



# Eyes Over Puget Sound

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DEPARTMENT OF ECOLOGY State of Washington **Eyes Over Puget Sound** Publication No. 20-03-071

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**Surface Conditions Report: March 16, 2020**

Critter of the month: *The humpback shrimp*

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

Picture by: Jesse Miller



## 2020 in Review

DEPARTMENT OF ECOLOGY State of Washington **Eyes Over Puget Sound** Publication No. 20-03-073

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**Surface Conditions Report: October 26, 2020**

*The Jelly-dwelling anemone*

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

People contribute their observations

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Bowman Bay, 7/16/2020 (Julie Morse)

Bowman Bay, 7/16/2020 (Julie Morse)

Algae blooms can come in all colors. Bright yellow-green blooms occasionally occur in some bays.

DEPARTMENT OF ECOLOGY State of Washington **Eyes Over Puget Sound** Publication No. 20-03-072

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**Surface Conditions Report: September 28, 2020**

People share their observations

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

Up-to-date observations of visible water quality conditions in Puget Sound and the Strait of Juan de Fuca

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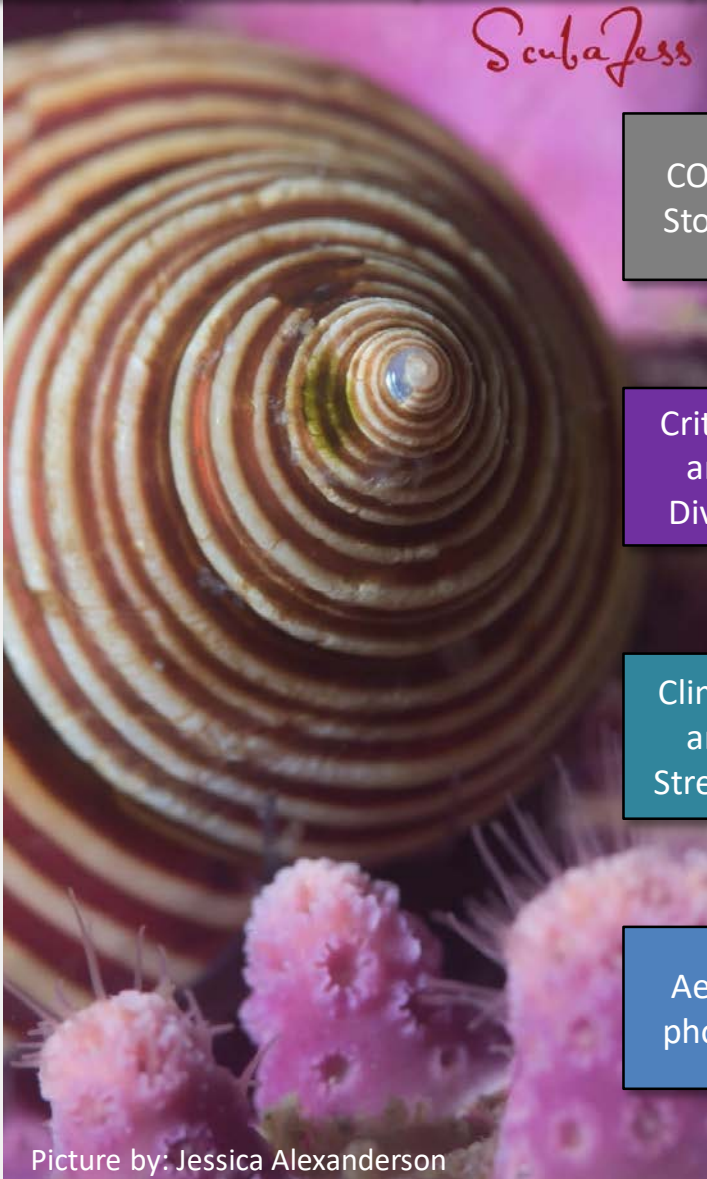
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LONG-TERM MARINE MONITORING UNIT



Picture by: Jessica Alexanderson

COVID  
 Stories

The COVID pandemic of 2020 resulted in an information gap in our work between March and September. Our field crew slowly has restored full capacity and data collection, and EOPS photography resumed in September.

Critters  
 and  
 Divers

Critters in the sediment and water are a testament that life continues in beautiful ways, and it's worth going for a dive in Puget Sound when the water is clear.

Climate  
 and  
 Streams

Despite wildfires and a lot of smoke during a dry late summer, precipitation and flows of major rivers were as expected, or even above normal, for most of the year.

Aerial  
 photos

With volunteers sending in images on the water we can say that 2020 was a productive year for Puget Sound. Schools of herring were abundant, *Noctiluca* blooms were big and numerous, and large amounts of decaying organic material washed onto beaches.



# PSEMP Marine Waters Workgroup Report of 2018



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Follow-up on the conditions that led up to 2019, in Puget Sound's comprehensive marine waters report.



Citation and contributors

**Recommended citation**

PSEMP Marine Waters Workgroup (2020). Puget Sound marine waters, 2019 overview. J. Apple, R. Wisk, K. Stora, J. Igo, R. Williams, W. Harris, S. Yang, J. Selsick, S. K. Moore, J. Shaw, G. Kanto, C. Kemler, G. Hartrach, and J. Newton (Eds).

Available: [www.psp.wa.gov/PSmarinewatersoverview.php](https://www.psp.wa.gov/PSmarinewatersoverview.php)

Contact email: [psm@ps.wa.gov](mailto:psm@ps.wa.gov)

Contact web: [www.psp.wa.gov/PSmarinewatersoverview.php](https://www.psp.wa.gov/PSmarinewatersoverview.php)

**Contributors**

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# puget sound marine waters

2019  
overview

Available: <https://www.psp.wa.gov/PSmarinewatersoverview.php>



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

Stay plumbed into the the information stream...

## What's the story so far?

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

## Field work in the time of COVID-19



Mya and Elisa on the last flight in February. A few field days later would be our last outing for 226 days, or 7 months and 12 days.

On March 16<sup>th</sup>, 2020, we were all packed up and ready to head out for our northern sampling days for CTD casts and water samples from Ecology's 14 stations. But that was also the day Ecology abruptly transitioned to all telework. Over the next seven months, we rode the COVID-19 roller coaster along with everyone else.

All the while, we watched our data gap grow to the biggest in the program's 40 years of sampling. For someone who spends 90% of their job focused on the lab and field work, it was hard not to feel lost and discouraged. Luckily, some programs with bigger boats were able to get out sooner, averting an even larger data gap. After writing many COVID-19 mitigation documents covering everything from working in the lab to riding in a truck, we eventually stepped onto the boat again on October 21<sup>st</sup>.



Here we are, trying to make ourselves comfortable on the back deck, where we now have to stay all day.



Heating pads have become in high demand to battle cold air flow.

We have learned they also work great to warm grease if it's too cold to apply to CTD fittings.

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## Field work in the time of COVID-19



We have completed 13 field days since then. It took a bit of effort to get the gears of our big monitoring machine up and running again, but now we are steaming ahead, hopeful for many successful field days in 2021.

With our solid data gap from March to September, it will be hard to provide our usual annual data products. But if we have learned anything during this difficult year, it is to persist in taking little steps forward.

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In a year marked by unexpected challenges, researching these amazing animals from home for my **Critter of the Month** blog series was a silver lining for me. Life carries on in Puget Sound's benthic ecosystem!



Learn more about our program, including benthic Critters and how we identify them on our [website](#)

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



Juvenile Giant Pacific Octopus,  
Sunrise Beach, Gig Harbor  
(Jessica Alexanderson )

*ScubaJess*



Juvenile  
Whitespotted  
Greenling, Alki  
(Eric Askilsrud)



newly hatched



Stalked Jellyfish, Sekiu Jetty  
(Jesse Miller)



Sixgill Shark, at Redondo  
(Jesse Miller)





## What was the water visibility like for divers?

Only best visibility shown for Dec.  
in form of a small diver



### Best and worst horizontal visibility at corresponding vertical depth

Location	Best Visibility		Worst Visibility	
	Horizontal Distance (ft.)	Vertical Depth (ft.)	Horizontal Distance (ft.)	Vertical Depth (ft.)
1	22	10	21	56
2	11	26	1	2
3	25	82	19	10
4	35	80	19	3
5	27	26	25	94
6	38	59	2	7
7	35	41	23	3
8	34	36	29	5
9	37	38	18	5
10	14	38	13	3
11	36	64	27	11
12	34	62	29	3
13	21	41	12	98
14	27	79	22	3
15	6	46	4	3
16	19	94	12	5
17	19	97	16	5
18	17	28	10	3

### Find depths with high/low visibility

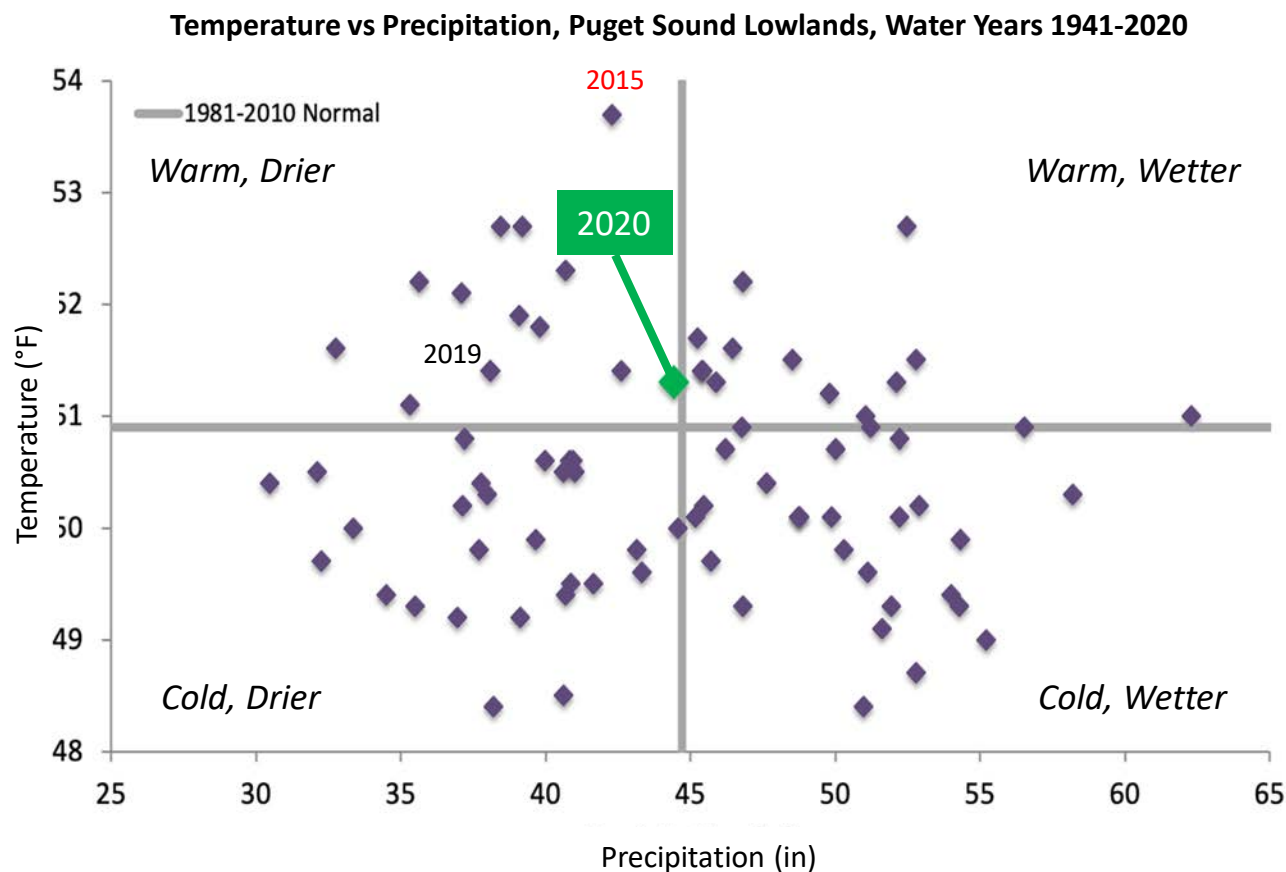


- **Best visibility** occurred in Hood Canal near Octopus Hole & Edmonds/Everett (locations 11 & 6), with almost 40 ft visibility at about 60-ft depth.
- **Poor visibility (no diver icon)** occurred near the surface in Bellingham Bay (location 2), but ironically also Edmonds/Everett near the surface (location 6).

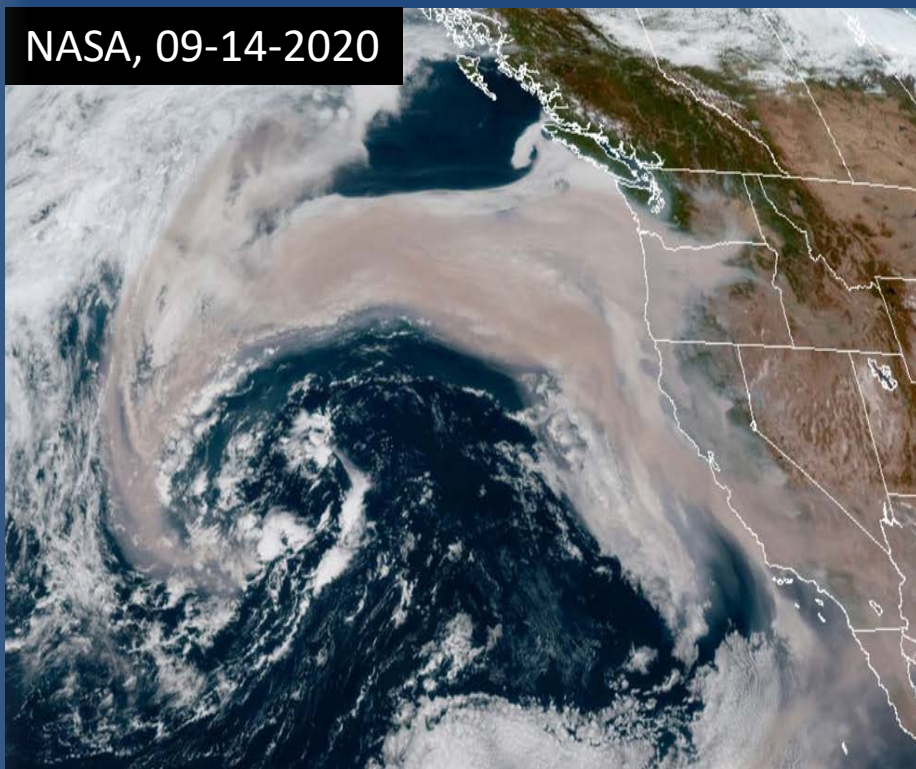
## Weather influences water circulation and the renewal in the Salish Sea

**Karin Bumbaco** and **Nick Bond**  
Office of the Washington State  
Climatologist

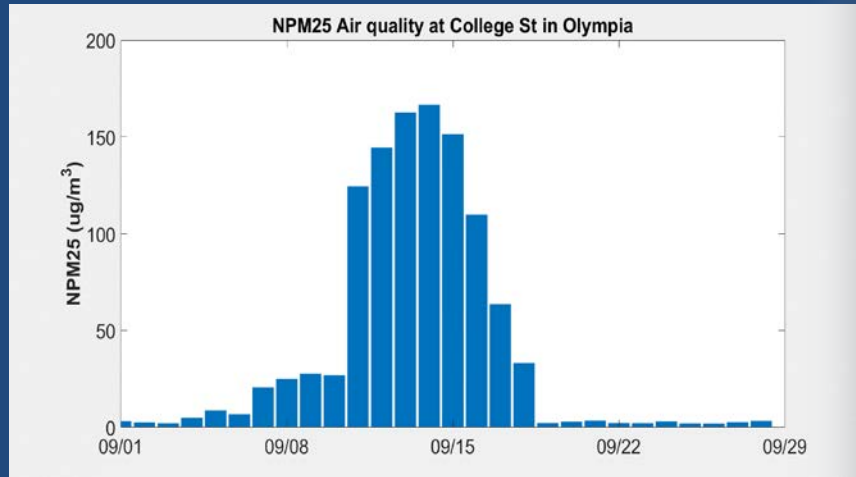
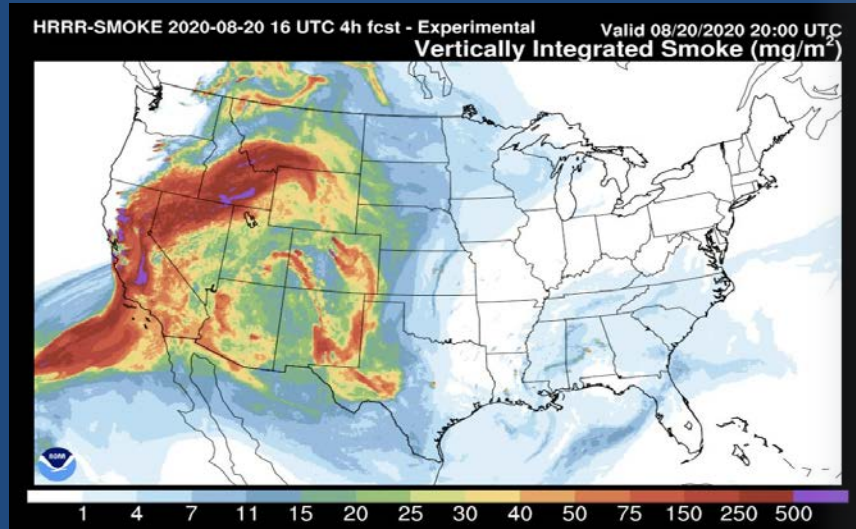
**Water Year 2020: Near-normal temperatures with normal precipitation in WA.** Remarkably dry September, leading to many severe wildfires and smoke (see next page).



## Large wildfires along the west coast brought much smoke to the region.



Air quality and visibility were very low in the Puget Sound region during September because of wildfire-related smoke. Such smoky conditions can lower air and water temperatures and may affect other aspects of 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 January:

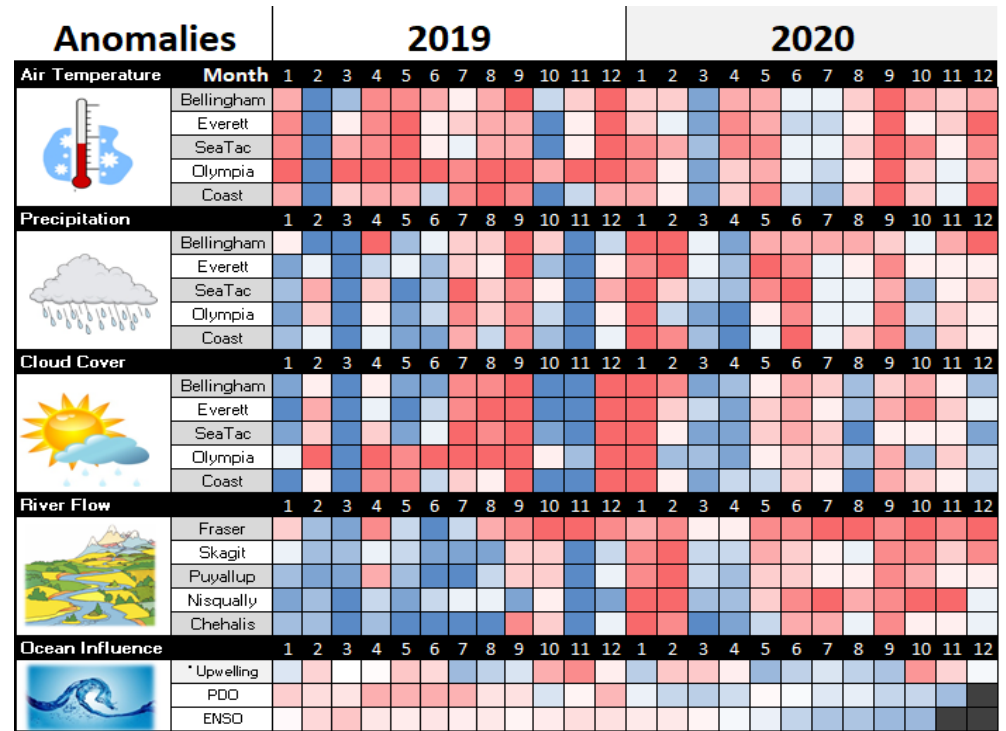
**Air temperatures** were generally warmer in fall 2020, especially in September.

**Precipitation** was above normal in northern Puget Sound. Precipitation was closer to normal in 2020 than in 2019.

**Cloud cover** levels were slightly above normal, generally being closer to normal in 2020 than in 2019.

**River flows** were higher than normal in the Fraser. Flows in 2020 were generally higher than in 2019.

**Upwelling** was weaker. PDO is lower and La Niña is gaining strength.

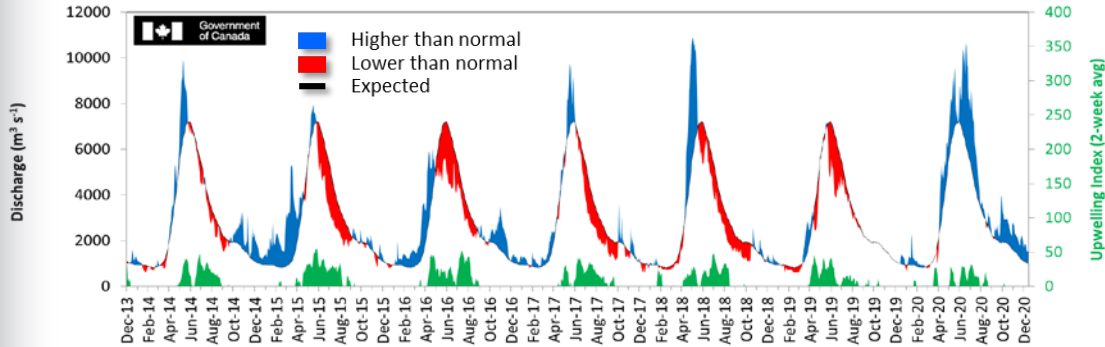


\*Upwelling/downwelling Anomalies (PFEL)  
PDO = Pacific Decadal Oscillation  
ENSO = El Niño Southern Oscillation

higher expected lower No data

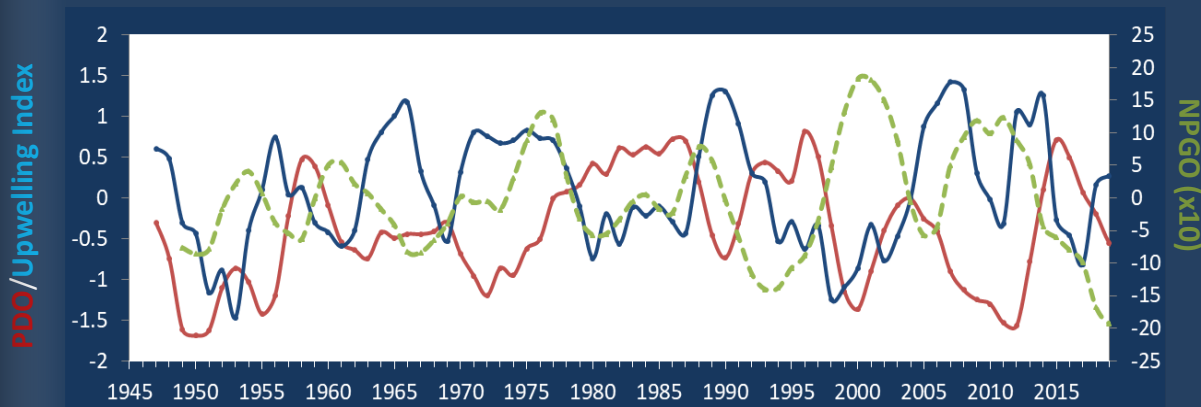
Historically, the peaks of coastal upwelling and the [freshet](#) are in sync..

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 was flowing consistently high in 2020.

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



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

Recent years' warm water is mostly gone (PDO). Upwelling (Upwelling Index [anomaly](#)) is expected. NPGO, which reflects the surface productivity along the coast, has fallen to one of its lowest numbers (updated through July 2020).

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



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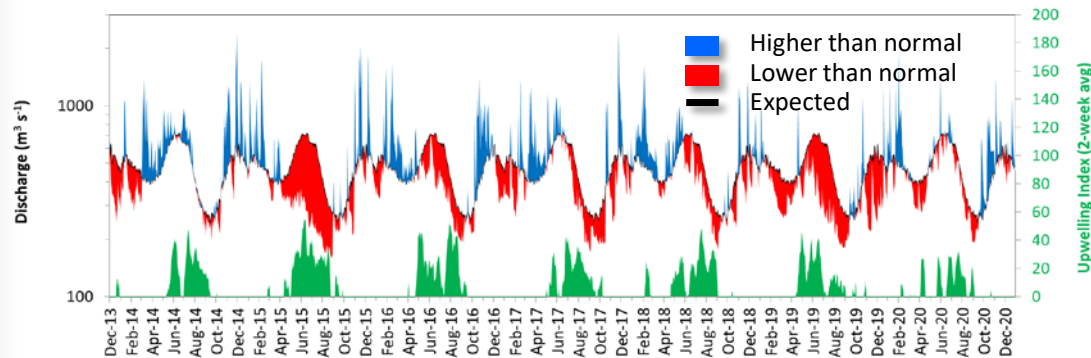
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The Skagit River is the largest freshwater source for Puget Sound. It is a river that is regulated.

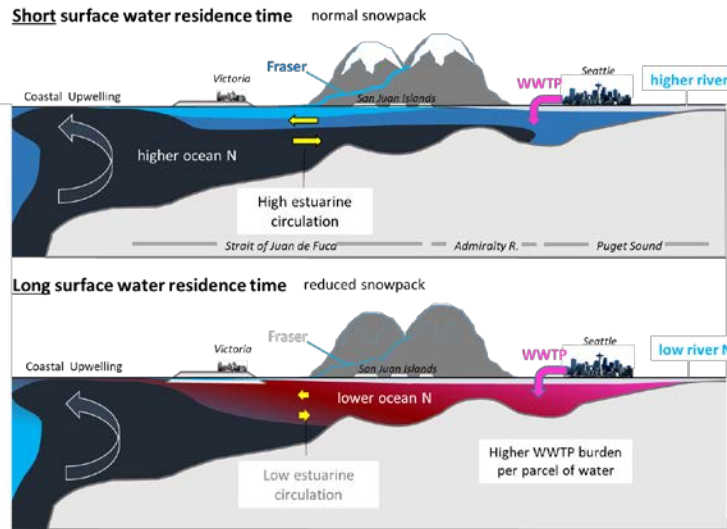
Skagit River (at midnight USGS)



The Skagit River freshet is no longer clearly pronounced, because 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. This year, flows of the Skagit were close to normal.

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

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



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

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).



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## During the pandemic, engaged people on the water shared their observations.



Christopher Krembs

In 2020 large schools of herring occurred in Central Sound, but schools of fish were also abundant in South Sound and Hood Canal. *Noctiluca* bloomed again in many places, followed by large amounts of decaying organic material washing onto beaches of Puget Sound.

[Start here](#)

### Oil sheen

Large oil sheen in northern Hood Canal near fishing vessels. Explore Spill Map in our region.



Contributions from so many people allowed us to document blooms of *Noctiluca* from Puget Sound to Bellingham Bay and other colorful blooms in early summer, followed by large amounts of decaying mucus and organic material in Central Sound in late summer.

### Jellyfish

Moon jellies occurred in typical places in lower numbers, while lion's mane jellyfish were more numerous.

### Macroalgae

Rotting macroalgae washed up on beaches in Edmonds. Yet kelp beds looked promising in fall.

### Fish

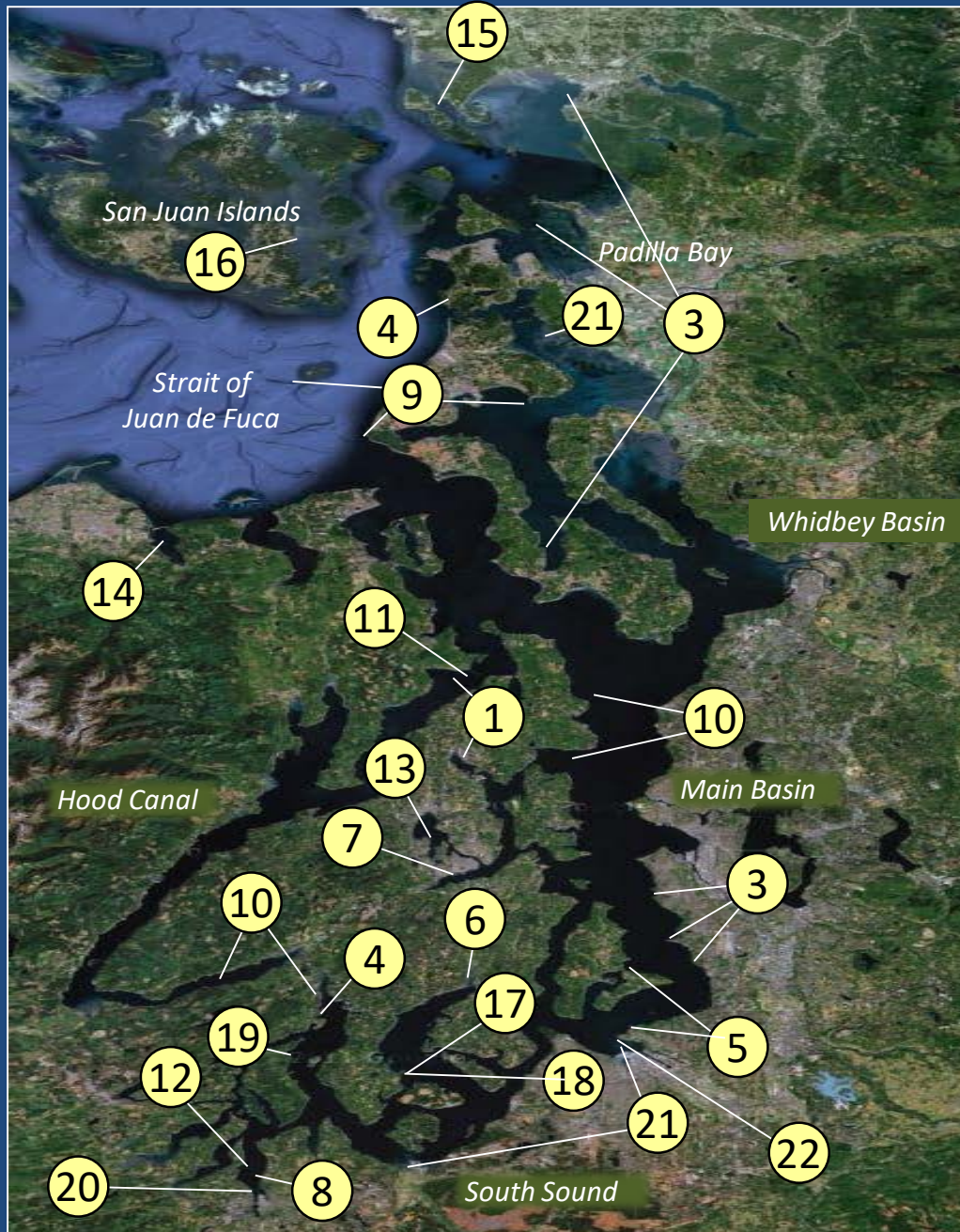
Unusually large numbers of schooling fish were seen in South Sound, Hood Canal, and Central Sound.

### Blooms

EOPS was suspended for 6 months due to the pandemic, but was able to document the tail-end of blooms in terminal bays.

### Sediment

Wind and exposed beaches show large effects on resuspension of sediment during windy conditions. Could this be important in the supply of silicate to Puget Sound?



# Aerial photography & navigation guide

## Date: 2020



Click on numbers

The map is a navigation guide to quickly find aerial pictures in a region. The numbers depict locations ordered by topics:





Reported spills from July 2015 –March 2020

Many small spills go unnoticed. Help us fill the gap.

Explore Ecology’s Spill Map to study spills in our region.

[Click to go to page](#)



Various oil sheens. A. Northern Hood Canal, B. Off West Point, Seattle, C. near Poulsbo Yacht Club, Liberty Bay



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## We are grateful for the contributions from so many who shared their observations on the water.



### Special thanks to:

*Ben Budka, Christine Goodwin, Cliff Coomber, Elisa Rauschl, Julie Morse, Karen McDonell, Karlista Rickerson, Katharine Ellingson, Kathryn Sobocinski, Katie Remine, Michael Joffe, Robin Beck, Steve Tuckerman, Tim Ellis, Yerda Yearsley, and one anonymous contributor*

Enjoy their wonderful contributions on ~~the~~ pages 18 to 22.

3



*Noctiluca* blooms (June and August), [page 19](#).  
 Central Sound, Holmes Harbor, Chuckanut Bay, and Saddleback Island.

4



Striking red-brown bloom of *Protoceratium* (July), [page 20](#),  
 in northern Case Inlet, and bright-green bloom in Bowman Bay.

5



Mucus and decaying organic material (August and September):  
 In Central Sound from Redondo Beach to Edmonds, [page 21](#).

6



Decaying shellfish and organic material (September):  
 In Carr Inlet, Burley Lagoon, [page 22](#).

7



More lion's mane jellies reported in South Sound and at entrance to Hood Canal, [page 23](#).



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Des Moines Marina, 6/7/20 (Robin Beck)



Three Tree Point, 6/7/2020 (Elisa Rauschl)



Lincoln Park 6/10/2020 (Ben Budka)

Chuckanut Bay, Bellingham Bay, 8/4/2020  
(Steve Tuckerman)

Holmes Harbor, 6/16/2020 (Christine Goodwin)



Saddlebag Island, 8/11/2020 (Kathryn Sobocinski)

*Noctiluca is a putative eutrophication indicator that thrives when excess organic material is present.*



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A.

Bowman Bay, 7/16/2020 (Julie Morse)



B.

Allyn-Grapeview, Case Inlet, 7/29/2020 (Michael Joffe)



*Algae blooms can come in all colors, sometimes bright yellow-green as in A. Bowman Bay, or B. brown-red such as the *Protoceratium reticulatum* bloom in Case Inlet which persisted for several months.*



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Redondo, 9/1/2020 (Cliff Coomber)



Dash Point State Park, 8/30/2020 (Katharine Ellingson)



Tramp Harbor Docton, 8/27/2020 (Karlista Rickerson)

Tramp Harbor, *Protoceratium reticulatum* bloom in August (Karlista Rickerson)

*When organic material and debris from excessive amounts of algae die, it washes onshore as mucus.*



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Edmonds Underwater Park, 8/24/2020 (Tim Ellis)

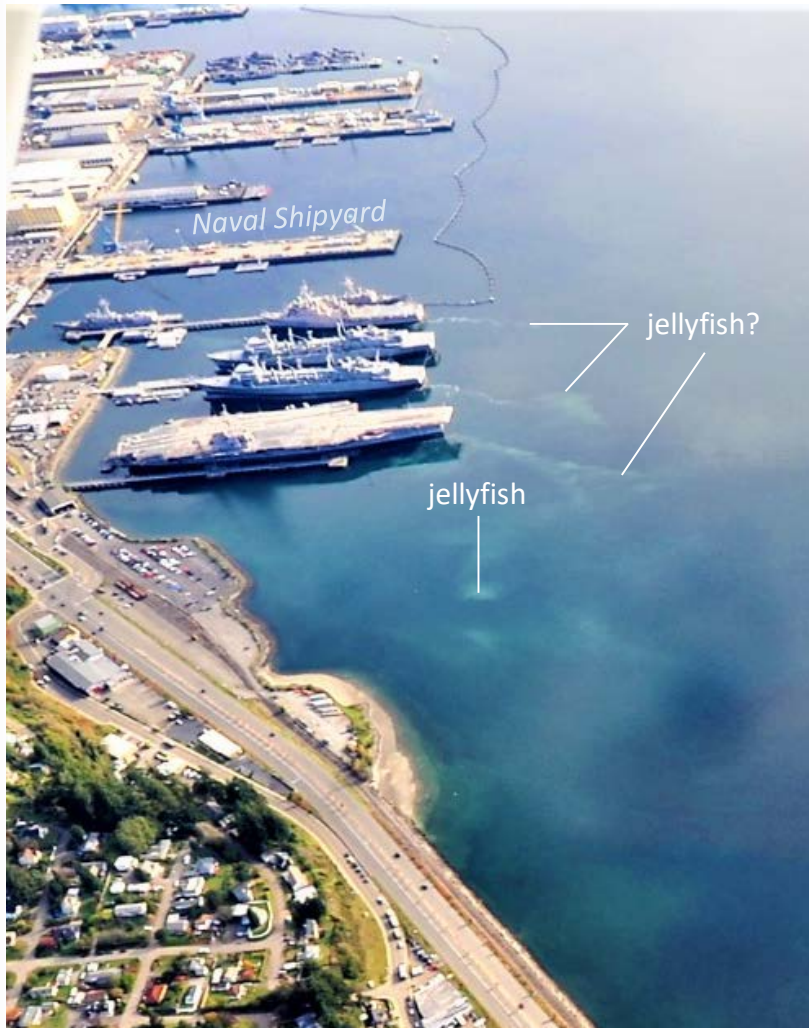


Burley Lagoon, 9/3/2020, with stench from dying organisms (Karen McDonell)



Edmonds, 8/17/2020 (photographer unknown)

*Mucus and beach wrack can smother the system and often lead to smells emanating from decaying material.*


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*Milky white patches that are likely moon jellyfish in Sinclair Inlet, 10/26/2020 (EOPS)*



*Lion's mane in Peale Passage, 7/28/2020 (Katie Remine)*



*Reports of numerous lion's manes washing onto beaches north of Port Ludlow towards Snake Rock during December. Picture 12/26/2020 (Yerda Yearsley)*



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*Aggregations of jellyfish. Location: Budd Inlet (South Sound)*





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*Kelp bed west of Polnell Point.*  
 Location: *Crescent Harbor (Whidbey Basin)*



Read more on Making Waves: **Puget Sound is losing its kelp, but there's a plan to save it.** [Click here.](#)

*Kelp beds off Point Partridge.*  
 Location: *Strait of Juan de Fuca (North Sound)*

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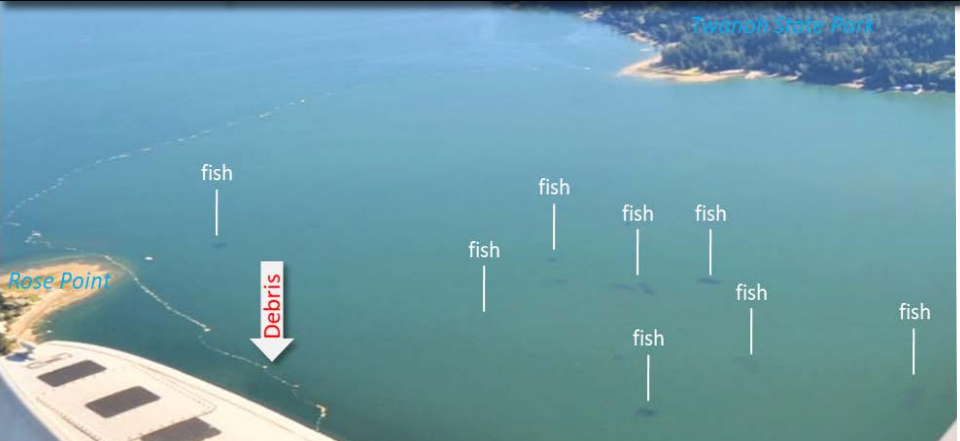
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*Schools of fish near the surface.*  
Location: Twanoh State Park, (Hood Canal)



*Several large schools of fish around Point Jefferson.*  
Location: Port Madison (Central Sound)



*Isolated red-brown bloom surrounded by schools of fish.*  
Location: North Bay, Case inlet (South Sound)



*A. A dozen fishing vessels harvest the annual chum salmon run south of the bridge, B. while others are waiting north of the bridge. Location: Hood Canal Bridge, (Hood Canal)*

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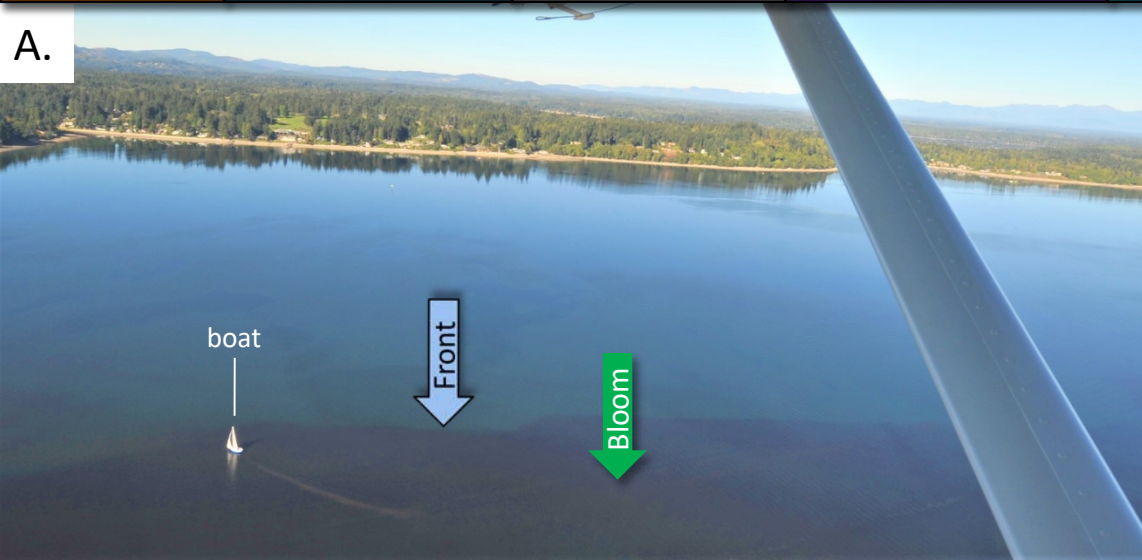
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*Red-brown bloom.* Location: A. Butler Cove, B. West Bay, C. Gull Harbor, D. Priest Point Park, Budd Inlet (South Sound)

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*Red-brown blooms in patches.*

Location: A-B. Sinclair Inlet, C-D. Dyes Inlet (Central Sound)



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*Water mixing with bloom.* Location: Sequim Bay (North Sound)



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*Red-brown bloom in Hale Passage, and sediment-rich plume of the Nooksack River in Bellingham Bay.  
Location: Hale Passage (North Sound)*



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*Two large tidal eddies with sediment-rich water.*  
Location: Across Center Island, Lopez Sound (North Sound)



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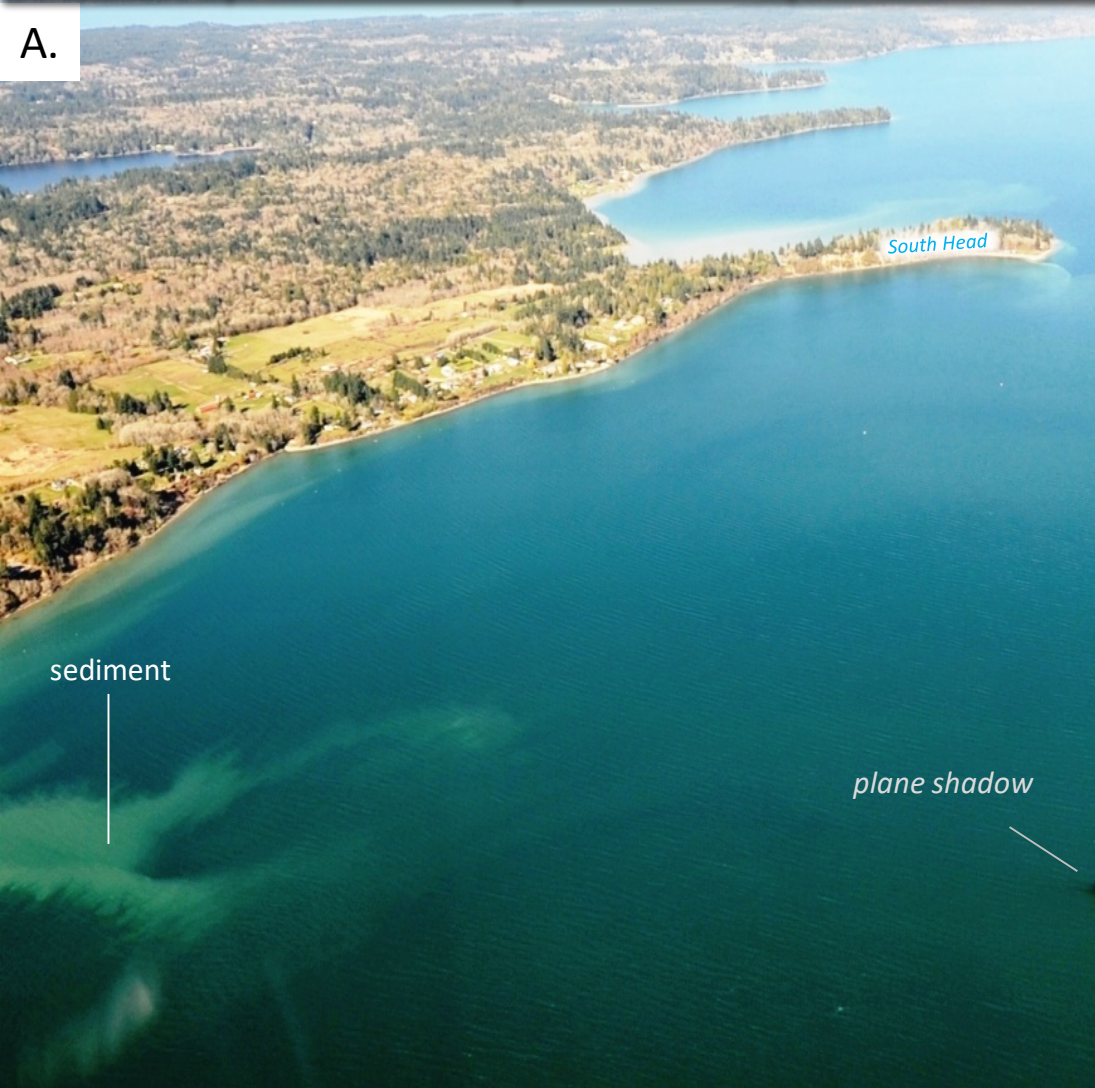
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*Resuspended sediment makes nearshore tidal eddies visible. A. looking north, B. looking south.  
 Location: Pitt Passage, McNeil Island, Carr Inlet (South Sound)*



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*Strong northerly winds cause sediment resuspension on wave-exposed north-facing beaches.  
Location: Carr Inlet (South Sound)*



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*Sediment resuspension on wave-exposed beaches.*  
Location: Harstine Island, Case Inlet (South Sound)



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*Large ship approaching the Port of Olympia and stirring up sediment.*

Location: Budd Inlet (South Sound)

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A. 1:31 PM



B. 12:14 PM



Mount Rainier

1:42 PM

C.



Three different glacier-fed estuaries. A. The urbanized Puyallup river estuary. B. The north fork of the Skagit river. C. the Nisqually River and its national wildlife refuge. Location: A. Tacoma, B. La Conner, C. Lacey



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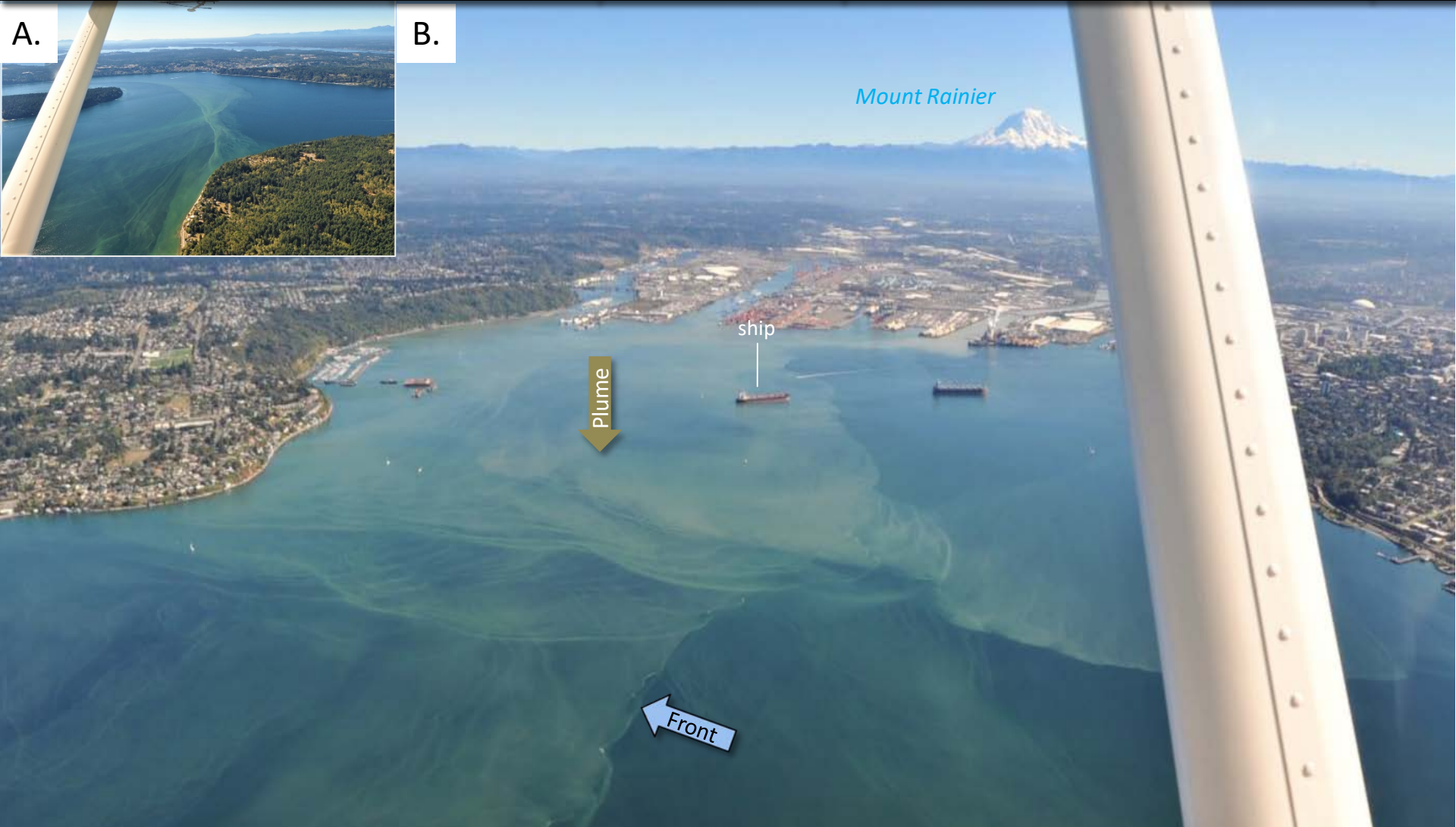
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B.



A. Sediment from the Puyallup River getting pulled into the Tacoma Narrows. B. Puyallup River plume.  
Location: Commencement Bay (Central Sound)

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**We have published 89 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>.



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

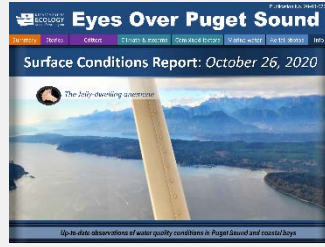
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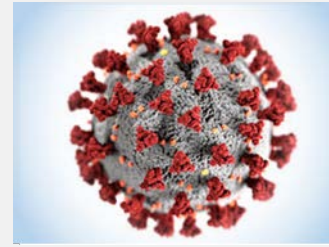
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October\_26\_2020,  
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No coverage due to COVID-19  
pandemic from April-September



March\_16\_2020,  
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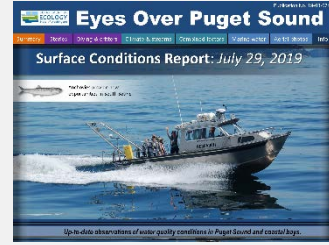
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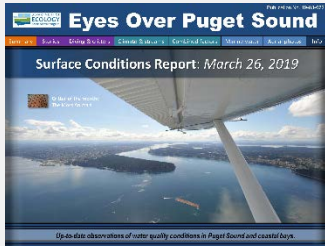
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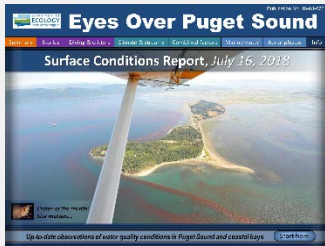
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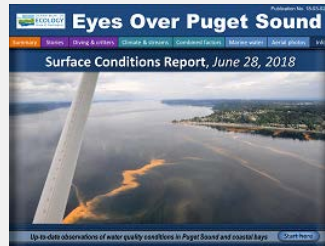
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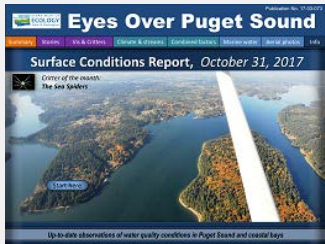


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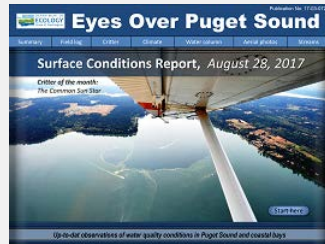


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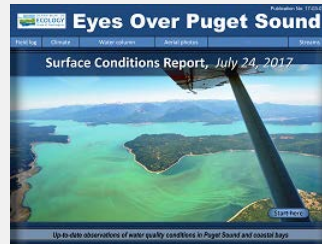




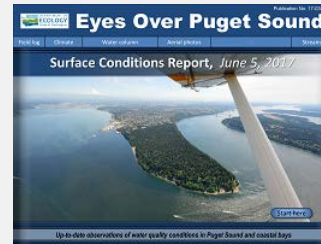
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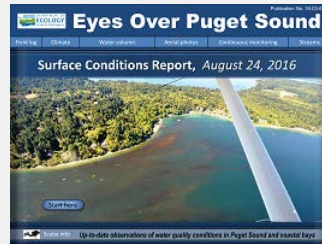
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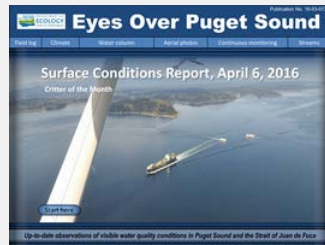
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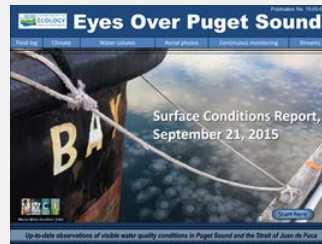
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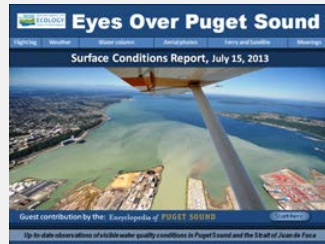
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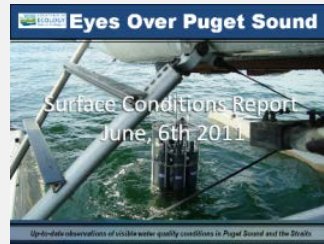
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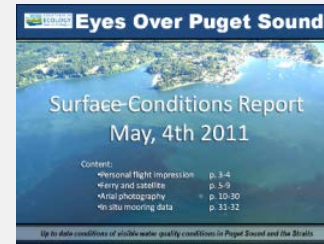
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