



Eyes Over Puget Sound

- Summary
- Stories
- Diving & critters
- Climate & streams
- Combined factors
- Marine water
- Aerial photos
- Info

Surface Conditions Report: *September 12, 2019*



**The benefits of
beach wrack**



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

*Jason Toft
UW SAFS*



Dany Burgess



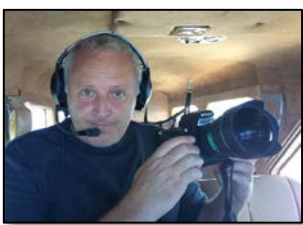
*Tyler Burks
Jim Shedd*



Skip Albertson



*Dr. Christopher
Krembs (Editor)*



Guest contribution

[p.4](#)

The benefits of beach wrack.

Personal stories

[p. 6](#)

Ecology scientists contribute to “global biodiversity library.”

Climate & streams

[p. 10](#)

This year, air temperatures were warmer: a pattern that has lasted several years and is predicted to continue. Precipitation was low, but over the last half-year, conditions improved in some regions. River flows remained low, in step with the warming temperatures.

Water temperature and food web

[p. 13](#)

In August, surface water temperatures were 0.6 °C warmer across all regions; this was beneficial for anchovies in Central Sound, Whidbey Basin, and Hood Canal, and for herring and salmon in the San Juan Islands. Optimum geoduck growth temperatures occurred in the Straits.

Aerial photography

[p. 14](#)

Water is unusually clear, and blooms are restricted to smaller inlets; however, macroalgae are still abundant. Jellyfish are present in Sinclair Inlet, while schools of anchovies are present in Eld Inlet.

Have you seen the blog?

[Start here](#)

PUGET SOUND: IT'S WORTH SAVING

Organizations from across Washington state are coming together to stand up for Puget Sound protection and recovery. **The stories in this blog are curated from partners and community members who are each invested in keeping this place great.**

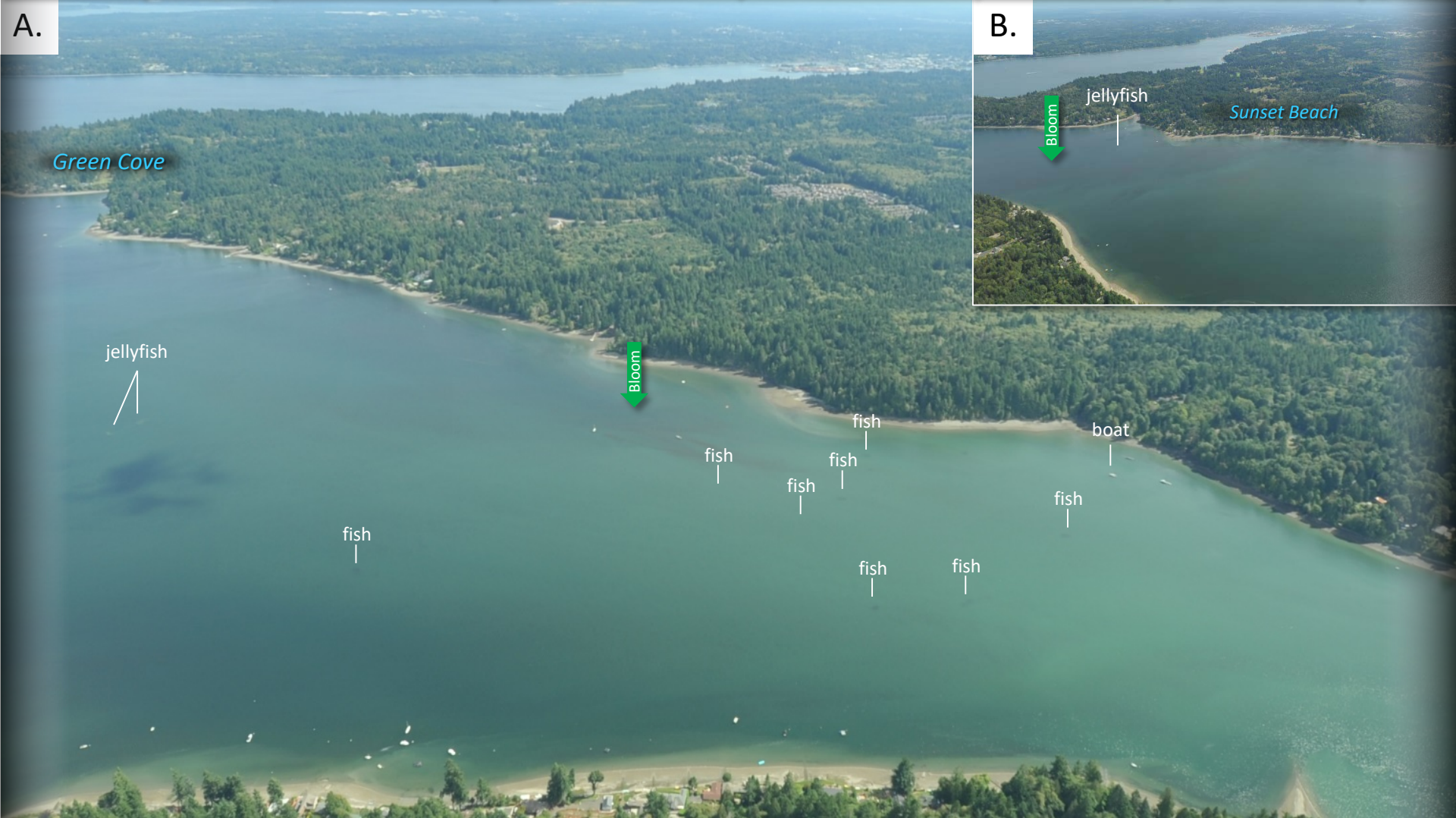




Anchovies still provide opportunities in South Sound

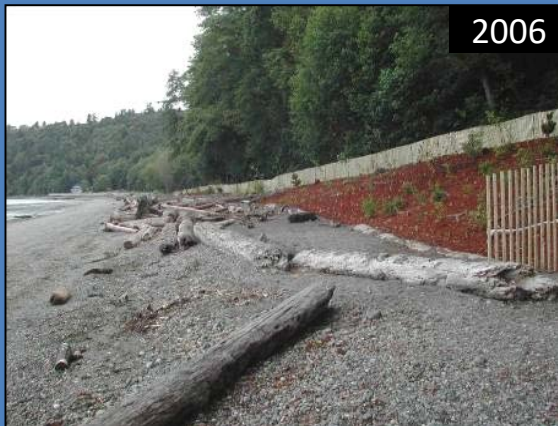


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A. Schools of anchovies are still present in some finger inlets. B. Bloom and jellyfish.
Location: Eld Inlet (South Sound) 1:29 PM

Seahurst Park, armor removed in 2005



Reestablishment of beach wrack, logs, and shoreline vegetation. Logs, wrack, and high-shore invertebrates [decline with shoreline armoring](#).



Young scientists exploring the "hoppers" in the wrack...



...and their dad, Jason.

Beach-hopper amphipods live in the wrack, feeding and taking refuge. They are also prey for fish and birds.



Jason Toft (UW SAFS), measuring percent of beach wrack.



Juhi LaFuente (UW SAFS) measuring percent of beach wrack at the Bowman Bay armor-removal restoration site.

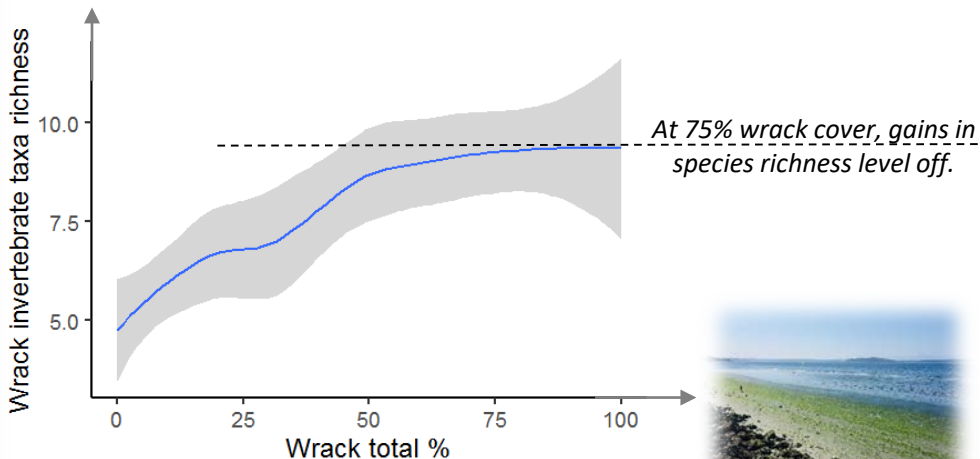
A balance between ecological benefits and human impacts

- **At normal levels, beach wrack provides food and shelter for many invertebrates.**
- Beach wrack can also act as a reservoir for bacteria. With too much wrack, your **risk of getting sick** increases. See [Washington BEACH Program](#).

Beach wrack serves as a habitat.



It's all about a health balance. With too much wrack, negative impacts to humans might begin to outweigh ecological benefits.



Shoreline Monitoring Toolbox

[Protocols for monitoring beach wrack](#) and a [new database](#).

Shoreline Monitoring Database

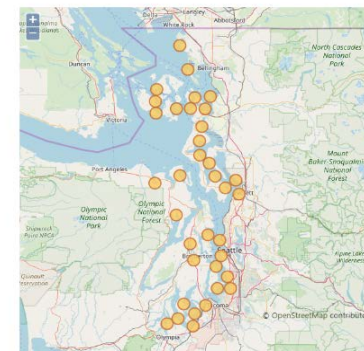
Home | Protocols and Data | **Map** | User Guide | Contact | Logs | Jason Toft | Log Out

Map of surveys

Showing 9027 surveys.

- 6720 beach wrack surveys
- 2307 insects surveys

Click on a marker to see all surveys near that location. Zoom in to see more granular survey information.



Ecology scientists contribute to “global biodiversity library”

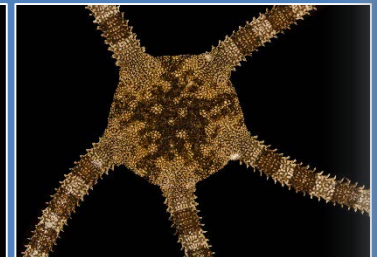


Dany Burgess

Los Angeles Urban Ocean Expedition (LAUOE)

Recently I had the pleasure of participating in a “bioblitz” in sunny Los Angeles, where expert scientists from around the country gathered to collect and document the amazing marine invertebrate biodiversity of Southern California. Bioblitz events like this one are happening worldwide, and many employ genetic techniques like DNA barcoding to identify new and existing species. Learn more about the LAUOE on [Ecology’s EcoConnect blog](#).

Marine Sediment Monitoring Team

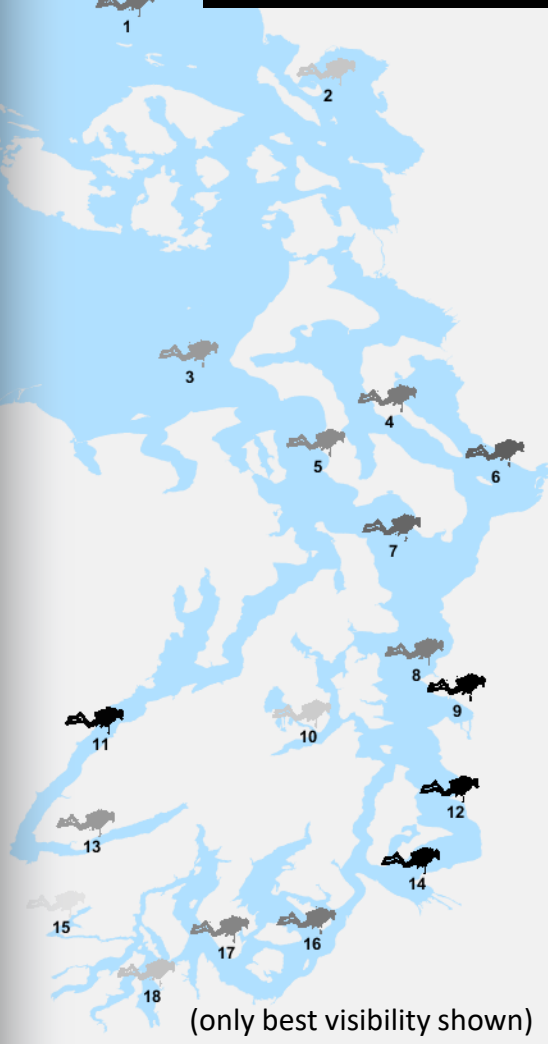


Volunteers sorted colorful live organisms into trays that were then passed to taxonomists to identify and photograph. Images courtesy of LAUOE staff.



What was the water visibility like for divers?

Best visibility in Aug



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	32	64	7	2
2	13	2	9	30
3	23	5	17	97
4	31	71	6	31
5	27	71	23	3
6	38	85	15	18
7	36	66	7	8
8	30	67	4	7
9	79	98	23	21
10	11	18	5	52
11	59	90	8	20
12	63	95	13	11
13	23	69	6	5
14	65	97	0	3
15	6	36	4	5
16	31	98	23	7
17	28	98	17	5
18	14	31	3	8

Find depths with high/low visibility

- **Best visibility** occurred in Elliott Bay near Seacrest Park (location 9), with nearly 80 ft visibility at 98 ft depth. Other locations along East Passage (e.g., Three-Tree & Dash Point) also had good visibility at similar depths.
- **Poor visibility (no diver icon)** occurred near the surface in Commencement Bay (location 14) and also in Oakland Bay near Shelton (location 18).
- The poster, “Underwater Visibility Maps — a Tool for Scuba Divers,” is available [here](#)



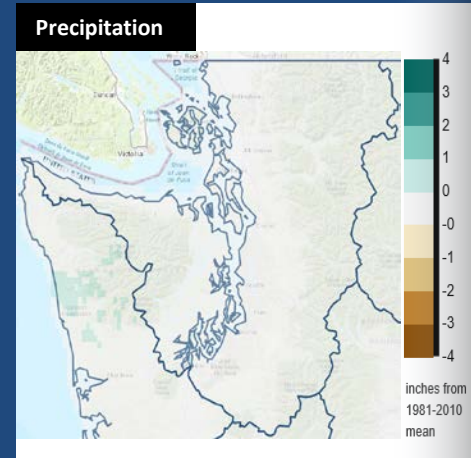
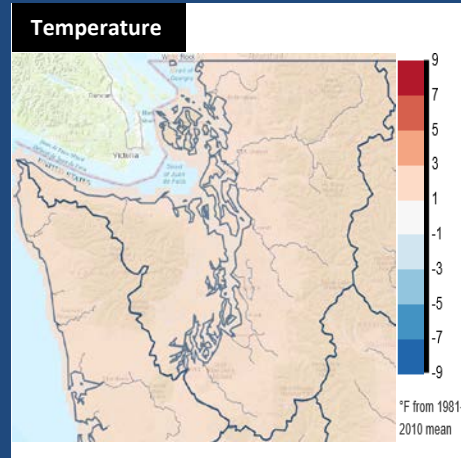
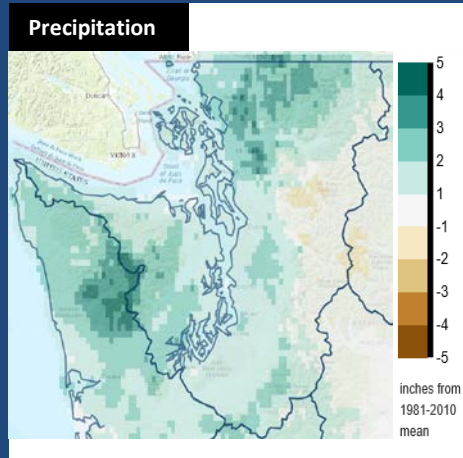
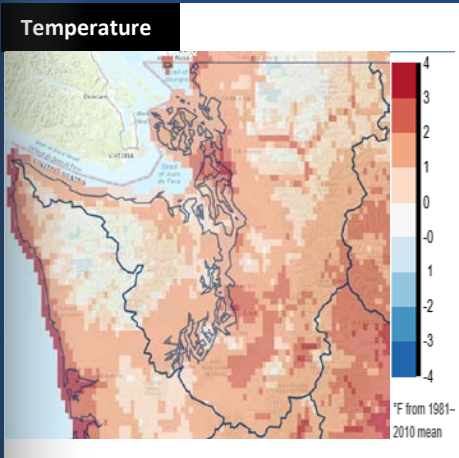
This is a new feature and we are soliciting feedback (skip.albertson@ecy.wa.gov).



In the last 30 days, Puget Sound air temperatures and precipitation were generally above normal (A). In the next 30 days, temperatures are forecasted to be warmer than normal, while precipitation is expected to normalize (B). With a shift to fall-like weather patterns, rivers are beginning to recover.

A. Northwest Climate Toolbox (Previous 30 days)

B. Northwest Climate Toolbox (Next 30 days)



Temperature Anomaly

from historical mean ranged from -1 to +4 °F in the Puget Sound region during the past 30 days.

Precipitation Anomaly

from historical mean ranged from -2 to +5 inches in the Puget Sound region during the past 30 days.

Temperature Anomaly

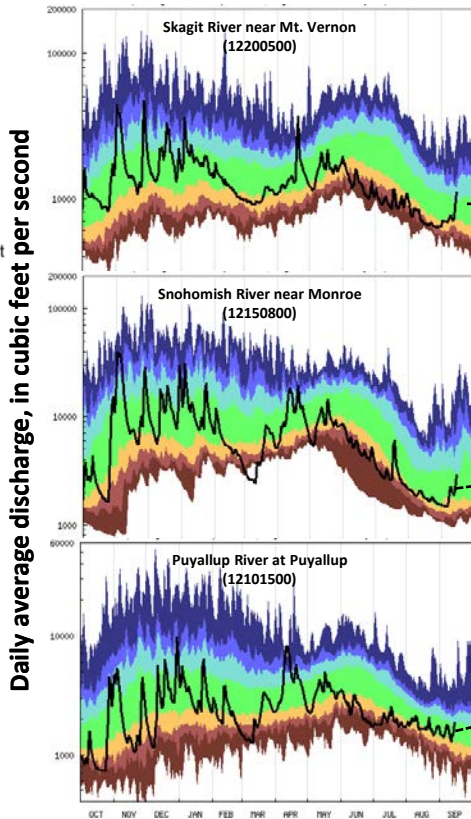
from historical mean is forecasted to be +2 °F in the Puget Sound region during the next 30 days.

Precipitation Anomaly

from historical mean is forecasted to be near normal in the Puget Sound region during the next 30 days.

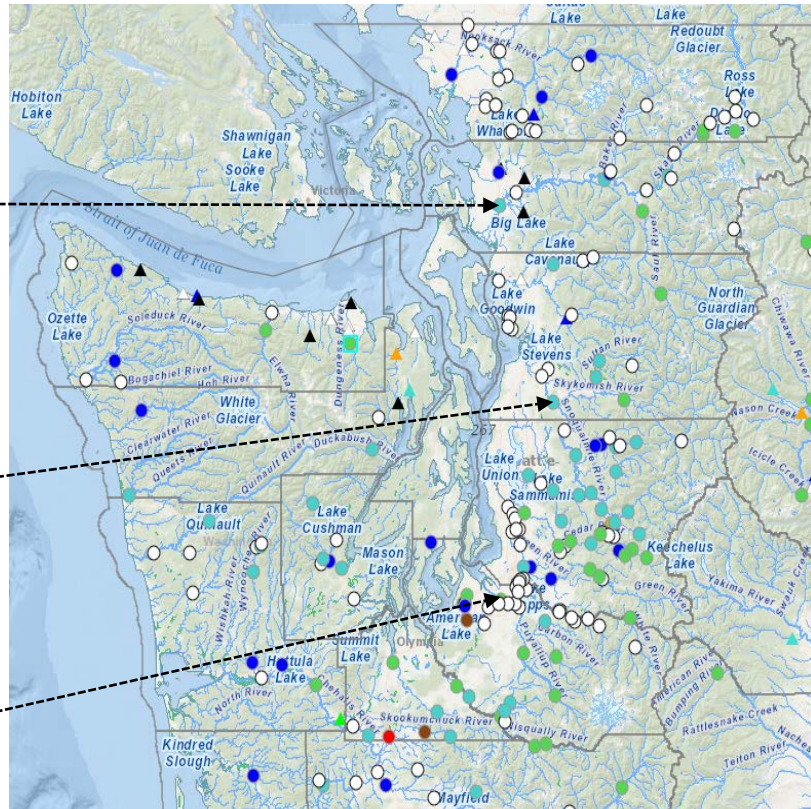
Following a dry summer, the return of precipitation has resulted in normal to above-normal freshwater inputs to Puget Sound (trend charts, left). Current flow distribution across the watershed is mixed (map, right), due to the variable delivery of rain over the region. Flows will continue to be variable until the regular pattern of precipitation is established.

Select Puget Sound Streamflow Trends



USGS WaterWatch: [CLICK HERE!](#)

Current Streamflow Conditions as of 9/16/2019



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

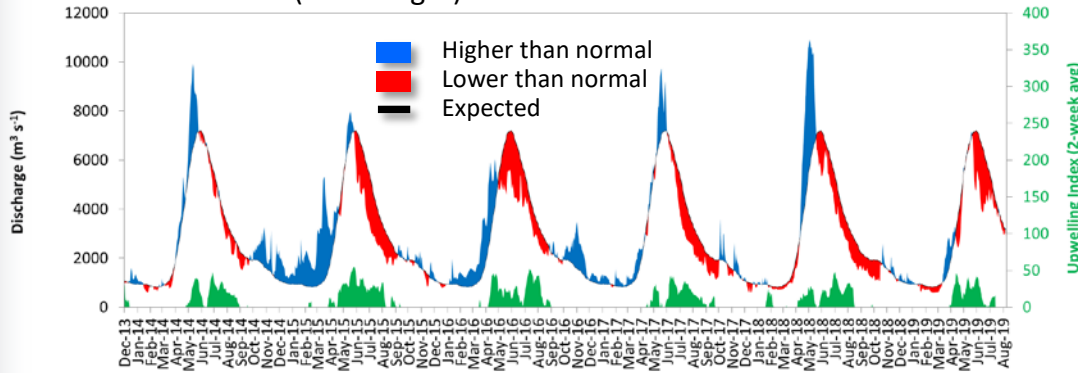
Ecology Daily Streamflow

- 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

Current conditions: [CLICK HERE!](#)

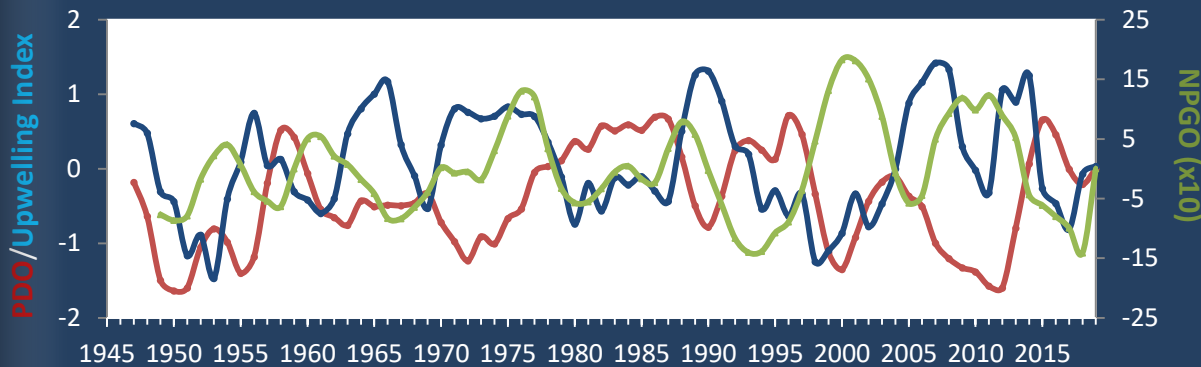
Historically, the peaks of coastal upwelling and the [freshet](#) are in sync. In 2019, the freshet is weak.

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 has regained expected levels. Dramatic snow melt in May resulted in well-below-normal flows in early summer.

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 gone (PDO). Upwelling (Upwelling Index anomaly) and NPGO, which reflects the surface productivity along the coast, are at neutral levels.

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



In the anomaly plot, we want to connect different factors influencing water quality in the context of space and time. Conditions leading up to June 2019 were drier, with lower river flows than in Spring 2018. The past winter was consistently warmer than the previous two winters, although February was much colder. Early-onset upwelling was a factor in both 2018 and 2019. For recent river and stream inflow, [see page 8](#).

Conditions leading up to September:

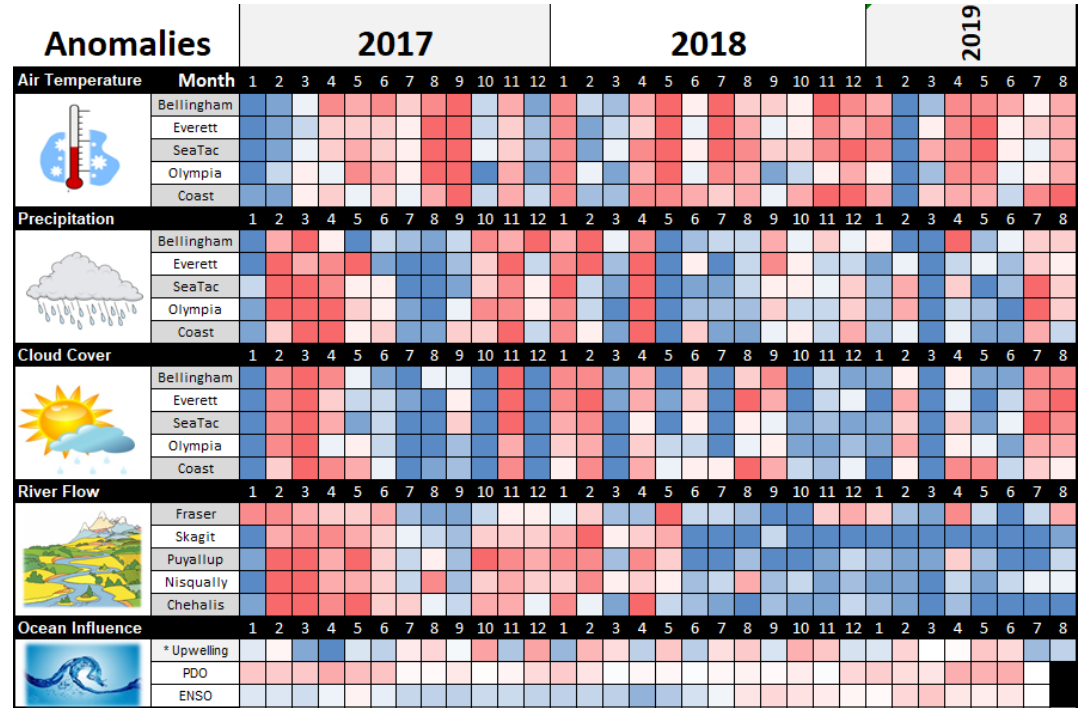
Air temperatures were generally warm this year, following recent years.

Precipitation for the past five months was lower than in 2018, but July and August were wetter.

Sunshine (opposite of cloud cover) has been high, except in July and August.

River flows have been low since last year, June 2018.

Upwelling started early in spring in 2018 and 2019. In summer of 2019, it weakened prematurely.



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

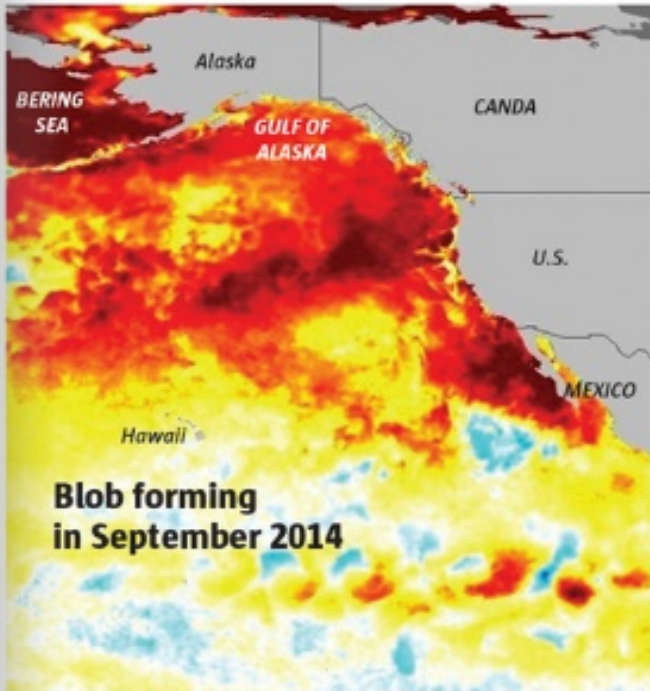
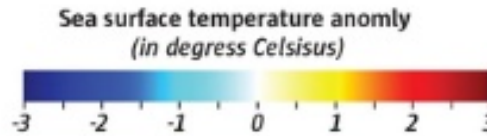
higher expected lower

No data

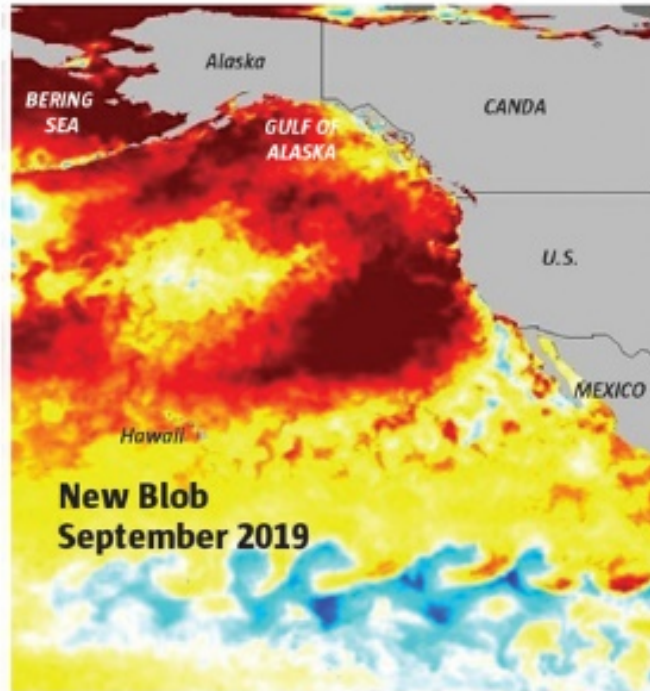
Like The Blob, the new heat wave emerged over the course of a few months.

New marine heat wave forms off West Coast

A similar event began to take shape in 2014, resulting in dire conditions for sea life including salmon. It's not yet known whether the warm conditions this year will continue or dissipate.



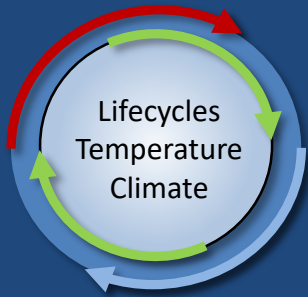
Source: NOAA



MARK NOWLIN / THE SEATTLE TIMES

The Seattle Times

By [Lynda V. Mapes](#), Seattle Times environment reporter. "A new marine heat wave has formed off the West Coast that is similar to a 2015 event — nicknamed 'The Blob' — that devastated sea life and ravaged runs of Pacific salmon. Although the similarities are striking, whether the new system will cause the same havoc is yet to be seen."



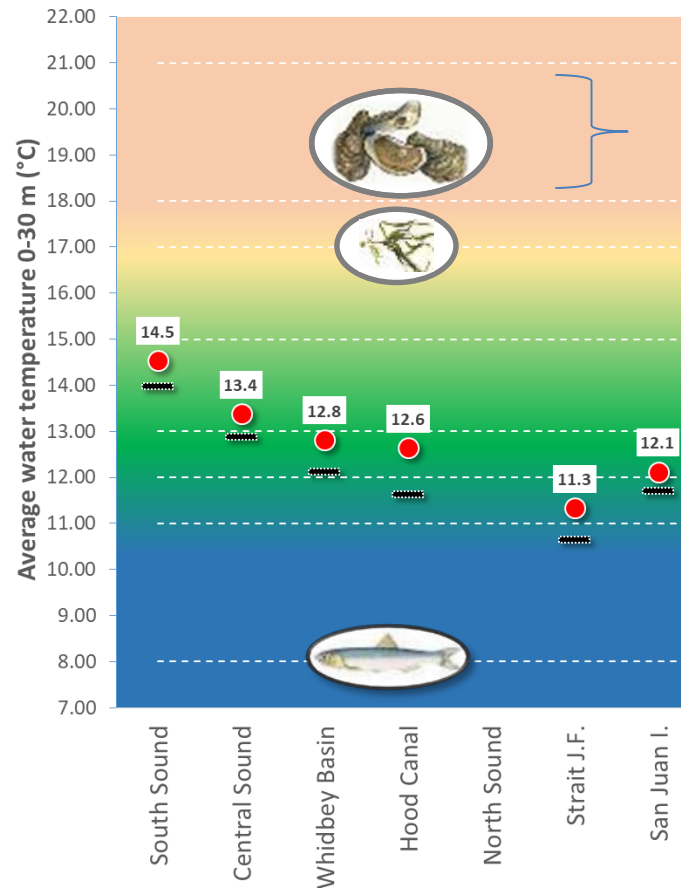
Can organisms thrive and survive?

The life cycles of organisms respond to temperature. To be successful, the timing of early life stages must line up with good growth conditions.

Temperature is important for growth, but also dictates if certain organisms can overwinter in Puget Sound (e.g., Northern anchovy).

* Help us get these right. We scoured the literature for temperatures important to the success and survival of marine organisms.

In August, average surface water (0 – 30 m) temperatures were 0.6 °C above the baseline (1999 – 2018) across all regions. Central Sound, Whidbey Basin, and Hood Canal reached optimal spawning temperatures for anchovies. Optimum growth temperatures for herring and salmon were reached in the San Juan Islands, and near-optimum geoduck growth temperatures occurred in the Straits.



Optimal temperatures for Puget Sound organisms*

- Oyster spawning range
- Max temp for bull kelp and coho and Chinook salmon
- Increase in HAB toxicity risk >15°C, Dungeness crab egg production optimum
- Anchovy spawning optimum
- Herring and salmon growth optimum/ Herring spawning upper range 12°C
- Geoduck growth optimum
- Anchovy survival minimum

Legend:

- Expected 18-year average
- Cooler than expected
- Warmer than expected

Summary	Stories	Diving & critters	Climate & streams	Combined factors	Marine water	Aerial photos	Info
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Water is unusually clear, and red-brown fall blooms are restricted to smaller inlets. Case Inlet has a dark maroon color. Macroalgae are still abundant in Carr and Case Inlets and have been sighted near Normandy Park. Jellyfish abundance is high in Sinclair Inlet but much lower than previous years. In South Sound, schools of anchovies still are present.

Elisa Rauschl, our new team member, joined the EOPS flight.



[Start here](#)



Mixing and fronts:

Tidal eddies near Fox Island, fronts off Maury Island.



Jellyfish and fish:

Many jellyfish patches in Sinclair Inlet; few patches in Eld and Budd Inlets. Schools of fish in Eld Inlet.



Suspended sediment:

Glacial flour from the Puyallup and Nisqually Rivers extending into Puget Sound.



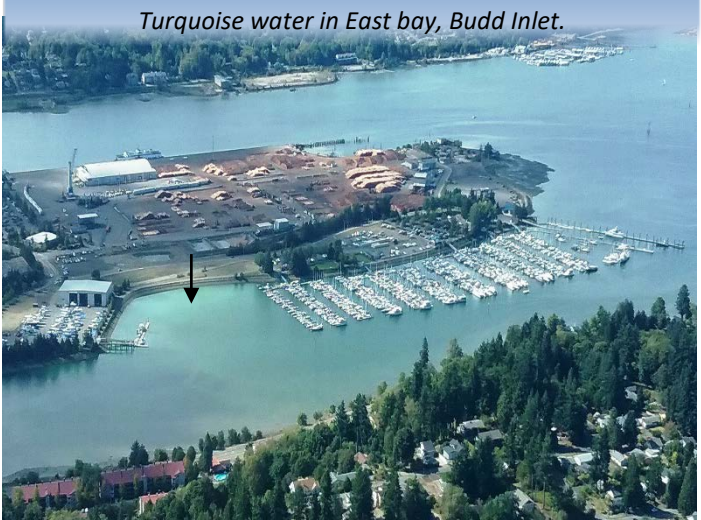
Visible blooms:

Red-brown bloom in Henderson, Eld and Budd Inlets. Turquoise water in some bays, cause unknown. Dark maroon bloom in Case Inlet.

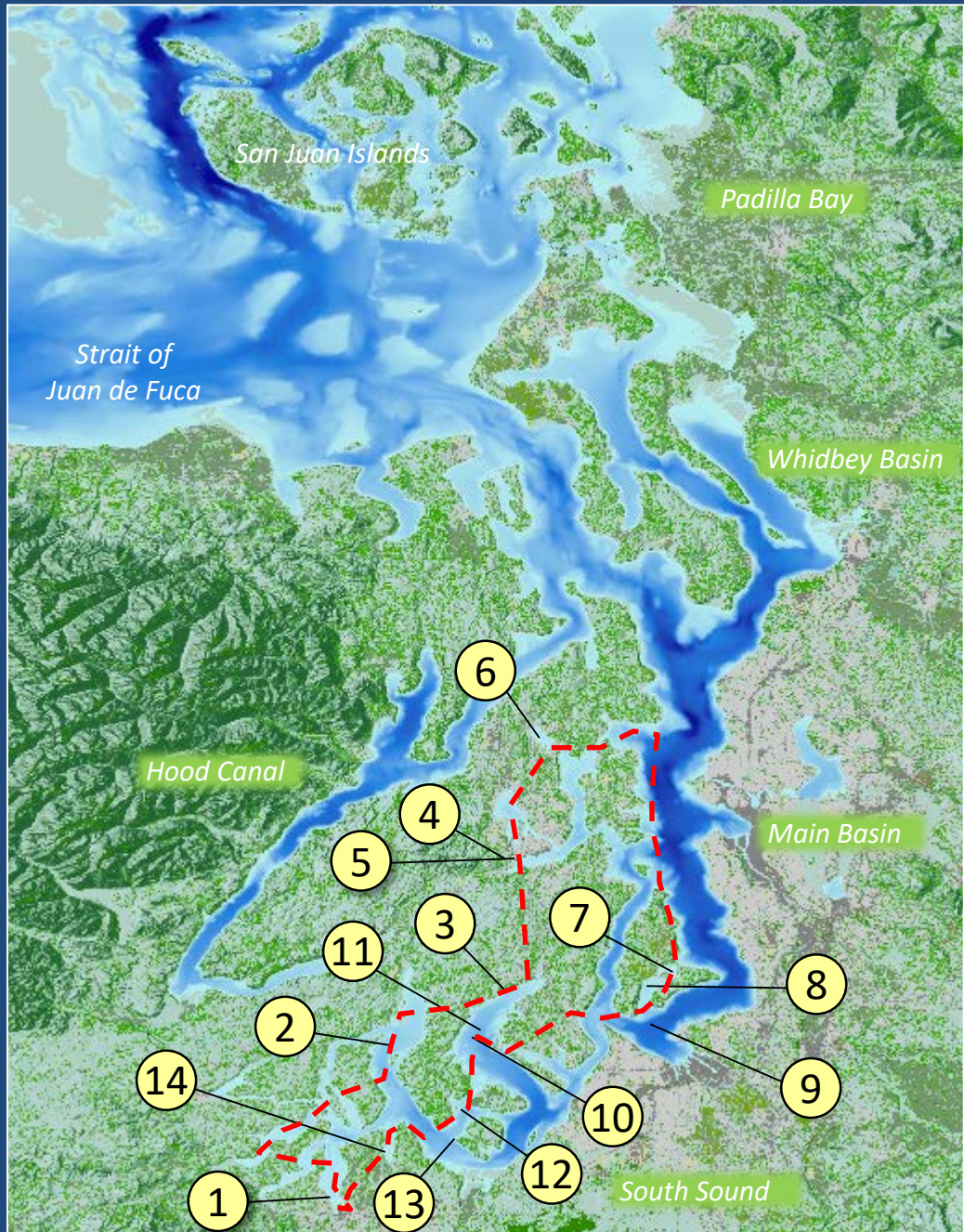


Debris:

Rafts of macroalgae in Central and South Sound still present.



Turquoise water in East bay, Budd Inlet.



Aerial navigation guide

Date: 9/12/2019

Click on numbers

Tide data from 9/12/2019 (Seattle):

Time	Pred	High/Low
04:16 AM	9.44	H
10:41 AM	0.43	L
5:43 PM	10.90	H
11:37 PM	4.43	L

Flight Observations

Sunny and hazy

People sharing images





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Red-brown bloom.

Location: Budd Inlet (South Sound), 1:29 PM



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A.



B.



Bloom near *Allyn P. reticulatum* and *Prorocentrum* spp. (Sound Toxins).

A. Macroalgae accumulating along tidal front. B. Macroalgae patch drifting across Long Island.
 Location: Case Inlet (South Sound), 1:40 PM



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Red-brown bloom and aggregations of organic material in Henderson Bay.

Location: Carr Inlet (South Sound), 1:46 PM



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Patches of jellyfish and red-brown bloom mixed with what appears to be turquoise water.
Location: Sinclair Inlet (Central Sound), 1:51 PM



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*Patches of jellyfish and red-brown bloom mixed with what appears to be turquoise water.
Location: Sinclair Inlet (Central Sound), 1:54 PM*



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A. Thin layer of surface water of different color mixing around piling structures. B. Red-brown bloom.
 Location: Liberty Bay (Central Sound), 2:02 PM



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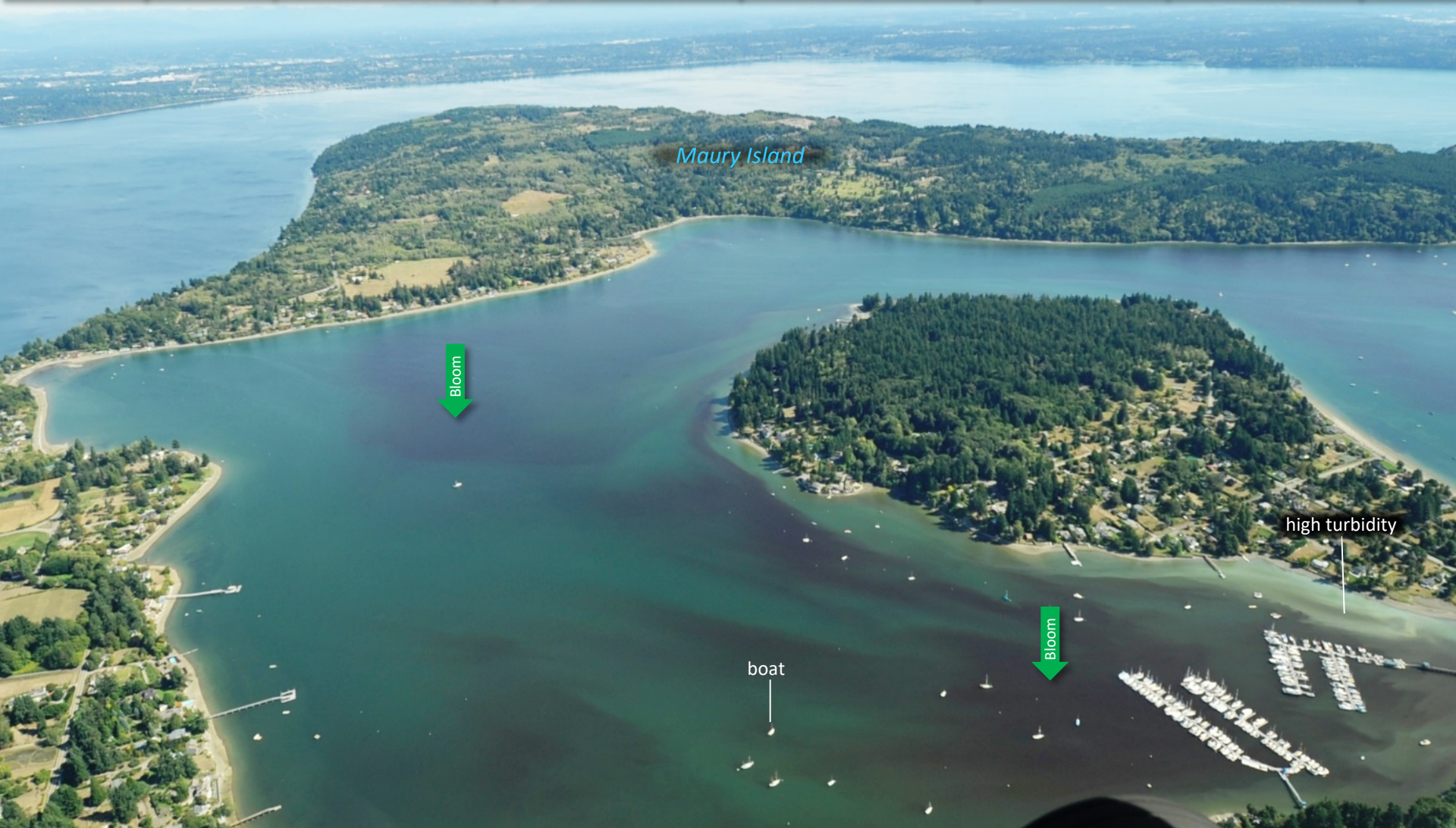
Climate & streams

Combined factors

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Red-brown bloom and very turbid water.

Location: Quartermaster Harbor (Central Sound), 2:20 PM



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Red-brown bloom and very turquoise water.

Location: Quartermaster Harbor (Central Sound), 2:21 PM



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Puyallup River plume, rich in sediment, extending into Central Sound.
Location: Vashon Island and Commencement Bay (Central Sound), 2:23 PM



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Macroalgae rafts accumulating in large tidal eddy.

Location: Carr Inlet (South Sound), 2:23 PM



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Multiple macroalgae rafts accumulating along parallel lines.

Location: Carr Inlet (South Sound), 2:32 PM



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Macroalgae patches at end of Balch Passage.
Location: Balch Passage (South Sound), 2:35 PM



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*Sediment plume of Nisqually River hugging Anderson Island, flowing West (toward the bottom).
Location: Nisqually Reach (South Sound), 2:37 PM*



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Red-brown bloom and turquoise water showing circulation of river water preferentially northward (toward the bottom). Location: Henderson Inlet (South Sound), 2:40 PM



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A. 9/7/2019



B. 9/6/2019



citizen contribution

citizen contribution

A. Macroalgae rafts at Normandy Park. B. Diffuse jellyfish smacks in West Sound, Orcas Island.

Location: A. Normandy Park (Central Sound), B. West Sound (San Juan Islands).

Find past editions of EOPS on the next pages



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We have published 83 editions!

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

Recommended Citation (example for September 2018 edition):

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<https://fortress.wa.gov/ecy/publications/documents/1803075.pdf>.

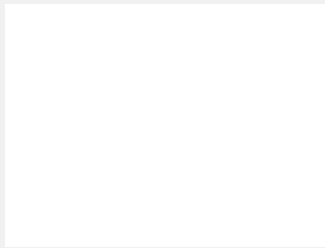


Many thanks to our business partners:
Shannon Point Marine Lab (WWU), Jorgensen Air

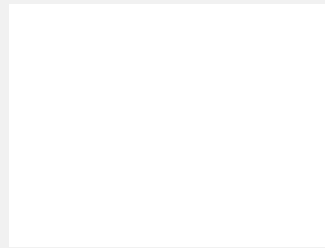
Contact:

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Marine Monitoring Unit
Environmental Assessment Program
Washington State
Department of Ecology

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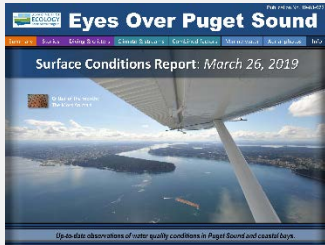
[September_12_2019,](#)
[Publication No. 19-03-075](#)



[July_29_2019](#)
[Publication No. 19-03-074](#)



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



[March_26_2019](#)
[Publication No. 19-03-072](#)



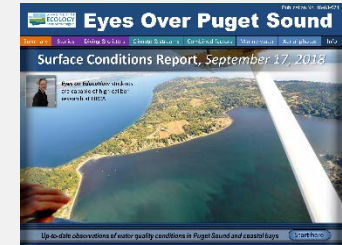
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[January_10_2019](#)
[Publication No. 19-03-070](#)



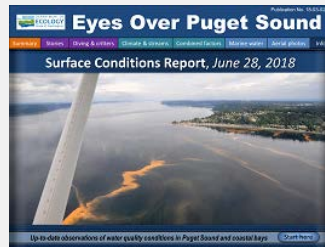
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[Publication No. 18-03-075](#)



[September_17_2018,](#)
[Publication No. 18-03-074](#)



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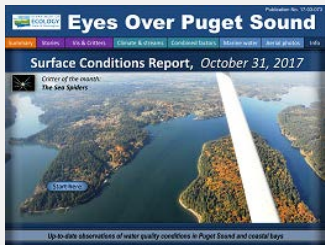
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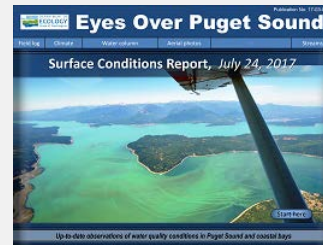
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[Publication No. 18-03-070](#)



[October_31_2017,](#)
[Publication No. 17-03-073](#)



[August_28_2017,](#)
[Publication No. 17-03-072](#)



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[June_6_2017,](#)
[Publication No. 17-03-070](#)



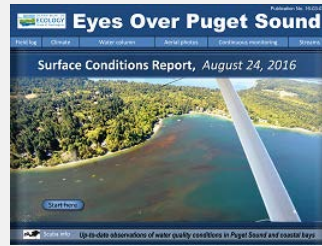
[December_31_2016,](#)
[Publication No. 16-03-079](#)



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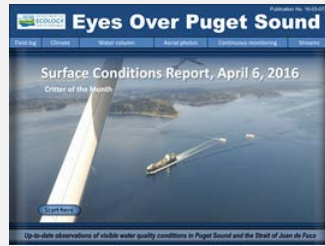
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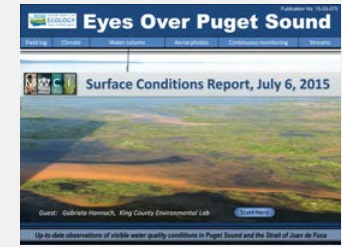
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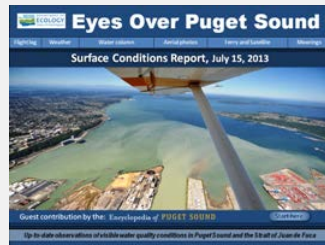
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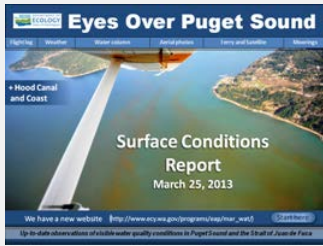
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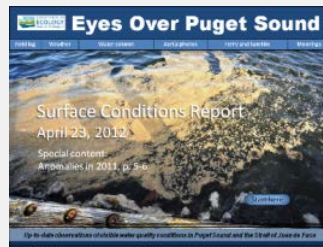
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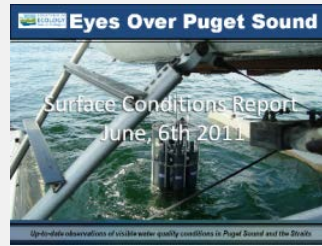
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