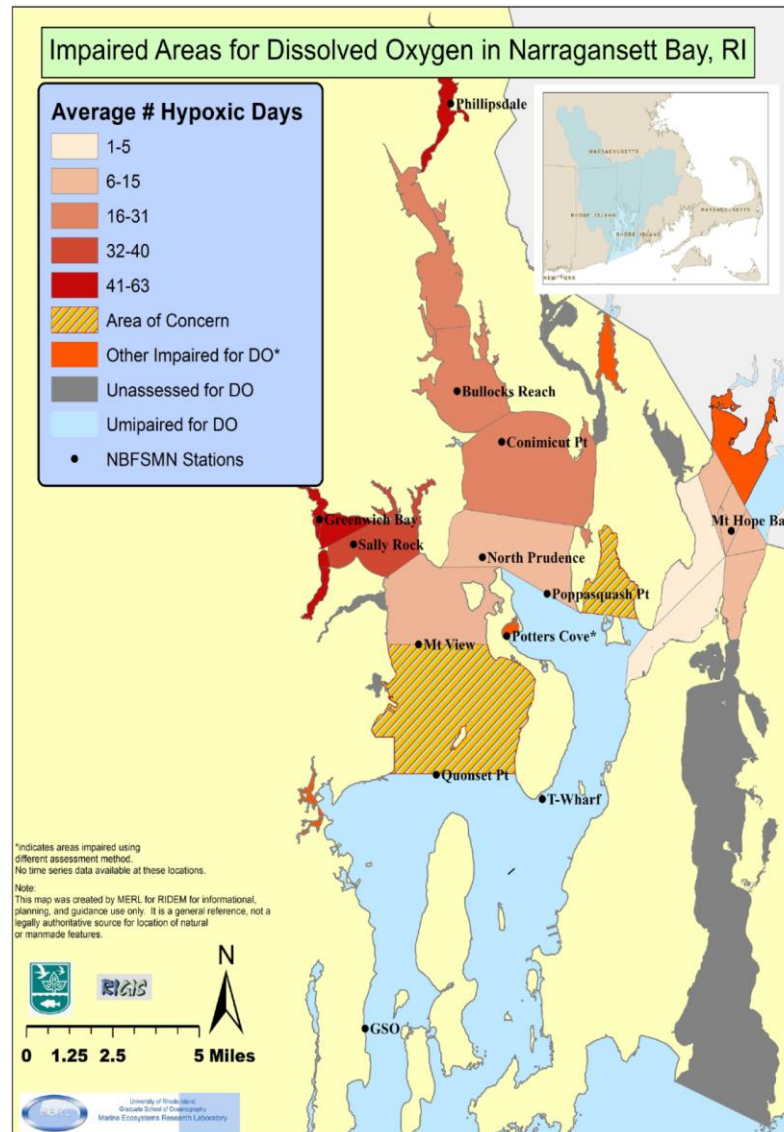
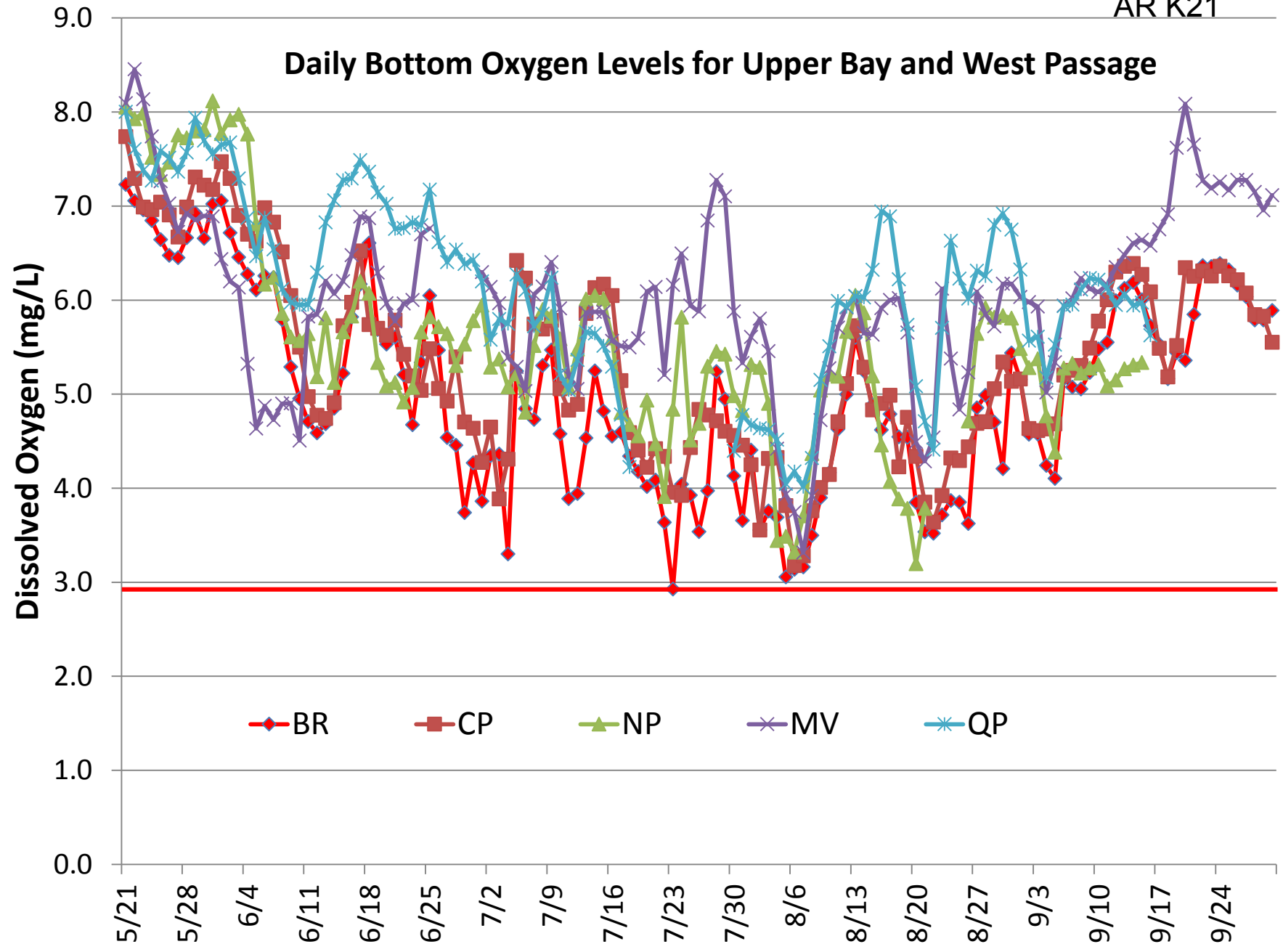


2014 Dissolved Oxygen Assessment EXHIBIT K AR K21

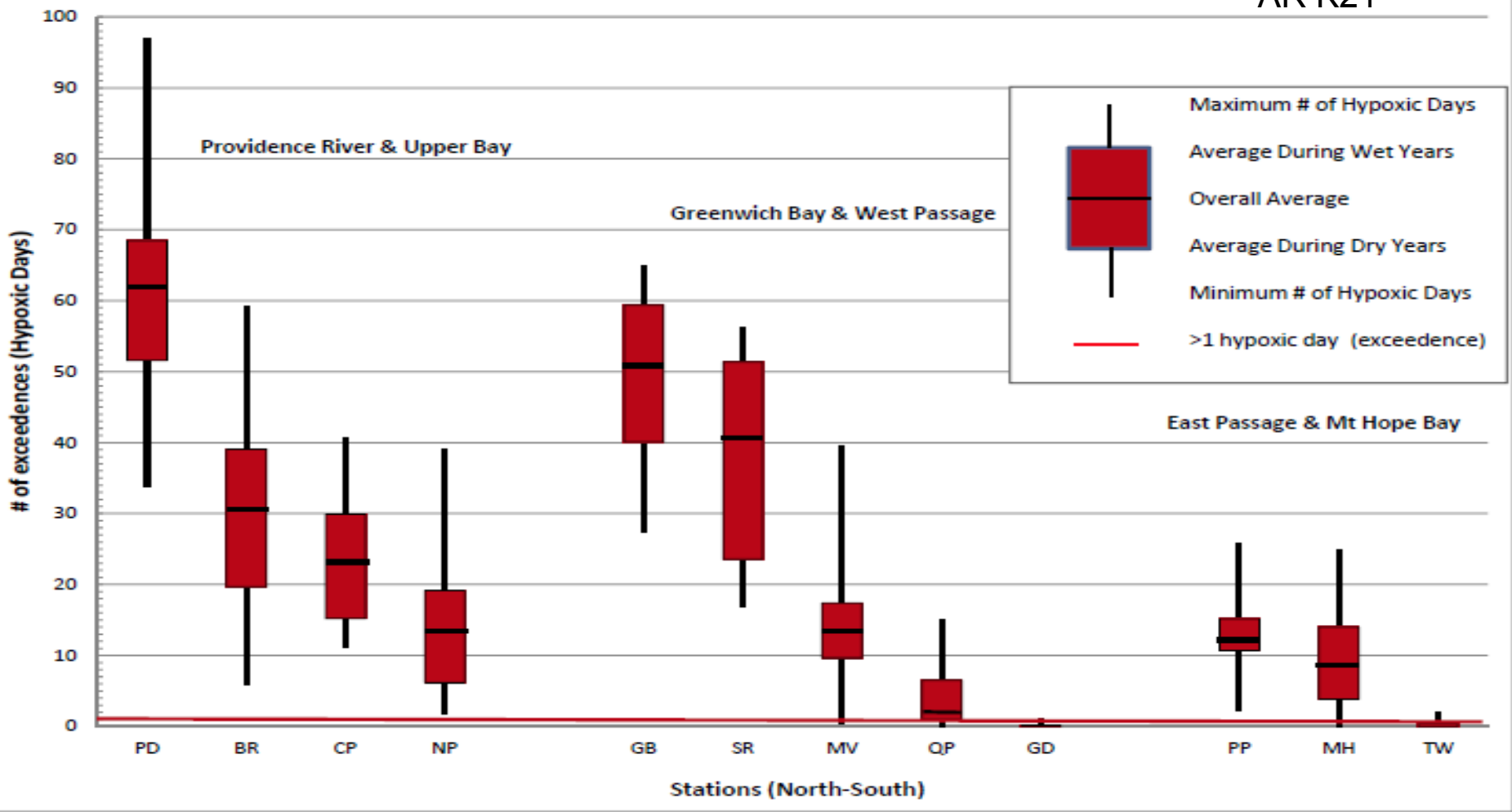


CHRP Meeting
December 17, 2014
Heather Stoffel

Daily Bottom Oxygen Levels for Upper Bay and West Passage

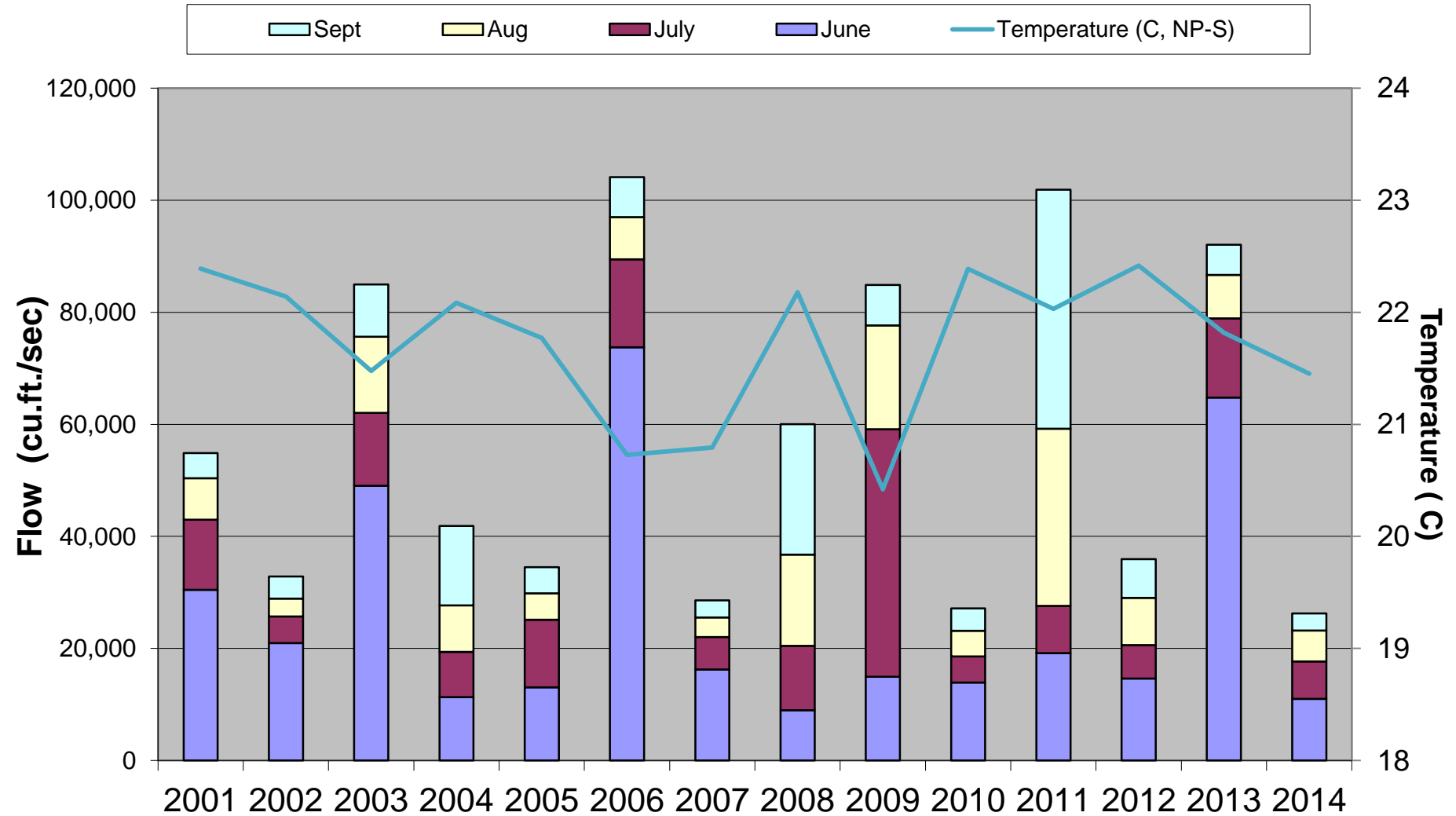


of Exceedences of State Criteria for Dissolved Oxygen in Narragansett Bay

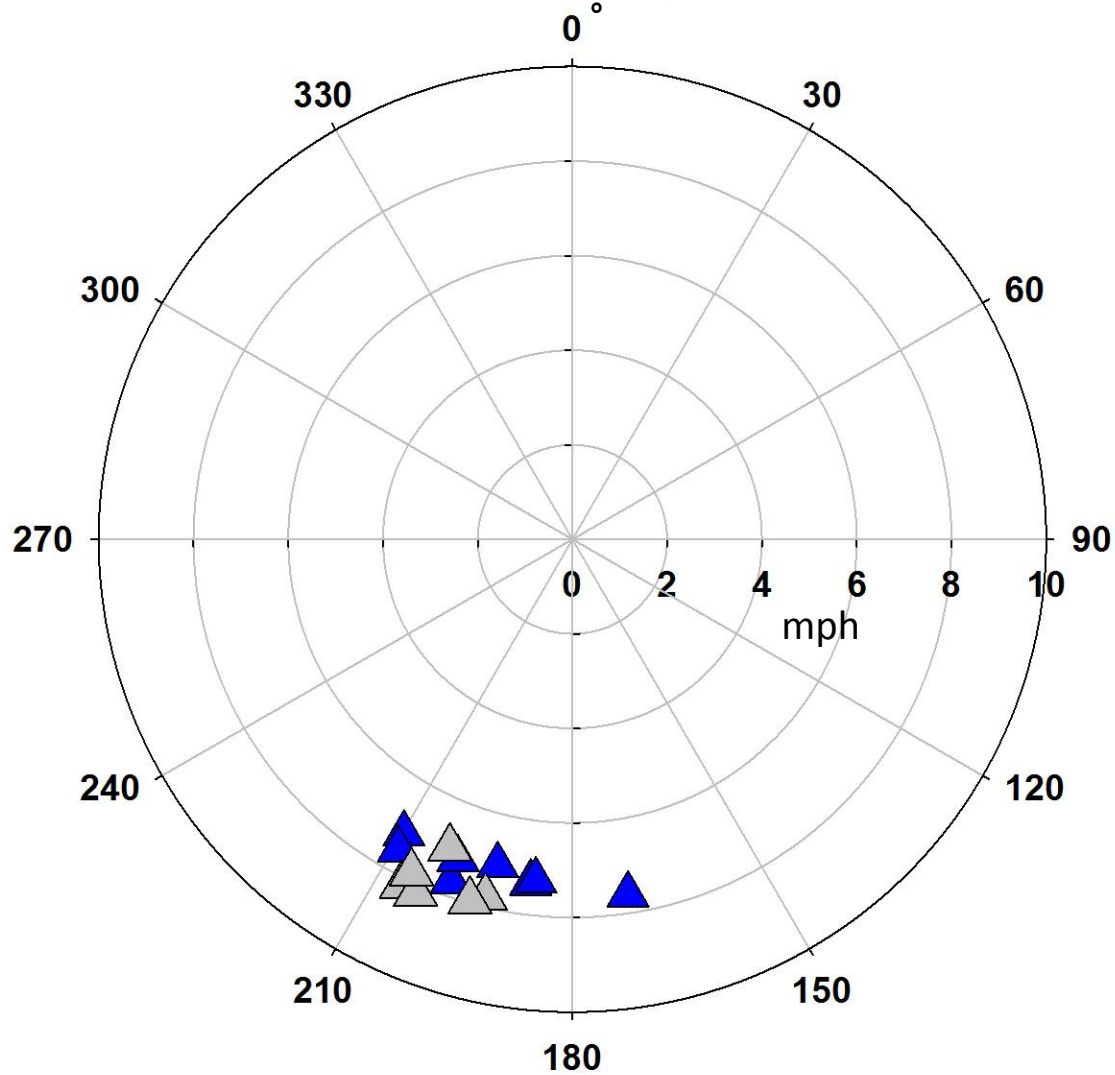


This is the over all range of exceedences for each station for all years of data in a down bay gradient. The ranges considers inter-annual variability due to weather. An exceedence is greater than 1 day. The Seekonk (PD) to Mt View (MV) and Poppasquash Pt (PP) are consistently in exceedence every year. That is why this area is listed as impaired for dissolved oxygen. Areas of concern are areas like Quonset Pt (QP). The Seekonk, Providence River, and Greenwich Bay have the worst exceedence with average exceedences of a month or more a year.

Seasonal Cumulative River Flow from the Blackstone River and Seasonal Mean Surface Temperature from North Prudence Station



Seasonal Average Wind Speed and Direction



Seasonal wind directions tend to be from the SSW.

Dry seasons (7.83 mph) tend to have slightly higher average wind speed compared to wet seasons (7.35 mph).

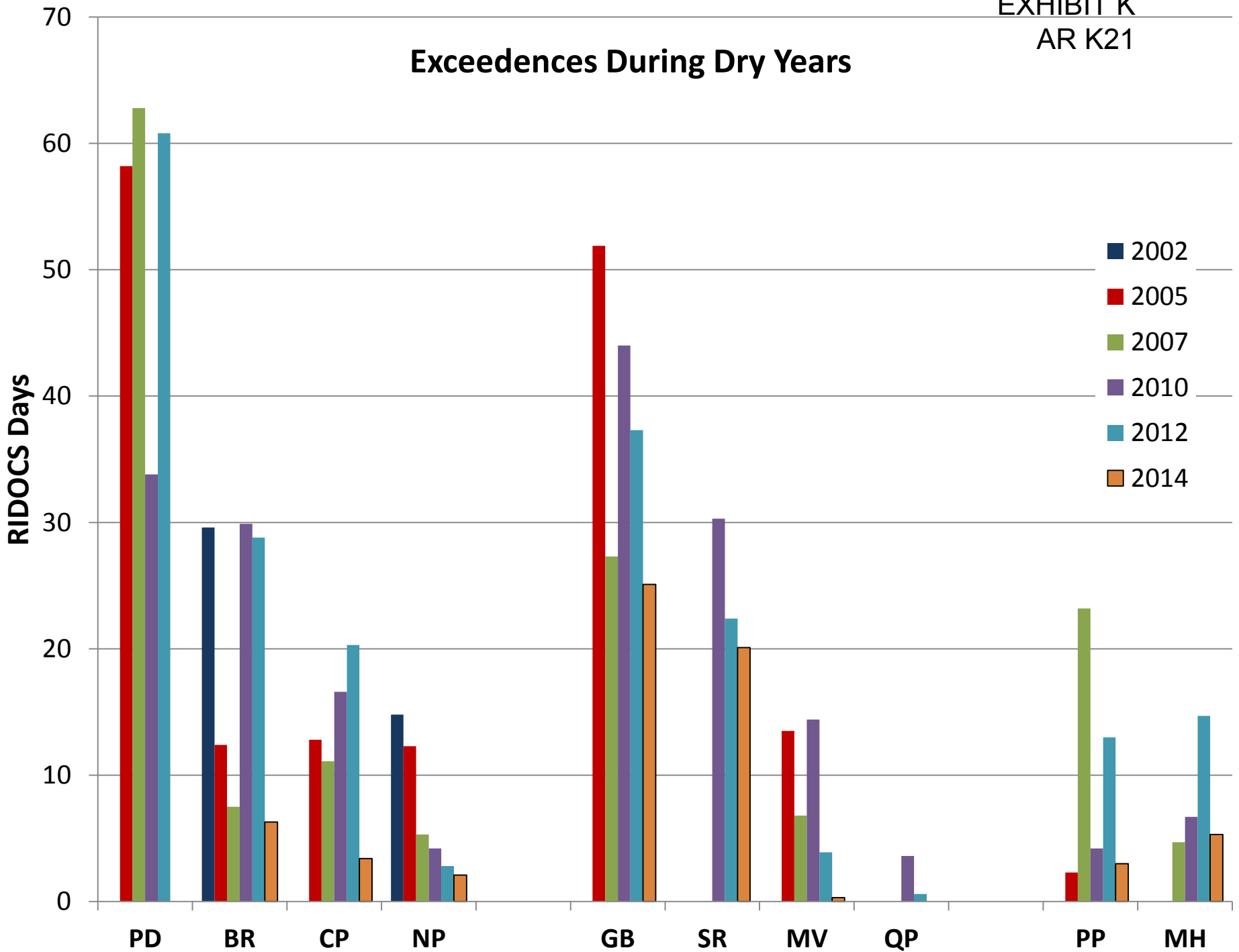
2012 had lowest wind speed for dry season (7.02 mph)

2009 had SSE wind direction

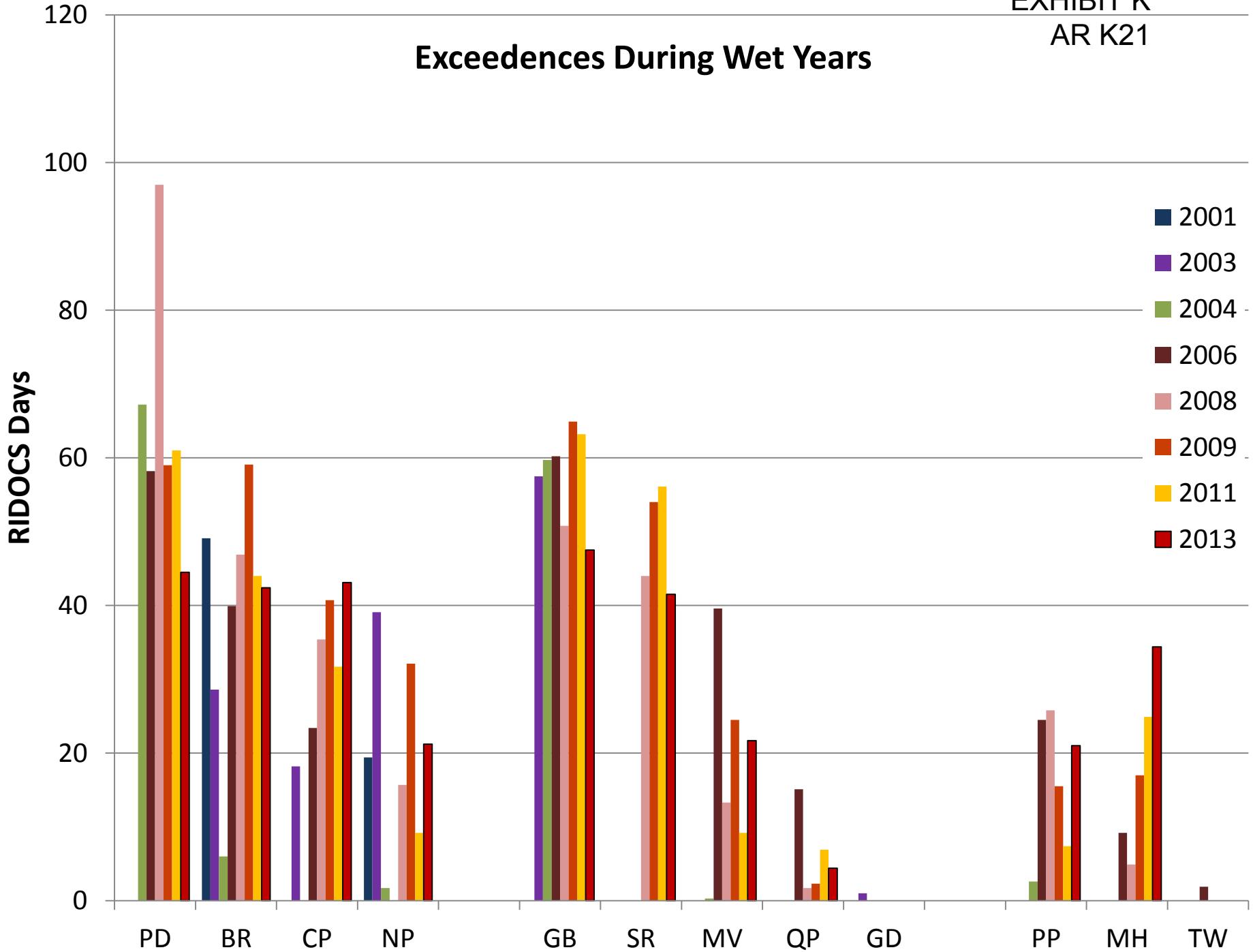
▲ Dry Years
(2002, 2005, 2007, 2010, 2014)

▲ Wet Years
(2001, 2003, 2004, 2006, 2008, 2009, 2011, 2013)

Exceedences During Dry Years

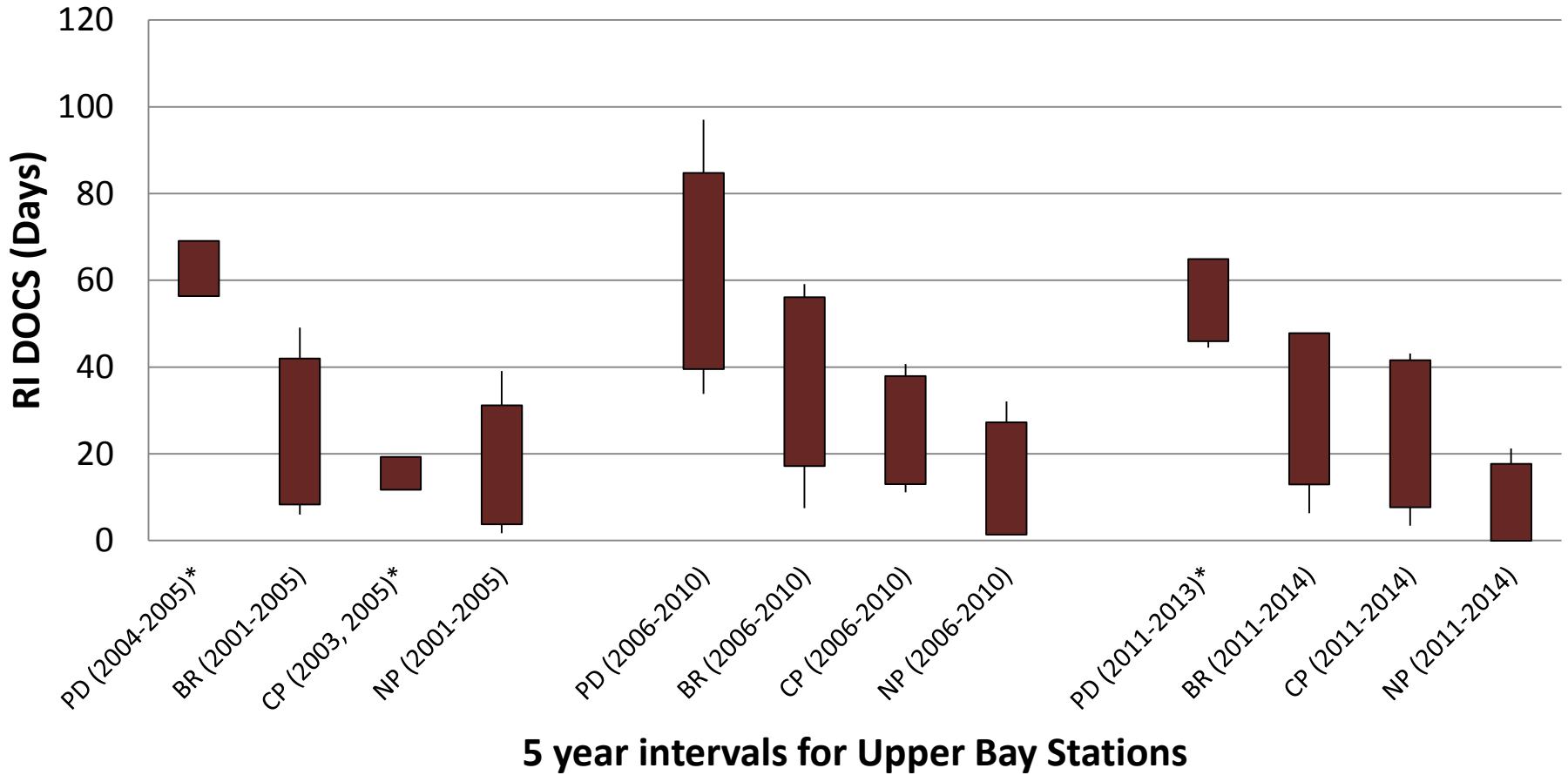


Exceedences During Wet Years



Dissolved Oxygen Exceedences Over Time

Dissolved Oxygen Exceedence Ranges for Upper Bay from 2001-2014

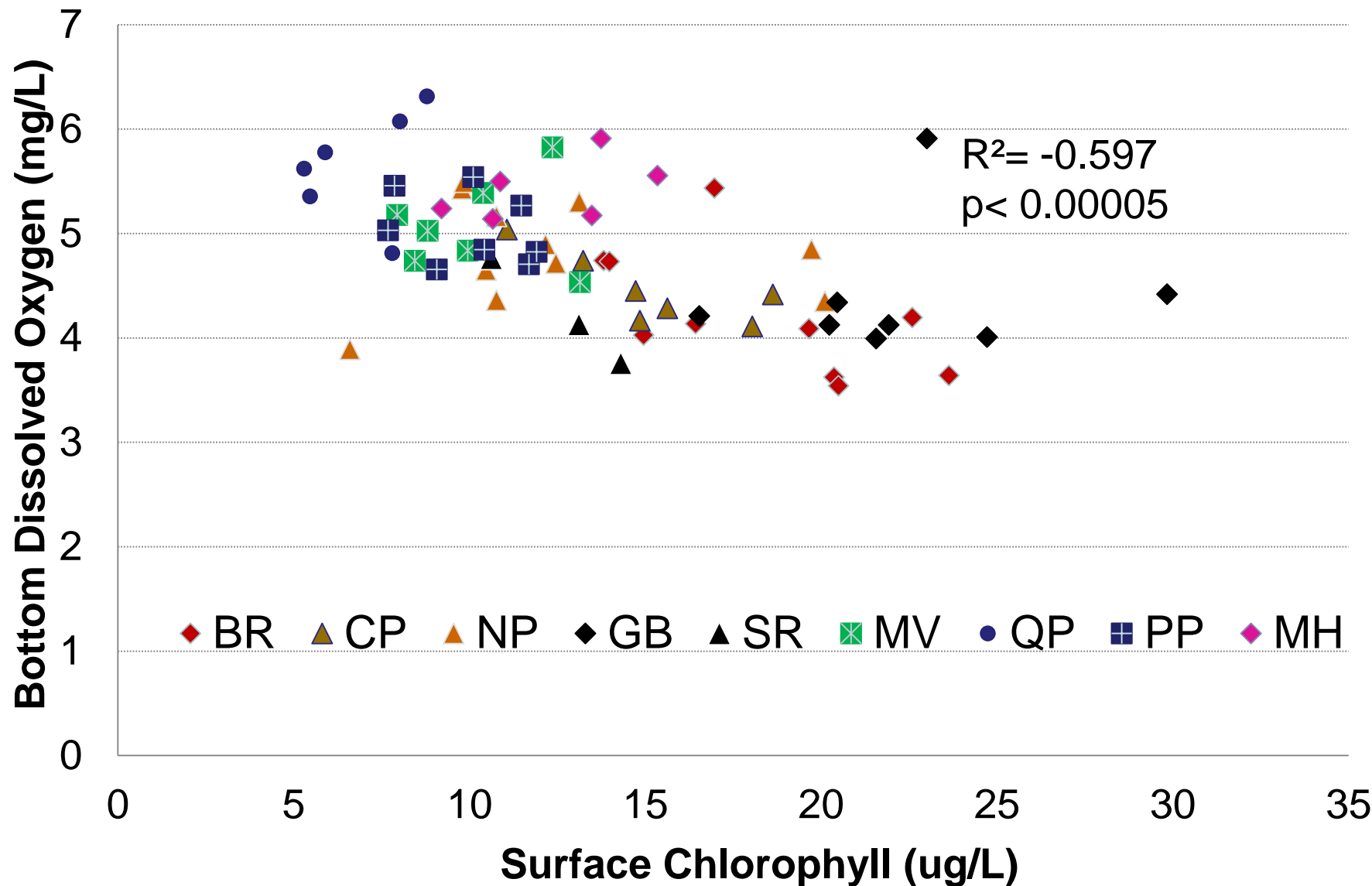


North Prudence is showing a downward trend towards compliance. An exceedence is 1 day. The Providence River is in exceedence consistently over all years.

(Grouped data in 5 year intervals with the exceptions of 2011-2014 * indicates not complete dataset.)

Comparison of Seasonal Average Surface Chlorophyll Levels to Bottom Dissolved Oxygen in Upper Narragansett Bay

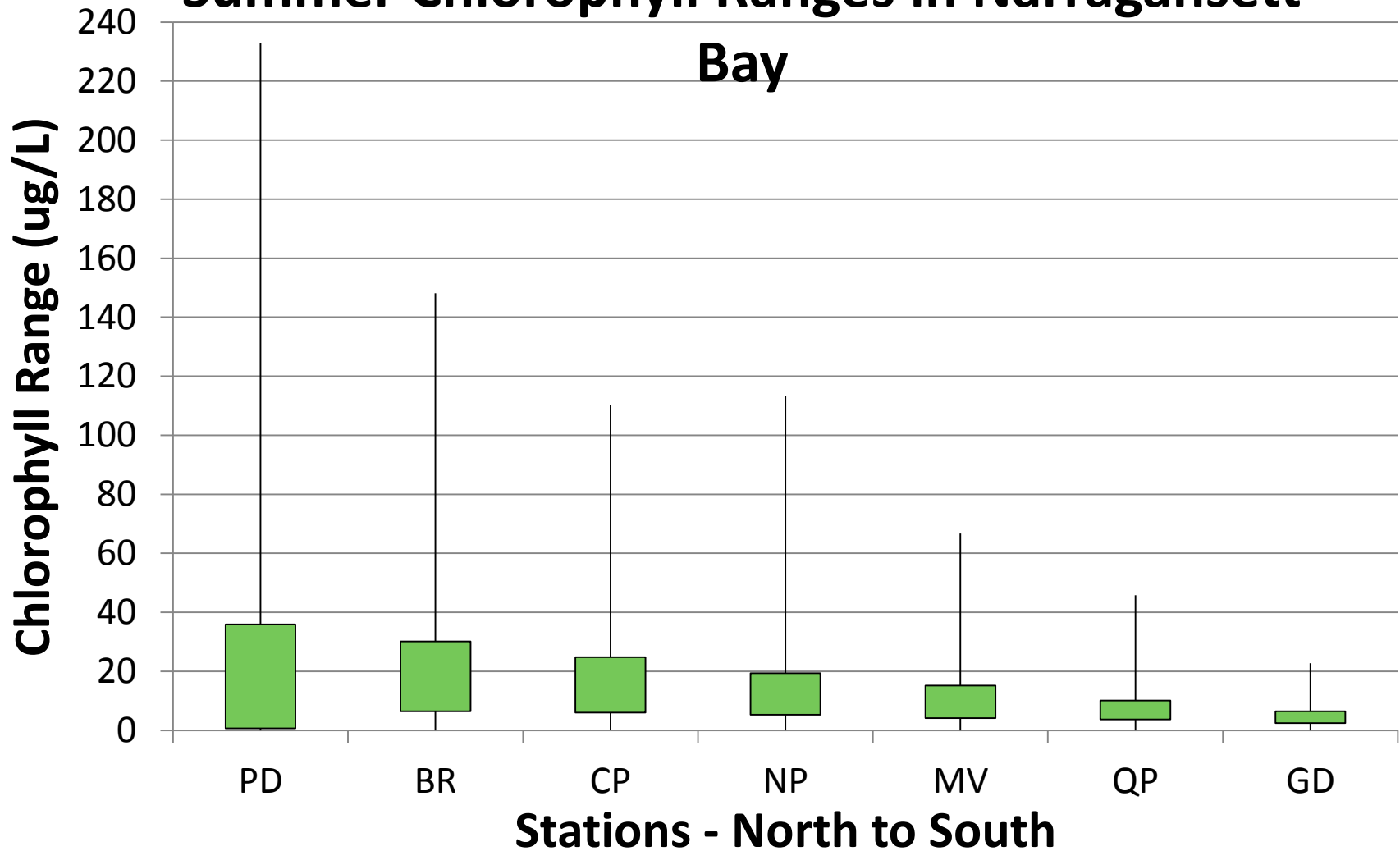
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Chlorophyll as an Indicator

- Many New England and Mid-Atlantic estuaries use 20 ug/L as a threshold during the growing season (i.e., EPA-National Coastal Condition Reports (NCCR) threshold)
- The figure showing the relationship between low bottom oxygen and surface chlorophyll also shows that on average seasonally Bullock Reach and Greenwich Bay are consistently over the 20 ug/L threshold (which under the EPA-NCCR definition would be “poor” water quality for chlorophyll)
- Many of Upper Narragansett Bay stations have events with peaks above the 20 ug/L threshold

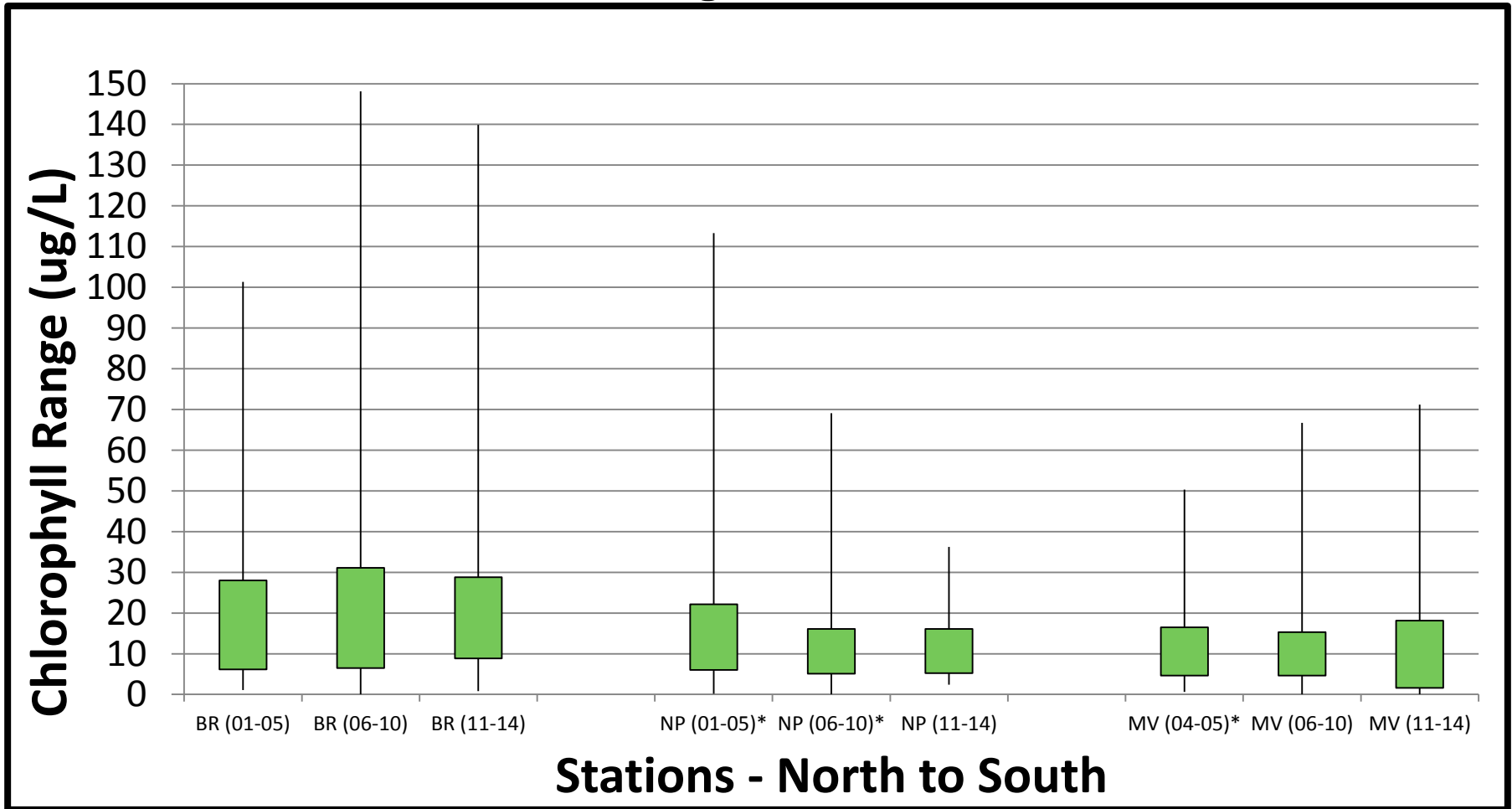
Summer Chlorophyll Ranges in Narragansett Bay



From the Seekonk River to North Prudence on average is considered eutrophic based on EPA definitions. Mt View and Quonset have episodic events at eutrophic levels. (Data (2001-2012) June 1-Sept 30)

Comparison of Chlorophyll Seasonal Ranges for Upper Bay and West Passage Stations

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Bullock Reach remains eutrophic throughout all years. North Prudence chlorophyll levels have dropped since 2006. Mt. View ranges vary, but remain below 20 ug/L. Data is grouped over 5 years to account for inter-annual variability and several years are examined during assessments.

* Indicates data gaps greater than 15 days

Conclusions

- 2014 was a “good year” (drier and cooler than average).
- NP appears to be showing a downward trend in oxygen exceedences and chlorophyll levels.
- MV may also be showing a downward trend in oxygen, but further analysis is needed.
- MH needs further examination. It is possible hypoxia is increasing in this area.