

# Macrophytes and Eutrophication in Oyster Pond

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# Background

- Different contributions of wastewater in each sub-watersheds as seen from groundwater data
- Land use → source of N into pond →  $\delta^{15}\text{N}$  signature of macrophytes
- Why Macrophytes?
  - Long lived
  - Abundant
  - Widespread
  - Store N in tissues

# Survey Questions

- What are the inter-annual changes in the dominant species present?
- What is the dominant source of nitrogen for macrophytes?
  - Wastewater
  - Atmosphere
  - Fertilizer run-off

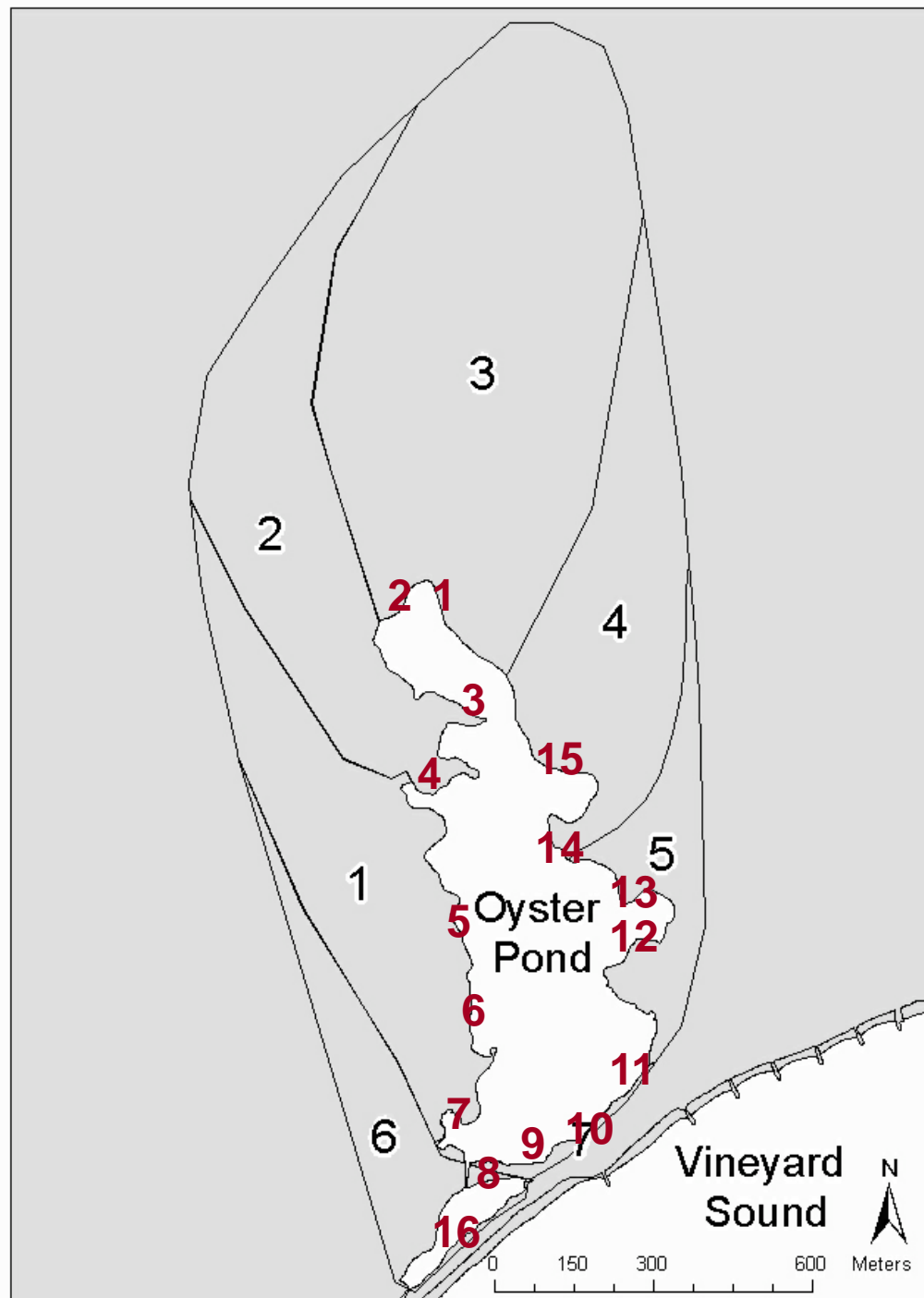
# Macrophyte Sampling Sites

Sixteen Sites

N=40

6 macrophytes

4 algae



*Potamogeton* spp.  
(Pondweed)



*Myriophyllum tenellum*



*Najas flexilis*  
(Bushy Pondweed)



*Zannichellia palustris*

(Horned Pondweed)



*Ceratophyllum demersum*

(Coontail)



*Chara vulgaris*

(Stonewort)



# *Ceratophyllum demersum* - Coontail

- Tracy *et al.* 2003 have found coontail is common in nutrient enriched lakes in Michigan
- Coontail is floating – foliar uptake of nutrients from water column

# Isotope Signature

- This is important for examining  $\delta^{15}\text{N}$  signatures of macrophytes to determine nitrogen source – particularly wastewater

| Source                 | $\delta^{15}\text{N}$ (‰) of nitrate in groundwater |
|------------------------|---|
| Wastewater             | 10 - 20   |
| Atmospheric Deposition | 2 - 8   |
| Fertilizer             | -3 - 3  |

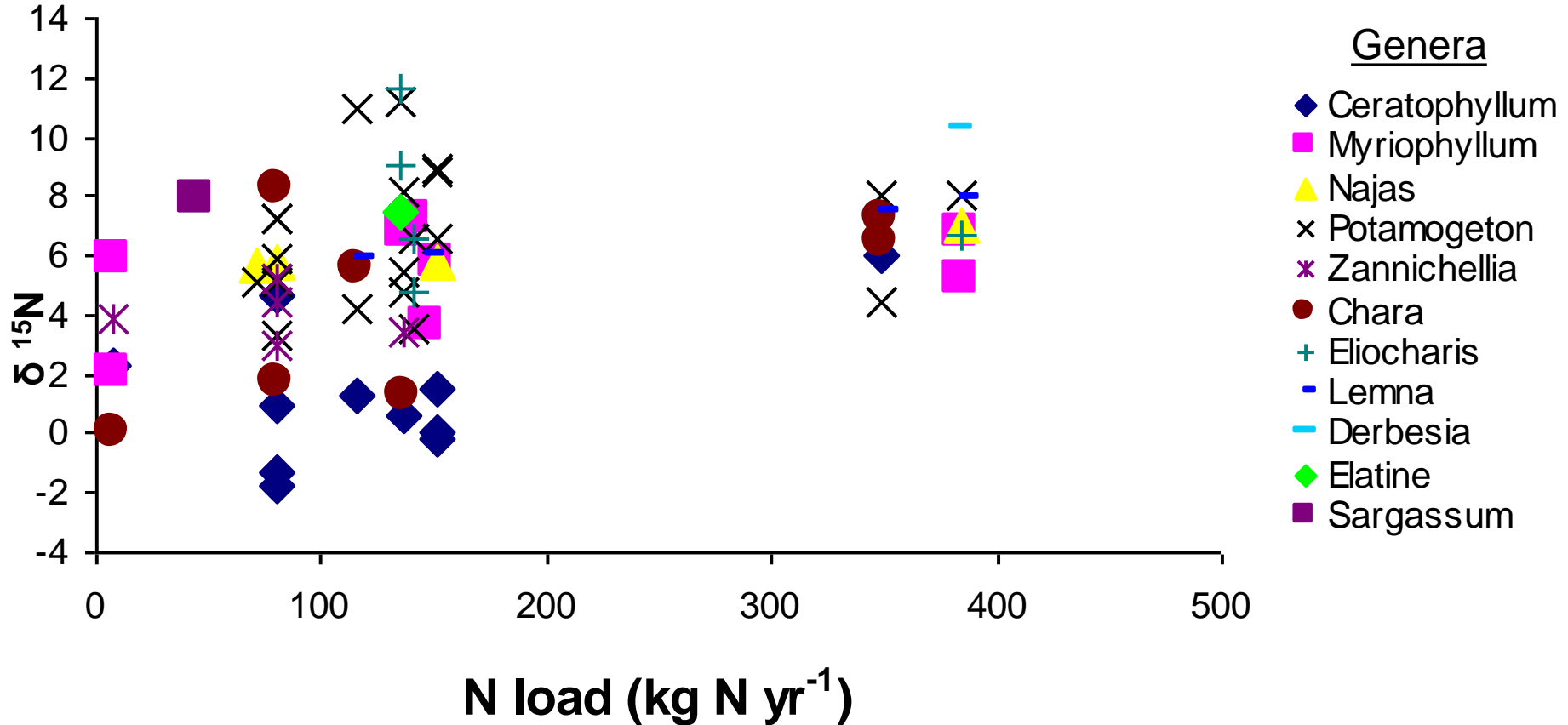
(Valiela *et al.* 2000)

# Isotope Signature

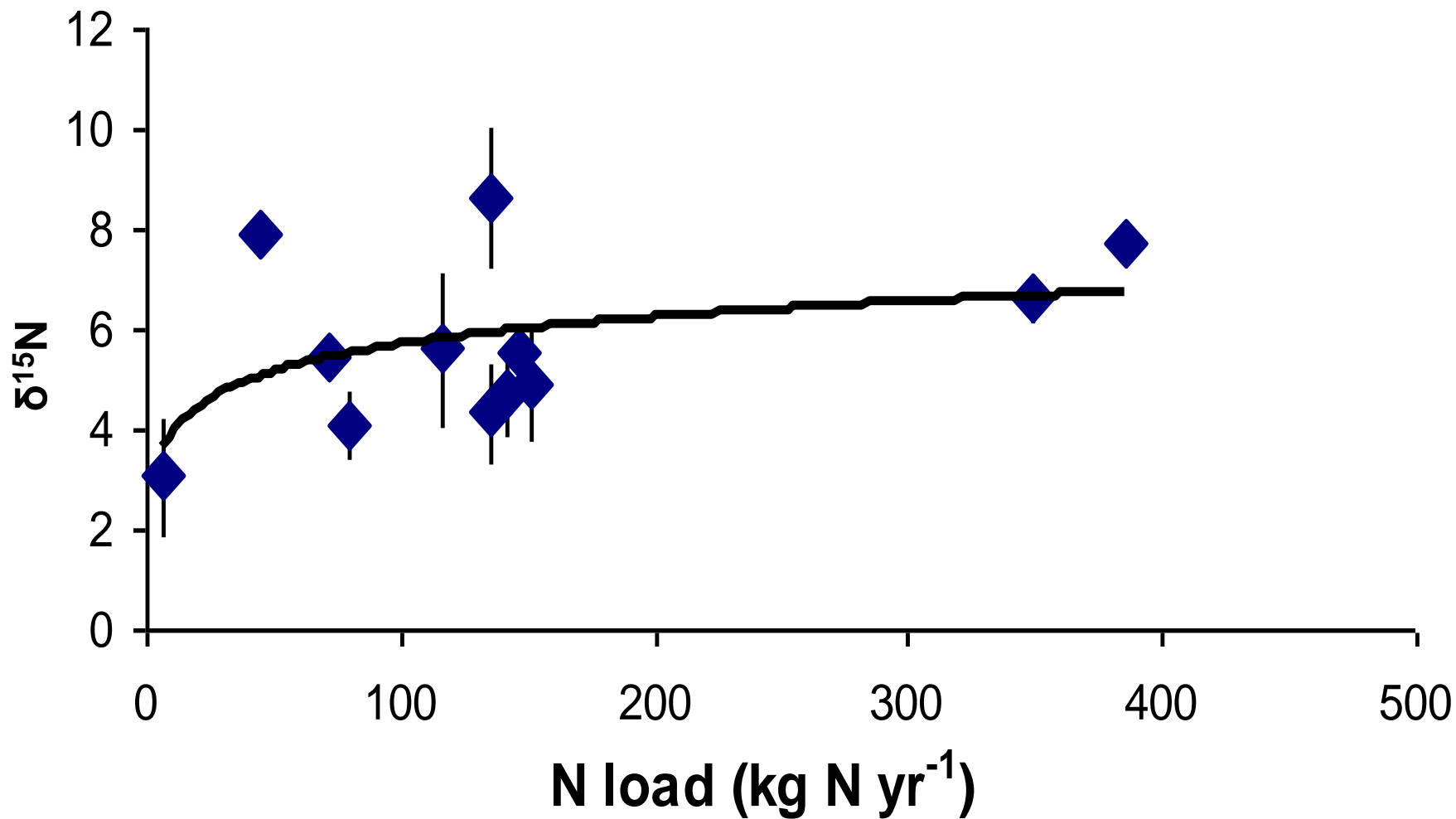
- Dried and packaged for isotope analysis:  
UC Davis Stable Isotope Facility
  - Continuous Flow Isotope Ratio Mass Spectrometer



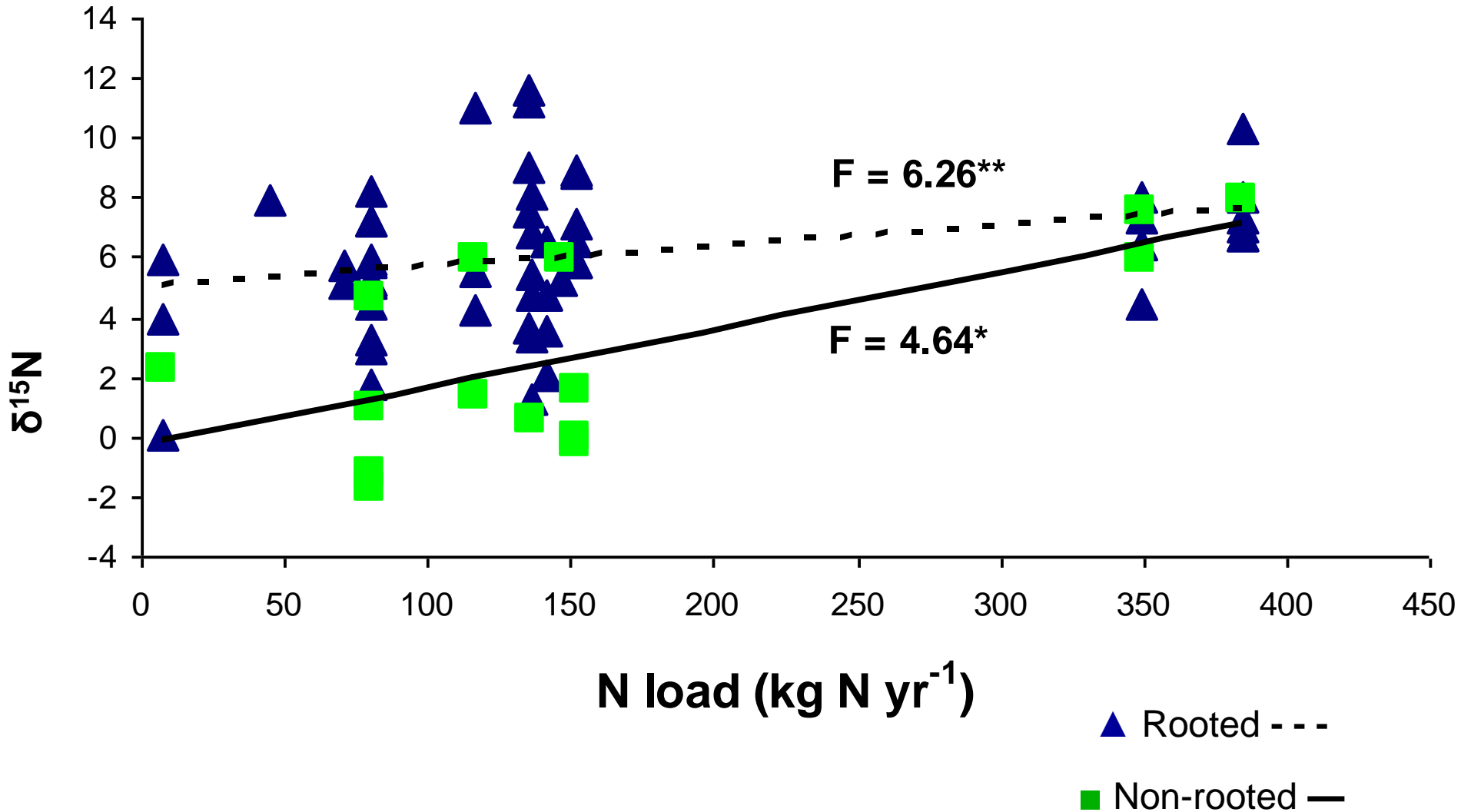
# $\delta^{15}\text{N}$ for Each Genus in Oyster Pond in 2001, 2002 and 2004 Combined



**Mean ( $\pm$  s.e.) Macrophyte Nitrogen Signature  
in 2001, 2002 and 2004 at Each Measured N load**



# Isotope Signatures for Rooted and Non-rooted Macrophytes in Oyster Pond for years 2001, 2002 and 2004



# Oyster Pond

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| Location       | $\delta^{15}\text{N}$ (‰) |
|----------------|---------------------------|
| Oyster Pond    | 3-9                       |
| Childs River   | 7 - 8.2                   |
| Quashnet River | 5.9 - 6.6                 |
| Sage Lot Pond  | 4 - 5                     |
| Mashpee River  | 6 - 8                     |
| N. Atlantic    | 4 - 13                    |
| Gulf of Mexico | 4 - 6                     |

(Cole 2004)

# Conclusions

- Macrophyte genera may indicate eutrophication of Oyster Pond
- $\delta^{15}\text{N}$  values of macrophytes are more sensitive of nutrient source at low N load
- Floating macrophytes are a better indicator of incipient N load

# Thank you!

Residents of Oyster  
Pond

Mr. Weeks

Mr. and Mrs. Sears

Ivan Valiela and  
Jennifer Bowen

Leanna Heffner

