



Eyes Over Puget Sound

Summary

Stories

Diving & critters

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Info

Surface Conditions Report: *July 29, 2019*



Anchovies provide new opportunities in South Sound



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

*Phillip Dionne
Steve Jeffries
Todd Sandell*



*Julianne Ruffner
Laura Hermanson*



*Tyler Burks
Jim Shedd*



Skip Albertson



*Dr. Christopher
Krembs (Editor)*



Guest contribution [p.3](#)

Anchovies provide new opportunities in South Sound.

Personal stories [p. 8](#)

Macroalgae growth is fueled by excessive nutrients and sunshine. When it washes onto the beach, it is called beach wrack, and it can turn into a health risk to beachgoers.

Climate & streams [p. 10](#)

In July, some recent trends of warm, dry conditions weaken, but river flows remain low.

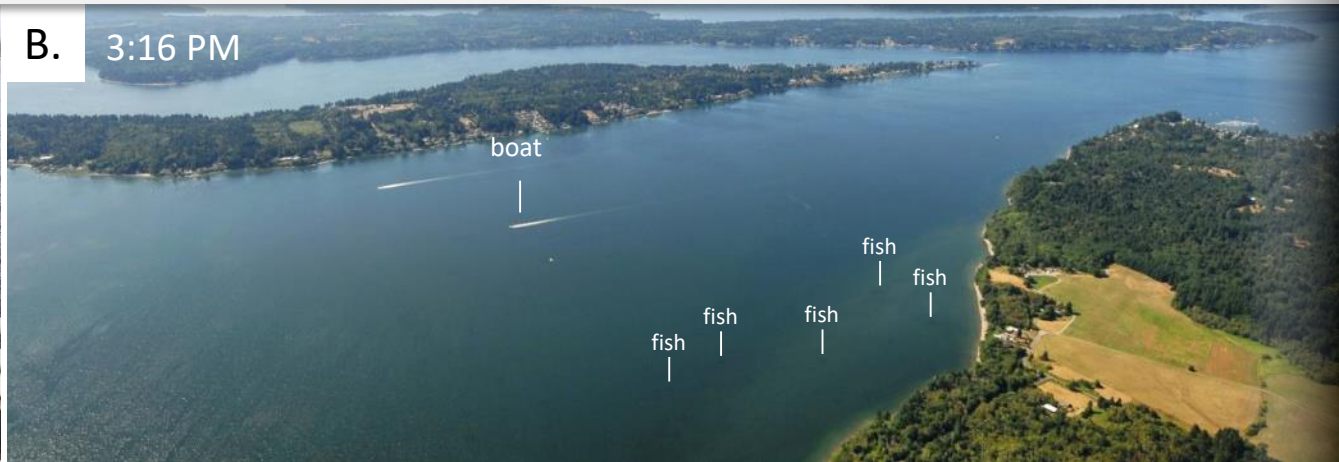
Water temperature and food web [p. 14](#)

In June, average surface water temperatures were slightly warmer with good temperatures for geoduck growth. South Sound exceeded water temperatures needed for herring to spawn. Inching now toward optimum anchovy spawning temperatures.

Aerial photography [p. 15](#)

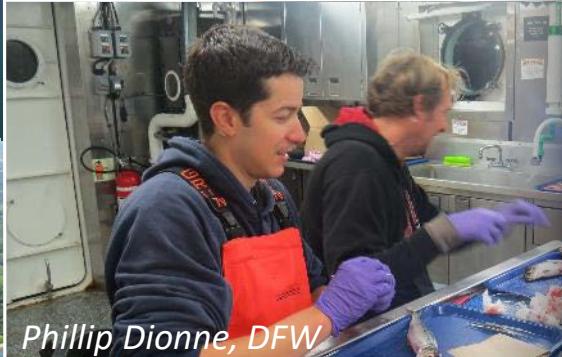
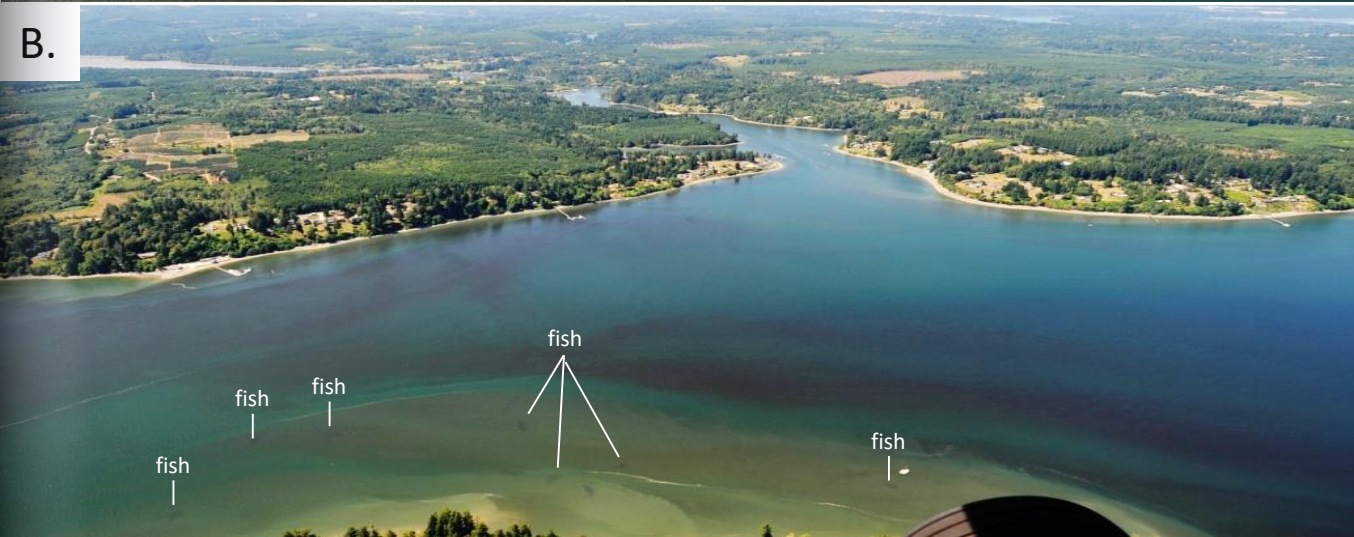
There were large numbers of fish in South Sound and southern Hood Canal, and lots of macroalgae on the water in South and Central Sound. Hood Canal was bright turquoise, stained from a bloom of coccolithophore.

Large schools of anchovy in Budd Inlet, Eld Inlet, and Peale Passage



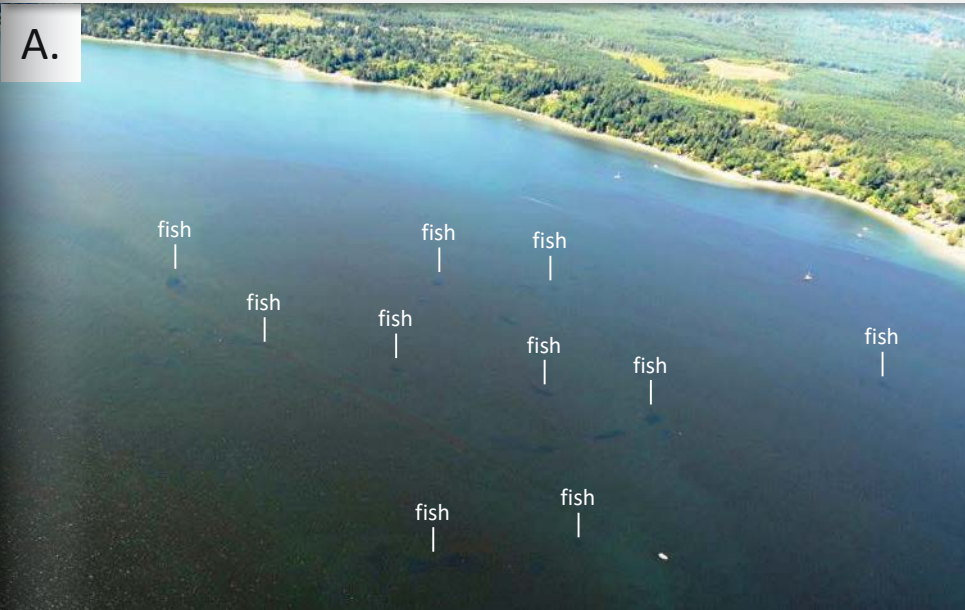
DFW staff are documenting anchovies in high numbers in winter 2019, and numbers remain high in July. Location: A., B. Budd Inlet, C. Peale Passage, D. Eld Inlet (South Sound) [How do we know it's fish?](#)

Large schools of anchovy in Totten Inlet



DFW staff are documenting anchovies in high numbers in winter 2019, and numbers remain high in July. Location: A. and B. Totten Inlet (South Sound) [How do we know it's fish?](#)

Large schools of anchovy in Totten Inlet



In July, fish schools in Totten Inlet (A) outnumbered those in Case Inlet (B), where fish schools occurred in high numbers in May and supported a huge group of California sea lions (C) and other mammals during late winter 2019.



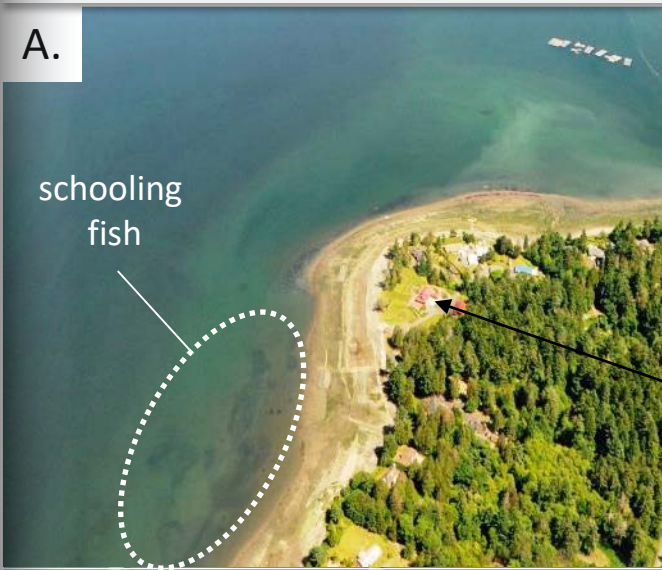
Large schools of fish are also present in Hood Canal



Many small fish schools and a coccolithophore bloom in Southern Hood Canal.

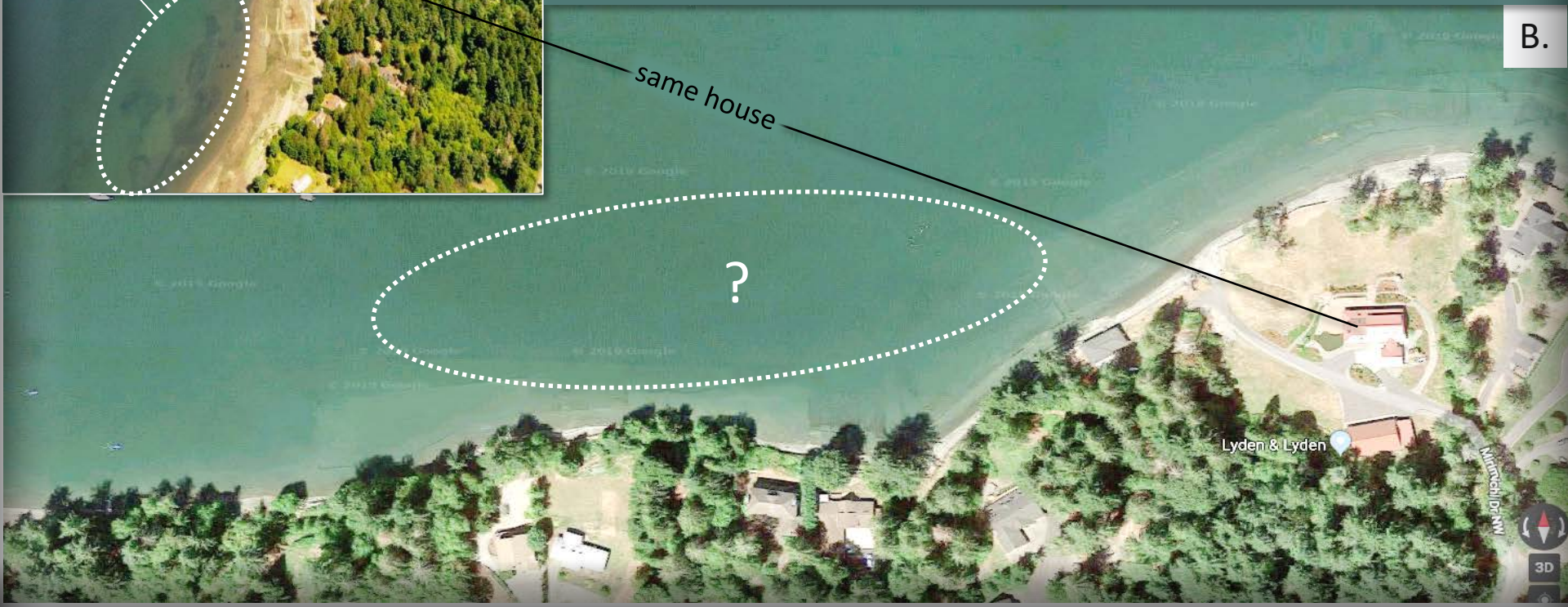
Location: 3 miles west of Sun Beach (Hood Canal), 2:08 PM

How can we tell what might be schooling fish vs. seagrass?



Google images help us figure it out.
Fish move around—seagrass beds do not.

A. Round dark patches in photos taken on 7-29-2019 in Totten Inlet are not present in Google images (date unknown) and therefore very likely schooling fish.



B. The dark patches are missing in Google images yet other nearshore features are preserved.

Google image

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Julianne Ruffner & Laura Hermanson

Beach wrack can be a health risk to beachgoers.

Large piles of organic debris can wash up on beaches. This **wrack** lingers on beaches and in shallow waters and **can act as a reservoir for bacteria**. If you come in contact with bacteria in wrack, sand, or water, your risk of getting sick increases. To prevent you and your family from getting exposed, the BEACH program monitors fecal indicator bacteria and advises beachgoers when bacteria numbers are high. **At normal levels, beach wrack provides food and shelter for many invertebrates and should not be removed.** [Read more](#)

[Read swimming tips](#) to minimize your risk of illness while visiting our beaches.



Advisories are issued if we see high levels of bacteria in the water.

Washed up wrack on the beach can harbor bacteria.



Signs warn of exposure risk

Macroalgae washed ashore at Dash Point State Park

Critter of the Month – The Striped Nudibranch



Dany Burgess & Angela Eagleston,
Marine Sediment Monitoring Team

Armina californica

July's critter may look cute and innocent, but beneath the squishy sea slug body and beautiful stripes lies a ferocious predator. Meet the striped nudibranch: a taxonomist's dream and a sea pen's nightmare!

Fun Striped Nudibranch Facts

- They hide beneath the sand during the day, emerging at night to hunt.
- Sensory organs on their heads, called rhinophores, help them “smell” the location of their sea pen prey.
- They incorporate toxins from sea pens into their tissues, making them distasteful to other animals.



Image by Dave Cowles, wallawalla.edu

Learn more about the striped nudibranch and other critters on Ecology's [EcoConnect blog](#).



What was the water visibility like for divers?

Best visibility in July



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	97	5	11
2	11	23	6	3
3	17	2	14	98
4	26	77	7	7
5	18	41	15	3
6	32	98	9	3
7	30	54	13	3
8	40	79	14	3
9	46	61	12	3
10	25	7	7	46
11	61	79	5	10
12	32	98	8	11
13	23	41	2	16
14	49	61	14	5
15	5	5	5	33
16	44	67	29	7
17	44	97	15	10
18	11	28	1	8

Find depths with high/low visibility

- **Best visibility** occurred in Hood Canal near Octopus Hole (location 11) with 61 ft visibility (at 79 ft depth), despite having poor visibility near the surface.
- **Poor visibility (no diver icon)** occurred in Oakland Bay near Shelton (location 18) with 1 ft visibility at a depth of 8 ft.
- The poster, “Underwater Visibility Maps – a Tool for Scuba Divers,” is available [here](#)



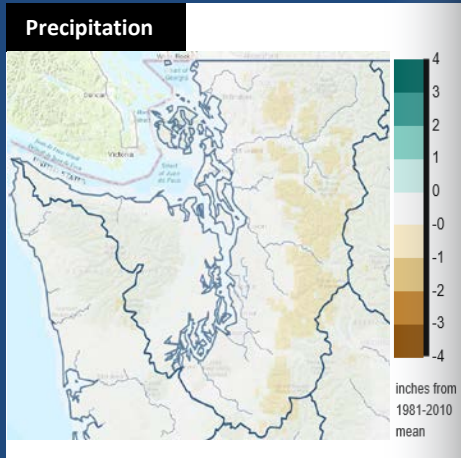
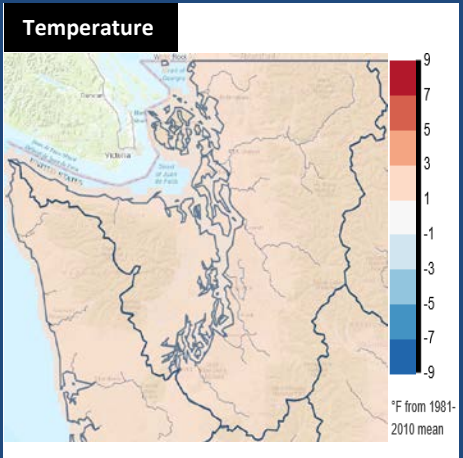
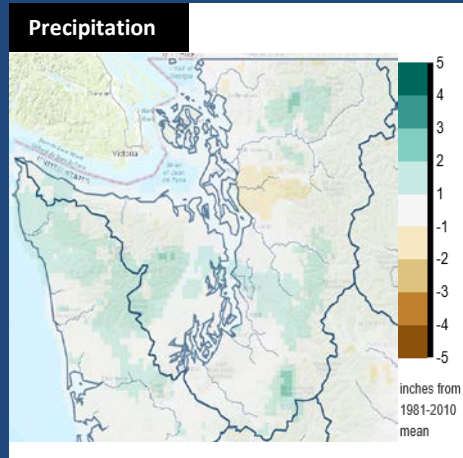
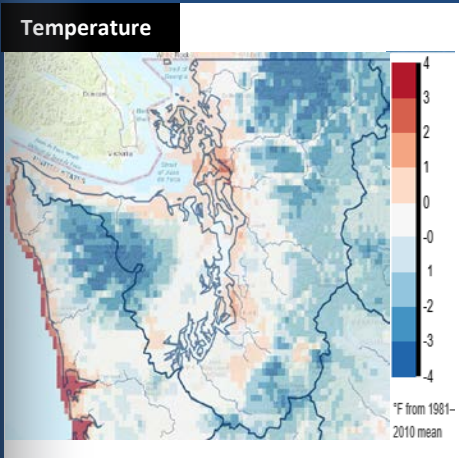
This is a new feature and we are soliciting feedback (skip.albertson@ecy.wa.gov).



During the last 30 days, Puget Sound air temperatures and precipitation were generally dependent on elevation (A). It was cooler at high elevations with some precipitation, and drier and warm in the lowlands. During the next 30 days, temperatures are expected to be moderately warmer than normal, and precipitation is expected to be normal with some deficits in the Cascades (B).

A. Northwest Climate Toolbox (Previous 30 days)

B. Northwest Climate Toolbox (Next 30 days)



Temperature Anomaly

from historical mean ranged from -4 to +3 °F in the Puget Sound region during the past 30 days.

Precipitation Anomaly

from historical mean ranged from -2 to +3 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.

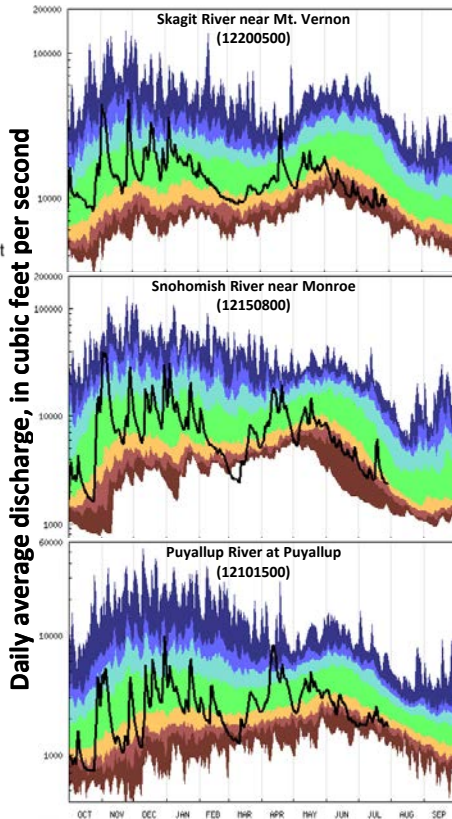
Precipitation Anomaly

from historical mean is forecasted to be up 0 to -1 inches in the Puget Sound region during the next 30 days.

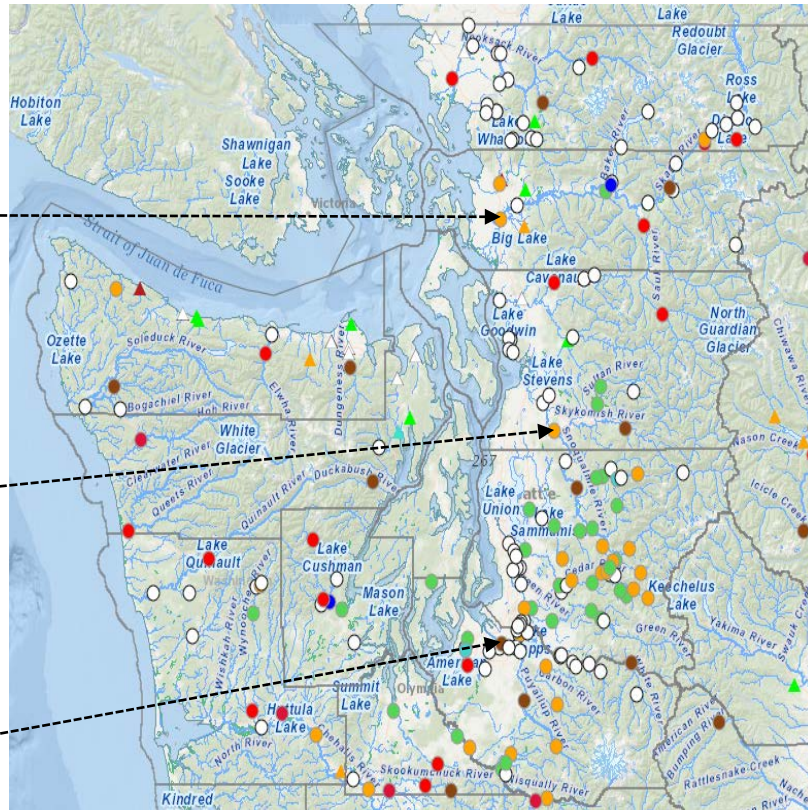
Moderate temperatures and variable precipitation conditions have resulted in below-normal freshwater inputs to Puget Sound (trend charts, left). Current flow distribution across the watershed is mixed (map, right), due to variable rates of decline after recent precipitation in mid-July. Precipitation has slowed steep declines after early snowmelt, but may not sustain flows for the remainder of the summer.

Select Puget Sound Streamflow Trends

Current Streamflow Conditions as of 7/30/2019



USGS WaterWatch: [CLICK HERE!](#)



Current conditions: [CLICK HERE!](#)

USGS Real Time Streamflow Values

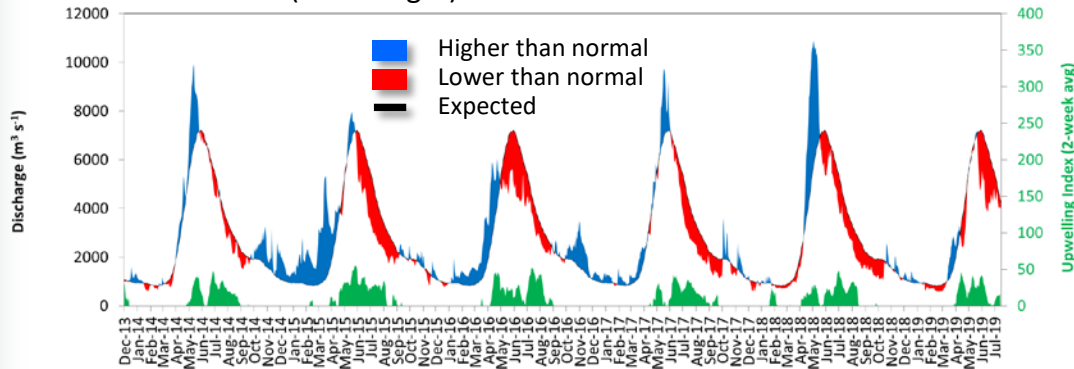
- Much above normal (>90%)
- Above normal (76-90%)
- Normal (25-75%)
- Below normal (10-24%)
- Much below normal (5-10%)
- Far below normal (>5%)
- Lowest recorded
- Not Ranked

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

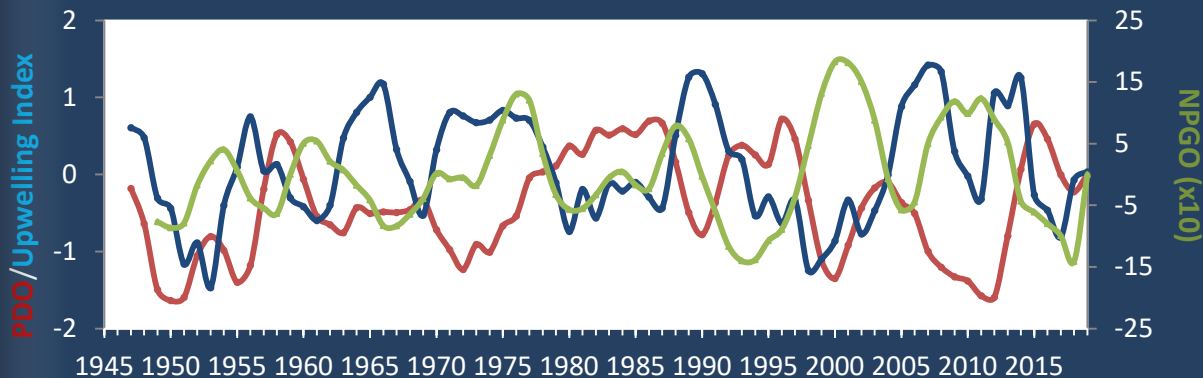
Historically, the peaks of coastal upwelling and the [freshet](#) are in sync. In 2019, the freshet is weak.

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 flows are below expected levels. Dramatic snow melt in May resulted in well below normal flows.

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) and upwelling is expected (Upwelling Index anomaly). NPGO, which reflects the surface productivity along the coast, is expected as well.

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 12](#).

Conditions leading up to August:

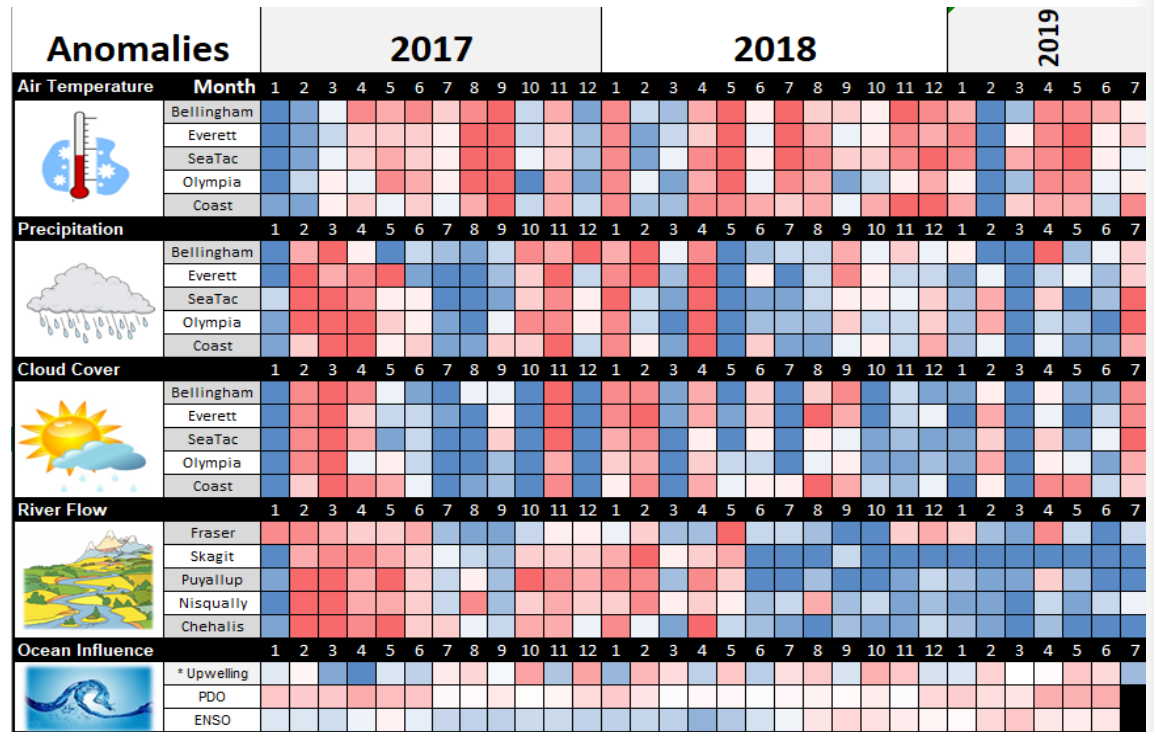
Air temperatures were again generally warmer this year, except in February and early March.

Precipitation for the past five months was lower than in 2018, but July was wet and provided a break.

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

River flows into Puget Sound have been generally low since June 2018.

Upwelling started earlier in spring both in 2018 and 2019. ENSO has showed warming.



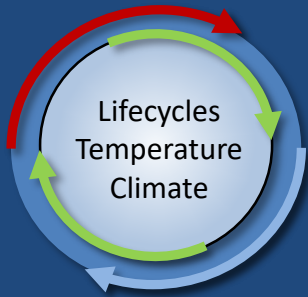
All data are from public sources: UW GRAYSKIES; river flows from USGS and Environment Canada; indices from NOAA & UW (PDO).

*Upwelling/downwelling Anomalies (PFEL)

PDO = Pacific Decadal Oscillation

ENSO = El Niño Southern Oscillation

higher
expected
lower
No data



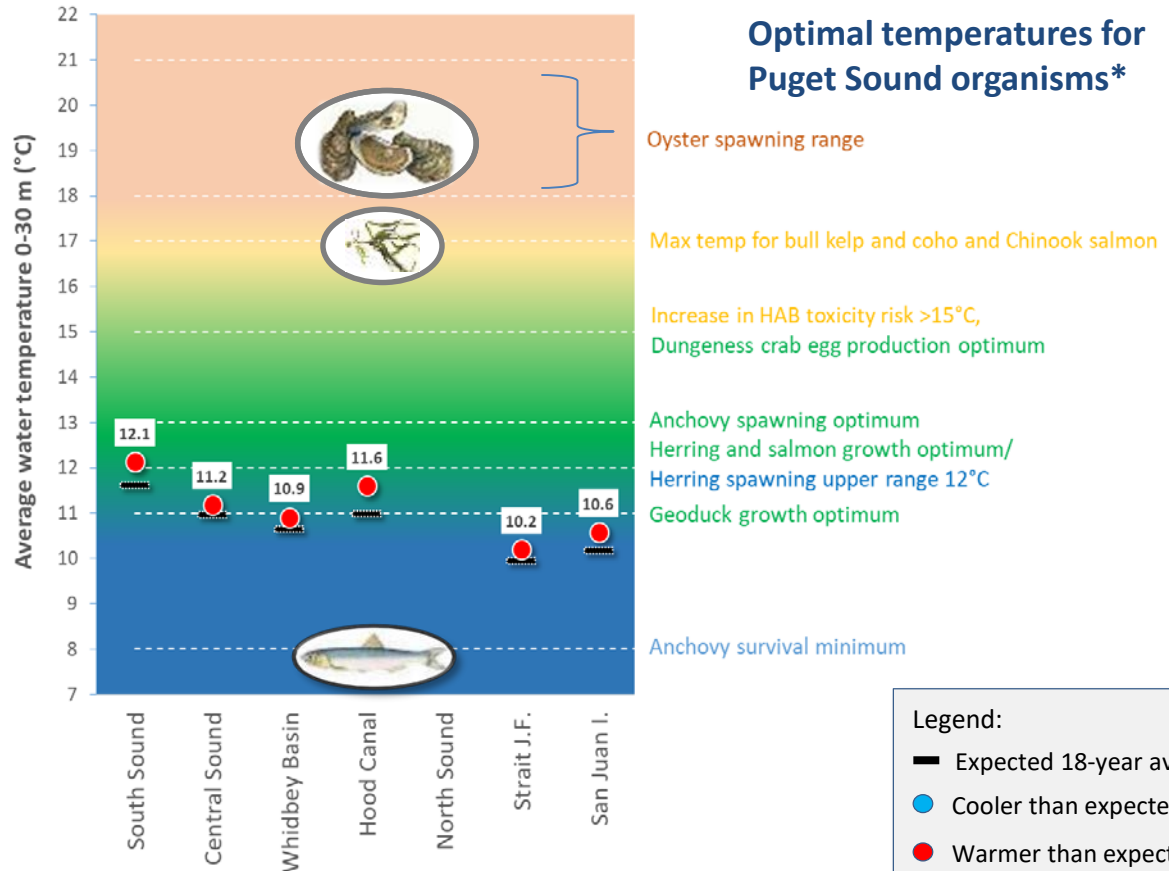
Can organisms thrive and survive?

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 June, average surface water temperatures (0 – 30 m deep) were slightly warmer than the baseline (1999 – 2016). Optimal temperatures for geoduck growth were reached inside Puget Sound and Hood Canal. South Sound surpassed water temperatures for herring to spawn but is inching toward optimum anchovy spawning temperatures.



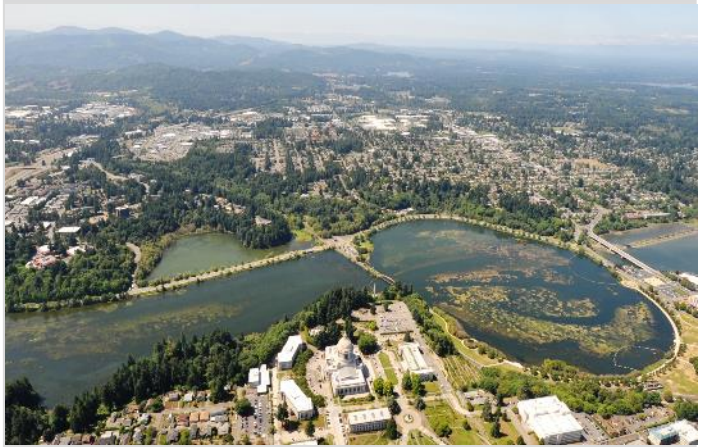
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Macroalgae on the water are very abundant in South and Central Sound. *Noctiluca* are still active in Central Sound and Case Inlet. A large coccolithophore bloom is present in Southern Hood Canal. Totten and other finger inlets in South Sound and Southern Hood Canal enjoy a huge number of fish. Jellyfish are abundant in Quartermaster Harbor.

Start here

Macroalgae in Capitol Lake, Olympia 7/29/2019



Red-brown bloom Keyport Lagoon, 6/26/2019



Mixing and fronts:

Tidal eddies near Blake Island, Liberty Bay, and Dyes Inlet. Several fronts in Nisqually Reach.



Jellyfish and fish:

Jellyfish patches in Quartermaster Harbor. Schools of fish in Totten, Eld, Budd, Case Inlets, Peale Passage and southern Hood Canal.



Suspended sediment:

Glacial flour from the Puyallup River flowing into the Tacoma Narrows.



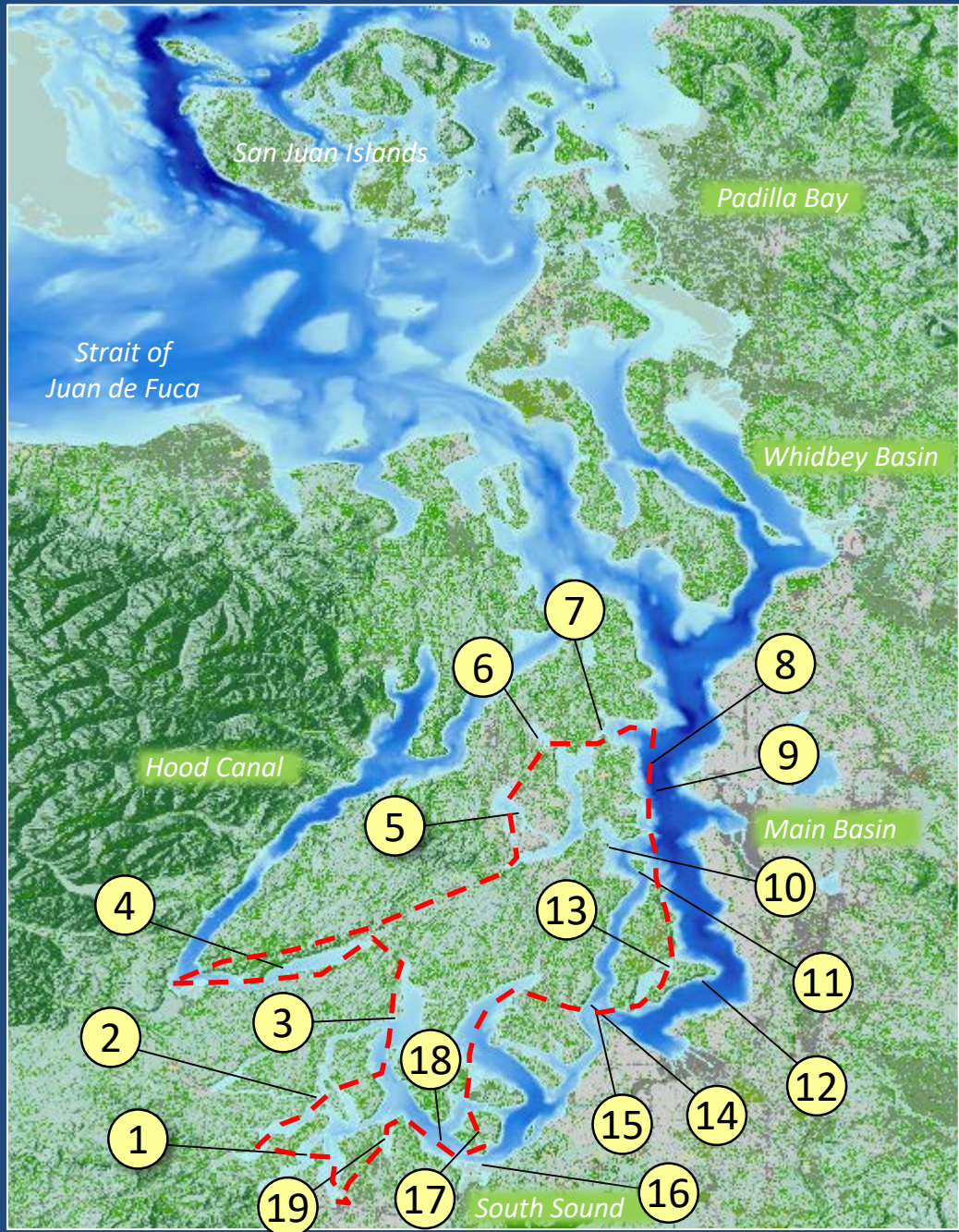
Visible blooms:

Brown-green blooms in Central Sound and Sinclair Inlet. Red-brown bloom in Totten Inlet, Henderson Inlet, Budd Inlet, and Keyport Bay. Turquoise bloom in Southern Hood Canal. Green bloom in Oro Bay.



Debris:

Orange-colored organic material of *Noctiluca* in Central Sound, Dyes Inlet, and Case Inlet. Extensive rafts of macroalgae in Central and South Sound.



Aerial navigation guide

Date: 7/29/2019

Click on numbers

Tide data from 7/29/2019 (Seattle):

Time	Pred	High/Low
2:07 AM	10.6	H
9:22 AM	-1.48	L
5:07 PM	10.62	H
10:03 PM	7.49	L

Flight Observations

Sunny and hazy

People sharing images





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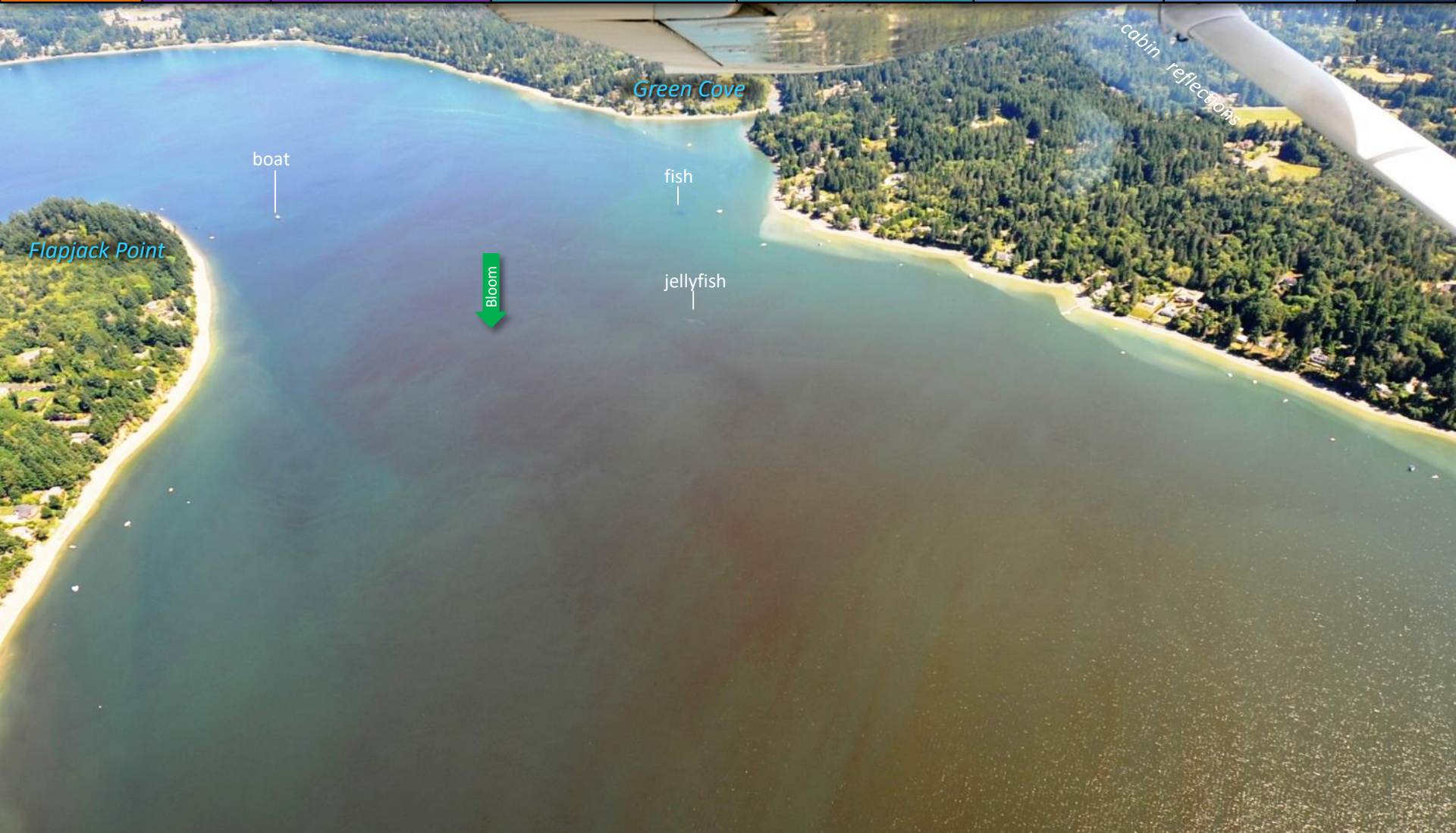
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Red-brown bloom, schooling fish, and a patch of jellyfish.

Location: Eld Inlet (South Sound), 1:49 PM



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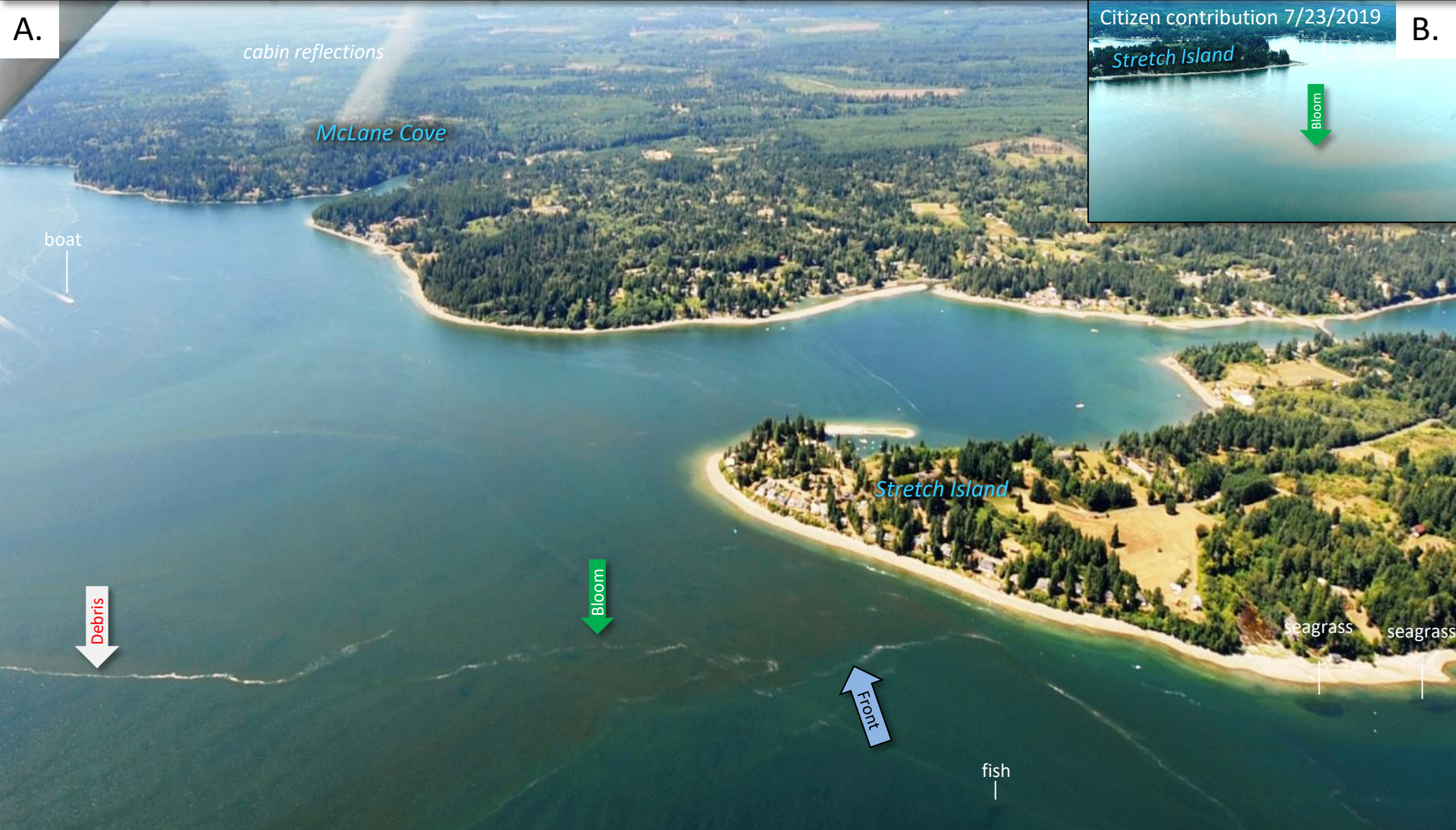
Schools of fish and bloom contrasted by incoming clear tidal water via Squaxin Passage.

Location: Hope Island (South Sound), 1:56 PM



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A.



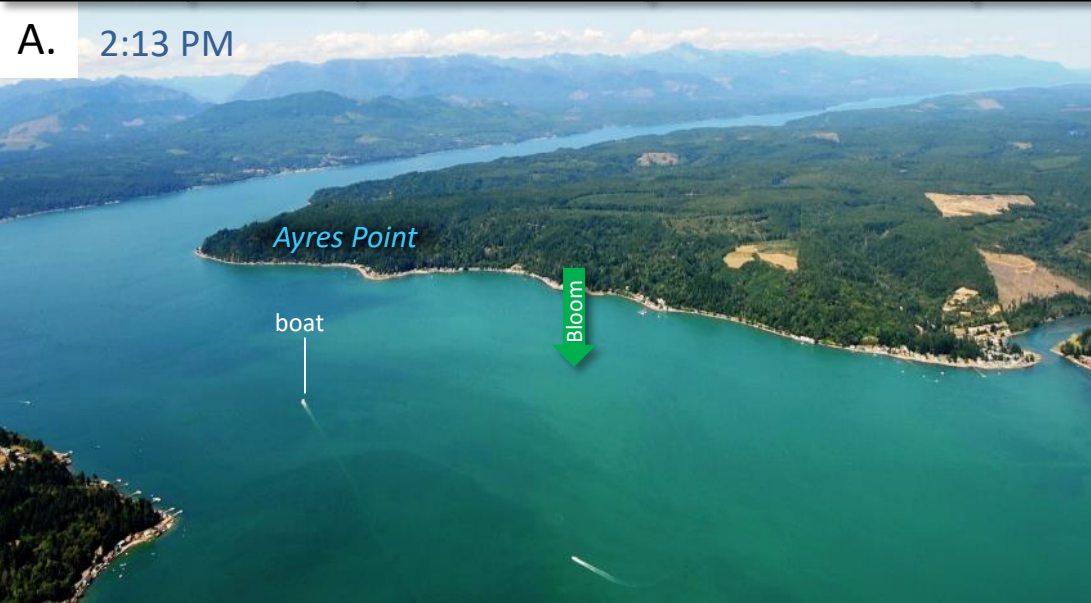
B.

A. Schools of fish, red-brown bloom at the entrance to Pickering Passage. B. Noctiluca bloom on July 23.
 Location: Pickering Passage, Case Inlet (South Sound), 2:02 PM

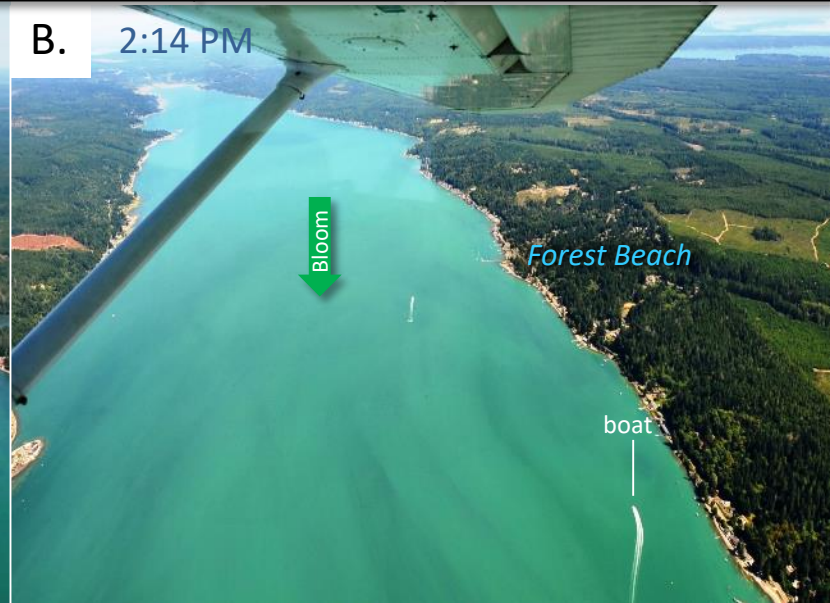


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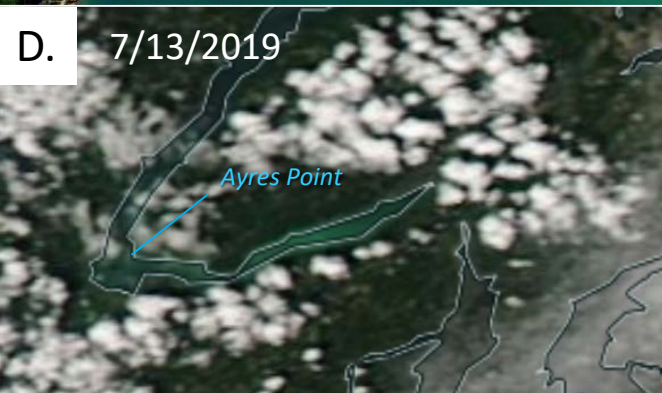
A. 2:13 PM



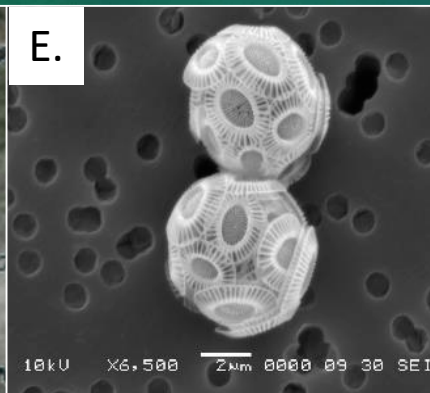
B. 2:14 PM



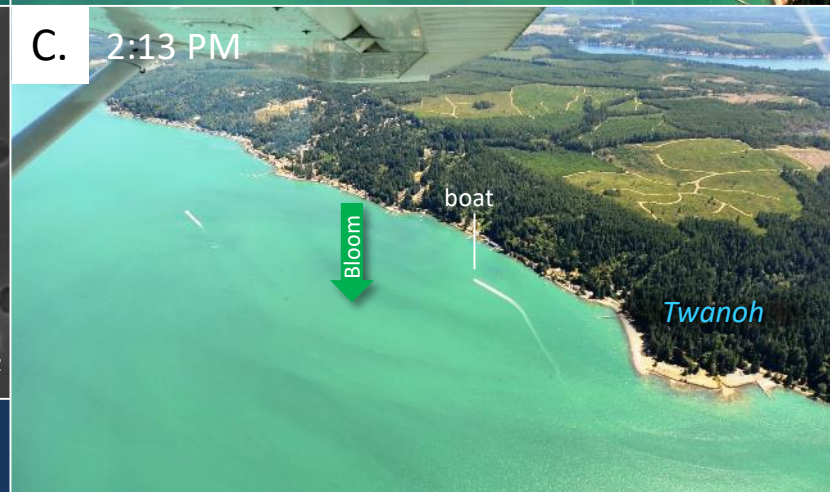
D. 7/13/2019



E.



C. 2:13 PM



D. NASA satellite image southern Hood Canal

E. Microscopic coccolithophore

*Strong coccolithophore bloom stretching from Union (A) to Lynch Cove (B). C. Twanoh State Park.
 Location: A–D. Southern Hood Canal (Hood Canal)*



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*Noctiluca and tidal eddies bringing in algal bloom from Sinclair Inlet and mixing into water of Dyes Inlet.
Location: Dyes Inlet (Central Sound), 2:30 PM*



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Large tidal eddy with bloom in Liberty Bay.
Location: Liberty Bay (Central Sound), 2:34 PM



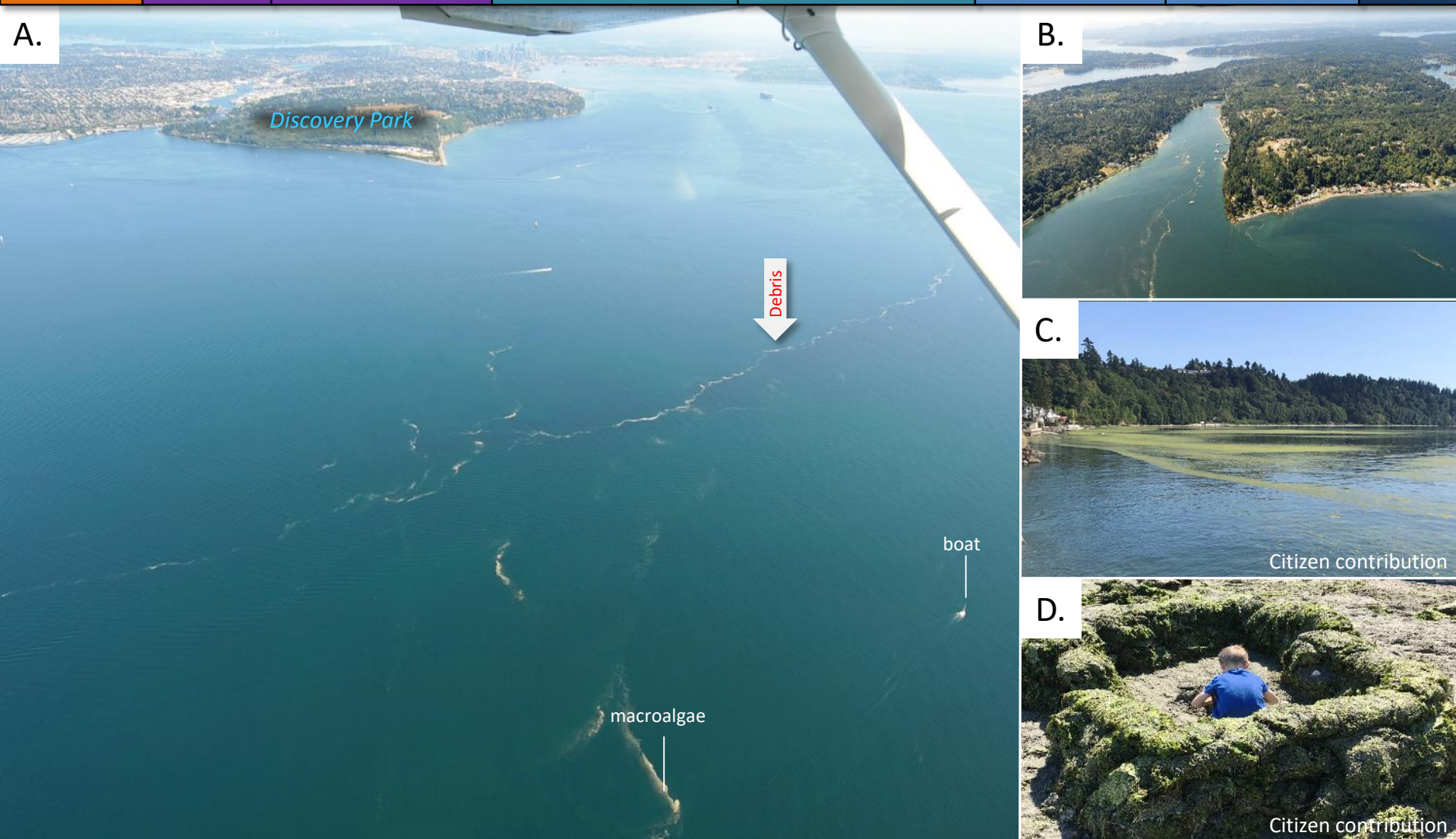
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Large rafts of macroalgae stretching along Suquamish shoreline into the bay.
Location: Port Madison (Central Sound), 2:36 PM



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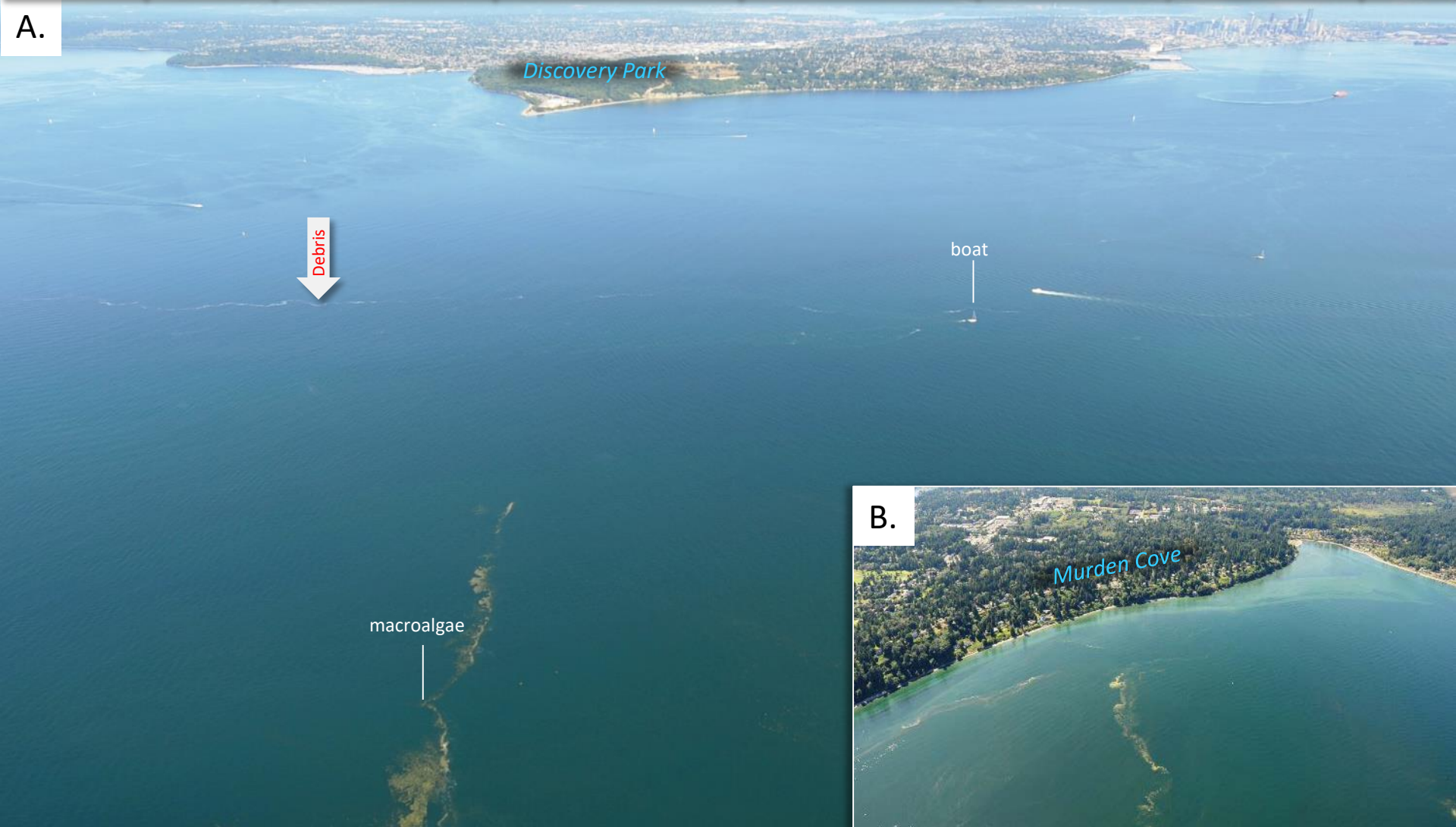
A. & B. Large rafts of macroalgae. C. Macroalgae washing onto beaches. D. Beachgoers touching macroalgae.

Location: A. Across Discovery Park, B. Blakely Harbor, C. Burien, D. Dash Point (Central Sound), 2:39 PM



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A.



B.



A. Large rafts of macroalgae. B. Macroalgae stretching across Central Basin to Murden Cove.
 Location: A. Across Discovery Park, Seattle, B. Murden Cove, Bainbridge Island (Central Sound), 2:40 PM



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Large rafts of macroalgae stretching along the shores of Manchester.

Location: Manchester (Central Sound), 2:41 PM

A.



B.

Water lined with macroalgae and stained by bloom circulating in large eddy.
 Location: Blake Island A. looking North B. looking East (Central Sound), 2:46 PM



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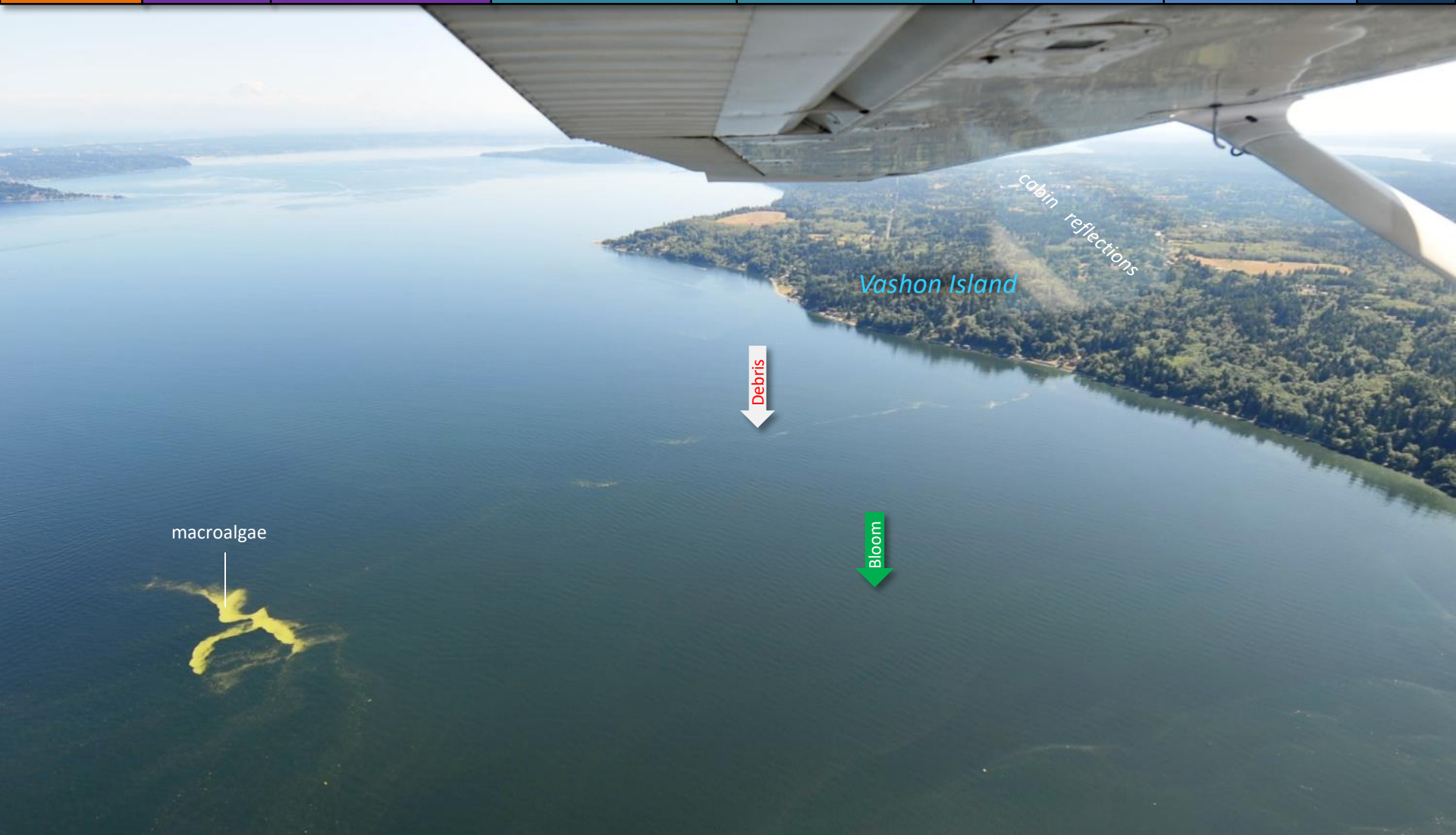
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Multiple large rafts of macroalgae stretching along the shores of Vashon Island.

Location: Vashon Island (Central Sound), 2:48 PM

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A. Large aggregations of moon jellies in several locations of the inner bay. B. Citizen contribution.
 Location: Quartermaster Harbor (Central Sound), 2:53 PM



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*Puyallup River plume lined by macroalgae flowing into the Tacoma Narrows during incoming tide.
Location: Vashon Island (Central Sound), 2:57 PM*



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Puyallup River plume flowing into the Tacoma Narrows during incoming tide.

Location: Vashon Island (Central Sound), 2:57 PM



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Nisqually River delta and Mount Rainier. A place worth protecting for generations to come.

Location: Nisqually Reach (South Sound), 3:10 PM



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Bloom in Oro Bay.

Location: Anderson Island (South Sound), 3:09 PM



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Macroalgae accumulating along tidal front.
Location: Nisqually Reach (South Sound), 3:10 PM

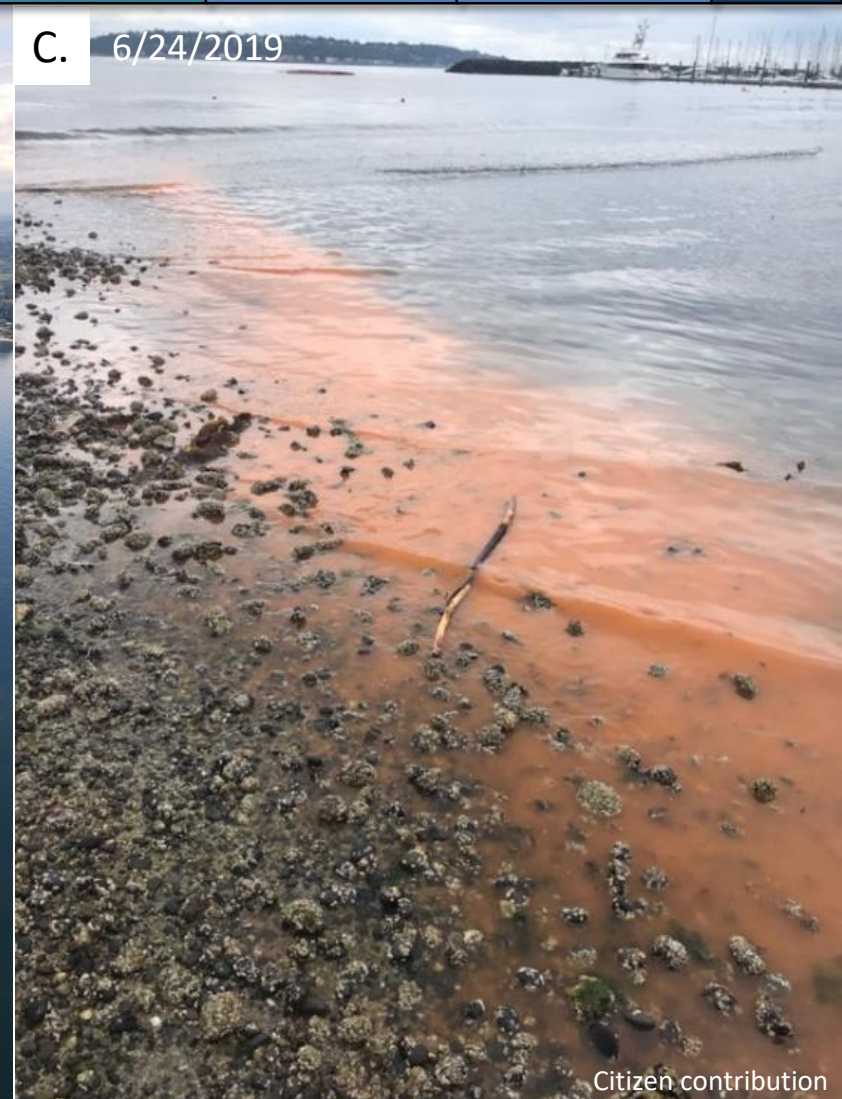
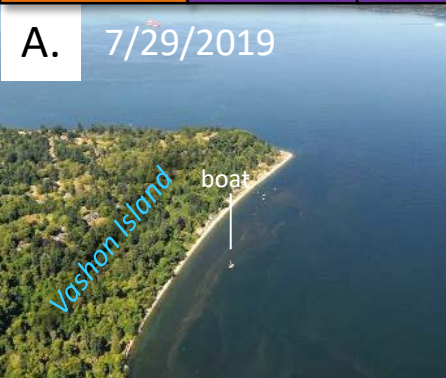


Red-brown bloom and green bloom.

Location: Henderson Inlet (South Sound), 3:14 PM



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Noctiluca in various places documented by engaged citizens.

Location: A. Vashon Island, B. Commencement Bay, C. Smith Cove, Elliot Bay (Central Sound).

Find past editions of EOPS on the next pages



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We have published 82 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), Jorgensen Air

Contact:

Dr. Christopher Krembs
Christopher.Krembs@ecy.wa.gov
Marine Monitoring Unit
Environmental Assessment Program
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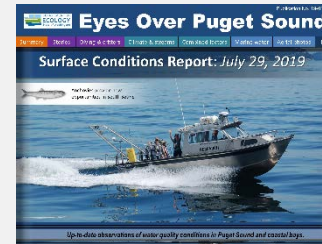
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[Publication No. 19-03-076](#)



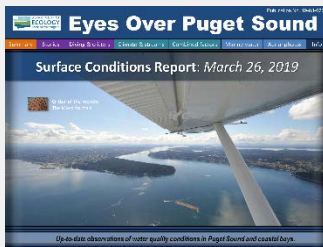
[September_12_2019,](#)
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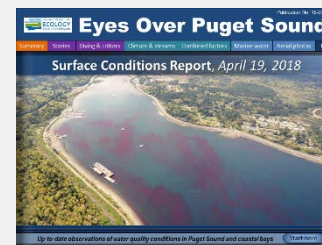
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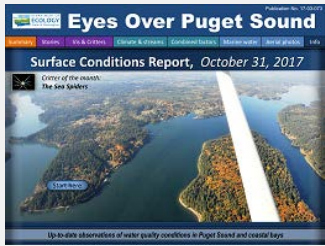
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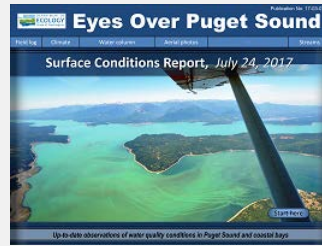
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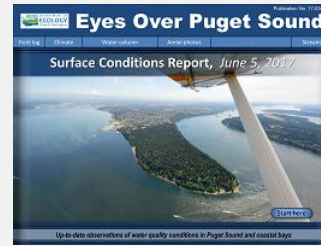
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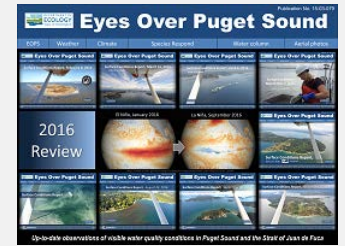
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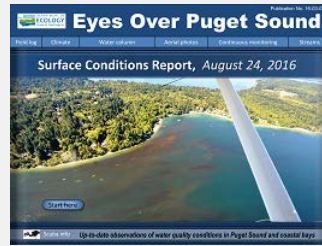
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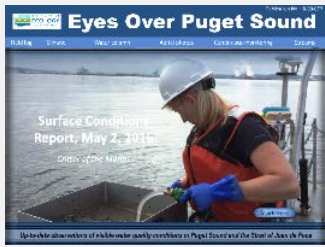
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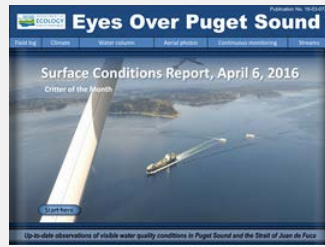
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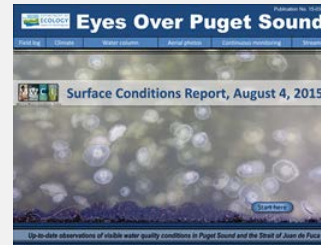
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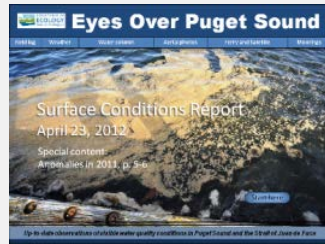
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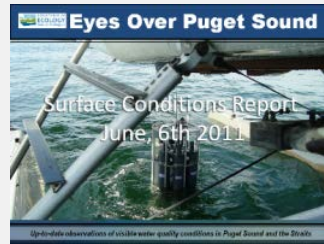
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