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Nutrient dynamics and ties to environmental conditions and drivers in central Puget Sound

Stephanie Jaeger  
King County Dept. of Natural Resources and Parks, United States, stephanie.jaeger@kingcounty.gov

Ben Larson  
King County Dept. of Natural Resources and Parks, United States, blarson@ocean.washington.edu

Bob Kruger  
King County Dept. of Natural Resources and Parks, United States, bob.kruger@kingcounty.gov

Kimberle Stark  
King County Dept. of Natural Resources and Parks, United States, kimberle.stark@kingcounty.gov

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Nutrient Dynamics & Ties to Environmental Conditions in Central Puget Sound

Highlights from 2016-2017

Stephanie Jaeger, Ben Larson, Kimberle Stark, & Bob Kruger

King County Dept. of Natural Resources & Parks
Water and Land Resources Division

April 6th, 2018
How Do We Monitor Water Quality?

- **Offshore waters: 1994**
  - *CTD Sensors & Discrete Data*
- **Beach waters: 1999**
  - *Discrete Data*
- **Moorings: 2008**
  - *Automated sensors sample every 15-min*
  - *Point Williams buoy since 2013*
- **Phytoplankton: 2008**
  - *Semi-Quantitative and FlowCam since 2014*
- **Zooplankton: 2014**
- **Sediments (offshore and beach)**
Offshore Water Column Sites and Moorings
• Optical continuous nitrate sensor added in April 2017 (with sensor loan and help from WA Dept. of Ecology)
Figure 2. Rough time scales of physical, bio-optical, and biogeochemical processes along with time scales that are accessible with different sampling platforms. Figure is a schematic and is not to scale. Note: The mooring designation refers to both fixed location and AUVs and gliders used as virtual moorings (Griffiths et al., 1999b). From Dickey & Chang, 2001
Variability in short and long time scales

Point Williams sites: 1-m

1997 – 2016 Bi/Monthly discrete
2017 15-min mooring

Nitrate (+Nitrite) N (mg/L)

Month

1 2 3 4 5 6 7 8 9 10 11 12

0 10 uM
20 uM
30 uM
Tidal and daily signals are significant.
July – early August 2017

Water level (NOAA)

Winds at WP light (NOAA)

Surf. Salinity

Surf. Temp.

Surf. Nitrate
Surface Nitrate between years: 2016 vs. 2017

2017 Point Williams: 1-m

SUNA Nitrate Nitrogen (mg/L)

- 2016 Nitrate
- 2017 Nitrate
Stratification greater in 2017 than 2016

* = Depth of Max buoyancy frequency calculated as in S. Moore et. al 2008
Nutricline follows chlorophyll

* = Depth of Max buoyancy frequency calculated as in S. Moore et. al 2008
Consider drivers when evaluating change over time.

- Nitrate+nitrite anomaly (1-m) +0.002 mg/L (0.1 uM) /yr (p<0.01)
- Chl-a anomaly (1-m) (no trend)
- Si:DIN molar anomaly (1-m) +0.03 /yr (p<0.05)
Summary Points

• Scales are important when looking at drivers of change, and can impact inter-annual variability, along with large scale climate drivers.
  – These can impact sensitivity to eutrophication
  – Different processes can arise between basins
• Large short-term variability in surface nitrate conditions at times during growing season, higher at night.
• Nutricline depth provides information on where waters could be most sensitive to local inputs
• Range of nitrate variability and understanding of drivers can be applied to models to better characterize the natural system
Thank you!

Contributors:

– King County Environmental Lab staff for year-round field sampling and lab analysis
– WA Dept. of Ecology Marine Monitoring Unit for use of SUNA nitrate sensor