

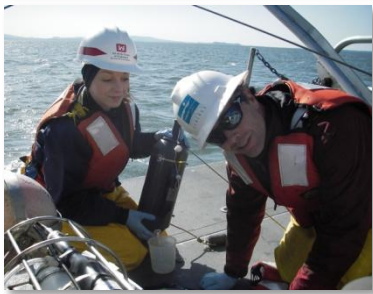
Eyes Over Puget Sound



Surface Conditions Report
June, 6th 2011

Up-to-date conditions of visible water quality conditions in Puget Sound and the Straits

Meet us in the field:



Content:

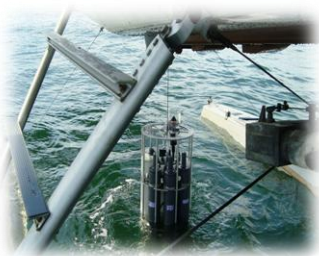
- Personal flight impression p. 4-5
Find out what it's like to be in the field.
- Aerial photography p. 6-22
Find out what you see at the surface.
- Ferry and satellite p. 23-31
Find out what we measure at the surface every day
- *In-situ* mooring data p. 32-33
Find out what we measure below the surface every day

Get your data from Ecology's Environmental Assessment Program

Long – Term Monitoring Network

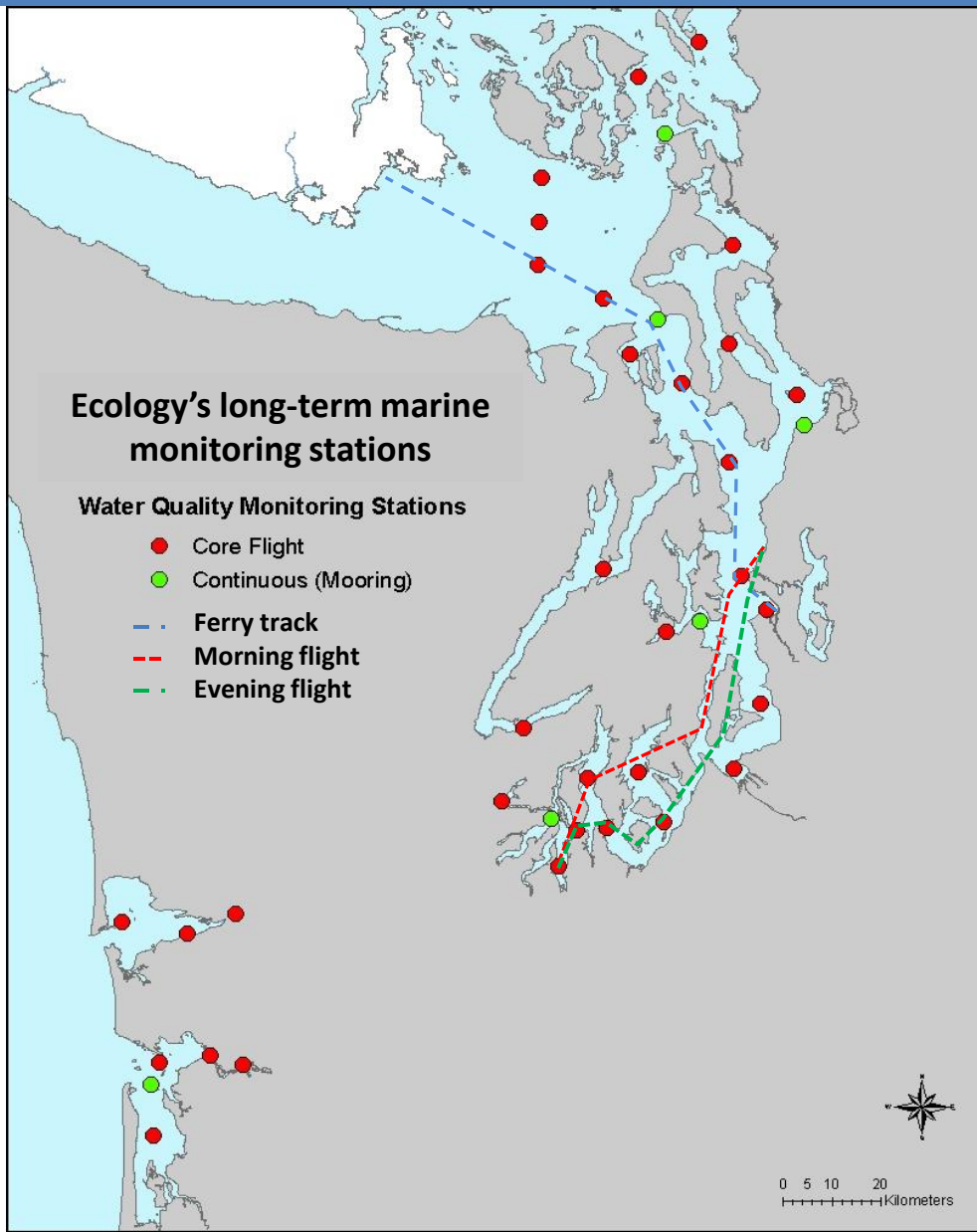


ftp://www.ecy.wa.gov/eap/Flight_Blog/



Access core monitoring data:

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



Real – Time Sensor Network



brandon.sackmann@ecy.wa.gov



Access mooring data:

http://www.ecy.wa.gov/programs/eap/marine_wat/mooring.html



Flight Impressions from 6-6-2011

Monday June 6th was a beautiful day to sample. Today I was lucky to have Christopher Krembs, our Senior Oceanographer, aboard. It is always valuable to bridge the office to field gap. He even got in the back to do a cast! We saw evidence of algae biomass at most stations and saw several blooms in transit between stations. The wind picked up as the day progressed so I was glad we stayed in the South Sound. Besides some unexpected bottles firing on board (they are suppose to wait until they are in the water!) it was a very successful flight with 100% station attainment.



Algae bloom and debris near Carr Inlet



Interesting surface upwelling leaving Commencement Bay

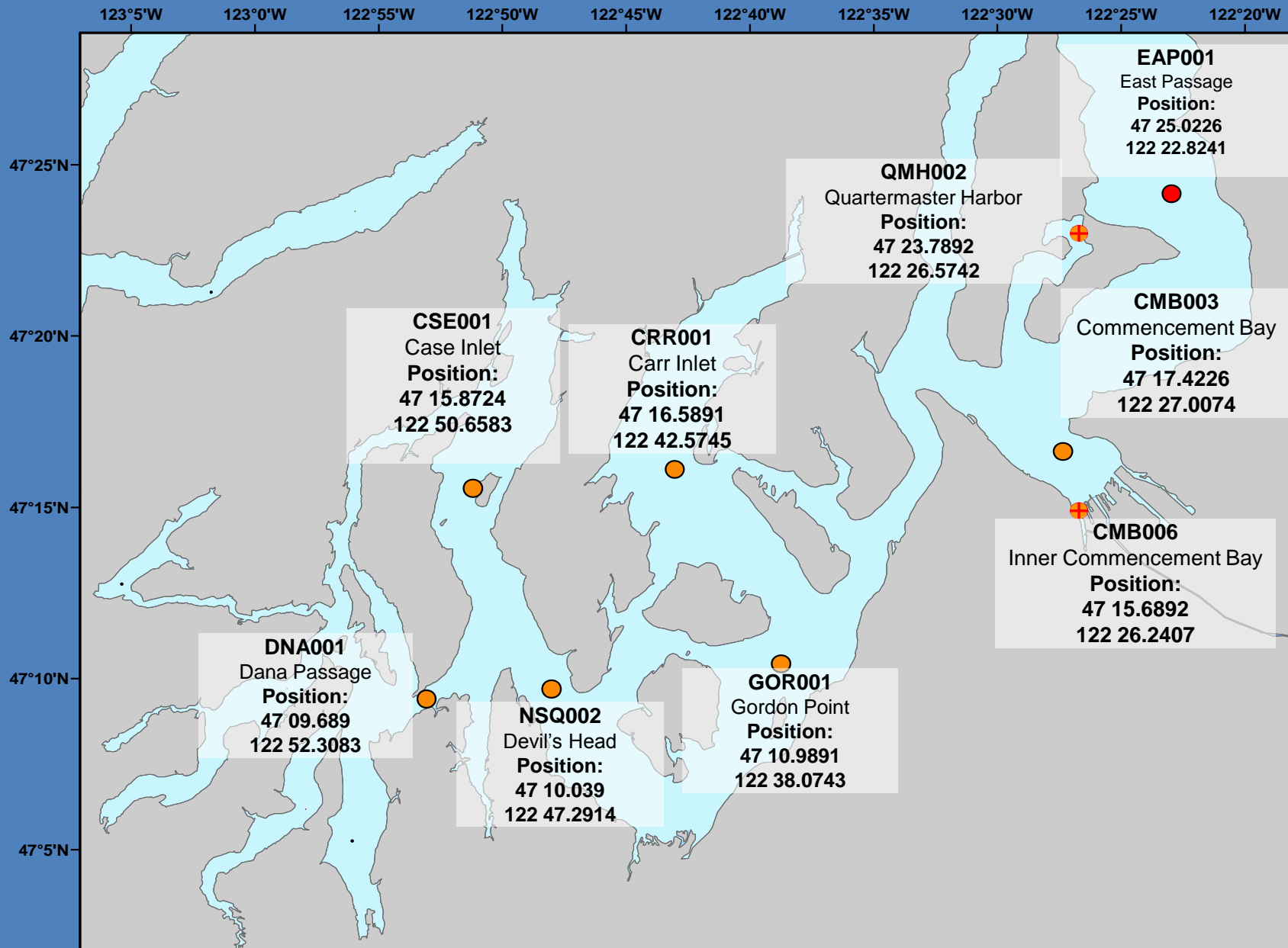


Bringing the CTD back onboard



Christopher getting in on the action.

2010 Marine Flight 4 – South Sound

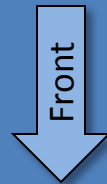




Summary of observation: 6-6-2011

Comment: Large blooms in South Sound and Main Basin with abundant macro-algae mats.
Very complex surface water masses that meet at a triple point in Main Basin

Green bloom near Rosedale, Carr Inlet



Mixing and Fronts:

Distinct fronts between Nisqually past Anderson Island (South Sound), spectacular image of three water masses in Main Basin



Suspended sediment:

Plume patches near Anderson Island (South Sound) and along beaches due to wind



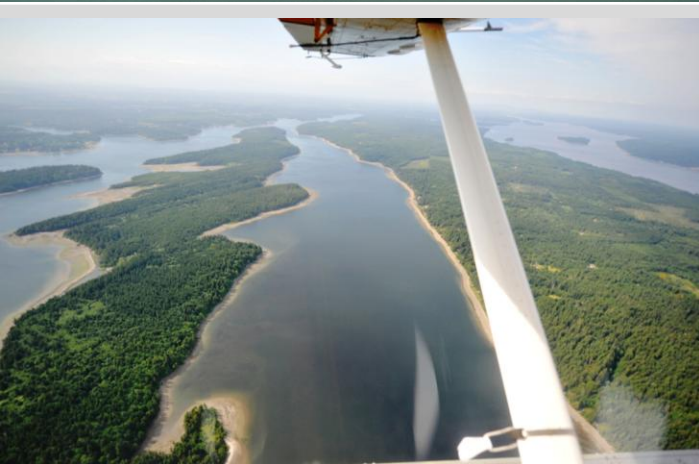
Visible blooms:

Brown-red, green, olive in South Sound (Case and Carr Inlet) very high concentrations in central Main Basin and north of Vashon Island



Debris (anything floating at surface):

Many surface debris patches and debris lines and foam. Very high macro-algae abundance in Main Basin and Colvos Passage



Red-Brown bloom in near Squaxin Island



Flight conditions between Olympia and Seattle on 6-6-2011

Find and download all aerial images at ftp://www.ecy.wa.gov/eap/Flight_Blog/

Flight Details:

Flyer Christopher Krembs

Morning 8:03 AM:

Seattle via Main Basin, Colvos Passage, Carr Inlet, Case Inlet, Dana Passage, Budd Inlet into Olympia

Evening 4:25 PM:










Olympia via Dana Passage, Anderson Island, Nisqually, Gordon Point, Commencement Bay, Quartermaster Harbor, Central Basin, Westpoint/Seattle

Conditions:

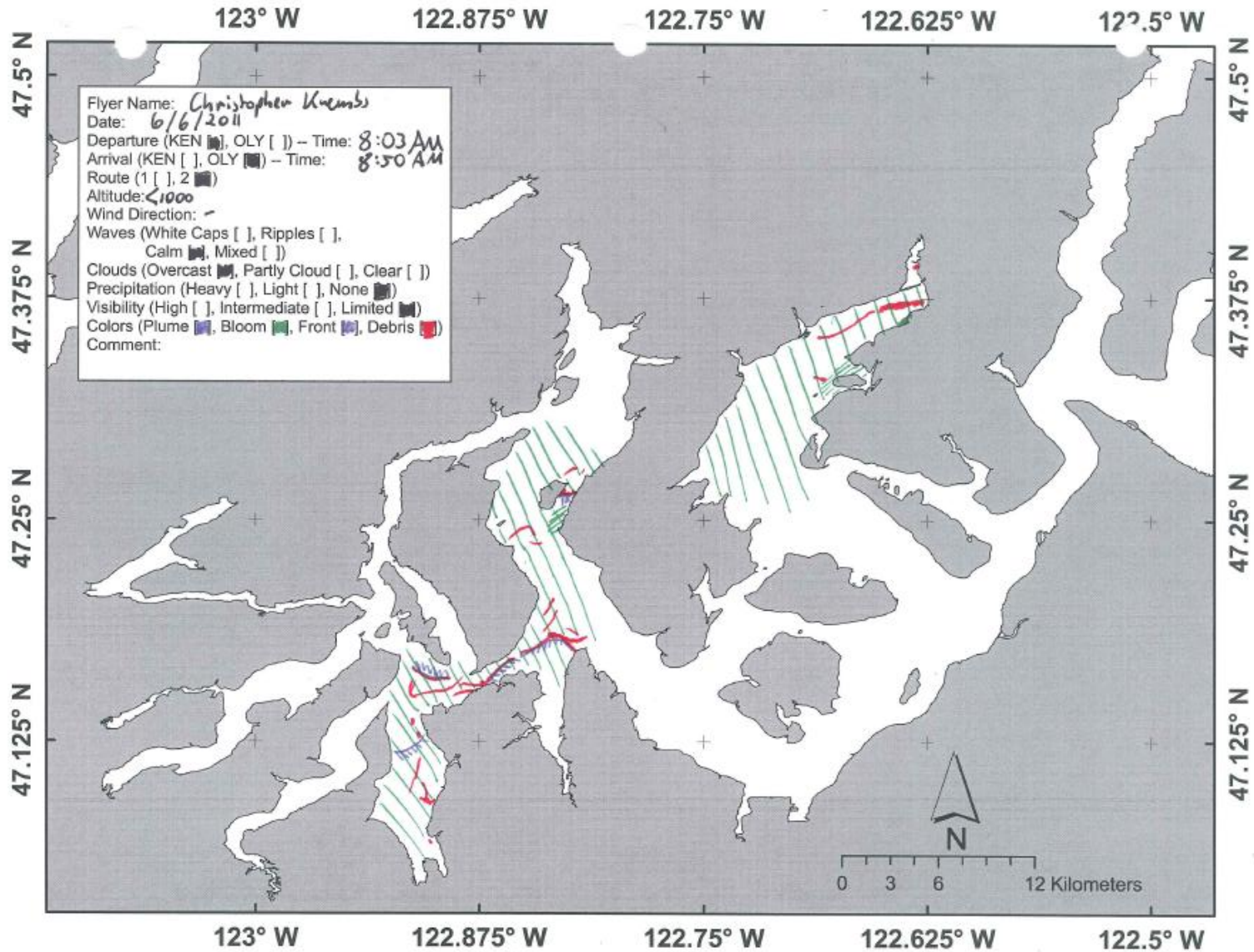
AM: Foggy, low visibility and difficult light conditions.

PM: Good visibility altitude 2500 ft, sunny, few clouds.

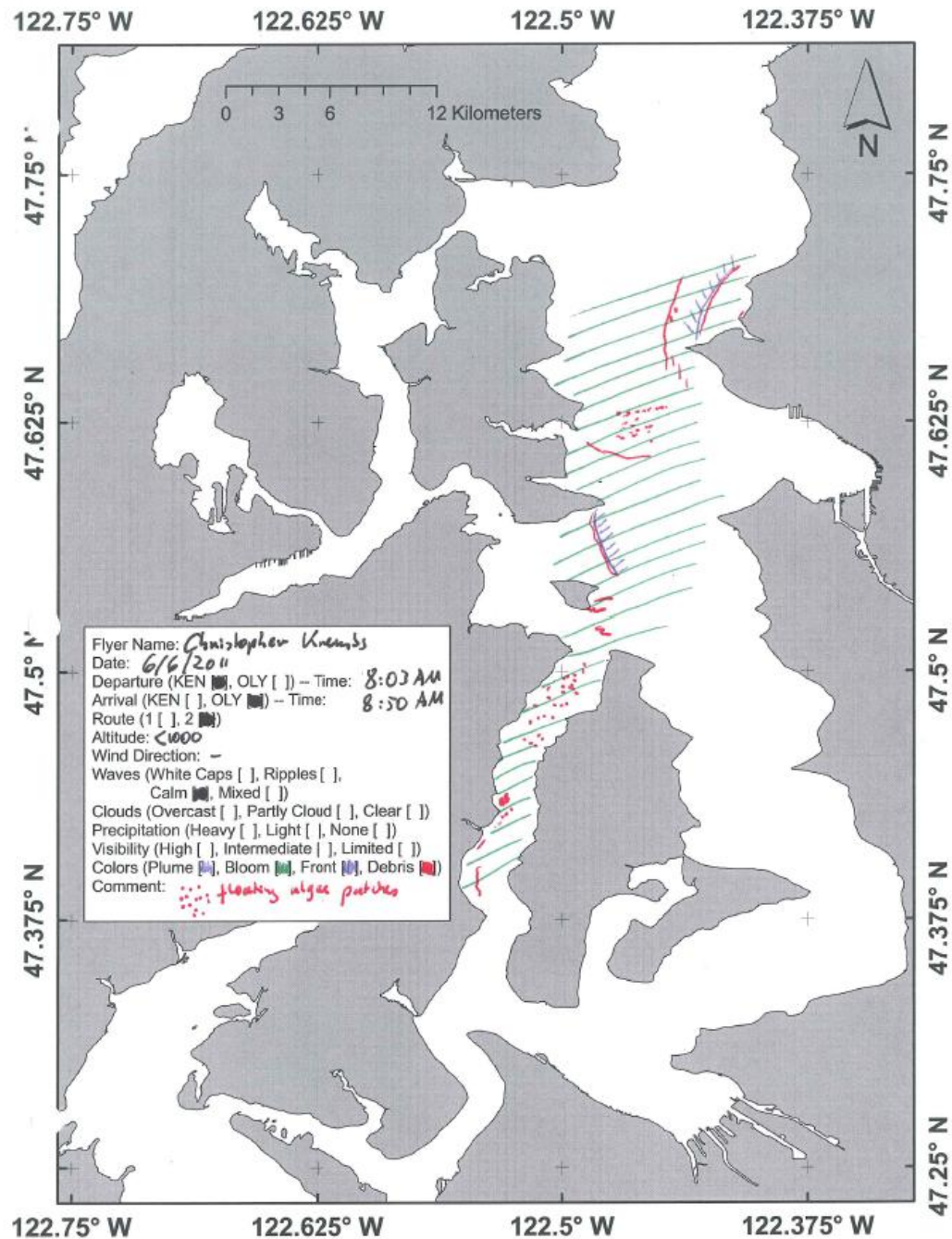
Legend to map annotations

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	

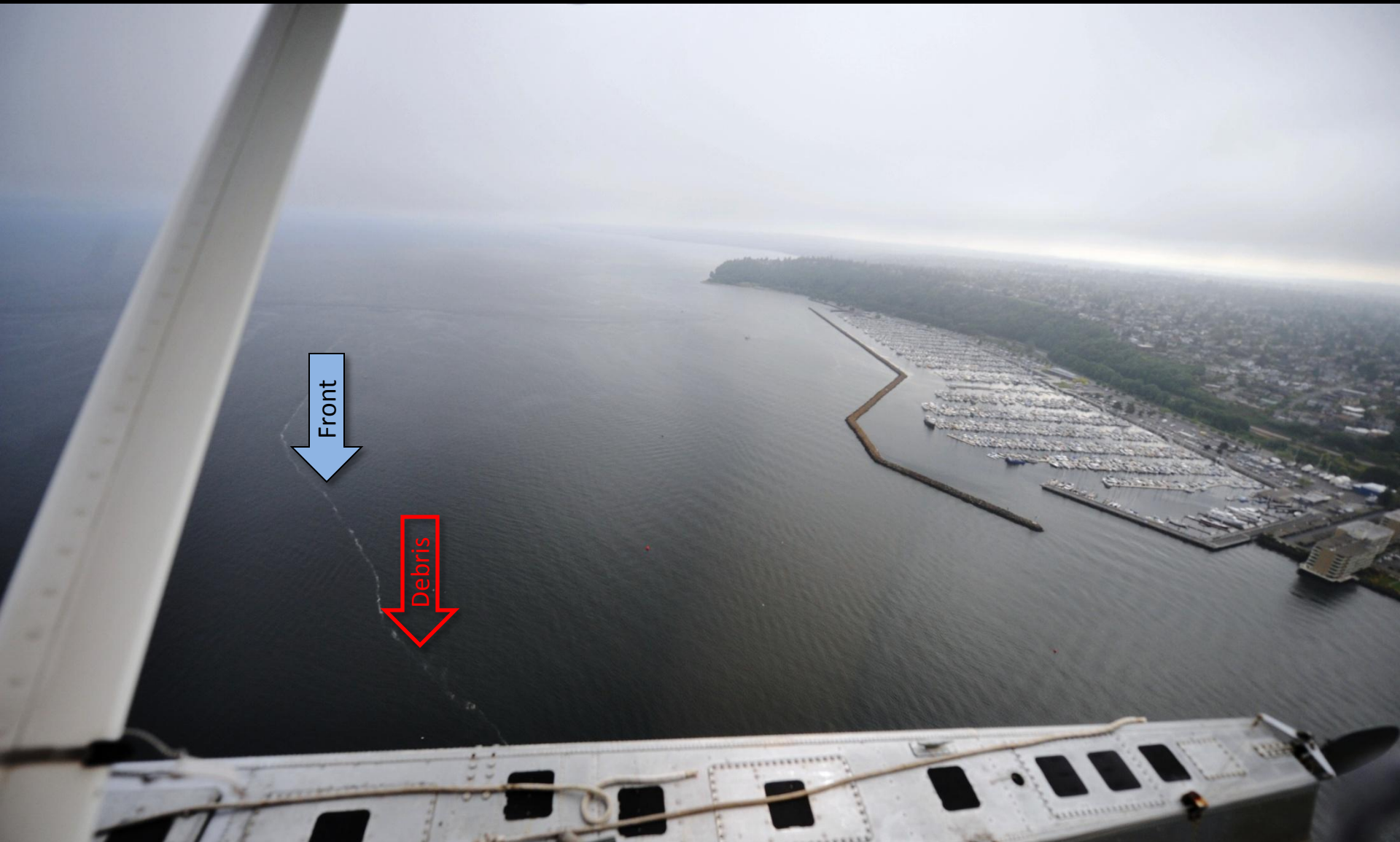
South Sound: 8:03-8:50 AM



Central Sound 8:03-8:50 AM

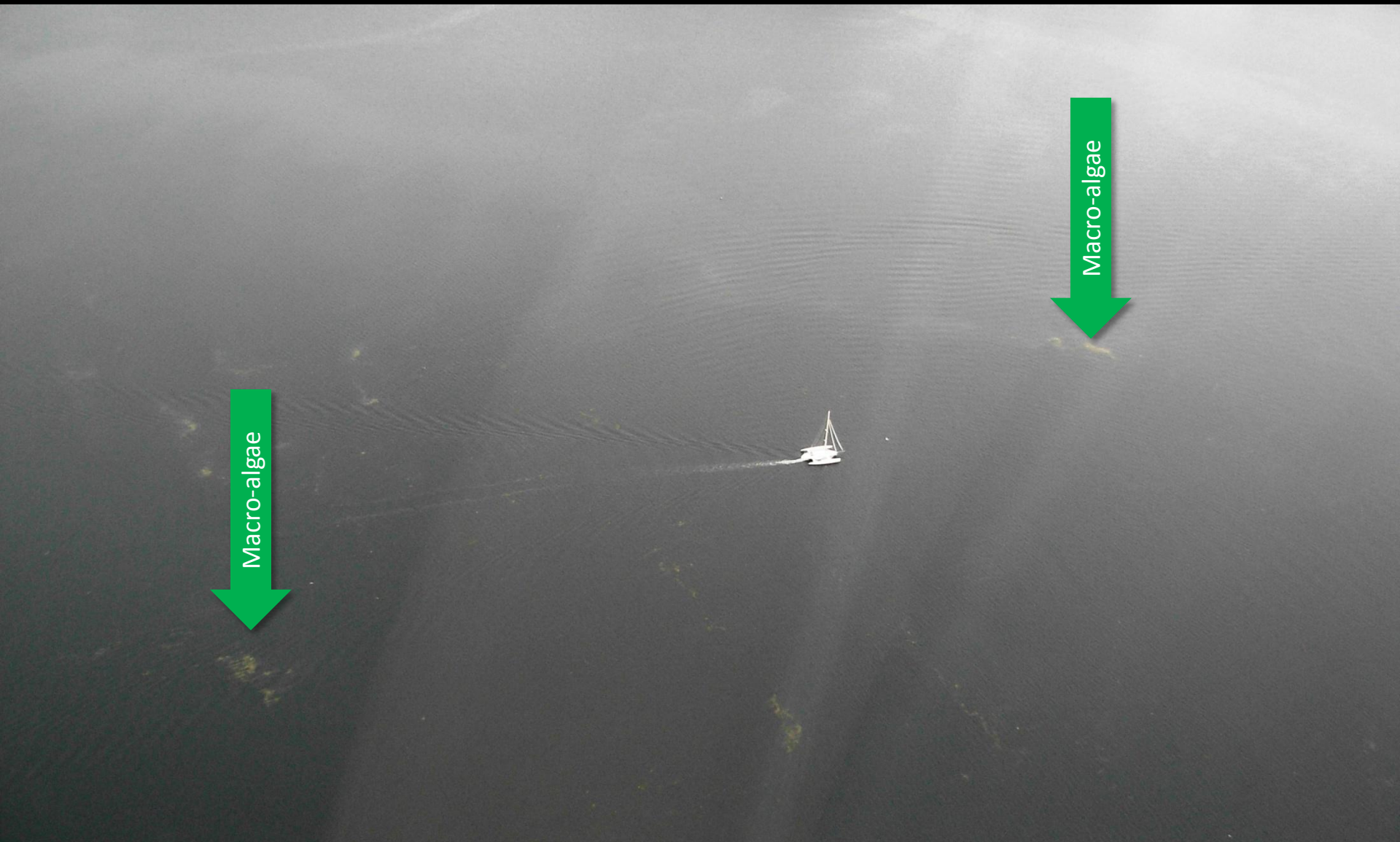


Morning flight from Seattle to Olympia at <math><1000\text{ ft}</math> altitude



Shilshoal Bay front of different surface water and debris line, 8:05 AM

Morning flight from Seattle to Olympia at <1000 ft altitude



Many floats of macro-algae in the northern reaches of Colvos Passage at 8:20 AM

Morning flight from Seattle to Olympia at <1000 ft altitude



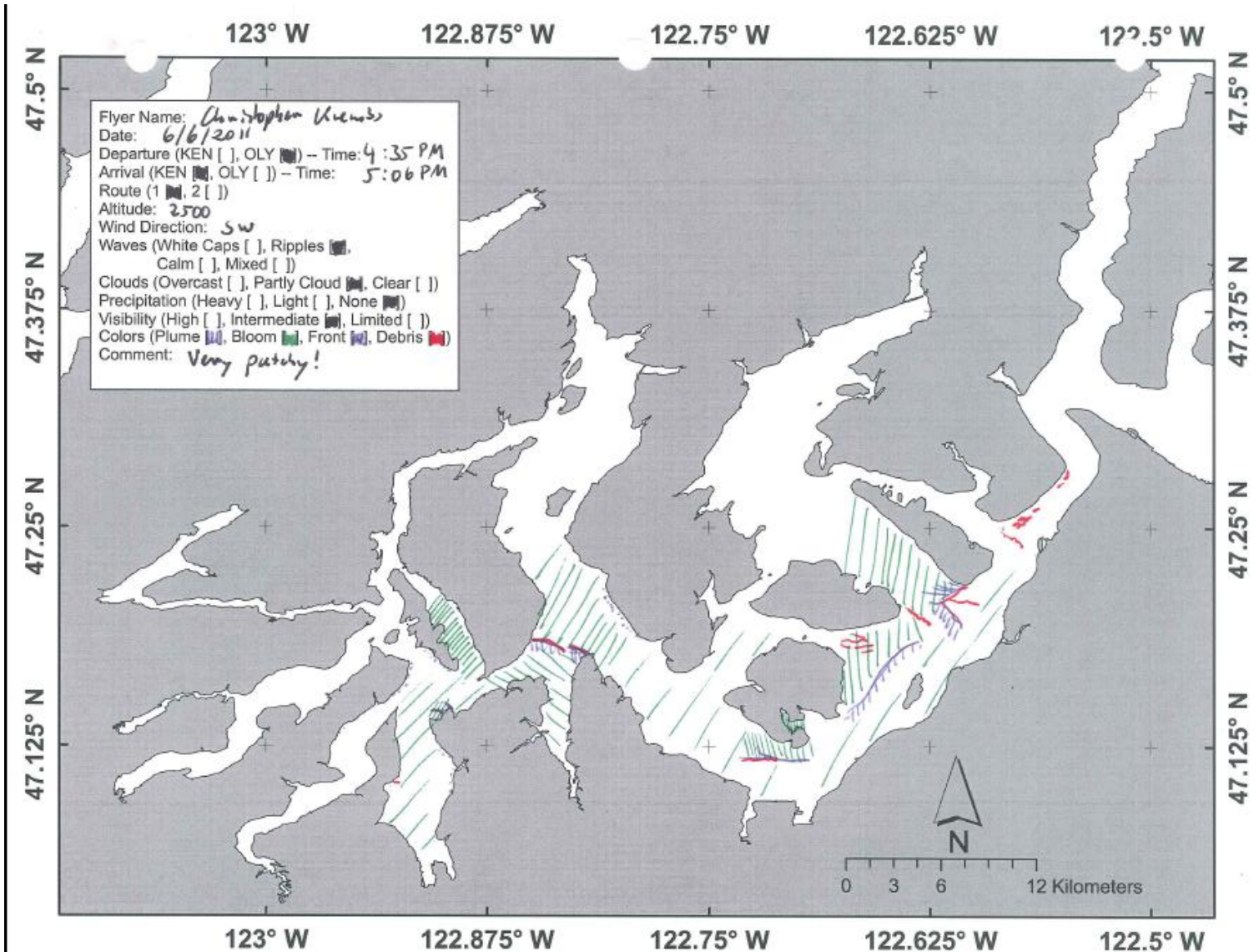
Surface foam and debris patch in northern Carr Inlet, Henderson Bay at 8:30 AM

Morning flight from Seattle to Olympia at <1000 ft altitude

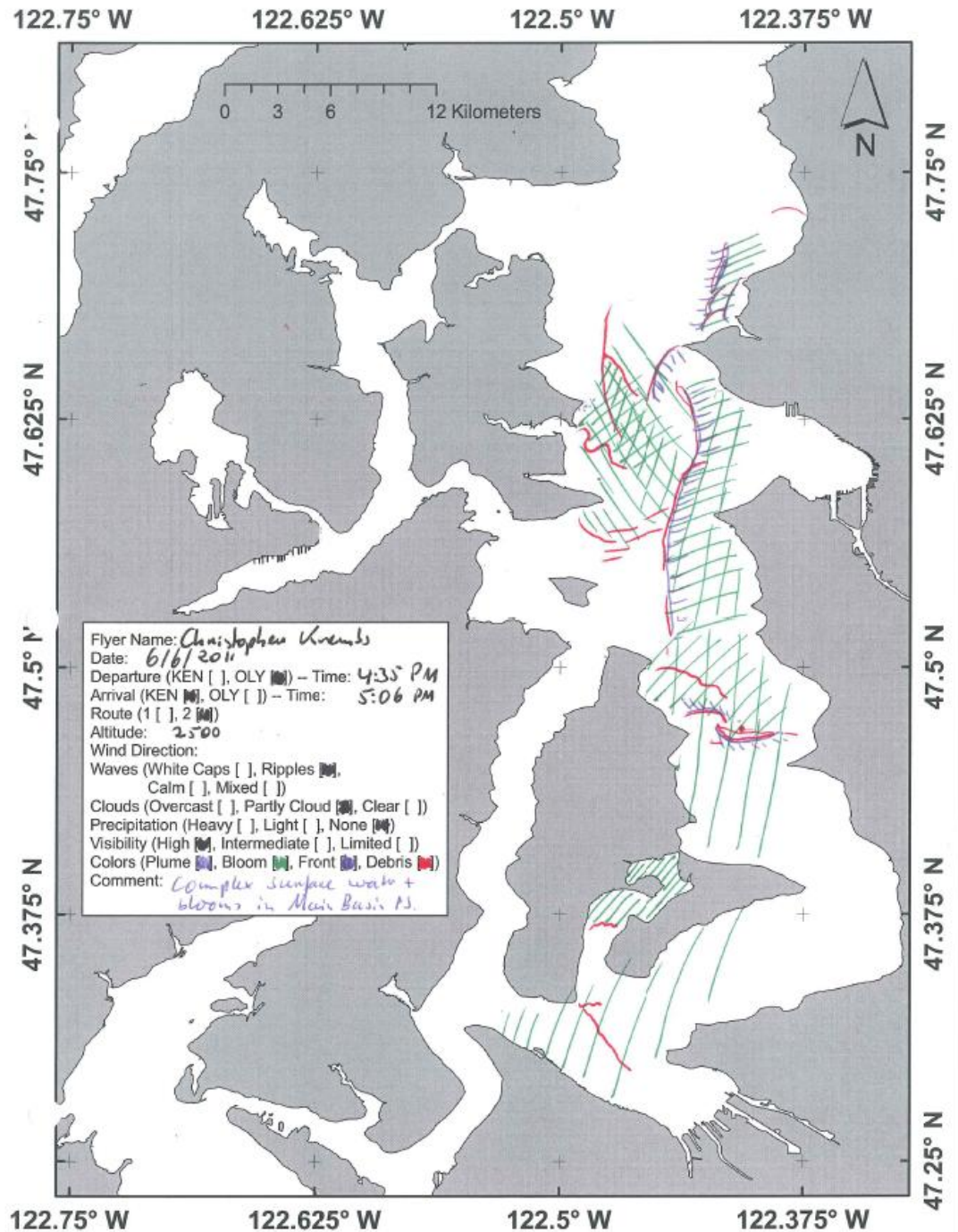


Debris line with macro-algae patch in Case Inlet , Herron Island at 8:40 AM

Evening, South Sound 4:25-5:00 PM



Evening
Central
Sound
4:25-5:00
PM

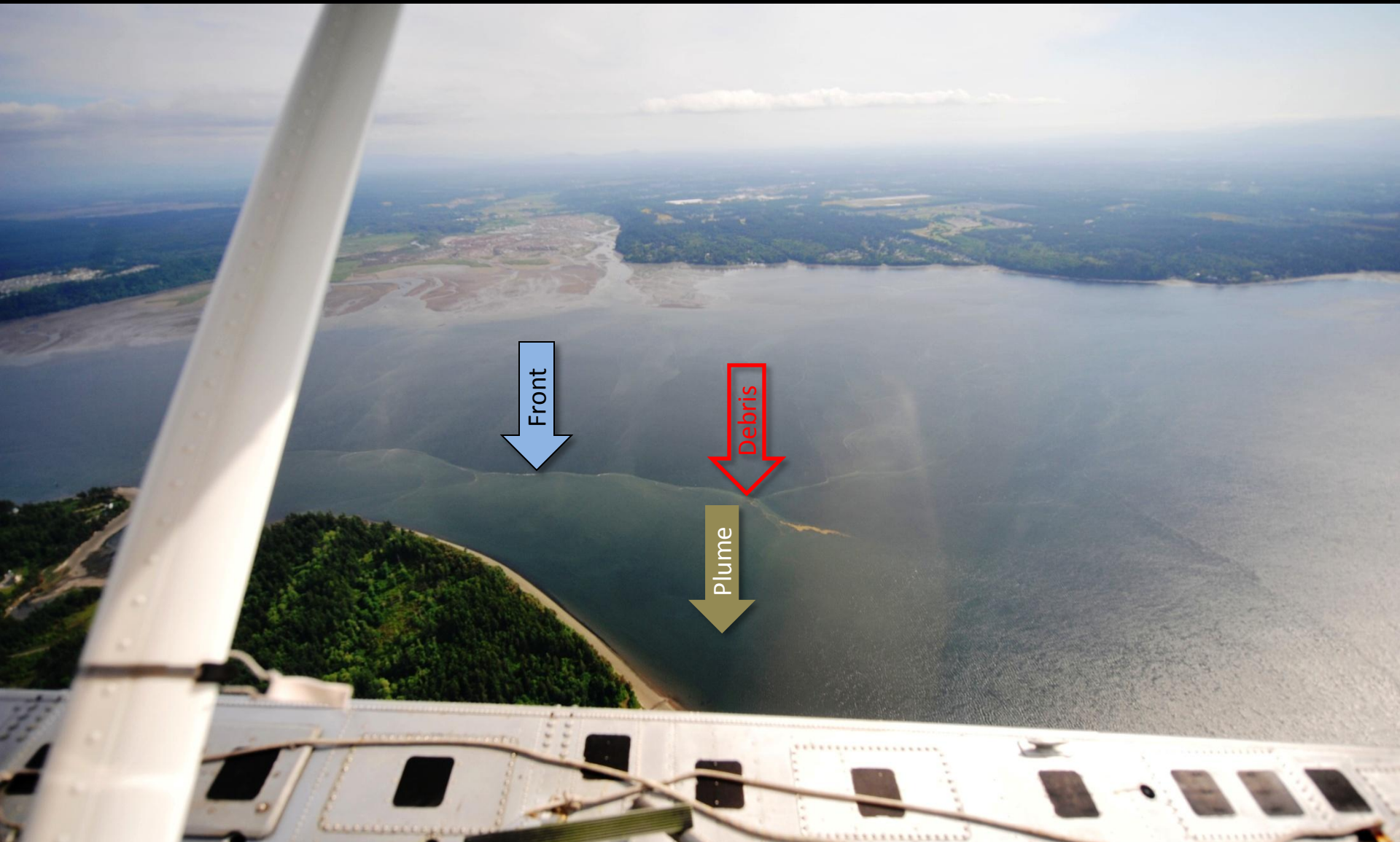


Evening flight from Olympia to Seattle at 2500 ft altitude



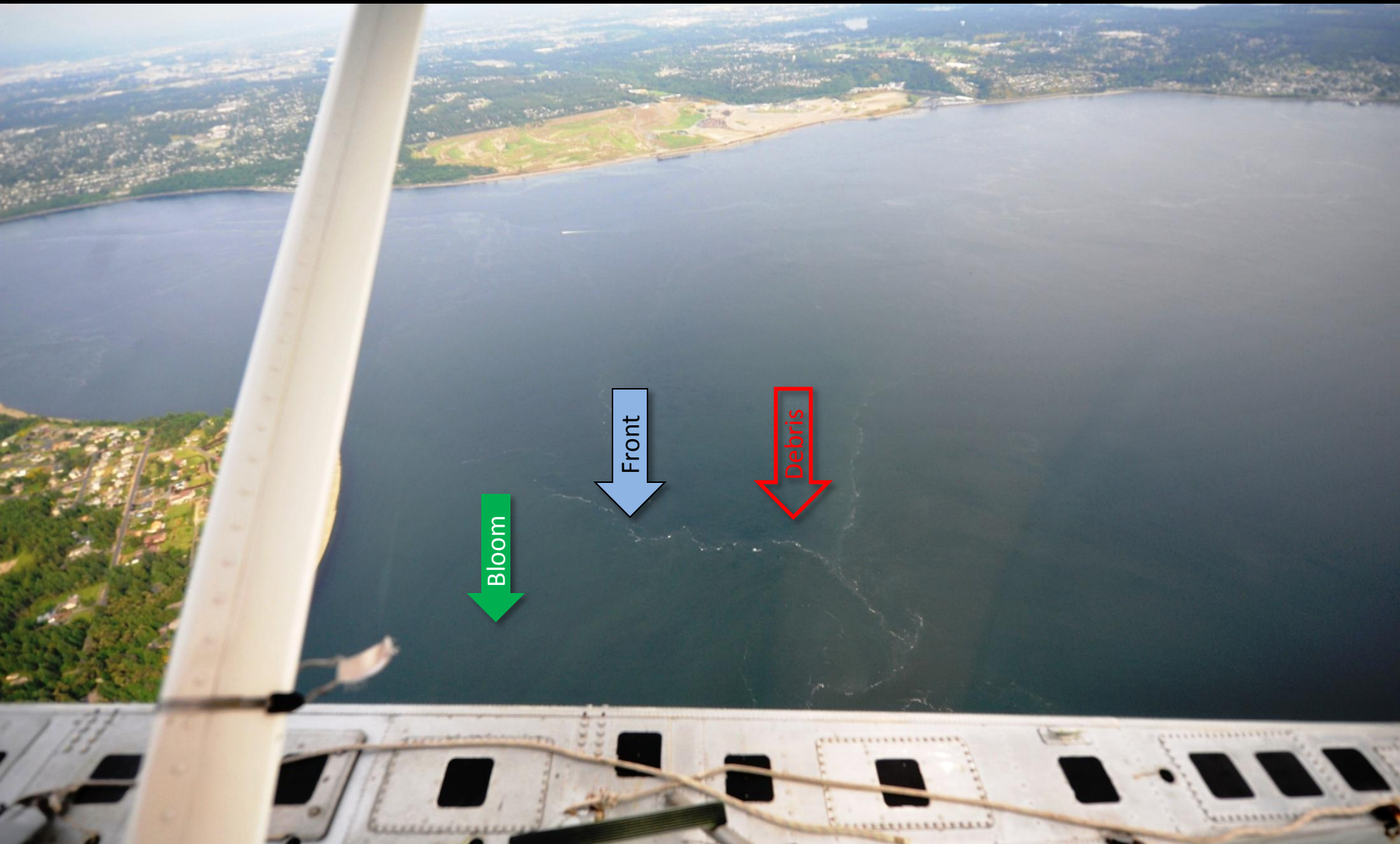
Front of water masses meeting between Henderson Inlet, Dana Passage and Case Inlet 4:35 PM

Evening flight from Olympia to Seattle at 2500 ft altitude



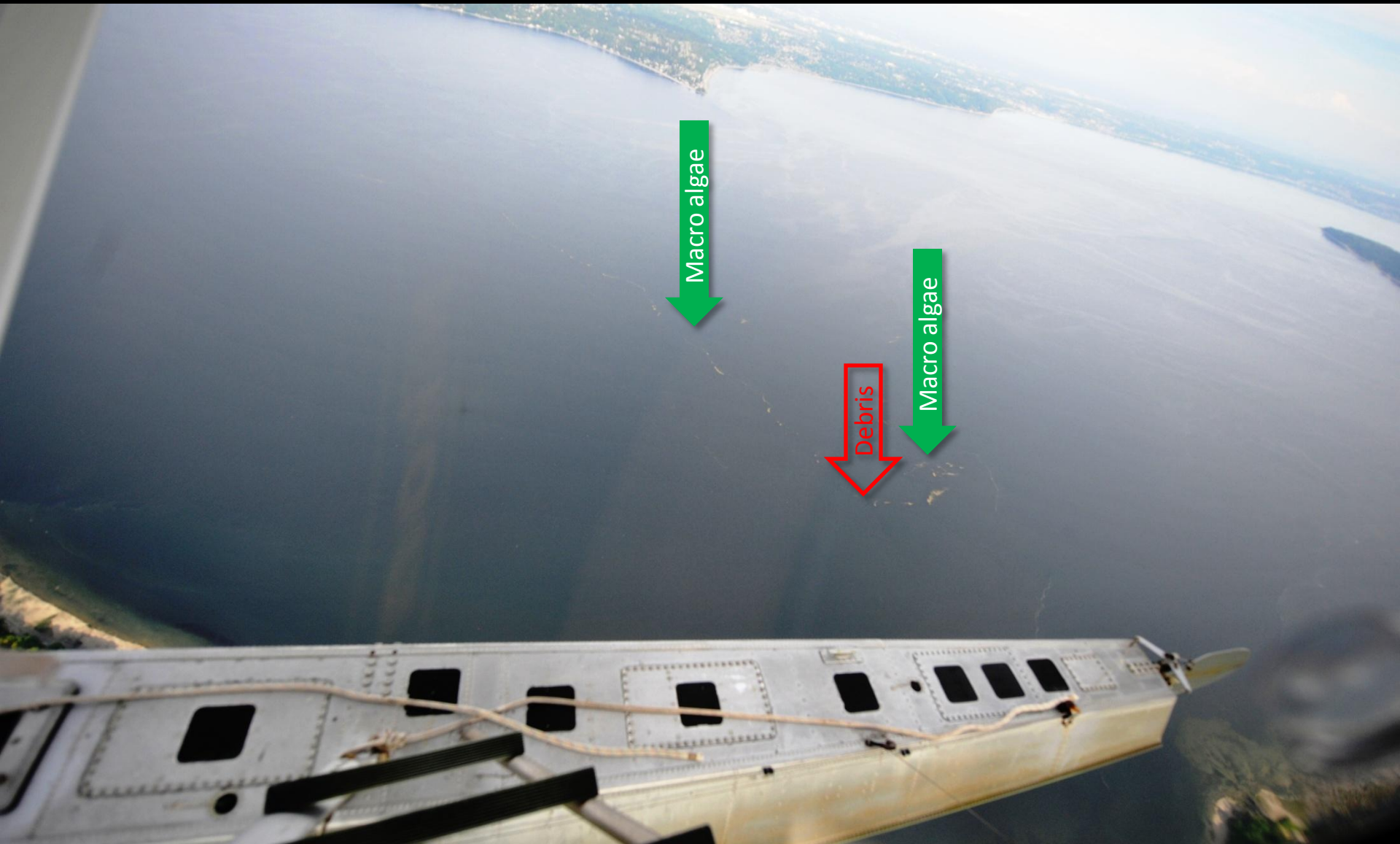
Distinct surface features of a plume, debris accumulation and a front near Nisqually delta, at 4:45 PM

Evening flight from Olympia to Seattle at 2500 ft altitude



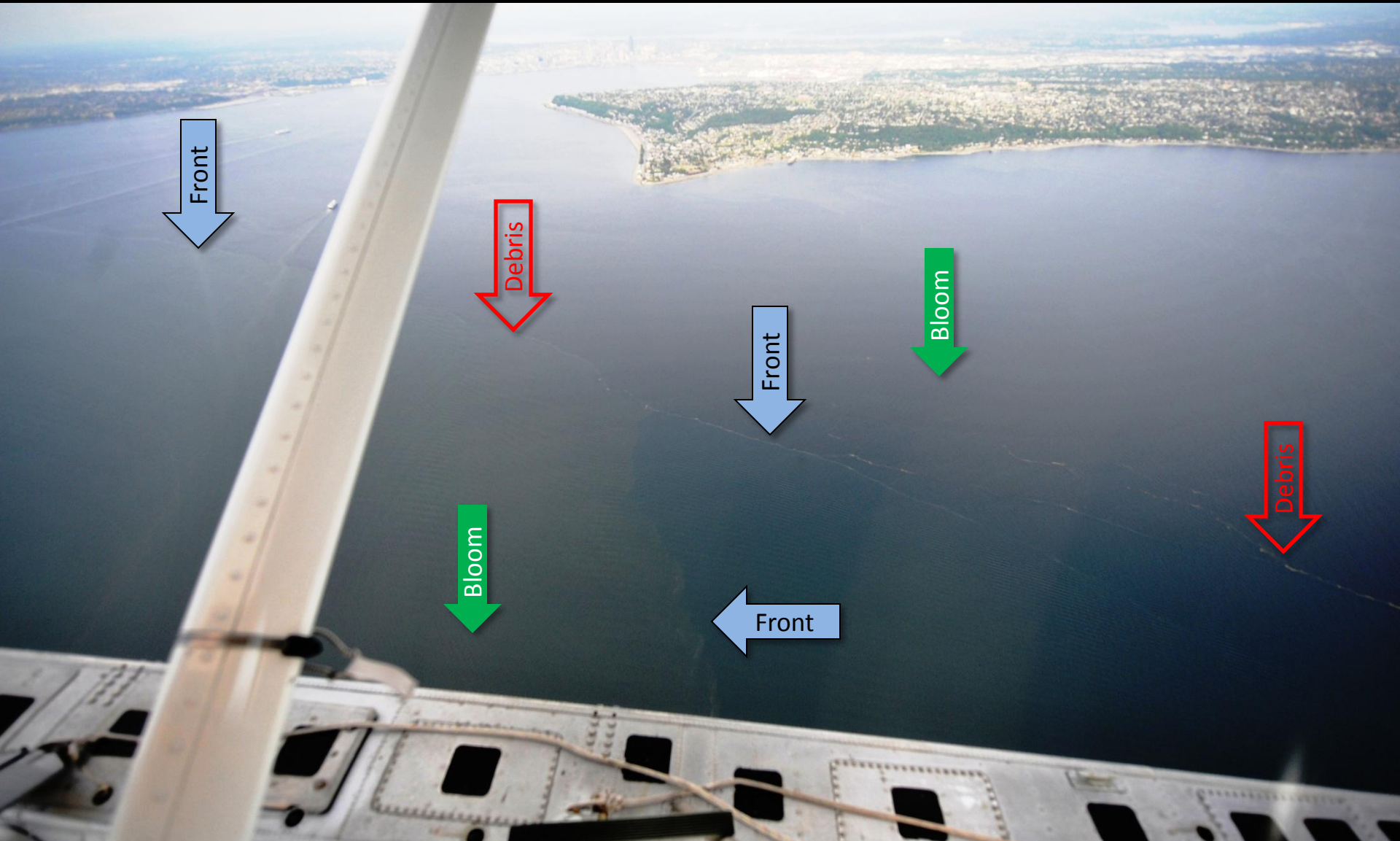
Algae bloom from Carr Inlet, front and debris line near Fox Island at 4:50 PM

Evening flight from Olympia to Seattle at 2500 ft altitude



Large patches of macro-algae drifting in East Passage, Main Basin at 4:55 PM

Evening flight from Olympia to Seattle at 2500 ft altitude



Front

Debris

Bloom

Front

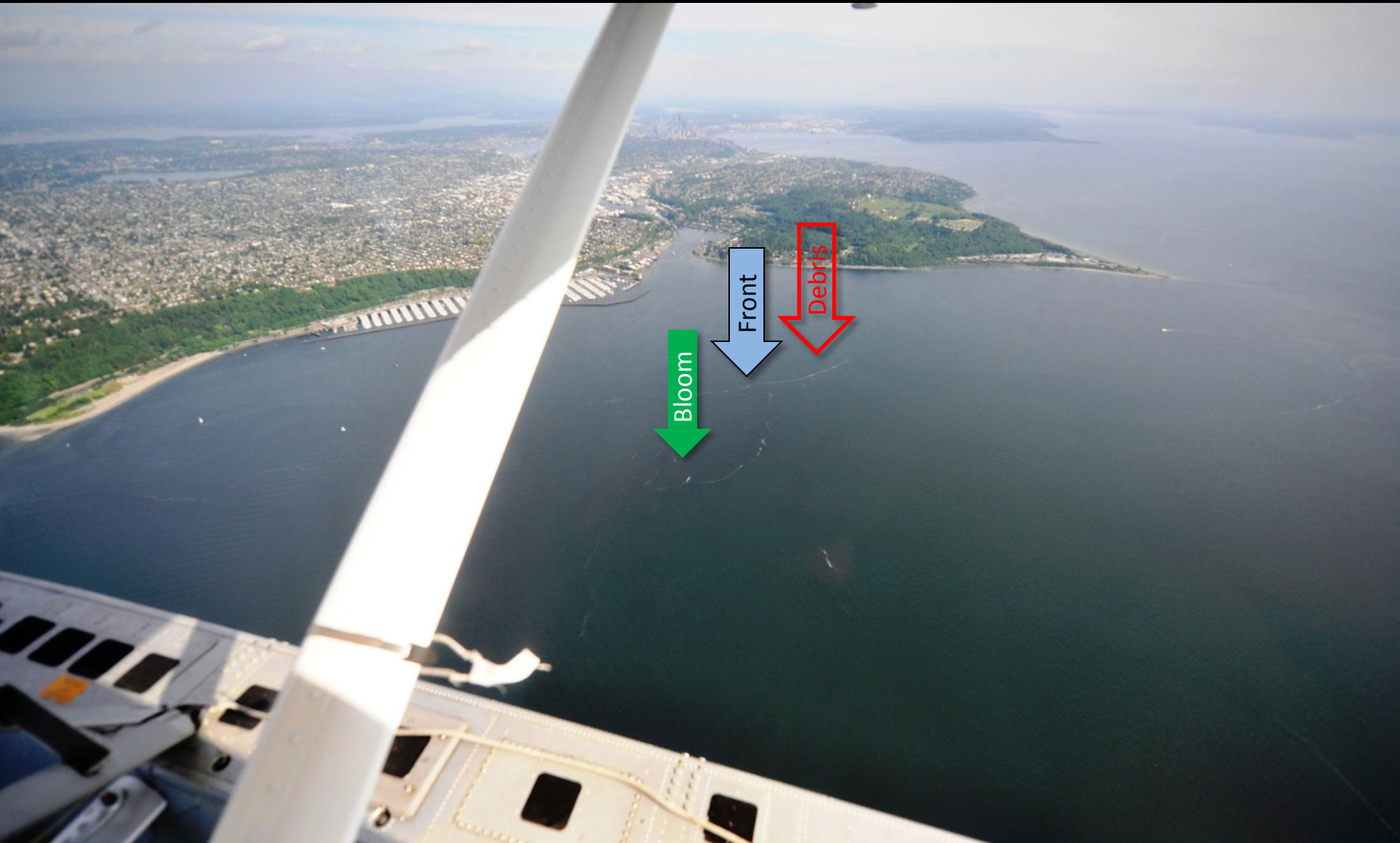
Debris

Bloom

Front

Three distinct surface water masses (two with optically distinct algal blooms) meet in Main Basin between West Seattle and Manchester at 5:00 PM

Evening flight from Olympia to Seattle at 2500 ft altitude



Shilshoal distinct surface water masses meet with brown bloom at 5:10 PM



Daily Ferry and Satellite observations in Main Basin, Monday June 6, 2011

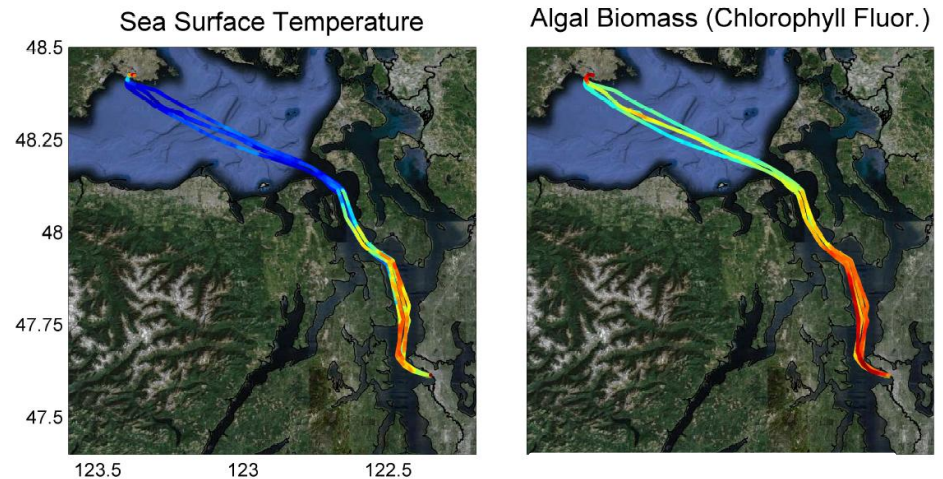


Contact: brandon.sackmann@ecy.wa.gov

***** Daily 'Quick-Look' Products Now Available *****



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



Current Conditions: Widespread algae bloom in Main Basin continues; surface water temperatures have warmed rapidly in the last few days to between 13-14 °C.

Historical Comparison: Temperatures in May were 1-2 °C colder than last year (10-12 °C vs. 11-13 °C).

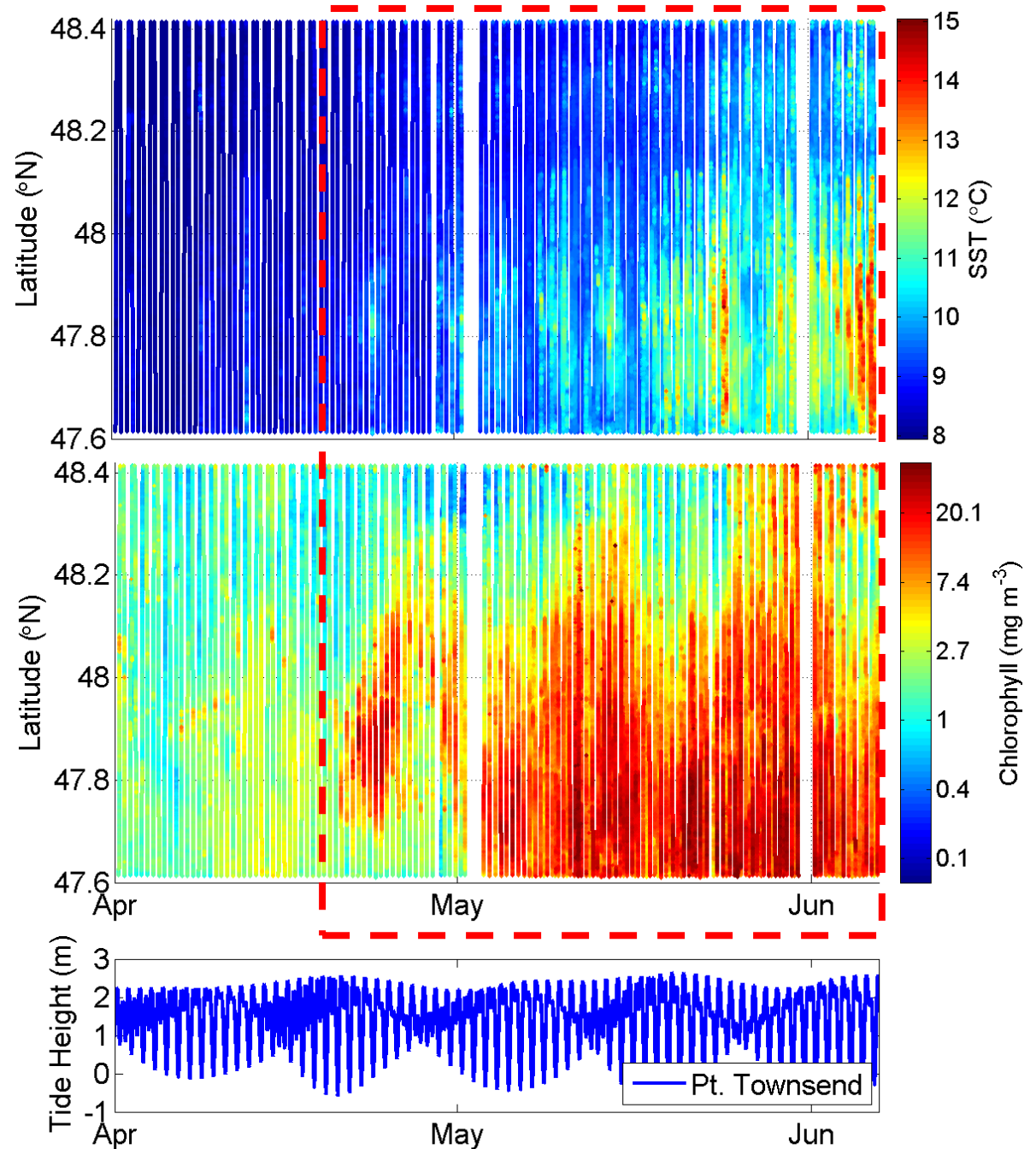
Victoria Clipper

Widespread algae bloom in Main Basin continues...

Bloom began in late April; associated with increased near surface temperatures (and presumably increased stratification).

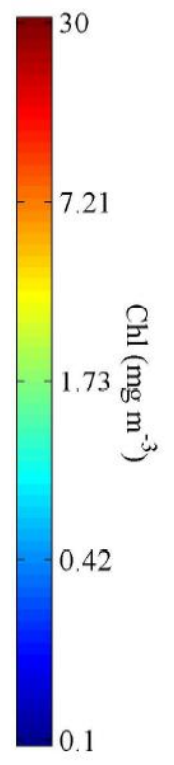
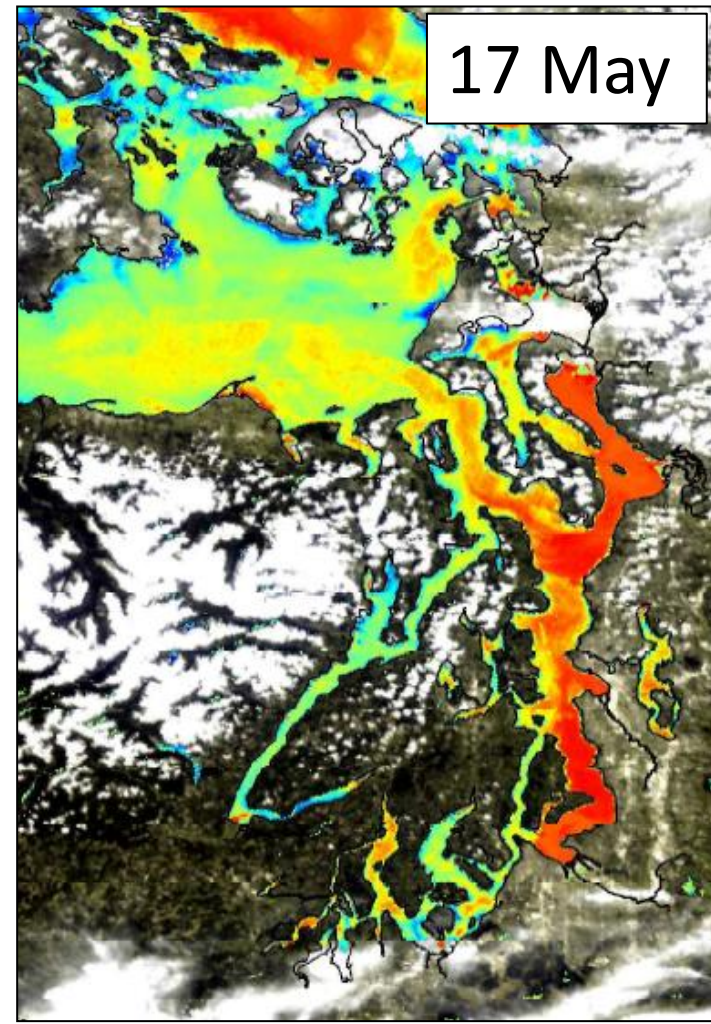
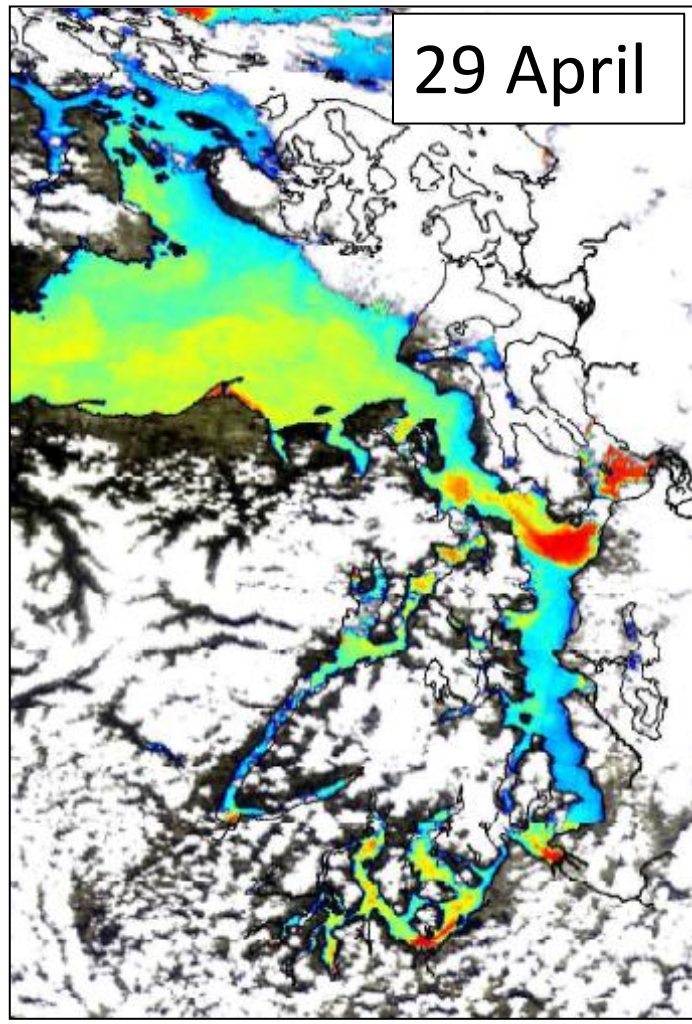
Temperatures have warmed rapidly during the past few days to between 13-14 °C.

High chlorophyll waters have been extending farther into the Straits of Juan de Fuca during [neap](#) tides (i.e., weak tides).



MERIS Satellite Ocean Color - Chlorophyll

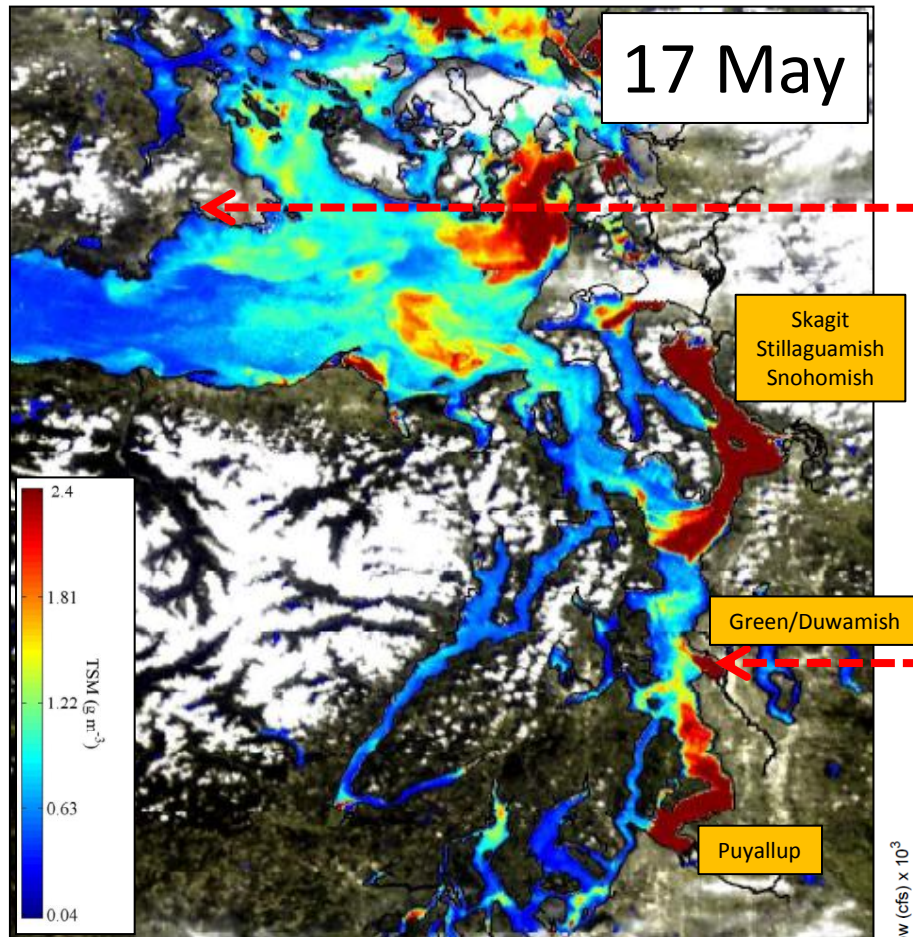
Bloom has intensified and spread throughout Main Basin



*** Additional Products Available ***

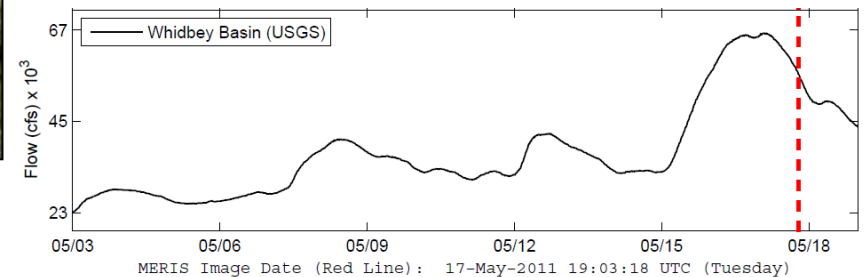
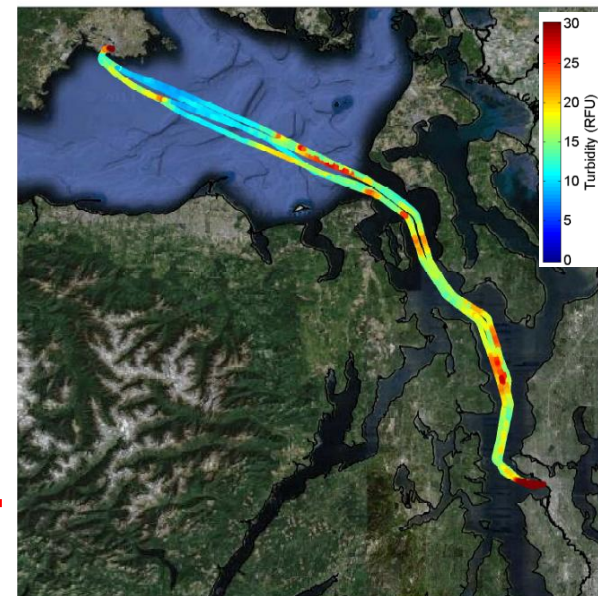
MERIS Satellite Ocean Color – TSM/Turbidity

Puget Sound water quality is strongly affected by local rivers
(image collected shortly after a rapid rise in river discharge)



*** Additional Products Available ***

Water Clarity (Turbidity)



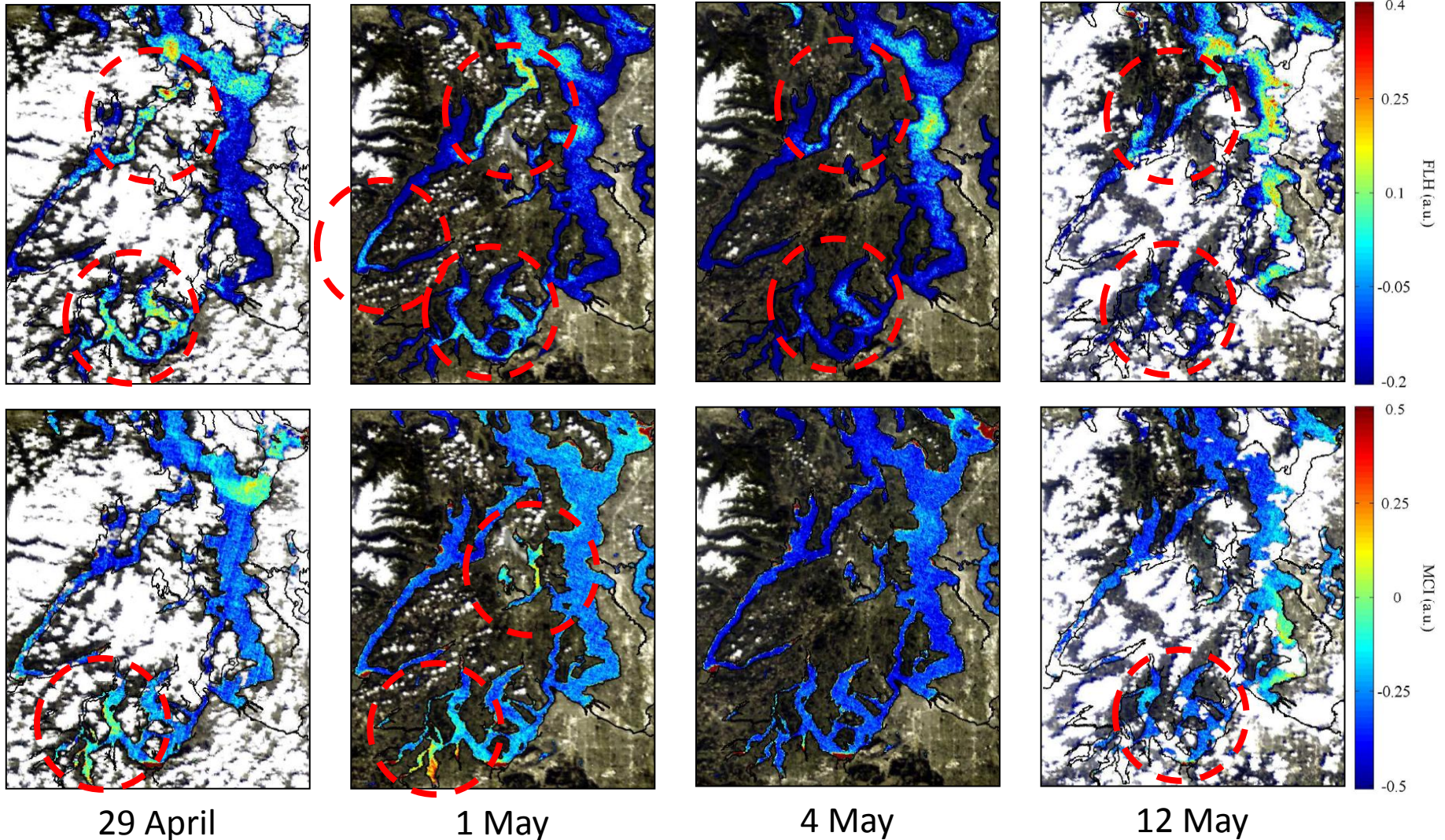
*** MERIS Ocean Color data provided by European Space Agency - ESA ***
Data processed by Washington State Department of Ecology
Contact: Brandon Sackmann, Ph.D (bsac461@ecy.wa.gov)

MERIS Satellite Ocean Color – FLH & MCI

What else has been blooming in Puget Sound?

FLH: Fluorescence Line Height – Proxy for algae bloom

MCI: Maximum Chlorophyll Index – Proxy for intense algae bloom (near surface)

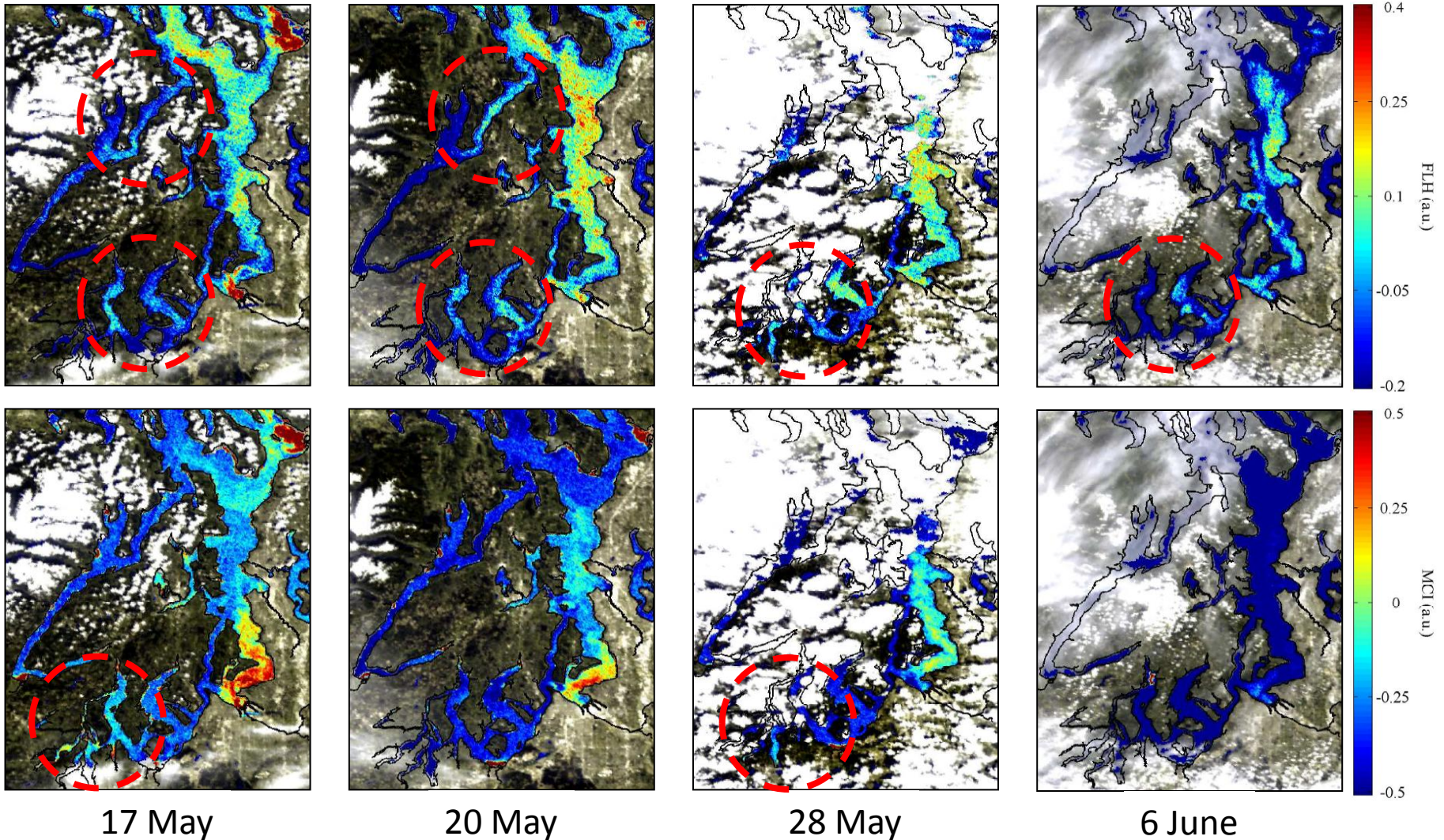


MERIS Satellite Ocean Color – FLH & MCI

What else has been blooming in Puget Sound?

FLH: Fluorescence Line Height – Proxy for algae bloom

MCI: Maximum Chlorophyll Index – Proxy for intense algae bloom (near surface)

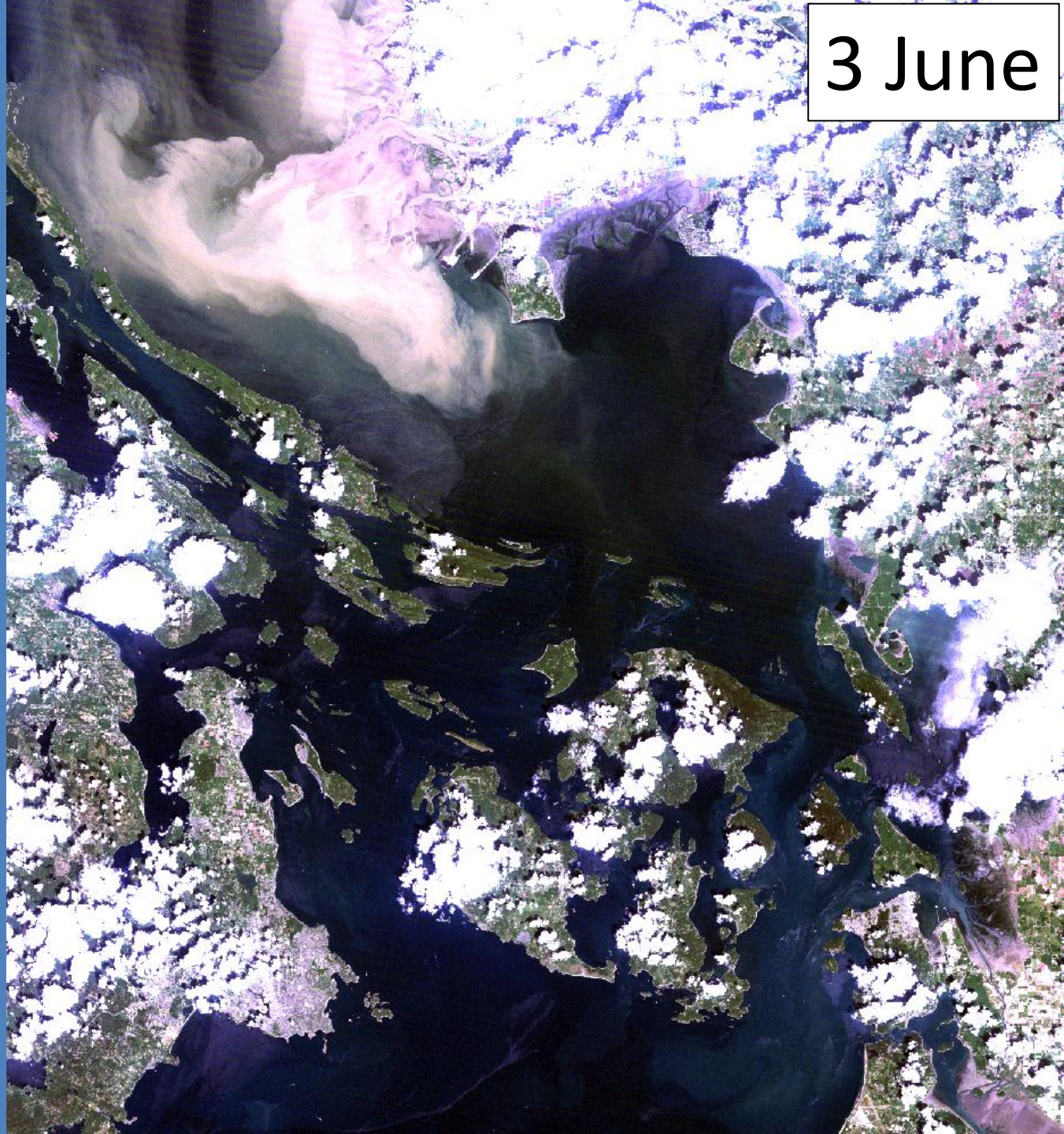


3 June

Landsat

(30m True Color)

Fraser River plume
entering Strait of
Georgia north of San
Juan Islands.

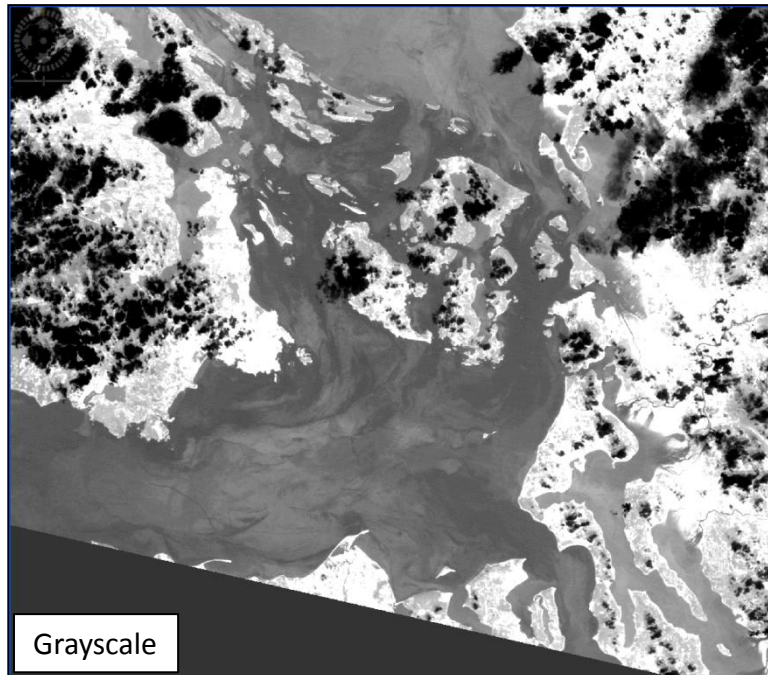
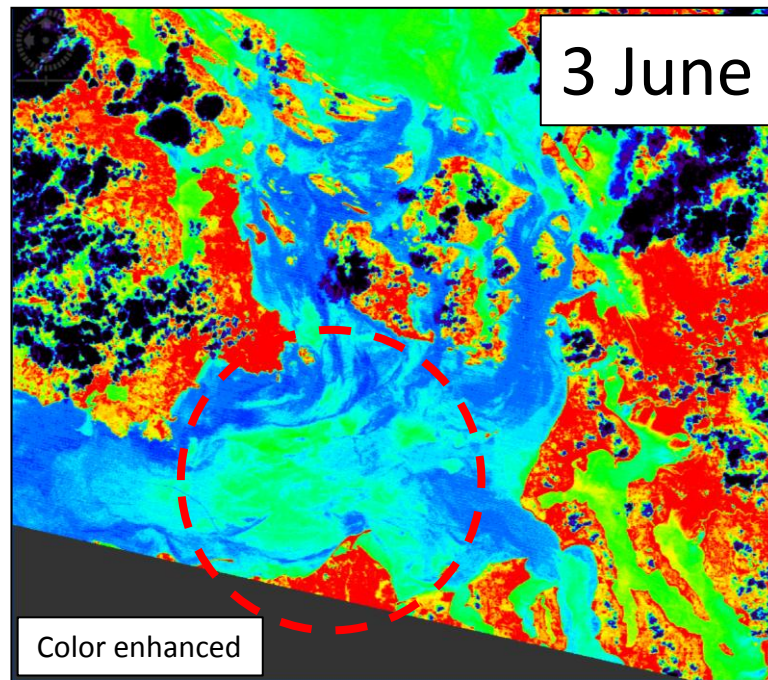


Landsat

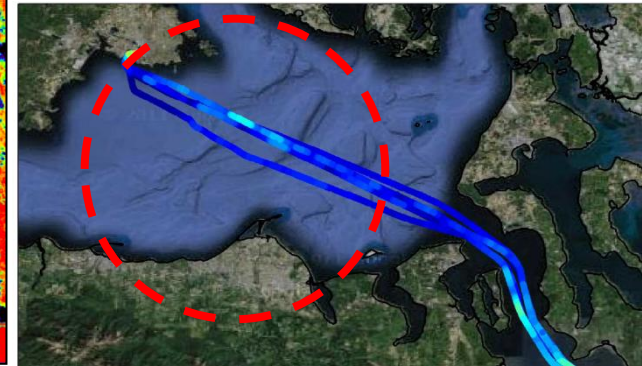
(30m Thermal Band)

Parcel of warmer water moving through the Strait of Juan de Fuca.

Agreement between Landsat thermal imagery and Victoria Clipper SST.



Victoria Clipper
Sea Surface Temperature

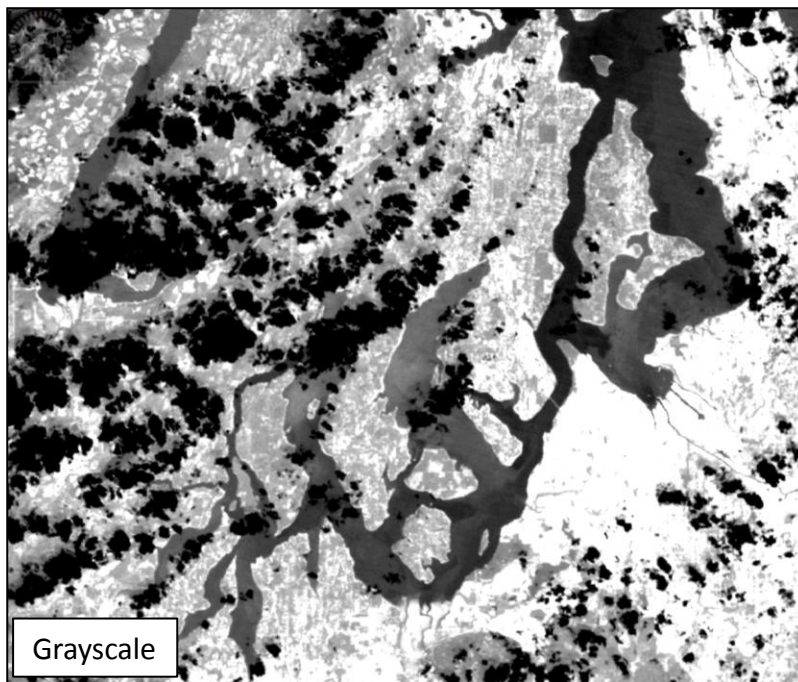
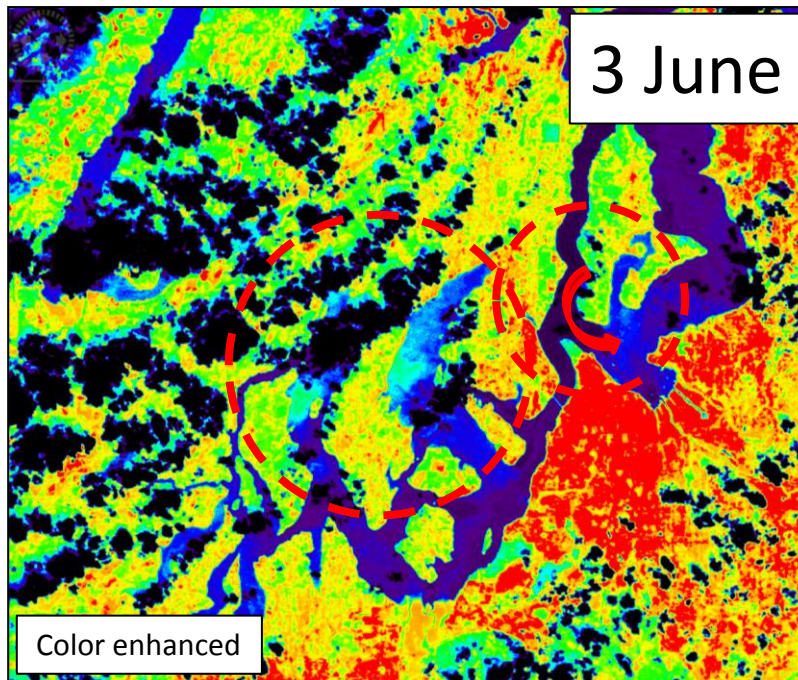


Landsat

(30m Thermal Band)

Warmer temperatures
at the northern ends of
Carr and Case Inlets.

Strong temperature
front near Colvos
Passage/Tacoma
Narrows/Main Basin
junction





Mooring observation from May 24 to June 6, 2011



http://www.ecy.wa.gov/programs/eap/mar_wat/moorings.html

General observation: Although dissolved oxygen levels remain fairly high, occasional spikes downward were observed, even during daylight.

Mukilteo, Whidbey Basin near Everett

MUK01BR (16m): DO values dropped 0.6 mg/L with mean daily values decreasing from 9.6 mg/L to 9.0 mg/L. River outflow appeared more dominant during the neap tide (5/26 to 5/29), where mean daily DO values surged to 11.6 mg/l and mean daily salinity values dropped to 27.7 PSU. Mean daily salinity values were 28.6 PSU, before and after neap tide. Temperature increased by 0.4C with mean daily values rising from 9.1C to 9.5C.

MUK01SR (surface): Mean daily salinity values were about 25.0 PSU. Temperature increased by 0.8 C with mean daily values rising from 10.2C to 11.6C.

Manchester, Main Basin (not shown)

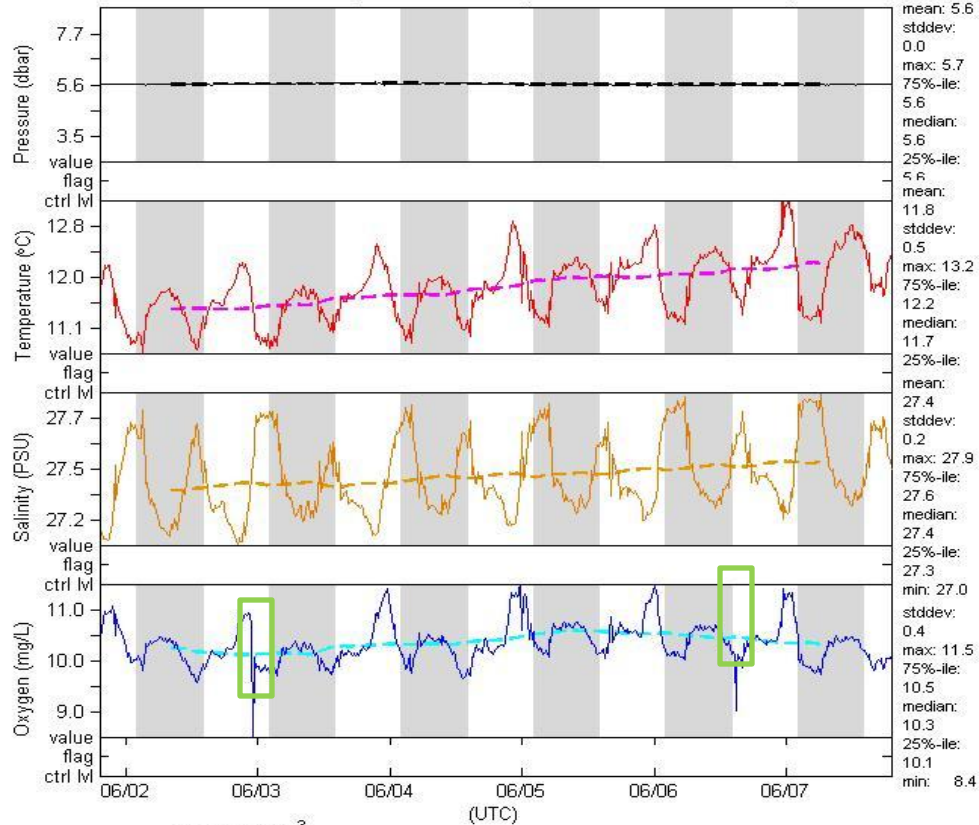
MCH01SR: Salinity increased by 0.2 PSU rising from 28.3 to 28.5 PSU. Temperature increased by 0.7 C increasing from 10.0 to 10.7 C

Squaxin Passage (South Sound) near Olympia

SQX01CR: Mean daily DO values were about 10.5 mg /L. Salinity increased by 0.4 PSU with mean daily values rising from 27.1 to 27.5 PSU. Temperature increased by 0.8 C with mean daily values rising from 11.1 to 11.9 C.

Mooring data from Squaxin Passage (South Sound) and Mukilteo (Whidbey Basin) confirming high DO concentrations and warming water

SQX01CF Squaxin Island (Water Column, Float)



MUK01BR Mukilteo (Near Bottom, Rigid)

