

**AN HISTORICAL PERSPECTIVE OF
NUTRIENTS AND DISSOLVED OXYGEN:
CHANGES IN WASTEWATER LOADS
AND WATER QUALITY IN
LOWER SOUTH SAN FRANCISCO BAY,
1957-2013**

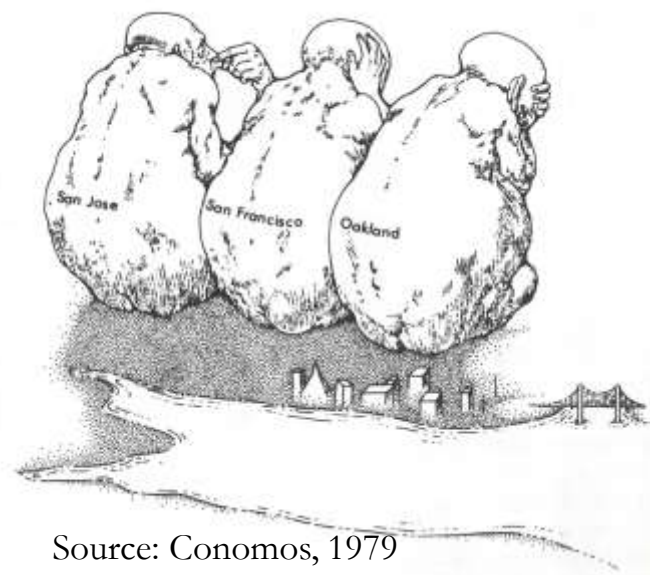
**Simret Yigzaw
City of San Jose**

Introduction



Problem Statement

- From 1957 - 1964, BOD was released in substantial amounts by the Facility directly into the waters of the Bay
- From 1964 - present, BOD has been created in the Bay as a result of nutrients (such as nitrogen and phosphorus), released by the Facility



Source: Conomos, 1979



Source: SWRCB, 1971

Research Questions

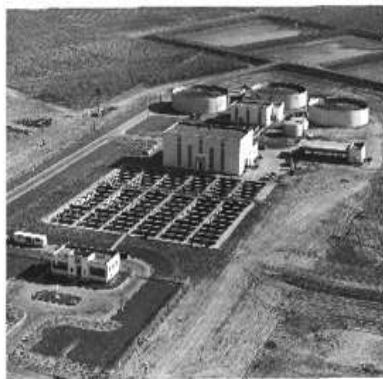
- Did expansion and upgrades result in improved effluent quality?
- Did improved effluent quality translate into improved Bay water quality?



Treatment Eras

- 1957-1964: primary treatment
- 1964-1979: secondary treatment
- 1979-1997: tertiary/advanced treatment
- 1997-2013: Biological Nutrient Removal (BNR)

1956



1964



1979



1997



Hypotheses

1. As wastewater treatment improves, effluent pollutant loads decline
2. Ambient DO concentrations are inversely \propto effluent pollutant loads
3. Ambient DO and nutrient concentrations follow temporal, seasonal, and spatial patterns



Methodology



Historical monitoring stations



Then



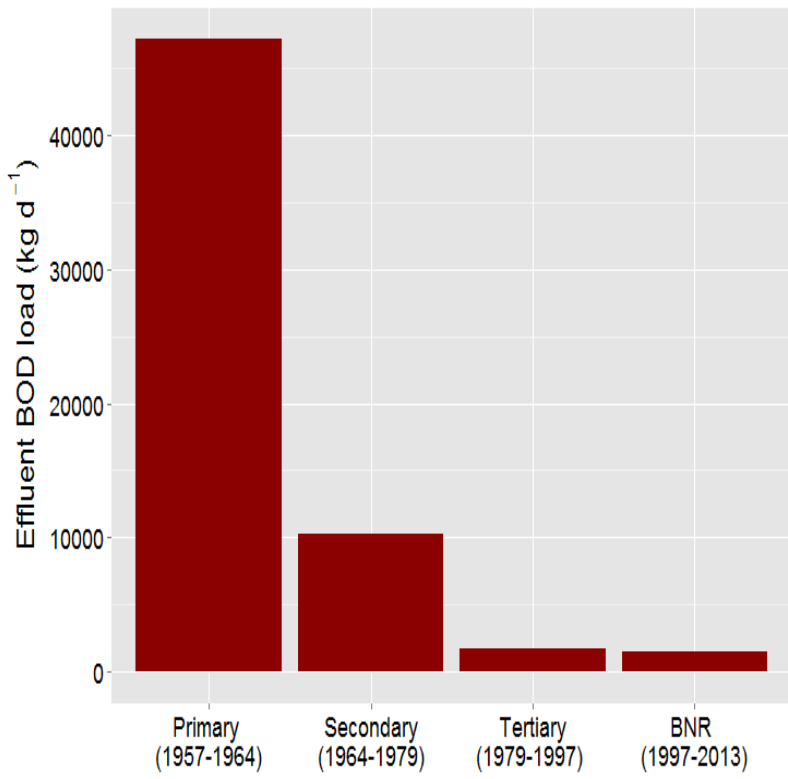
Now



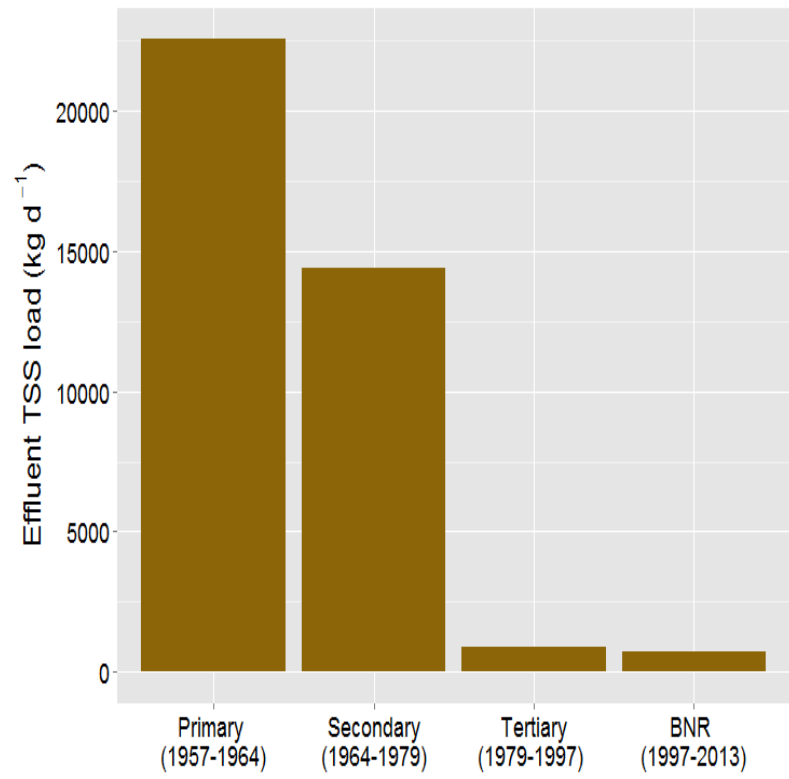
Effluent load reduction & Facility upgrade



BOD



TSS

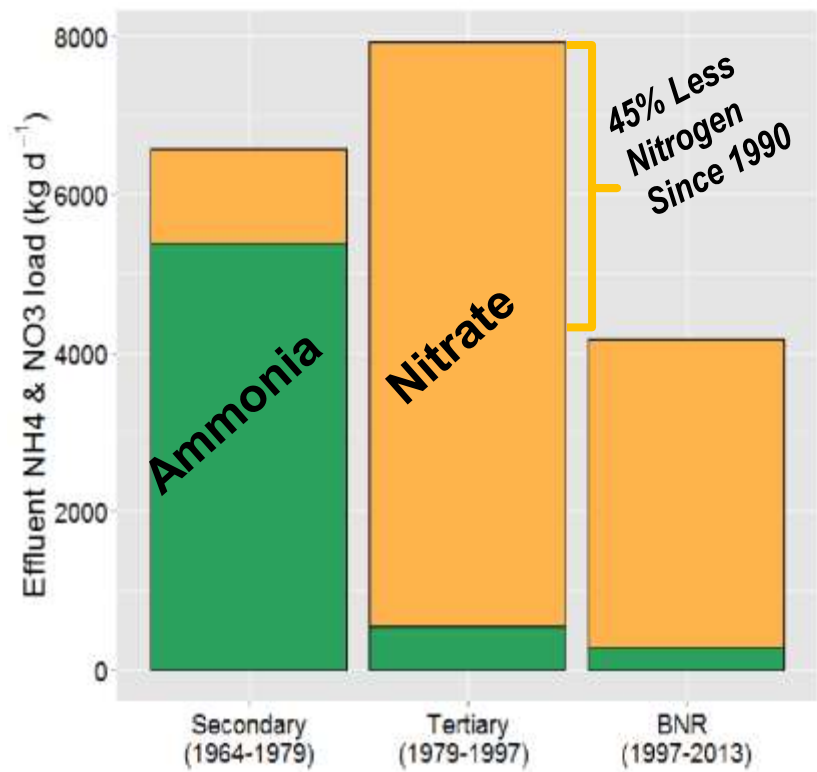




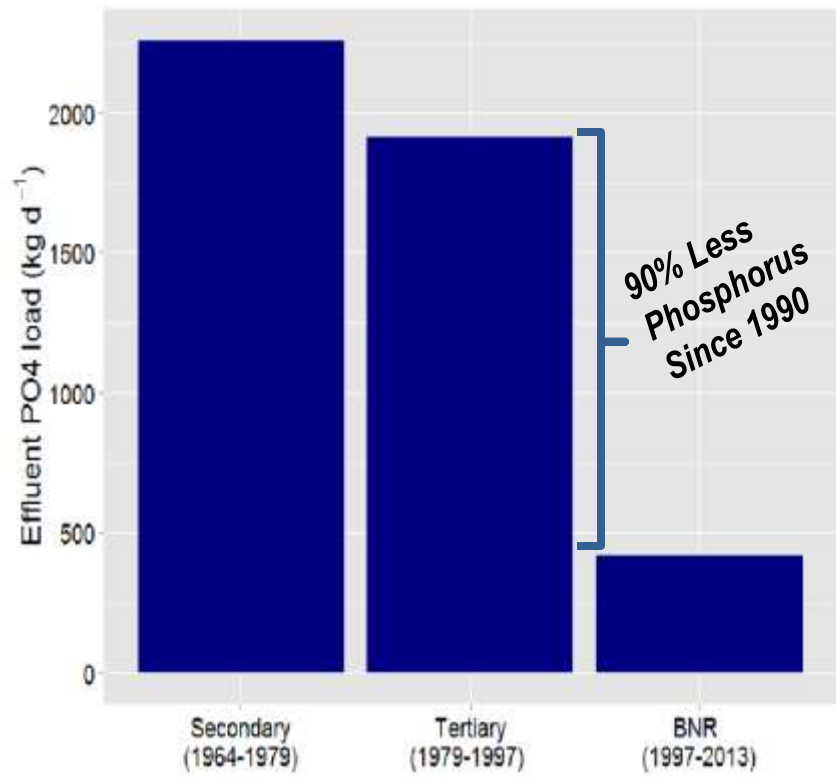
Effluent load reduction & Facility upgrade



Ammonia & Nitrate



Phosphorus





Ambient DO conc. & effluent load

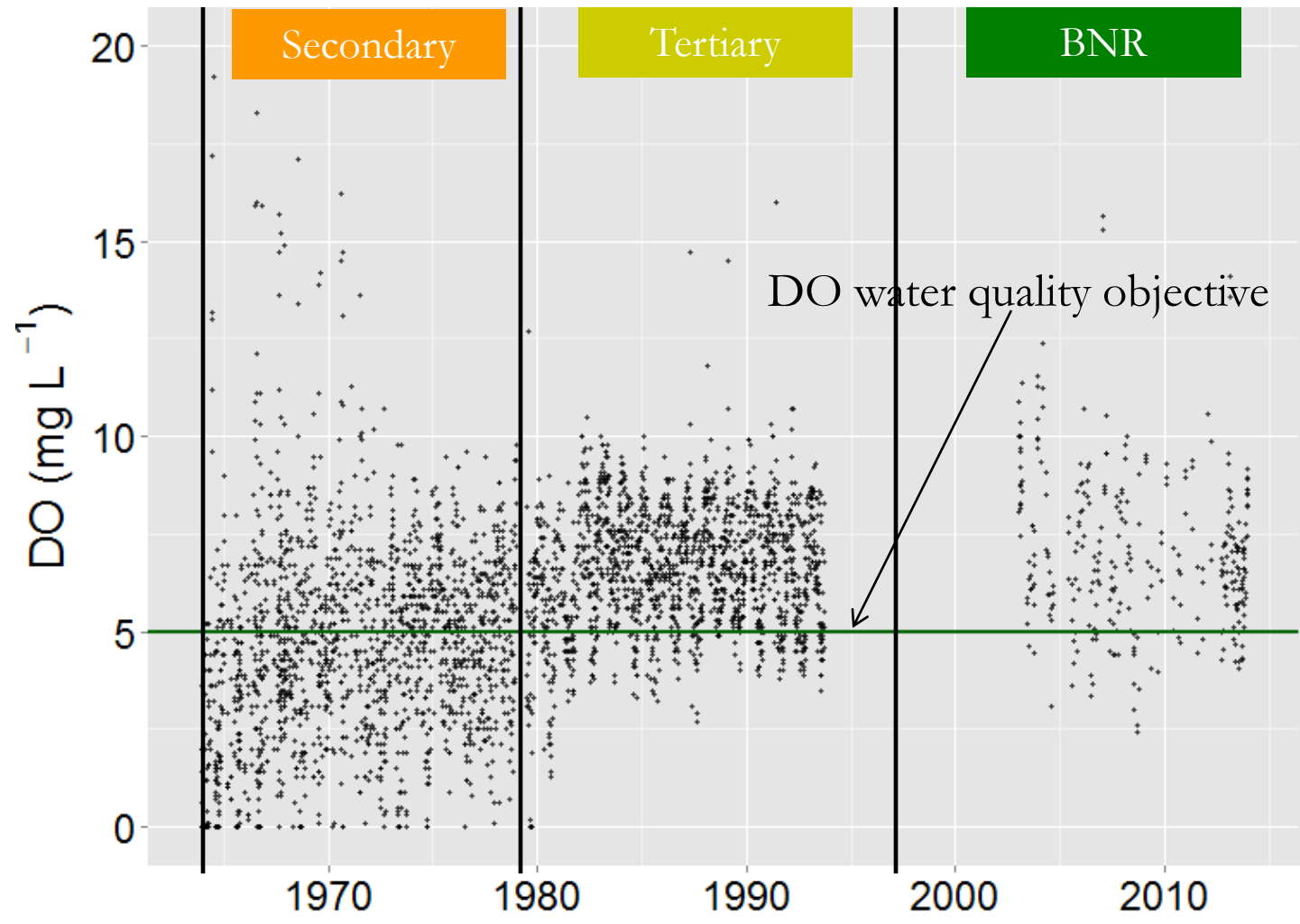


Pearson correlation

	BOD - DO	NH ₄ ⁺ - DO	NO ₃ ⁻ - DO	PO ₄ - DO
SB15	-0.66	-0.55	0.68	-0.26
SB13	-0.45	-0.47	0.63	-0.18
SB04	-0.42	-0.43	0.49	-0.17
SB05	-0.37	-0.26	0.34	-0.12
SB03	-0.29	-0.19	0.22	-0.13



DO conc. in Lower stretch of Coyote Creek



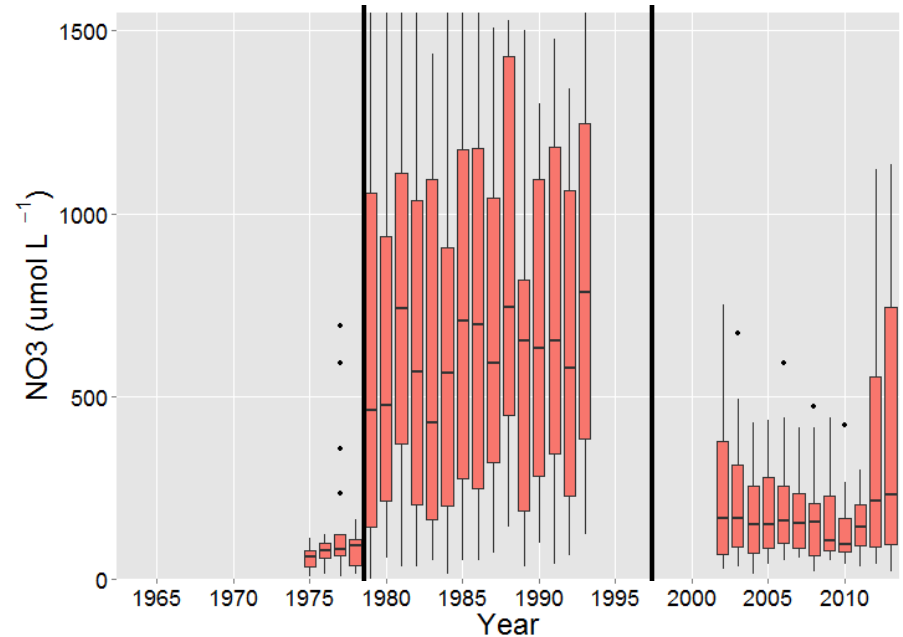
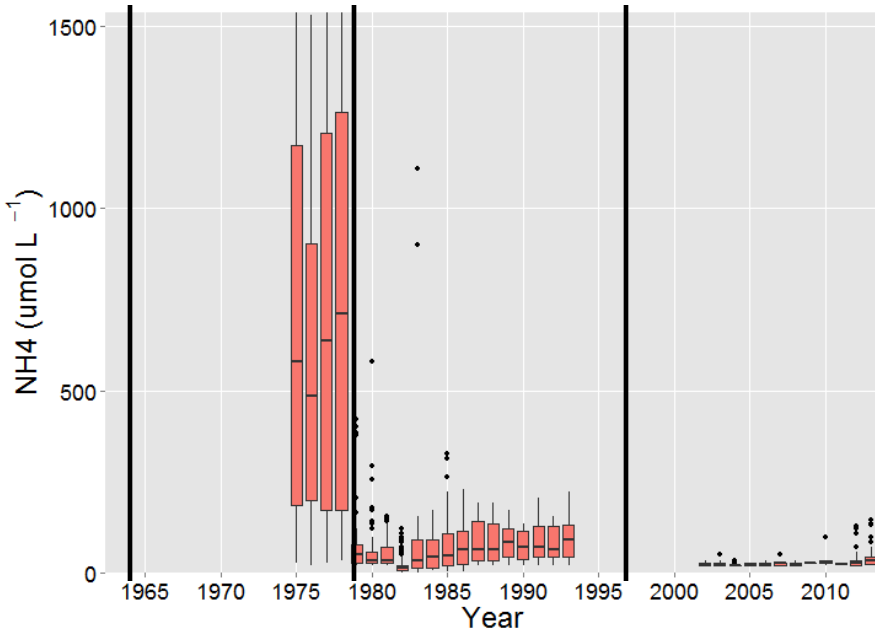


Temporal nutrient conc. in the LSB



Ammonia

Nitrate



- Ammonia concentrations declined with nitrification
- Nitrate concentrations declined with BNR

1956

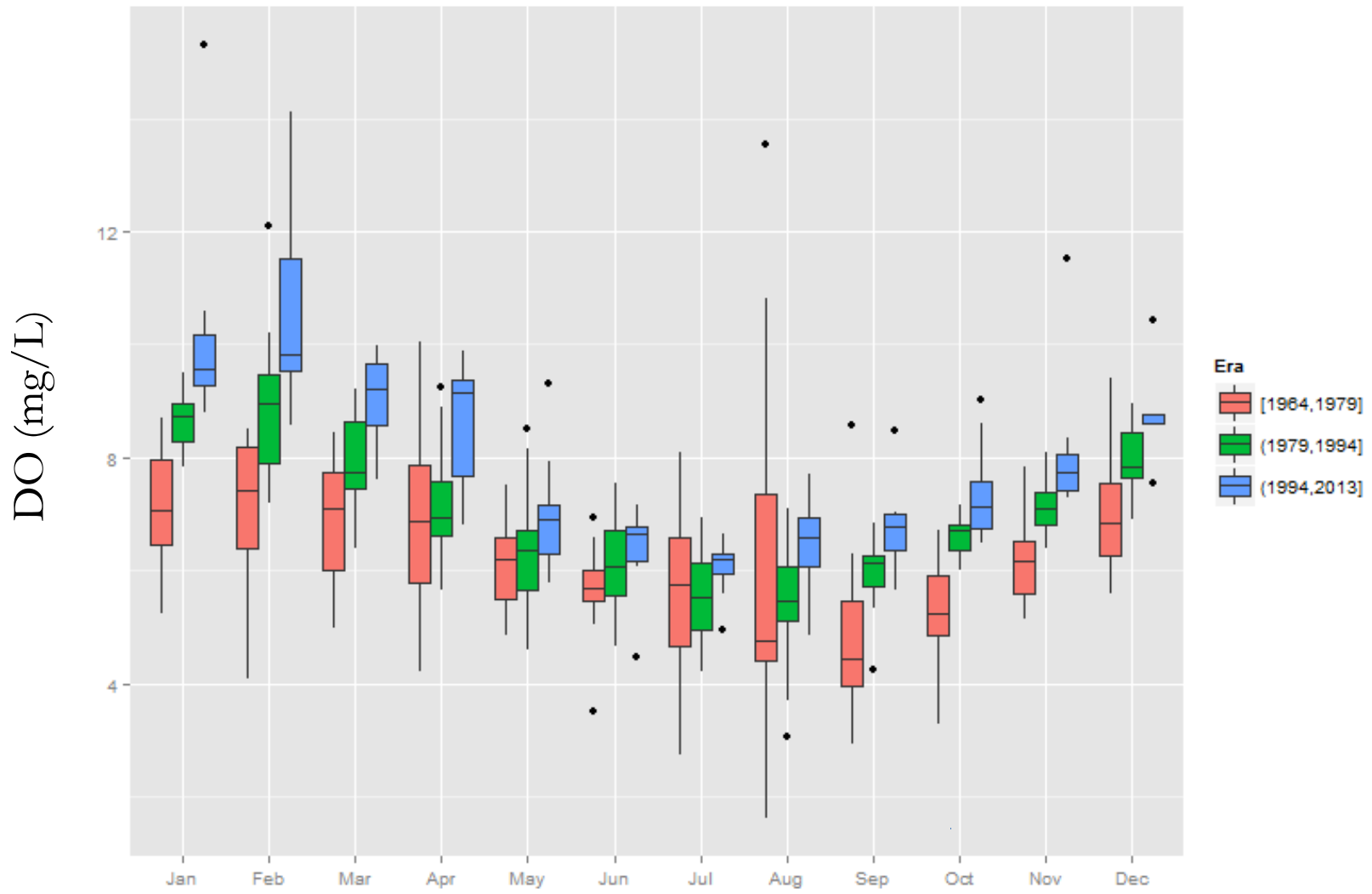
1964

1979

1997



Seasonal DO conc. at SB03



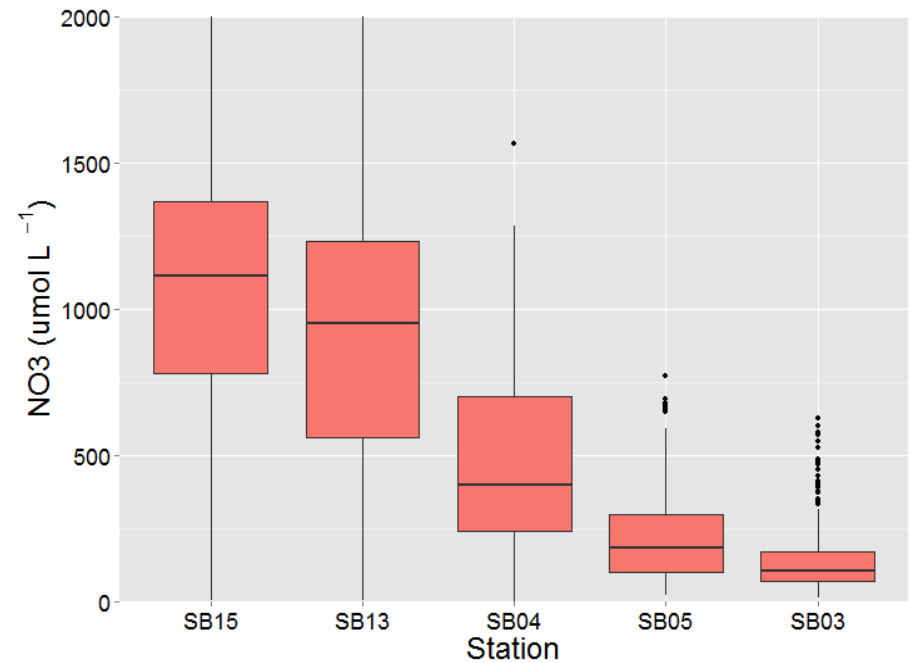
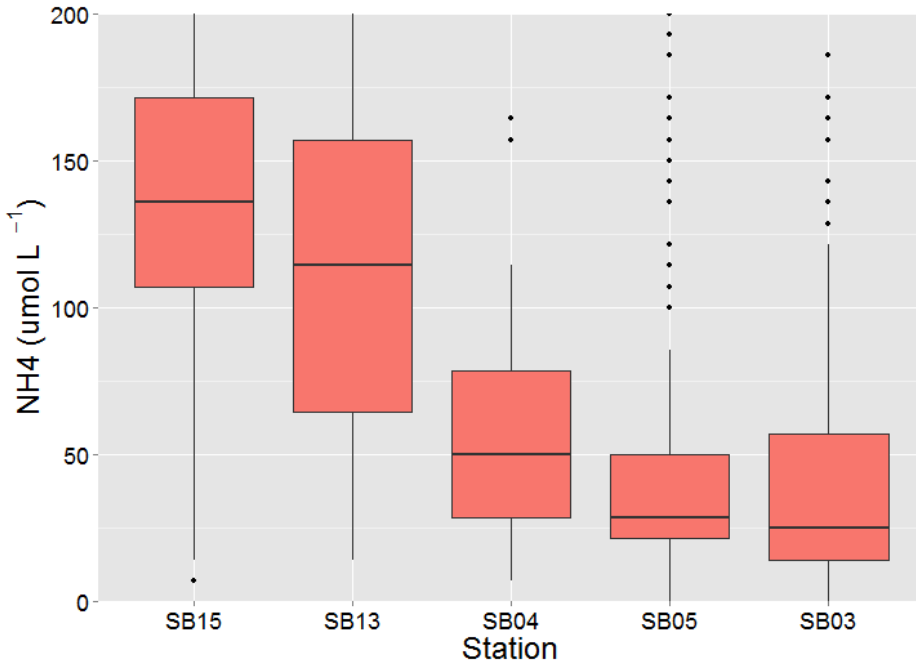


Spatial nutrient conc. in the LSB



Ammonia

Nitrate



- Nutrient concentrations declined further from the Facility

Conclusions

- Facility improvements correspond to major load reductions of BOD, TSS and nutrients
- DO concentration in LSB significantly improved following implementation of nitrification
- Nutrient concentrations in LSB significantly decreased following Facility improvements
- Complexity of contributing factors
- Strong need for coherent nutrient science and management strategy

Acknowledgement

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Thank you!



Questions?