

Eyes Over Puget Sound

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

Surface Conditions Report

February 27, 2012

Contributing Guest:
Donovan Rafferty, Air Quality Program

[Start here](#)

Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings

*Mya Keyzers
Laura Friedenber*



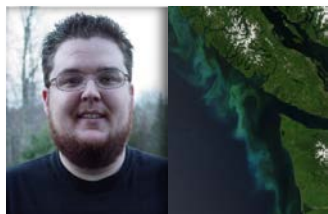
Skip Albertson



*Dr. Christopher
Krembs*



*Dr. Brandon
Sackmann*



David Mora



Personal flight impression

[p. 3-4](#)

We got a sunny day and are testing an ozone sampler.

Weather conditions

[p. 7](#)

Little sunshine, cold air temperatures, and higher river flows in the second part of February.

Aerial photography

[p. 8-27](#)

Freshwater plumes extend far into the waterways. First blooms begin in South Sound.

Ferry and satellite

[p. 28-29](#)

Chilly surface temperatures and pulses of high CDOM waters in Central Sound.

In-situ mooring data

[p. 30](#)

A thinner freshwater layer at Mukilteo reflects a low discharge of the Snohomish river.

Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Mya and Laura ready to go!



Olympic Mountains near Lilliwap



A sharp clam shell gave us yet another flat tire!

Marine Flight 4 (South Sound)

The weather this month made getting our last flight out very unpredictable. Luckily, there was a break in the weather on Monday and we were able to get it done. It turned out to be a stellar day for sampling! It was clear with some sun but cold with wind 10kts or below. Everything was working great (including field crew) and we successfully worked our way through all 10 stations. The Olympics looked particularly gorgeous with a dusting of snow in the foothills.

We started a new collaboration this month with Donovan Rafferty from Ecology's Air Quality Program. We will be taking his ozone analyzer along on flights to sample the air we pass through looking for ozone plumes. Ozone in the lower atmosphere is a pollutant and also acts as a greenhouse gas. It can cause eye and respiratory tract irritation, as well as damage to plants by inhibiting photosynthesis and growth. Monitoring for ozone can help us understand where it comes from and in what concentrations.

Donovan has rigged up a special box to hold the ozone sensor, a fan, a battery pack and a GPS unit. A GPS receiver is strung through to the front window of the plane and tubing which connects to the analyzer is threaded out of the cabin vent to "sniff" and gather data. We are in the testing phase right now. We want to be ready to collect quality data this summer when ozone plumes can be found in our more urban areas. Collaborations like this provide more data for the public and managers without additional costs. It also makes our time in the plane even more valuable and expands the contextual envelope for our own data.

Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Donovan (Air Quality Program, Ecology) and Joe (pilot, Kenmore Air) getting the ozone analyzer set up



Instruments and intake tubing

Intake tubing for analyzer

GPS receiver

Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Donovan assembles the portable ozone analyzer (A) and installs GPS (B) and tubes for the air intake (C) on board the float plane.

The instrument is turned on and continuously records ozone concentrations, position, and altitude during the routine marine flight. This saves resources and time.

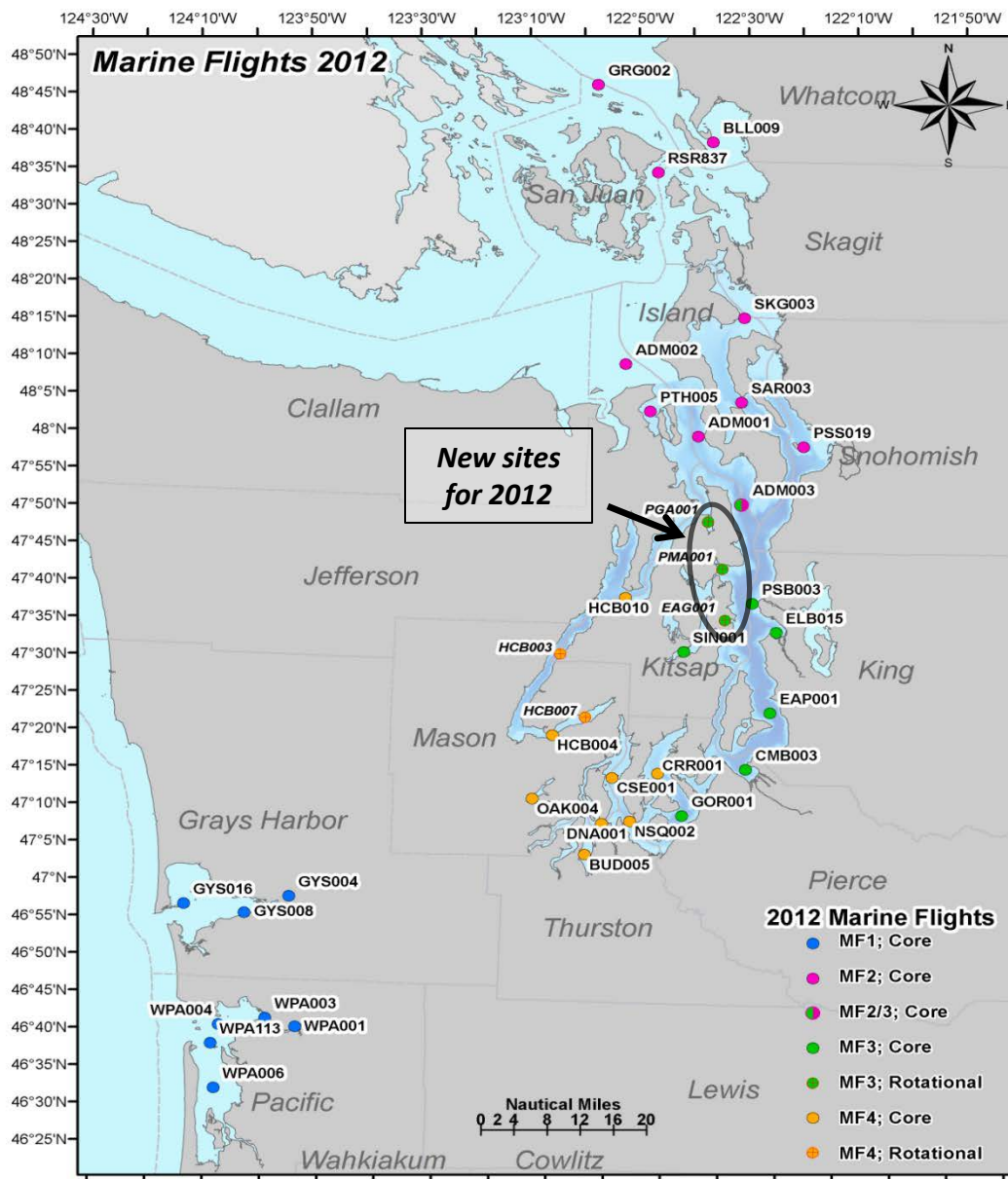
Guest: Donovan Rafferty



Seasonally, elevated ozone concentrations occur in the Puget Sound Basin. At the ground they can affect public and environmental health.

- Air quality models forecast high concentrations near the San Juan Islands.
- Placing a portable ozone analyzer on marine flights can test and verify ozone model predictions.
- We are currently testing the ozone monitoring package on marine flights to prepare for summer measurements over the Central Salish Sea.

Many thanks to the Marine Monitoring Unit and Kenmore Air pilot Joe.



Flight and Station Maps 2012



Port Gamble (PGA001) - This site was last visited in 2001. It was considered impaired for DO and bacteria in previous water quality assessments and has undergone sediment remediation activities.

Port Madison (PMA001) - Sampled most recently in 1995, this location has had several improvements & shellfish harvest has recently been restored in this bay.

Eagle Harbor (EAG001) - A super-fund site, this location has been part of clean-up efforts conducted by EPA and WSDOT at a ferry maintenance site.



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

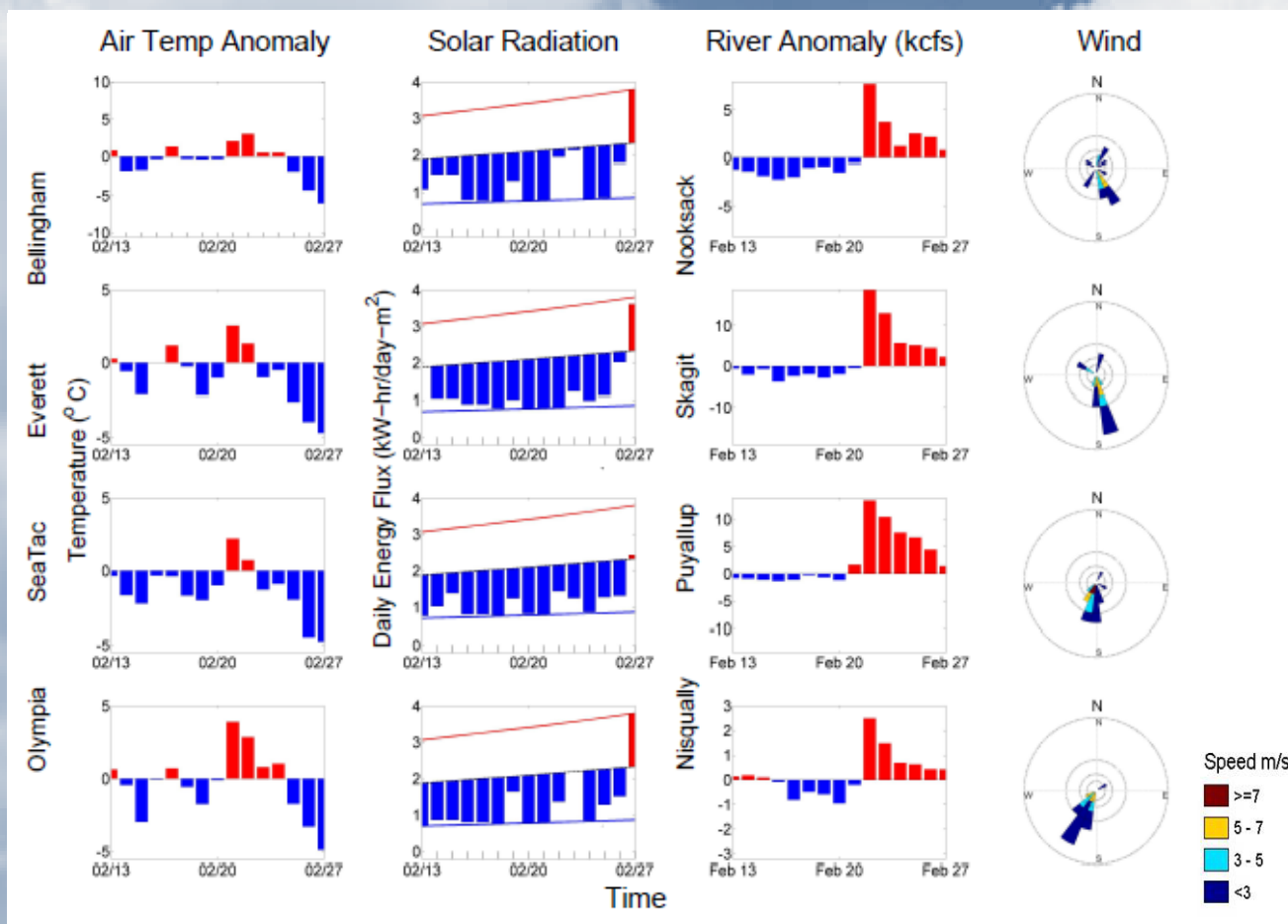
Summary:

Air temperatures during the past few days have been increasingly colder than expected. This follows a weak warm spell a week ago.

Sunshine has been very low except on the day of the marine flight.

Rivers have been running above normal for the past week.

Winds have been predominantly from the SE in the north, to the SW in the south.



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



River plumes extend largely into Central Basin. Some jellyfish aggregations persist in Budd Inlet. South Sound has first signs of algae blooms.

Eddy north of McNeil Island 4:20 PM



Collaborating with Air Quality, (Ecology)



Start here

Front

Mixing and Fronts:

(2) (5) (8) (9) (10) (11) (12)

Commencement Bay, Blake Island, Central Basin
Dana Passage (14) (15)

Plume

Suspended sediment:

(1) (2) (6) (9) (10) (11)

Extensive in Central Basin and Commencement Bay
and near major river estuaries. (12) (14)

Bloom

Visible blooms:

(6) (7)

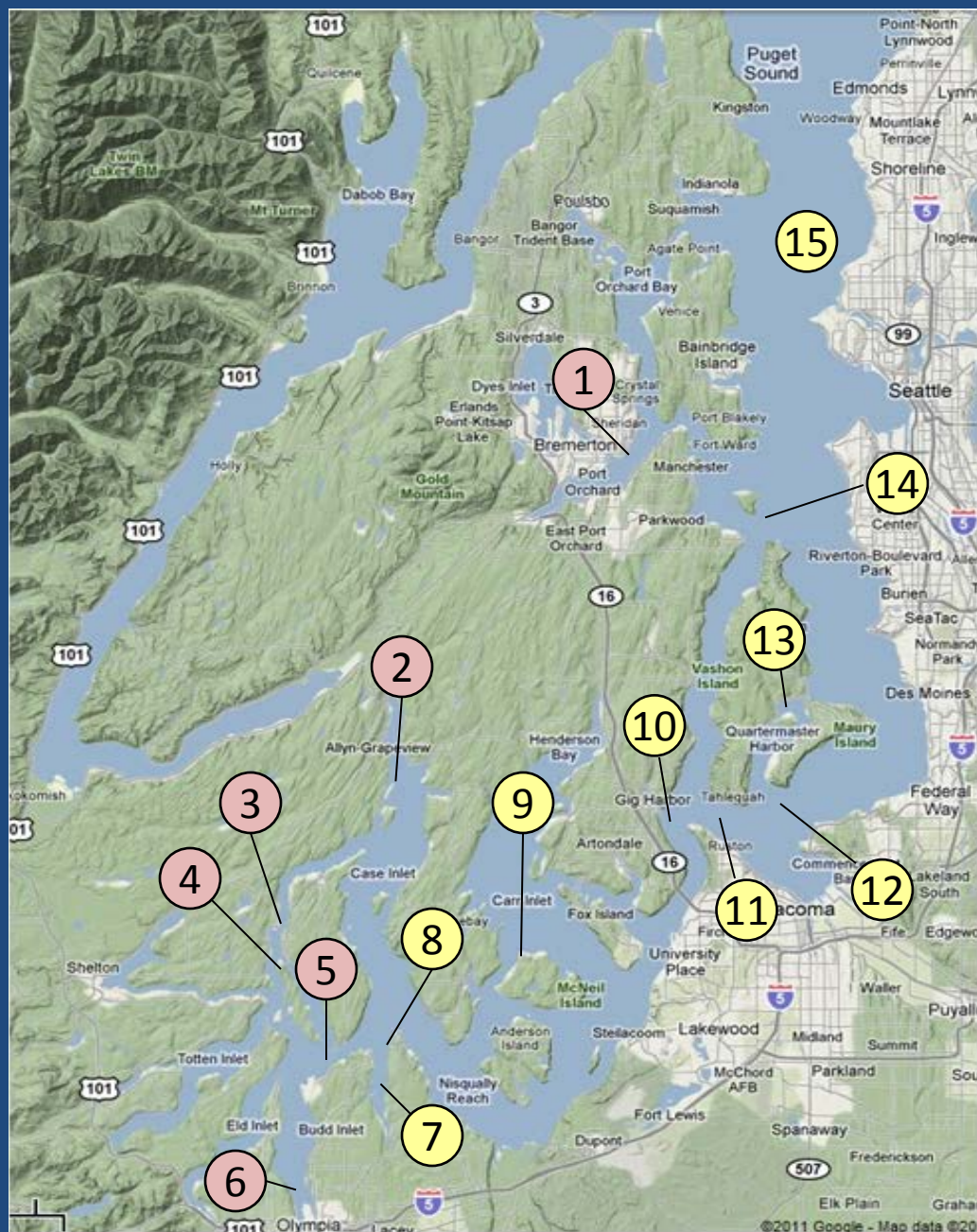
South Budd Inlet and Henderson Inlet

Debris

Debris

(1) (2) (3) (4) (7) (8) (11)

South Sound: West of Harstine Island, Dana Passage
Central Basin: Off Shilshole Bay



Aerial photography image guide 2-27-2012



Click on numbers

-  Morning Flight
-  Evening Flight

Flight Information:

Morning flight:
Freezing temperature
High visibility but de-icing
Left residue on window

Evening flight:
High visibility, altitude 2500ft

Observational maps (AM)

Observational maps (PM)



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Plume along shore.

Location: Bremerton, Sinclair Inlet, 8:28 AM



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Front, debris line and plume. Location: Harstine Island, Case Inlet 8:31 AM



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Mooring



Debris near Harstine Island Bridge. Location: West of Harstine Island (South Sound) 8:40 AM

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

Debris line. Location: West of Squaxin Island (South Sound) 8:41 AM

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

Debris line. Location: Dana Passage (South Sound), 8:44 AM



Field log

Weather

Water column

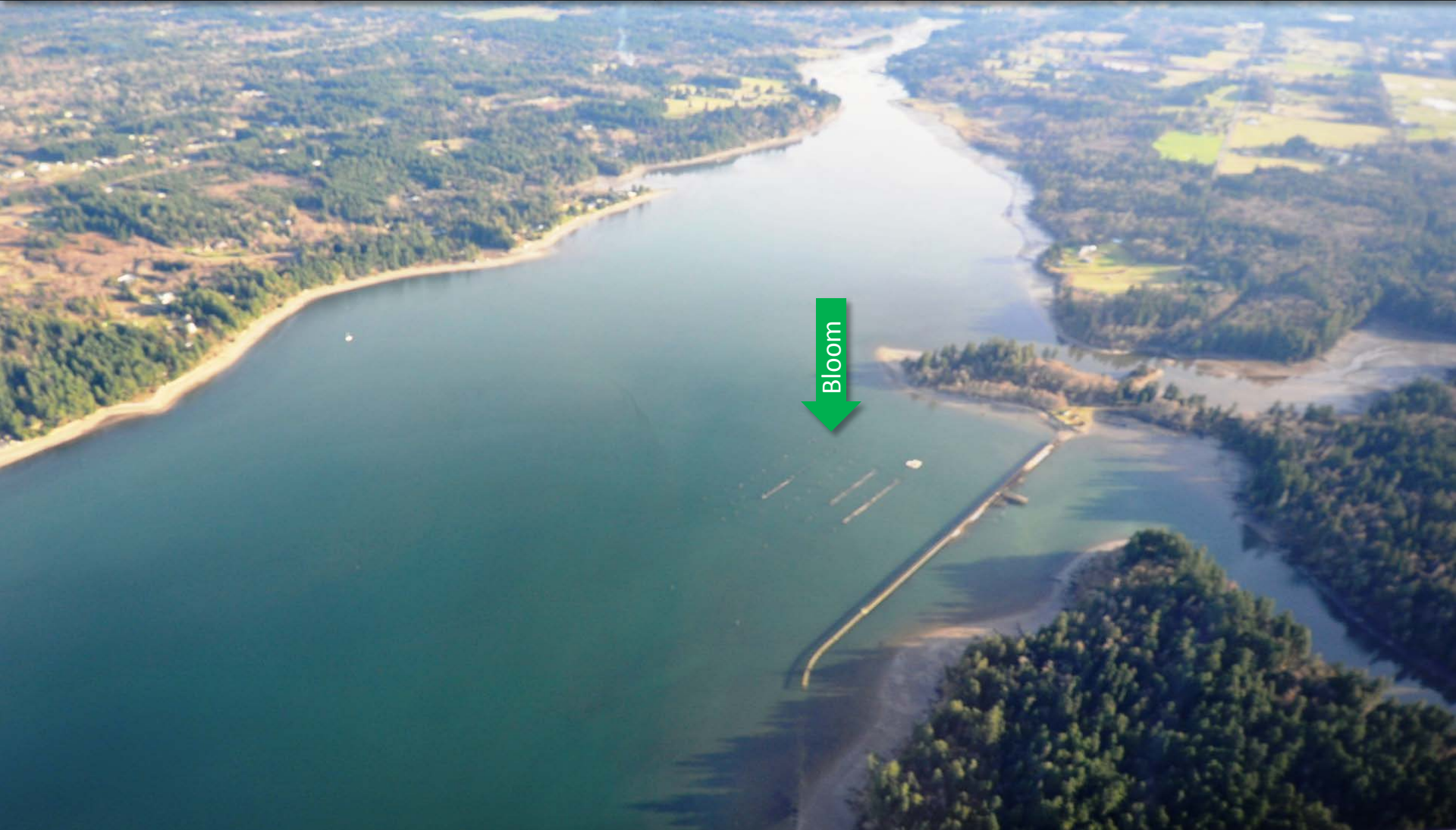
Aerial photos

Ferry and Satellite

Moorings



Beginning bloom. Location: Near Swantown Marina, Budd Inlet (South Sound), 8:46 AM

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

First signs of an algal bloom. Location: Henderson Inlet (South Sound), 4:10 PM



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Algal bloom and weak front. Location: Henderson Inlet (South Sound), 4:15 PM



Field log

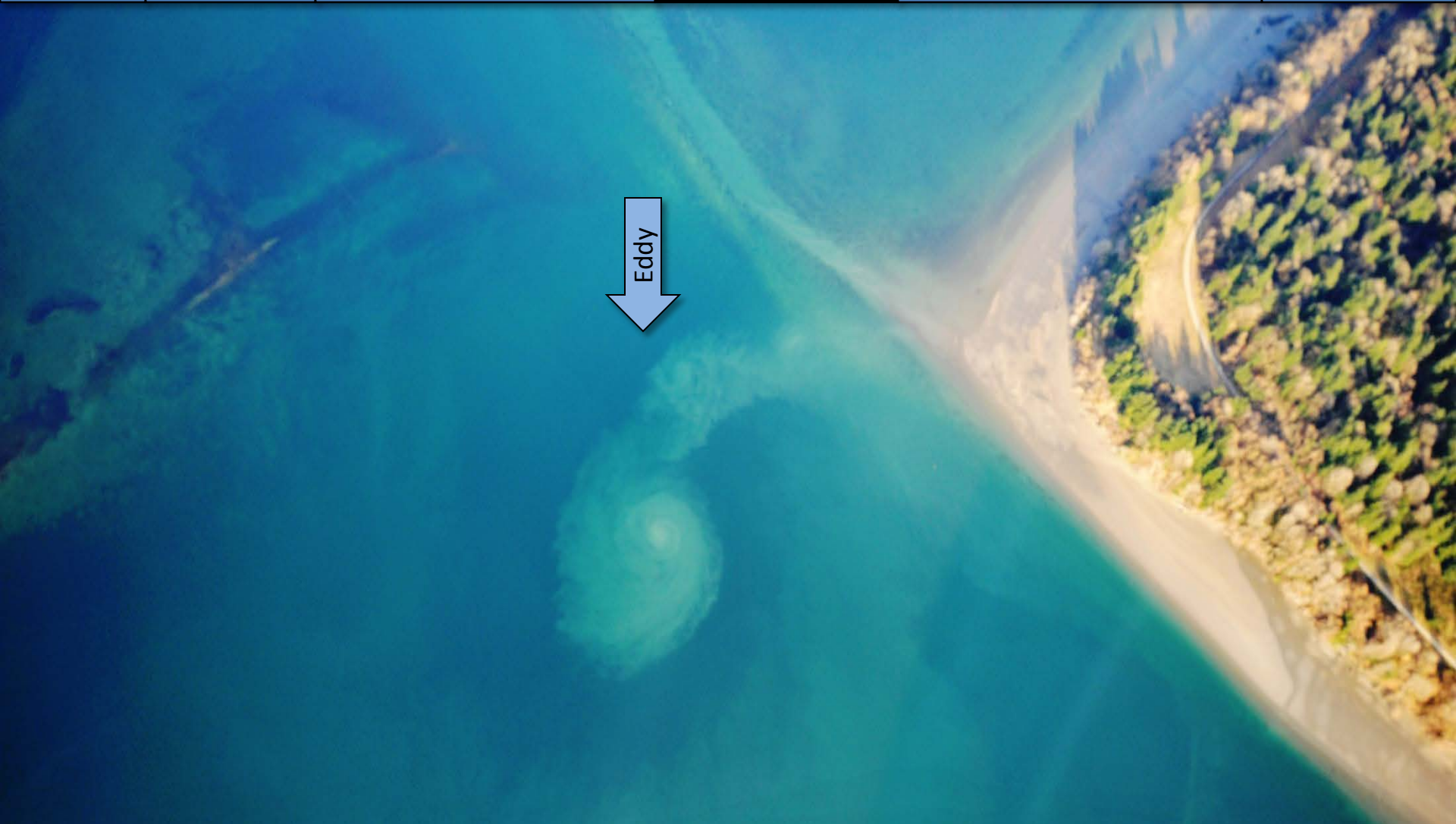
Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Eddy with suspended sediment. Location: McNeil Island (South Sound), 4:20 PM



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Front north of Tacoma Narrows. Location: Gig Harbor (Central Sound), 4:21 PM

Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



River plume west of Tacoma. Location: Vashon Island (Central Sound), 4:22 PM



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Front and river plume. Location: Entrance to Quartermaster Harbor, Vashon Island (Central Sound), 4:23 PM



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Beginning algal bloom. Location: Quartermaster Harbor 4:28 PM



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Front . Location: Near Blake Island (Central Sound), 4:36 PM



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Front stretching in direction of Edmonds. Location: Off Carkeek Park (Seattle), 4:39 PM

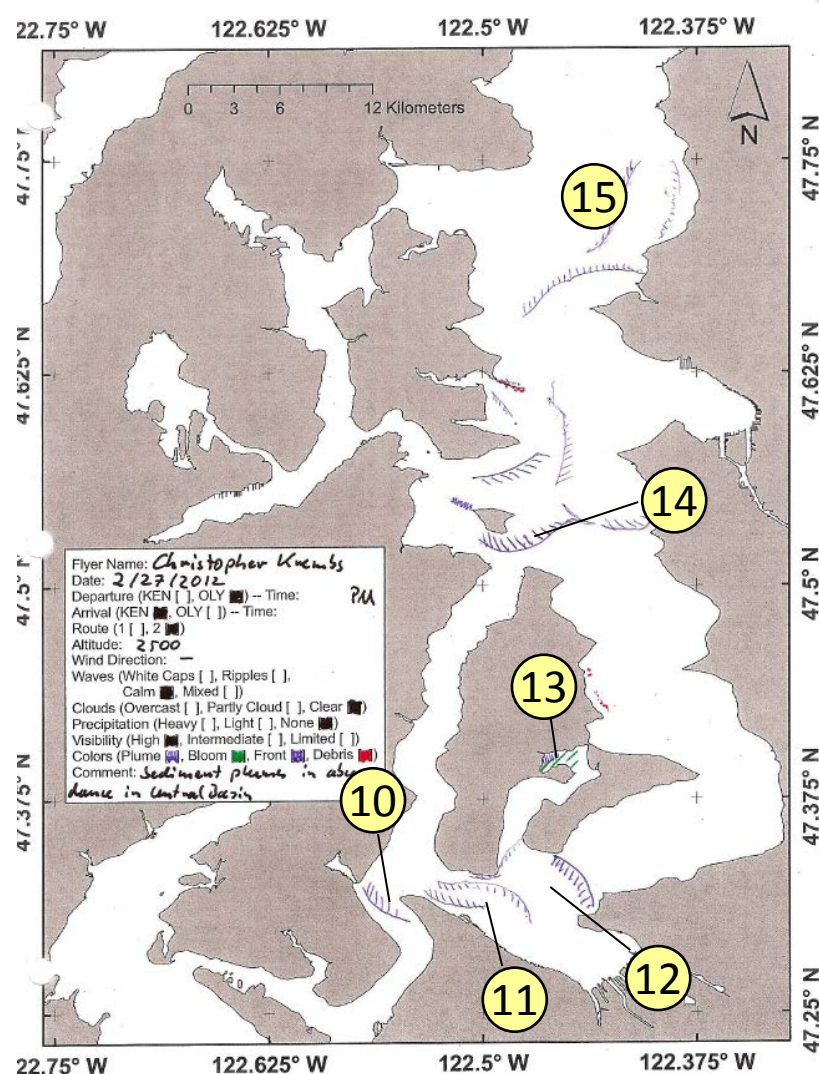
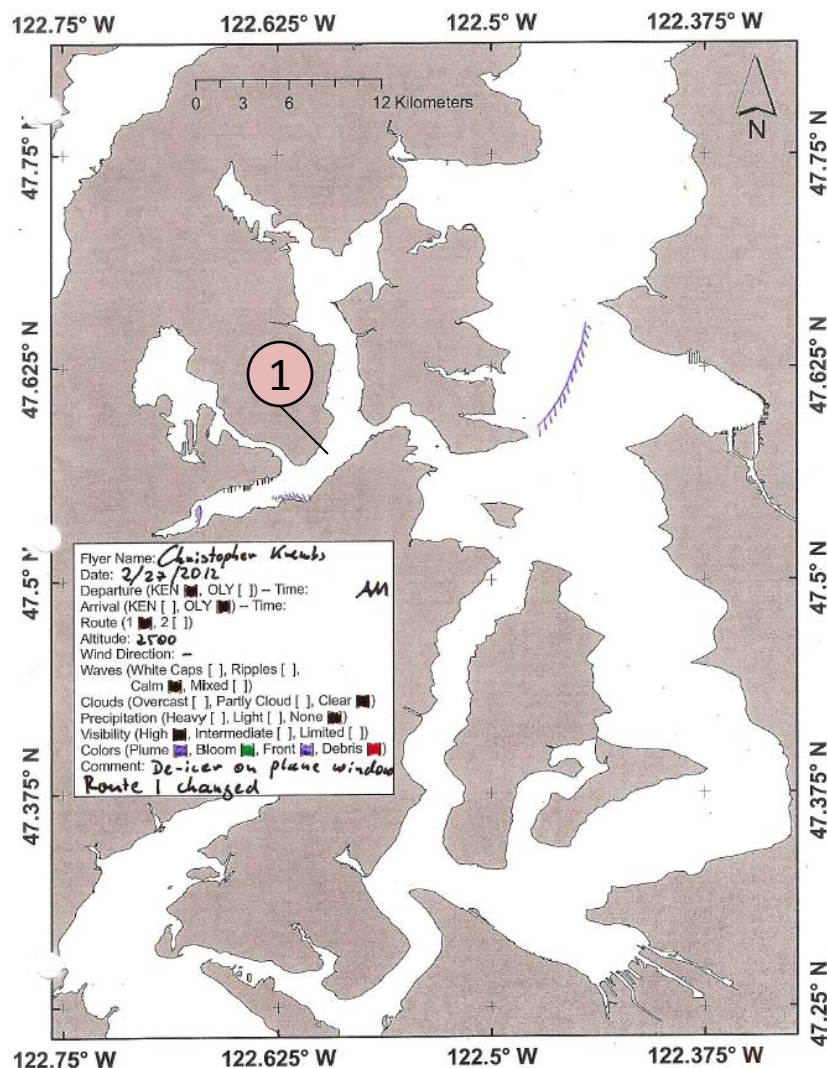
Aerial photography observations in Central Sound

[Navigate](#)

Date: 2-27-2012

Morning

Evening



Numbers on map refer to picture numbers for spatial reference



Navigate

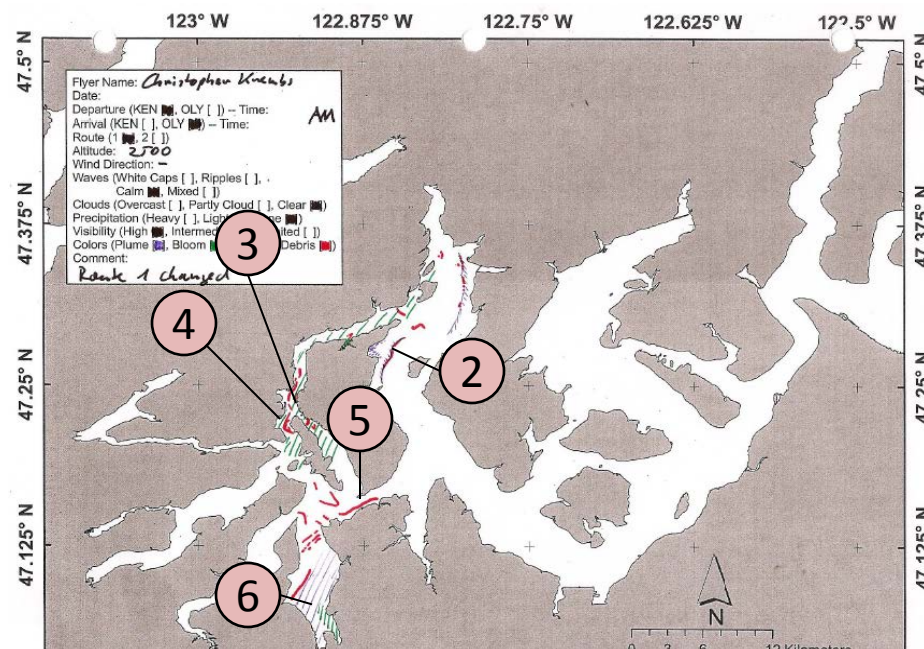
Aerial photography

Observations in
South Sound:
2-27-2012

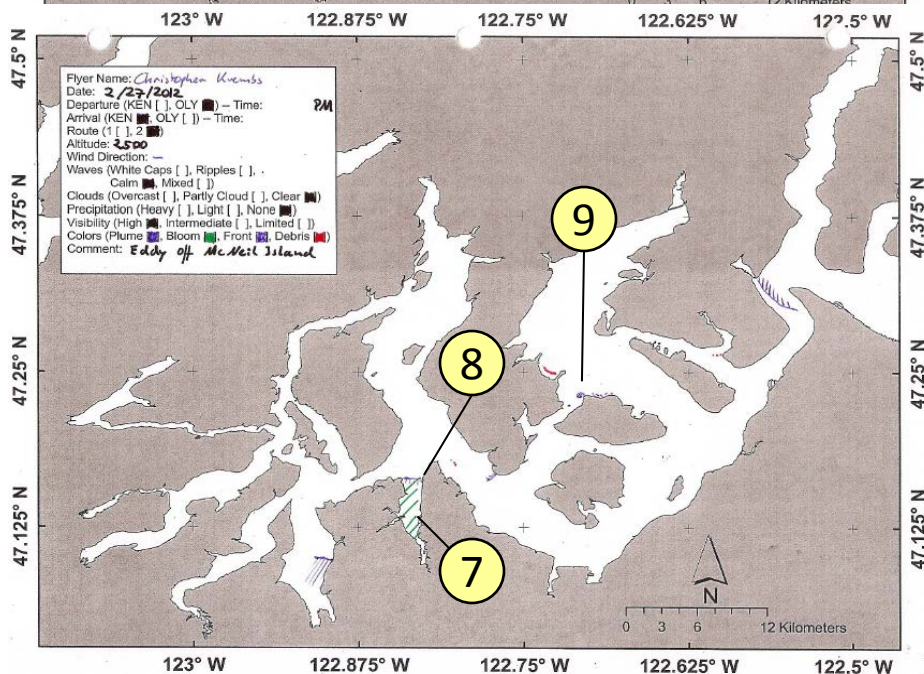


Numbers on map refer to picture
numbers for spatial reference

Morning












Evening



Legend to map annotations


[Navigate](#)

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.

Daily ferry and satellite observations in Central Sound, 2-27-2012



Field log

Weather

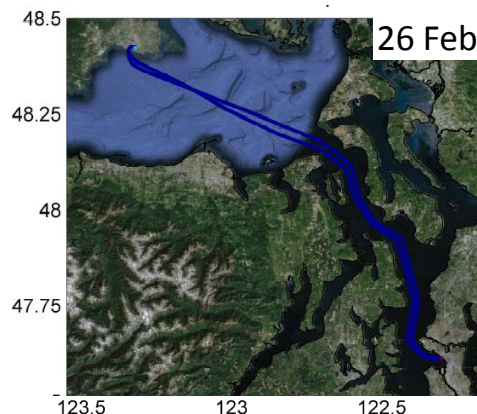
Water column

Aerial photos

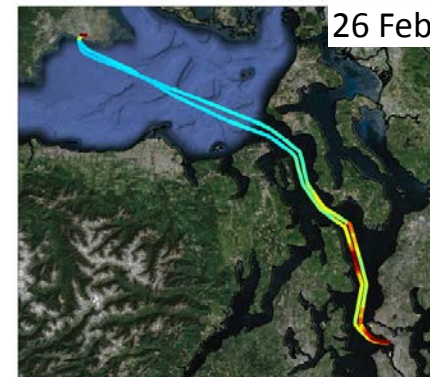
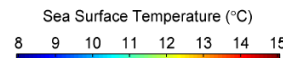
Ferry and Satellite

Moorings

Contact: brandon.sackmann@ecy.wa.gov



Sea surface temperature (SST) is the water temperature close to the surface (2-3 m below). Warm colors show higher SST.



Measurements of Colored Dissolved Organic Matter (CDOM) fluorescence can be high in rivers and stormwater. Warm colors are often associated with river influenced areas.



Current Conditions:



Localized areas of high colored dissolved organic material (associated with higher river flows); surface temperatures are 7-8 °C throughout Central Sound and the Strait of Juan de Fuca.

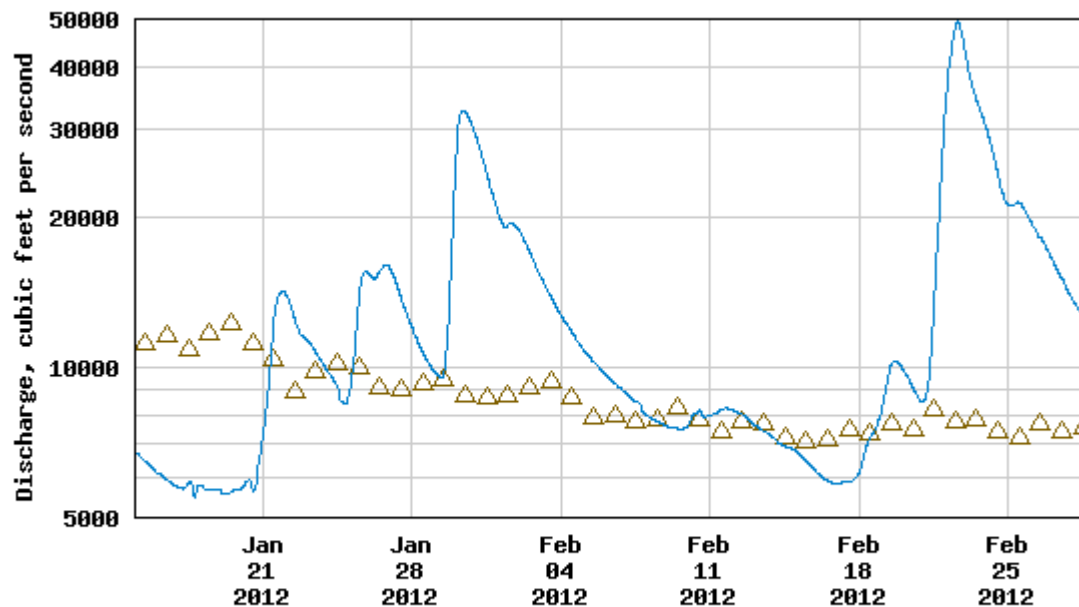
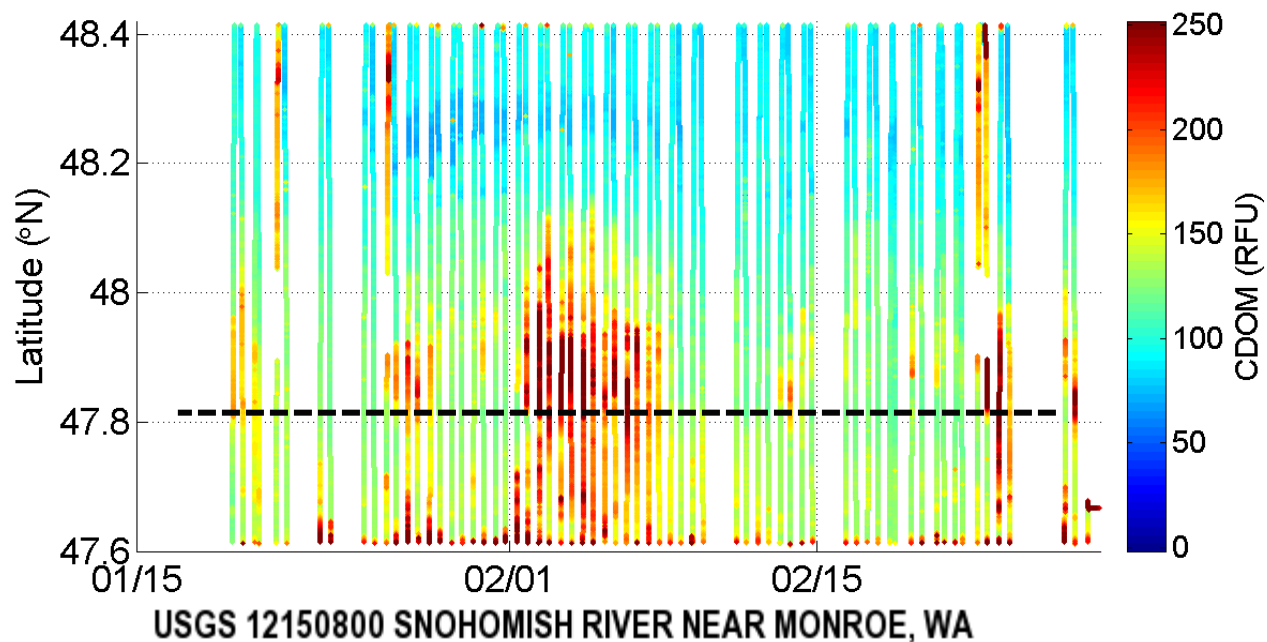
--- Daily 'Quick-Look' Products Available ---

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

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.

Pulses of colored water have
been seen making their way
from Whidbey Basin into
Central Puget Sound,
associated with recent rainfall
and high river flows.



----- Provisional Data Subject to Revision -----

△ Median daily statistic (48 years) — Discharge

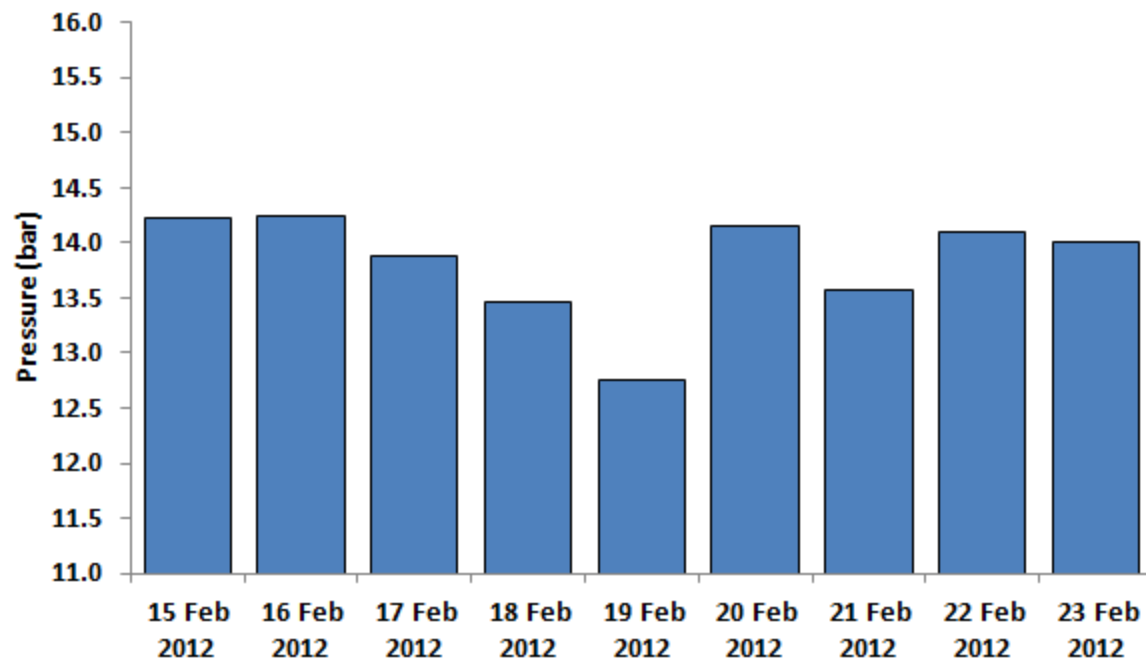
[Field log](#)
[Weather](#)
[Water column](#)
[Aerial photos](#)
[Ferry and Satellite](#)
[Moorings](#)


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

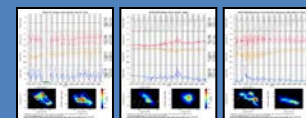
Summary: On February 19 the freshwater layer thickness was low reflecting the Snohomish discharge minimum (see previous page).

The mooring report is currently limited to describing the thickness of the freshwater layer between Whidbey Basin and Central Basin.

Daily average depth of the 28.55 isohaline at Mukilteo



We track the depth of the isohaline 28.55 (± 0.05) and measure the thickness of the freshwater layer at our Mukilteo station. The sensor experiences tidal pressure variations of 11.8 to 15.6 dbar.



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



Get your data from Ecology's Environmental Assessment Program

Long – Term Monitoring Network

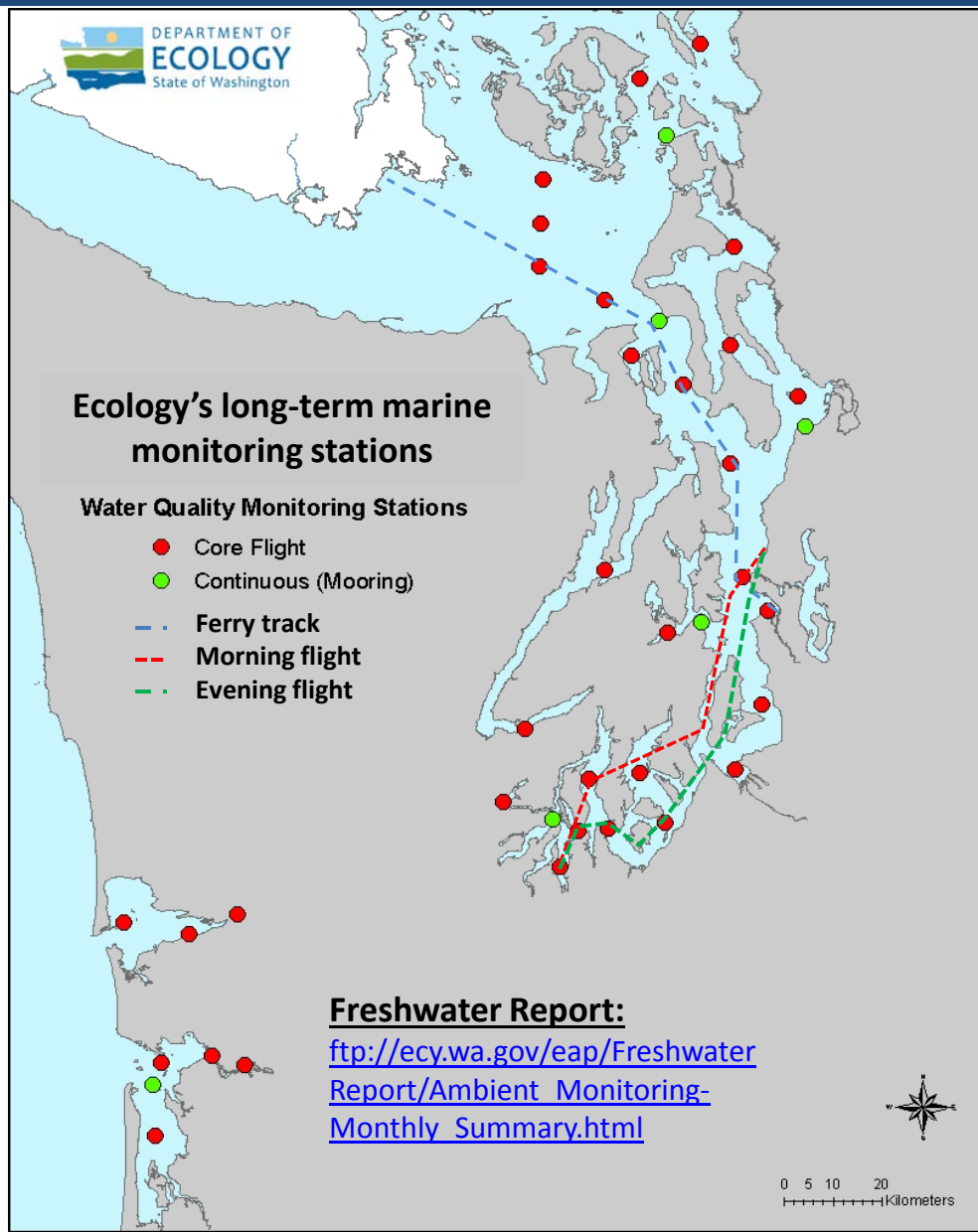


ftp://www.ecy.wa.gov/eap/Flight_Blog/



Access core monitoring data:

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



Real – Time Sensor Network



brandon.sackmann@ecy.wa.gov



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:

<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

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

