

# Eyes Over Puget Sound

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

## Surface Conditions Report

### July 31, 2012

[Start here](#)

We have a new website ([take a look](#))

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

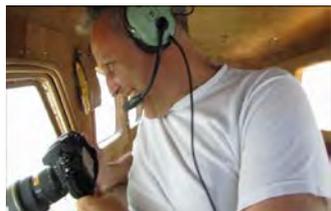
*Julia Bos*



*Skip Albertson*



*Dr. Christopher Krembs*



*Dr. Brandon Sackmann*



*David Mora  
Suzan Pool*



## Personal flight impression

[p. 3-4](#)

Blue skies, green seas and bountiful debris.

## Weather conditions

[p. 5](#)

Sunshine is strong in the north. In the south a persistent marine layer over the lowlands keeps conditions cooler than normal. River flows are higher.

## Aerial photography

[p. 7-25](#)

Extensive red-brown and turquoise blooms in South Sound: Case, Budd, Eld and Henderson Inlet.

## Ferry and satellite

[p. 26-29](#)

High fluorescence in the Main Basin. Temperatures approach 15 °C, near-surface salinity ~27 PSU.

## *In-situ* mooring data

[p. 30-32](#)

In Whidbey Basin, higher DO levels coincide with lower salinity, warmer water and algal blooms.

## Marine Flight 2 (North Sound)

### When it is foggy we can't land on the water.

For the past few weeks, western Washington has been beset by low marine fog brought by onshore flow from the Pacific. "High pressure produces sinking air which warms up.....with cool water near the surface we end up with an inversion in the lower atmosphere. So we have cool, moist air (with lots of low clouds) near the surface and dry warm air aloft."

<http://cliffmass.blogspot.com/2012/06/ocean-full-of-clouds.html>

When it is foggy on the water, we can't land at our sampling sites, so it has been difficult to get our July sampling completed. It has been foggier over South & Central Sound than in areas North of Admiralty Inlet where the marine layer was more intermittent.

Because of these conditions, we completed our last flight of July, the North Sound, on the 31<sup>st</sup>.



*Julia Bos has been flying for us for 13 years*



*CTD in green water at Georgia Strait*

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We started the day in overcast conditions at Admiralty Inlet & Port Townsend. As we flew further north, the clouds disappeared. Summertime is in full swing in the San Juan Islands!

Salish Sea waters are very green right now with abundant growth of both micro and macro algae in many bays & passages. Algal mats have formed on the surface and foam and debris from decay of plankton blooms can be seen along shorelines and fronts formed by different currents. A very red bloom is growing along the southern shoreline of Samish Bay.

Donovan Rafferty of the Air Quality Program joined the flight and took great pictures as well as measurements of ozone along the entire flight route.



*Macro-algae and bloom debris in Padilla Bay*



*Red bloom in Samish Bay*

*Macro-Algae Mats in Saratoga Passage*



**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](http://www-k12.atmos.washington.edu/k12/grayskies/nw_weather.html)

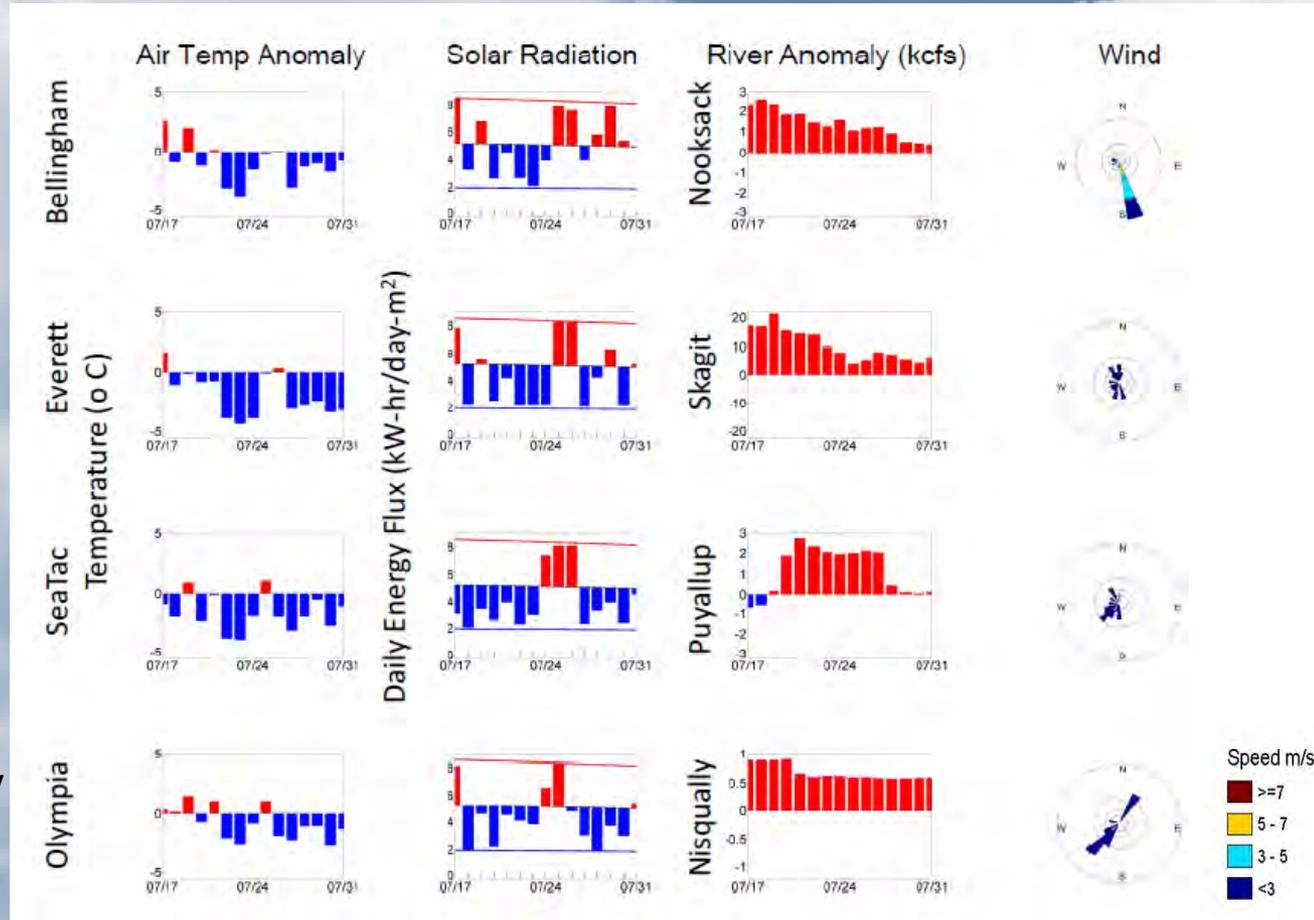
## Summary:

**Air temperatures** during the past few weeks have generally been below average.

**Sunshine** has been stronger in the north. In the south a persistent marine layer lingers over the lowlands.

**Rivers** have generally been running above normal.

**Winds** have been predominantly from the south and stronger in the north.



## Combined reporting of long-term monitoring products and present conditions

Go to website

Slideshow highlighting data products and the Marine Water Condition Index (MWCI)

Find past conditions for weather, the water column and surface and mooring sites.

**MARINE WATERS HOME**

Estuaries like the Puget Sound have naturally large differences in water quality. We [monitor marine water](#) in Puget Sound, Grays Harbor and Willapa Bay using seaplanes, ferries and moored instruments.

**Our Products at a Glance:** *(click on slide)*

Regions	1999	2000	2001	2002	2003	2004	2006	2007	2008	2009	2010
Admiralty Reach	20	13	8	4	0	-5	-3	-6	3	1	7
Georgia Basin	-2	14	13	2	2	0	2	-7	2	9	10
S. Hood Canal	28	7	5	2	4	8	-1	12	6	10	-13
Central Basin	15	14	12	8	0	-6	3	4	1	7	11
Bellingham Bay	10	13	25	-3	1	6	13	10	7	2	12
Sinclair Inlet	8	16	15	0	-1	5	-8	10	3	1	-14
Oakland Bay	16	13	14	-1	-6	10	-5	1	3	-3	-7
South Sound	19	14	14	-6	4	0	-5	-2	3	0	-12
Elliot Bay	23	19	5	-4	-9	3	-10	9	3	3	-6
Commencement Bay	17	8	15	-3	-6	1	4	-1	6	4	8
Whidbey Basin	11	8	8	-8	-2	-10	-1	1	8	7	13
Budd Inlet	8	14	17	1	-12	-9	-7	-1	8	4	0

**Reporting changes in eutrophication and marine conditions for Washington's coastal bays and Puget Sound**

**MARINE CONDITIONS AT A GLANCE:**

**Water Surface** | Water Column | Tidal Effects | Weather Conditions

**Conditions at the Water Surface for the Last Month:**

Update 6/13/12  
 Large Noctiluca bloom in Central Sound. Strong red-brow bloom and turquoise in Case Inlet. Oil sheen in Sinclair Inlet. Reduced fluorescence south of Edmonds; likely related to intense Noctiluca bloom. (Read more)

EOPS releases

Video of Marine Waters Unit activities

Video and information on algae blooms

Video of long-term nutrient trends

Field log	Weather	Water column	<b>Aerial photos</b>	Ferry and Satellite	Moorings
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Extensive red-brown blooms in South Sound Inlets and parts of Central Sound. High algae blooming activity in most of Puget Sound. Jellyfish aggregations grow in size and number in Budd Inlet. Several large tidal eddies.

[Start here](#)

Red-brown and turquoise bloom - Budd Inlet



Puyallup river front entering Colvos Passage



**Mixing and Fronts:** [2](#) [7](#) [11](#) [13](#) [14](#)  
Fronts in Central Basin, Squaxin Passage, Budd Inlet and Quartermaster Harbor



**Suspended sediment:** [11](#) [14](#) [15](#)  
Budd Inlet, Commencement Bay extending to Quartermaster Harbor and Colvos Passage

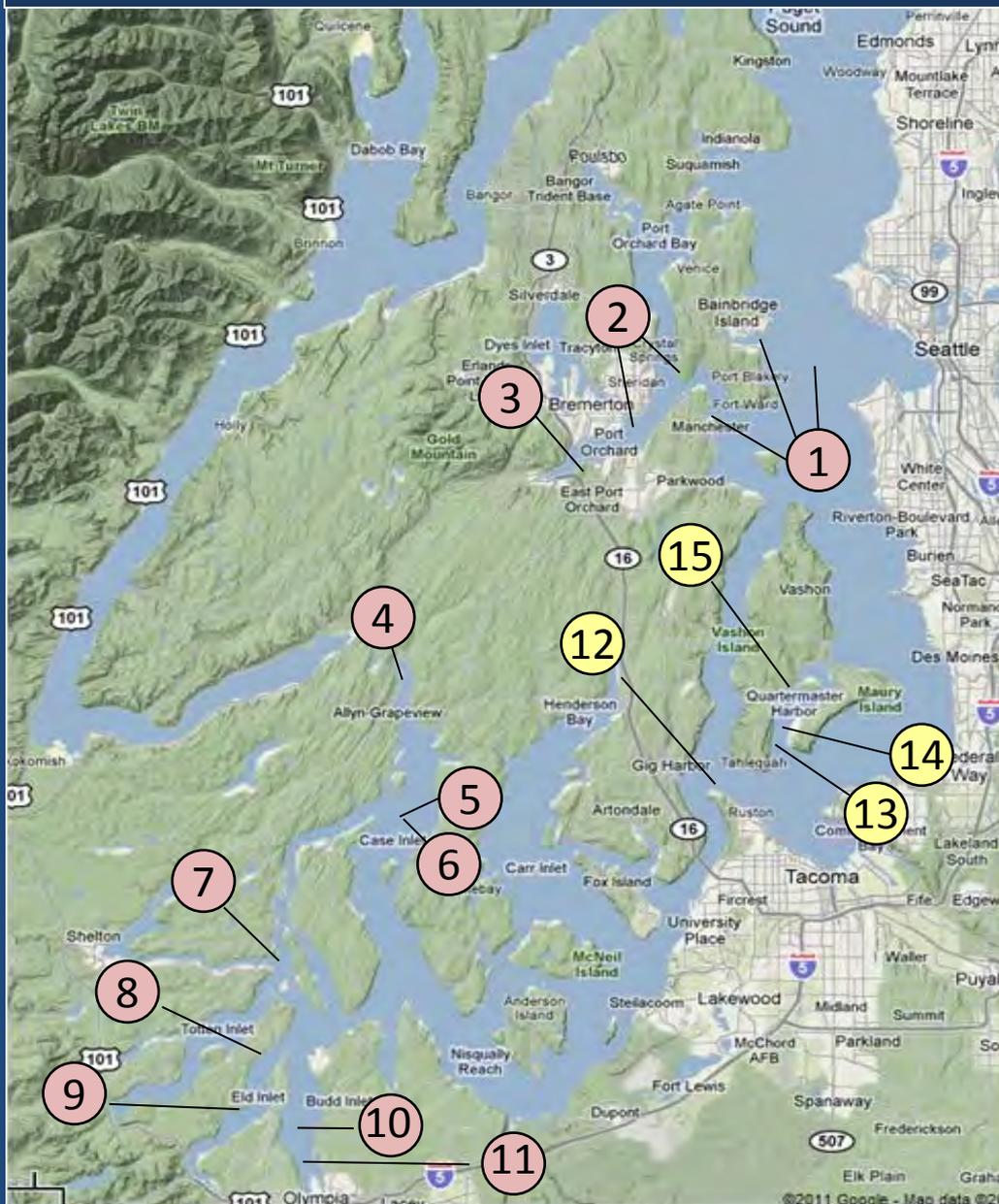


**Visible blooms:** [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [11](#)  
Red-brown : Sinclair, Case , Budd, Eld, Henderson Inlets. Quartermaster Harbor, East Passage. Olive to green: Central Basin, Sinclair, Carr, Henderson, Budd, Eld Inlets. Dana Passage, Squaxin Passage [13](#) [14](#) [15](#)



**Debris** [1](#) [2](#) [3](#) [5](#) [7](#) [8](#) [9](#) [10](#) [13](#) [14](#) [15](#)  
Abundant in Central Sound and usual locations in South Sound (Squaxin Passage, Case & Carr Inlets)

High tides : 2:58 AM 5:37 PM, Low tides: 10:30 AM, 10:45 PM



## Aerial photography navigation guide 7-31-2012



Click on numbers

### Flight Information:

- **Afternoon flight:**  
High visibility, calm, flooding
- **Evening flight:**  
High visibility, calm, high tide

### Observation Maps:

Central Sound

South Sound



Field log

Weather

Water column

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*Brown bloom in Central Sound.* Location: Between Elliott Bay and Sinclair Inlet, A. Eagle Harbor. B. Manchester Labs. C. Looking north. D. Looking south. 4:20 PM.



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*Green bloom in Sinclair Inlet.* A. Front from incoming tide.

B. Tidal eddy C. Water mixing. D. Tidal eddy. Location: Central Sound, 4:20 PM



Field log

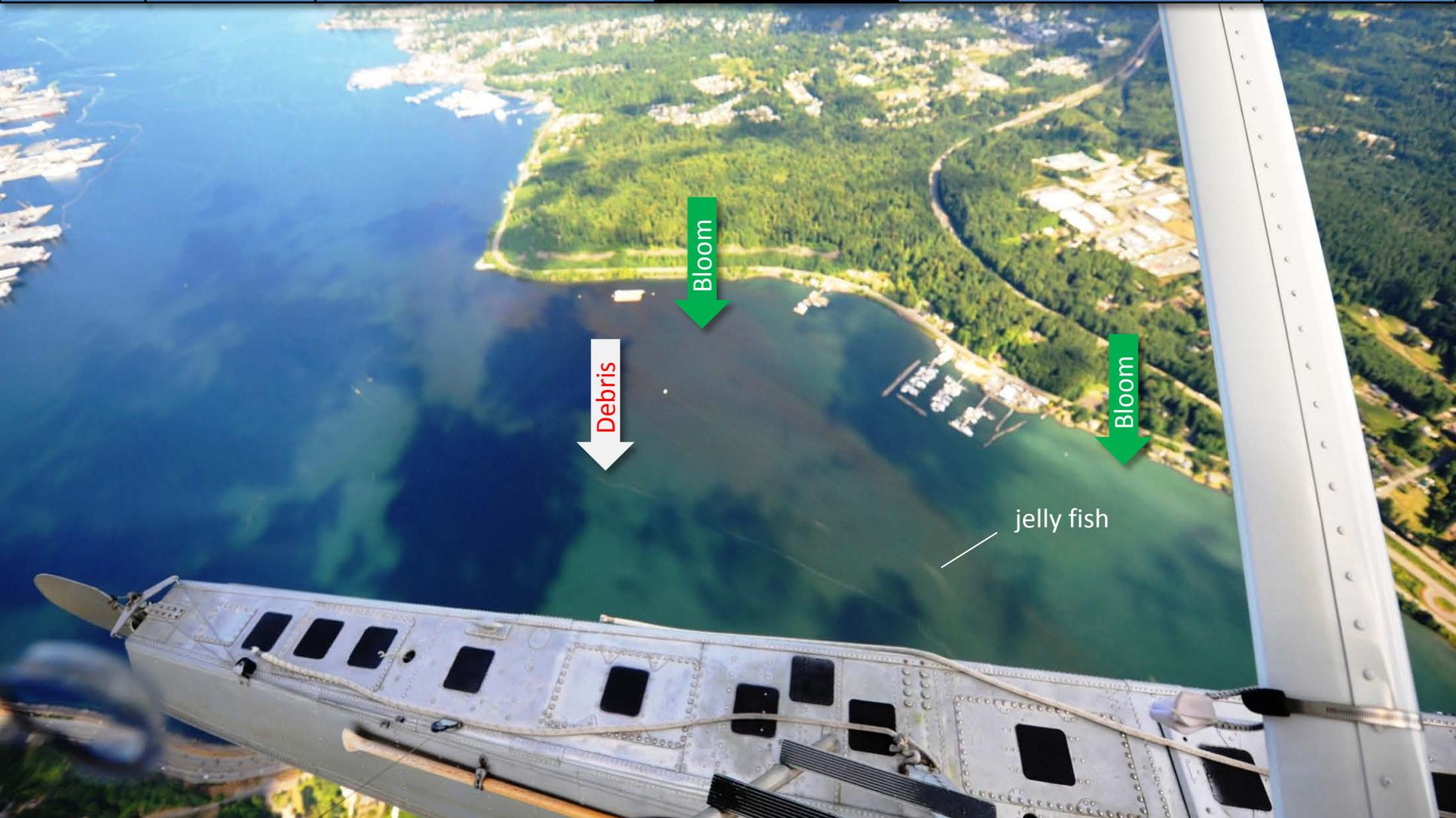
Weather

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Moorings



*Red-brown and turquoise bloom (+ cloud shadows). Location: Sinclair Island (Central Sound), 4:25 PM*



Field log

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Red-brown and olive-brown bloom. A. North Bay. B. Rocky Bay. C. Pickering Passage.  
Location: Case Inlet (South Sound), 4:32 PM



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*Extensive red-brown bloom.* Location: Case Inlet (South Sound), 4:33 PM

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*Extensive red-brown bloom.* Location: Case Inlet (South Sound), 4:33 PM



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*Algal bloom meeting different water. Location: Squaxin Passage (South Sound), 4:49 PM*



Field log

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*Tidal eddy and strong bloom. Location: Eld Inlet (South Sound), 4:51 PM*



Field log

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Moorings



*Red-brown and turquoise blooms (+ cloud reflections).* Location: Eld Inlet (South Sound), 4:52 PM



Field log

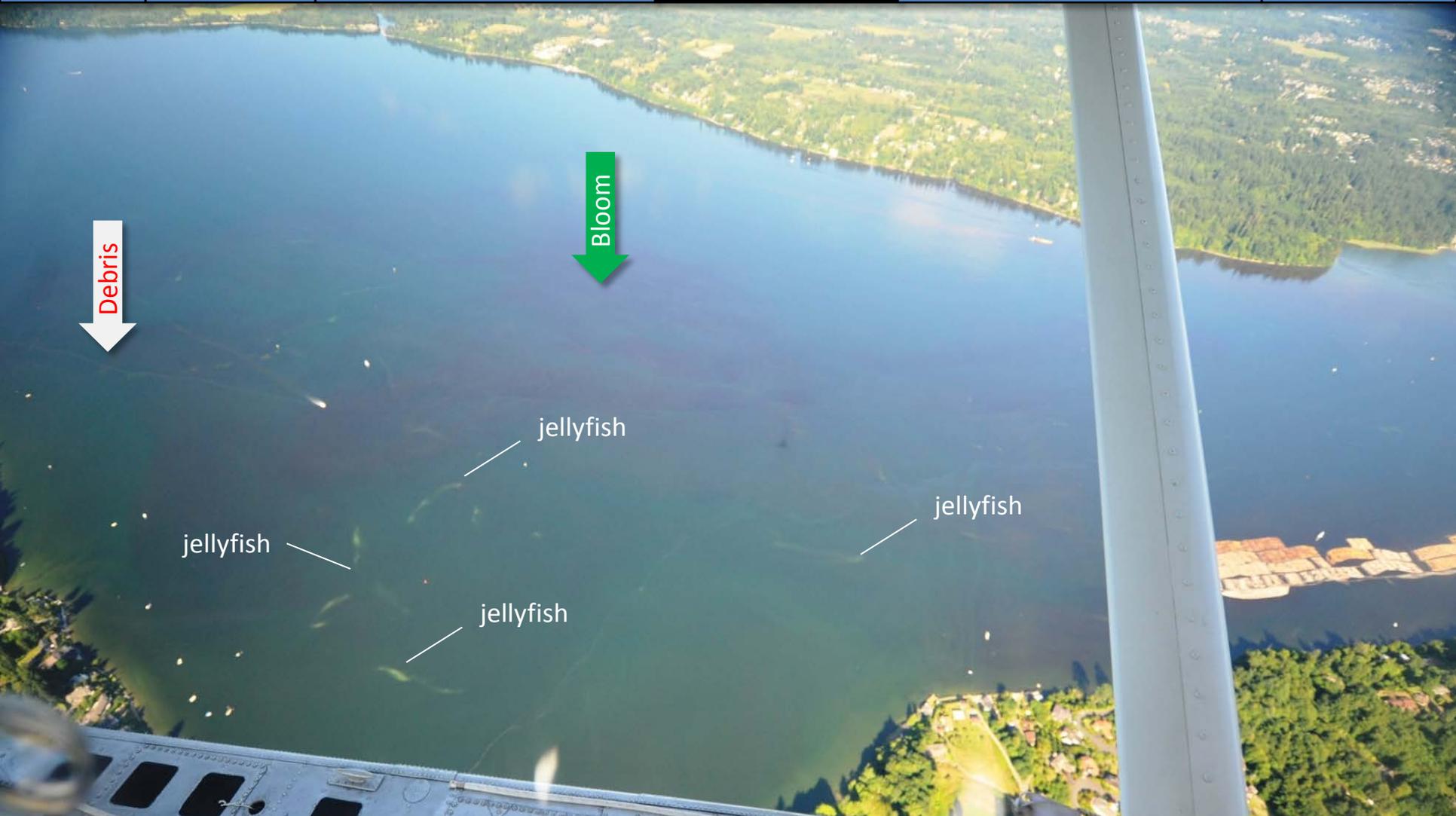
Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



*Red-brown and turquoise blooms, jellyfish (+ cloud reflections).* Location: Budd Inlet (South Sound), 4:54 PM



Field log

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*Red-brown and turquoise blooms, jellyfish (+ cloud reflections).* Location: Budd Inlet (South Sound), 4:56 PM



Field log

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*Puyallup River plume entering Tacoma Narrows. Location: Point Defiance (Tacoma) 5:38 PM*



Field log

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*Puyallup plume meets red-brown bloom.* Location: Quartermaster Harbor - Vashon Island,  
5:40 PM



Field log

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*Puyallup plume meets red-brown bloom.* Location: Quartermaster Harbor - Vashon Island,  
5:40 PM



Field log

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*Strong red-brown bloom* . Location: Quartermaster Harbor - Vashon Island, 5:40 PM

Field log

Weather

Water column

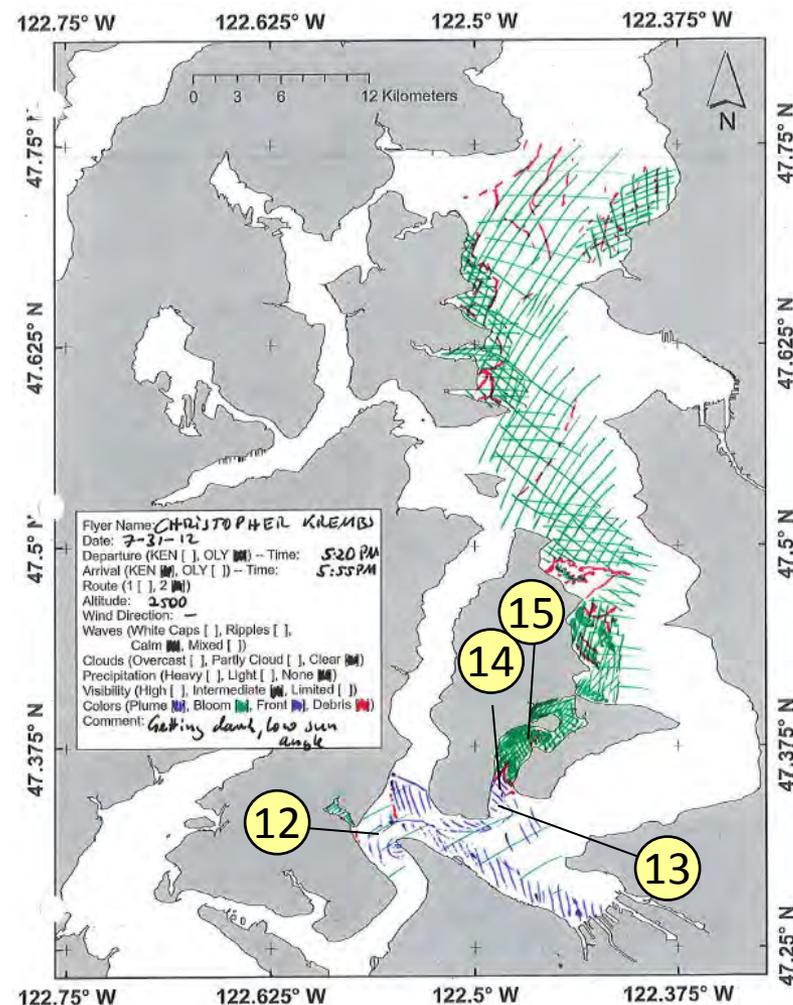
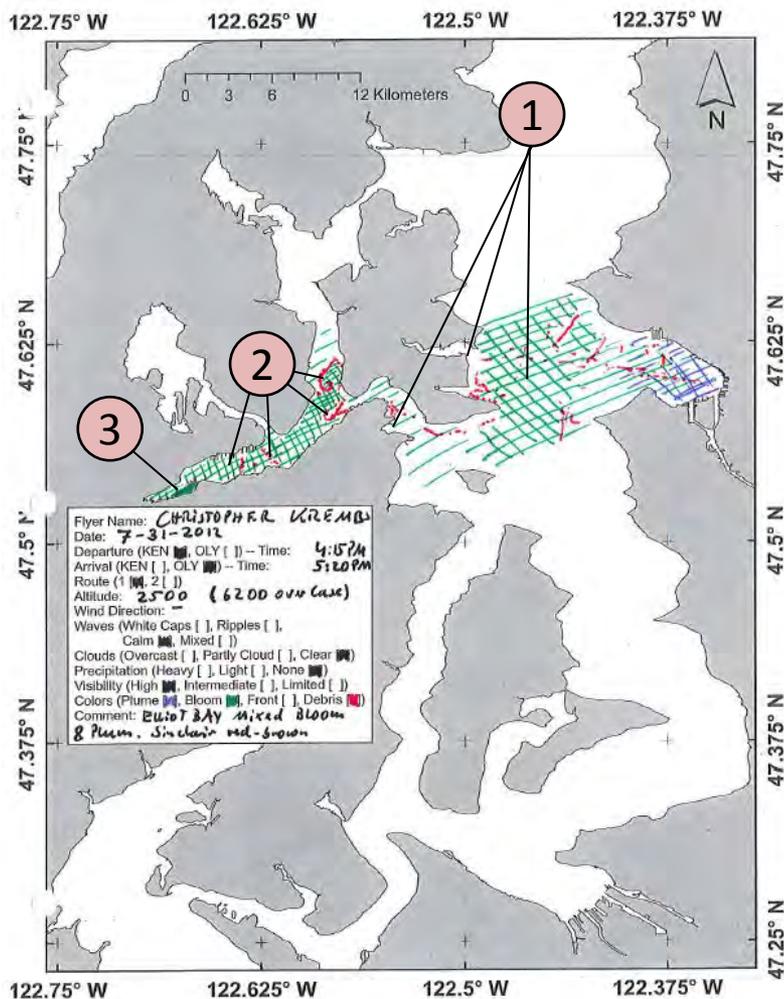
Aerial photos

Ferry and Satellite

Moorings

Morning

Evening



Numbers on map refer to picture numbers for spatial reference



# Aerial photography

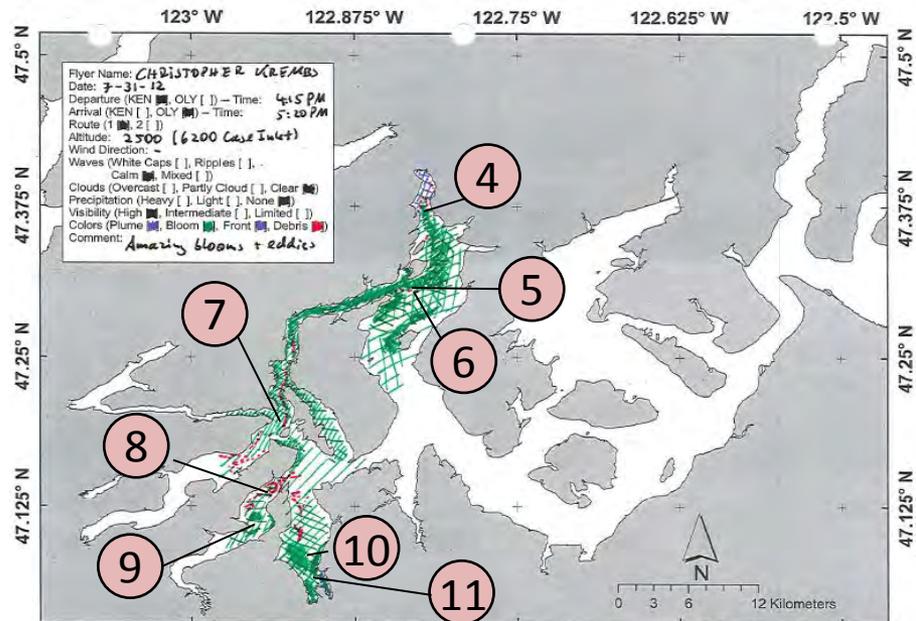
Observations in  
South Sound:  
7-31-2012



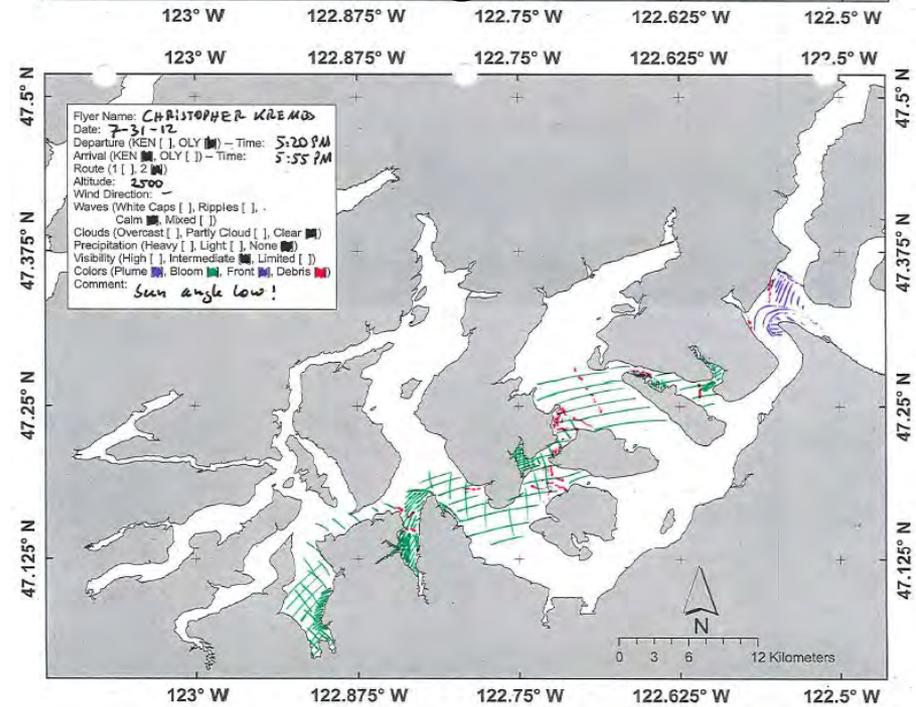
Navigate

Numbers on map refer to picture  
numbers for spatial reference

Morning (limited visibility)



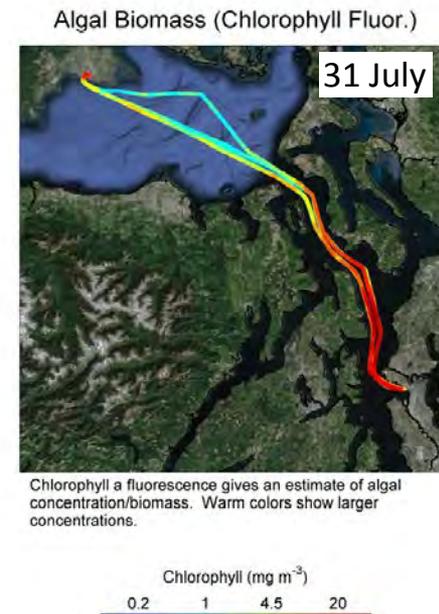
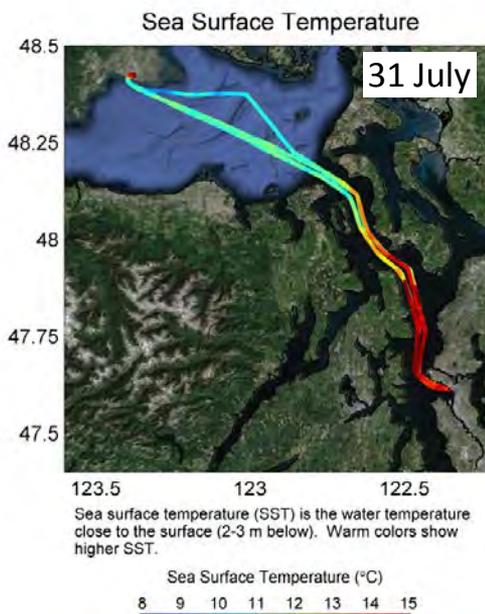
Evening



<b>Plumes</b>	
• Freshwater with sediment <b>solid</b>	
• Freshwater with sediment <b>dispersed</b>	
• Coastal erosion with sediment	
<b>Blooms</b>	
• Dispersed	
• Solid	
<b>Debris</b>	
• Dispersed	
• Solid	
<b>Front</b>	
• 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.



**Current Conditions:** High fluorescence and elevated turbidity (likely due to phytoplankton) from Elliott Bay to Triple Junction. Temperatures in Main Basin approach 15 °C, near-surface salinity ~27 PSU.

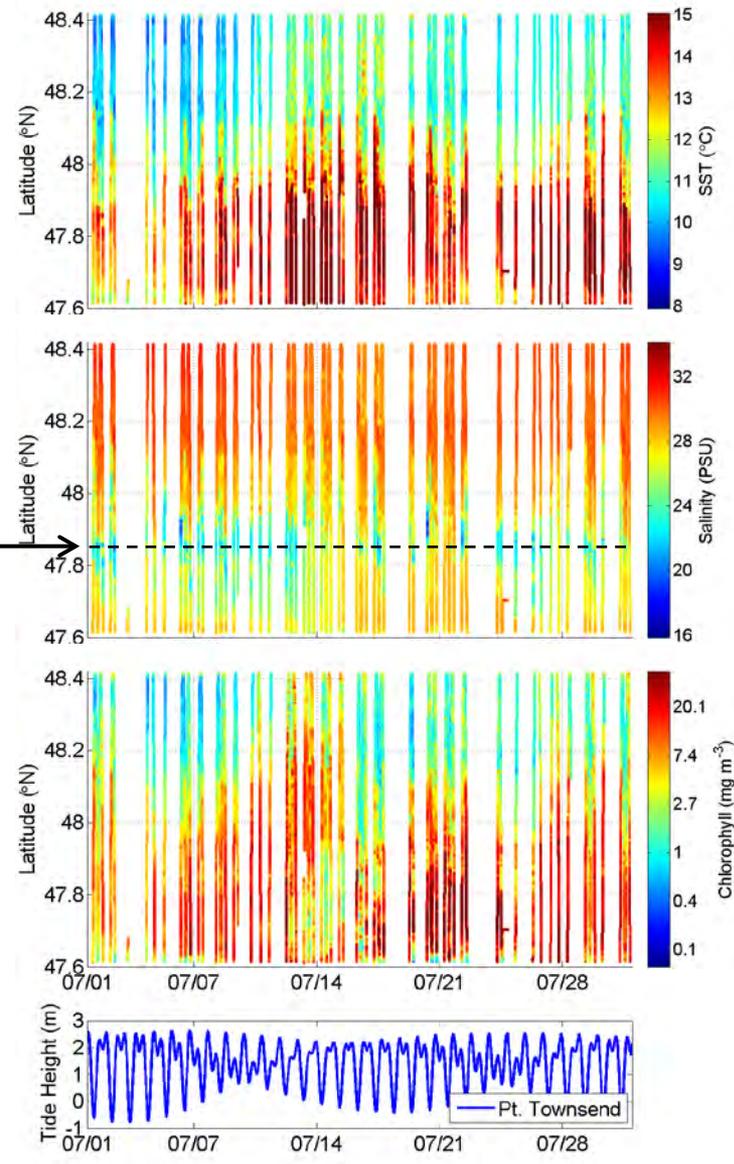
--- Daily 'Quick-Look' Products Available ---

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

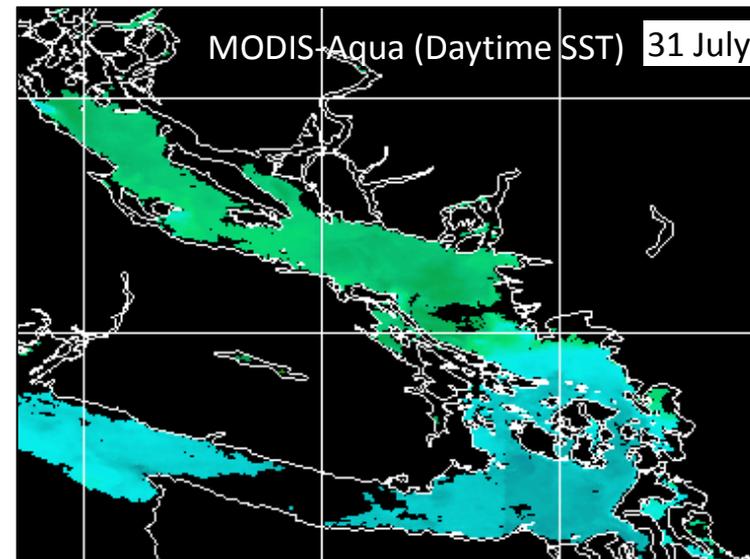
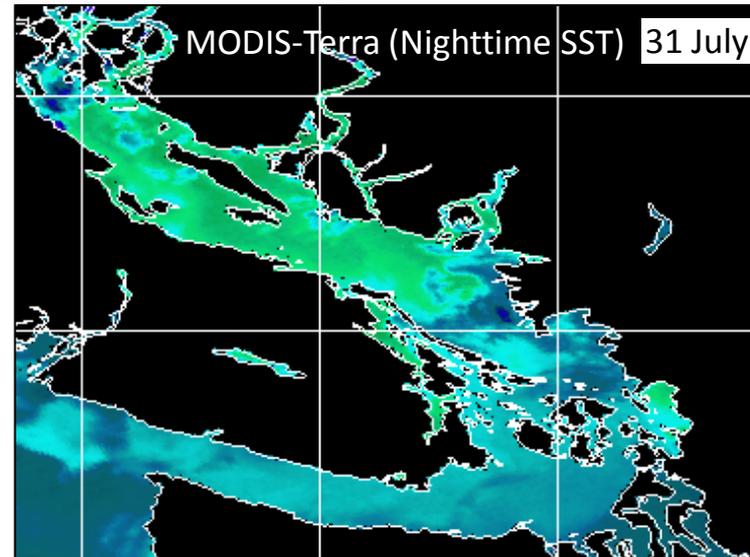
Warm near-surface temperatures in Main Basin promote widespread phytoplankton bloom.

Newly installed thermosalinograph provides near-surface salinity measurements that help us understand how freshwater sources affect Puget Sound marine water quality.

Freshwater from Whidbey Basin at Triple Junction

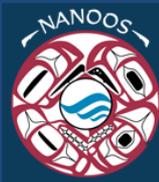


Satellite-derived SST imagery reveals significantly warmer surface waters in Strait of Georgia (> 15 °C; due to local circulation patterns and influence of Fraser River discharge).



Sea Surface Temperature (°C)





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**Moorings**



Summary: In Whidbey Basin, higher DO levels correlated with lower salinity and warmer water indicating high algae activity in the surface layer. Water is highly stratified.

**Mukilteo, Whidbey Basin near Everett:** At both near-bottom (12 – 16 m) and near-surface (2 – 5.5 m) , the overall trend was toward warmer and saltier water. Water is more stratified at Mukilteo than at Manchester.

### Mean values & trend over past week:

NB: DO: 7.3 mg/L (no net change - 0.0 mg/L)  
Temp: 11.5°C (↑ 0.2°C)  
Salinity: 28.8 PSU (no net change - 0.0 PSU)

Surface: Temp: 14.2°C (↑ 0.5°C)  
Salinity: 23.6 PSU (↑ 1.0 PSU)

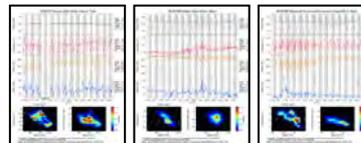
**Manchester, Central Sound:** At both near-bottom (8 – 13 m) and near-surface (1.1 - 5.7 m), the overall trend was towards saltier water.

### Mean values & trend over past week:

NB: DO: 7.7 mg/L (↓ 0.9 mg/L)  
Temp: 12.3°C (↑ 0.1°C)  
Salinity: 28.9 PSU (↑ 0.1 PSU)

Surface: Temp: 12.8°C (↓ 0.3°C)  
Salinity: 28.7 PSU (↑ 0.3 PSU)

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

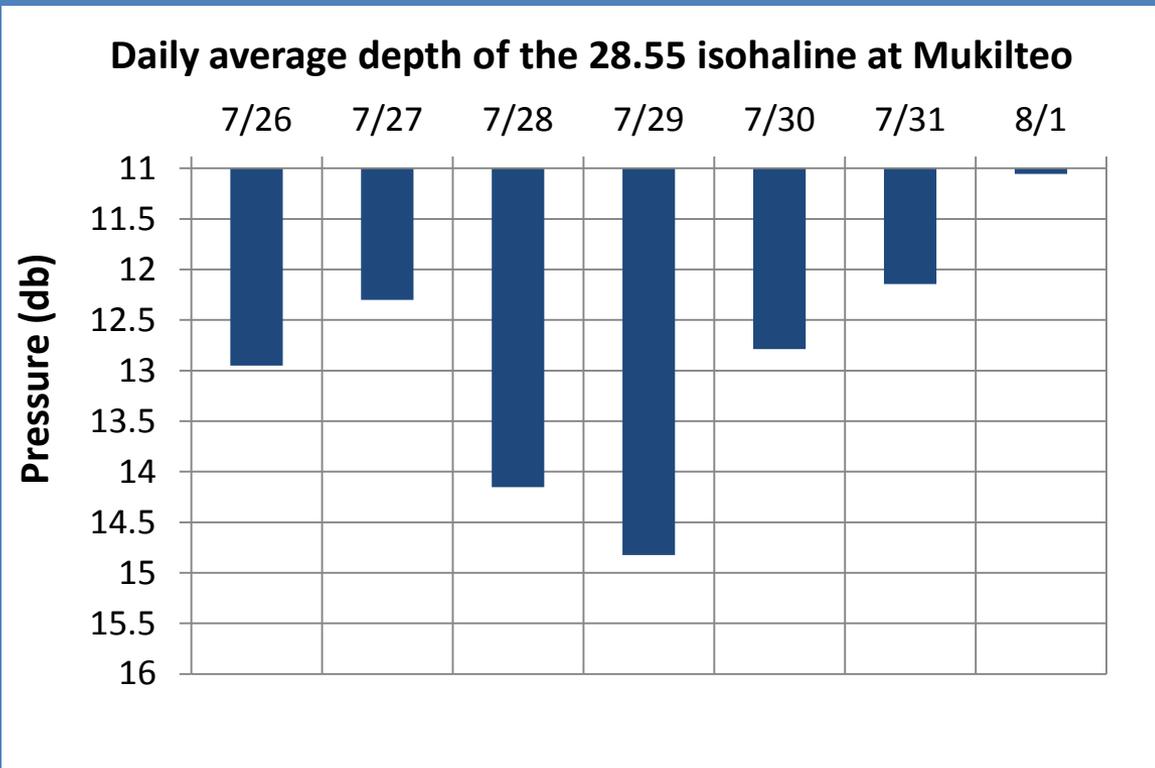




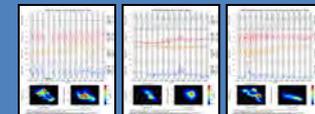
Go to our mooring site at: [http://www.ecy.wa.gov/programs/eap/mar\\_wat/moorings.html](http://www.ecy.wa.gov/programs/eap/mar_wat/moorings.html)

**Summary:** Compared to the previous month, the 28.55 isohaline depth decreased indicating a thinner freshwater layer.

We currently report the thickness of the freshwater layer between Whidbey Basin and Central Basin to understand freshwater input to Puget Sound.



We track the depth of the isohaline where salinity is 28.55 ( $\pm 0.05$ ) to measure the thickness of the freshwater layer at our Mukilteo station. The sensor experiences tidal pressure variations of 11.8 to 15.6 meters (or dbar).

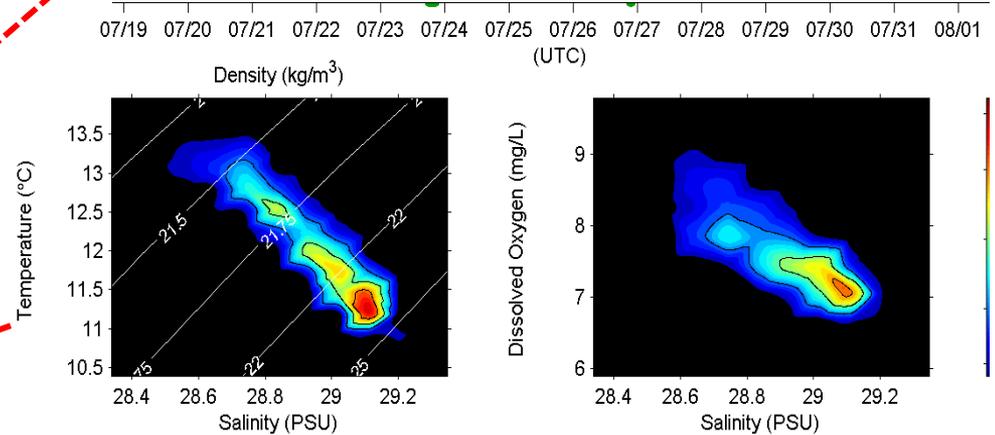


Real-time data online (click)



No telemetry (real-time) information

MUK01BR, plots are based on only two weeks.



Top panels: Two-week time series and 24 h avg. (12/12 h day/night cycle in local time shown by gray bands). Green date sunrimsposed onto x-axis are periods of missing data.

**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

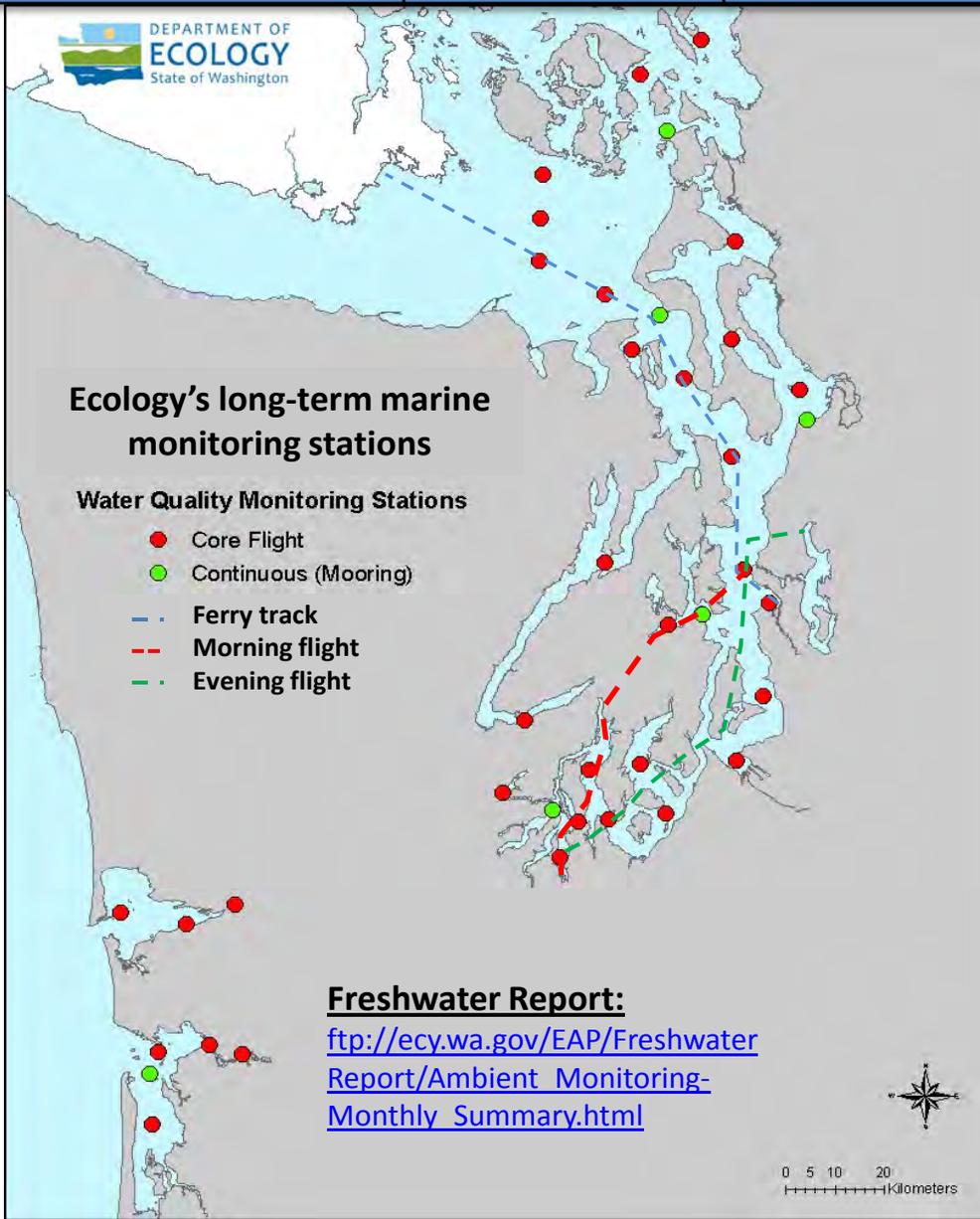


[christopher.krems@ecy.wa.gov](mailto:christopher.krems@ecy.wa.gov)



## 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/mar\\_wat/moorings.html](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**

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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.