

Eyes Over Puget Sound

[Field log](#)[Weather](#)[Water column](#)[Aerial photos](#)[Ferry and Satellite](#)[Moorings](#)

Surface Conditions Report

October 8, 2012

[SoundToxins.org](http://www.soundtoxins.org)

Guest Contribution:
Squaxin Island Tribe,
Coordinated Phytoplankton Sampling
Phytoplankton Identification on the Ground

We have a new website (http://www.ecy.wa.gov/programs/eap/mar_wat/)

[Start here](#)

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Skip Albertson



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Julia Bos
Suzan Pool*



Personal flight impression [p. 4](#)

Commencement Bay surface slick not so chic!

Weather conditions [p. 5](#)

Strong sunshine, warm days, and cool nights have characterized the past week. Wind has been off the land and river flows are below normal.

Aerial photography [p. 7-26](#)

Big patches of surface debris, red-brown blooms, and abundant, large jellyfish aggregations continue in the inlets of South and Central Sound.

Ferry and satellite [p. 27-28](#)

Low to moderate fluorescence from Triple Junction through Admiralty Inlet. Clear skies provide impressive image sequence off the Washington coast.

In-situ mooring data [p. 29-31](#)

In Possession Sound, dry weather and decreased thickness of the freshwater layer continue. Dissolved oxygen levels declined by 0.7 mg/L. A short-lived surface bloom raised oxygen levels for a few days.

Why Eyes Over Puget Sound?

We observe increasing nutrients and algal blooms in Puget Sound:

Algae bloom Budd Inlet 2010



Nitrate



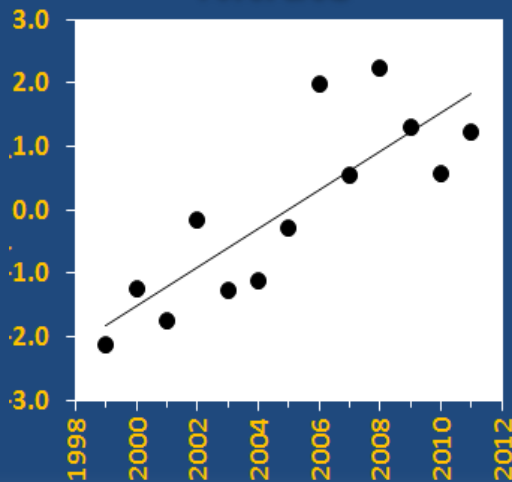
Phosphate



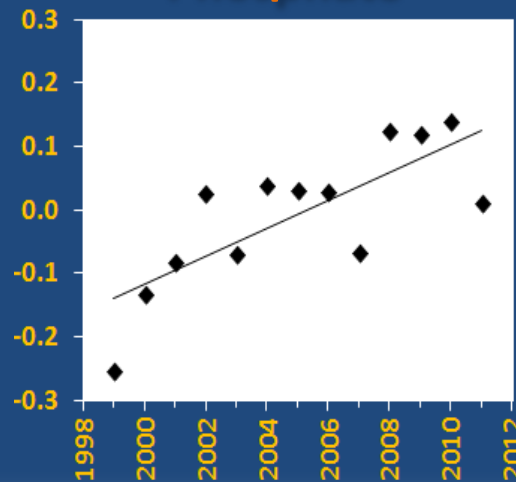
**Changing
Nutrient Balance**

Nutrients in Puget Sound are increasing, read more http://www.ecy.wa.gov/programs/eap/mar_wat

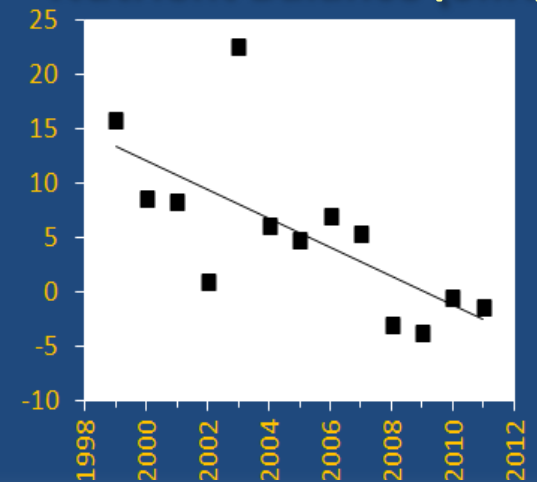
Nitrate



Phosphate



Nutrient Balance (Si:N)



Marine Flight 3 (Central Sound)

When the plane landed, we observed this film on the surface of the water in Commencement Bay



Julianne using the Yuma



The region's lack of rainfall was very apparent at the Commencement Bay station. When it rains, the Puyallup River plume drains into the bay and can be visible and very dramatic (see EOPS 9-12-2011). Today, the bay was uniformly dark green and clear. The secchi disk, which measures how deep light penetrates the water, was lowered to 10.5 meters which is unusually deep for this station. Also notable was a patch of organic film on the surface of the water. At the operations level, we have recently been preparing to transition away from paper logs to digital ones. This is an exciting advancement in efficiency and we are happy to be field-testing these with our Yuma Trimble device.



Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. I summarized the specific conditions prevalent during the past two weeks, from north to south. Source: http://www-k12.atmos.washington.edu/k12/grayskies/nw_weather.html

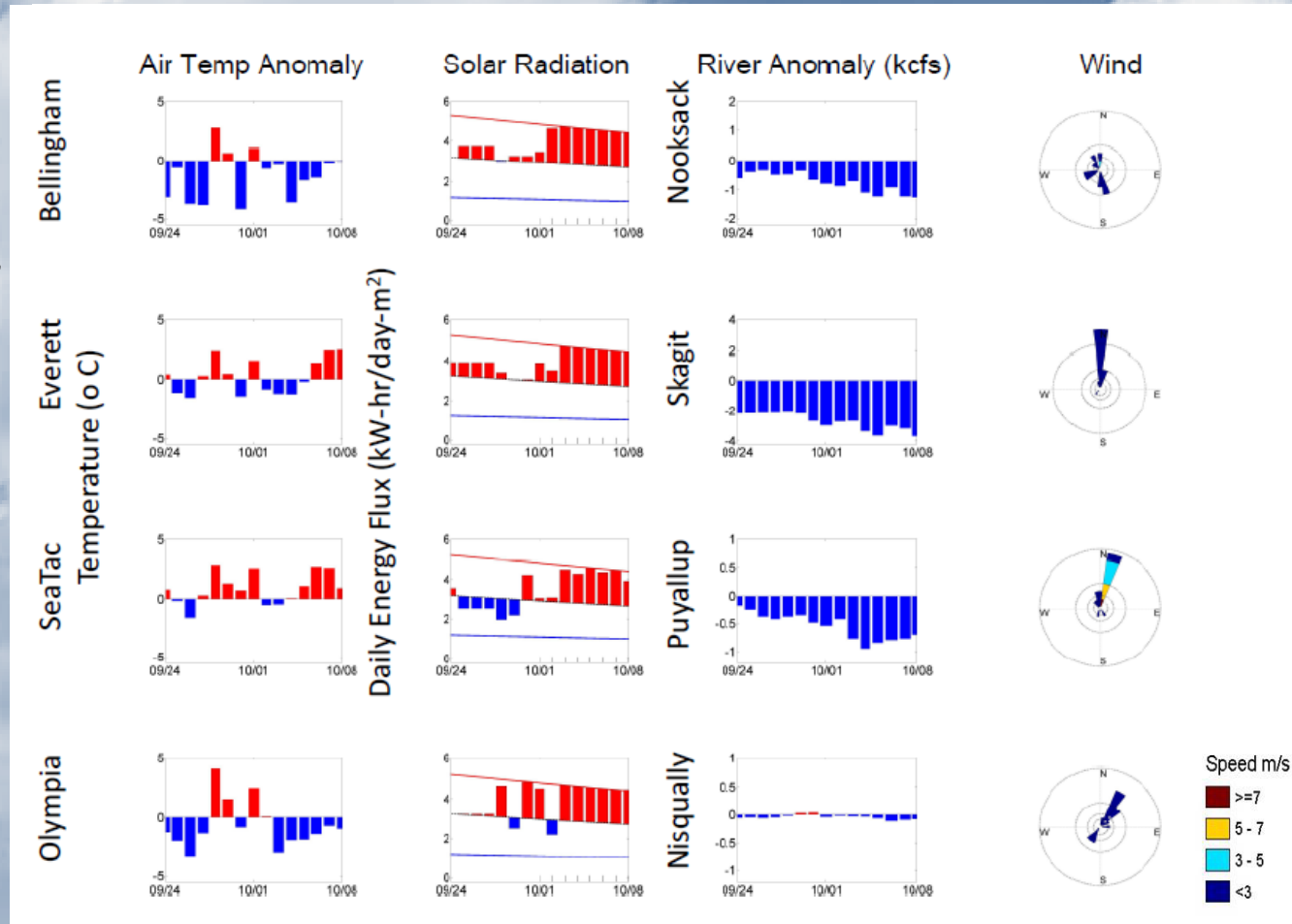
Summary:

Air temperatures during the past few days have been below average because of cool nights, but above average in the more urban Central Sound.

Sunshine has been abundant.

Rivers have generally been running below normal.

Winds have been predominantly from the north (off the land).



Squaxin Island Tribe, Coordinated Phytoplankton Sampling



Field log

Weather

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Ferry and Satellite

Moorings



The **Squaxin Island Tribe** sampled the algal blooms identified during this flight in Budd and Henderson Inlets. We have begun this coordination to try and better understand factors that may contribute to salmonid mortality in South Sound.

Summary:

The predominant species in both inlets was *Ceratium fusus*, although a number of other species were present. No harmful algae were identified. Jellyfish were mostly *Aurelia aurita*.

Conditions:

Budd Inlet [6](#)

Surface Temp = 14.1 °C
Salinity = 26.0 ppt

Henderson Inlet [7](#)

Surface Temp = 13.8 °C
Salinity = 27.4 ppt

Joe Puhn



Joe Puhn, resource tech, assisting **Scott Steltzner**, fisheries biologist, and **John Konovsky**, water quality specialist, sampling phytoplankton

Henderson Inlet



Ceratium fusus, a needle-like photosynthetic dinoflagellate, has been linked to the mortality of larval invertebrates. *C. fusus* is found in oceanic to estuarine (pre-dominantly coastal) waters.

Field log	Weather	Water column	Aerial photos	Ferry and Satellite	Moorings
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Big patches of surface debris, red-brown blooms, and abundant and large jellyfish aggregations continue in inlets of South and Central Sound.

[Start here](#)

Olympia from the air



Seattle from the air



Mixing and Fronts:

Quartermaster Harbor and near McNeil Island.
[9](#) [13](#)

Jellyfish: [4](#) [5](#) [6](#) [8](#)

Budd and Henderson Inlet



Visible blooms:

- Red-brown:** Still strong in most inlets of South Sound, Sinclair Inlet, and Eagle Harbor.
- Turquoise:** Swantown Marina in Budd Inlet and Quartermaster Harbor.

[2](#) [3](#) [6](#) [7](#) [8](#) [10](#) [11](#) [13](#) [14](#) [15](#)

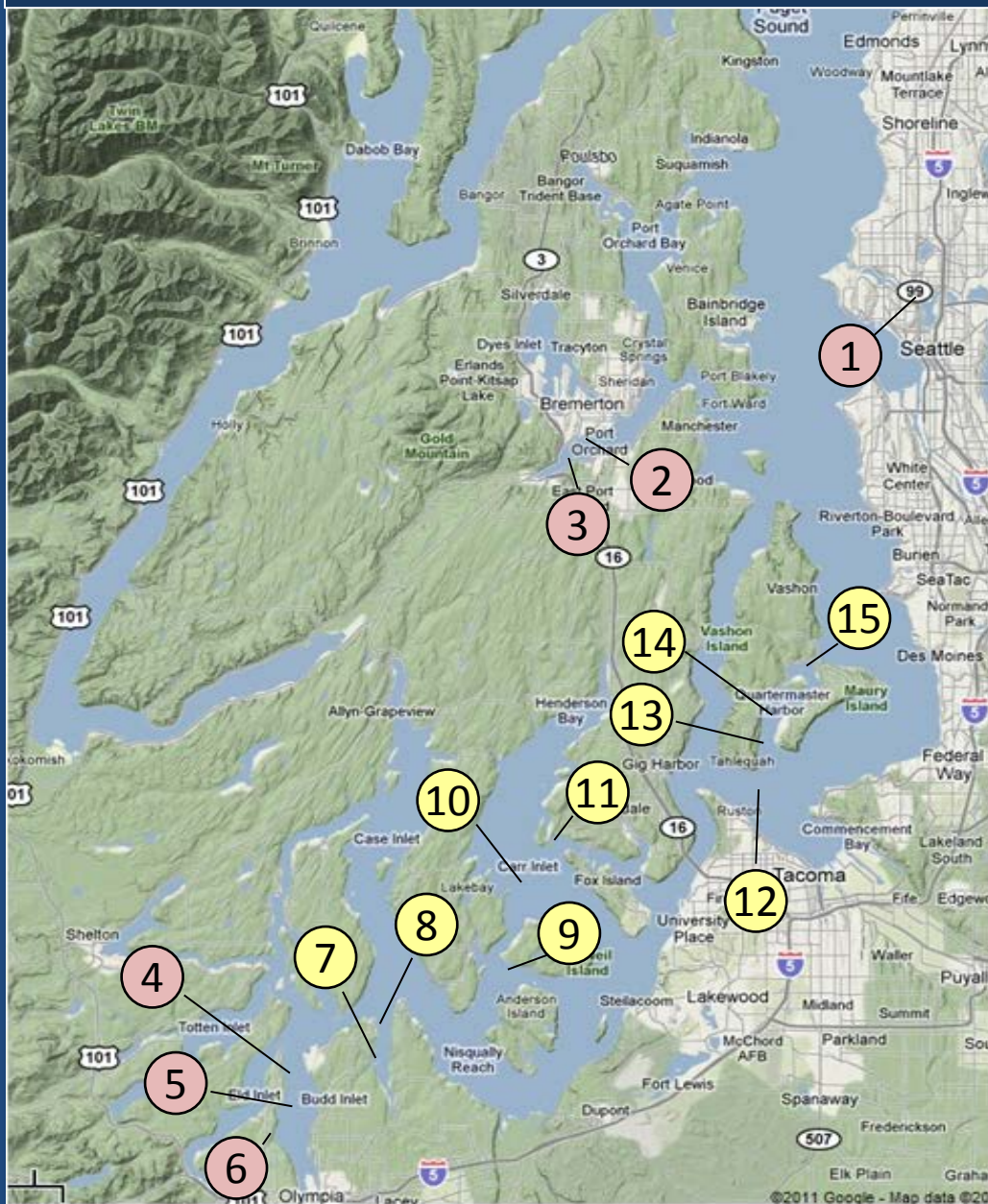


Debris:

Abundant and large in inlets of South Sound, Commencement Bay, and Quartermaster Harbor

[2](#) [3](#) [4](#) [6](#) [8](#) [9](#) [10](#) [12](#) [13](#)

High tides: 12:35 PM, 11:19 PM; Low tides: 4:52 AM, 7:05 PM



Aerial photography navigation guide, 10-8-2012



Click on numbers

Flight Information:

- **Morning flight:**
Low visibility, calm, flooding
- **Afternoon flight:**
Intermediate visibility, calm, flooding

Observation Maps:

Central Sound

South Sound

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Oil sheen. Location: Seattle, Lake Union, 8:36 AM



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Red-brown algal bloom and debris. Location: Bremerton, Sinclair Inlet, 8:46 AM



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Teri King from Sound Toxins Program provided wonderful coordination for on the ground support.

The Story: A WSG agent in Kitsap County, **Jeff Adams**, took a sample from Sinclair Inlet. **Karlista**, a SoundToxins volunteer determined the dominant species of the bloom shortly after. The dominant species is *Akashiwo sanguinea*



Red-brown algal bloom and debris. Location: Bremerton, Sinclair Inlet, 8:46 AM



Field log

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Moorings



Jellyfish aggregating in long lines. Location: Budd Inlet (South Sound), 9:06 AM



Field log

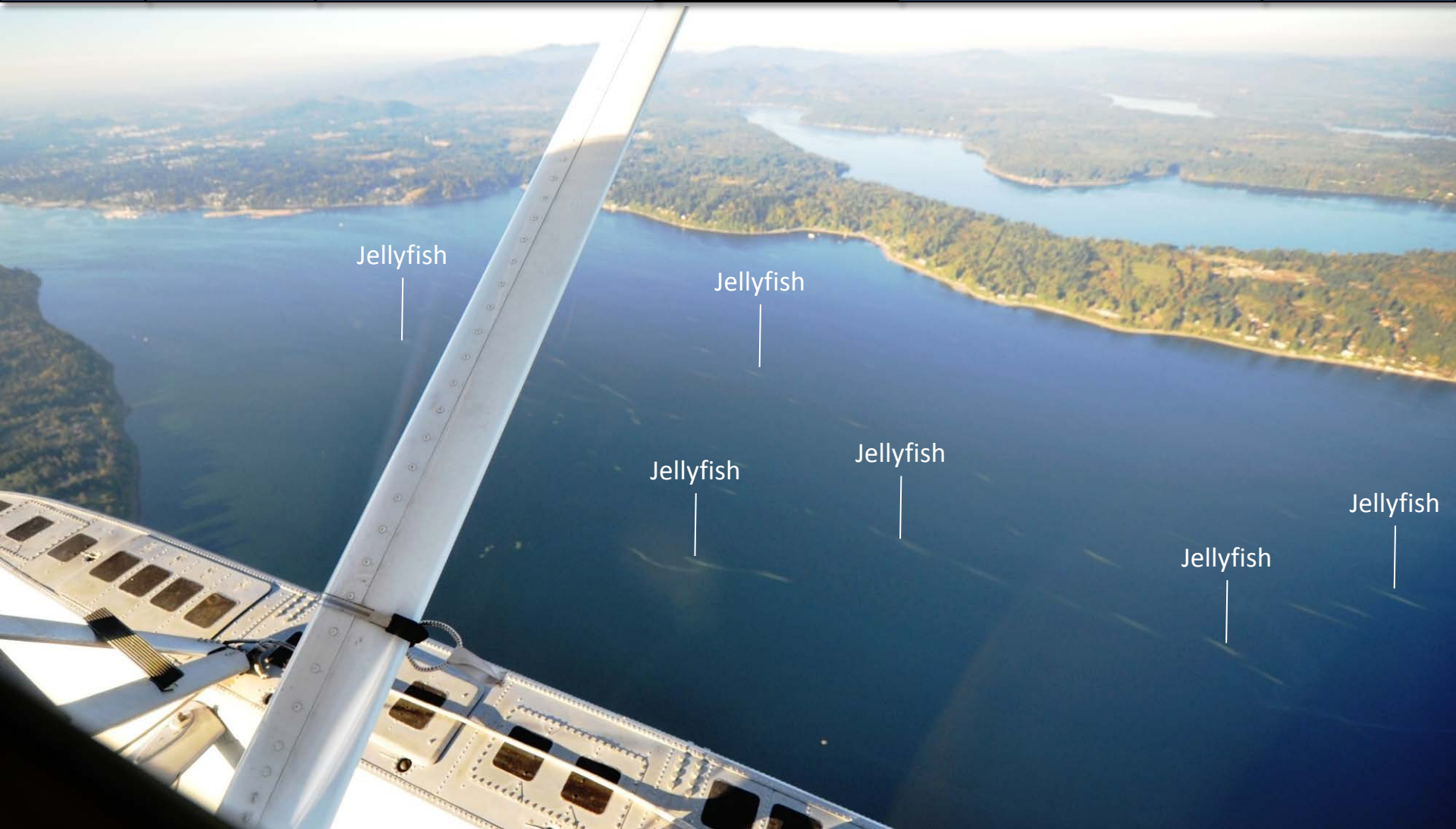
Weather

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Moorings



Jellyfish aggregating in long lines. Location: Budd Inlet (South Sound), 9:06 AM



Field log

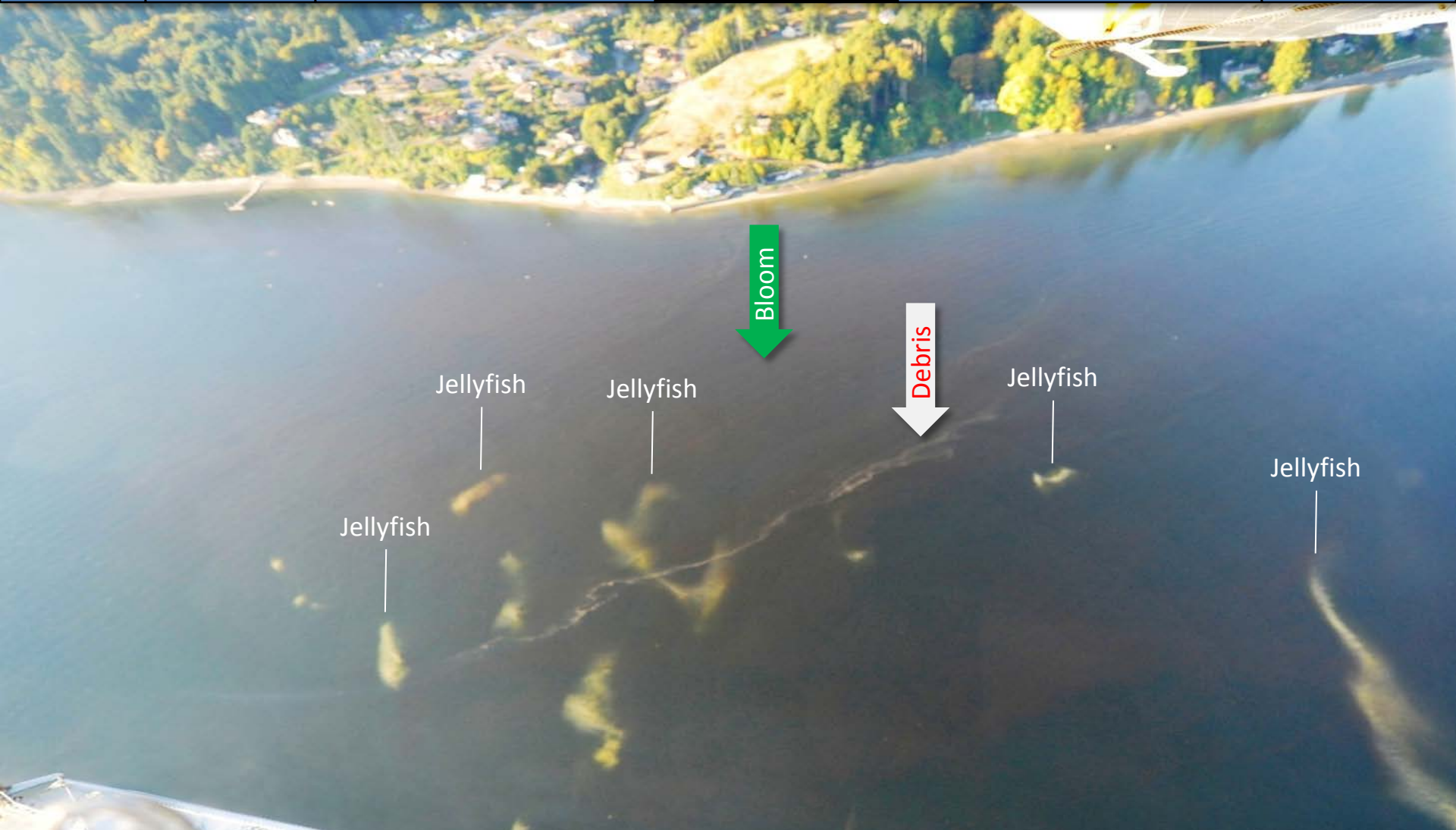
Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Patches of jellyfish and red-brown algae bloom. Location: Budd Inlet (South Sound), 9:11 AM



Field log

Weather

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Red-brown algal bloom. Location: Henderson Inlet (South Sound), 4:26 PM



Field log

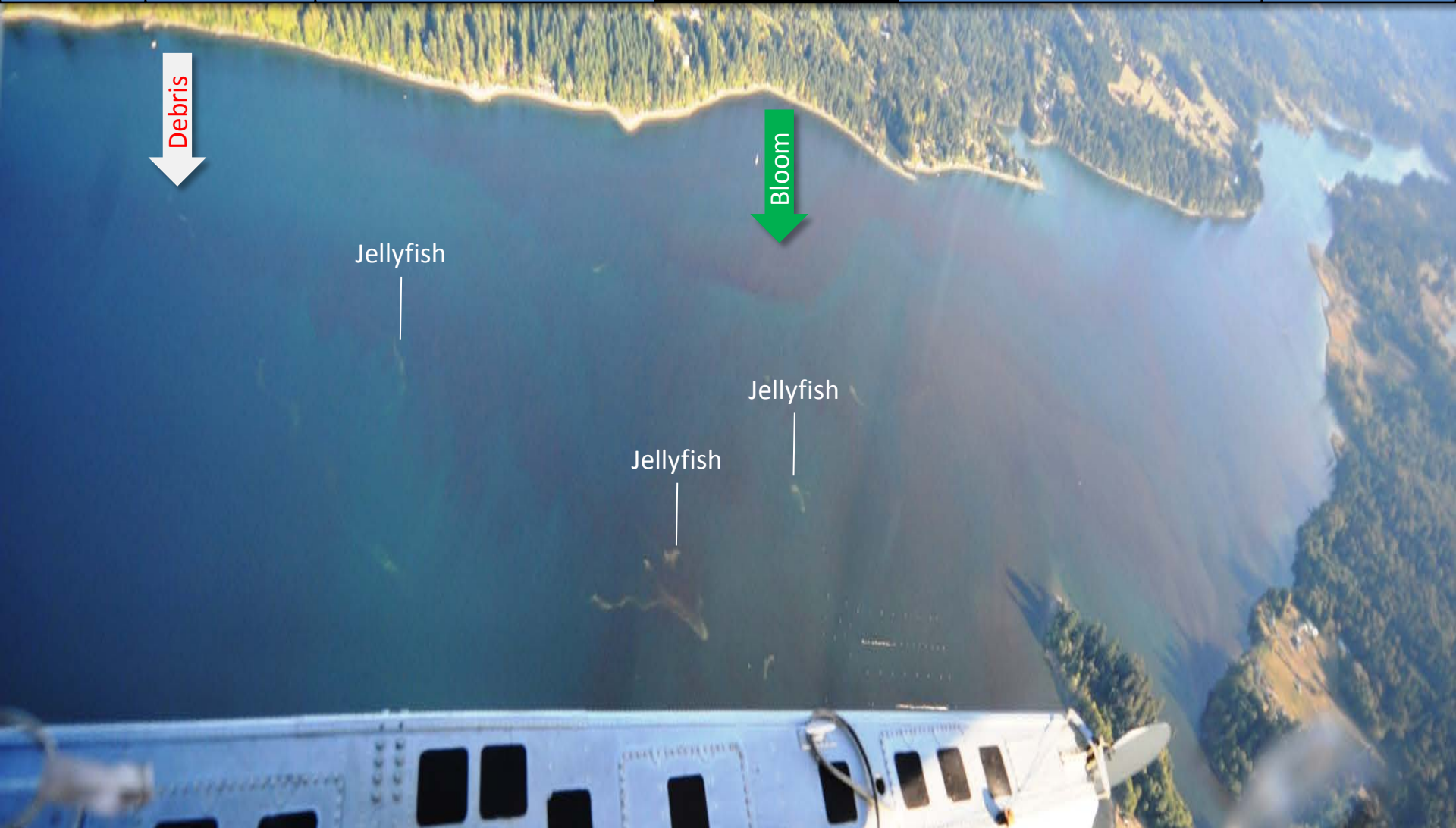
Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Patches of jellyfish and red-brown algae bloom.
Location: Henderson Inlet (South Sound), 4:26 PM



Field log

Weather

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Front and debris line. Location: McNeil Island (South Sound), 4:30PM



Field log

Weather

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Aerial photos

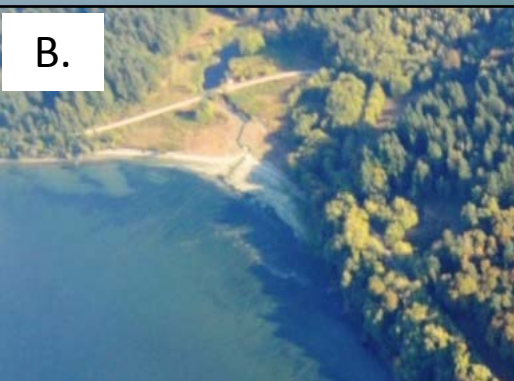
Ferry and Satellite

Moorings

A.

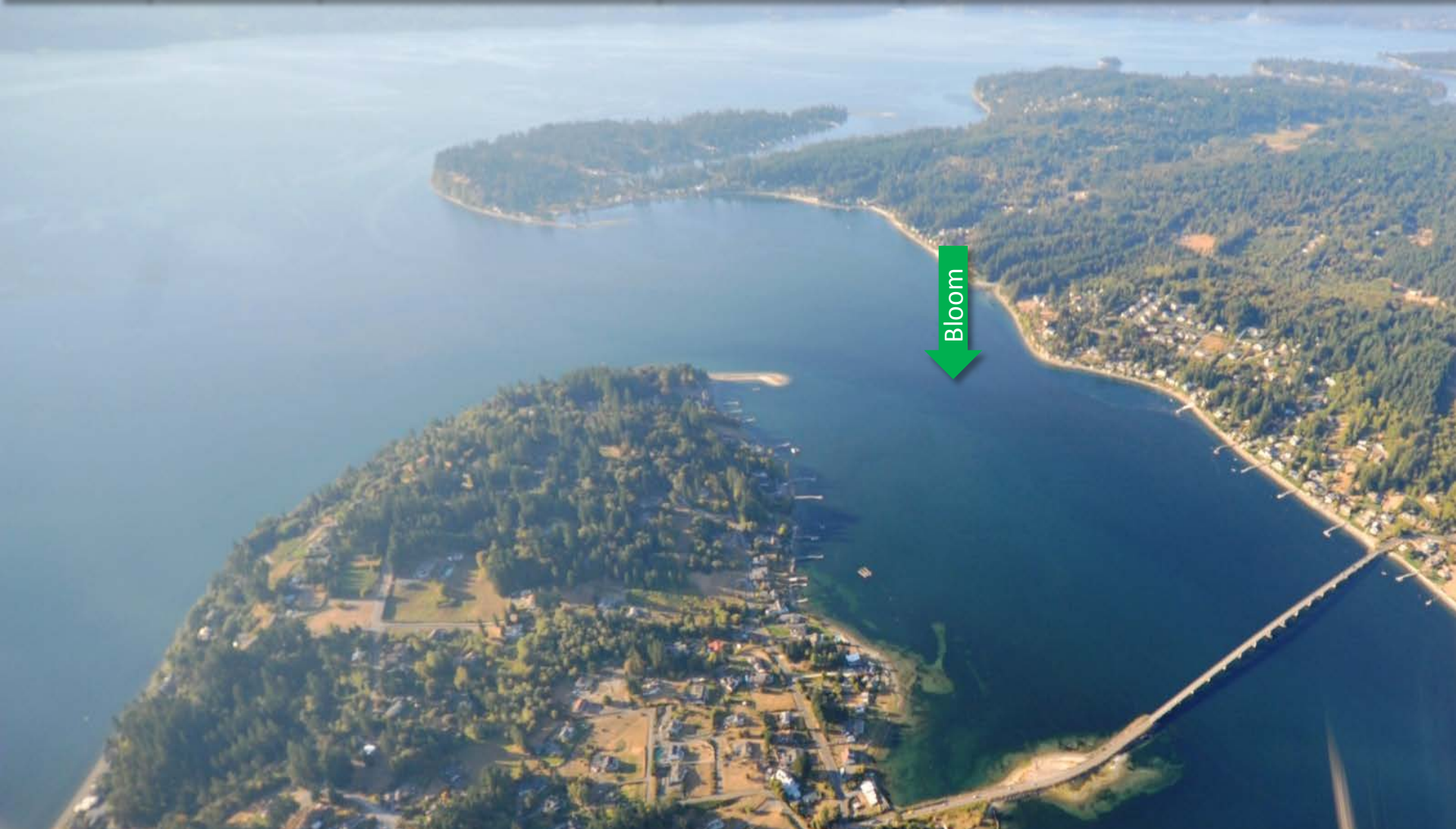


B.



Water masses meet and debris patches (A) accumulate and wash ashore at McNeil Island (B).

Location: Carr Inlet (South Sound), 4:32 PM

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Water with red-brown algal bloom flowing around western tip of Fox Island.

Location: Fox Island (South Sound), 4:33 PM

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Debris patch and weak Puyallup river plume.
Location: Commencement Bay (Central Sound), 4:37 PM



Field log

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Red-brown algae bloom, front, and debris lines.

Location: Quartermaster Harbor (Vashon Island), 4:39 PM



Field log

Weather

Water column

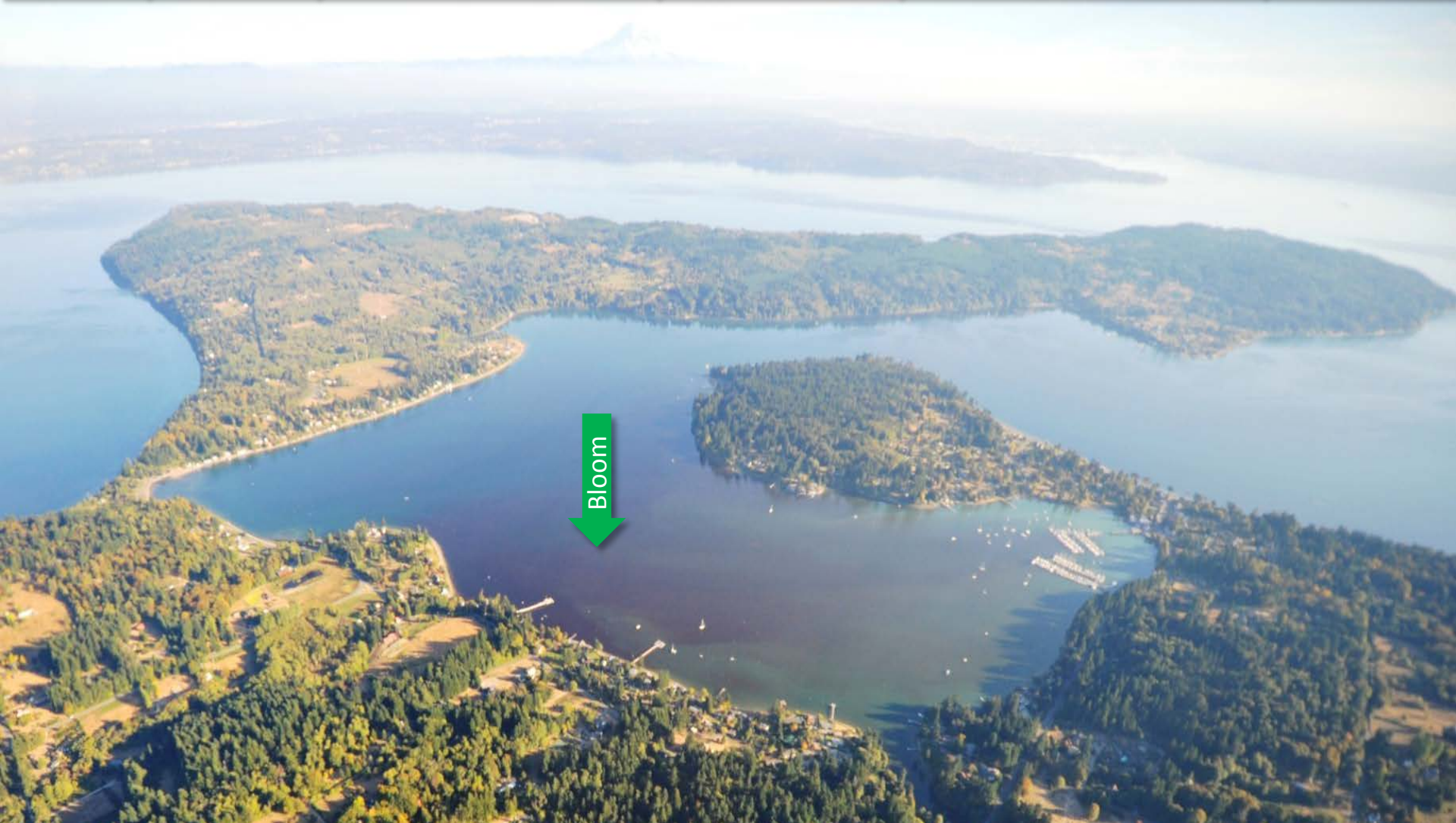
Aerial photos

Ferry and Satellite

Moorings



Red-brown algae bloom. Location: Quartermaster Harbor (Vashon Island), 4:39 PM

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Red-brown and turquoise algae bloom.

Location: Quartermaster Harbor (Vashon Island), 4:40 PM

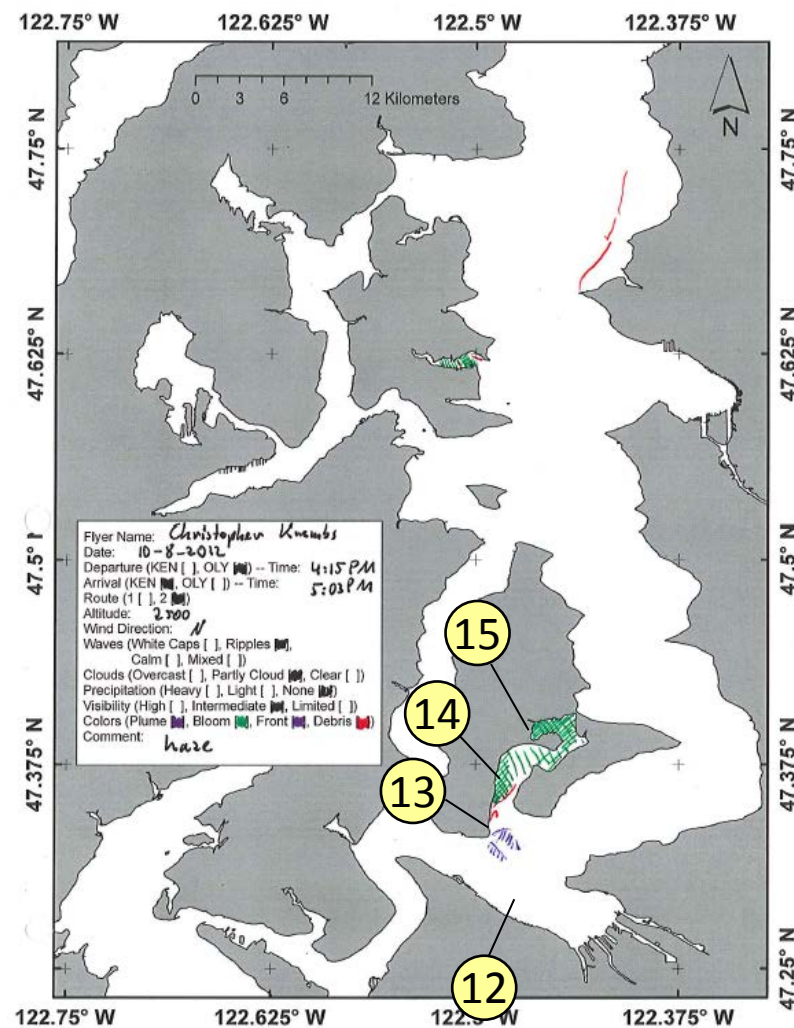
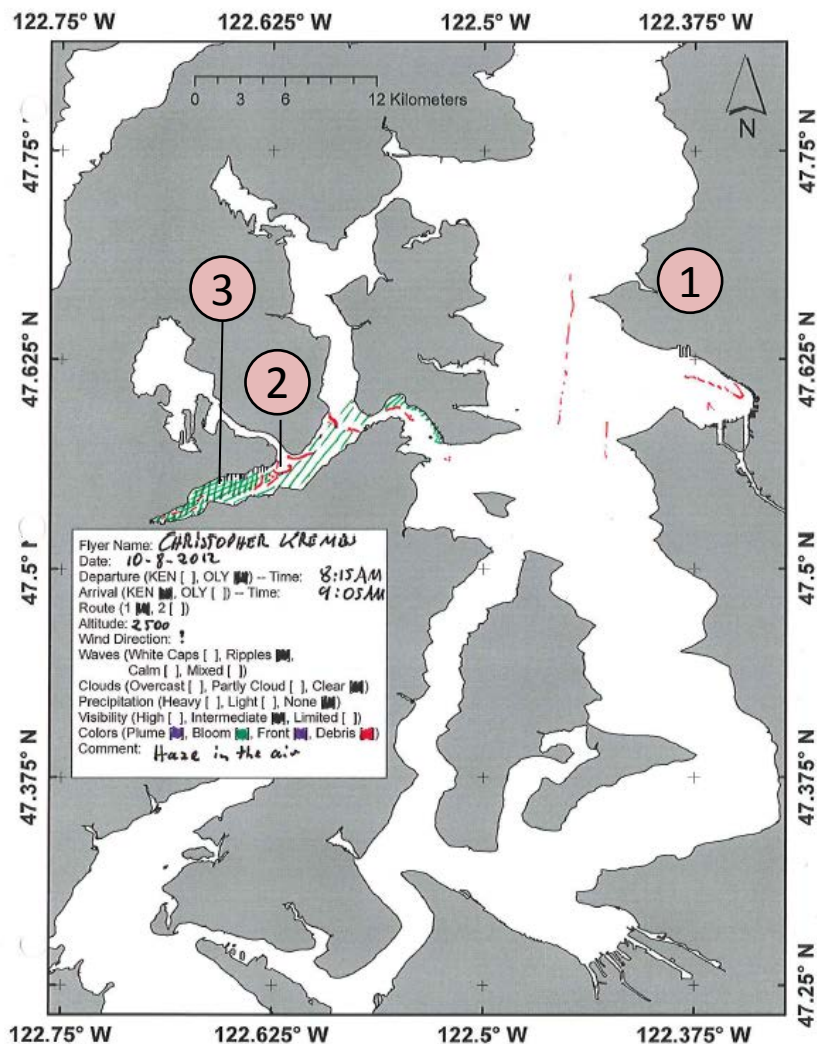
Aerial photography observations in Central Sound

[Navigate](#)

Morning

Date: 10-08-2012

Evening



Numbers on map refer to picture numbers for spatial reference



Navigate

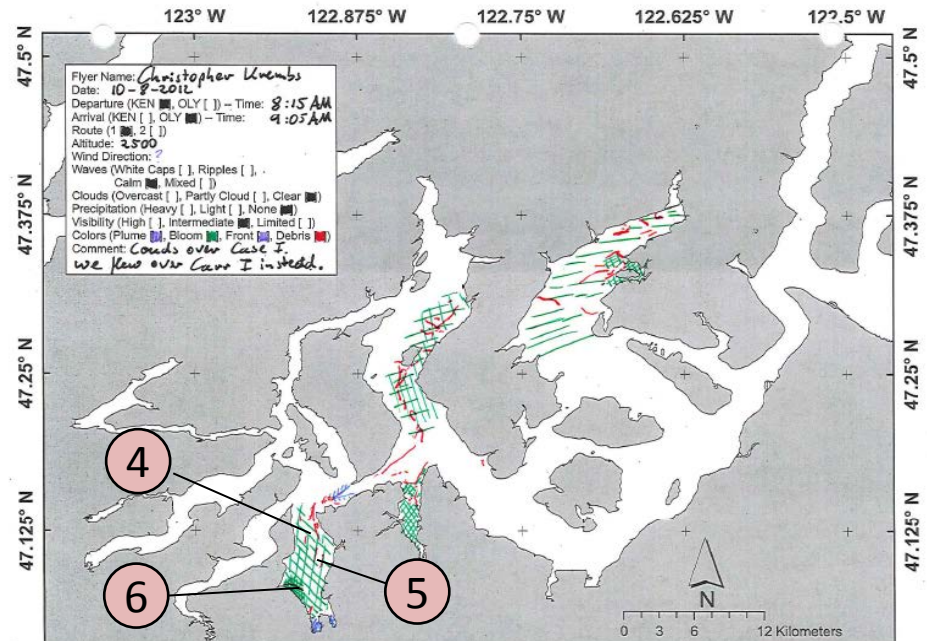
Aerial photography

Observations in
South Sound:
10-08-2012

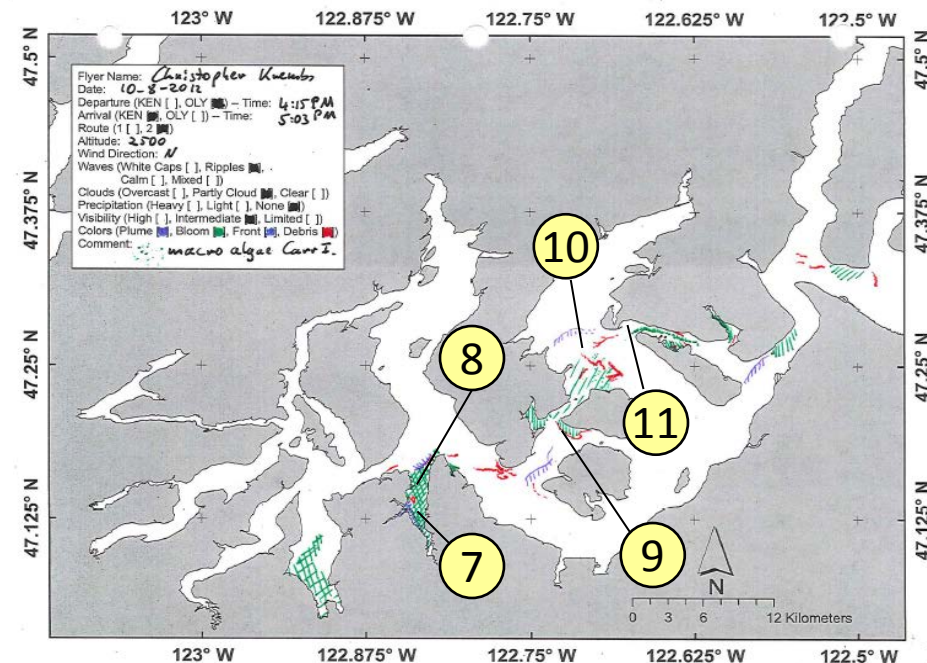


Numbers on map refer to picture numbers for spatial reference

Morning



Evening





Field log










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Moorings

Plumes	
• Freshwater with sediment solid	
• Freshwater with sediment dispersed	
• Coastal erosion with sediment	
Blooms	
• Dispersed	
• Solid	
Debris	
• Dispersed	
• Solid	
Front	
• Distinct water mass boundaries	
• Several scattered	

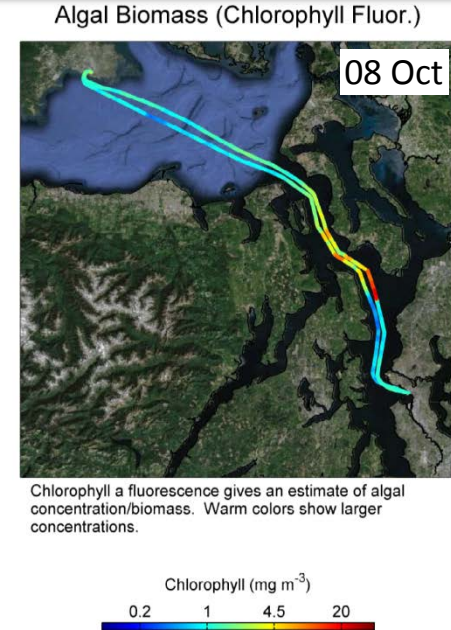
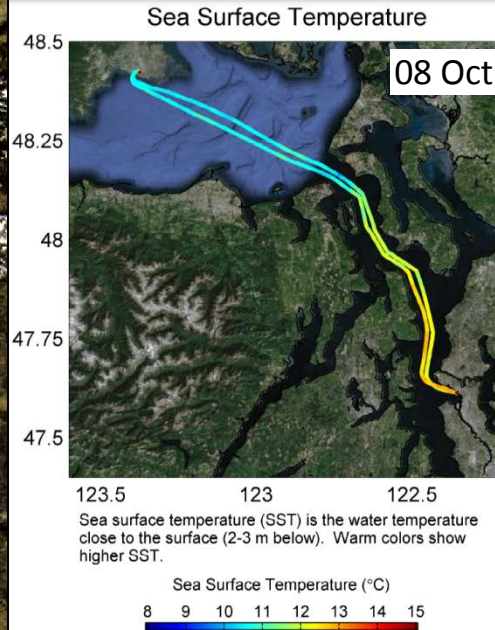
Comments:

Maps are produced by observers during and after flights. They are intended to give an approximate reconstruction of the surface conditions on scales that connect to and overlap with satellite images in the section that follows.

Debris: Debris can be distinguished into natural and anthropogenic debris *sensu* Moore and Allen 2000. The majority of debris in Puget Sound is natural mixed with discarded man made pieces of plastic, wood etc. From the plane we can't differentiate the quality of debris at the surface and therefore call it for reasons of practicality just "debris".

S.L. Moore, M. J. Allen. 2000. Distribution of Anthropogenic and Natural Debris on the Mainland Shelf of the Southern California Bight. Marine Pollution Bulletin, 40(1), 83-88.

Contact: brandon.sackmann@ecy.wa.gov



Current Conditions: Low to moderate fluorescence from Triple Junction through Admiralty Inlet. Temperatures in Puget Sound and Strait of Juan de Fuca range 10-13°C, near-surface salinity >29.5 PSU.

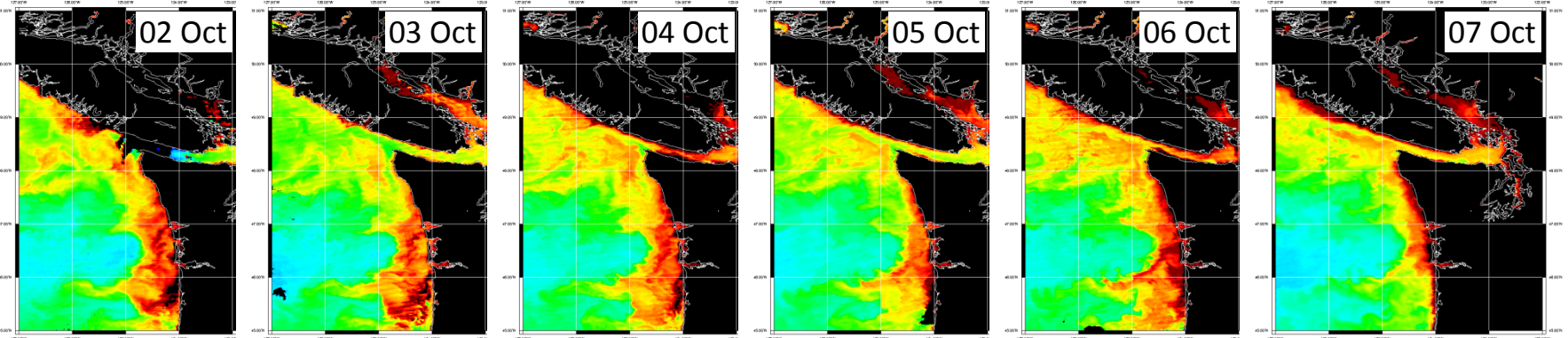
--- Daily 'Quick-Look' Products Available ---

http://www.ecy.wa.gov/programs/eap/mar_wat/eops/clipper.html



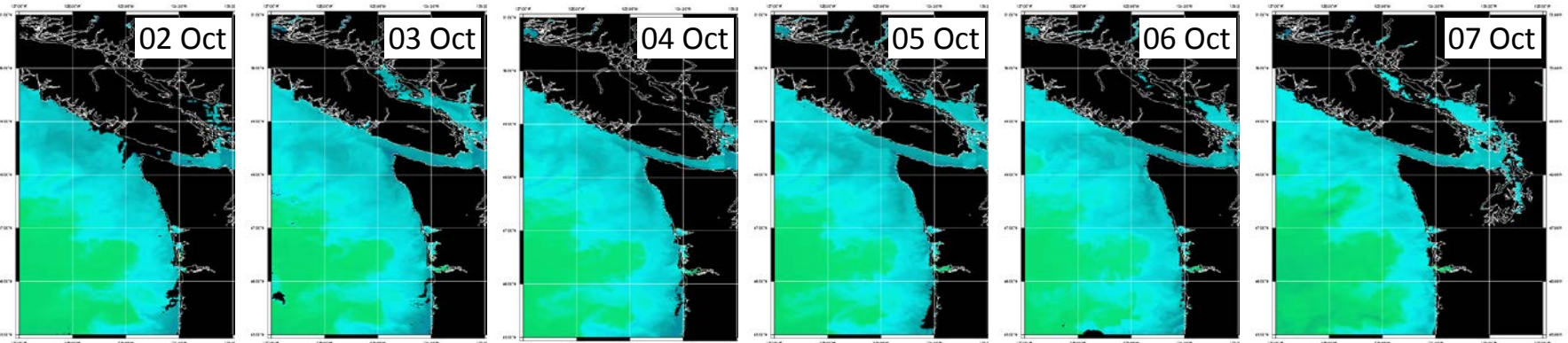
Clear skies provide rare, cloud-free insight into upwelling dynamics on the Washington continental shelf!

Chlorophyll a (Chl)



Chlorophyll Concentration ($\mu\text{g}/\text{m}^3$)

Sea Surface Temperature (SST)



Sea Surface Temperature ($^{\circ}\text{C}$)



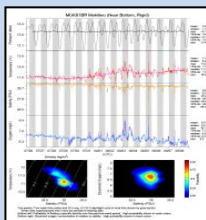


Summary: While dissolved oxygen decreased overall in Whidbey Basin (by 0.7 mg/L), an algal bloom appears to have occurred during the first few days of October. The effects of the recent dry weather spell and lack of freshwater input are continuing to show in the mooring data.

Mukilteo, Whidbey Basin near Everett:

Mukilteo Dissolved Oxygen Conditions (12-16 m)

DO Max	11.1 mg/L	on 10/2	at 28.5 PSU	13.0 C	13.0 db
DO Min	4.7 mg/L	on 10/4	at 29.9 PSU	11.2 C	13.9 db
DO Avg	5.7 mg/L				
DO Trend	-0.7 mg/L				
DO-Sal Corr	-0.78				
DO-Temp Corr	0.84				



Real-time data online (click)

Mukilteo Salinity (Sal) Conditions (12-16 m)

Sal Max	30.1 PSU	on 10/6	at 11.5 C	14.6 db
Sal Min	28.1 PSU	on 9/29	at 12.8 C	13.4 db
Sal Avg	29.6 PSU			
Sal Trend	+0.2 PSU			

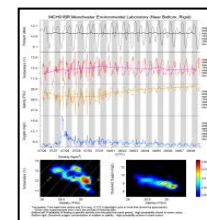
Mukilteo Temperature (T) Conditions (12-16 m)

T Max	13.1 C	on 10/2	at 28.5 PSU	12.9 db
T Min	11.1 C	on 10/4	at 29.7 PSU	12.9 db
T Avg	11.6 C			
T Trend	-0.7 C			

Manchester, near Clam Bay:

Manchester Dissolved Oxygen Conditions (8.6-12.7 m)

DO Max	8.0 mg/L	on 10/3	at 29.9 PSU	12.7 C	11.2 db
DO Min	5.8 mg/L	on 10/3	at 30.0 PSU	12.1 C	11.4 db
DO Avg	6.6 mg/L				
DO Trend	No trend				
DO-Sal Corr	-0.66				
DO-Temp Corr	0.86				



Real-time data online (click)

Manchester Salinity (Sal) Conditions (8.6-12.7 m)

Sal Max	30.0 PSU	on 10/7	at 12.0 C	12.1 db
Sal Min	29.7 PSU	on 9/24	at 13.1 C	9.4 db
Sal Avg	29.9 PSU			
Sal Trend	+0.2 PSU			

Manchester Temperature (T) Conditions (8.6-12.7 m)

T Max	13.2 C	on 9/26	at 29.7 PSU	9.8 db
T Min	12.0 C	on 10/7	at 30.0 PSU	12.1 db
T Avg	12.5 C			
T Trend	-0.4 C			

Mooring observation and trends

9-24-2012 to 10-7-2012



Field log

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Ferry and Satellite

Moorings

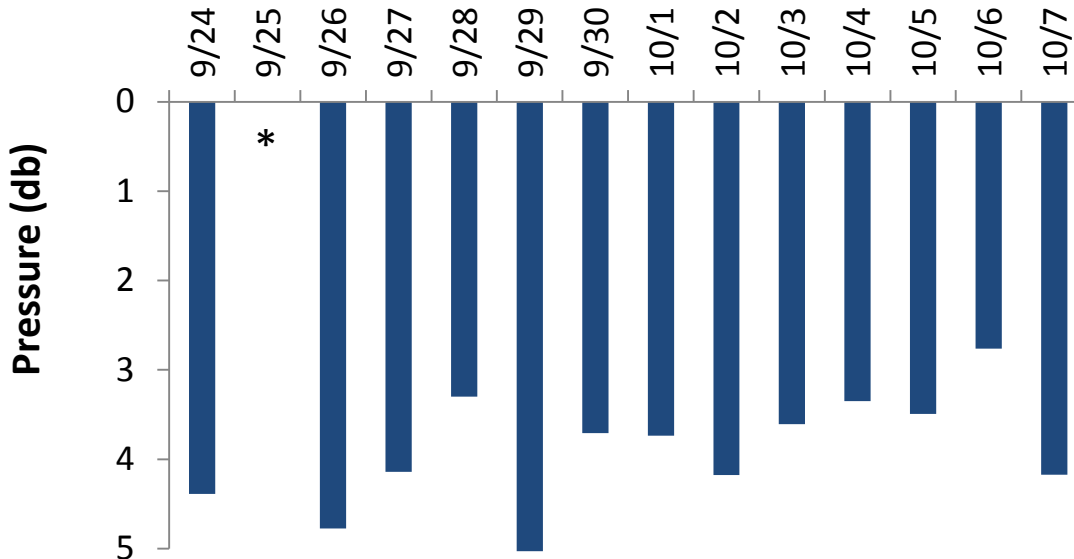


Go to our mooring site at: http://www.ecy.wa.gov/programs/eap/mar_wat/moorings.html

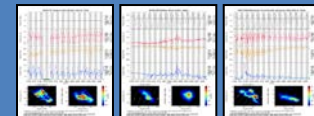
Summary: The prolonged dry weather and lower river flows are leading to a decreased thickness and strength of the freshwater layer in Possession Sound (Whidbey Basin).

This month we report on thickness of the fresh water layer by monitoring our near-surface sensor. The pycnocline is often near the surface sensor (*).

Daily average depth of the 28.55 isohaline at Mukilteo



We track the depth of the isohaline where salinity is 28.55 (± 0.05) to measure the thickness of the freshwater layer at our Mukilteo station. The near-surface sensor experienced tidal pressure variations of 1.3 to 5.3 meters (or dbar).



Real-time data online (click)



Field log

Weather

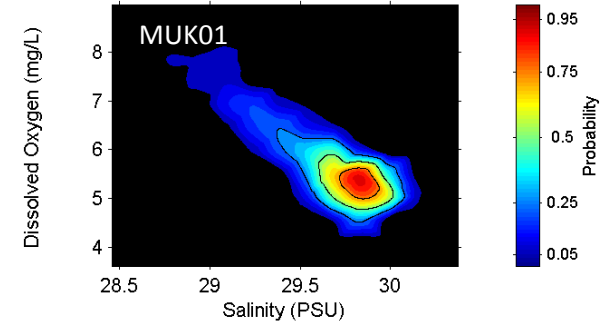
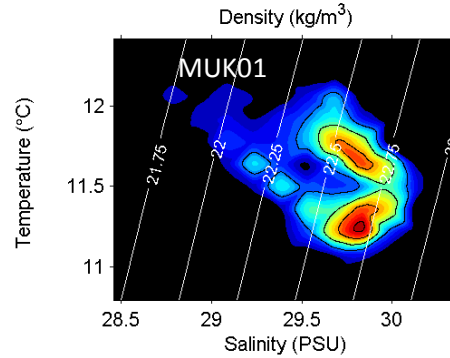
Water column

Aerial photos

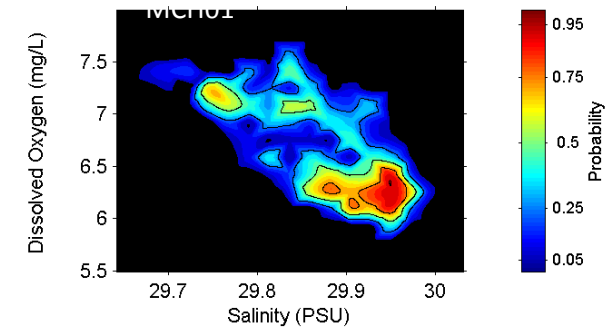
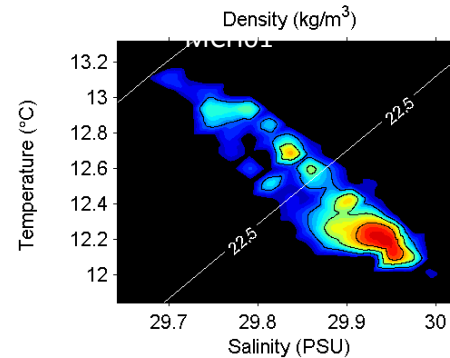
Ferry and Satellite

Moorings

Change in DO (mg/L) over last 2 weeks



At Mukilteo, two principal water masses were observed. Lowest dissolved oxygen concentrations occurred with the water mass of lower temperature.



At Manchester and Mukilteo, salinity continues to increase.

Left Panel: Probability of finding a specific density over the past two-week period. High probability shown in warm colors.

Right Panel: Dissolved oxygen concentration in relation to salinity. High probability shown in warm colors.

Get data from Ecology's Monitoring Programs



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Long-Term Monitoring Network

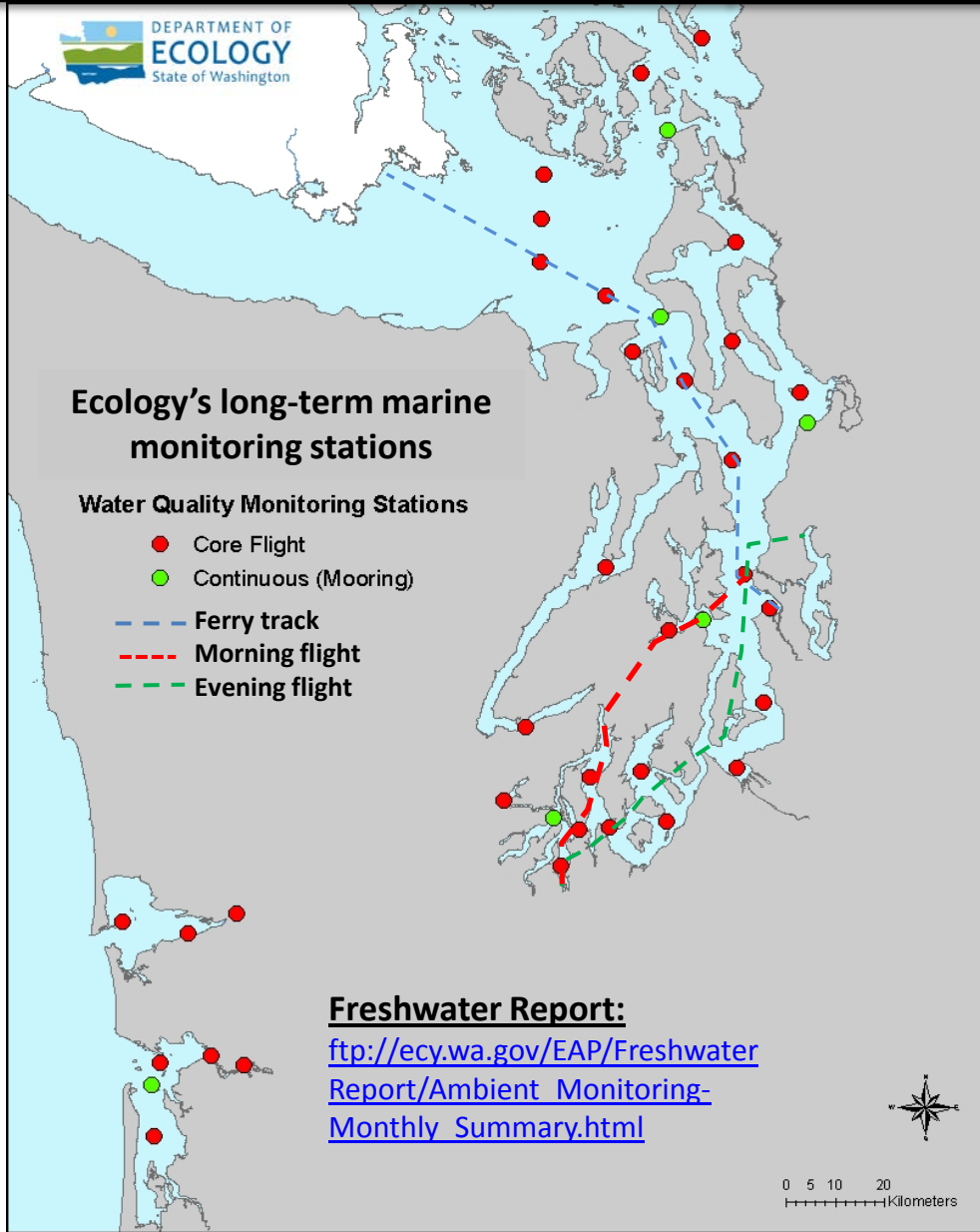


christopher.krems@ecy.wa.gov



Access core monitoring data:

<http://www.ecy.wa.gov/apps/eap/marinewg/mwdataaset.asp>



Real-Time Sensor Network



brandon.sackmann@ecy.wa.gov



Access mooring data:

http://www.ecy.wa.gov/programs/eap/mar_wat/moorings.html

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>



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We are looking for feedback to improve our products.

Dr. Christopher Krembs

ckre461@ecy.wa.gov

**Marine Monitoring Unit
Environmental Assessment Program
WA Department of Ecology**