Publication No. 16-03-073

DEPARTMENT OF ECOLOGY State of Washington

Eyes Over Puget Sound

Surface Conditions Report, May 2, 2016

Critter of the Month

Start here

Sandra Weakland, Marine Monitoring, Ecology

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

Marine conditions from 5-2-2016 at a glance

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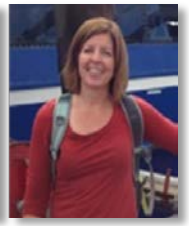

Don Watt

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Critter of the Month

Dany Burgess & Angela Eagleston
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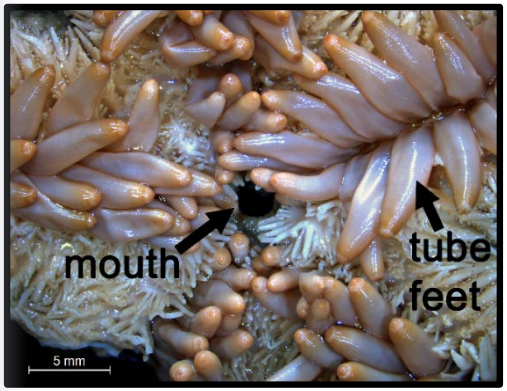
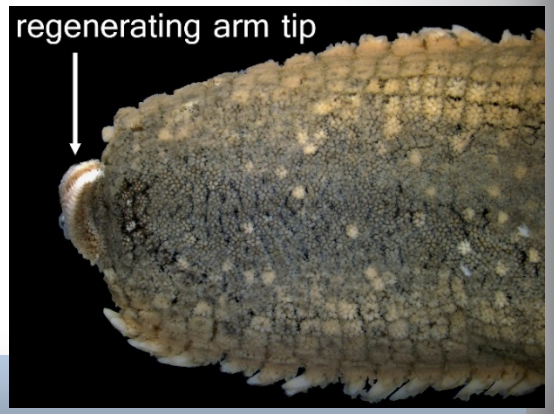


***Luidia foliolata* - The Sand Star**

This month's Critter is a familiar face! If you have ever been to an aquarium or explored tide pools, you may have encountered this creature before.

Fun Sand Star Facts!

- One of the fastest sea stars in the world, moving up to 9 feet per minute due to its unique adhesive system in its tube feet.
- Can quickly shed their arms and regenerate new ones.
- Voracious predators, ingesting sea cucumbers, small clams, brittle stars, and marine worms.



Learn more about sand star and other critters on Ecology's EcoConnect blog here.

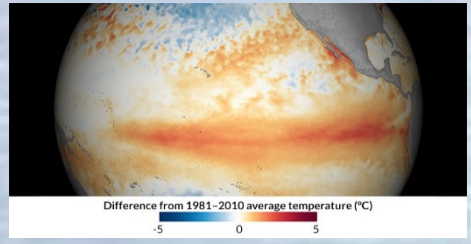
How's the Water Quality in Puget Sound?

We get asked this question often when interacting with the public. But the question can mean many different things. When you wonder about water quality in Puget Sound, what are you really interested in?

Is it safe to go swimming?

To check the safety of saltwater and freshwater swimming locations, go to the Department of Ecology's BEACH Program website for closures and advisories. You'll find further information about water quality standards and links to related information.

Read here



What is El Niño and how will it affect me?

In the Pacific Northwest, El Niño has caused this spring to be warmer and drier than usual. To understand how El Niño will influence your vacation plans, gardening schedule, and chances for an outdoor BBQ, check out the El Niño Theme Page from NOAA's Pacific Marine Environmental Laboratory.

Read here

Is it safe to harvest shellfish?

For recreational shellfish harvest information, visit the Department of Health Shellfish Safety website. The interactive map can help you to stay safe and informed about closures due to biotoxins and pollution.

Read here

Should I be worried about pollution and toxins?

The Toxic Studies Unit at the Department of Ecology monitors toxic chemicals in water, sediment, and fish tissue in all waterbodies, as well as children's products and consumer goods.

Read here

Photo Credit from left to right: mynorthwest.com, PMEL, Encyclopedia of Puget Sound, KOMO News.

Natural Influence leading to 5-2-2016

Climate and natural influences, including weather, rivers, and the adjacent ocean, can affect our marine waters. Graphics are based on provisional data and are subject to change. http://www.ecy.wa.gov/programs/eap/mar_wat/weather.html, page 26.

Putting the puzzle pieces of influencing factors together…

Summary for April 2016:

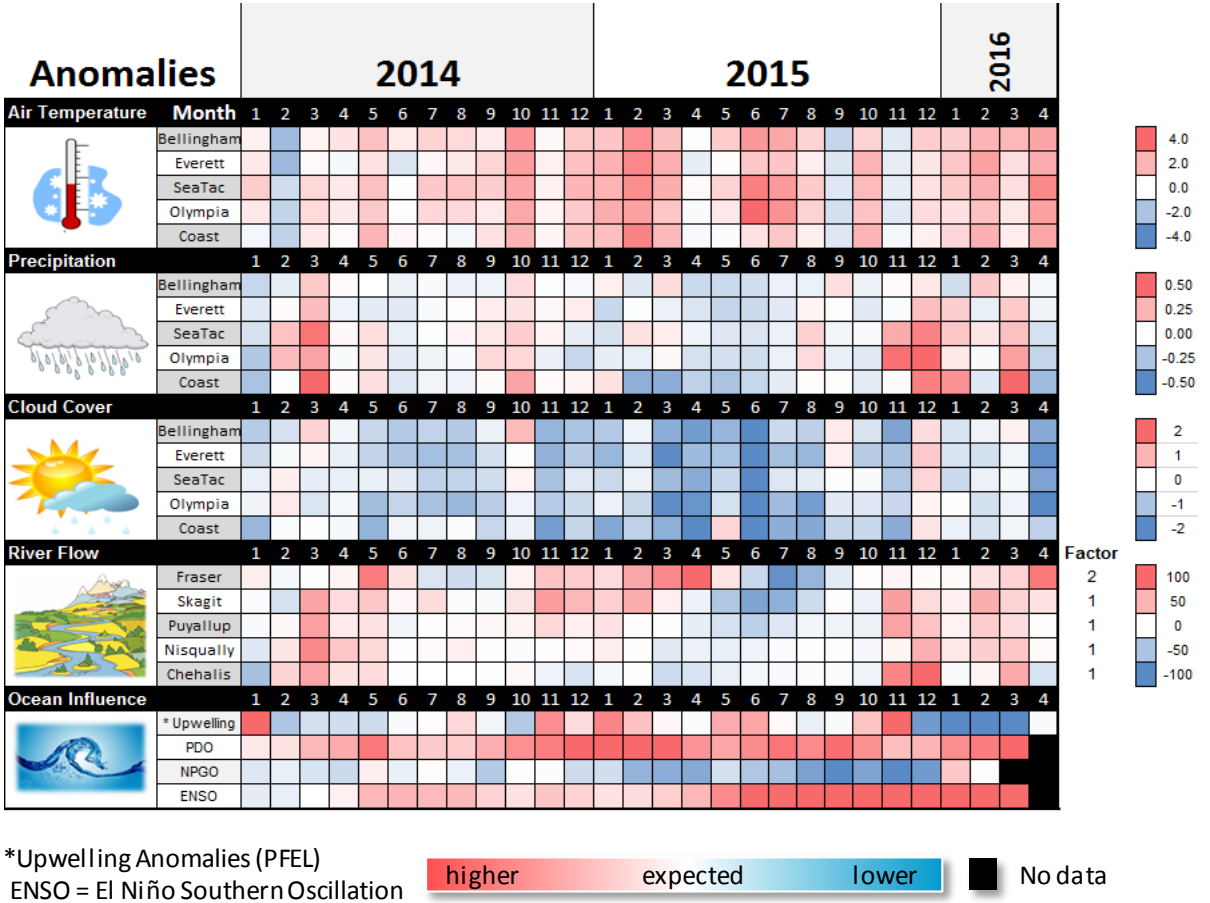
Air temperatures remain above normal in the Puget Sound lowlands.

Precipitation levels were below normal during April, after five months of above normal rain.

Sunshine levels were much above normal (low cloud cover).

River flows are slightly above normal, except for the Fraser River (very high) and Chehalis River (low), which is mostly fed by precipitation.

Downwelling eased off in April and ENSO and PDO remain in their warm phase (El Niño).

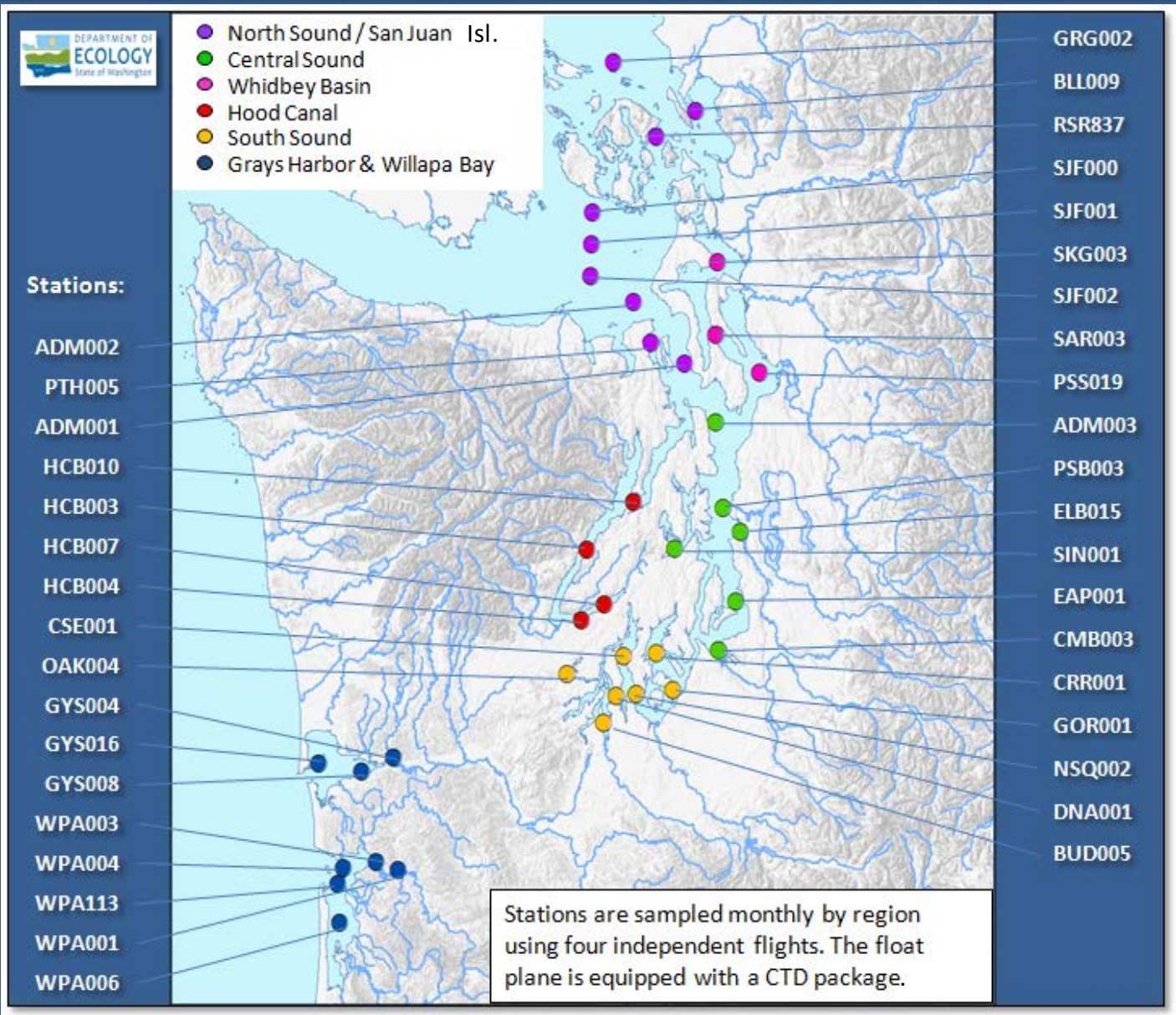


*Upwelling Anomalies (PFEL)
ENSO = El Niño Southern Oscillation

higher — expected — lower

No data

Our long-term marine monitoring stations in Washington



We use a boat and a chartered float plane to access our monthly monitoring stations.

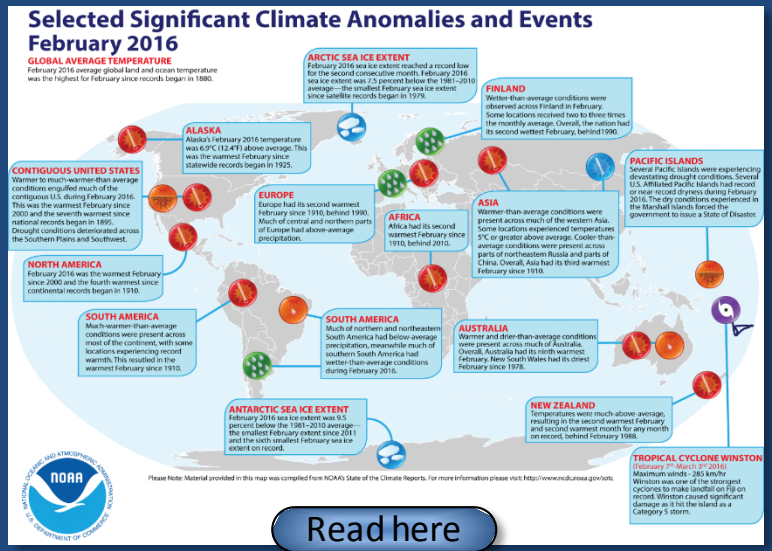
Start here

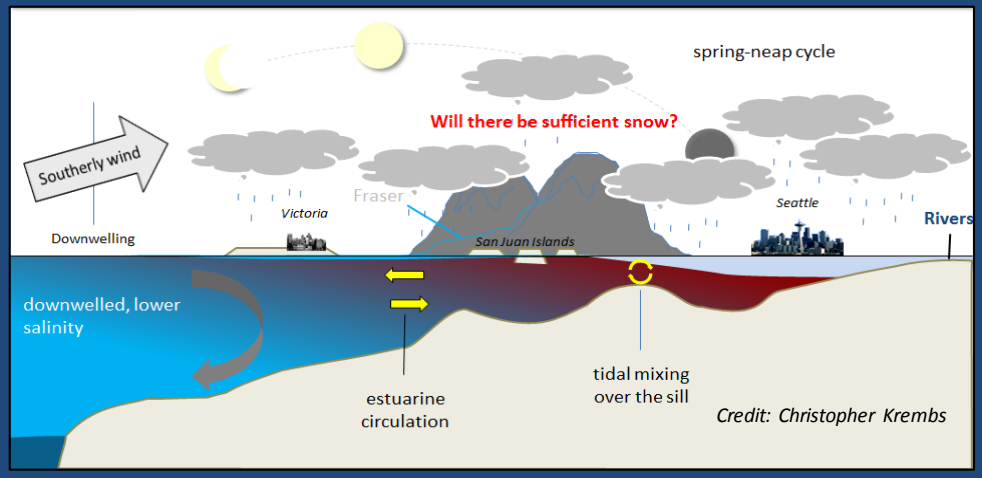
We communicate data and environmental marine conditions using:

1. **Marine Water Condition Index (MWCI)**
2. **Eyes Over Puget Sound (EOPS)**
3. **Anomalies and source data**

Are Puget Sound conditions normalizing?

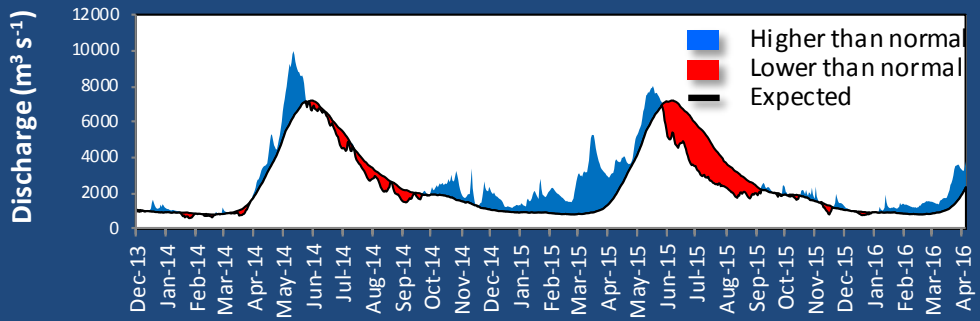
Year 2016 is continuing record breaking global temperatures. NOAA provides updates on the pages below. In our region, the Fraser River has not been flowing as high as last year, though it has picked up. A better snow base lets us hope that summer flows and estuarine circulation will be closer to normal, contrasting last year's drought. **Estuarine circulation is important because water temperatures in Puget Sound are still warmer than what they should be!**





If rivers continue to improve water exchange during summer, we have an opportunity to bring in cooler ocean water.

The Fraser River is the largest freshwater source for the Salish Sea, significantly affecting estuarine circulation.



Government of Canada

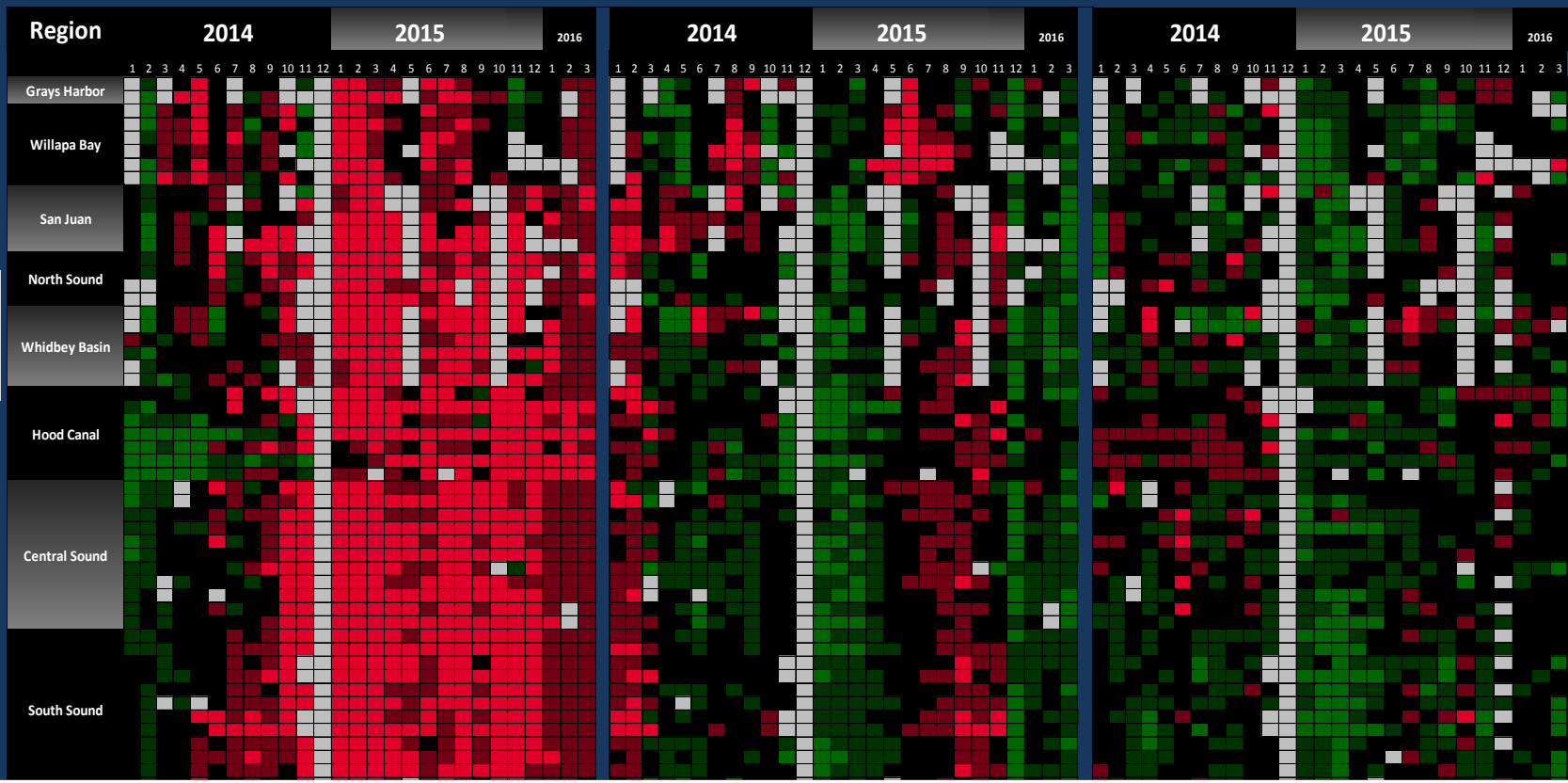
In winter and spring 2015, the Fraser River and other rivers discharged prematurely. Very low summer flows followed and inhibited the renewal of water in Puget Sound. Rivers are now normal or running higher, but not like last year. Estuarine circulation is presently as expected.

Source: http://wateroffice.ec.gc.ca/index_e.html

Physical conditions tracked in historical context

Temperatures from March remain high in Puget Sound and record warm water from last year persists much longer in Hood Canal. Oxygen in Puget Sound is generally expected. Conditions are comparable, but less pronounced at the Coast.

Still higher temperature in P. Sound | Salinity below normal | Expected Oxygen



Explore profiles at all stations

= higher than expected (>IQR, n=13)
= higher than previous measurements
= expected (=IQR, n=13)
= no data
= lower than expected (<IQR, n=13)
= lower than previous measurements

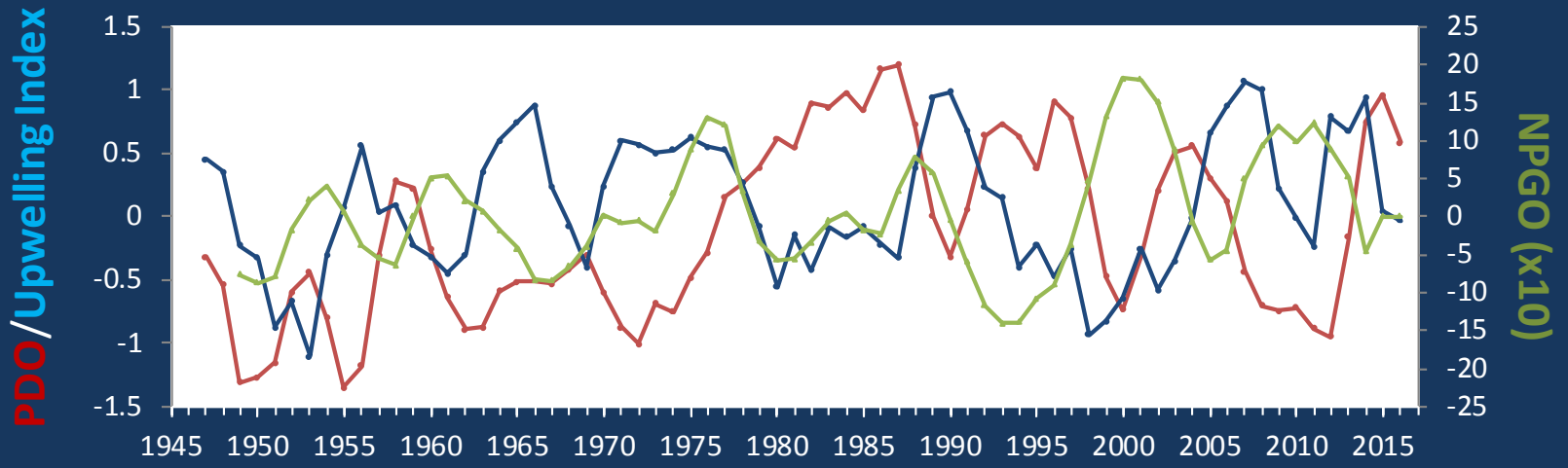
The ocean affects water quality: Ocean Climate Indices

a) *Pacific Decadal Oscillation Index (**PDO, temperature**)* *(explanation)*

b) *Upwelling Index (anomalies) (**Upwelling, low oxygen**)* *(explanation)*

c) *North Pacific Gyre Oscillation Index (**NPGO, productivity**)* *(explanation)*

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



Ocean boundary conditions are in transition: (a) water is still warm (PDO), (b) upwelling of low oxygen and high nutrient ocean water are normal (Upwelling Index anomaly), and (c) surface productivity along the coast is normalizing (NPGO).

Summary: Aerial photography 5-2-2016

Jellyfish are already occurring in high numbers in southern inlets. The spring phytoplankton bloom is in full swing creating abundant organic material at the surface that is washing onto beaches.

Start here

Salmon Bay with no oil sheen – that is good.

Lake Union, a busy place to land!

Front

Mixing and Fronts:
Occasional fronts in Central Sound, Dyes Inlet, and Colvos Passage delineating water of different coloration.

Jellyfish:
Numerous jellyfish patches in Budd, Eld, and Henderson Inlets.

Plume

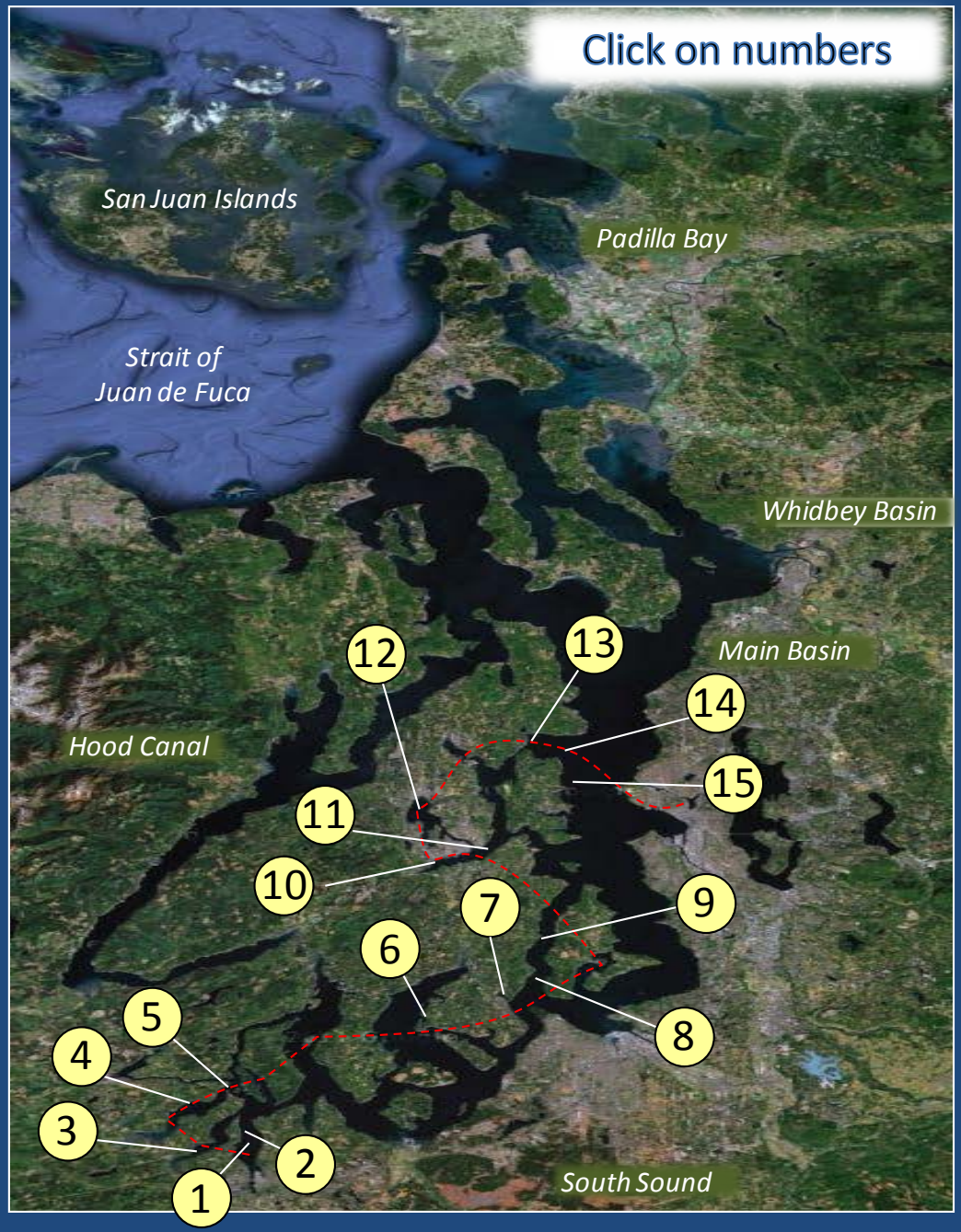
Suspended sediment:
Very little suspended sediment.

Bloom

Visible blooms:
Spring phytoplankton bloom in full swing in all places and staining water dark green and brown. In some places, blooms are colored red-brown.

Debris

Debris:
Abundant organic debris from decaying blooms in Colvos Passage, Dyes Inlet, Port Madison, Sinclair Inlet, and Central Sound.



Aerial photography and navigation guide

Date: 5-2-2016

Tide data (Seattle):

Time	Height (ft.)	High/Low
01:52 AM	11.1	H
08:24 AM	3.88	L
01:56 PM	8.56	H
08:00 PM	2.03	L

Flight Information:

Sunny, broken ceiling near Bremerton

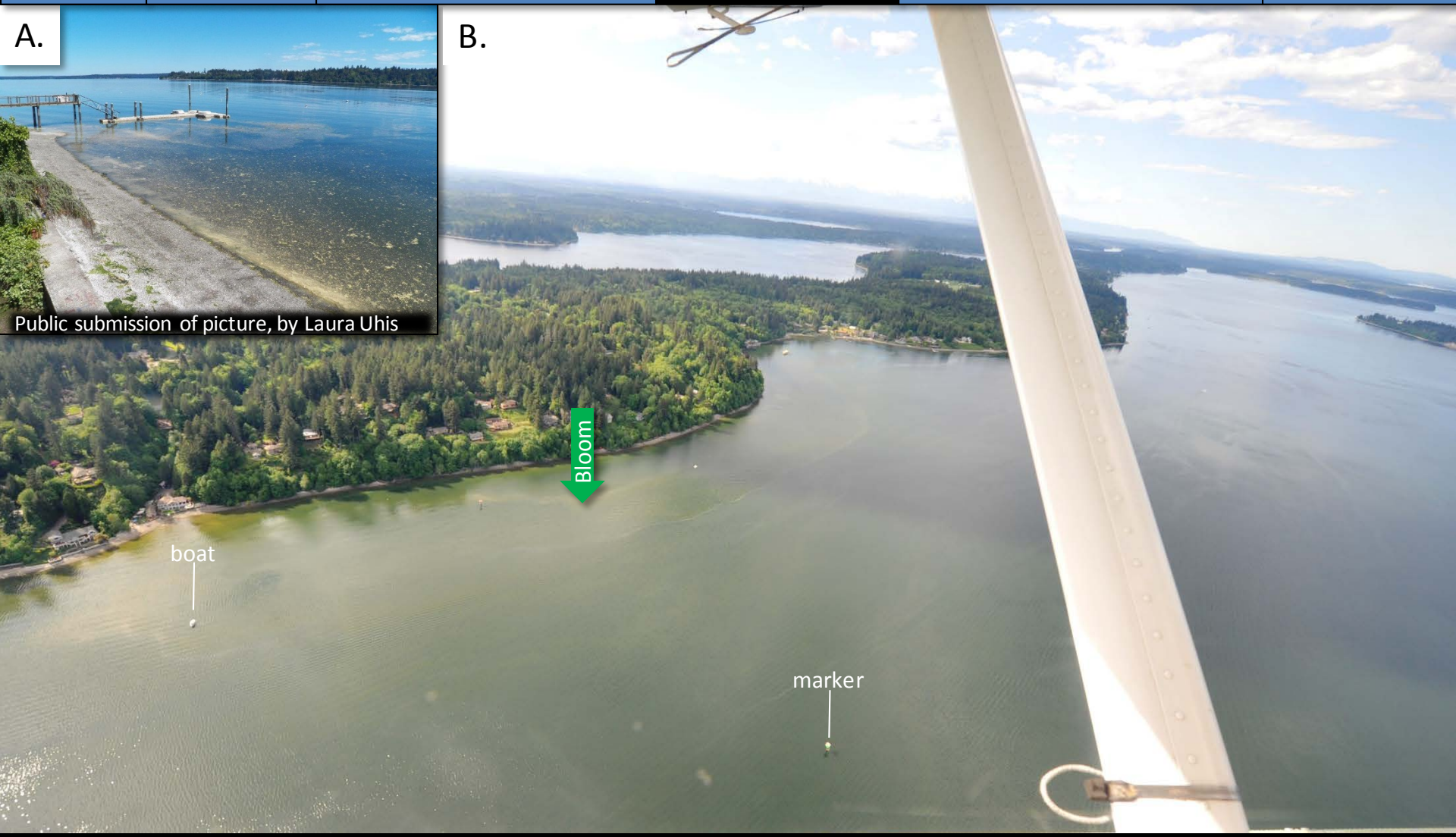
Flight route

Observation Maps:

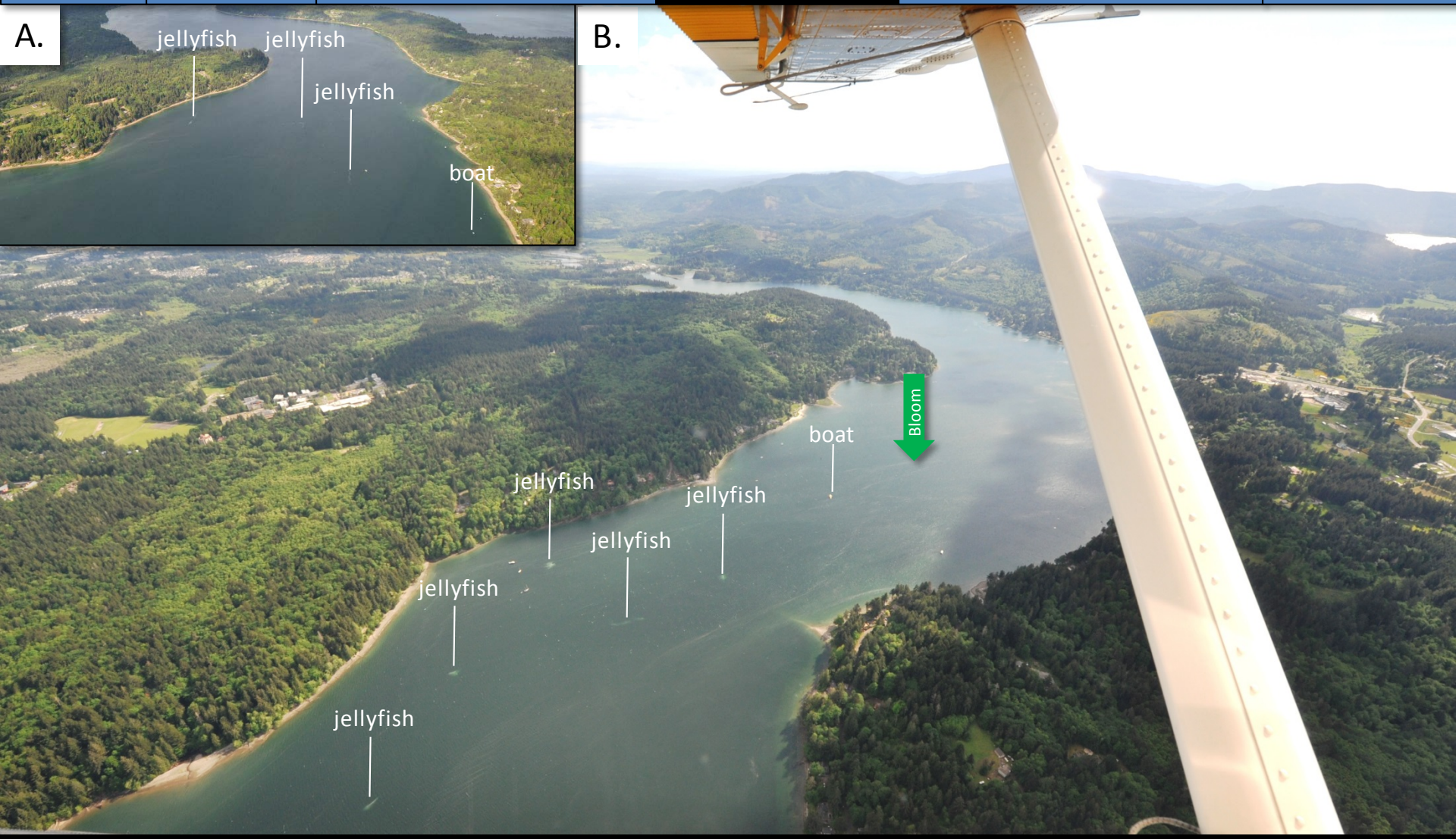
Central Sound

South Sound

Jellyfish patches in Budd Inlet and spring bloom conditions coloring the water green-brown.
Location: Budd Inlet (South Sound), 4:44 PM.



A. Organic material washing onto beaches and decaying. B. Very strong spring blooming conditions.
Location: West side of Budd Inlet (South Sound), 4:44 PM.



Numerous Jellyfish patches in Eld Inlet occurring unusually early. A. Looking north, B. Looking south.
Location: Eld Inlet (South Sound), 4:47 PM.

Water rich in phytoplankton of different species coloring the water green-brown or red-brown.

Location: Totten Inlet (South Sound), 4:51 PM.

Large patches of organic debris accumulating at the surface.

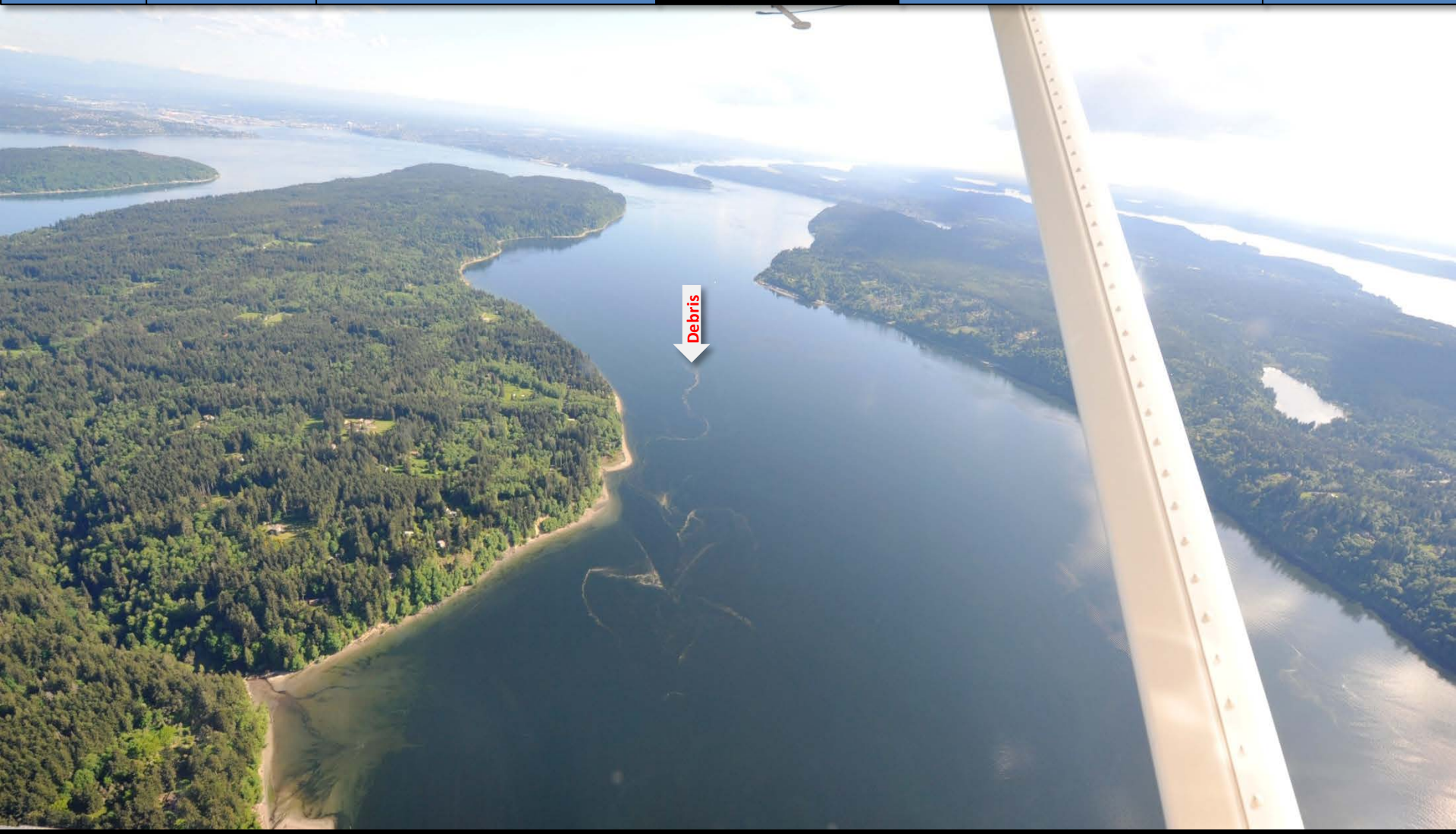
Location: Steamboat Island, Totten Inlet (South Sound), 4:52 PM.

Intense green bloom in Horsehead Bay.

Location: Forest Beach, Carr Inlet (South Sound), 5:00 PM.

Brown water different from colors in the adjacent Tacoma Narrows suggesting different phytoplankton species. Location: Gig Harbor (Central Sound), 5:03 PM.

Water rich in phytoplankton and organic material floating at the surface and entering Colvos Passage from South Sound on an ebb tide. Location: Southern entrance of Colvos Passage (Central Sound), 5:05 PM.



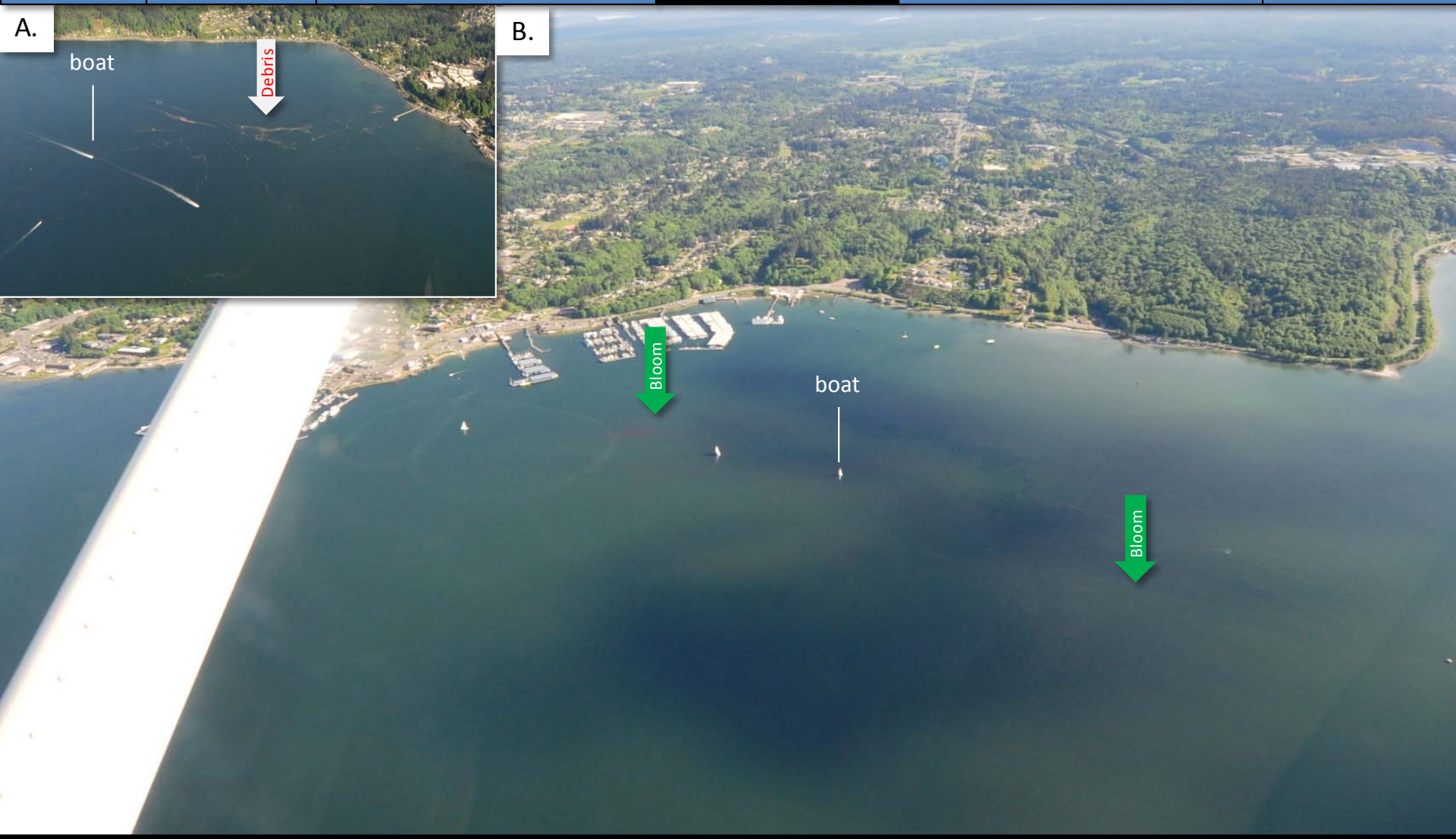
Large rafts of organic material floating at the surface through Colvos Passage.

Location: Colvos Passage (Central Sound), 5:08 PM.

Spring bloom in colors of green (hint of red), organic debris, but no jellyfish, unlike South Sound.

Location: Sinclair Inlet (Central Sound), 5:14 PM.

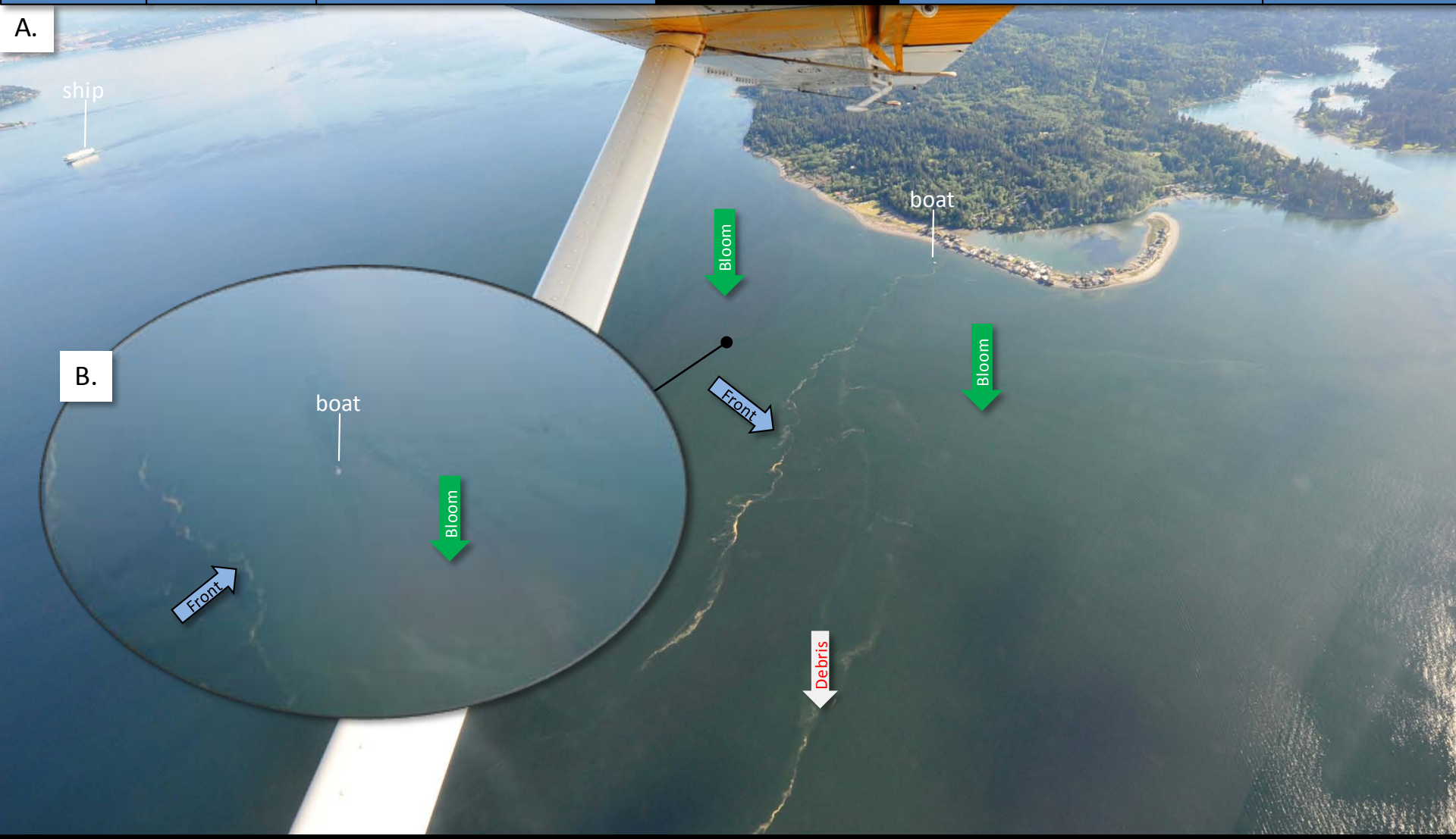
Aerial photography 5-2-2016



A. Large accumulations of organic material. B. Spring bloom in colors of green (hint of red).
Location: Sinclair Inlet (Central Sound), 5:15 PM.

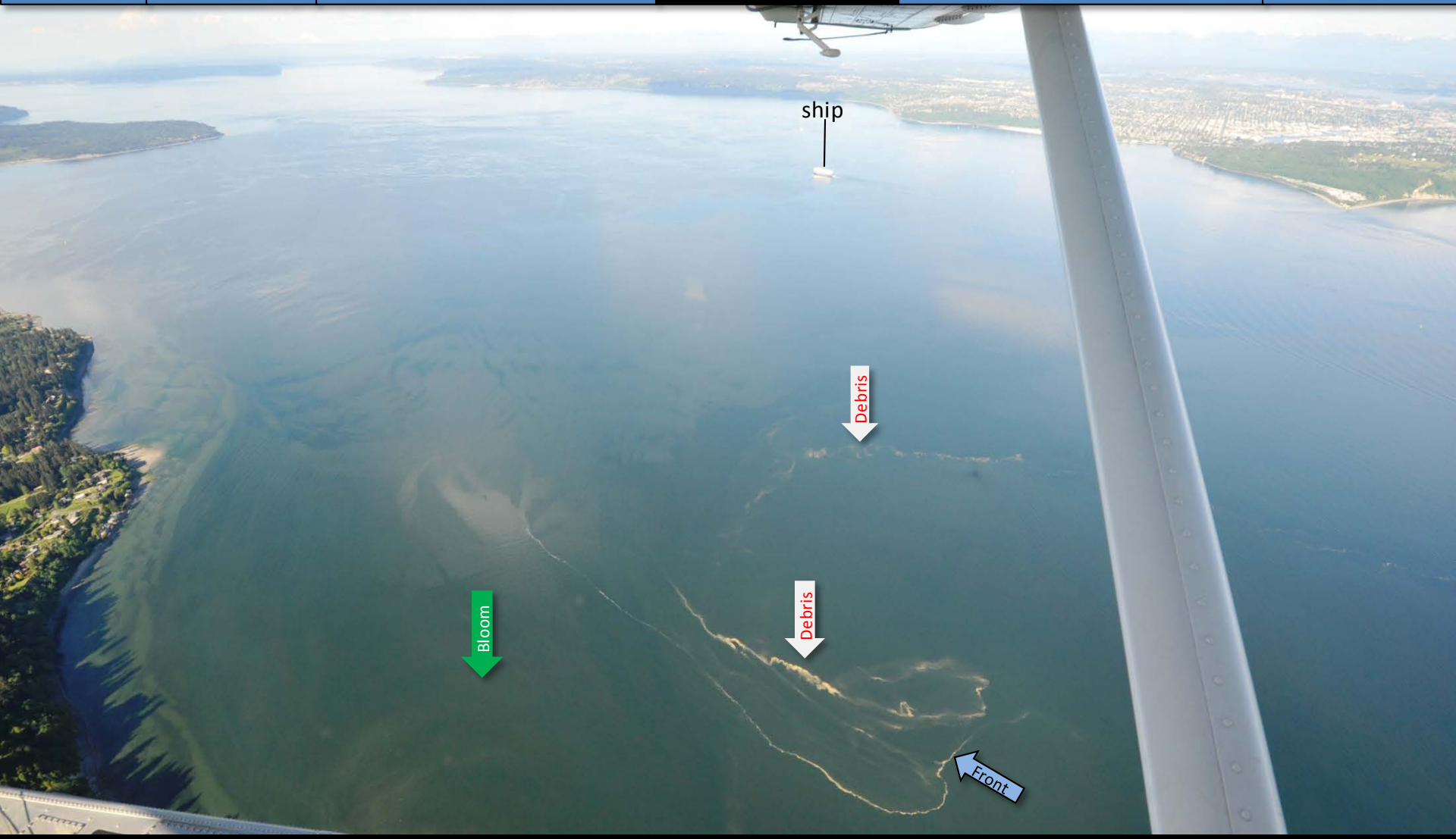
Large and numerous accumulations of organic material at the surface. Phytoplankton bloom.
Location: Dyes Inlet (Central Sound), 5:19 PM.

Large and numerous accumulations of organic material at the surface. Phytoplankton bloom.
Location: Port Madison (Central Sound), 5:26 PM.



A. Large and numerous accumulations of organic material. B. Phytoplankton bloom in red-brown and green visible near a tidal front. Location: Port Madison (Central Sound), 5:26 PM.

Aerial photography 5-2-2016



Large and numerous accumulations of organic material. Phytoplankton bloom around Bainbridge Island.

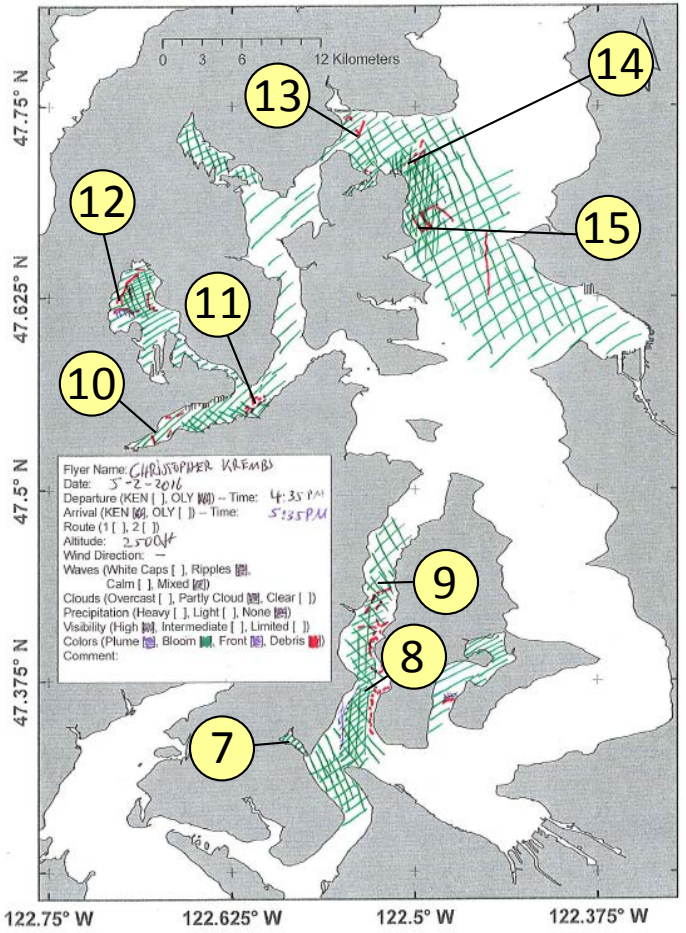
Location: East of Bainbridge Island (Central Sound), 5:30 PM.

Date: 5-2-2016

Hood Canal

n.a.

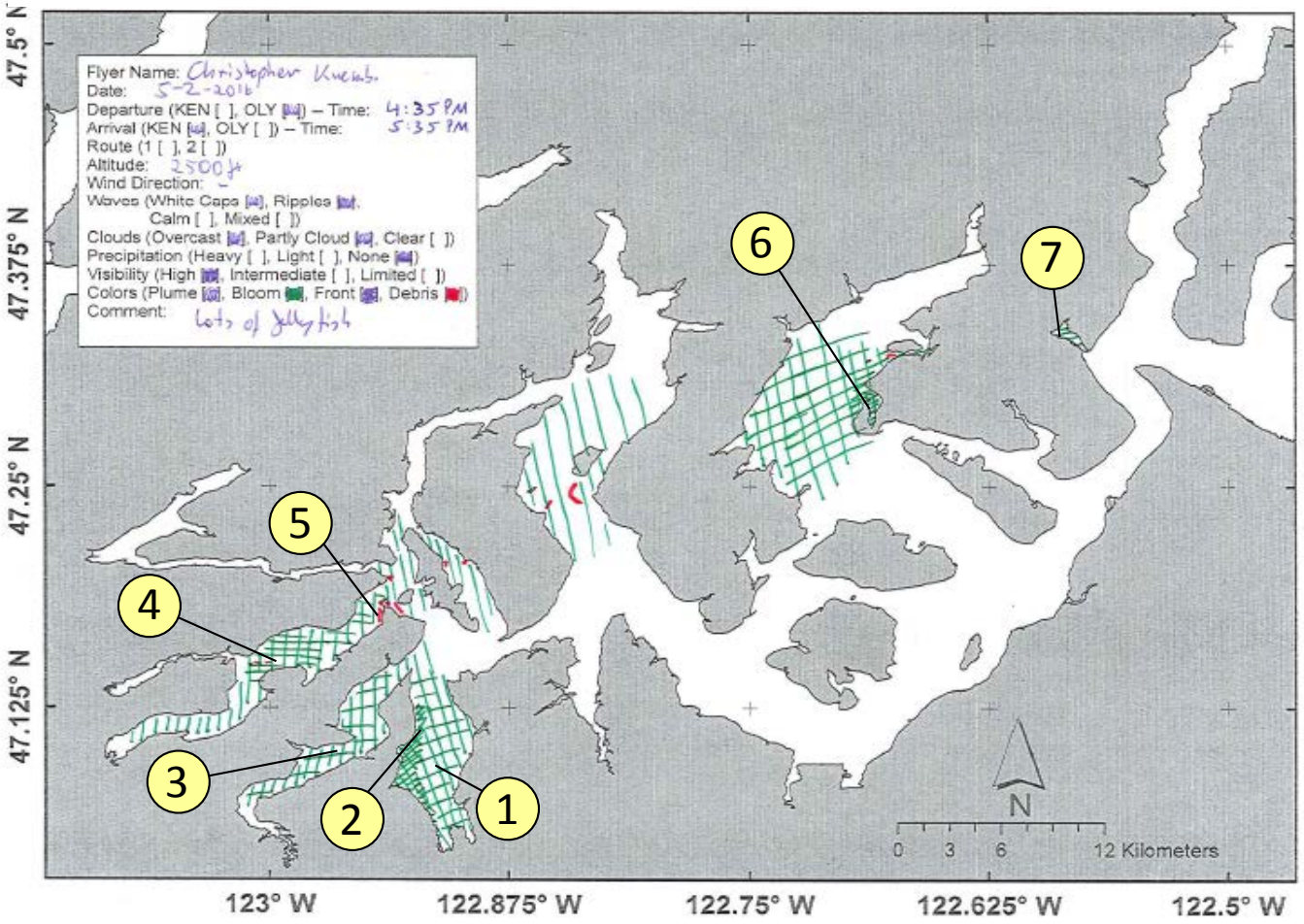
Central Sound



Numbers on map refer to picture numbers for spatial reference

Date: 5-2-2016

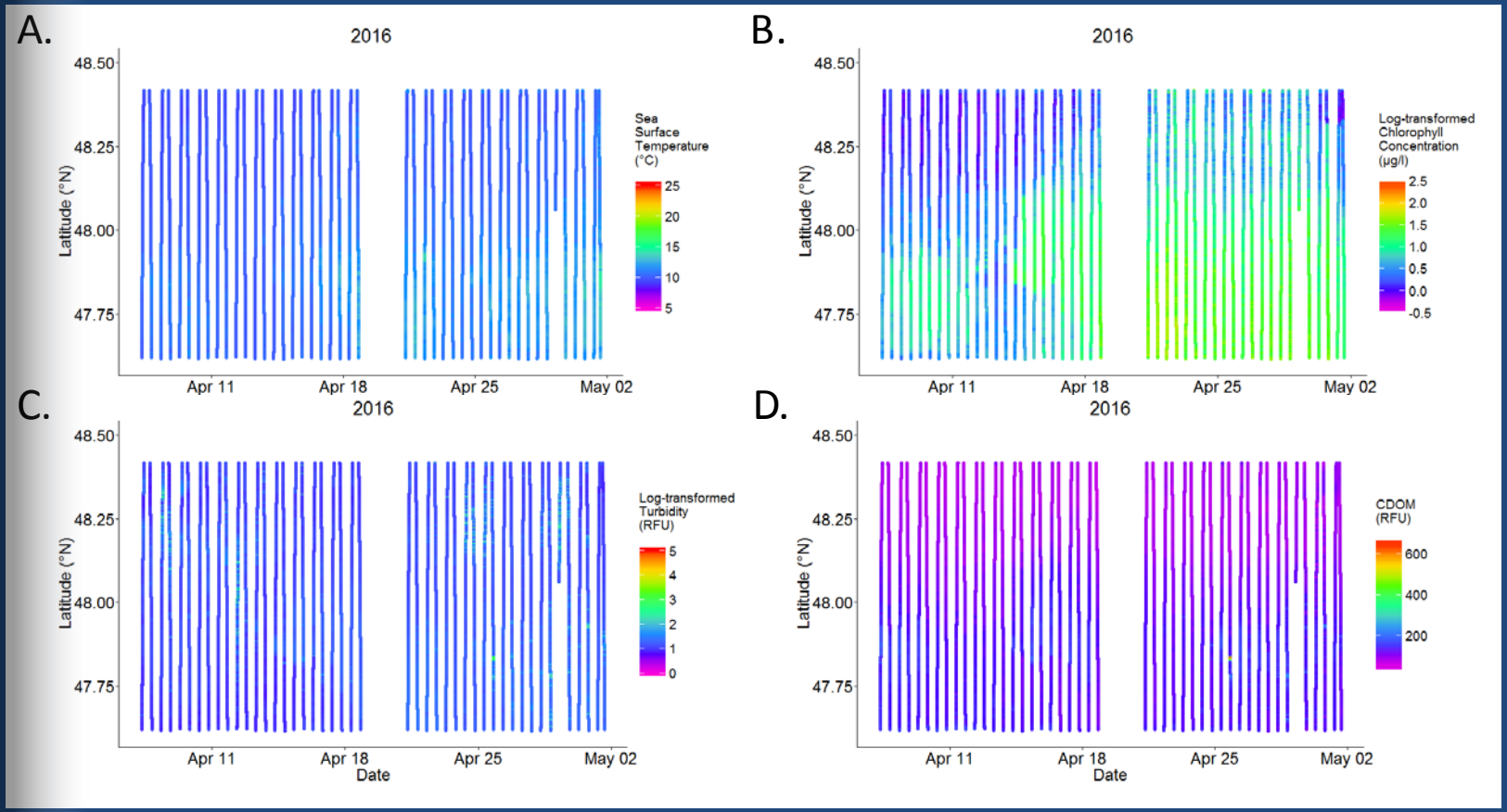
South Sound



Numbers on map refer to picture numbers for spatial reference

Continuous monitoring 5-2-2016

Summary of *Victoria Clipper IV* ferry data:
The near-surface water started making a seasonal transition. Temperature has increased over the last few days. Chlorophyll concentrations increased throughout Puget Sound and more recently, in the Strait of Juan de Fuca between Admiralty Inlet and Victoria Harbour. Turbidity and CDOM remain low.



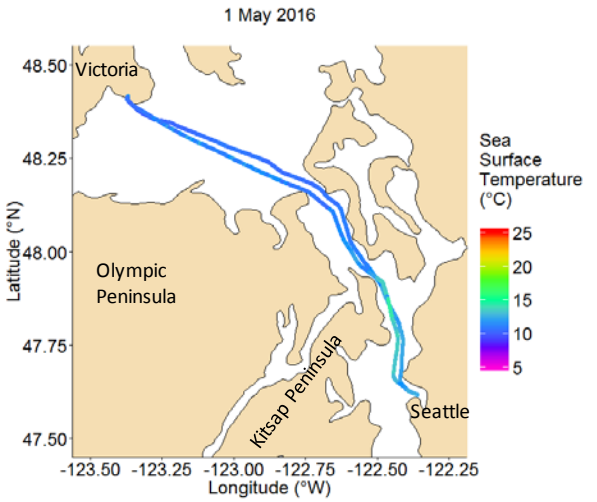
The *Victoria Clipper IV* carries sensors in its sea chest. The sensors allow us to plot over time transects of:

A. Temperature
B. Chlorophyll
C. Turbidity
D. CDOM

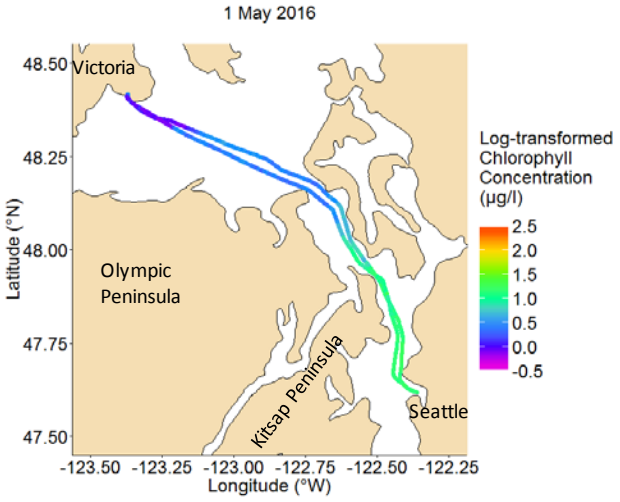
Over time, we see the dynamics of these variables in surface water between Seattle and Victoria, BC.

Continuous monitoring 5-2-2016

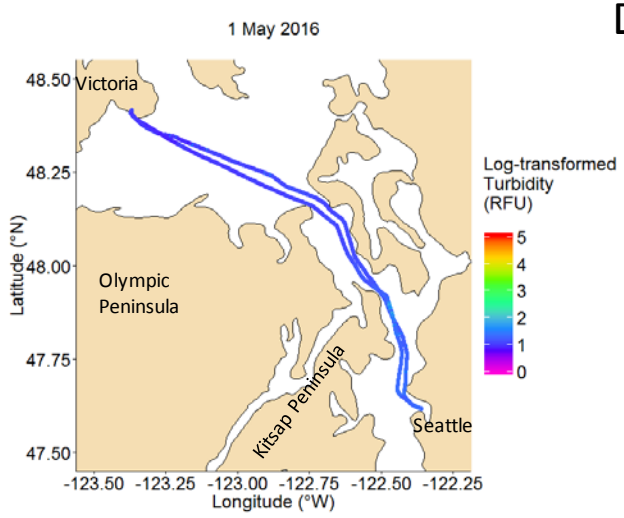
A.



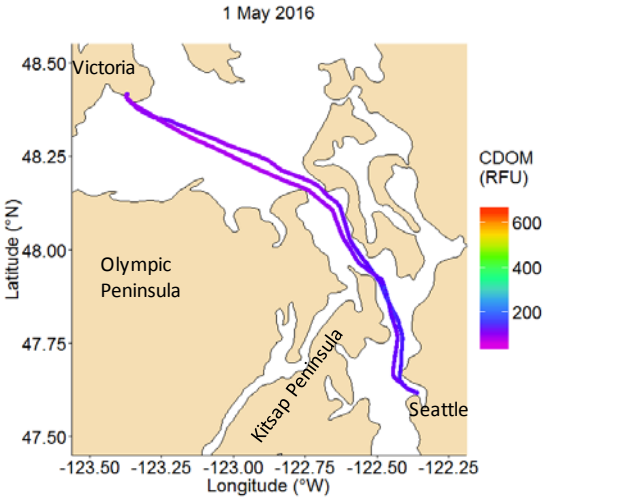
B.



C.



D.



Figures show daily sensor data installed on the ferry which measure near-surface water at 5-sec intervals while the *Victoria Clipper IV* transits between Seattle and Victoria, BC.

A. Sea Surface Temperature: Water is becoming warmer in Central Basin.

B. Chlorophyll: Concentrations were low in the Strait and clearly increased in Puget Sound.

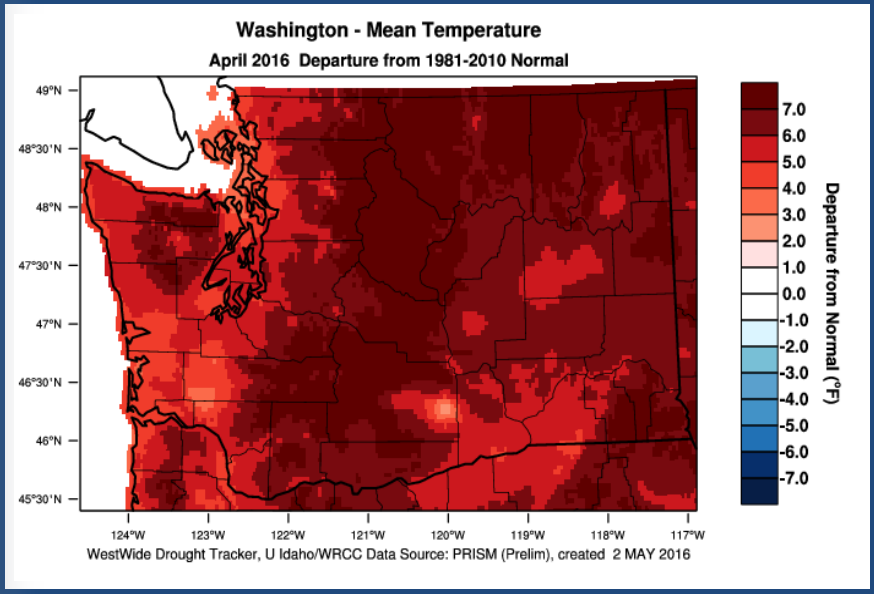
C. Turbidity: Turbidity was low on entire route.

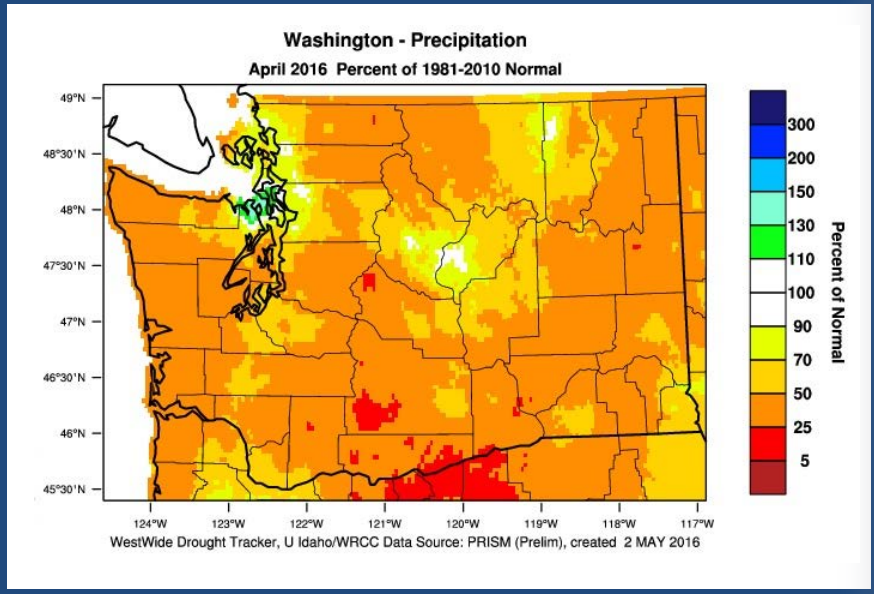
D. Colored Dissolved Organic Matter (CDOM): Humics in the water are low in Central Basin and nearly absent in the Strait of Juan de Fuca.

Warm and dry weather, losing the snow fast

Don Watt, Ecology

At first, warmer air temperatures in April did not affect snow water equivalencies. However, continued warmer temperatures into May have reduced the snowpack quickly in Washington. Precipitation has dropped to less than normal. What can we expect for the summer to come?



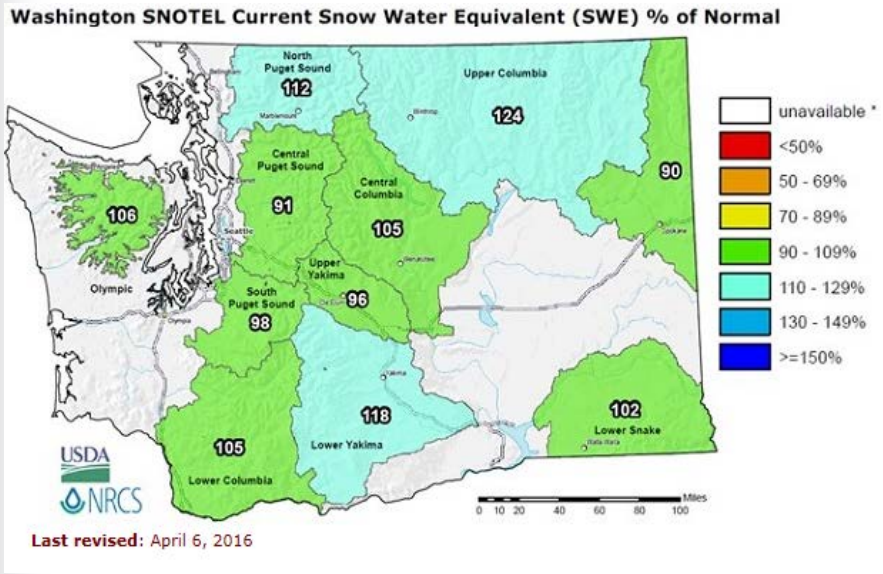


Over the last month, weather in the Puget Sound Region was very warm and dry. Mean temperatures were 3 to 6 °F above normal for the Puget Sound basin and 6 to 7 °F above normal along the Cascade Crest and on the higher peaks in the Olympics.

Along with the exceptionally warm temperatures in April came much lower than normal precipitation for much of the Puget Sound Basin.

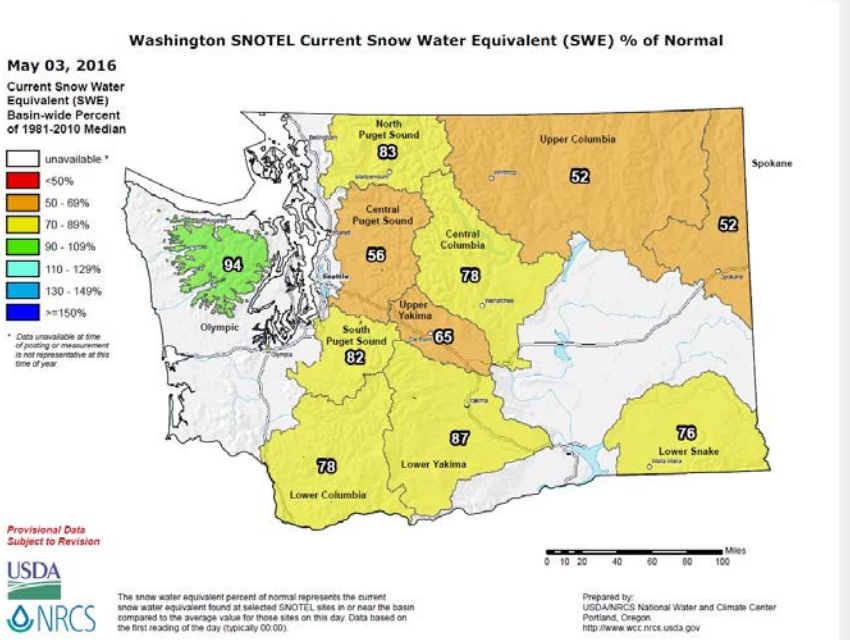
Warm and dry weather, losing the snow fast

April



The combined effect of the very warm and dry weather in April has been a rapid loss of snowpack across much of the region. Snowpack had been near or above normal across the region in early April.

May



But by early May, snowpack in the mountains east of Puget Sound had dwindled to between 56 and 83% of seasonal normal. Snowpack in the Olympics remains in the near-normal category.

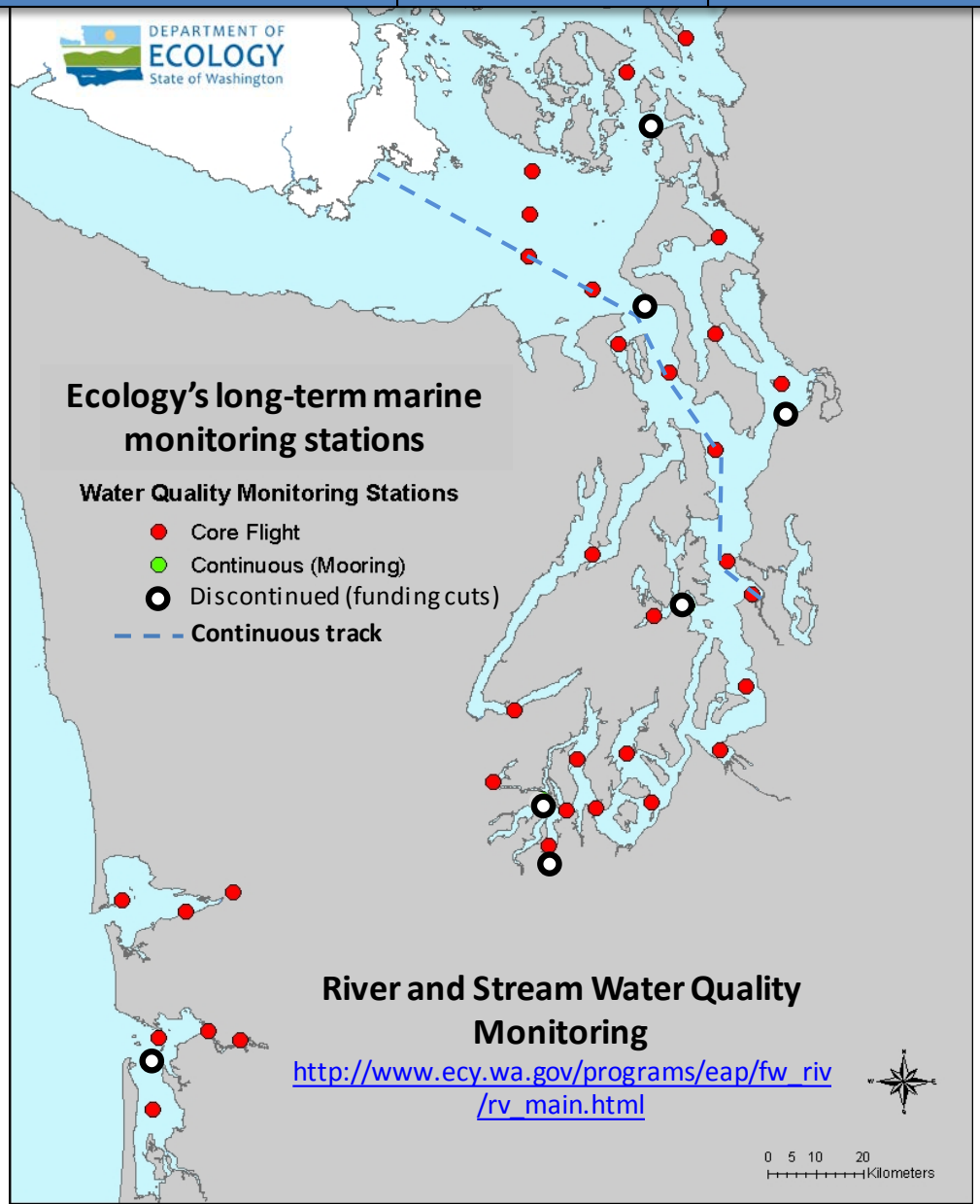
Get data from Ecology's Marine Monitoring Programs

Field log	Climate	Water column	Aerial photos	Continuous monitoring	Streams

Long–Term Monitoring Network

christopher.krembs@ecy.wa.gov

Access core monitoring data:
https://fortress.wa.gov/ecy/eap/marinewq/mwdataset.asp



Real–Time Sensor Network

Suzan.Pool@ecy.wa.gov

Access mooring data:
ftp://www.ecy.wa.gov/eap/Mooring_Raw/Puget_Sound/

You may subscribe or unsubscribe to the Eyes Over Puget Sound email listserv by going to:
http://listserv.wa.gov/cgi-bin/wa?A0=ECOLOGY-EYES-OVER-PUGET-SOUND

We are looking for feedback to improve our products.

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Marine Monitoring Unit
Environmental Assessment Program
WA Department of Ecology

Many thanks to our business partners: Clipper Navigation, Swantown Marina, and Kenmore Air.