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DEPARTMENT OF ECOLOGY State of Washington

Eyes Over Puget Sound

Surface Conditions Report

January 28, 2015

Start here

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

Marine conditions from 1-28-2015 at a glance

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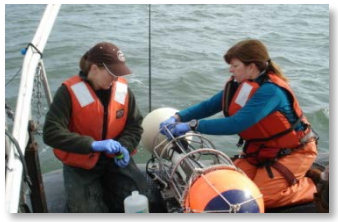
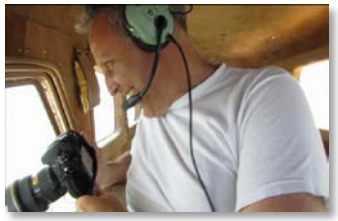


Dr. Christopher Krembs



Please give us feedback

Editorial assistance provided by: Carol Maloy and Julianne Ruffner

Personal Field Impression 1-28-2015

Once a month we travel to Grays Harbor and Willapa Bay for our Coast marine flight. During these flights we usually see brown pelicans. It is always entertaining to watch these large, beautiful pelicans fly and dive for food. So this month we wanted to highlight some facts about this charismatic coastal bird.

The Brown Pelican *Pelecanus occidentalis*

Characteristics

Habitat

Coastal areas including sandy beaches, lagoons, and marine estuaries.

Sandy Beaches at Ocean Shores

Mudflats in Grays Harbor

Range Map

Atlantic, Pacific, and Gulf Coast

Personal Field Impression 1-28-2015

Behavior

Brown pelicans are gregarious birds that roost, migrate, and feed in groups. They plunge dive from up to 60 ft. to catch fish with their huge bill pouches.

Diving pelican

Brown pelicans and seagulls feasting on a school of fish in Willapa Bay

Diet

Marine invertebrates and mostly small forage fish such as…

Herring

Mullet

Sardines

Conservation Connection

Brown pelicans almost went extinct in the late 1950's due to harmful pesticides, such as DDT, entering the food web.

Past protection under the endangered species act and banning DDT has enabled brown pelican populations to recover and thrive today.

Affected by an Unusually Warm Ocean?

NOAA scientists observed much higher than usual sea surface temperatures in the North Pacific Ocean throughout 2014 that did not follow typical El Niño weather patterns. The warm waters may benefit some species and negatively impact others. Scientists also observed rare sightings of tropical species off the west coast due to these warmer waters.

Click links to articles for more info. →

NOAA Article & OPB Article

Photo Credits – Christopher Krembs; Bill Holsten on www.whatbird.com ; www.montereyfish.com; www.monkeyfacenew.com; www.fooduniversity.com; http://www.theanimalfiles.com/birds/pelicans_relatives/brown_pelican.html

Climate and natural influences before 1-28-2015

New section! **Climate and natural influences** are conditions that influence our marine waters, including weather, rivers, and the adjacent ocean (previously called Weather). For an explanation of the figure, see: http://www.ecy.wa.gov/programs/eap/mar_wat/weather.html, page 26.

Summary:

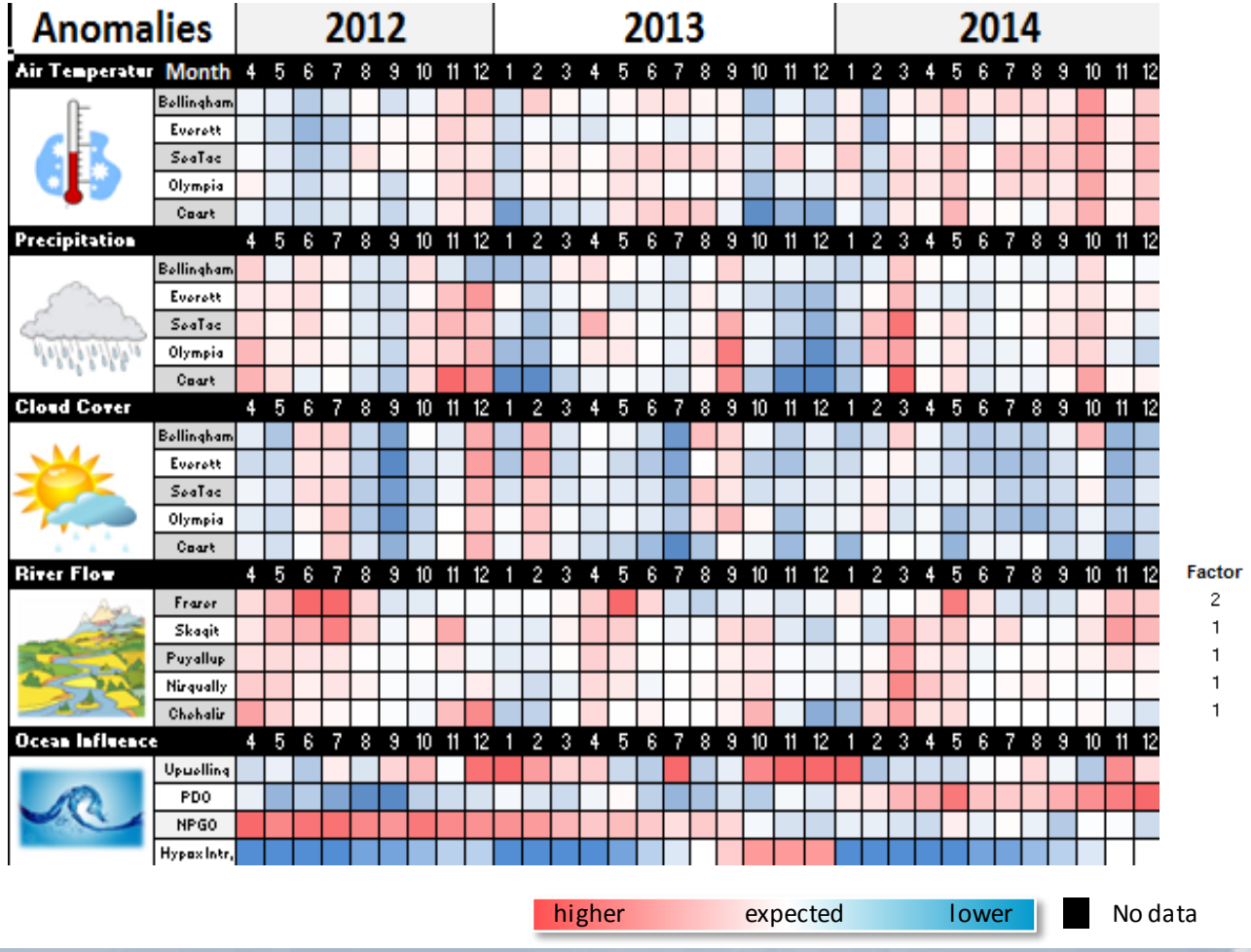
Air temperatures have generally been above normal continuing a 9-month trend.

Precipitation has been episodic, with several rain events in the past two weeks.

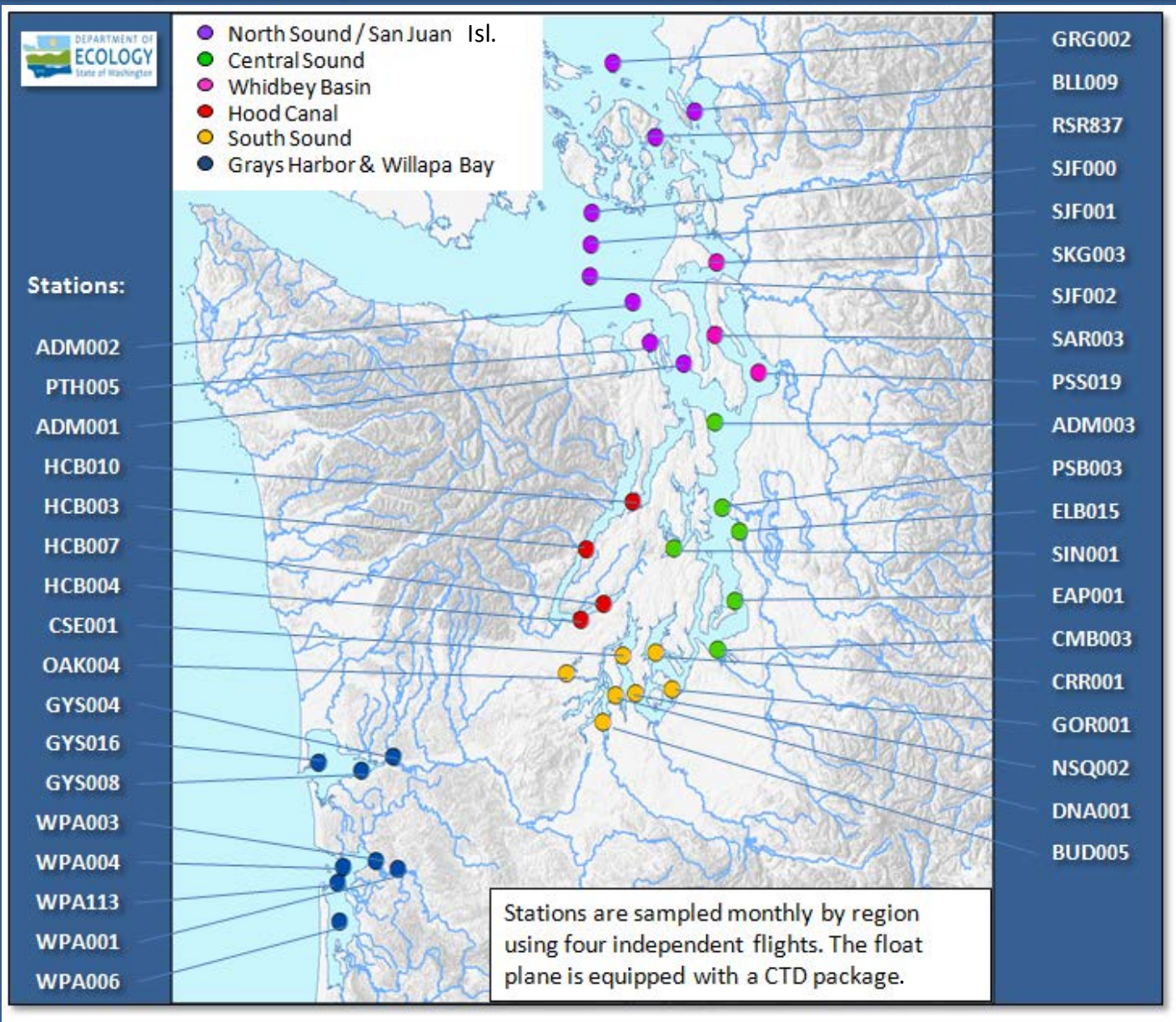
Sunshine has alternated with clouds over the past two weeks.

River flows are above normal across the Puget Sound region, but below normal at the coast (Chehalis River).

PDO remains in the warm phase, and **upwelling** is increasing.



Our long-term marine monitoring stations in Washington



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

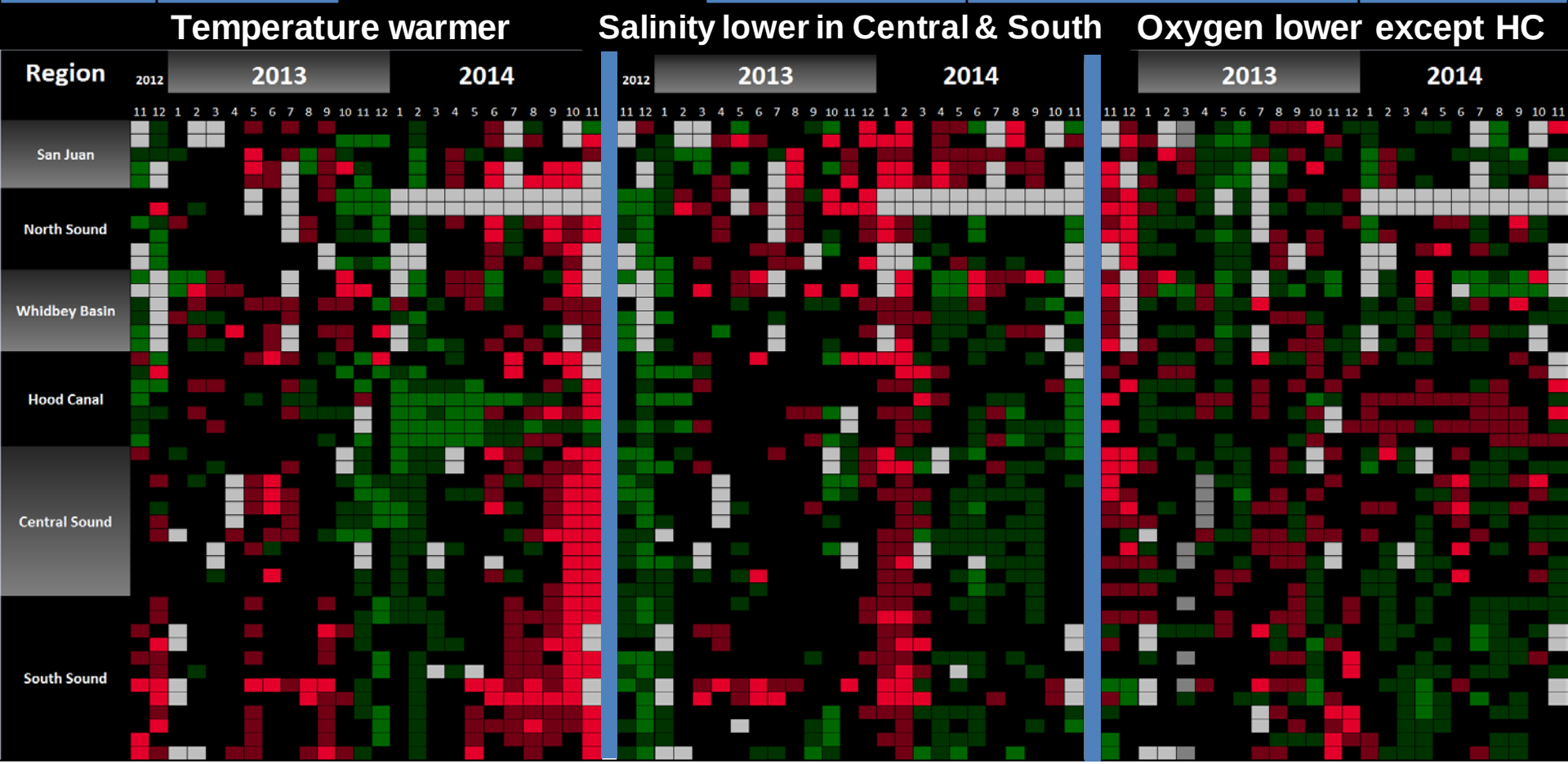
Start here

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**

2014: Very Warm Fall! Physical conditions in the water column

Field log | Weather | Water column | Aerial photos | - | -



In 2014, conditions were dominated by warm water during summer and fall, associated with the NE Pacific warm surface anomaly. In October and November, temperatures were the highest on our record since 1989. Salinity was higher in early 2014, then waters south of Admiralty Reach became fresher while saltier conditions persisted in the San Juans. Oxygen was mostly lower except in Hood Canal where a high anomaly persisted into the fall.

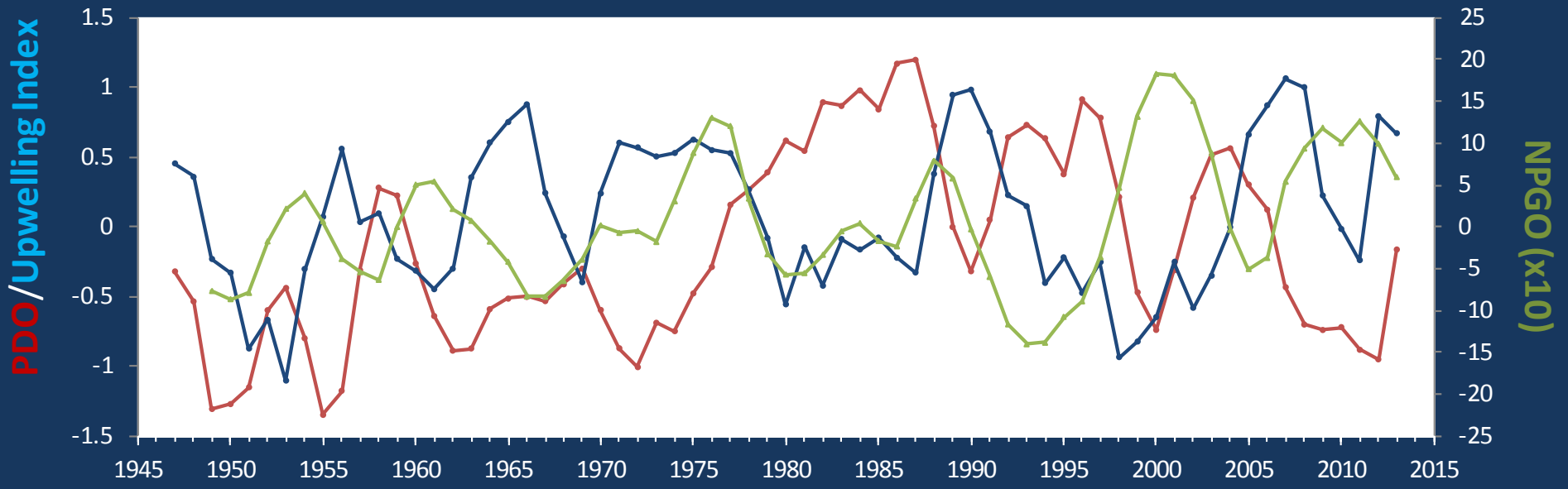
The ocean affects water quality: Ocean Climate Indices

a) *Pacific Decadal Oscillation Index (**PDO, temperature**)* *(explanation)*

b) *Upwelling Index (anomalies) (**Upwelling, low oxygen**)* *(explanation)*

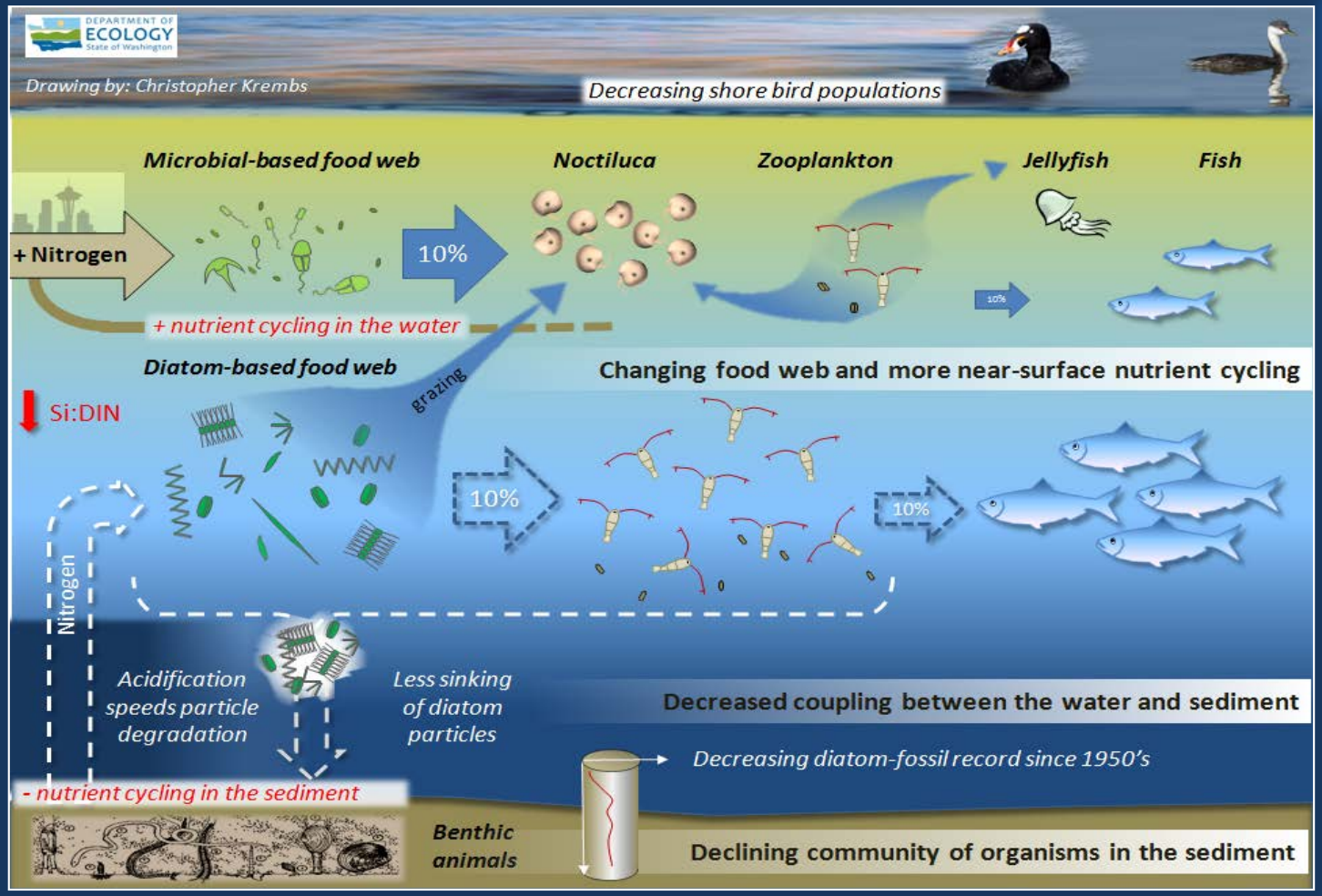
c) *North Pacific Gyre Oscillation Index (**NPGO, productivity**)* *(explanation)*

Three-year running average of PDO, Upwelling, and NPGO indices scores



Ocean boundary conditions have been favorable for water quality in Puget Sound: (a) colder water (PDO), (b) less upwelled low oxygen and high nutrient ocean water reaching Puget Sound (Upwelling Index), and (c) higher surface productivity along the coast (NPGO). Where are we heading next?

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



Hypothesis!

Increases in nitrate concentrations could be caused by a top-down control on phytoplankton biomass.

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

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

[Follow the experts WebEx]

Summary: Aerial photography 1-28-2015

Numerous patches of jellyfish persist in clear water of the finger inlets in South Sound. Willapa Bay reveals it's interesting subtidal pattern and human activity during ebbing tide.

Start here

Brooke McIntyre: our talented intern

CTD package being lowered into the water

Front

Mixing and Fronts: 3 8 16

Strong tidal fronts in Grays Harbor and Willapa Bay.

Jellyfish: 1 20 Click on numbers

Jellyfish patches still numerous in southern inlets of South Sound (Totten, Eld, and Budd Inlets).

Plume

Suspended sediment: 11 12

Suspended sediment along rivers and draining mudflats.

Bloom

Visible blooms: 4 5

Within surf zone of coastal beach.

Debris

Debris: 3 8 9 10 16

Organic debris and foam forming in patches near mudflats, river plumes, and tidal fronts.

Seattle Tides: H. tide: 12:02 AM 10:58 AM, , L. tide: 4:57 AM, 6:11 PM

Aerial photography and navigation guide

Date: 1-28-2015

Click on numbers

Flight Information:

Morning flight, photos 1-9
Offshore winds, clouds, low visibility

Afternoon flight, photos 10-20:
Sunny, mild, winds decreasing

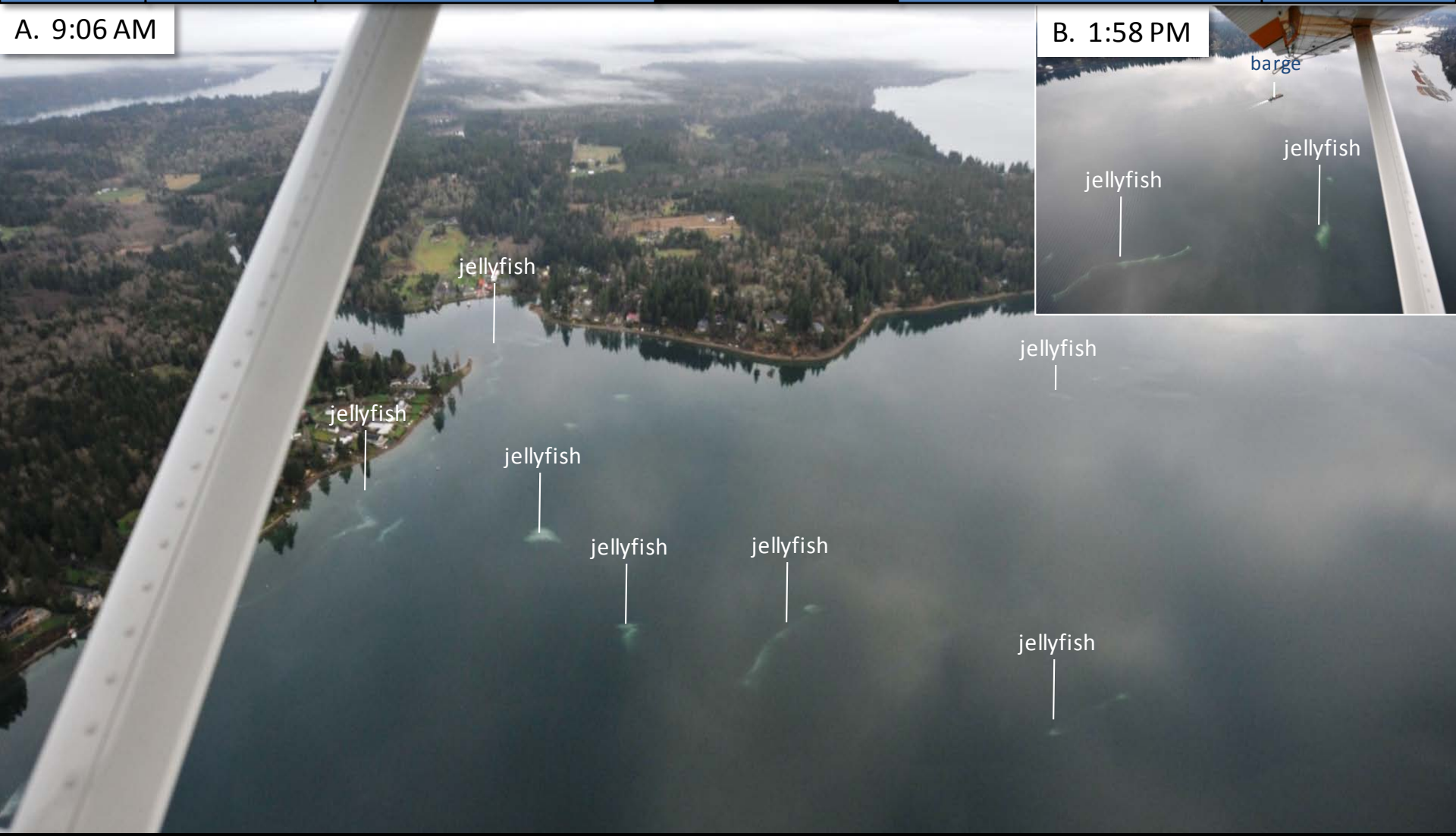
Flight route

Observation Maps:

Coast

South Sound

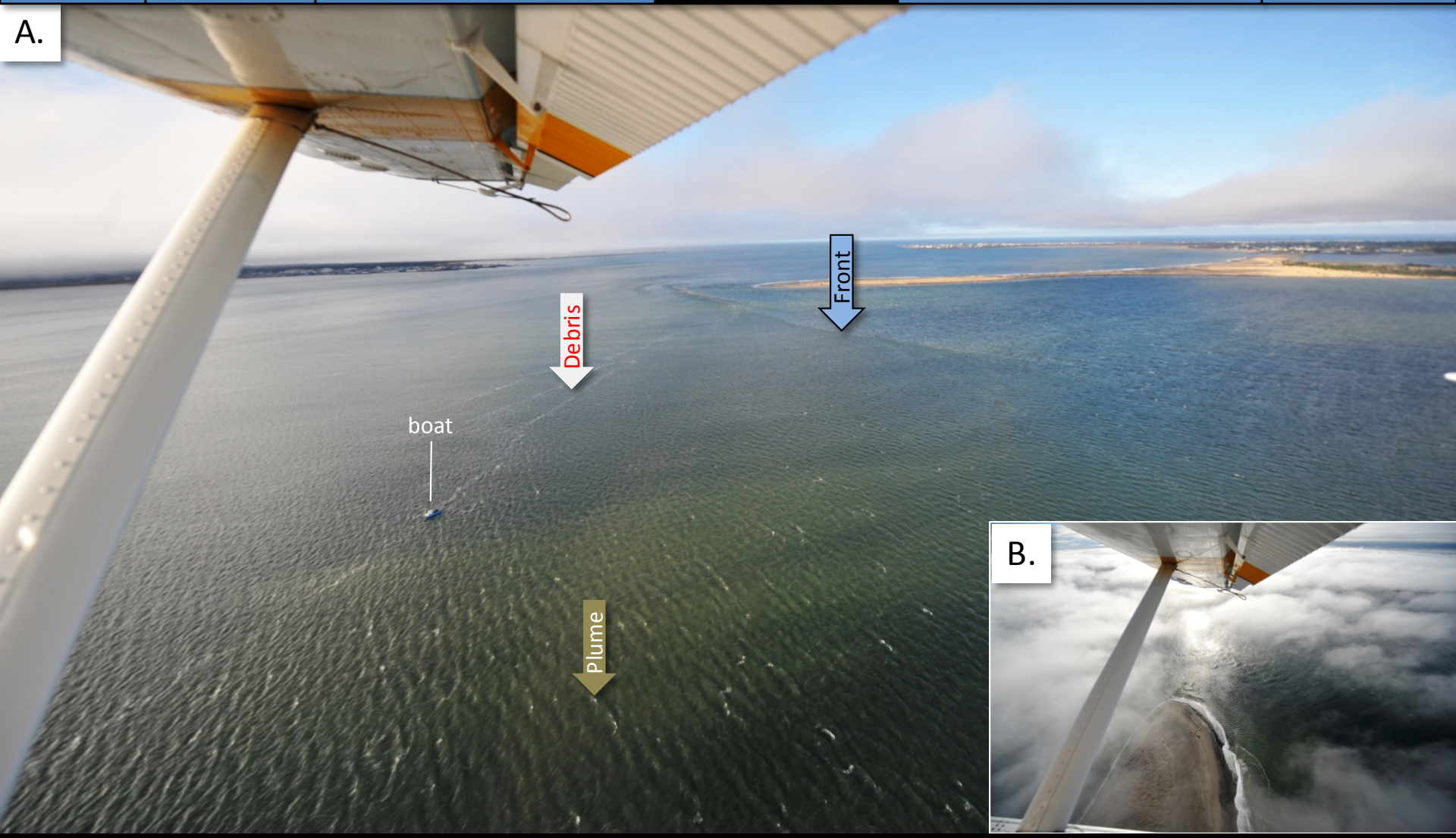
Aerial photography 1-28-2015



Numerous jellyfish patches in otherwise clear blue green water.

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

Industrial complex next to Chehalis River with billowing emissions traveling at low altitude.
Location: Cosmopolis, Aberdeen (Gray Harbor) 9:25 AM.



A. Offshore wind pushing sediment rich Chehalis River plume into the ocean below. B. Low lying clouds.
Location: Off Damon Point (Grays Harbor), 10:19 AM.

Aerial photography 1-28-2015

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.

Boggy water mixing with a diatom bloom in surf zone.

Location: Off Twin Harbor State Park, Cohasset Beach (Coast), 10:26 AM.

Cranberry fields with a nice splash of color, cloud banks and windmills.

Location: Grayland, (Coast), 10:29 AM.

Boggy water entering from Drainage Ditch number 1 into Willapa Bay.

Location: Entrance to Willapa Bay (Willapa Bay), 10:32 AM.

Aerial photography 1-28-2015

Numerous large fronts lined by organic debris and foam show surface water flow during ebbing tide.

Location: Off Kindred Island (Willapa Bay), 11:00 AM.

A.

B.

Regular convection cells at the transition to deeper water as ebbing water moves into channels.

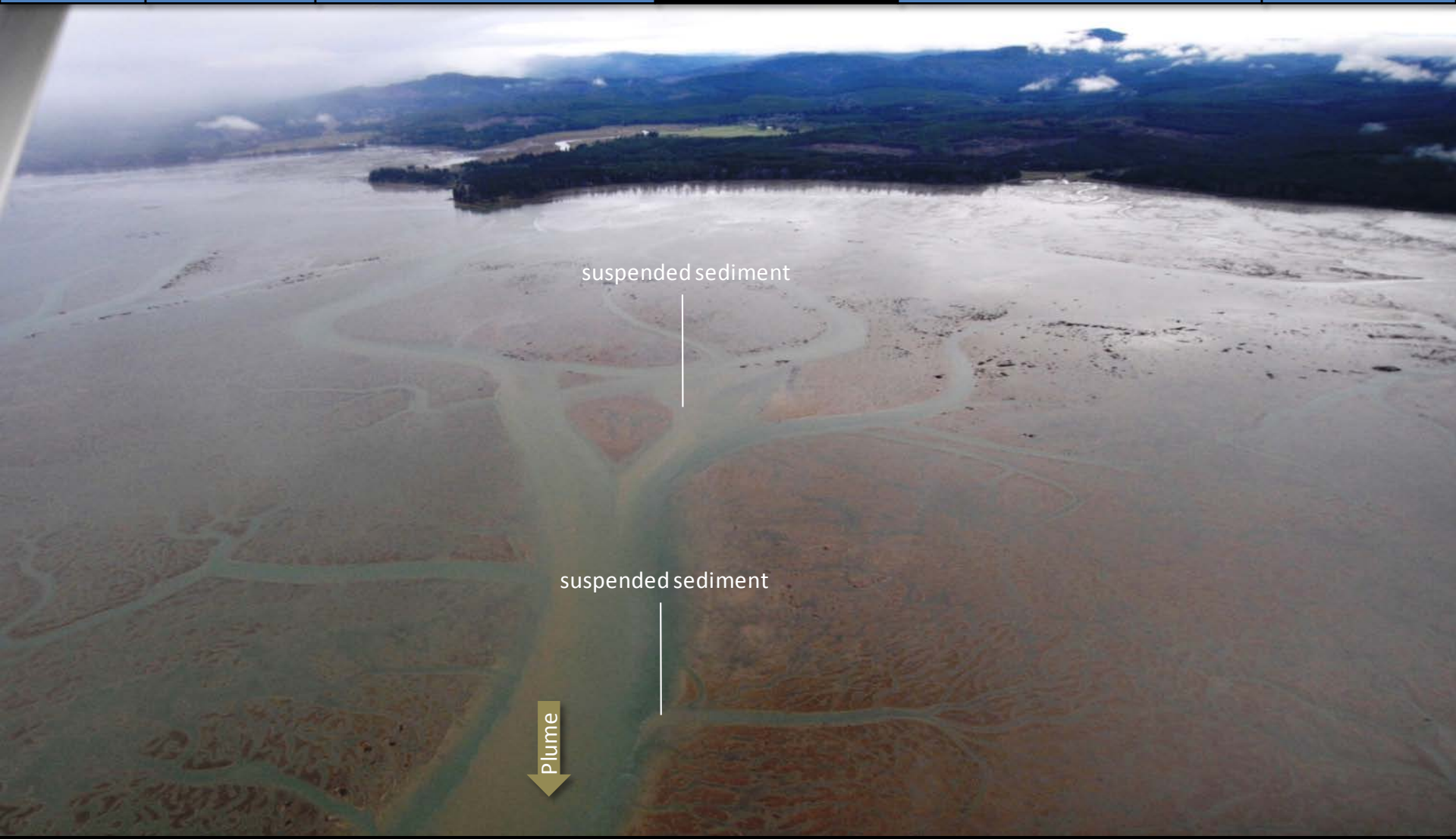
Location: A. Off Diamond Point on Long Island, B. Stanley Channel (Willapa Bay), 12:00 PM.

Aerial photography 1-28-2015

Surface water of different origins (South and North Bay) meeting at the entrance to Grays Harbor.
Location: Off Sunshine Point, Naselle River (Willapa Bay), 12:24 PM.

Tidal gullies connect draining mud flats during ebbing tide and expose nice patterns.

Location: Off Sunshine Point, Naselle River (Willapa Bay), 12:44 PM.



A draining mudflat showing a mixing of clearer and muddier water during ebbing tide.

Location: Off Needle Point, near South Nemah River (Willapa Bay), 12:45 PM.

Crushed shells distributed on mud flats highlight the large-scale underwater management of the bay.

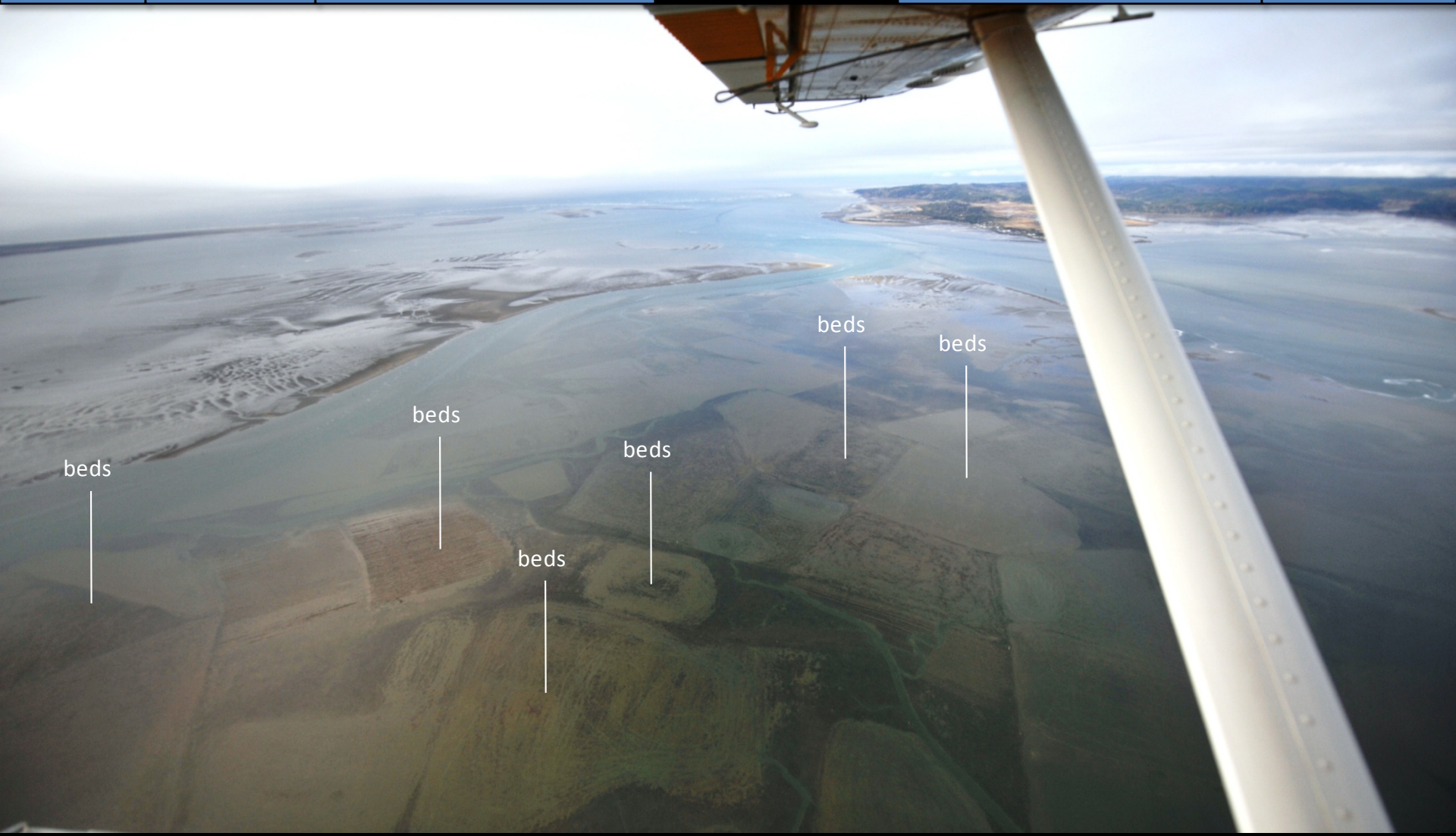
Location: Bay Center (Willapa Bay), 12:50 PM.

Aerial photography 1-28-2015

Patterns on mud flats, resembling fields, highlight the large-scale underwater management of the bay.

Location: Bay Center (Willapa Bay), 12:50 PM.

Aerial photography 1-28-2015



Patterns on mud flats, resembling fields, highlight the large-scale underwater management of the bay.

Location: Bay Center (Willapa Bay), 12:51 PM.

Aerial photography 1-28-2015

Long foamy debris lines form along convergences of surface water leaving the bay.

Location: Russell Channel (Willapa Bay), 12:51 PM.

A.

B.

Tidally regulated regions at the Willapa Bay estuary garner productive grasslands.

Location: A. Mailboat Slough, B. Stuart Slough (Willapa Bay), 12:53 PM.

The artistic patterns of mud flats and tidal gullies.

Location: Across Kellogg Slough (Willapa Bay), 12:53 PM.

Aerial photography 1-28-2015

Interstate crossing southern reaches of Eld Inlet during high tide.

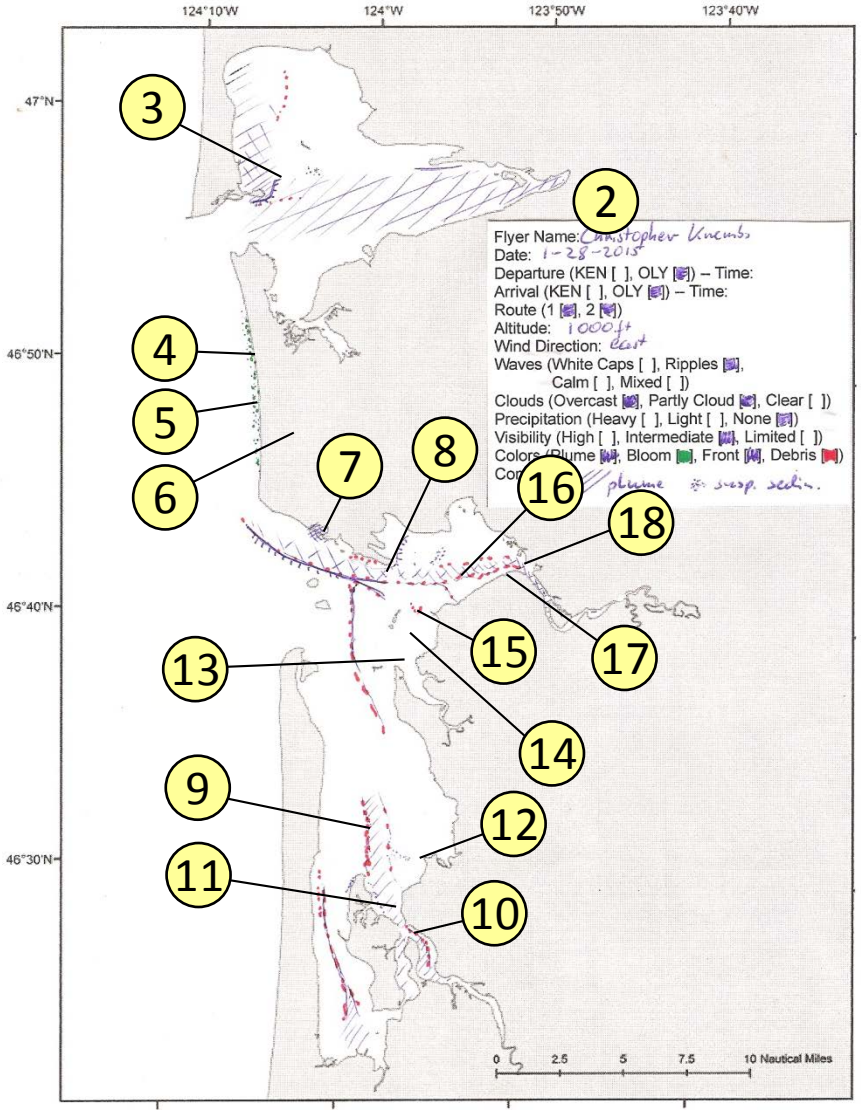
Location: Mudd Bay Road, Southern extent of Eld Inlet (South Sound), 1:52 PM.

Numerous jellyfish patches in otherwise clear bluegreen water.

Location: Across Snyder Cover, Eld Inlet, (South Sound) 1:55 PM.

Observations in Central and North Sound

Navigate



Coast

Date: 1-28-2015

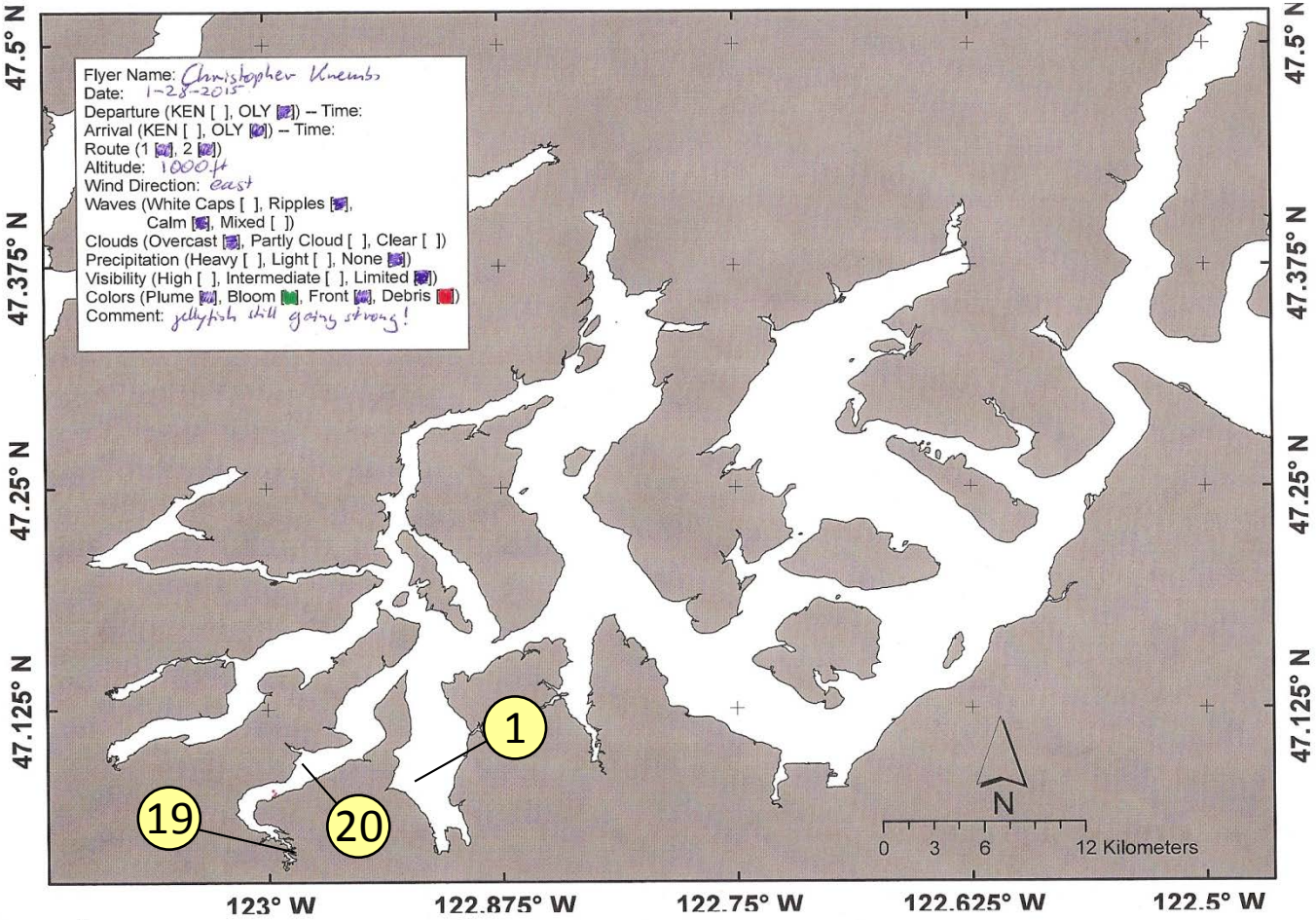
Numbers on map refer to picture numbers for spatial reference

Observations in Hood Canal and South Sound

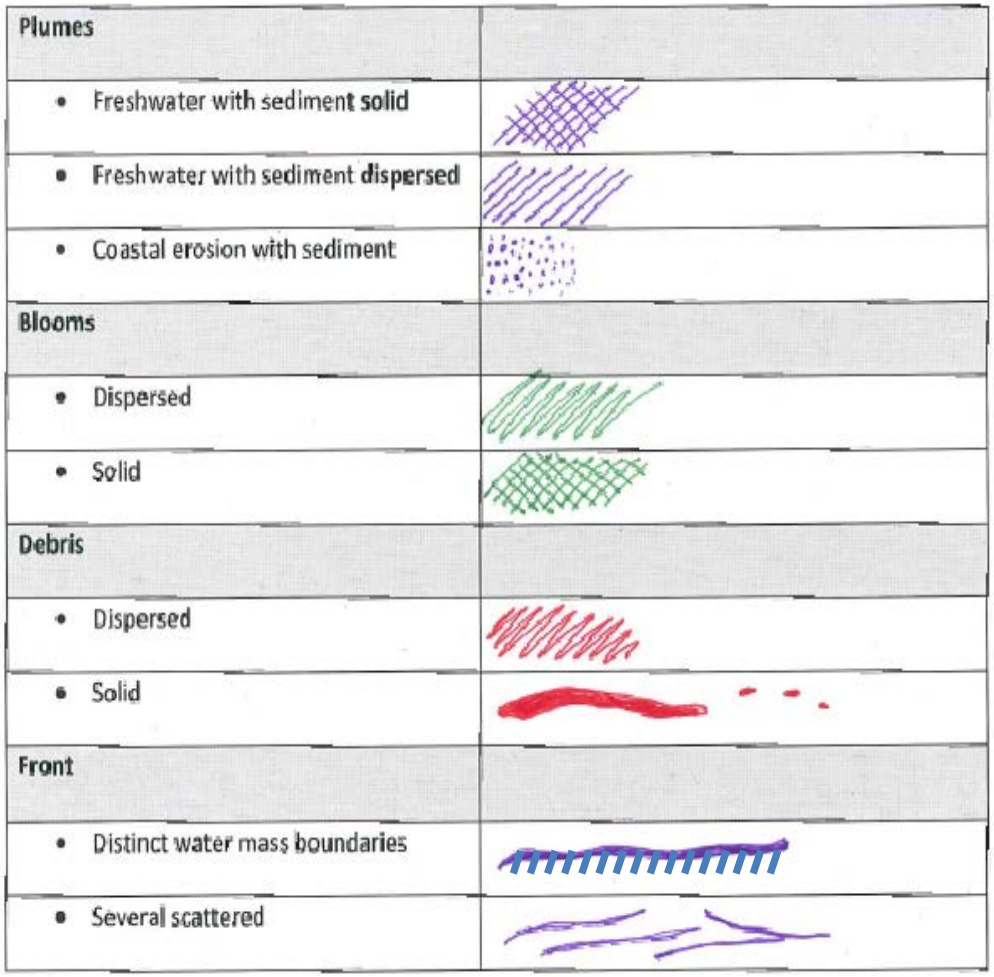
Navigate

Date: 1-28-2015

South Sound



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.

Debris:
Debris can be distinguished into natural and anthropogenic debris floating at the surface *sensu* Moore and Allen (2000). The majority of organic debris in Puget Sound is natural and mixed with discarded man-made pieces of plastic, wood, etc. From the plane, we cannot differentiate the quality of debris at the surface and therefore, call it for reasons of practicality just “debris”.

S.L. Moore, M. J. Allen. 2000. Distribution of Anthropogenic and Natural Debris on the Mainland Shelf of the Southern California Bight. Marine Pollution Bulletin, 40(1): 83–88.

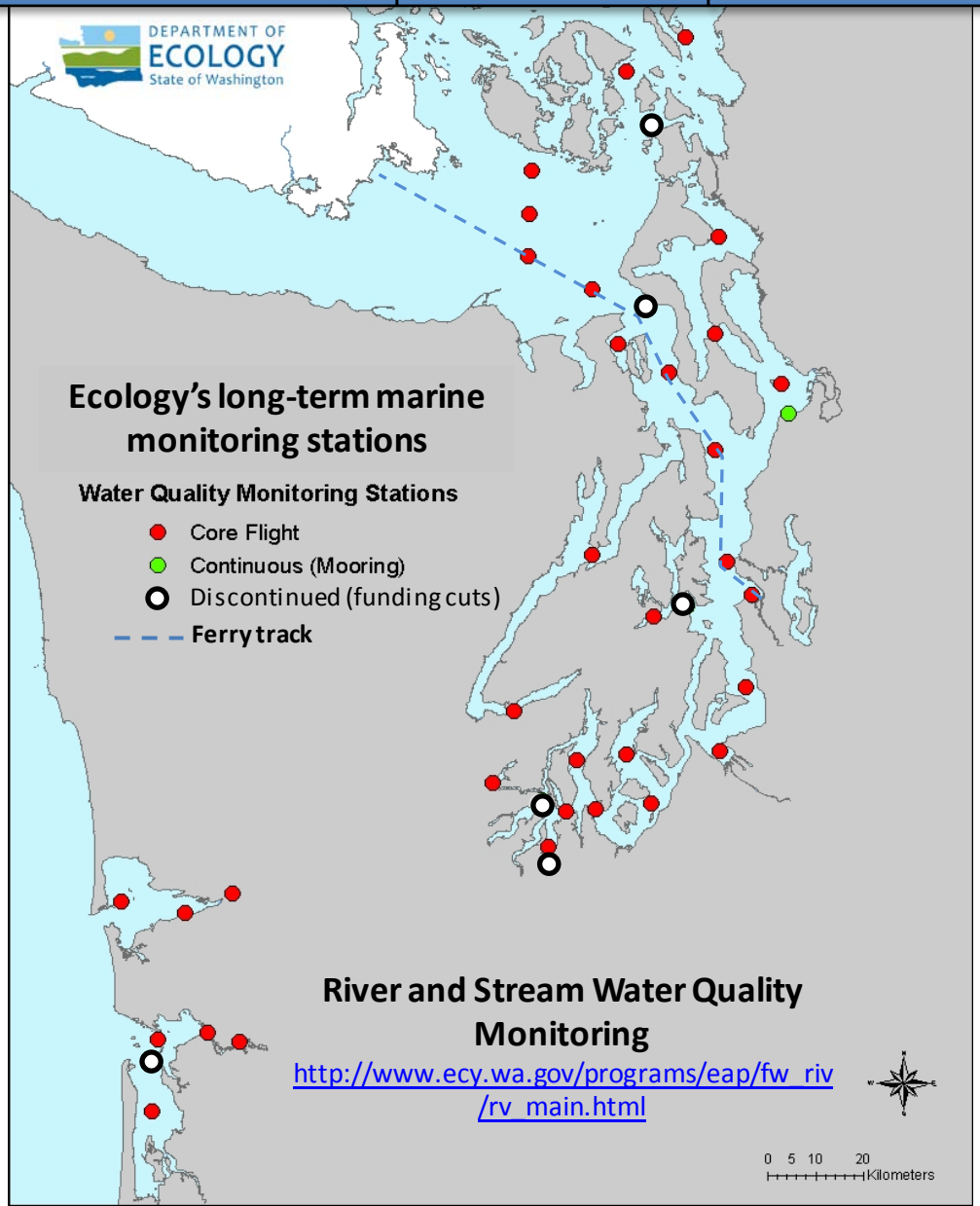
Get data from Ecology's Marine Monitoring Programs

Field log	Climate	Water column	Aerial photos	-	-

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.

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Marine Monitoring Unit
Environmental Assessment Program
WA Department of Ecology

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