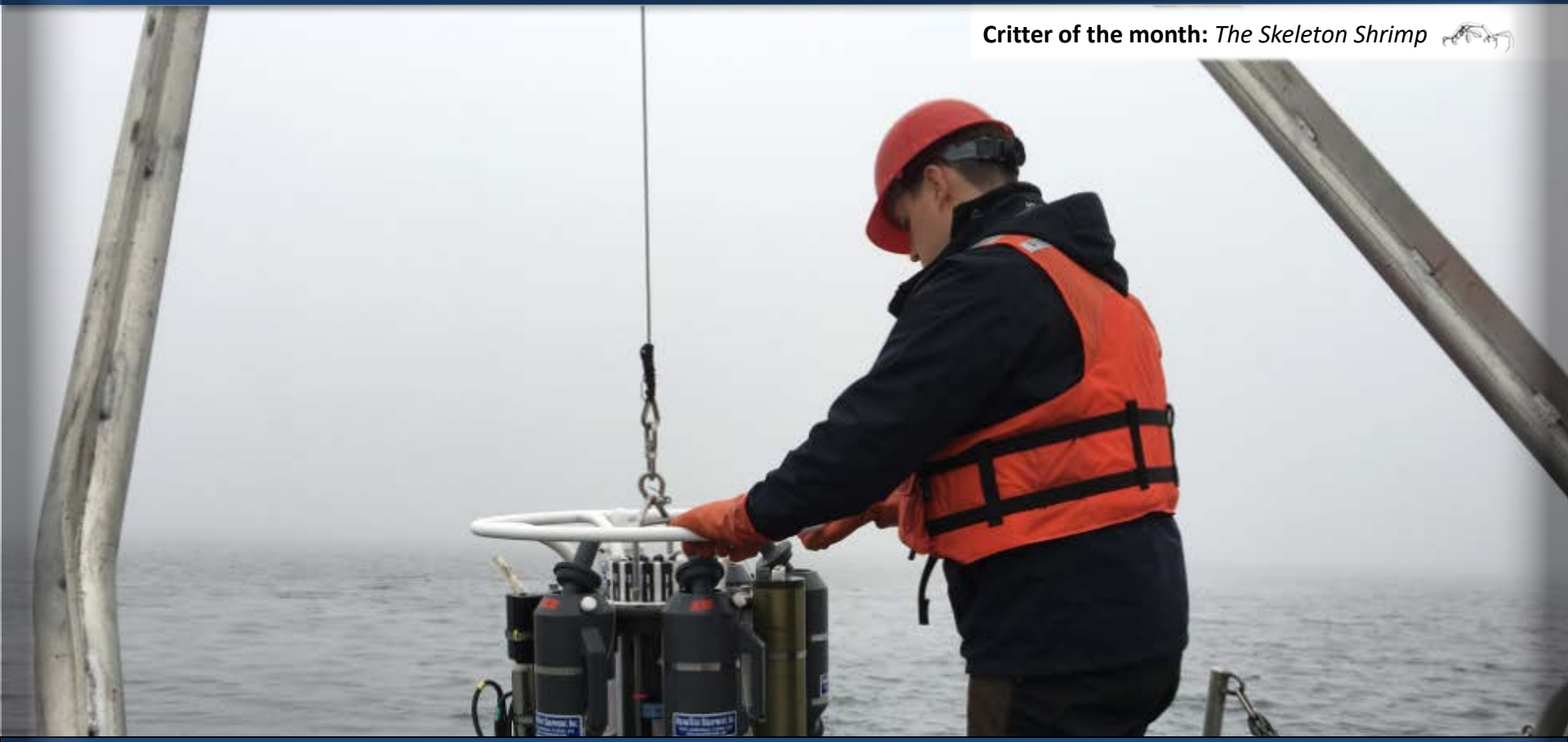
Publication No. 18-03-075

DEPARTMENT OF ECOLOGY State of Washington

Eyes Over Puget Sound

Surface Conditions Report: *November 6, 2018*

Critter of the month: *The Skeleton Shrimp*



Up-to-date observations of water quality conditions in Puget Sound and coastal bays.

LONG-TERM MARINE MONITORING UNIT

Stephen Gonski
Allison Brownlee

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Jim Shedd

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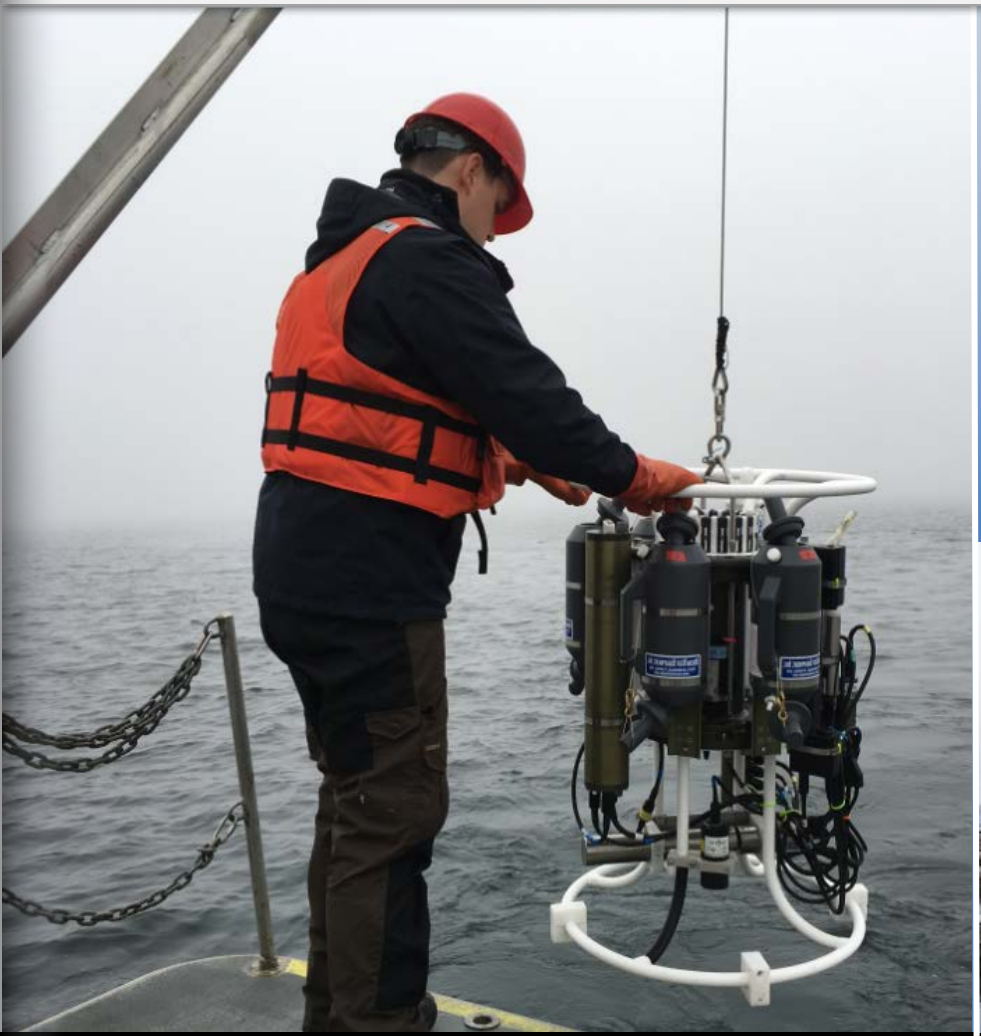
Editorial assistance provided by: Julianne Ruffner, Carol Maloy, Ruth Froese, and Jeanne Ponzetti.

New equipment takes its first plunge off the R/V Skookum



Our larger instrument package now accommodates requests for samples from collaborators.

You may know we use a sea plane for EOPS, but did you know that the majority of our monitoring in Puget Sound is done via boat?

One of our boat captains, Patti Sandvik.

Our boat is a 26-foot Almar used for water column and sediment sampling work.

What was the water visibility like for divers?

Best and worst horizontal visibility at corresponding vertical depth

Station	Best Visibility		Worst Visibility	
	Horizontal Distance (ft.)	Vertical Depth (ft.)	Horizontal Distance (ft.)	Vertical Depth (ft.)
1	45	95	29	13
2	39	44	6	3
3	52	97	37	13
4	40	94	16	10
5	42	3	37	92
6	52	92	21	3
7	40	95	27	3
8	44	21	39	3
9	46	71	31	3
10	49	98	42	3
11	16	30	5	11
12	58	69	10	5
13	5	8	5	44
14	29	52	26	74
15	23	85	17	8
16	15	3	13	51

Find depths with high/low visibility

- **Best visibility** occurred in Tacoma near Dash/Browns Point (station 12) at almost 60 ft (70 ft depth), despite having mediocre visibility near the surface.
- **Poor visibility** occurred in Oakland Bay (station 13, near Shelton).
- The poster, "Underwater Visibility Maps – a Tool for Scuba Divers," is available here

This is a new feature and we are soliciting feedback (skip.albertson@ecy.wa.gov).

Critter of the month — The Skeleton Shrimp

Dany Burgess & Angela Eagleston,
Marine Sediment Monitoring Team

Family Caprellidae

You might spot these alien-like crustaceans attached to floating docks or eelgrass in Puget Sound – or you might not! Skeleton shrimp are masters of disguise.

Fun Skeleton Shrimp Facts

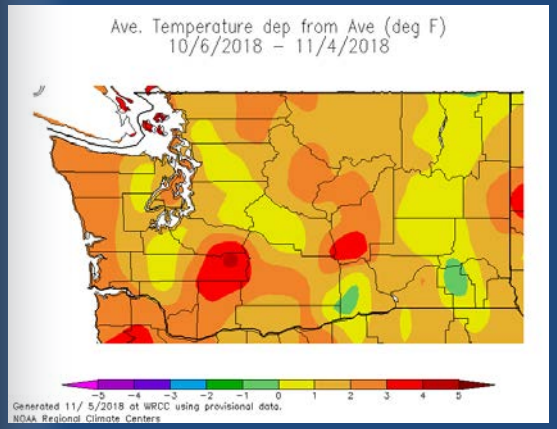
- The males have a poison tooth on their huge claws.
- Their bodies are modified for clinging rather than swimming.
- They can change color to blend in with their surroundings.

Learn more about skeleton shrimp and other critters on Ecology's EcoConnect blog.

How much water did we get and what can we expect?

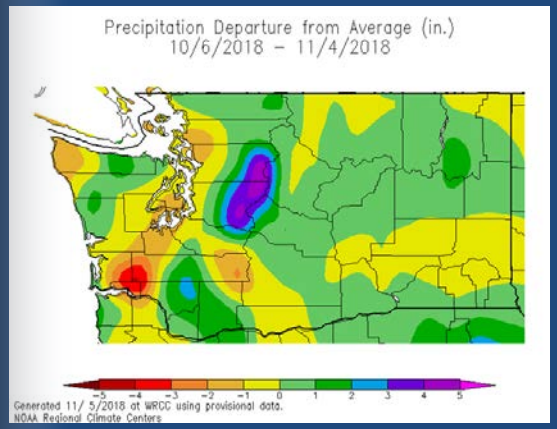
Puget Sound air temperatures were above normal while precipitation remained mostly near normal except at higher elevations in the Central Cascades (A). The fall and winter climate outlook suggests warmer and drier conditions (B). This could continue to stress rivers and limit snow accumulation.

A. Western Regional Climate Center



Average temperature

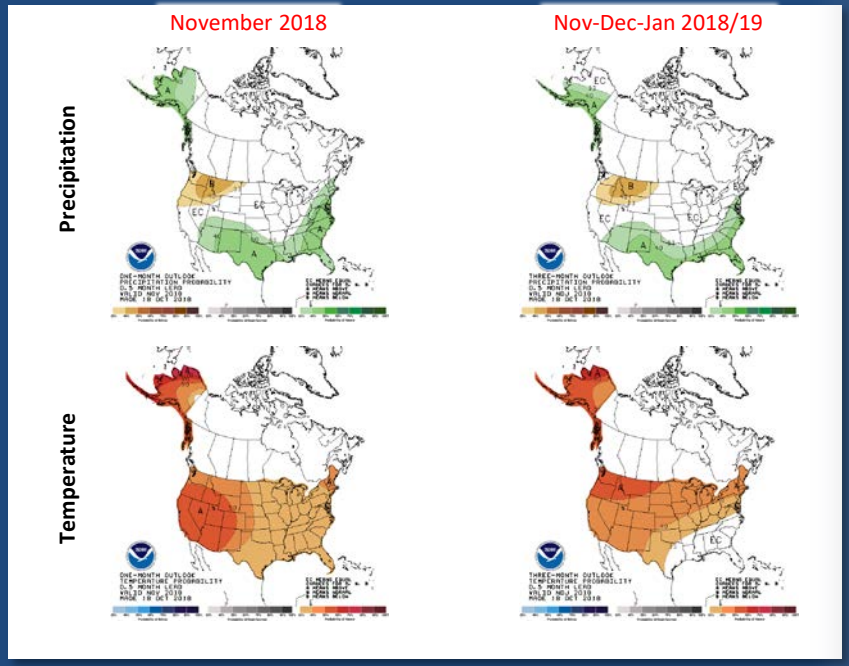
In Puget Sound, departures from average ranged from +1 to +4 degrees (F) in localized areas during the past 30 days.



Precipitation

Departures from average ranged from -2 to +5 inches in the Central Cascade and Puget Sound regions during the past 30 days.

B. Climate Prediction Center, NOAA

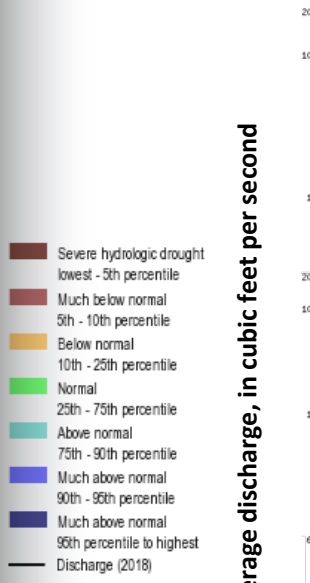


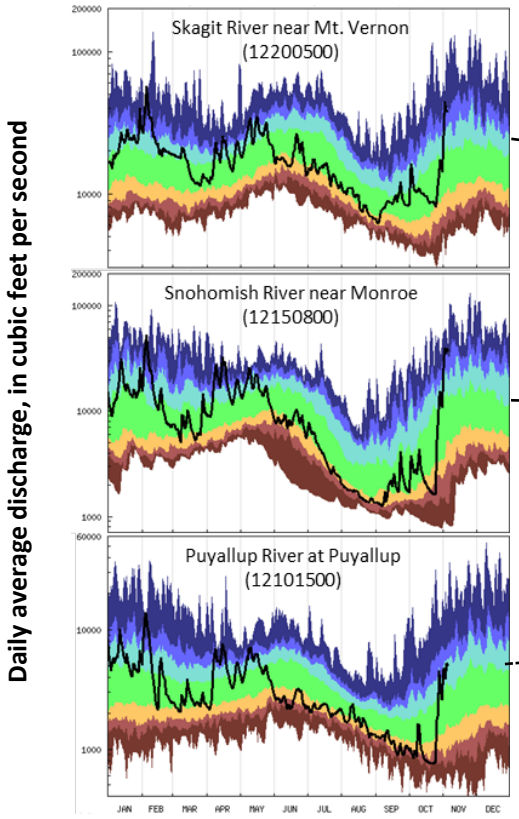
There is a moderate probability that precipitation will be below-normal disappearing by early winter. Warmer air temperatures are expected in the northwest through winter. Click here.

How much water flows into Puget Sound?

A moderate atmospheric river event, predominantly impacting the central and northern Cascades, resulted in a temporary recovery in flow conditions from their summer deficits (see trend charts). Nearly all stream gages are reporting normal to well-above-normal flows as of the date of the aerial photos (see map). Short periods of high flows "flashy" are common during this season and recede quickly.

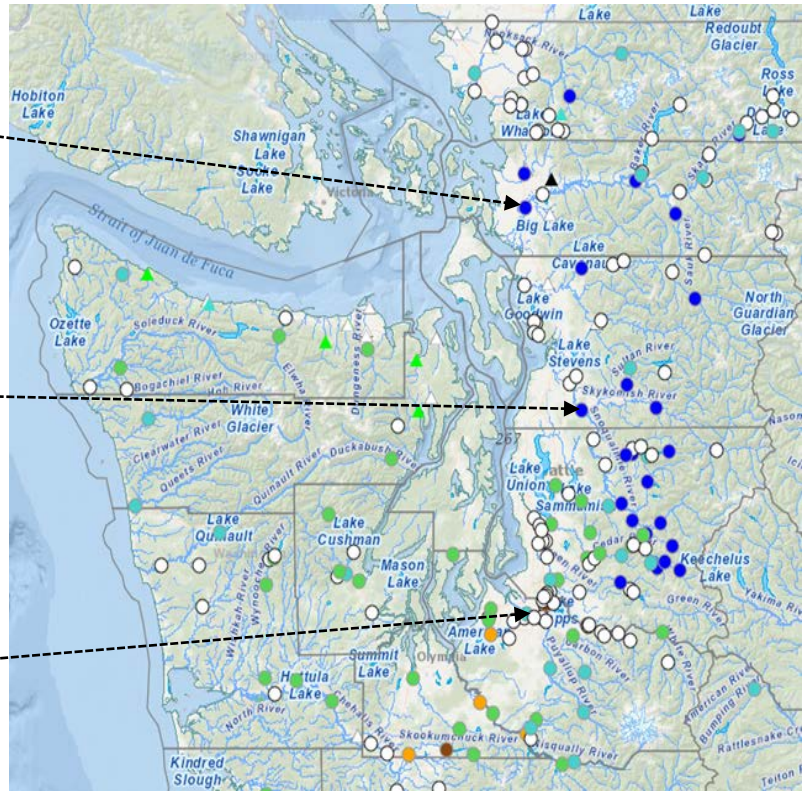
Select Puget Sound Streamflow Trends





USGS WaterWatch: CLICK HERE!

Current Streamflow Conditions as of 11/06/2018



USGS Real Time Streamflow Values

- Much above normal (>90%)
- Above normal (76-90%)
- Normal (25-75%)
- Below normal (10-24%)
- Much below normal (5-10%)
- Far below normal (>5%)
- Lowest recorded
- Not Ranked

Ecology Daily Streamflow

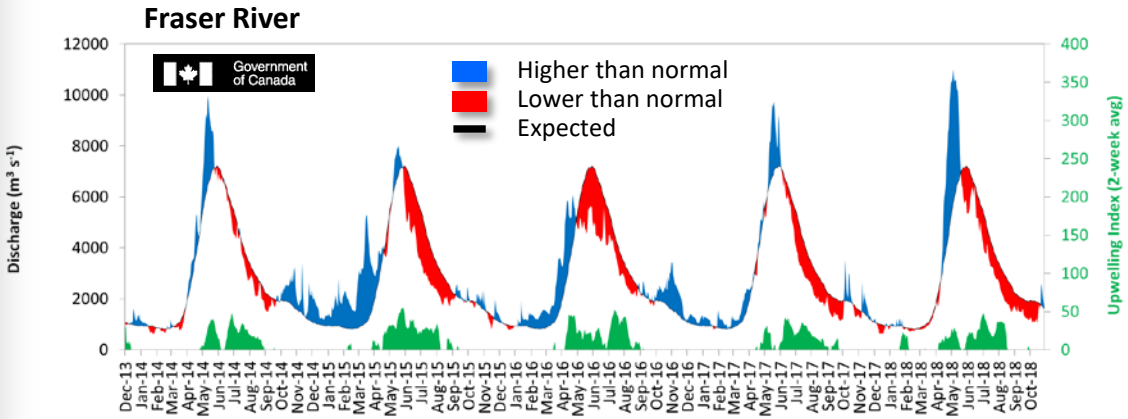
Daily Streamflow

- Highest recorded
- Much above normal (>90%)
- Above normal (76-90%)
- Normal (25-75%)
- Below normal (10-24%)
- Much below normal (<10%)
- Lowest recorded
- Not ranked

Current conditions: CLICK HERE!

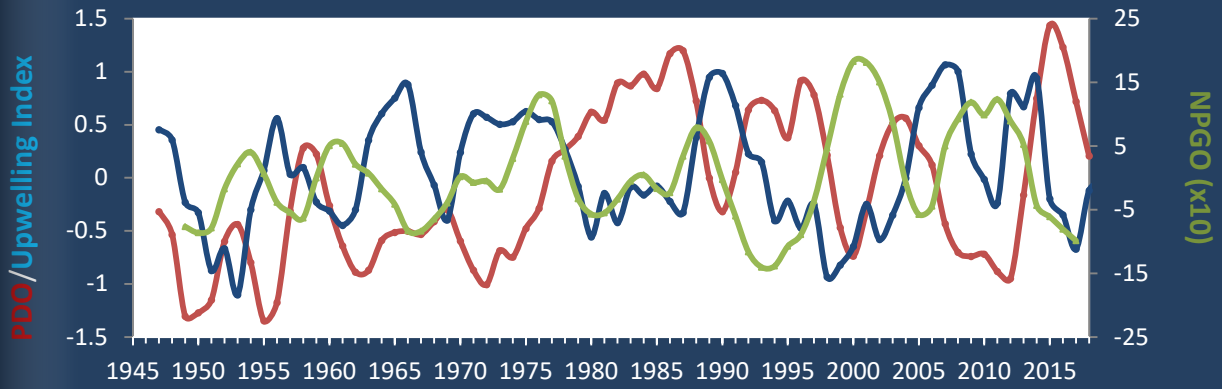
Climate influences: How well is Puget Sound exchanging its water?

Historically, the peaks of coastal upwelling and the freshet are in sync. This year a strong freshet preceded low flows.



The Fraser River is the major driver of estuarine circulation and water exchange between the Salish Sea and the ocean. Fraser River flows finally rebounded in November.

Three-year running average of PDO, Upwelling, and NPGO Indices



How do ocean boundary conditions affect the quality of water we exchange with the ocean?

Past years' warm water is gone (PDO) and upwelling is normal (Upwelling Index anomaly). Unfortunately, reporting of the NPGO, which reflects the surface productivity along the coast, has been discontinued.

*Pacific Decadal Oscillation Index (**PDO, temperature**, explanation). Upwelling Index (anomalies) (**Upwelling, low oxygen**, explanation). North Pacific Gyre Oscillation Index (**NPGO, productivity**, explanation).*

What influences Puget Sound's water quality?

Conditions leading up to October 2018 included a cool and wet spring followed by a warm, dry, and sunny summer with low river flows. In 2018, the onset of the dry summer began in May, a month earlier than in 2017. Recent precipitation at the end of October bumped up river flows, but has decreased again in November (see page 7).

Current conditions leading up to November:

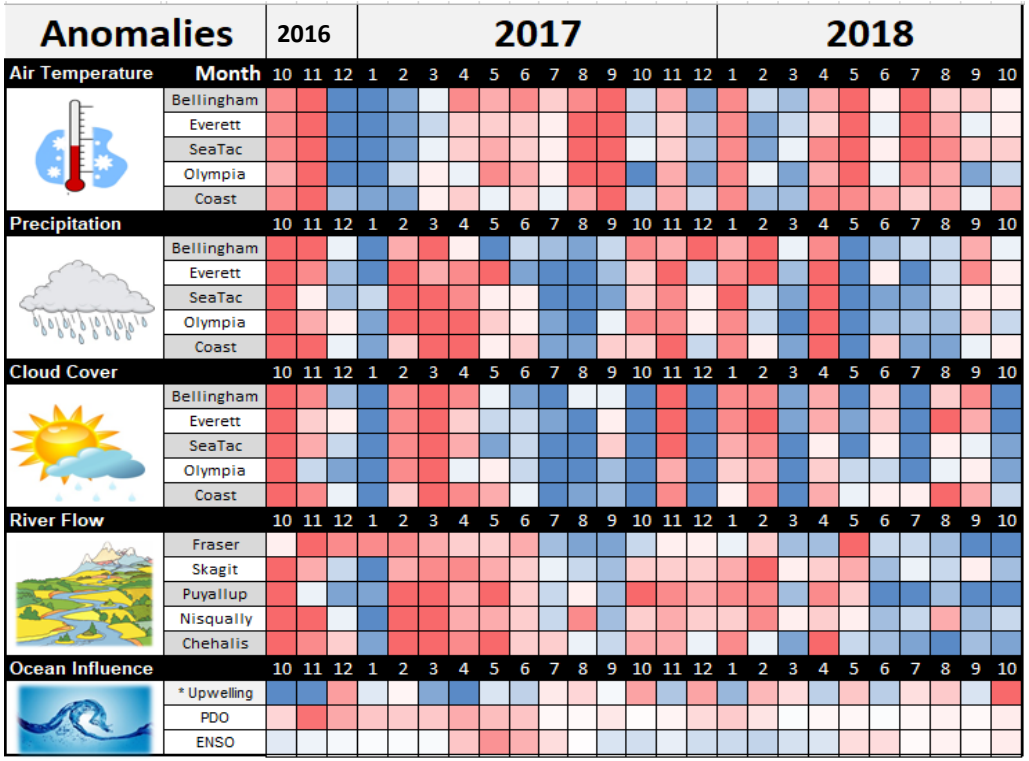
Air temperatures continue to be slightly higher.

Precipitation is largely back to normal after a dry summer.

Sunshine this year was more variable than in 2017.

River flows had a spike toward the end of October, but continues to be low since summer (page 7).

Upwelling and ENSO (MEI) were more moderate in 2018 than 2017 and are positive in October.

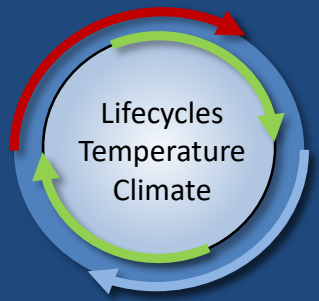


*Upwelling/downwelling Anomalies (PFEL)
PDO = Pacific Decadal Oscillation
ENSO = El Niño Southern Oscillation

higher — expected — lower | No data

All data are from public sources: UW GRAYSKIES; river flows from USGS and Environment Canada; indices from NOAA & UW (PDO).

Water temperature affects ecosystem performance



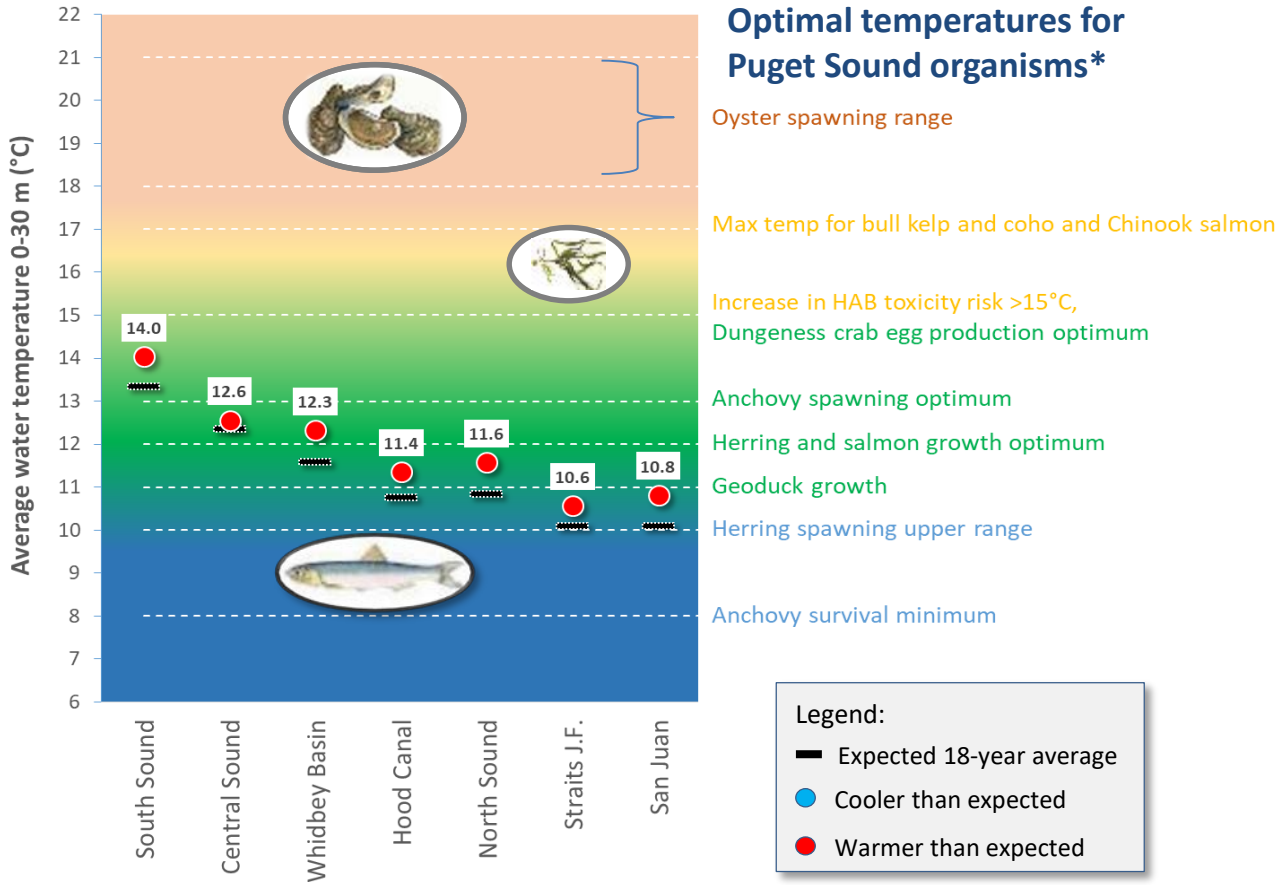
Can organisms thrive and survive?

The life cycles of organisms respond to temperatures. In order to be successful, the timing of early life stages must line up with good growth conditions.

Temperature is important for growth, but also dictates if certain organisms can overwinter in Puget Sound (e.g., northern anchovy).

* Help us get these right. We scoured the literature for temperatures important to the success and survival of marine organisms.

In October, average water temperatures in surface water 0 – 30m were still warmer than the baseline (1999 – 2016). South and Central Sound were the warmest and the Straits of Juan de Fuca were the coolest. Temperatures for organism growth were generally in optimal ranges (green) after a warm summer.



What are the conditions at the surface?

The productive season comes to an end in South Sound and the water gets more transparent. An opportunity to document jellyfish and schools of fish that are visible in many inlets of South Sound.

Start here

Edge of the Deschutes River plume, Budd Inlet

Suspended sediments off Burns Point, Totten Inlet

Front

Mixing and fronts:
Front off Priest Point Park, Budd Inlet.

Jellyfish:
Jellyfish patches in Eld, Totten, Henderson, and Budd Inlets.

Plume

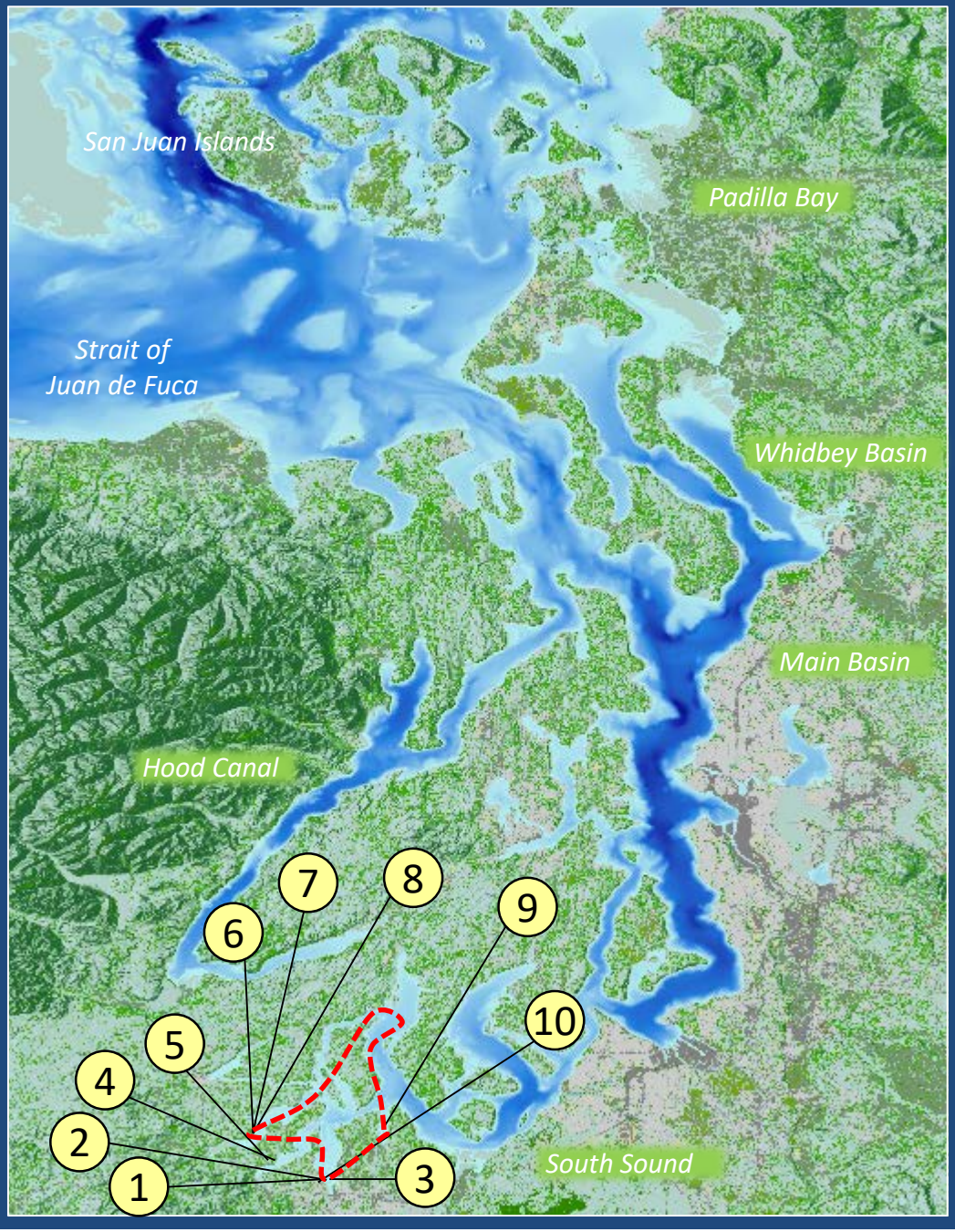
Suspended sediment:
Nearshore in Totten Inlet.

Bloom

Visible blooms:
Fading red-brown blooms in Eld and Henderson Inlet. Water is getting clearer.

Debris

Debris:
Red-brown ribbons of leaves in Budd Inlet, Gull Harbor.



Aerial navigation guide

Date: 11-6-2018

Click on numbers

Tide data from November 6, 2018 (Seattle):

Time	Pred	High/Low
03:57 AM	10.56	H
09:32 AM	3.71	L
03:24 PM	11.83	H
10:07 PM	-0.46	L

Flight Observations

Broken cloud ceiling.

Map Key

– – Flight routes

Jellyfish forming large aggregations on both sides of a front.

Location: Budd Inlet (South Sound), 12:28 PM

Jellyfish forming large aggregations that appear to align with the current.

Location: Budd Inlet (South Sound), 12:29 PM

Jellyfish aggregations prefer the inner side of Inlets.

Location: Budd Inlet (South Sound), 12:30 PM

Aerial photography 11-6-2018

Jellyfish aggregations prefer the inner side of Inlets.

Location: Eld Inlet (South Sound), 12:34 PM

Red-brown bloom and jellyfish.

Location: Eld Inlet (South Sound), 12:34 PM

Near-shore water rich in suspended sediment.

Location: Totten Inlet (South Sound), 12:39 PM

Occasional jellyfish aggregations and schools of fish.

Location: Totten Inlet, Gallagher Cove (South Sound), 12:41 PM

Numerous schools of fish.

Location: Totten Inlet (South Sound), 12:41 PM

Occasional jellyfish smacks and red-green water of a fading fall bloom.

Location: Henderson Inlet (South Sound), 12:55 PM

Long ribbons of jellyfish stretched along direction of tidal flow.

Location: Budd Inlet (South Sound), 1:00 PM

Find past editions of EOPS on the next pages

We have published 77 editions!

Find all previous Eyes Over Puget Sound editions at the end of this document.

Recommended Citation (example e.g., September):

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Environmental Assessment Program
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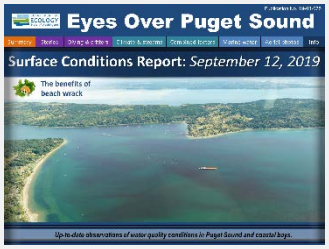

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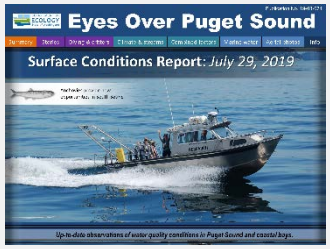

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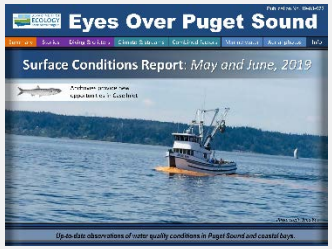

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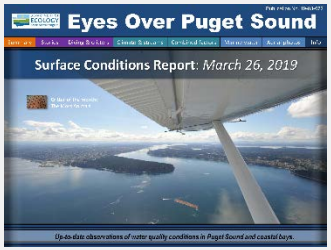

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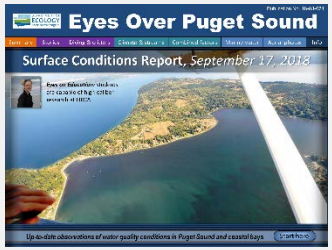

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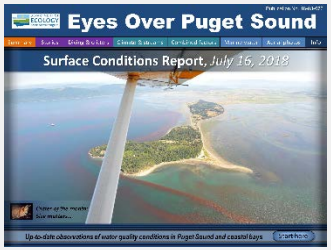

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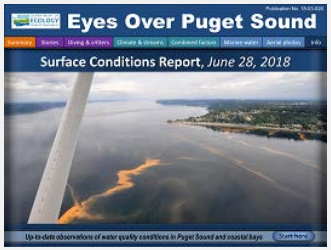

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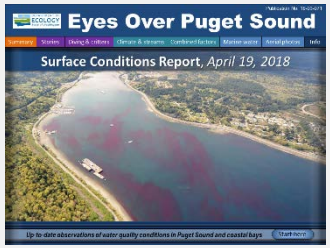

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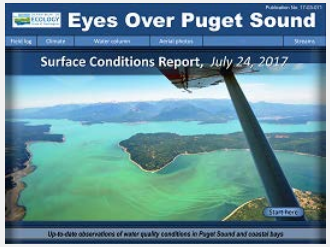

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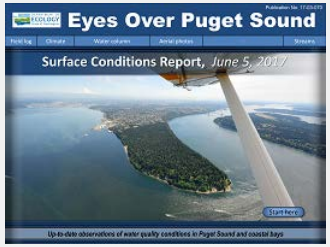

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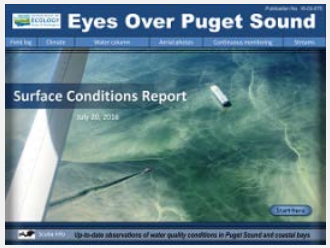

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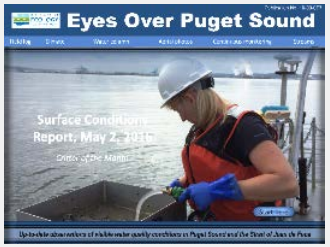

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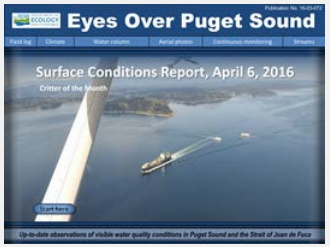

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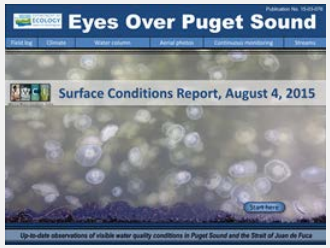

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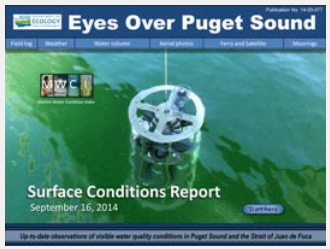

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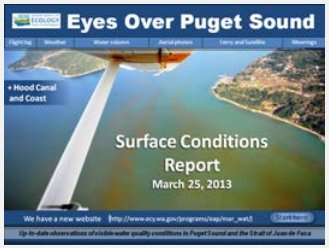

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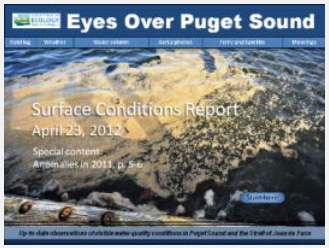

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November_15_2011,
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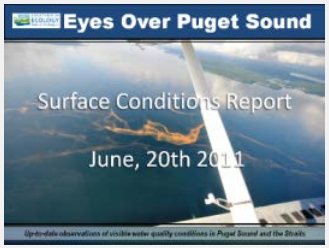
July_6_2011,
Publication No. 11-03-077



June_20_2011,
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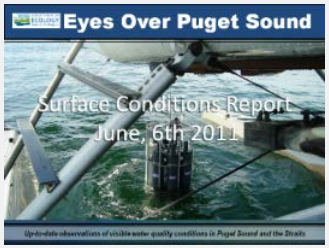

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May_4_2011,
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April_27_2011,
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