

# Effects of Hypoxia on the Macrobenthic Community



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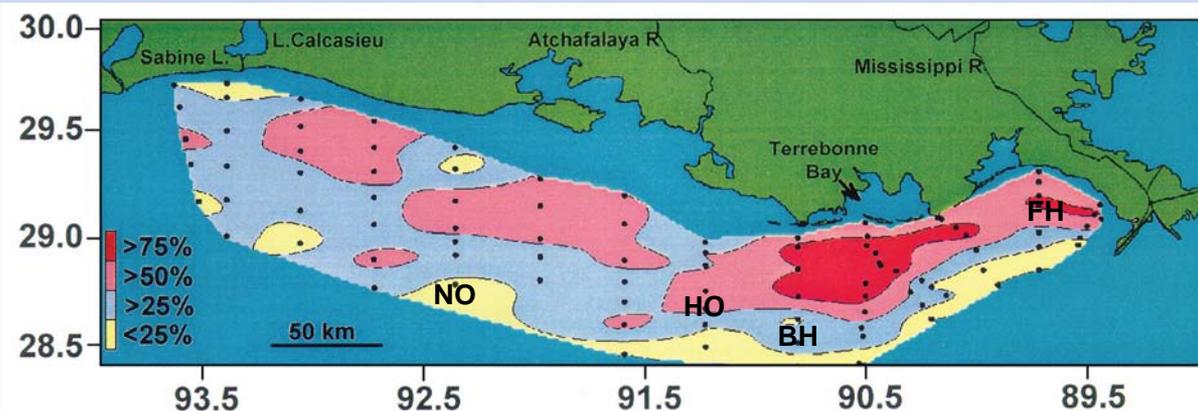
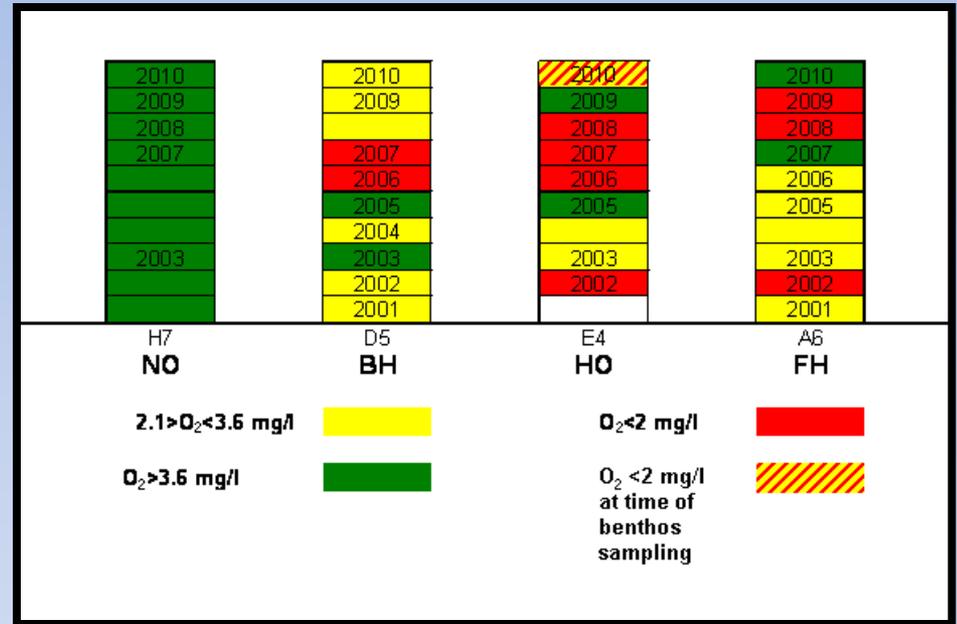
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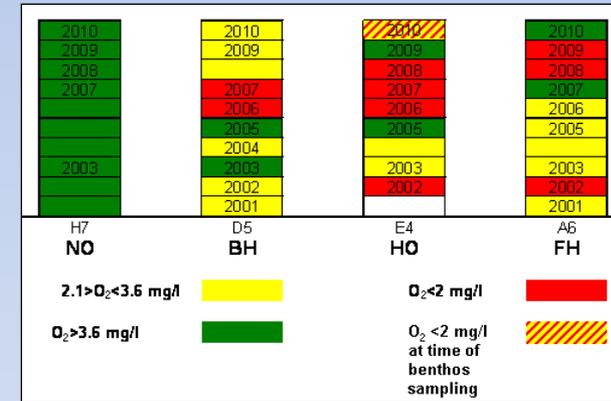
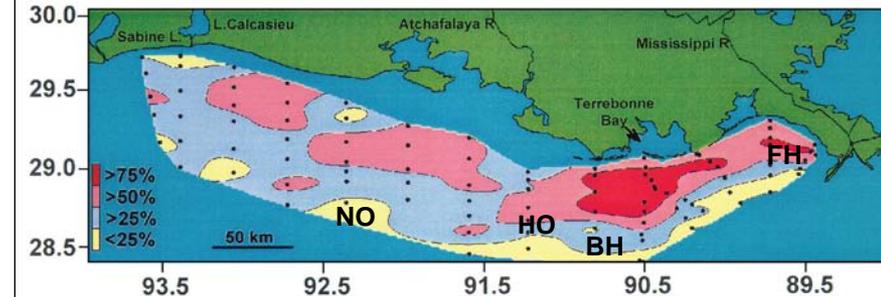
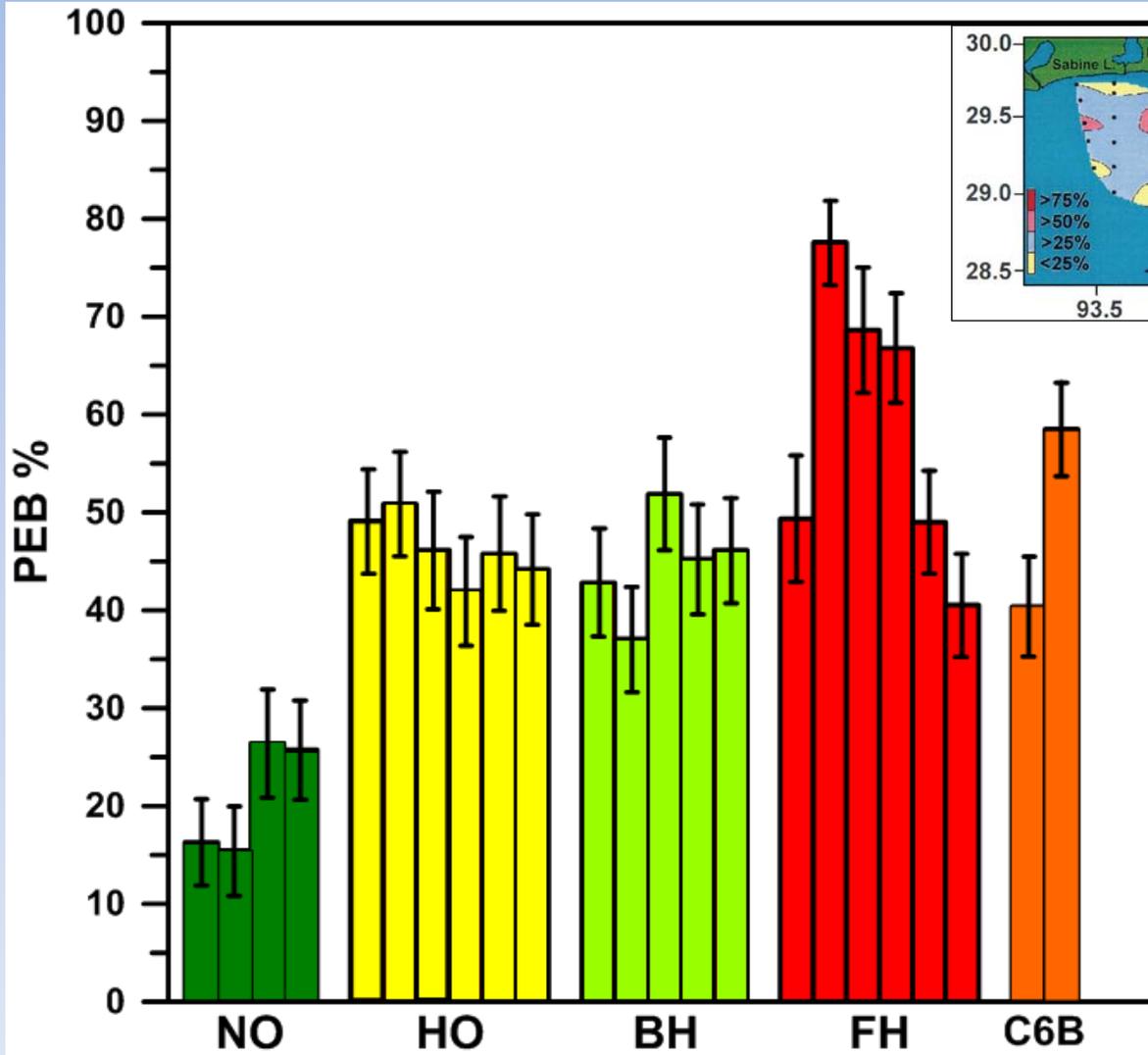
# Hypoxia in the Northern GOM

- Field measurements at 4 sites with differing exposures to hypoxia
- Frequency of hypoxia ascertained using NOAA Rabalais data from 1992-2010
- Sampling in April and Sept 2009, Aug 2010



*N. Rabalais data through 2008*

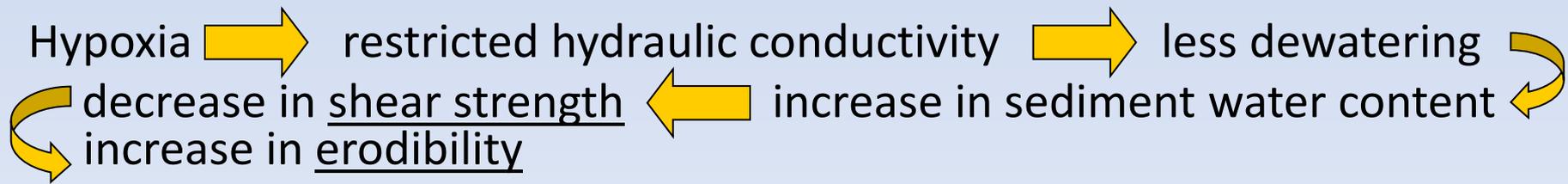
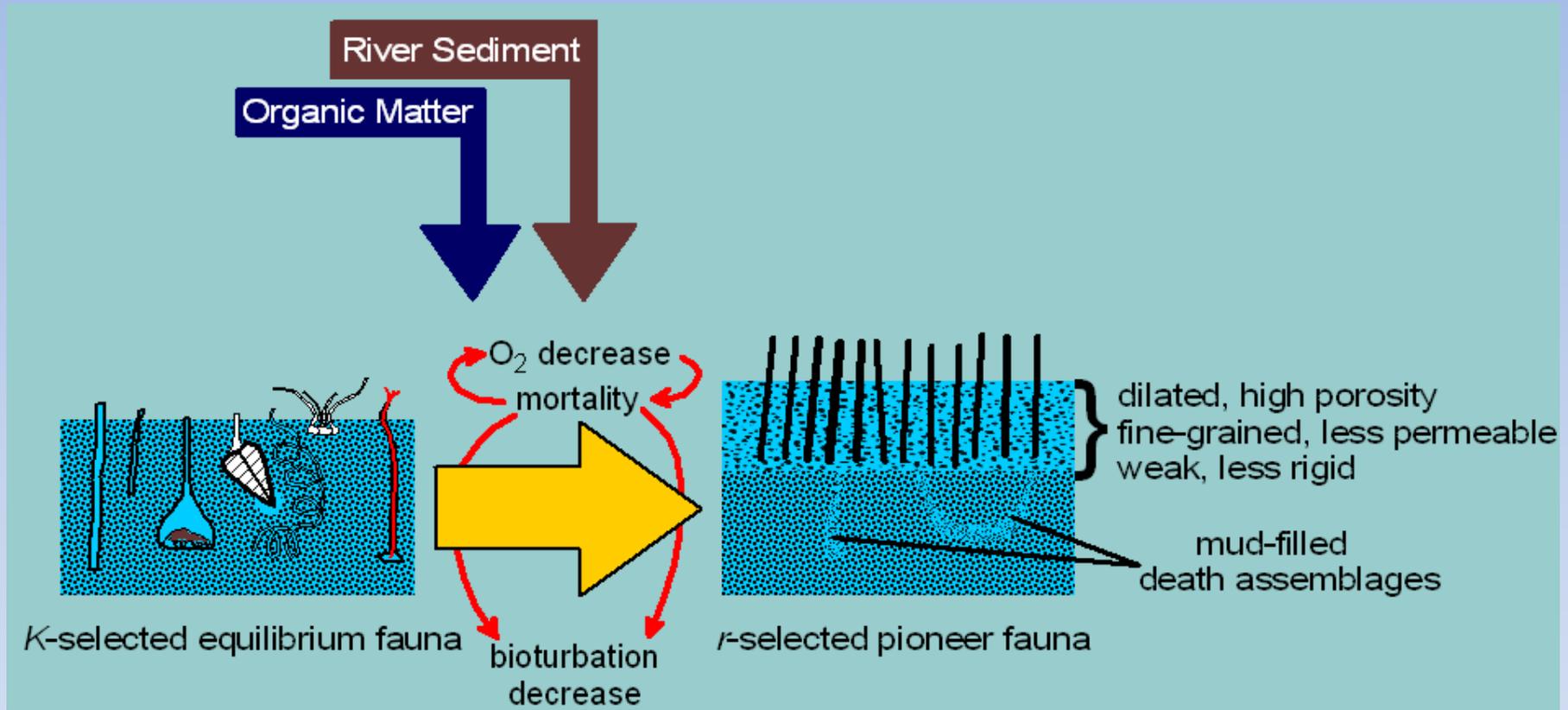
# Hypoxia History: Foraminifera



*Pseudononion atlanticum*  
*Epistominella vitrea*  
*Buliminella morgani*

Courtesy of L. Osterman, USGS

# Conceptual Model



## **April 2009 cruise aboard R/V Pelican**

24 box cores

3 subcores for macrofauna

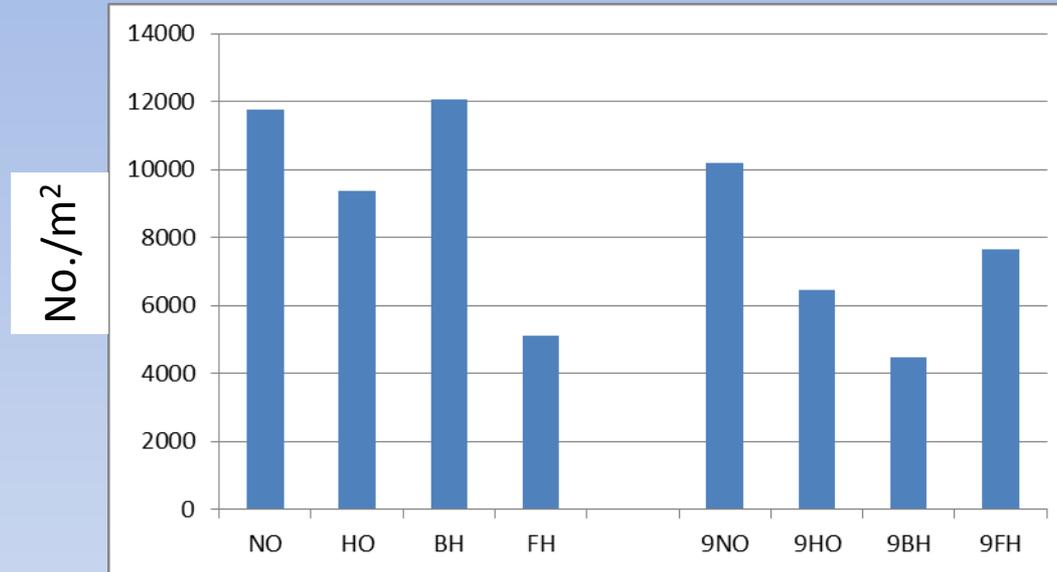
648 sieved, preserved samples for macrofauna (300- $\mu$ m)

## **September 2009 cruise (repeat)**

**August 2010 cruise (only 336 macrofauna samples)**

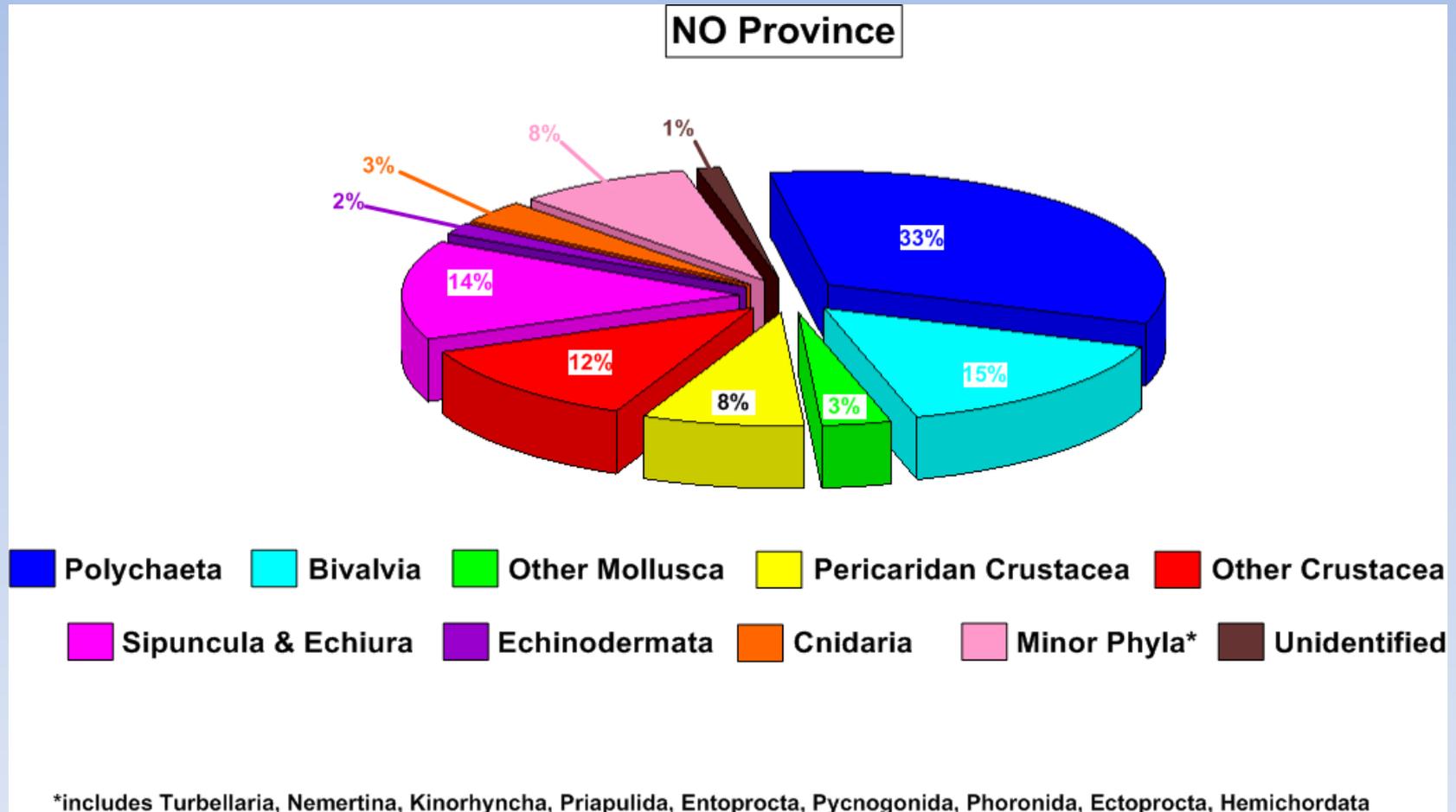


## Standing Crop of Macrofauna: April 2009



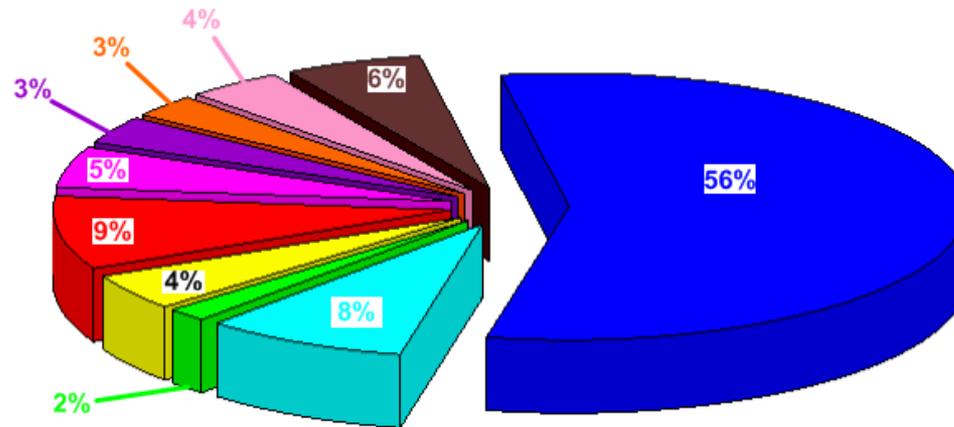
- NO and BH provinces have the highest numerical densities /m<sup>2</sup> of macrofauna in April 2009
- NO and FH provinces are highest at end of summer
- Abundance is not the whole story!

# Diversity of Macrofauna April 2009



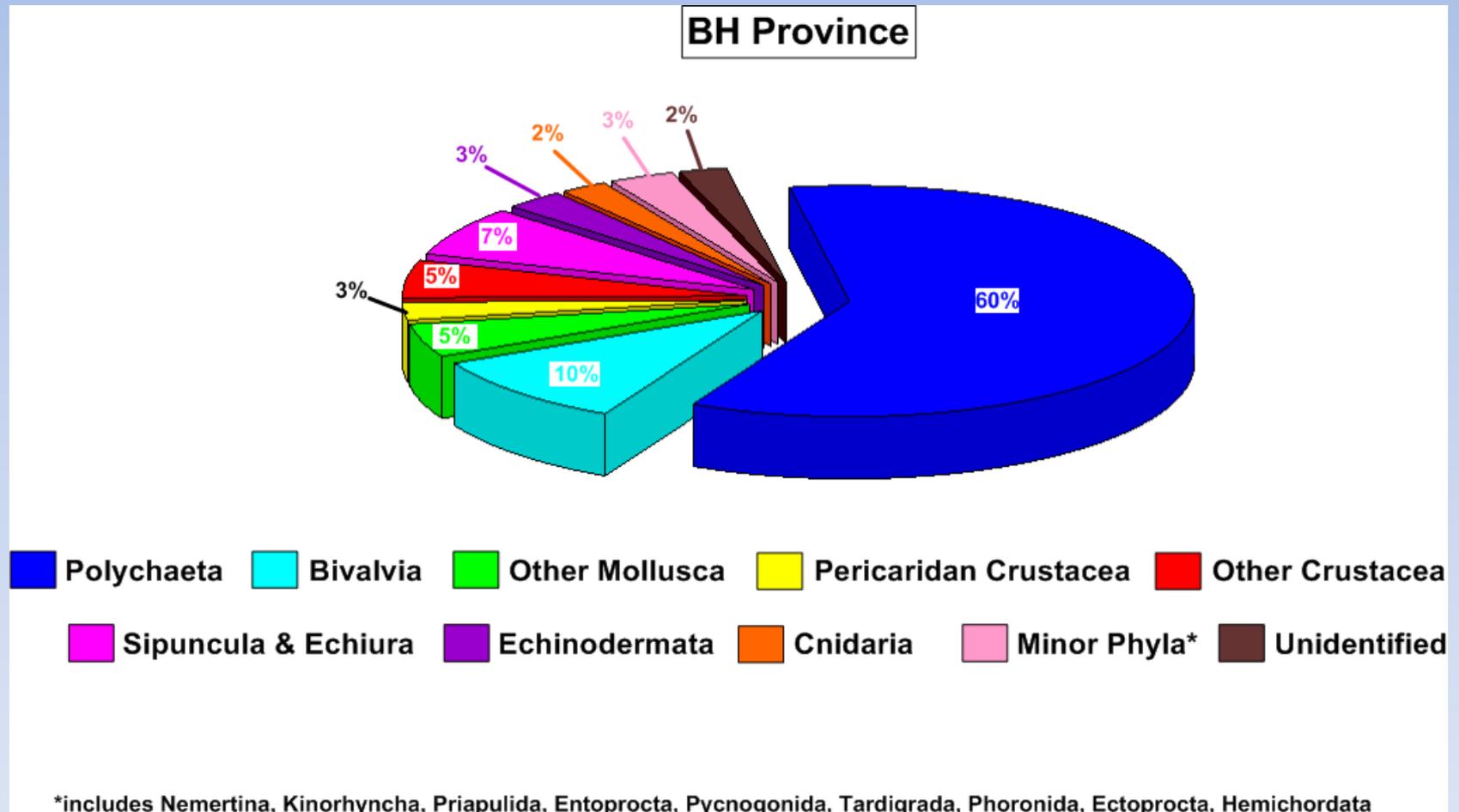
# Diversity of Macrofauna April 2009

HO Province

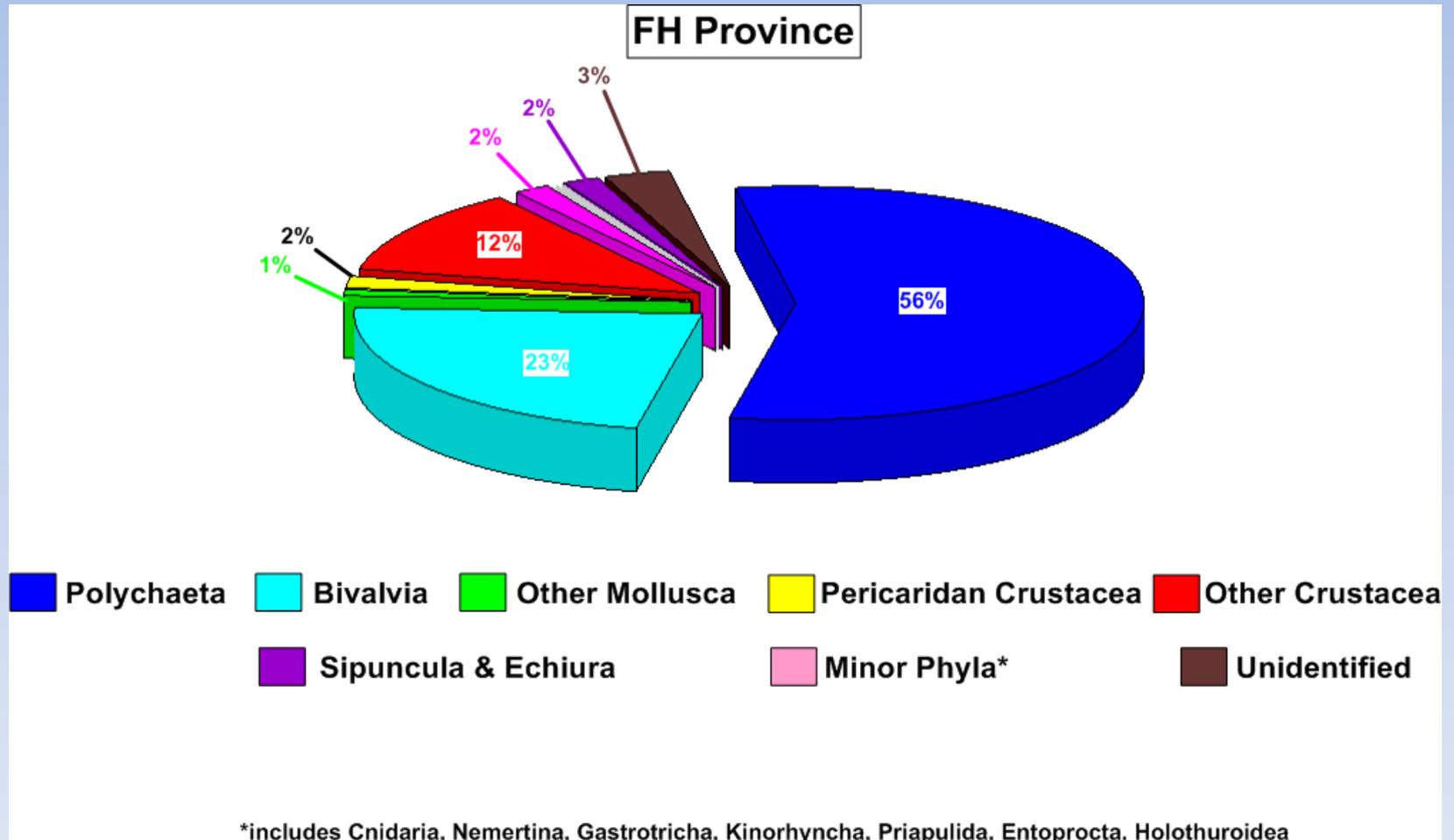


\*includes Nemertina, Kinorhyncha, Priapulida, Entoprocta

# Diversity of Macrofauna April 2009

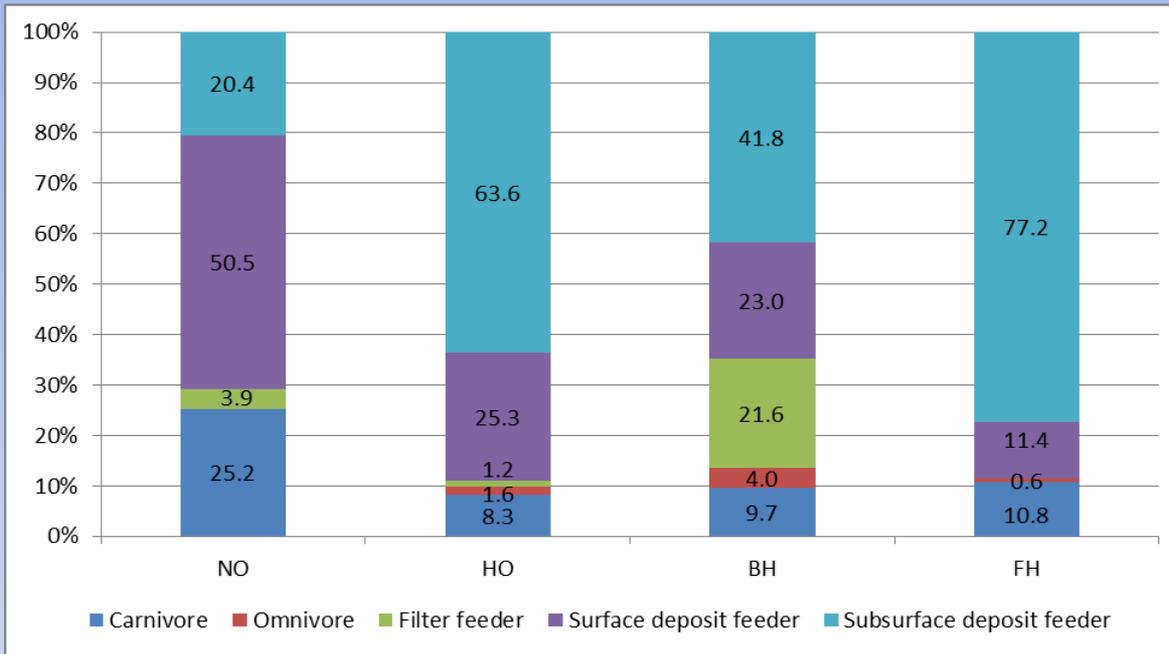


# Diversity of Macrofauna April 2009



# Feeding Guilds for Polychaete Worms

April 2009:  
Abundance



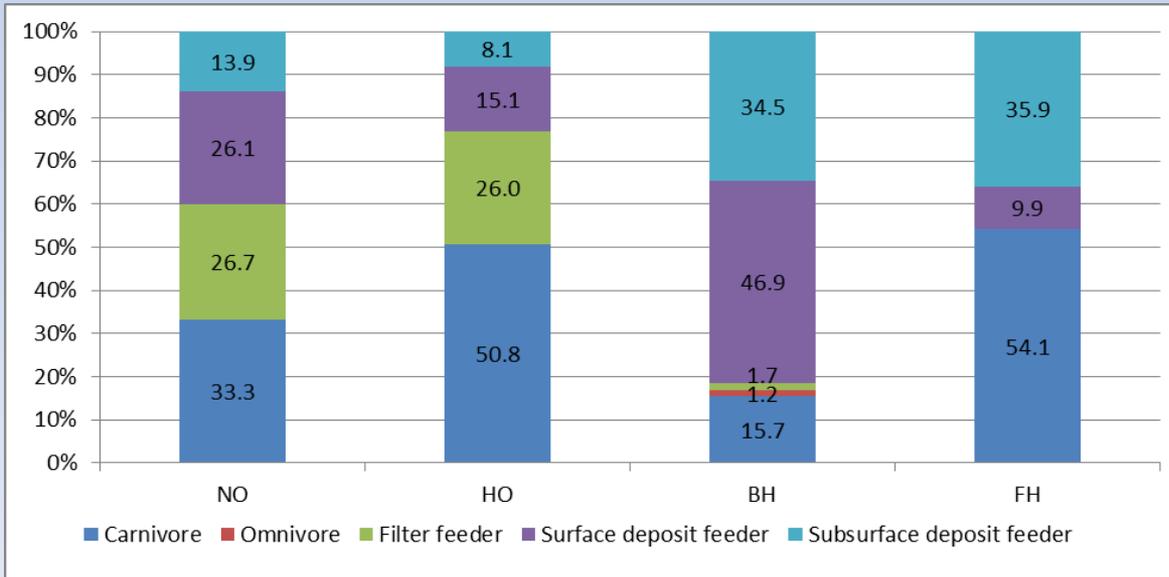
**NO:** Few large suspension/filter feeders and a lot of small surface deposit feeders

**HO:** Few large carnivores and suspension/filter feeders and a lot of small subsurface deposit feeders

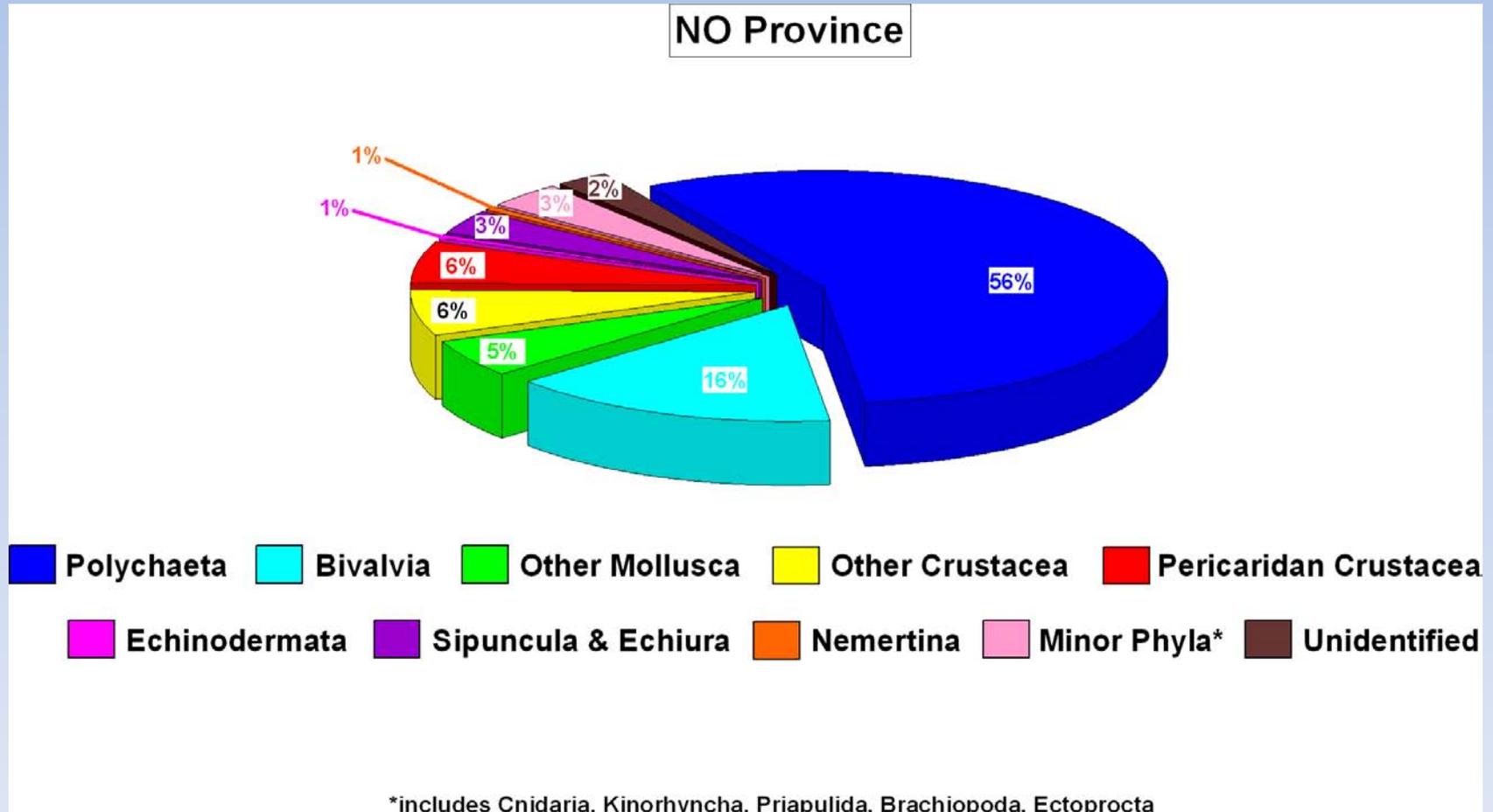
**BH:** Few large surface deposit feeders and a lot of small suspension feeders

**FH:** Few large carnivores and a lot of small subsurface deposit feeders

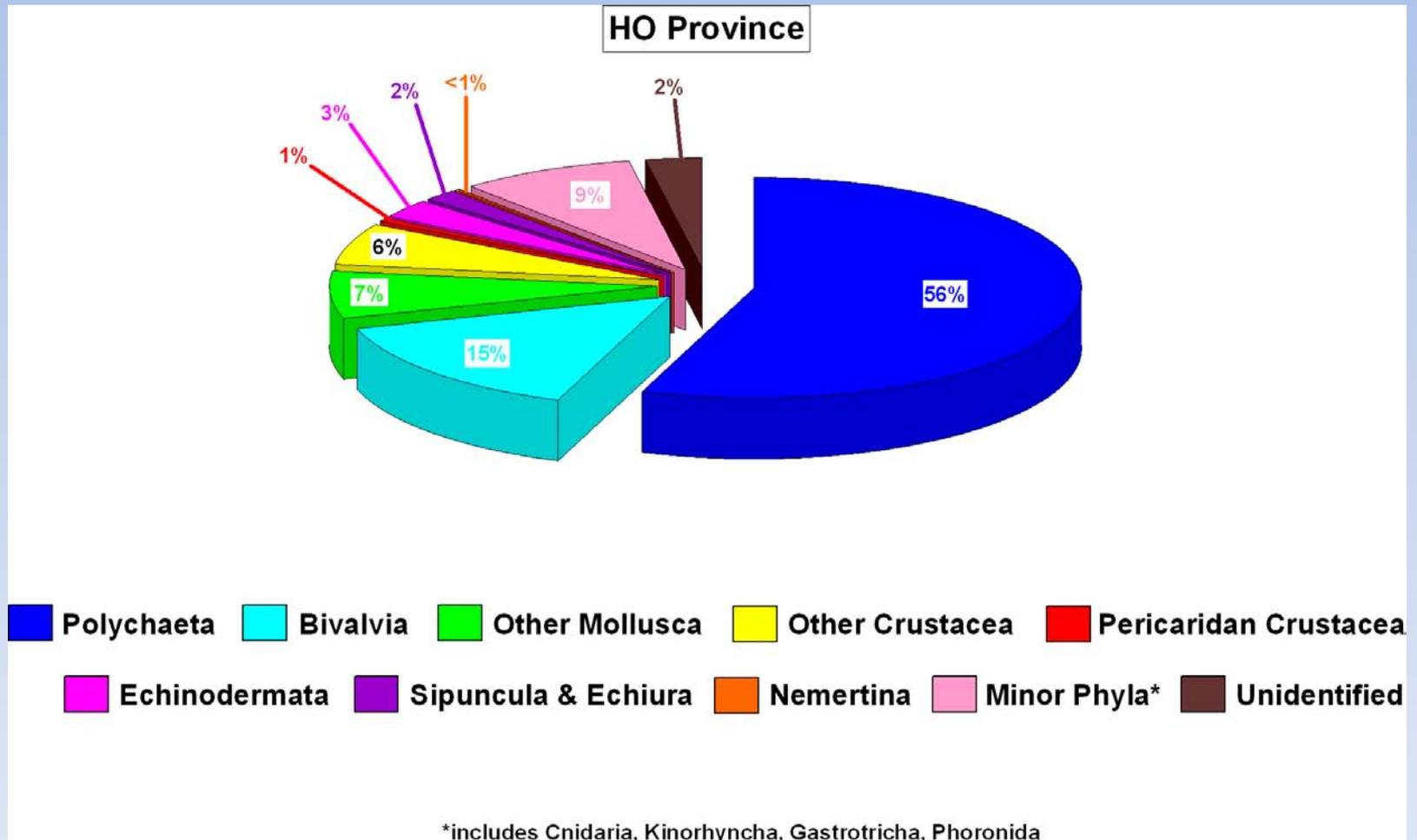
April 2009:  
Biomass



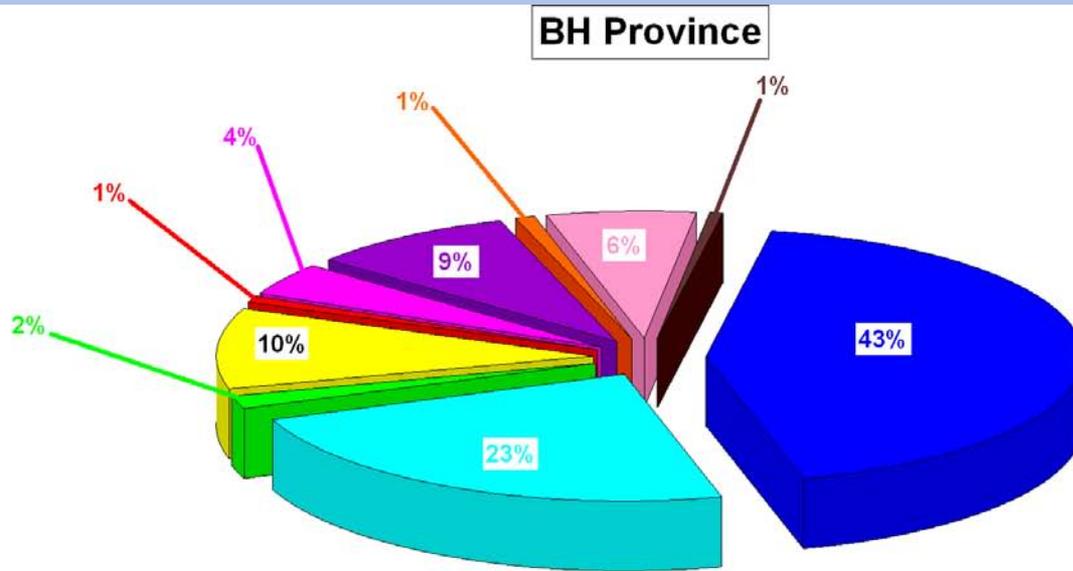
# Diversity of Macrobenthos September 2009



# Diversity of Macrobenthos September 2009

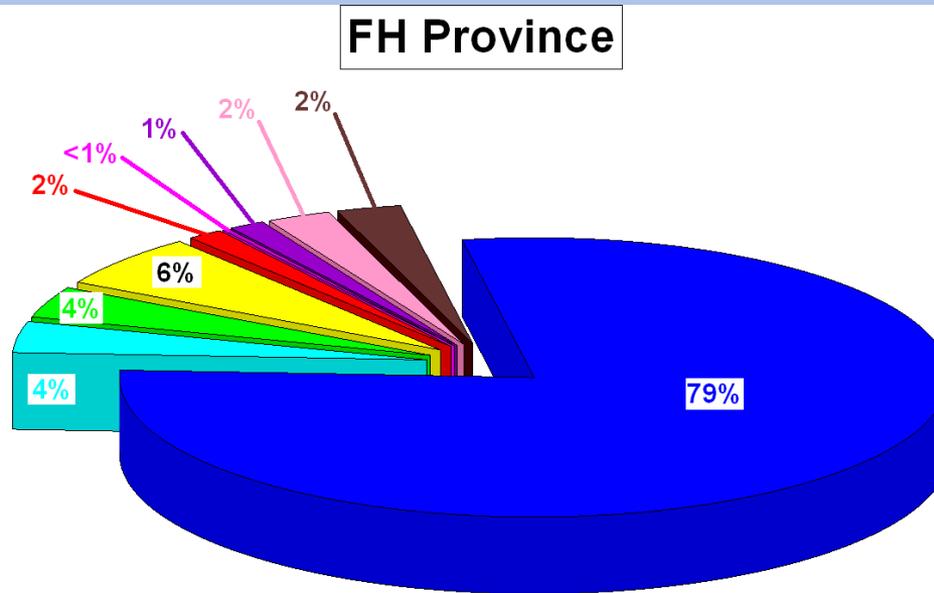


# Diversity of Macrobenthos September 2009



\*includes Cnidaria, Kinorhyncha, Phoronida, Hemichordata

# Diversity of Macrobenthos September 2009

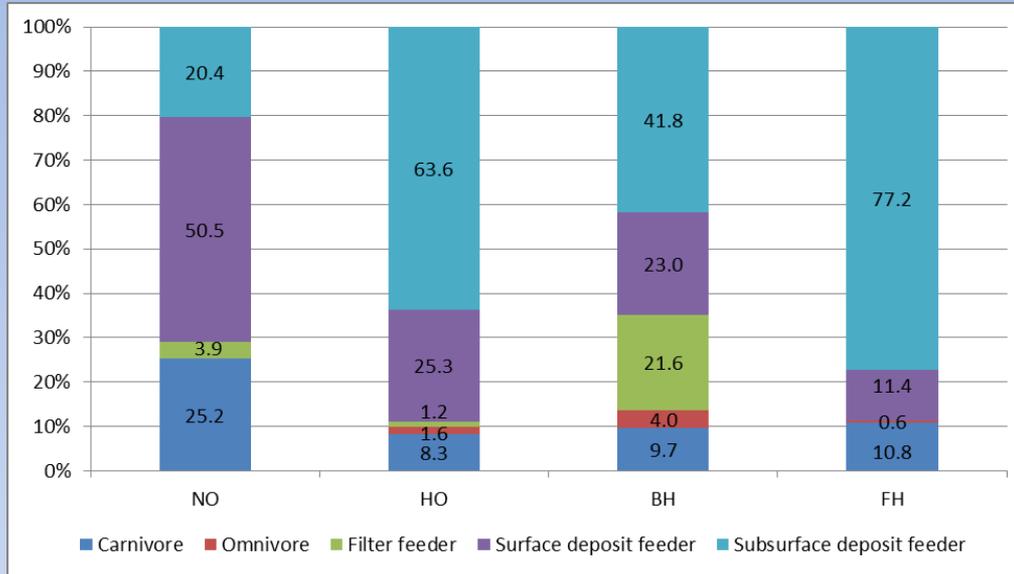


- Polychaeta
- Bivalvia
- Other Mollusca
- Other Crustacea
- Pericaridan Crustacea
- Echinodermata
- Sipuncula & Echiura
- Minor Phyla\*
- Unidentified

\*includes Cnidaria, Kinorhyncha

# Feeding Guilds for Polychaete Worms

## April 2009: Abundance



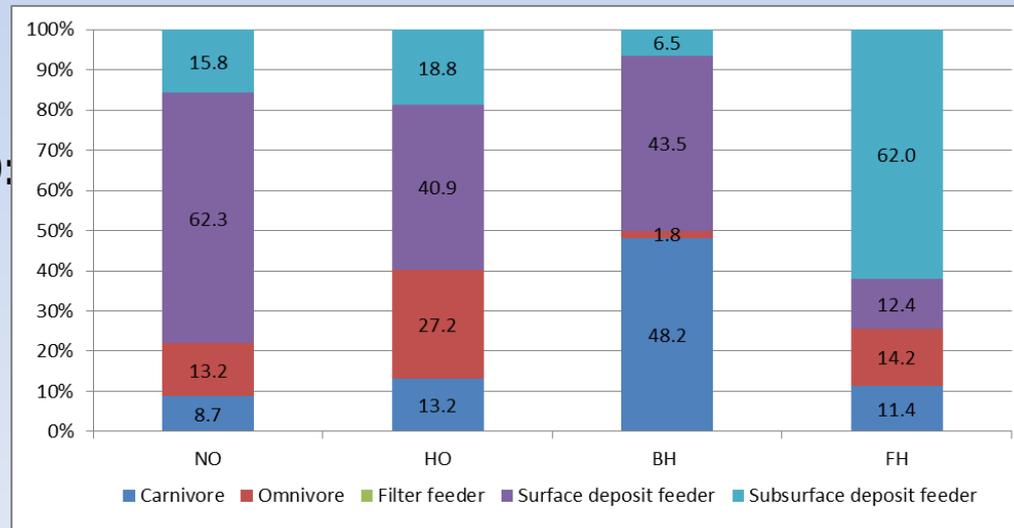
After Summer Season  
**NO:** Carnivore/omnivore/  
 deposit feeder proportion  
 changes little

**HO:** More carnivores/  
 omnivores, deposit  
 feeders; less subsurface  
 deposit feeders

**BH:** More carnivores;  
 less deposit feeders

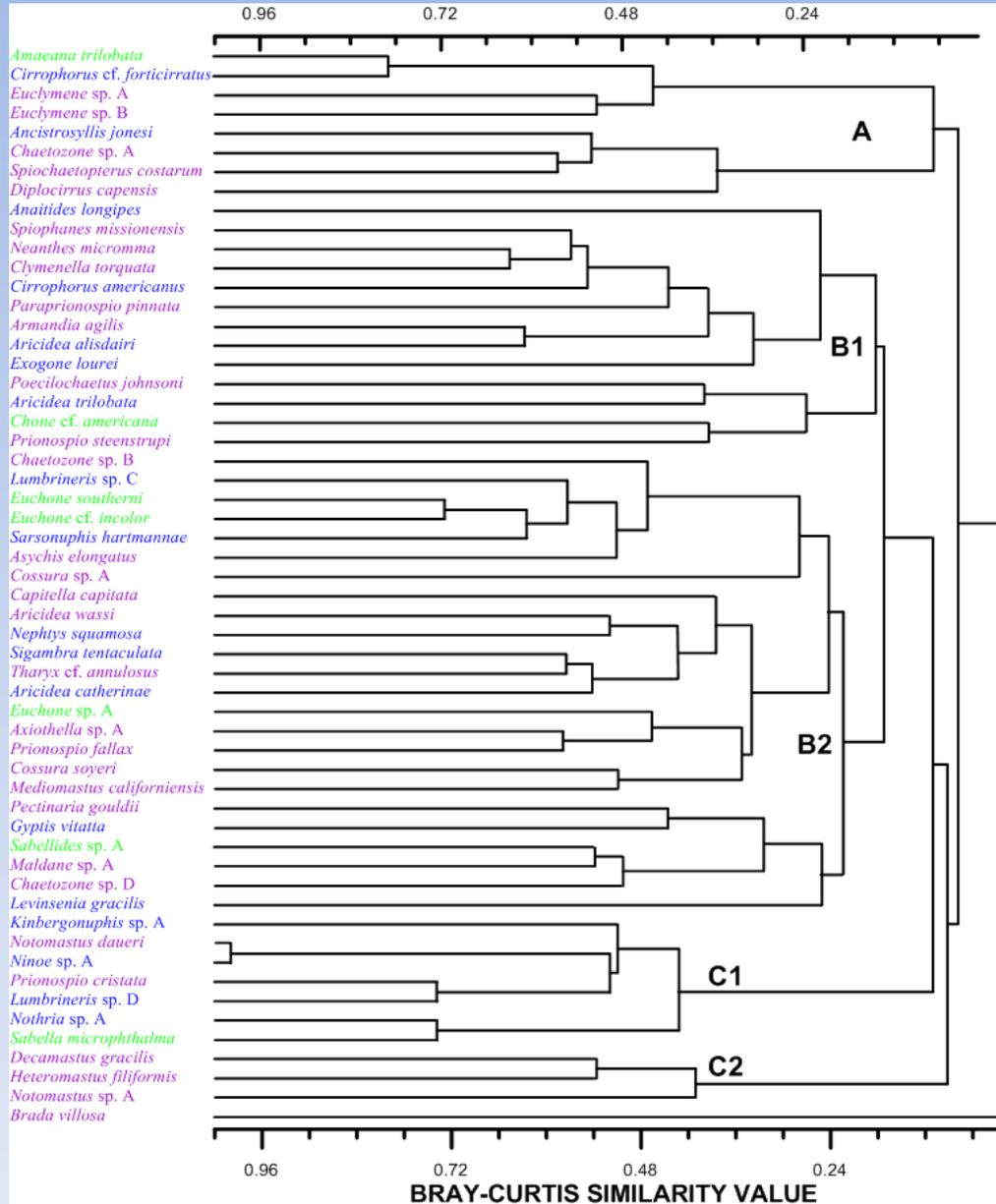
**FH:** More carnivores/  
 omnivores, but not large  
 gains in numbers

## September 2009: Abundance



# Polychaete Community Analysis

**April 2009:  
Abundance**

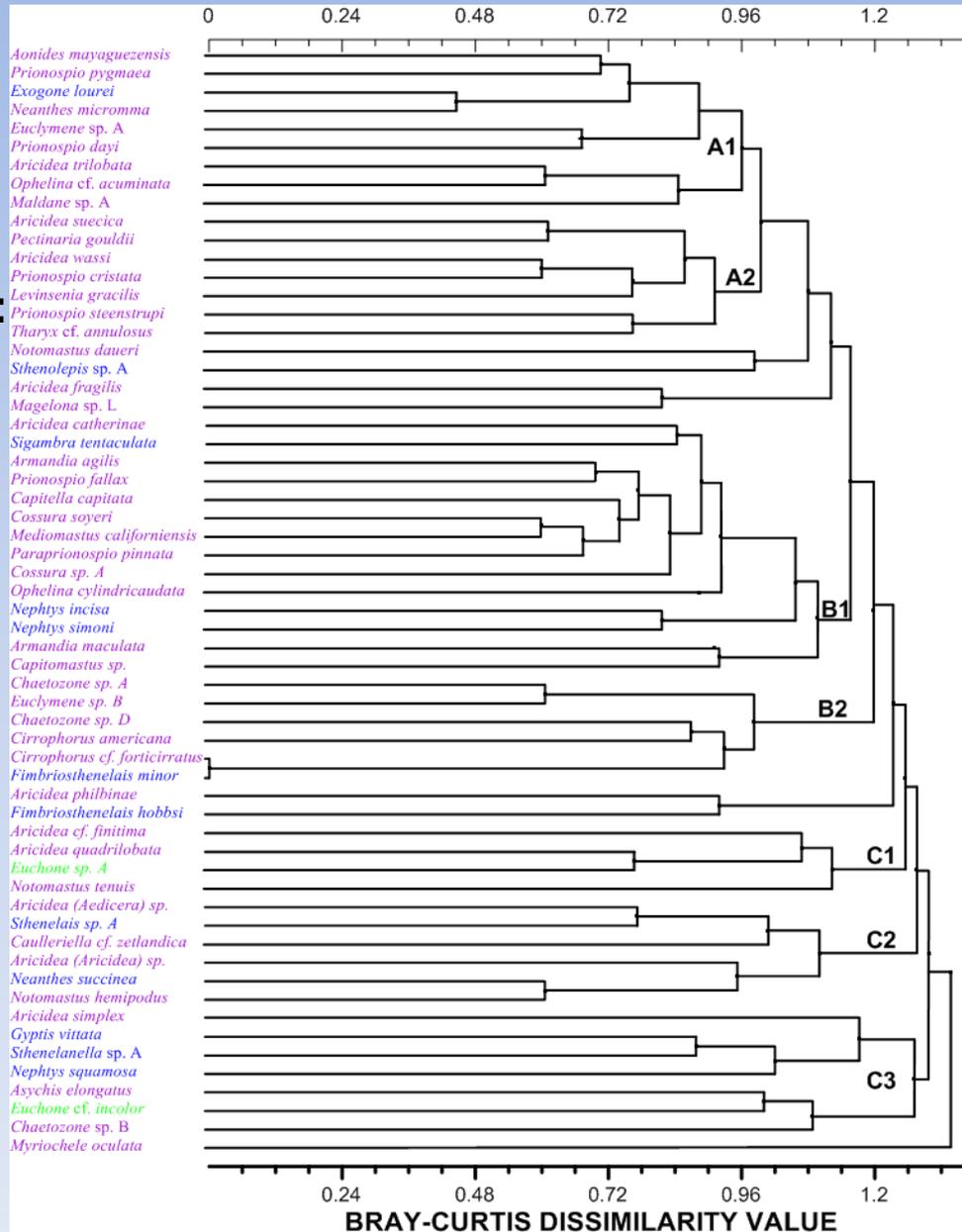


Groups A, B, C have associations of suspension/filter feeders, deposit feeders, and predators that show affinity

- Suspension/Filter Feeder
- Deposit Feeder
- Predator/Omnivore

# Polychaete Community Analysis

**September 2009:  
Abundance**

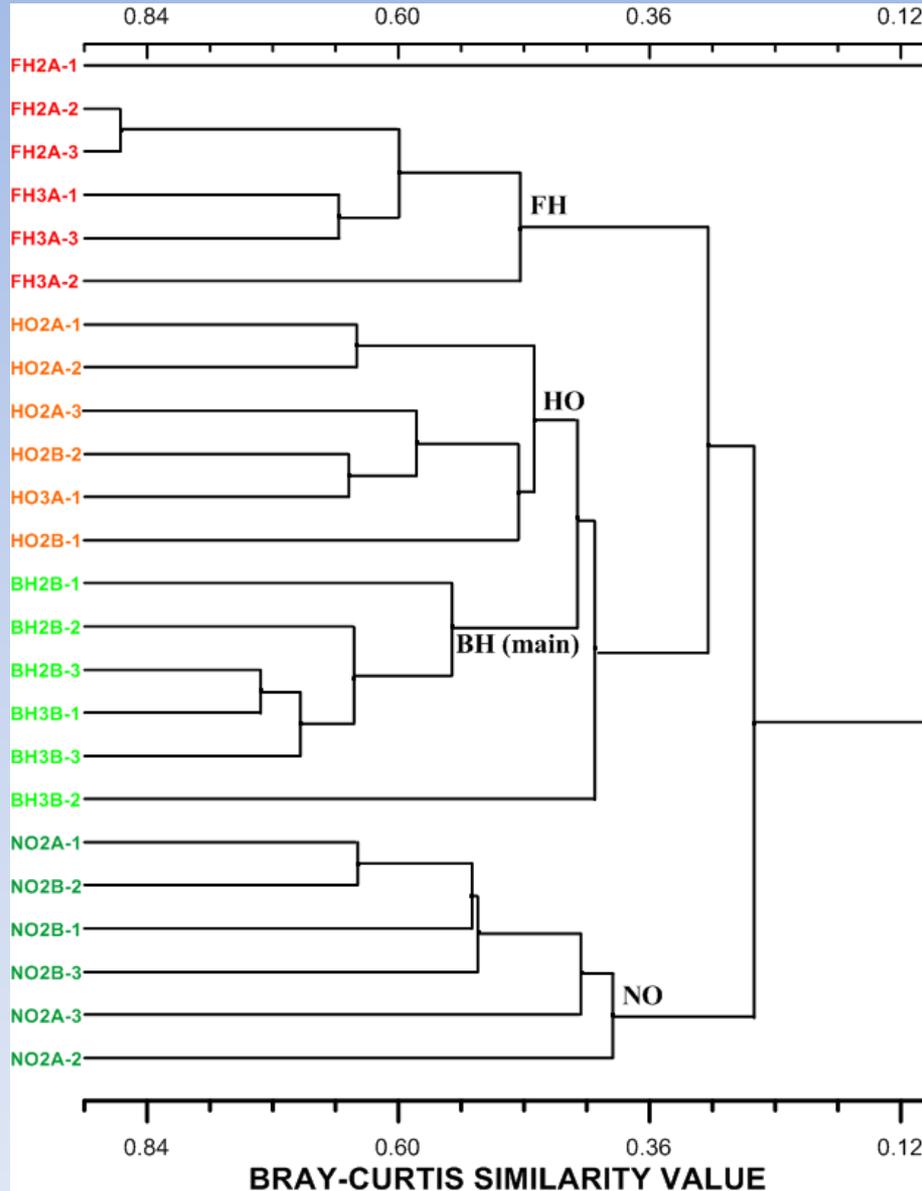


Post-summer census shows weaker affinities within groups, less suspension/filter feeders

- Suspension/Filter Feeder
- Deposit Feeder
- Predator/Omnivore

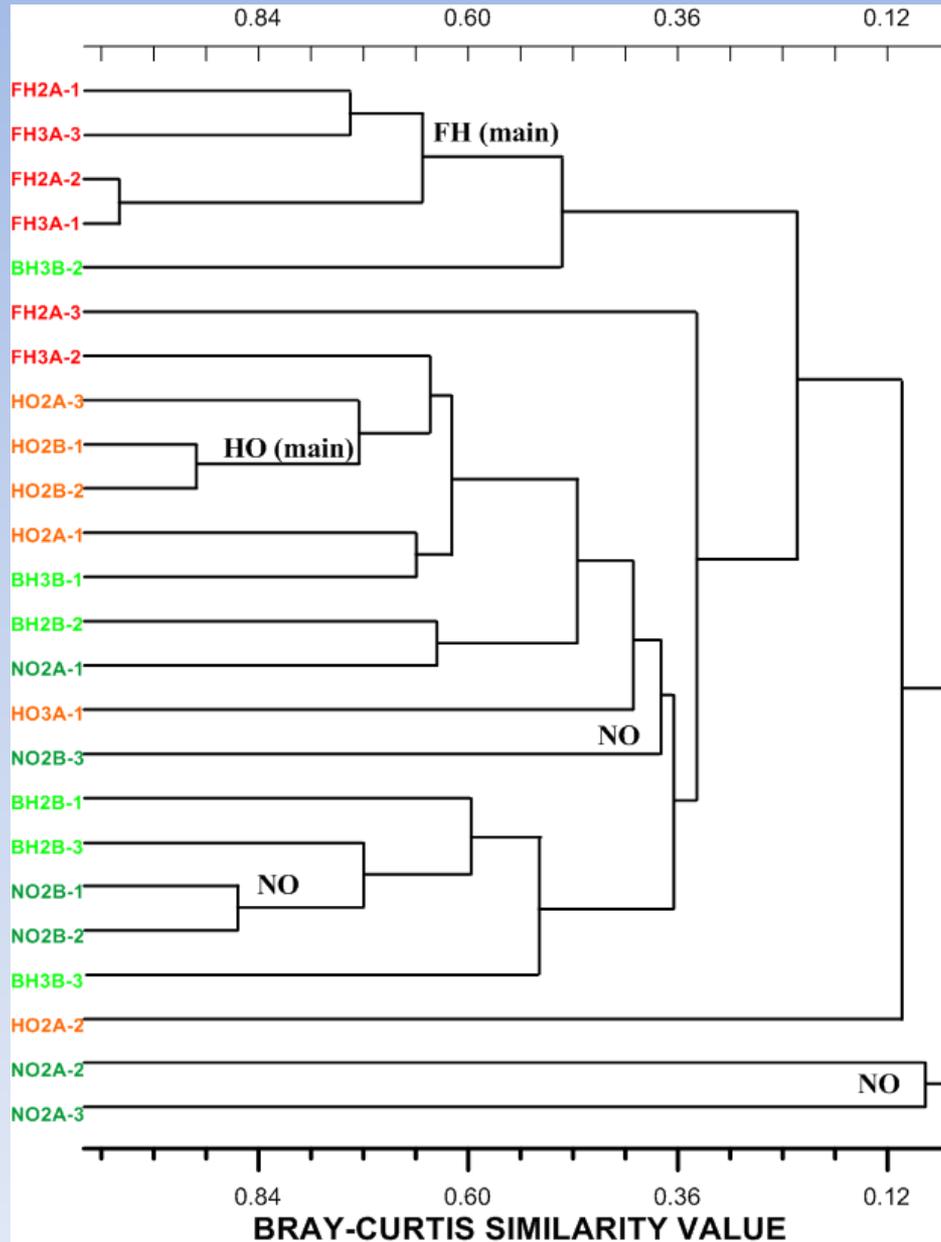
# Polychaete Community Analysis

**April 2009:  
Abundance**



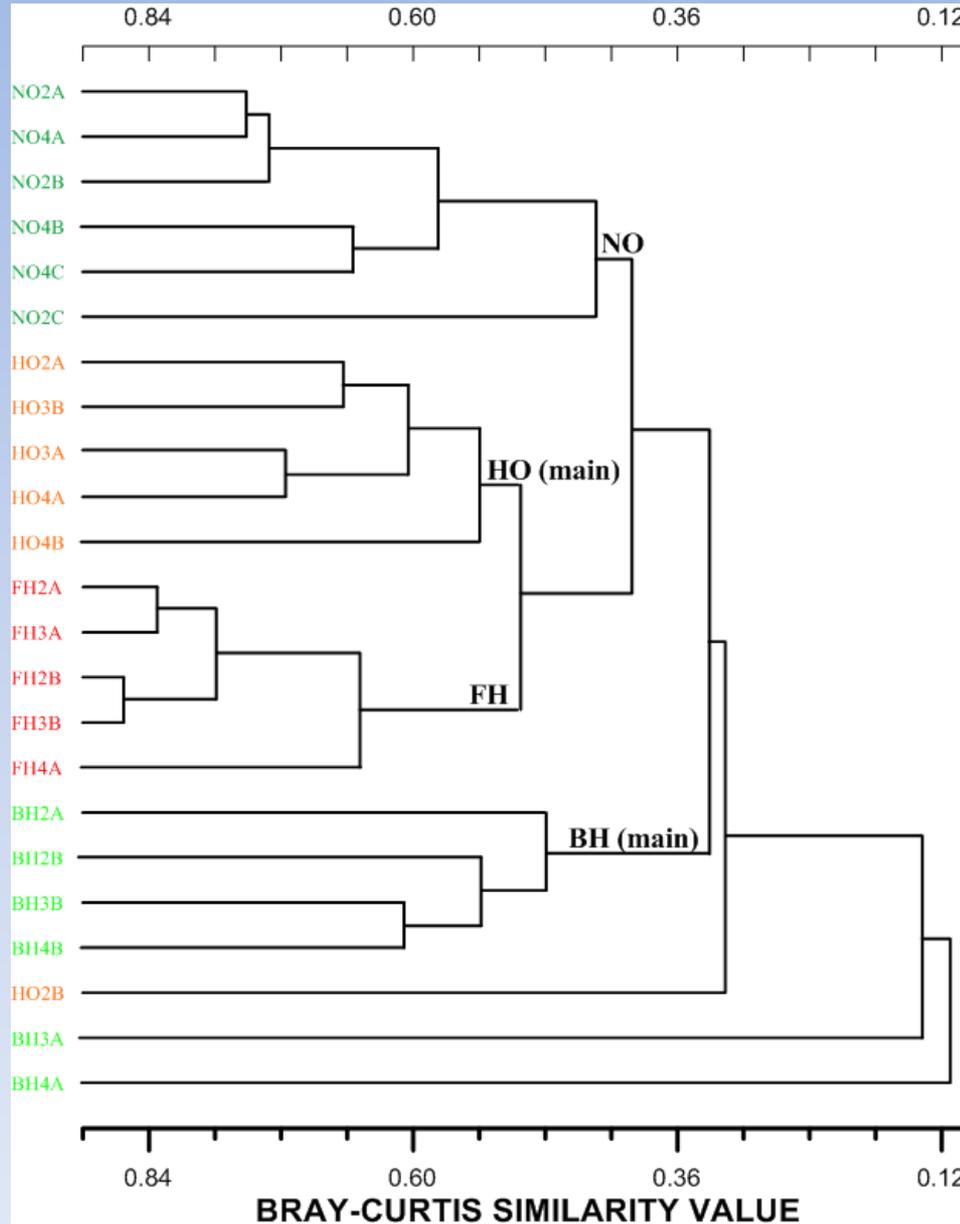
# Polychaete Community Analysis

**April 2009:  
Biomass**



Some affinity within FH and HO due to biomass, but most subcores are too variable in terms of biomass

# Polychaete Community Analysis



**September 2009:  
Abundance**

**NO** and **FH** show the strongest affinities; More variability in abundance data of **HO** and **BH** may be a result of recovery from hypoxia

# Diversity Indices: Polychaete Abundance

April	NO	HO	BH	FH
<i>SR</i>	9.4	7.4	10.4	4.1
<i>H'</i>	4.4	2.8	3.5	2.2
<i>J'</i>	0.8	0.5	0.6	0.5

- Before summer 2009 NO and BH have comparable Species Richness, Diversity, and Evenness
- Before summer 2009 HO and FH have the least diverse communities

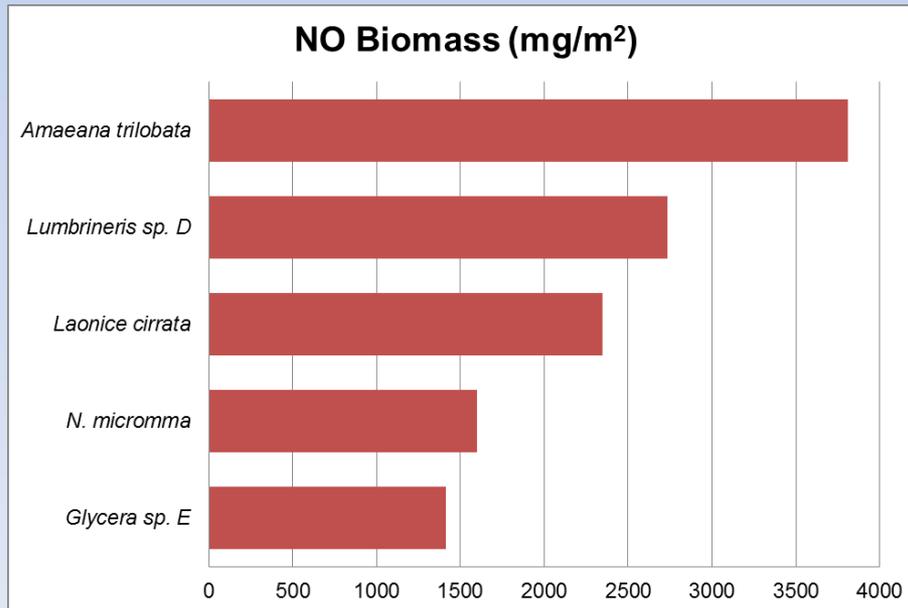
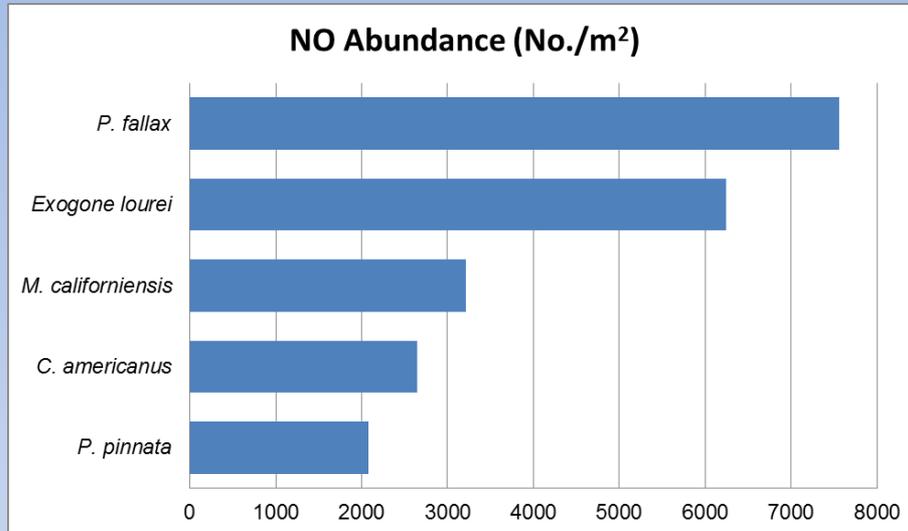
September	9NO	9HO	9BH	9FH
<i>SR</i>	12.2	10.6	8.1	5.3
<i>H'</i>	4.9	4.6	4.3	2.9
<i>J'</i>	0.8	0.8	0.8	0.6

- After summer 2009 all sites show diversity gains
- After summer 2009 hypoxic event FH has the least diverse community; HO has the greatest evidence of recovery

# Conclusions

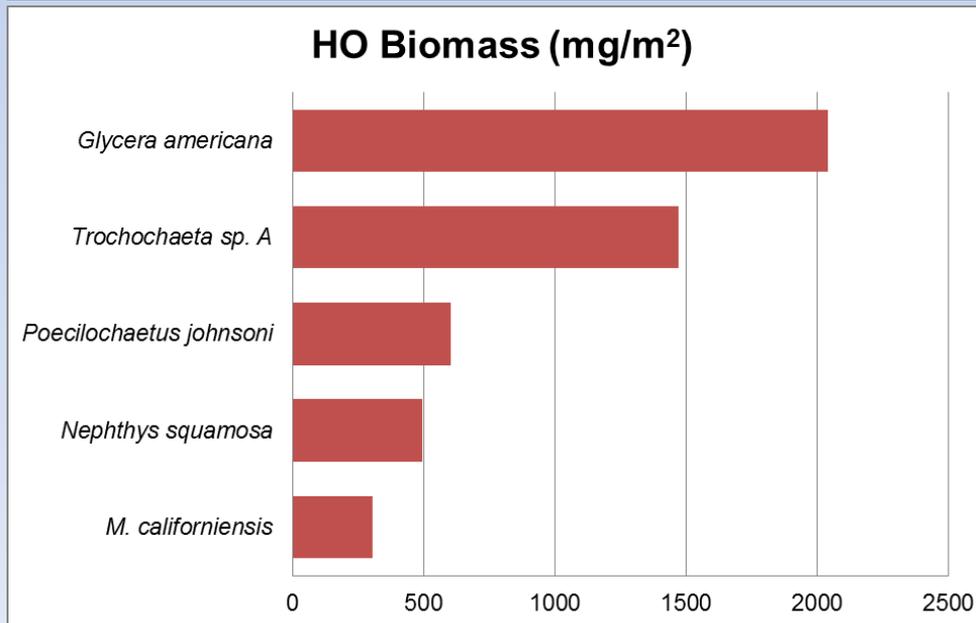
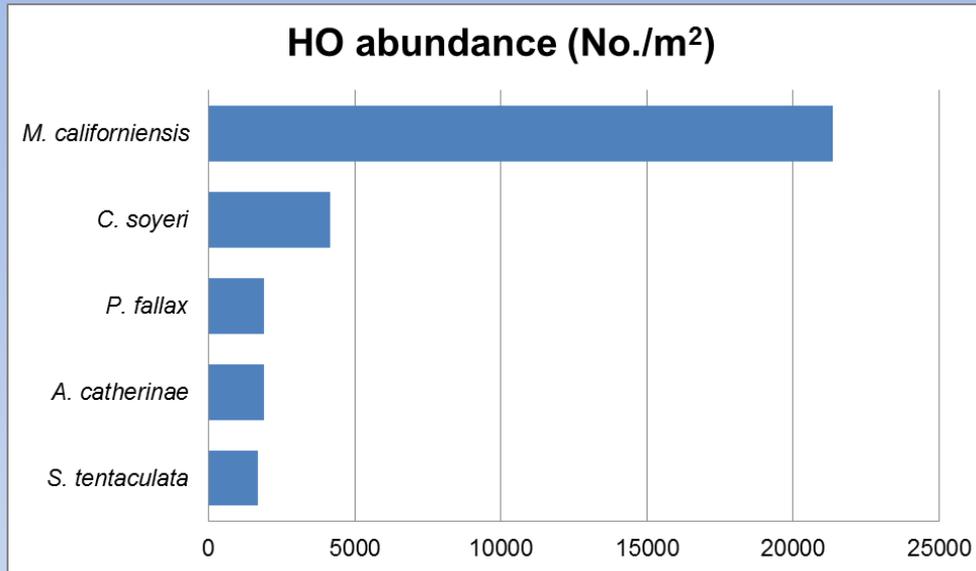
- Real differences observed among control, hypoxic and recovering hypoxic provinces:
  - Diversity substantially depressed in hypoxic areas
  - Suspension/filter feeders depleted from hypoxic areas
  - Abundance of carnivore/omnivores increases proportionately in hypoxic and recovering hypoxic areas
- Trends exhibited by polychaetes likely to be accentuated with inclusion of other taxa (crustaceans, bivalves)
- Recovery starts soon after hypoxic episode—advanced after 2 years post-hypoxia (BH)

# Dominant Polychaetes: NO



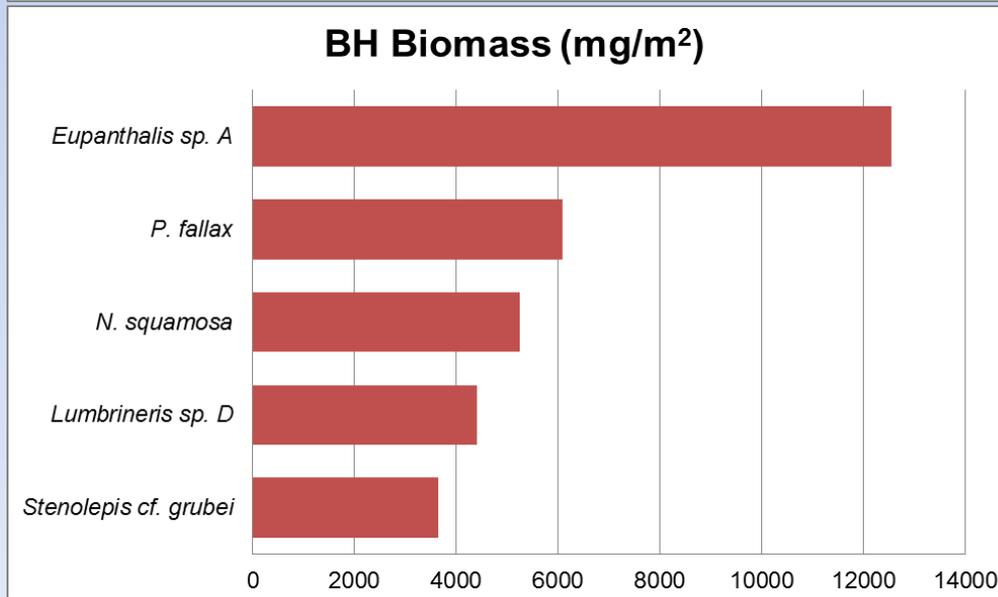
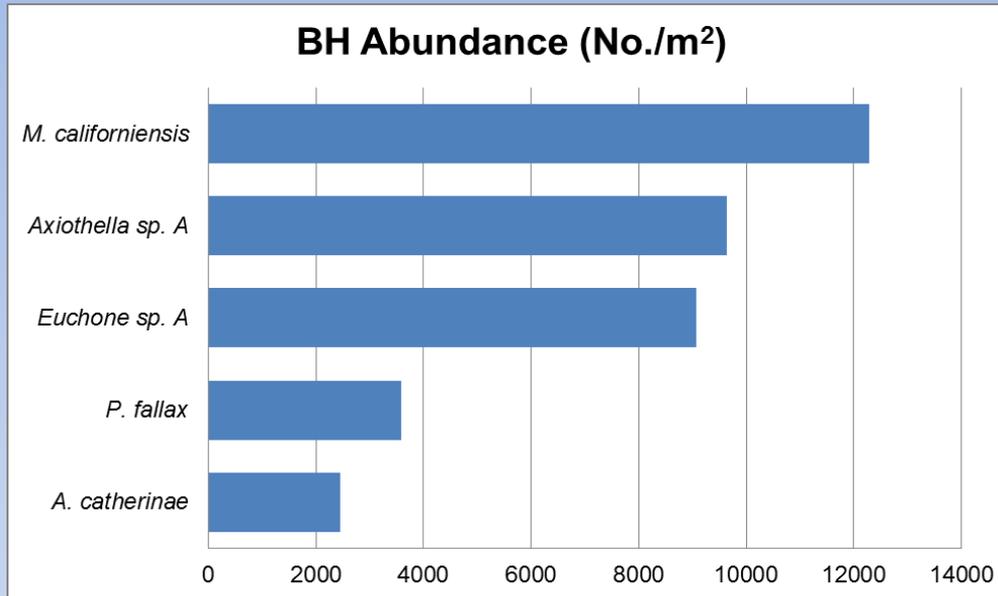
- Lots of deposit feeders
- Large carnivore/predators (3/5)

# Dominant Polychaetes: HO



- Lots of deposit feeders
- Few large carnivore/predators

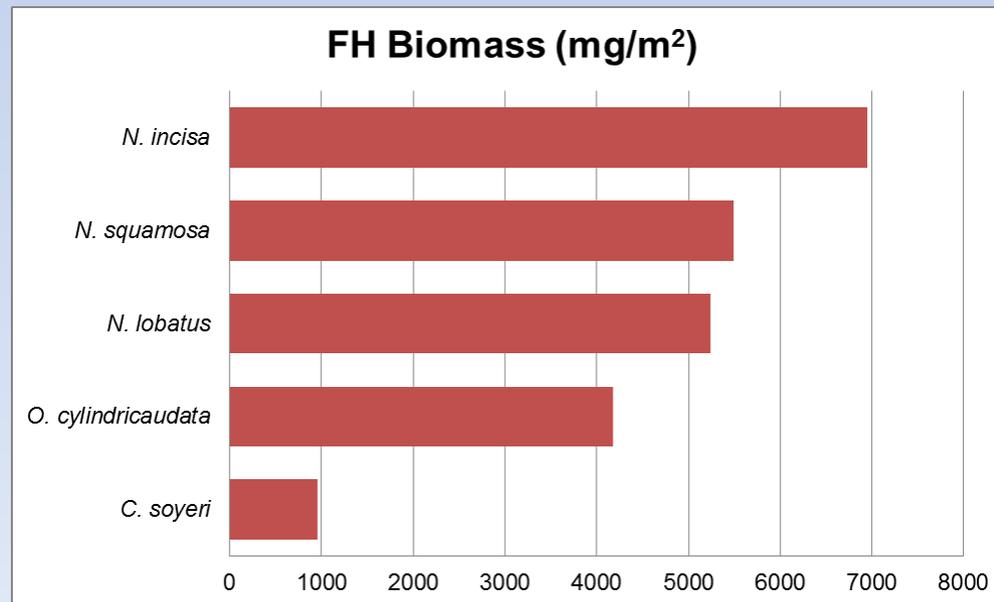
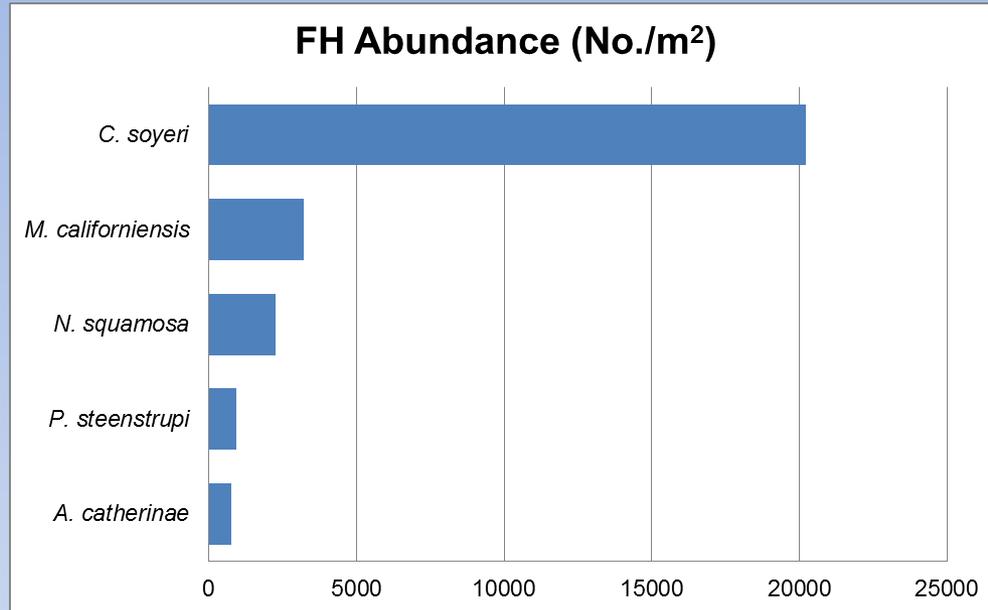
# Dominant Polychaetes: BH



- Lots of deposit feeders and suspension/filter feeders

- Similar large mass of deposit feeders and carnivore/predators

# Dominant Polychaetes: FH



- Mostly deposit feeders
- Large biomass of carnivore/predators

# Principal Component Analysis: April Polychaete Abundance

