The role of oyster 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 N₂, an unreactive form of N, and N₂O and an important greenhouse gas.
- Oyster microbiomes may play a significant role in the biogeochemical N cycle and N₂O emissions in estuarine and coastal ecosystems.
- Rates of denitrification and N₂O 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 N₂ and N₂O as end products of denitrification.

Methods

- Sample Collection
- Incubation
- Study Sites
  - Microcosms, with oyster shell, live oysters or oyster reef sediment were incubated in a continuous flow system.
  - Production of N₂ and N₂O were quantified.

Results: Source of N₂O

- Relationship between N₂ and N₂O
  - Figure 3: Linear relationship between N₂ and N₂O, suggesting that N₂ production (denitrification) is the source of N₂O.

Conclusions

- Production of both N₂ and N₂O was detected in live oysters and oyster shells collected from both study sites.
- There was a strong positive relationship between N₂ and N₂O production, suggesting denitrification was the major source of N₂O.
- Higher activities of denitrification were found in summer than fall.
- Live oysters from both study sites had the highest rates of denitrification and N₂O. This indicates that oysters are an important N remover and a N₂O source in coastal ecosystems.