Publication No. 11-03-082

DEPARTMENT OF ECOLOGY State of Washington

Eyes Over Puget Sound

Surface Conditions Report December 5, 2011

Start here

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

Marine Conditions from Dec. 5, 2011 at a Glance

LONG-TERM MARINE MONITORING UNIT

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Previous Eyes Over Puget Sound reports:

Personal flight impression p. 3-4

December has challenging conditions for crew and instruments

Weather conditions p. 5

Less rain, colder temperatures and less sun than typical for this time of year

Aerial photography p. 7-26

Large jelly fish patches in Inlets: Budd, Sinclair, and Case. Numerous debris lines mark hydrodynamic processes

Ferry and satellite p. 27-29

Central Sound bloom continues even as temperatures continue to fall; high CDOM water moves into Central Sound

In-situ mooring data p. 30-31

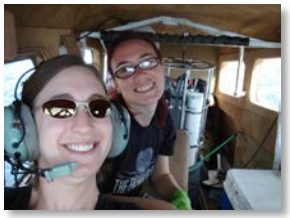
Water continues to cool and freshens while oxygen is still decreasing at some places

www.ecy.wa.gov/programs/eap/mar_wat/eops/

CTD being deployed

Low clouds and fog

Marine Flight 3 (Central Sound)



On the morning of our first December flight, we experienced patchy fog and low clouds. However, our pilot Joe was able to maneuver through it, and we made it out. December is typically a challenging month for flying in terms of weather and light, but it is also the last month before our sampling plan changes. As the days grow shorter and colder, we look forward to the opportunity to visit new stations in 2012 during longer day hours.

For the past few years, our sampling plan has been focused on the South Sound. This upcoming year we will visit stations that have not been sampled for a while in Central Sound. We have "*core stations*" that we sample every year and we add regional "*rotational stations*" that may have water quality issues or other monitoring considerations. Next year we will be sampling sites in Port Gamble, Port Madison, and Eagle Harbor. Totten and Eld Inlets have been sampled during 2009 and 2010 and will be dropped.

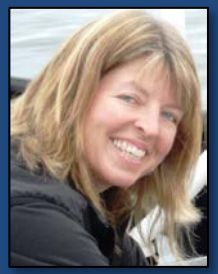
During this particular December flight, we experienced technical difficulties with our CTD package (conductivity, temperature and depth profiler and Niskin bottles) and had to abort the flight. Back at the lab we were able to swap instruments and got the package ready for another day of sampling. Even though our flight was cut short, we saw spectacular views of the Seattle skyline and Commencement Bay.

Personal flight impression 12-05-2011

Seattle Aquarium and Skyline

Patches of sun in Commencement Bay

NEW Flight and Station Maps



For 2012 we have shifted emphasis of our rotational monitoring effort to stations of the Kitsap Peninsula and Bainbridge Island.

Julia Bos

We will be visiting these stations:

- Port Gamble (PGA001)
- Port Madison (PMA001)
- Eagle Harbor (EAG001)

Click here for more Info and station maps

The data will allow us to determine if significant long-term trends in marine water quality occurred in this focus region.

Each of 4 regional flight routes are shown on the map, and will be conducted monthly.

Weather of the last two weeks 12-05, 2011

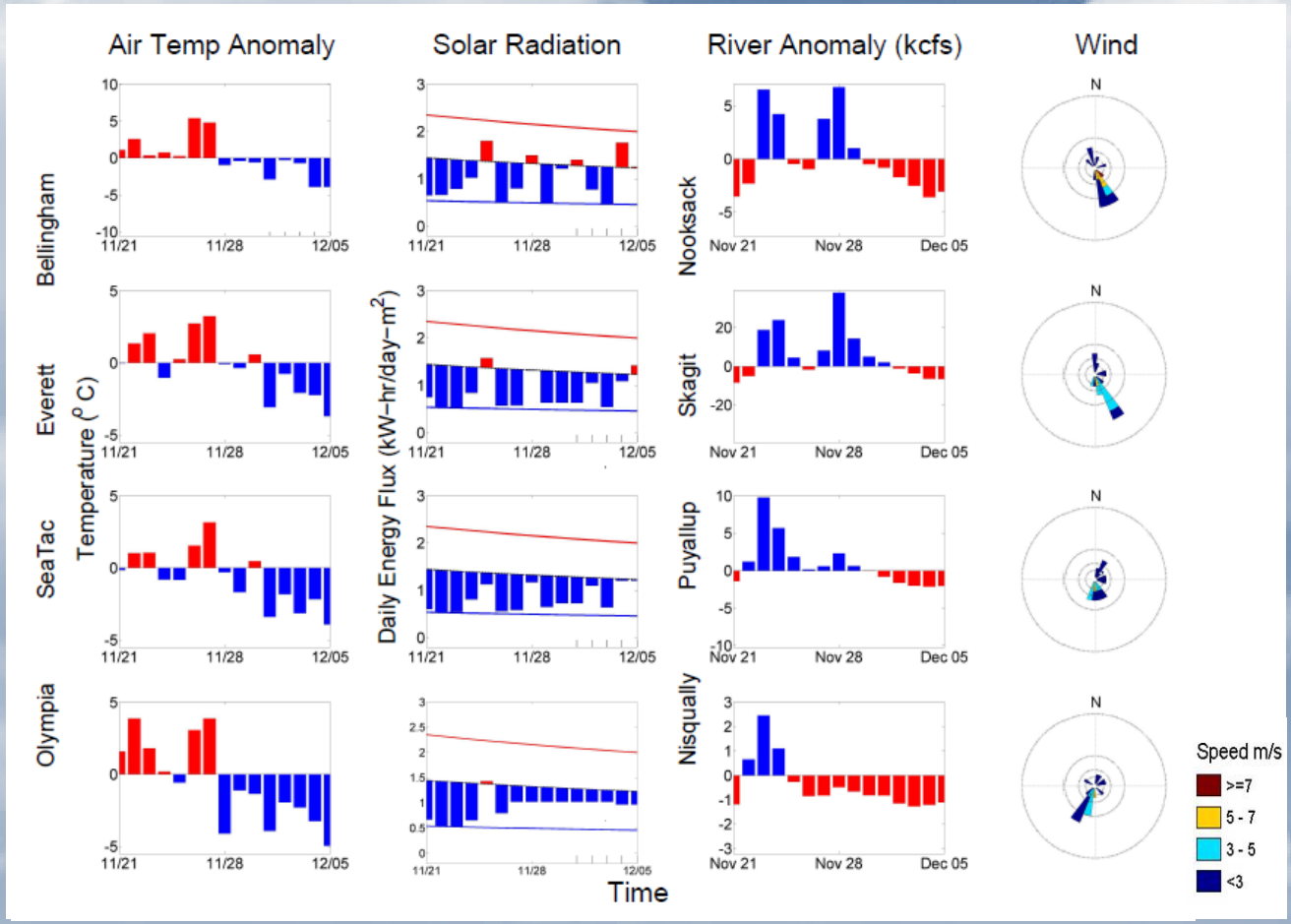
Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. I summarized the specific conditions prevalent during the past two weeks, from north to south. Source: http://www-k12.atmos.washington.edu/k12/grayskies/nw_weather.html

Summary (11-21 to 12-05):

Air temperatures during the past few days have been decreasing, and are cooler than expected. Sunlight has been lower than expected for this time of the year.

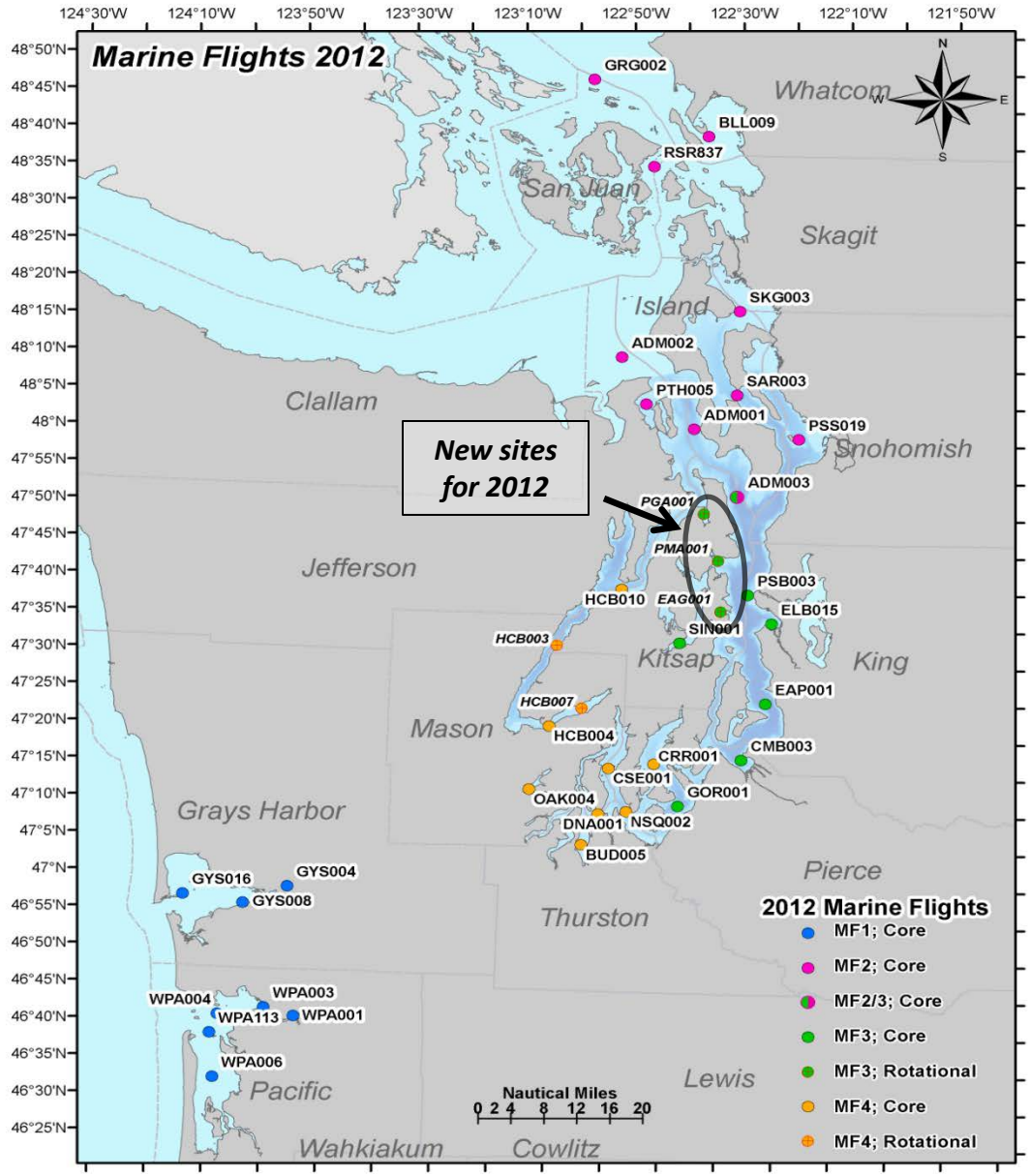
Rivers have been running first above and then below normal, particularly in South Puget Sound

Winds have been predominantly from the SE at northern regions, from the SW in southern regions.



Moore et al. 2008. Local and large-scale climate forcing of Puget Sound oceanographic properties on seasonal to interdecadal timescales. Limnol. Oceanogr., 53(5), 1746–1758

New Flight and Stations for the year 2012



NEW Flight and Station Maps

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.

Summary: Aerial Photography 12-05-2011

Impressive jelly fish patches in Budd Inlet, Sinclair Inlet and some smaller aggregations in Case inlet. Interesting and numerous debris lines visualize hydrodynamic processes at several locations

Start here

Aggregation in Sinclair Inlet, is it jelly fish?

Thank you for Kenmore's dedicated service

Front

Mixing and Fronts: 5 9 11 12

Budd Inlet, near Anderson Island, Colvos Passage, near Manchester

Plume

Suspended sediment: 11 13

Colvos Passage, Ballard ship canal, Seattle

?

Bloom

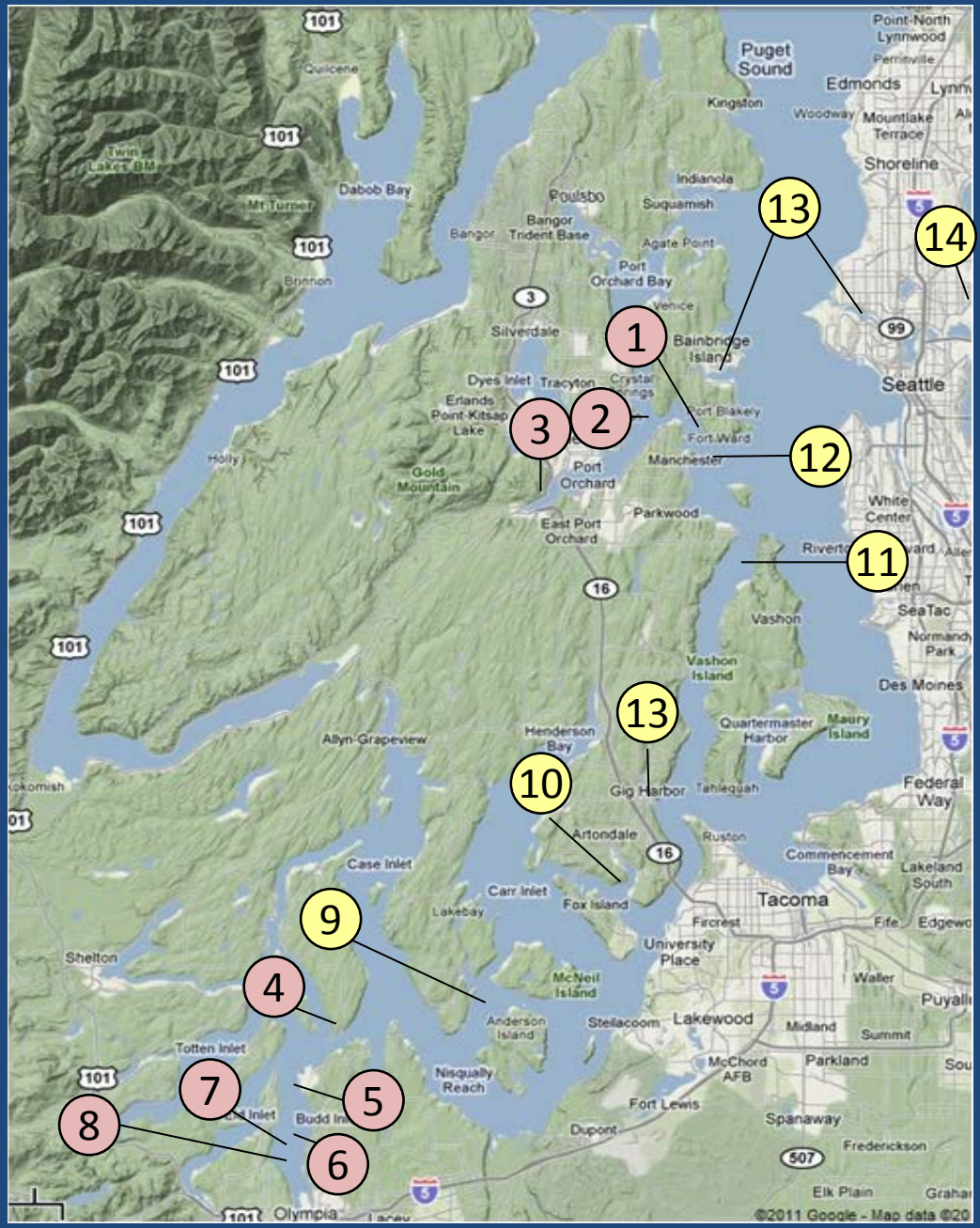
Visible blooms: 14

Green: Fountain, University of Washington

Debris

Debris 1 2 4 6 7 10 12 13

South Sound: Some filaments in Carr Inlet, Budd Inlet. Central basin: Colvos Passage, East of Vashon Island



Aerial Photography Image guide

12-05-2011

Click on numbers

- Morning Flight
- Evening Flight

Flight Information:

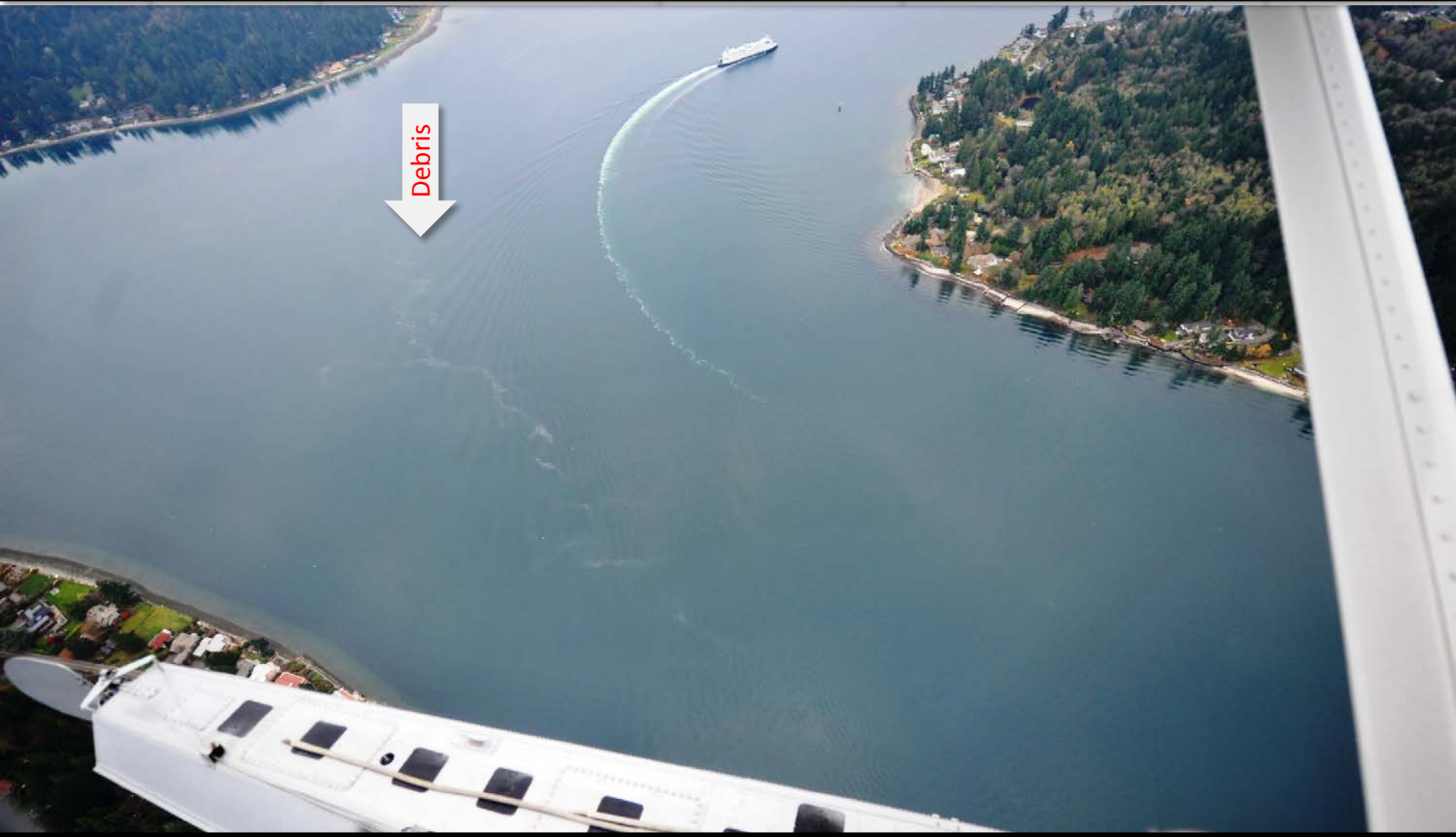
Morning flight:
Low clouds, altitude 1000ft, no wind (visibility limited, dark)

Evening flight:
Cloud banks affected flight route
Visibility limited, altitude 2500ft

Observational maps Central Sound

Observational maps South Sound

Surface slick and debris. Location: South-eastern tip, Bainbridge Island, 9:08 AM



Surface slick and debris. Location: South-westrn tip, Bainbridge Island, 9:09 AM

Aggregations of jellyfish (unconfirmed). Location: Western Sinclair Inlet, 9:12 AM

Debris line. Location: Dana Passage (South Sound), 9:26 AM

Front and debris line. Location: Northern Budd Inlet (South Sound), 9:28 AM

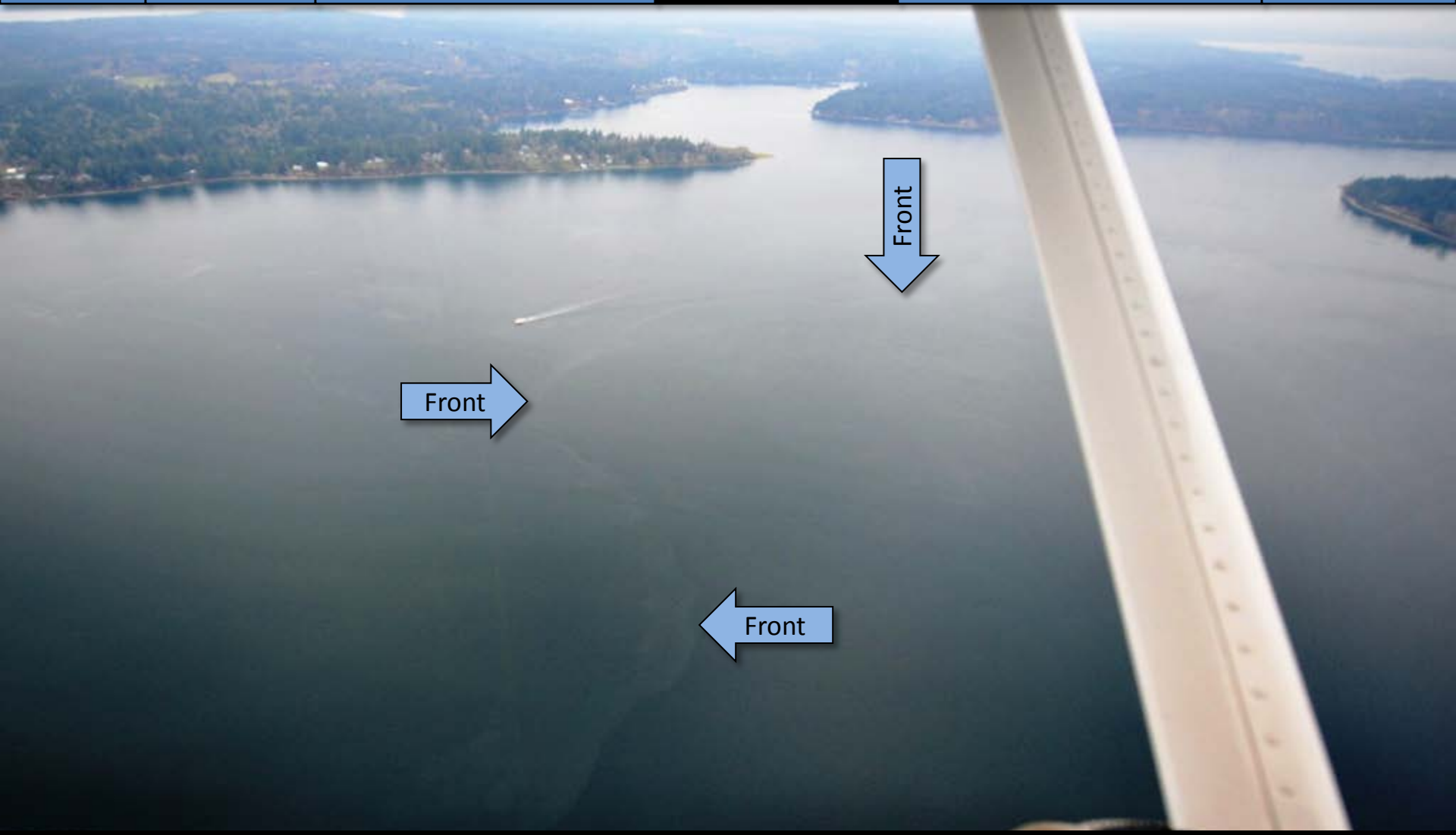
Debris line and large jelly fish patch. Location: Central Budd Inlet (South Sound), 9:29 AM

Numerous and large jelly fish patch. Location: Central Budd Inlet (South Sound), 9:30 AM

Aerial photography

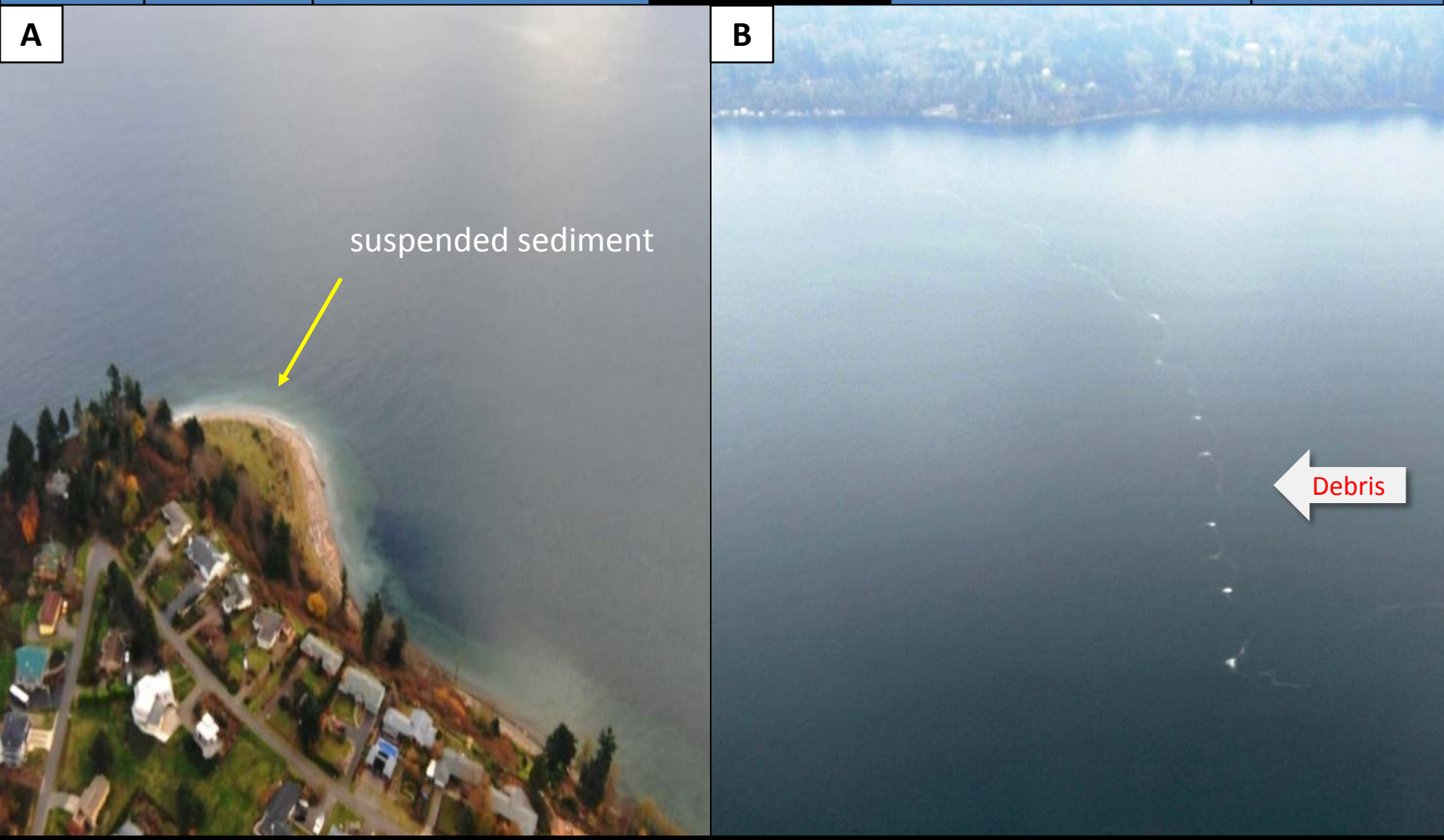
Numerous and large jelly fish patch. Location: Central Budd Inlet (South Sound), 9:30 AM

Aerial photography



Surface water front. Location: Between Anderson, McNeil Islands and Filucy Bay (South Sound), 1:33 PM

A line of debris, Location: West of Tacoma Narrows Airport (South Sound), 1:38 PM



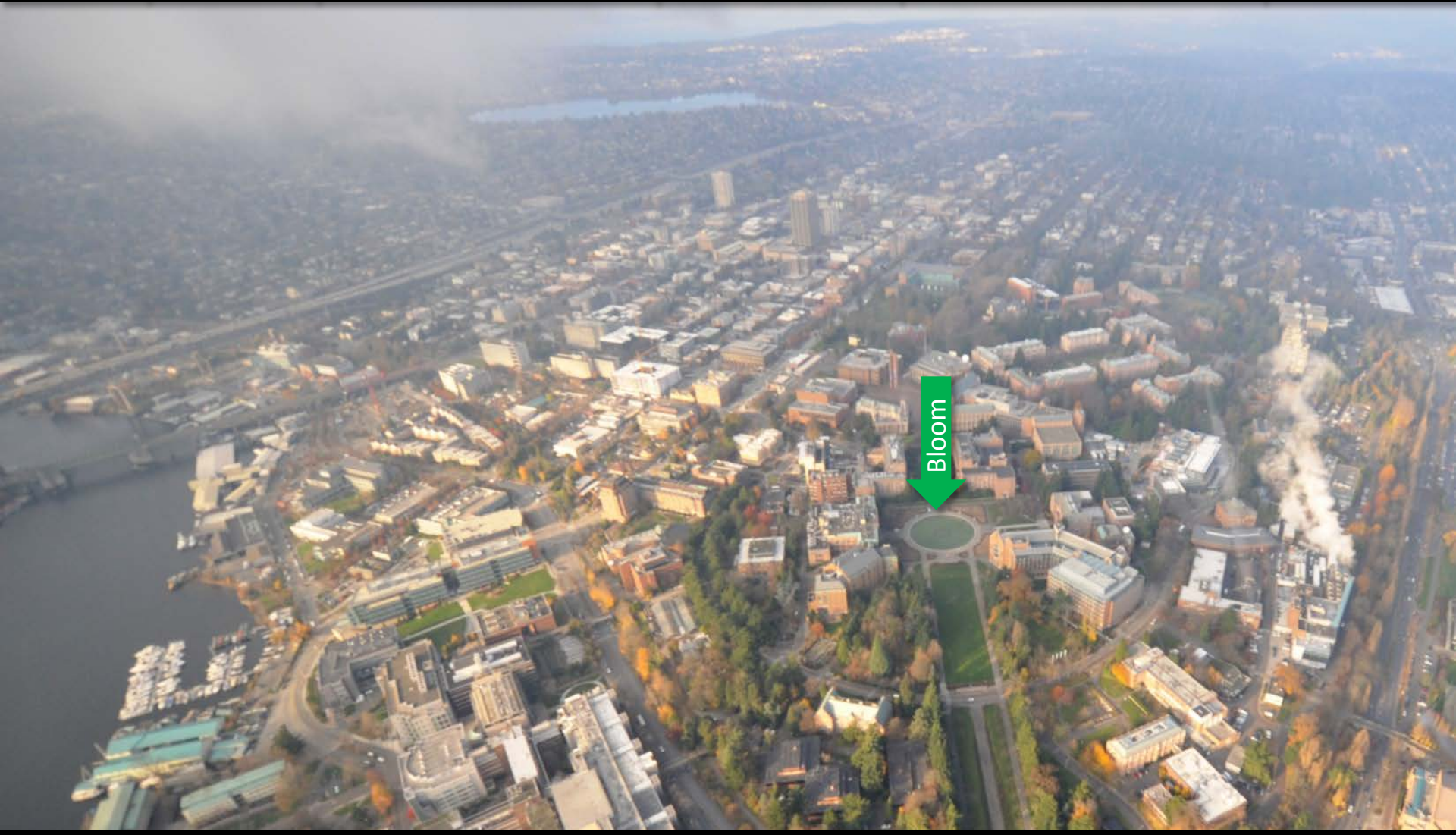
Beach erosion (A) and debris line (B). Location: Colvos Passage, Vashon Island (Central Sound), 1:46 PM

Aerial photography

Parallel surface slick/debris lines. Location: Off Manchester entering Sinclair Inlet (Central Sound), 1:50 PM

Aerial photography

Harbor check: (A) Eagle Harbor, (B) Gig Harbor, (C) Ballard. Location: (Central Sound)



Algae bloom. Location: University of Washington Campus (Seattle), 2:05 PM

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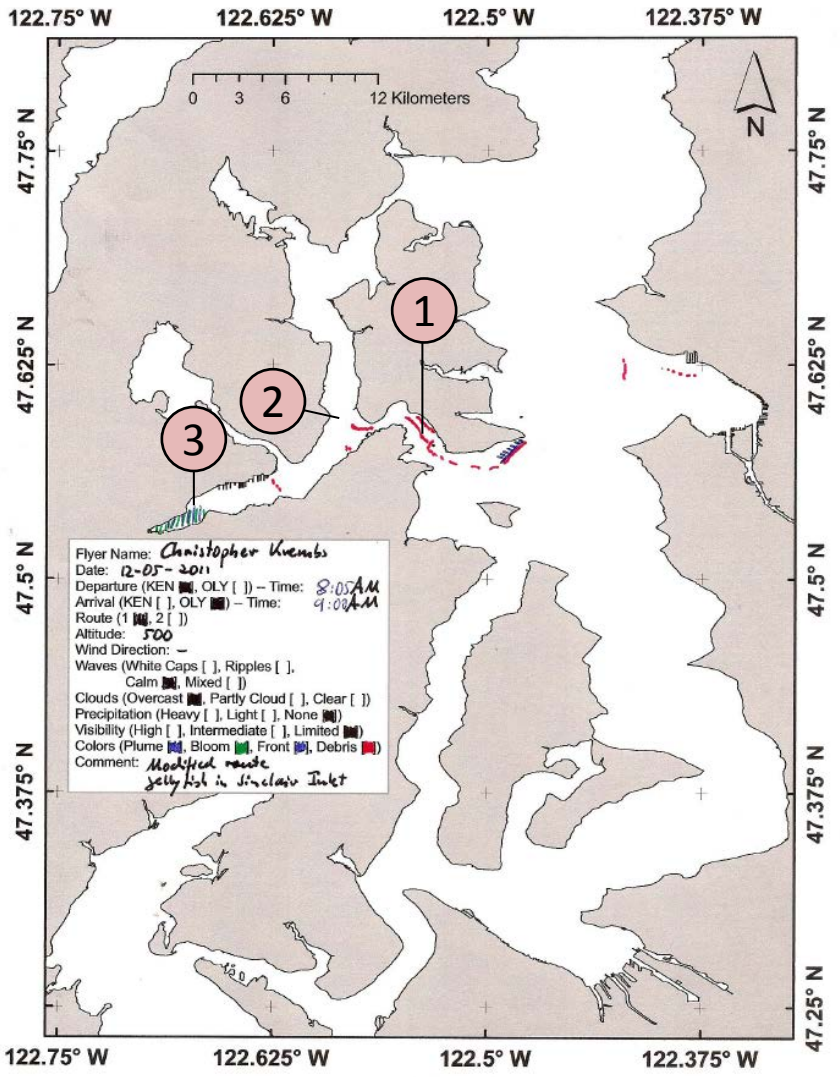
Aerial photography observations in Central Sound

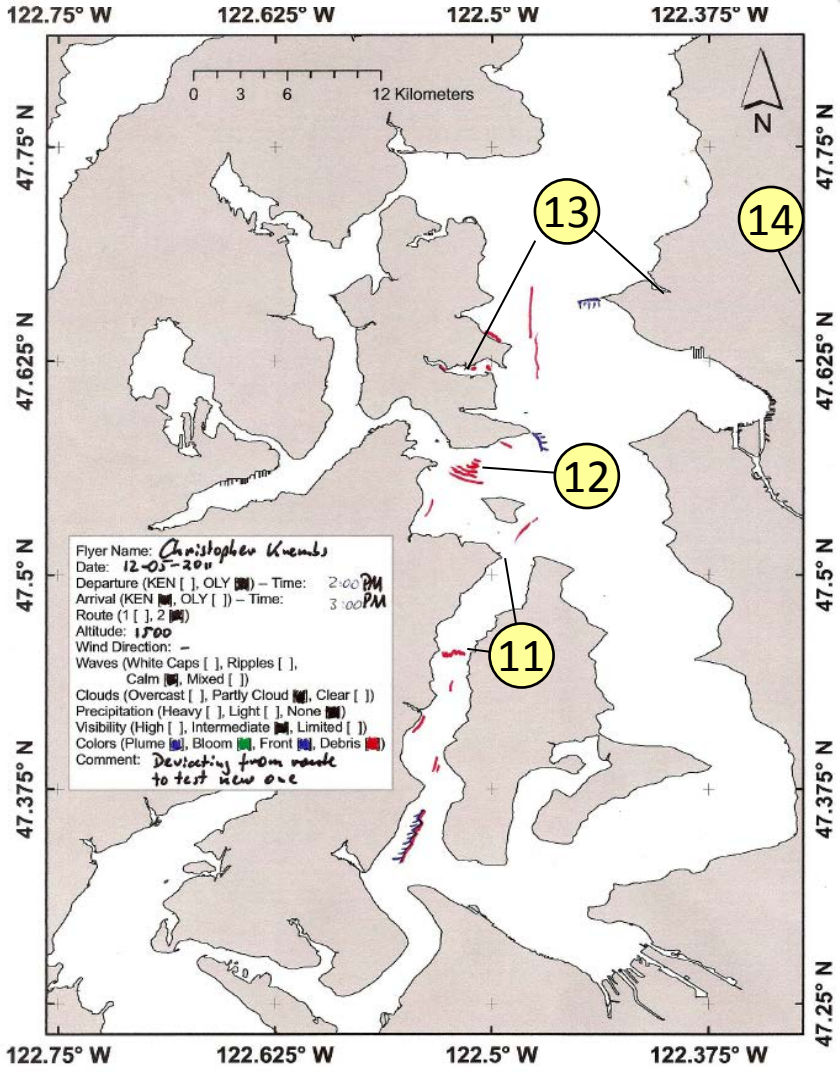
Navigate

Date: 12-05-2011

Morning



Evening

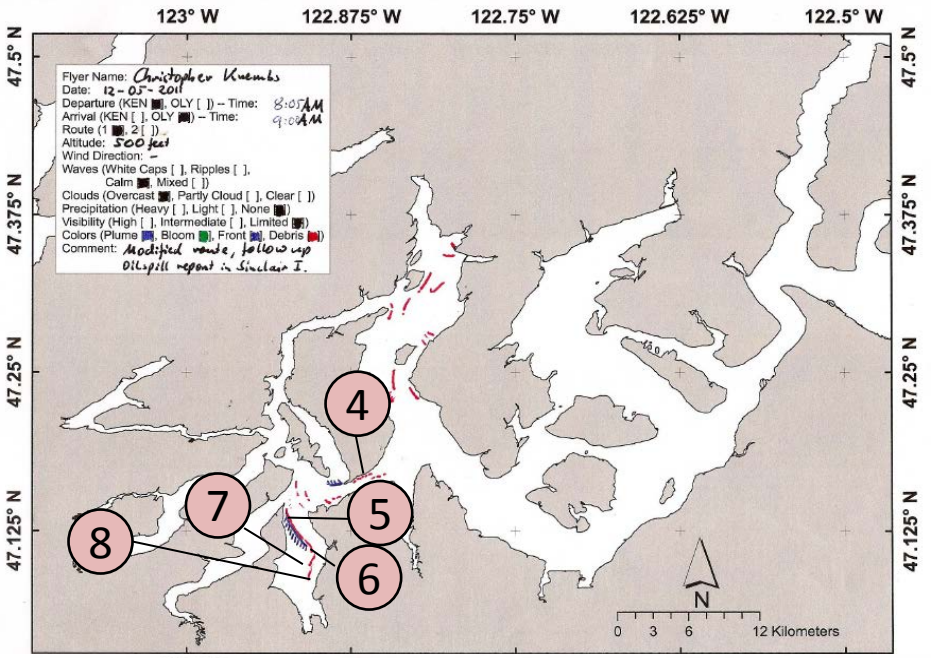


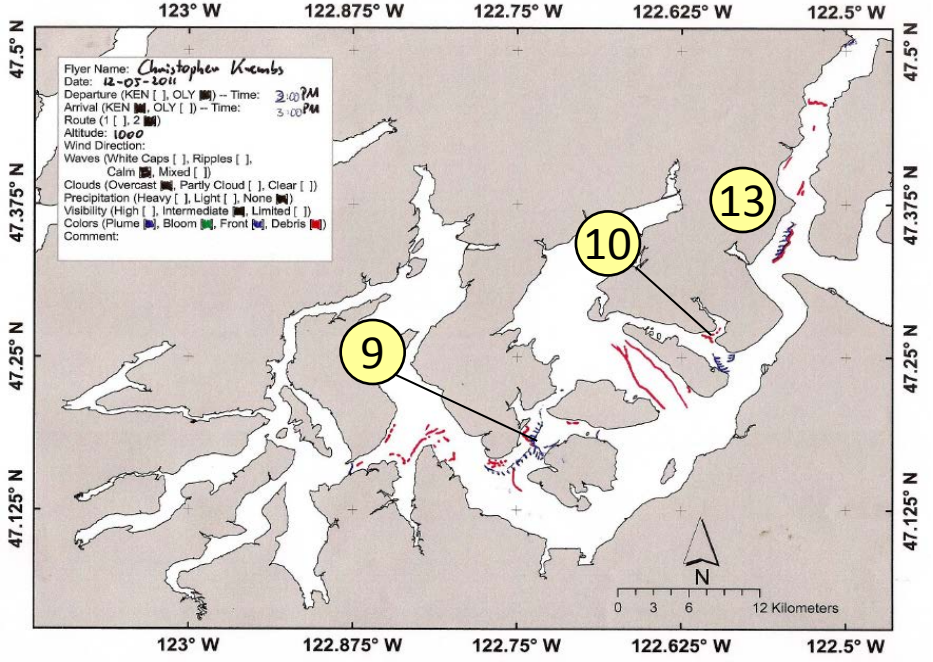
Numbers on map refer to picture numbers for spatial reference

Navigate

Aerial photography

Observations in South Sound: 12-05-2011





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Numbers on map refer to picture numbers for spatial reference

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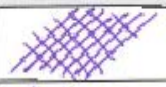
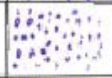
Legend to map annotations

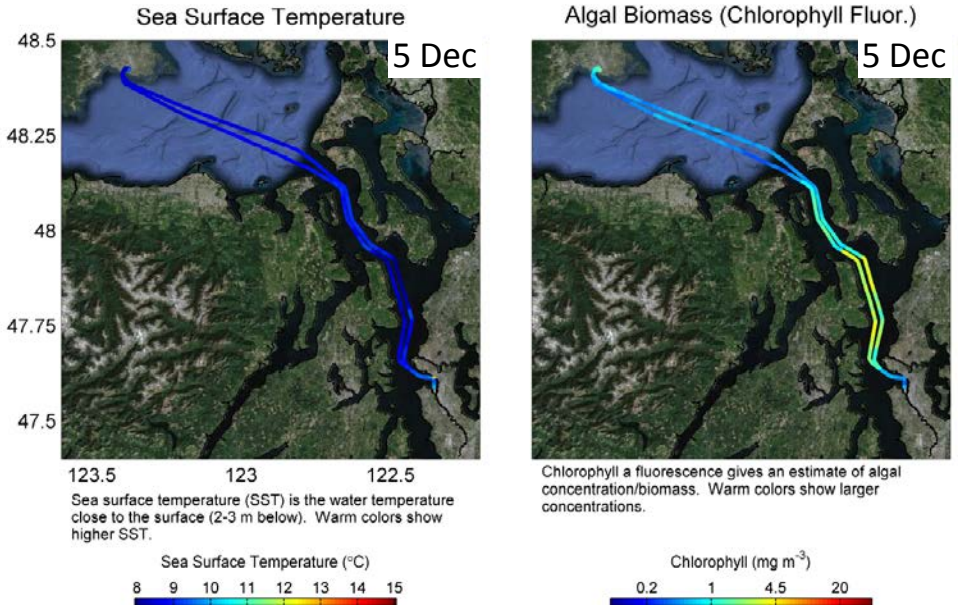
Plumes	
• Freshwater with sediment **solid**	
• Freshwater with sediment **dispersed**	
• Coastal erosion with sediment	
Blooms	
• Dispersed	
• Solid	
Debris	
• Dispersed	
• Solid	
Front	
• Distinct water mass boundaries	
• Several scattered	

Comments:
Maps are produced by observers during and after flight and intended to give an approximate reconstruction of 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, 12-05-2011

Contact: brandon.sackmann@ecy.wa.gov

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



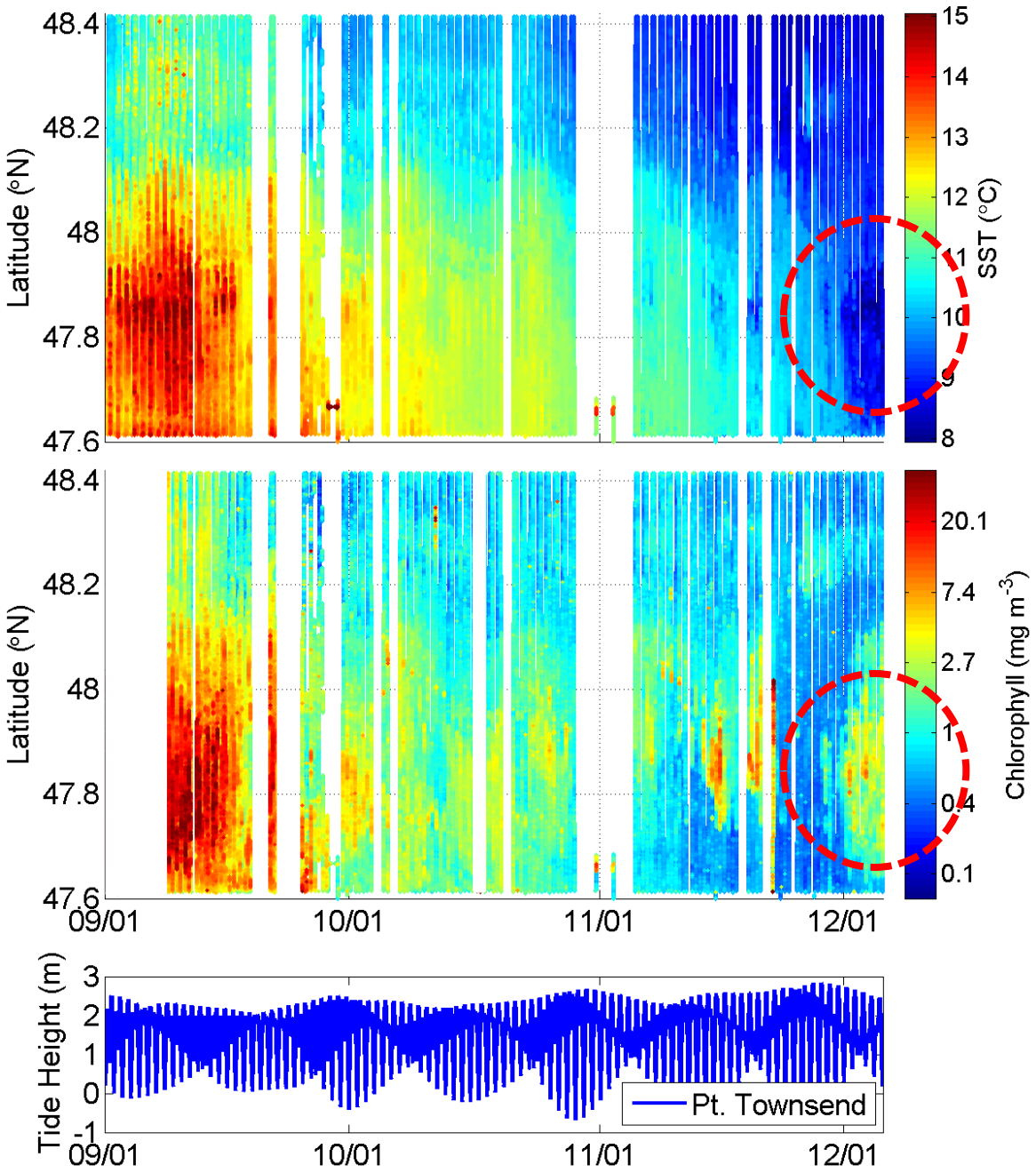
Current Conditions: Phytoplankton bloom visible in Central Sound (associated with increased river discharge); lowest fluorescence values in Strait of Juan de Fuca; surface temperatures are less than 9 °C throughout Central Sound and the Strait of Juan de Fuca.

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

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

Temperatures continue to cool and increased stratification near entrance to Whidbey Basin continues to encourage phytoplankton bloom

Waters in Central Sound and the Strait of Juan de Fuca have cooled to approx. 9 °C. Temperatures less than 8 °C are associated with freshwater from Whidbey Basin.



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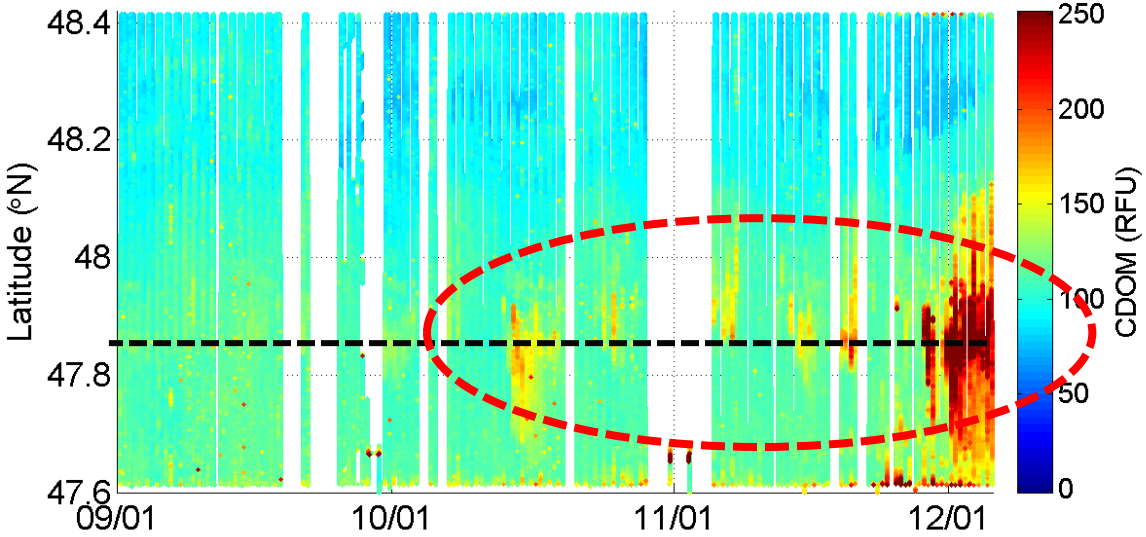
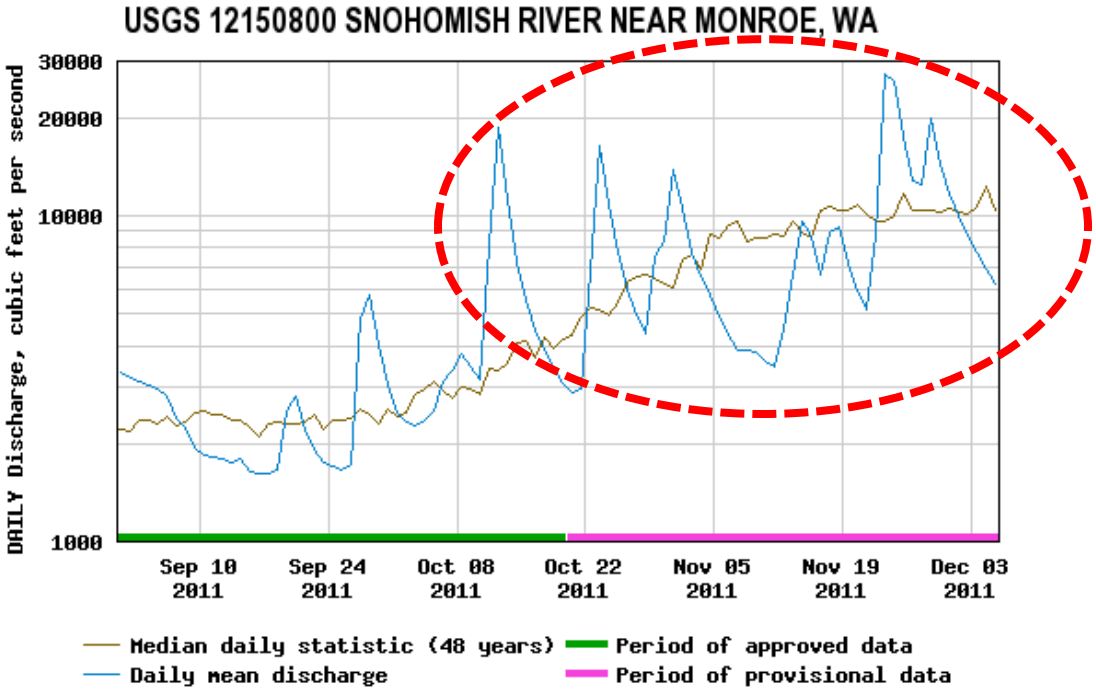
CDOM fluorescence as an indicator of freshwater influence in Central Sound

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

Recent rainfall events and increasing river discharge lead to highly colored pulses of water moving from Whidbey Basin (dashed black line) into Central Sound.

Latest freshwater pulse will likely lead to increased stratification that promotes ongoing phytoplankton blooms.





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Mooring observation and trends from Nov. 2 - 16, 2011

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

Summary: Over the past 2 weeks, waters have become colder and locally fresher in the south. Oxygen on the other hand is still slowly decreasing at places suggesting winter mixing has not fully set in.

1. **Mukilteo, Whidbey Basin near Everett:** Higher DO related to lower salinity. Temperature decreased at depth (12-16m, NB). Mean values:

NB: **DO: 5.9 mg/L** (↓ 0.1 mg/L)
Temp: 10.3°C (↓ 0.5°C)
Salinity: 29.5 PSU

Surface: Not reporting

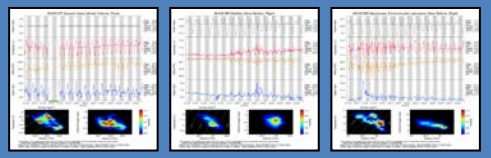
2. **Manchester, Central Sound:** DO at depth (11 m, NB) increased while temperature and salinity decreased. Stratification weak throughout most of the deployment.
Mean values:

NB: **DO: 6.2 mg/L** (↑ 0.3 mg/L)
Temp: 10.1°C (↓ 0.8°C)
Salinity: 29.9 PSU (↓ 0.4 PSU)

Surface: **Temp: 10.0 °C** (↓ 1.0°C)
Salinity: 29.9 (↓ 0.7 PSU)

3. **Squaxin Passage (South Sound) near Olympia:** Dissolved oxygen, salinity, and temperature at depth (5 m) decreased. Mean values:

DO: 7.3 mg/L (↓ 0.2 mg/L)
Temp: 9.5°C (↓ 0.8°C)
Salinity: 28.0 PSU (↓ 1.1 PSU)



Real-time data online (click)

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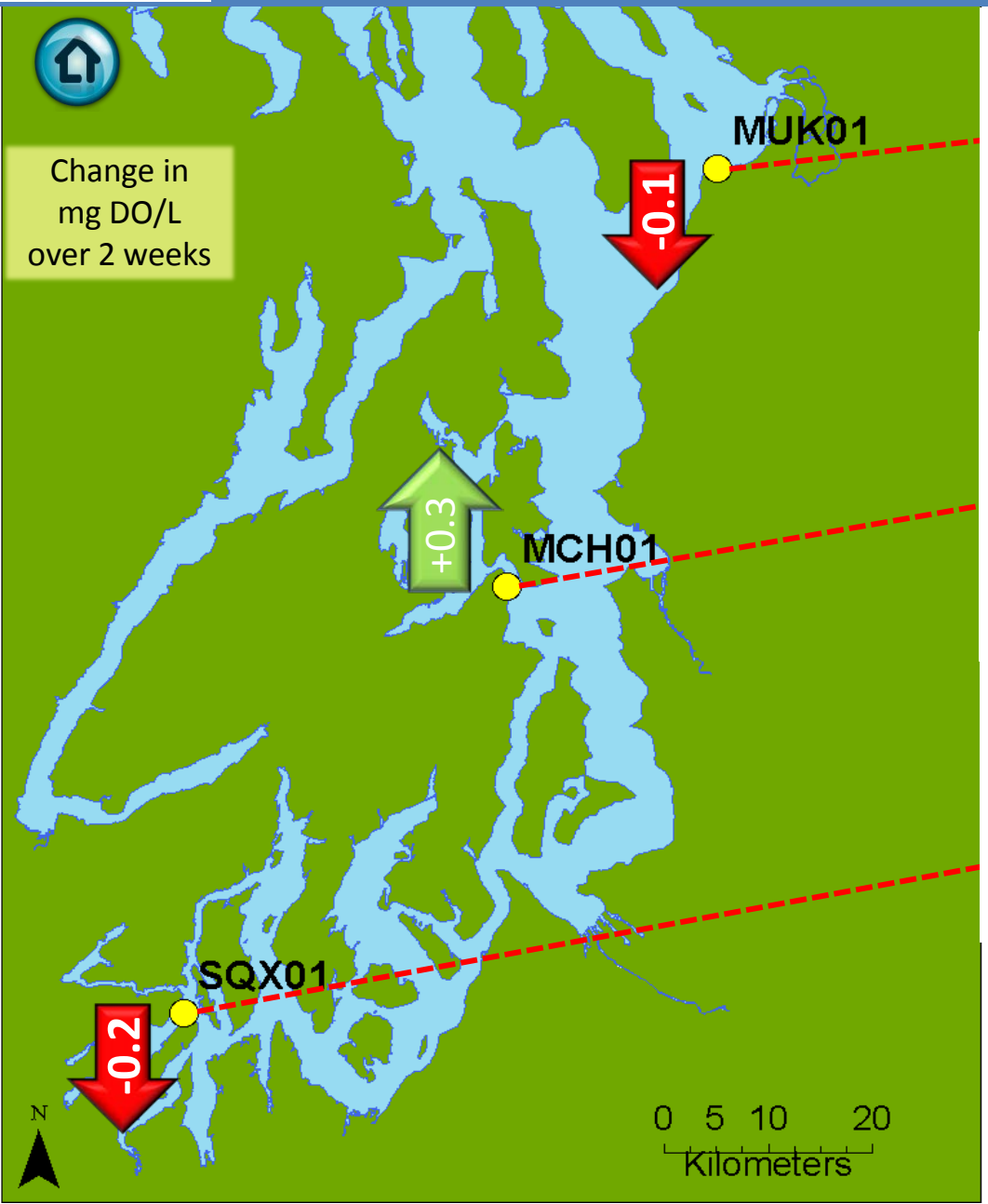
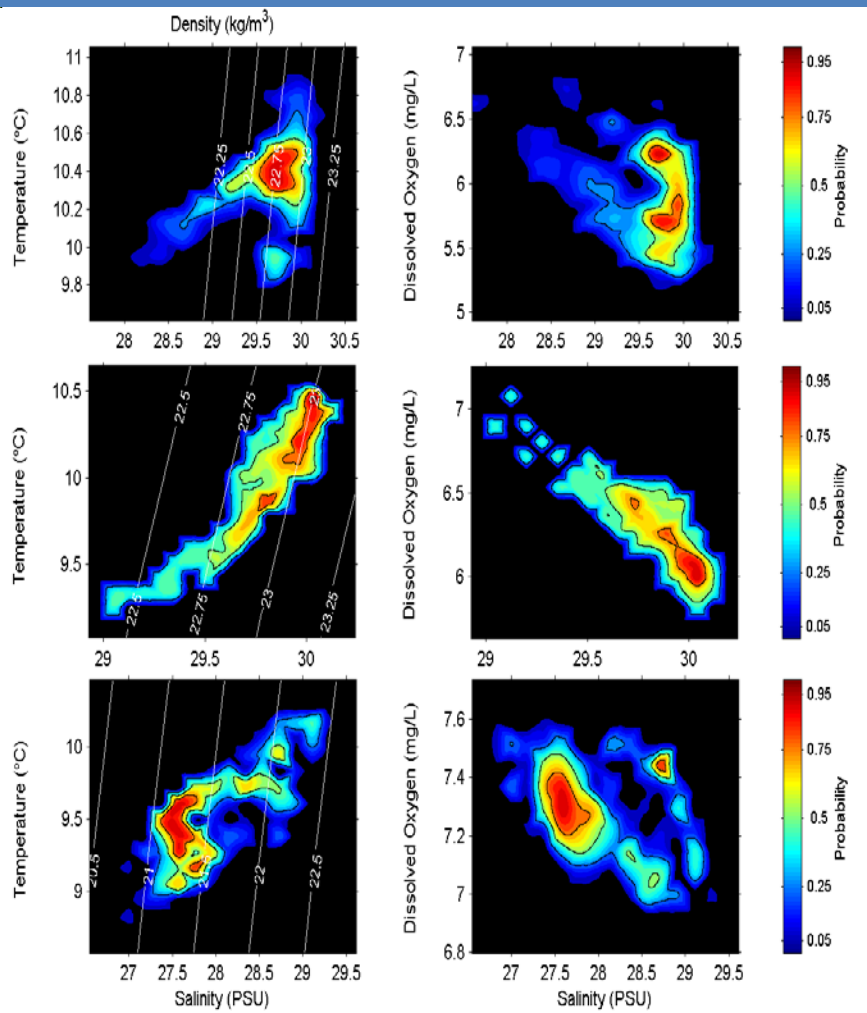
Water characteristics from our moorings: 11/21-12/05/2011





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

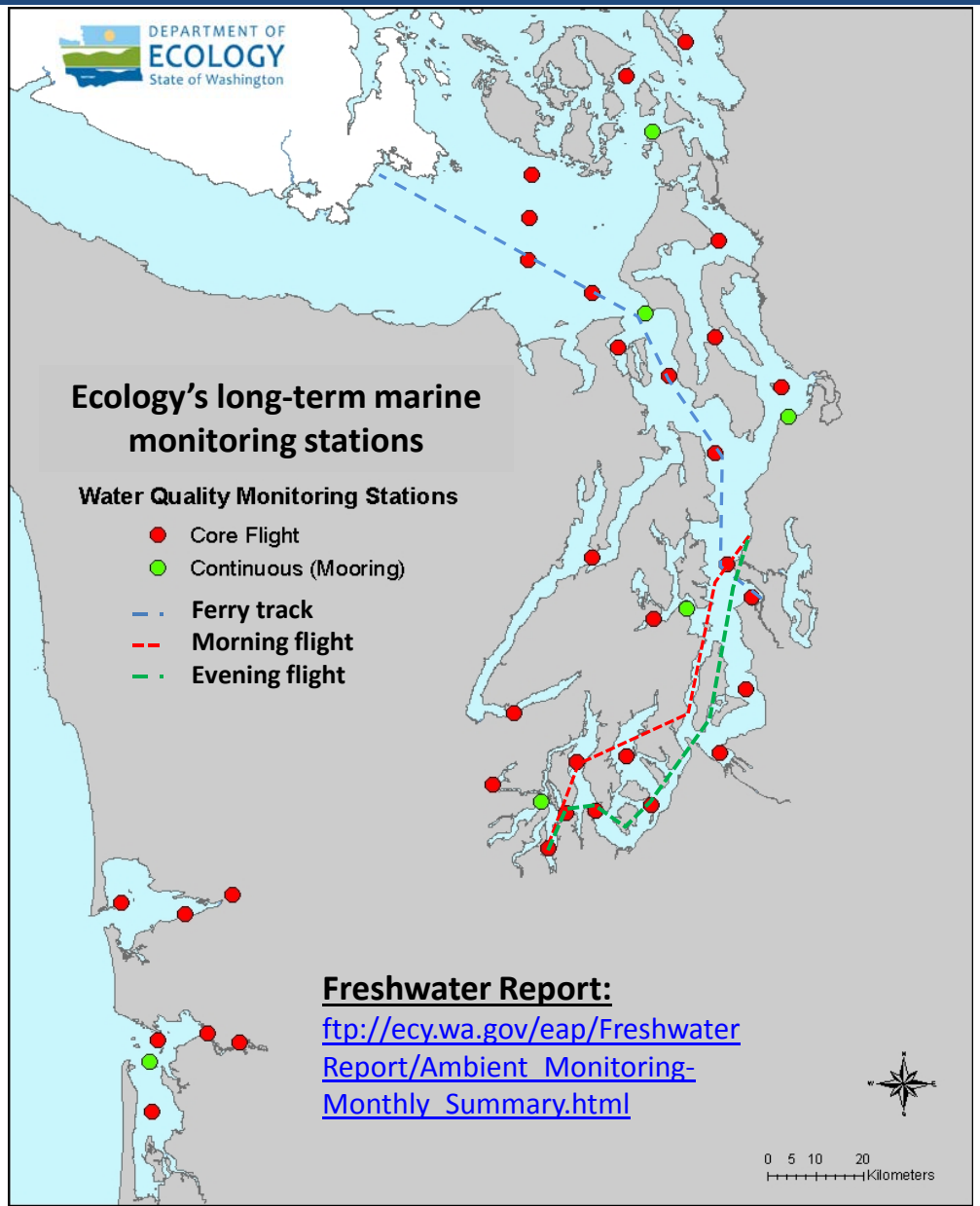
Right Panel: Dissolved oxygen concentration in relation to salinity. High probability shown in warm colors.

Get your data from Ecology's Environmental Assessment Program

Long – Term Monitoring Network

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

Access core monitoring data:
http://www.ecy.wa.gov/apps/eap/marinewq/mwdataset.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

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.