Publication No. 18-03-070

DEPARTMENT OF ECOLOGY State of Washington

Eyes Over Puget Sound

Surface Conditions Report, *winter 2018*

Critter of the month:
The Peanut Worm

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

Start here

LONG-TERM MARINE MONITORING UNIT

Mya Keyzers
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Skip Albertson

Tyler Burks
Jim Shedd

Suzan Pool
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Dr. Christopher Krembs (Editor)

Personal stories

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Sometimes thoughts run deep…

Climate & Streams

p. 5

Regional impacts of large-scale climate patterns are currently normalizing and so are local weather patterns. Stream conditions are also largely normal.

La Niña helped build a favorable snowpack that persists due to cooler weather. Predicted ENSO neutral and cooler conditions should provide a steady supply of cool fresh water to Puget Sound.

Marine waters

p. 9

Strait of Juan de Fuca data now included! Puget Sound was much fresher than normal for most of 2017. Temperature is finally normalizing.

Aerial photography

p. 11

Strong bloom conditions in Central Sound, northern Hood Canal (reported), and Whidbey Basin. Herring appear to be still spawning in Admiralty Reach and further north. Salmon Bay, Seattle, continues to have frequent oil sheens on the water.

Editorial assistance provided by: Allison Brownlee, Suzan Pool, Dany, Burgess, Carol Maloy

Our crew looking for answers…

Critter of the Month – The Peanut Worm

Dany Burgess & Angela Eagleston
Marine Sediment Monitoring Team

Phylum Sipuncula

We're just nuts about this amazing group of critters! Despite their simple appearance, Peanut Worms have an important role to play in the Puget Sound food web.

Fun Peanut Worm Facts

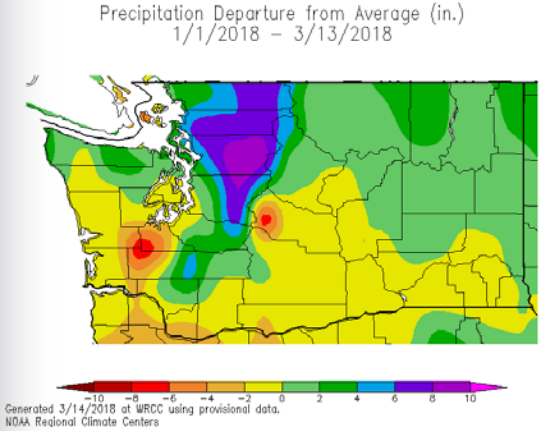
- Not currently considered true marine worms…or ARE they??
- Can retract their head end, or introvert, when disturbed.
- "Sea Worm Jelly" is considered a delicacy in parts of the world.

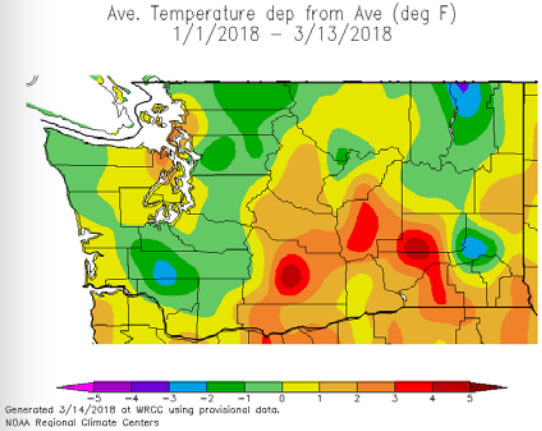
Learn more about the Peanut Worms and other critters on Ecology's EcoConnect blog here

How much water flows into coastal marine waters?

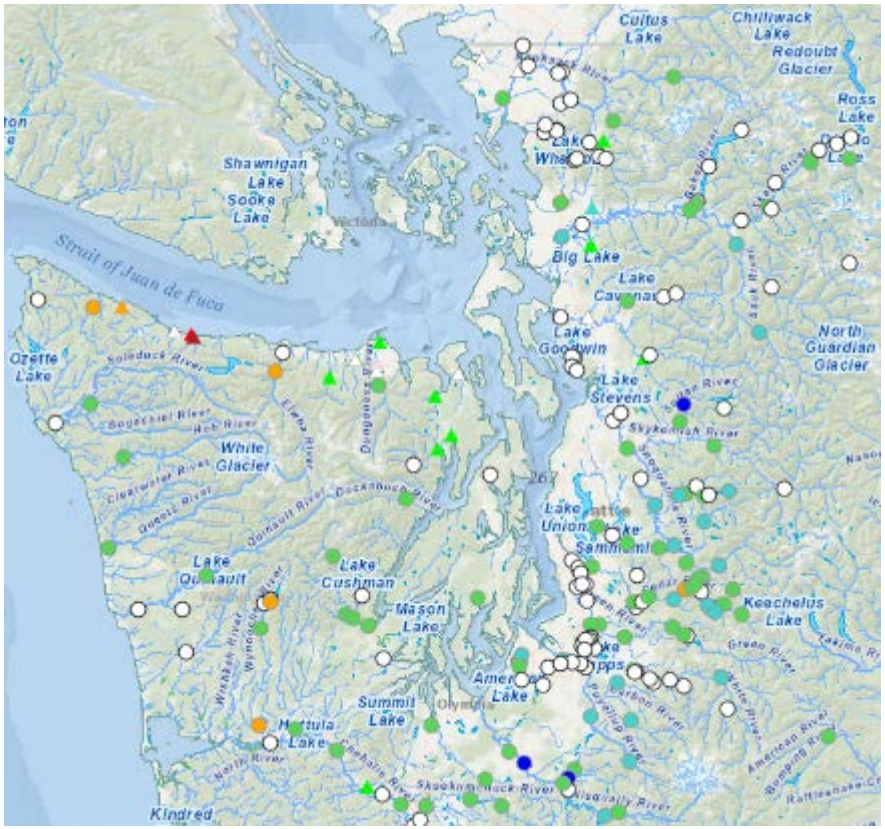
Tyler Burks, Jim Shedd

At the end of 2017, weather and stream flows scattered around normal. La Niña conditions did not take shape until mid-January 2018, with above normal precipitation in north Puget Sound and the Cascades (maps, left). Further south, lower precipitation and higher temperatures left streamflow largely unaffected. La Niña helped build a favorable snowpack. Predicted neutral and cooler ENSO conditions should provide a steady supply of cool fresh water to Puget Sound.





Current Streamflow Conditions as of 3/14/2018



USGS Real Time Streamflow Values

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

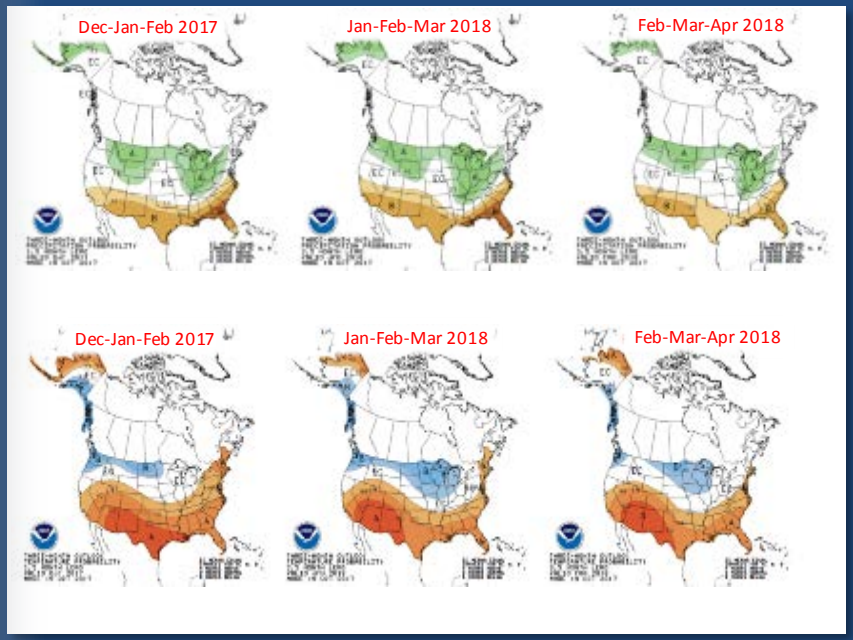
Ecology Daily Streamflow

Daily Streamflow

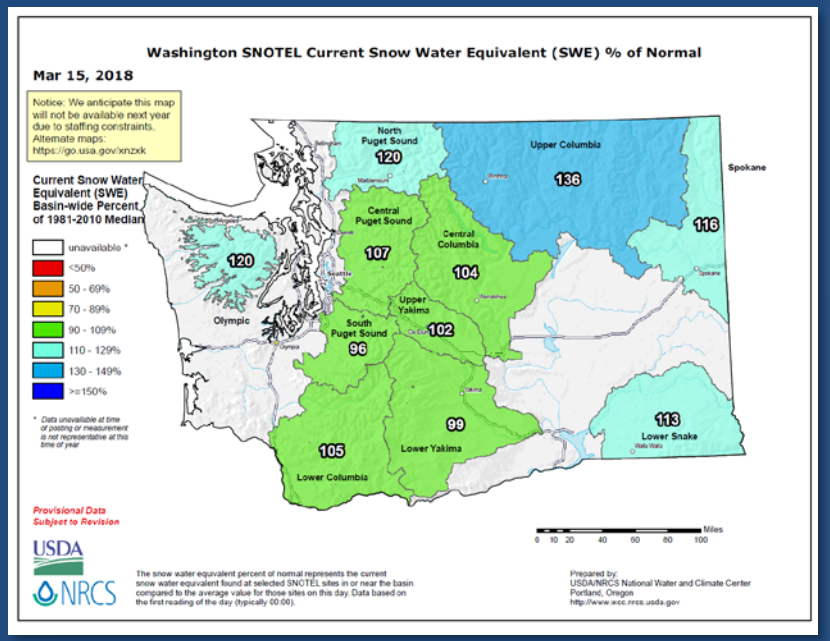
- Highest recorded
- Much above normal (>90%)
- Above normal (76-90%)
- Normal (25-75%)
- Below normal (10-24%)
- Much below normal (<10%)
- Lowest recorded
- Not ranked

How much water flows into coastal marine waters?

Climatologists predict wetter and cooler conditions this spring due to an expected La Niña followed by ENSO neutral conditions in early summer. Does this mean a good supply of cool water will be flowing to Puget Sound this spring?



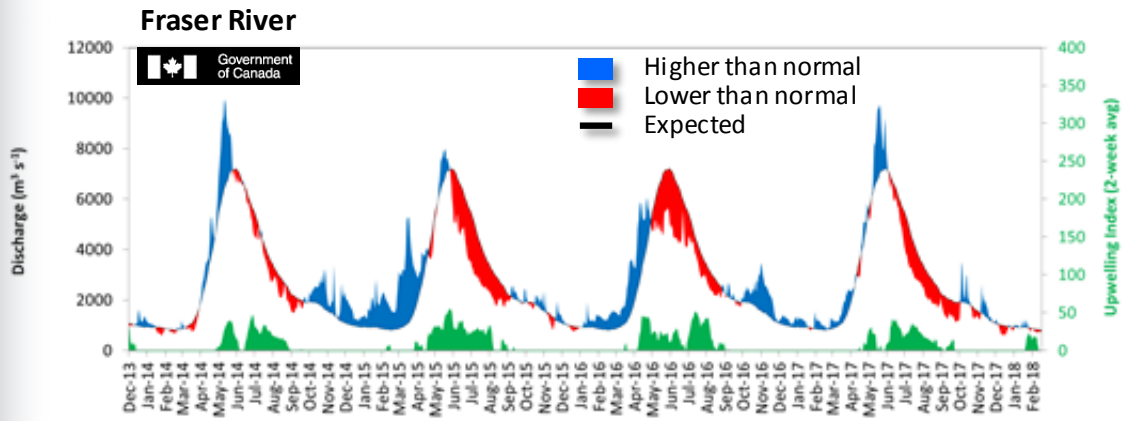
The map on the top shows higher than usual probability of above normal precipitation. The map on the bottom shows a higher chance of cooler temperatures. Click here



Snow water equivalence (SWE) in the mountains is good, near 100%.

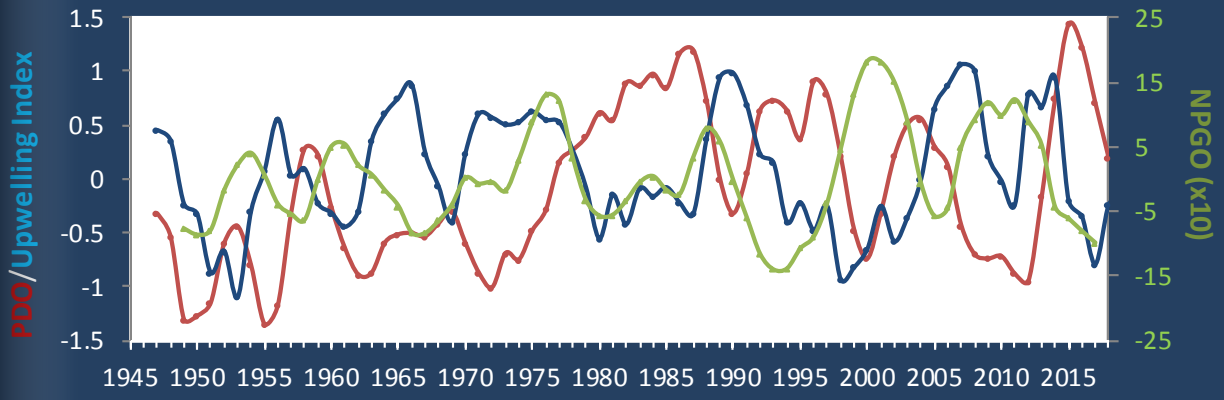
Climate influences: How well is Puget Sound exchanging its water?

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



The Fraser River is the major driver of estuarine circulation and water exchange with the ocean.
Fraser River flows were higher than normal in May 2017 and similar to 2014. Then flows got weaker until October. Current flows are at expected levels.

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



How do ocean boundary conditions affect the quality of water we exchange with the ocean?
Past years' warm water is gone (PDO), upwelling of low oxygen and high nutrient ocean water is low (Upwelling Index anomaly), and surface productivity along the coast is low (NPGO).

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

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

Summary:

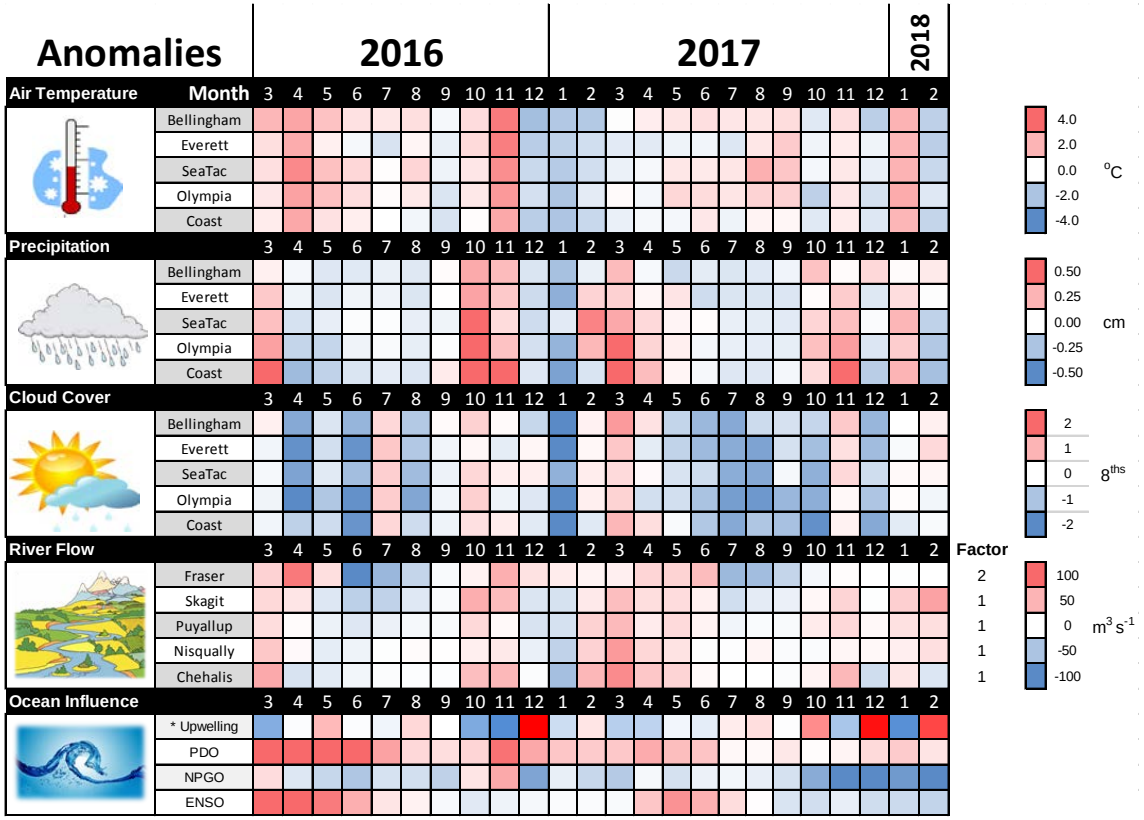
Air temperatures were cooler in February after a warmer January.

Precipitation throughout fall and winter was mostly higher. In February, South Sound stayed drier.

Sunshine levels were relatively expected.

River flows were higher, particularly for the Skagit River.

We had unexpected upwelling events this winter. Ocean conditions are normalizing with only the NPGO index being low.



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

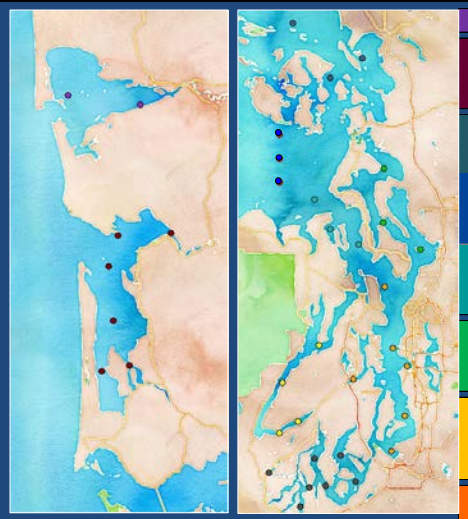
higher — expected — lower

No data

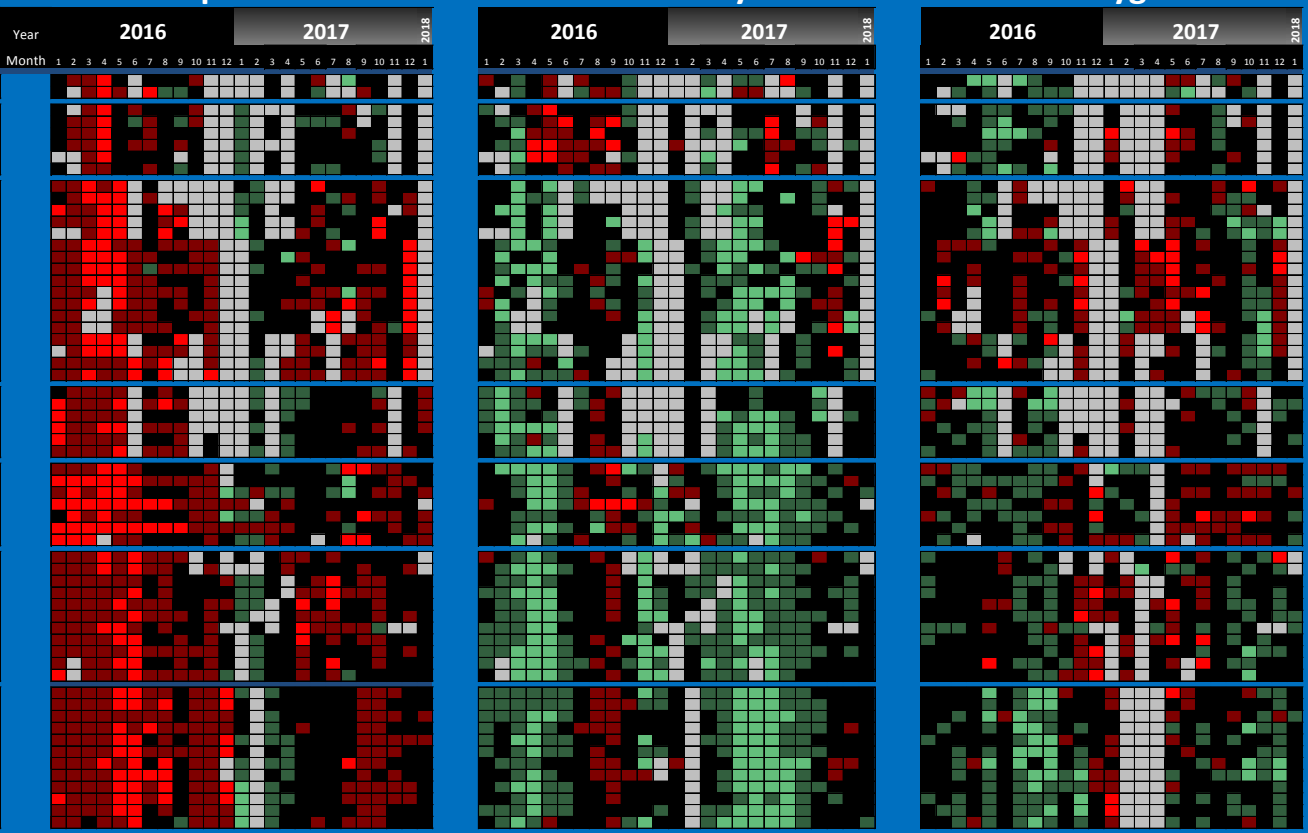
How did water quality respond to recent conditions?

As of Jan 2018, temperatures are normal in Central and South Sound. **Low salinity that persisted through most of 2017 has normalized.** Higher dissolved oxygen values persisted in Hood Canal during summer 2017 while dissolved oxygen was somewhat lower in Central and South Sound. Strait of Juan de Fuca data now included!

Anomalies:



Ecology's long-term monitoring stations are sampled monthly. Color code matches regions for the anomaly plots displayed on the right.



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

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

What are conditions at the surface?

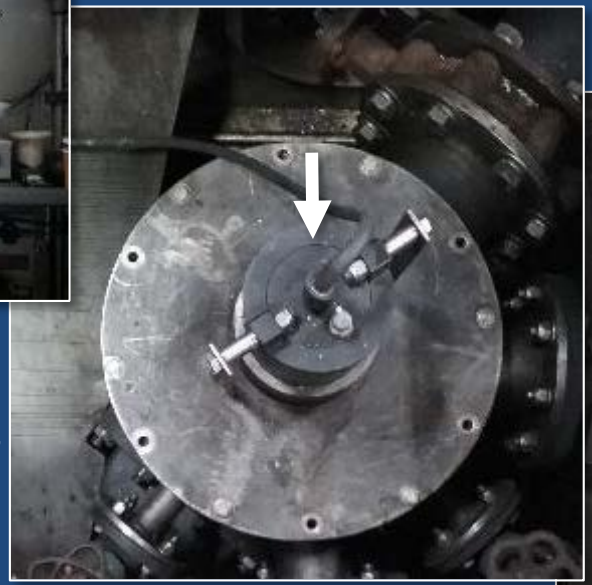
***Victoria Clipper IV* ferry:** A wonderful, collaborative opportunity for cost-effective measurements of surface water properties between Seattle and Victoria, BC twice daily. Unfortunately, the project is coming to an end. This spring, the *Victoria Clipper IV* will be replaced with a larger ferry vessel. Last week, we took the equipment off the ship. Suzan Pool will present temperature data (~22 million records) from the project which covers May 2010 to Nov 2017 at the Salish Sea Ecosystem Conference in April.

Brandon Sackmann's ingenious practical design. *Thank you Brandon*

CLIPPER VACATIONS

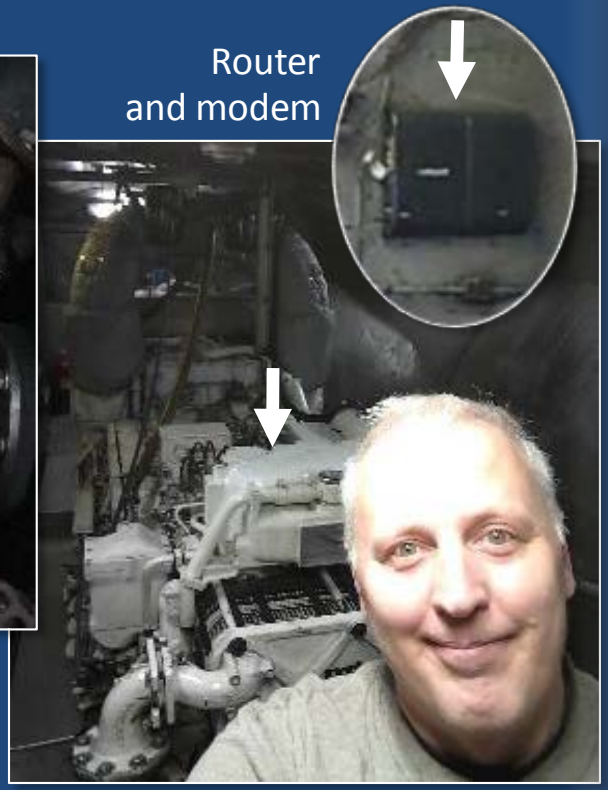
Collaboration with Clipper Vacations came with their tremendous support. *Thank you, Clipper Vacations*

Electronic boxes housing the controllers, data storage, and power backup.



Sensor package mounted into the sea chest (above) of the large engine (right).

Router and modem



Christopher Krembs in engine room

What are conditions at the surface?

Strong spring bloom conditions present in Central Sound, northern Hood Canal (reported), and Whidbey Basin in March. Herring appear to be still spawning in Admiralty Reach and further north. During the winter, suspended sediment is visible nearshore in many places. Salmon Bay, Seattle, continues to have frequent oil sheens on the water.

Start here

Art: Twin Spits and a sea-snake! (Kitsap Peninsula)

Art: Lynch Cove (Hood Canal)

Art: Skokomish estuary (Hood Canal)

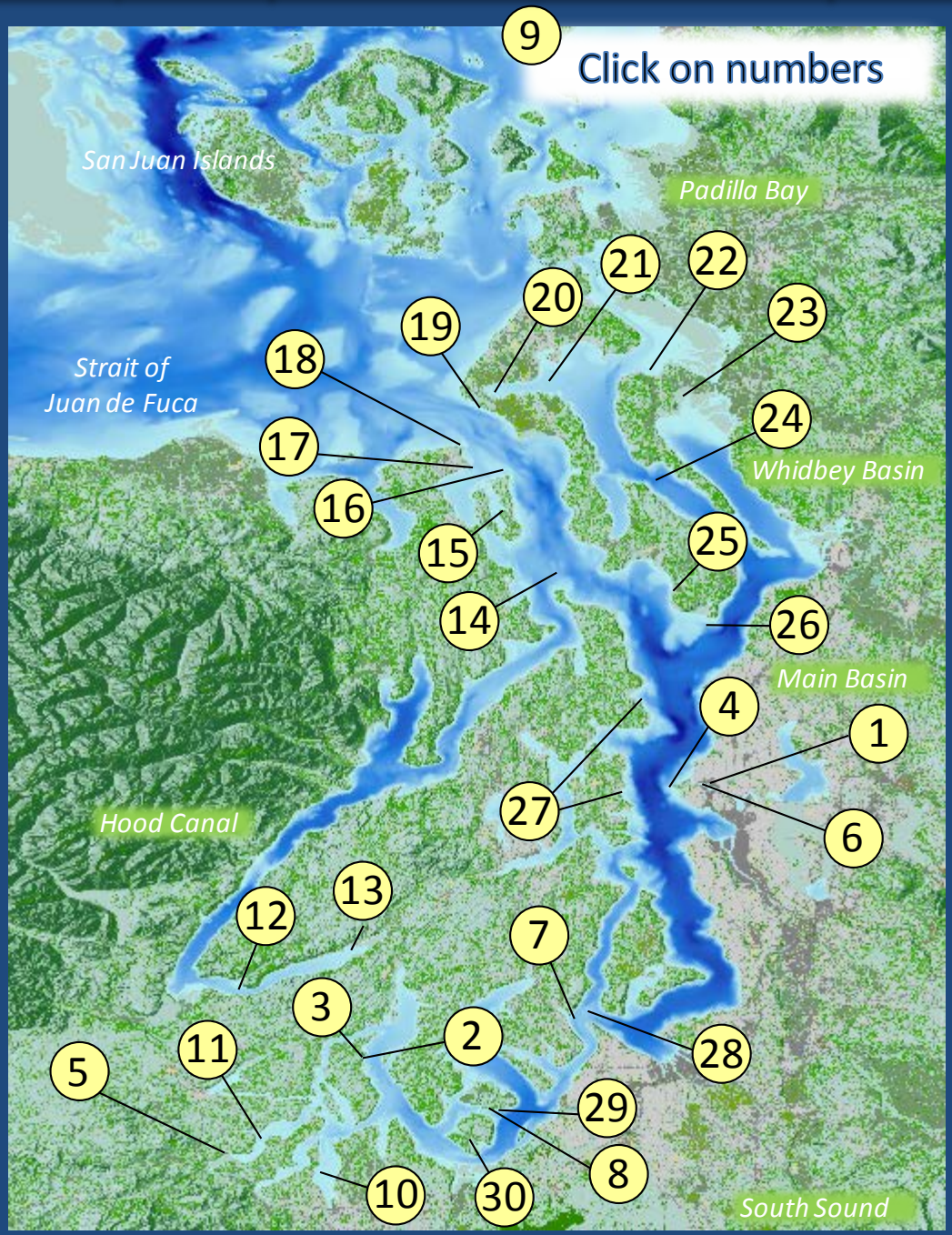
Mixing and Fronts:
Rip currents near Harstine Island in winter. Large tidal fronts separating Hood Canal and Admiralty Inlet waters on March 16.

Jellyfish:
Occasional jellyfish patches in Budd, Eld, and Sinclair Inlets during winter.

Suspended sediment:
Near-shore suspended sediment in many places in winter. Likely herring spawning along Admiralty Reach and Birch Bay (north) in March. Boggy water visibly discharging in some places.

Visible blooms in March:
Gold-brown: Strong blooms in Central Sound and Whidbey Basin. Otherwise low activity in South Sound and southern Hood Canal (a reported bloom in northern Hood Canal).

Debris in March:
Woody debris in Port Susan (Triangle Cove).
Orange-colored organic surface debris in southern Hood Canal and South Sound, extending north past the Tacoma Narrows.



Aerial photography and navigation guide

Date: 3-16-2018

Tide data from March 16 (Seattle):

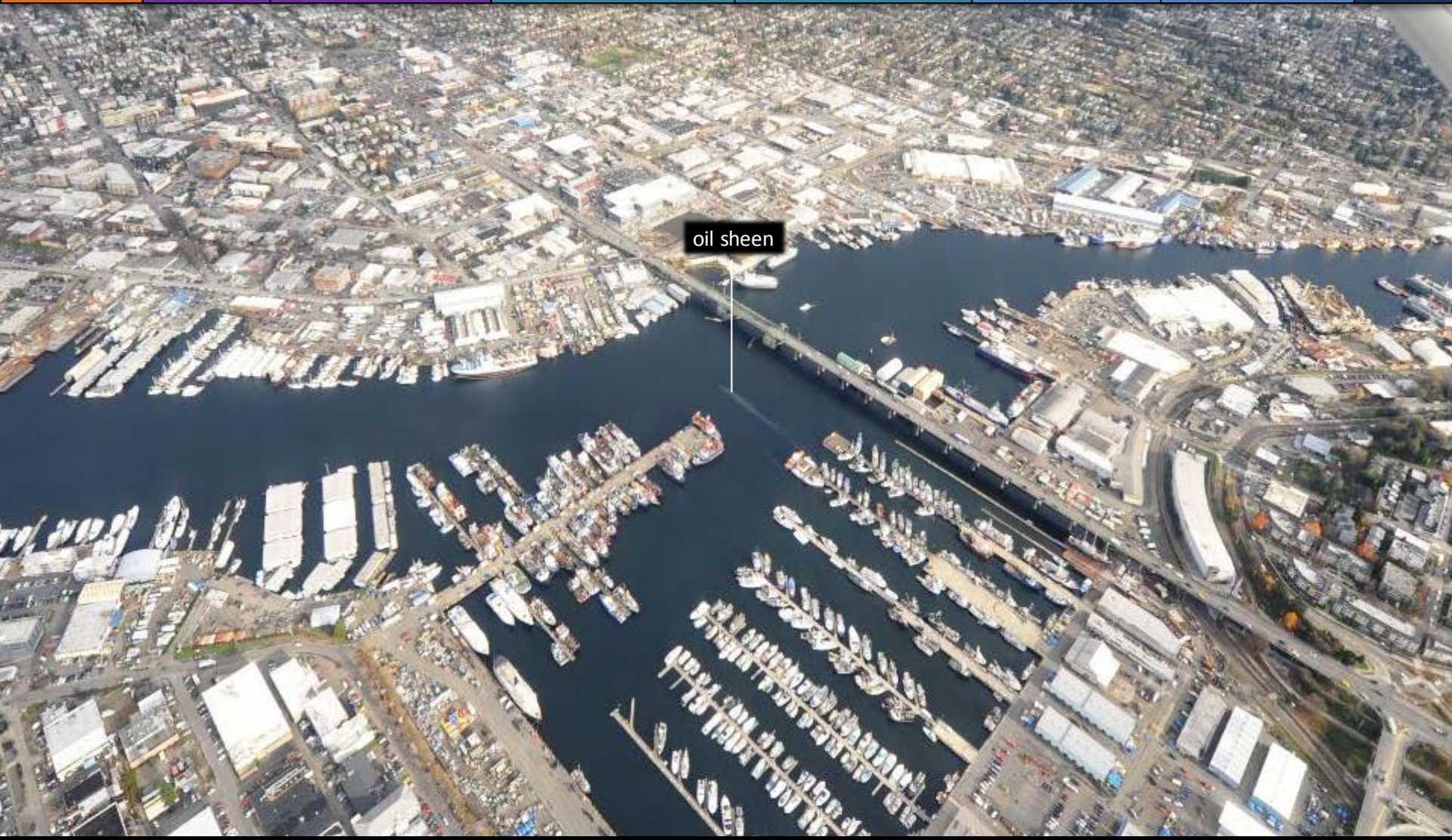
	Height (ft)	High/Low
05:40 AM	11.22	H
11:37 AM	4.35	L
5:10 PM	10.05	H
11:28 PM	0.89	L

Flight Information:

Sunny in March, windy in winter.

– – · Multiple Flight routes (n.a.)

Aerial photography 12-1-2017



Repeated oil sheen on water near Seattle Fire Station, Dock 3.
Location: Salmon Bay, Seattle (Central Sound), 12:38 PM.

Suspended sediment and rip current along shoreline of Harstine Island.
Location: Across Jarrell Cove, Harstine Island, Case Inlet (South Sound), 12:17 PM.

Suspended sediment and rip current along shoreline of Harstine Island.
Location: Harstine Island, Case Inlet (South Sound), 12:18 PM.

Aerial photography 12-1-2017

Suspended sediment at West Point on a day with strong wind and waves.

Location: West Point, Seattle (Central Sound), 12:37 PM.

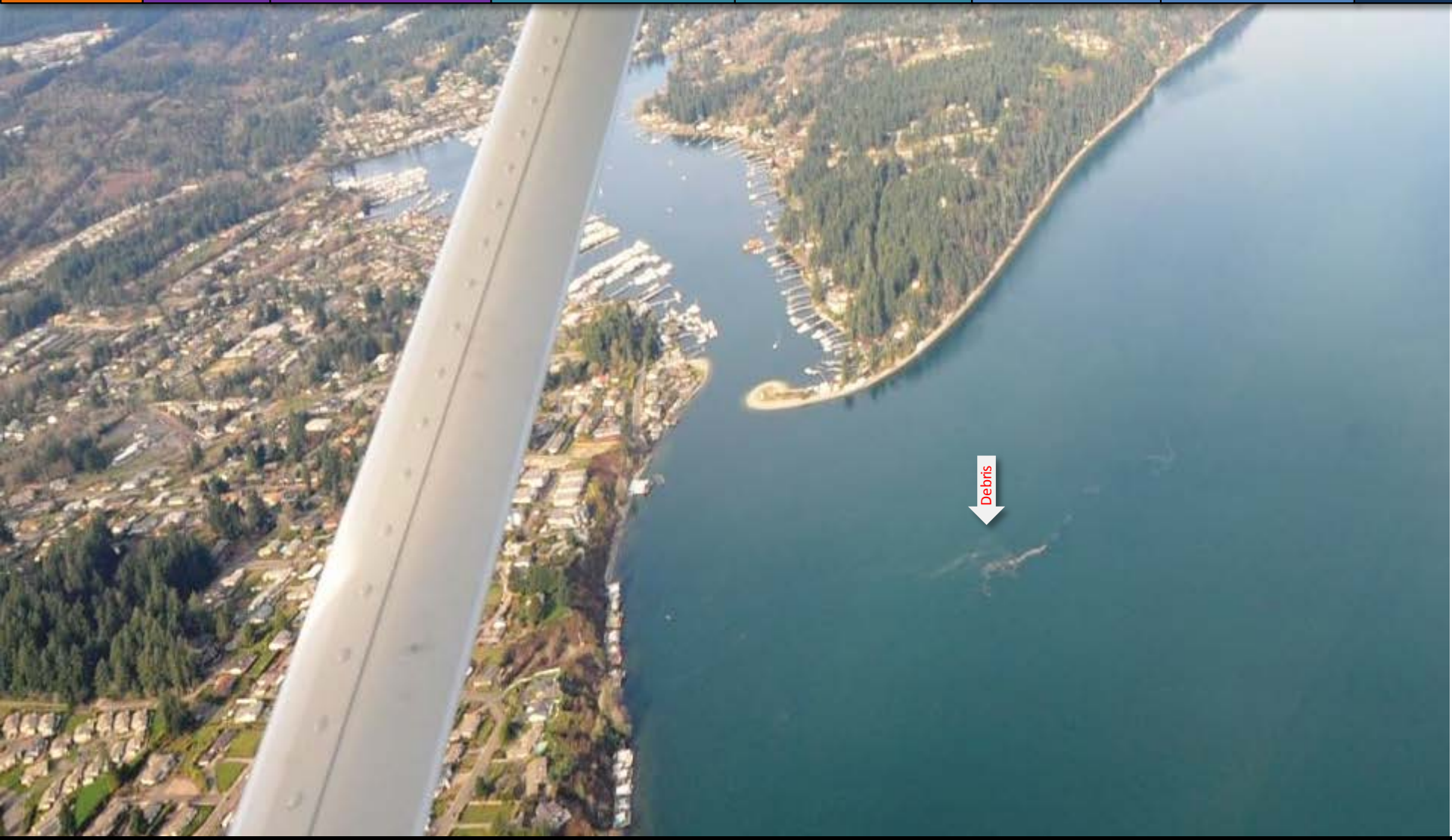
Aerial photography 2-13-2018

Sizable area of suspended sediment off Slocum Ridge.

Location: Totten Inlet (South Sound), 1:42 PM.

Repeated oil sheen on water near Seattle Fire Station, Dock 3.
Location: Salmon Bay, Seattle (Central Sound), 2:25 PM.

Aerial photography 2-13-2018



Organic surface debris patch about 500 feet long in a reddish color.

Location: Gig Harbor (Central Sound), 2:42 PM.

Beautiful spring view of South Puget Sound.

Location: McNeil Island (South Sound), 2:48 PM.

Aerial photograph, by pilot Mike MacKay. For more information e-mail: starsailor@fidalgo.net

Herring spawning. Note: Milky white water does not touch shore, whereas suspended sediment would.

Location: Birch Bay (Georgia Basin), 12:30 PM.

Jellyfish patch

Location: Budd Inlet (South Sound), 12:55 PM.

Aerial photography 3-16-2018

Sediment plume fanning out. Organic surface debris.

Location: Totten Inlet (South Sound), 1:03 PM.

Organic material accumulating at surface.

Location: Across Tahuya River (Hood Canal), 1:13 PM.

Schooling fish in the shallows?

Location: Lynch Cove (Hood Canal), 1:19 PM.

Aerial photography 3-16-2018

Surface blooms originating from Central Sound and Hood Canal meet in Admiralty Inlet.

Location: North of Twin Spit (North Sound), 1:41 PM.

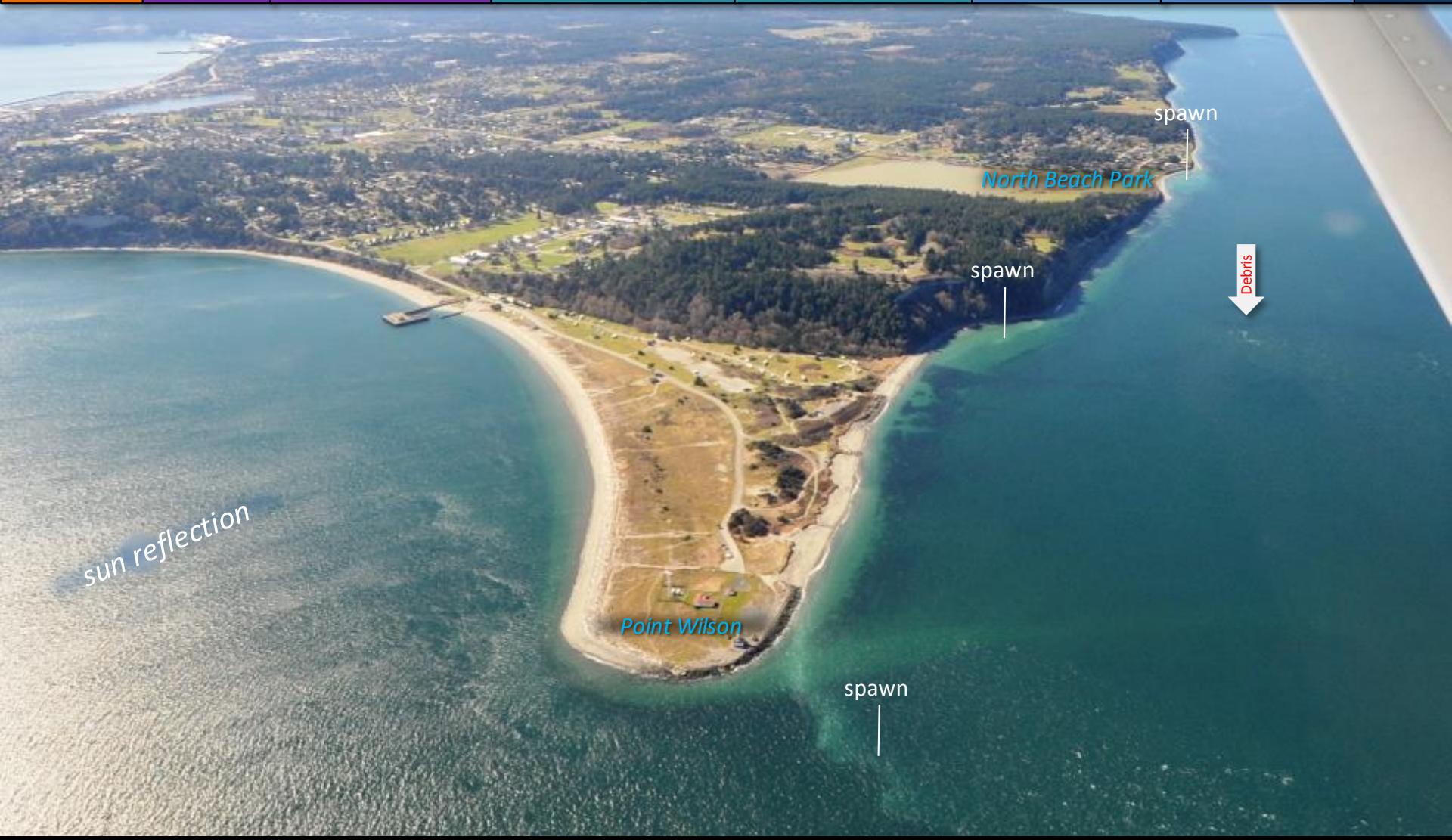
Moderate spring bloom activity inside Kilisut Harbor.

Location: Kilisut Harbor, Marrowstone Island (North Sound), 1:46 PM.

Water from Port Townsend Bay flowing past Marrowstone Point.
Location: Marrowstone Island (North Sound), 1:48 PM.

Water with spring bloom next to sediment rich water from Admiralty Inlet

Location: Port Townsend Bay (North Sound), 1:48 PM.



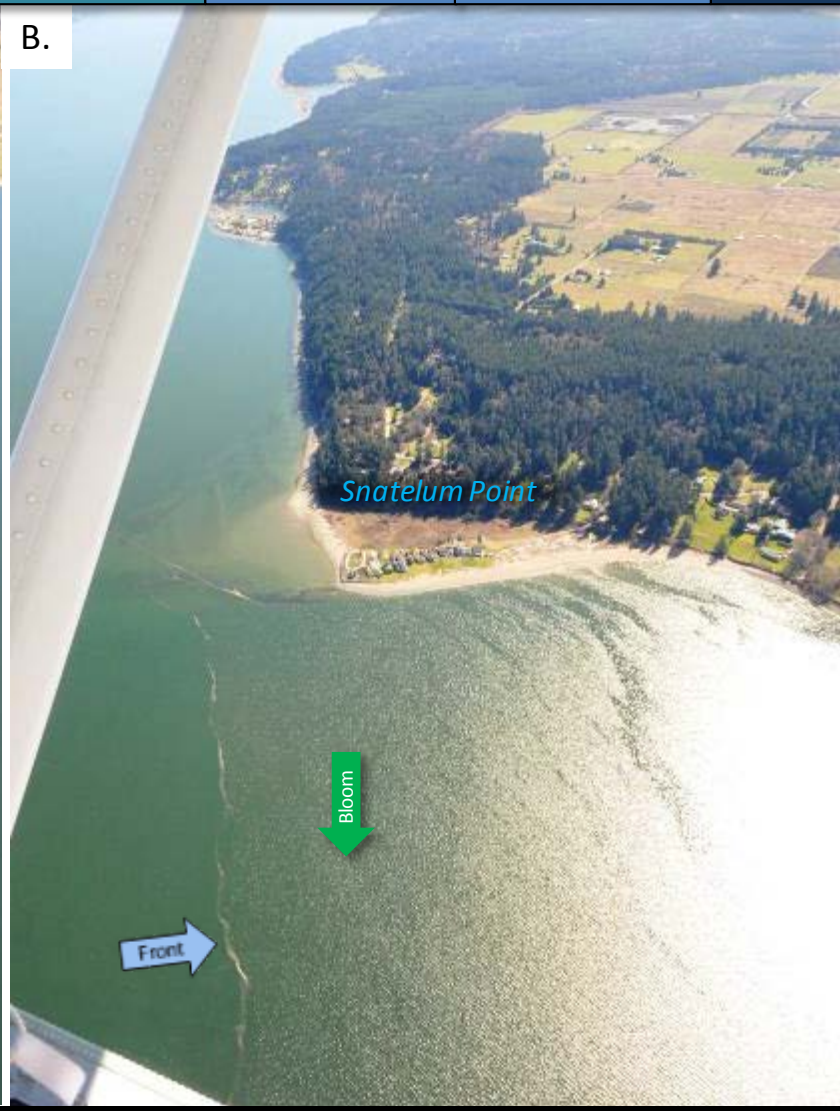
White cloudy water stretching from North Beach Park past Point Wilson. Spawning herring?

Location: Point Wilson, Admiralty Inlet (North Sound), 1:50 PM.

Aerial photography 3-16-2018

White cloudy water stretching from Point Partridge past Perego's Lagoon. Spawning herring?

Location: Admiralty Reach (North Sound), 1:52 PM.



A. Aquaculture rafts affecting algae. B. Tidal front accumulating organic material

Location: Penn Cove (Whidbey Basin), 1:53 PM.

Aerial photography 3-16-2018

Bloom originating in Penn Cove and organic surface debris accumulating at front

Location: Whidbey Basin (North Sound), 1:57 PM.

Red-brown bloom and front

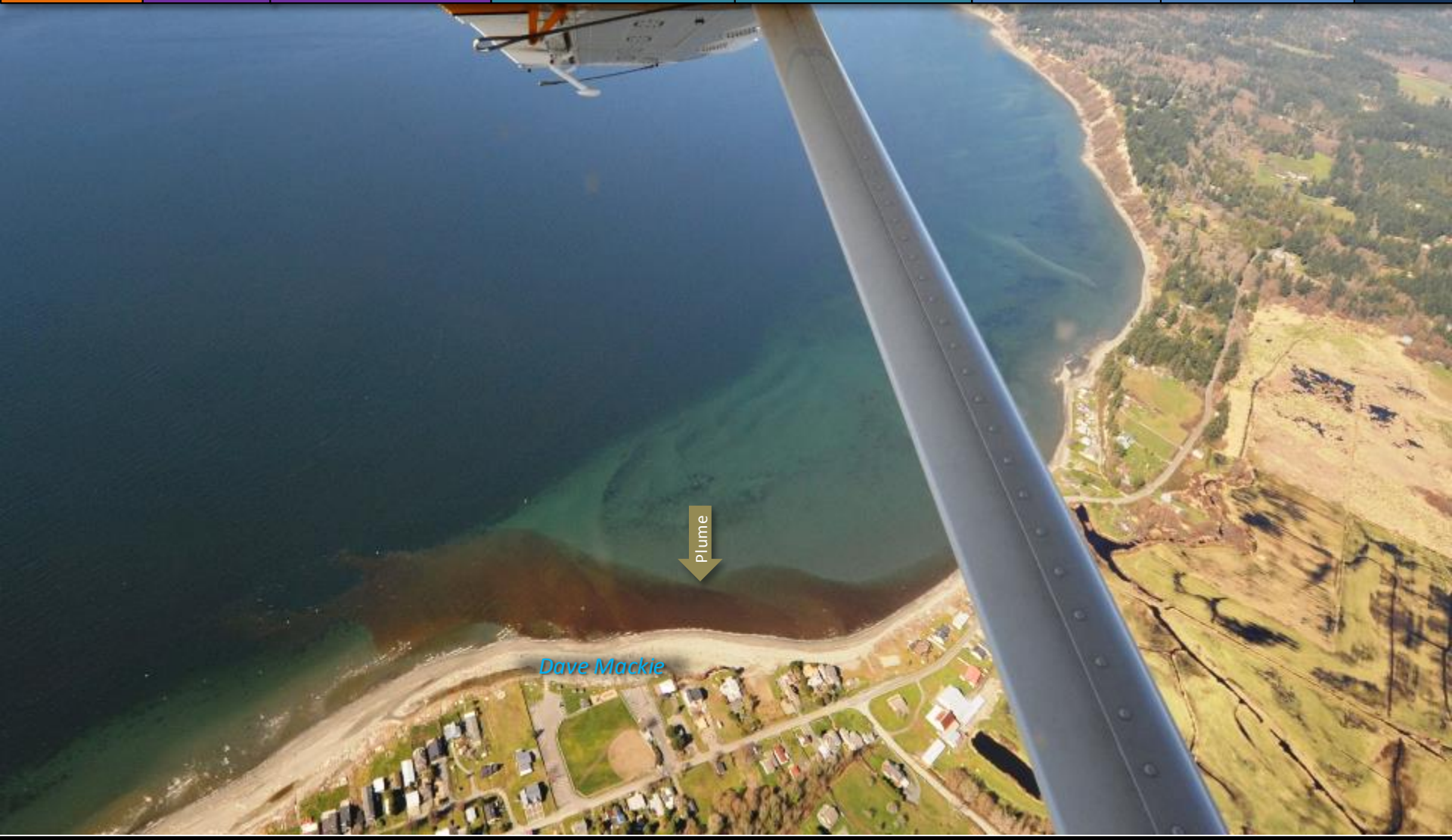
Location: Camano Island (Whidbey Basin), 1:59 PM.

Humic-rich river water hugging shore with receding tide

Location: Camano Island, Port Susan (Whidbey Basin), 2:00 PM.

Bloom drifting south past Camano Island State Park

Location: Saratoga Passage (Whidbey Basin), 2:04 PM.



Boggy water entering and flowing at surface of Admiralty Inlet

Location: Maxwellton, Whidbey Island (North Sound), 2:12 PM.

Water with sediment and bloom drifting from Possession Sound into Central Basin

Location: Triple Junction (Central Sound), 2:14 PM.

Near-shore milky white or turbid water? Is it suspended sediments or herring spawning?

Location: A. Bainbridge Island B. Kitsap Peninsula (Central Sound), 2:18 PM.

Aerial photography 3-16-2018

Spring bloom drifting into the Tacoma Narrows on an incoming tide

Location: Dalco Passage (North Sound), 2:33 PM.

Organic debris accumulating in a line at entrance to Balch Passage

Location: McNeil Island (South Sound), 2:39 PM.

Calm conditions in South Sound

Location: Anderson Island (South Sound), 2:41 PM.

Find past editions of EOPS with images on last pages

We have published 70 editions!

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

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

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Environmental Assessment Program
WA Department of Ecology

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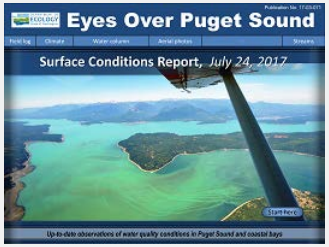

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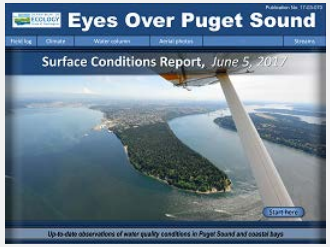

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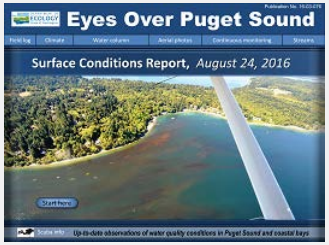

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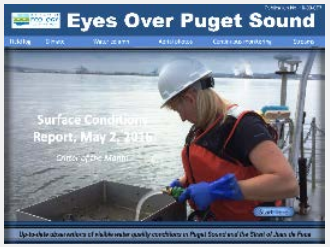

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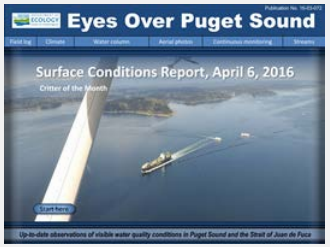

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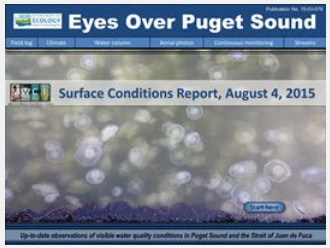

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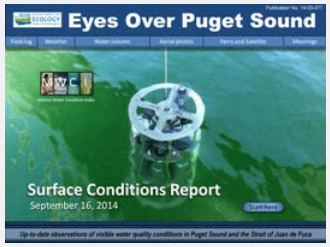

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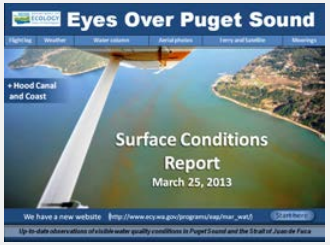

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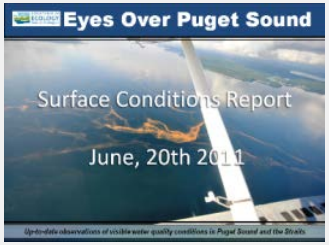

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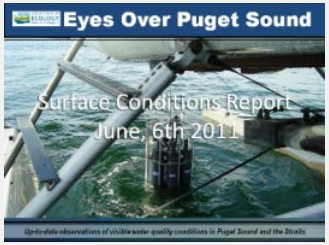

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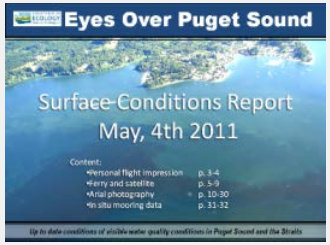

May_4_2011,
Publication No. 11-03-074

April_27_2011,
Publication No. 11-03-073