# Long term monitoring of two fixed sites in the upper Narragansett Bay: A trend analysis

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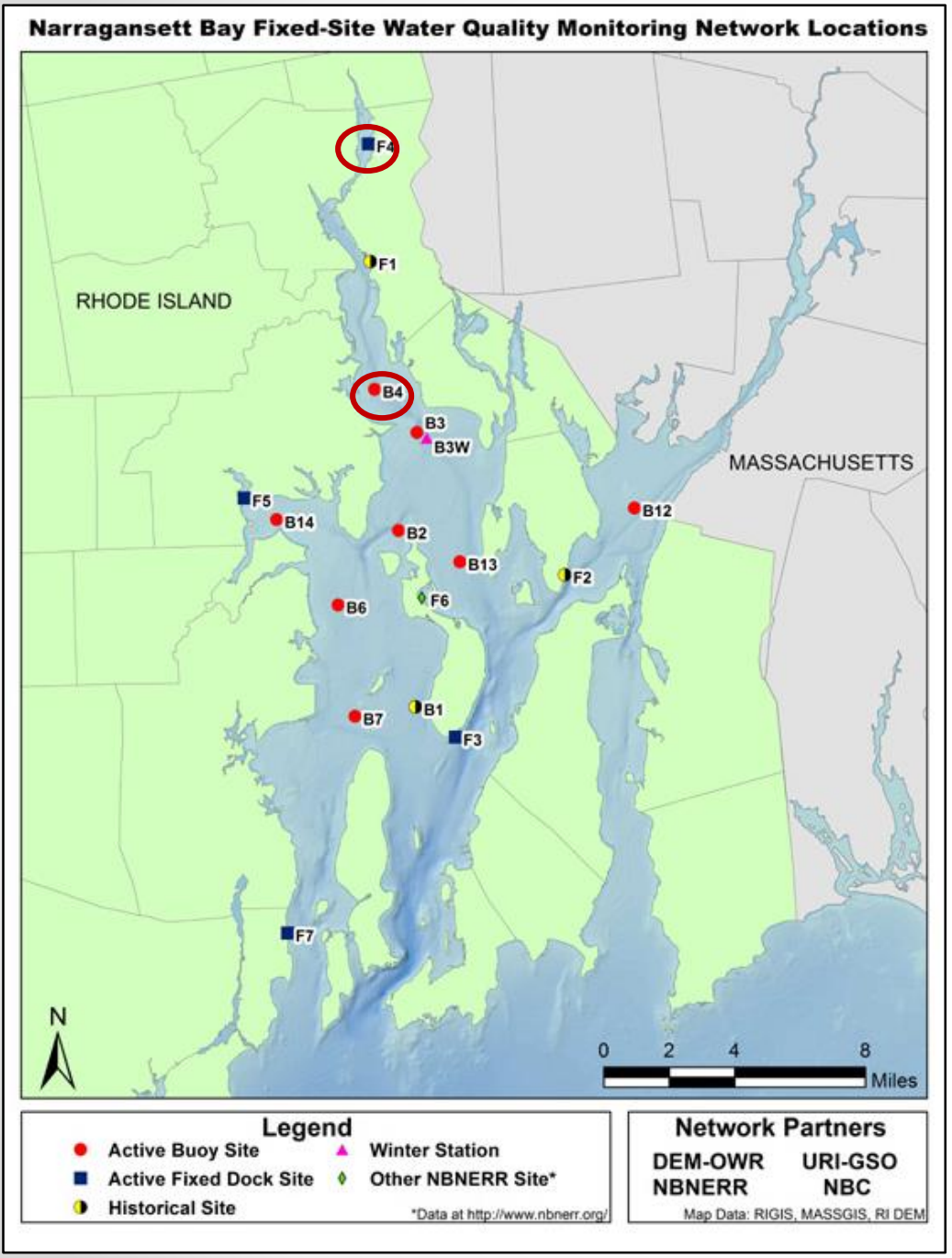
Narragansett Bay Commission
Spring NEERS, April 28, 2018

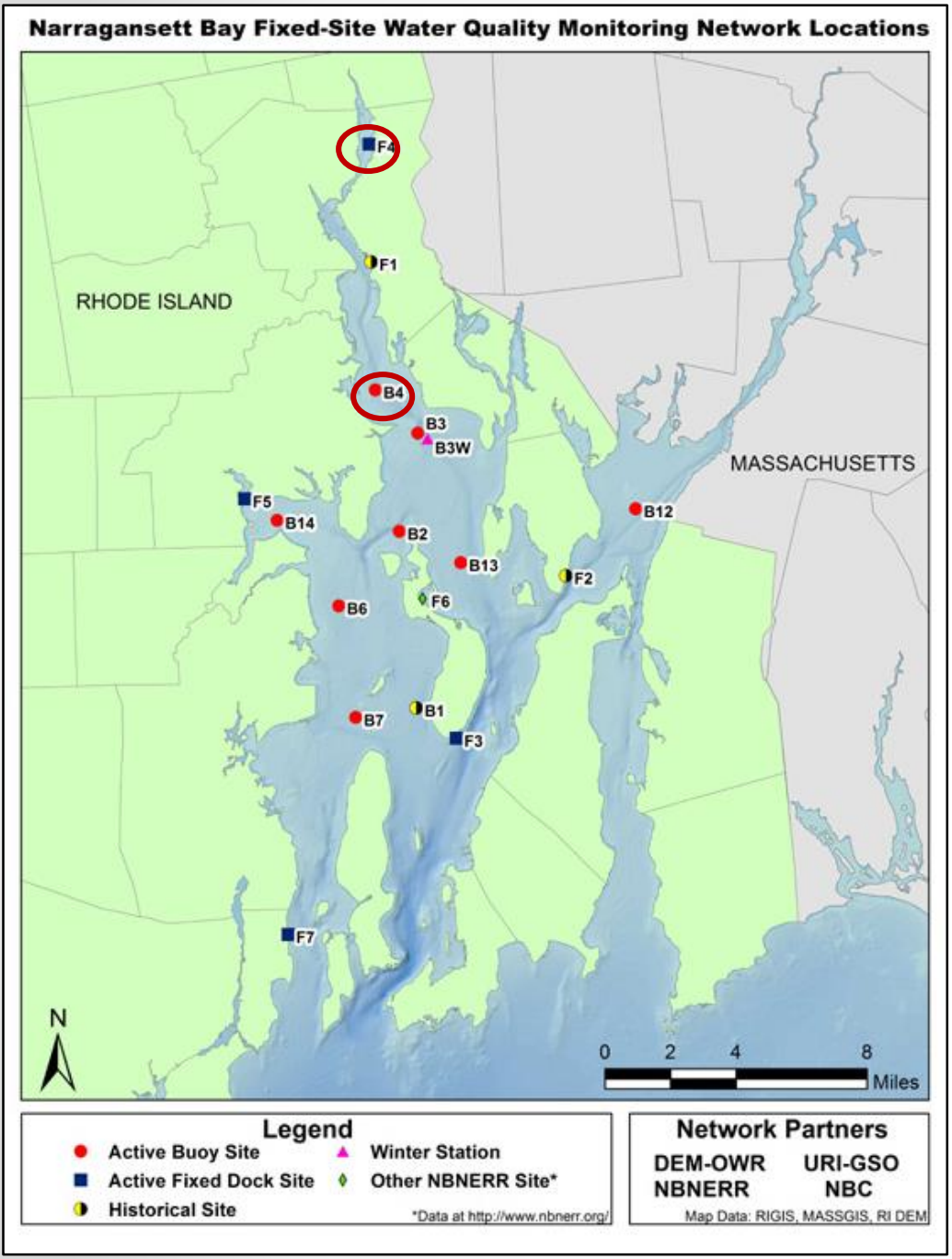
# NBC and why monitor?

- NBC is the owner and operator of the two largest WWTFs in RI – Bucklin Point and Field's Point
- Mandated nitrogen reductions in 2014 to 5 mg/L
- Lower N will lead to reduced hypoxia




- Narragansett Bay Fixed Site Monitoring Network (NBFSMN) –
  - 14 buoy or dock site
- Collaboration of 4 entities
- NBC has 2 sites

http://www.dem.ri.gov/programs/emergencyresponse/bart/stations





- Part of NBCs RIPDES permit to monitor as of 2017

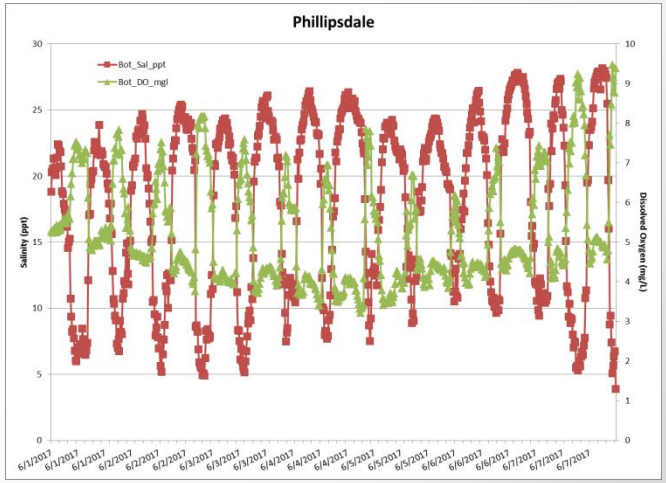
http://www.dem.ri.gov/programs/emergencyresponse/bart/stations

# Bullock Reach

- Early 2000's (EPA grant)
- Buoy site w/ 3 depths
  - Surface - ~0.5 – 1.0
  - Mid - ~3.0 – 4.0 m
  - Bottom - ~7.0- 8.0 m
- YSI 6-series sondes
  - C/T, Dissolved Oxygen, pH, Chlorophyll (surface and mid), turbidity (bottom)
  - Every 15 minutes
- Telemetered and reported near real-time on NBC website (http://snapshot.narrabay.com)
- Seasonal – May – November

# Phillipsdale

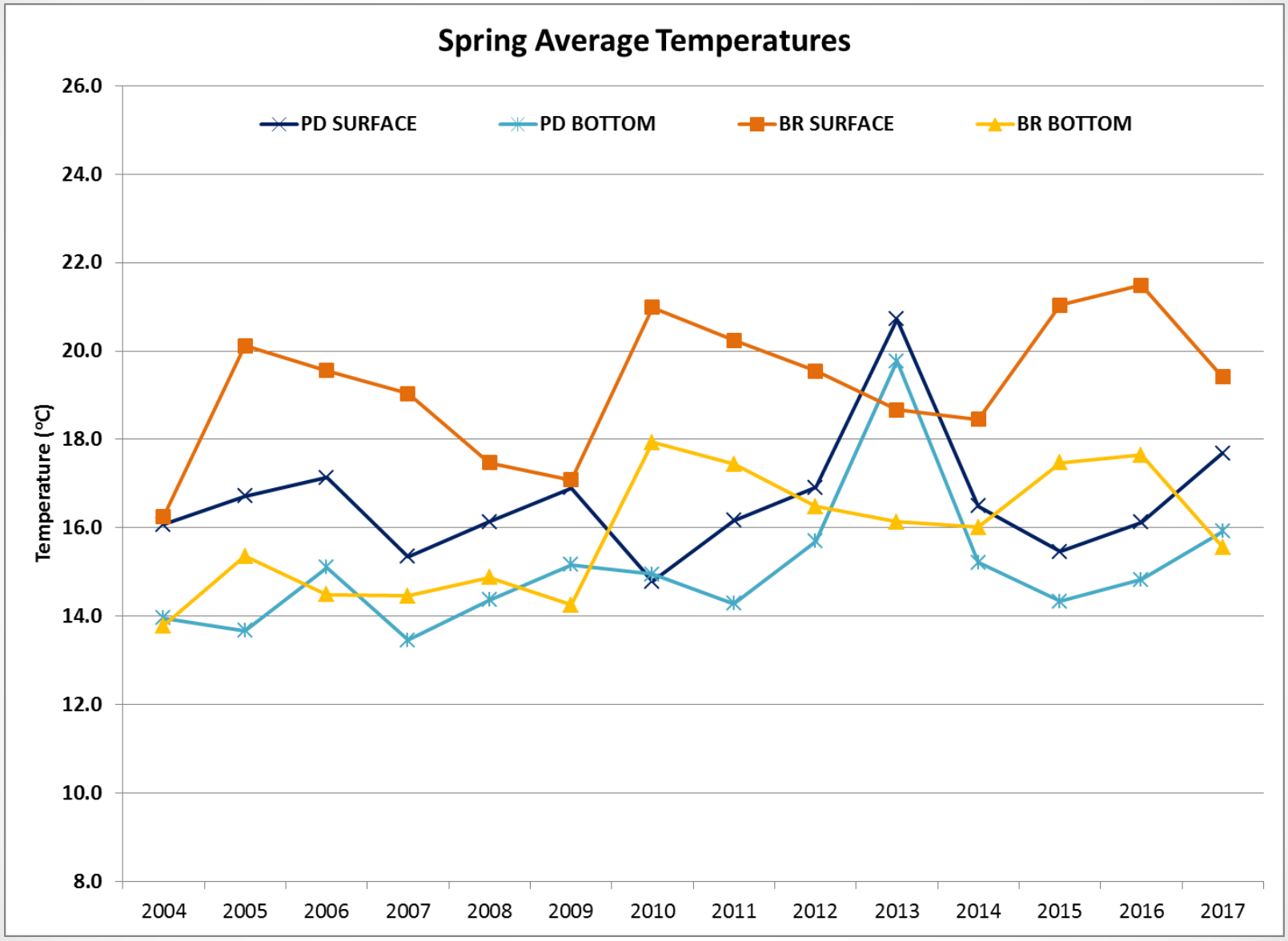
- 2004
- Dock site with 2 depths
  - Surface – ~0.5 m
  - Bottom – ~2.0 m
- Highly affected by Blackstone River and tidal fluctuations, can have large daily swings in salinity and DO
- YSI 6-series sondes
  - C/T, Dissolved Oxygen, pH, Chlorophyll (surface)
  - Every 15 minutes
- Telemetered and reported near real-time on NBC website
- In most of the year, taken out when icing in Seekonk occurs (Jan/Feb)
-



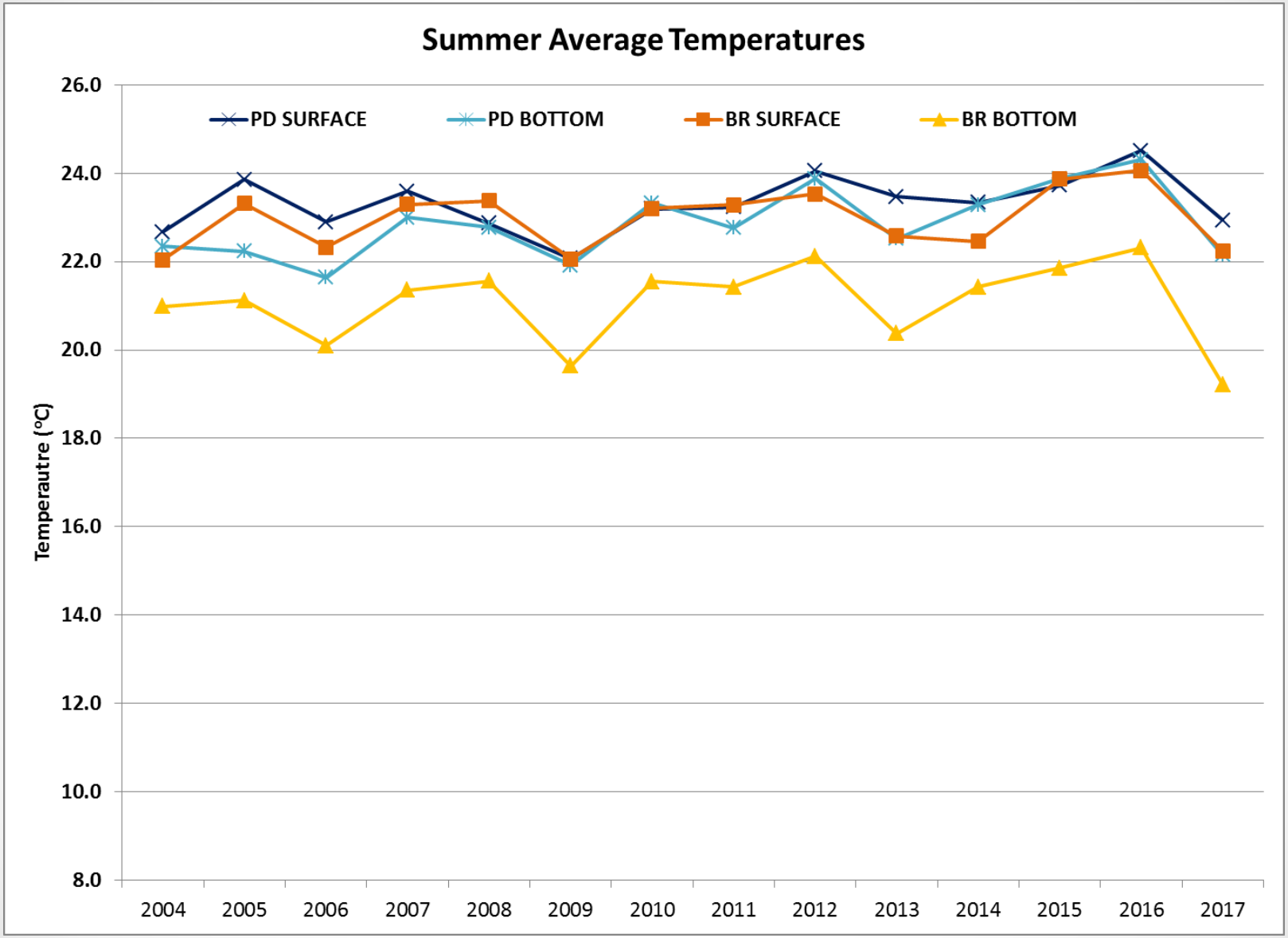
# Analysis

- Data 2004 - 2017
  - Spring (Apr-May-June)
  - Summer (July-Aug-Sept)
  - Fall (Oct-Nov-Dec)
- 15 minute data averaged seasonally each year
- n per season/per parameter varies

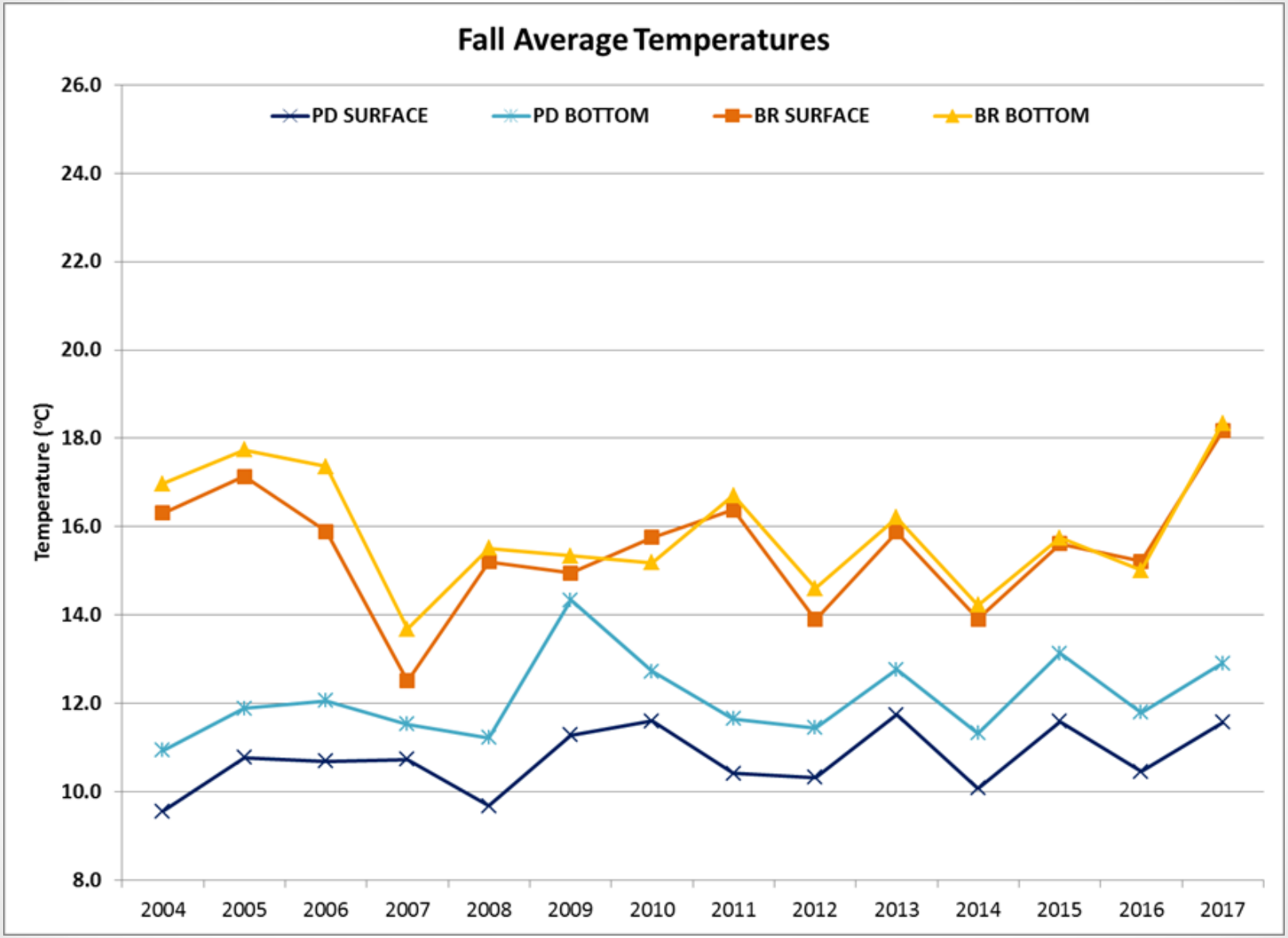
# Spring Average Temperatures



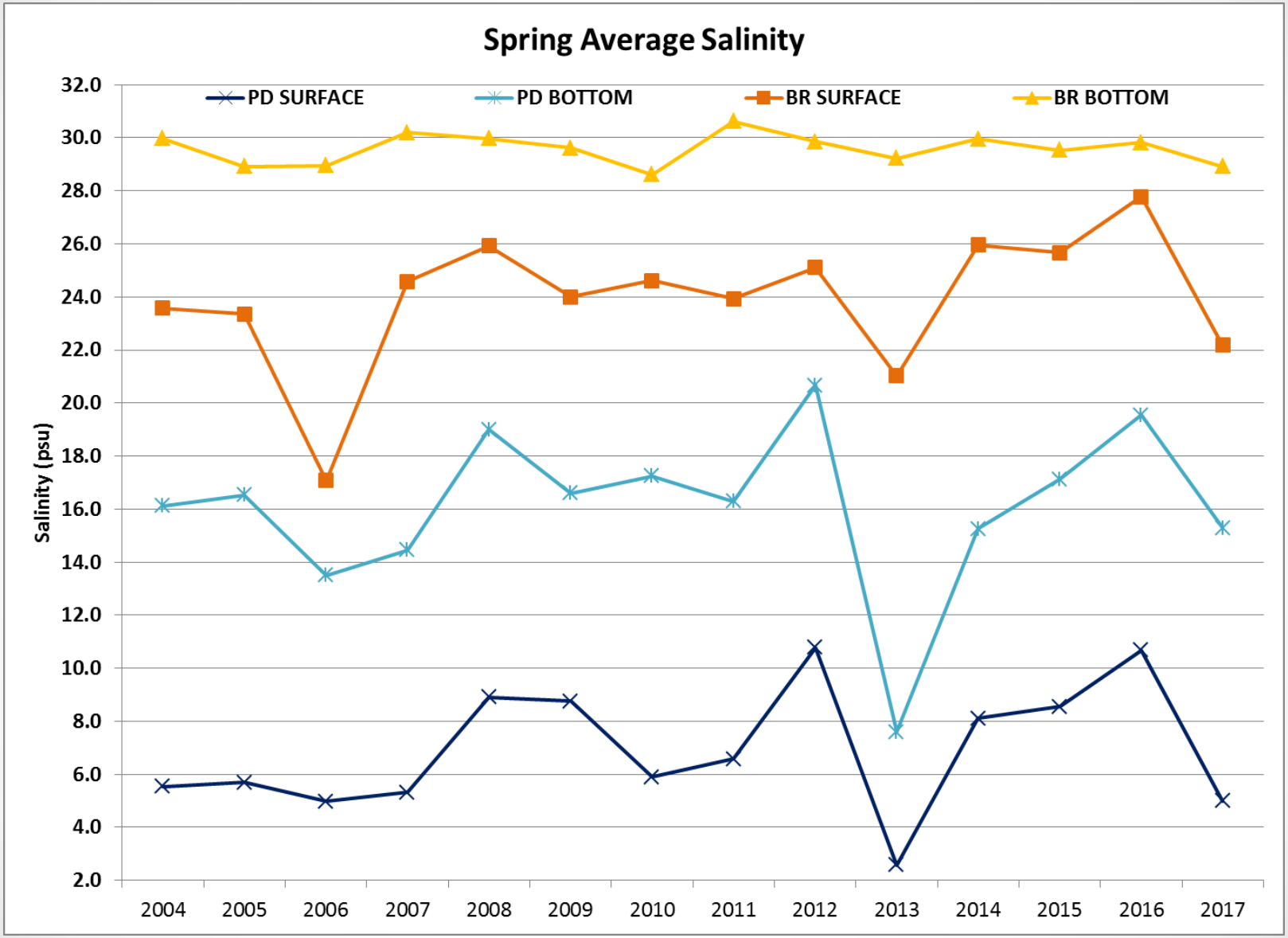
# Summer Average Temperatures



# Fall Average Temperatures



# Spring Average Salinity



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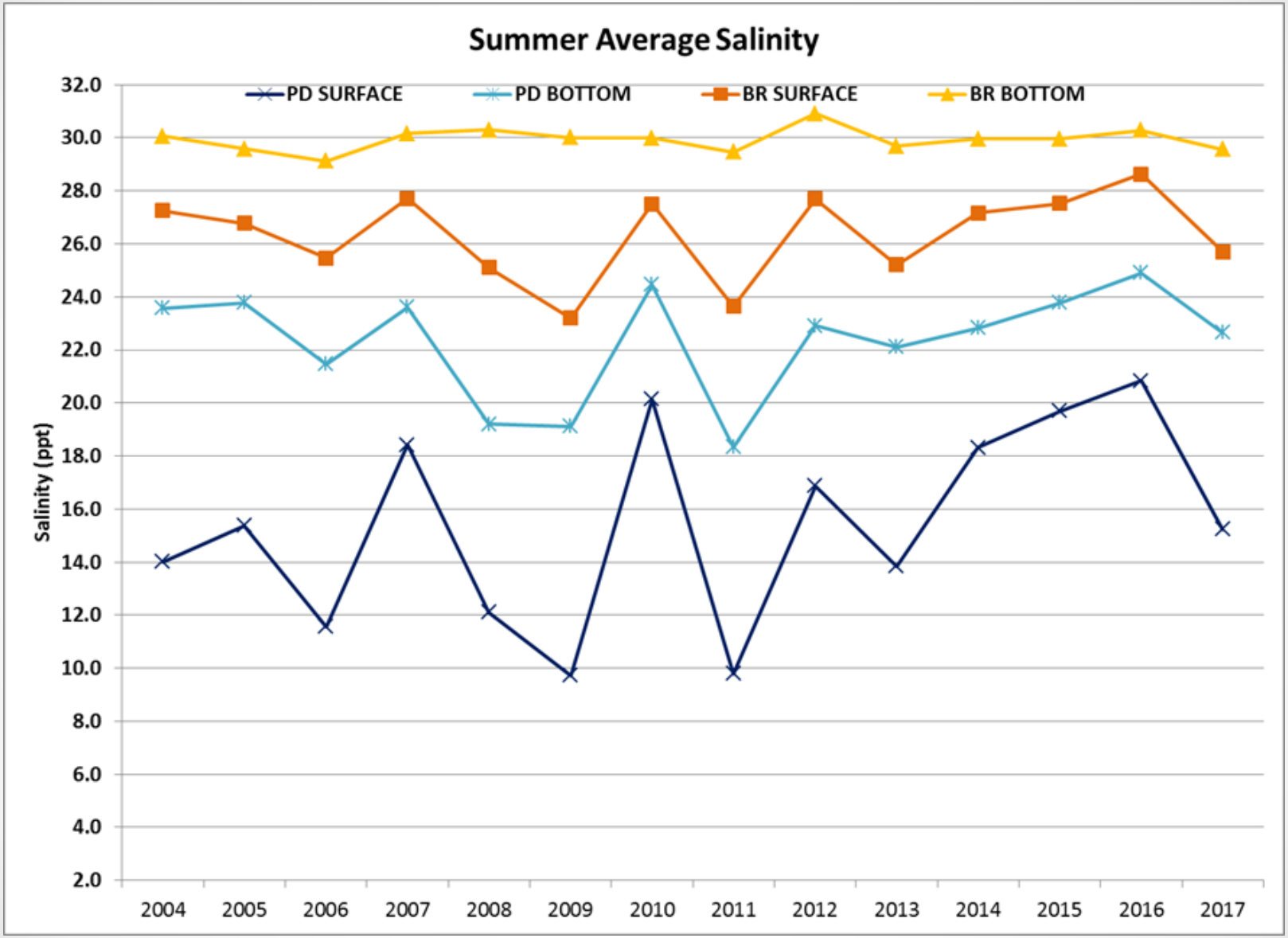

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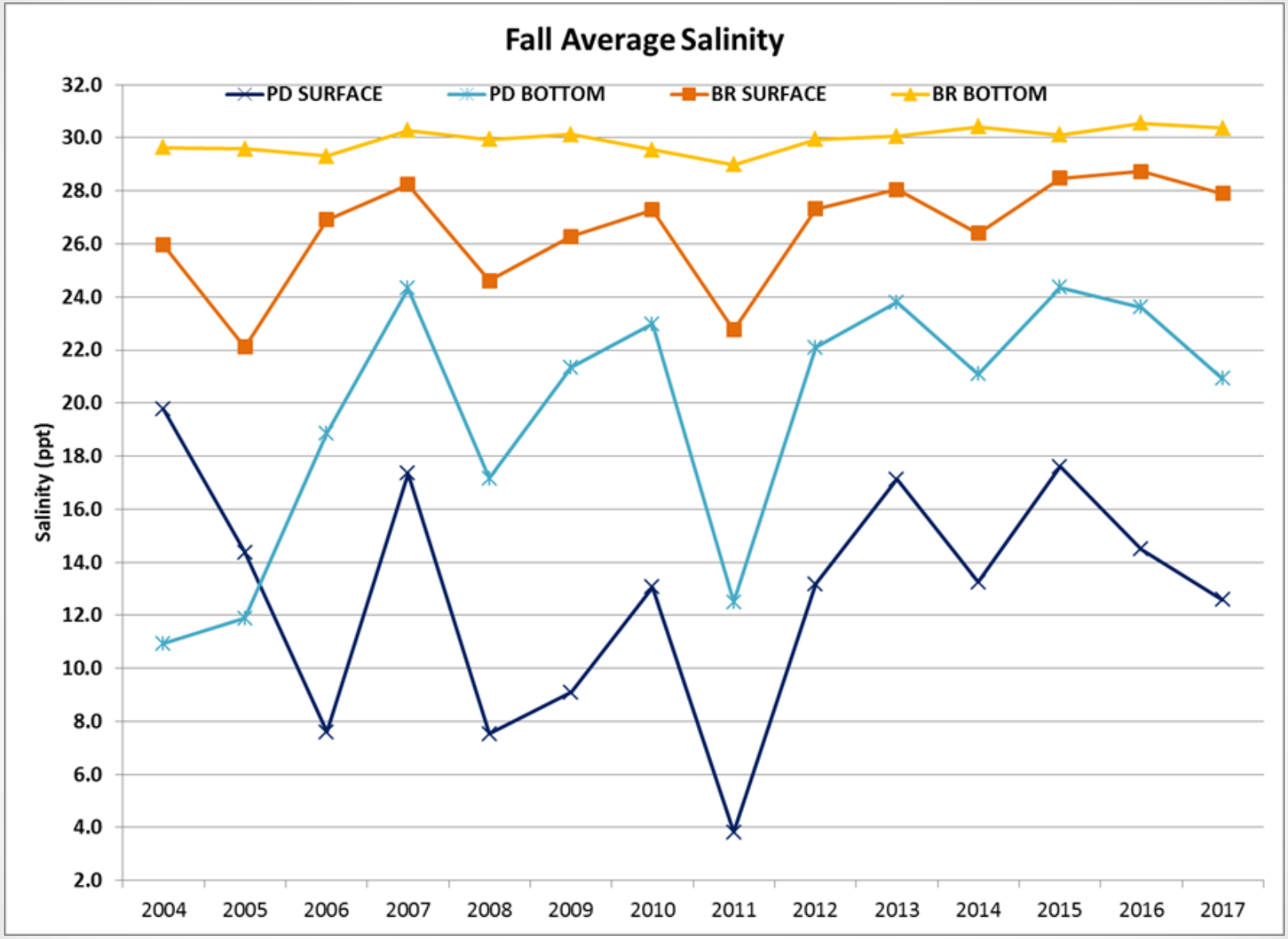
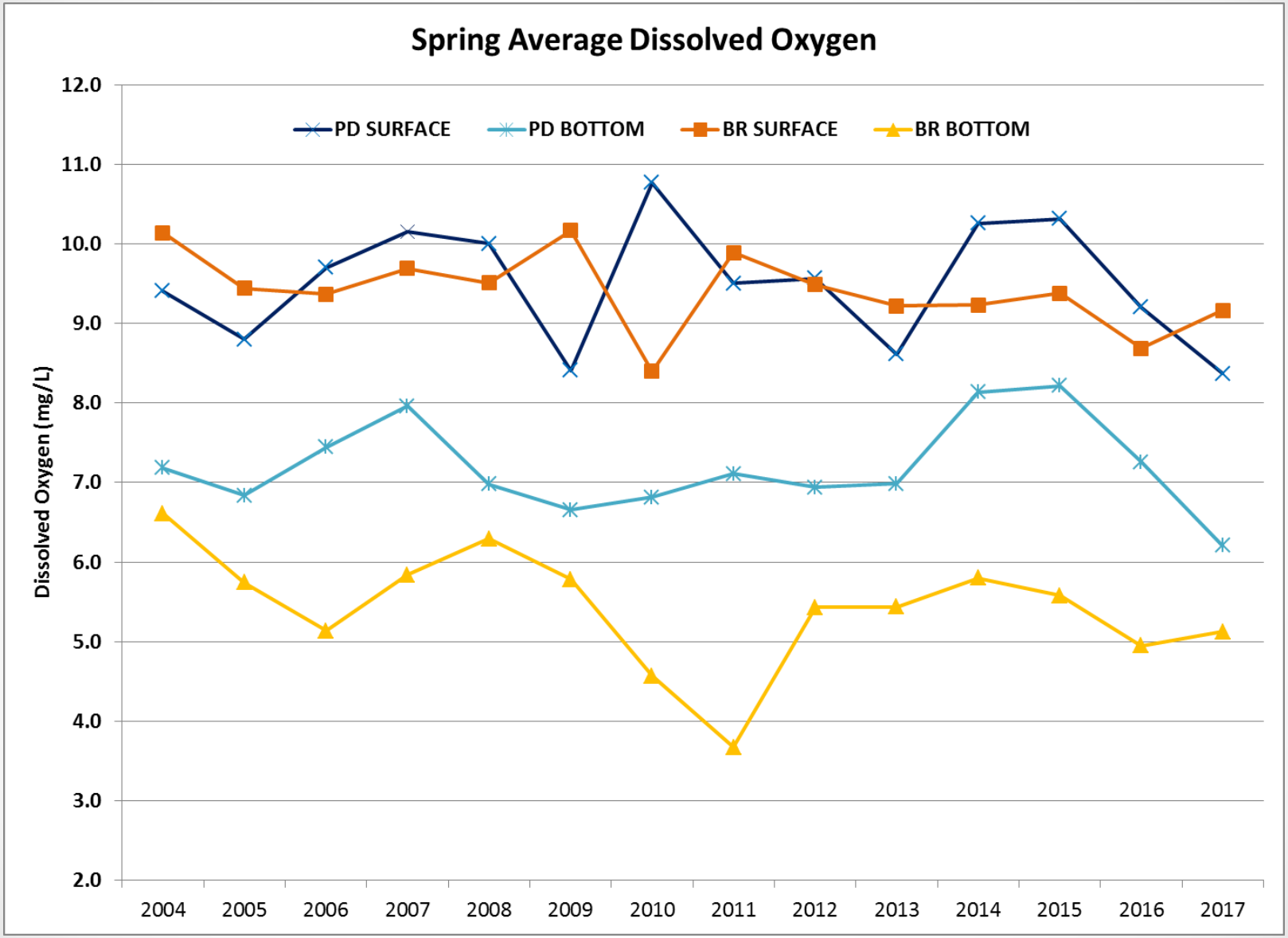


# Spring Average Dissolved Oxygen



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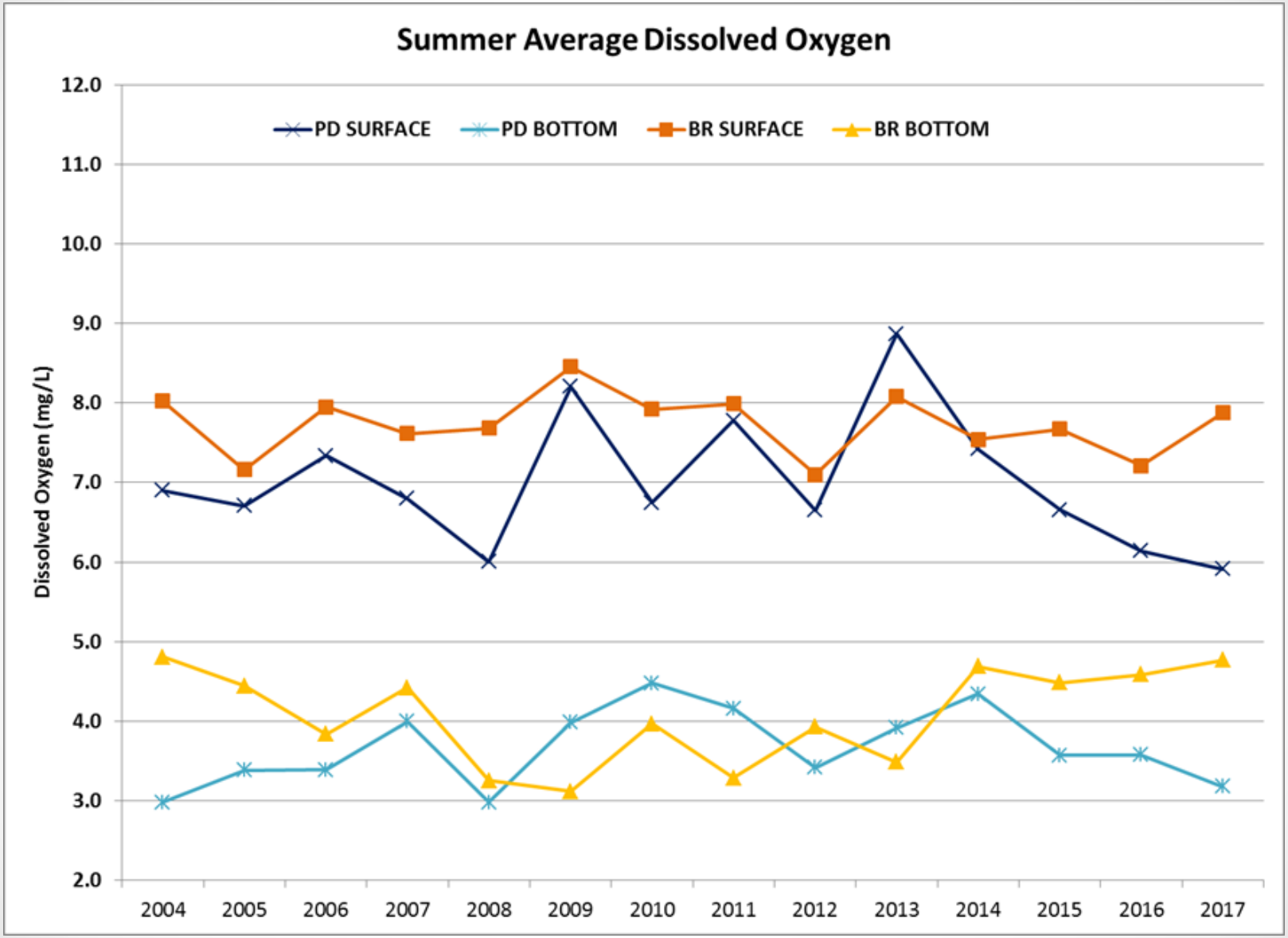

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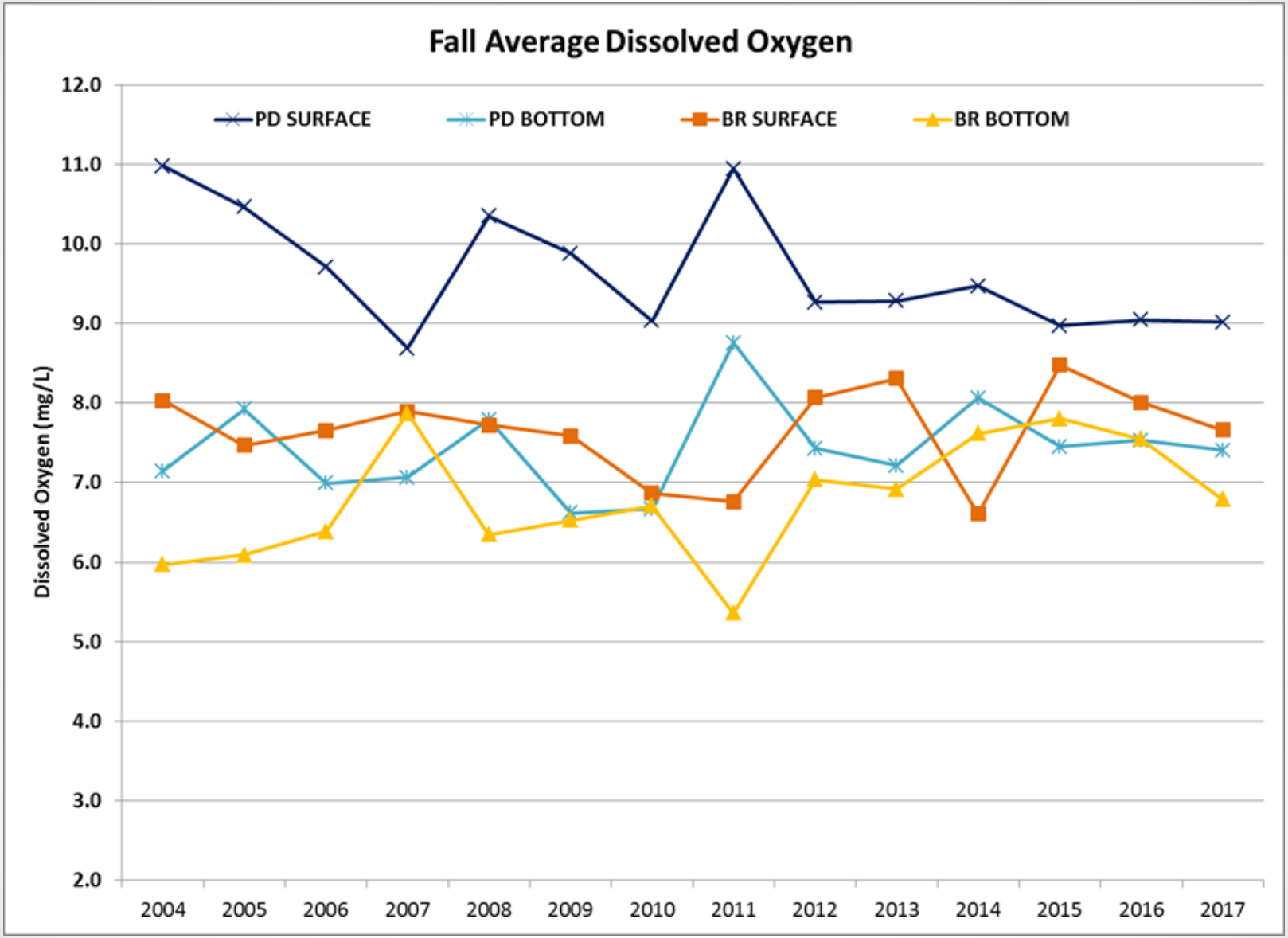
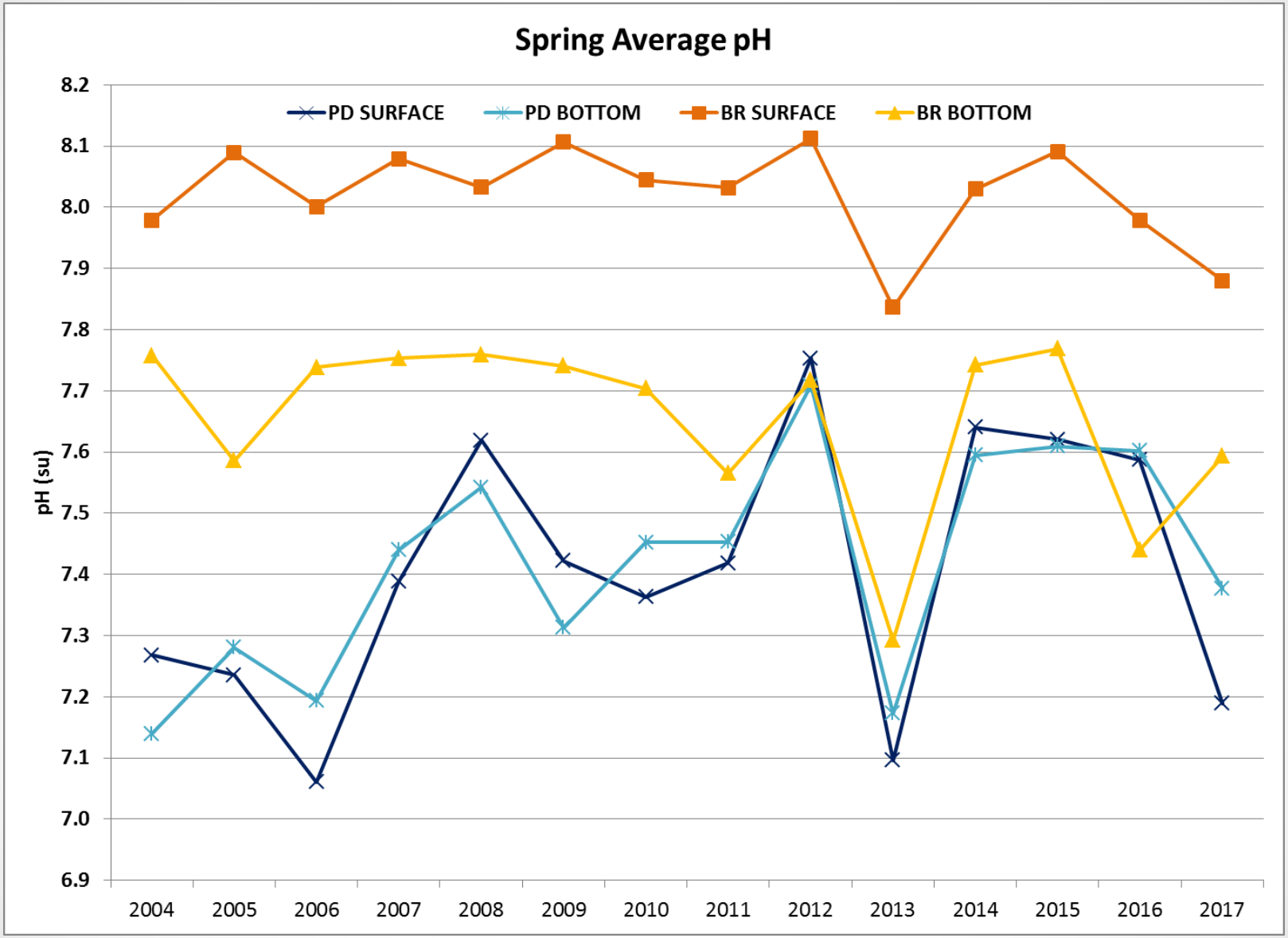


# Spring Average pH



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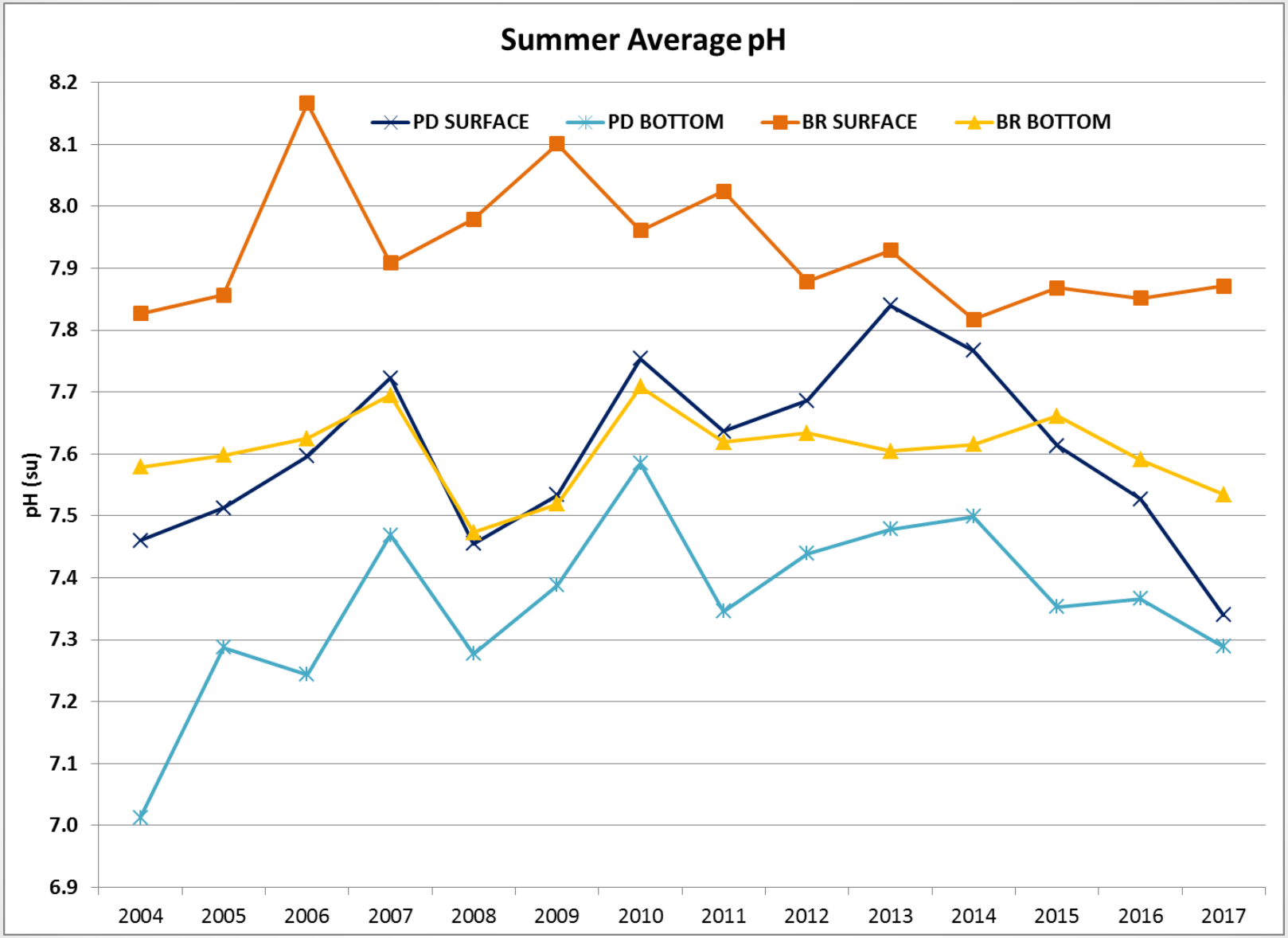

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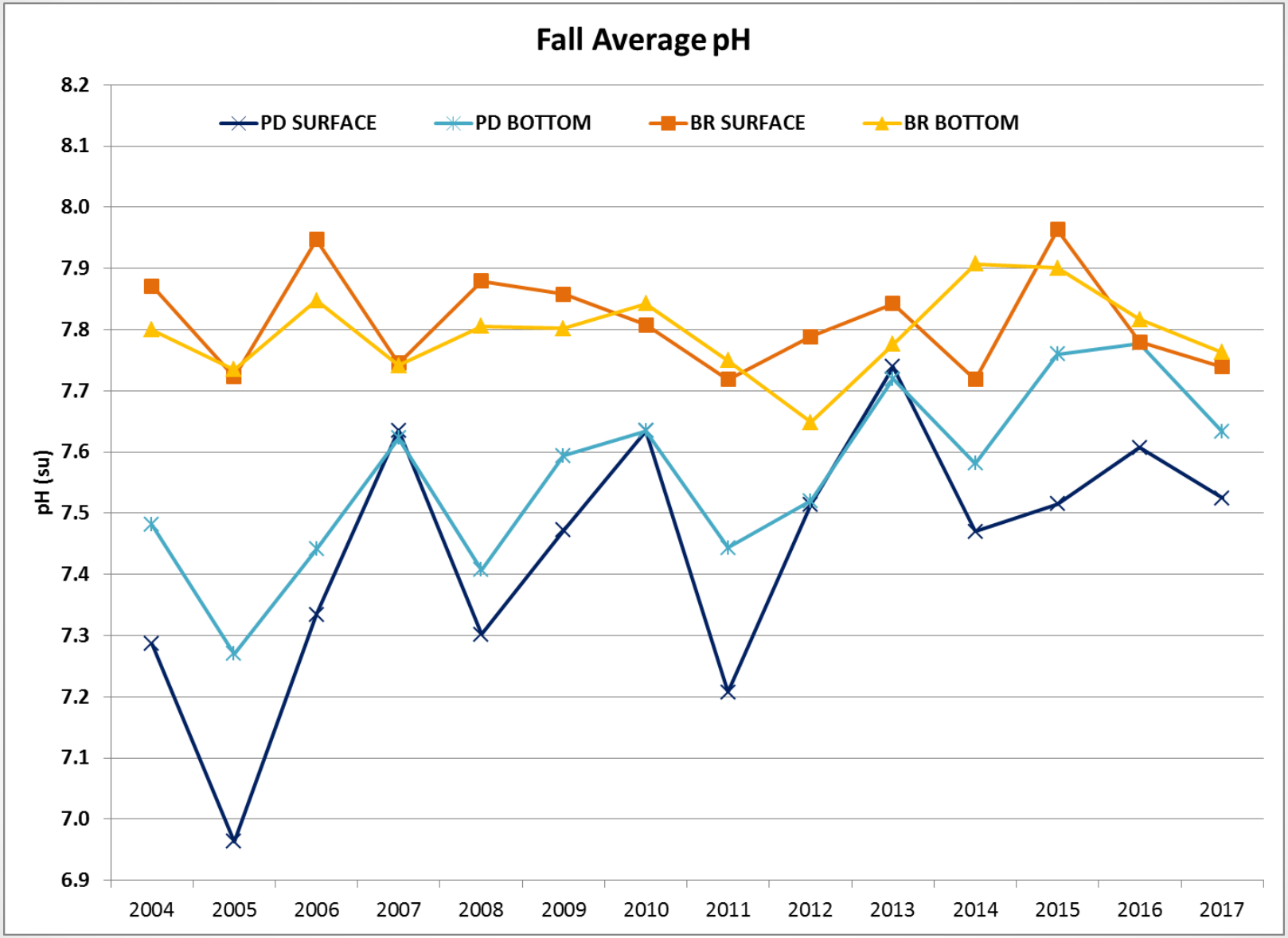
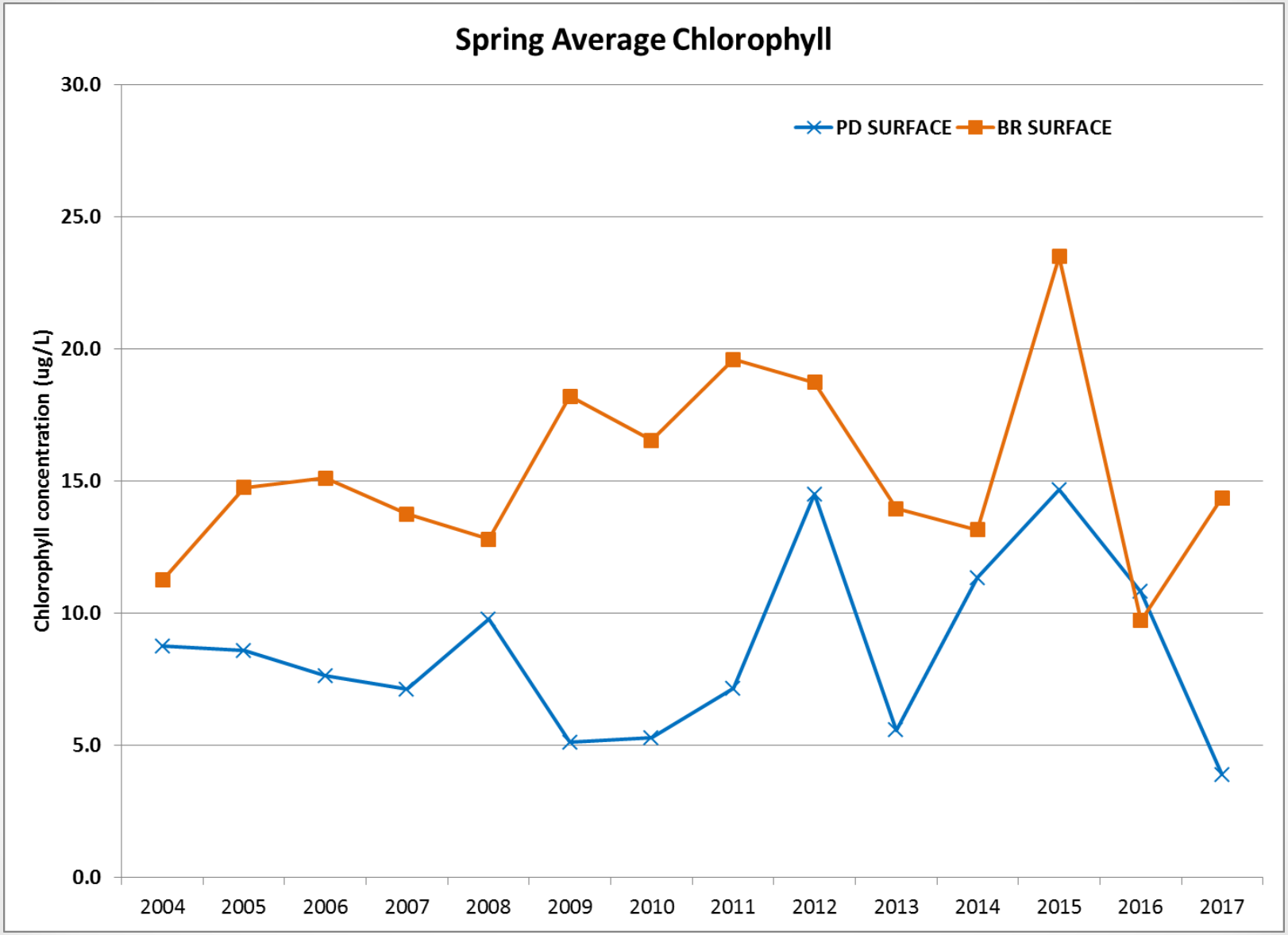


# Spring Average Chlorophyll



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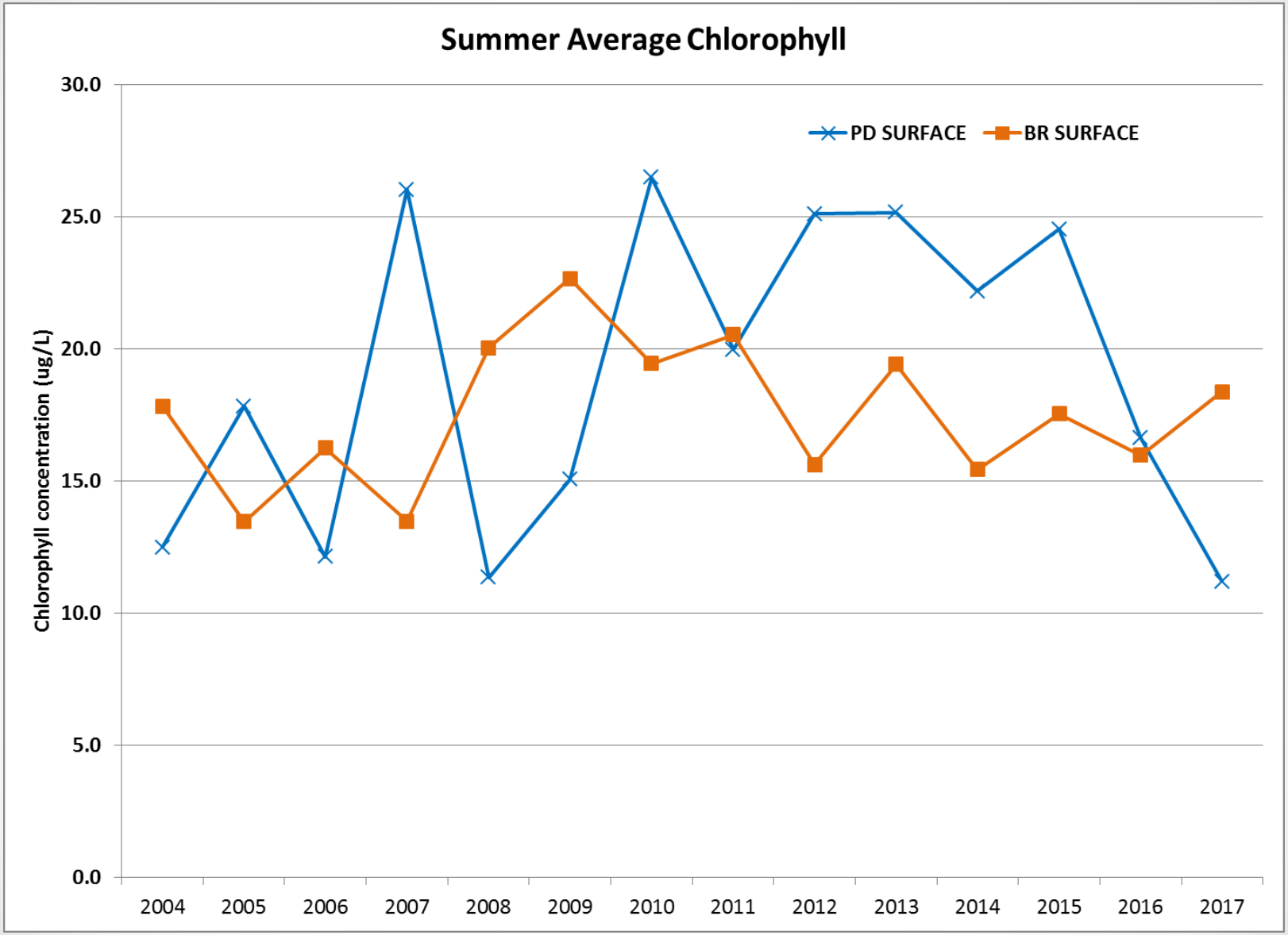

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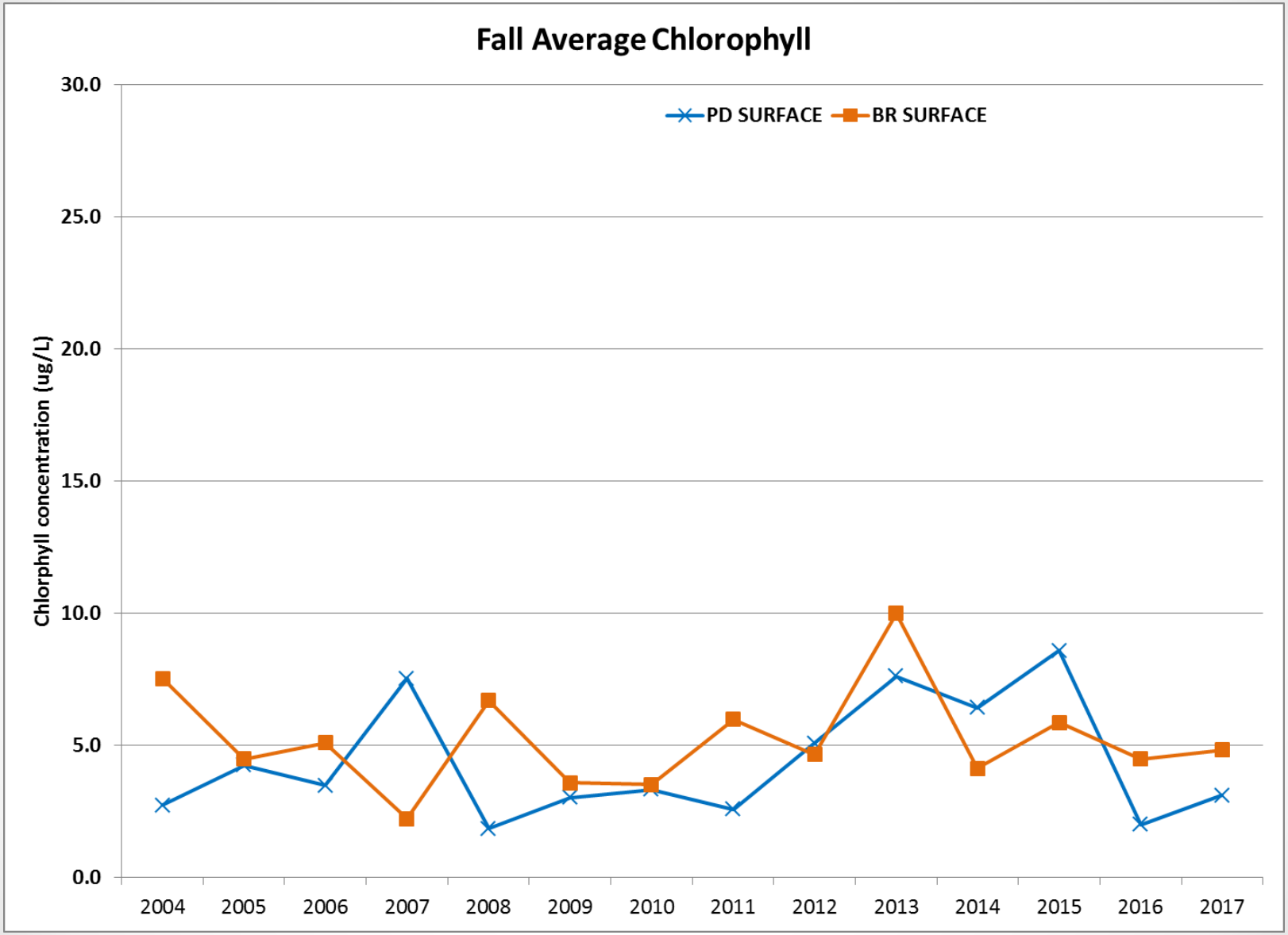
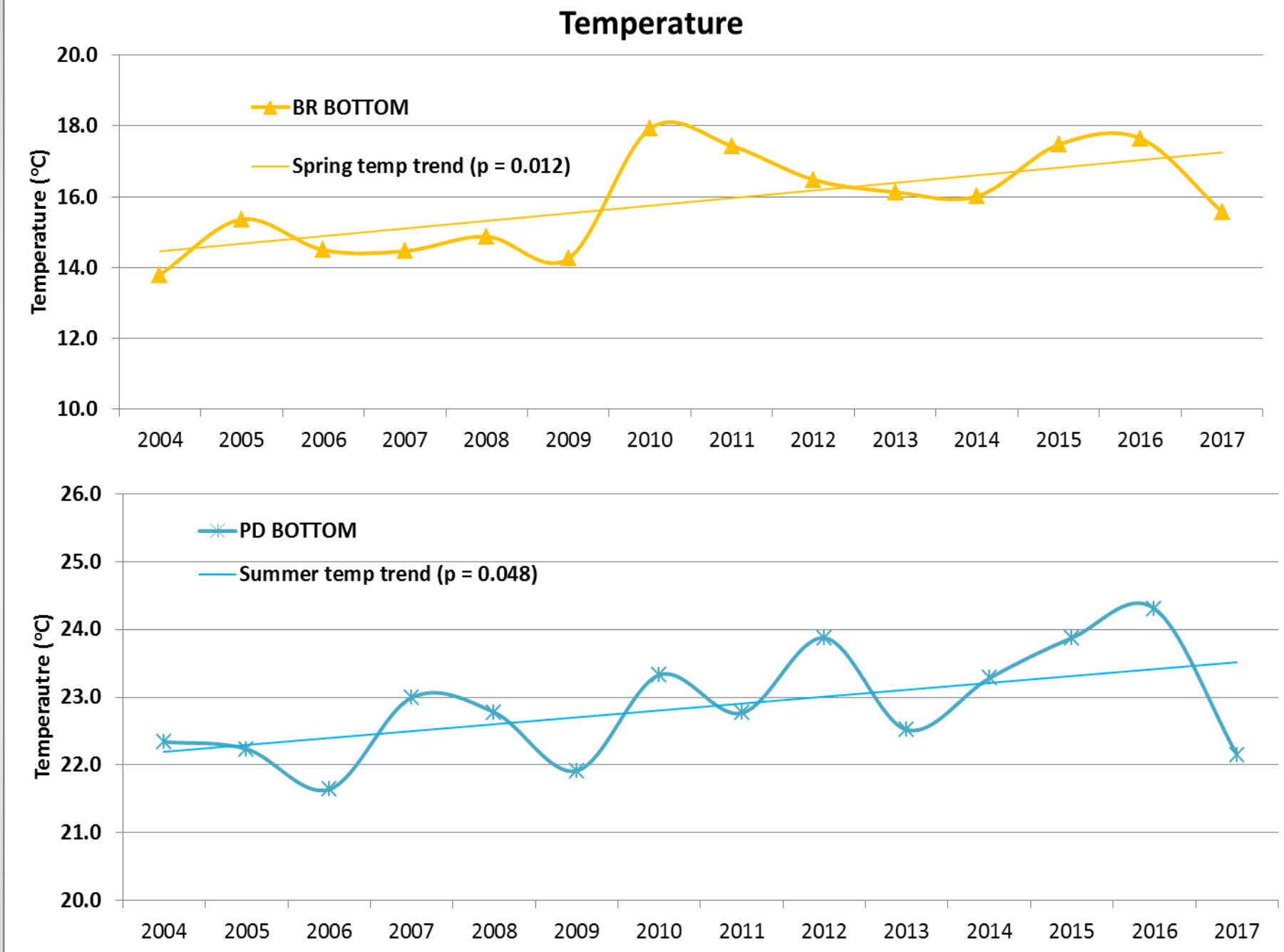
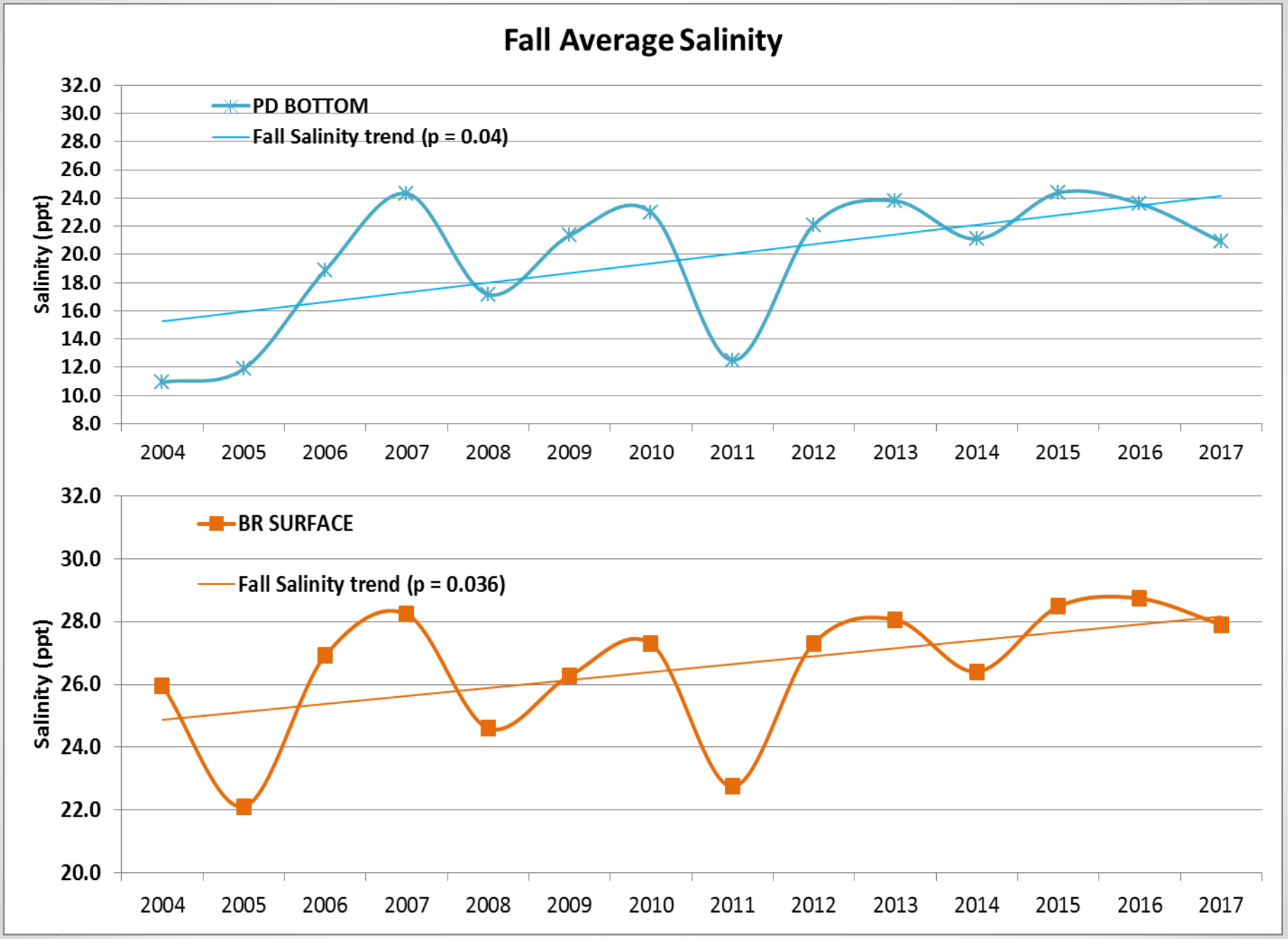


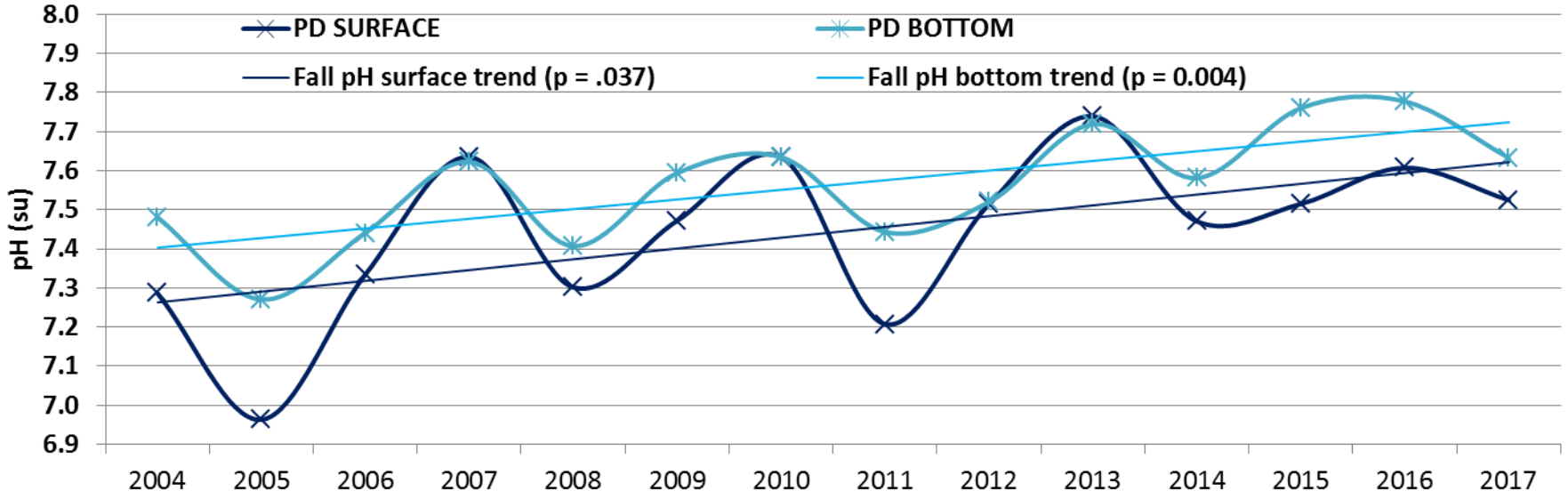
# Significant Trends?

…

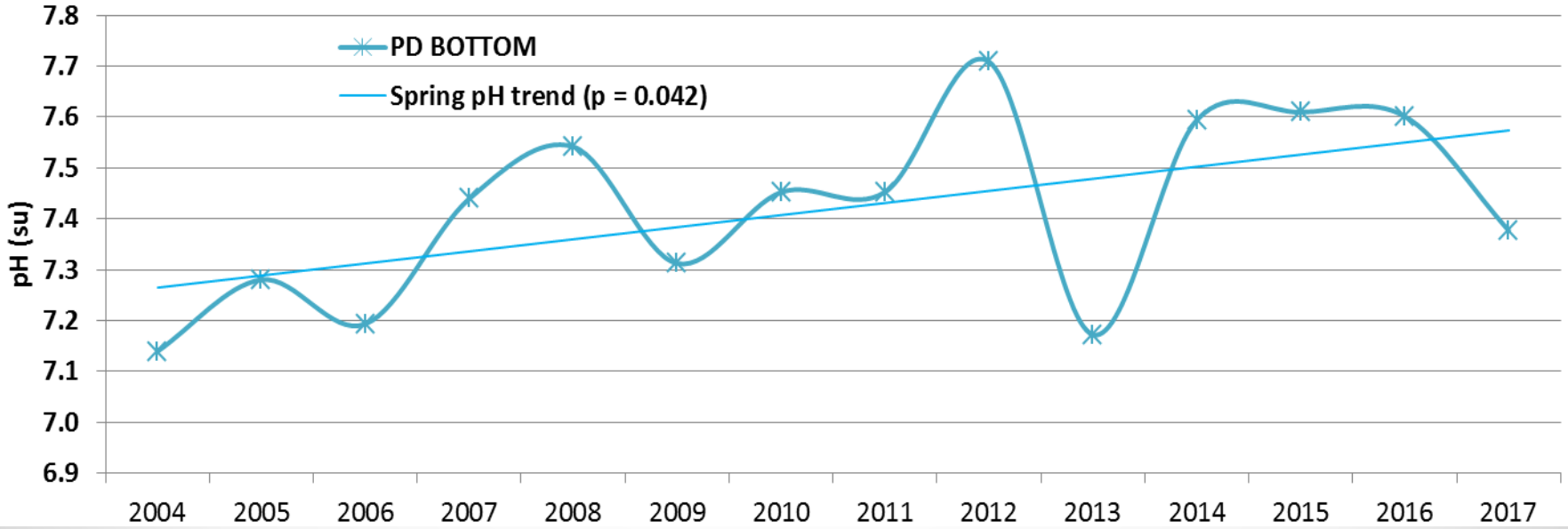

Temperature
20.0
18.0
16.0
14.0
12.0
10.0
Temperature (°C)
BR BOTTOM
Spring temp trend (p = 0.012)
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
26.0
25.0
24.0
23.0
22.0
21.0
20.0
Temperautre (°C)
PD BOTTOM
Summer temp trend (p = 0.048)
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017


Fall Average Salinity
PD BOTTOM
Fall Salinity trend (p = 0.04)
Salinity (ppt)
32.0
30.0
28.0
26.0
24.0
22.0
20.0
18.0
16.0
14.0
12.0
10.0
8.0
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
BR SURFACE
Fall Salinity trend (p = 0.036)
Salinity (ppt)
32.0
30.0
28.0
26.0
24.0
22.0
20.0
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

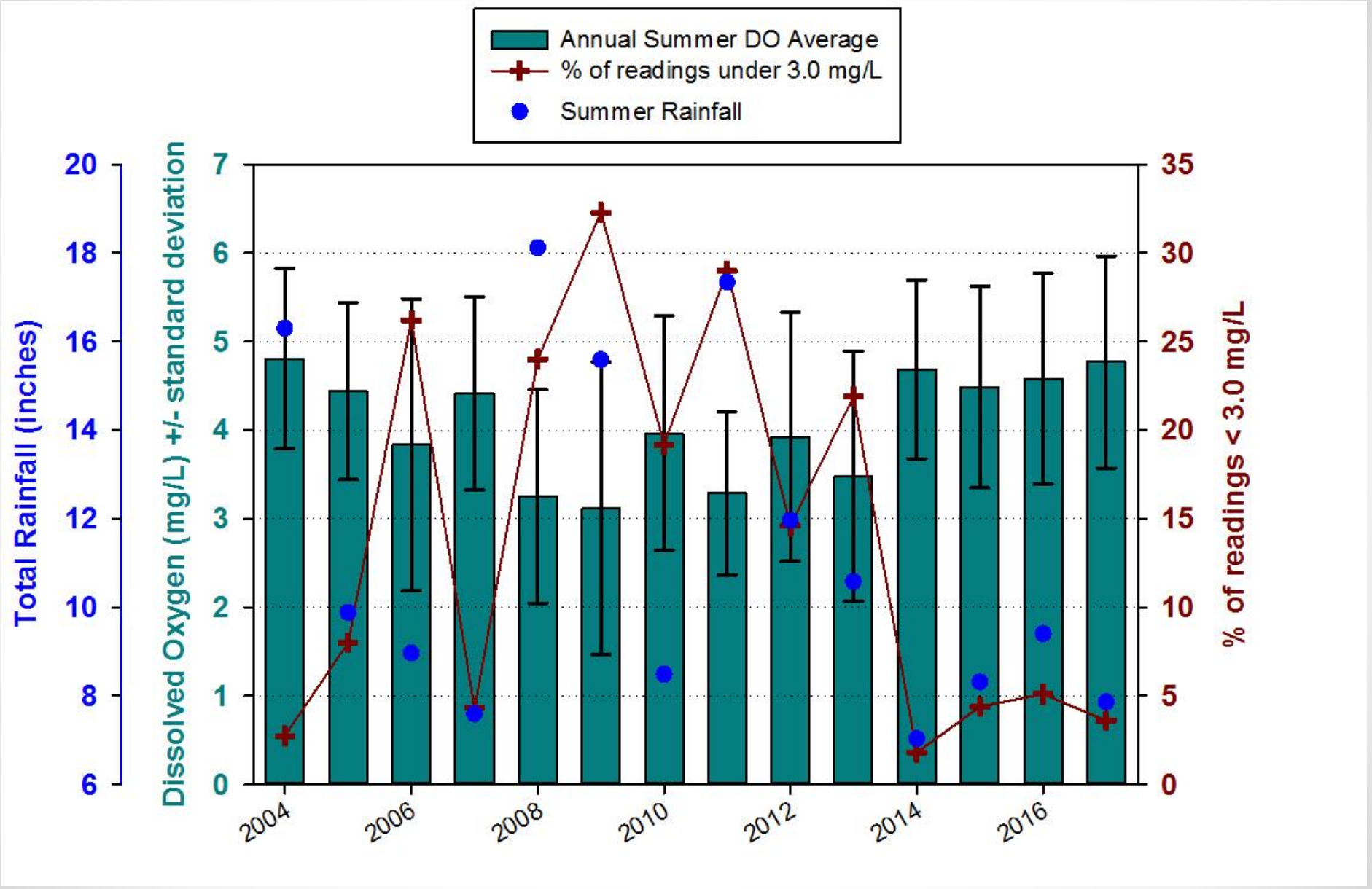
## Fall Average pH



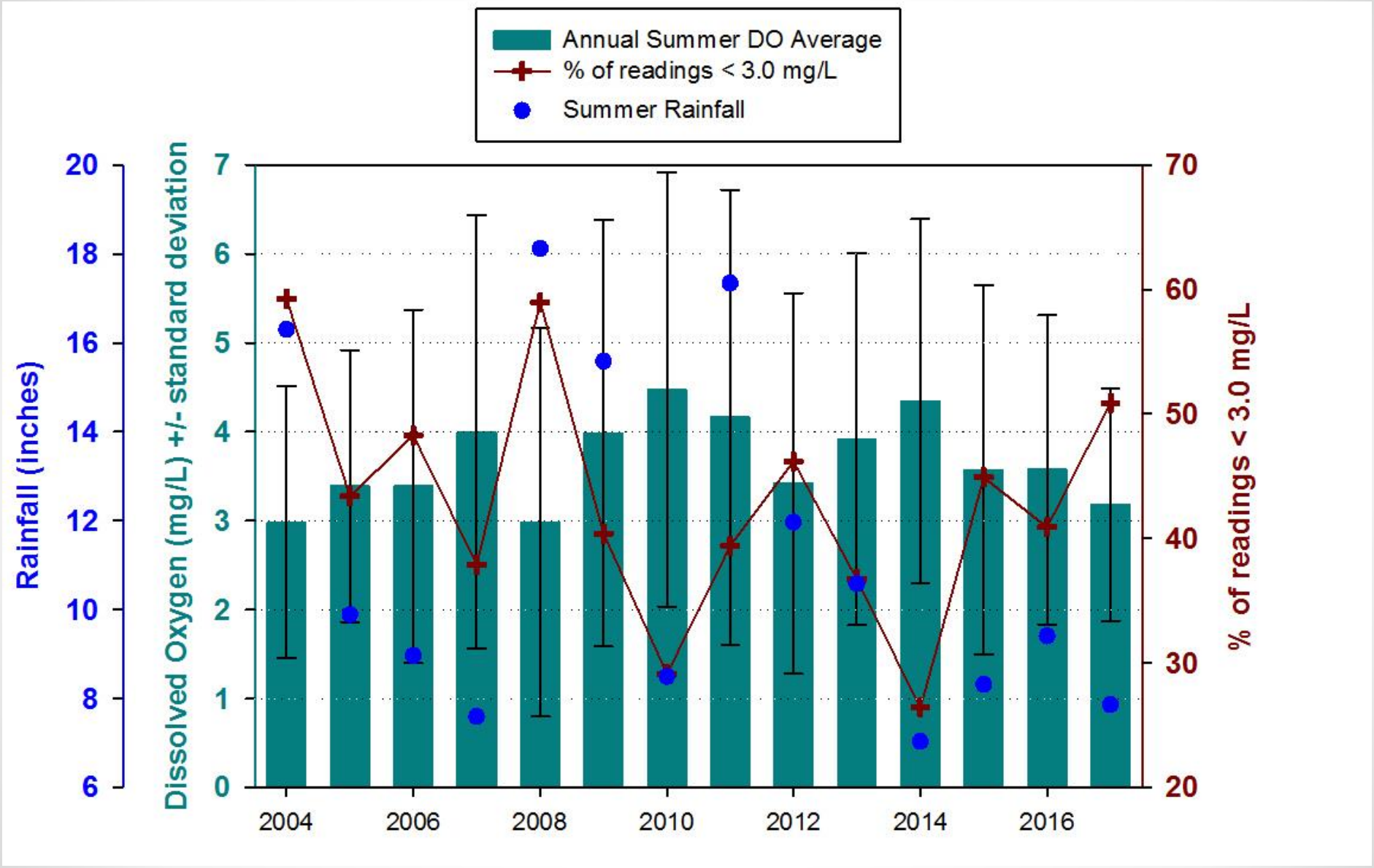

## Spring Average pH



# Bullock Reach Bottom



# Phillipsdale Bottom



# Conclusions

- Temperature – generalized increasing trend at all sites
  - though only BR Bottom (spring) and PD Bottom (summer) are significantly trending upwards
- Salinity – Generally steady
  - Fall salinity at BR Surface and PD Bottom are significantly trending upwards.
  - BR bottom always highest and most steady.
  - Larger divergence between PD Surface and PD Bottom (7-9 ppt)
- Dissolved Oxygen – no significant trends in DO
  - Spring - steady or slight downward trend,
  - Summer – surface trending down, bottom trending up;
  - Fall – PDS downward, other sites upward
- pH – PD has significantly trending upwards pH, surface and bottom in fall and surface in spring
- Chlorophyll – no significant trends in CHL;
  - generally steady or slight trend upwards,

# Questions?

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http://snapshot.narrabay.com/app/

- Thank you!
- ES&C/EMDA staff –
  - Sara Nadeau, Jeff Tortorella
- Heather Stoffel
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