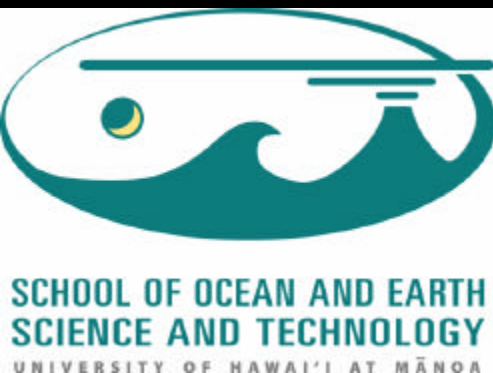




Examining expression of the ammonia monooxygenase (amoA) gene in the ocean

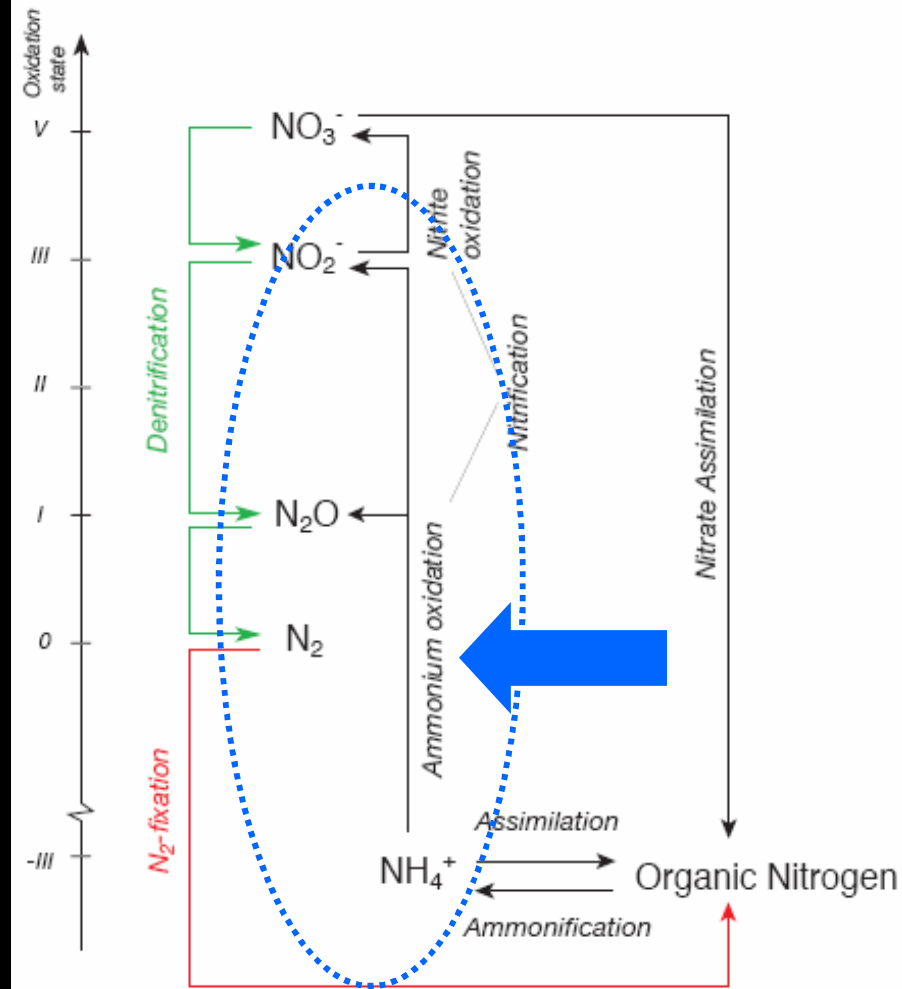
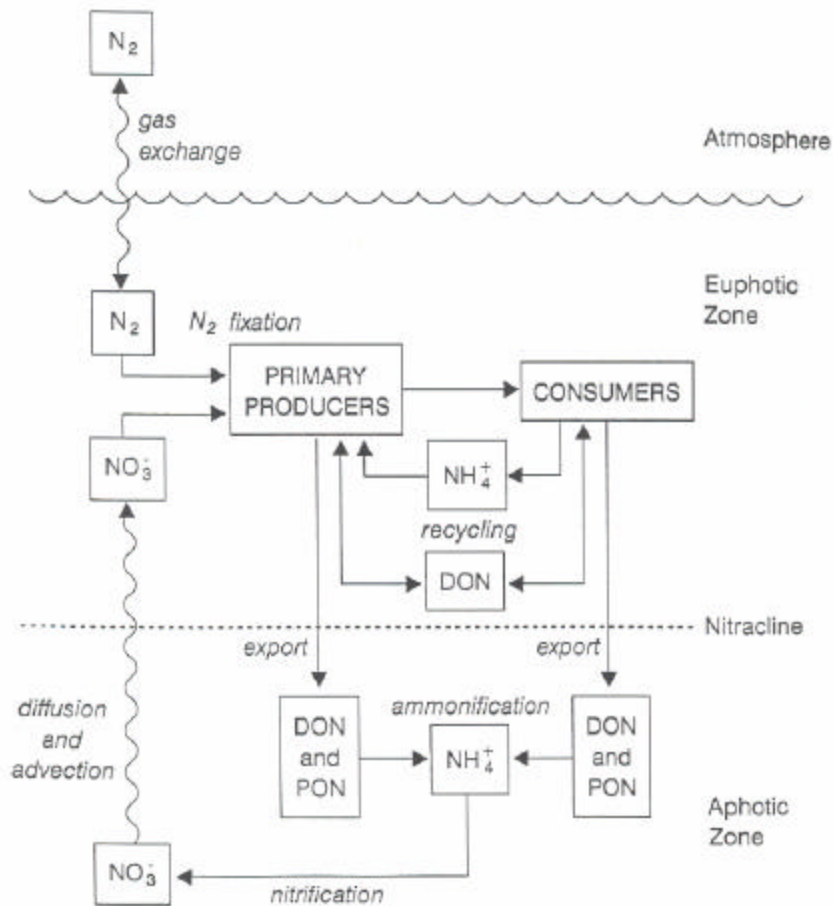
Brenner Wai
Dr. Matthew J. Church



Outline

- Introduction
 - Marine N cycle and microorganisms
 - Nitrification and ammonium oxidation
- Study objectives
 - Identify distributions of amoA-containing Archaea
 - Evaluate dynamics of archaeal amoA gene expression
- Methods
 - Study site
 - QPCR/Q-RT-PCR
- Results
- Conclusion

The Marine Nitrogen Cycle



Nitrification

Ammonium oxidation

NH_4^+ ?

Nitrite oxidation

NO_2^- ?

NO_3^-

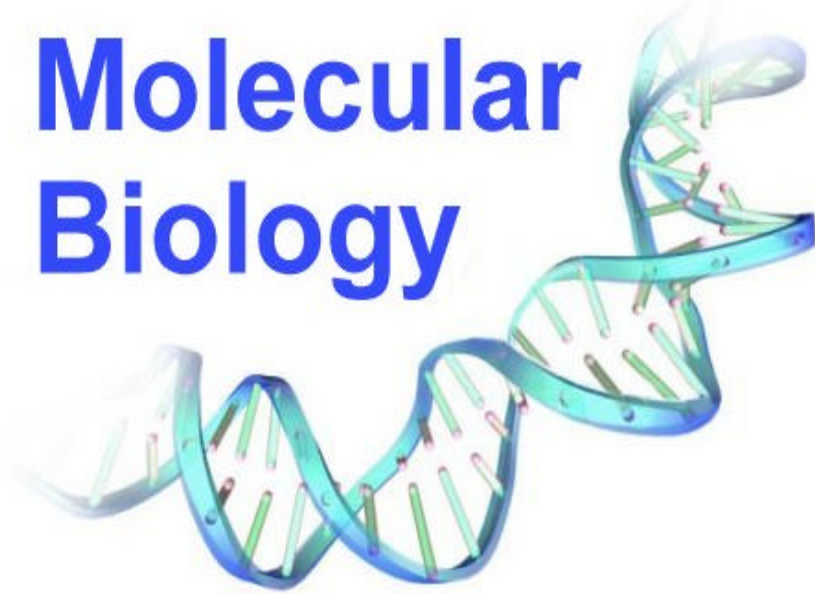
Nitrogen inventories in the Ocean

Species	Oceanic inventory (Tg N)
Nitrate NO_3^-	5.8×10^5
Nitrite NO_2^-	160
Ammonium NH_4^+	340

Study Objectives:

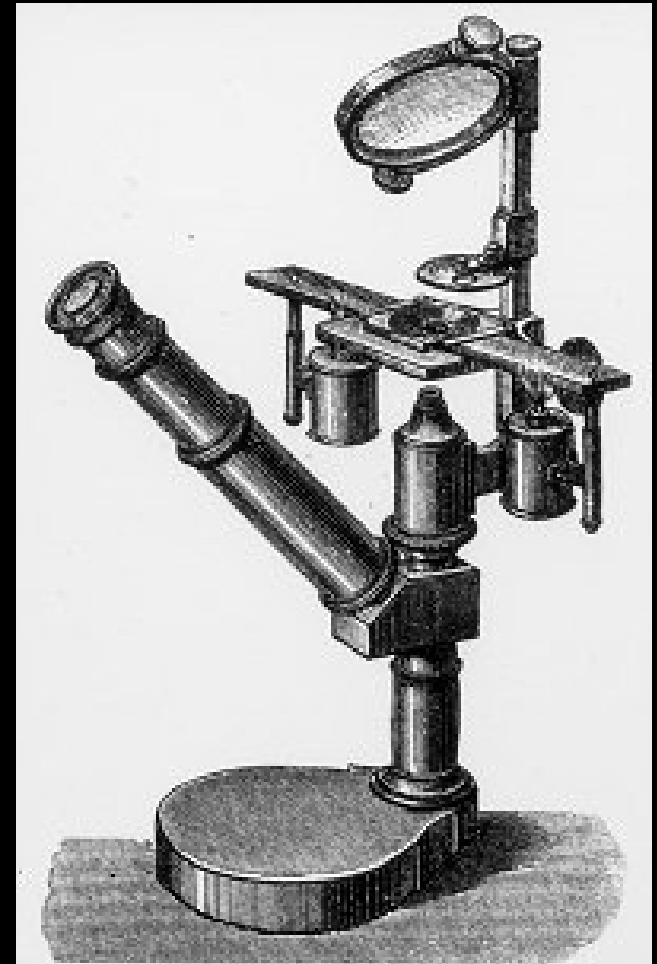
- Identify spatial distributions of ammonium oxidizing Archaea in Pacific Ocean
- Examine activities of ammonium oxidizing Archaea based on expression of amoA gene.
- Use information on distributions and activities of ammonium oxidizing microbes to better understand nitrogen cycle processes in the sea

Molecular Biology

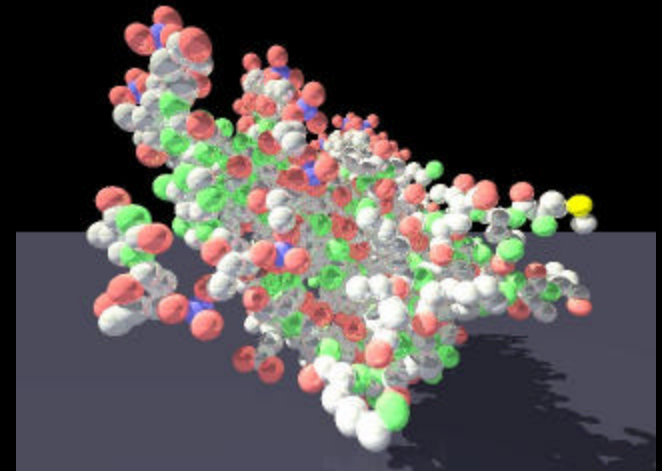
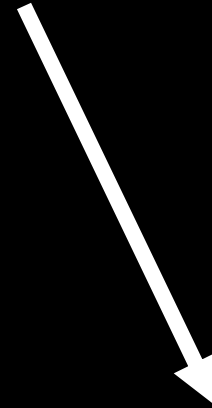
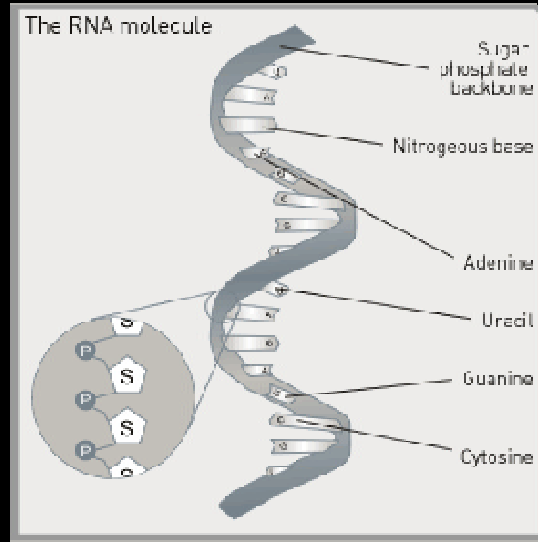


VS.

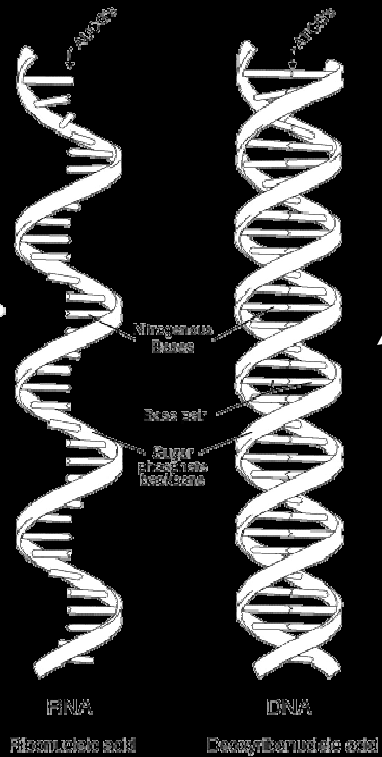
amoA ????



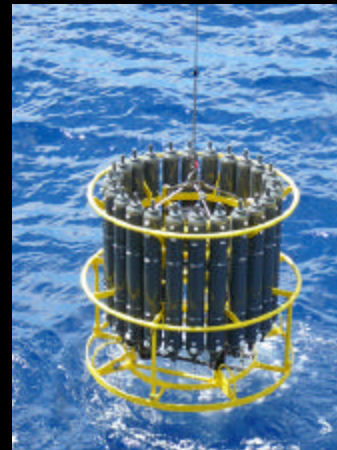
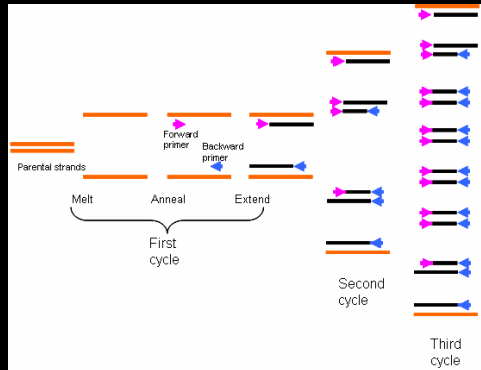
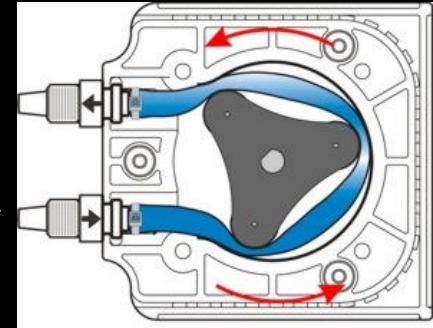
From genes to proteins to biomes



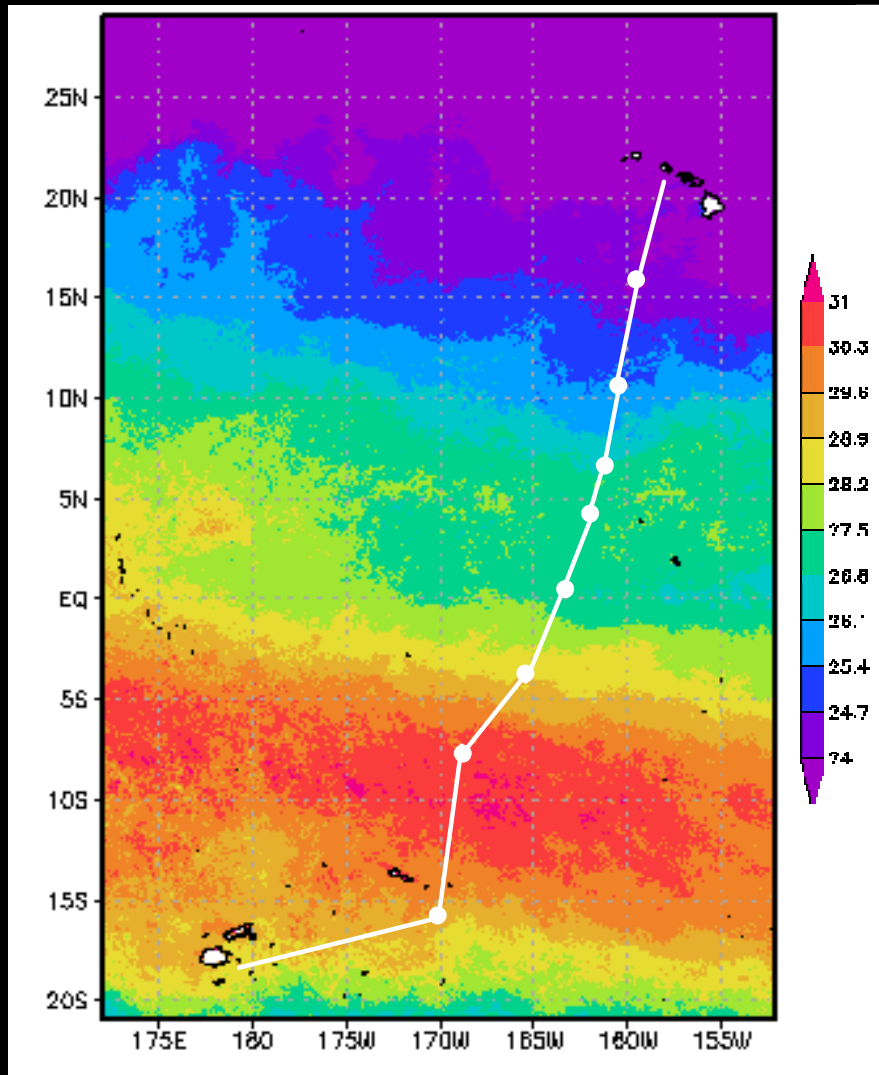
Methods:



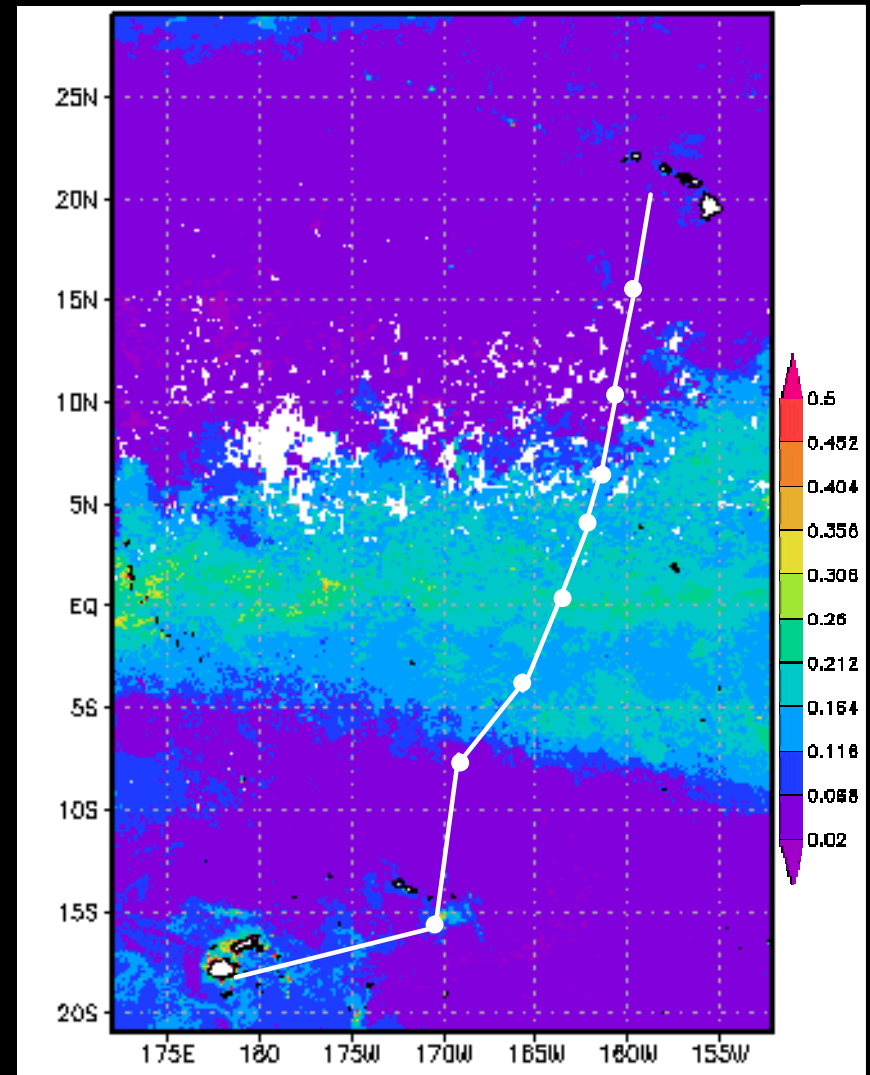
0.2 μm



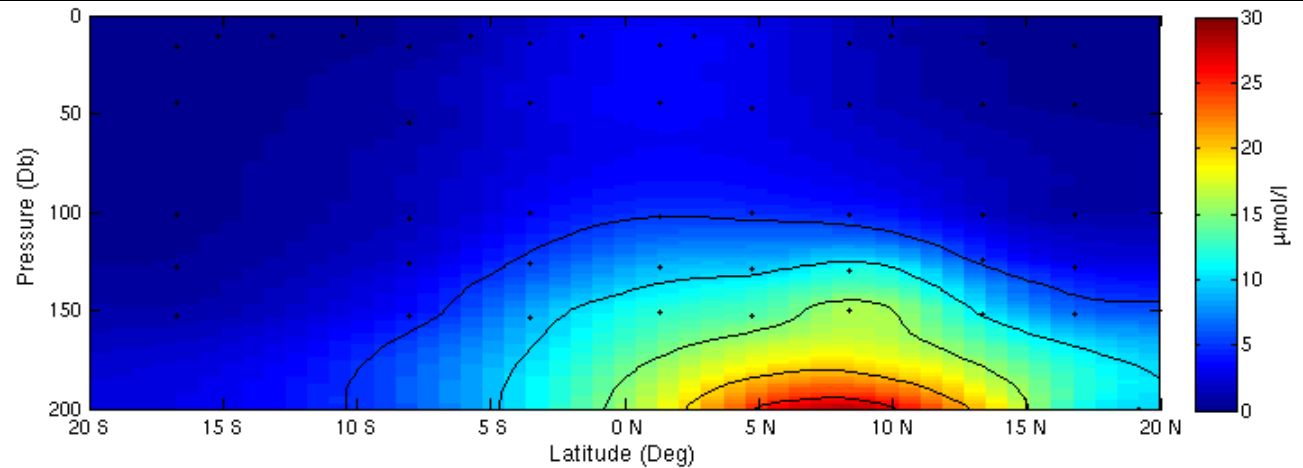
Study site



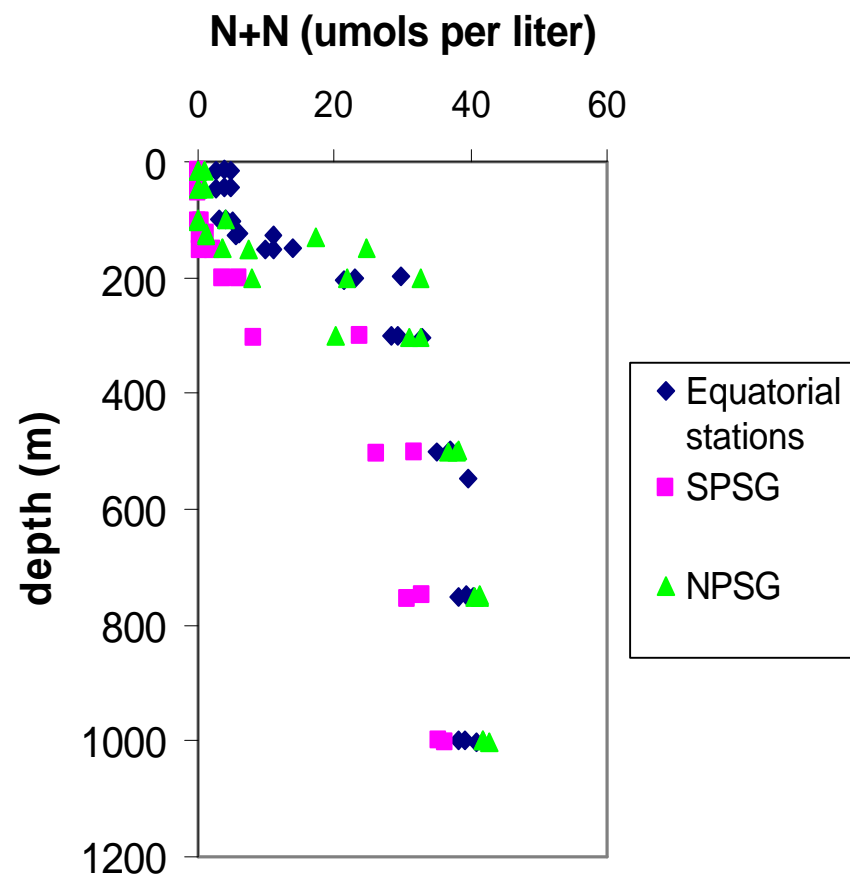
**Satellite sea surface temperature
(April 2007)**



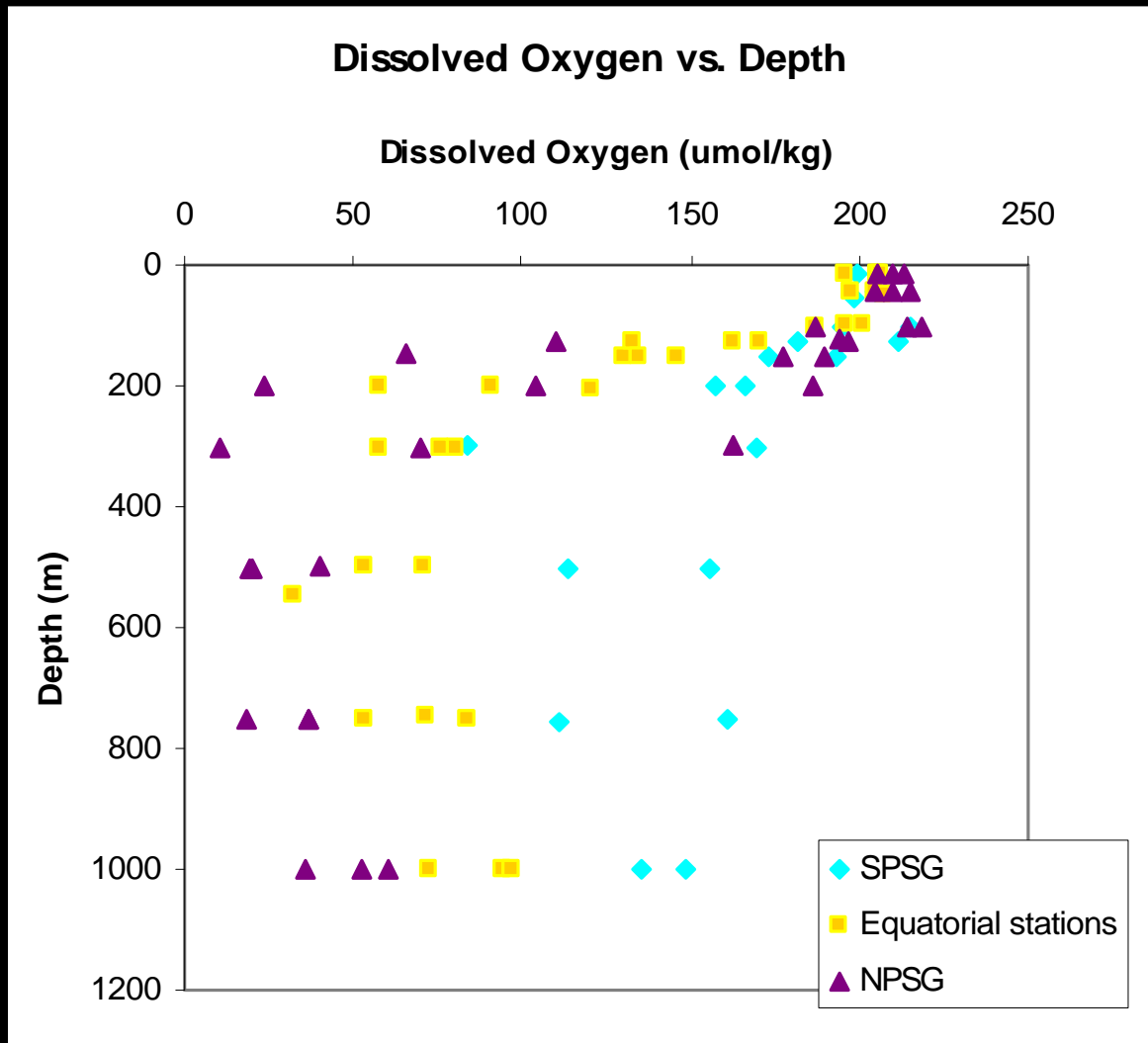
**Satellite sea surface chlorophyll
(April 2007)**



Nitrate + Nitrite along the transect



Dissolved Oxygen Concentrations



Results

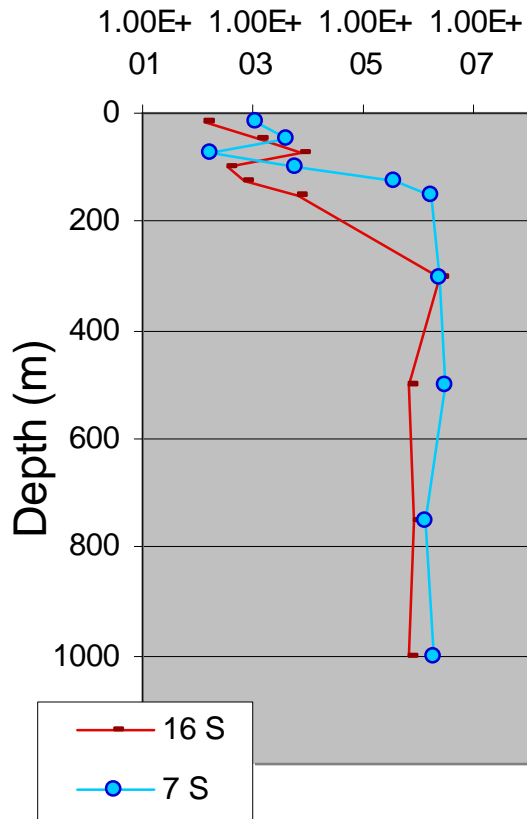
Depth profiles of amoA gene copy abundances

SPSG

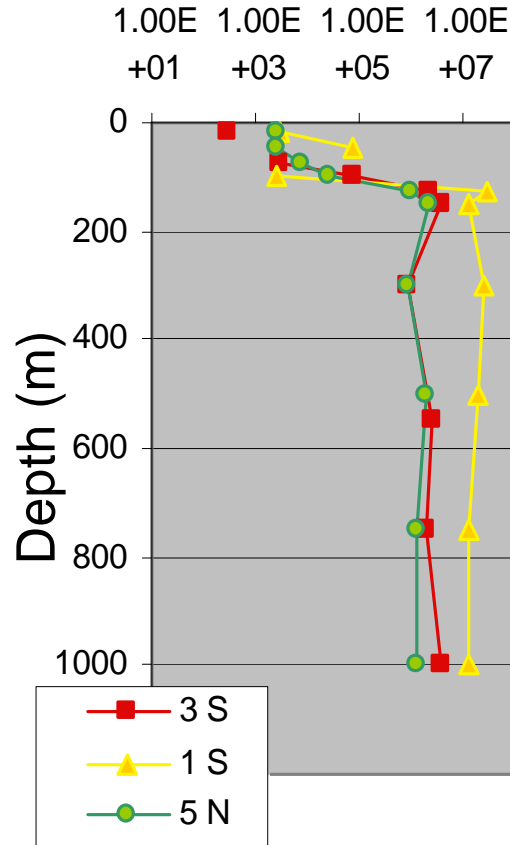
EQ

NPSG

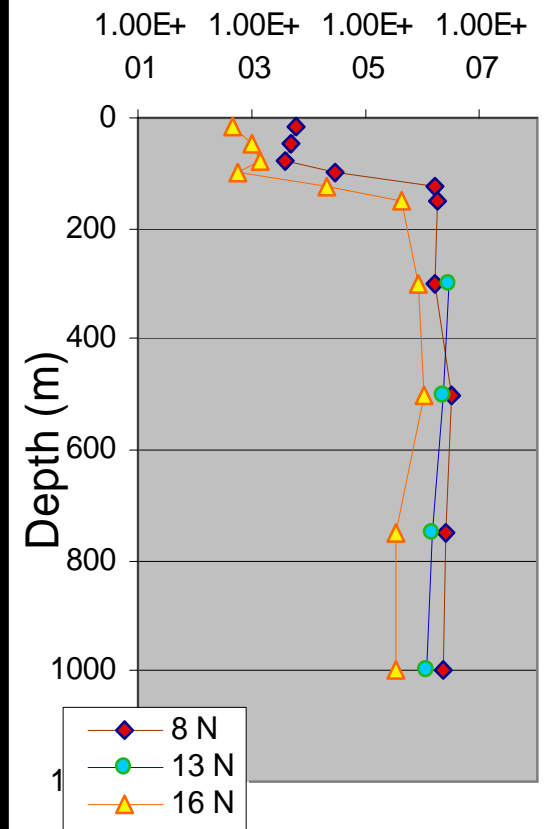
Gene Copies per Liter



Gene Copies per Liter



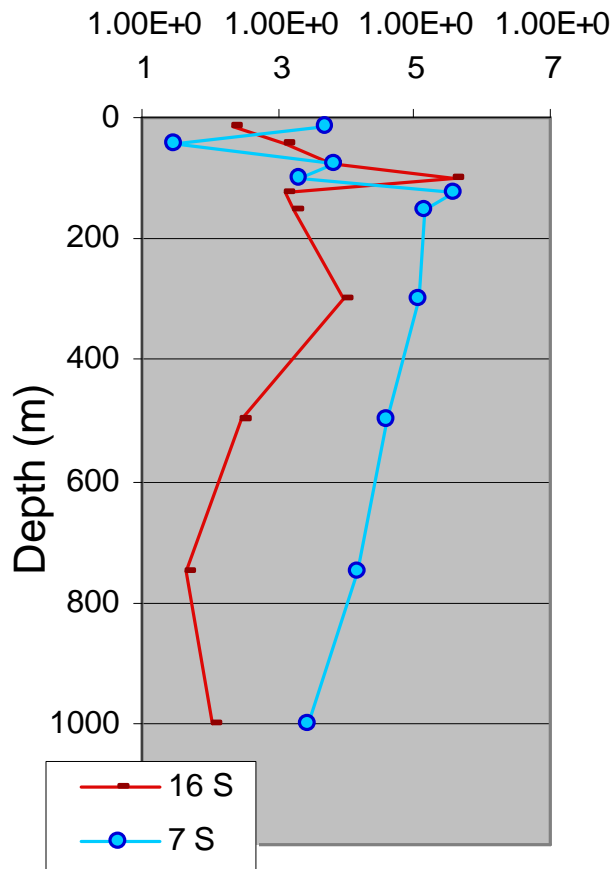
Gene Copies per Liter



Gene Expression: Depth profiles of amoA gene transcripts

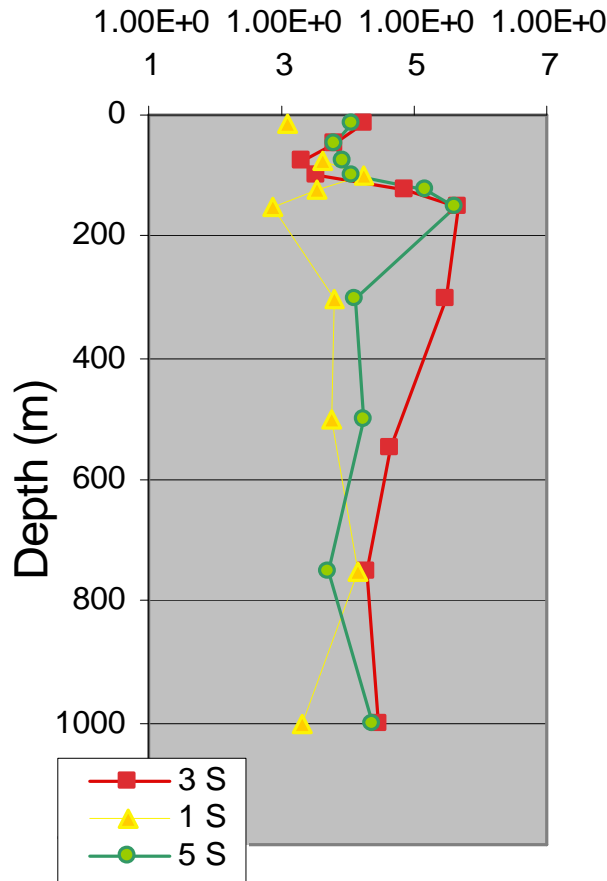
SPSG

Transcripts per Liter



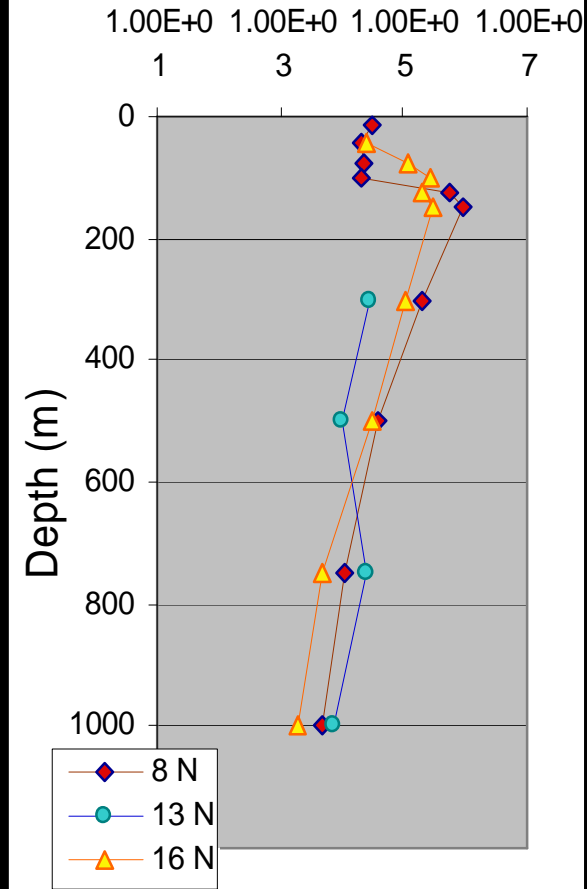
EQ

Transcripts per Liter



NPSG

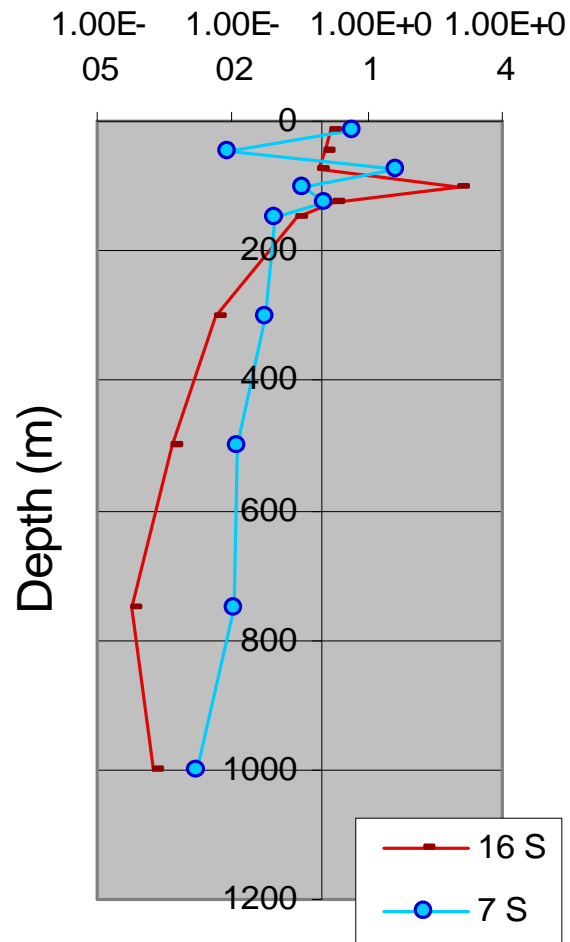
Transcripts per Liter



On a per cell basis...

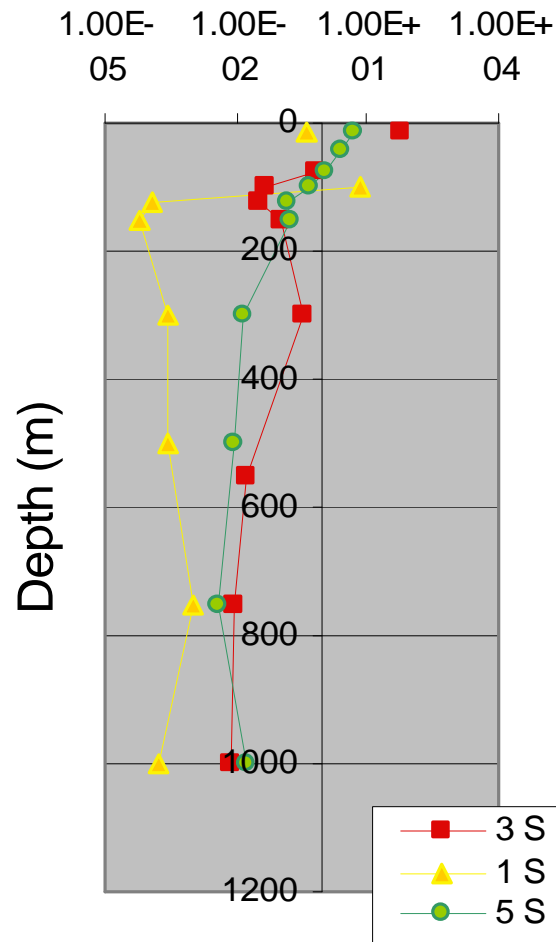
SPSG

Transcripts per Gene



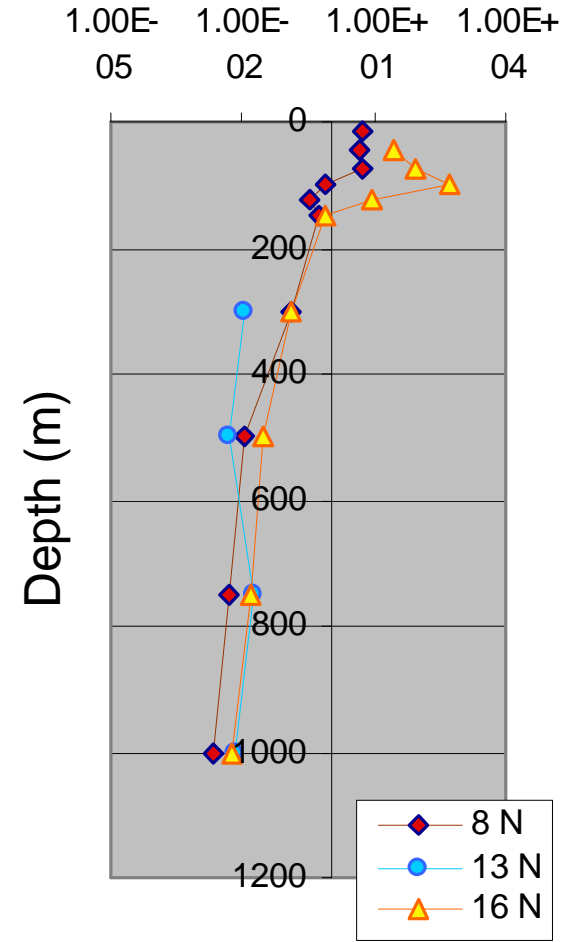
EQ

Transcripts per Gene



NPSG

Transcripts per Gene



Conclusion

The abundance of ammonium oxidizing archaea is highest near the equator.

Expression of amoA is highest near the photic zone boundary and decreases with increasing depth.

Transcription per gene is highest near the base of the photic zone in the SPSG and NPSG

Implications

- Nitrification rates appear to be greatest near the base of the photic zone.
- Factors controlling nitrification are not very well understood.
- More research needs to be done to understand the process of ammonium oxidation.

Acknowledgements



Matt Church, Grieg Steward, Dave Karl, Barb Bruno, Barbara Gibson, Alex Culley, Gordon Walker, Jennifer Edmonds, Jennifer Brum, Tara Clemente, Ken Doggett, Lance Fujieki, Donn Viviani, Ben Li, and the rest of the C - MORE crew.

stoked!

