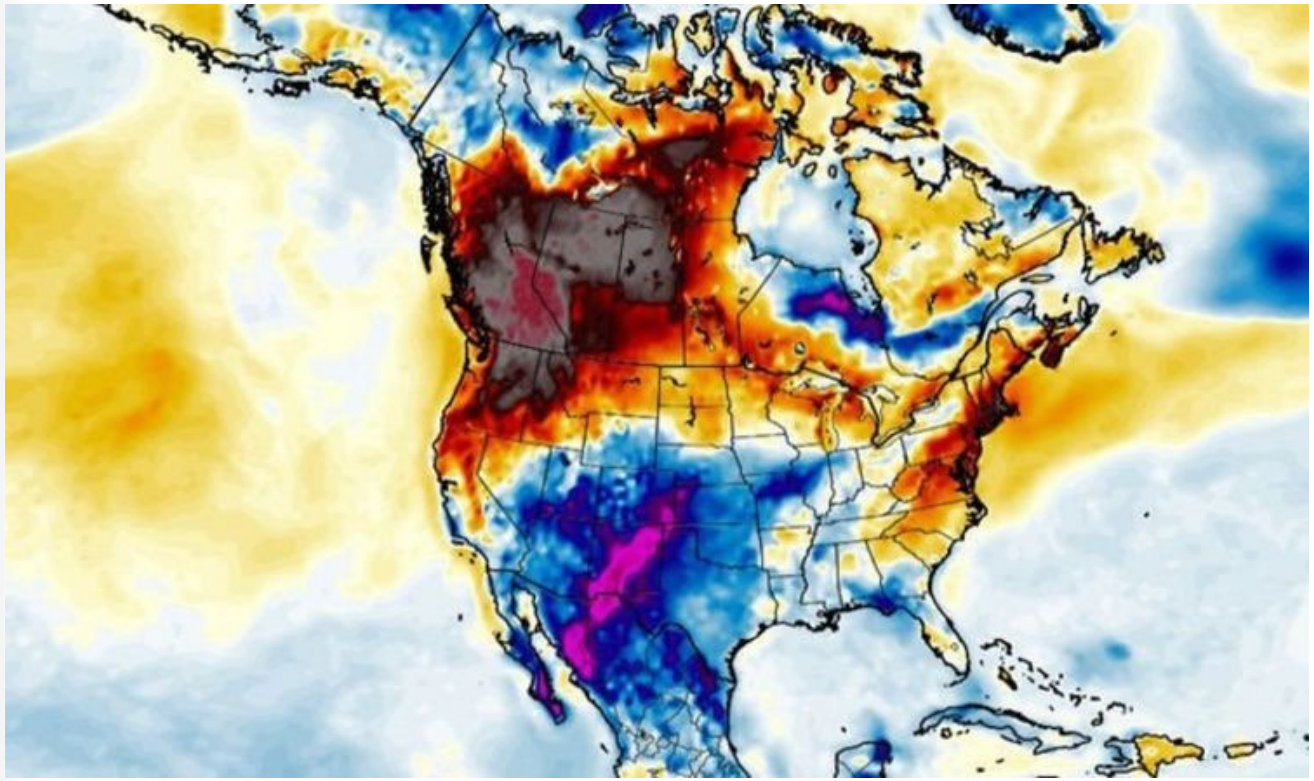


*Upwelling/downwelling Anomalies (PFEL)
PDO = Pacific Decadal Oscillation
ENSO = El Niño Southern Oscillation

higher — expected — lower

No data

A heatwave caused by a "heat dome" resulted in air temperatures over 48 °C in the last week of June 2021

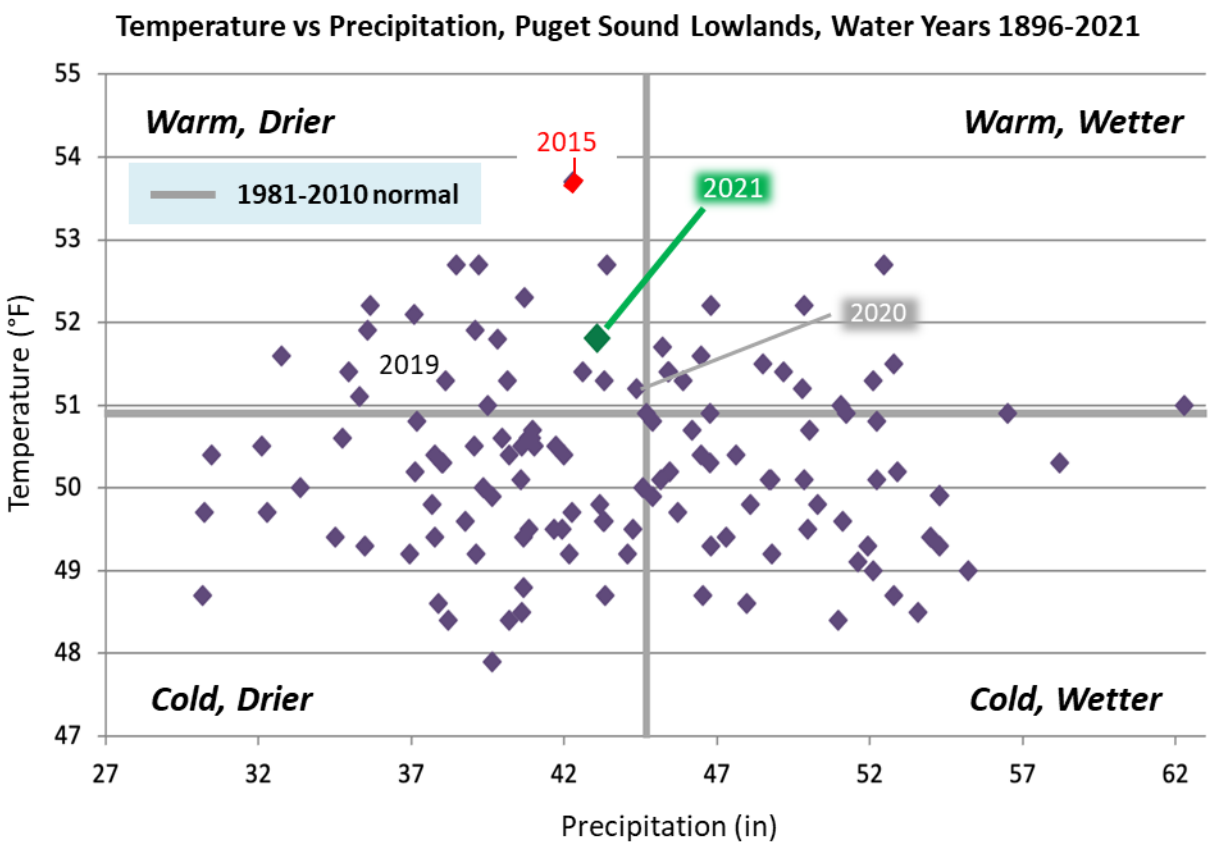


Map showing a huge expanse of temperature anomaly northwest North America that was affected by the heatwave at the end of June 2021. (Image: WXCHARTS)

In the last week of June 2021, an unusual weather pattern over the Pacific Northwest created a record-strong and high air pressure area — known as a "heat dome". The condition resulted in temperature departures from average between 25°F to 45°F across multiple states and British Columbia and cooked shellfish in the intertidal zone alive by the millions. (Seattle times)

Karin Bumbaco
Office of the Washington State Climatologist

The water year 2021 was **moderately warmer** and **drier** than climatological data for the Puget Sound Lowlands (gray line). Average values for the year do not reflect the short but severe heat wave at the end of June which was accompanied by severe wildfires in British Columbia.



Flames rise from a burning building during a wildfire in Lytton, British Columbia, June 30, 2021 2 RIVERS REMIX SOCIETY/via REUTERS

What were the conditions at the surface in 2021

Pictures in 2021 continue to capture the diversity of phenomena on the surface of the large Puget Sound region. Documenting Puget Sound water from the air allows you to understand processes, impacts, and spatial complexity on a large spatial scale. We hope that our pictures will inspire, educate, and motivate our communities to protect the wonderful place we and many animals call home.

Suspended sediment	1 2 3 4 5
Species aggregations	6 7 8 9 10 11
Water quality	12 13 14
Physical processes	15 16
Algal blooms	17 18 19 20 21 22
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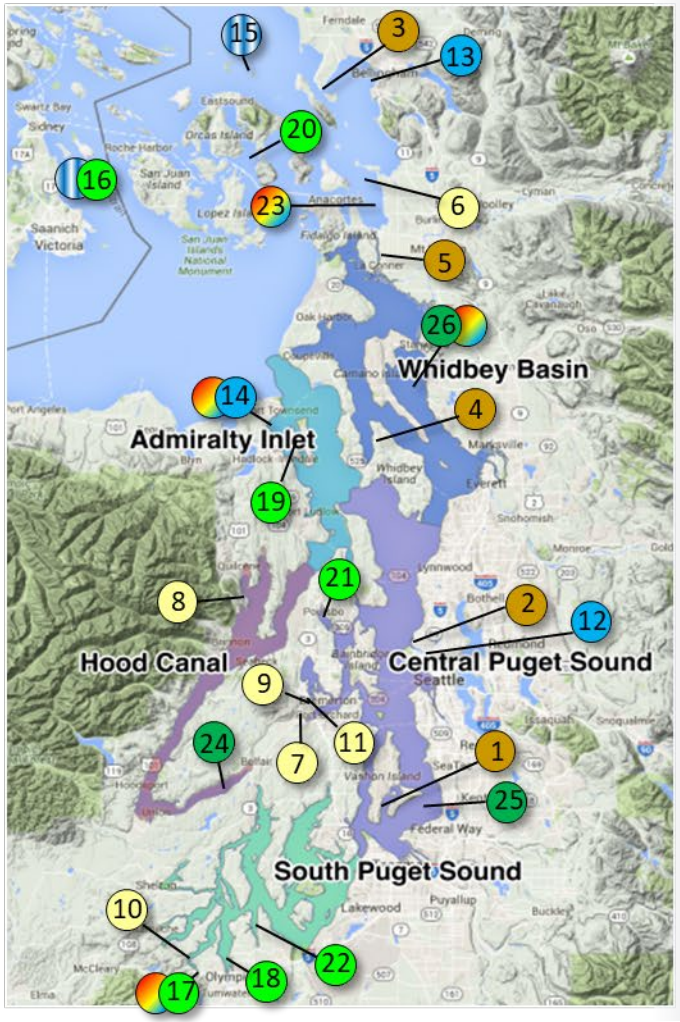
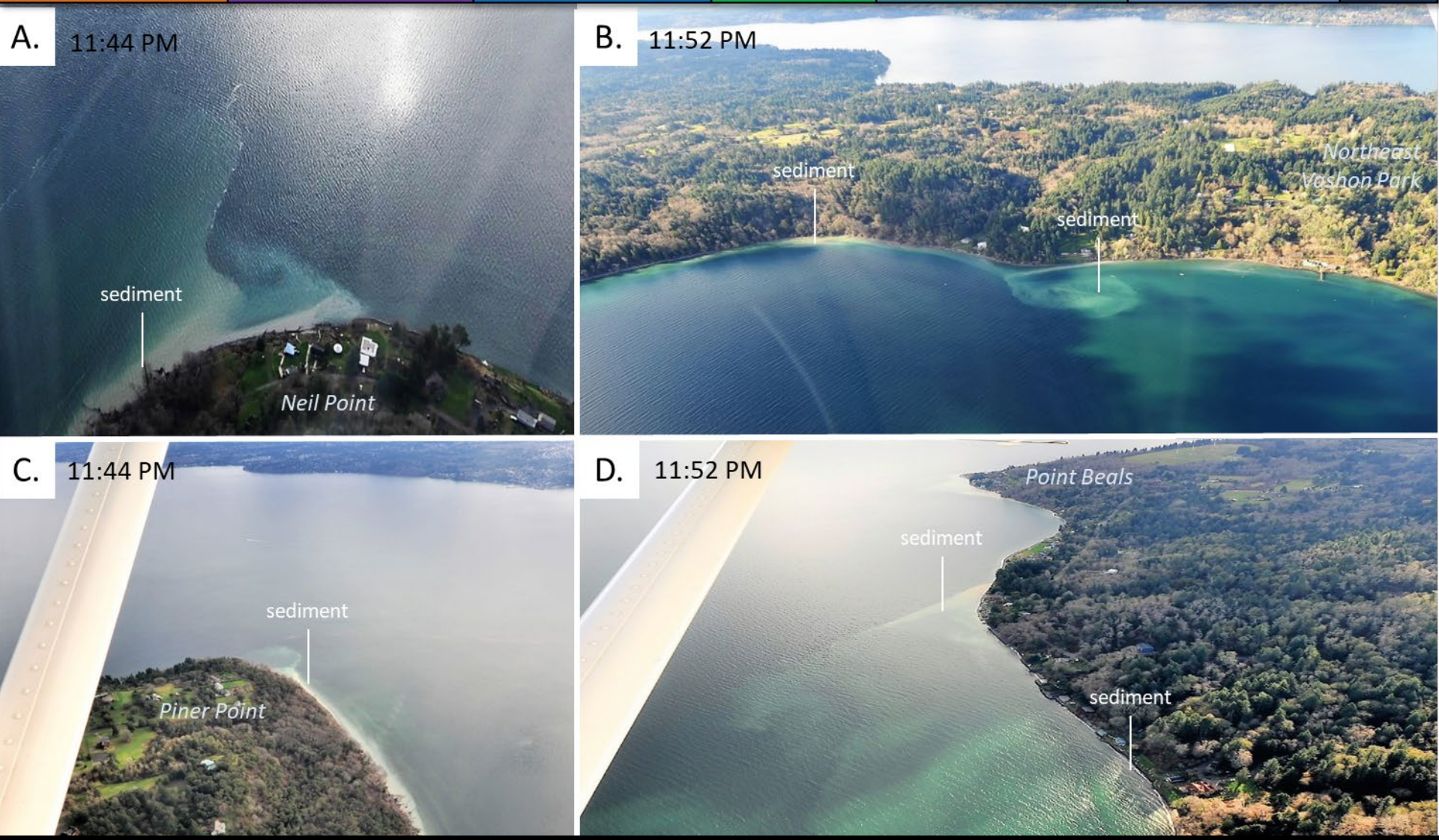


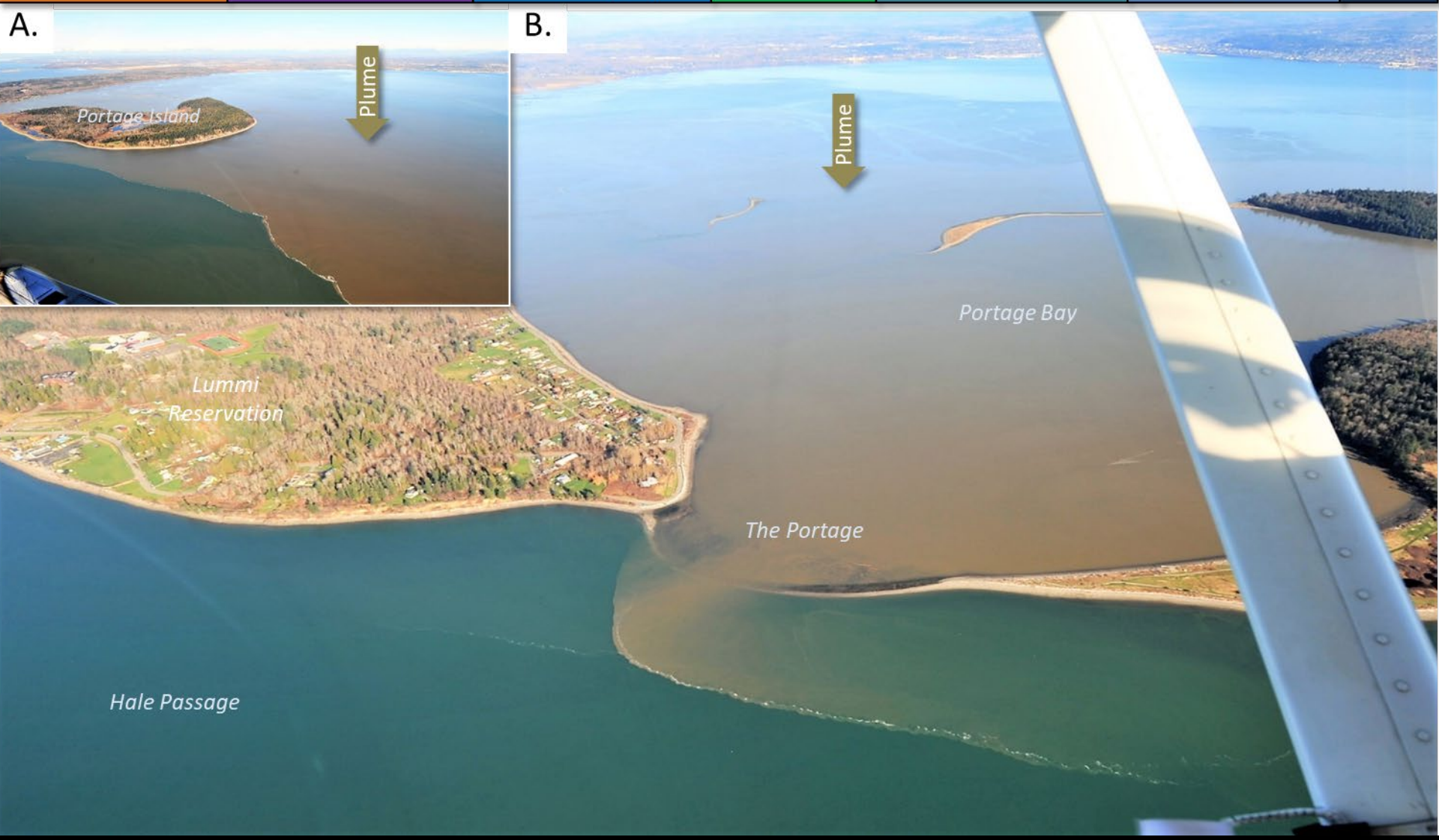
Suspended sediment 2-3-2021



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.

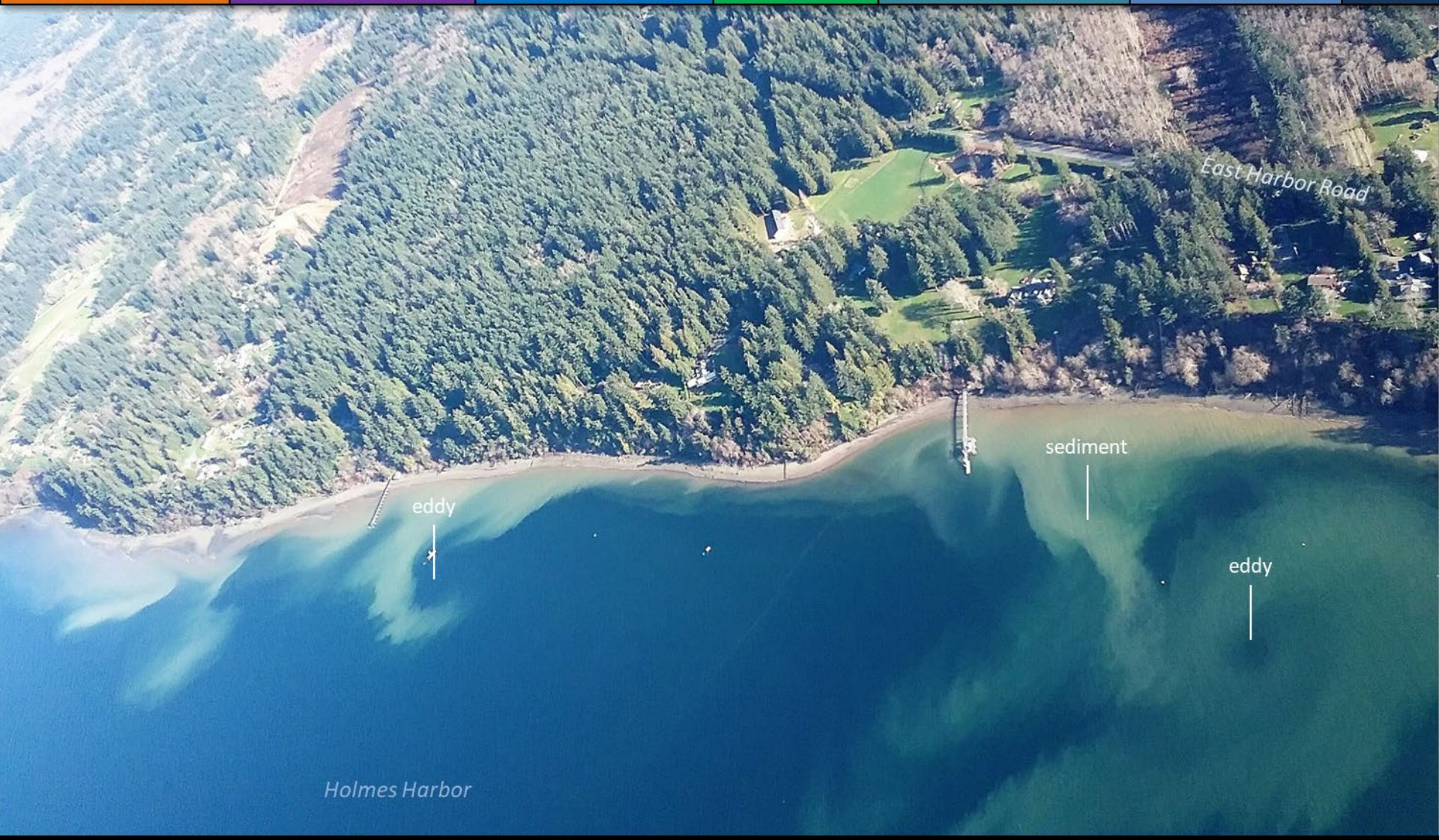
Suspended sediment near the shoreline extending into Central Sound.
Location: West Point (Central Sound), 12:01 PM

Suspended sediment 2-3-2021



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

Suspended sediment 2-3-2021



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

Suspended sediment 4-1-2021

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

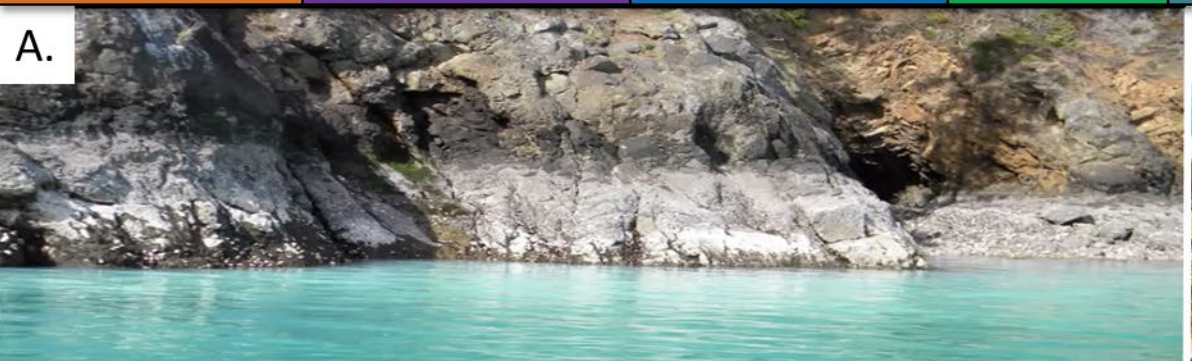
Species aggregations 2-3-2021

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

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

A.



Adam Lindquist Forage Fish Biologist DFW : "… Quilcene had lots of spawning activity with several miles of white water and many schools of fish right up next to shore. Purdy, POPM, and Portage Bay all had reports of white water and lots of marine mammal activity. If you get a chance, get out there and check it out for yourself!..."

Picture by Roy Clark, DFW

B.

Picture by Roy Clark, DFW

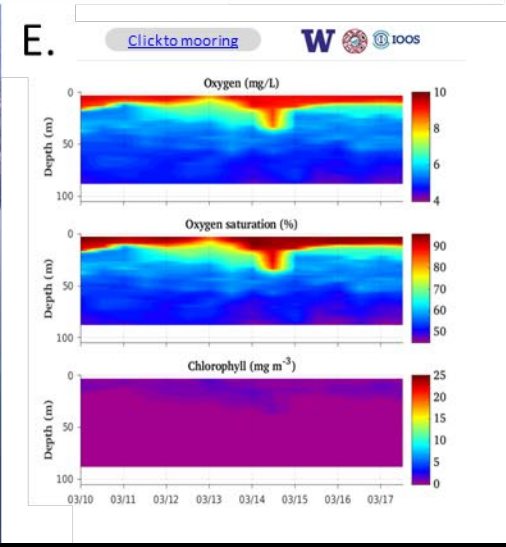
C.

Picture by Roy Clark, DFW

D.

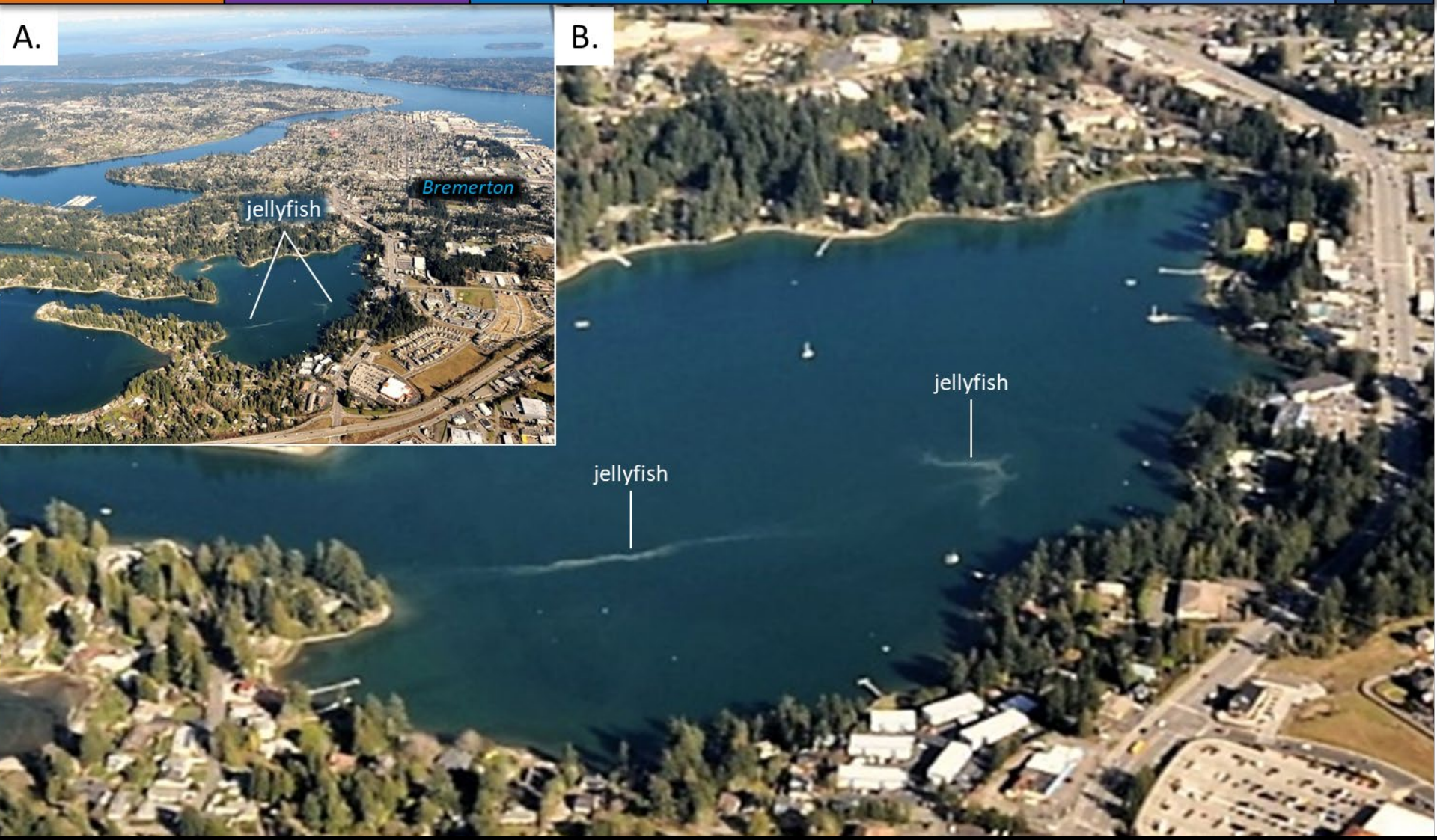
Picture by Roy Clark, DFW

E.



Department of Fish and Wildlife reports: A-B. Quilcene herring spawning and eggs deposited on macro-algae between C-D. Jackson Cove and Pt Whitney. E. ORCA mooring data. Location: Quilcene Bay (Hood Canal)

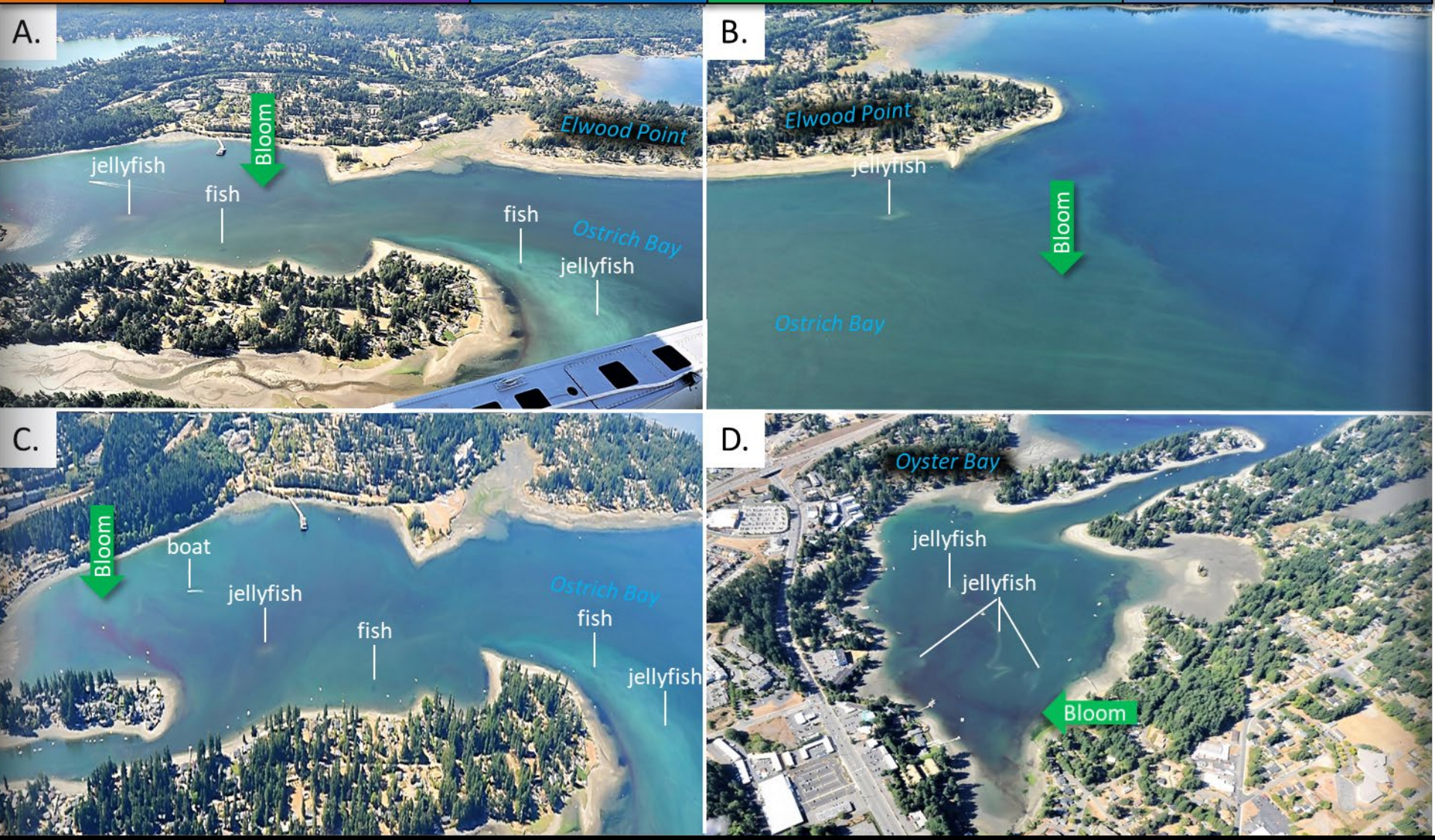
Species aggregations 3-11-2021



Jellyfish aggregations and early signs of phytoplankton growth.
Location: Oyster Bay, Dyes Inlet (Central Sound), 2:19 PM

Schools of fish, a bloom, and suspended sediment.
Location: Eld Inlet (South Sound), 11:26 AM

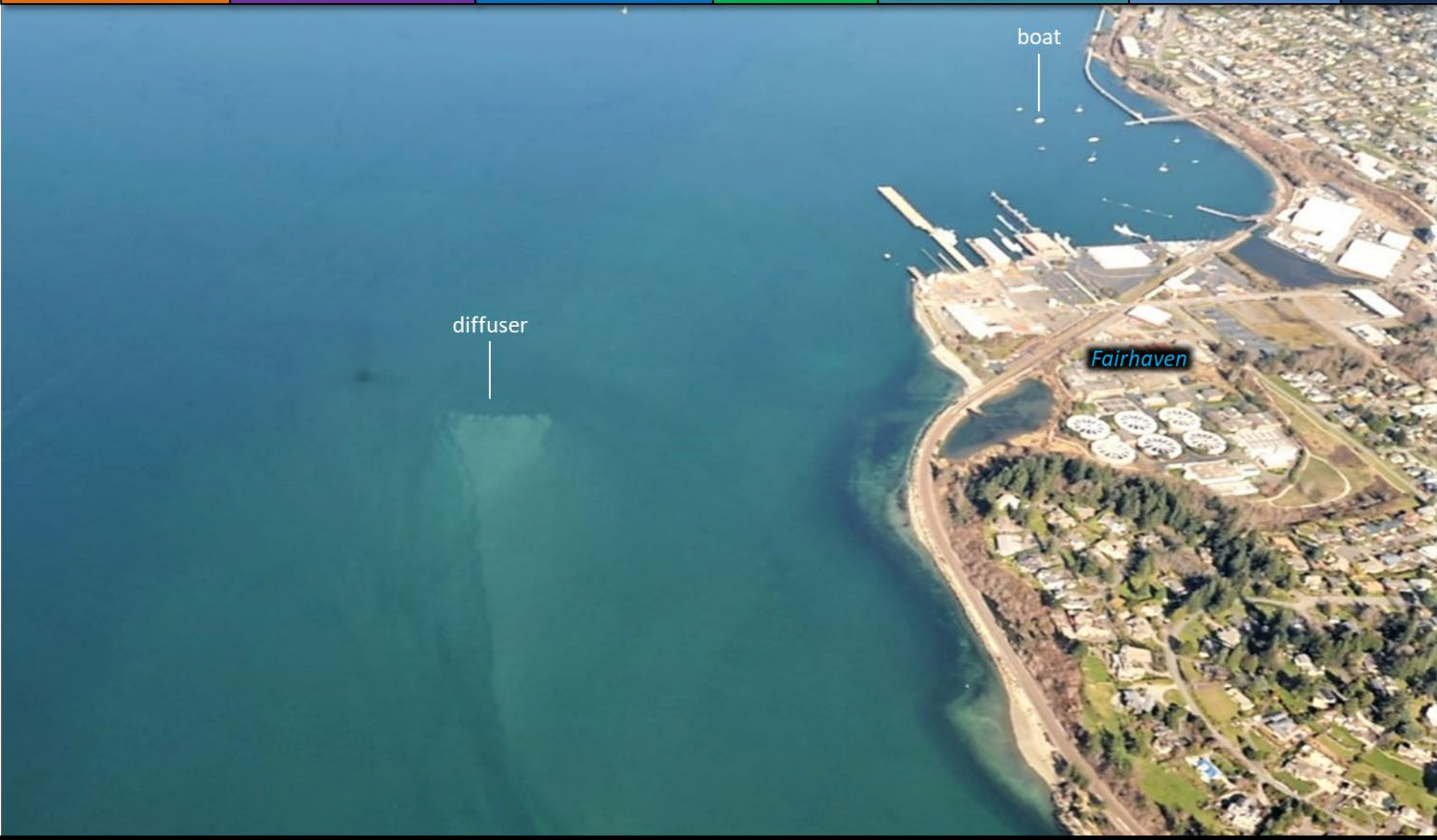
Species aggregations 9-8-2021



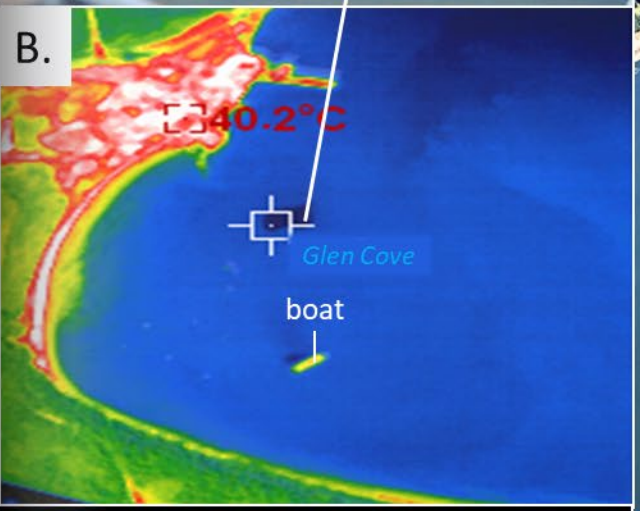
A. Milky-white patches and red-brown bloom in Ostrich Bay. B-D. Jellyfish patches in Ostrich and Oyster Bays.
Location: Dyes Inlet (Central Sound), 2:08 PM

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



Diffuser of the Fairhaven Wastewater treatment plant. Effluent can be seen miles to the south.
Location: Fairhaven, Bellingham Bay (North Sound), 12:52 PM



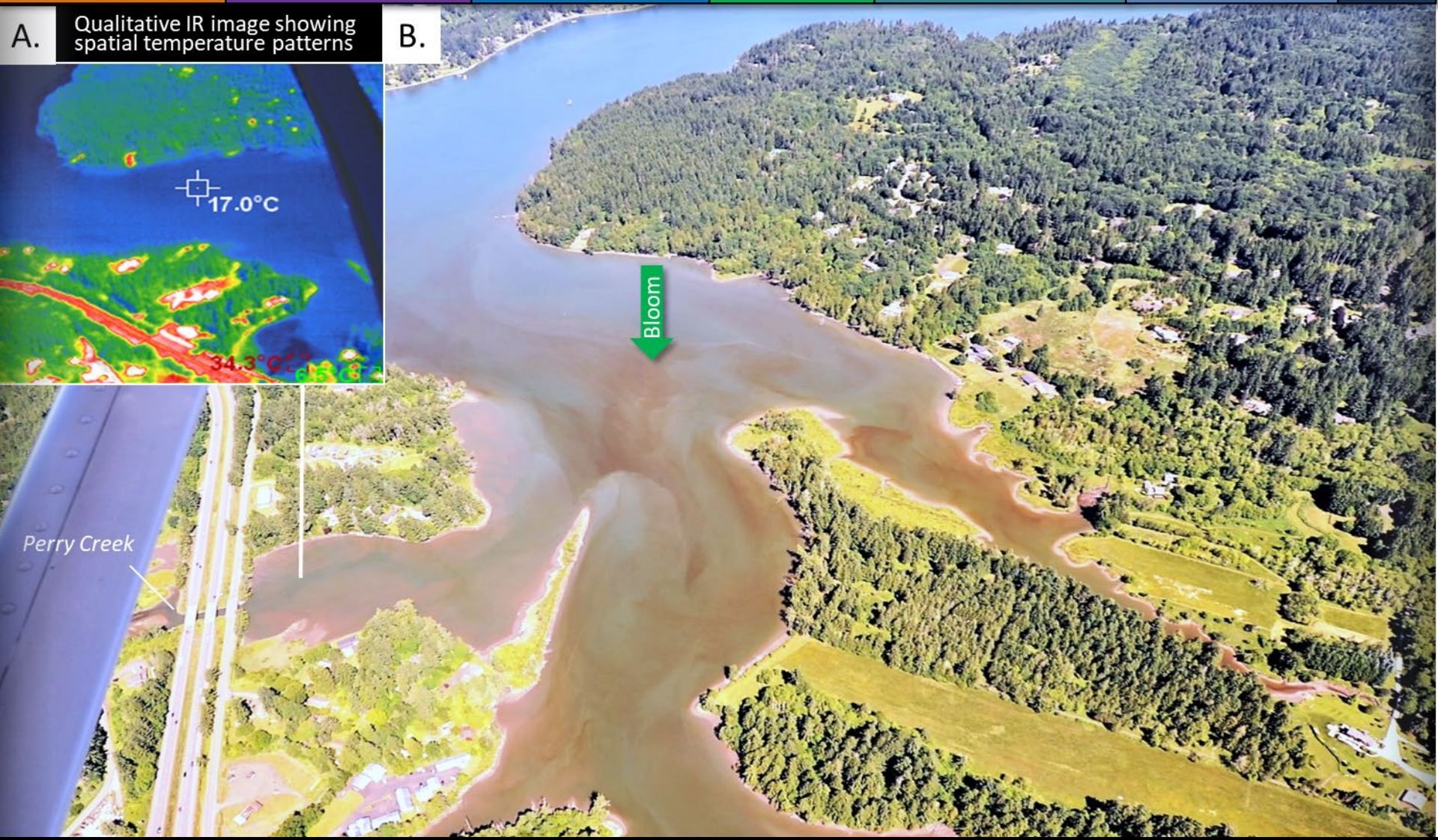
Qualitative IR image showing spatial temperature patterns

A. Outfall in Glen Cove surfaces and has B. colder IR signature. C. Bloom and line of bubbles in Western Bay.
Location: Port Townsend Bay (North Sound), 1:51 PM

Sediment shows circulation pattern of sediment-rich water mixing south of Matia Island.
Location: Matia Island (San Juan Islands), 1:58 PM

Bloom along front in Mosquito Bay originating in Horseshoe and Mitchell Bays.
Location: San Juan Island (San Juan Islands), 1:24 PM

Algal blooms 6-17-2021

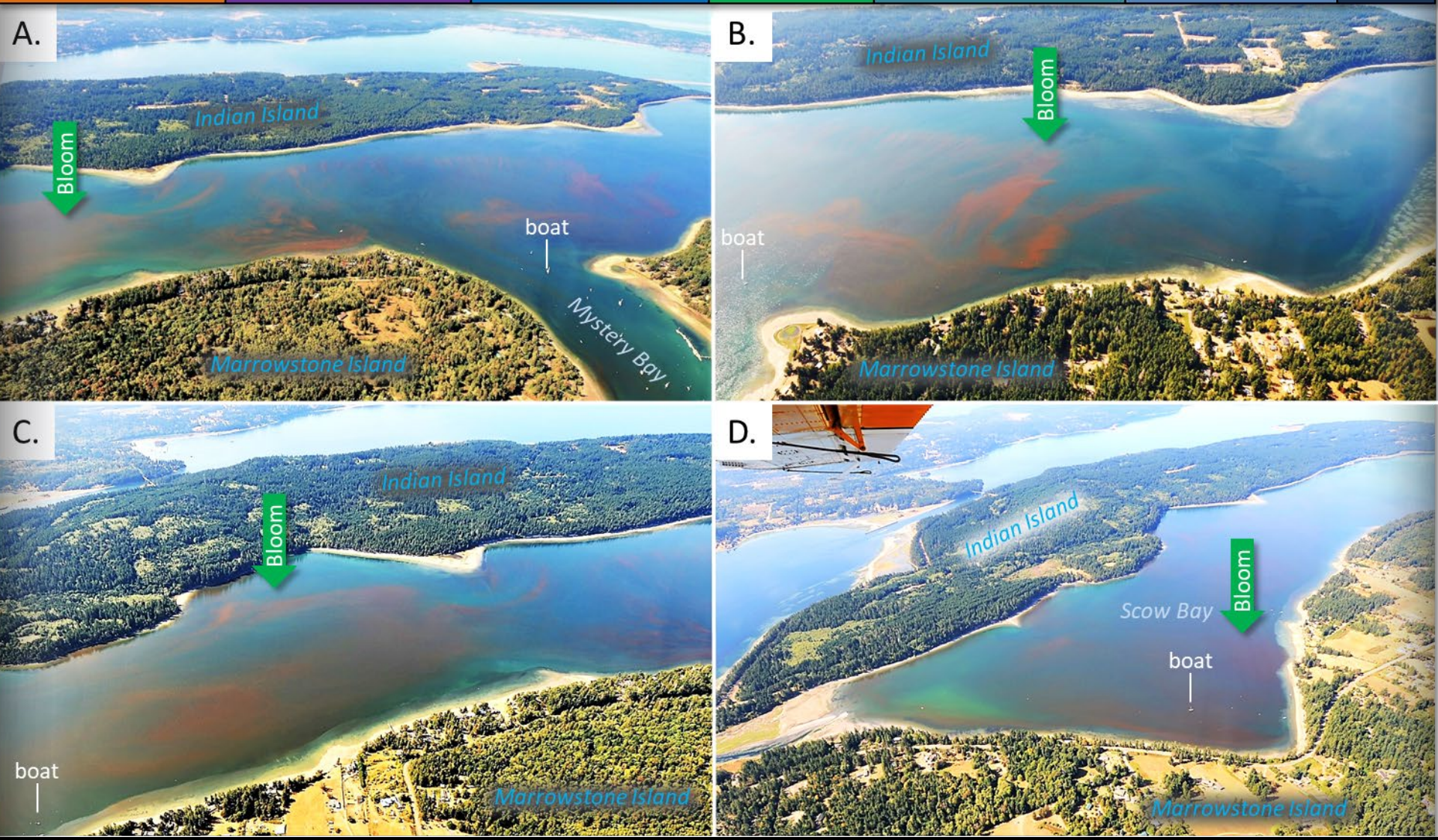


A. Colder water entering from Perry Creek. B. Strong brown-orange bloom.

Location: Eld Inlet (South Sound), 11:24 AM

Strong red-brown bloom.
Location: Budd Inlet (South Sound), 11:34 AM

Algal blooms 9-8-2021



Very red-brown bloom spanning the entire length of Kilisut Harbor, from the entrance of the bay to Scow Bay.
Location: Marrowstone Island (Central Sound), 1:50 PM

Algal blooms 9-8-2021

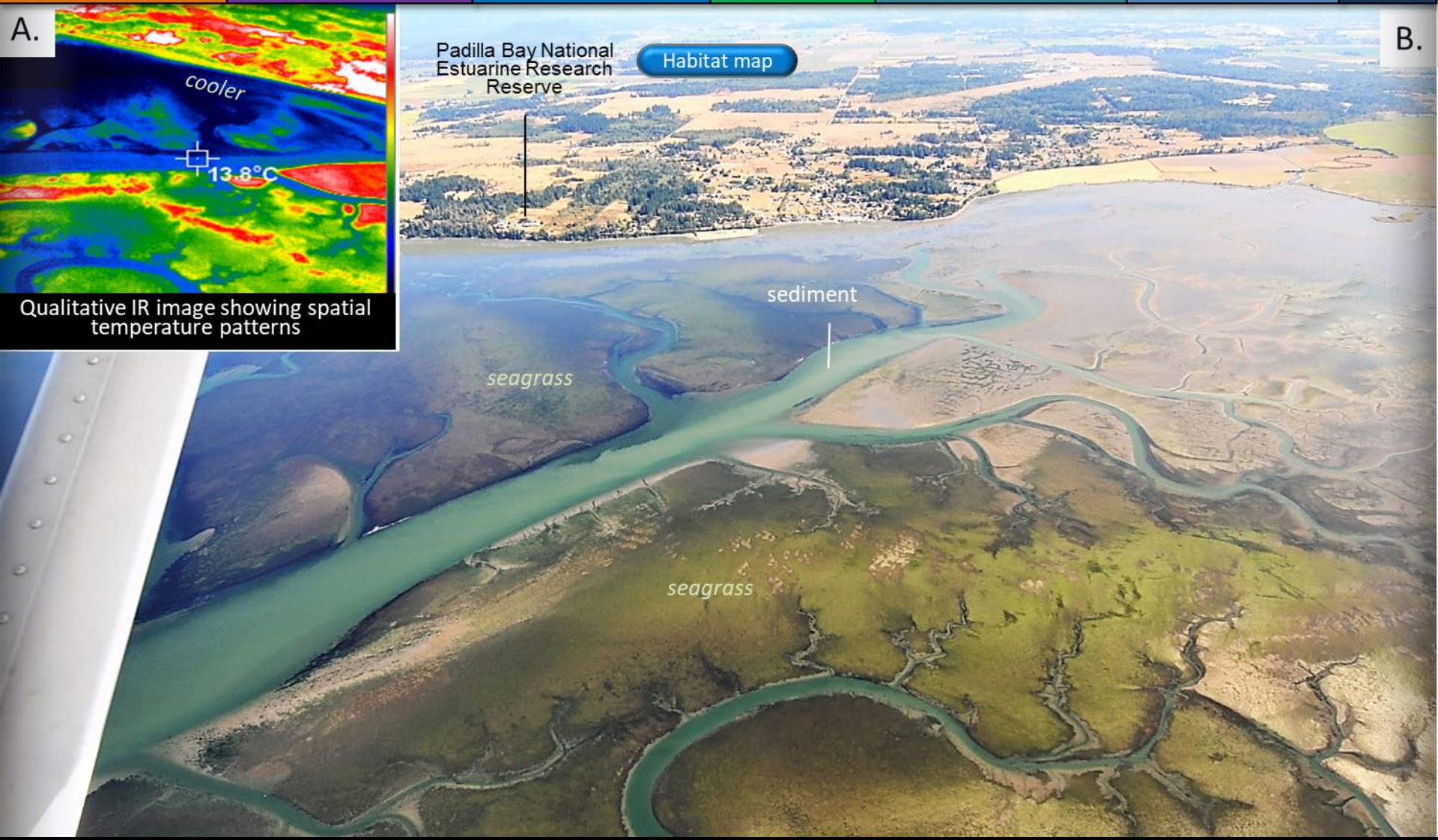
Strong brown bloom and organic material accumulating at a distinct front.

Location: Shoal Bay (North Sound), 1:12 PM

Bright-green bloom patches in shallow portions of Liberty Bay.
Location: Liberty Bay (Central Sound), 2:02 PM

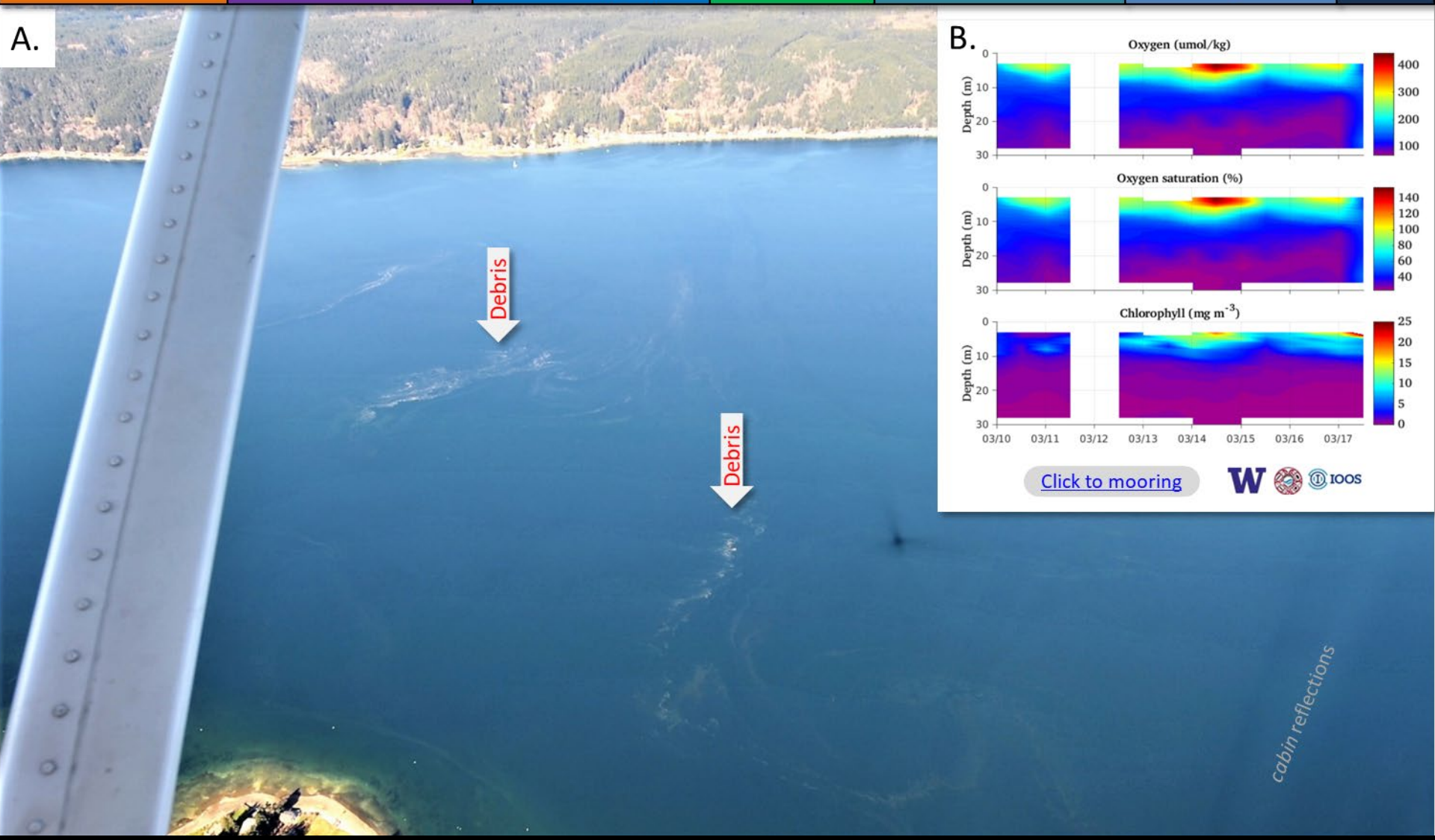
Algal blooms 9-8-2021

Strong red-brown bloom with turquoise water mixing in from Chapman bay.
Location: Henderson Inlet (South Sound), 2:30 PM



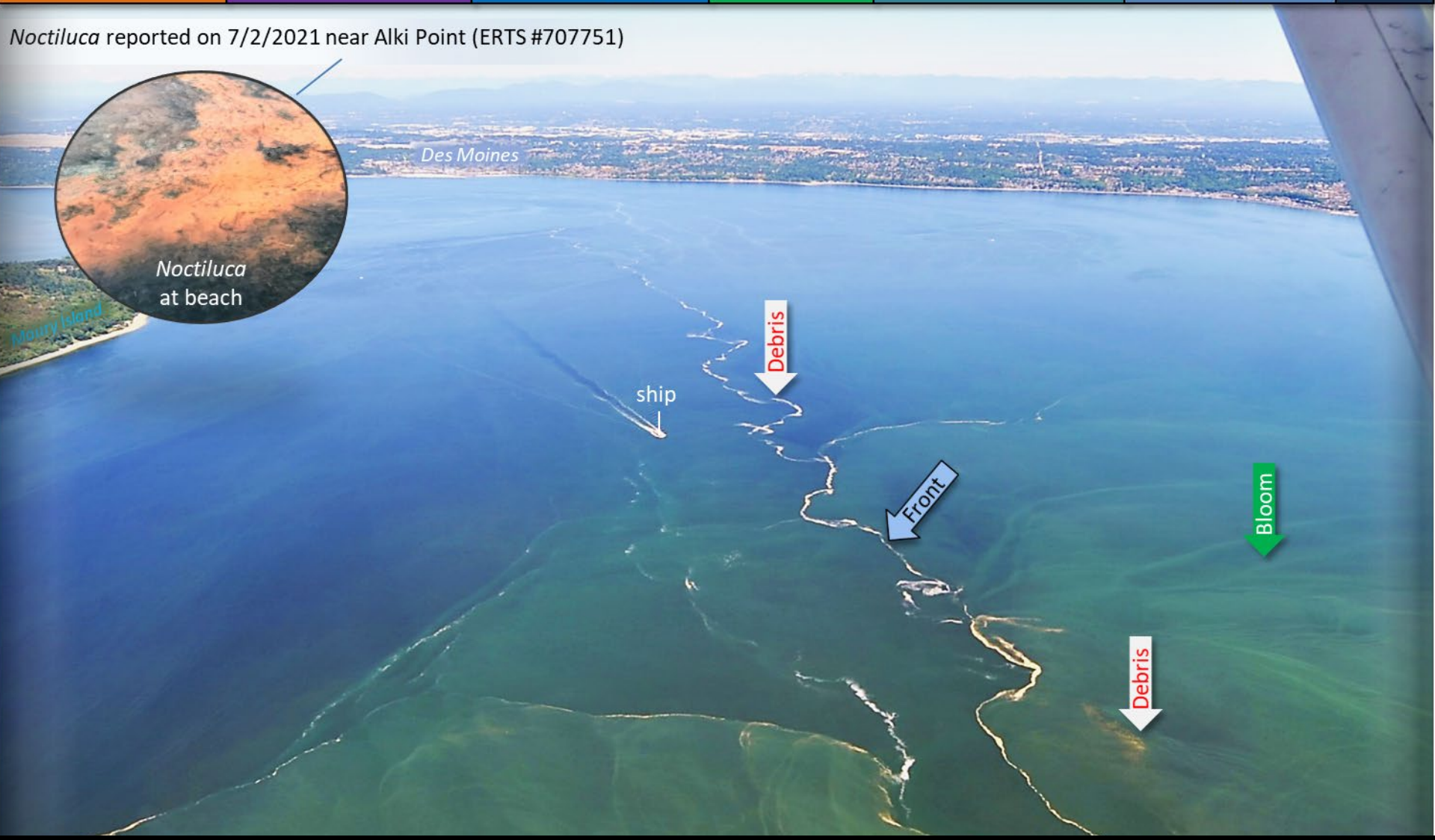
Padilla Bay seagrass experiences much cooler temperatures north of the tidal gully. Sediment from south of the gully discolors the water. Location: Padilla Bay (North Sound), 12:35 PM

Macroalgae and debris 3-11-2021



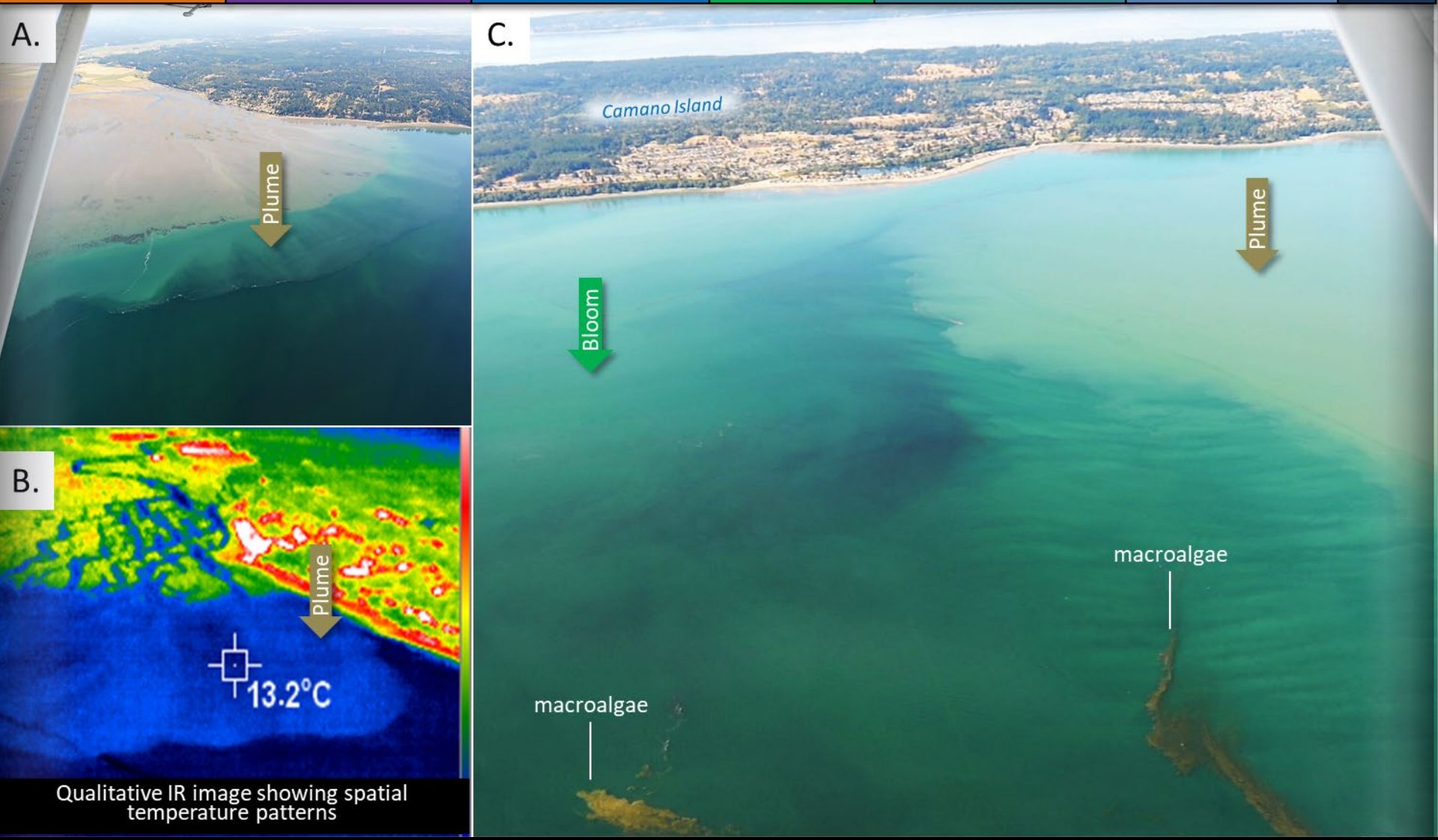
A. Large patches of organic surface debris following a bloom. B. Nearby ORCA mooring with coincident data.
Location: East of Twanoh State Park (southern Hood Canal), 11:49 AM

Macroalgae and debris 6-17-2021



Puyallup River plume with glacial flour, bloom, and orange organic debris (likely Noctiluca*) accumulating at front.*
Location: East of Maury Island (Central Sound), 2:22 PM

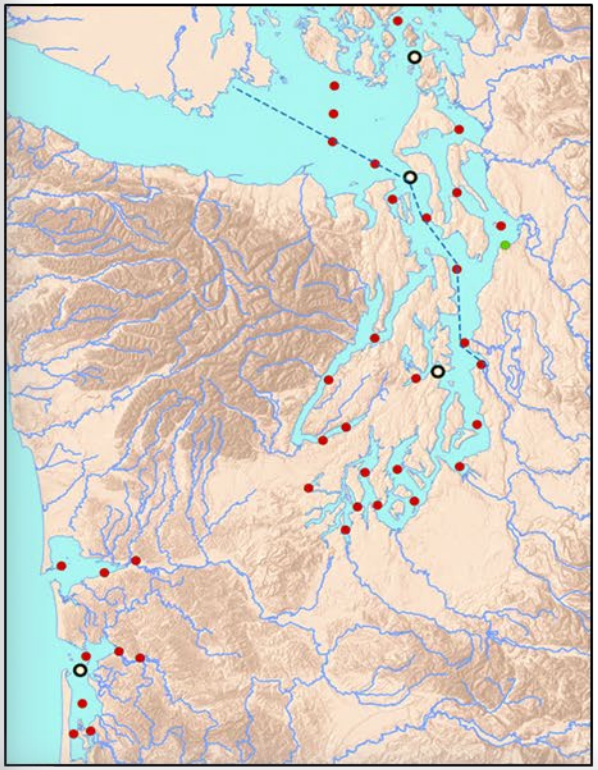
Macroalgae and debris 9-8-2021



A. Stillaguamish estuary with B. relatively cool tideflat despite sunshine. C. Large rafts of organic material of different color and composition. Location: Port Susan (Whidbey Basin), 12:23 PM

Long-term monitoring data from Puget Sound and coastal bays

- 39 stations sampled monthly
- 16 physical, chemical, and biogeochemical parameters
- Data from 1999 to present



Get your data

https://apps.ecology.wa.gov/eim/search/SMP/MarineAmbientSearch.aspx?StudyMonitoringProgramUserId=MarineAmbient&StudyMonitoringProgramUserIdSearchType=Equals

We have published 95 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.

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January_7_2022
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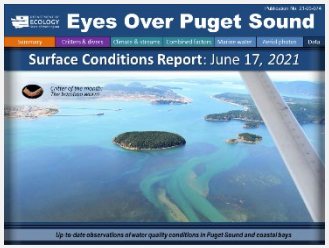
September_8_2021
Publication No. 21-03-075



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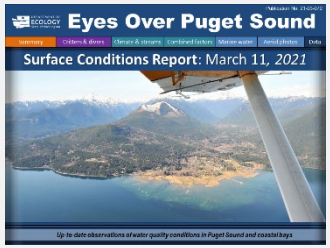
April_1_2021
Publication No. 21-03-073



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February_3_2021
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January_14_2021
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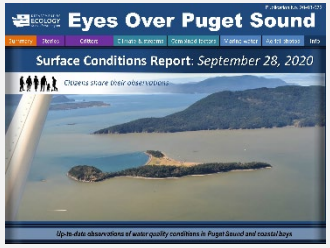

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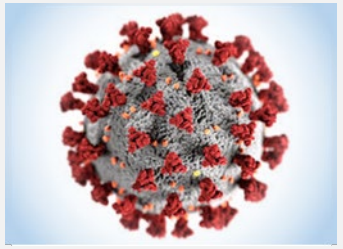

No coverage due to COVID-19 pandemic from April-September

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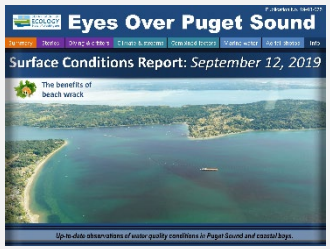

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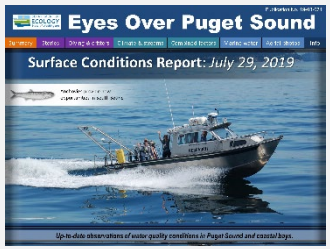

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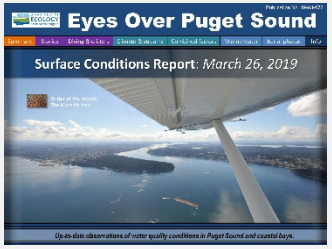

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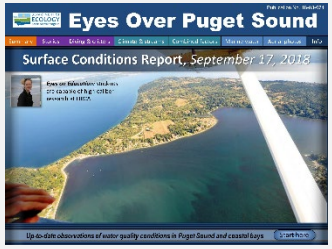

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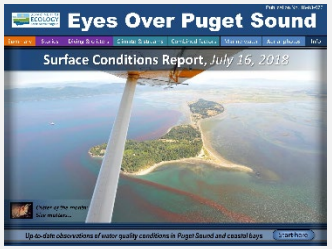

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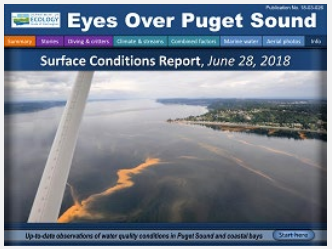

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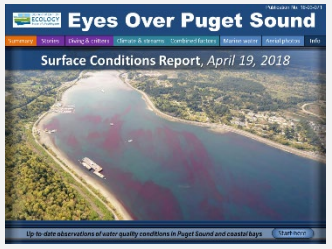

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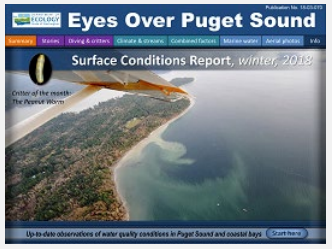

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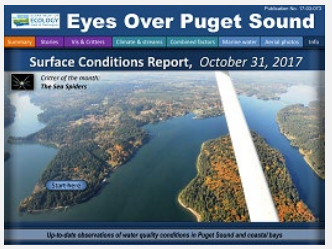

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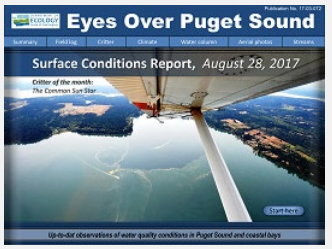

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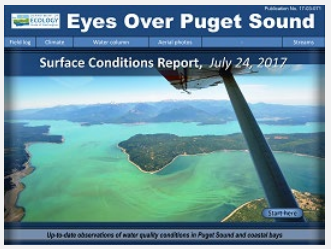

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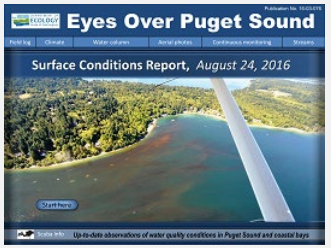

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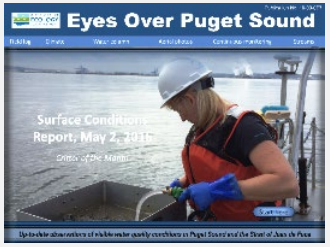

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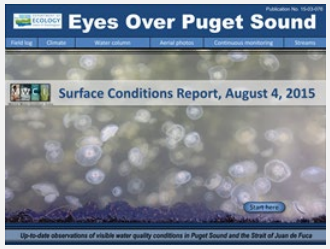

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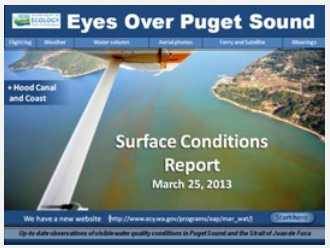

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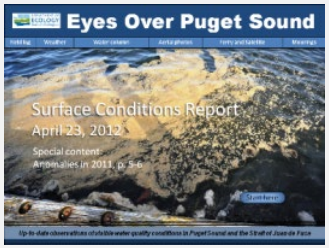

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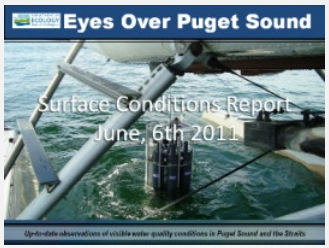

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