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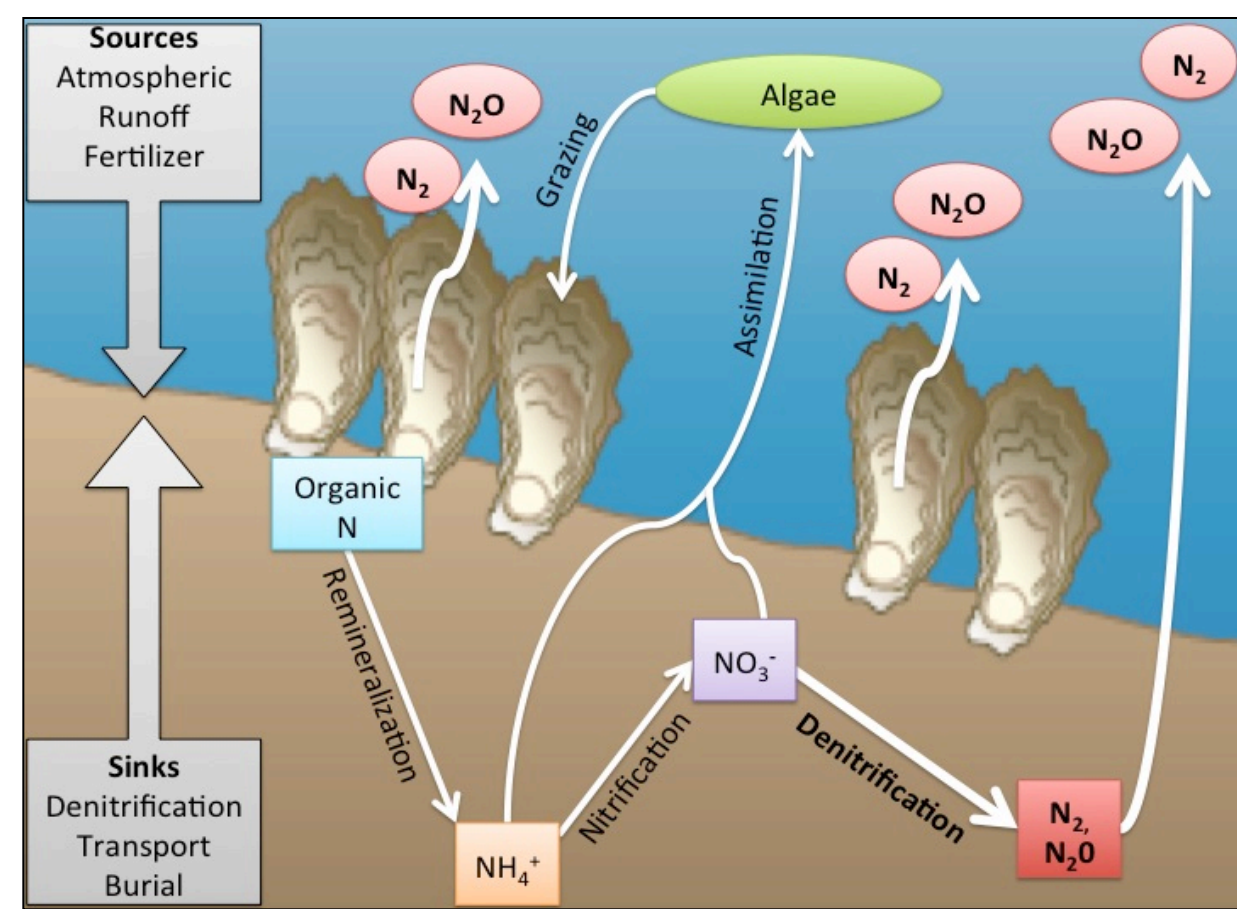
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# The Role of Oysters in Nitrous Oxide Emissions From Oyster Reefs

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## Background

- Anthropogenic nitrogen (N) loading has been linked to excessive algal growth, fish kills, and overall decrease of water quality in Virginia's estuaries and bays.
- During denitrification biologically-available N is reduced to the gaseous form  $N_2$ , an unreactive form of N, and  $N_2O$  and important greenhouse gas.

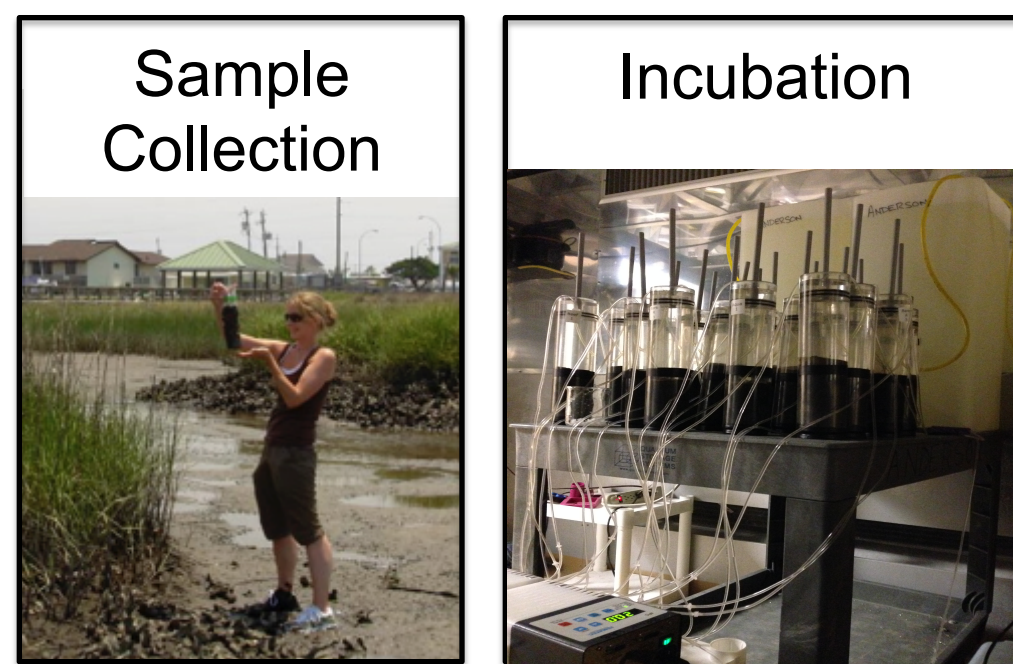


- Oyster microbiomes may play a significant role in the biogeochemical N cycle and  $N_2O$  emissions in estuarine and coastal ecosystems.
- Rates of denitrification and  $N_2O$  production were measured from live oysters and oyster shells collected at a coastal lagoon and a tidal estuary in the Chesapeake Bay.

## Objectives

- Characterize the spatial and temporal variation of denitrification in oyster reef ecosystems.
- Evaluate the relative production of  $N_2$  and  $N_2O$  as end products of denitrification.

## Methods



- Microcosms, with oyster shell, live oysters or oyster reef sediment were incubated in a continuous flow system.
- Production of  $N_2$  and  $N_2O$  were quantified.

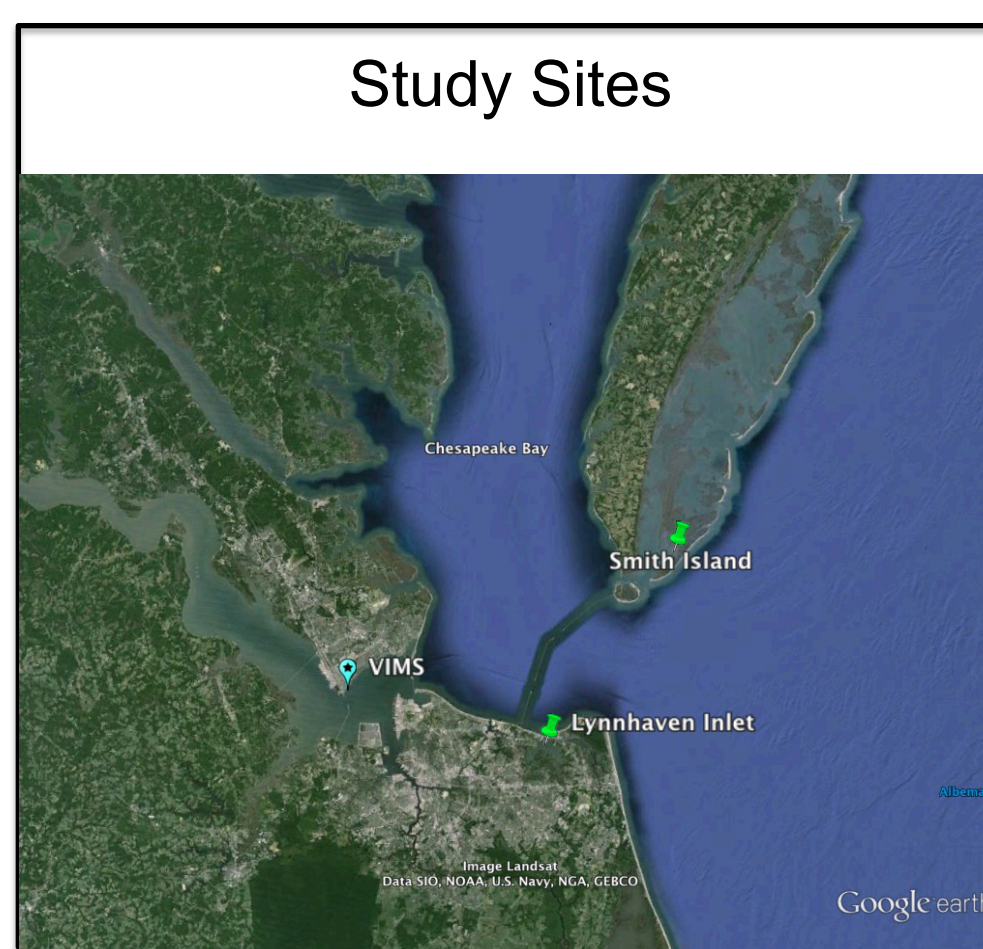


Figure 1: Sampling sites located in Chesapeake Bay Watershed.

## Acknowledgements

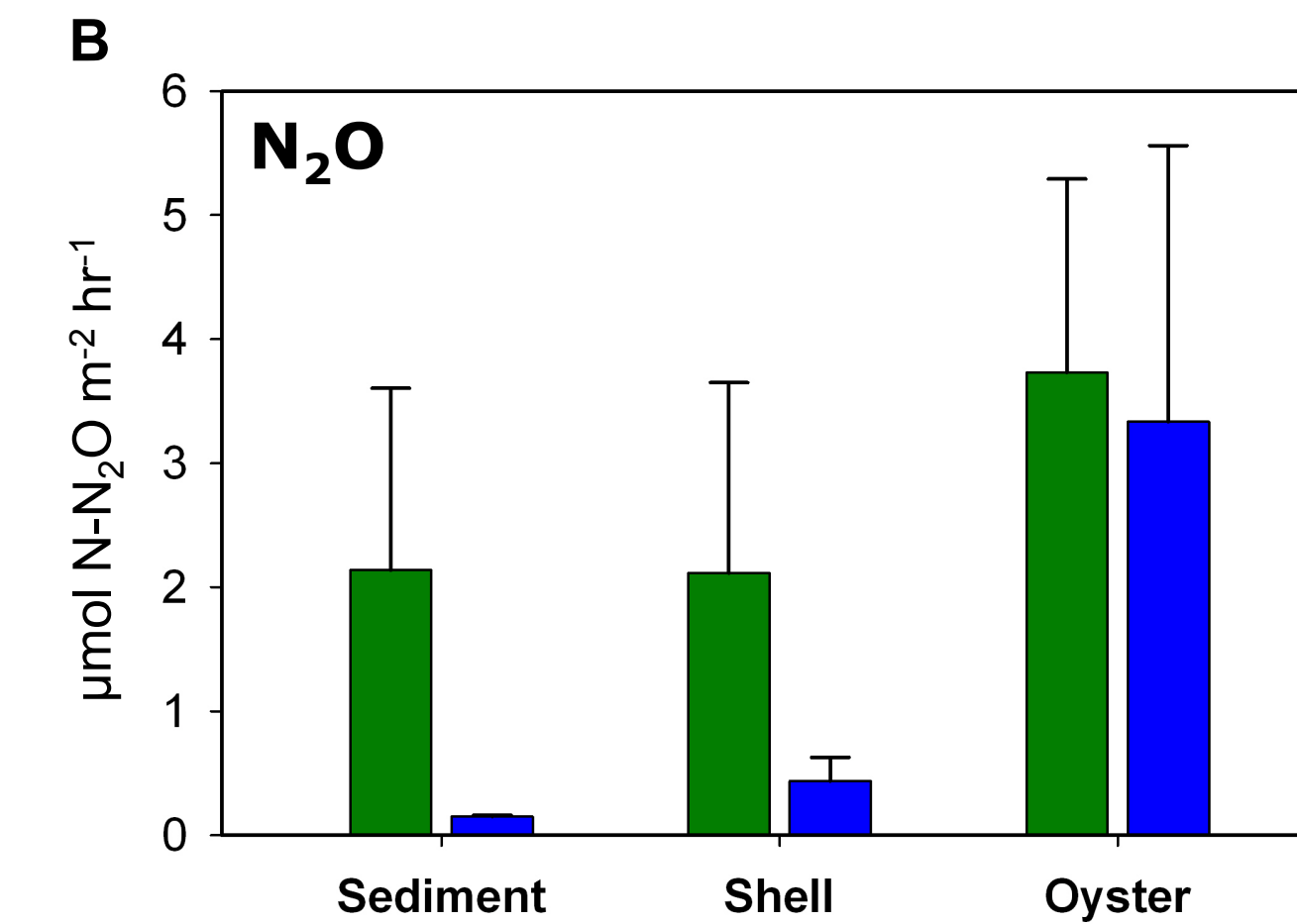
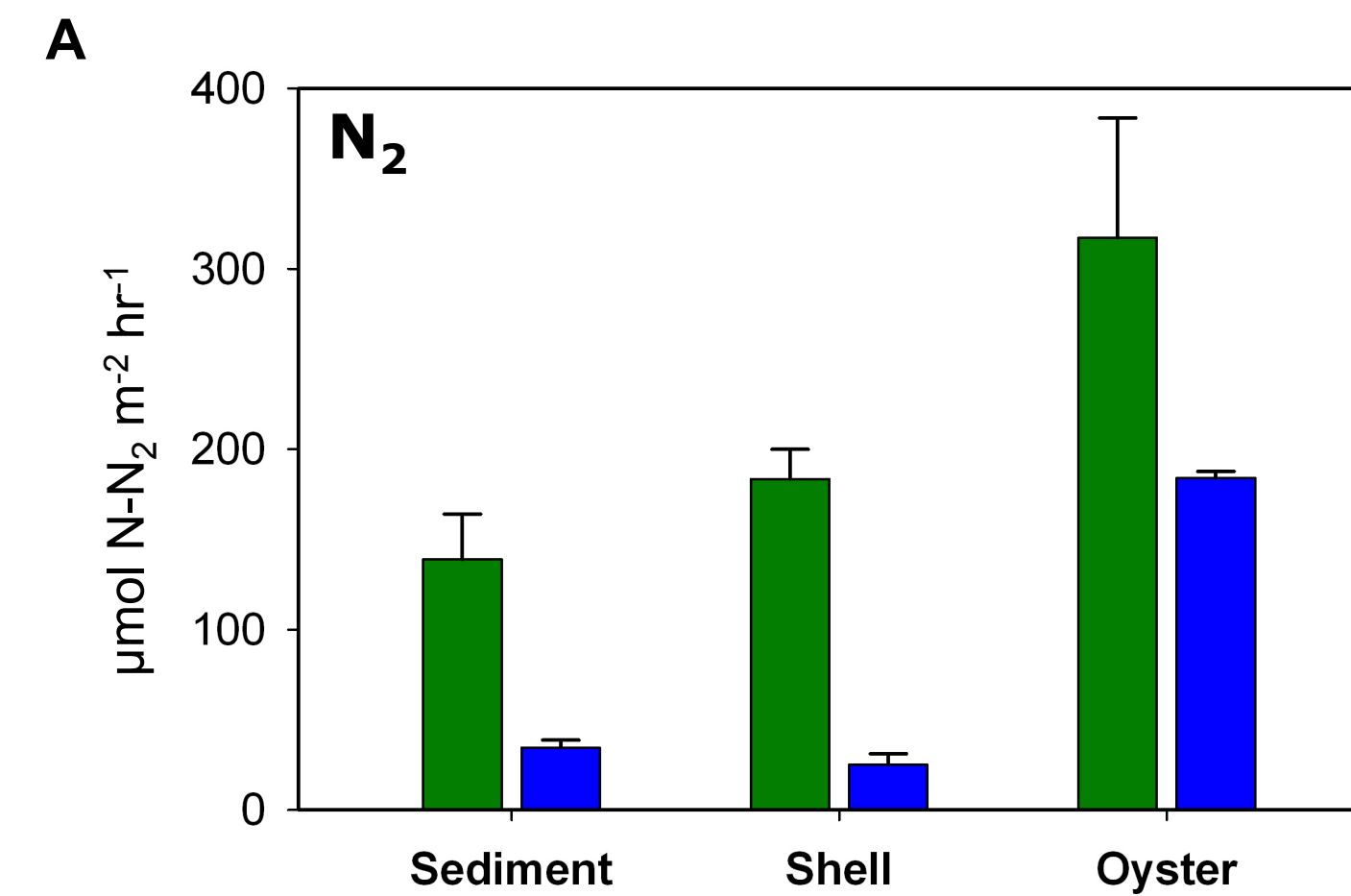
Special thanks to Jess Lisa, Tavis Sparrer, Miguel Semedo, and to the Anderson Lab for field and lab assistance.

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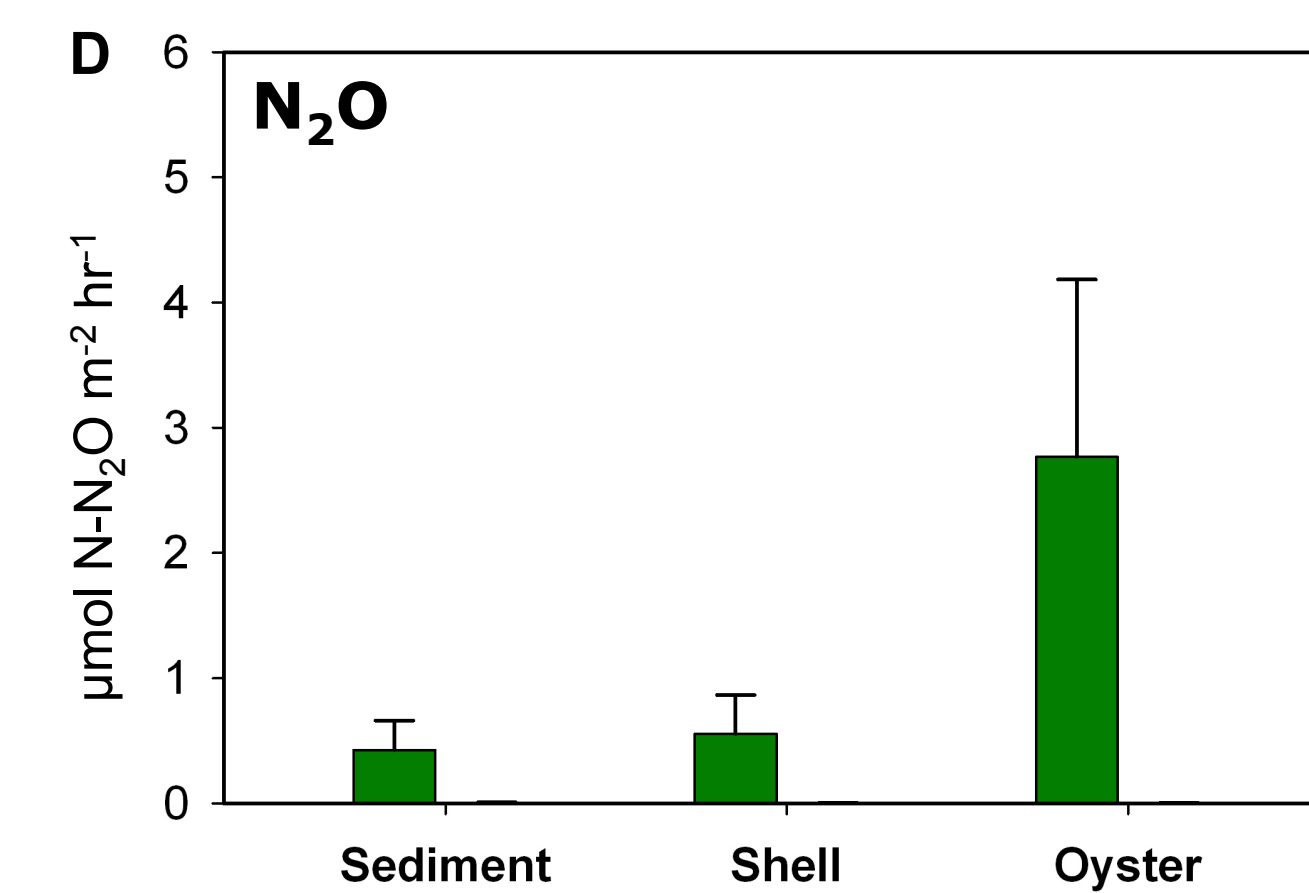
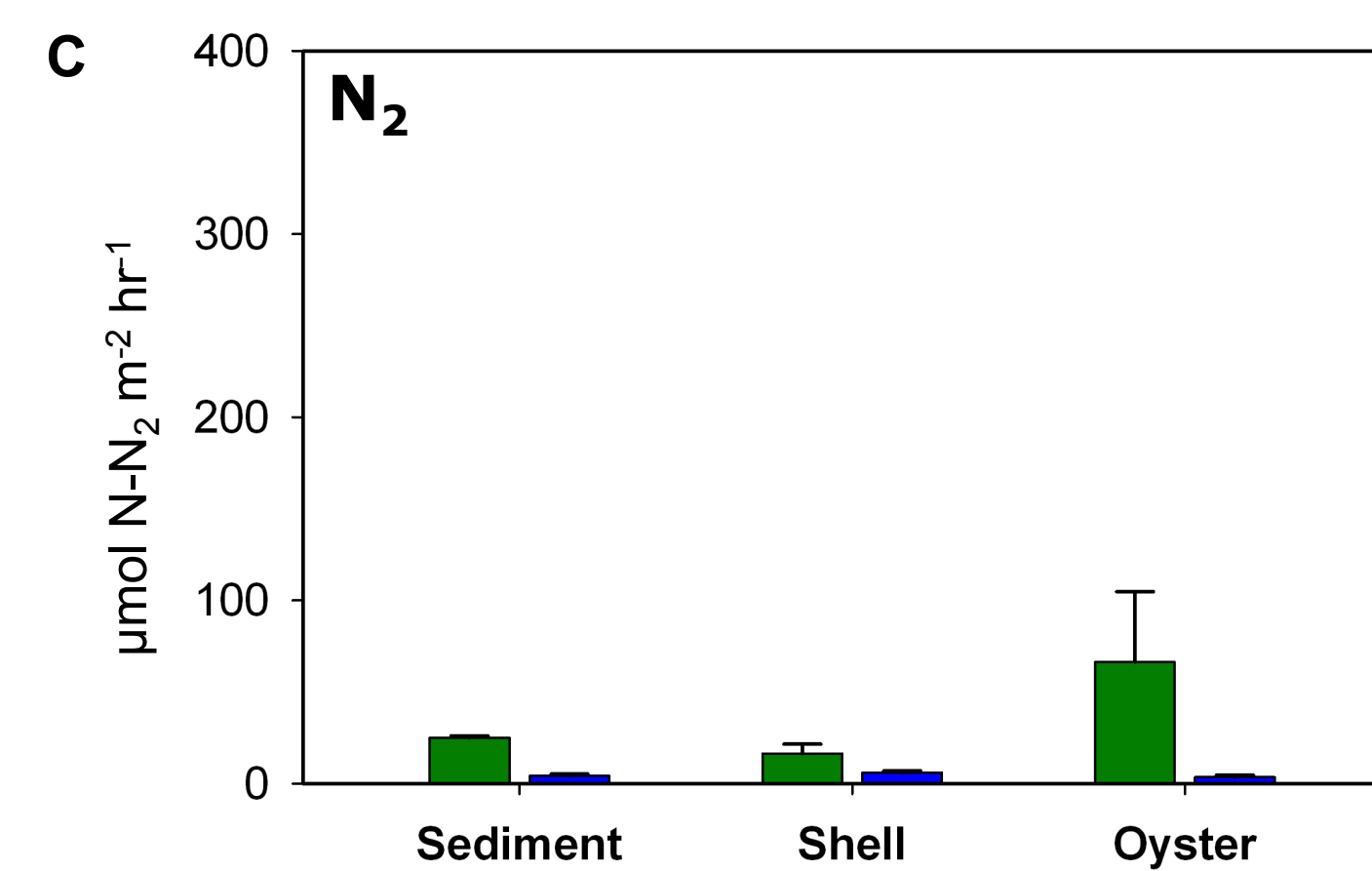


## Results: Spatial & Temporal Variation in Oyster Denitrification Rates

### Lynnhaven Inlet—Tidal Estuary



### Smith Island—Ocean Side Lagoon



Summer (green bars), Fall (blue bars)

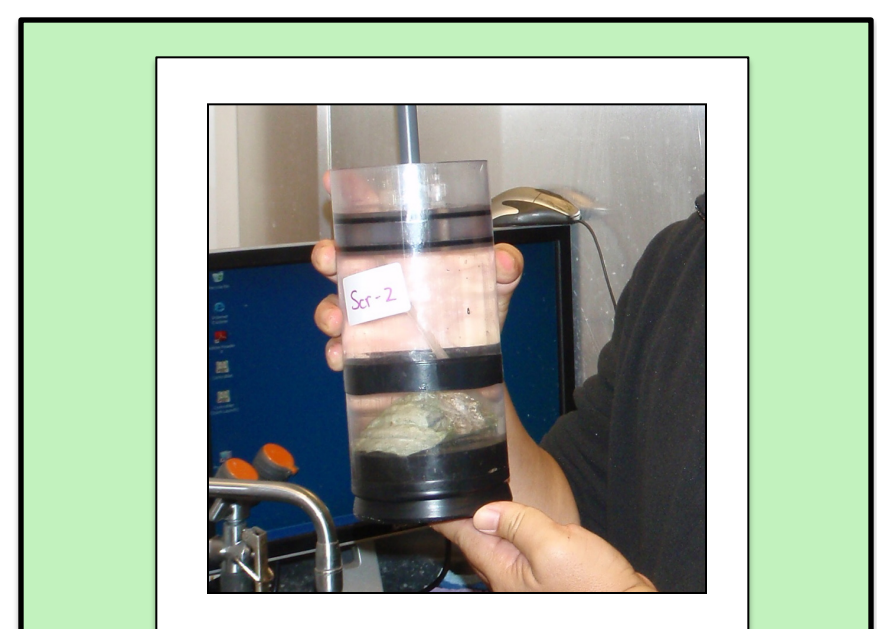
Figure 2:  $N_2$  (A & C) and  $N_2O$  (B & D) fluxes from Lynnhaven Inlet and Smith Island.  $N_2$  production was greater than  $N_2O$  production at both sites. Live oyster tended to have higher rates of N cycling processes than other treatments.



Oyster Reef Sediment



Live Oyster



Oyster Shell

## Results: Source of $N_2O$

### Relationship between $N_2$ and $N_2O$

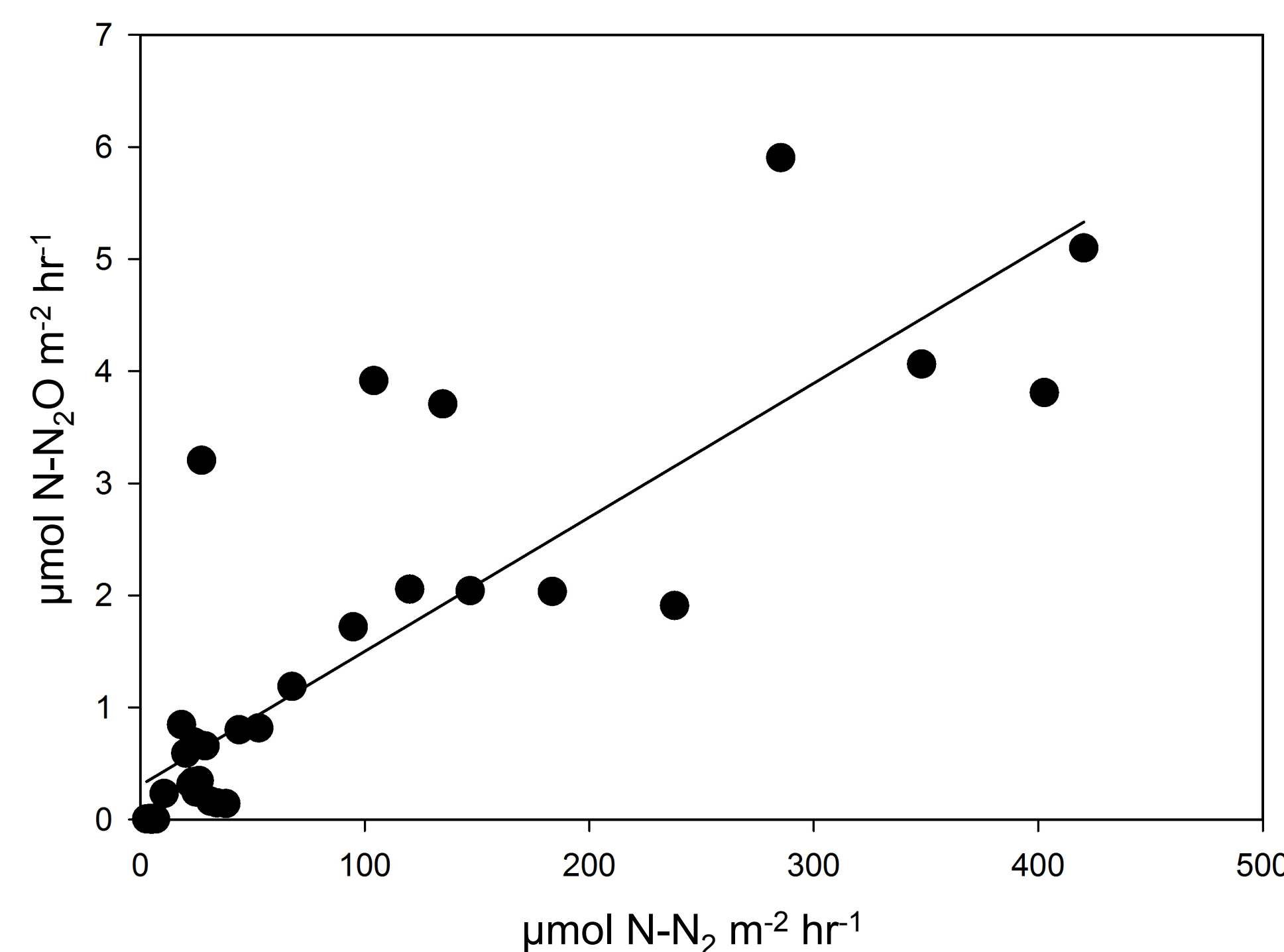


Figure 3: Linear relationship between  $N_2$  and  $N_2O$ , suggesting that  $N_2$  production (denitrification) is the source of  $N_2O$ .

## Conclusions

- Production of both  $N_2$  and  $N_2O$  was detected in live oysters and oyster shells collected from both study sites.
- There was a strong positive relationship between  $N_2$  and  $N_2O$  production, suggesting denitrification was the major source of  $N_2O$ .
- Higher activities of denitrification were found in summer than fall.
- Live oysters from both study sites had the highest rates of denitrification and  $N_2O$ . This indicates that oysters are an important N remover and a  $N_2O$  source in coastal ecosystems.

