Publication No. 12-03-078

DEPARTMENT OF ECOLOGY State of Washington

Eyes Over Puget Sound

Field log | Weather | Water column | Aerial photos | Ferry and Satellite | Moorings

Surface Conditions Report

September 11, 2012

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

Start here

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

Marine conditions from 9-11-2012 at a glance

LONG-TERM MARINE MONITORING UNIT

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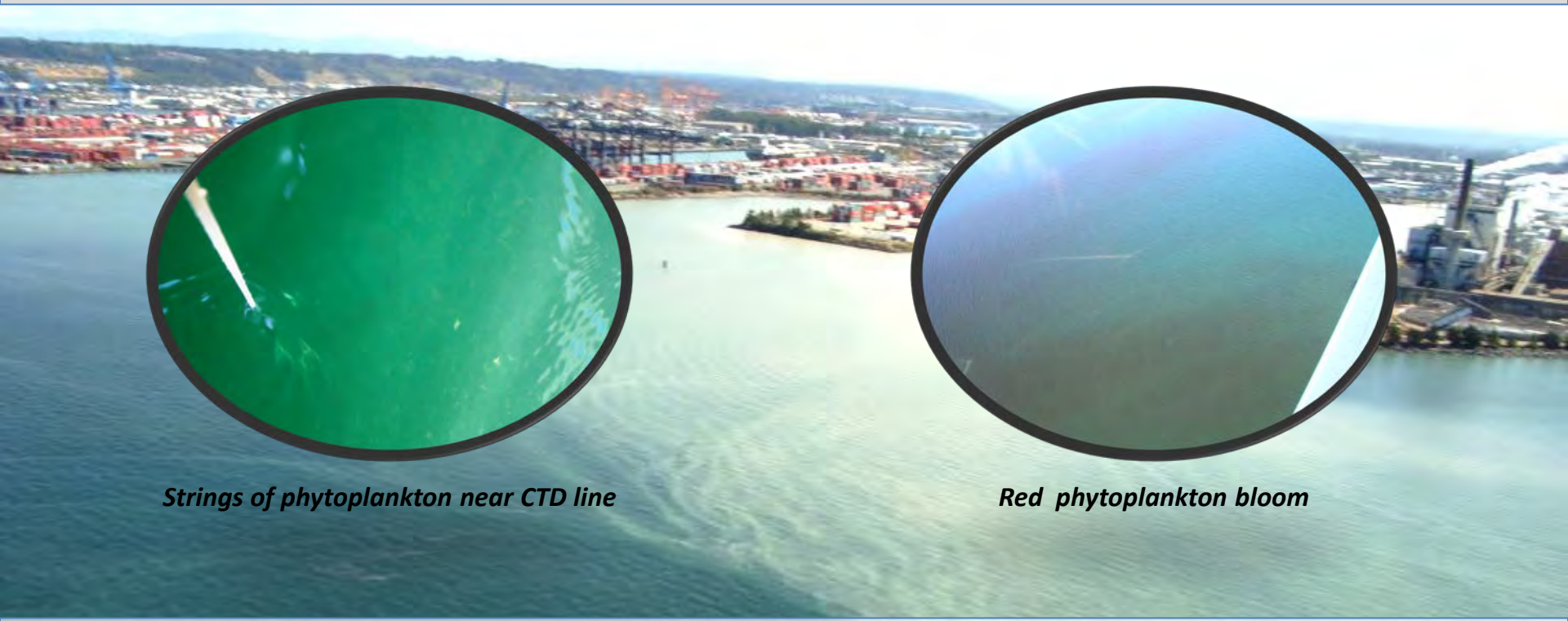
Previous Eyes Over Puget Sound reports: www.ecy.wa.gov/programs/eap/mar_wat/eops/

Marine Flight 3 (Central Sound)

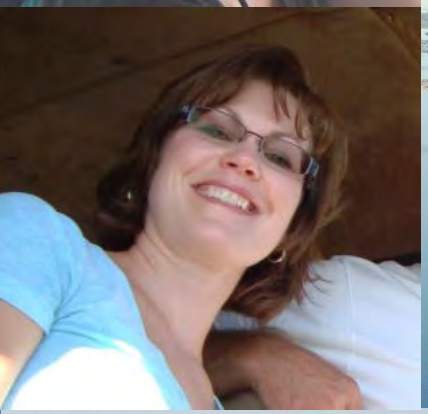


Strings of phytoplankton near CTD line

Red phytoplankton bloom

Following a few days of gusty winds and a smattering of rain, Central Puget Sound stations responded accordingly. At all of our Central Sound sites sampled on the 11th, the surface layer was strongly impacted. There was a fresh layer of very clear water with a muted-gray green color at all sites. There were also a lot of visible long, brown, almost slimy-looking strings in the water, too. These are clumps of broken-down plankton, algae and other organic matter, which form aggregates through wind and wave action.

Personal flight impression, 9-11-2012



Sub-surface algae bloom and secchi disk

Right below the surface layer, at about 2 – 3 meters, the instrument and secchi disc would visually reveal a very green-brown layer, where most of the growing plankton were hanging out. We loosely refer to these as "sub-surface" blooms. In addition to clearer water, a brief, transient weather system like this can re-introduce new nutrients and organic matter to the surface layer. As September progresses, it will be interesting to watch if we get a significant "fall bloom", or if the winter southerlies will arrive for good, mixing the Sound, breaking down the stratified surface layer and bringing about the annual demise of algae growth.

Weather patterns from 8-28-2012 to 9-11-2012

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

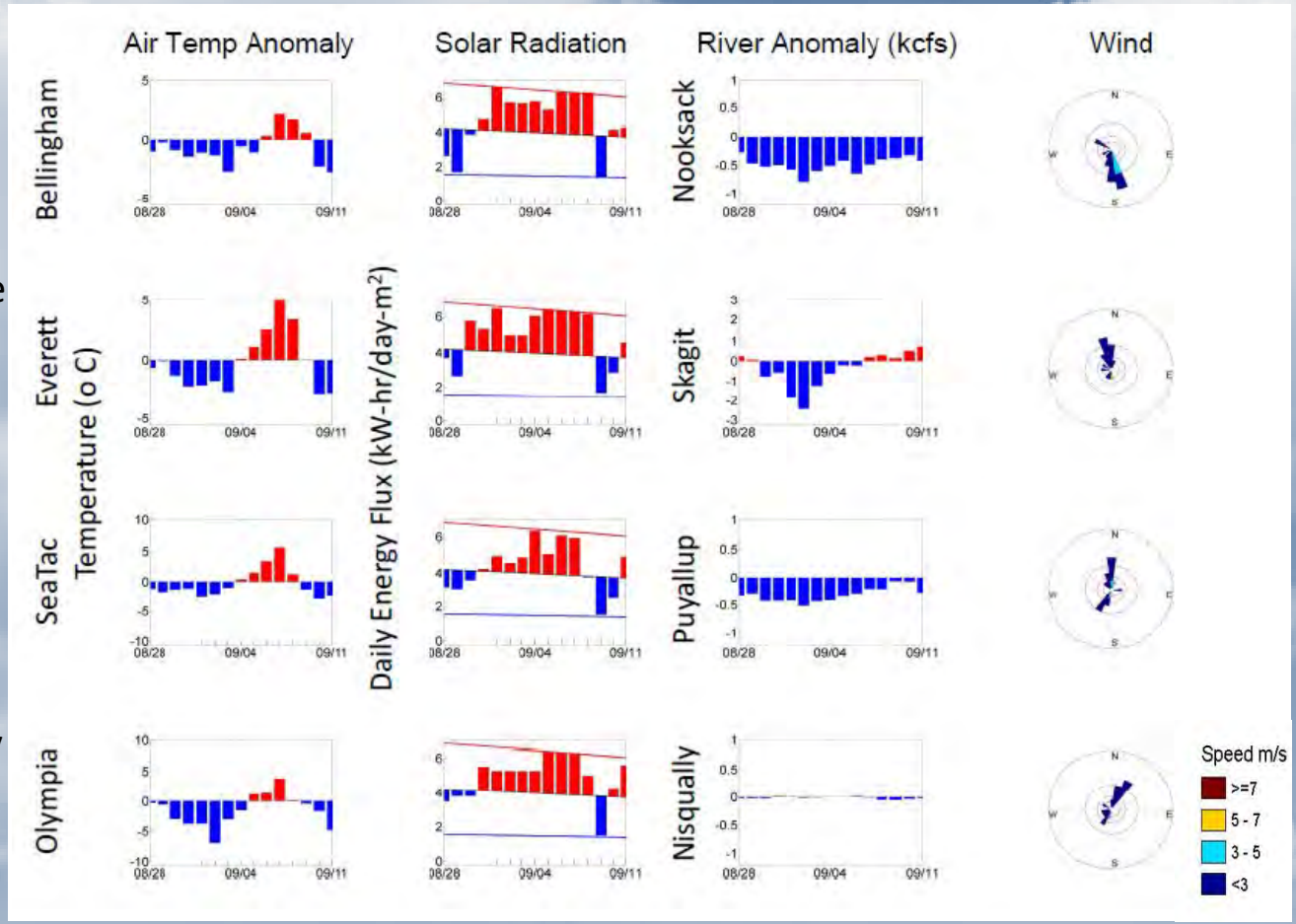
Summary:

Air temperatures during the past few days have been below average because of the cool nights, but above average before that (look for cool surface water, but warmer water below the surface).

Sunshine has been prevalent.

Rivers have generally been running below normal.

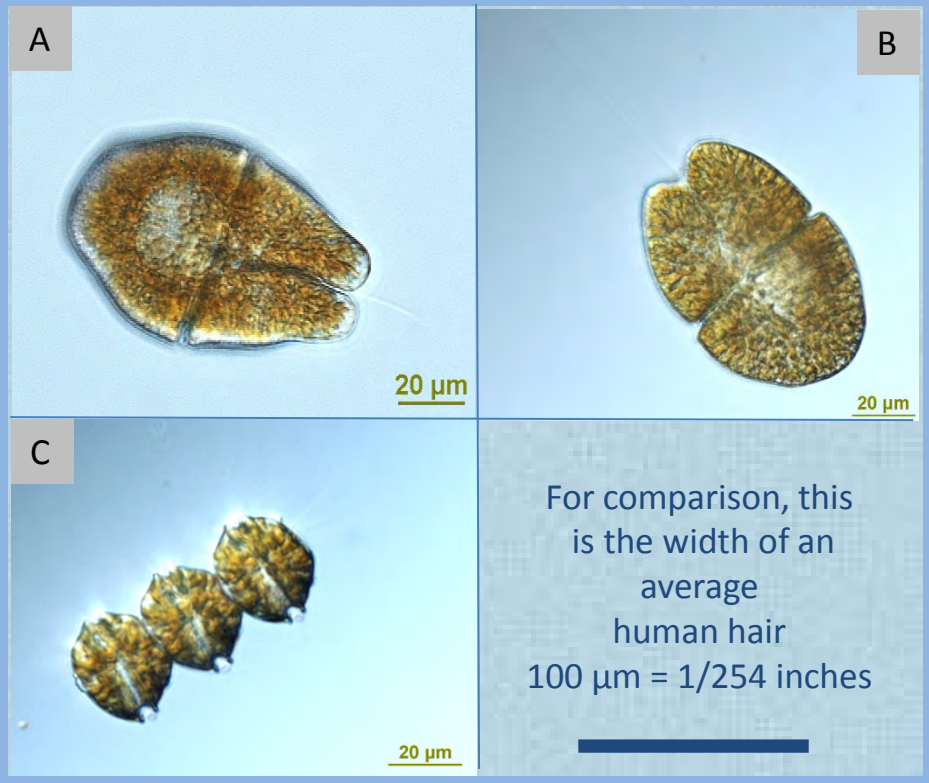
Winds have been predominantly coming from the north except in the northern Puget Sound where south winds prevail.



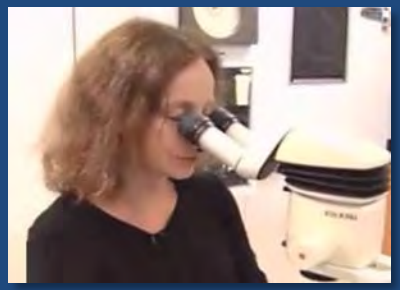
Moore et al. 2008. Local and large-scale climate forcing of Puget Sound oceanographic properties on seasonal to interdecadal timescales. Limnol. Oceanogr., 53(5), 1746–1758

King County RESEARCH

Late Summer: Dinoflagellates are in charge!



(A), (B) *Akashiwo sanguinea* has been blooming in central Puget Sound. This dinoflagellate is considered a harmful species but the mechanism of toxicity is not yet understood. The cell is full of chloroplasts yet it is mixotrophic (does not depend solely on photosynthesis). (C) *Alexandrium catenella*, the organism that produces saxitoxins (Paralytic Shellfish Poisoning) has been blooming in Quartermaster Harbor and other sites.



Contributed by Gabriela Hannach, King County Environmental Lab

link

Diatoms are taking a break in Puget Sound!

- Dinoflagellates are abundant and causing red colored blooms.
- Following a typical seasonal progression, dinoflagellate populations have greatly increased during the last few weeks of summer whereas diatoms have almost disappeared from the water column.
- Dinoflagellate late season abundance is related to their ability to utilize nutrients at depth after these have been depleted from the photic zone.

Summary: Aerial photography 9-11-2012

Extensive red-brown blooms in inlets of South Sound and the Kitsap Peninsula. Jellyfish aggregations grow in size and number in Budd and Eld Inlets and appear in Quartermaster Harbor.

Start here

Red-brown bloom - Sinclair Inlet

Puyallup river plume in Tacoma Narrows

Front

Mixing and Fronts: 1 2 11

Tidal fronts at Point Defiance and Port Orchard.

Plume

Suspended sediment: 1 2 3 6 11 14

Puyallup River plume extending far into Tacoma Narrows and Quartermaster Harbor. Deschutes plume in Budd Inlet. River plumes also in Sinclair Inlet and Eagle Harbor.

Bloom

Visible blooms: 1 4 5 6 7 8 9 10 11 12 13 14 15

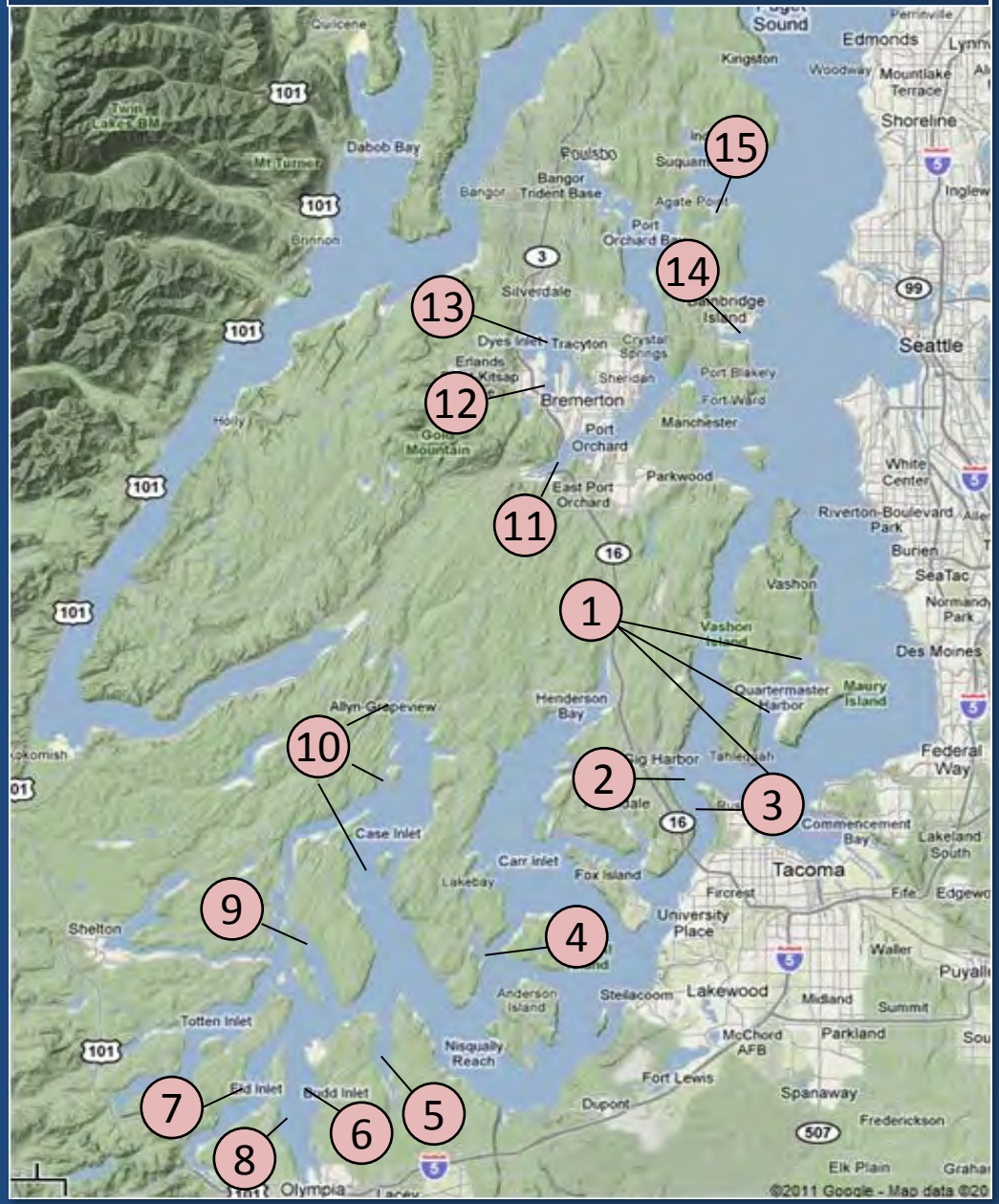
- **Red-brown:** Very strong in most inlets of South Sound and Kitsap Peninsula.
- **Olive-green:** Filucy Bay (Pitt Passage).
- **Turquoise:** Parts of Dyes Inlet.

Debris

Debris: 2 3 4 11 14

Debris limited to few places.

High tides : 1:06 AM 3:34 PM, Low tides: 7:51 AM, 9:24 PM



Aerial photography navigation guide

9-11-2012

Click on numbers

Flight Information:

Afternoon flight:
High visibility, calm, flooding

Observation Maps:

Go here

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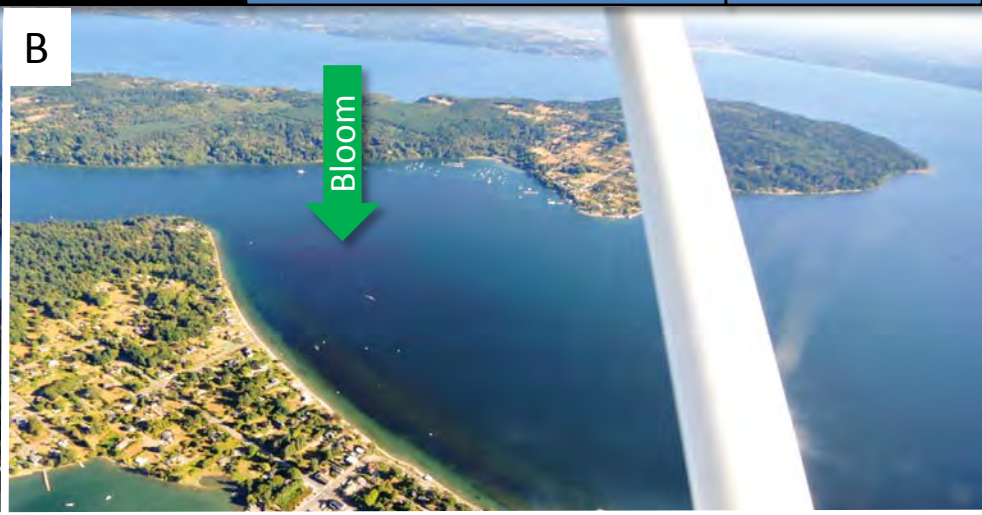
Aerial photography 9-11-2012



Brown algae bloom in Quartermaster Harbor. Location: A. North, B. Burton, C. Manzanita, D. Neill Point with Puyallup river plume. 4:26 PM.

Front and Puyallup River plume entering Tacoma Narrows on incoming tide. Location: Point Defiance, Tacoma, 4:30 PM

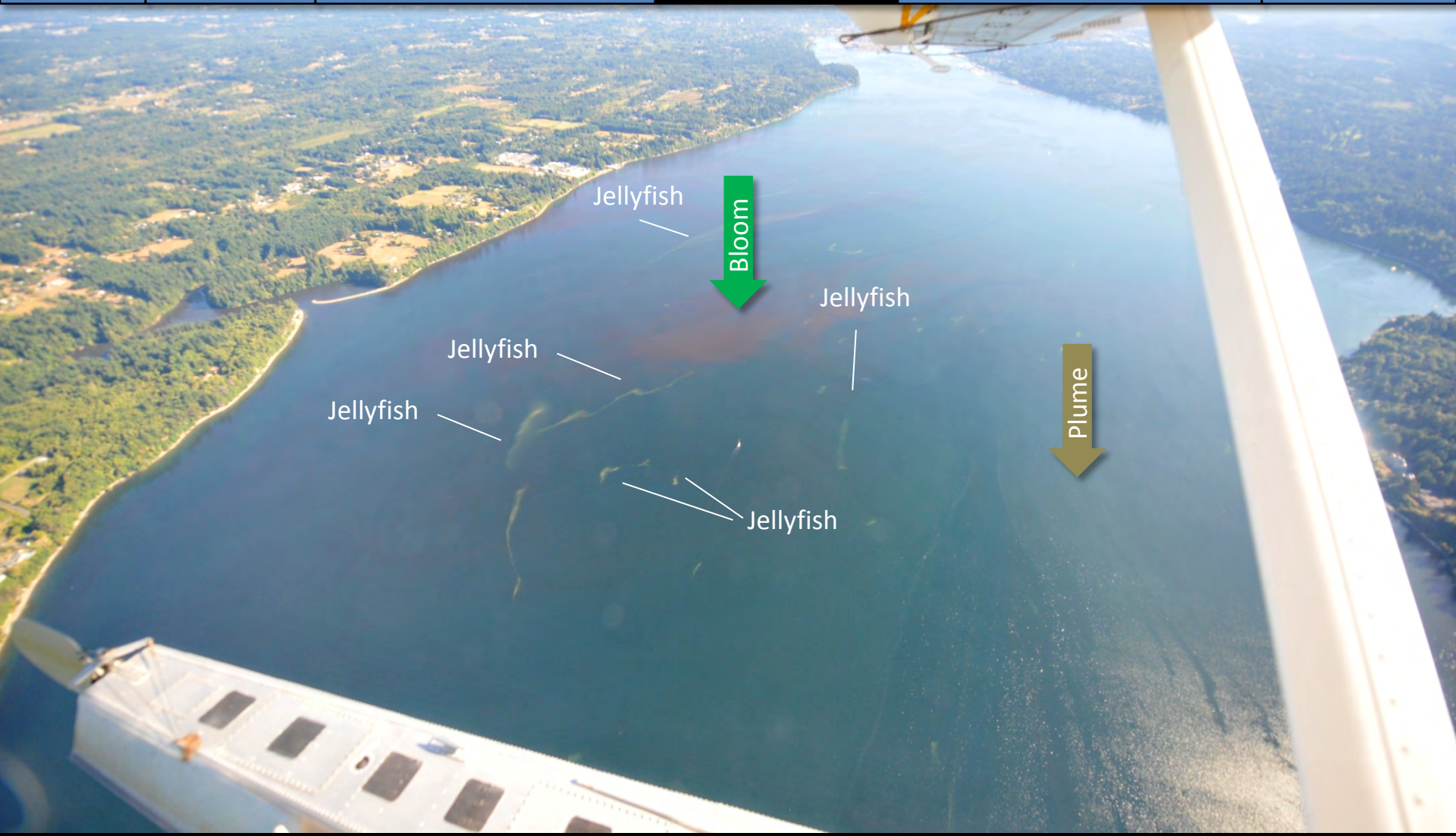
Well-separated, distinct waters in Tacoma Narrows on incoming tide. Location: Tacoma Narrows Bridge, Tacoma, 4:30 PM

Olive-brown algae bloom coming out of Filucy Bay

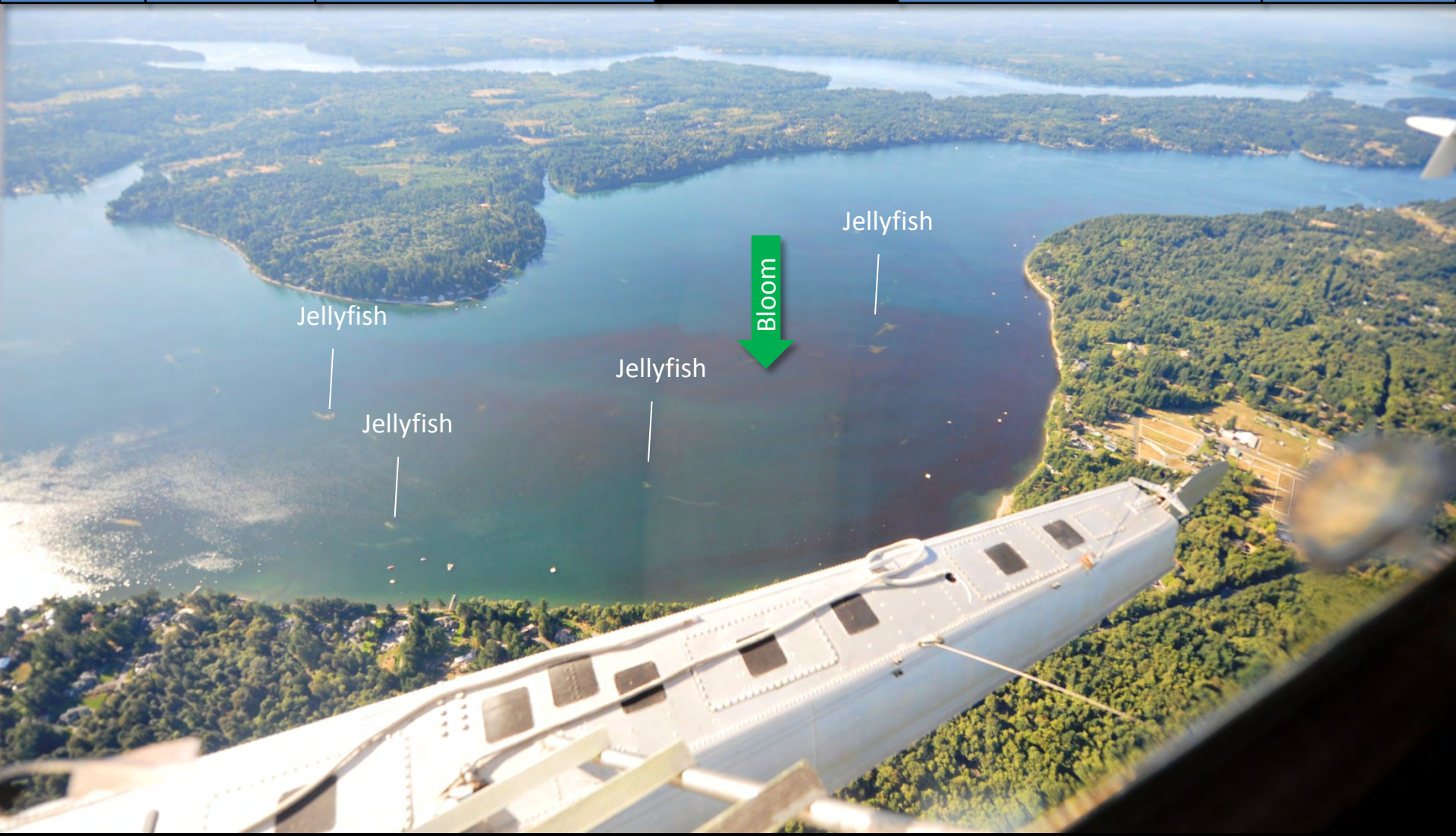
Location: Balch Passage, (South Sound), 4:37 PM

Red-brown algae bloom. Location: Henderson Inlet (South Sound), 4:41 PM

Aerial photography 9-11-2012



Patches of jellyfish and red-brown algae bloom. Location: Budd Inlet (South Sound), 4:43 PM

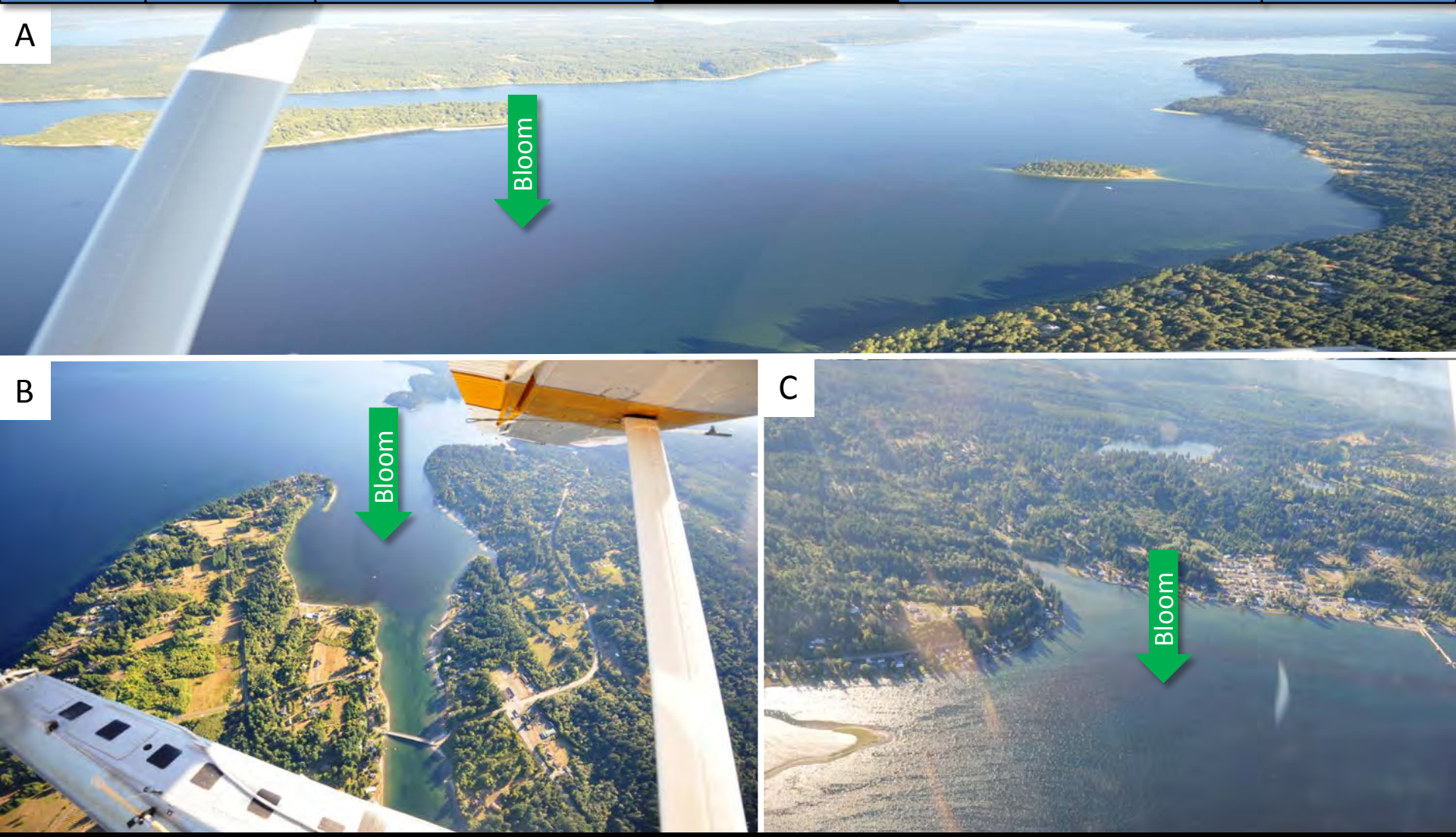


Patches of jellyfish and red-brown algal bloom. Location: Eld Inlet (South Sound), 4:44 PM

Aerial photography 9-11-2012

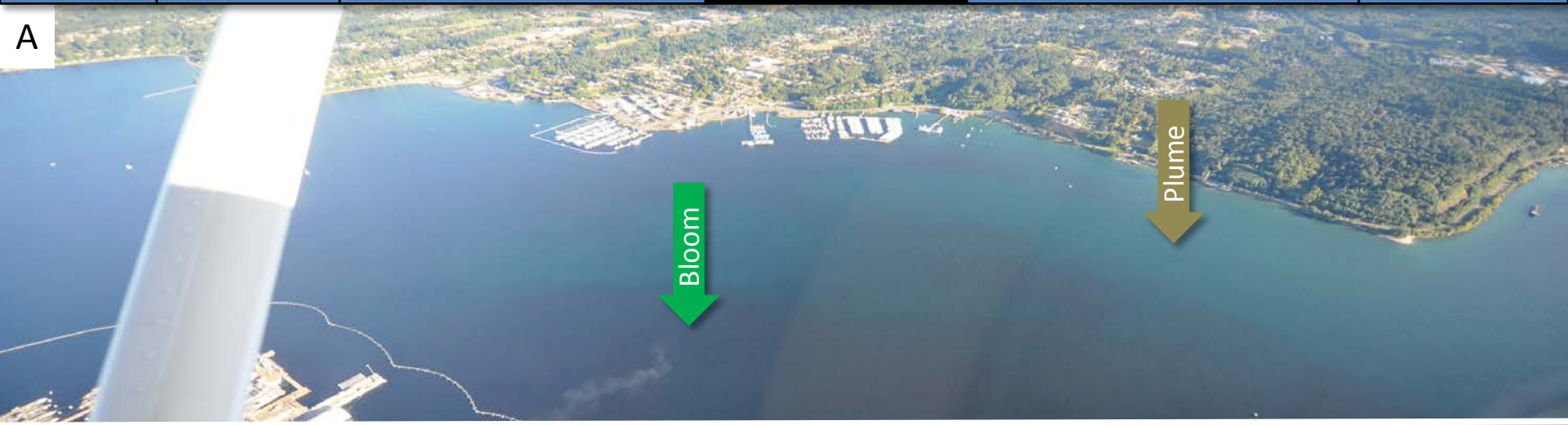
Patches of jellyfish and red-brown algae bloom. Location: Budd Inlet (South Sound), 4:45 PM

Red-brown algae bloom. Location: Peale Passage (South Sound), 5:20 PM

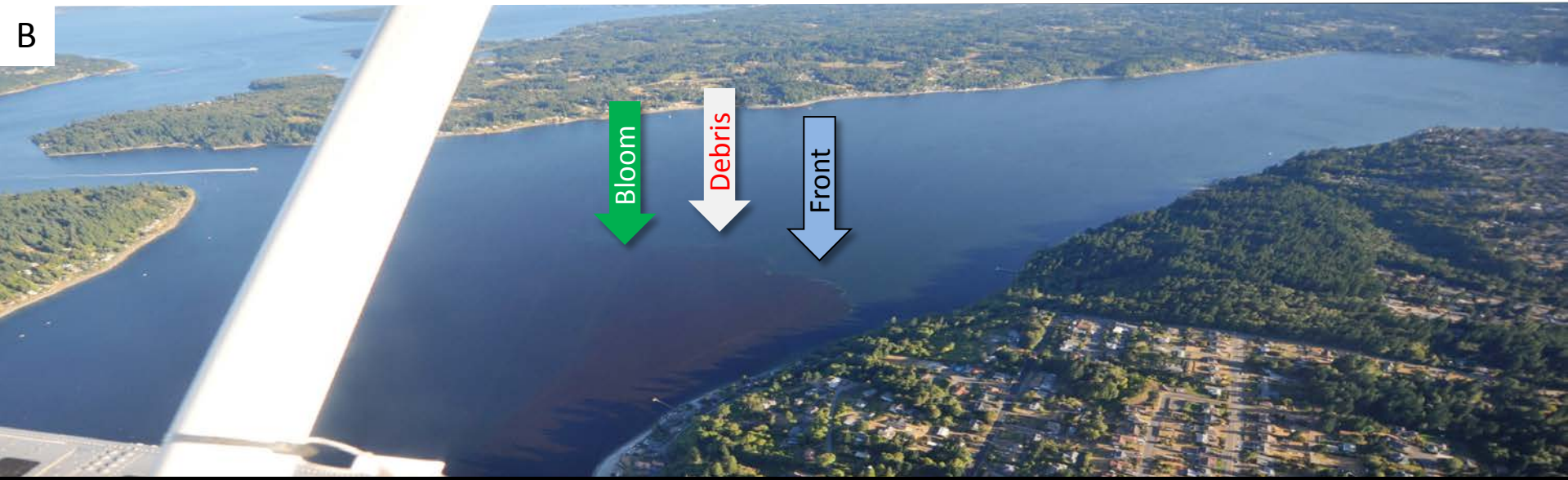


Red-brown algae blooms. Location: A. Herron Island B. Stretch Island C. North Bay of Case Inlet (South Sound), 5:27 PM

A



B



Red-brown algae bloom and turquoise water. Location: Sinclair Inlet (Central Sound), 5:38 PM

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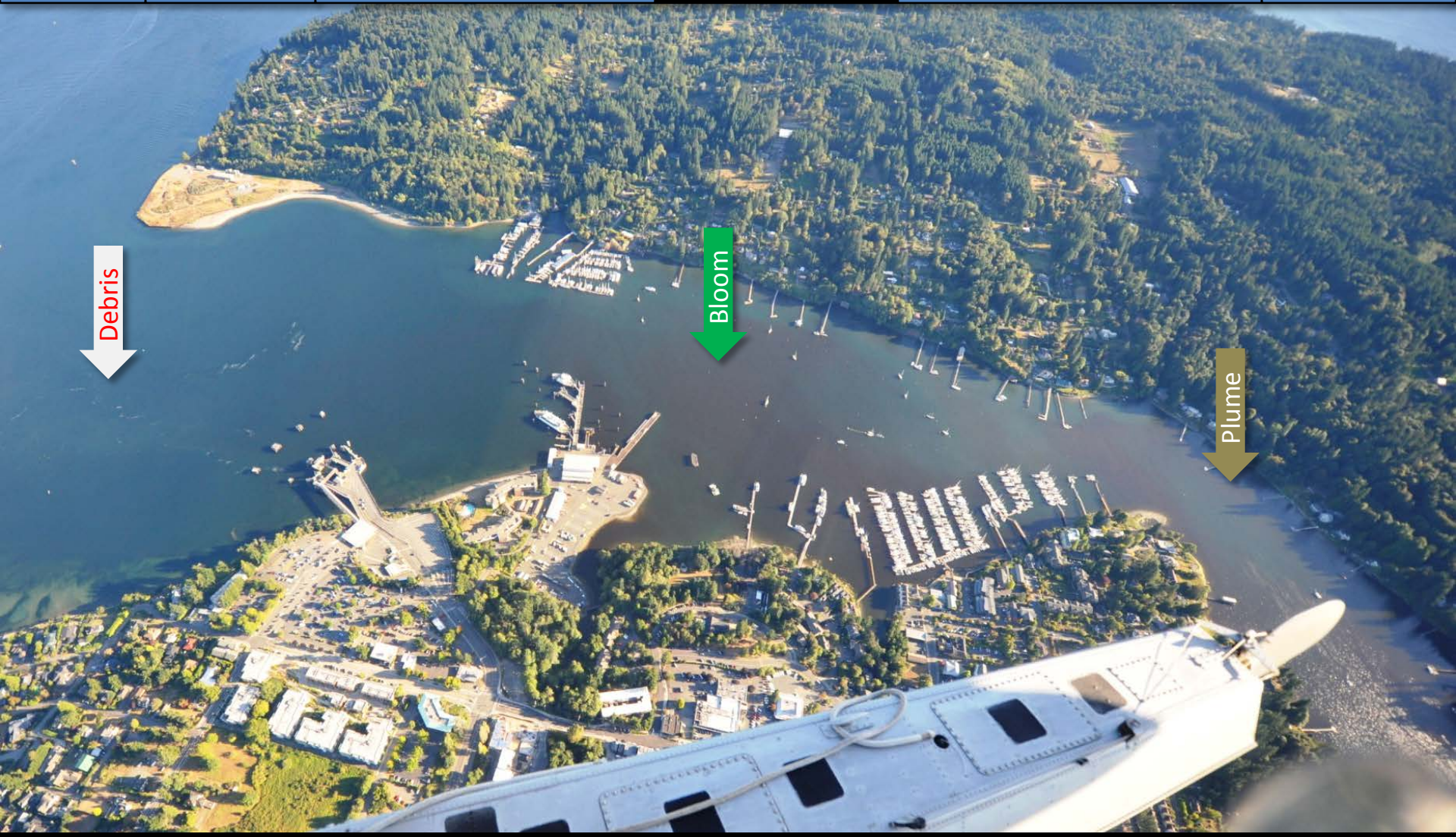
Aerial photography 9-11-2012

Red-brown and bright green-yellow algae blooms. Location: Dyes Inlet (Bremerton) 5:40 PM

Aerial photography 9-11-2012

Red-brown algae bloom. Location: Ostrich Bay, Dyes Inlet (Bremerton) 5:40 PM

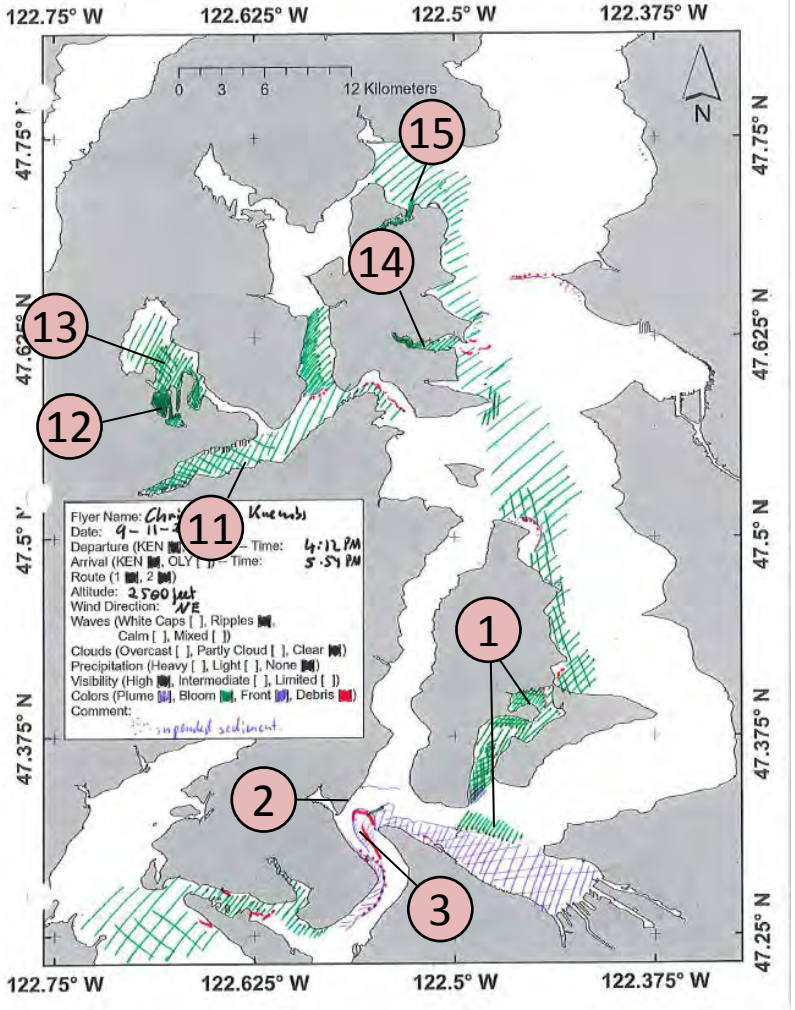


Red-brown colored algae blooms. Location: Eagle Harbor (Bainbridge Island) 5:45 PM

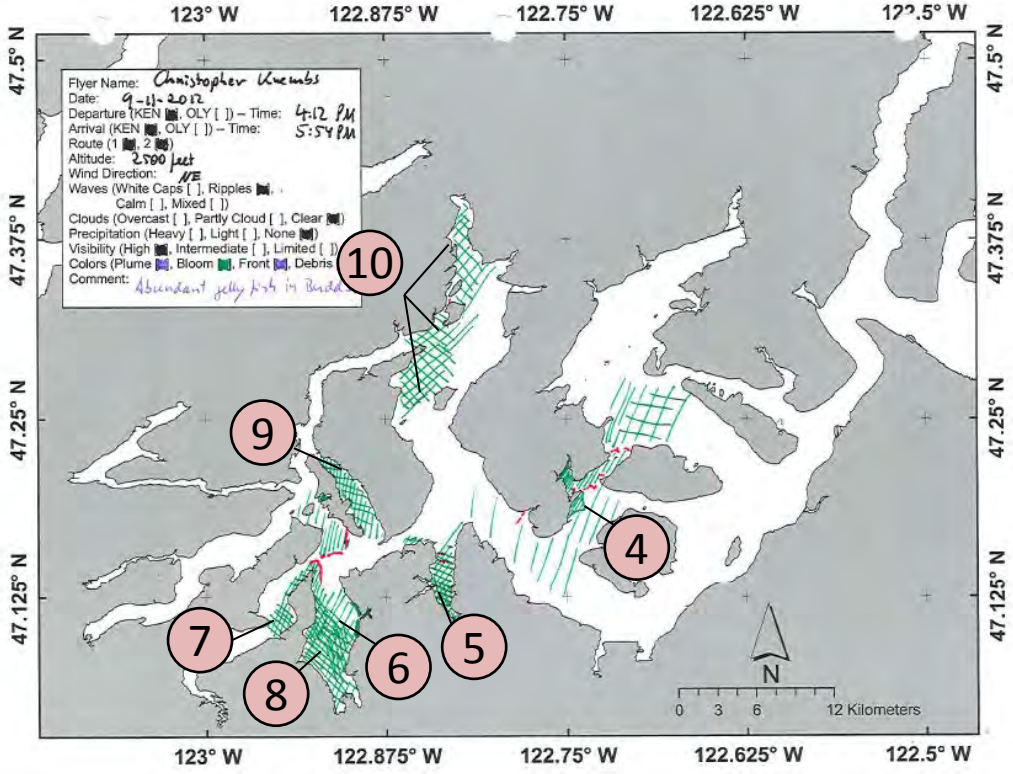
Aerial photography 9-11-2012

Red-brown and turquoise algae blooms. Location: Hidden Cove (Bainbridge Island), 5:45 PM

Central Sound

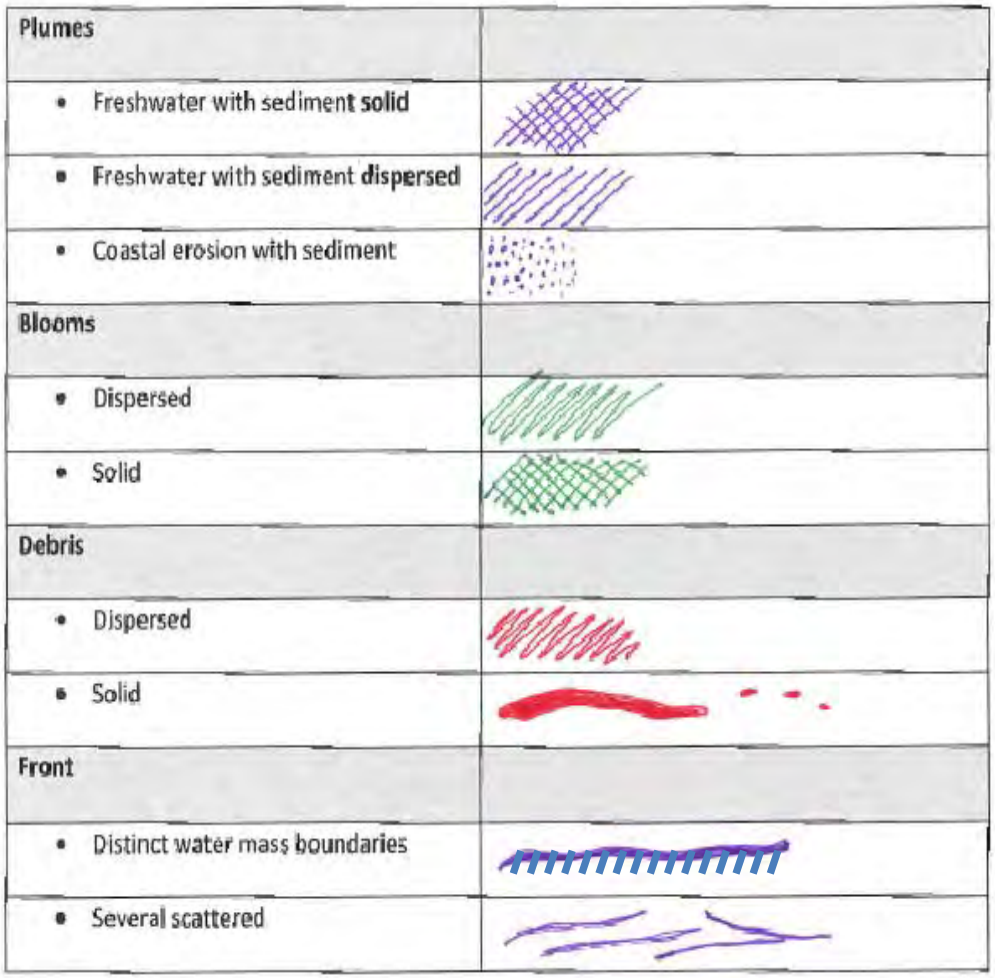


South Sound



We had the opportunity to fly a complete loop without interruption. Maps are therefore only separated by location.

Numbers on map refer to picture numbers for spatial reference

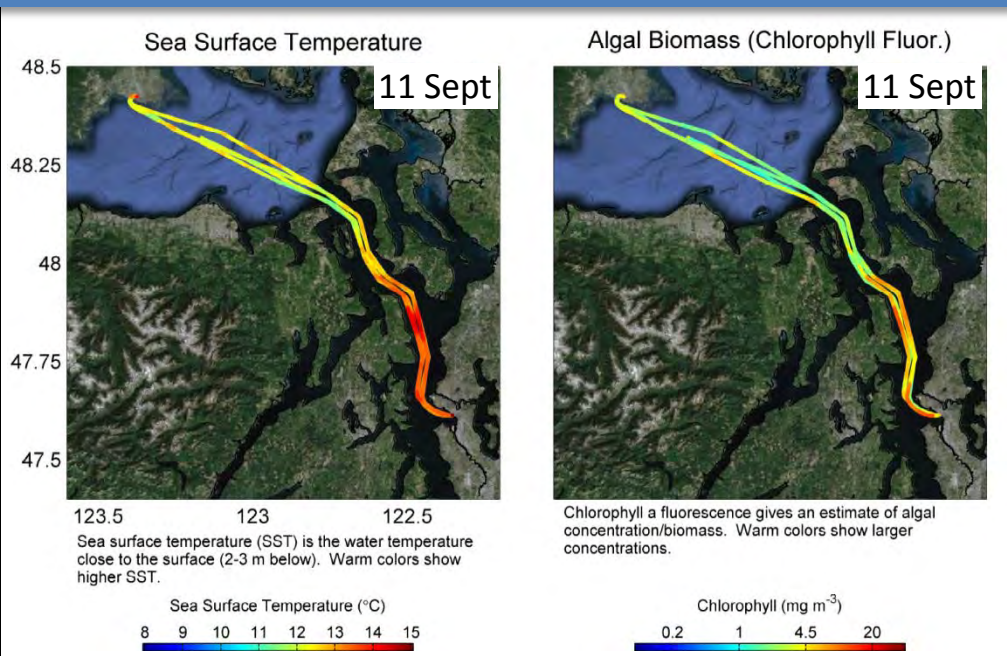


Comments:
Maps are produced by observers during and after flights. They are intended to give an approximate reconstruction of the surface conditions on scales that connect to and overlap with satellite images in the section that follows.

Daily ferry and satellite observations in Central Sound, 9-11-2012

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.



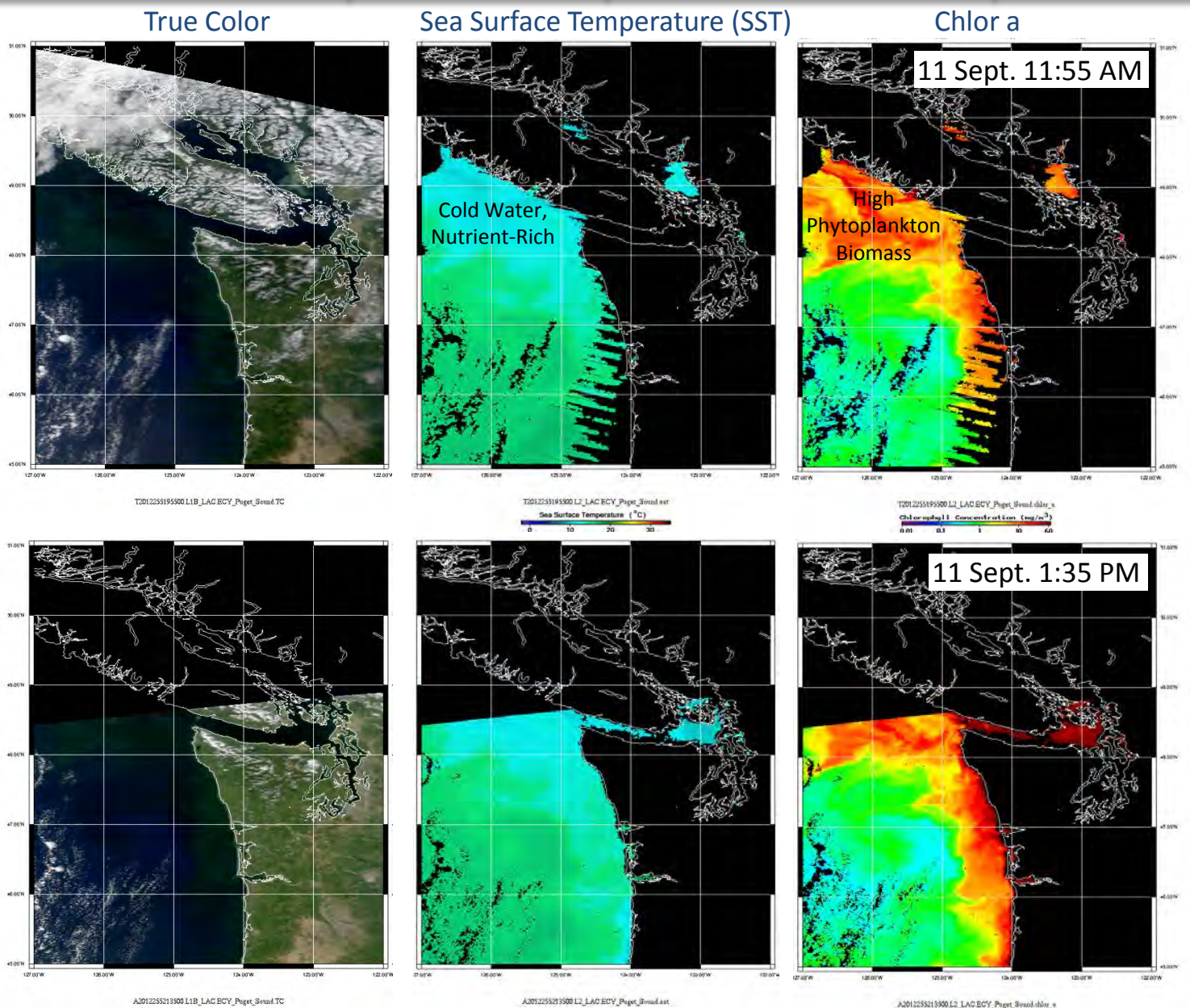
Current Conditions: Low to moderate fluorescence and turbidity in Central Sound and Admiralty Inlet. Temperatures in Puget Sound and Strait of Juan de Fuca range from 12-14°C, near-surface salinity >28.5 PSU.

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

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

Ferry & satellite observations 9-11-2012

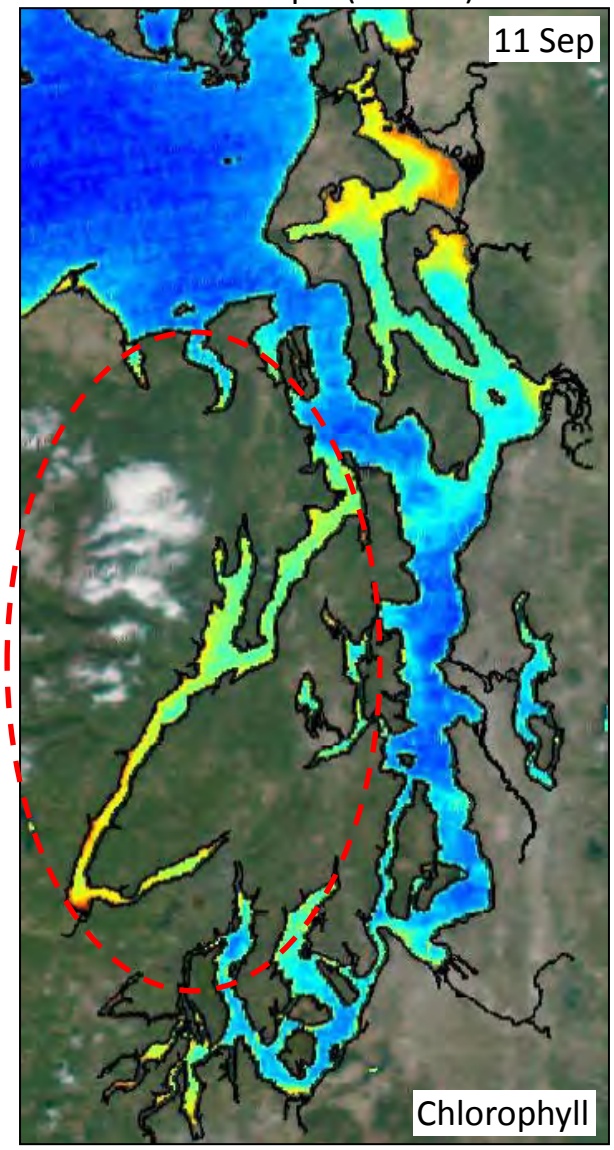
Seasonal upwelling brings cold, nutrient-rich waters to the surface where it supports a large-scale phytoplankton bloom off the Washington/ Vancouver Island shelf.

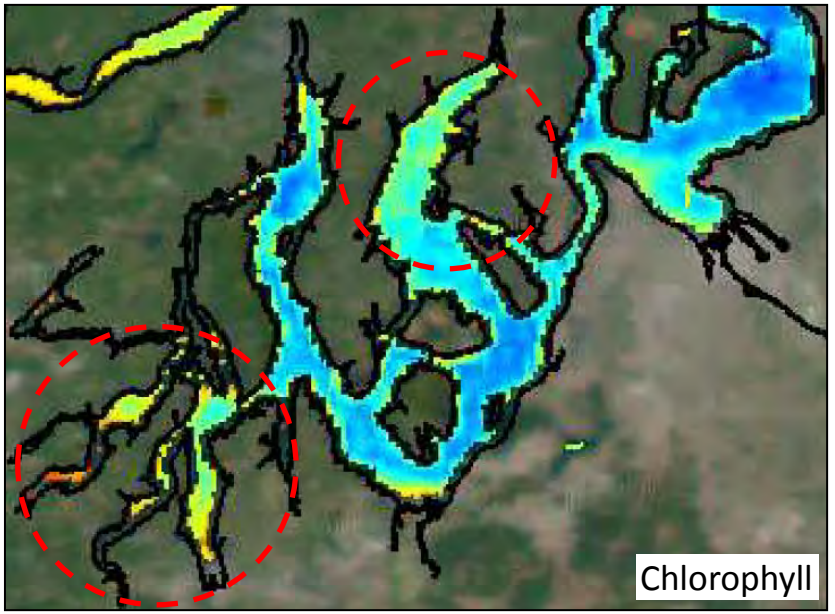


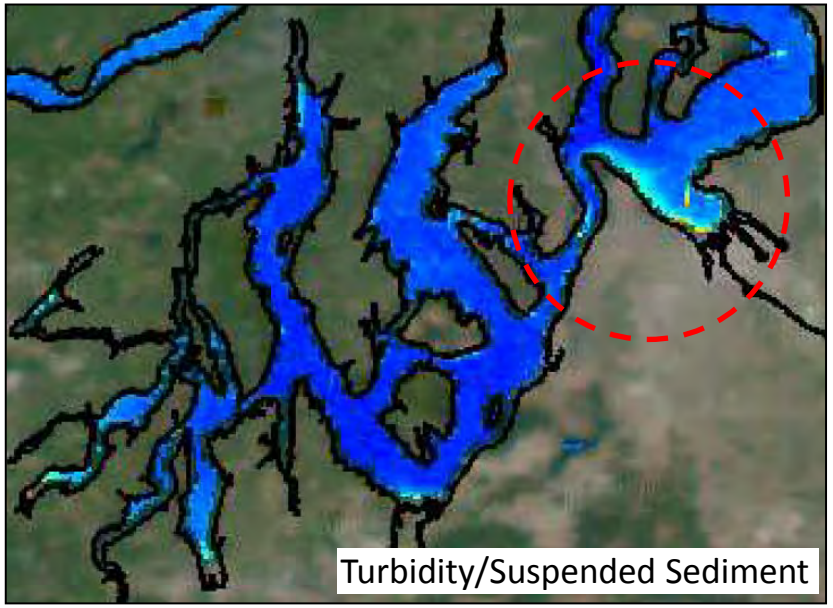
Ferry & satellite observations 9-11-2012

Phytoplankton bloom in Hood Canal and finger inlets in South Sound. Turbid water from the Puyallup River seen entering Commencement Bay.

MODIS-Aqua (Chlor *a*)







Mooring observation and trends 8-28-2012 to 9-10-2012

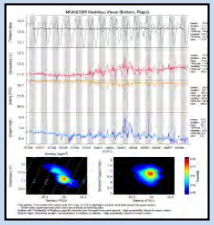
Summary: Whidbey Basin dissolved oxygen decreased by 1.1 mg/L. Higher dissolved oxygen levels are highly correlated with higher temperature and lower salinity. The recent dry spell and lack of freshwater input are showing in the mooring data.

Mukilteo, Whidbey Basin near Everett:

Mukilteo Dissolved Oxygen Conditions (12-16 m)

DO Max	11.4 mg/L	30-Aug	28.1 PSU	14.1 C	14.3 db
DO Min	5.4 mg/L	6-Sep	29.4 PSU	11.0 C	13.2 db

DO Avg	6.4 mg/L
DO Trend	(-)1.1 mg/L
DO-Sal Corr	-87%
DO-Temp Corr	96%



Real-time data online (click)

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

Sal Max	29.6 PSU	9-Sep	at 11.7 C	at 14.1 db
Sal Min	27.1 PSU	31-Aug	at 14.5 C	at 12.6 db

Sal Avg	29.2 PSU
Sal Trend	0.3 PSU

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

T Max	14.6 C	31-Aug	27.2 PSU	12.7 db
T Min	10.9 C	5-Sep	29.4 PSU	14.1 db

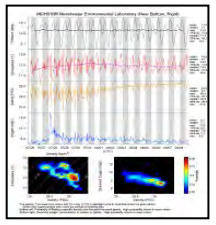
T Avg	11.8 C
T Trend	(-)0.7 C

Manchester, near Clam Bay:

Manchester Dissolved Oxygen Conditions (8.6-12.7 m)

DO Max	9.5 mg/L	5-Sep	29.5 PSU	13.2 C	10.6 db
DO Min	5.8 mg/L	9-Sep	29.7 PSU	11.9 C	11.9 db

DO Avg	6.98 mg/L
DO Trend	0.6 mg/L
DO-Sal Corr	-51%
DO-Temp Corr	95%



Real-time data online (click)

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

Sal Max	29.7 PSU	10-Sep	12.0 C	11.8 db
Sal Min	29.2 PSU	28-Aug	13.5 C	9.8 db

Sal Avg	29.5 PSU
Sal Trend	0.2 PSU

Manchester Temperature (T) Conditions (11.6 - 12.7 m)

T Max	13.9 C	9-Sep	29.4 PSU	9.8 db
T Min	11.9 C	9-Sep	29.7 PSU	11.9db

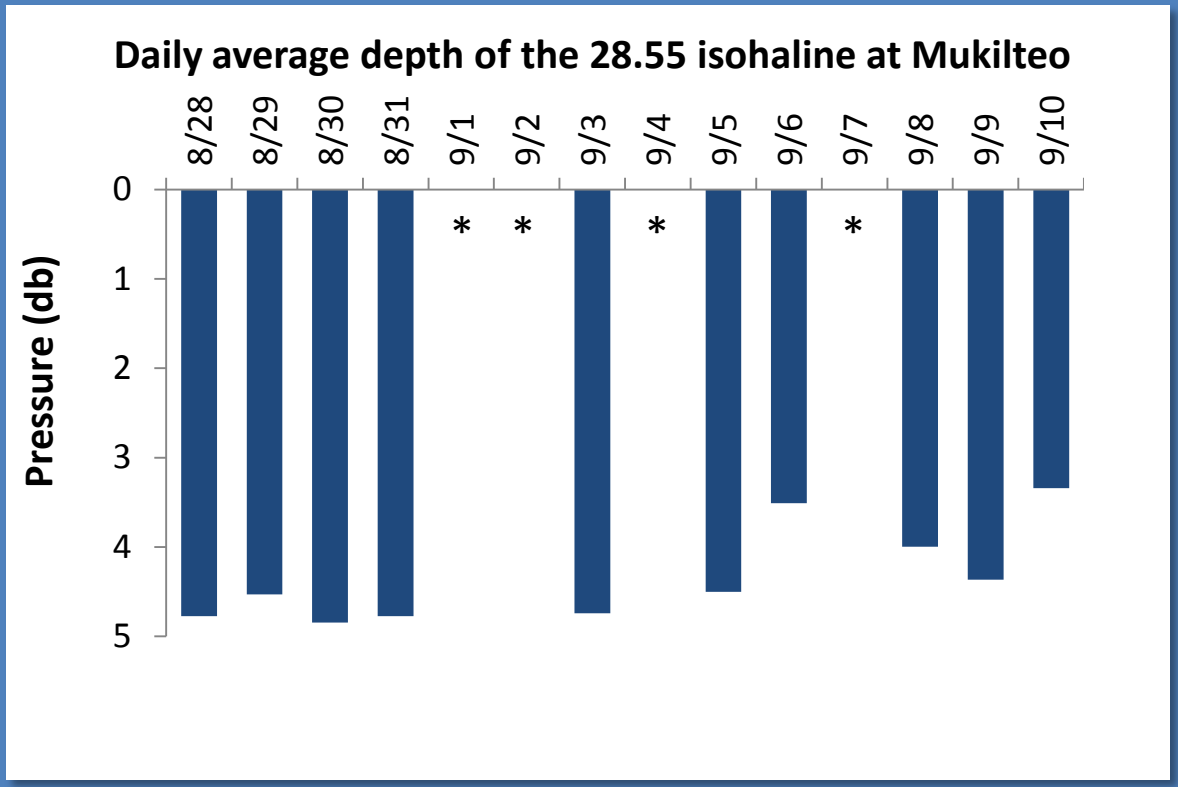
T Avg	12.6 C
T Trend	0.1 C

Mooring observation and trends 8-28-2012 to 9-10-2012

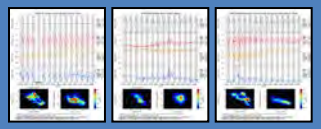
Go to our mooring site at: http://www.ecy.wa.gov/programs/eap/mar_wat/moorings.html

Summary: Prolonged dry spell is 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 (*).

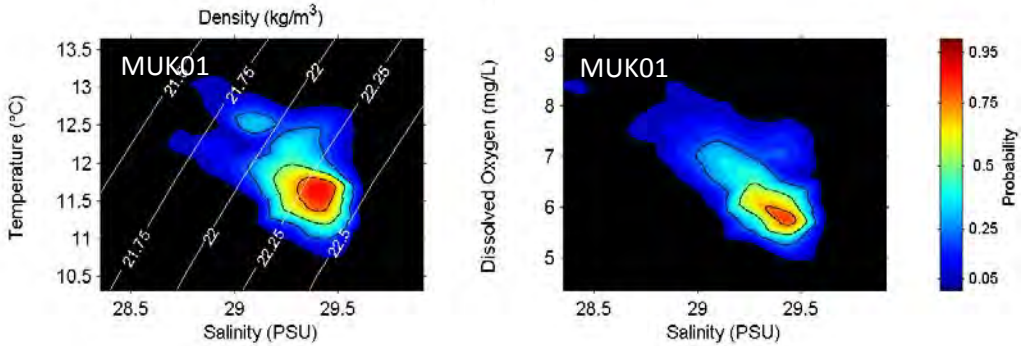


We track the depth of the isohaline where salinity is 28.55 (±0.05) to measure the thickness of the freshwater layer at our Mukilteo station. The near surface sensor experienced tidal pressure variations of 1.3 to 5.3 meters (or dbar).

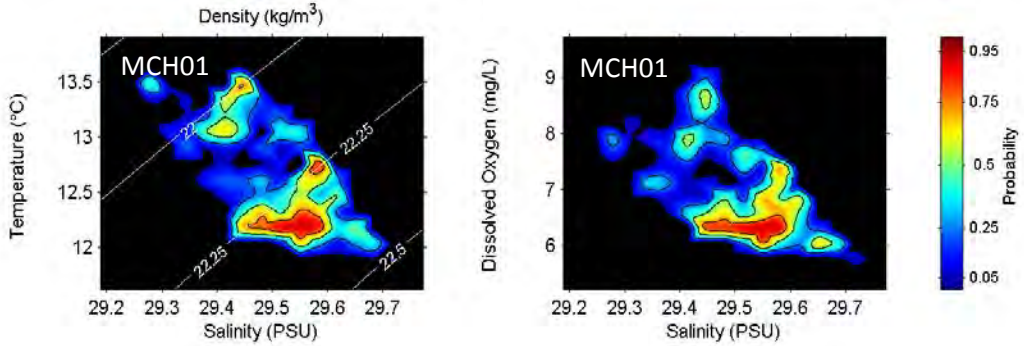


Real-time data online (click)

Mooring observation and trends 8-28-2012 to 9-10-2012



At Mukilteo, the dominant water mass is well defined and appears to be more oceanic with relatively low dissolved oxygen content (red).



At Manchester several infrequent events showed warmer surface waters (yellow dots) overlying colder and saltier water with less oxygen.

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

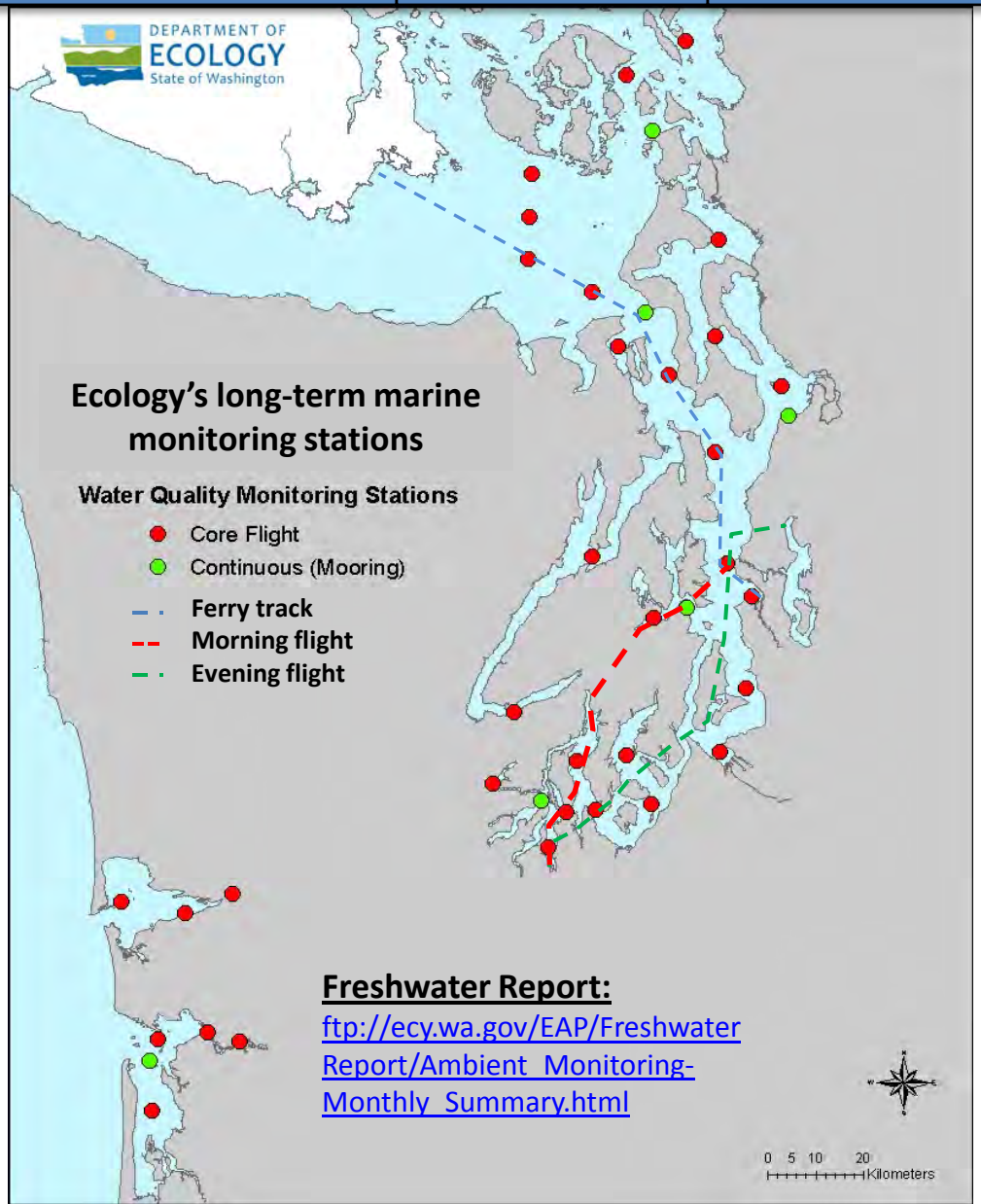
Field log	Weather	Water column	Aerial photos	Ferry and Satellite	Moorings

Long–Term Monitoring Network

christopher.krembs@ecy.wa.gov

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.

Dr. Christopher Krembs
ckre461@ecy.wa.gov

Marine Monitoring Unit
Environmental Assessment Program
WA Department of Ecology

Many thanks to our business partners: Clipper Navigation, Swantown Marina and Kenmore Air.