



# Eyes Over Puget Sound

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

## Surface Conditions Report October 17, 2011

[Start here](#)[Start here](#)

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

## Present Conditions at a Glance

*Mya Keyzers  
Laura Friedenberg*



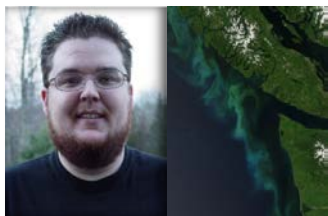
*Skip Albertson*



*Dr. Christopher  
Krembs*



*Dr. Brandon  
Sackmann*



*David Mora*



Personal flight impression

[p. 3-4](#)

First fog then skies are clear,  
the pattern shows that fall is here!

Weather conditions

[p. 5](#)

Warm afternoons with colder nights make cooler-  
than-normal conditions; sunlight stronger in the  
north.

Aerial photography

[p. 7-26](#)

Brown-red blooms in Carr Inlet and Budd Inlet.  
Green bloom near Squaxin Island.

Ferry and satellite

[p. 27-32](#)

Temperatures decrease and blooms fade as the  
summer growing season comes to an end.

*In-situ* mooring data

[p. 32-33](#)

Dissolved oxygen trends still vary  
geographically.



Mya collecting samples

## Fog and Clear Skies



Pilot Kevin Thomson, Kenmore Air

## Marine Flight 1 (Coast)

October is usually the foggiest month of the year, and we were effected by it the morning of the Coast flight. Patchy fog over the South Sound delayed us, but as soon as our pilot landed in Olympia, we were on our way to the coast. When we arrived there, skies were clear and cloudless, and much to our surprise the temperature was warm. Our first stop was Grays Harbor, where there was a distinct brown river plume that reached far into the middle of the harbor.

While we were flying along the coast to Willapa Bay, we watched surfers and beachcombers enjoying the beautiful weather. We also saw patches of brown algae in the surf. In Willapa Bay we saw a few flocks of snow geese flying around.

At the end of our flight, we flew past the Capital building for our landing in Budd Inlet. We got an aerial view of people camping out near the capital as part of the Occupy Olympia movement. The flight went quickly and smoothly, and we were happy to be out on such a nice day!



# Personal flight impression 10-17-2011



Field log

Weather

Water column

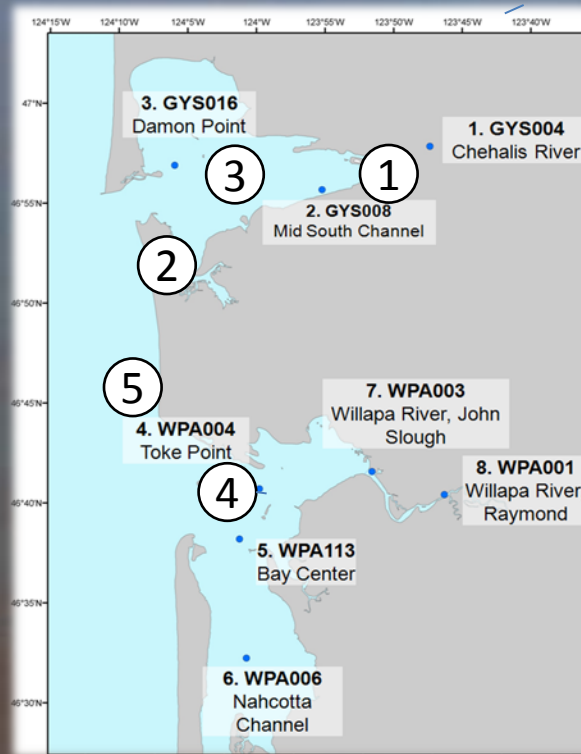
Aerial photos

Ferry and Satellite

Moorings



*River Plume in Grays Harbor*



*Occupy Olympia Movement*



*Brown Algae on the Coast*



*Tide Line in Grays Harbor*



*Clear Skies and River Plume in Willapa Bay*





# Weather of the last two months 10-17-2011

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

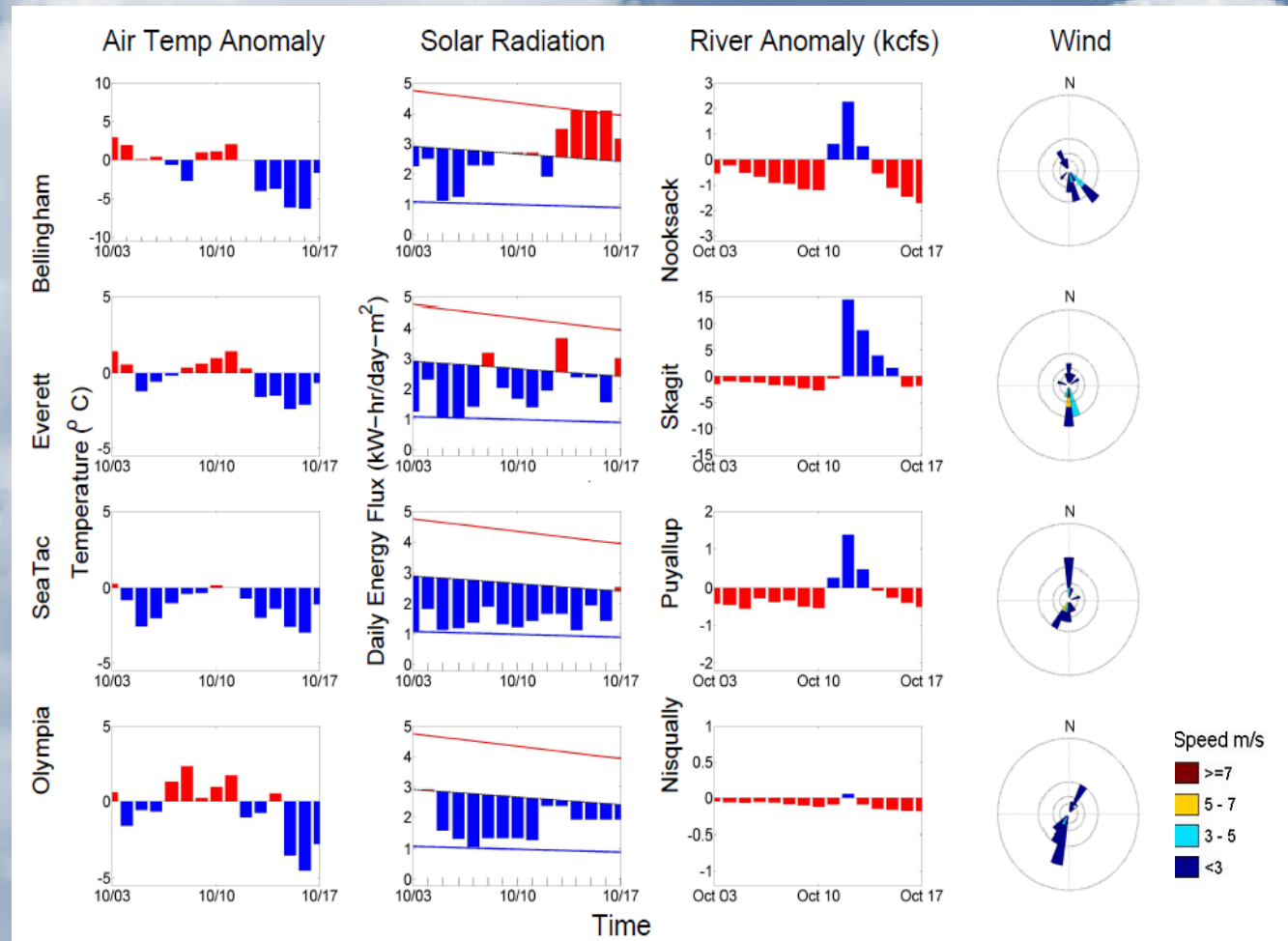
**Meteorological conditions typically explain up to half of the variance in observed marine variables** (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. I summarized the specific conditions prevalent during the past two weeks, from north to south, below.

## Summary:

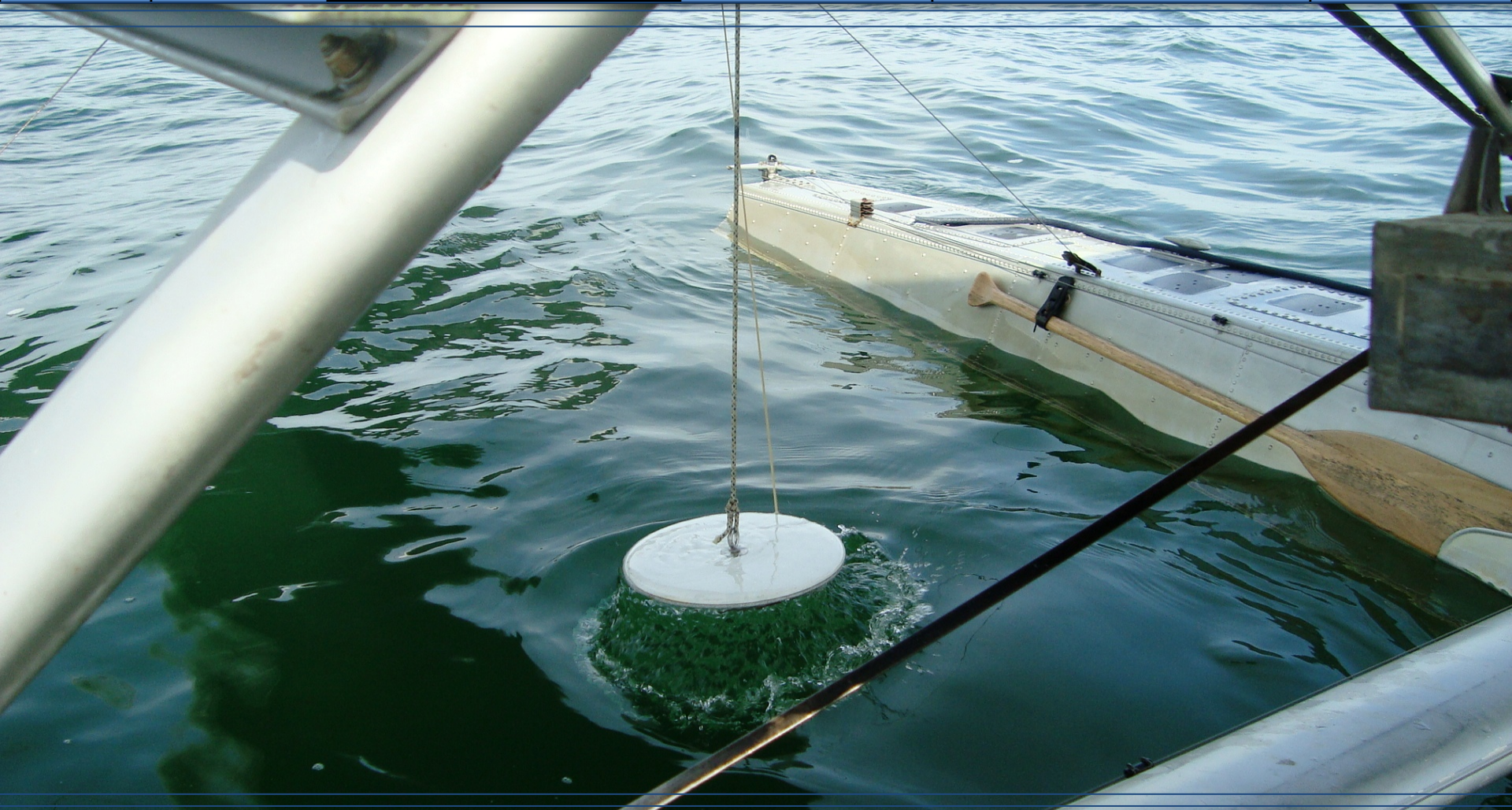
**Air temperatures** during the past few days have been cooler than average, with warm afternoons but colder nights. Light availability has been higher to the north and inland.

**Coastal and northern rivers** have been running lower than normal, except in Central Sound where the Puyallup and Skagit had higher flows last week.

**Winds** have been from predominantly the north, with southerlies last week.



# Water conditions of the previous month

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

## Section is currently in development:

We will present CTD measurements from our Marine Flight Program and discuss observations in the temporal context of Ecology's Long-Term Marine Monitoring data. The focus will rest on anomalies of physical and optical variables throughout the water column.





# Aerial Photography, Summary 10-17-2011

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

Comment: Red-brown blooms in Budd Inlet, Carr Inlet and other South Sound bays. Jelly fish in Budd Inlet (resembles conditions of 10-17-2011)

--- **Start** exploring aerial observations and click **here!** ---

Red-brown bloom and jelly fish, Budd Inlet



Cloud banks affected flight route!

Front

## Mixing and Fronts:

Dana Passage, clear water surfacing on western side

Plume

## Suspended sediment:

No observations

Bloom

## Visible blooms:

**Brown-red:** Budd Inlet, Carr Inlet (north west side)

**Green:** North of Squaxin Island

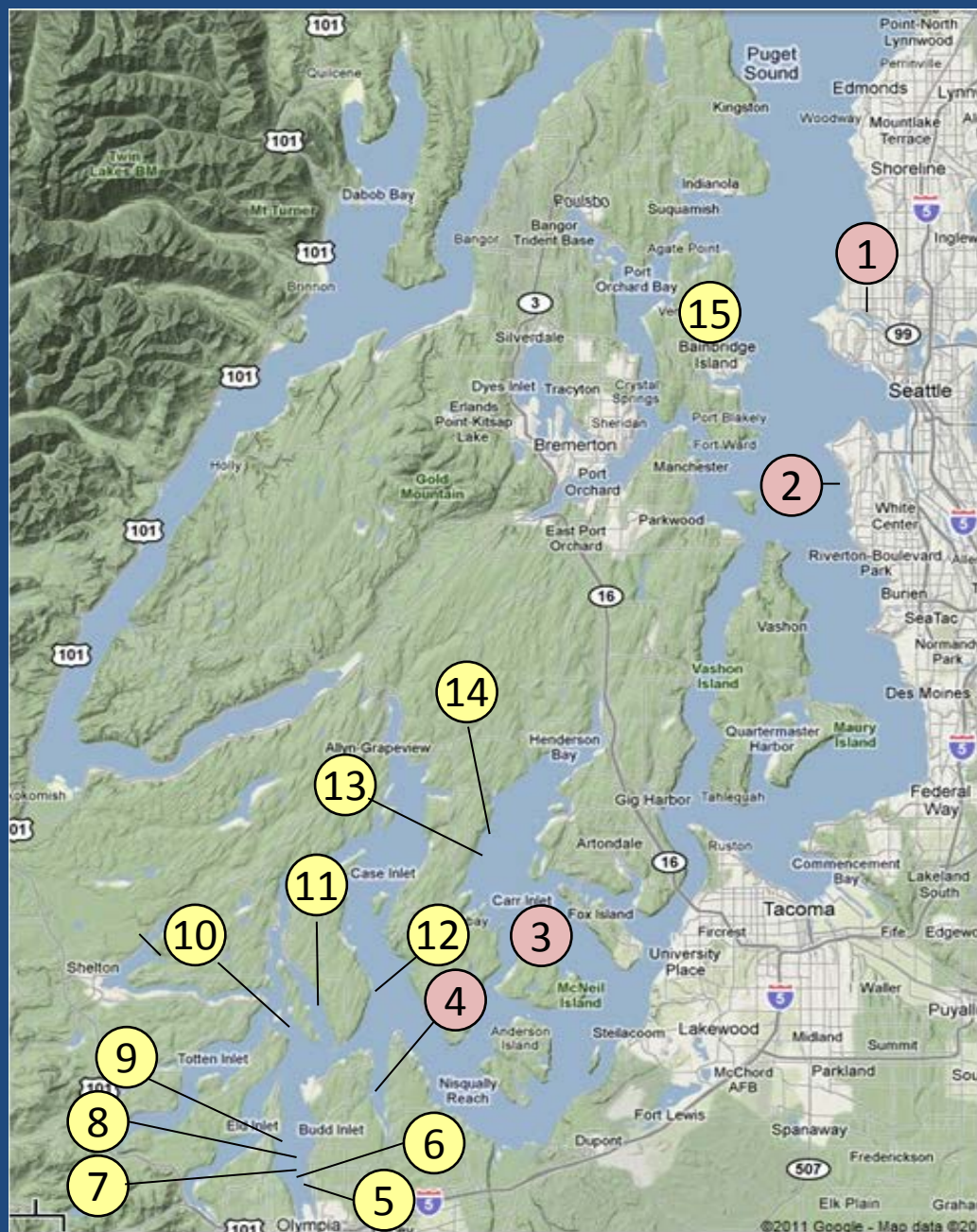
**Turquoise :** Budd Inlet south end

Debris

## Debris

Some filaments in South Sound. Central basin clear





# Aerial Photography Image guide 10-17-2011



## Click on numbers

- Morning Flight
- Evening Flight

## Flight Information:

Morning flight:

Low clouds, altitude 1000ft, no wind  
(visibility limited, dark)

Evening flight:

Cloud banks affected flight route  
Visibility limited, altitude 2500ft

Observational maps Central Sound

Observational maps South Sound



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

Urban waterways. Location: Seattle, Fremont and Ballard, 10:09 AM



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

Recovery activity around sunken barge. Location: West Seattle, 10:14 AM



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

What a magnificent place we live in! Location: Above Carr Inlet (South Sound), 10:31 AM



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Blooming activity seen between clouds. Location: Henderson Inlet (South Sound), 10:32 AM

Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Red-brown bloom. Location: Budd Inlet (South Sound), 4:20 PM





Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Red-brown bloom with abrupt transition and surface debris. Location: Budd Inlet (South Sound), 4:21 PM



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Red-brown bloom, and surface debris. Location: Budd Inlet (South Sound), 4:21 PM



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Red-brown bloom, surface debris. Location: Budd Inlet (South Sound), 4:23 PM





Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Jellyfish aggregations, see sailboat for scale. Location: Budd Inlet (South Sound), 4:24 PM



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Surface debris filament. Location: Squaxin Passage (South Sound), 4:30 PM





Field log

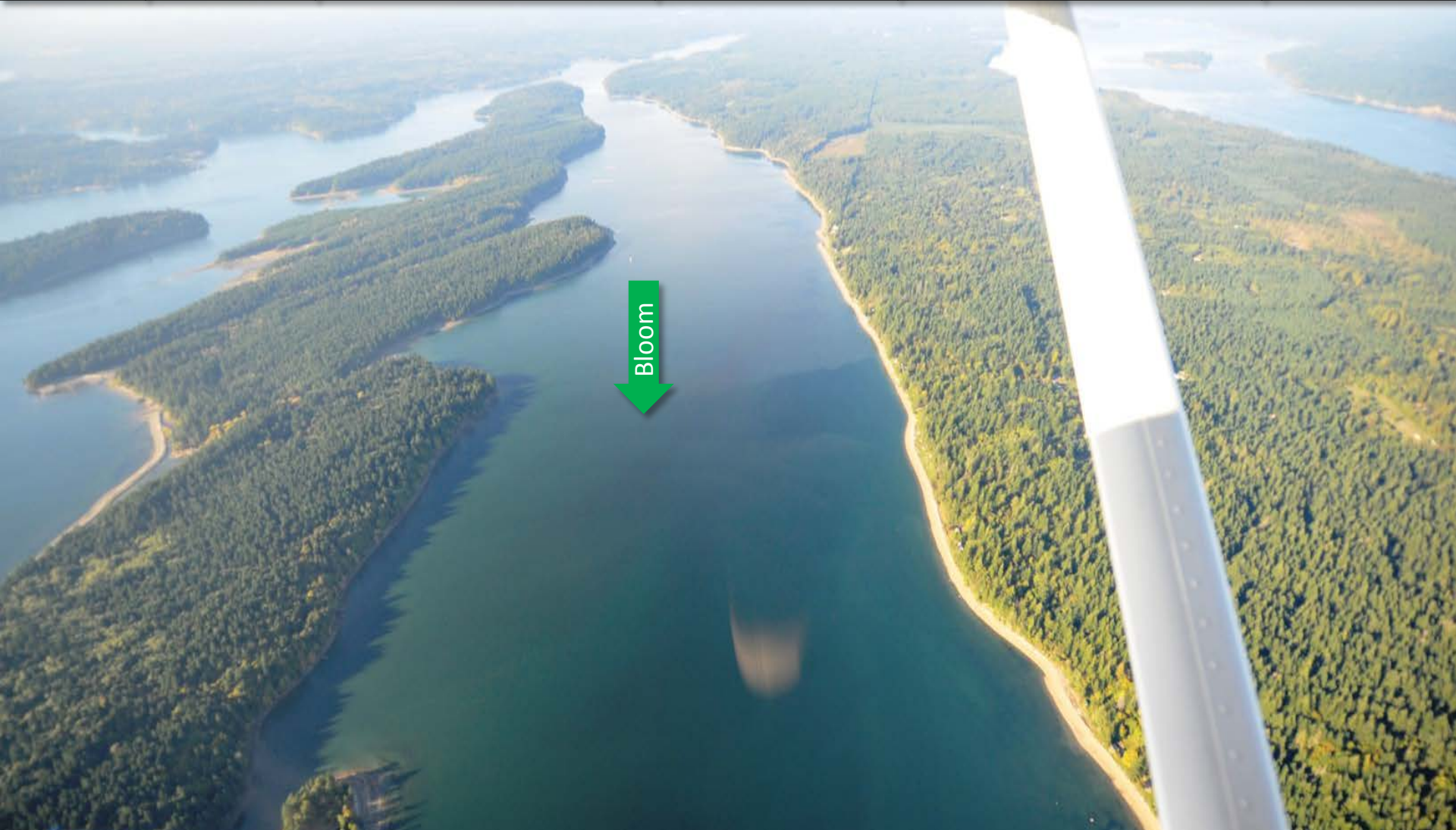
Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Algae bloom. Location: Next to Squaxin Island (South Sound), 4:30PM



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

Clear water surfacing in Dana Passage. Location: Dana Passage, across Henderson Island (South Sound), 4:31 PM



Field log

Weather

Water column

Aerial photos

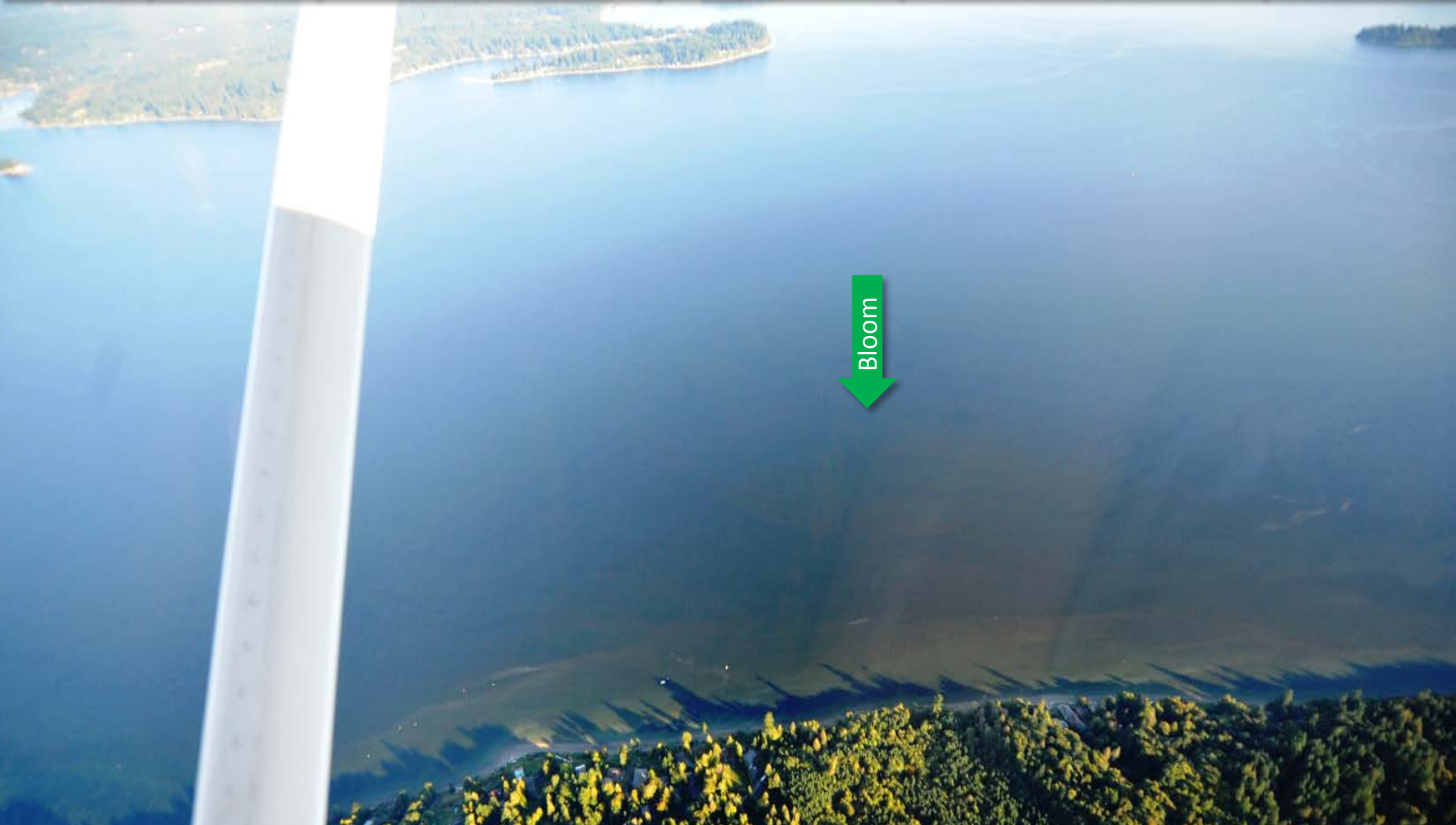
Ferry and Satellite

Moorings



Red-Brown bloom. Location: Carr Inlet (South Sound), 4:38 PM



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

Red-Brown bloom. Location: Carr Inlet (South Sound), 4:38 PM

15

# Aerial photography



Navigate

Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Clear condition. Location: From Bainbridge Island into Elliott Bay, Seattle (Central Sound), 4:54 PM



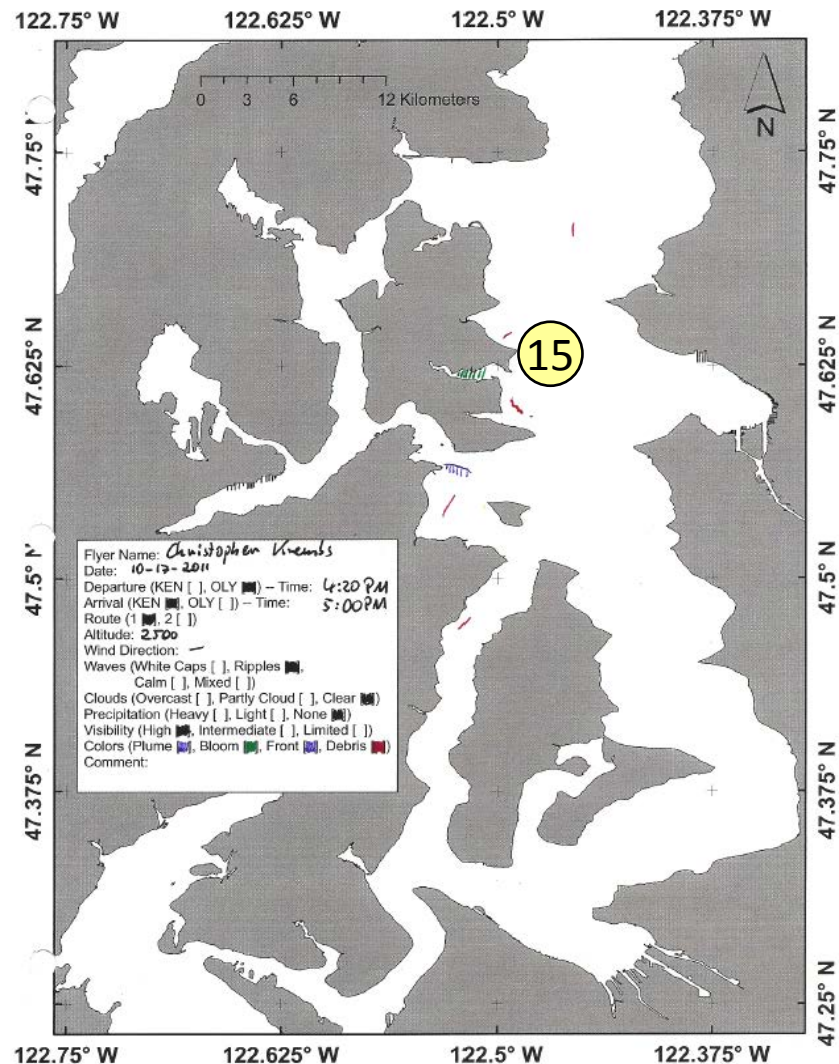
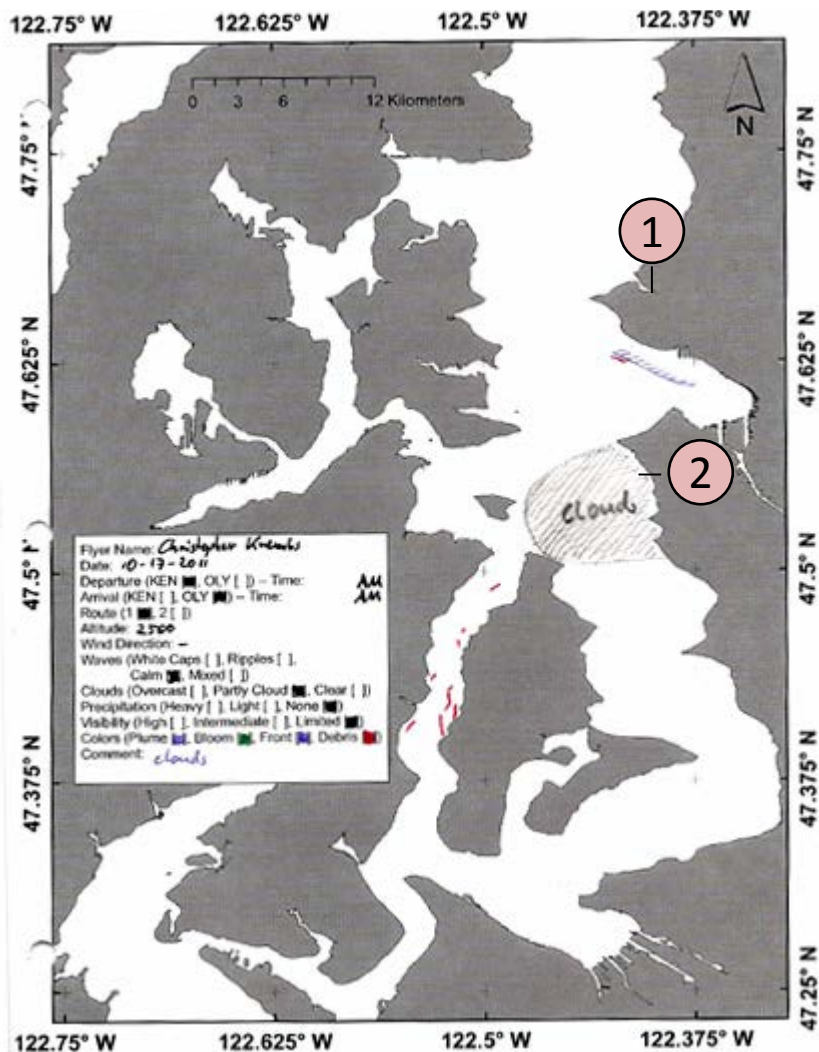
# Aerial photography observations in Central Sound

[Navigate](#)

Date: 10-17-2011

Morning

Evening



Numbers on map refer to picture numbers for spatial reference

Navigate

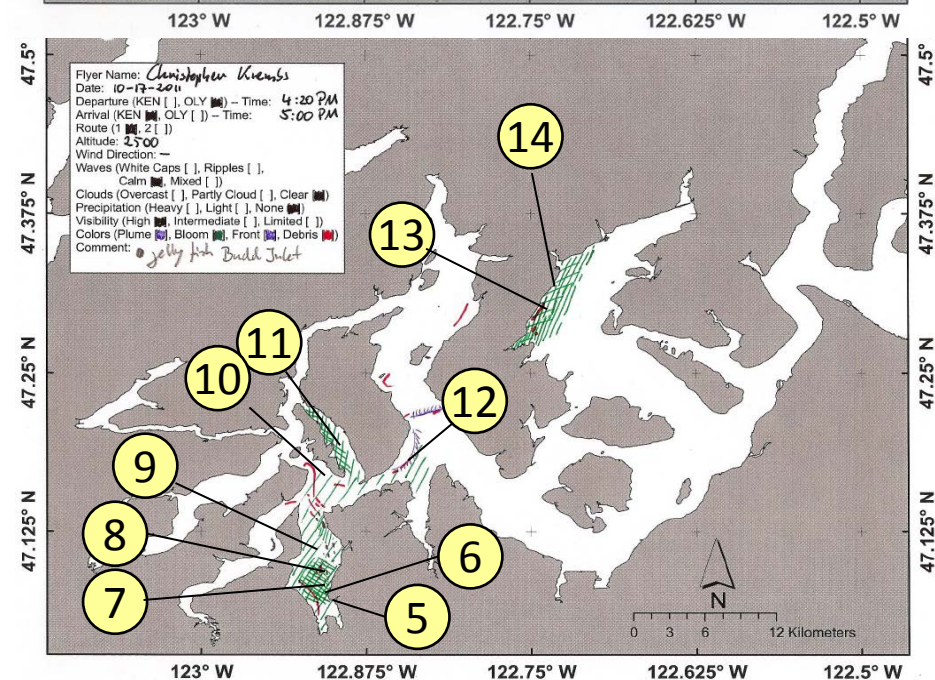
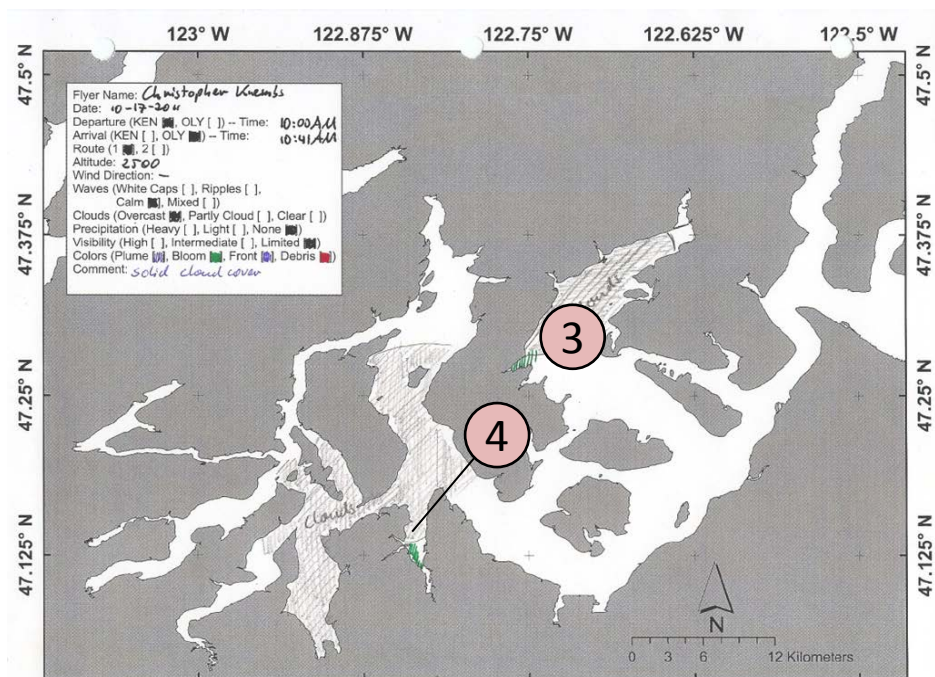


# Aerial photography

Observations in  
South Sound:  
10-17-2011












Numbers on map refer to picture  
numbers for spatial reference





# Legend to map annotations


[Navigate](#)

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

## Comments:

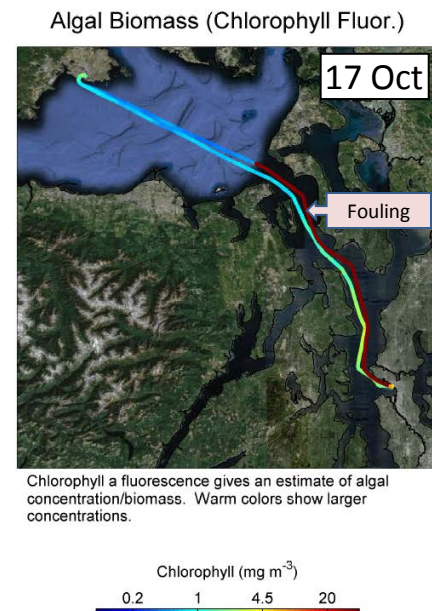
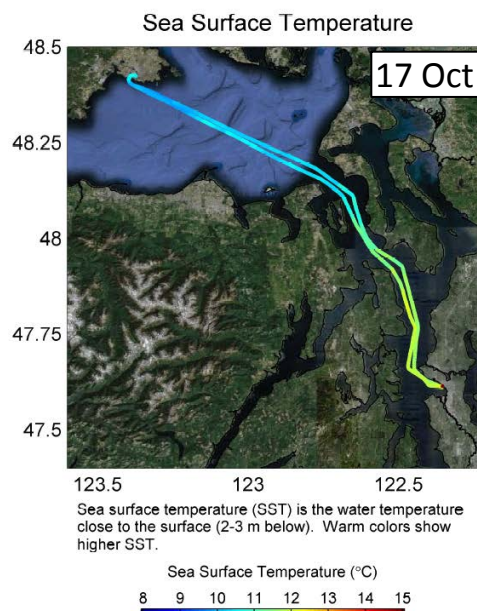
Maps are produced by observers during and after flight and intended to give an approximate reconstruction of surface conditions on scales that connect to and overlap with satellite images in the following section.



# Daily ferry and satellite observations in Central Sound, 10-17-2011

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

Contact: [brandon.sackmann@ecy.wa.gov](mailto:brandon.sackmann@ecy.wa.gov)



**Current Conditions:** Minimal surface fluorescence in Central Sound (fouling observed on 17 Oct. AM transect); lowest values in Strait of Juan de Fuca; surface temperatures in Central Sound range from 11.5-12.5 °C and 10-11 °C in Strait of Juan de Fuca.

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

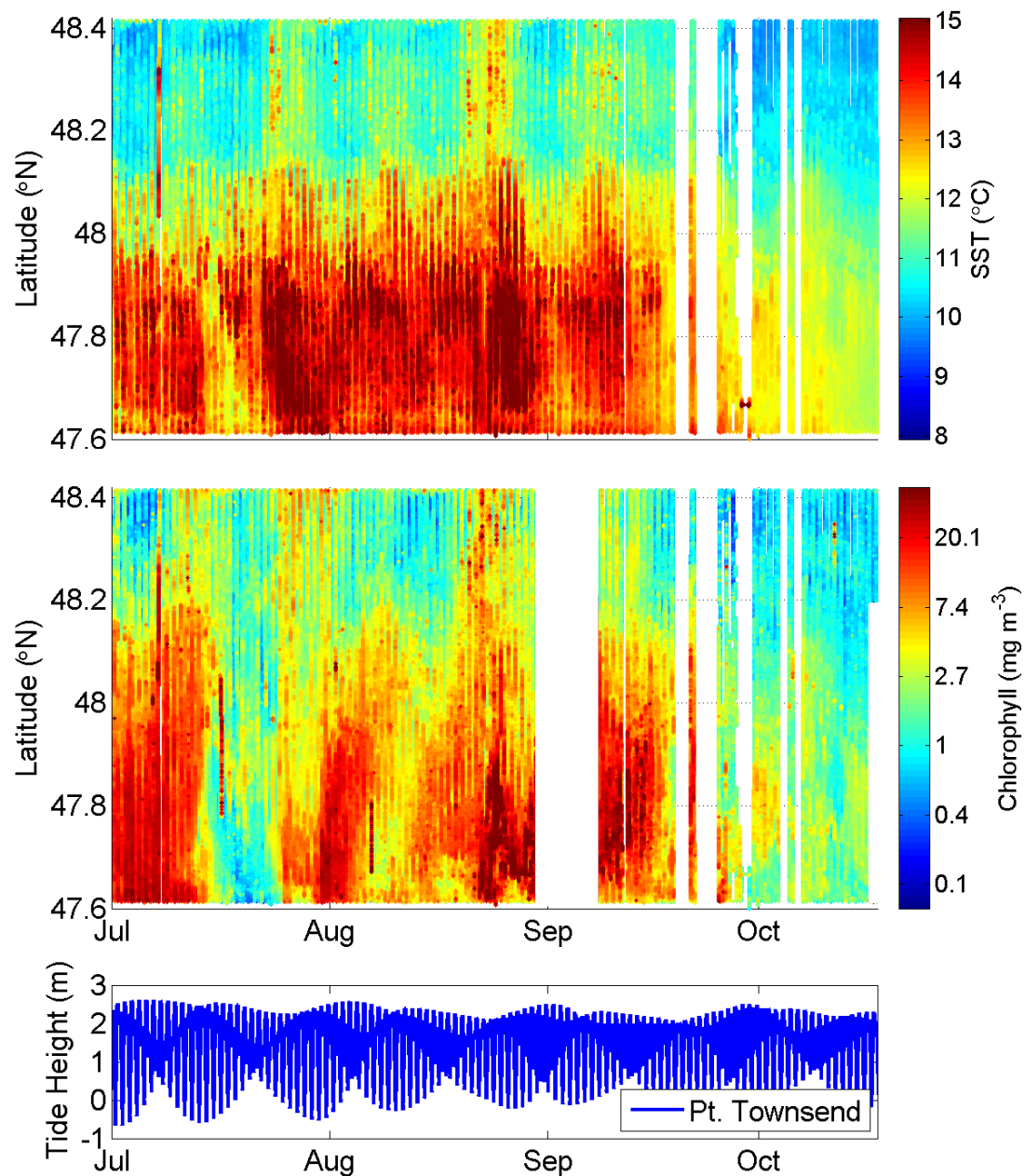
[http://www.ecy.wa.gov/programs/eap/mar\\_wat/eops/clipper.html](http://www.ecy.wa.gov/programs/eap/mar_wat/eops/clipper.html)

MERIS True Color image used for spatial context (19 February 2011). Image is not coincident with ferry data shown on right



Temperatures decrease  
and blooms fade as the  
summer growing season  
comes to an end in  
Puget Sound

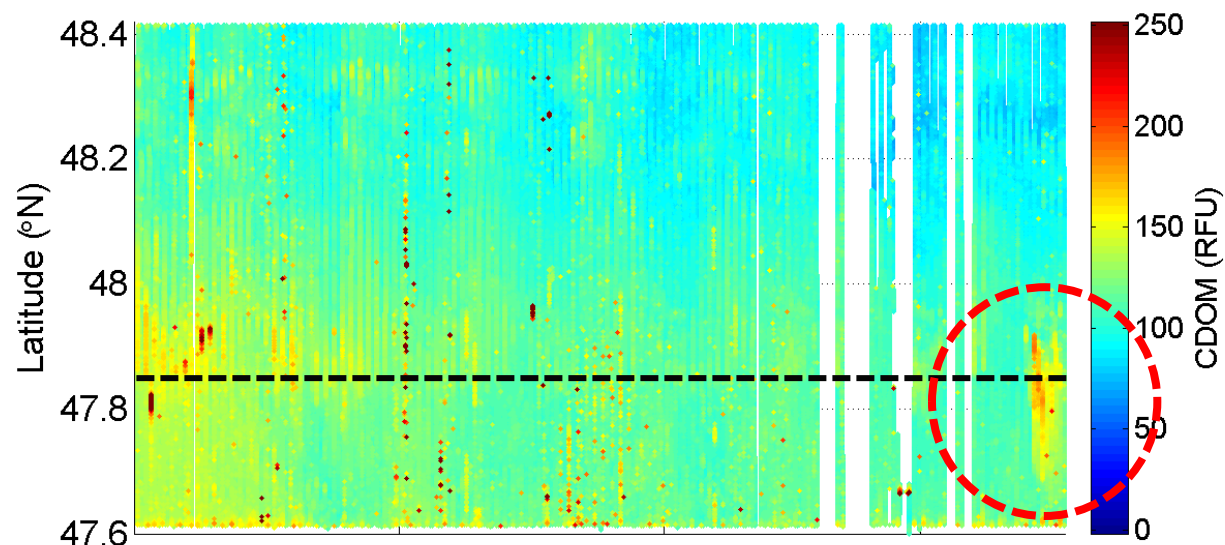
Late September saw a  
dramatic transition to much  
cooler sea surface  
temperatures and lower  
fluorescence values  
throughout Puget Sound.



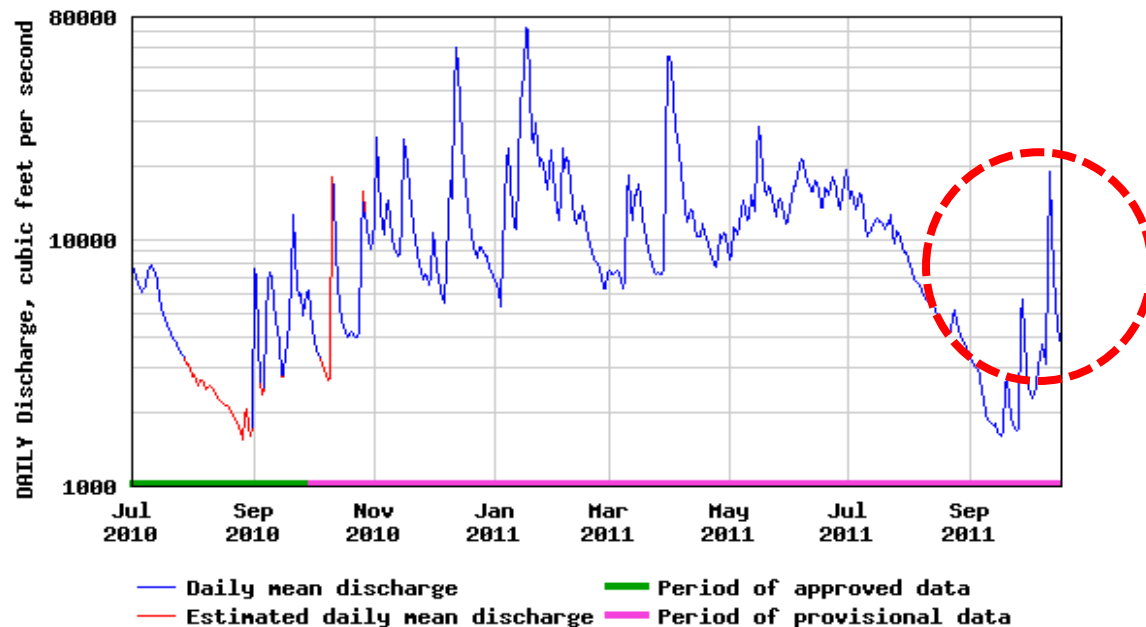
## CDOM fluorescence as an indicator of freshwater influence in Central Sound

A primary source of [Colored Dissolved Organic Matter](#) (CDOM) to Puget Sound is from rivers.

Recent rainfall and increased river discharge has lead to a highly colored pulse of water seen moving from Whidbey Basin into Central Sound.



USGS 12150800 SNOHOMISH RIVER NEAR MONROE, WA



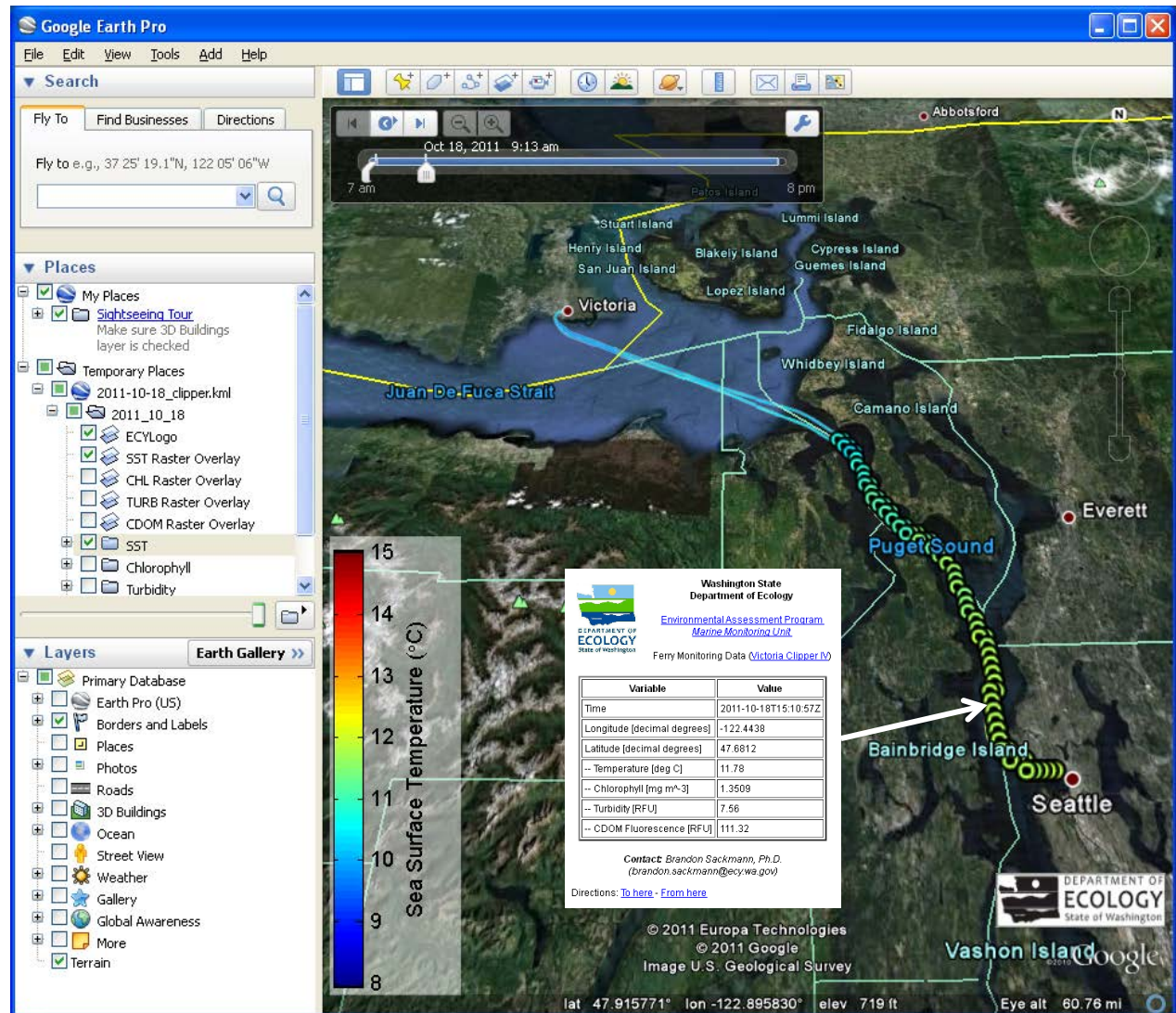


Interactive Google KML products now available for Clipper-based products!

Google-friendly KML products can now be downloaded from our website:

[http://www.ecy.wa.gov/programs/eap/mar\\_wat/eops/clipper.html](http://www.ecy.wa.gov/programs/eap/mar_wat/eops/clipper.html)

These products complement our standard daily PDF products. To minimize file size the KML point-based data have been binned to a standard Lat/Lon grid.

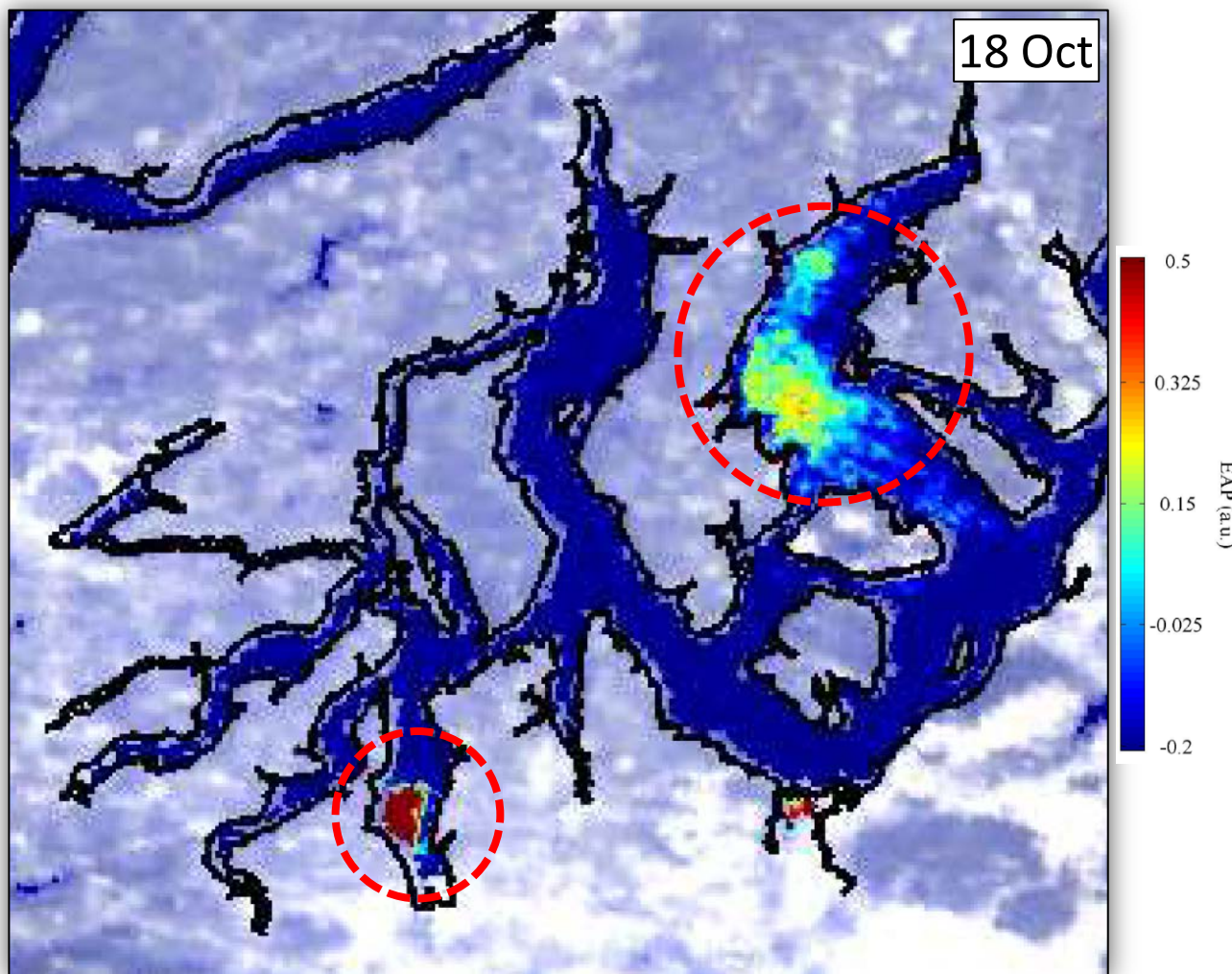


## Estuarine Algal Proxy (EAP)

Ecology is exploring a hybrid algal proxy that blends characteristics of both Fluorescence Line Height (FLH) and Maximum Chlorophyll Index (MCI)

EAP is calculated as the maximum of MERIS bands 8 (681 nm) and 9 (709 nm) above a linear baseline between bands 7 (665 nm) and 10 (753 nm)

EAP captures separate algal blooms in Carr and Budd Inlets. Blooms were visually identified in [aerial photos](#) taken on 17 Oct.







# Mooring observation from 10/4-10/18/2011

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

Go to our mooring site at: [http://www.ecy.wa.gov/programs/eap/mar\\_wat/moorings.html](http://www.ecy.wa.gov/programs/eap/mar_wat/moorings.html)

- 1. Mukilteo, Whidbey Basin near Everett:** DO and temperature decreased while salinity increased at depth (14-18 m, NB). Surface salinity and temperature decreased as stratification strengthened. Mean values:

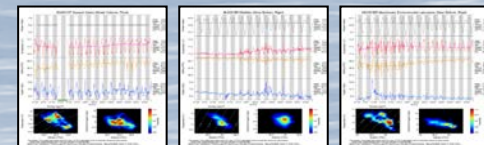
<u>NB:</u>	<b>DO: 5.9 mg/L</b> (down 0.9 mg/L)	<u>Surface:</u>	<b>Temp: 12.0°C</b> (down 0.4 °C)
	<b>Temp: 11.8°C</b> (down 0.8°C)		<b>Salinity: 27.6 PSU</b> (down 1.5 PSU)
	<b>Salinity: 29.8 PSU</b> (up 0.1 PSU)		

- 2. Manchester, Central Sound:** DO at depth (11 m, NB) increased while temperature decreased. Near surface temperature decreased. Mean values:

<u>NB:</u>	<b>DO: 6.1 mg/L</b> (up 0.5 mg/L)	<u>Surface:</u>	<b>Temp: 12.0°C</b> (down 0.4°C)
	<b>Temp: 12.0°C</b> (down 0.3°C)		<b>Salinity: 29.9 PSU</b>
	<b>Salinity: 30.0 PSU</b>		

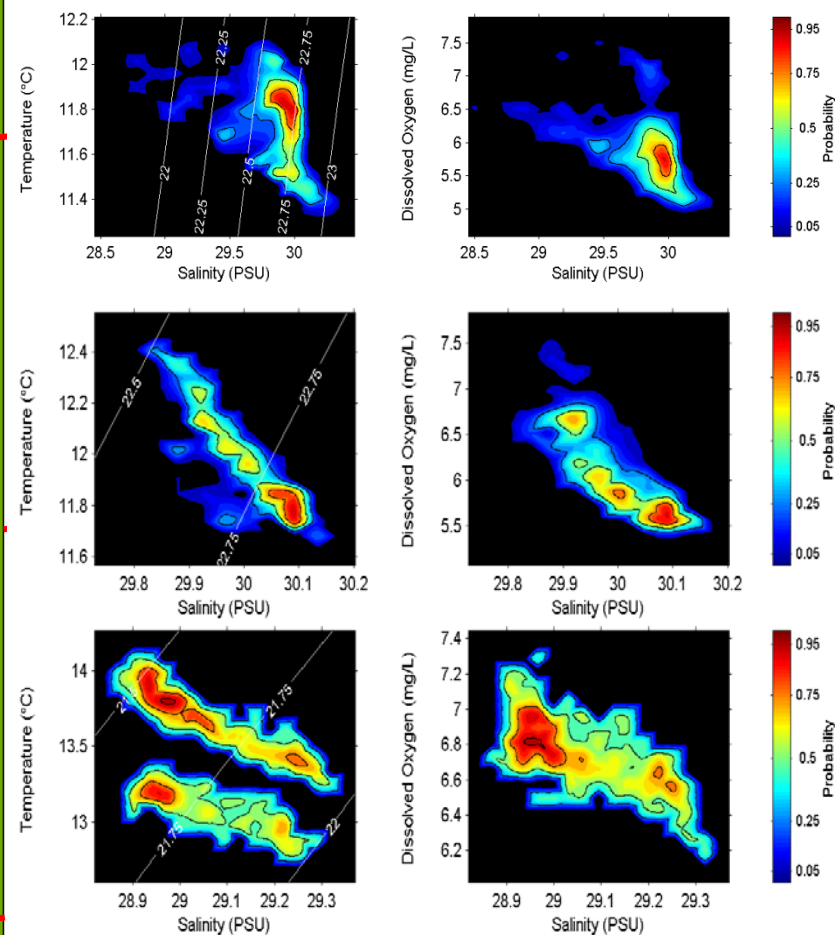
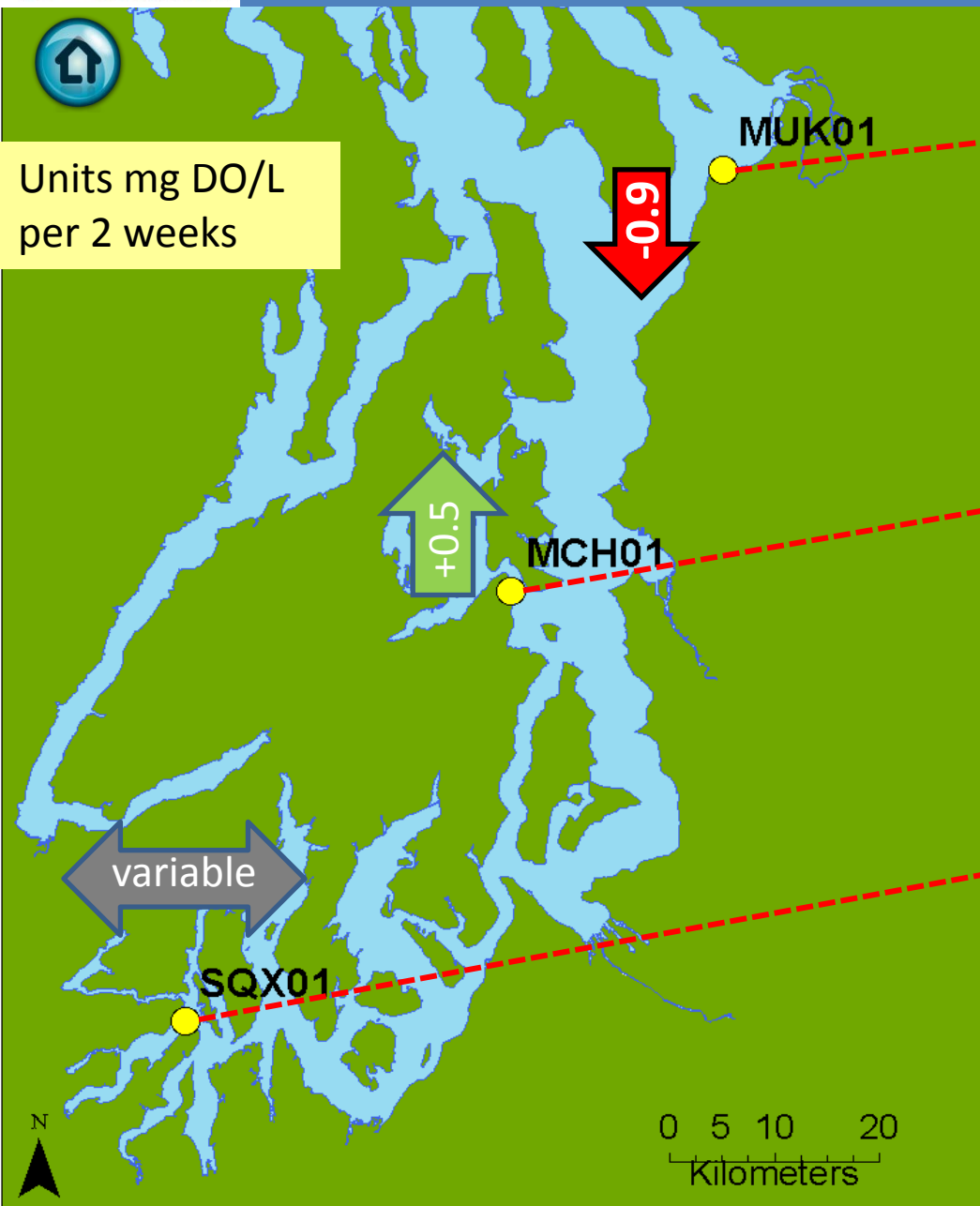
- 3. Squaxin Passage (South Sound) near Olympia:** Temperature at depth (5 m) decreased. Mean values:

**DO: 6.7 mg/L**  
**Temp: 13.5°C** (down 0.8 °C)  
**Salinity: 29.0 PSU**



[Real-time data online \(click\)](#)

# Water Masses and DO from our Moorings: 10/4-10/18/2011



**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 your data from Ecology's Environmental Assessment Program

## Long – Term Monitoring Network

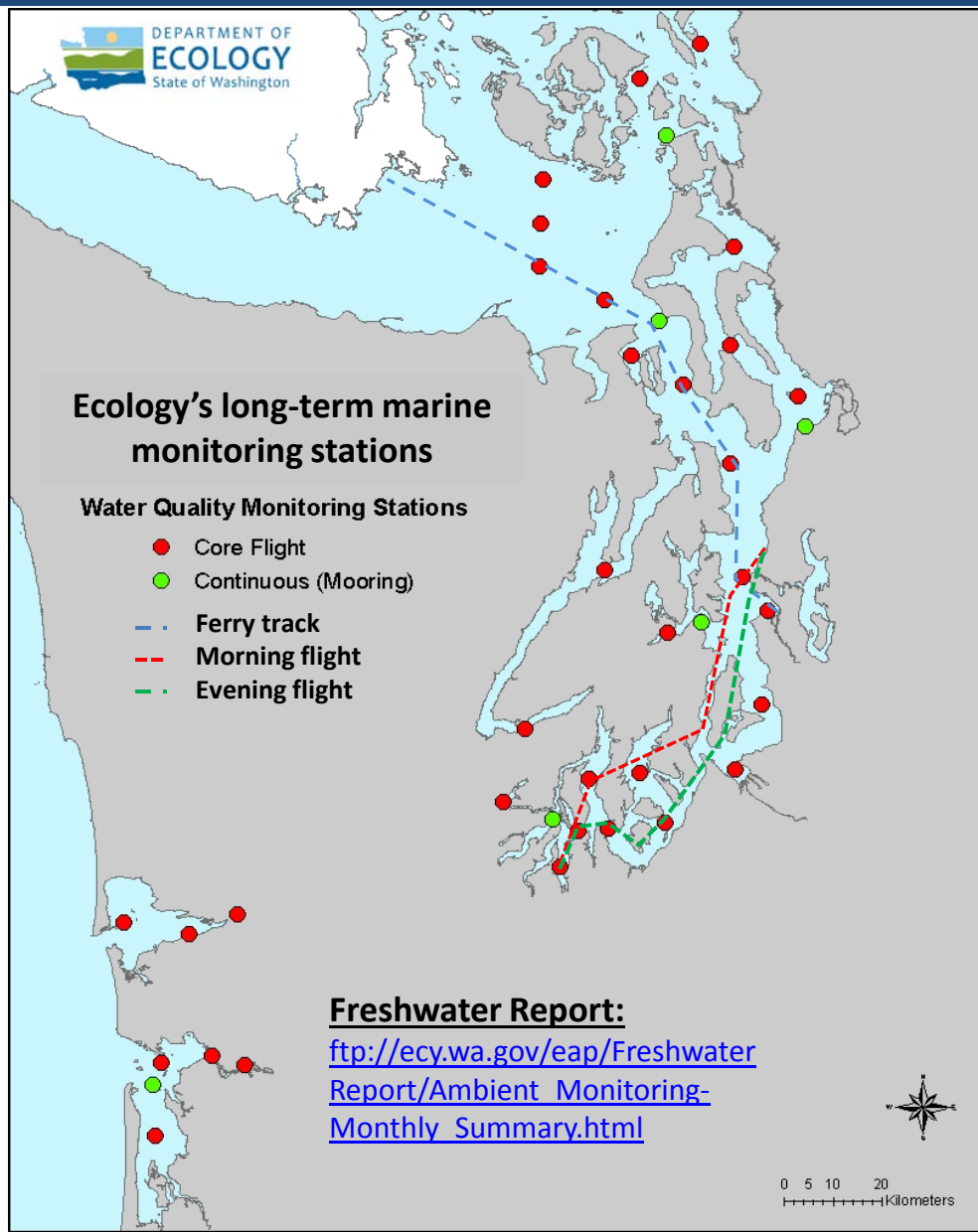


[ftp://www.ecy.wa.gov/eap/Flight\\_Blog/](ftp://www.ecy.wa.gov/eap/Flight_Blog/)



## Access core monitoring data:

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



## Real – Time Sensor Network



[brandon.sackmann@ecy.wa.gov](mailto:brandon.sackmann@ecy.wa.gov)



## Access mooring data:

<http://www.ecy.wa.gov/programs/eap/marinewq/moorings.html>



You may subscribe or unsubscribe to the Eyes Over Puget Sound email listserv by going to this link:

<http://listserv.wa.gov/cgi-bin/wa?A0=ECOLOGY-EYES-OVER-PUGET-SOUND>

**We are looking for feedback to improve our products.**

**Dr. Christopher Krembs**

[ckre461@ecy.wa.gov](mailto:ckre461@ecy.wa.gov)

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

