



New Jersey
Meadowlands Commission



The Lower Hackensack River: What Does Continuous 24 hour Monitoring Tell Us?

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Abstract

- The lower Hackensack River has a legacy of pollution that goes back more than 100 years. Today, over 20 million people live in its watershed which supports one of the highest population densities and industrial infrastructure footprint in the country. The lower Hackensack River is tidally influenced from Newark Bay and by freshwater discharges from two water treatment facilities and 20 miles upriver from the Oradell Dam. These factors, along with industrial and residential runoff during storms, greatly affect the water quality. Understanding how these factors impact the spatial and temporal patterns of water quality is crucial for managing this resource and the wildlife associated with it. The New Jersey Meadowlands Commission (NJMC) operates a distributed network of sensors that continuously monitors the water quality of the lower Hackensack River and makes this information available in real time. Currently there are water quality monitors strategically placed at 4 locations measuring water depth, dissolved oxygen, conductivity, salinity, pH, temperature, and turbidity. This study will show a few phenomena recorded by the monitoring system that illustrate the spatial and temporal effects on water quality by the man made discharges and natural events affecting the estuary. Our monitoring activity has shown for example that after a significant storm or discharge of fresh water from the Dam it takes 1 – 2 weeks for the river to return to its brackish baseline. Similarly, daily tidal pulses as always associated with increase turbidity and decrease oxygen levels also greatly affected by temperature. Due to the increased temperatures and the unusual amount of rainfall in June and July of 2009, the dissolved oxygen concentration fell below the criteria a couple times in August and September. Water level on the other hand is significantly affected by freezing temperatures and sea surge events from tropical storms.

Objectives

- Summarize a year of hourly water quality measurements from four locations on the Lower Hackensack River.
- Show seasonal and spatial differences in salinity, dissolved oxygen, and temperature.
- Show how natural effects (tide cycle) and man made effects (dam discharges) affect water quality of the lower estuary.



Average Max, Min, and Median of the parameters measured between January 2009 and January 2010 for each station.

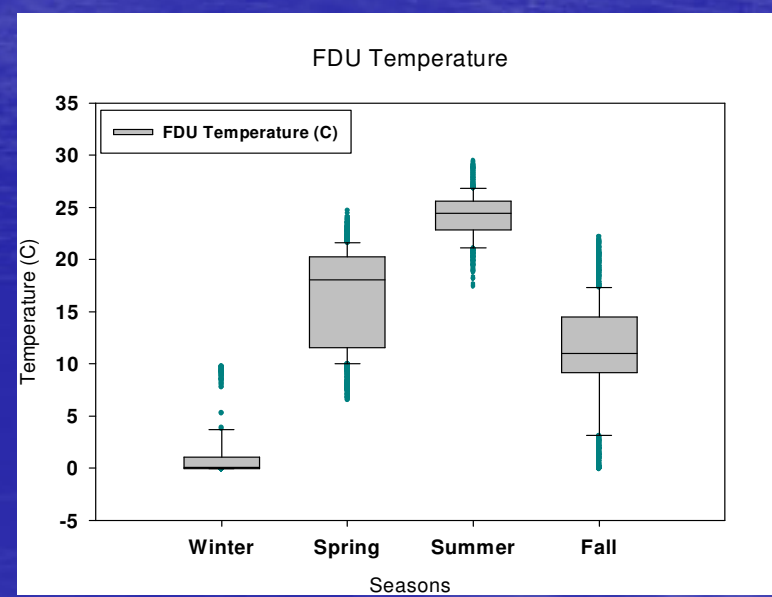
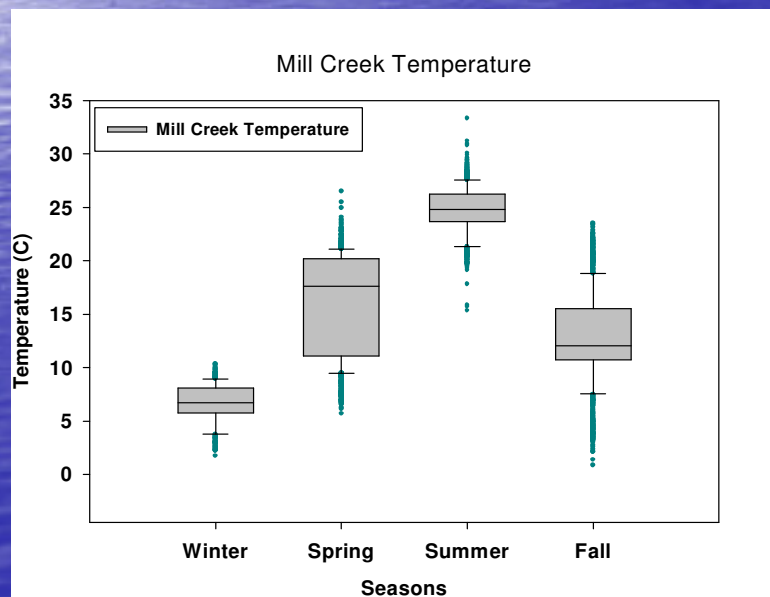
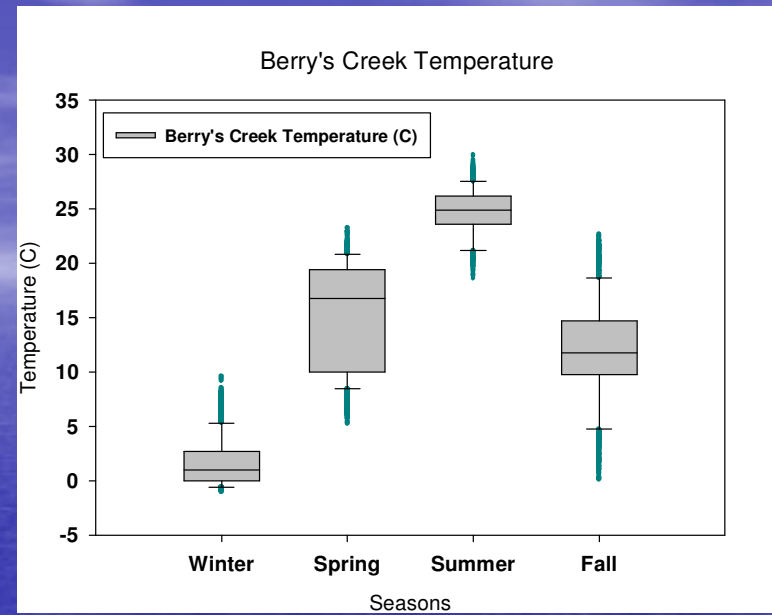
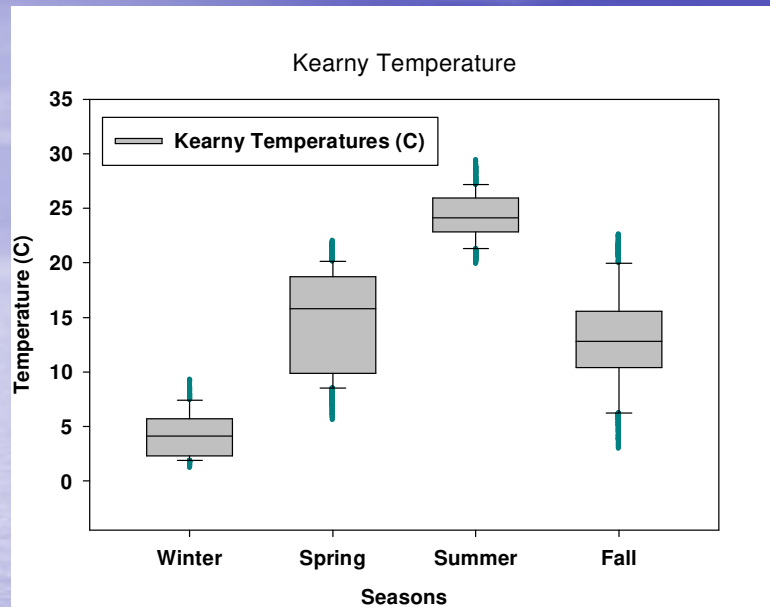
Kearny	Temperature	DO	pH	Turbidity	Salinity	Conductivity	Depth
Average	15.64	7.39	7.63	17.84	11.89	19.31	1.63
Max	29.45	14.04	8.21	173.70	21.82	34.64	6.13
Min	1.17	3.01	7.30	3.60	3.72	6.78	-4.71
Median	15.31	8.53	7.76	88.65	12.77	20.71	0.71

Berry's Creek	Temperature	DO	pH	Turbidity	Salinity	Conductivity	Depth
Average	13.11	5.58	7.36	44.06	7.01	12.21	0.46
Max	29.85	21.83	8.57	493.30	16.50	26.87	5.14
Min	-0.98	2.01	6.43	4.70	1.01	2.004	-3.77
Median	14.435	11.92	7.50	249	8.76	14.437	0.68

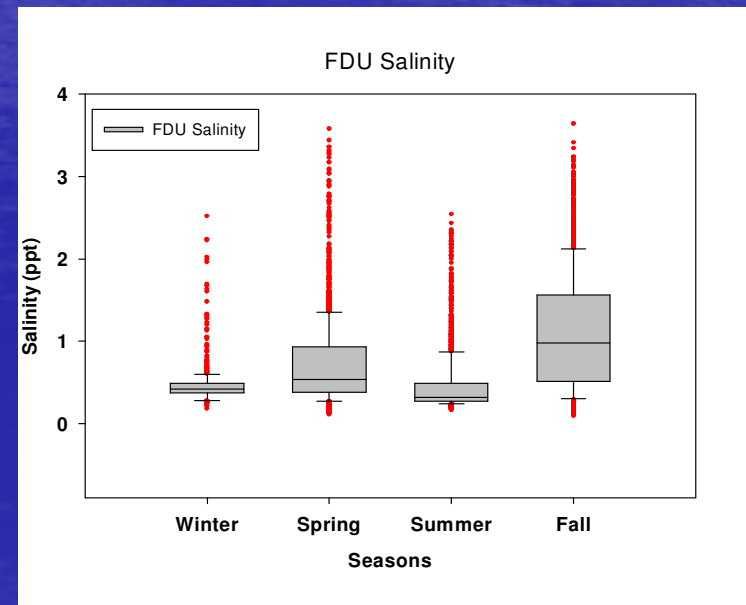
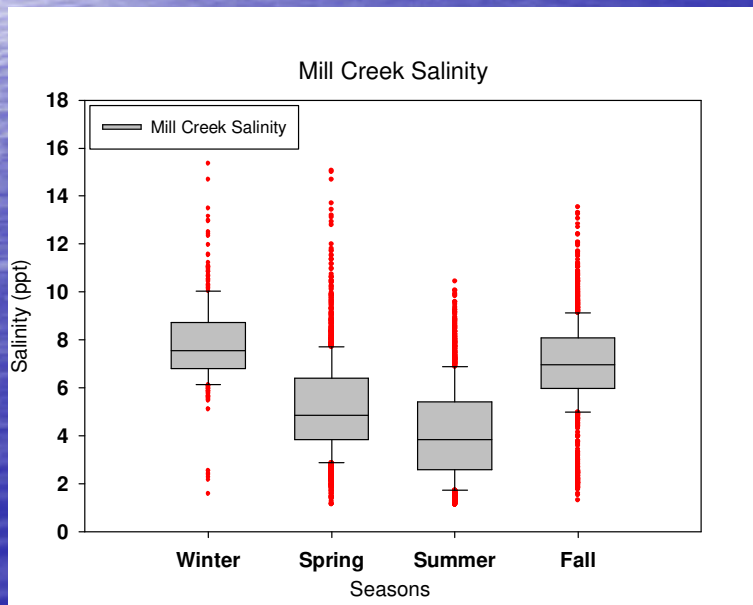
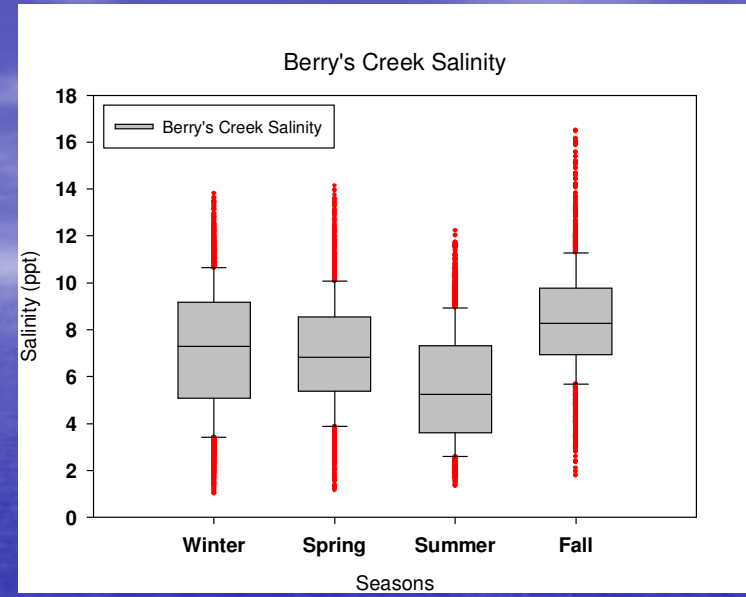
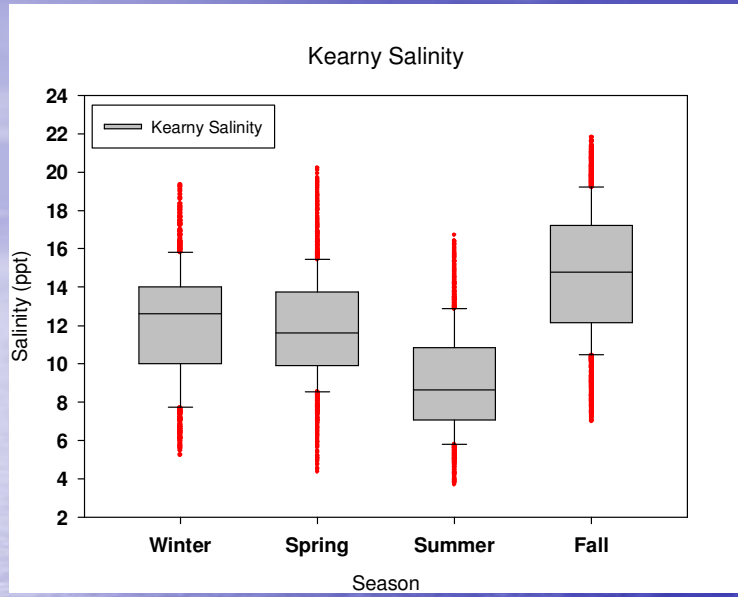
Mill Creek	Temperature	DO	pH	Turbidity	Salinity	Conductivity	Depth
Average	17.28	5.21	7.39	86.51	5.53	9.65	0.35
Max	33.31	18.35	8.73	594.80	15.36	25.37	5.08
Min	0.85	2.02	6.62	5.30	1.12	1.508	-4.23
Median	17.08	10.34	7.68	300.05	8.24	13.44	0.43

FDU	Temperature	DO	pH	Turbidity	Salinity	Conductivity	Depth
Average	15.88	8.11	7.95	48.66	0.73	1.43	-0.04
Max	29.51	25.8	9.94	393.40	3.64	6.62	4.83
Min	-0.1	2.02	7.06	5.10	0.09	0.20	-6.81
Median	14.705	14.0	8.50	199.25	1.865	3.41	-0.99

Seasonal Patterns of Temperature

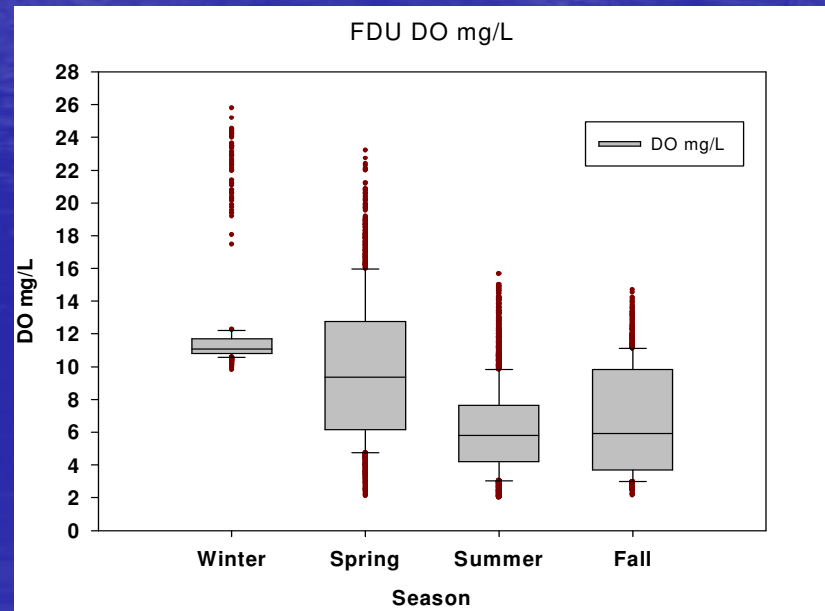
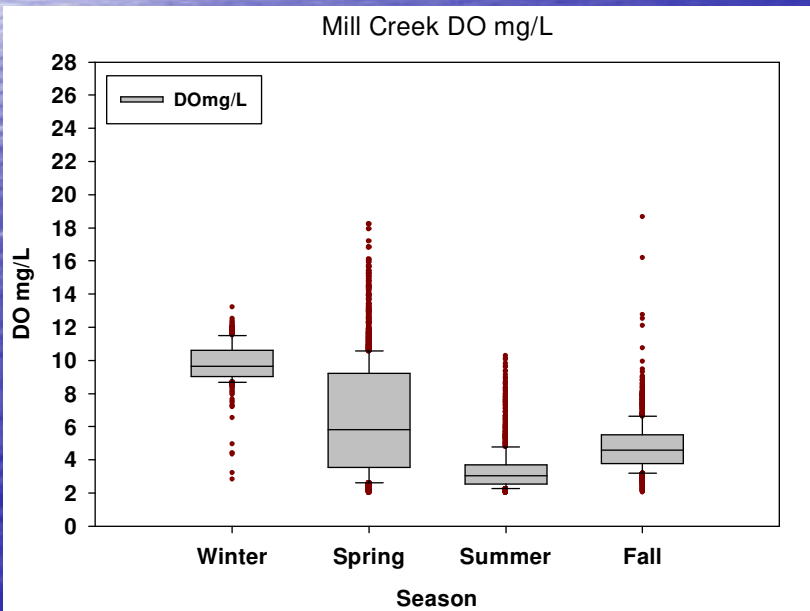
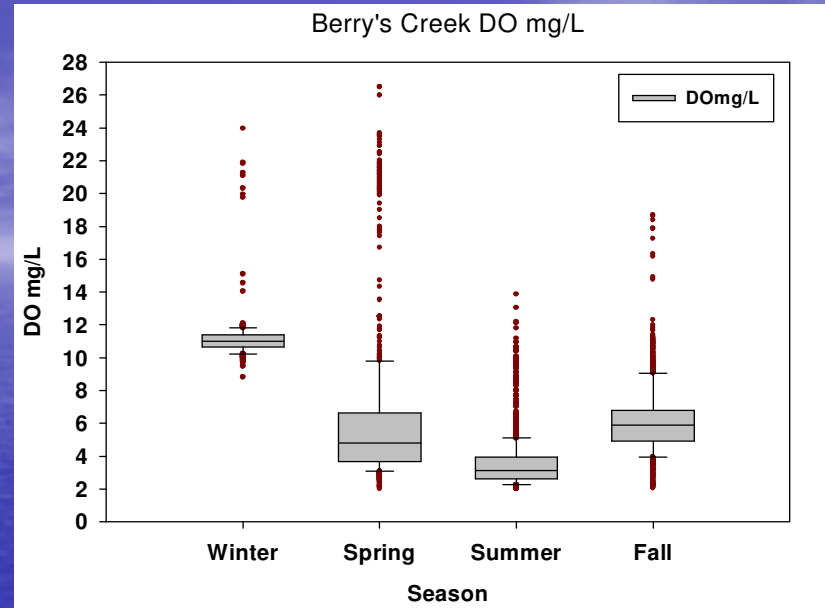
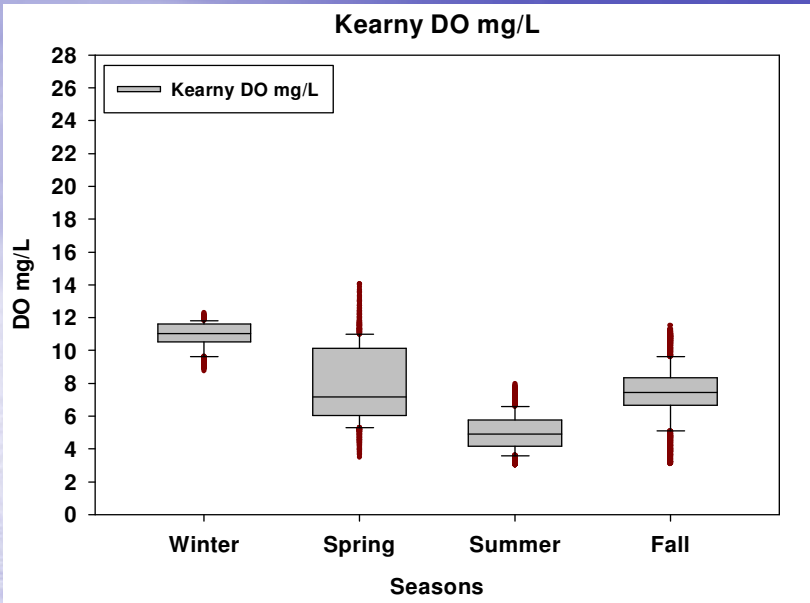


Seasonal Patterns of Salinity



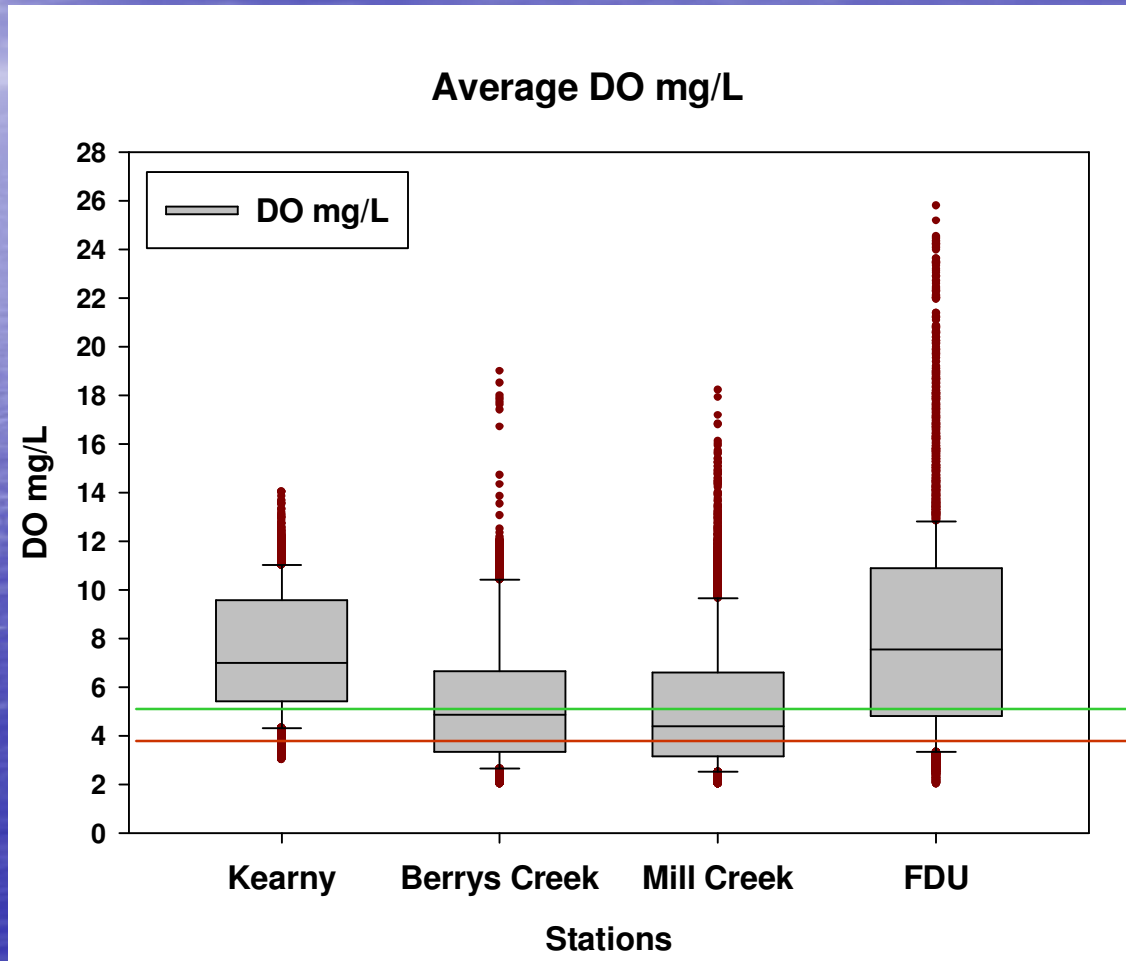
*Summer rainfall was 7-8 inches more than normal in 2009.

Seasonal Patterns of Dissolved Oxygen



Dissolved Oxygen

Average of all Stations Between January 2009 and January 2010

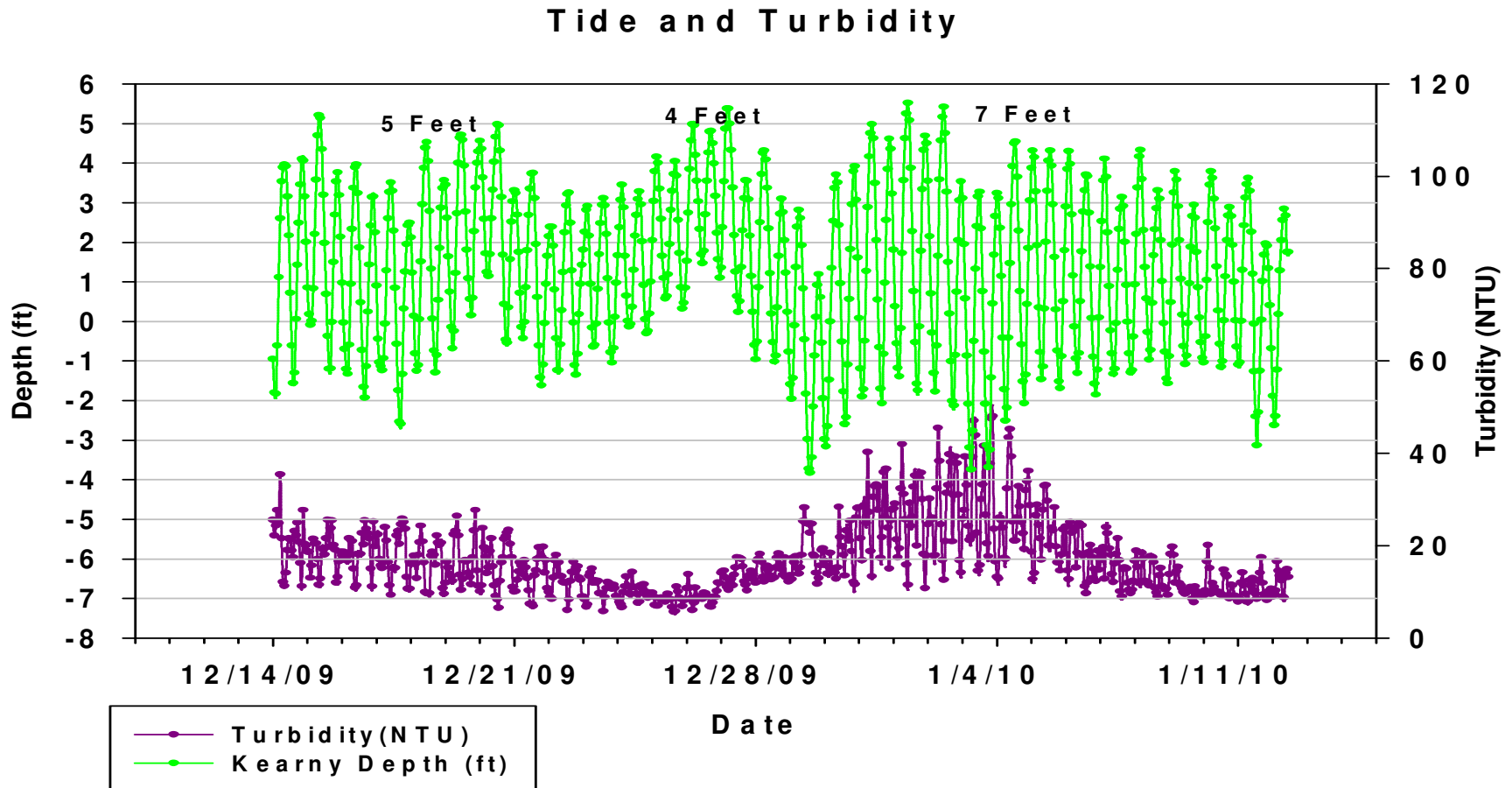


Aquatic Stress Level (5.0 mg/L)

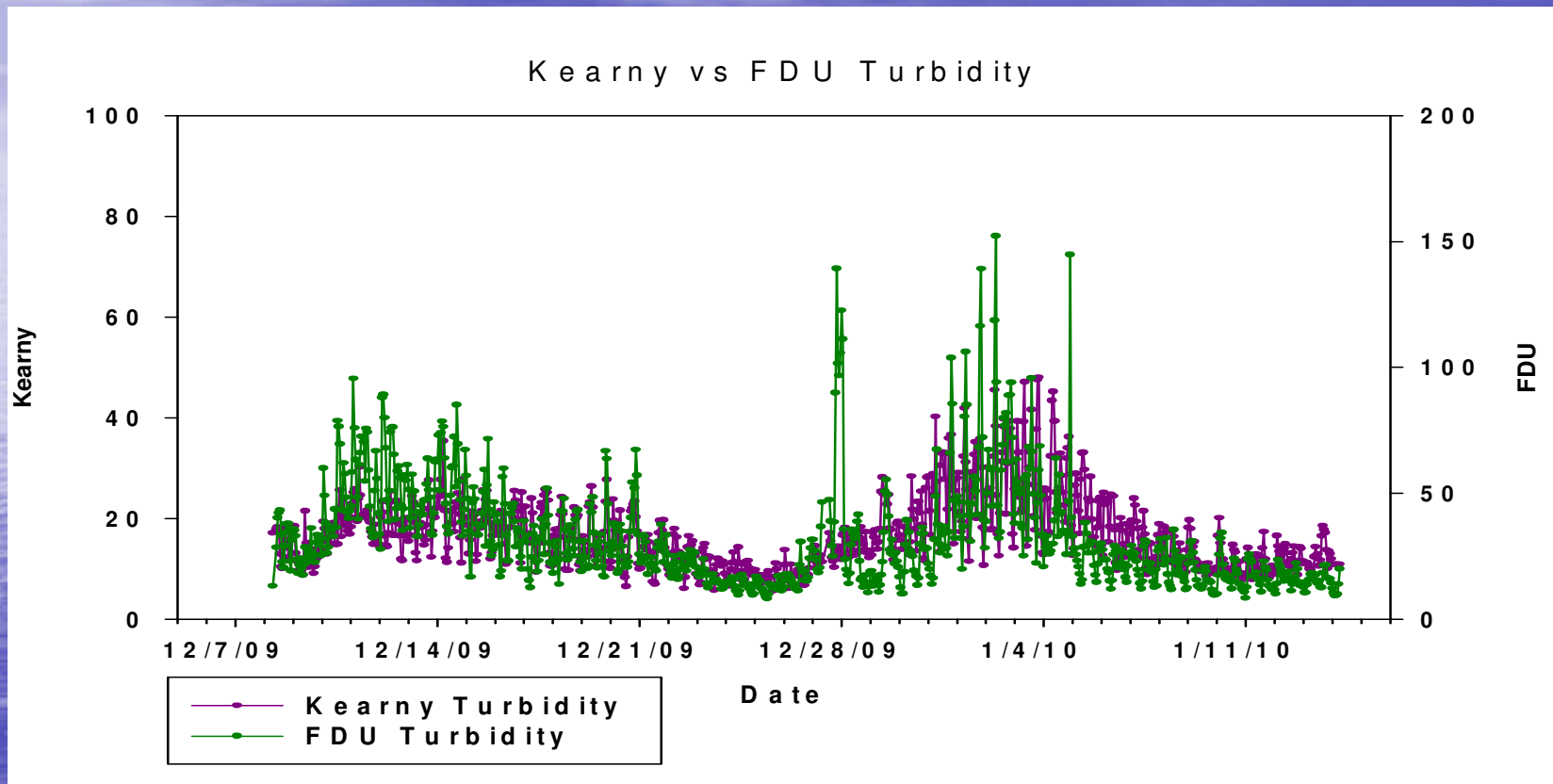
Criteria Level (4.0 mg/L)

Effects of Tidal Amplitude on Turbidity

(1 month, Dec 14 – Jan 14)



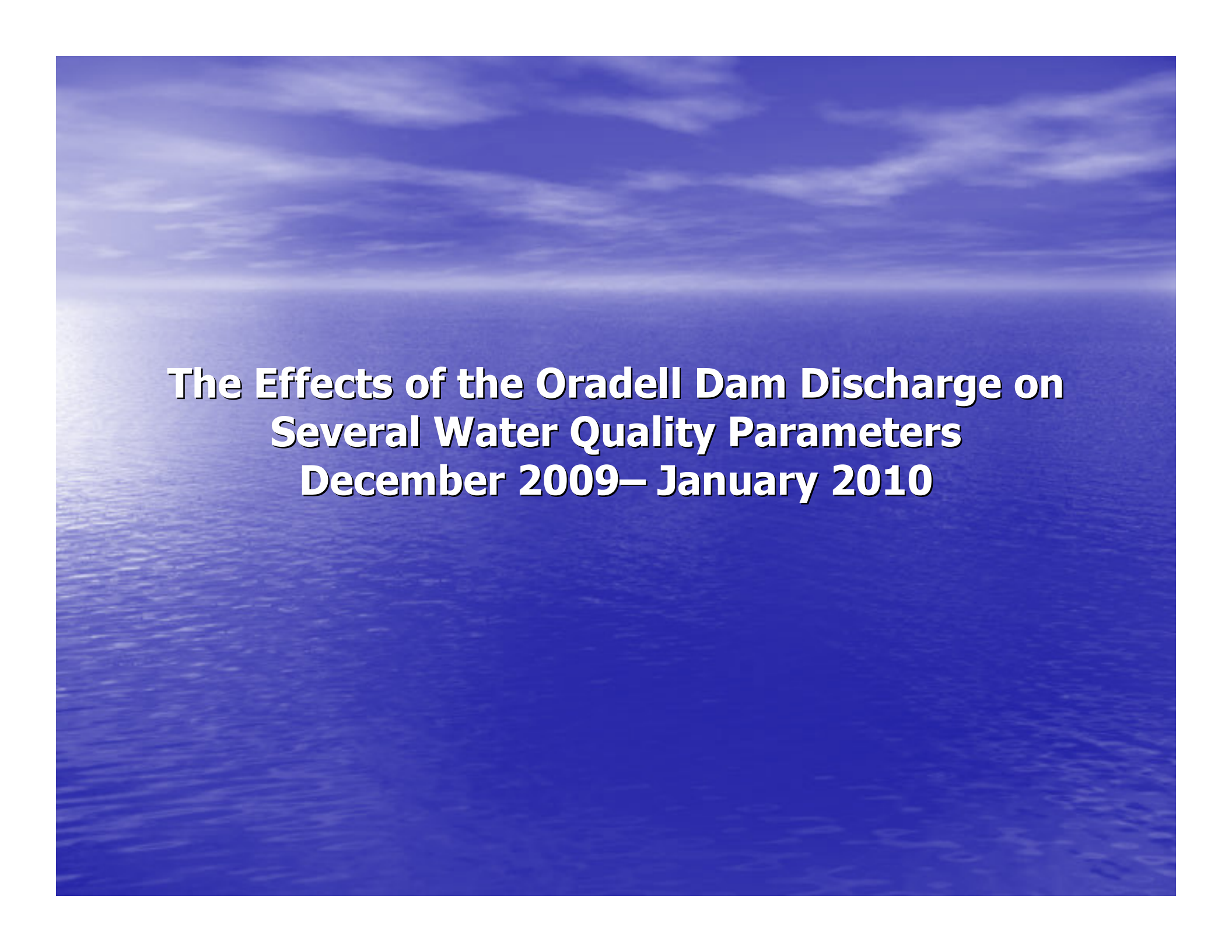
Turbidity relationship between Kearny and FDU



- Up river, the turbidity is always higher than near the Newark Bay.
- Both Kearny and FDU follow the same pattern, but FDU has twice the turbidity.

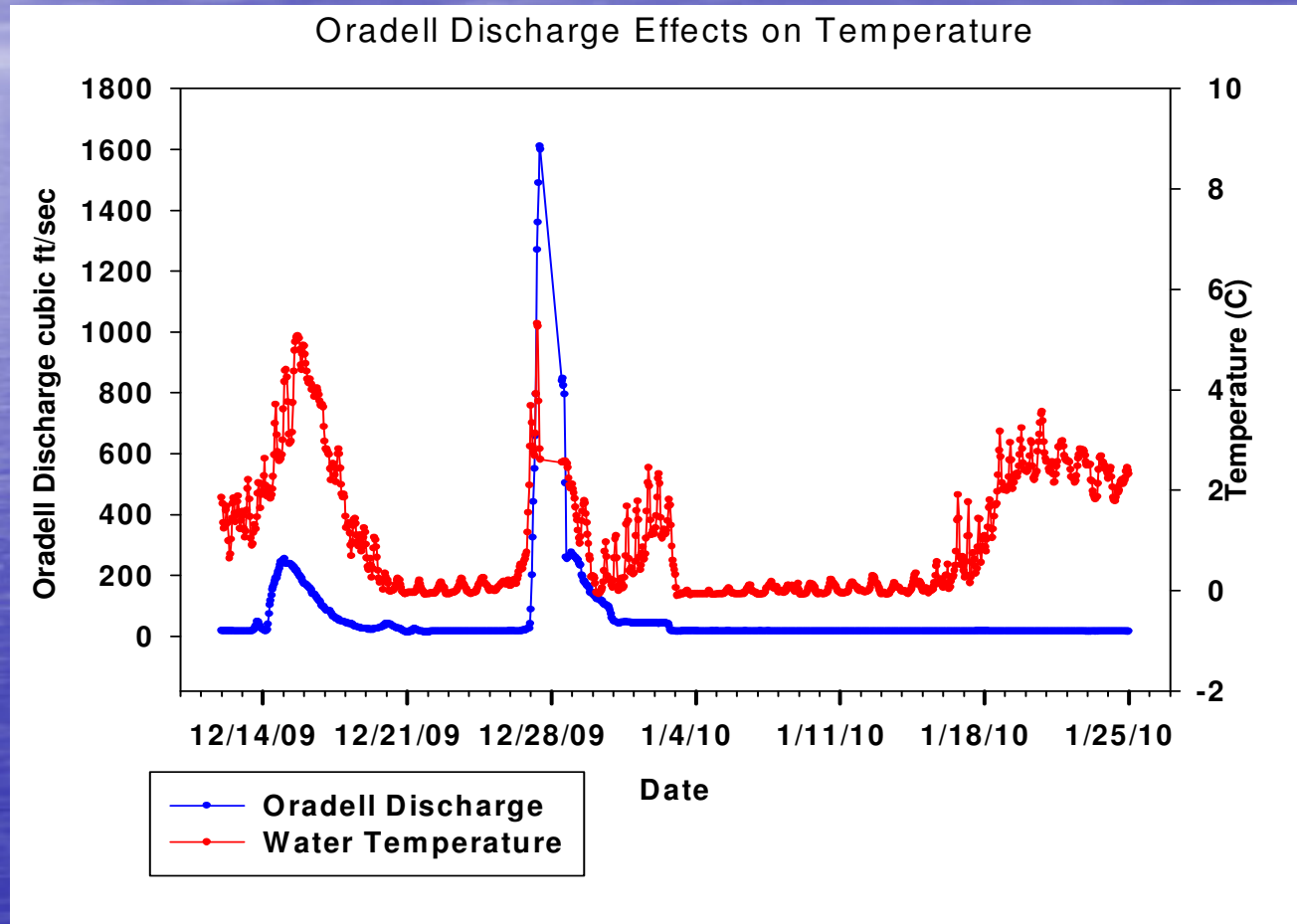


**During strong rain events Oradell Dam may
Discharge 1600 cubic feet per second for several
hours or days**

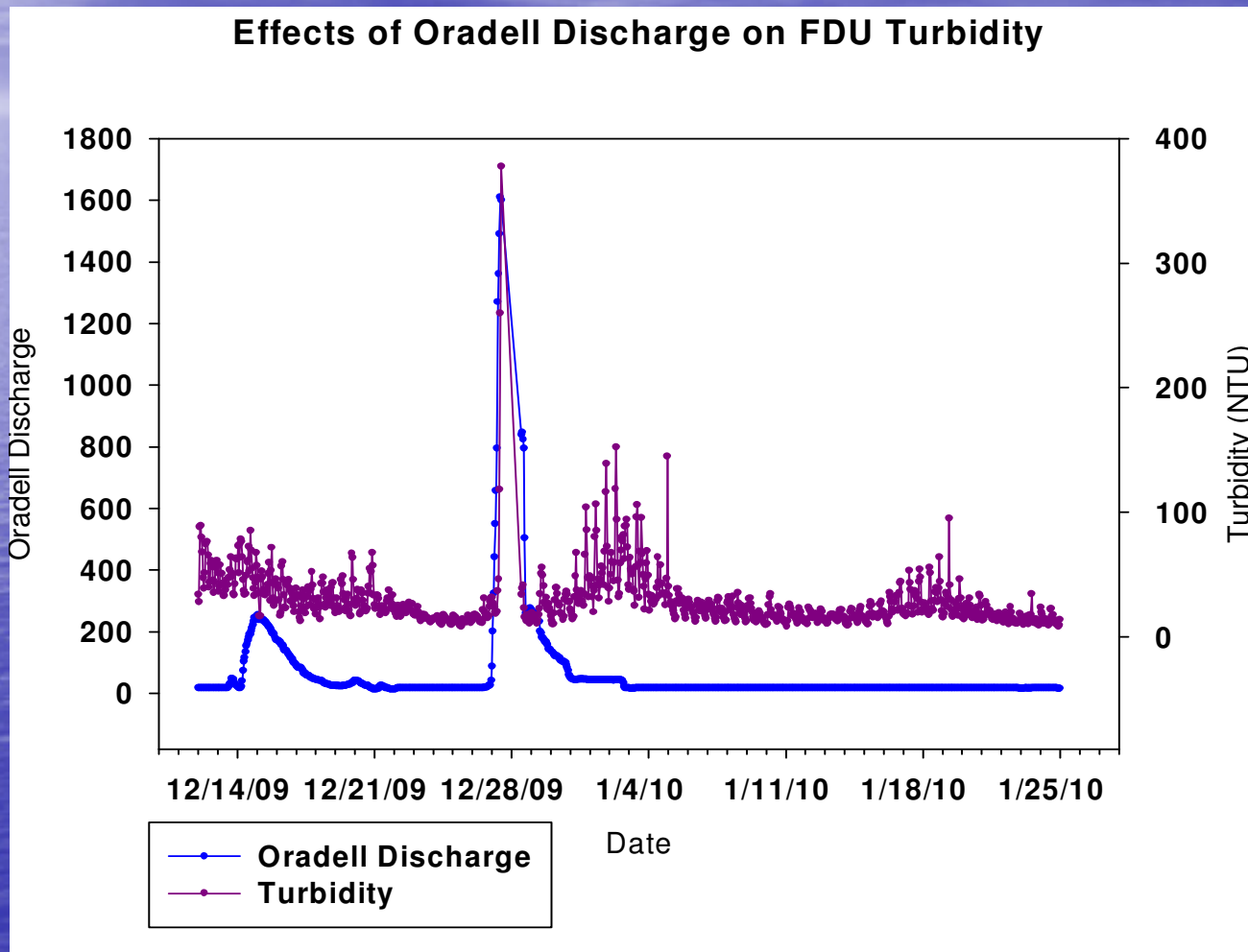


**The Effects of the Oradell Dam Discharge on
Several Water Quality Parameters
December 2009– January 2010**

Temperature

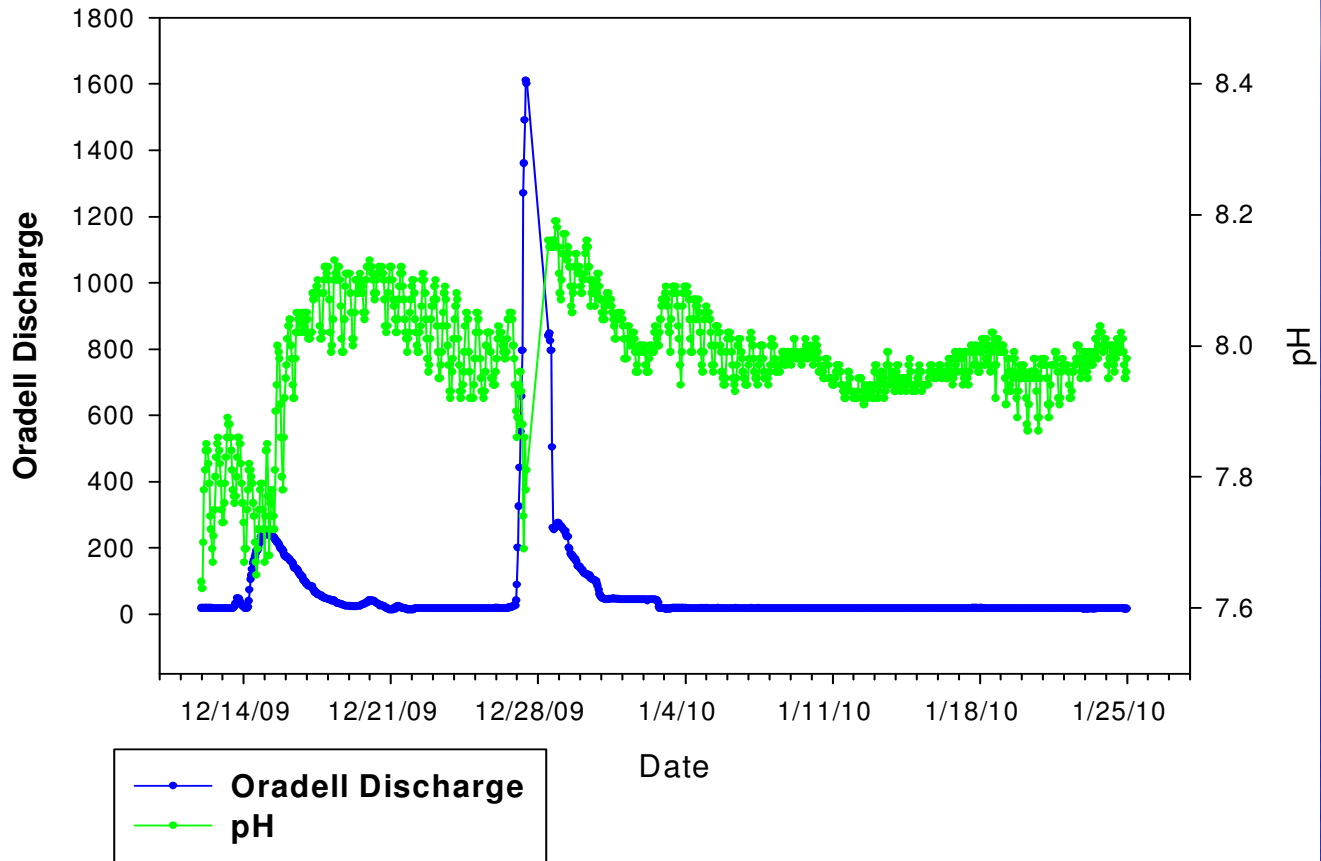


Turbidity



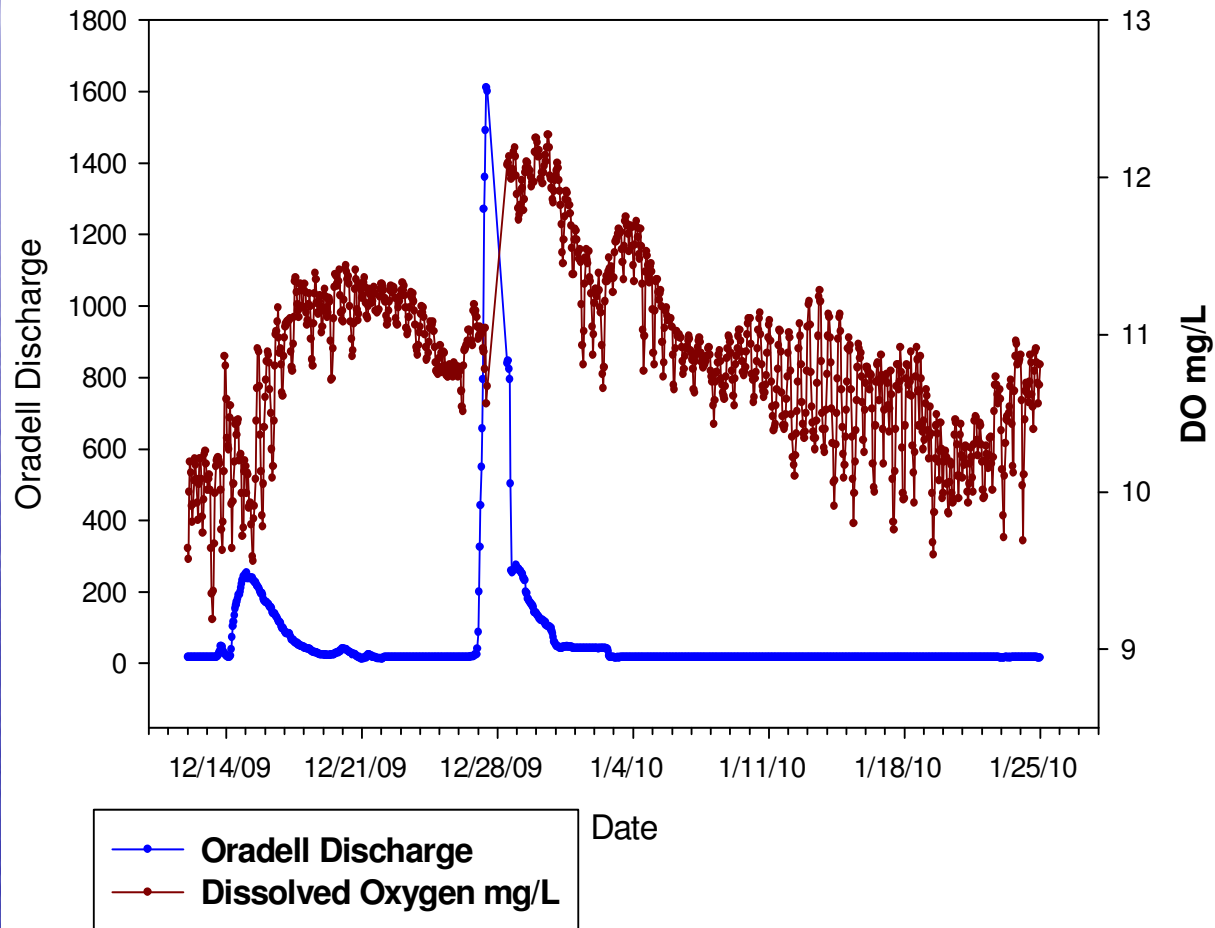
pH

Effects of Oradell Discharge on FDU pH

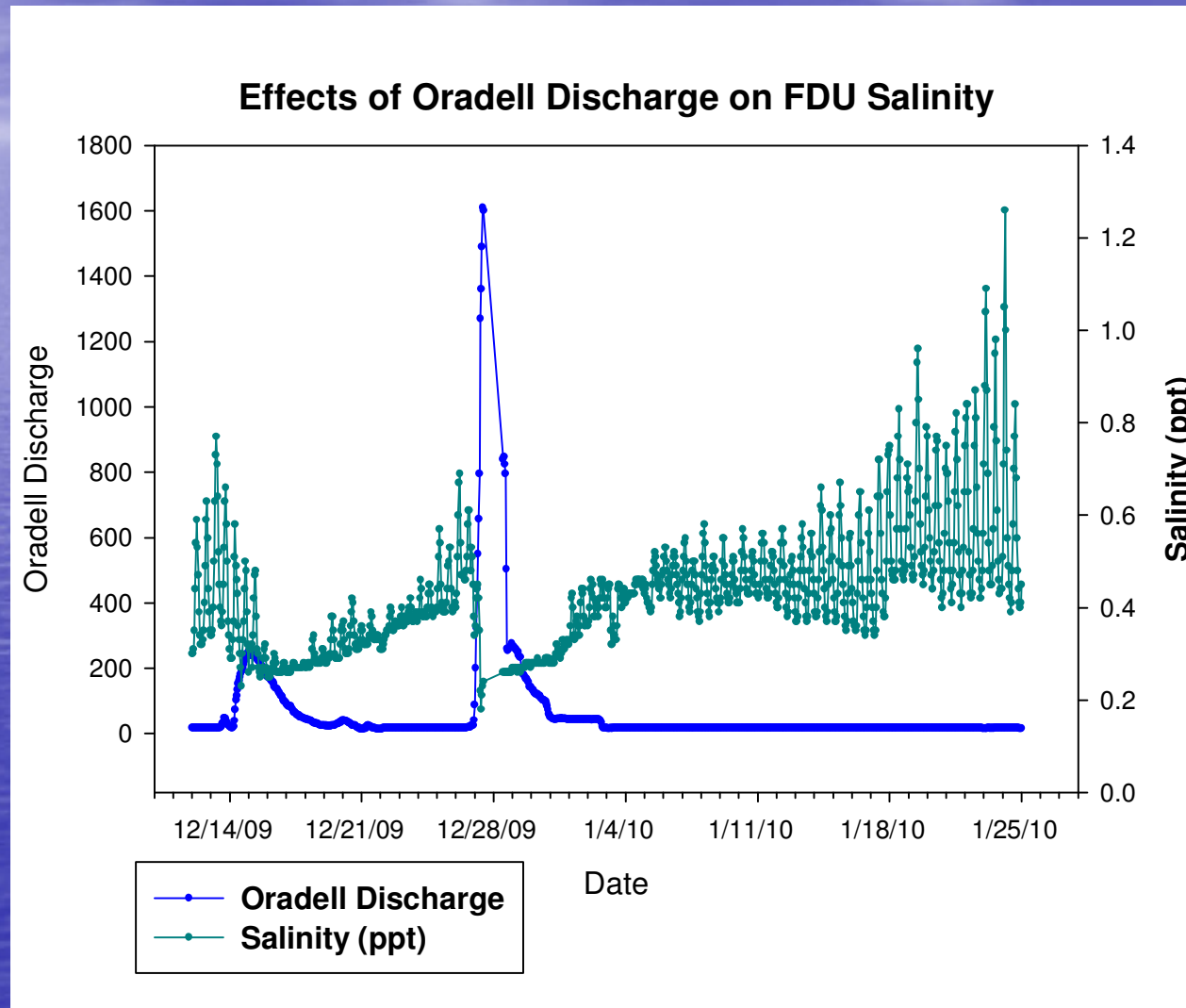


Dissolved Oxygen

Effects of Oradell Discharge on FDU Dissolved Oxygen



Salinity



Conclusions

- Only stations near water treatment facilities had DO below or barely above criteria during the summer months

Conclusions (cont.)

- Higher than average precipitation (7-8 inches above normal) had a significant effect in lowering the overall salinity of the estuary during the summer months of 2009

Conclusions (Cont.)

- Tidal amplitude was greatly correlated with turbidity
- High energy Oradell Dam discharge has a significant effect on all water quality parameters measured and may contribute to the re-suspension of legacy contaminants in the lower estuary

Conclusions

- The distance from the source of discharge or tidal source (The Newark Bay) has huge effects on water quality parameters.
- Tidal amplitude, whether it is a spring tide or a neap tide, has major effects on the turbidity of the river.
- Sensor location can effect the data and results. Berry's Creek is shaded and Mill Creek is in full sunlight. Both Mill Creek and Berry's Creek Sensors are not located within the center of the river causing different results.
- By knowing the distances between stations and applying the data, we can calculate and assume the water quality at any point and time on the river.

Questions?

- Water Quality Data for the Hackensack River in the Meadowlands is available in real-time at:
- <http://merigis.njmeadowlands.gov/vdv/index.php>
- joe.grzyb@njmeadowlands.gov