



Eyes Over Puget Sound

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

Surface Conditions Report: *October 30, 2019*

New Marine Waters Report



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

PSEMP and NOAA



Guest contribution

[p. 3](#)

Puget Sound Marine Waters Report.

*Dany Burgess
Angela Eagleston*

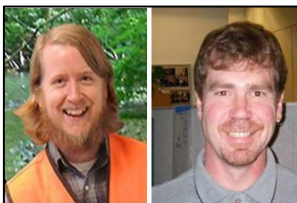


Jeepers creepers!

[p. 4](#)

Ecology scientists surprise us with the creeping pedal sea cucumber.

*Tyler Burks
Jim Shedd*



Water visibility for divers

[p. 5](#)

Know the best and worst for October.

Skip Albertson



Climate & streams

[p. 6](#)

After a dry summer we have had several months of higher precipitation, but river flows mostly remain lower than in 2018. The past summer was warmer than in 2018, but October was colder.

*Dr. Christopher
Krembs (Editor)*



Water temperature and food web

[p. 9](#)

South and Central Sound retained temperature ranges for spawning for anchovies. Optimum growth temperatures for herring and salmon persisted in Whidbey Basin.

Aerial photography

[p. 11](#)

Sizable rafts of orange debris drift in South Sound, looking like *Noctiluca*. Whidbey Basin, East Sound, and Bellingham, Padilla, and Discovery Bays have sizable rafts of organic debris. By the end of October many red-brown blooms typical for fall have vanished, yet the waters of South Sound are still green.



Summary

Stories

Diving & critters

Climate & streams

Combined factors

Marine water

Aerial photos

Info



puget sound marine waters

2018
overview

Critter of the Month – The Creeping Pedal Sea Cucumber



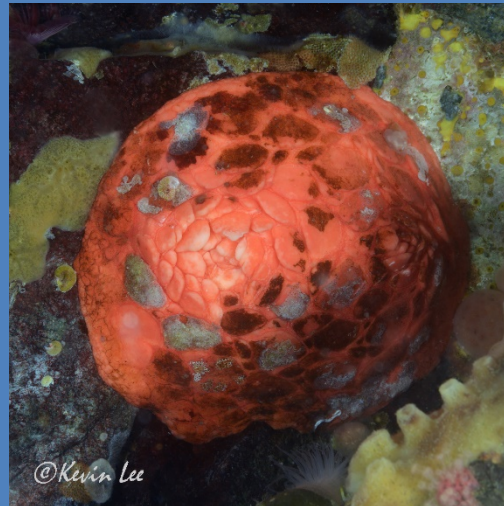
Dany Burgess & Angela Eagleston
Marine Sediment Monitoring Team

Psolus chitonoides

With its sticky, spiny, scaly body, the creeping pedal sea cucumber is one of the more bizarre members of the Puget Sound benthic community. It prefers to creep on rocks rather than mud, making it a rare and special find for our team!

Fun Creeping Pedal Cuke Facts

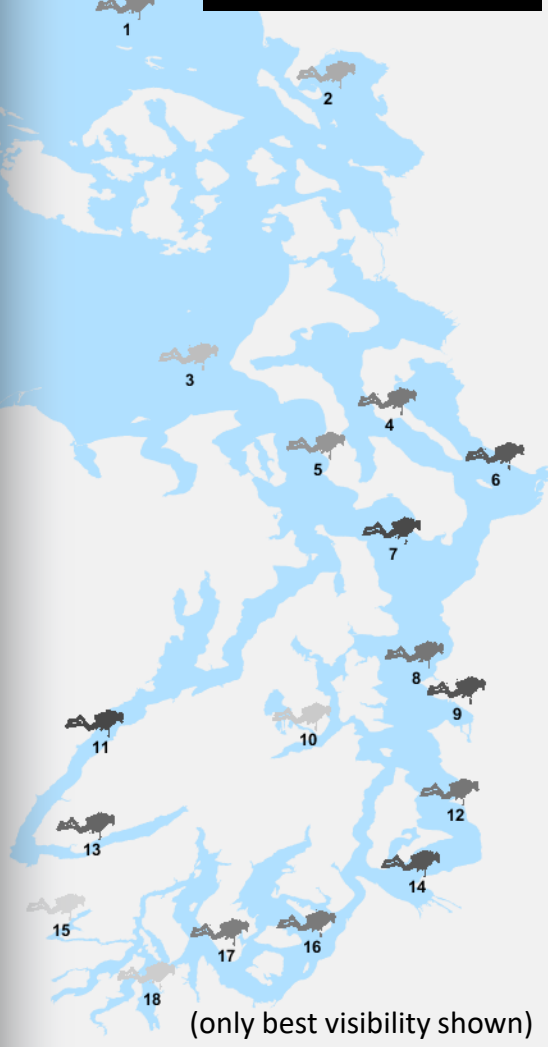
- The Latin name “*chitonoides*” comes from the armored mollusk it resembles: the chiton.
- Its tentacles form a cup-shaped mesh that is sticky like a spider’s web.
- Its body contains a toxin that is poisonous to some predators.





What was the water visibility like for divers?

Visibility in October



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	27	56	12	2
2	19	20	12	3
3	15	5	13	85
4	31	85	10	10
5	24	8	20	94
6	38	66	7	8
7	42	31	23	3
8	32	64	24	18
9	40	44	16	3
10	12	7	6	61
11	43	79	28	10
12	32	98	26	46
13	36	41	16	10
14	39	95	8	5
15	9	57	8	5
16	31	97	15	3
17	30	97	21	5
18	11	28	10	38

Find depths with high/low visibility

- **Best visibility** occurred in Hood Canal near Octopus Hole (location 11), with over 40 ft visibility at about 80 ft depth.
- **Poor visibility** occurred near the surface in Sinclair Inlet (location 10).
- The poster, "Underwater Visibility Maps — a Tool for Scuba Divers," is available [here](#)



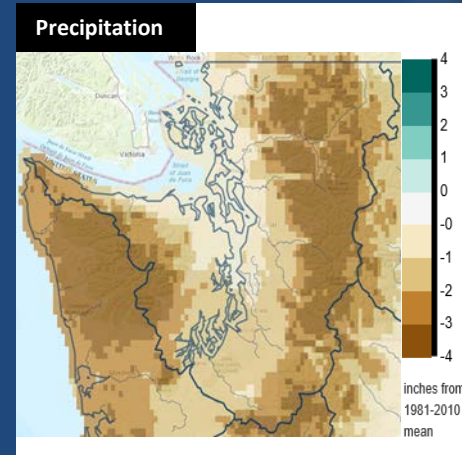
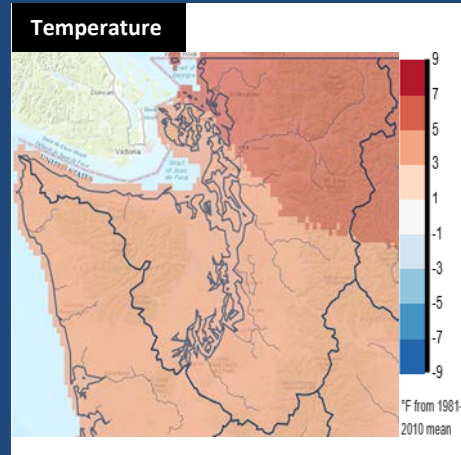
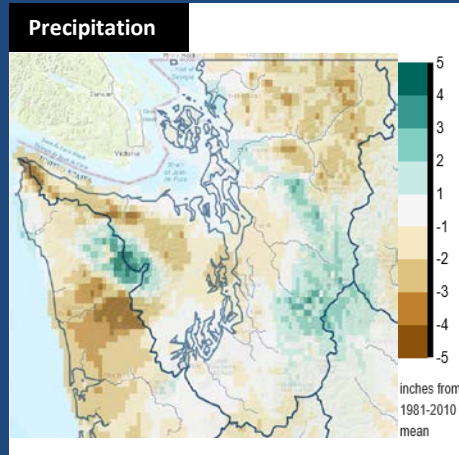
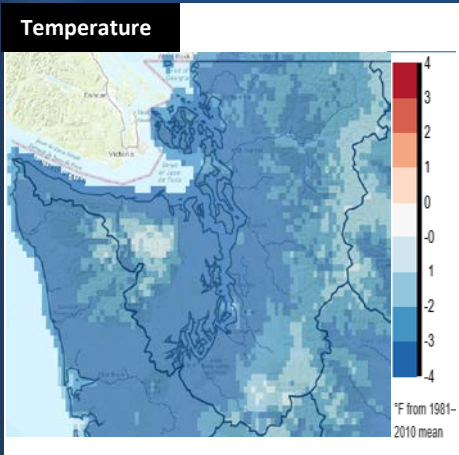
This is a new feature and we are soliciting feedback (skip.albertson@ecy.wa.gov).



During the previous 30 days, Puget Sound air temperatures were below normal, while precipitation was generally below normal except for central Puget Sound (A). During the next 30 days, forecasted temperatures are projected to be warmer than normal, while precipitation is expected to be below normal (B).

A. Northwest Climate Toolbox (previous 30 days)

B. Northwest Climate Toolbox (next 30 days)



Temperature Anomaly

from historical mean ranged from 0 to -4°F in the Puget Sound region during the past 30 days.

Precipitation Anomaly

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

Temperature Anomaly

from historical mean is forecasted to be +3°F to +7°F in the Puget Sound region during the next 30 days.

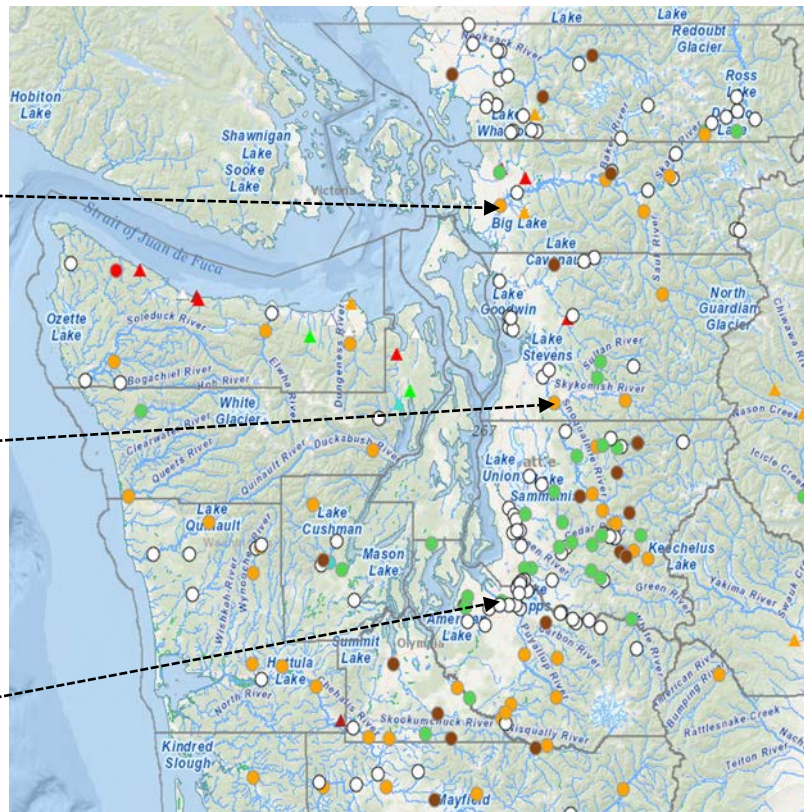
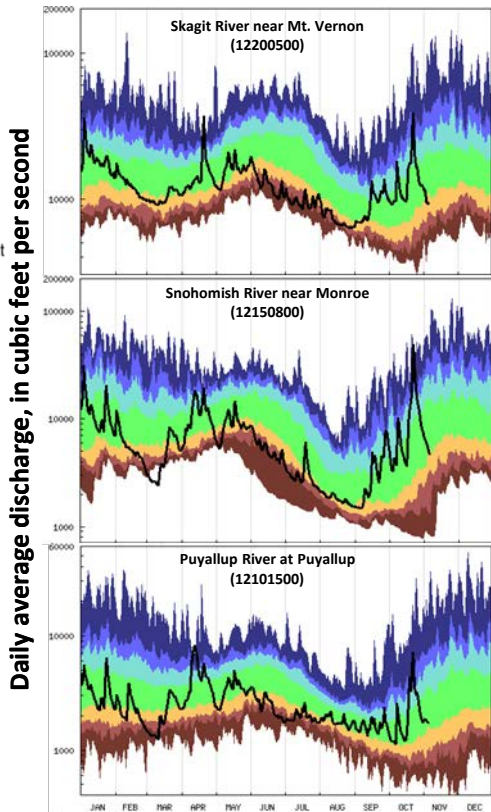
Precipitation Anomaly

from historical mean is forecasted to be 0 to -4 inches in the Puget Sound region during the next 30 days.

Despite a strong atmospheric river precipitation event (10/21), an unusual dry spell has resulted in normal to below-normal freshwater inputs to Puget Sound (trend charts, left). Current flow distribution across the watershed is mixed (map, right), due to variable delivery of rainfall and differing rates of streamflow decline after recent precipitation.

Select Puget Sound Streamflow Trends

Current Streamflow Conditions as of 11/06/2019



USGS Real Time Streamflow Values

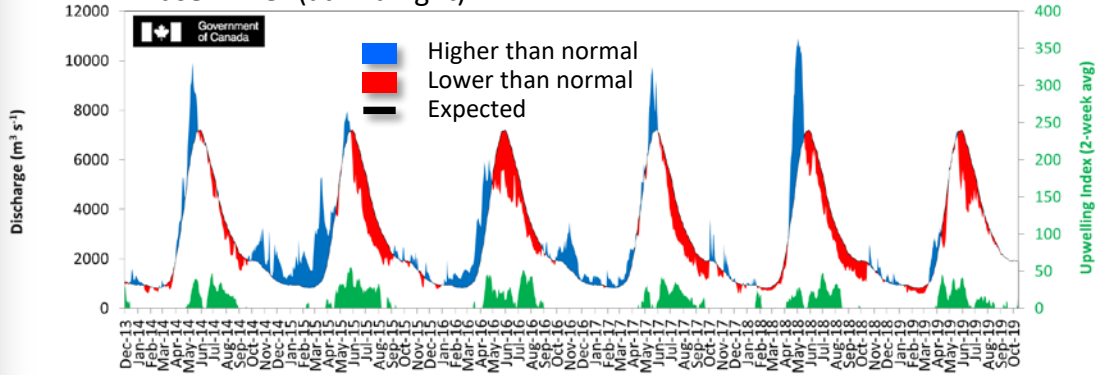
- Much above normal (>90%)
- Above normal (76-90%)
- Normal (25-75%)
- Below normal (10-24%)
- Much below normal (5-10%)
- Far below normal (>5%)
- Lowest recorded
- Not Ranked

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

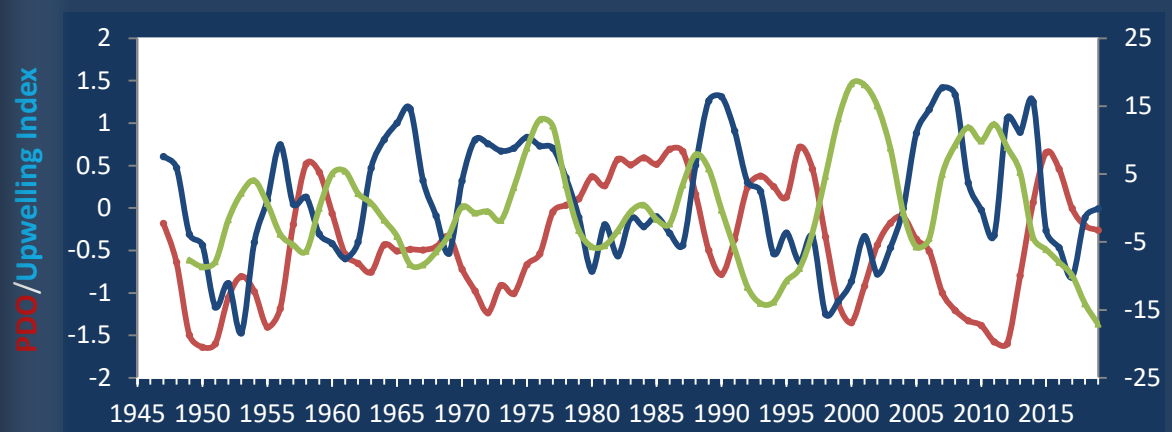
Historically, the peaks of coastal upwelling and the [freshet](#) are in sync. In 2019, the freshet was weak.

Fraser River (at midnight)



The Fraser River is the major driver of [estuarine circulation](#) and water exchange between the Salish Sea and the ocean. The 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 low 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. After a dry beginning of summer we have had several months of higher precipitation (October variable), but river flows mostly remain lower than in 2018. The past summer was warmer than in 2018, but October was colder. Early onset upwelling was a factor in both 2018 and 2019. For recent river and stream inflow, [see page 7](#).

Conditions leading up to November:

Air temperatures have generally been warmer than normal this year, but October was colder.

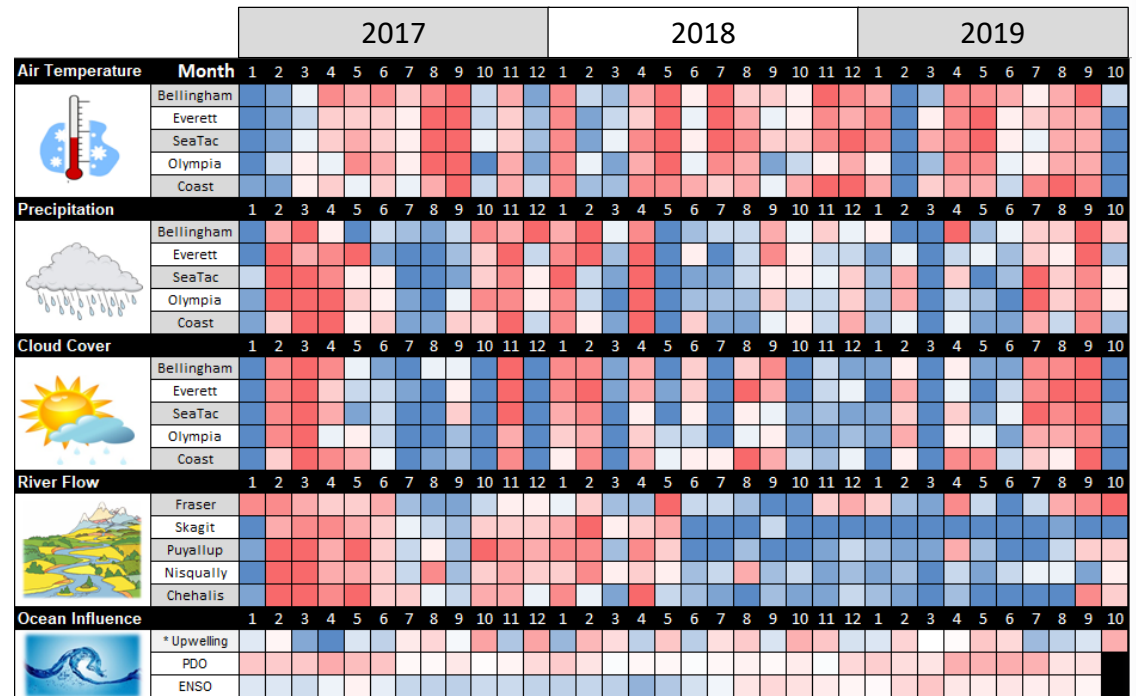
Precipitation for this year has been lower than in 2018, but July through September have been wetter.

Sunshine (opposite of cloud cover) has been high, except in July through September.

River flows have been low since June of last year (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).



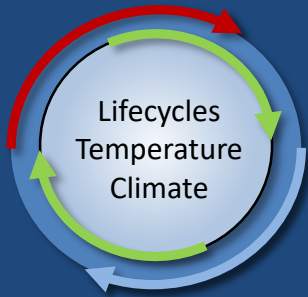
*Upwelling/downwelling Anomalies (PFEL)

PDO = Pacific Decadal Oscillation

ENSO = El Niño Southern Oscillation



No data



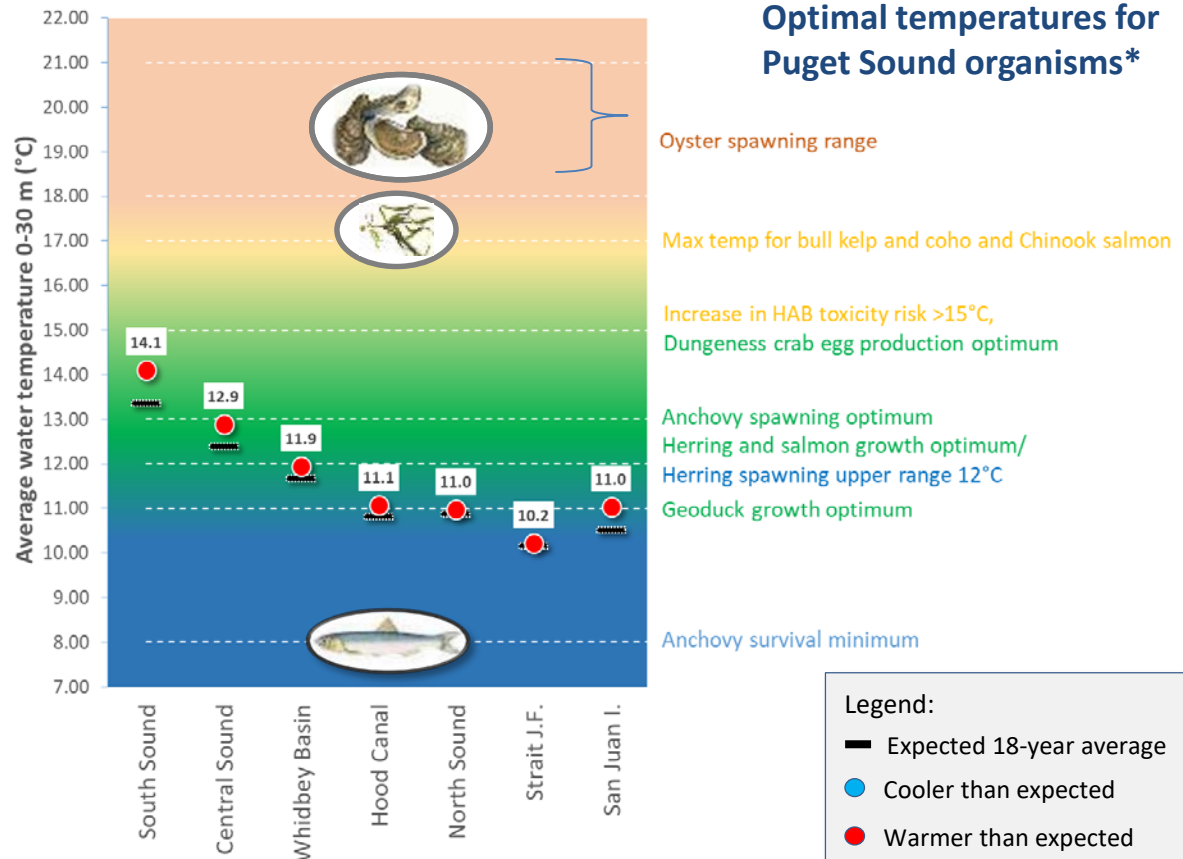
Can organisms thrive and survive?

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 October, average surface water (0 – 30 m) temperatures were still 0.4 °C above the baseline (1999 – 2018) across all regions. South and Central Sound retained temperature ranges for spawning for anchovies. Optimum growth temperatures for herring and salmon persisted in Whidbey Basin. Expected coolest temperatures occurred in the Straits with 10.2 °C. These temperatures do not reflect nearshore conditions that can be quite different.



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



Sizable rafts of orange debris drift in South Sound, looking like *Noctiluca*. Whidbey Basin, East Sound, and Bellingham, Padilla, and Discovery Bays have sizable rafts of organic debris. By the end of October many red-brown blooms typical for fall have vanished, yet the waters of South Sound are still green. Jellyfish and schools of fish are no longer abundant in South Sound.

Start here

Brown water leaving marina in La Connor Marina.



We love Portage Island, too.



Mixing and fronts:

Tidal fronts in Tacoma Narrows, tidal eddies in Obstruction Pass. Interesting patches of different water masses in East Sound and Sequim Bay.



Jellyfish:

Very few jellyfish patches in Budd Inlet. The previously reported large jellyfish patches in Quartermaster Harbor have disappeared.



Suspended sediment:

In Skagit Bay and along sandy spots.



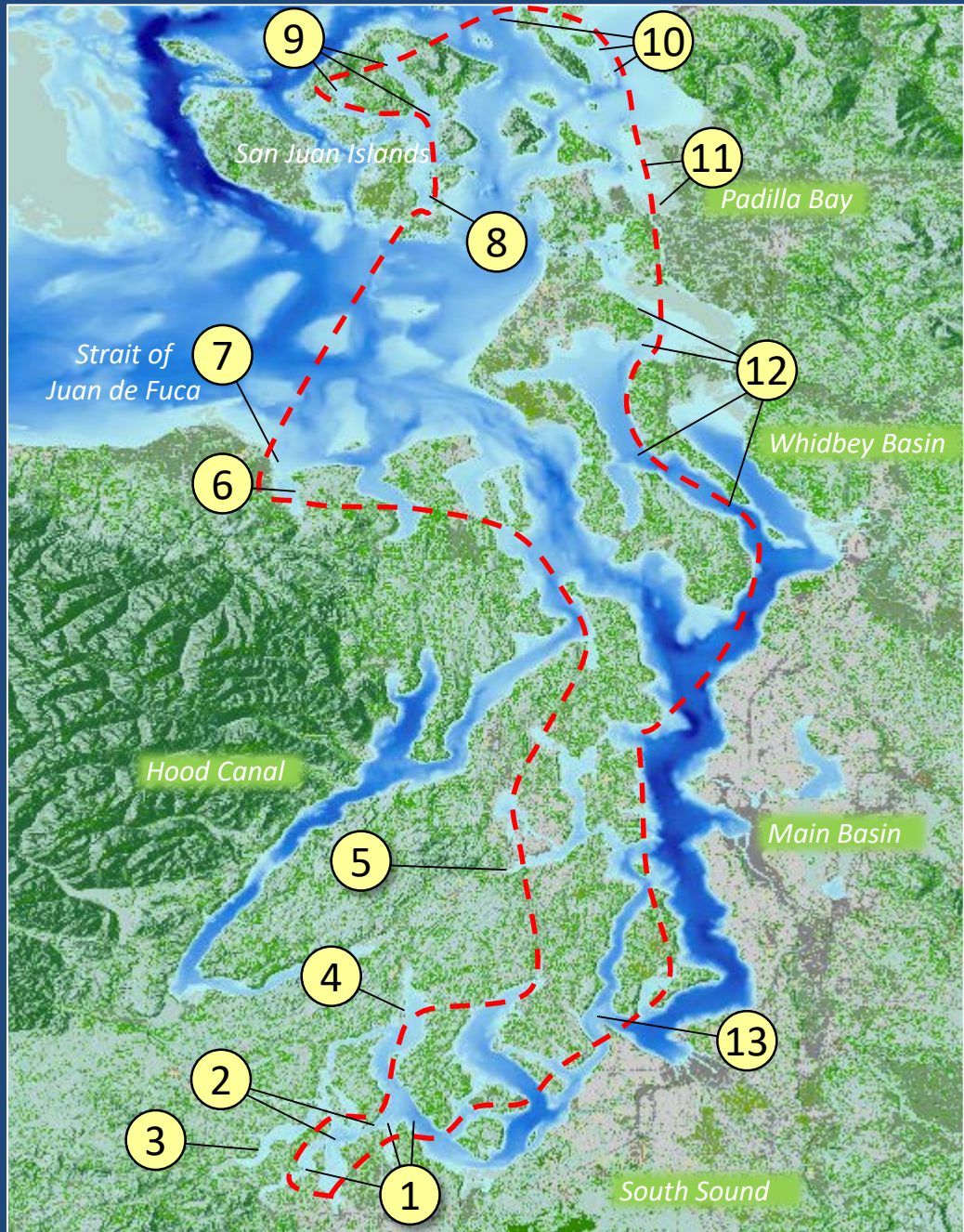
Visible blooms:

Red-brown bloom in Henderson and Sinclair Inlets and Sequim Bay. Greenish water still persists in South Sound.



Debris:

Sizable rafts of organic debris in South Sound, Whidbey Basin, East Sound, Discovery Bay, Bellingham Bay, and Padilla Bay.



Aerial navigation guide

Date: 10/30/2019

Click on numbers

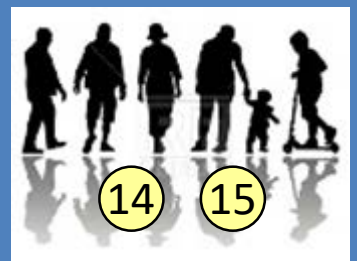
Tide data from 10/30/2019 (Seattle):

Time	Pred (ft)	High/Low
12:40 AM	-1.93	L
7:38 AM	11.91	H
1:13 PM	5.48	L
6:31 PM	11.24	H

Flight Observations

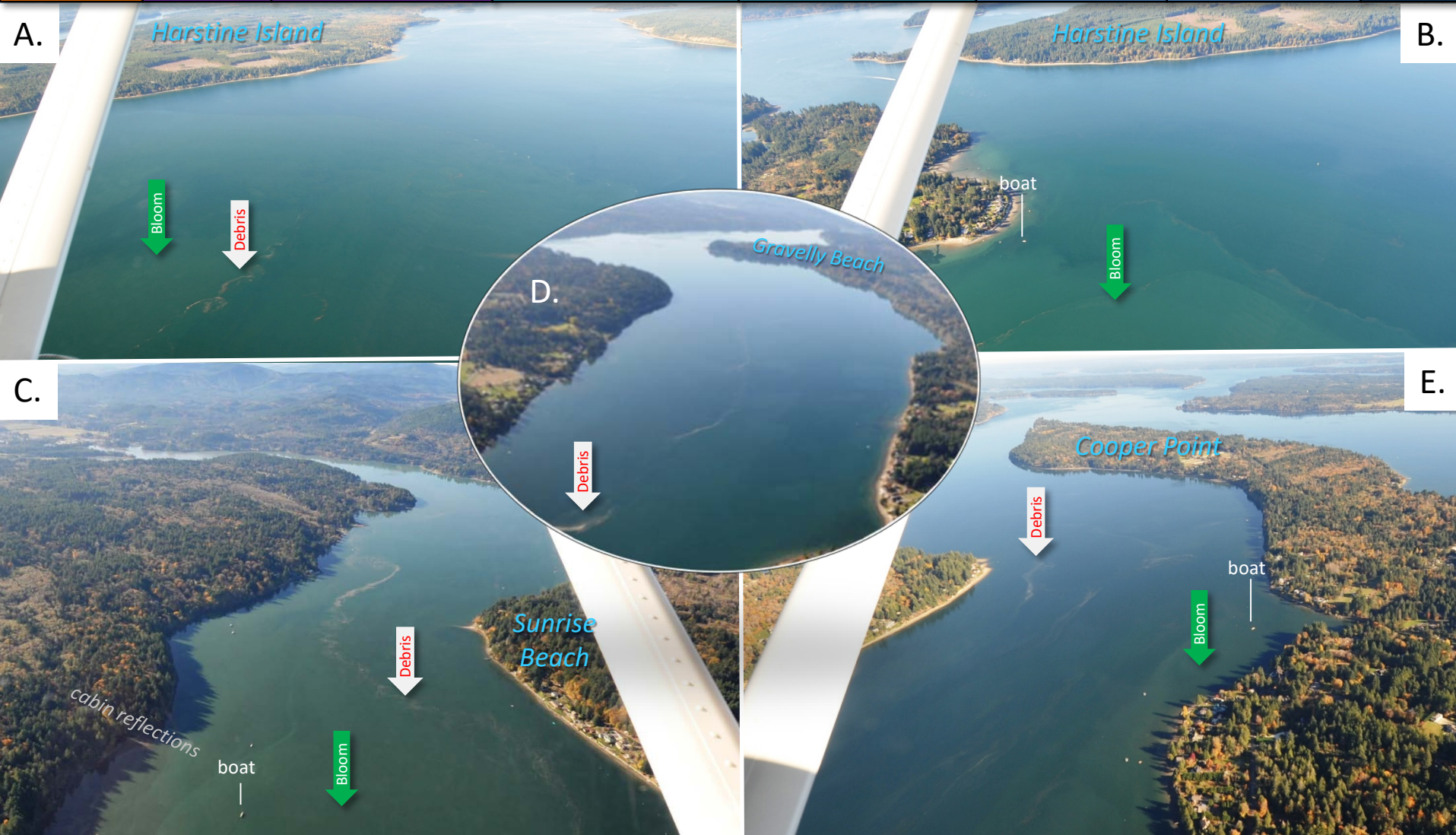
Sunny and hazy

Citizens contributing observations





[Summary](#)
[Stories](#)
[Diving & critters](#)
[Climate & streams](#)
[Combined factors](#)
[Marine water](#)
[Aerial photos](#)
[Info](#)



Reddish organic material (perhaps Noctiluca) drifting at surface in South Sound. Green water.
 Location: A. Dana Passage, B. Entrance to Henderson Inlet, C-E. Eld Inlet (South Sound), 11:20 AM



[Summary](#)
[Stories](#)
[Diving & critters](#)
[Climate & streams](#)
[Combined factors](#)
[Marine water](#)
[Aerial photos](#)
[Info](#)



Reddish organic material (perhaps Noctiluca) drifting at surface in South Sound. Green water.
 Location: A. Entrance to Eld Inlet, B. Dana Passage (South Sound), 11:27 PM



Summary

Stories

Diving & critters

Climate & streams

Combined factors

Marine water

Aerial photos

Info



Reddish organic material (perhaps Noctiluca) drifting at surface. Suspended sediment.

Location: Totten Inlet (South Sound), 11:23 AM



Summary

Stories

Diving & critters

Climate & streams

Combined factors

Marine water

Aerial photos

Info



Green water, likely a bloom, towards the western shore.
Location: Lang Island, Case Inlet (South Sound), 11:39 AM



Summary

Stories

Diving & critters

Climate & streams

Combined factors

Marine water

Aerial photos

Info



boat

Bloom

Dark maroon bloom.

Location: Sinclair Inlet (Central Sound), 11:50 AM



Summary

Stories

Diving & critters

Climate & streams

Combined factors

Marine water

Aerial photos

Info



Large greenish eddy of water of very different color, surrounded by maroon-colored bloom.
Location: Sequim Bay (North Sound), 12:22 PM



Summary

Stories

Diving & critters

Climate & streams

Combined factors

Marine water

Aerial photos

Info



Faint red-brown bloom outside Sequim Bay.
Location: Sequim Bay (North Sound), 12:23 PM



Summary

Stories

Diving & critters

Climate & streams

Combined factors

Marine water

Aerial photos

Info



A. Green turbid water leaving Lopez Sound via Lopez Pass. B. Red-brown bloom between Reeds Bay and Center Island.

Location: Lopez Sound, San Juan Islands (North Sound), 12:42 PM



Summary

Stories

Diving & critters

Climate & streams

Combined factors

Marine water

Aerial photos

Info



A. Large eddy, B. Patch of greener water and debris, C. Green patch.

Location: A. Off Obstruction Pass, B. East Sound, C. West Sound, Orcas Island (North Sound), 12:49 PM



Summary

Stories

Diving & critters

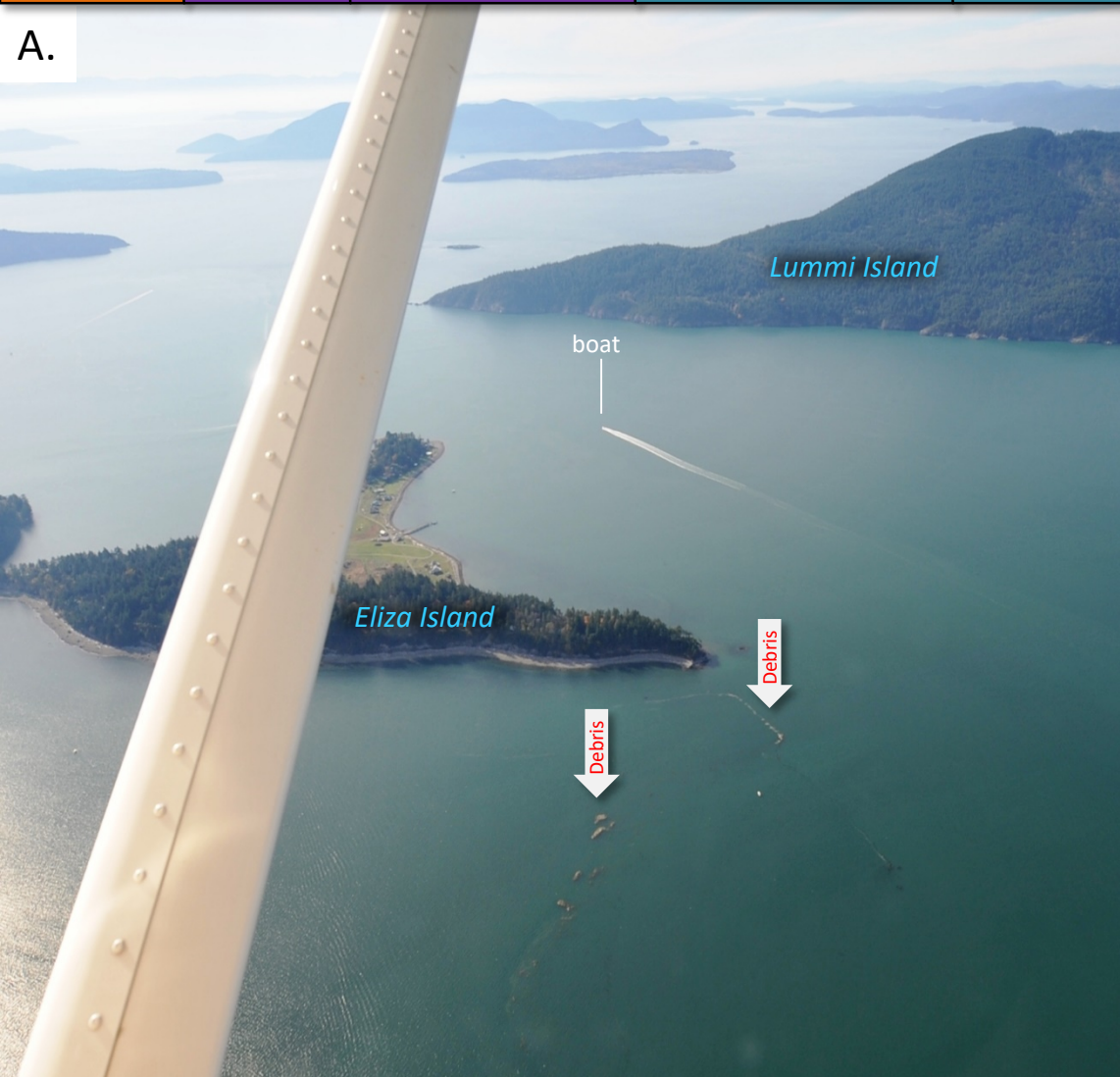
Climate & streams

Combined factors

Marine water

Aerial photos

Info



A. Macroalgae rafts, B & C. Fronts between clearer and murkier water around Lummi Island.
 Location: A. Eliza Island, B. Portage Island, C. Lummi Island (North Sound), 1:03 PM



Summary

Stories

Diving & critters

Climate & streams

Combined factors

Marine water

Aerial photos

Info

A.



B.



A, B. Multiple rafts of organic debris accumulating at edges of tidal gullies.
Location: Padilla Bay National Estuarine Research Reserve (North Sound), 1:08 PM



Summary

Stories

Diving & critters

Climate & streams

Combined factors

Marine water

Aerial photos

Info



A. Suspended sediment, B. Organic debris accumulating at front, C & D. Patches of organic debris.
 Location: A. Skagit Bay, B. Polnell Point, C. Saratoga Passage, D. Off Langley (Whidbey Basin), 1:18 PM



Summary

Stories

Diving & critters

Climate & streams

Combined factors

Marine water

Aerial photos

Info



Tidal front separating green water from South Sound from clearer water in Central Sound.
Location: Entrance of the Tacoma Narrows (Central Sound), 1:56 PM



Summary

Stories

Diving & critters

Climate & streams

Combined factors

Marine water

Aerial photos

Info

A. 10/30/2019

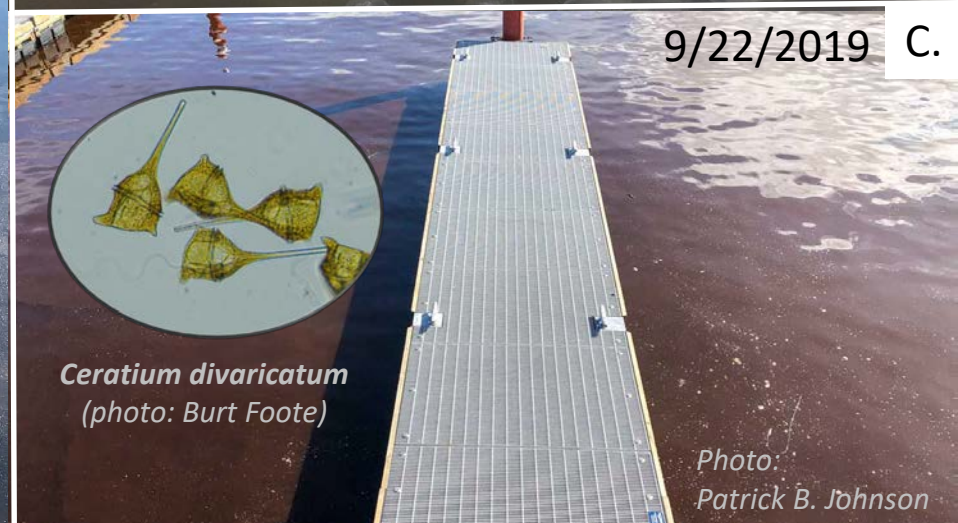


10/5/2019 B.



Photo: Zuzko Jewelry

9/22/2019 C.



Ceratium divaricatum
(photo: Burt Foote)

Photo:
Patrick B. Johnson

A. Patch of organic debris, B. Jellyfish, C. Red-brown bloom.

Location: A. Dyes Inlet, Silverdale, B. Quartermaster Harbor, C. Hollywood Beach, Port Angeles



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

10/6/2019



Red-brown bloom.
 Location: Discovery Bay (North Sound)

Find past editions of EOPS on the next pages



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

We have published 84 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.

Contact:

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

[Subscribe](#) to the Eyes Over
Puget Sound email listserv.



[March_16_2020,](#)
[Publication No. 20-03-071](#)



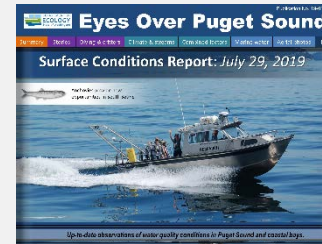
[Jan_10_2020,](#)
[Publication No. 20-03-070](#)



[October_30_2019,](#)
[Publication No. 19-03-076](#)



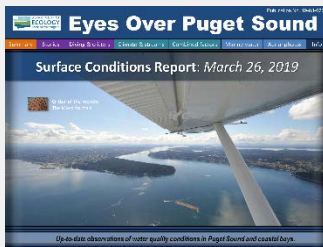
[September_12_2019,](#)
[Publication No. 19-03-075](#)



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



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



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



[February_21_2019](#)
[Publication No. 19-03-071](#)



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



[November_6_2018,](#)
[Publication No. 18-03-075](#)



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



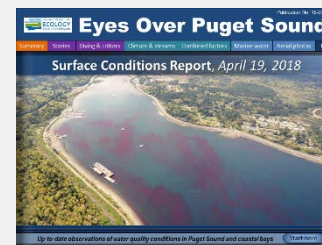
[July_16_2018,](#)
[Publication No. 18-03-073](#)



[June_28_2018,](#)
[Publication No. 18-03-072](#)



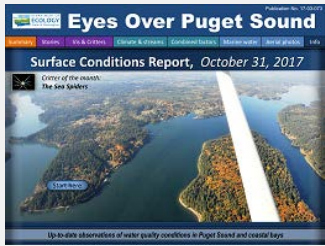
[May_22_2018,](#)
[Publication No. 18-03-025](#)



[April_19_2018,](#)
[Publication No. 18-03-071](#)



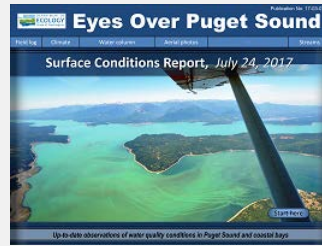
[Winter_2018,](#)
[Publication No. 18-03-070](#)



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



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



[July_24_2017,](#)
[Publication No. 17-03-071](#)



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



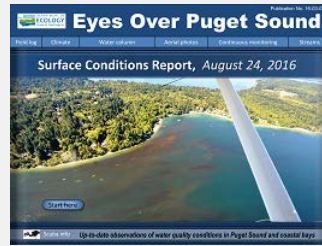
[December_31_2016,](#)
[Publication No. 16-03-079](#)



[November_22_2016,](#)
[Publication No. 16-03-078](#)



[September_26_2016,](#)
[Publication No. 16-03-077](#)



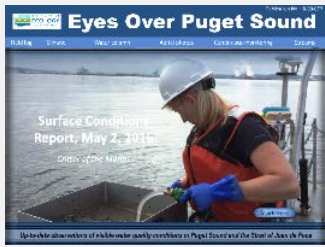
[August_24_2016,](#)
[Publication No. 16-03-076](#)



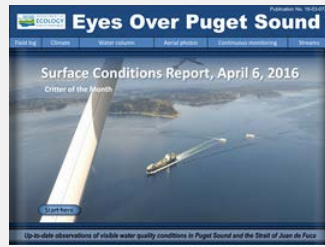
[July_20_2016,](#)
[Publication No. 16-03-075](#)



[June_27_2016,](#)
[Publication No. 16-03-074](#)



[May_2_2016,](#)
[Publication No. 16-03-073](#)



[April_6_2016,](#)
[Publication No. 16-03-072](#)



[March_16_2016,](#)
[Publication No. 16-03-071](#)



[February_8_2016,](#)
[Publication No. 16-03-070](#)



[December_30_2015,](#)
[Publication No. 15-03-080](#)



[December_14_2015,](#)
[Publication No. 15-03-079](#)



[October_6_2015,](#)
[Publication No. 15-03-078](#)



[September_21_2015,](#)
[Publication No. 15-03-077](#)



[August_8_2015,](#)
[Publication No. 15-03-076](#)



[July_6_2015,](#)
[Publication No. 15-03-075](#)



[June_8_2015,](#)
[Publication No. 15-03-074](#)



[April_29_2015,](#)
[Publication No. 15-03-073](#)



[March_24_2015,](#)
[Publication No. 15-03-072](#)



[February_17_2015,](#)
[Publication No. 15-03-071](#)



[January_28_2015,](#)
[Publication No. 15-03-070](#)



[December_30_2014,](#)
[Publication No. 14-03-080](#)



[November_17_2014,](#)
[Publication No. 14-03-079](#)



[October_29_2014,](#)
[Publication No. 14-03-078](#)



[September_16_2014,](#)
[Publication No. 14-03-077](#)



[August_18_2014,](#)
[Publication No. 14-03-076](#)



[July_28_2014,](#)
[Publication No. 14-03-075](#)



[June_23_2014,](#)
[Publication No. 14-03-074](#)



[May_12_2014,](#)
[Publication No. 14-03-073](#)



[April_21_2014,](#)
[Publication No. 14-03-072](#)



[March_24_2014,](#)
[Publication No. 14-03-071](#)



[February_4_2014,](#)
[Publication No. 14-03-070](#)



[December_31_2013,](#)
[Publication No. 13-03-081](#)



[November_21_2013,](#)
[Publication No. 13-03-080](#)



[October_28_2013,](#)
[Publication No. 13-03-079](#)



[September_11_2013,](#)
[Publication No. 13-03-078](#)



[August_21_2013,](#)
[Publication No. 13-03-077](#)



[July_15_2013,](#)
[Publication No. 13-03-076](#)



[June_17_2013,](#)
[Publication No. 13-03-075](#)



[May_20_2013,](#)
[Publication No. 13-03-074](#)



[April_8_2013,](#)
[Publication No. 13-03-073](#)



[Mar_25_2013,](#)
[Publication No. 13-03-072](#)



[February_26_2013,](#)
[Publication No. 13-03-071](#)



[January_15_2013,](#)
[Publication No. 13-03-070](#)



[December_13_2012,](#)
[Publication No. 12-03-081](#)



[November_8_2012,](#)
[Publication No. 12-03-080](#)



[October_8_2012,](#)
[Publication No. 12-03-079](#)



[September_11_2012,](#)
[Publication No. 12-03-078](#)



[August_27_2012,](#)
[Publication No. 12-03-077](#)



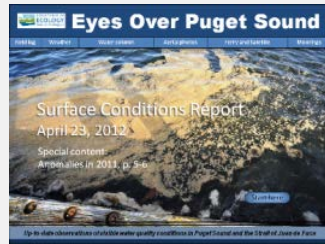
[July_31_2012,](#)
[Publication No. 12-03-076](#)



[June_12_2012,](#)
[Publication No. 12-03-075](#)



[May_14_2012,](#)
[Publication No. 12-03-074](#)



[April_23_2012,](#)
[Publication No. 12-03-073](#)



[March_19_2012,](#)
[Publication No. 12-03-072](#)



[February_27_2012,](#)
[Publication No. 12-03-071](#)



[January_30_2012,](#)
[Publication No. 12-03-070](#)



December_5_2011,
[Publication No. 11-03-082](#)



November_15_2011,
[Publication No. 11-03-081](#)



October_17_2011,
[Publication No. 11-03-080](#)



September_12_2011,
[Publication No. 11-03-079](#)



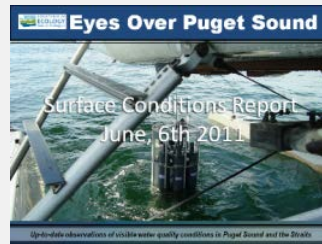
August_8_2011,
[Publication No. 11-03-078](#)



July_6_2011,
[Publication No. 11-03-077](#)



June_20_2011,
[Publication No. 11-03-076](#)



June_6_2011,
[Publication No. 11-03-075](#)



May_4_2011,
[Publication No. 11-03-074](#)



April_27_2011,
[Publication No. 11-03-073](#)

