Publication No. 18-03-071

DEPARTMENT OF ECOLOGY State of Washington

Eyes Over Puget Sound

Surface Conditions Report, *April 19, 2018*

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

Start here

LONG-TERM MARINE MONITORING UNIT

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Personal stories

p. 3

You might see our sediment team on the water.

Climate & Streams

p. 5

By March, regional impacts of large-scale climate patterns are normalizing and air temperatures and precipitation were below normal. April brought more rain and rivers quickly responded.

With La Niña predicted to return to ENSO-neutral conditions, will the favorable snowpack maintain healthy streamflows this summer?

Marine waters

p. 9

After three years of unusual patterns, 2018 conditions are mostly expected. The exception is Hood Canal.

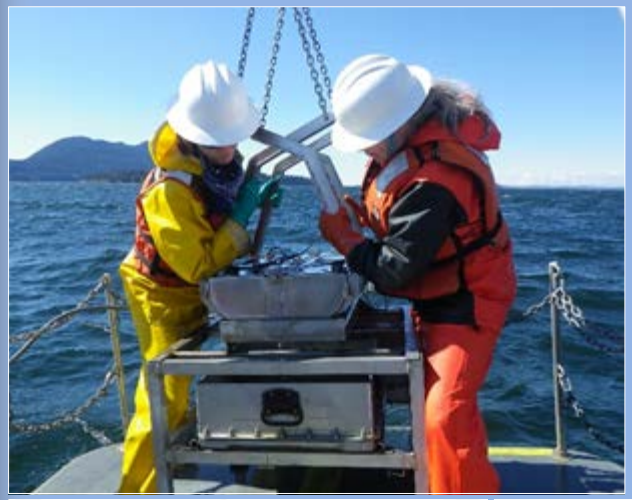
Aerial photography

p. 10

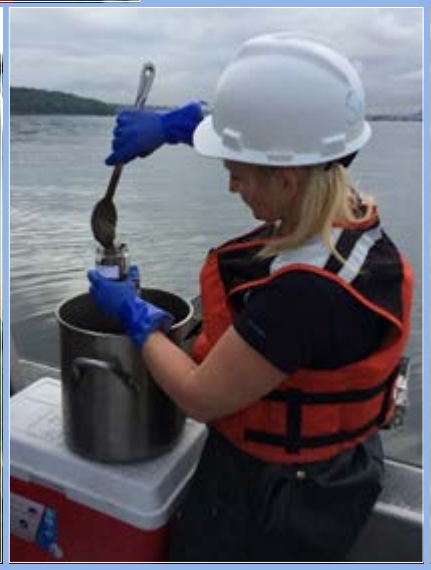
Many rivers and field ditches release sediment into Puget Sound. Strong blooms in Sinclair Inlet, Joe Leary Slough (Padilla Bay), and Bellingham Bay. It is colorful out there!

Editorial assistance provided by: Julianne Ruffner, Suzan Pool, Carol Maloy

It's field season for our Sediment Team!



[Program details are in our new monitoring plan!]

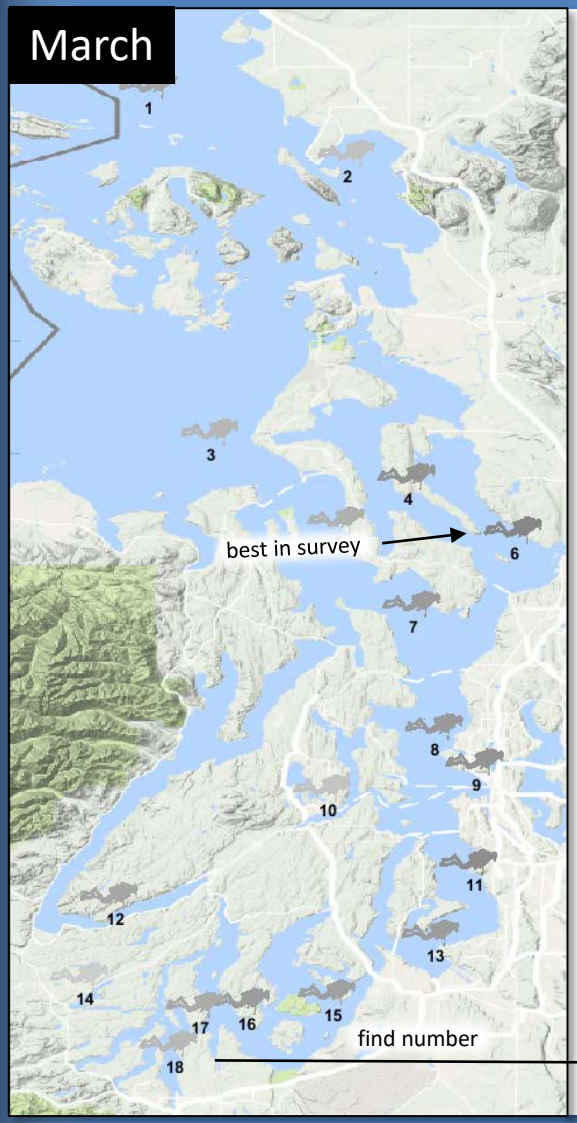


We collect sediment from the bottom of Puget sound every April and June to measure:

1. Habitat type
2. Nutrients
3. Chemistry
4. Biogeochemistry
5. Invertebrate community:
   - Composition
   - Function
   - Biomass

What can you find underwater?

What was the visibility in the water for divers?



Horizontal visibility /depth (ft)

#)	Best		Worst	
1)	20	80	19	5
2)	14	3	11	30
3)	16	94	15	16
4)	24	67	4	3
5)	18	90	12	3
6)	27	90	4	11
7)	23	94	5	13
8)	23	95	18	7
9)	24	95	15	18
10)	13	16	9	41
11)	26	72	22	8
12)	20	80	9	36
13)	22	57	8	7
14)	11	43	9	10
15)	21	82	18	10
16)	22	56	18	5
17)	19	75	10	10
18)	16	48	9	52

Find depths with high/low visibility

- **Best visibility** was 27 feet around Mukilteo and is overall poorer than average.
- **Poor visibility** occurred in Oakland Bay (near Shelton), in Sinclair Inlet (near Bremerton), but also in Bellingham Bay.
- We use transmissometer readings from our CTD package and convert them into horizontal visibility. The poster, Underwater Visibility Maps – a Tool for Scuba Divers, is available at: Click here

This is a new feature and we are soliciting feedback (salb461@ecy.wa.gov). Eventually we will feature the most recent data.

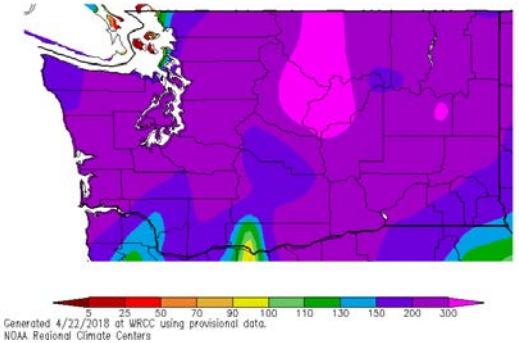
How much water flows into coastal marine waters?

Tyler Burks, Jim Shedd

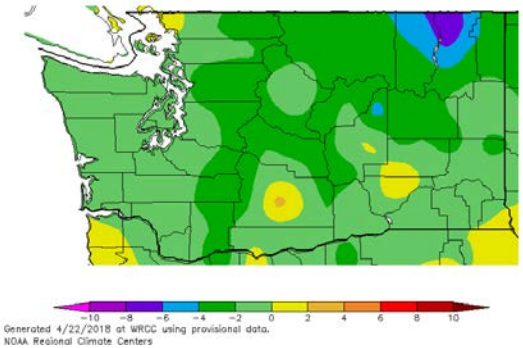
This winter we saw slightly cooler temperatures in most of the Puget Sound basin and above average precipitation in the north Sound. However, April has been VERY wet and cool (maps, left) despite the recent run of sunshine and relative warmth. Over 90 percent of Washington stream gages now report normal or above normal flow conditions (map, center).

Conditions April 1-21

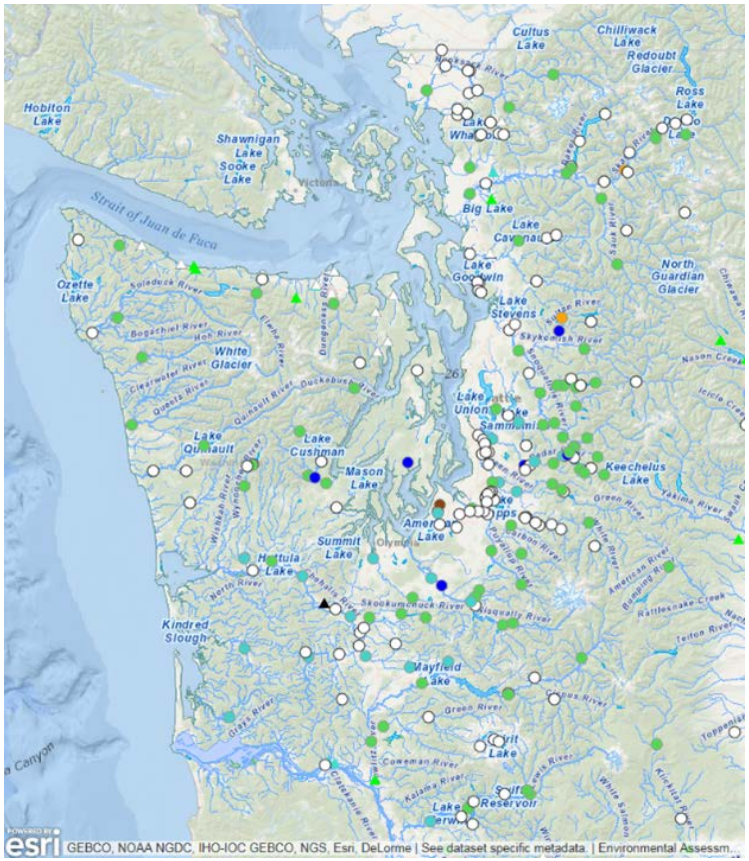
Percent of Avg. Precipitation (%)



Avg. Temperature departure (°F)



Current Streamflow Conditions as of 4/24/2018



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

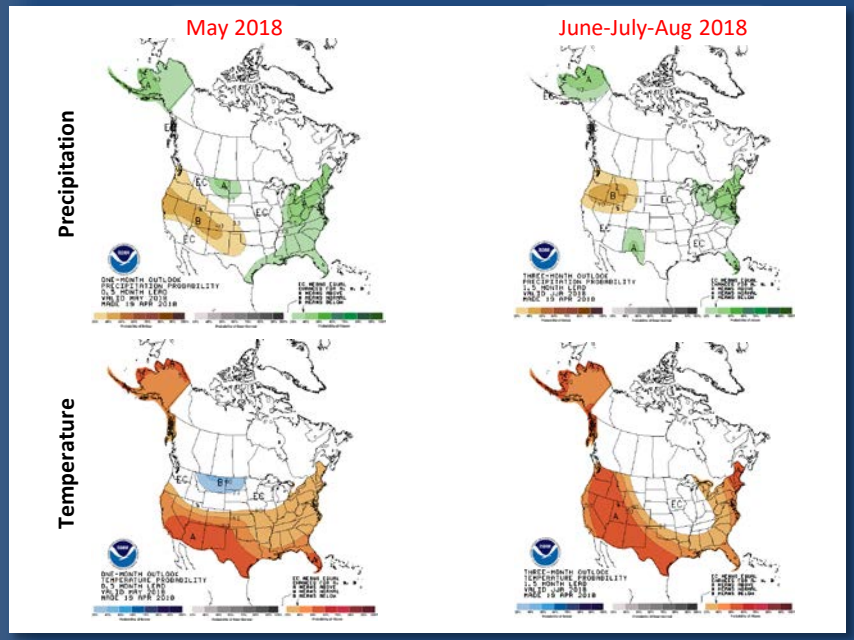
Ecology Daily Streamflow

Daily Streamflow

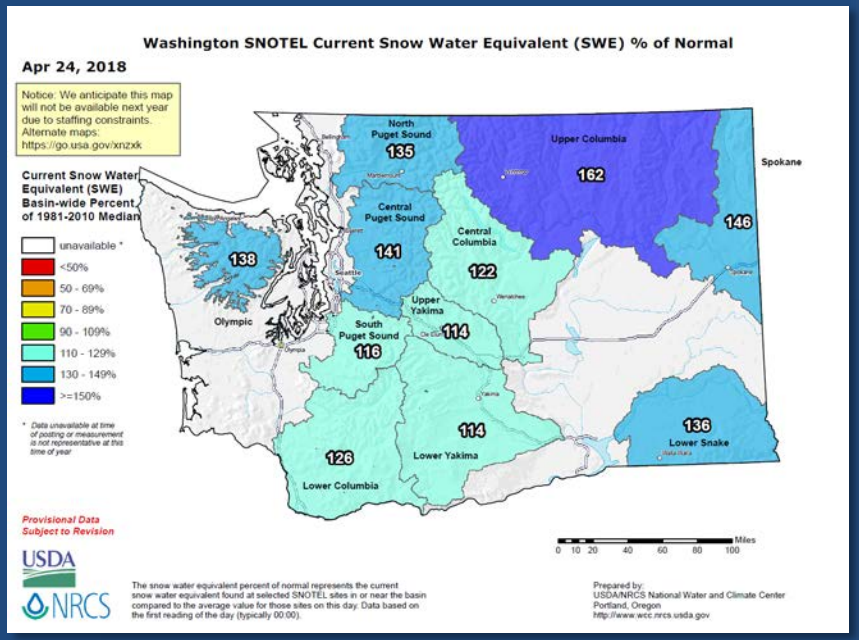
- Highest recorded
- Much above normal (>90%)
- Above normal (76-90%)
- Normal (25-75%)
- Below normal (10-24%)
- Much below normal (<10%)
- Lowest recorded
- Not ranked

How much water flows into coastal marine waters?

Climatologists predict drier and warmer conditions this summer. The dwindling La Niña is expected to transition to ENSO-neutral during April-May. Will the current favorable snowpack translate to healthy streamflows in September?



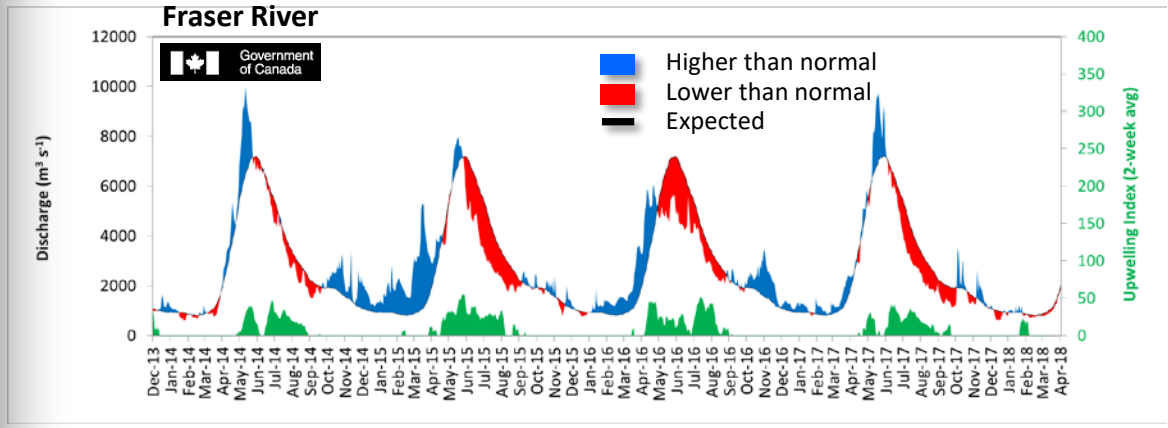
The maps on the top show higher than usual probability of below normal precipitation. The maps on the bottom show a greater chance of higher temperatures Click here



Snow water equivalence (SWE) in the mountains is very good and over 130% of normal. Last year at this time SWE was above normal as well. However, last summer's warmer temperatures and lower rainfall resulted in lower than normal streamflows in September 2017.

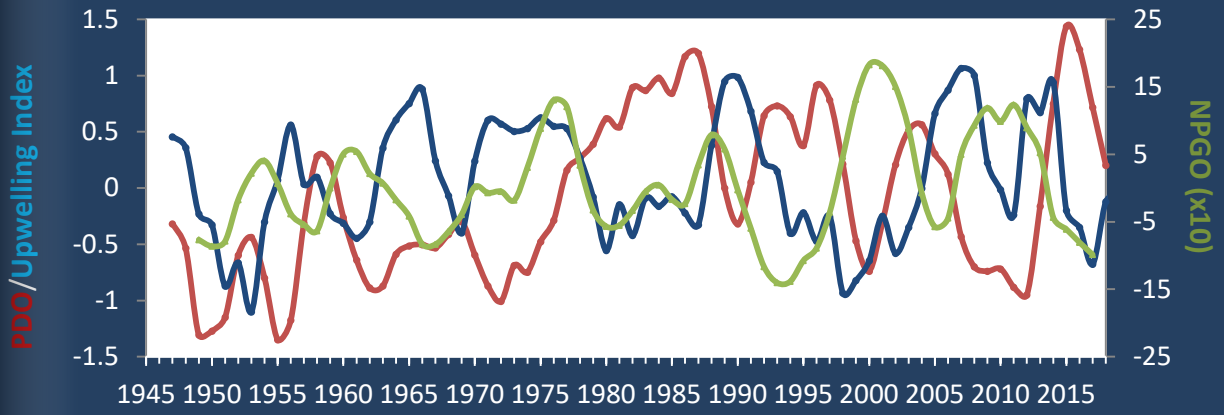
Climate influences: How well is Puget Sound exchanging its water?

Historically, peaks of coastal upwelling and the freshet are in sync. Will they be this year?



The Fraser River is the major driver of estuarine circulation and water exchange with the ocean.
Fraser River flows are presently expected and the snowpack in BC is near 100% (Basin Snow Water Index)

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?
Past years' warm water is gone (PDO), upwelling is neutral (Upwelling Index anomaly), and surface productivity along the coast is lower (NPGO).

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

What's the story of influences affecting water quality?

Climate and natural influences include weather, river flows, and the adjacent ocean conditions that affect our marine waters. This graphic provides context for interpreting Puget Sound marine conditions. All data are from public sources: weather from UW GRAYSKIES; river flows from USGS and Environment Canada; indices from NOAA, UW (PDO), and E. Di Lorenzo (NPGO).

Summary (March):

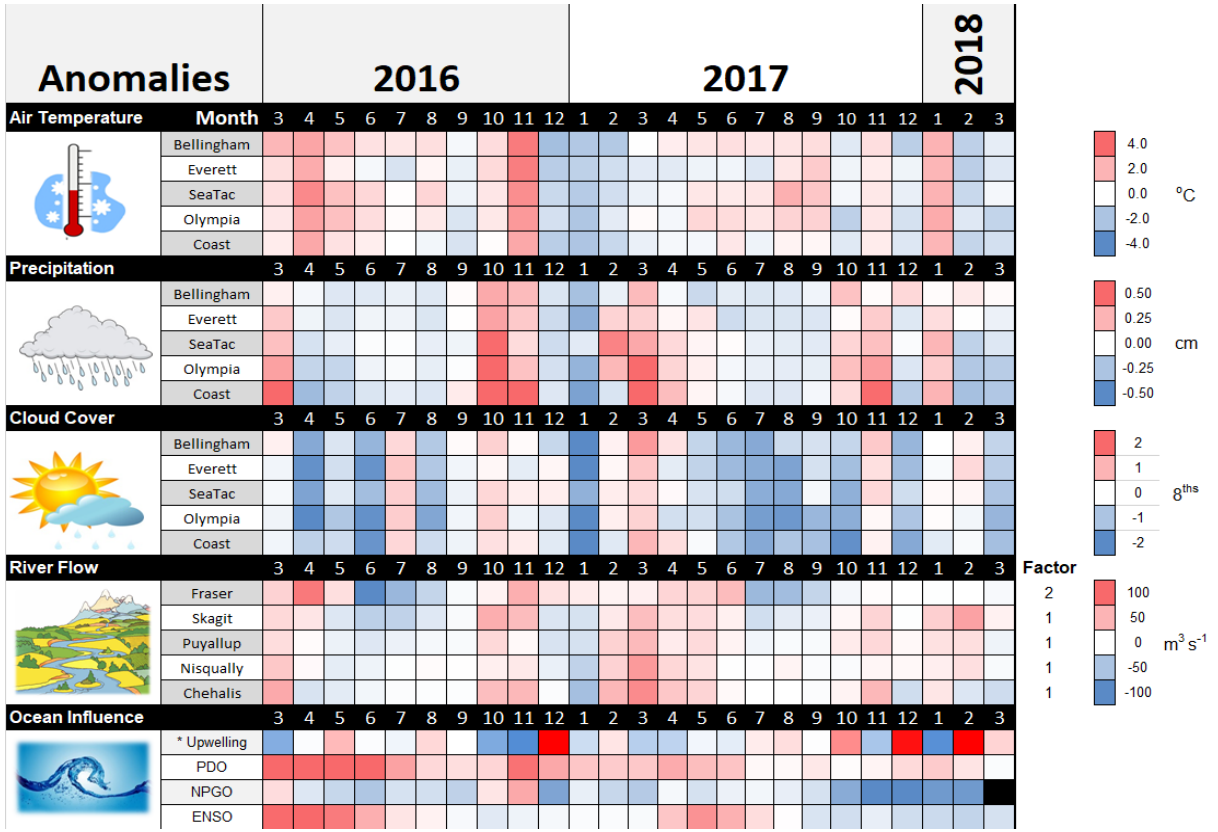
Air temperatures have been below normal since January.

Precipitation levels have been below normal until March, but less so to the north. See p. 5 for April conditions.

Sunshine levels have been above normal.

River flows are normal until March. See p. 5 for April conditions.

Downwelling is below normal. ENSO (MEI) is showing signs of a weak La Niña.



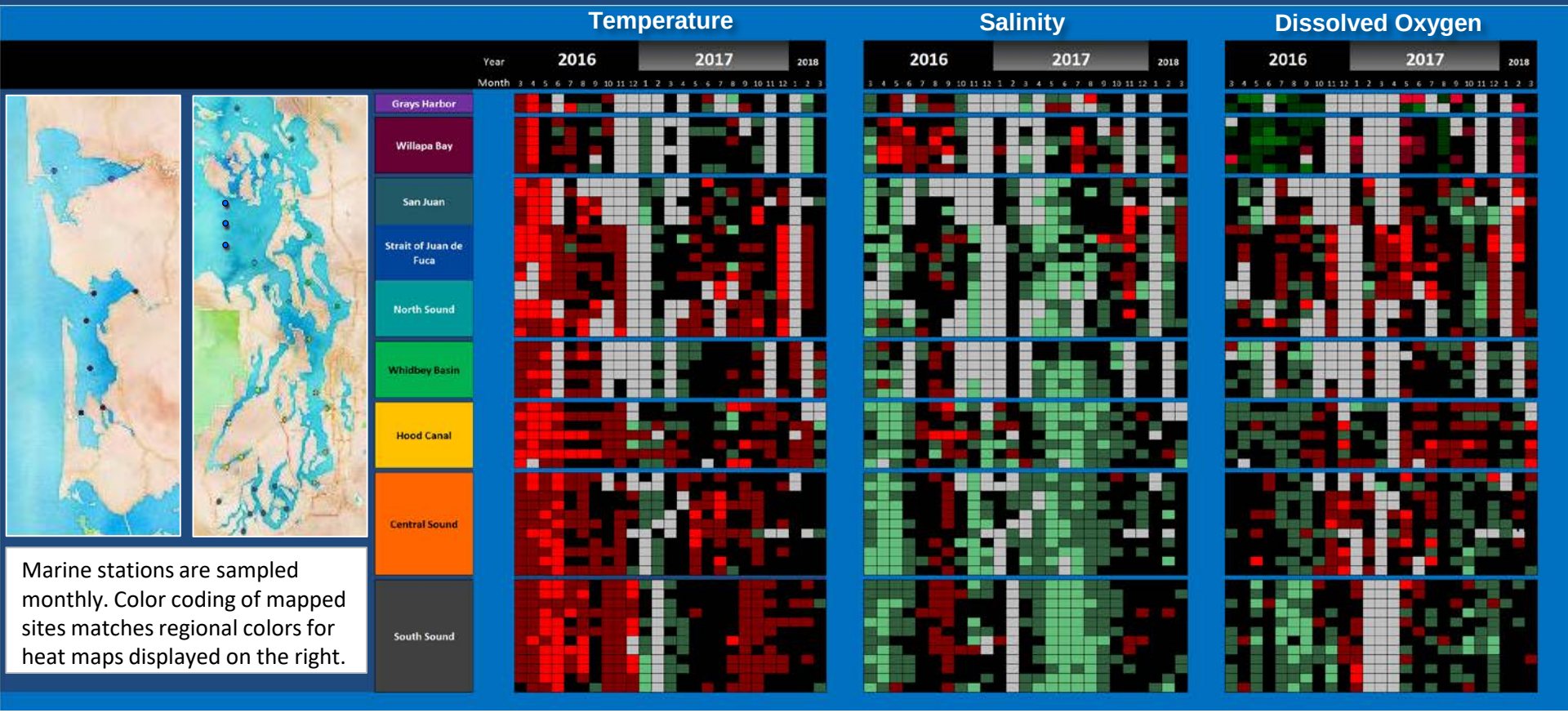
*Upwelling/downwelling Anomalies (PFEL)
PDO = Pacific Decadal Oscillation
NPGO = North Pacific Gyre Oscillation
ENSO = El Niño Southern Oscillation

higher — expected — lower

No data

How did water quality respond to recent conditions?

After large anomalies in temperature and salinities in the previous years, 2018 is mostly expected. The exception is Hood Canal (yellow), where anomalies persisted longer and have shifted in March to a pattern of lower temperatures and higher oxygen, beneficial to the aquatic food web.



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

Ecology's long term monitoring station network. Surface to full depth.

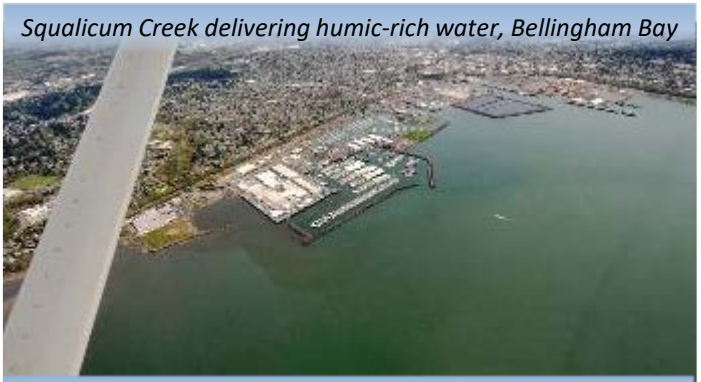
= higher than expected (> *IQR)
= higher than previous measurements
= expected (= *IQR)
= no data
= lower than expected (< *IQR)
= lower than previous measurements

*IQR = Interquartile Range (25th – 75th percentiles); n = 17

What are conditions at the surface?

Many rivers and field ditches discharging sediment into Puget Sound, especially the Stillaguamish. Strong red-brown bloom in Sinclair Inlet. Bright brown bloom in Joe Leary Slough (Padilla Bay). Bright green bloom in Bellingham Bay. An occasional jellyfish patch in Sinclair.

Start here



Squalicum Creek delivering humic-rich water, Bellingham Bay

Nooksack Estuary, Bellingham Bay

Flooded wetland delivering humic-rich water, Whidbey Island

Lat 48.008269, Long -122.567856

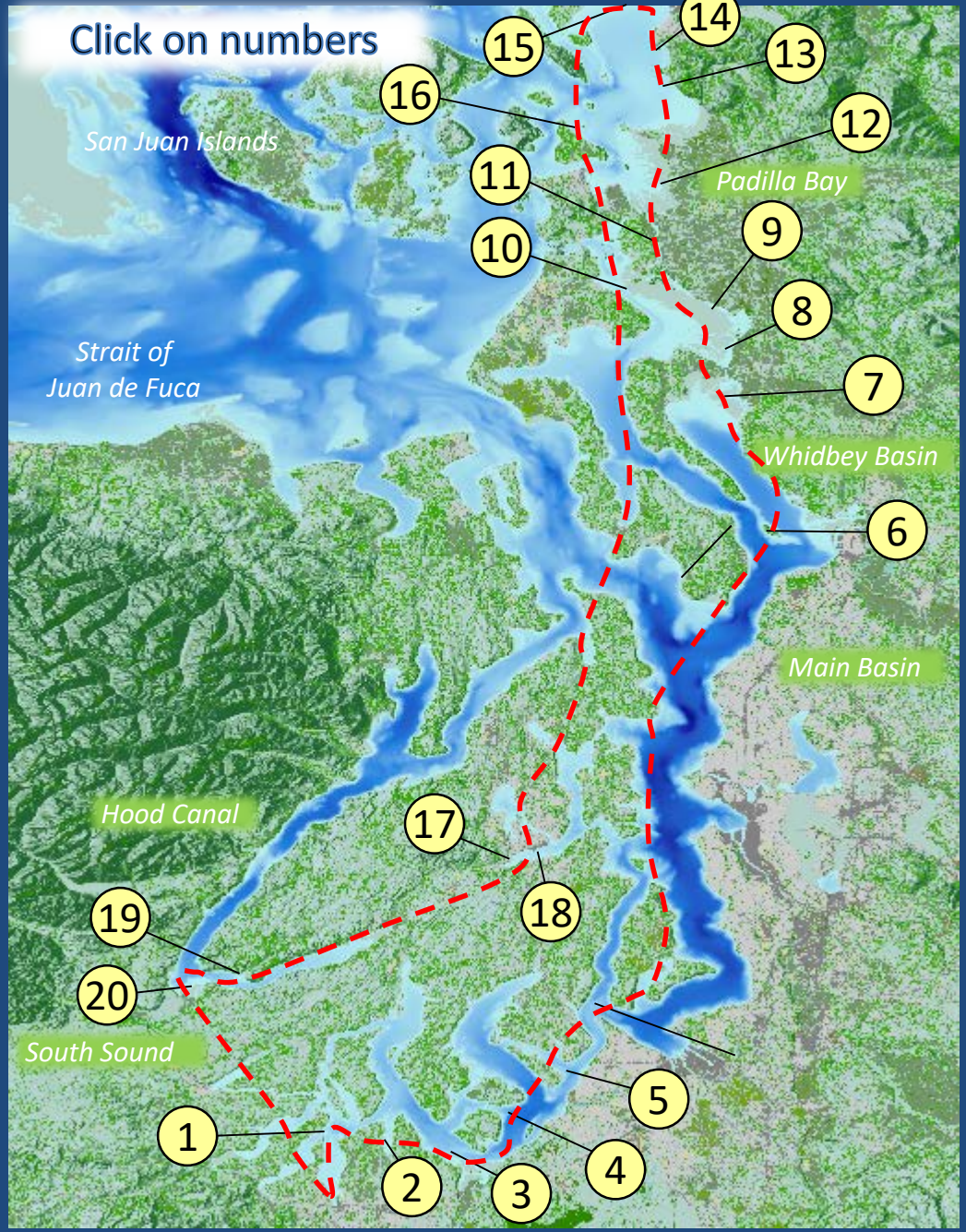
Mixing and Fronts:
Many tidal fronts near Tacoma Narrows and Admiralty Inlet

Jellyfish:
Occasional jellyfish patches in Sinclair Inlet

Suspended sediment:
Large amounts of suspended sediments entering with rivers after rainy period

Visible blooms:
Bright green: Bellingham Bay and Penguin Harbor
Red-brown: Sinclair Inlet
Bright brown: Joe Leary Slough (Padilla Bay)

Debris:
Little organic debris at surface



Aerial photography and navigation guide

Date: 4-19-2018

Tide data from April 19, 2018 (Seattle):

	Height (ft)	High/Low
1:52 AM	5.33	L
7:17 AM	10.99	H
2:09 PM	-1.59	L
9:08 PM	11.29	H

Flight Information:

Sunny and broken cloud ceiling.

Flight routes

A river plume with internal waves next to a tidal front of water leaving Eld Inlet

Location: Cooper Point (South Sound), 11:49 AM

Green bloom mixing with brown humic-rich water from Woodard Creek

Location: Henderson Inlet (South Sound), 11:45 AM

Nisqually river estuary with suspended sediment next to beds of submerged vegetation

Location: Hogum Bay, Nisqually Reach Aquatic Reserve (South Sound), 11:57 AM

Water of different character hugging shores of Anderson and McNeil Island

Location: Balch Passage (South Sound), 12:00 PM

Water of different character meeting sediment-rich water exiting through Tacoma Narrows

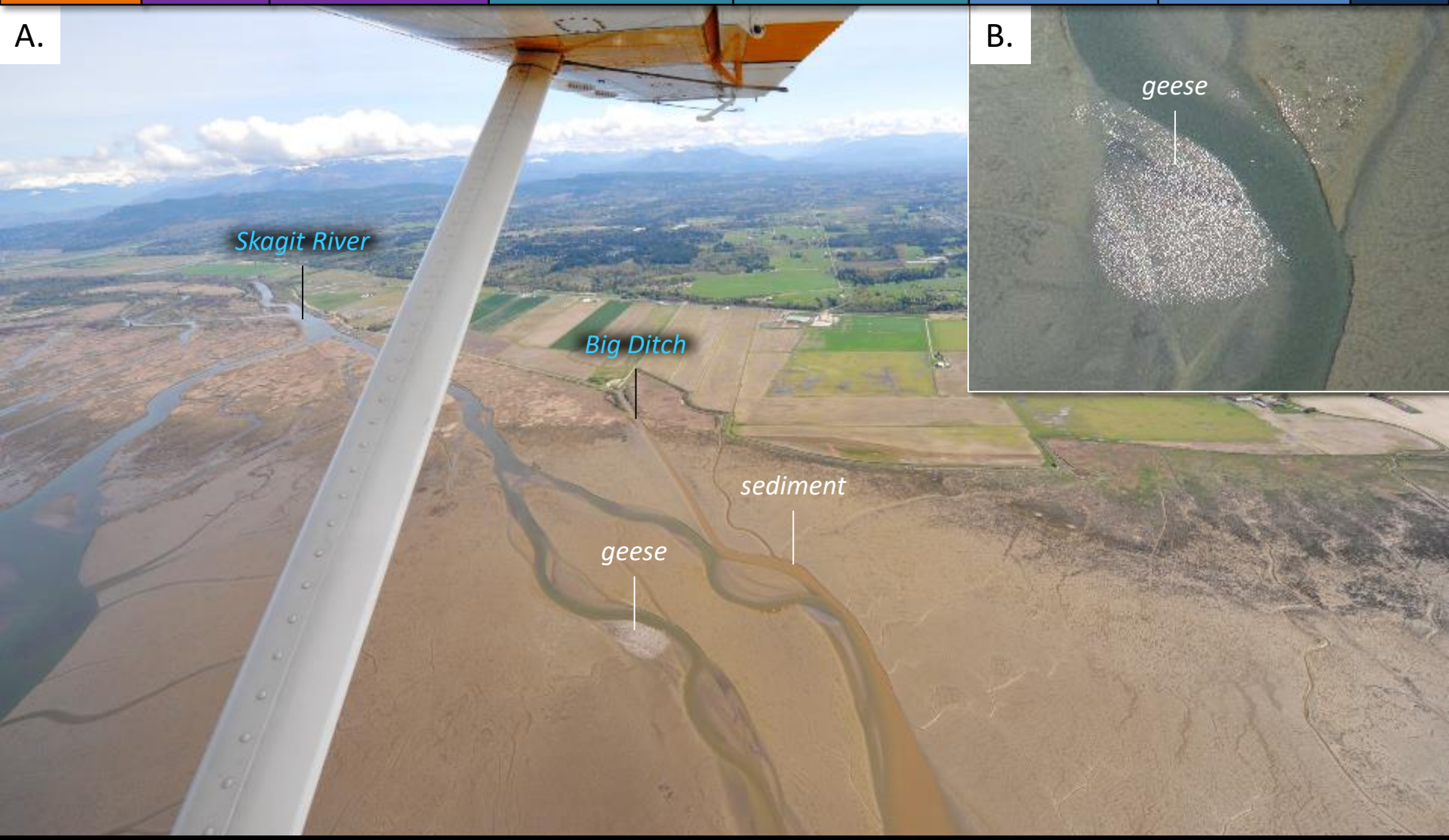
Location: The Tacoma Narrows (South Sound), 12:03 PM

Sediment-rich water from Port Susan and Snohomish River meeting water from Saratoga Passage

Location: Possession Sound (Whidbey Basin), 12:34 PM

Sediment-rich water of the Stillaguamish River flowing over the exposed mudflats at low tide

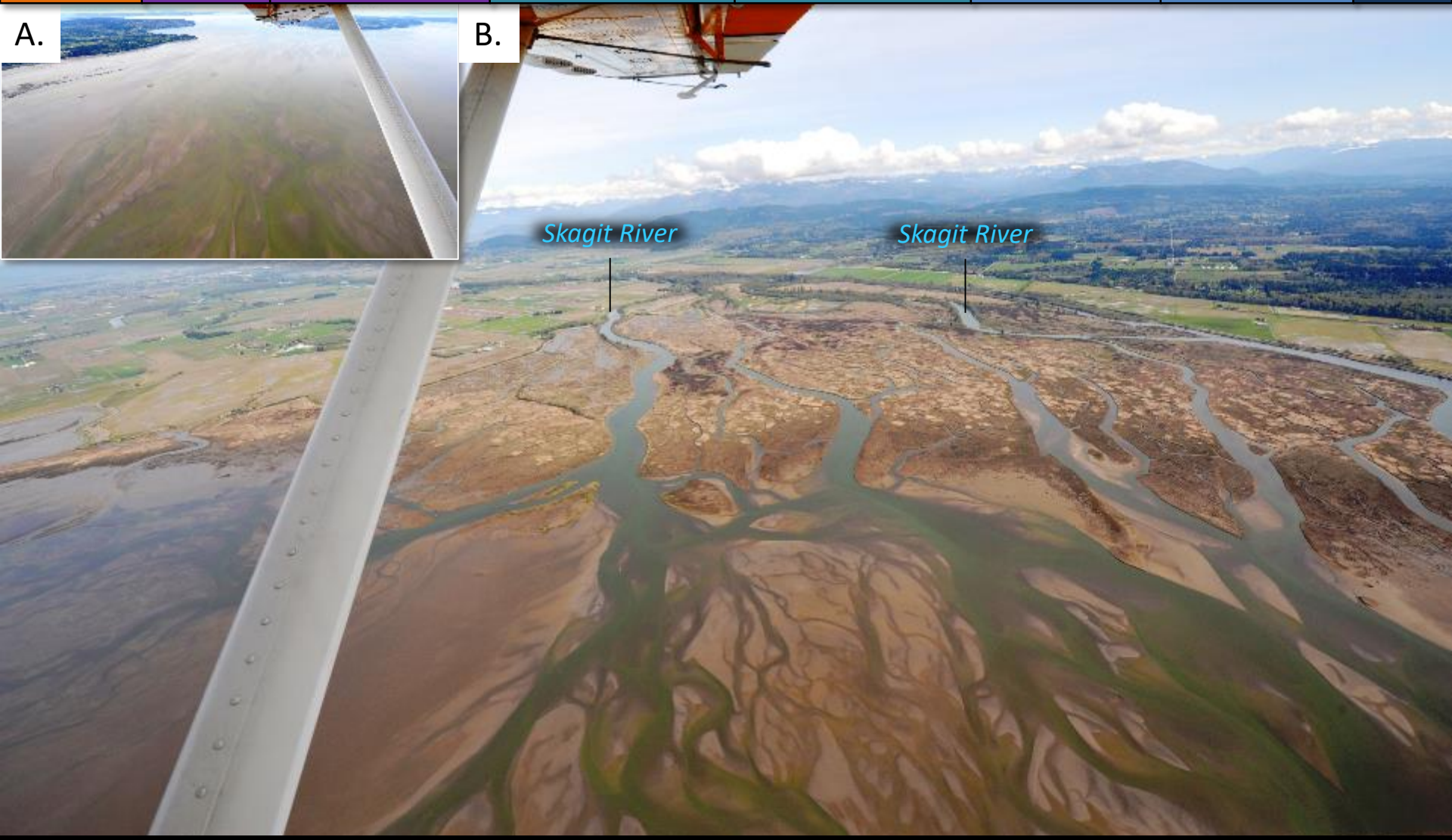
Location: Port Susan (Whidbey Basin), 12:41 PM



A. Snow geese on the mudflats. Draining field ditch more turbid than the Skagit River. B. Close-up

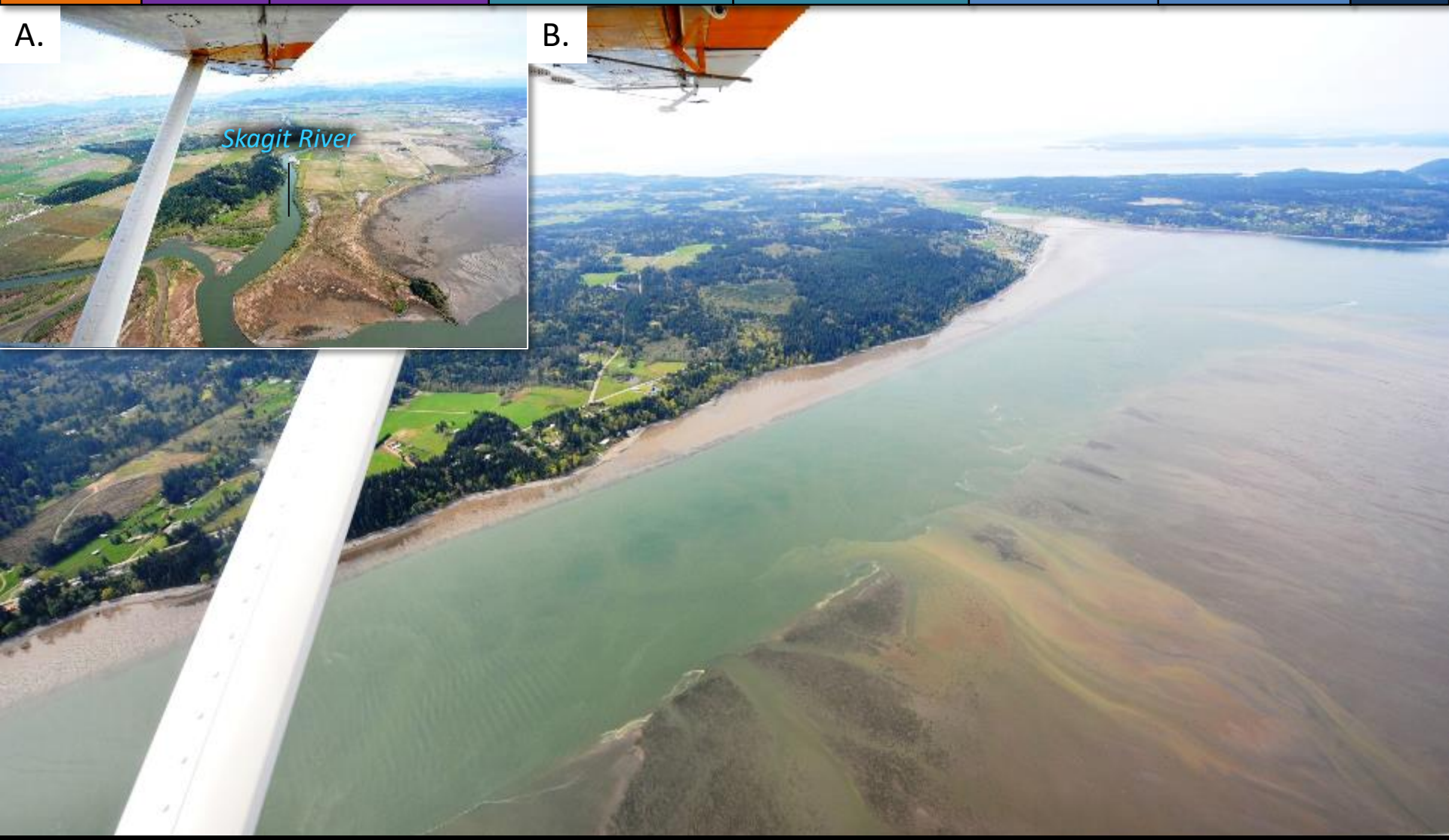
Location: Skagit Bay, (Whidbey Basin), 12:44 PM

Aerial photography 4-19-2018



A. Large exposed mudflats at very low tide. B. Water running over a gauntlet of channels

Location: Skagit Bay (Whidbey Basin), 12:45 PM



A. Sediment-rich water from the north fork of the Skagit River, B. entering Skagit Bay on low tide

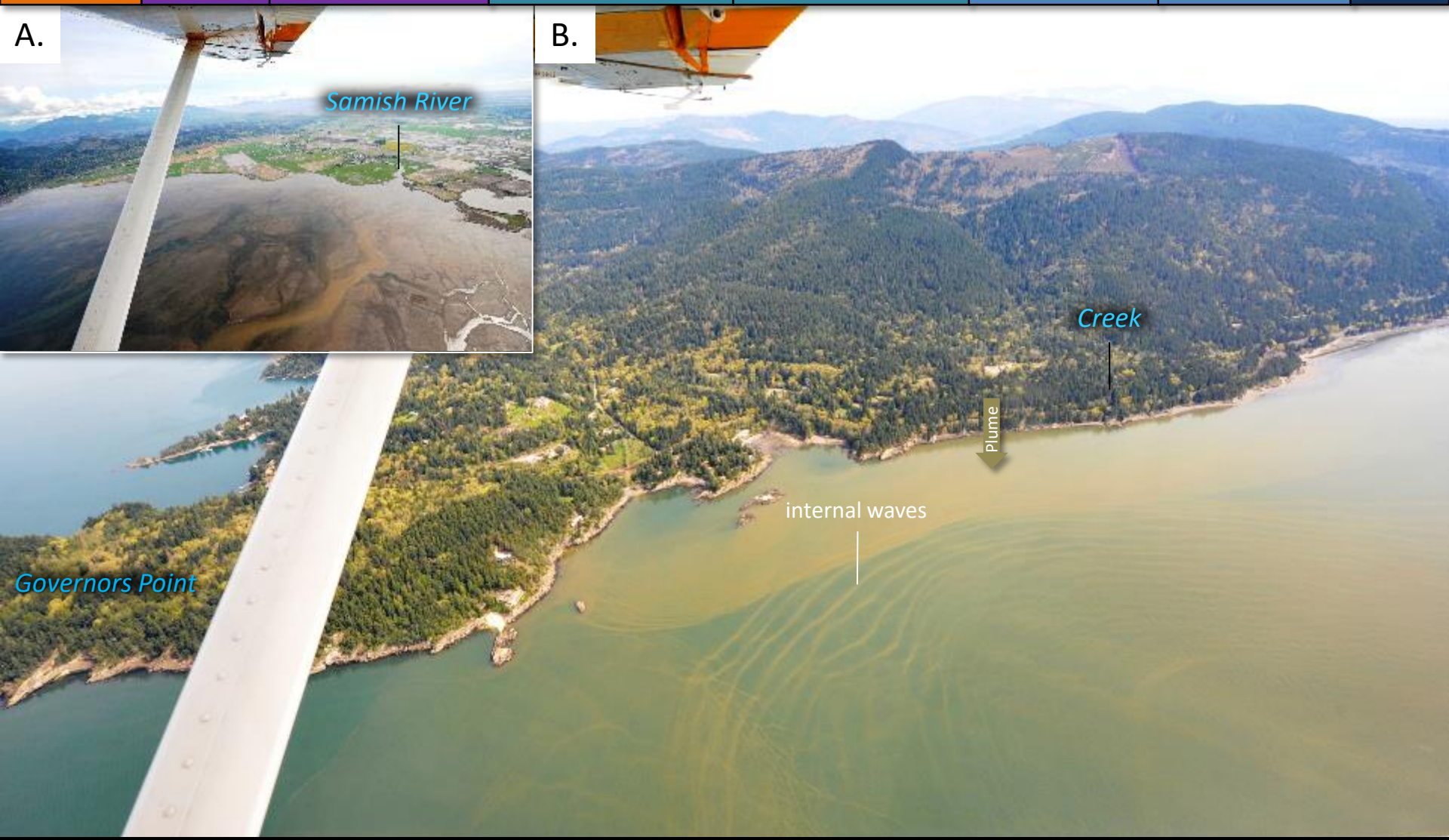
Location: Skagit Bay (Whidbey Basin), 1:19 PM

Sediment-rich plumes fanning out via A. Field drainage in La Conner, B. Higgins Slough draining fields

Location: Swinomish Channel (Whidbey Basin to Padilla Bay), 12:49 PM

A. Bright-brown water leaving Joe Leary Slough, B. following tidal channel. Is this a brown bloom?

Location: Padilla Bay (North Sound), 12:54 PM



A. Sediment likely from the Samish River plume, B. showing internal waves

Location: Wildcat Cove, Samish Bay (North Sound), 12:59 PM

Bright green algal bloom

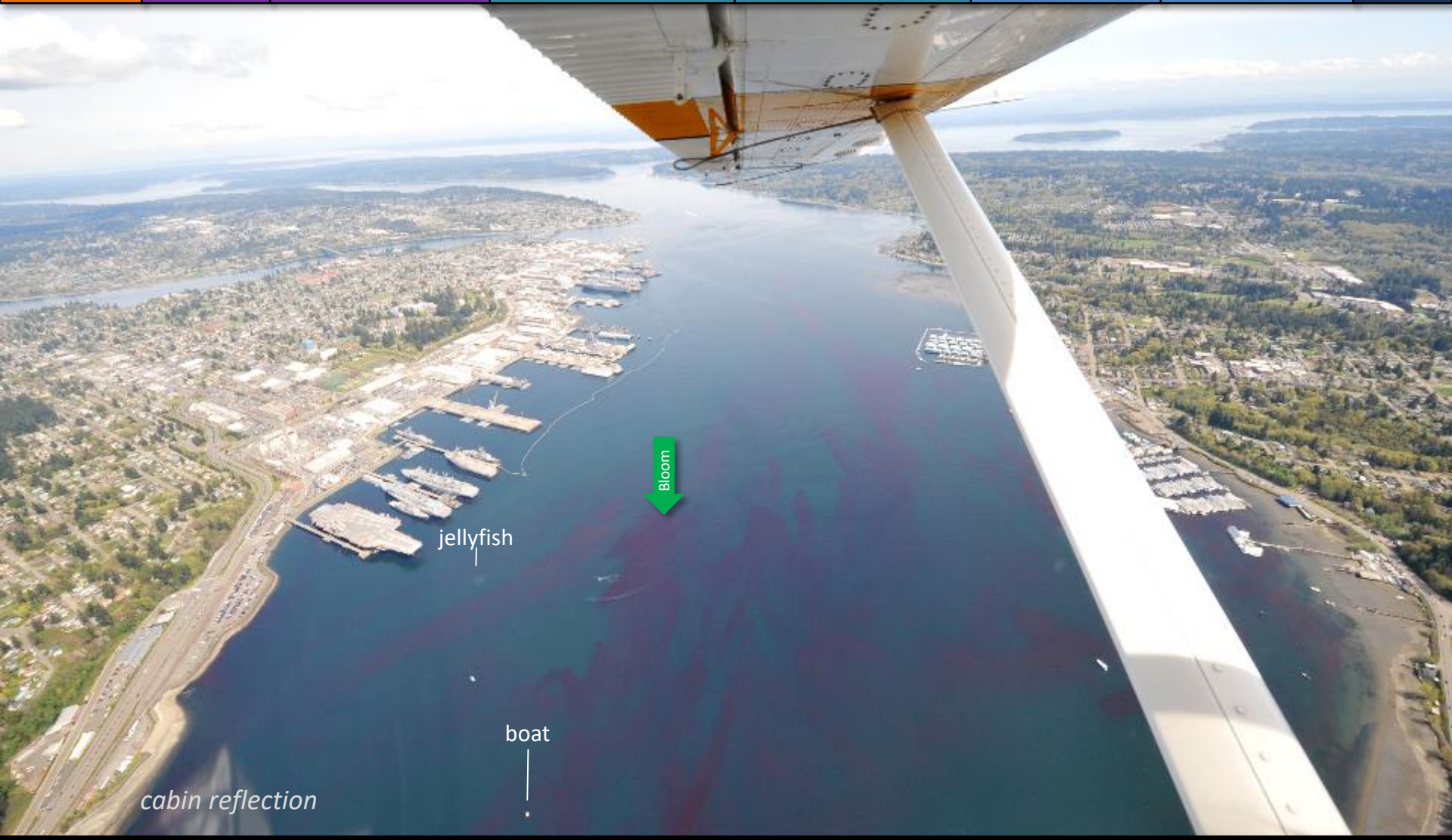
Location: Chuckanut Bay, Bellingham Bay (North Sound), 1:00 PM

Unidentified dark material west of the Nooksack River estuary

Location: Bellingham Bay (North Sound), 1:04 PM

Bright green bloom extending back across Penguin Harbor. Is the bloom connected to Chuckanut Bay?

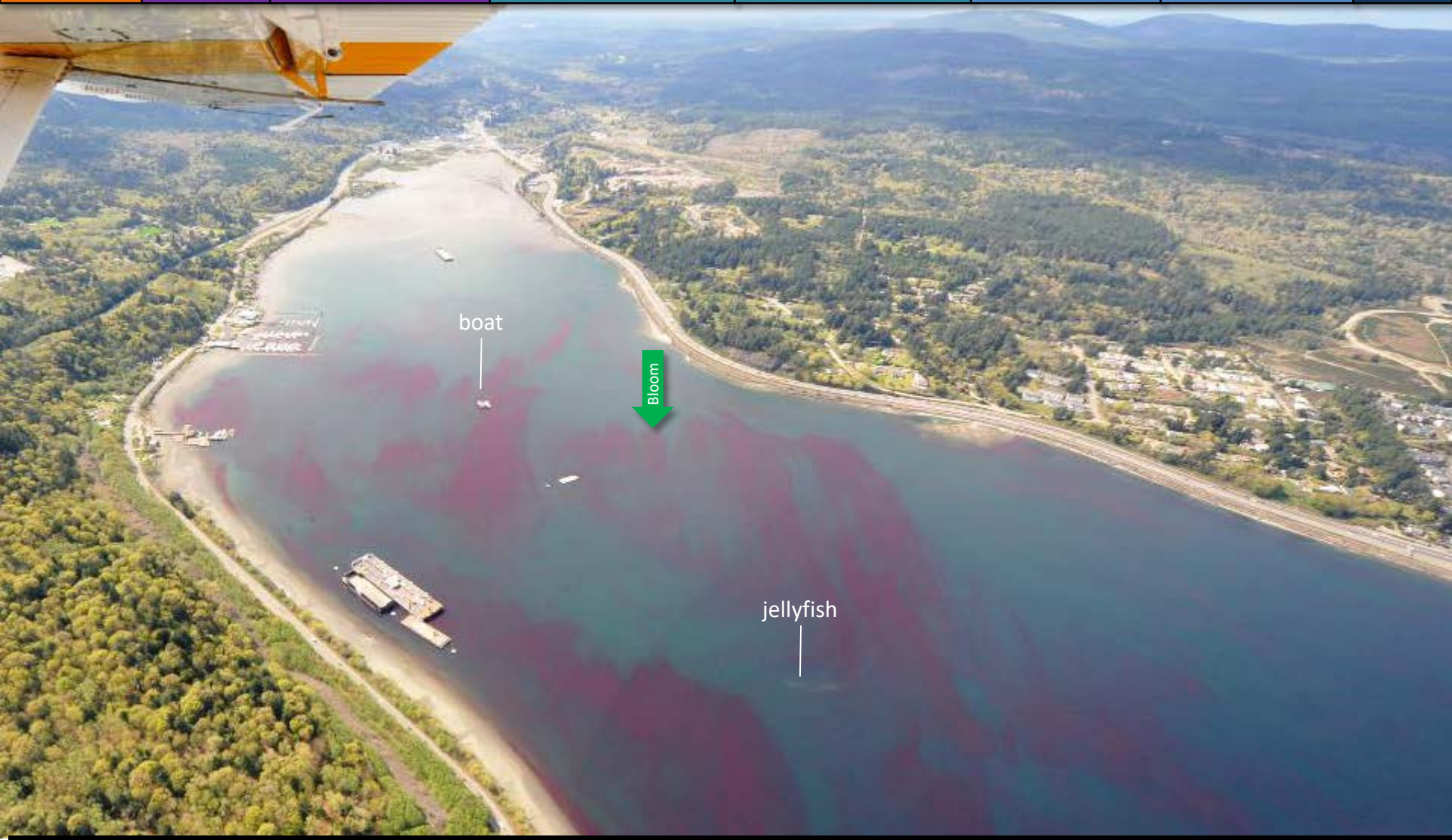
Location: Penguin Harbor (North Sound), 1:11 PM



Bright red-brown-purple bloom with an occasional jellyfish patch

Location: Sinclair Inlet (Central Sound), 1:48 PM

Aerial photography 4-19-2018



Bright red-brown-purple bloom with an occasional jellyfish patch

Location: Sinclair Inlet (Central Sound), 1:49 PM

Sediment-rich water entering Hood Canal via the Tahuya River

Location: Great Bend (Hood Canal), 2:03 PM

Sediment-rich water entering Hood Canal via the Skokomish River

Location: Great Bend (Hood Canal), 2:04 PM

Find past editions of EOPS with images on last pages

We have published 71 editions!

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

Recommended Citation (*example from August 2017*)**:**

Washington State Department of Ecology. 2017. Eyes Over Puget Sound, Surface Conditions Report, August 28, 2017. Ecology Publication No. 17-03-072. https://fortress.wa.gov/ecy/publications/documents/1703072.pdf

Many thanks to our business partners: Shannon Point Marine Lab (WWU), Swantown Marina, and Kenmore Air.

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Marine Monitoring Unit
Environmental Assessment Program
WA Department of Ecology

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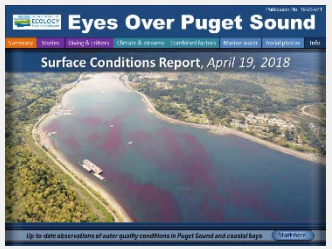

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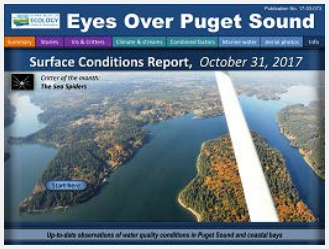

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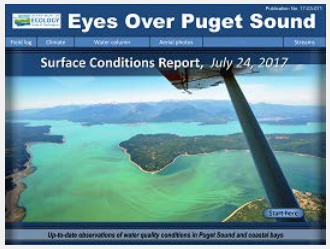

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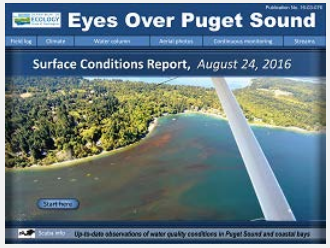

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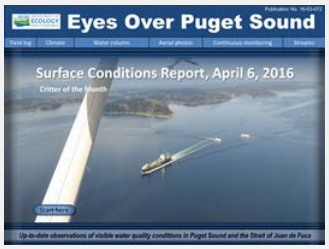

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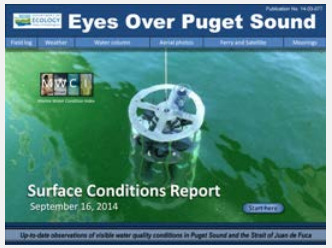

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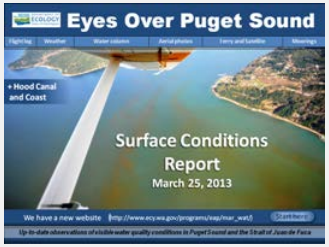

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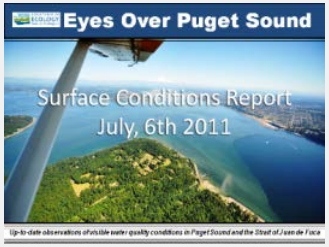

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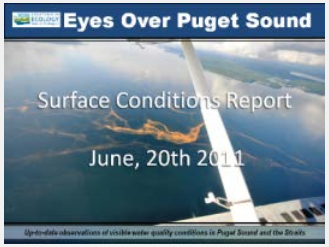

June_20_2011,
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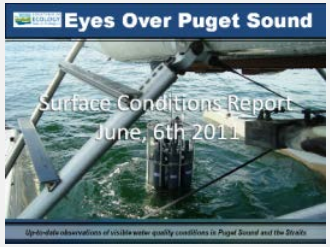

June_6_2011,
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