

Nutrient Dynamics & Ties to Environmental Conditions in Central Puget Sound

Highlights from 2016-2017

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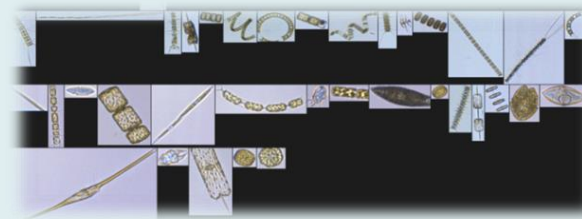


(Source: King
County DNRP GIS
Group)

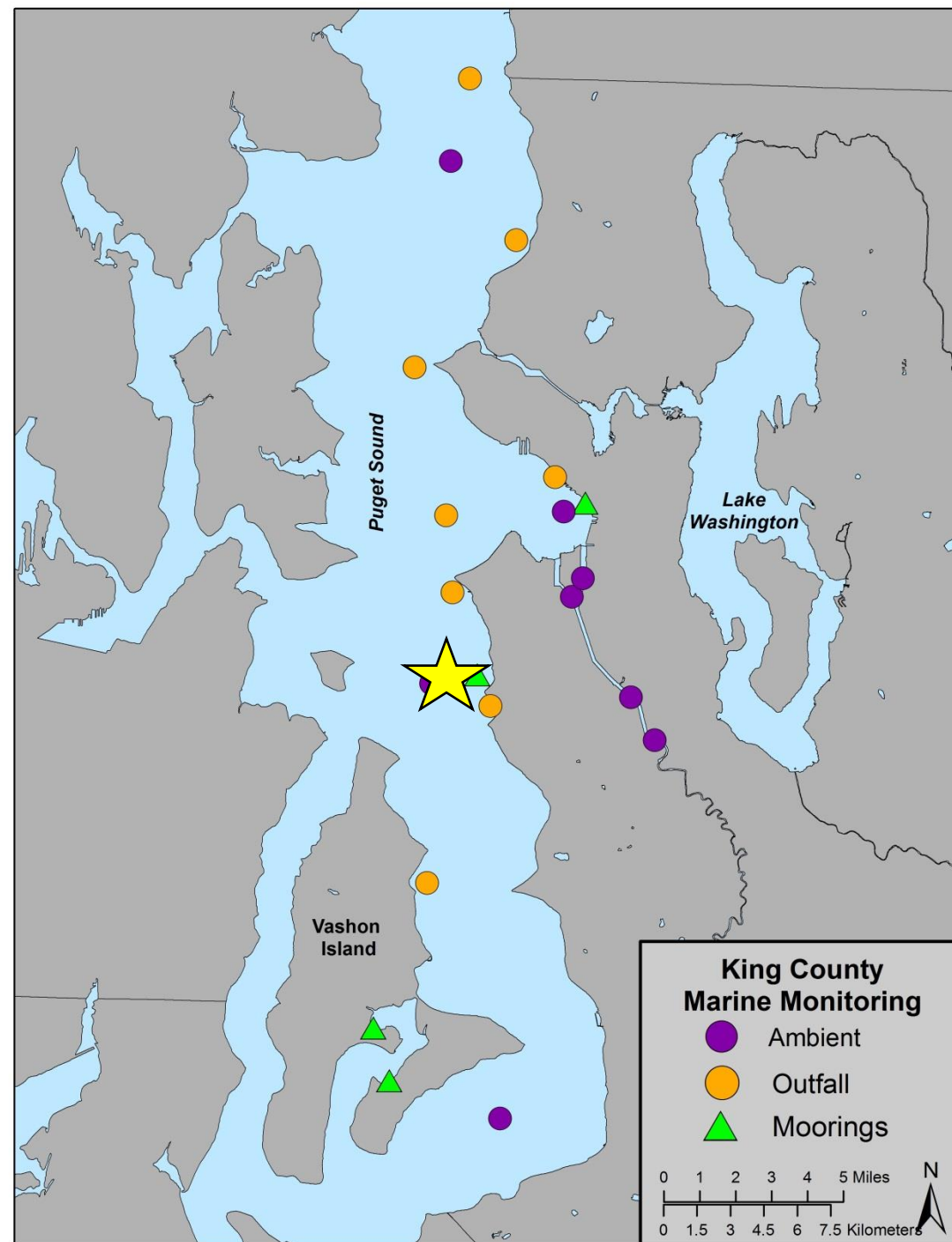
How Do We Monitor Water Quality?



- **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)



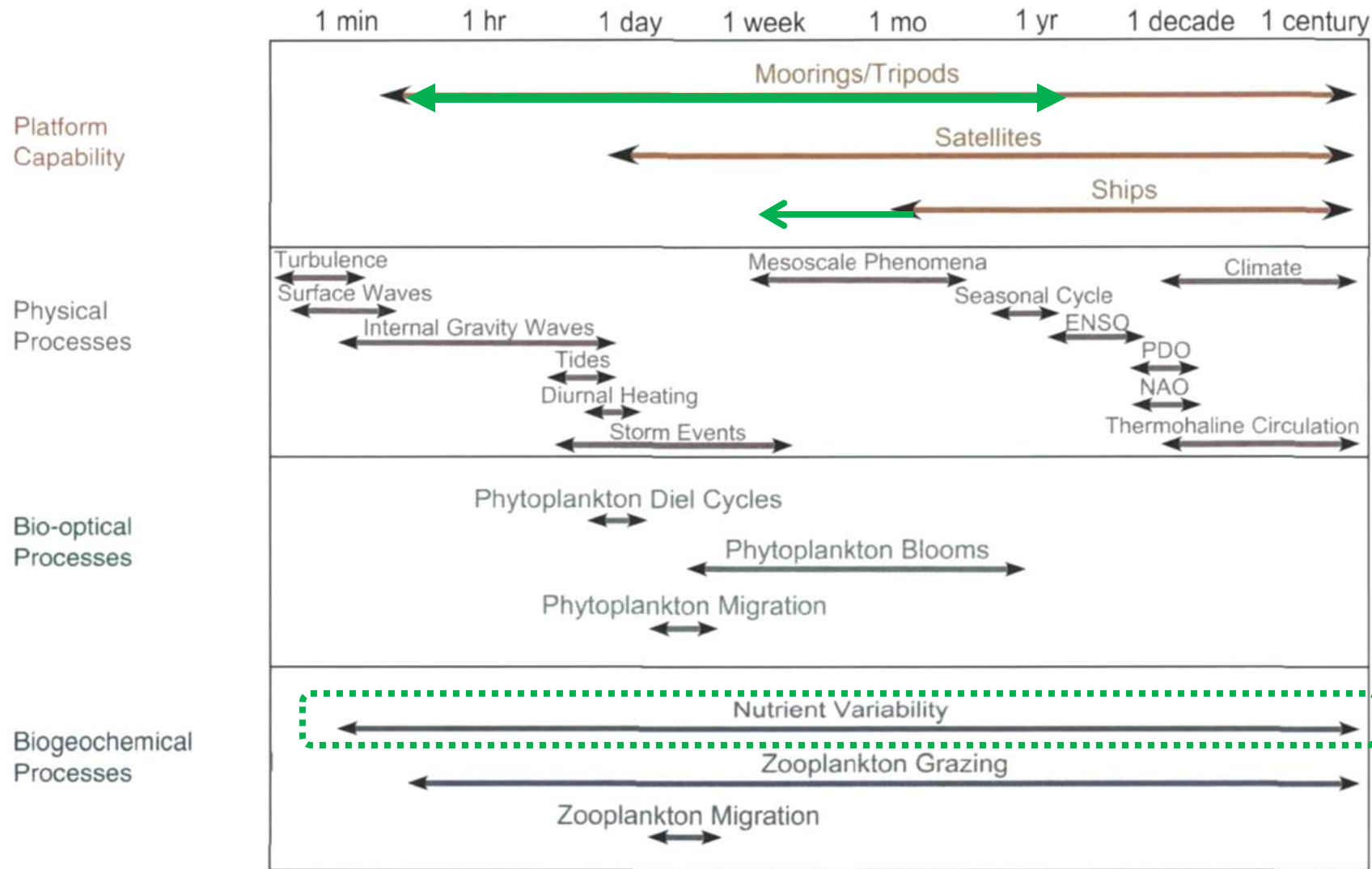
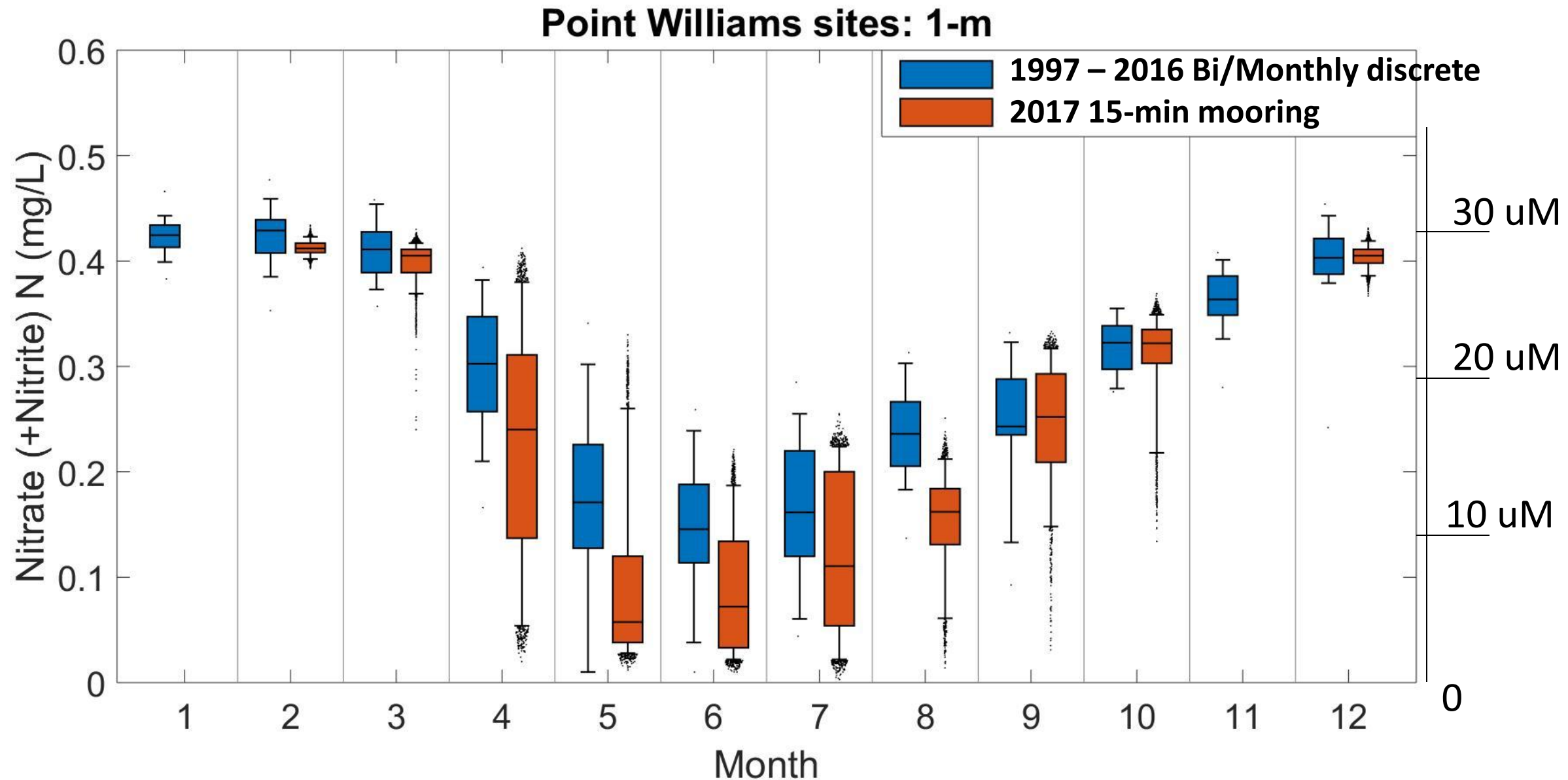


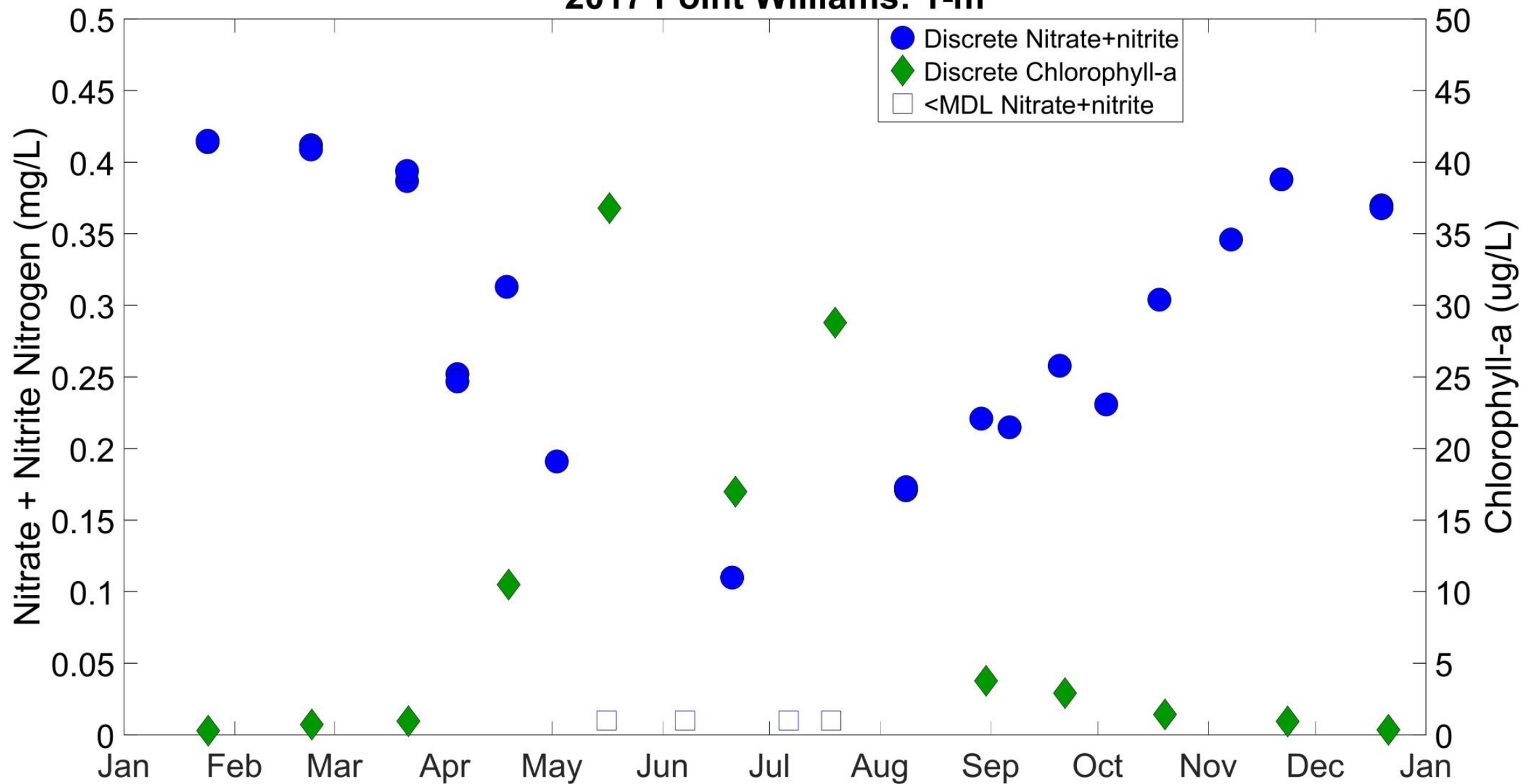
Figure 2. Rough time scales of physical, bio-optical, and biogeochemical processes along with time scales that are accessible with different sampling platforms. Figure is a schematic and is not to scale. Note: The mooring designation refers to both fixed location and AUVs and gliders used as virtual moorings (Griffiths et al., 1999b).

From Dickey & Chang, 2001

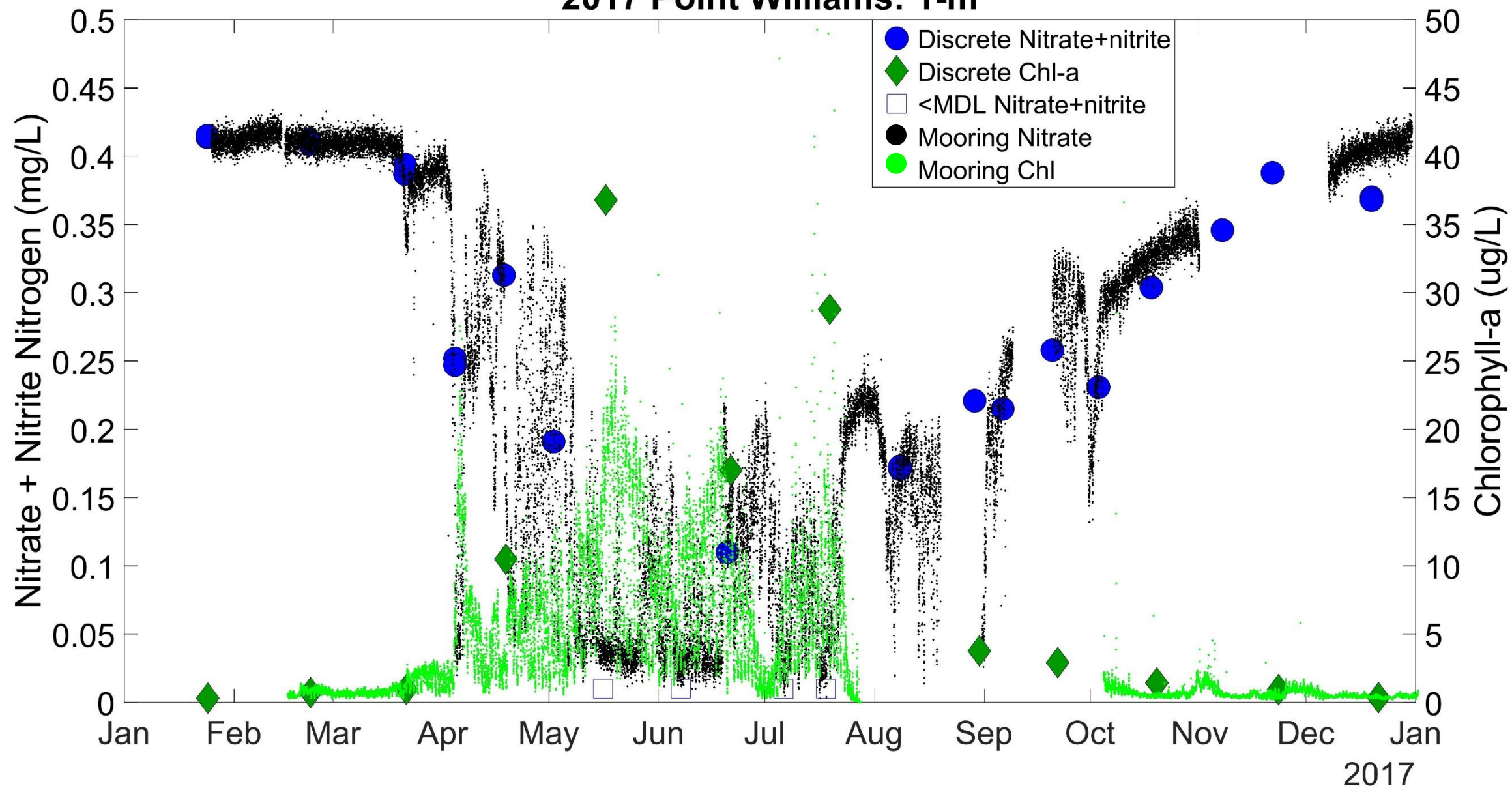
Variability in short and long time scales



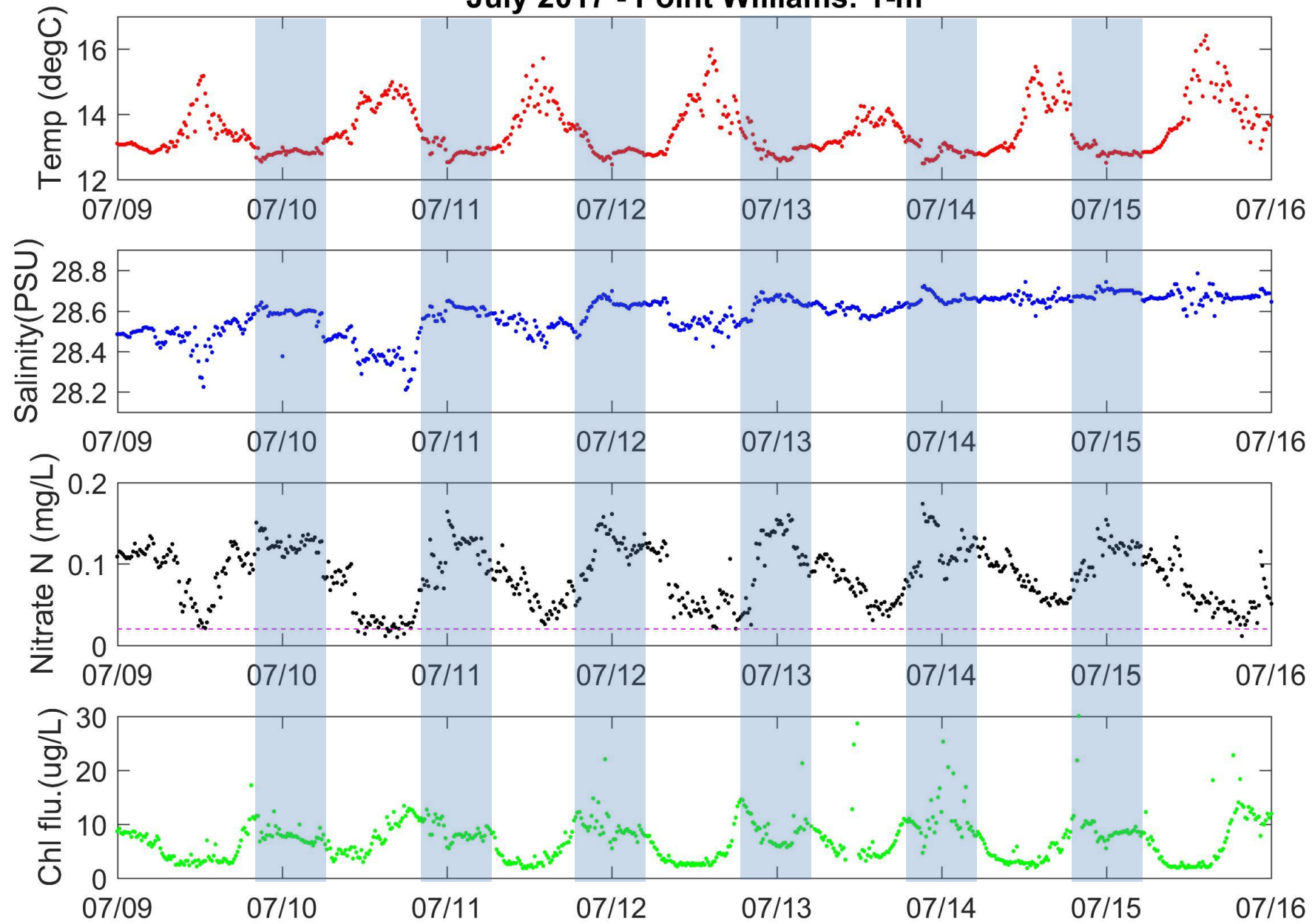
2017 Point Williams: 1-m



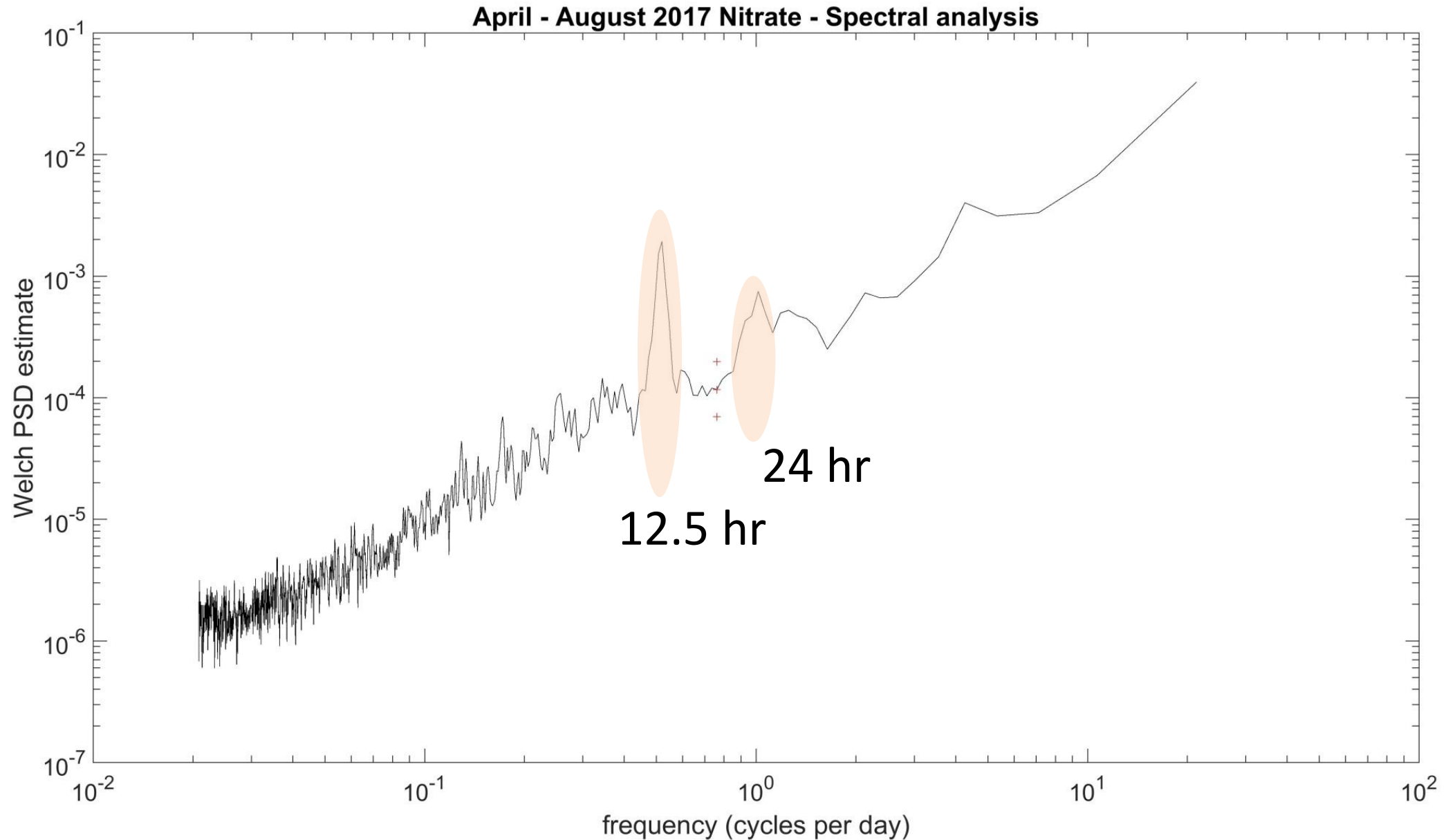
2017 Point Williams: 1-m



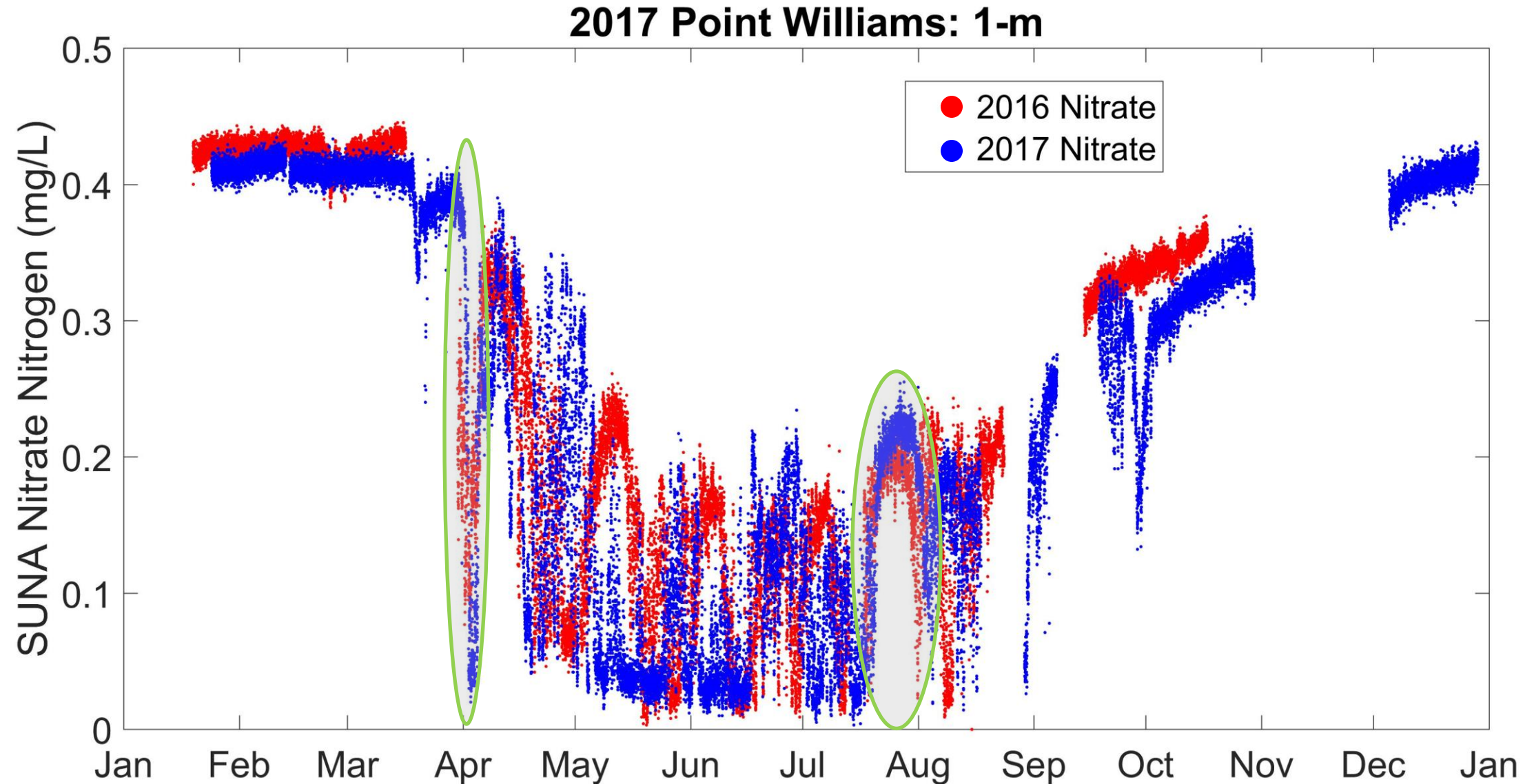
July 2017 - Point Williams: 1-m



Tidal and daily signals are significant

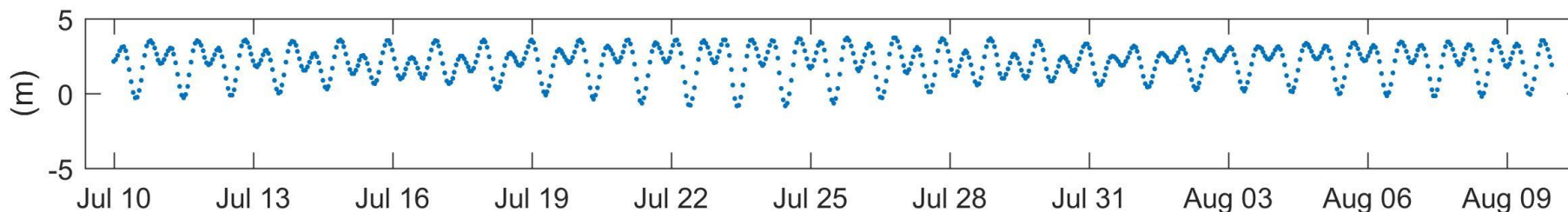


Surface Nitrate between years: 2016 vs. 2017

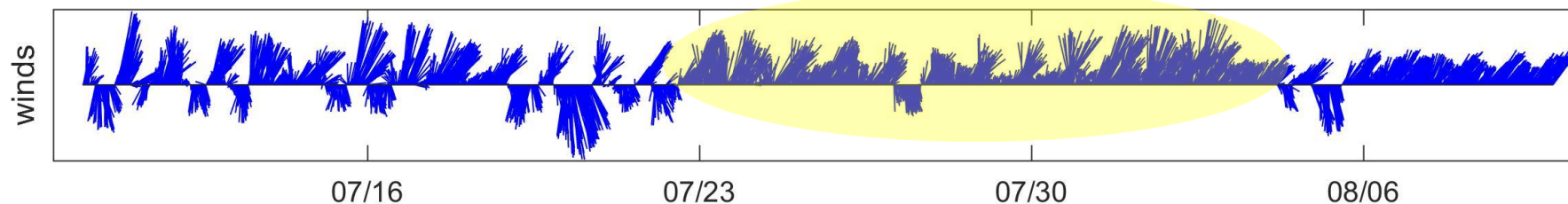


July – early August 2017

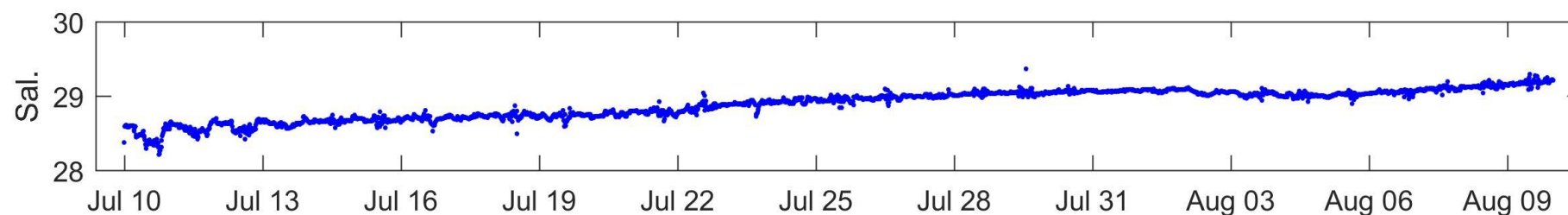
Water level
(NOAA)



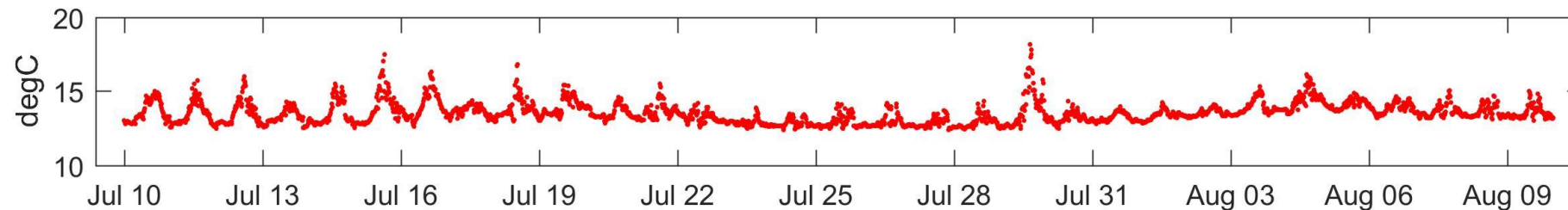
Winds at
WP light
(NOAA)



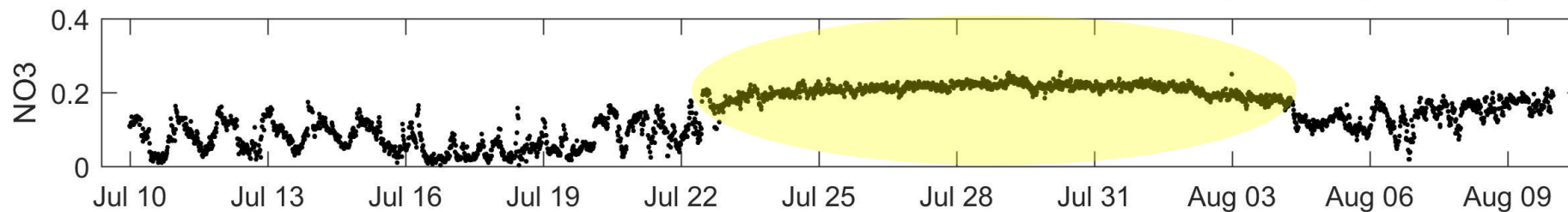
Surf.
Salinity



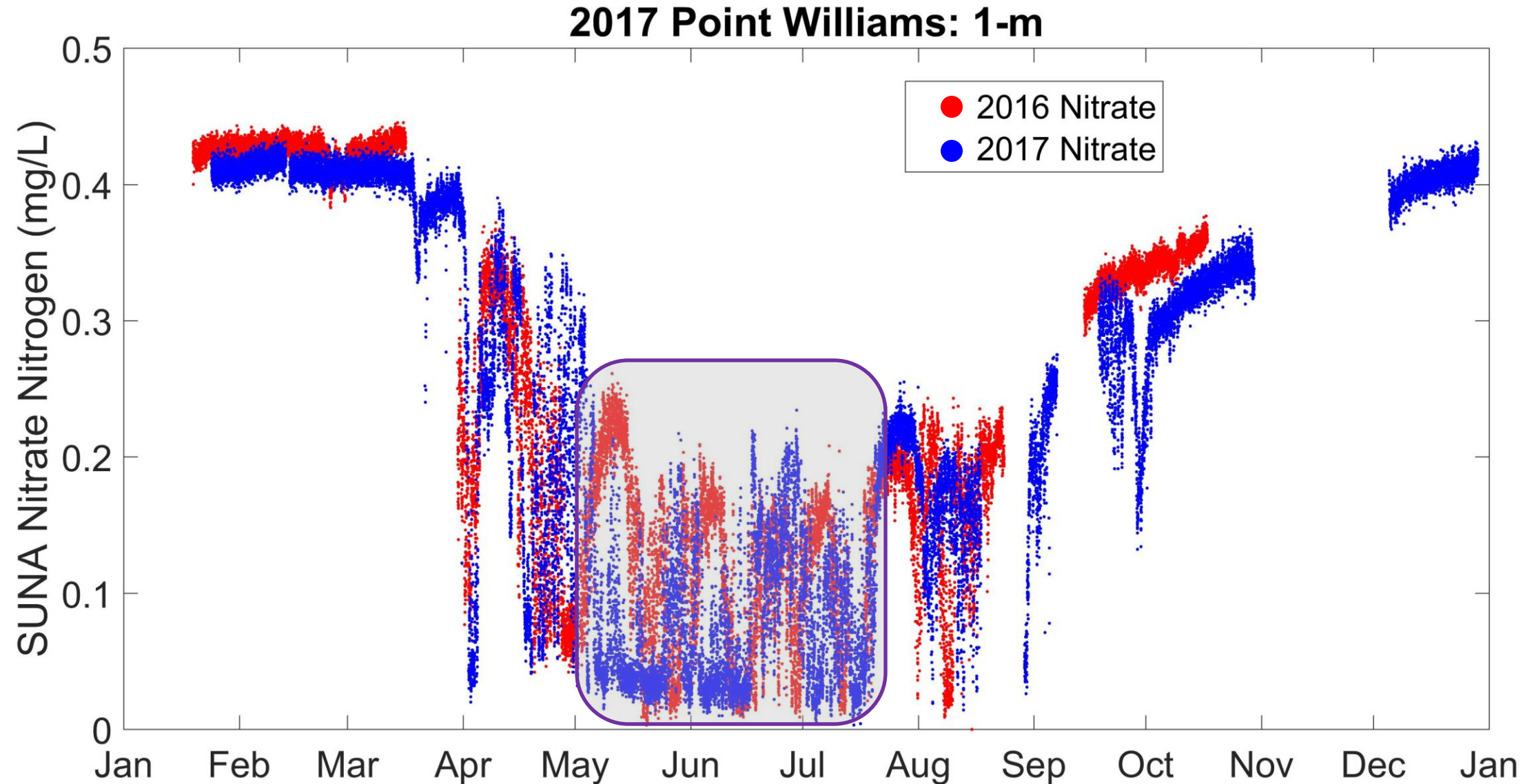
Surf.
Temp.



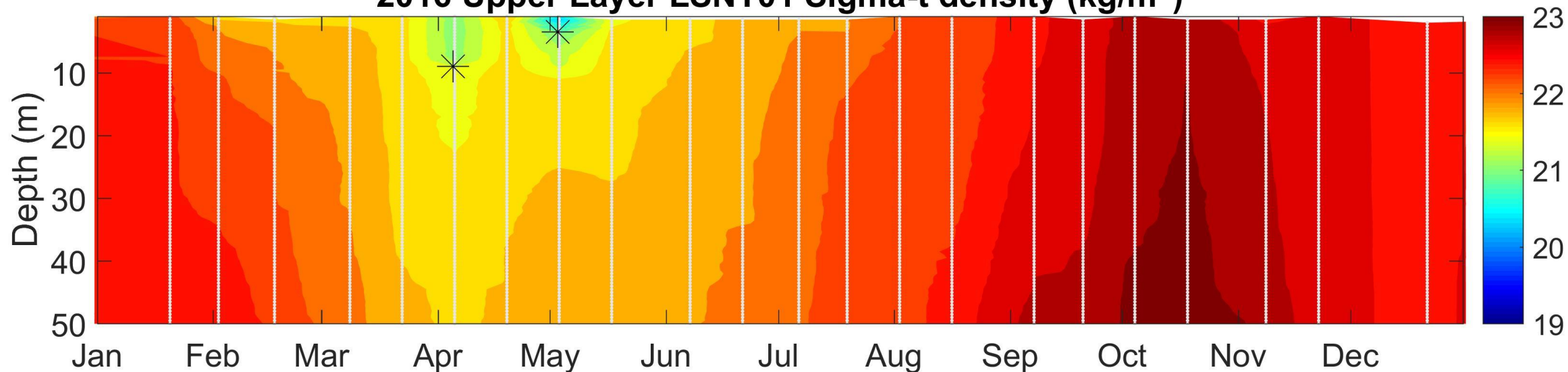
Surf.
Nitrate



Surface Nitrate between years: 2016 vs. 2017

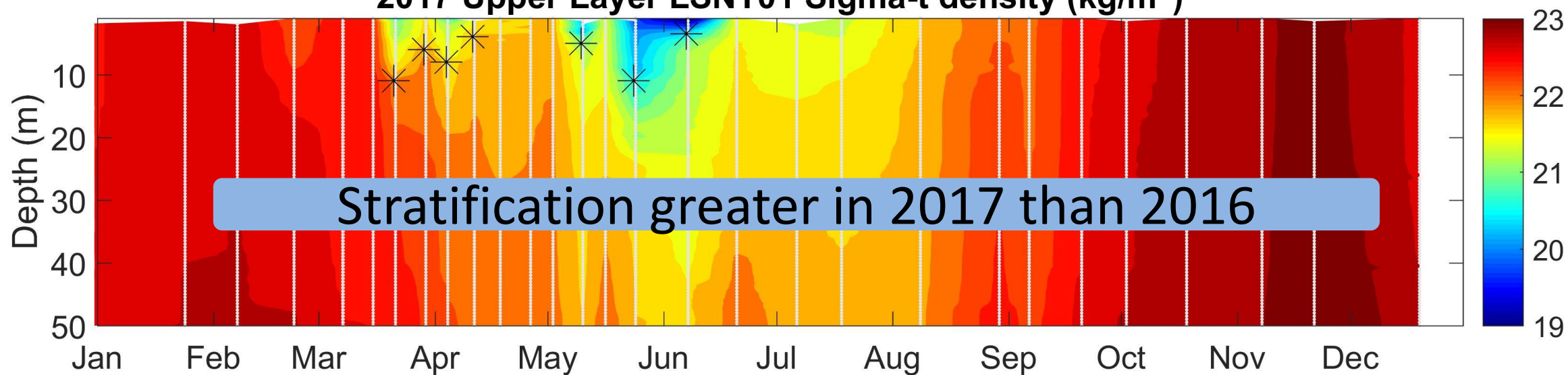


2016 Upper Layer LSNT01 Sigma-t density (kg/m³)

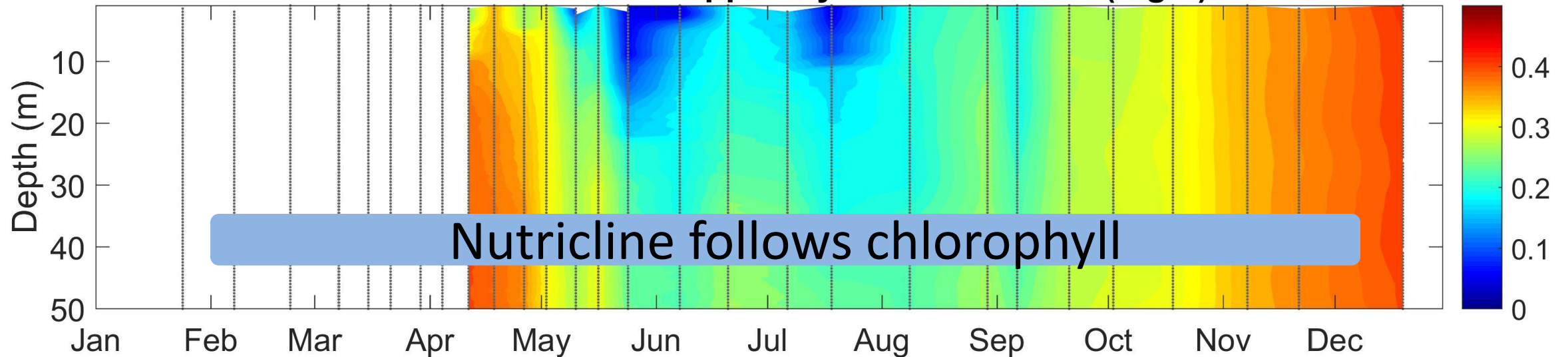


* = Depth of Max buoyancy frequency calculated as in S. Moore et. al 2008

2017 Upper Layer LSNT01 Sigma-t density (kg/m³)

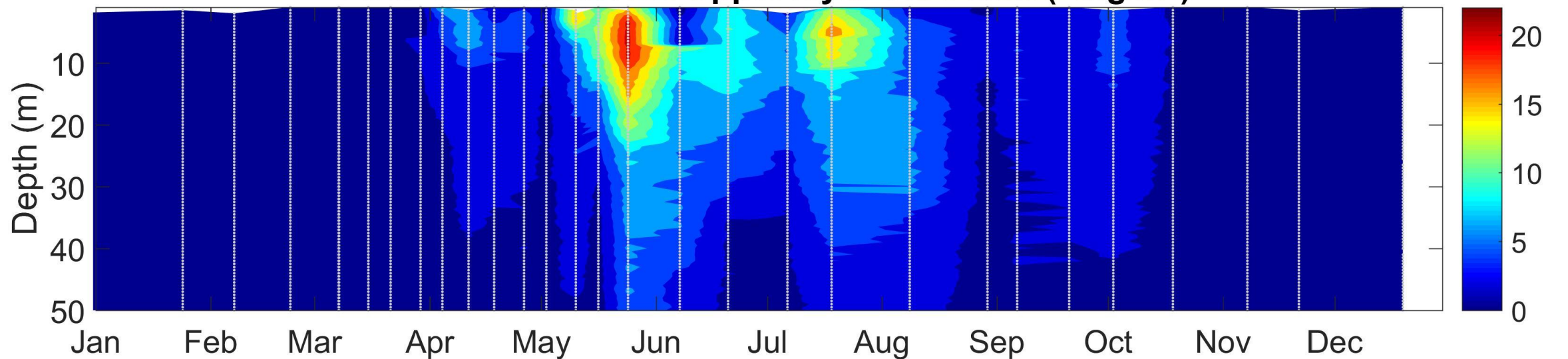


2017 Station LSNT01 Upper layer SUNA Nitrate (mg/L)

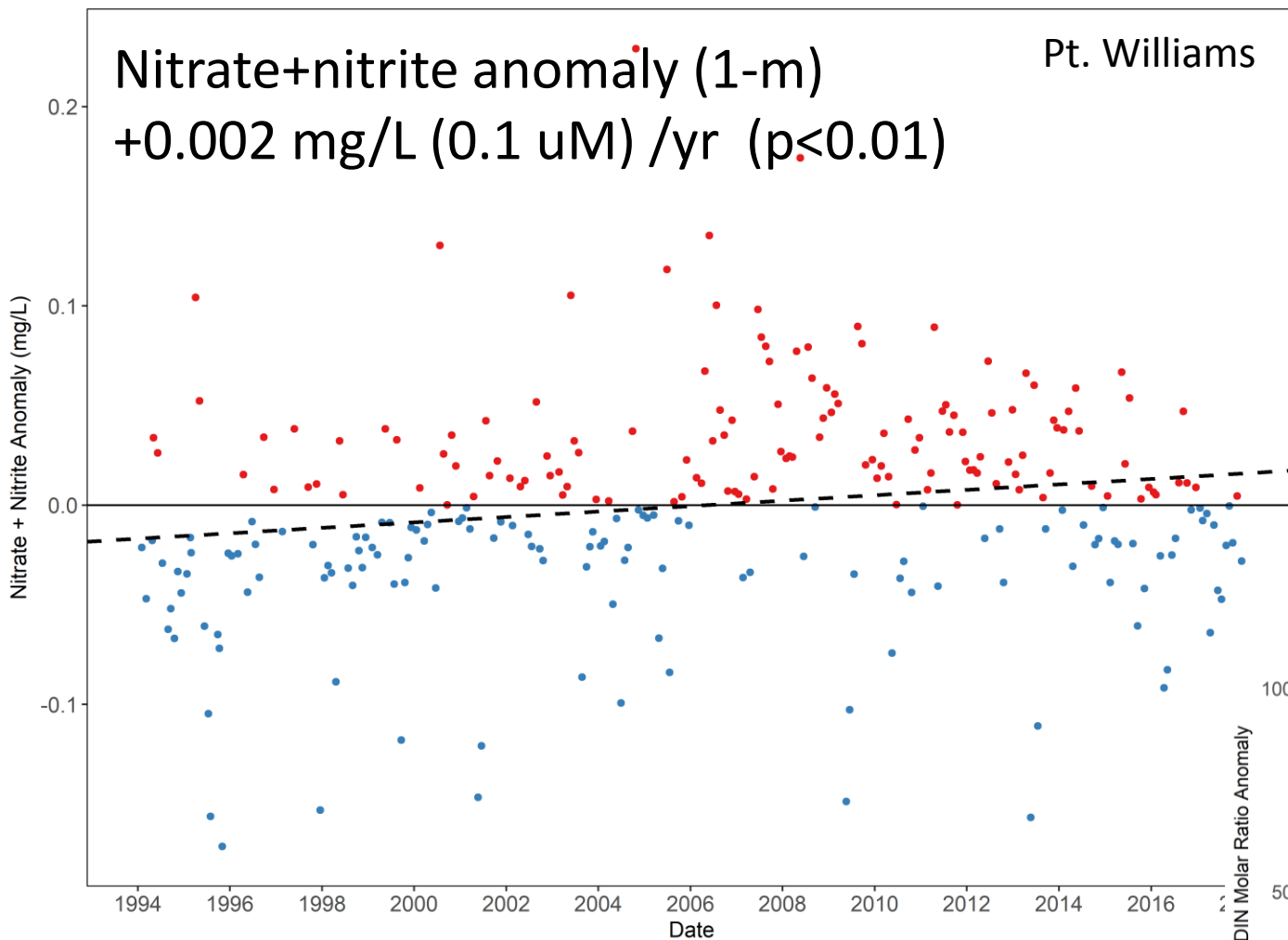


* = Depth of Max buoyancy frequency calculated as in S. Moore et. al 2008

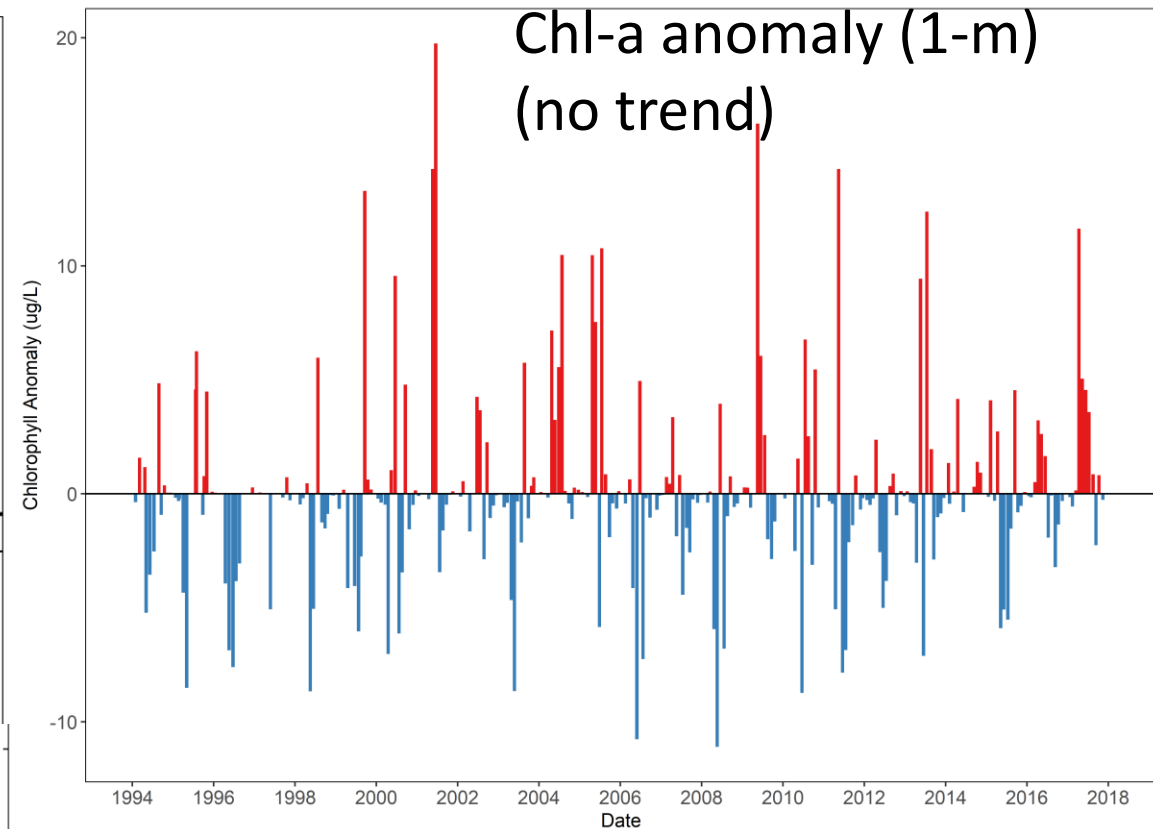
2017 Station LSNT01 Upper layer Chl Fluor. ($\sim\text{mg/m}^3$)



LSNT01 Surface

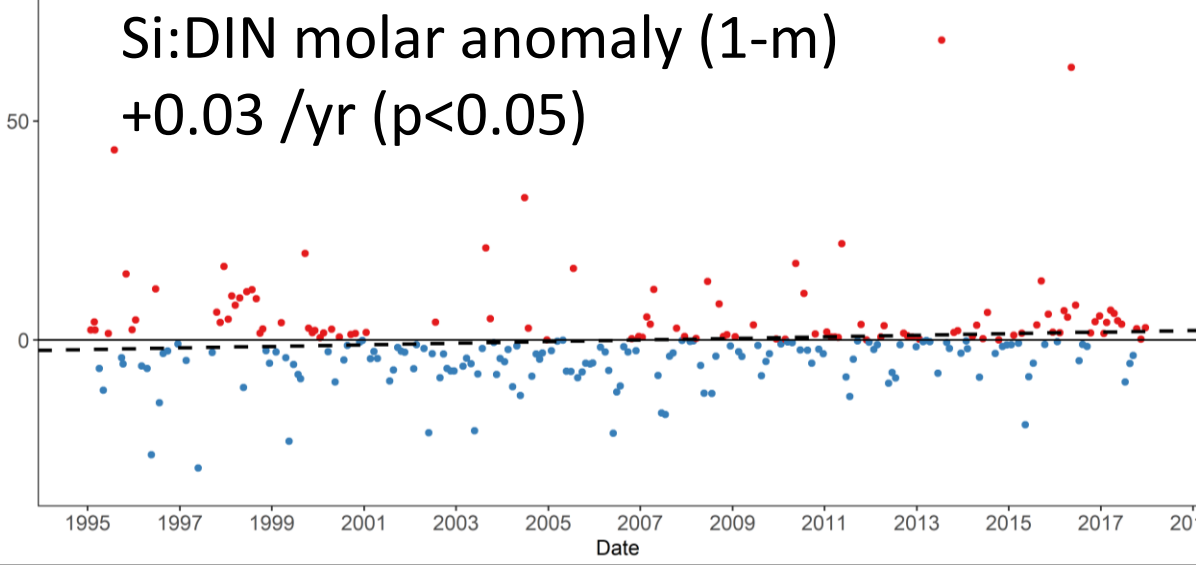


LSNT01 Surface



Si:DIN molar anomaly (1-m)
+0.03 /yr ($p < 0.05$)

Si:DIN Molar Ratio Anomaly



Consider drivers when
evaluating change over time

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



2017 Station LSNT01 SUNA Nitrate (mg/L)

