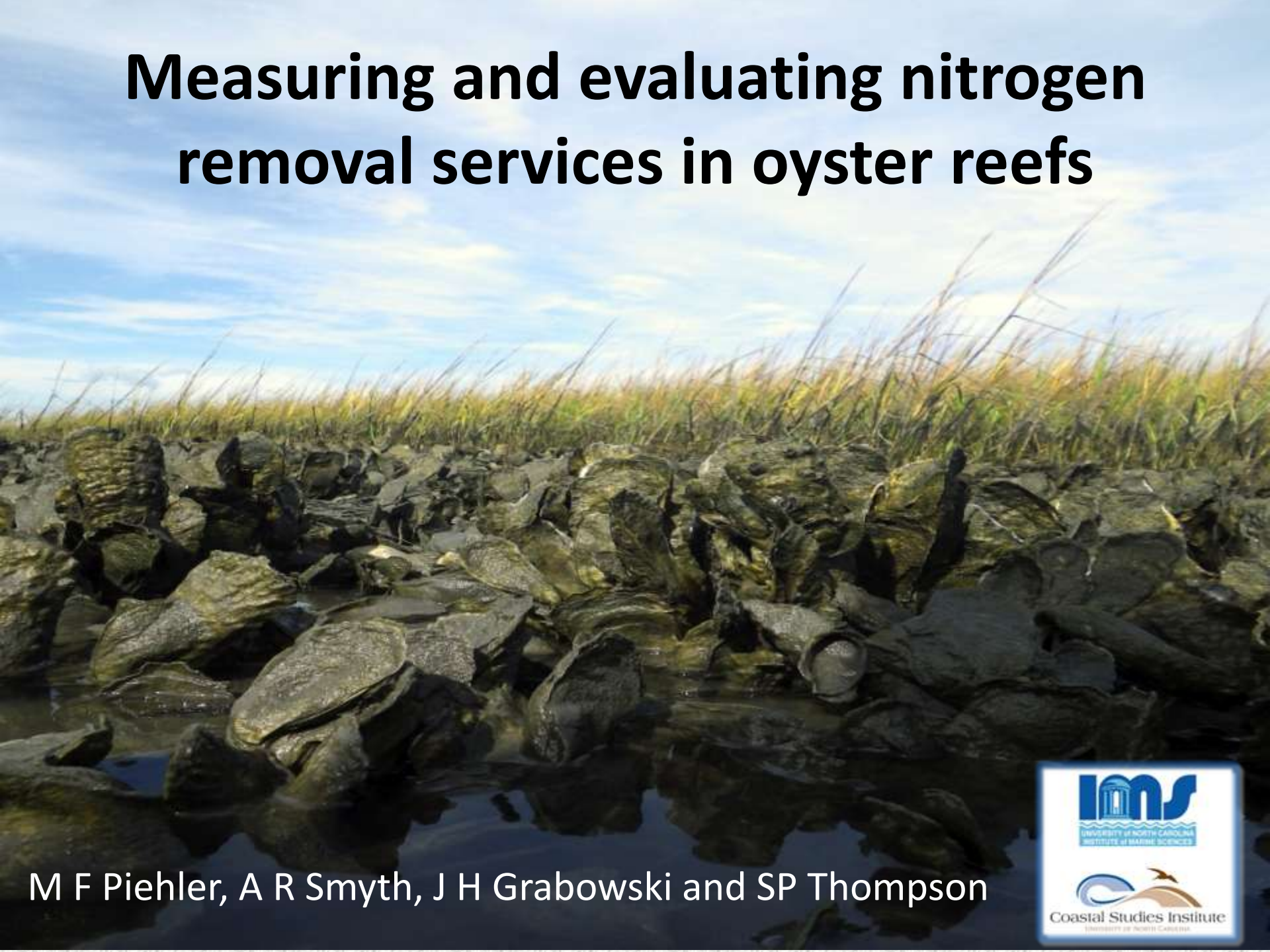
Measuring and evaluating nitrogen removal services in oyster reefs



M F Piehler, A R Smyth, J H Grabowski and SP Thompson

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Consequences of oyster habitat degradation

Filtration

Stabilization

Habitat

Loss of ecosystem goods and services

Habitat degradation tends to reduce habitat complexity




Complex Habitats

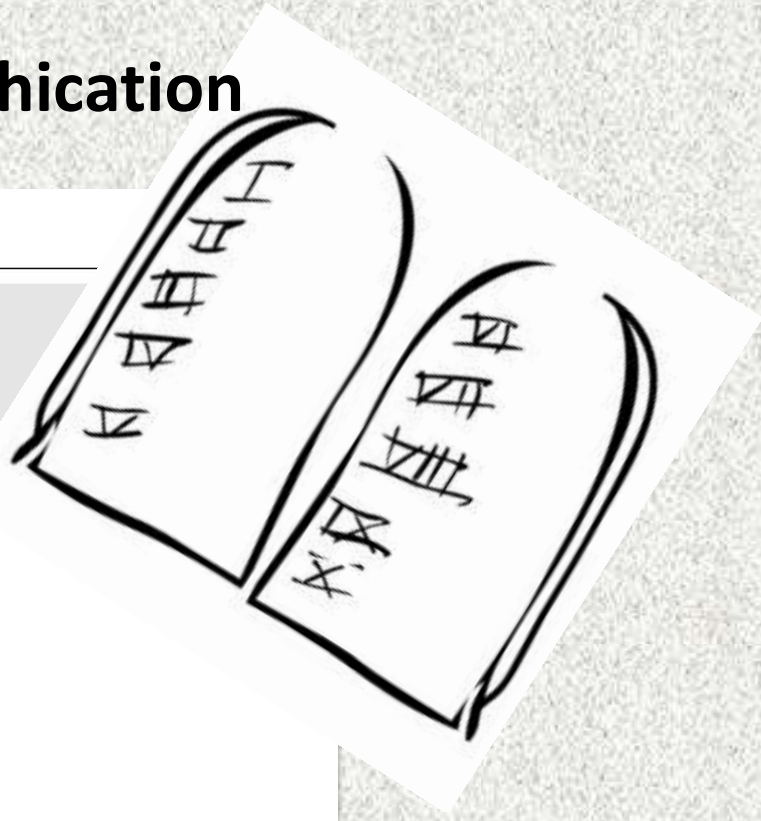
Simple Habitats

Table 1. Comparison of restoration effort for five coastal habitats in the United States.

Habitat type	Area restored[a]	Restoration cost[b]	Percentage global loss[c]
Salt marsh	36,625	3–242	50–80
Seagrass	3946	14–1035	29–65
Mangrove	1399	5–771	50
Coral reef	150	15–9267	20
Oyster reef	69	52–260	80–85

Grabowski et al. (2012) Bioscience

Oyster reefs may help resist eutrophication



Marine Pollution Bulletin 64 (2012) 1997–1999

Contents lists available at SciVerse ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Viewpoint

The eutrophication commandments

R.W. Fulweiler [a,*], N.N. Rabalais [b], A.S. Heiskanen [c]

2. Eutrophication commandments

1. **Thou shall protect coastal ecosystems to deliver biodiversity and ecological services.**
   Coastal ecosystems are diverse and productive. They rank among the most productive in the world comparable to rainforests (Cebrian and Duarte, 1996). In addition, coastal systems provide a series of harder to quantify ecosystem services including nursery habitat for commercially valuable species, nutrient filtering (Piehler and Smyth, 2011), and carbon sequestration. Marine ecosystem services alone are estimated to be worth \$20.9 trillion y^{-1} with the majority coming from coastal systems (10.6 trillion y^{-1}) and an additional 4.9 trillion y^{-1} coming from wetlands (Costanza et al., 1997). Thus of the \$33 trillion total ecosystem services supply annually, 75% of these dollars are dependent on coastal systems.

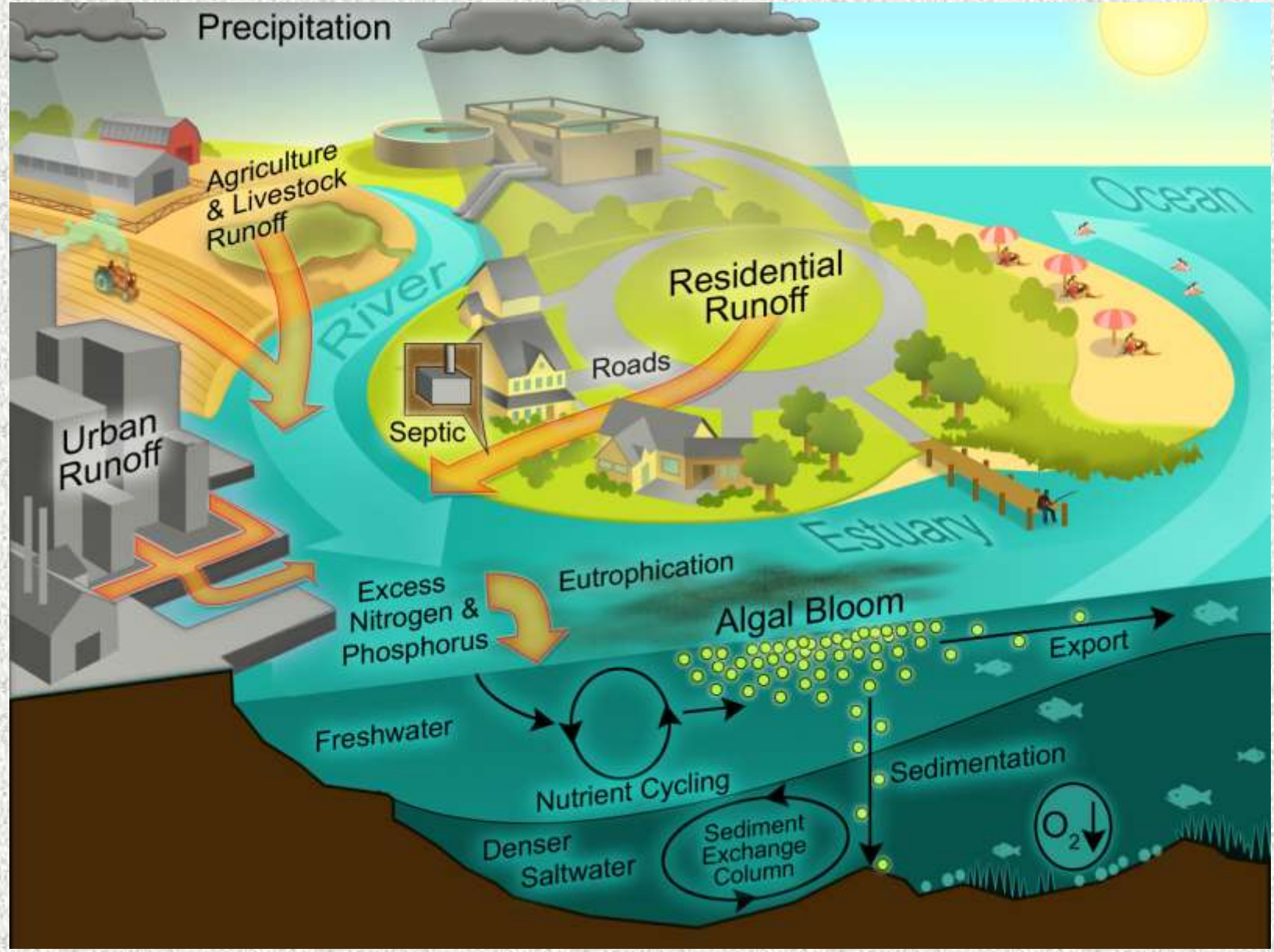
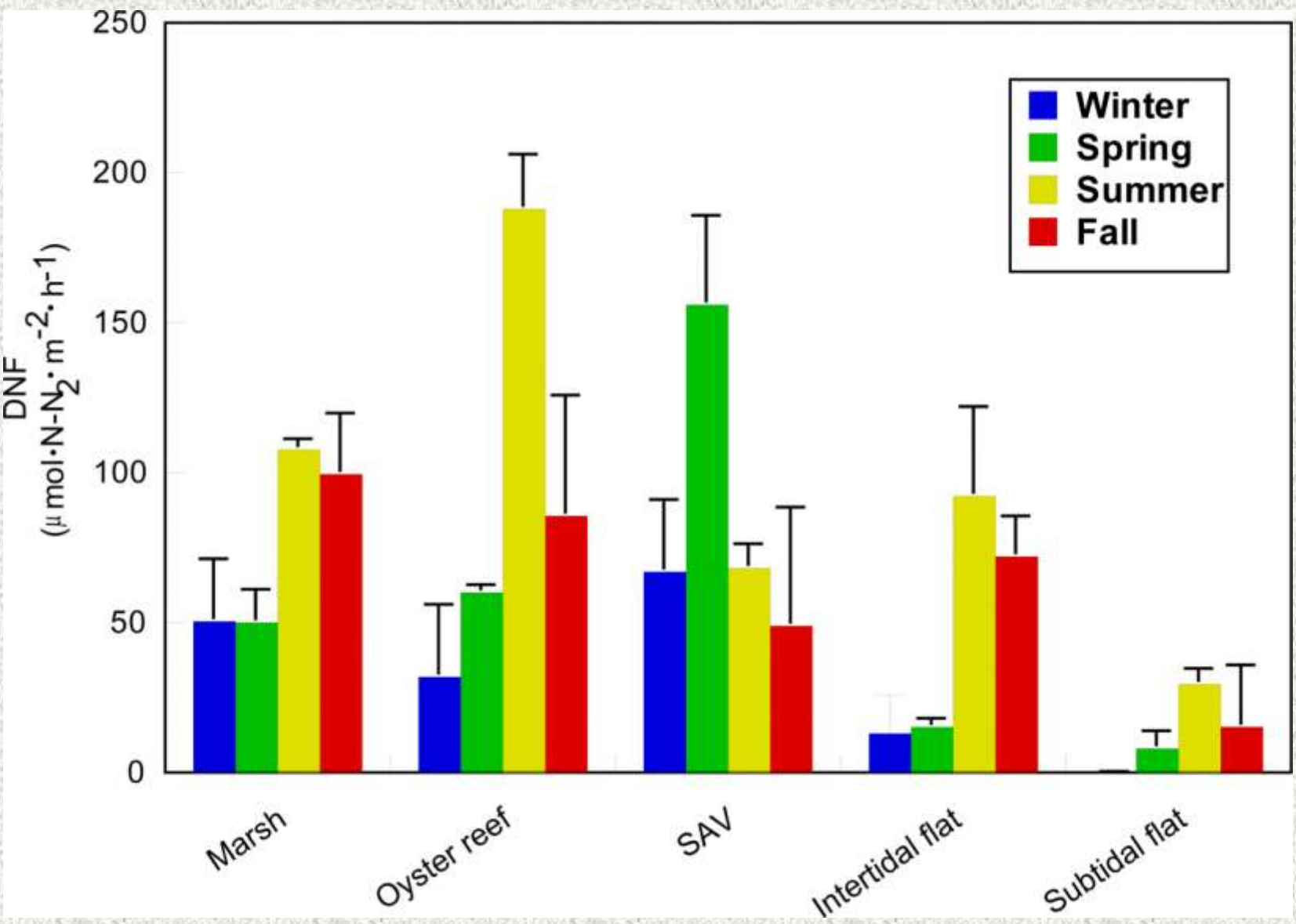


Illustration by AR Joyner and HW Paerl



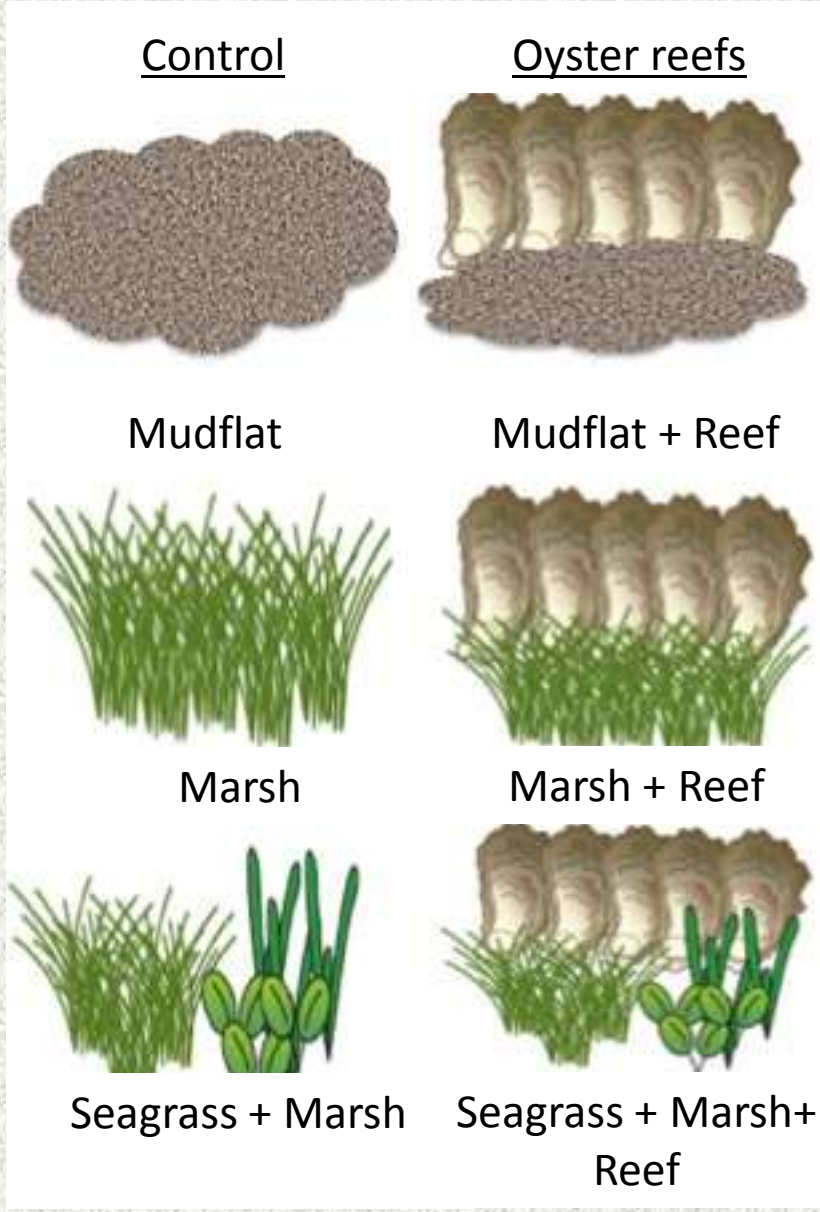
Piehler and Smyth 2011, Ecosphere

“Indeed, a man would have to eat sixteen dozen of these acephalous molluscs in order to gain the 315 grammes of nitrogen he requires daily.”

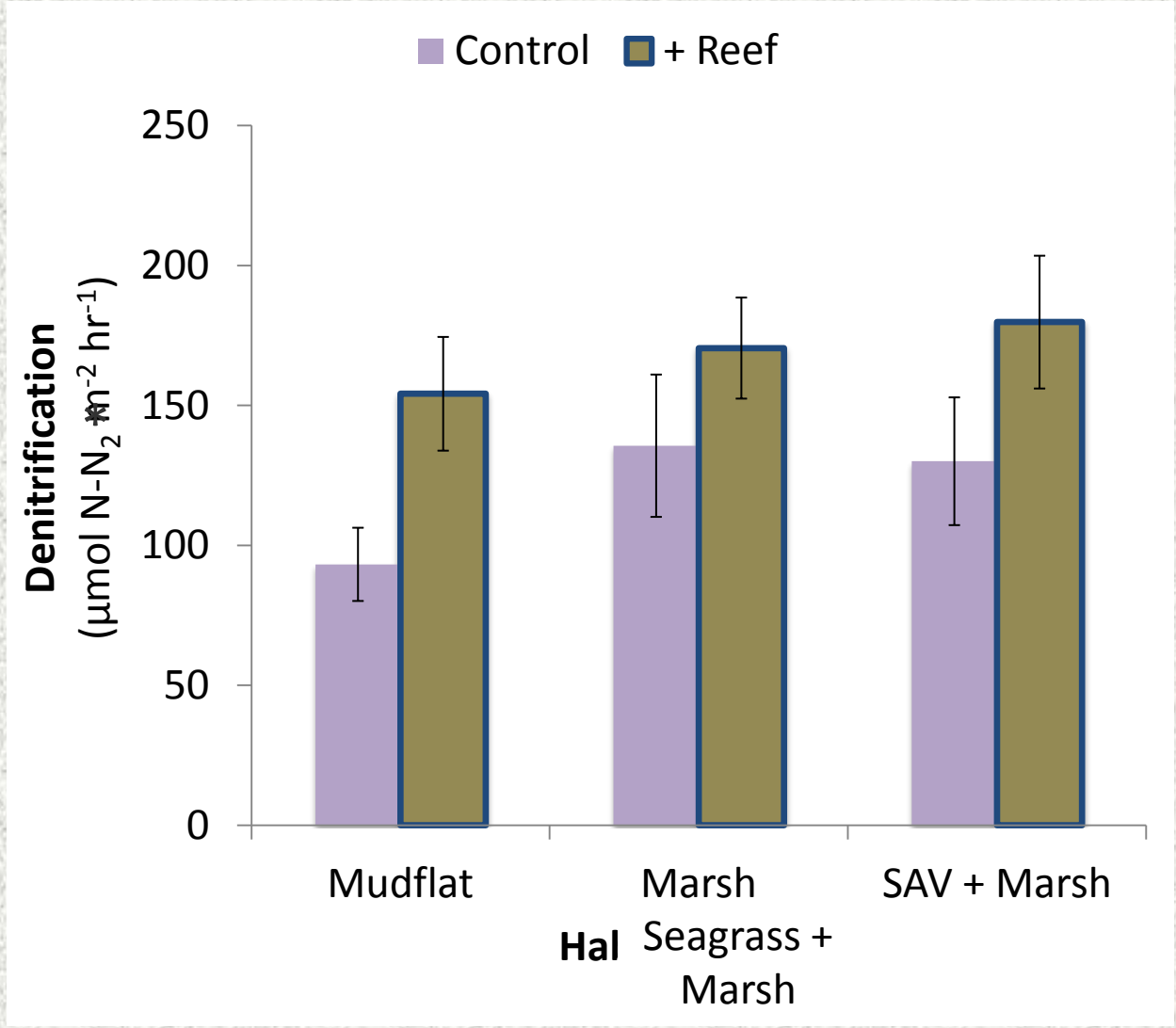
Jules Verne, 'Twenty Thousand Leagues Under the Sea’

Oyster Reef Denitrification and Landscape Position

How does landscape setting affect oyster reef denitrification?

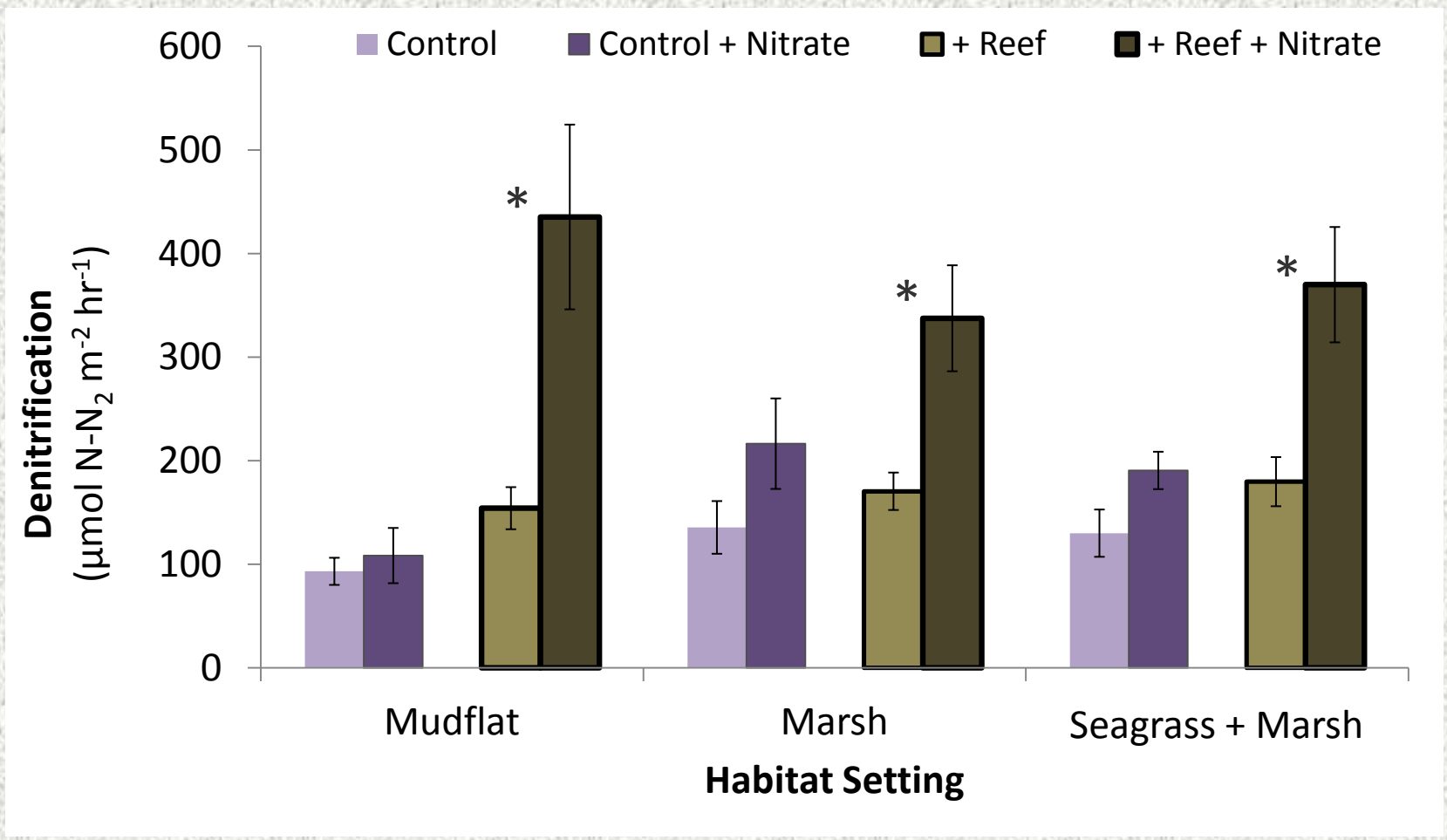


Oyster Reef Landscape Position And Denitrification



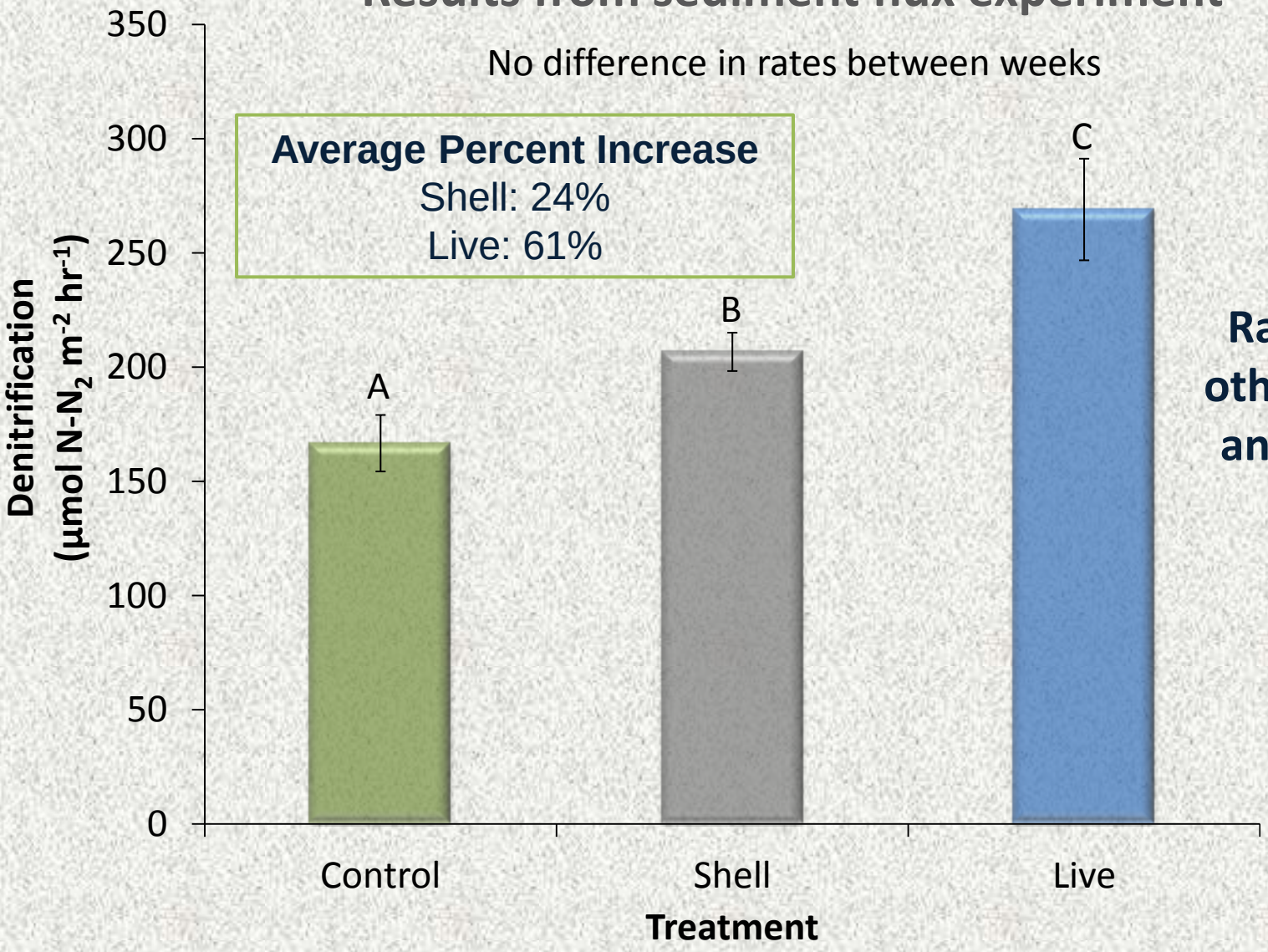
Oyster Reef Landscape Position And Denitrification

Response to increased nutrient loading



Biotic and Abiotic Denitrification

Results from sediment flux experiment



Rates similar to other oyster reefs and mud flats in area during summer.

N=8, Wilcoxon

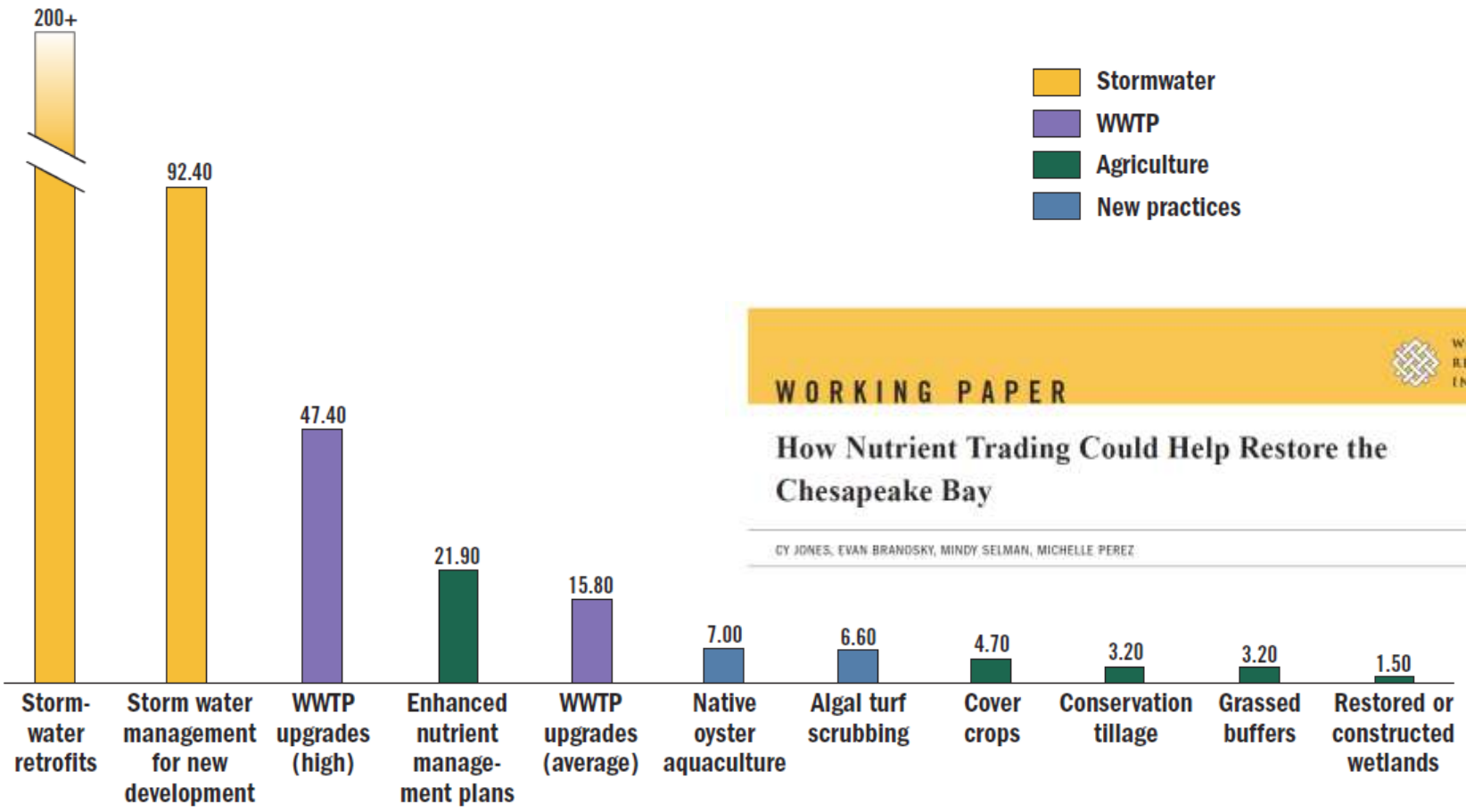
Evaluating estuarine N processing

- Rigorous measurements of processes
- Net contributions to N processing
- Transferable data

What does estuarine N removal cost?

Figure 2 | **Nitrogen Reduction Costs Differ Among Sectors and Practices, Creating Economic Opportunities for Credit Trading**

Dollars per pound of annual nitrogen reduction



WORKING PAPER

WORLD RESOURCES INSTITUTE

How Nutrient Trading Could Help Restore the Chesapeake Bay

CY JONES, EVAN BRANOSKY, MINDY SELMAN, MICHELLE PEREZ

Source: U.S. EPA and Abt Associates, 2009; Wieland, et al., 2009; MDNR, 2008; Stewart, E. A., 2006; WRI analysis using WWTP upgrade costs from MDE and VDEQ.

Where to next?

Invaluable contributions…

Many thanks…


NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE


NSF


Sea Grant
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