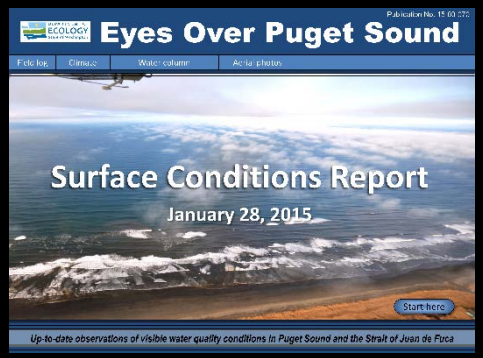
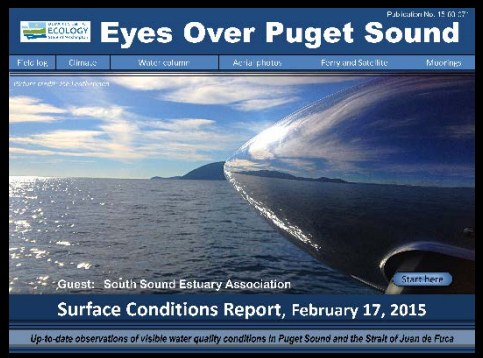
Publication No. 15-03-080

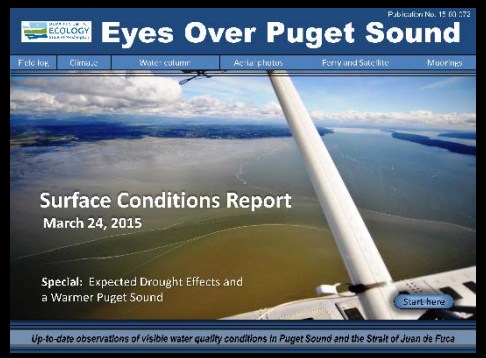
DEPARTMENT OF ECOLOGY State of Washington

# Eyes Over Puget Sound

Hypothesis | EOPS | People | Climate | Beach | Water column | Aerial photos





## 2015 Review



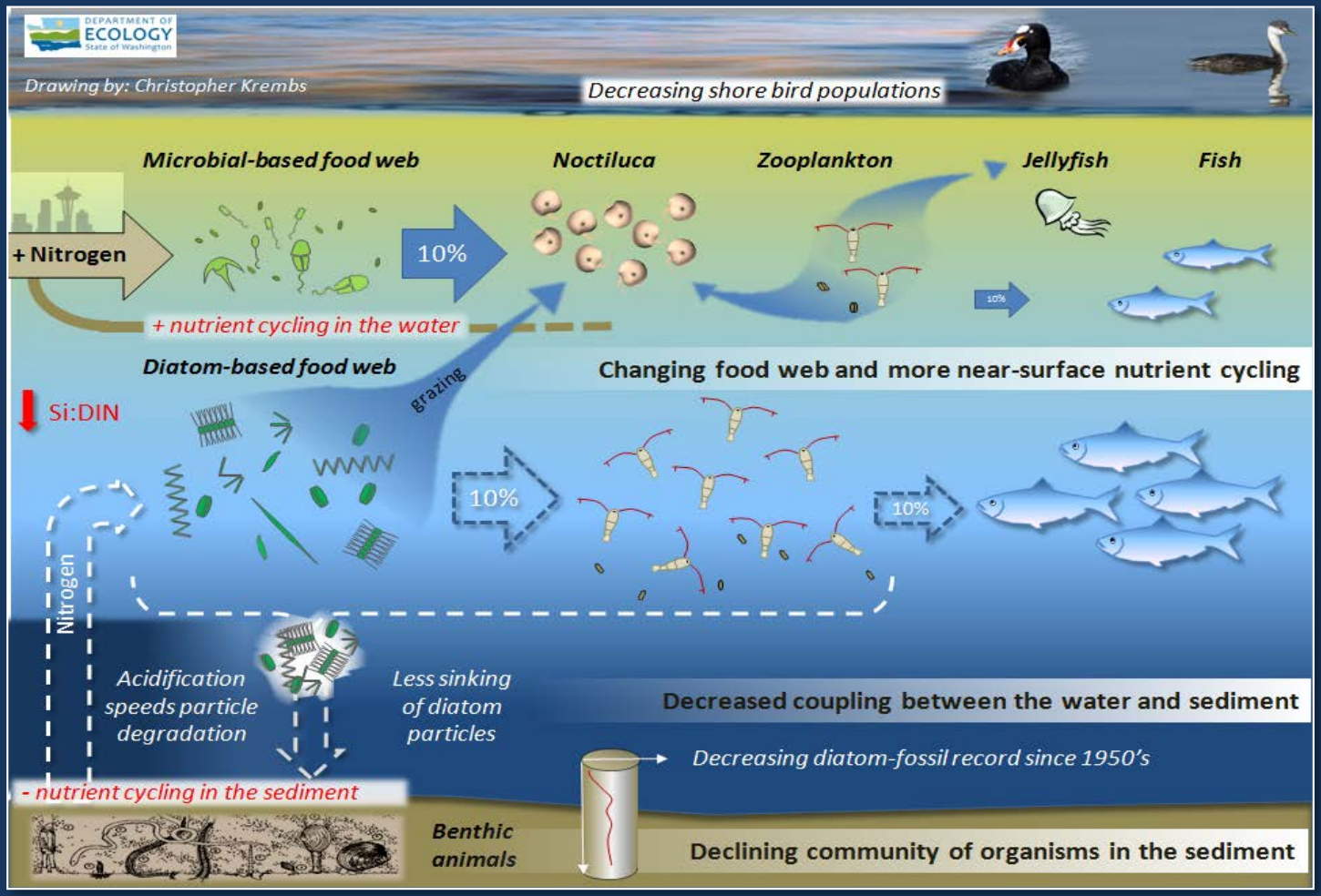





*Up-to-date observations of visible water quality conditions in Puget Sound and the Strait of Juan de Fuca*

# Hypothesis for combining a series of recent observations affecting energy and material transfer to higher trophic levels






We would like to encourage research into the cause and extent of recent changes that were observed at the base of Puget Sound's pelagic food web.

**Is *Noctiluca* a visible harbinger of a food web change?**

**Jellyfish responded very strongly to warmer water in 2015. Will this continue?**

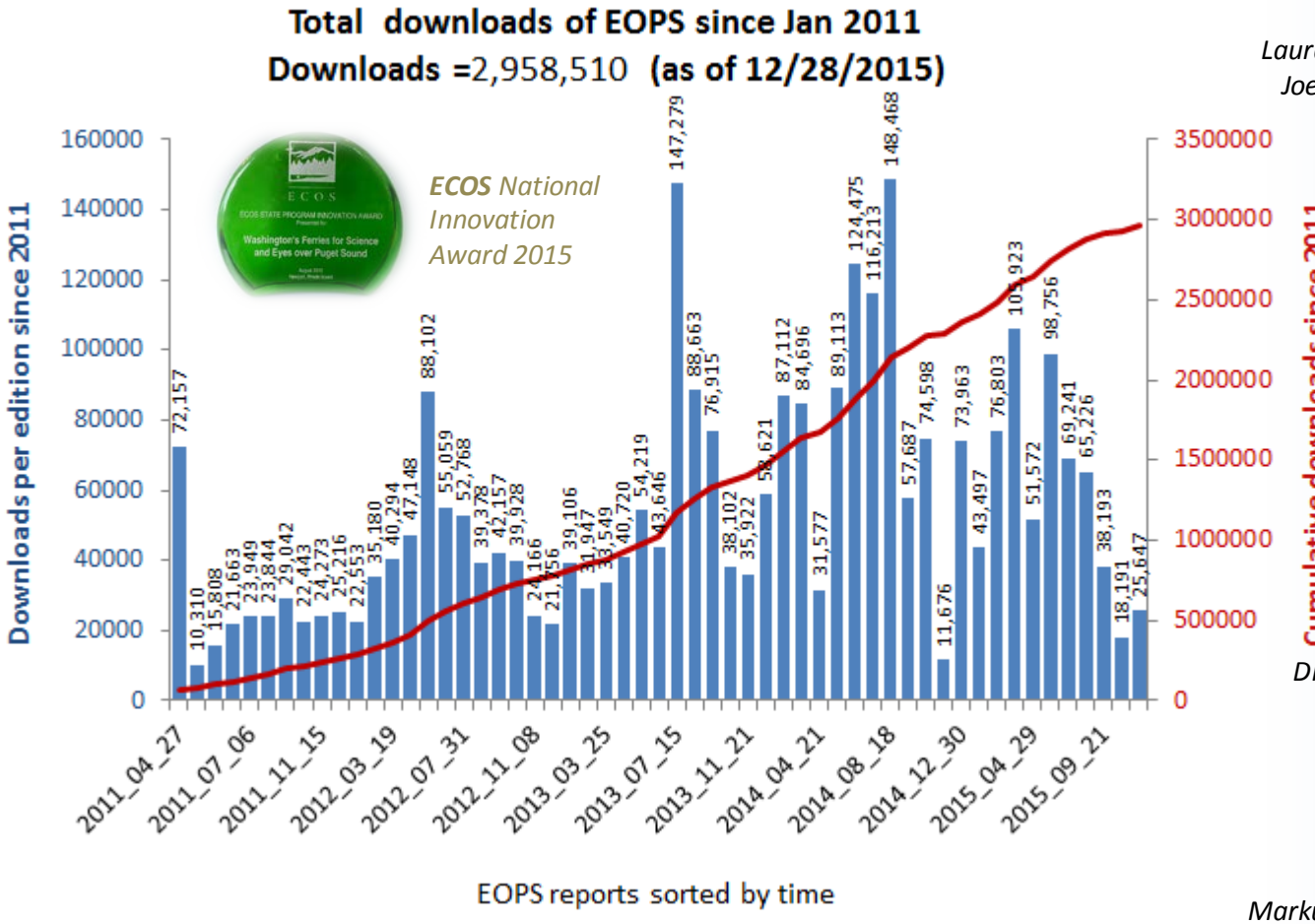
**Are changes in higher tropic levels part of a story of the low food web?**

Read more

# 2015 – The EOPS team thanks all our viewers



## LONG-TERM MARINE MONITORING UNIT, ECOLOGY

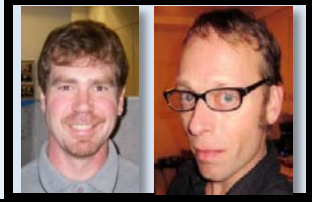



*Mya Keyzers*
*Laura Hermanson*
*Joe Leatherman*

*Skip Albertson*

*Julia Bos*
*Suzan Pool*

*Dr. Christopher Krembs*



*Jim Shedd*
*Markus von Prause*

***Thanks to interested viewers, we are approaching an estimated 3 million downloads…***

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

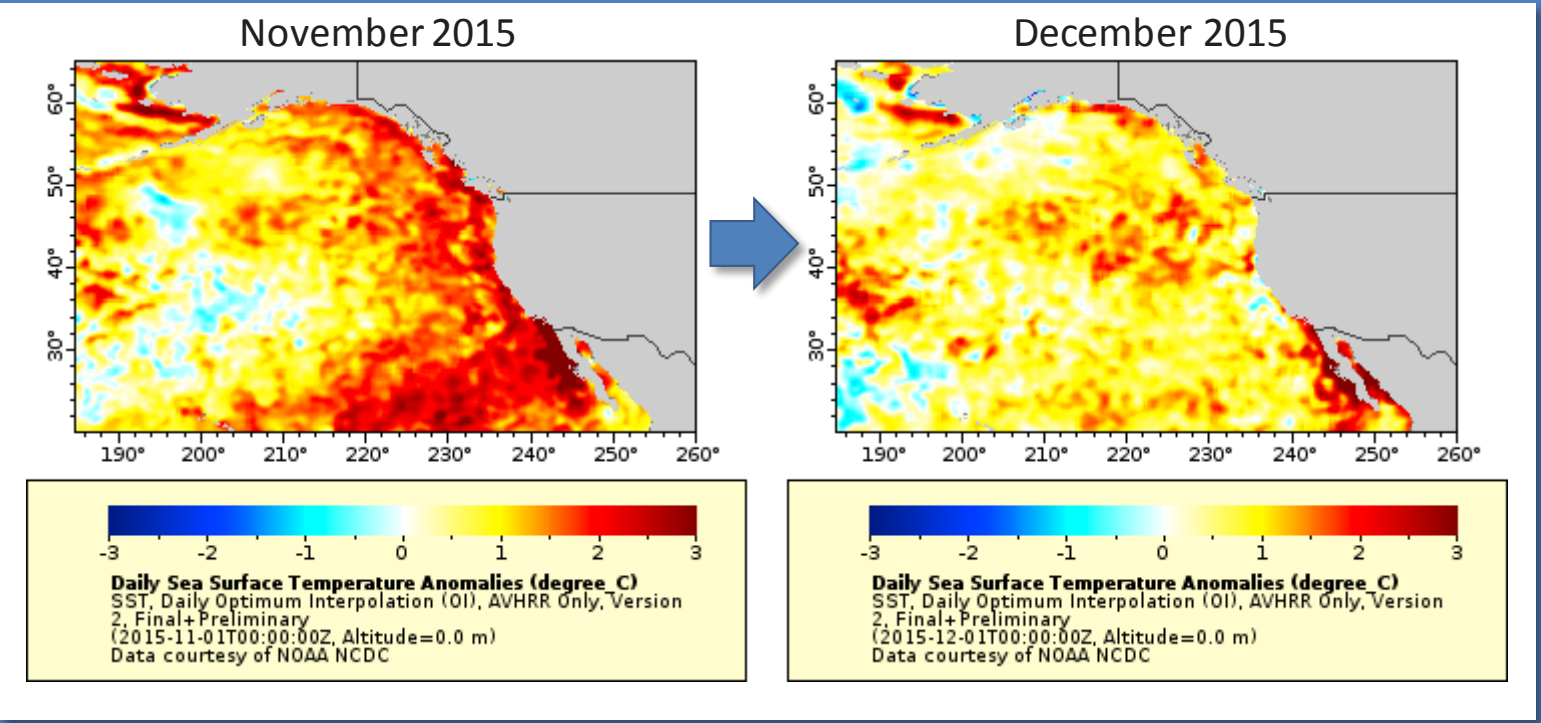
# 2015 – Your Marine Monitoring Unit thanks you



# November takes a bite out of 'the Blob'

*Fisheries Ecology Division, 12/10/2015 11:25:02 AM* *Read the full article: https://swfsc.noaa.gov/news.aspx?ParentMenuId=54&id=21508*

Strong northerly winds dominated the West Coast through much of November. They brought cold air and removed the warmer surface water of "the Blob", according to Nathan Mantua, leader of the Landscape Ecology Team at NOAA Fisheries' Southwest Fisheries Science Center in Santa Cruz, California.

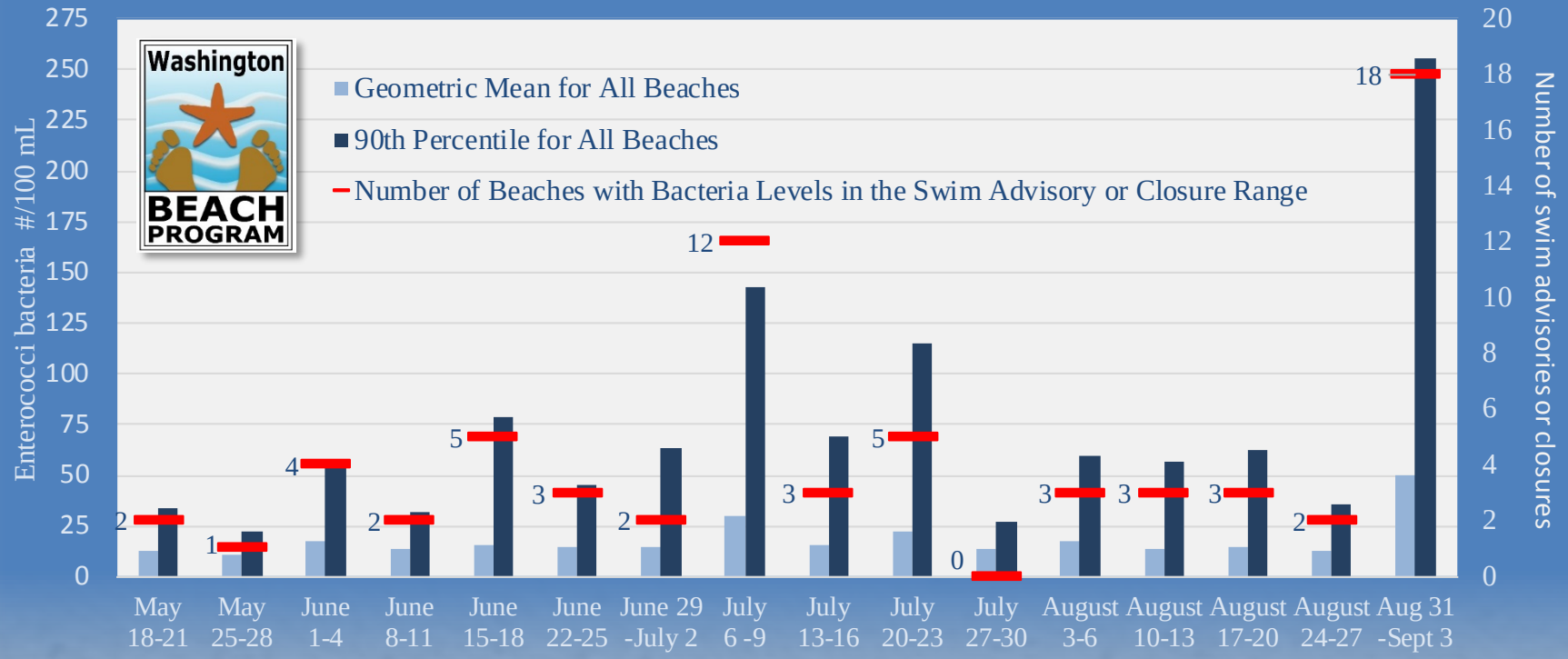



*Sea surface temperature maps from early November and early December show the decline of warm water off the West Coast that have become known as "the Blob." The maps chart the difference between current and average sea surface temperatures, with darker red illustrating temperatures farther above average.*

# 2015 – BEACH Program, the year in review



## Weekly summary of marine BEACH bacteria levels, swim closures and advisories for 2015



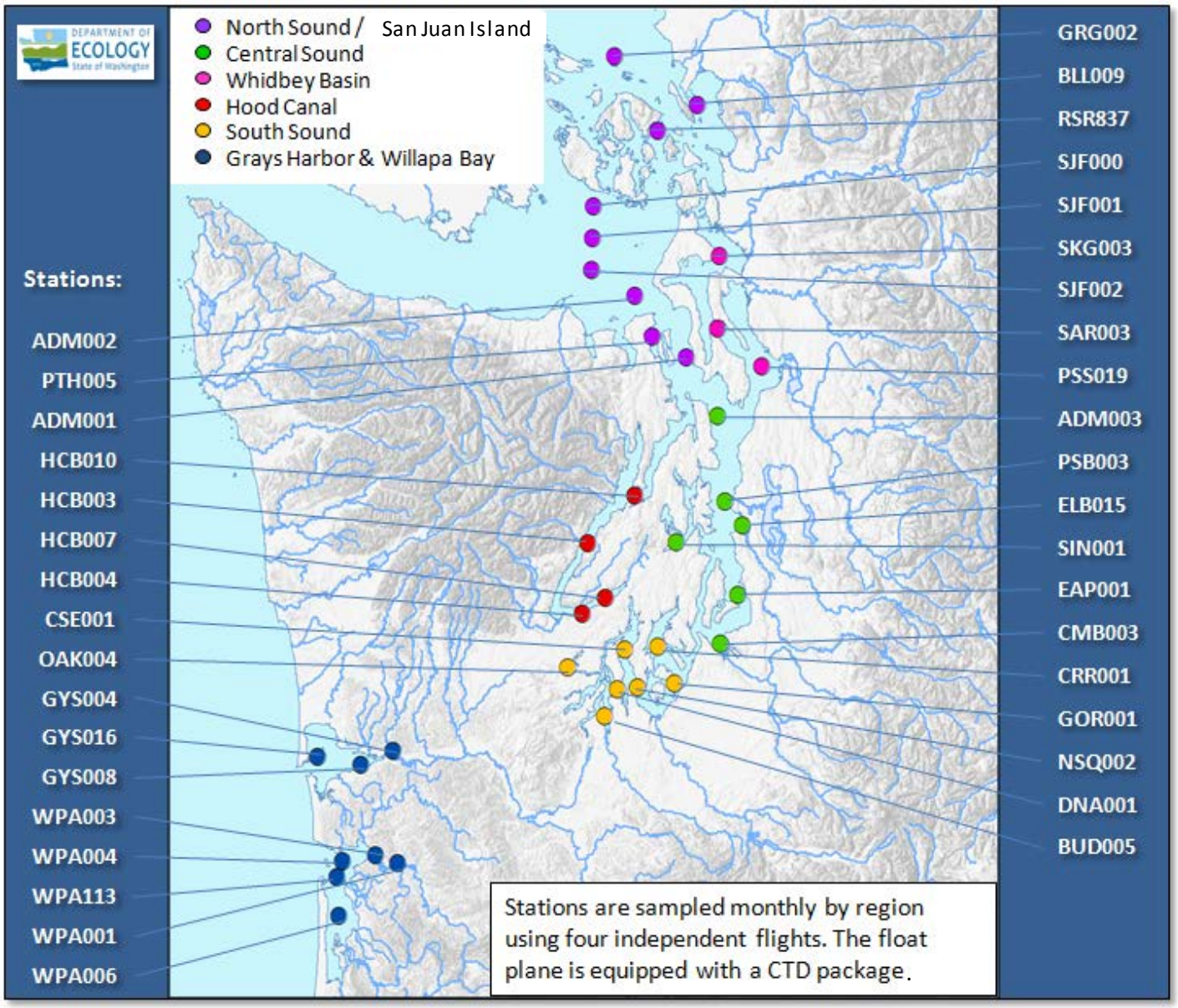

The BEACH Program monitors bacteria levels at popular marine beaches throughout the swim season. During 2015, higher bacteria levels were seen during the following periods:

- July 6-9, possibly due to greater beach use during the July 4th holiday.
- July 20-23, possible factors include high temperatures and beach use, pile up of beach wrack (see July EOPS).
- Aug. 31- Sep. 3, 18 beaches had high bacteria levels after a large storm event following a long dry period.

More information on the BEACH Program can be found at: http://www.ecy.wa.gov/programs/eap/beach/

# Our long-term marine monitoring stations (WA)






We use a chartered float plane to access our monthly monitoring stations most cost effectively.

Start here

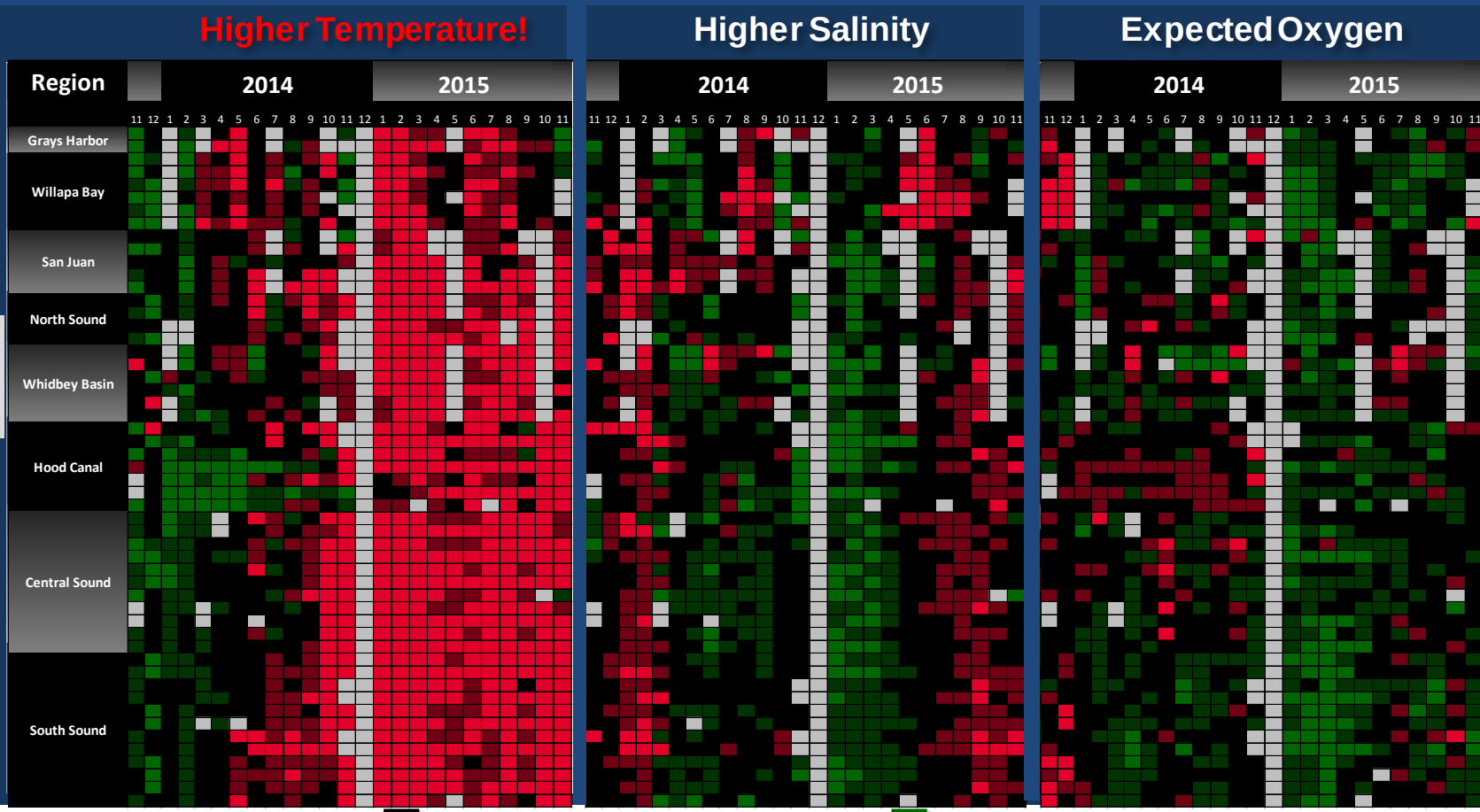
We communicate data and environmental marine conditions using:

1. **Marine Water Condition Index (MWCI)**
2. **Eyes Over Puget Sound (EOPS)**
3. **Anomalies and source data**

# Much Warmer! First lower DO then saltier water



Fall **temperatures** were still at record-breaking **highs in Puget Sound in November**. Drought effects (lower freshwater inputs) shifted salinity to higher than normal levels. With recent rains the past few months, (data not shown) salinity patterns are changing. In coastal bays, temperature and salinity are back to expected conditions. Oxygen is mostly expected.




[Explore profiles at all stations]

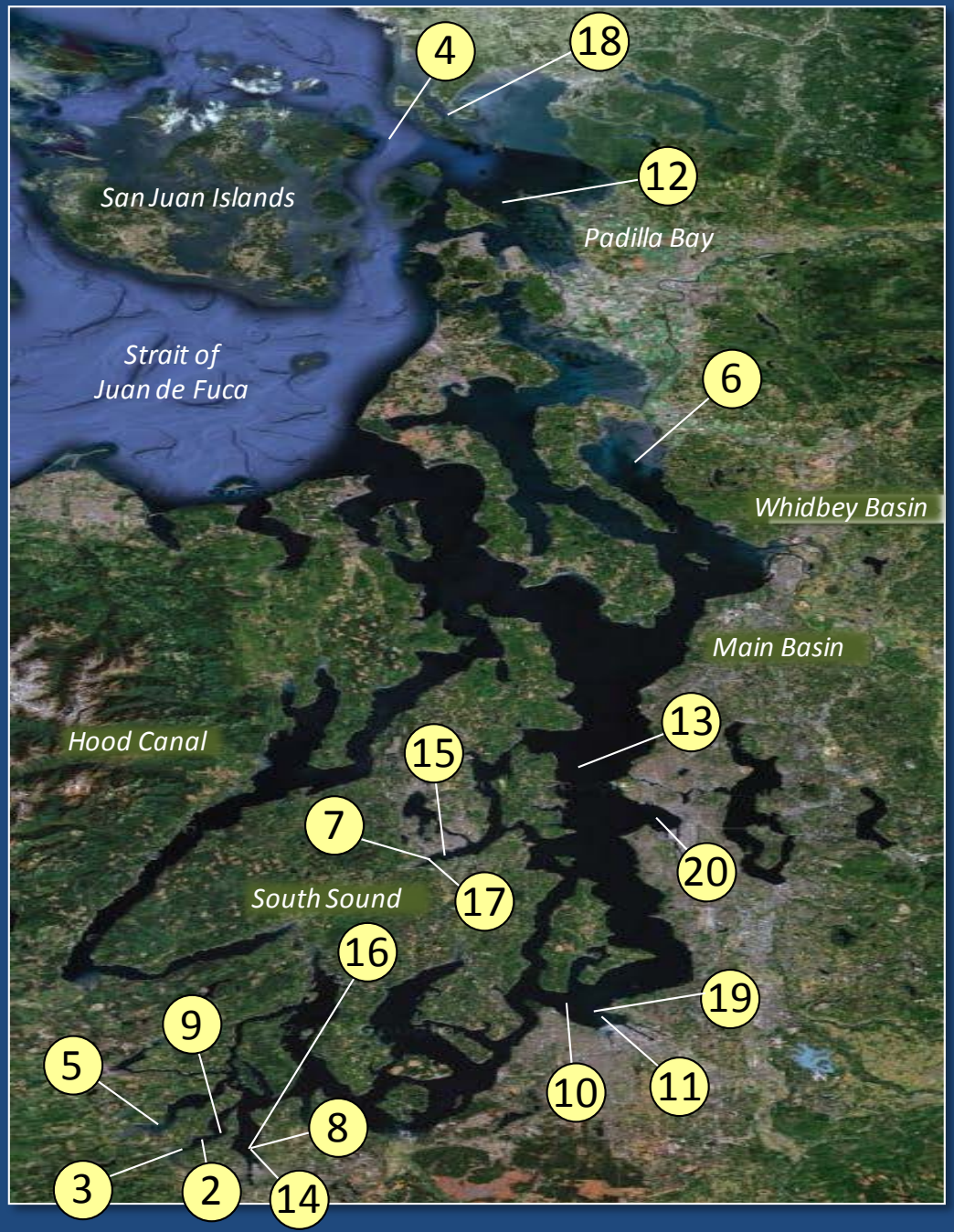
= higher than expected (>IQR, n=13)
= higher than previous measurements
= expected (=IQR, n=13)
= no data
= lower than expected (>IQR, n=13)
= lower than previous measurements

# 2015 Year in Review: Aerial photography



Jellyfish patches persisted through the entire year. Sediment loads are high as snow melts fast. Fall-blooming phytoplankton species occur early. *Noctiluca*, jellyfish, and macro-algae occur in high numbers while rivers drop into record low flows and water renewal in Puget Sound slows.

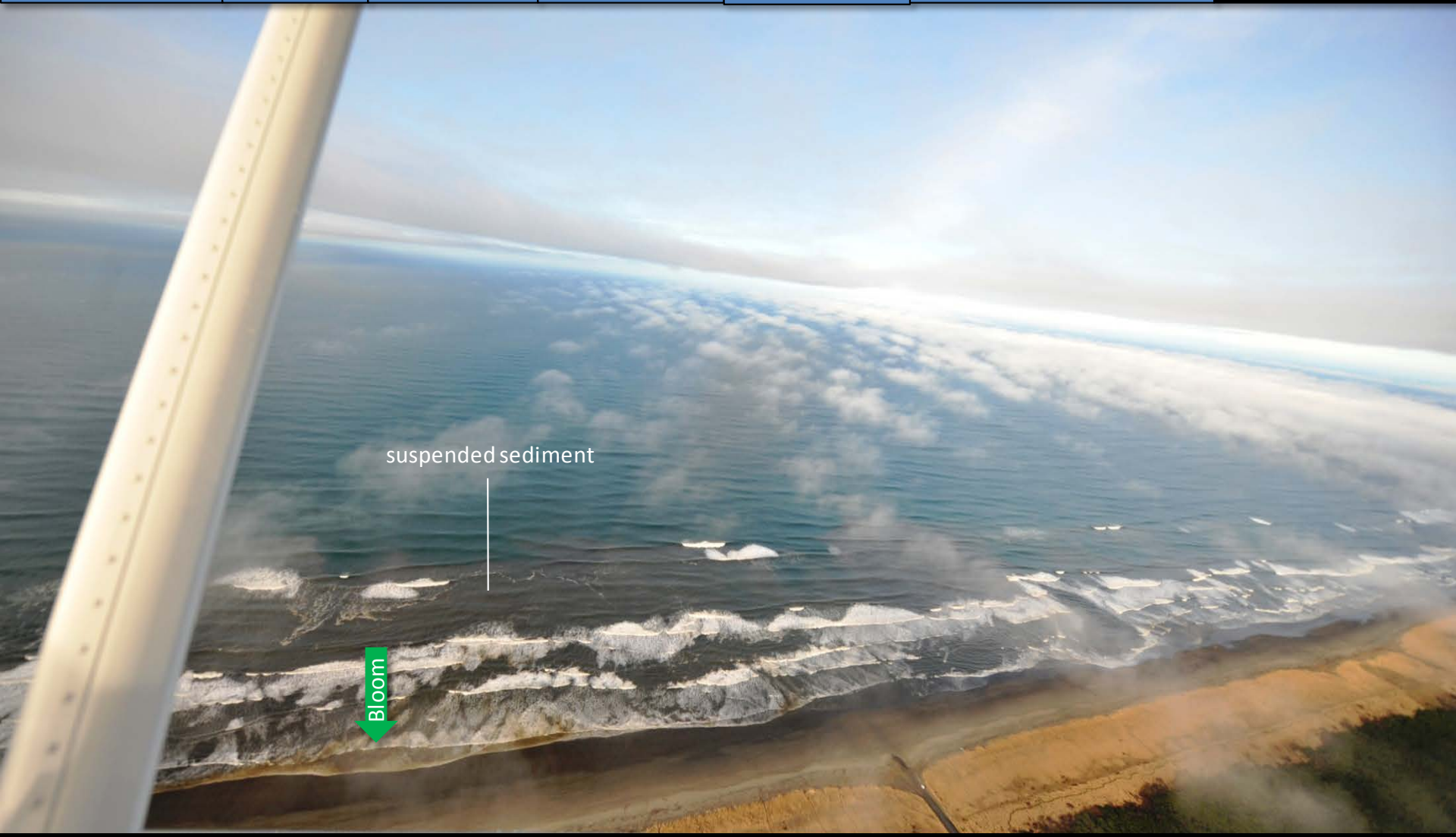
| | | |
|---|---|---|
| 1 2 | Jan. | Coastal water is warm due to the Blob. Jellyfish patches persisted through the mild winter. Start here |
| 3 4 | Feb. | Jellyfish patches numerous in southern inlets. Very strong sediment input from the Fraser River due to anomalously warm air temperatures, rain instead of snow, and snowmelt. |
| 5 6 | Mar. | Jellyfish patches abundant in uncommon places in winter (e.g. Totten Inlet). Very strong sediment input also from major rivers feeding into Puget Sound in response to unusually warm weather conditions. |
| 7 8 | Apr. | Red-brown phytoplankton blooms that typically come in late summer are going strong. Jellyfish patches persist through spring bloom in large numbers and never disappeared. |
| Turning Point | May | The majority of rivers feeding into Puget Sound have fallen well below expected flows. It marks the turning point when Puget Sound transitions from below to above normal salinities, thereby slowing estuarine circulation. |
| 9 10 11 | Jun. | Jellyfish patches, *Noctiluca*, and other phytoplankton blooms are going very strong as rivers drop into record low flows in response to the drought. |
| 12 13 | Jul. | Macro-algae drift in large mats throughout Puget Sound, Dyes Inlet, and Samish Bay and cause problems for beaches as they wash onshore and pile up into large rotting heaps. |
| 14 15 | Aug. | Jellyfish patches reach very high densities. Red-brown blooms are abundant. The water is warmer and saltier and does not renew as fast due to record low river flows. Very large oil sheens in Sinclair Inlet add environmental stress. |
| 16 17 18 | Sept. | Jellyfish patches are occurring in unusual places and reach peak numbers. Pictures around Lummi Island illustrate how spatially discrete sediment and influences from the Nooksack and Fraser Rivers can be in this area. |
| Turning Point | Oct. | Puget Sound started to normalize in response to cooler air temperatures, rain, and recovering river flows. Yet water temperatures remained anomalously high. |
| 19 20 | Nov. | The rain has picked up, and consequently, rivers now run higher than normal and deliver huge amounts of sediment into Puget Sound. |




# Aerial photography & navigation guide

## Date: 2015

Click on numbers

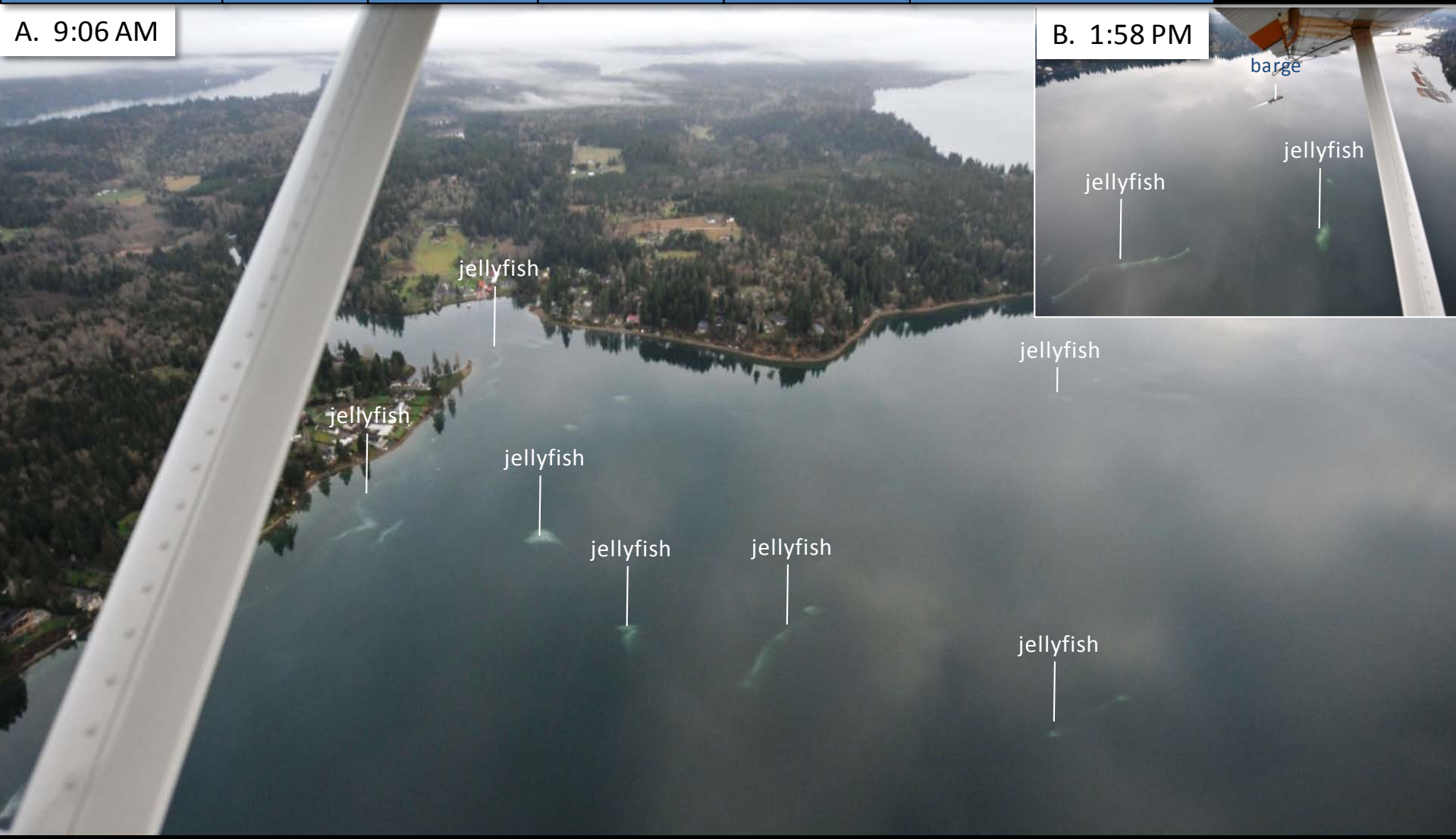



*Diatom bloom in surf zone, suspended sediment from waves and low lying clouds.*

Location: Off Twin Harbor State Park, Cohasset Beach (Coast), 10:25 AM.

# Aerial photography 1-28-2015






*Numerous jellyfish patches in otherwise clear blue green water.*

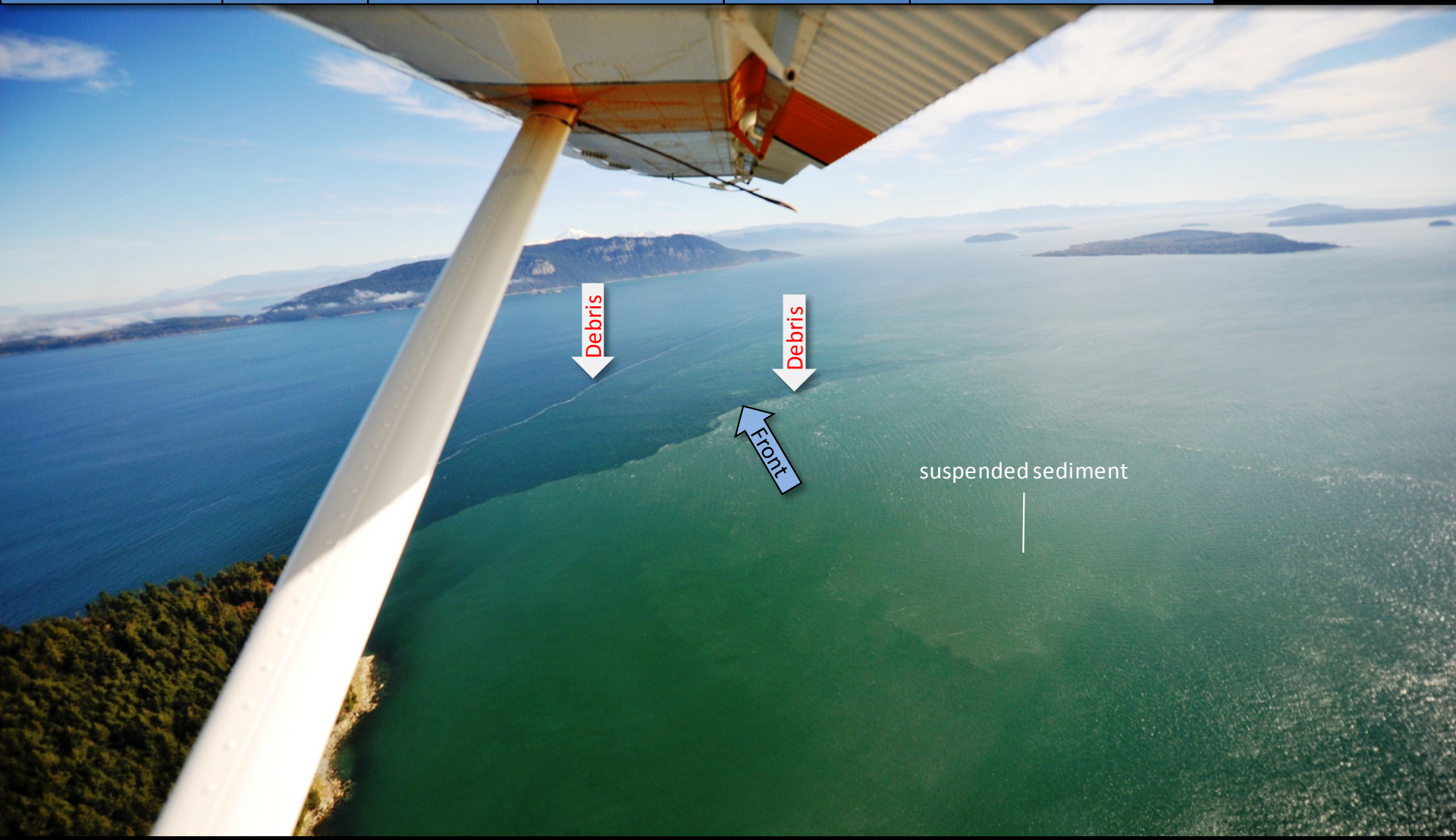
Location: A. Off Young Cove, Eld Inlet; B. Budd Inlet (South Sound).

# Aerial photography 2-17-2015




*Numerous jellyfish patches lasting through the warm winter.*

Location: Near Young Cove, Eld Inlet (South Sound), 9:34 AM.




*Strong front with debris line retaining sediment-rich surface water in Rosario Strait.*

Location: Entrance to Obstruction Pass (San Juan Islands), 11:58 AM.

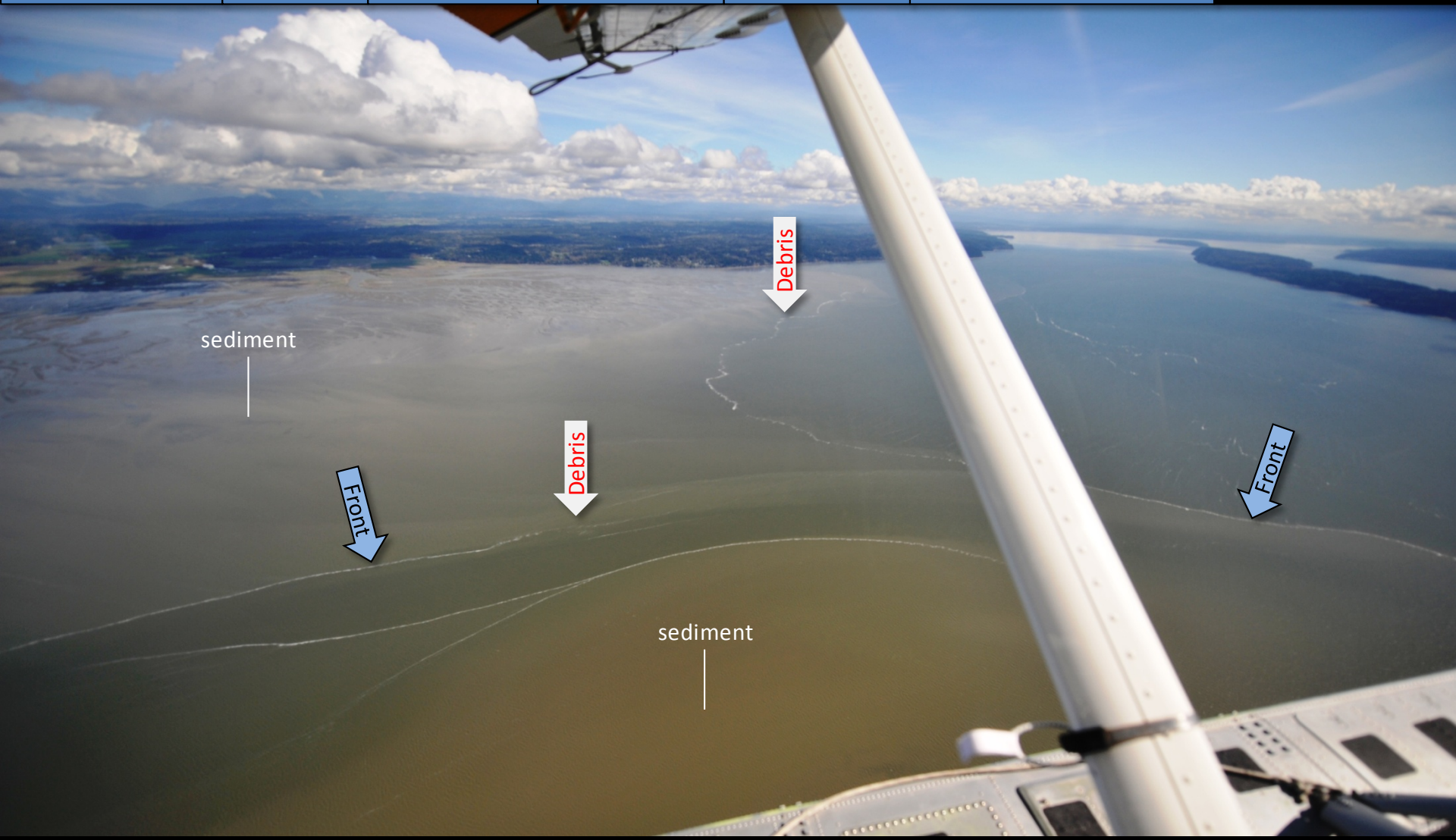
# Aerial photography 3-24-2015




*Jellyfish patches and debris lines.*

Location: Kamilche Shores, Totten Inlet (South Sound), 9:51 AM.

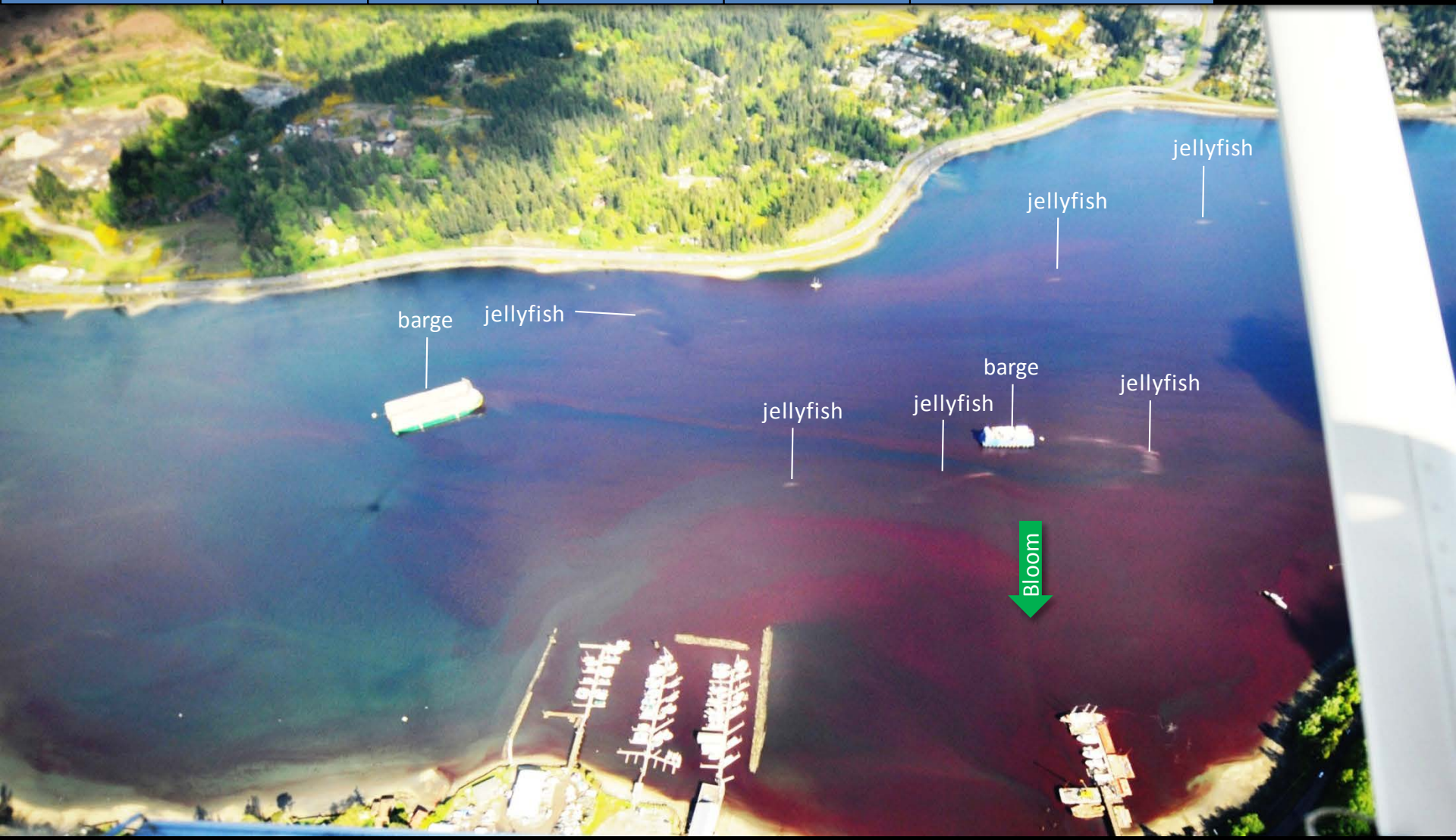
# Aerial photography 3-24-2015




*Plumes of a murky sediment-rich water showing different tidal fronts.*

Location: Across from Warm Beach, Port Susan (Whidbey Basin), 2:47 PM.

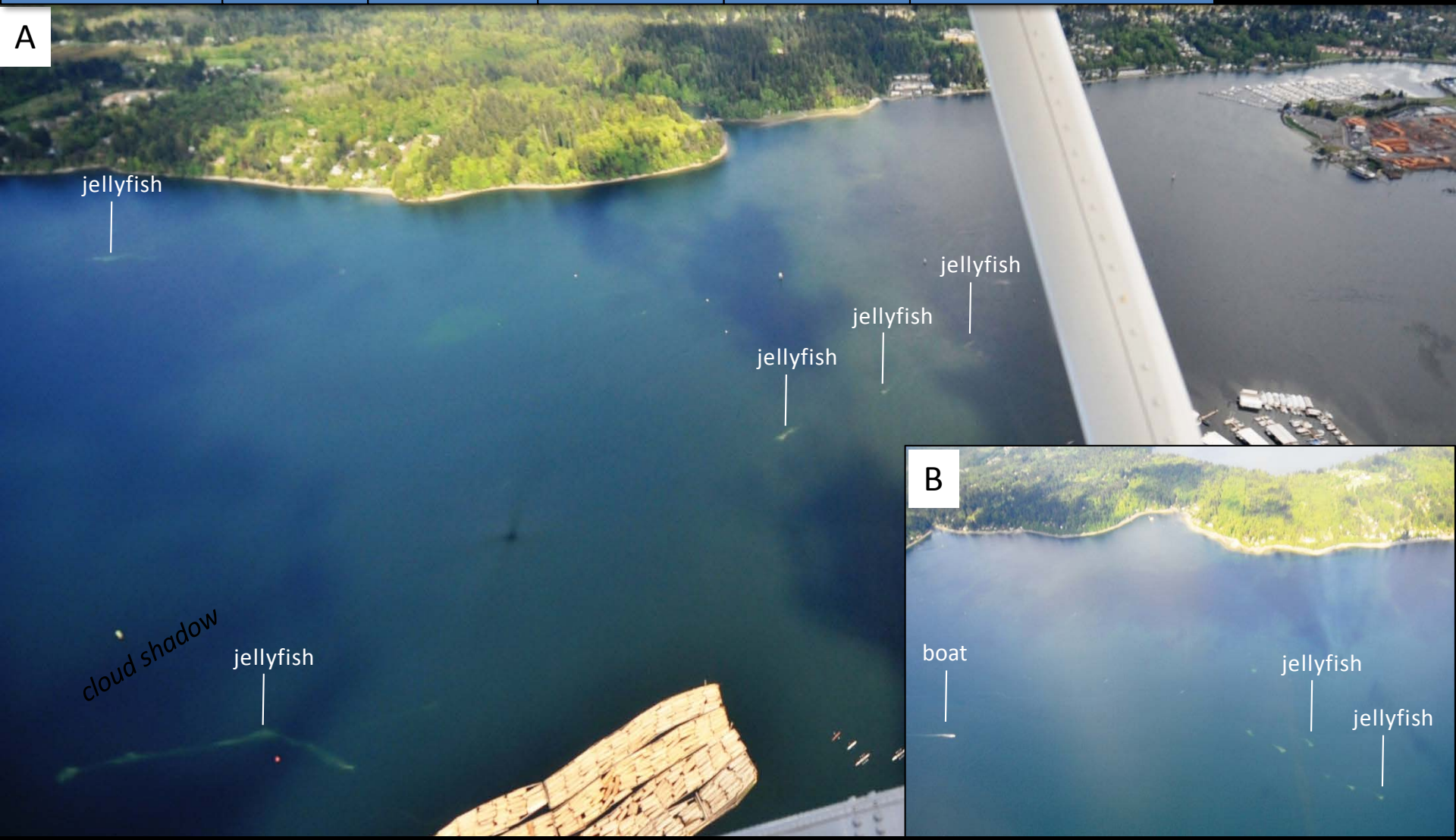
# Aerial photography 4-29-2015




*Red bloom and patches of jellyfish.*

Location: Kitsap Marina, Sinclair Inlet (Bremerton), 9:52 AM.

# Aerial photography 4-29-2015

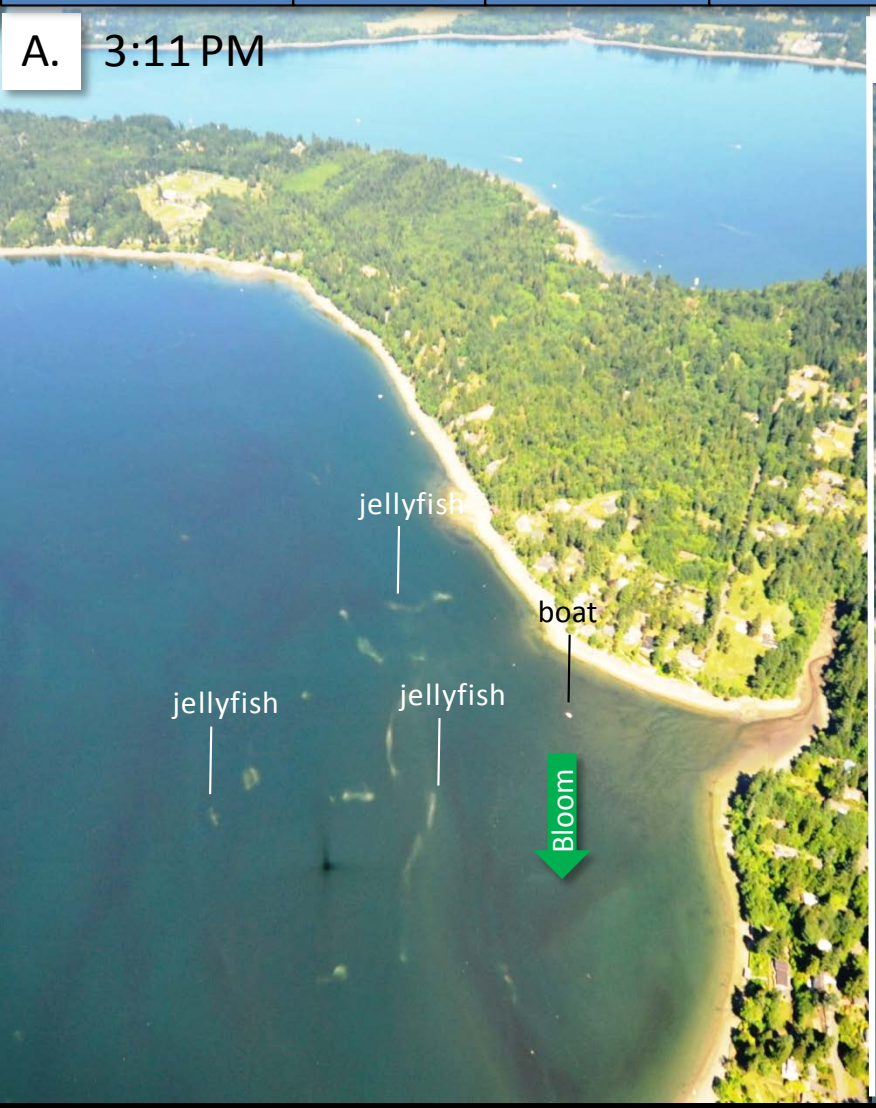


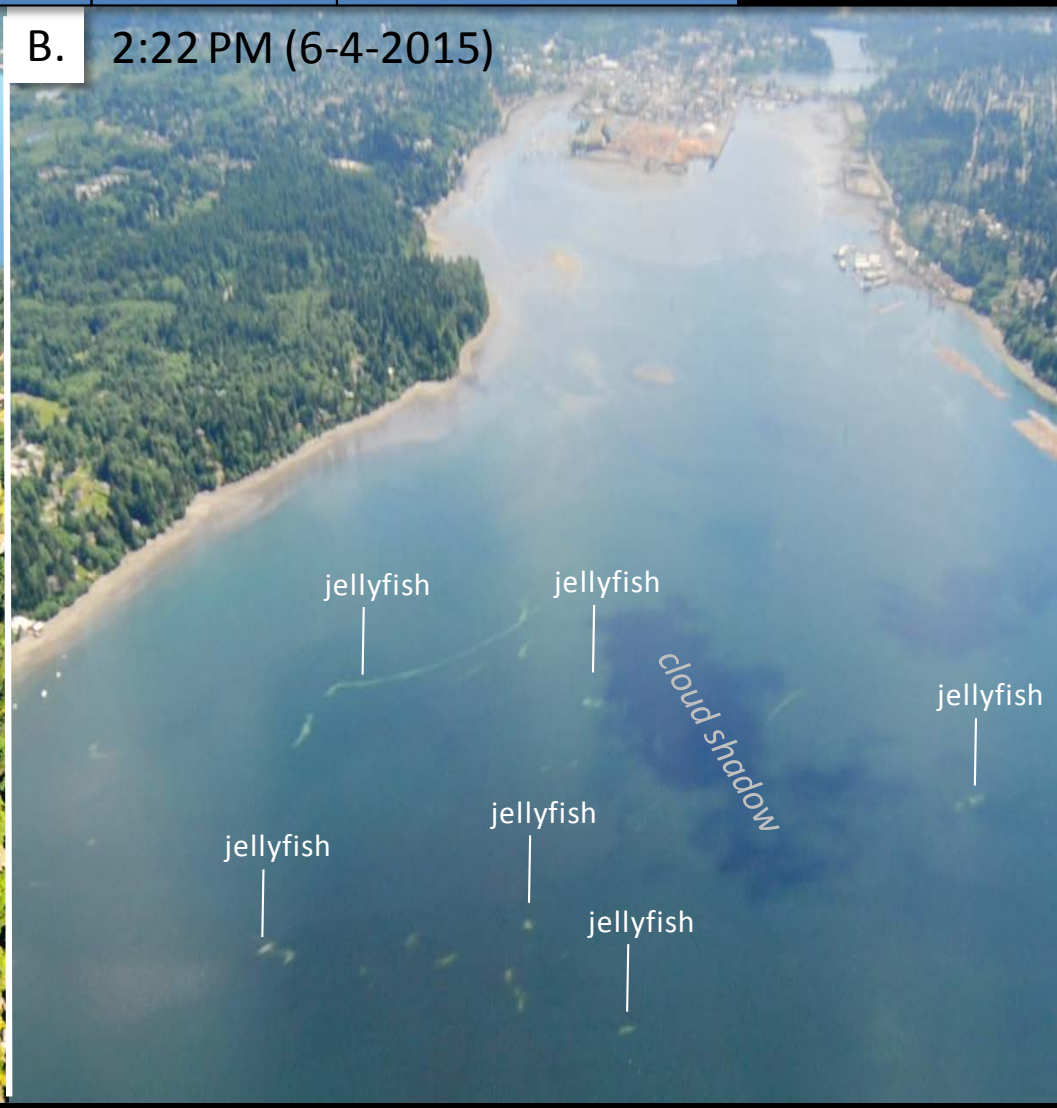

*Patches of jellyfish.*

Location: A. Across Priest Point; B. Big Tykle Cove, Budd Inlet (South Sound), 4:22 PM.

# Aerial photography 6-8-2015






*Large patches of jellyfish forming in finger inlets of South Sound.*
Location: A. Eld Inlet; B. Budd Inlet on 6-4-2015 (South Sound).


*Large* Noctiluca *bloom surfacing and gathering in large quantities at tidal front.*
Location: Commencement Bay (Central Sound), 3:32 PM.


*Sediment plume of Puyallup River with internal waves meandering into bay and mixing with a bloom.*
Location: Commencement Bay (Central Sound), 3:28 PM.


*Large islands of organic material drifting at the surface off Guemes Island.*

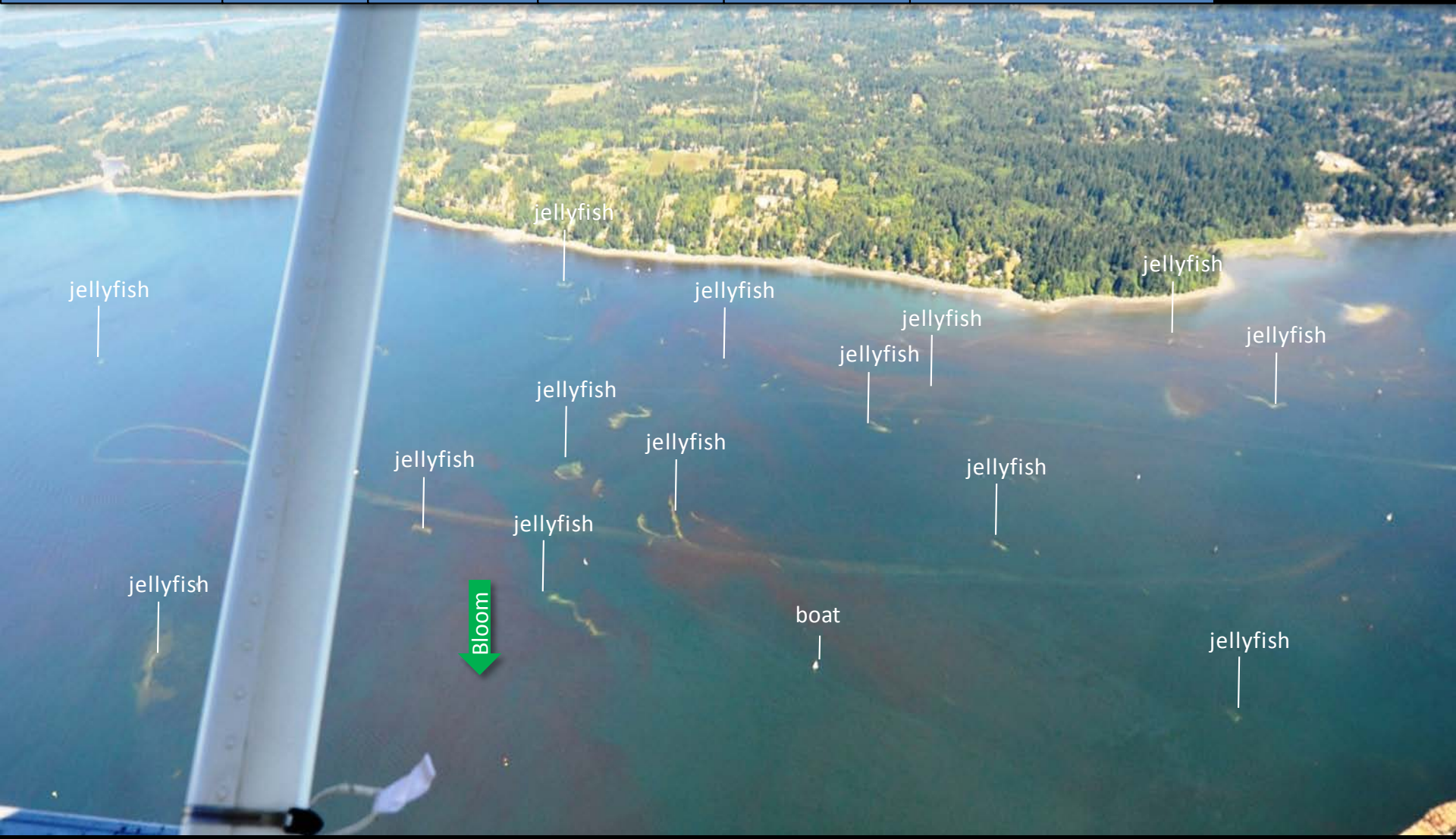
Location: Padilla Bay (North Sound), 1:05 PM.

# Aerial photography 7-6-2015




*Extensive accumulations of organic debris along fronts spanning across Central Sound. Brown bloom.*

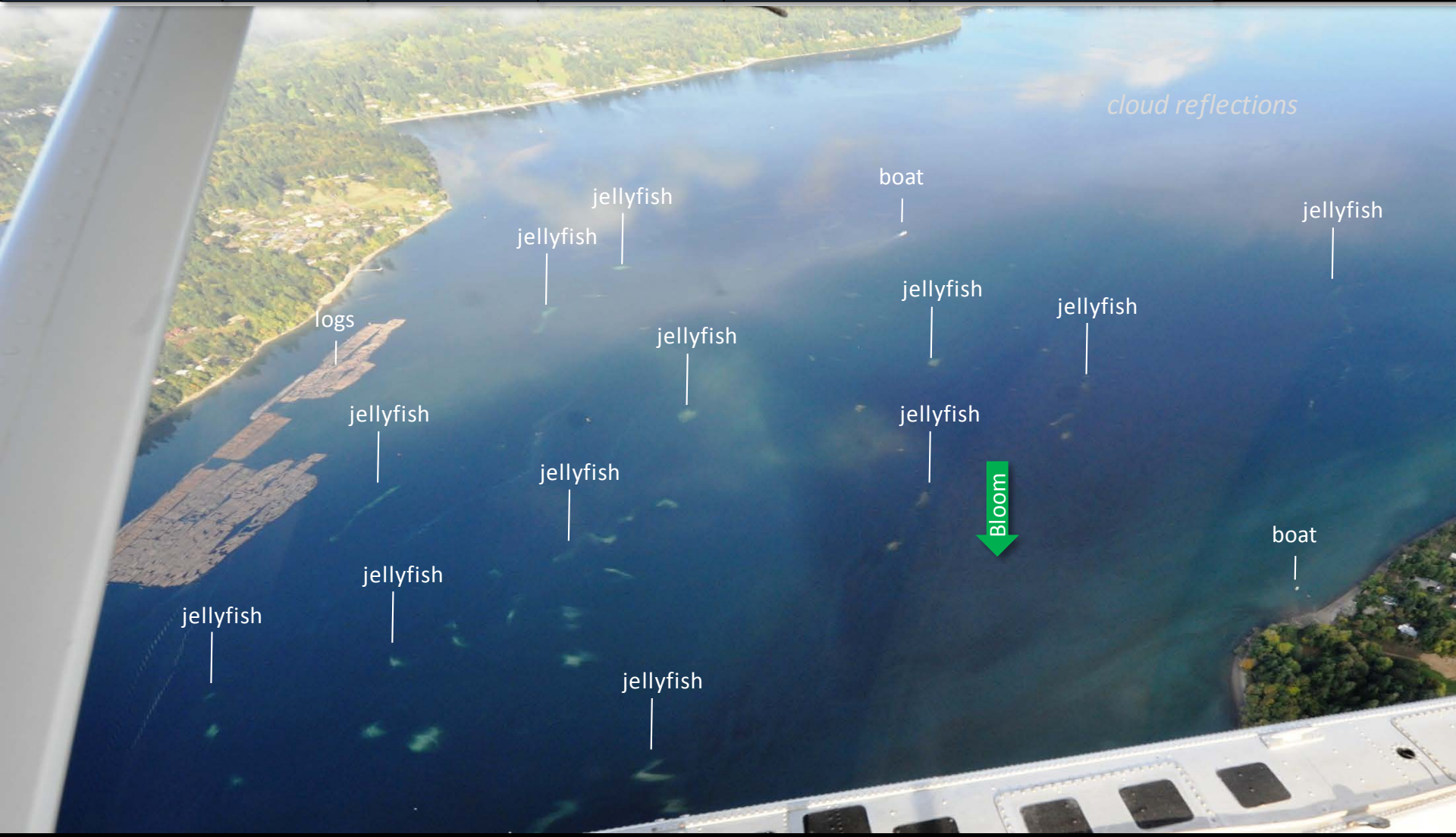
Location: Between Port Madison and Shilshole (Central Sound), 3:03 PM.




*Numerous large patches of jellyfish in water containing red-brown algal bloom.*
Location: Budd Inlet (South Sound), 3:12 PM.


*Extensive and multiple oil sheens (reported).*

Location: Port Orchard, Sinclair Inlet (Central Sound), 3:05 PM.




*Numerous patches of jellyfish in water containing red-brown algal bloom.*

Location: Priest Point Park, Budd Inlet (South Sound), 10:22 AM.


*Numerous large patches of jellyfish in water of turquoise color.*

Location: Sinclair Inlet (Central Sound), 10:46 AM.

# Aerial photography 9-21-2015


*Boat wake shows thin sediment-rich layer at surface. Front and water carrying glacial flour off Lummi Island.*

Location: Off Portage Island, Bellingham Bay (North Sound), 12:58 PM.


*Large sediment inputs of the Puyallup River into Commencement Bay and Puget Sound.*

Location: Commencement Bay, Tacoma (Central Sound), 2:34 PM.


*Brown-colored Duwamish River plume with ferry tracks reveal the thin layer of suspended sediment across Elliott Bay.* Location: Elliott Bay, Seattle (Central Sound), 2:46 PM.

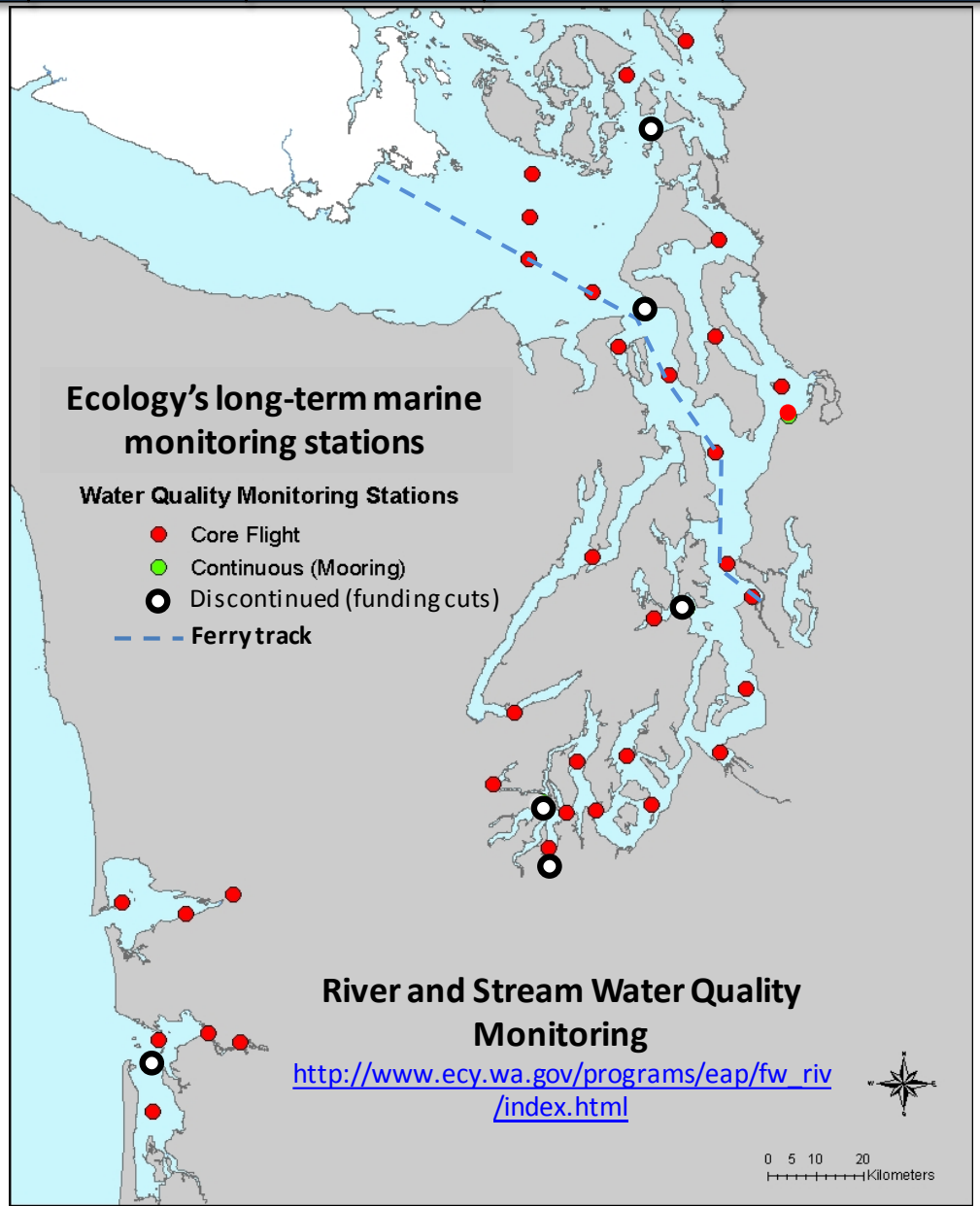
# Get data from Ecology's Monitoring Programs



## 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

Suzan.Pool@ecy.wa.gov

**Access mooring data:**
ftp://www.ecy.wa.gov/eap/Mooring_Raw/Puget_Sound/

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**
christopher.krembs@ecy.wa.gov

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

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