(B. Eggleton: www.godzillatemple.com)

FLUXZILLA:

The Start of a Comprehensive Analysis of over 7000 Sediment Oxygen and Nutrient Exchanges in Estuarine and Coastal Marine Systems

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Overview

- Background
- Methods
  - Measurement Methods
  - Data Inclusion Criteria
- Site Locations
- Data Set Characteristics
- Results
- Conclusions
- Acknowledgements

Background

- Numerous studies and modeling exercises have shown tight coupling between benthic and pelagic processes in shallow water ecosystems.
- With growing needs to better manage coastal waters efforts have been increased to understand the pathways of benthic-pelagic coupling.
- Have been able to put together two large data sets of *in situ* benthic flux rates with over 7500 individual solute measurements and associated environmental conditions.

Intact Sediment Core Incubations

Inclusion Criteria :

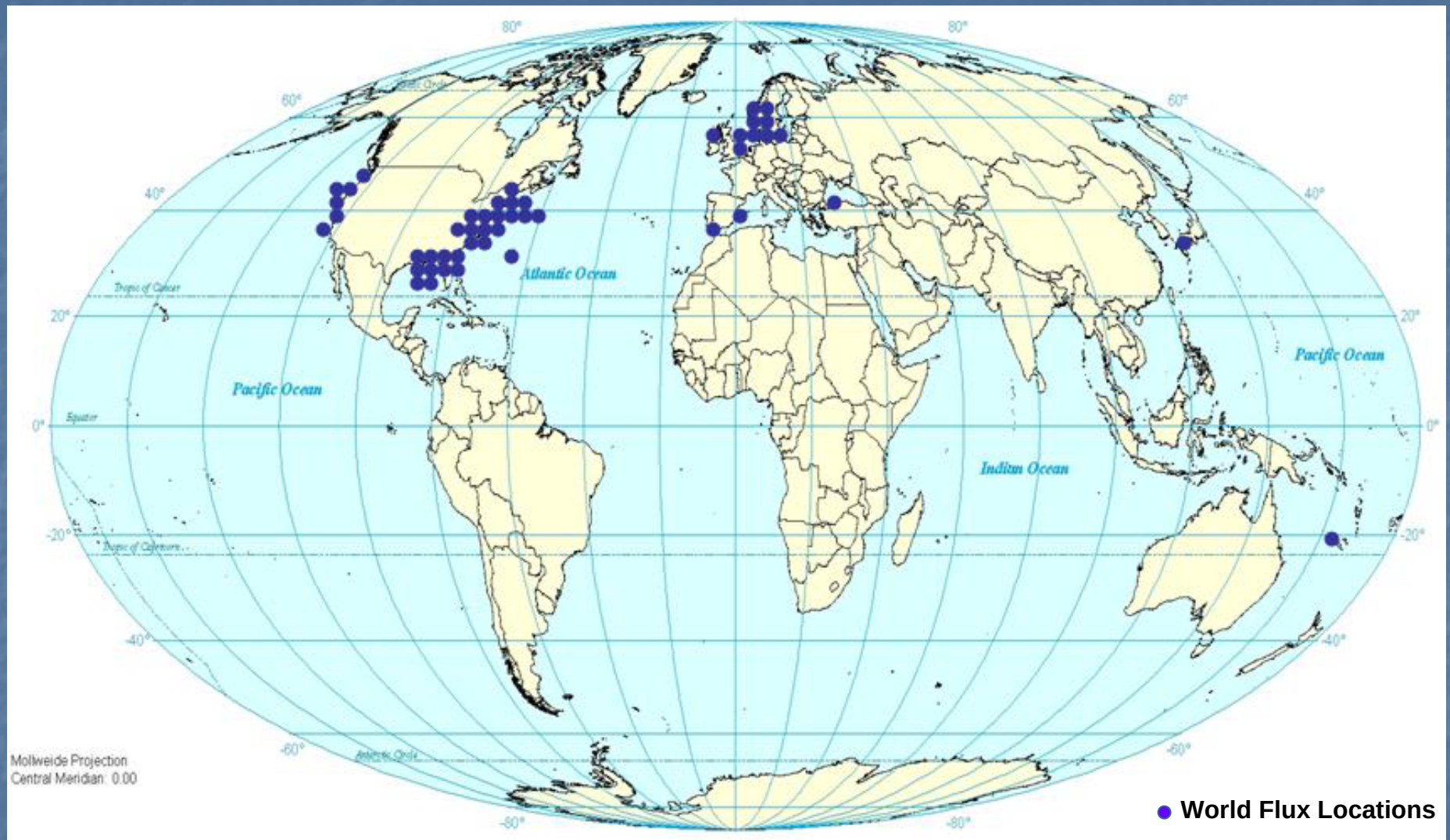
- **Direct constituent measurement**
  (no diffusional estimates)
- **Dark**
- ***In situ* conditions**

Plexiglas flux chambers

Bouma box corer

Benthic metabolism chambers

World Flux Data Site Locations



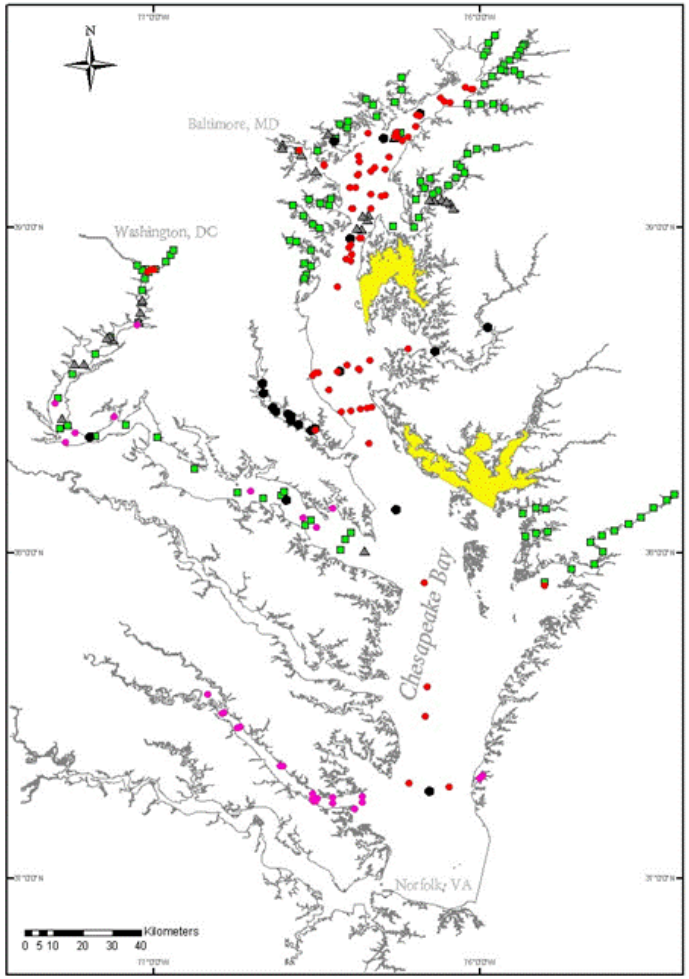
ArcGIS 8 Development Team
March 2000

Source: ESRI Data & Maps CD
Created in ArcGIS 8 using ArcMap

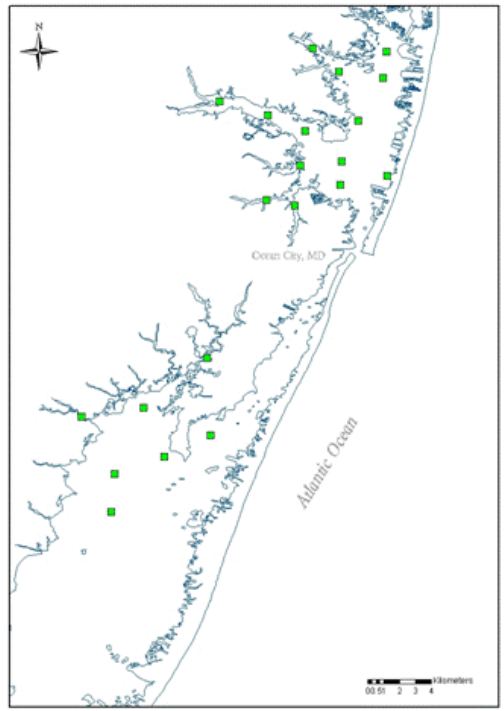
ESRI

Chesapeake Bay Site Locations

Chesapeake Bay



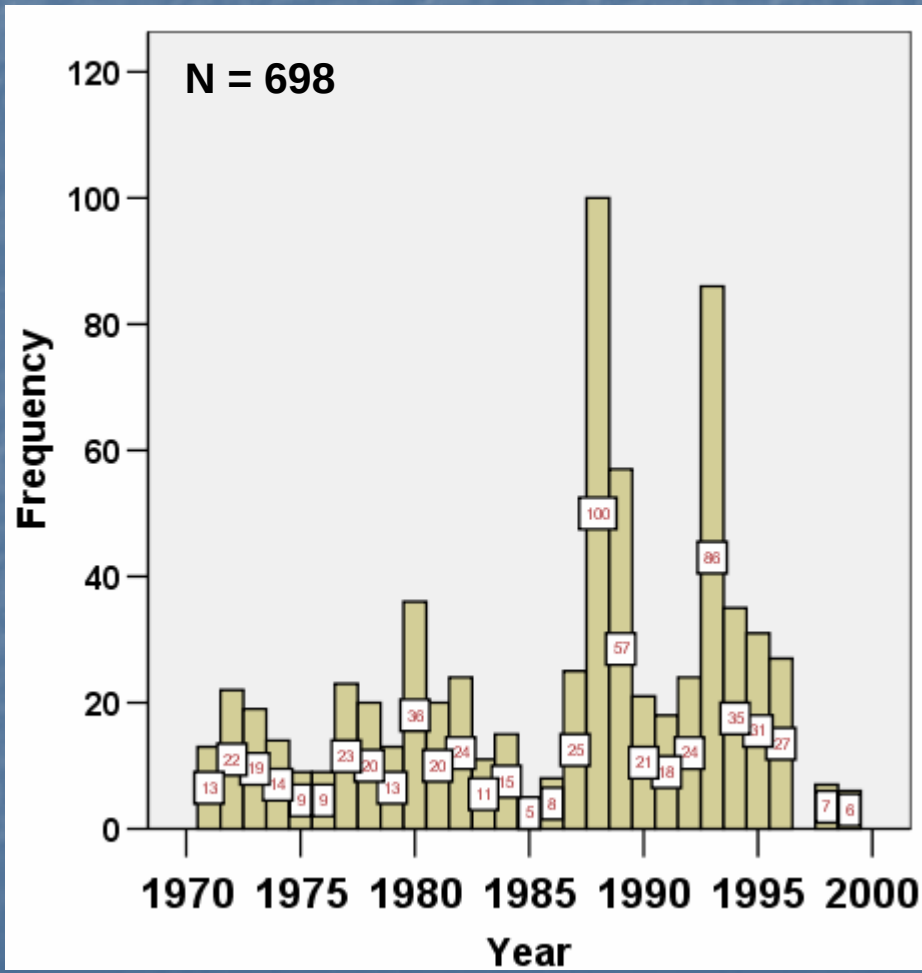
Maryland's Coastal Bays



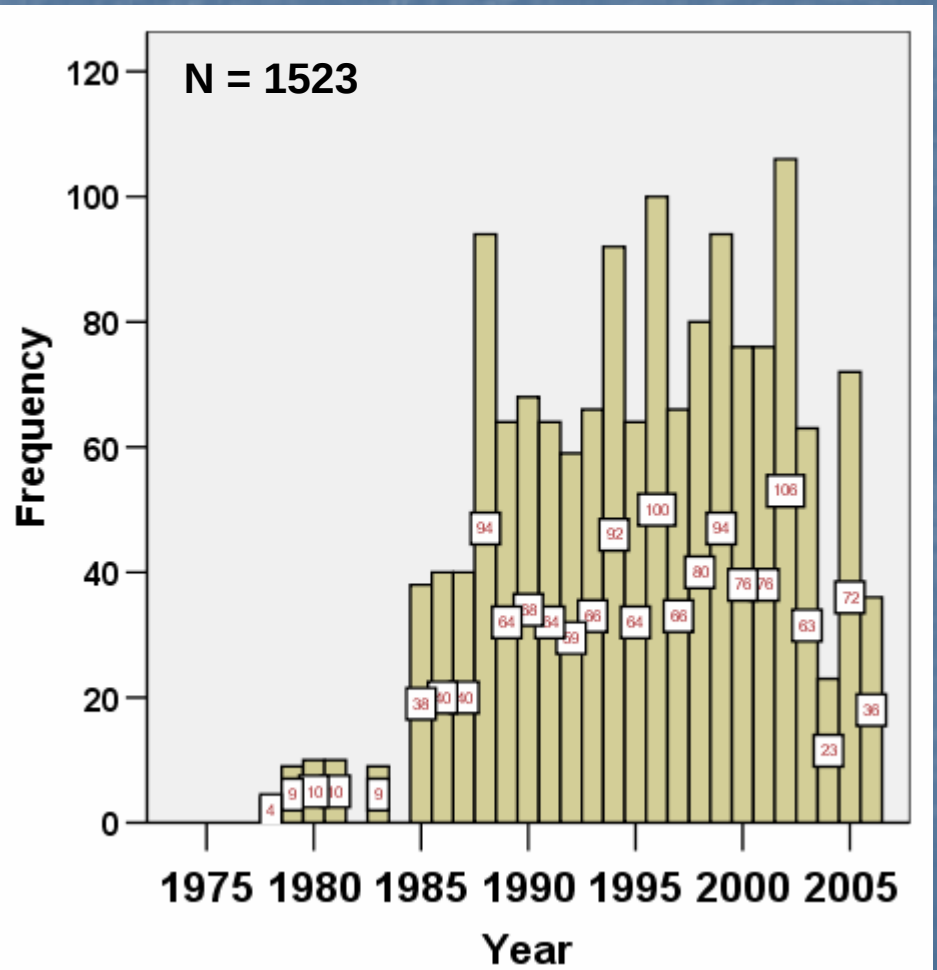
- TMDL Studies (1 year: June, July & August)
- Multi-Year Sampling
- Extended TMDL Style Sampling
- Limited Sampling (1 year; 1-2 sampling periods)
- Non-Boynton Studies
- Maryland Watersheds In Need of Data

Sampling Year Histograms

World Flux Data



Chesapeake Bay Data



We were all busy measuring fluxes in 1988!

Site Variable Ranges

World Flux Data

Variable	Median	Range	N
Depth (m)	14	0.2 to 3707	551
Salinity	13	0 to 38	272
Bottom Water Temperature (°C)	16	-2 to 32	437

Solute Fluxes N = 1701

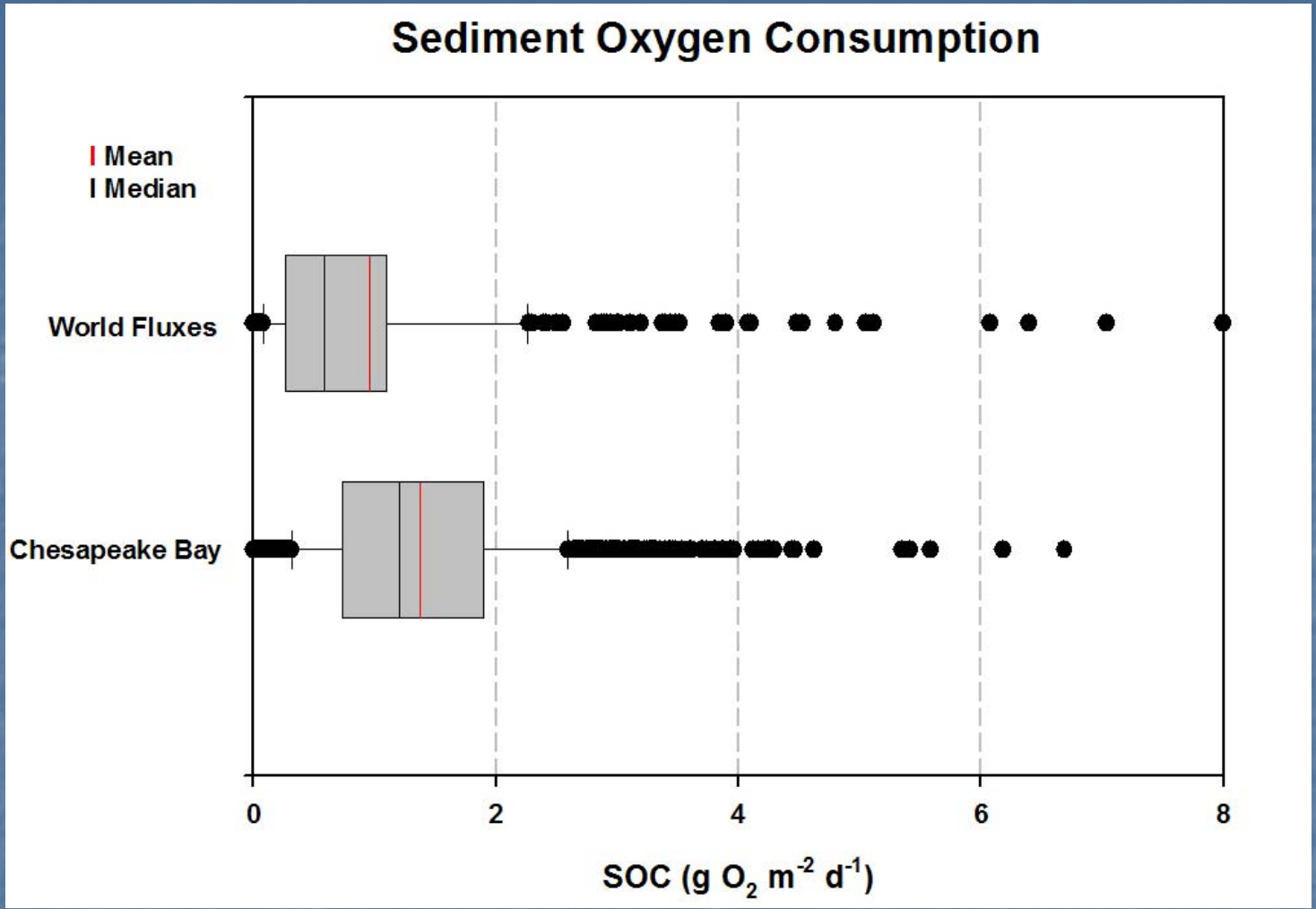
48 Sites

Chesapeake Bay Data

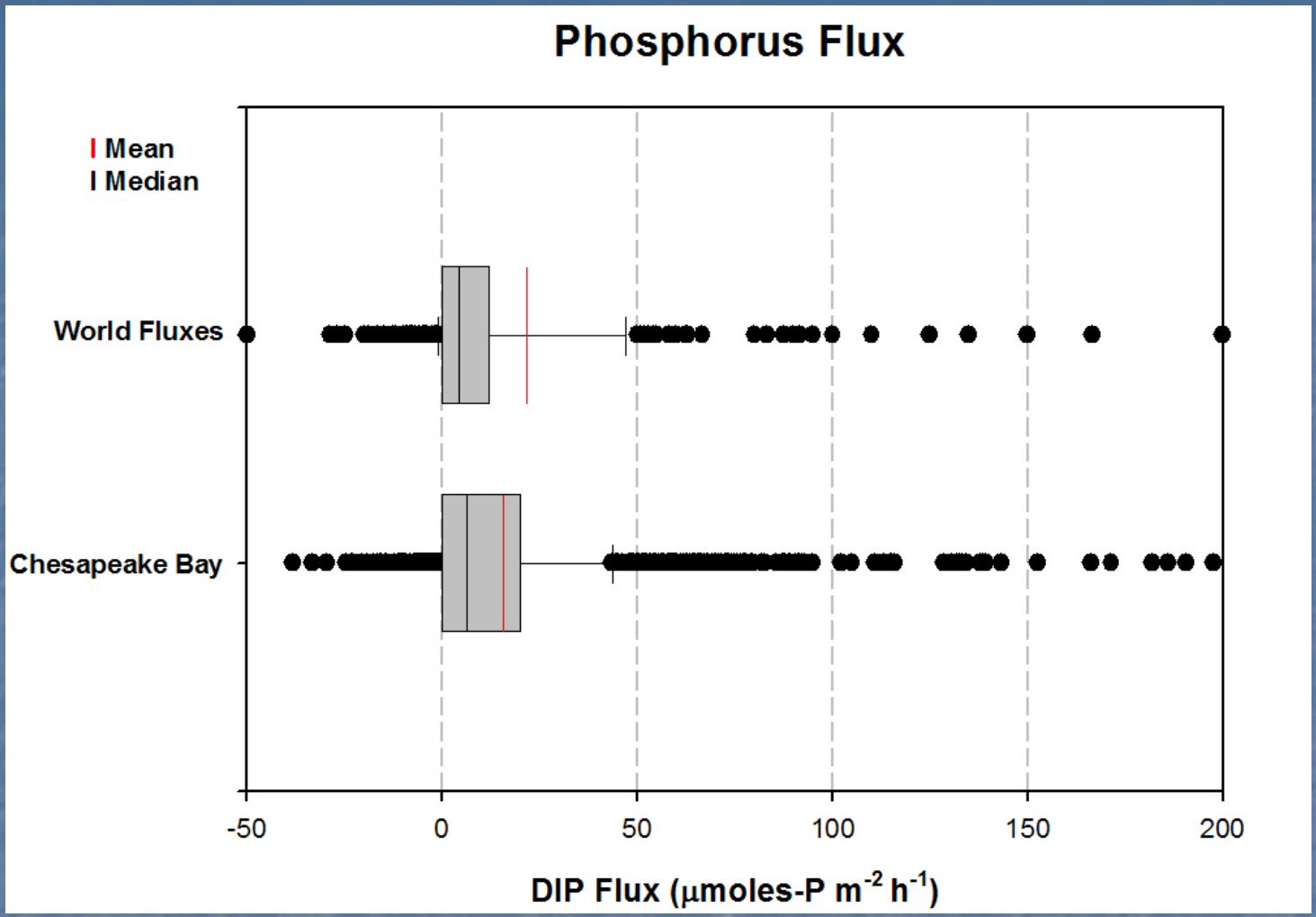
Variable	Median	Range	N
Depth (m)	6	0.5 to 42	1520
Salinity	12	0 to 30	1495
Bottom Water Temperature (°C)	25	4 to 28	1506

Solute Fluxes N = 5936

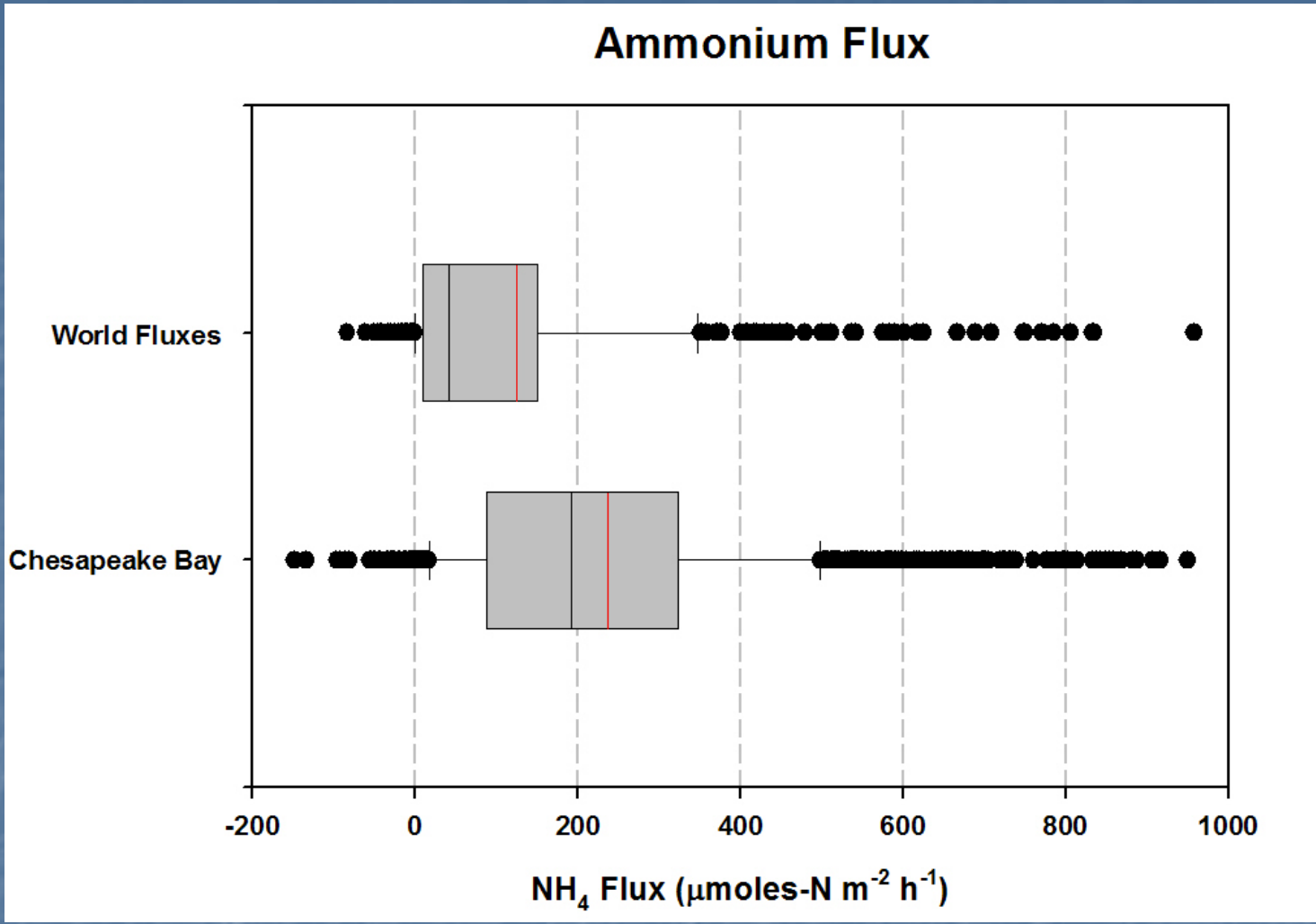
27 Tributaries



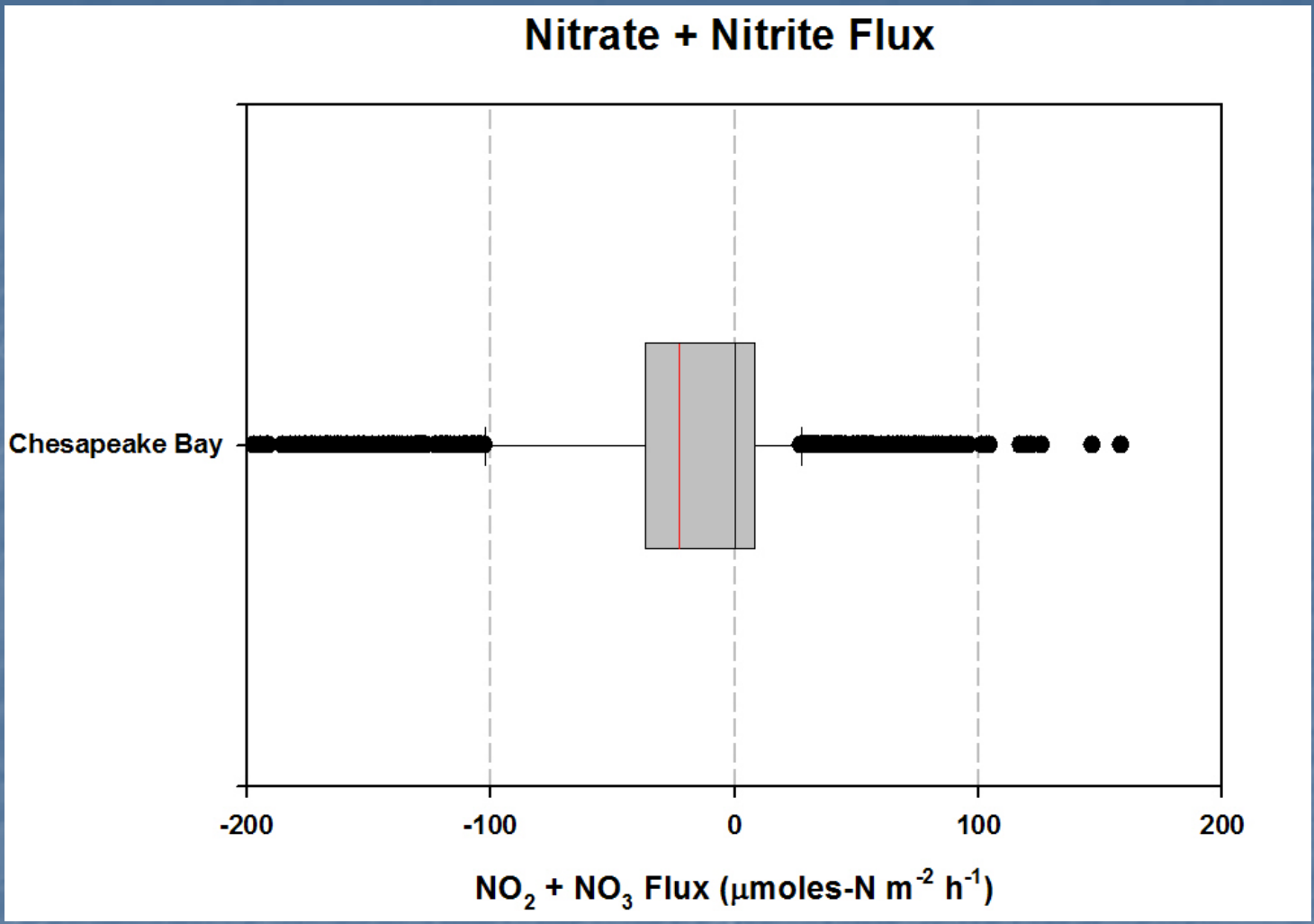
Data Set	Range	N
World Flux	0 to 14	554
Chesapeake Bay	0 to 7	1500



Data Set	Range	N
World Flux	-230 to 900	506
Chesapeake Bay	-140 to 230	1470

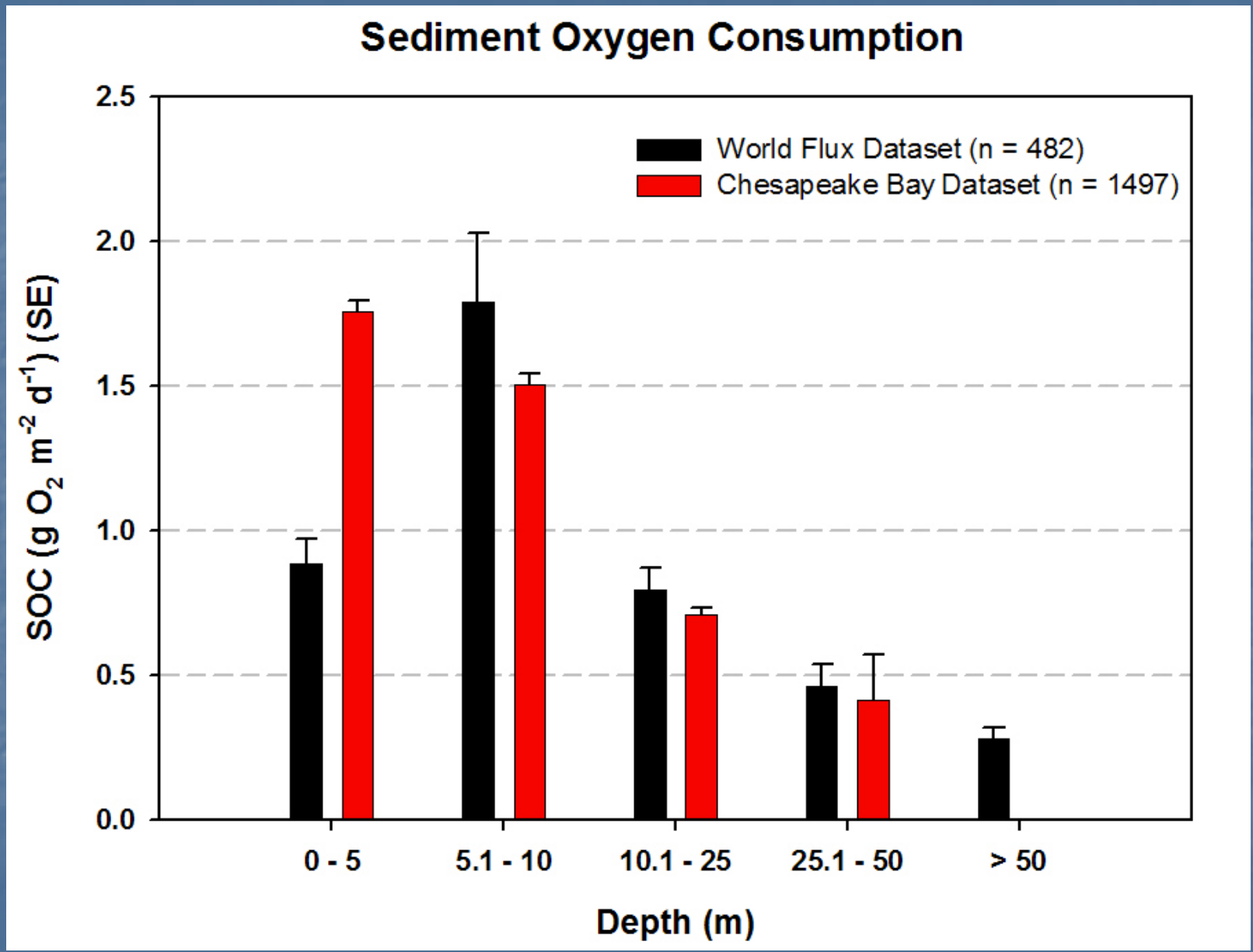


Data Set	Range	N
World Flux	-80 to 2700	641
Chesapeake Bay	-150 to 2200	1486

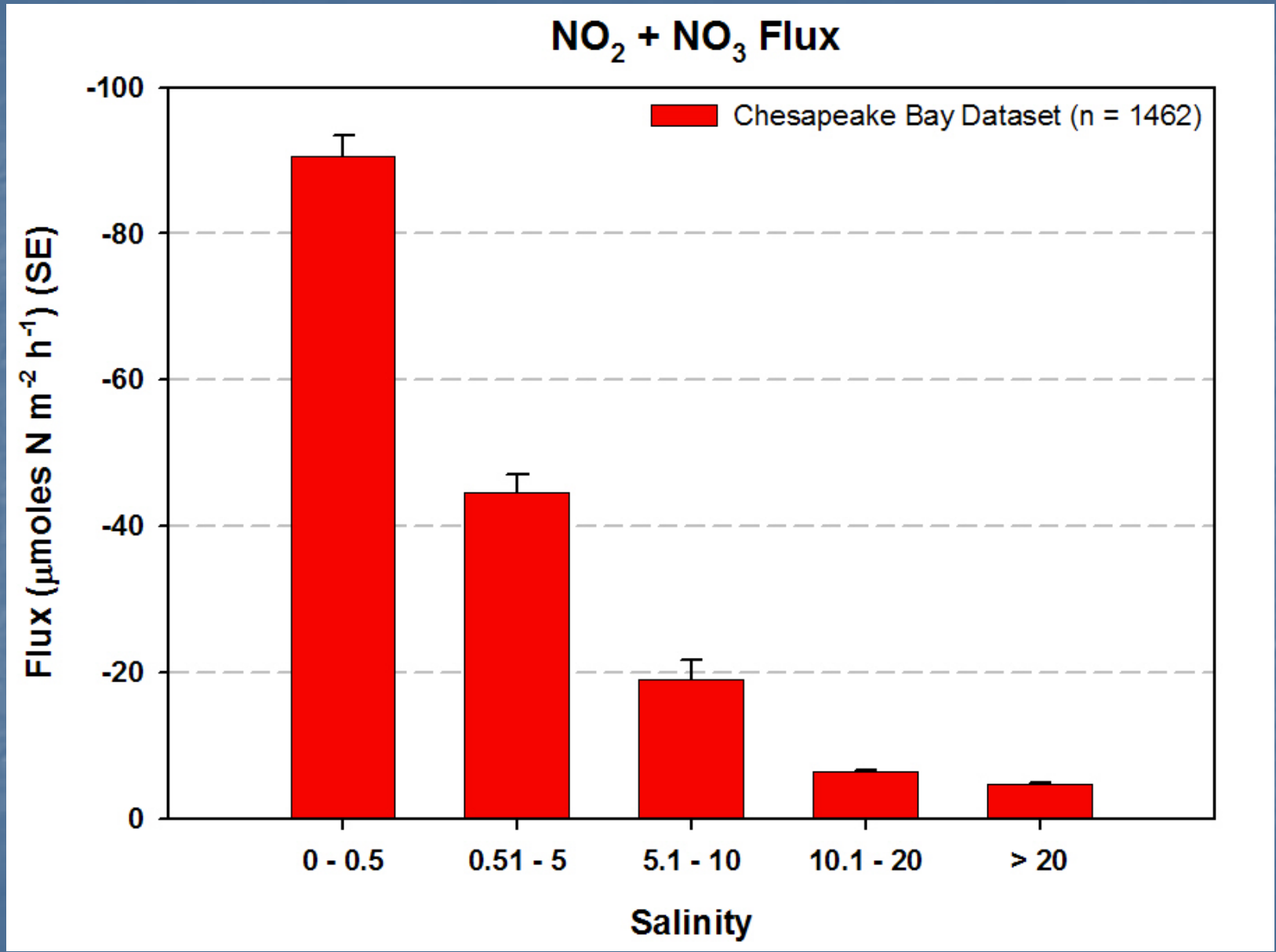


Data Set	Range	N
Chesapeake Bay	-600 to 290	1480

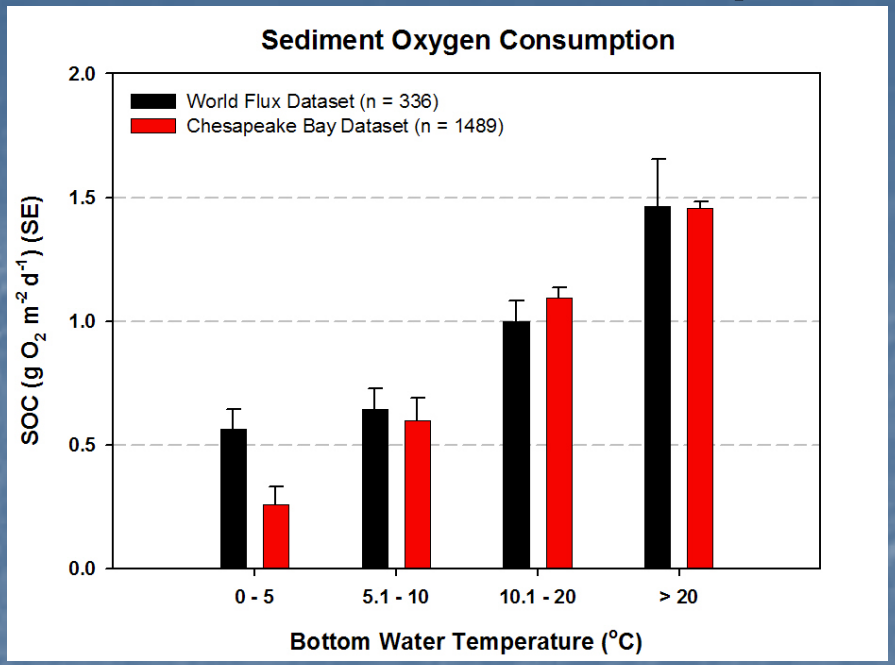
Depth Comparisons

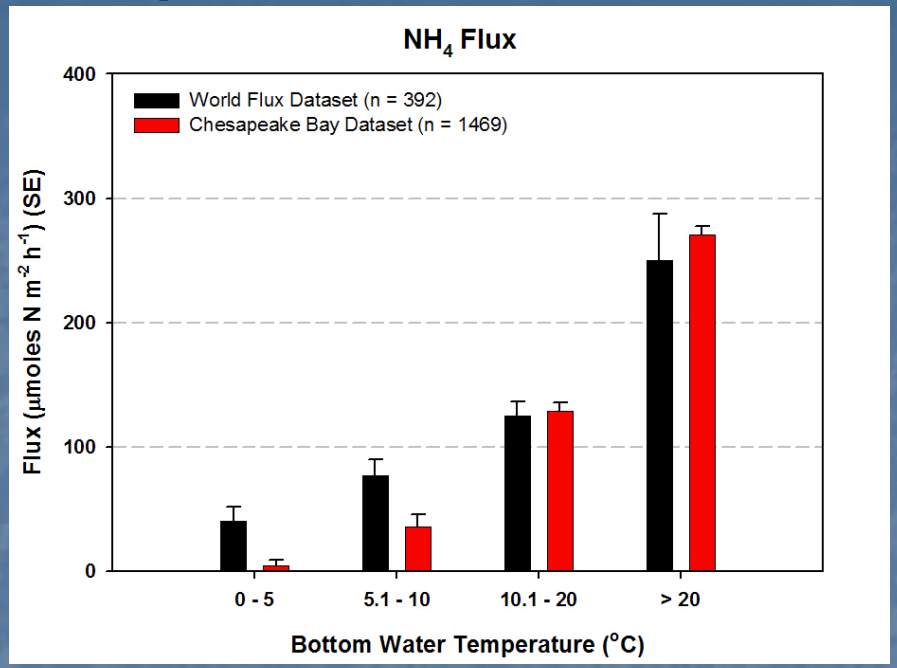


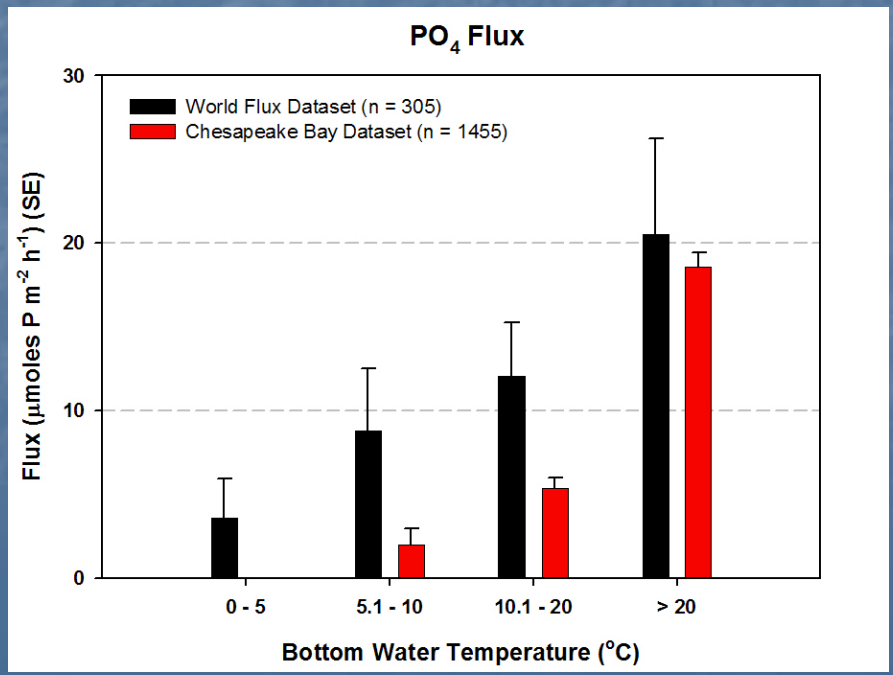
Salinity Comparisons

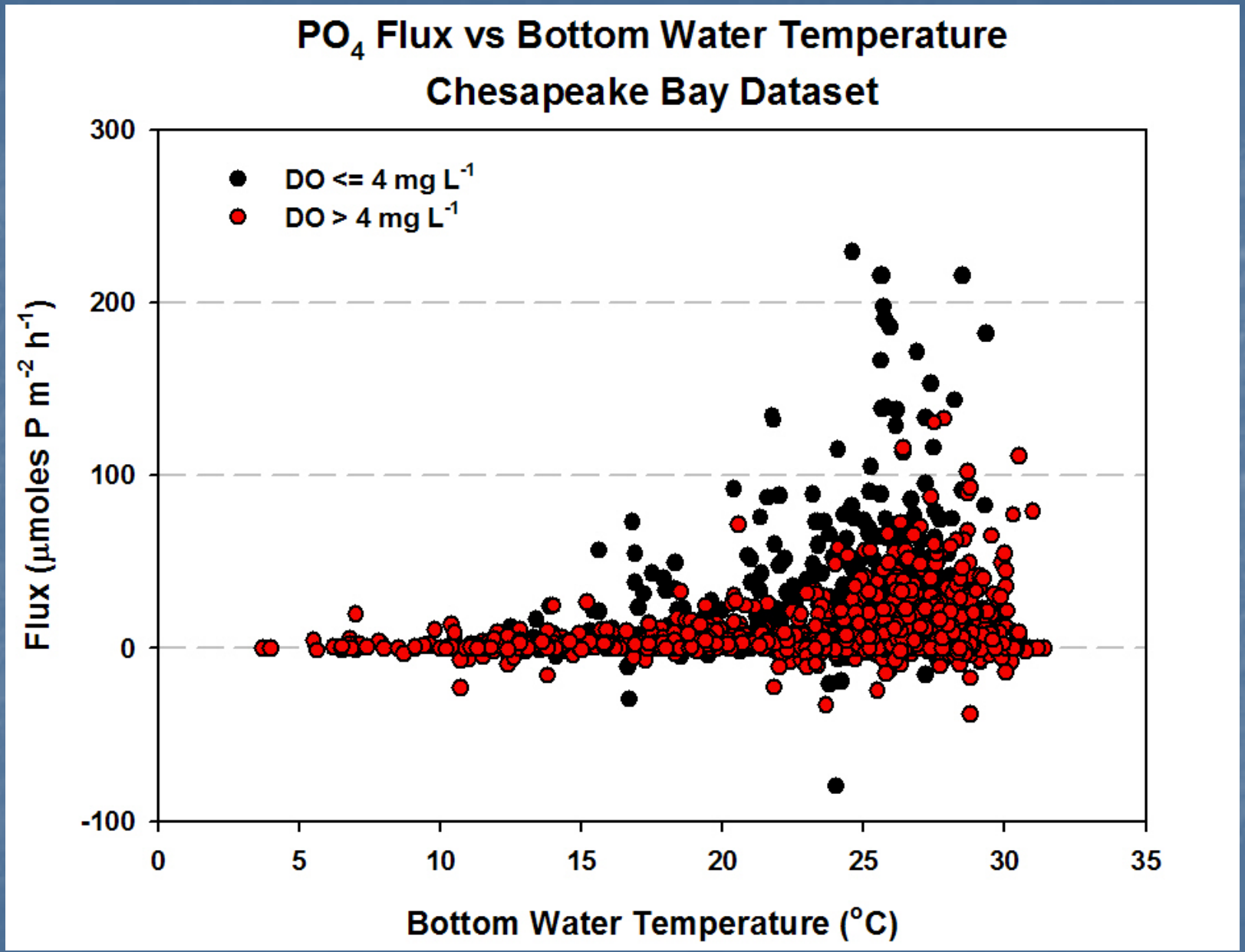


Temperature Comparisons

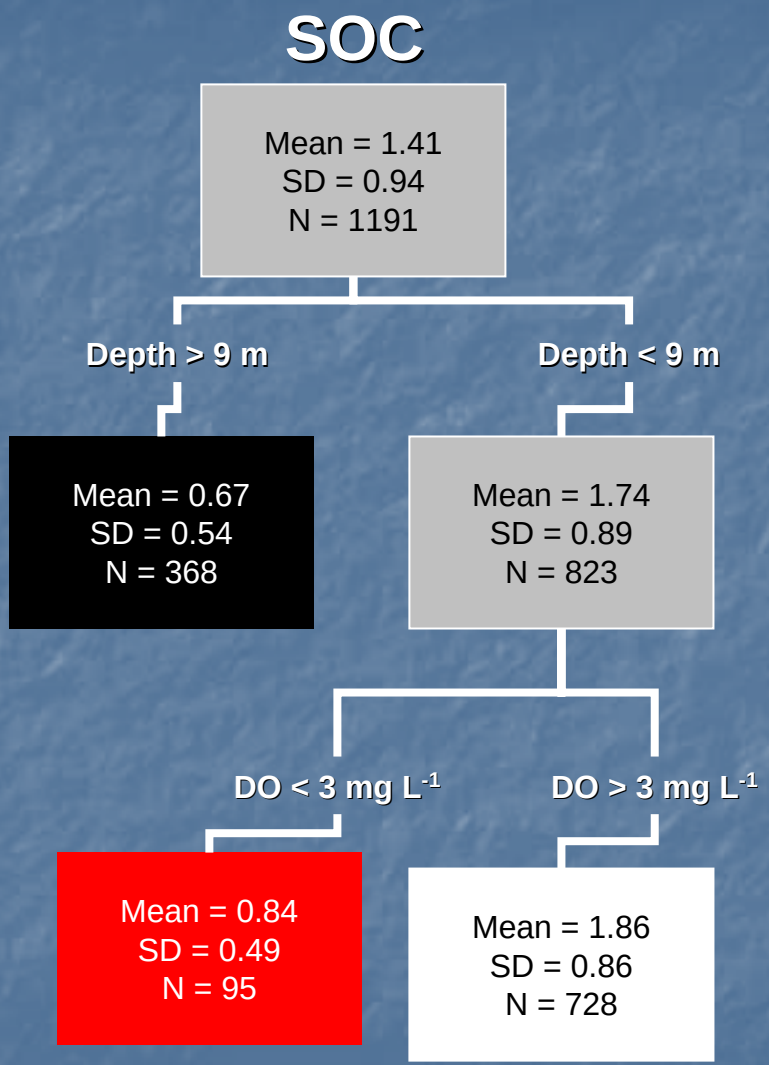


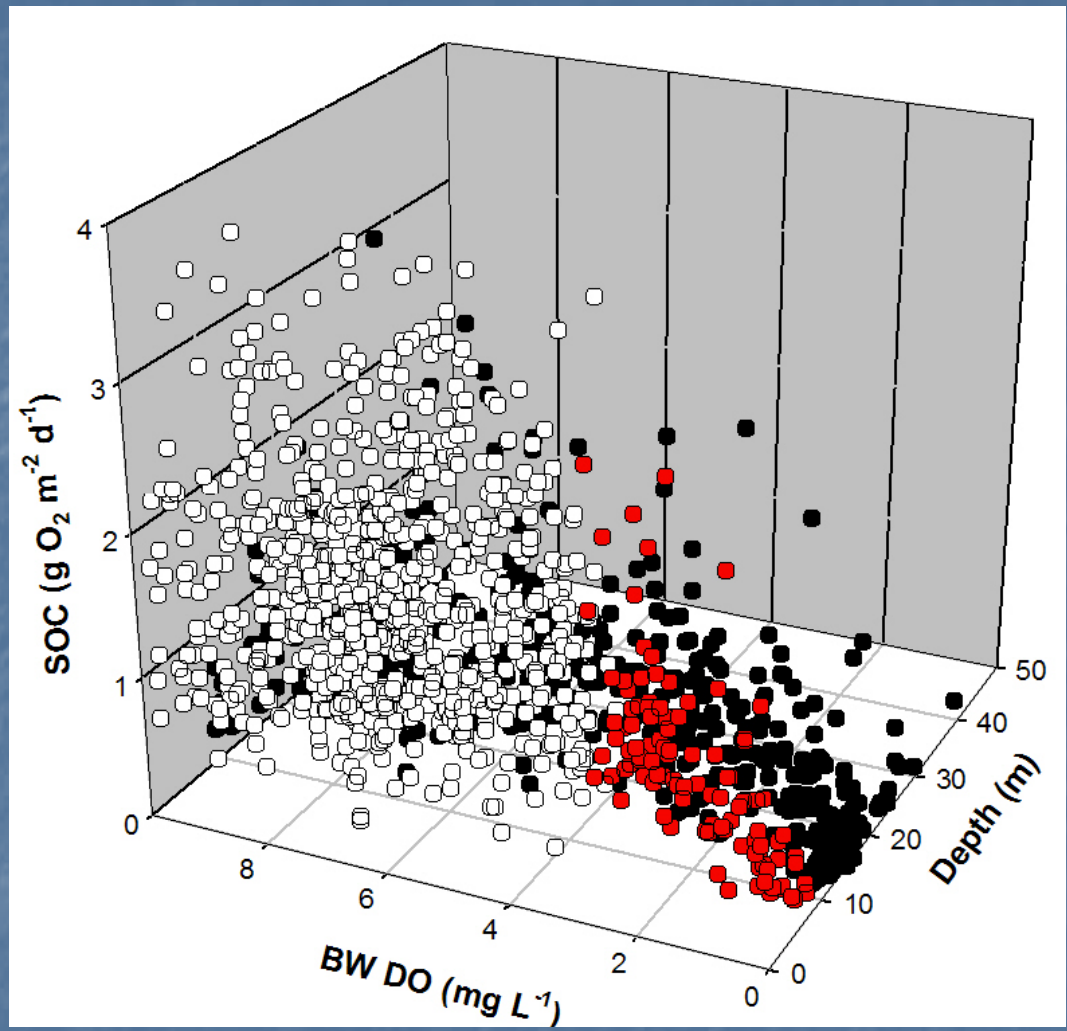





PO4 Flux vs Bottom Water Temperature
Chesapeake Bay Dataset
DO <= 4 mg L-1
DO > 4 mg L-1
Flux (µmoles P m-2 h-1)
300
200
100
0
-100
0
5
10
15
20
25
30
35
Bottom Water Temperature (°C)

SOC Flux Patterns





Ammonium Flux Patterns

NH_4 Flux

Mean = 250
SD = 222
N = 1171

Temp. < 20°C

Mean = 120
SD = 102
N = 217

Temp. > 20°C

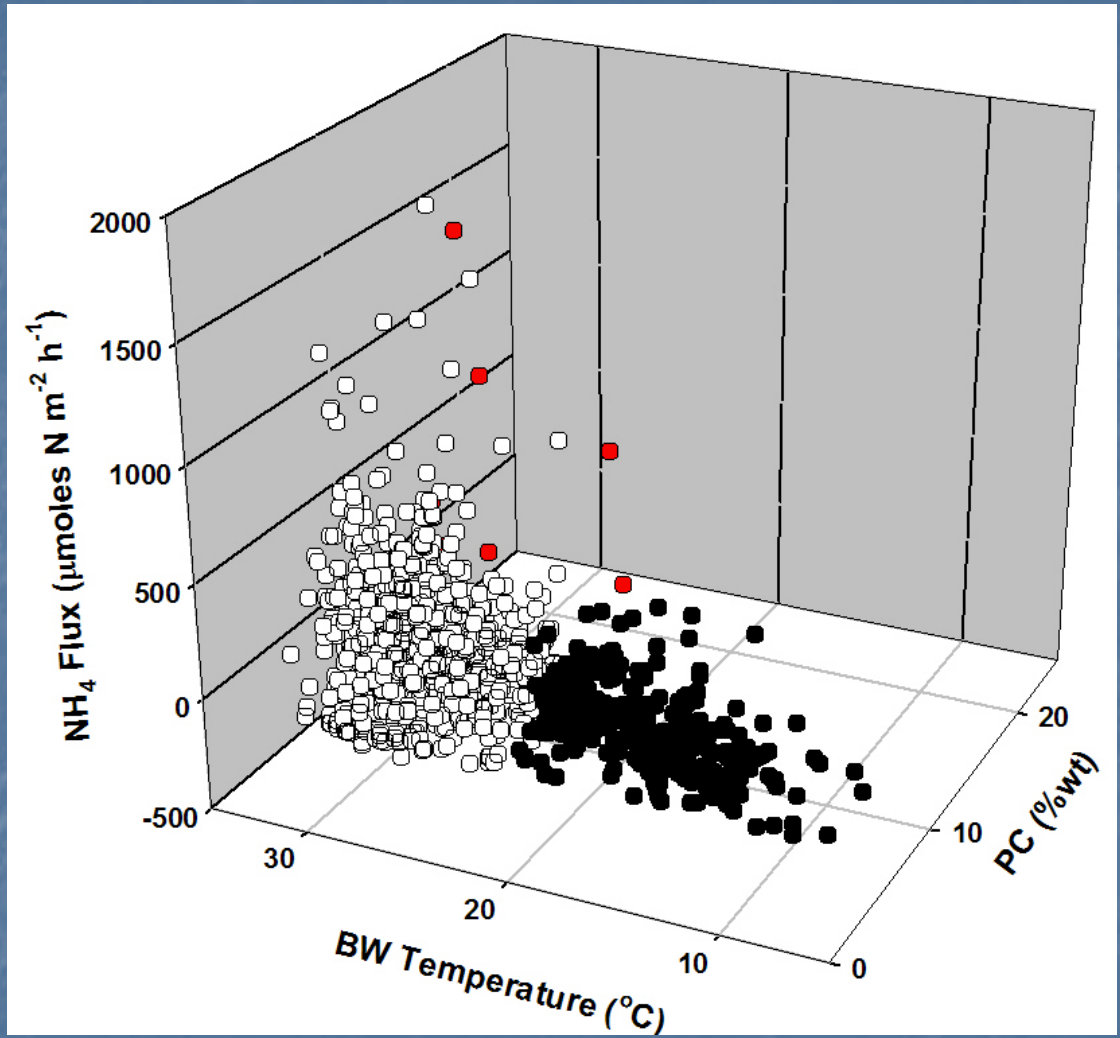
Mean = 280
SD = 232
N = 954

PC < 8%

Mean = 273
SD = 213
N = 945

PC > 8%

Mean = 939
SD = 733
N = 9



Conclusions

- Examination of the substantial number of sediment-water flux measurements made in the past 25 years allows us to begin making broader scale conclusions about how these rates are regulated.
- Chesapeake Bay flux rate patterns showed strong evidence of anthropogenic eutrophication; Chesapeake Bay fluxes tended to be higher than those measured in the World Flux data set.
- In both data sets there are encouraging indications of relationships between observed fluxes and simply measured envrionmental conditions.
- Future Analyses:
  - Site-specific characterizations of individual Chesapeake Bay tributaries
  - Examine seasonal flux patterns
  - Where available, examine the relative role of water column respiration rates
  - Compare Chesapeake Bay fluxes with other specific sites with large datasets available
  - Examine flux relationships to external nutrient loads
    - Total delivered loads
    - Seasonal load delivery

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