Predicting and Mapping Species Richness in the Deep Gulf of Mexico: Lessons Learned in the DGoMB Program

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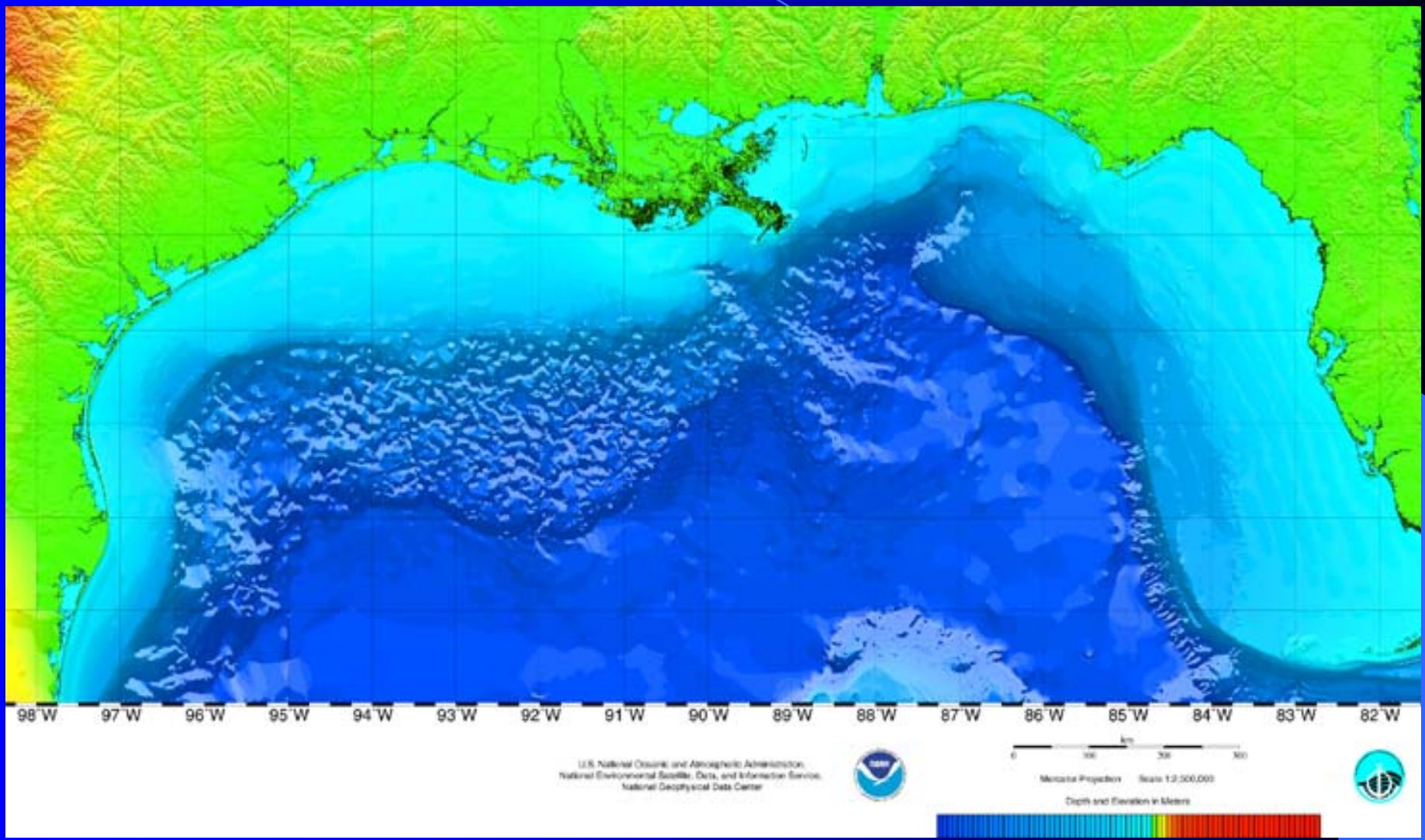
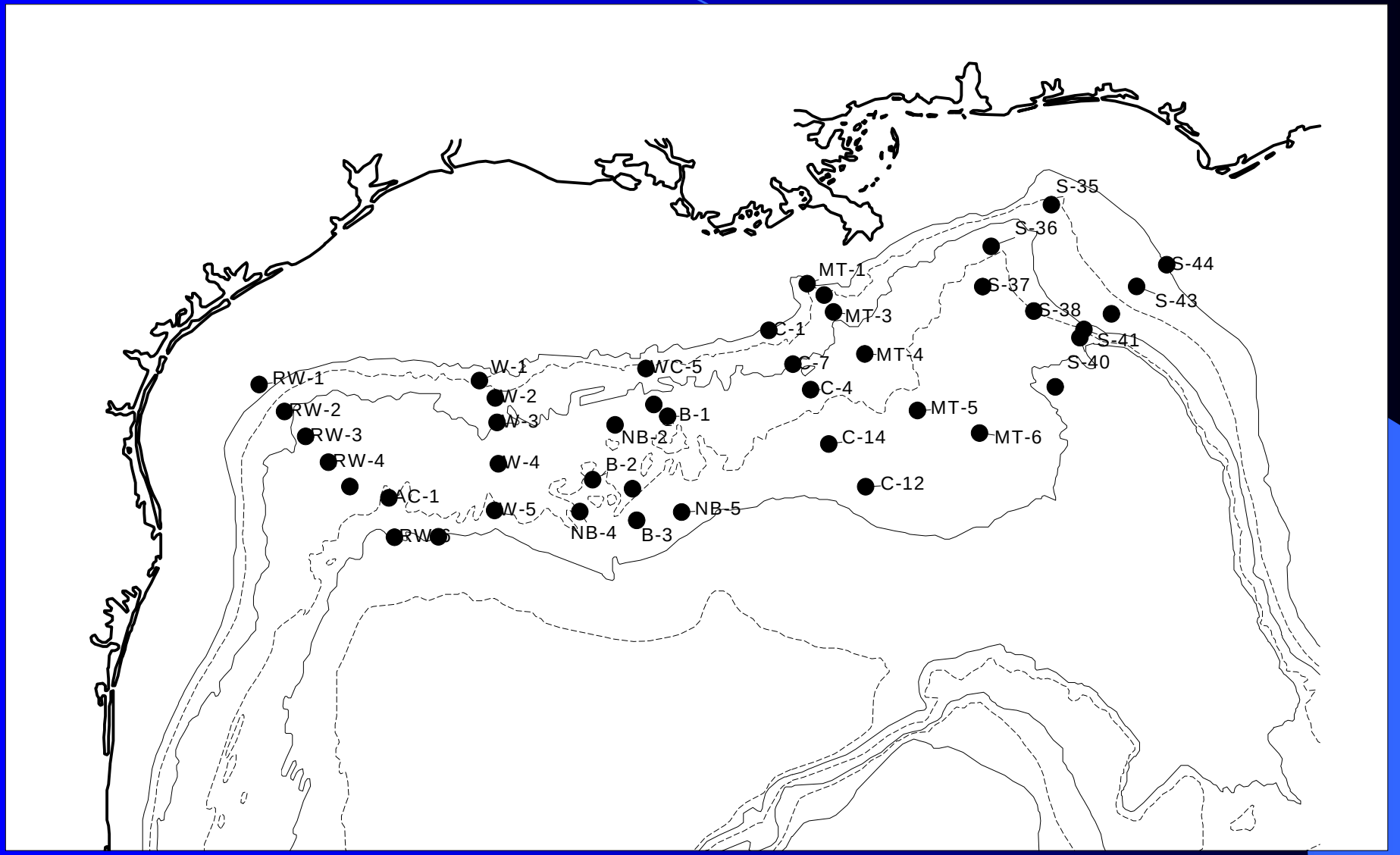
Gulf of Mexico Bathymetry



DGoMB Hypotheses

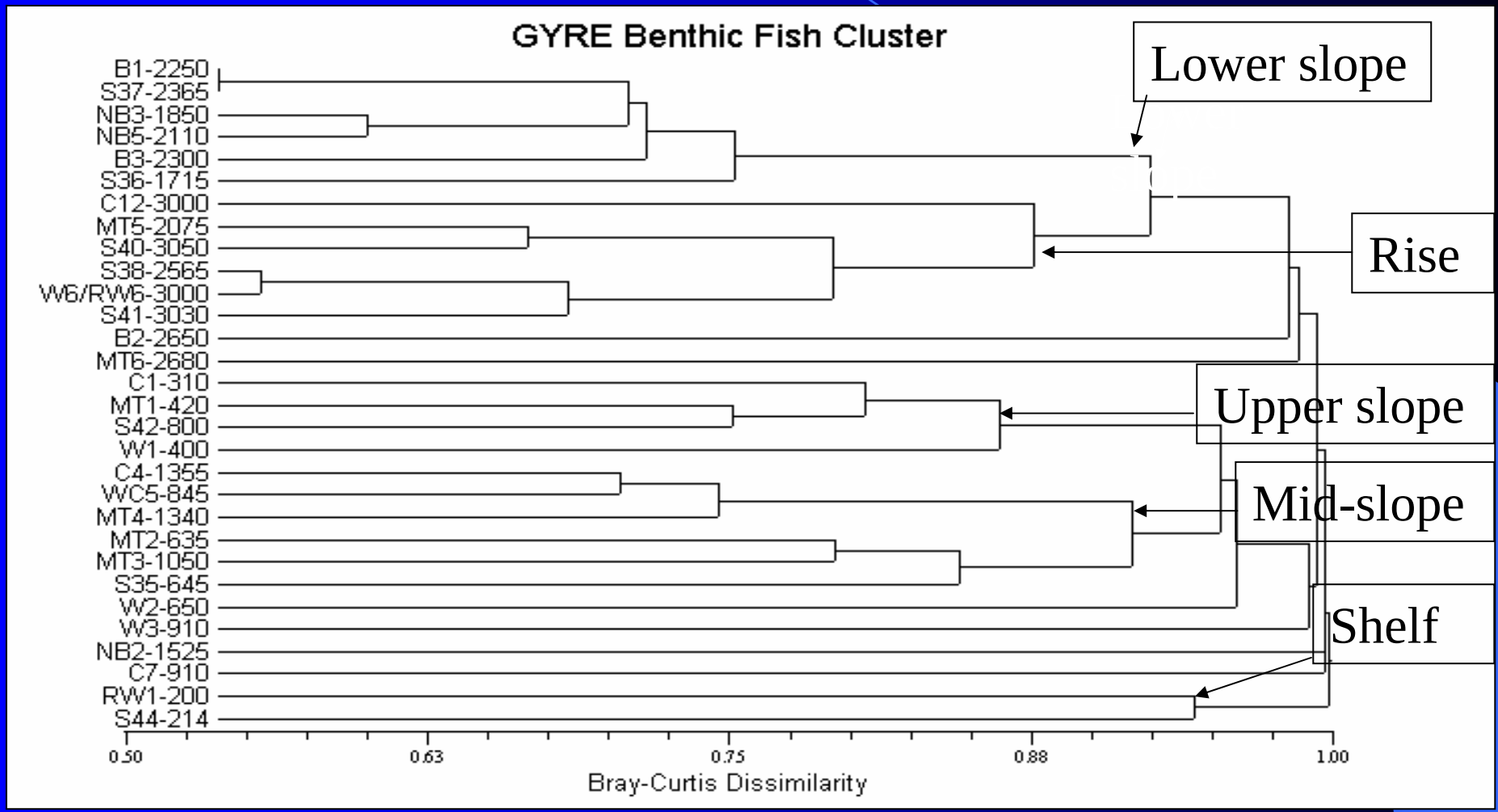
- Benthic fauna variation is best explained by depth
- Faunas exhibit an east-to-west gradient
- Basin faunas are different from non-basin faunas
- Canyon fauna is different from non-canyon fauna

DGoMB Stations

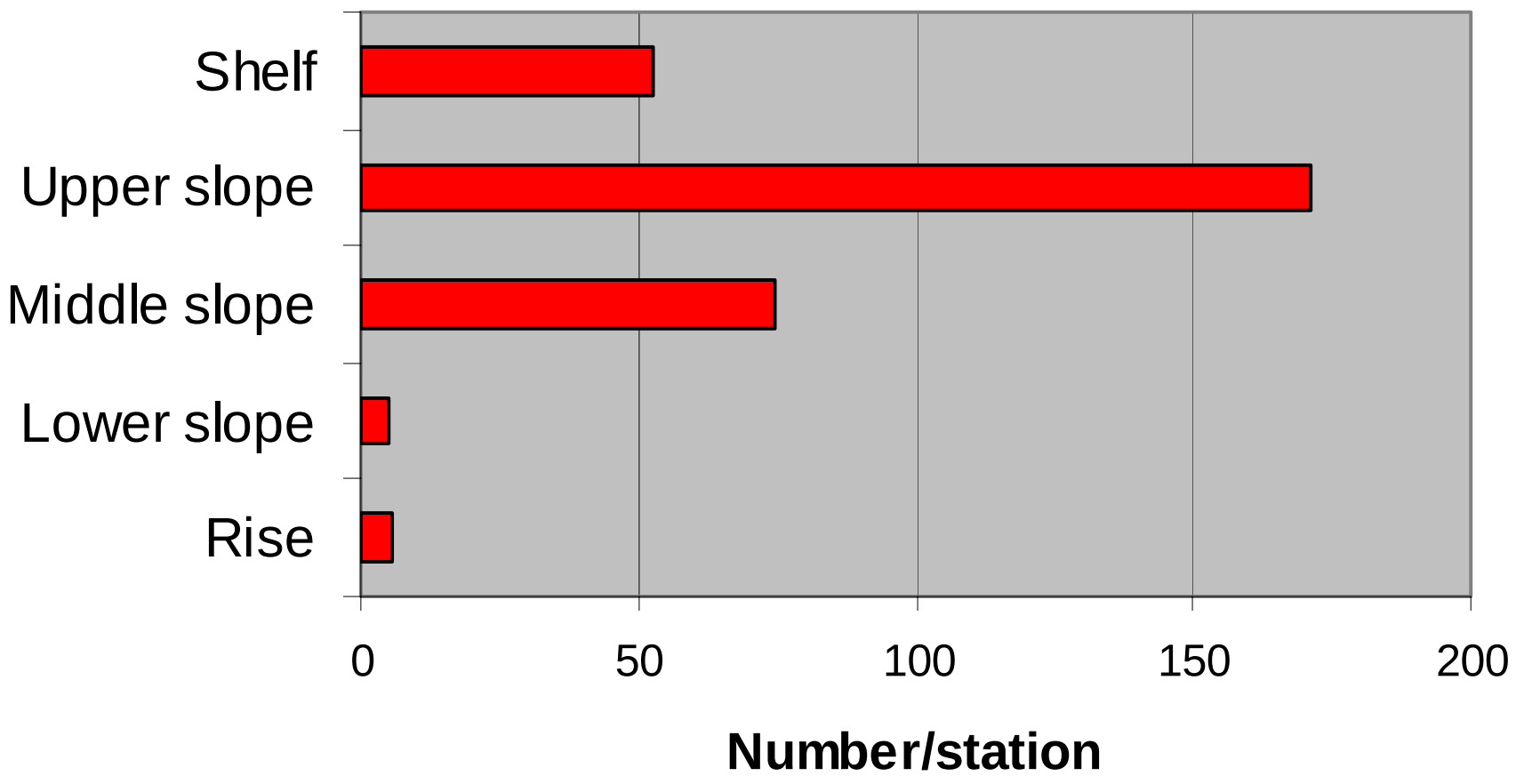


A Deep-Sea Trawl Sample

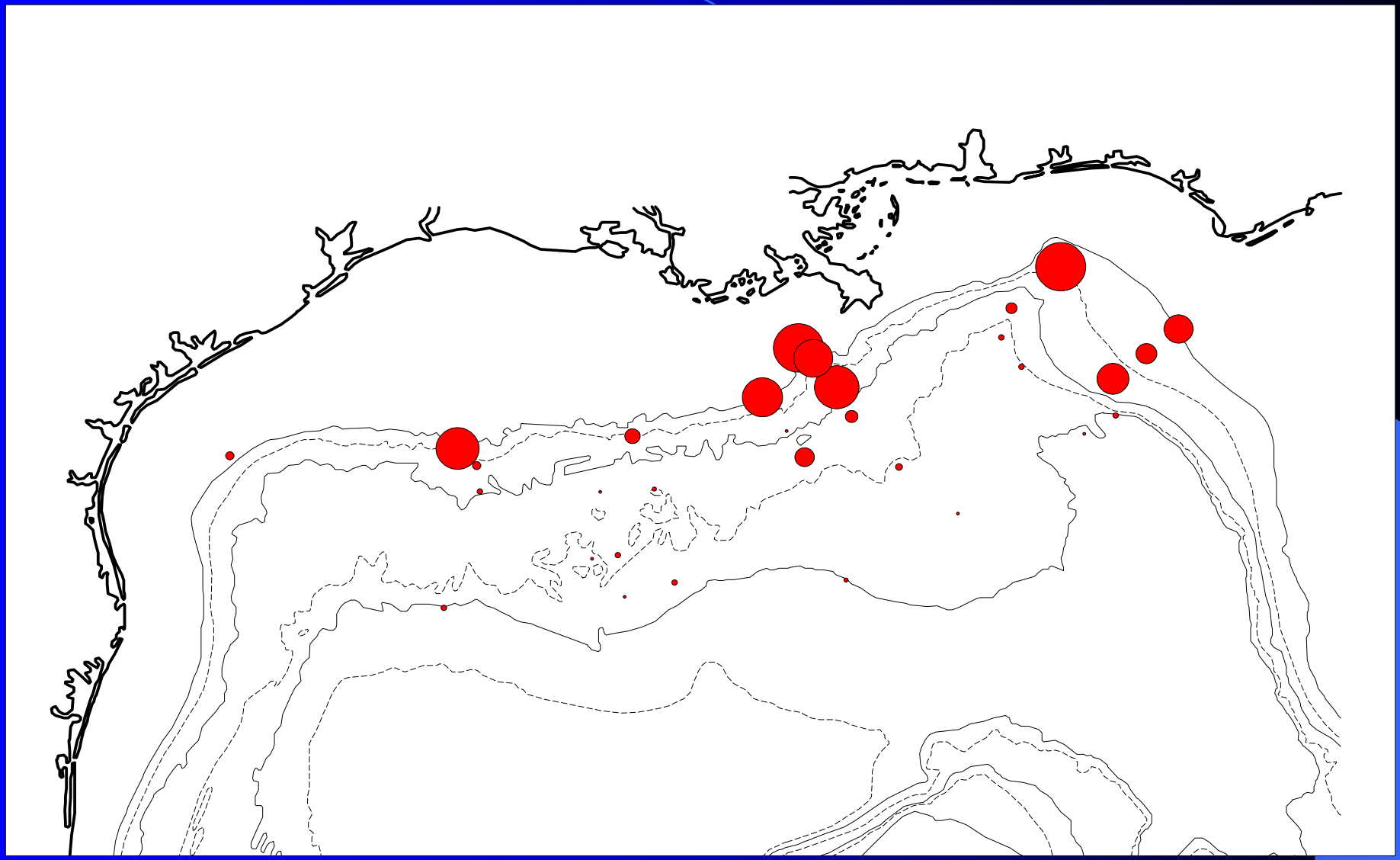
Cluster Analysis



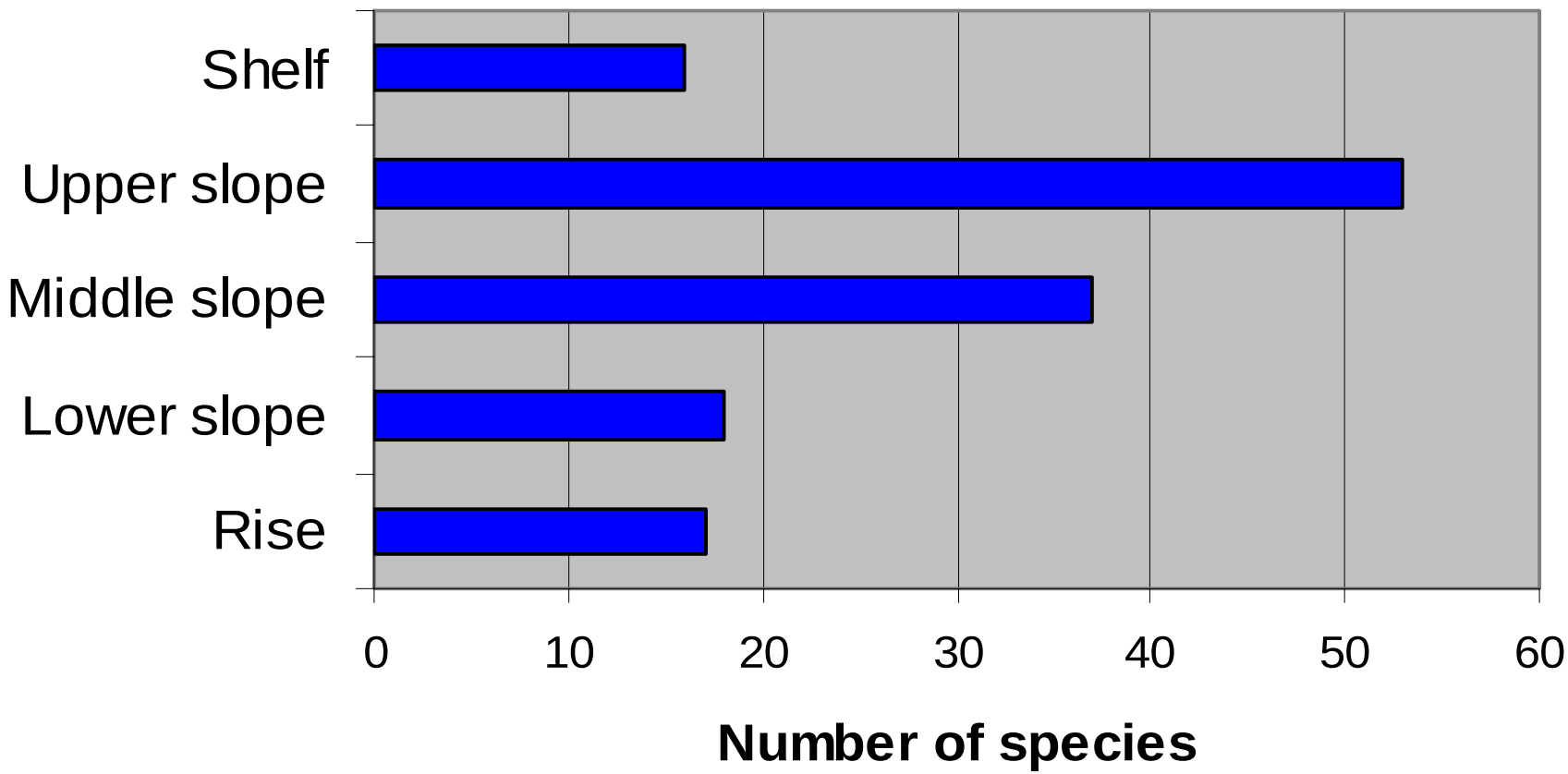
Where Is Abundance Greatest?



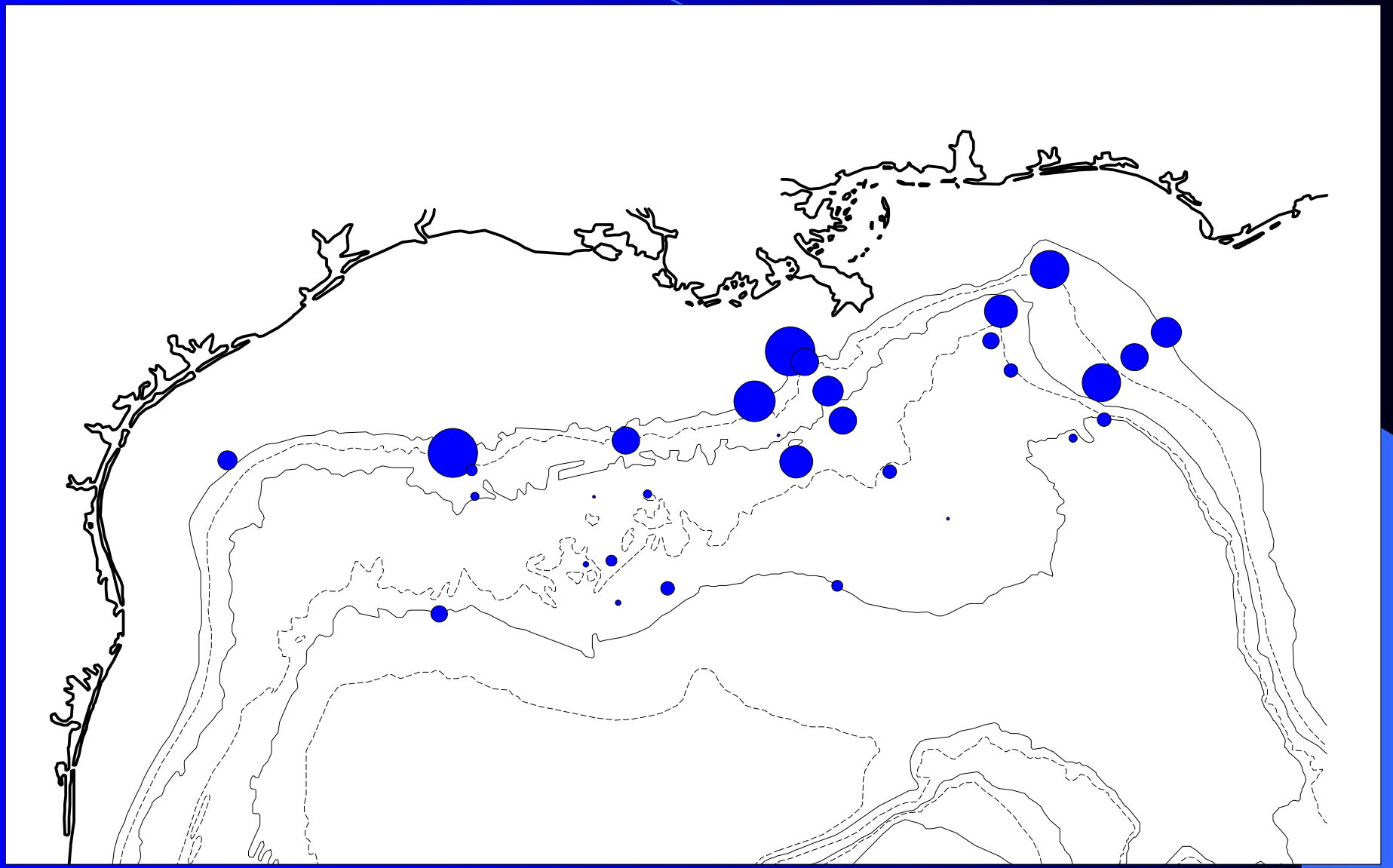
Abundance of Fish Mapped



Where Is Species Richness Greatest?



Species Richness Map



Potential Fishery?

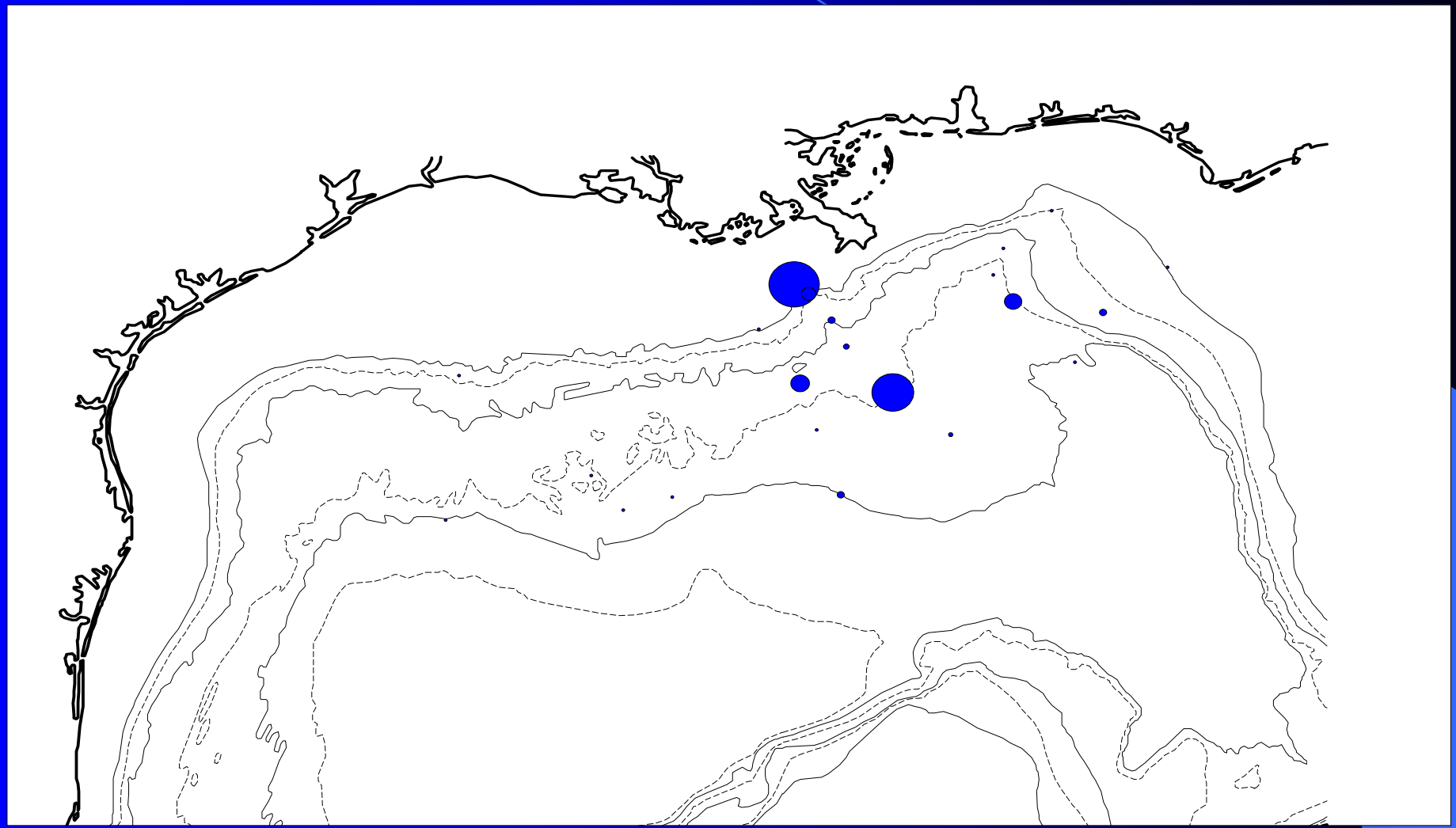
- None of the dominant deepwater fish are commercial species
- Fish species are small
- Deepwater fish are not very abundant

Conclusions from First Study

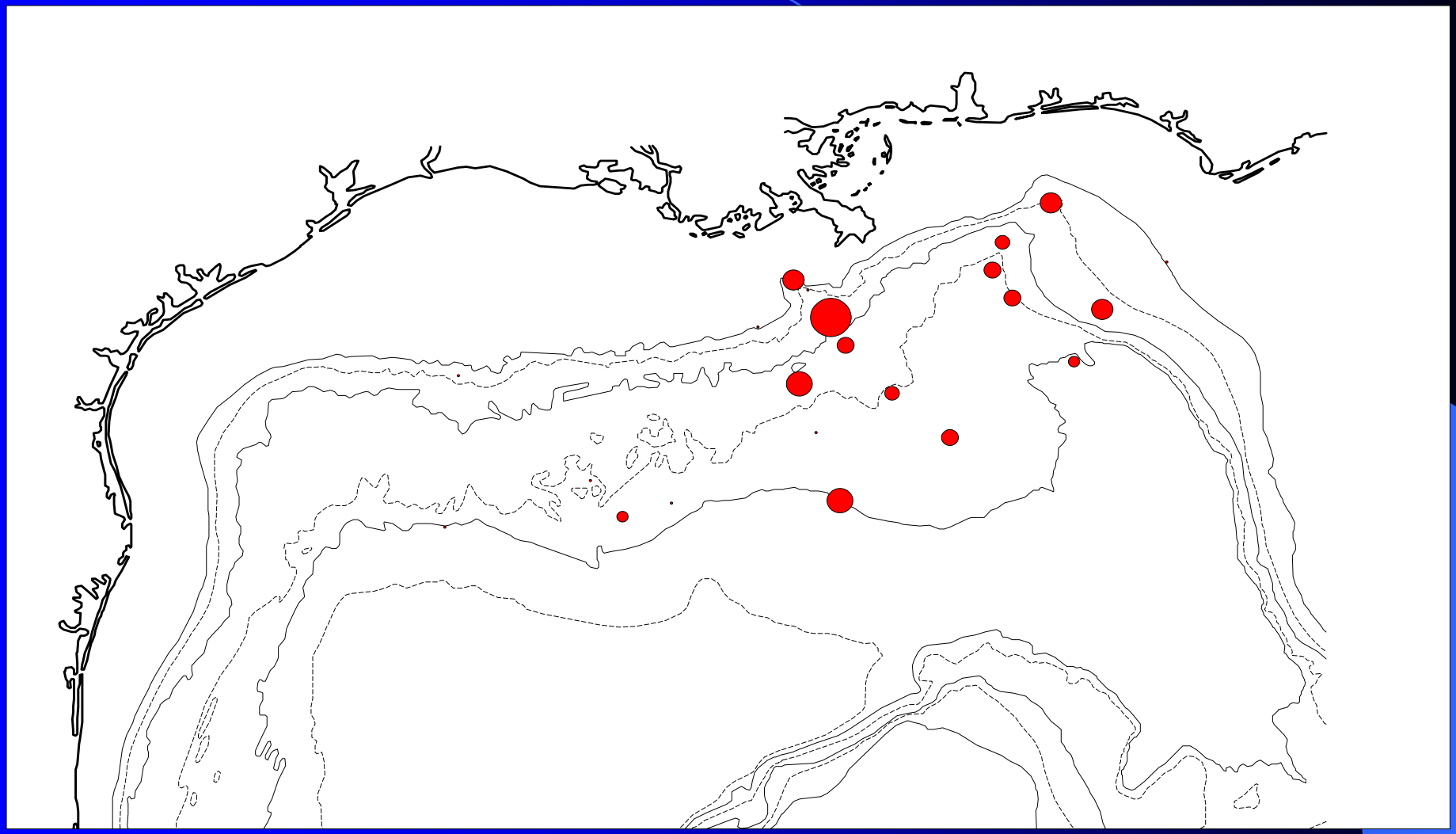
- Fish assemblages zoned with depth
- East-to-west faunal gradient at deep depths
- Fish abundance higher in canyons at shallow depths
- Slope and rise fish have little commercial potential

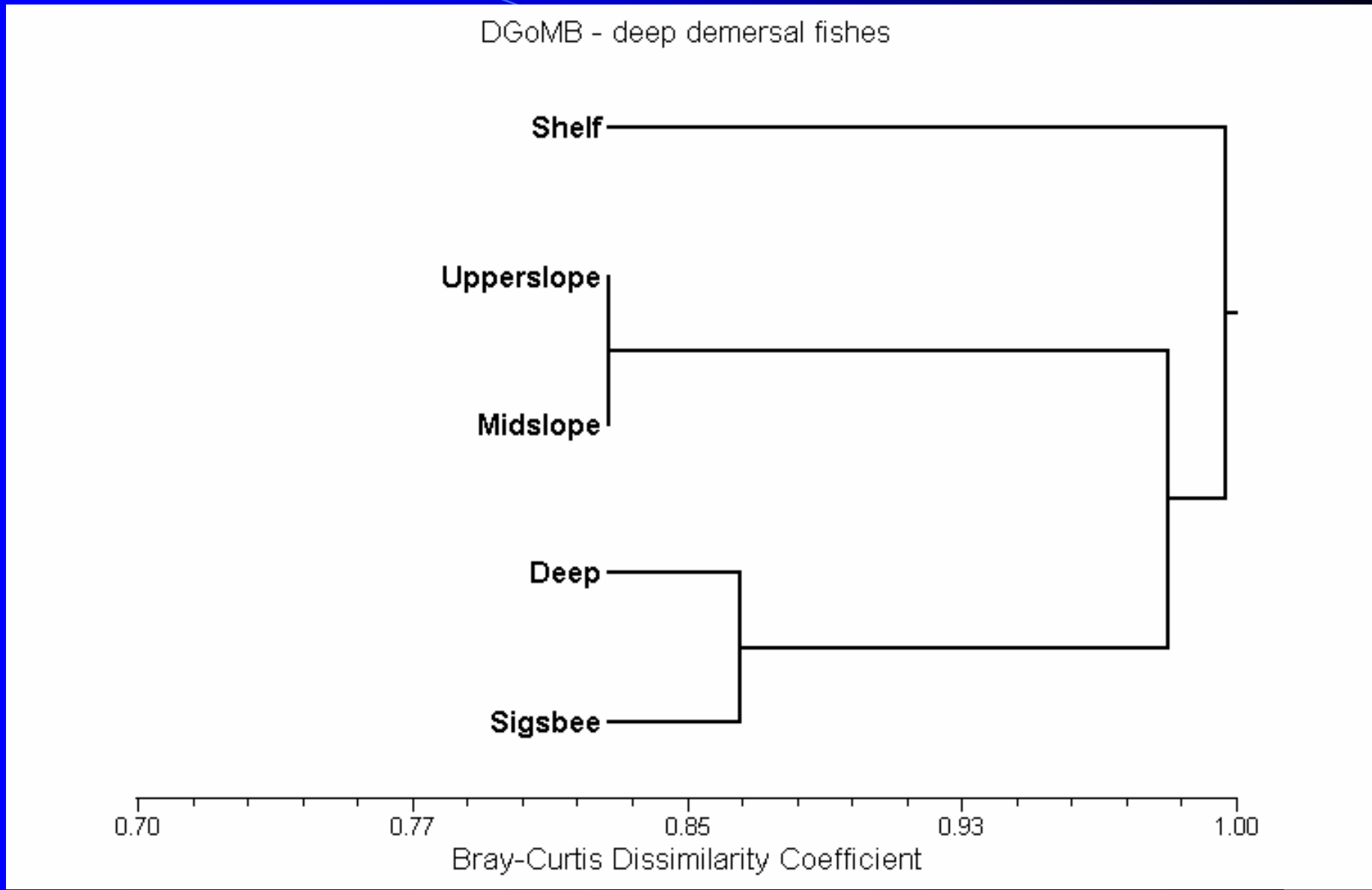
Trash in Trawls

Anthropogenic Trash Map

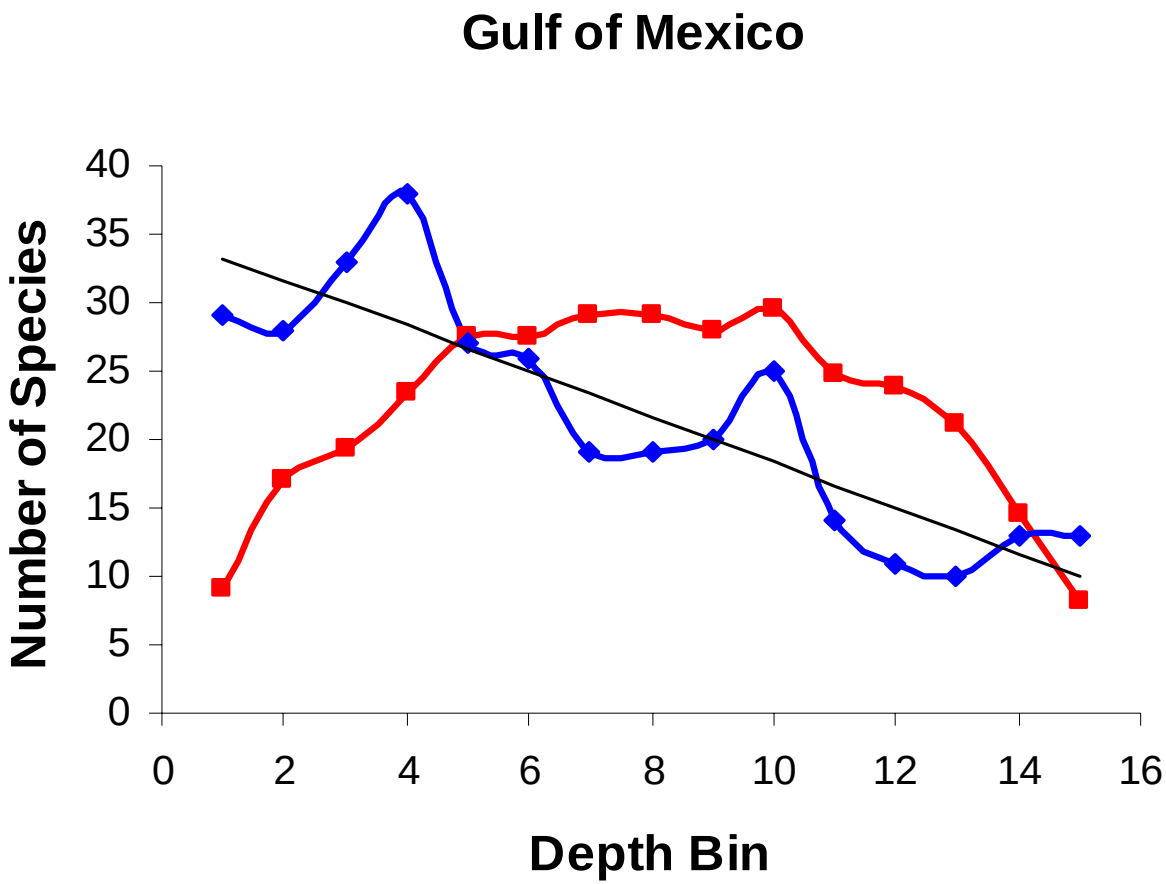


Aluminum Can Map

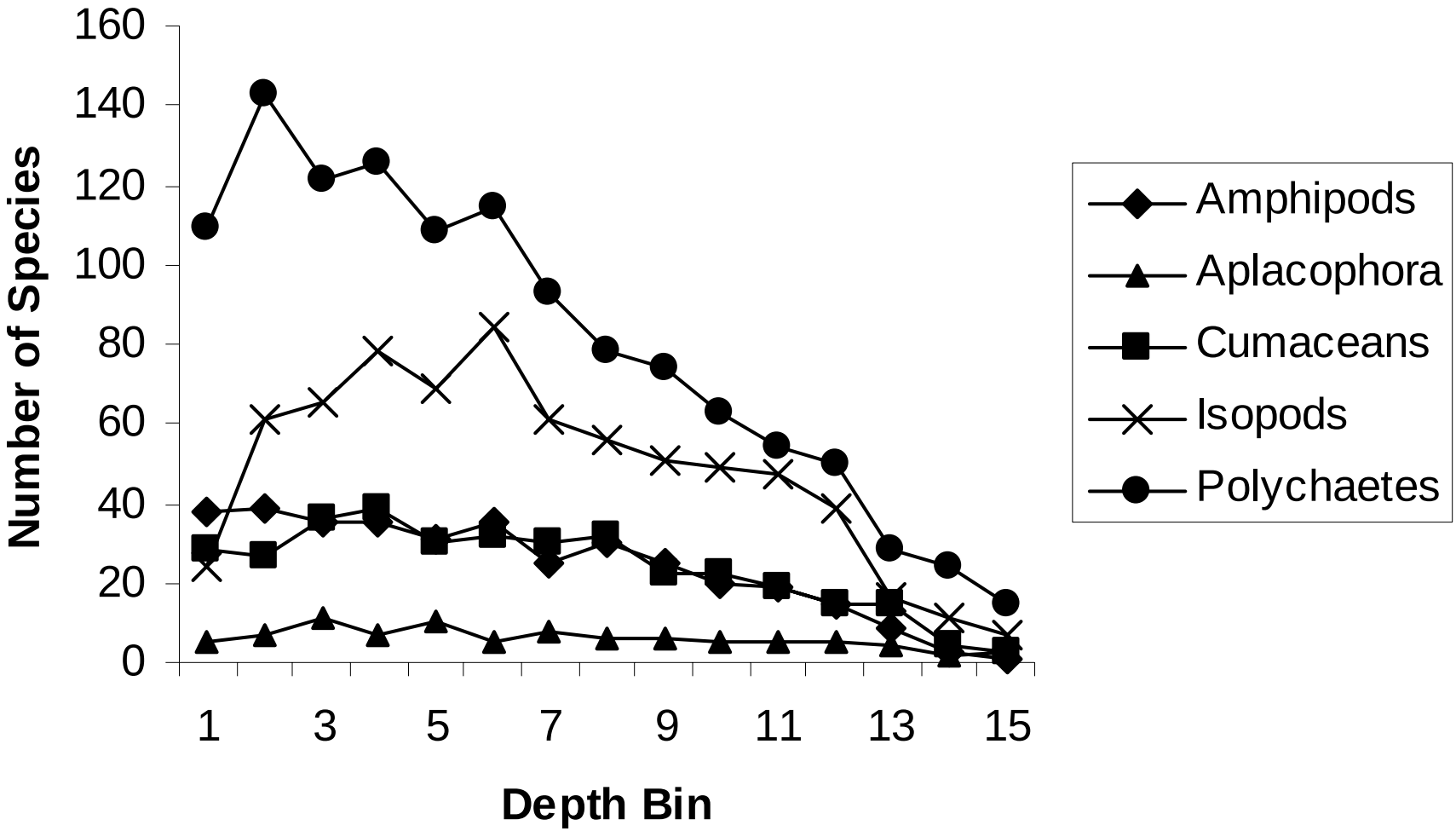



DGoMB - deep demersal fishes
Shelf
Upperslope
Midslope
Deep
Sigsbee
0.70
0.77
0.85
0.93
1.00
Bray-Curtis Dissimilarity Coefficient

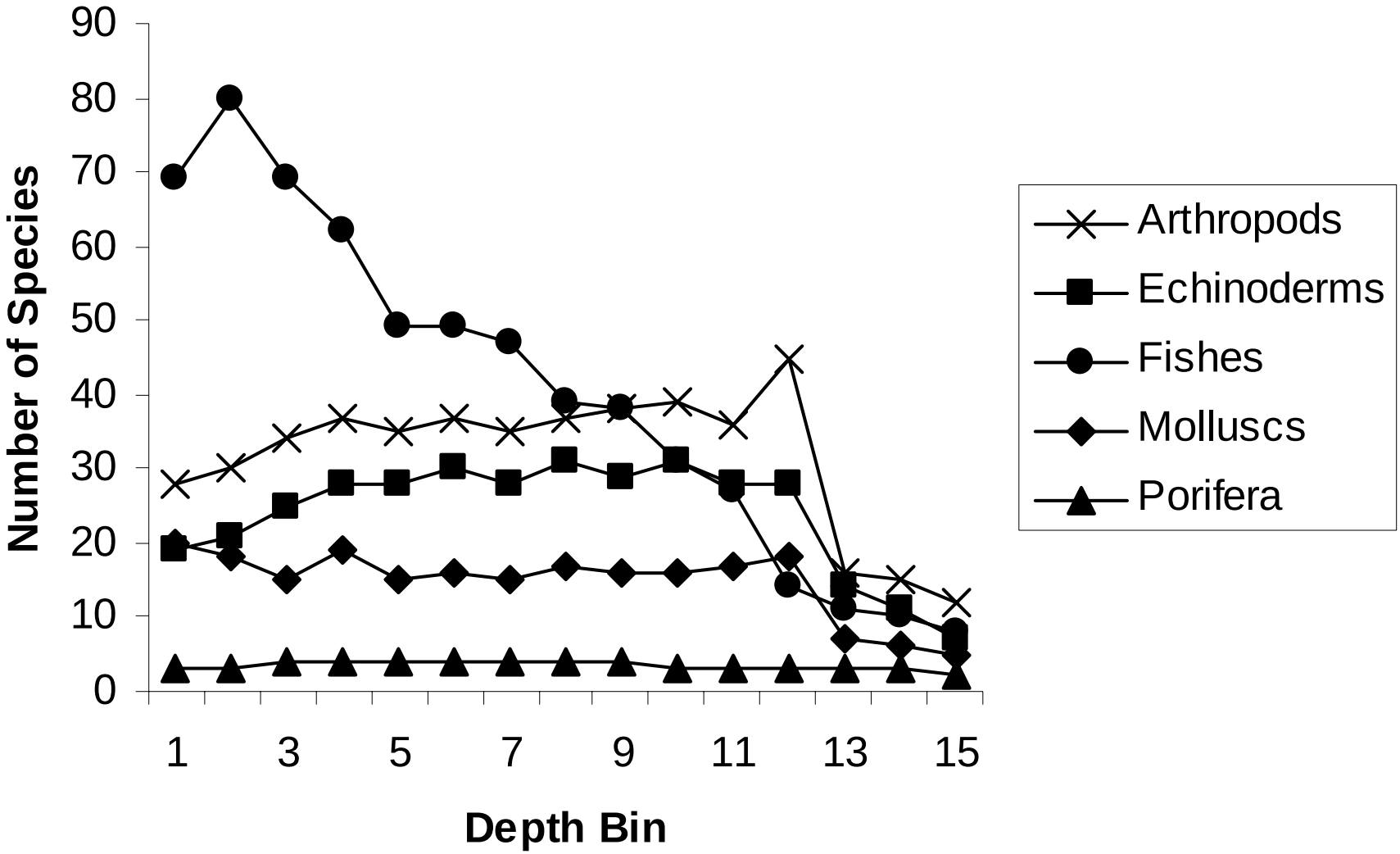
Random Model *vs* Observed



Macrofauna


Number of Species
160
140
120
100
80
60
40
20
0
1
3
5
7
9
11
13
15
Depth Bin
Amphipods
Aplacophora
Cumaceans
Isopods
Polychaetes

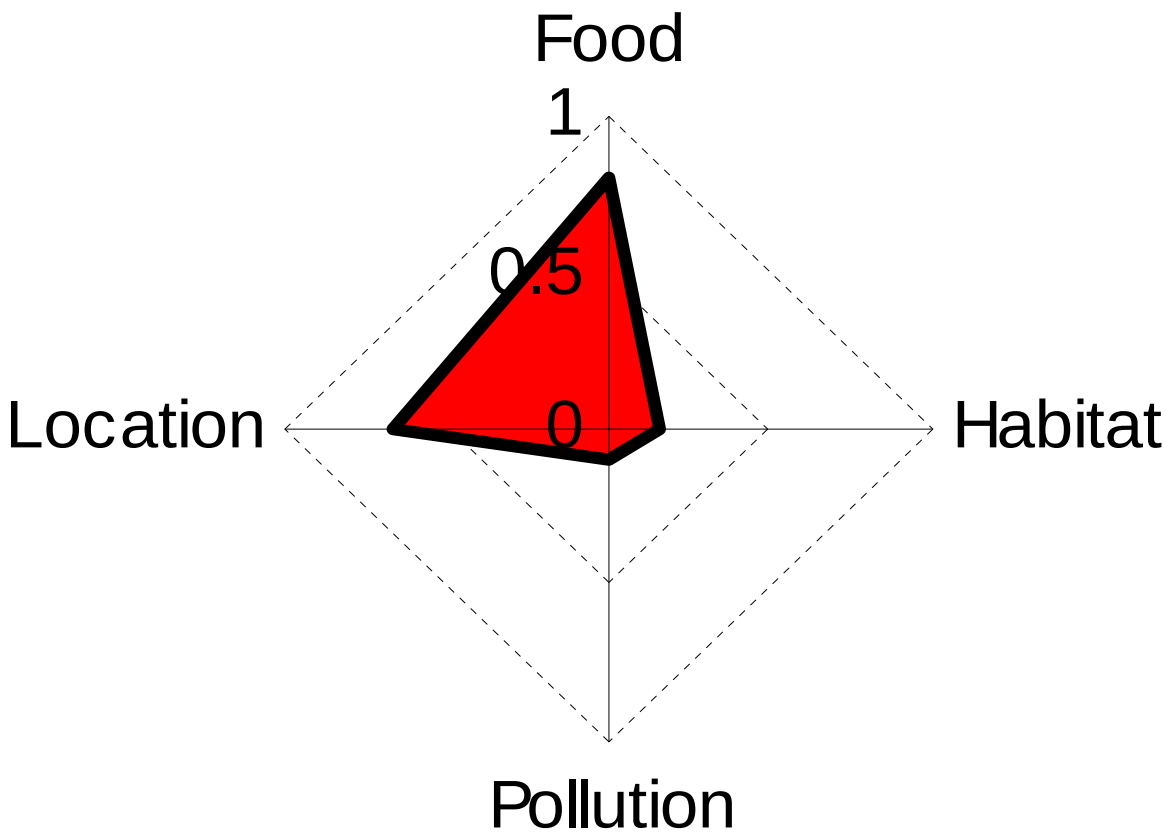
Megafauna

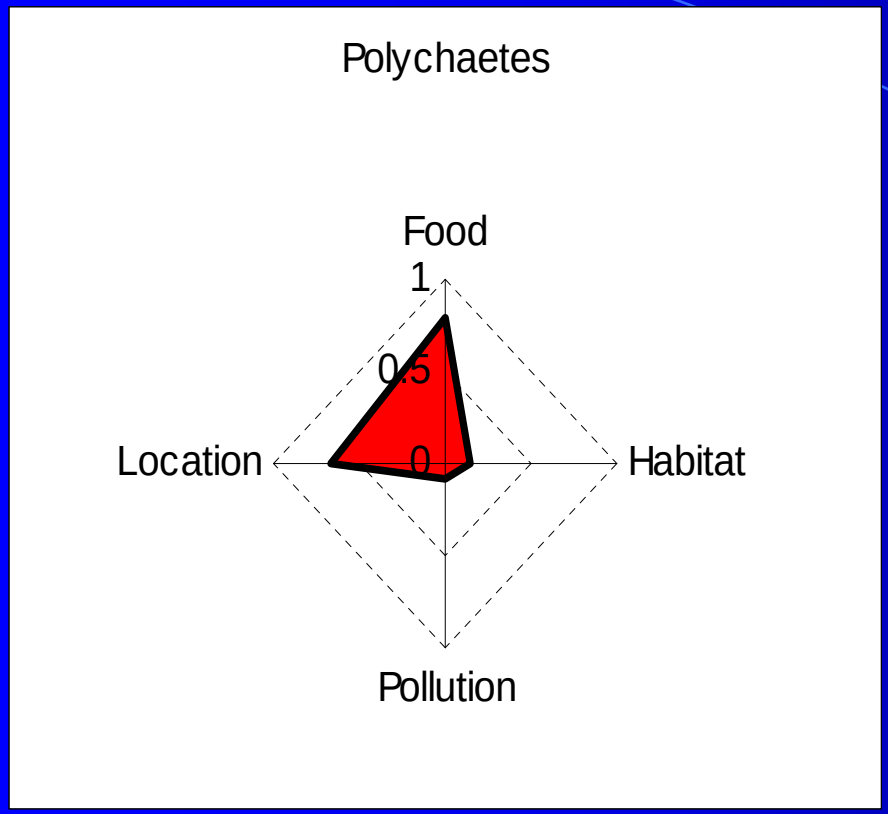

Number of Species
90
80
70
60
50
40
30
20
10
0
1
3
5
7
9
11
13
15
Depth Bin
Arthropods
Echinoderms
Fishes
Molluscs
Porifera

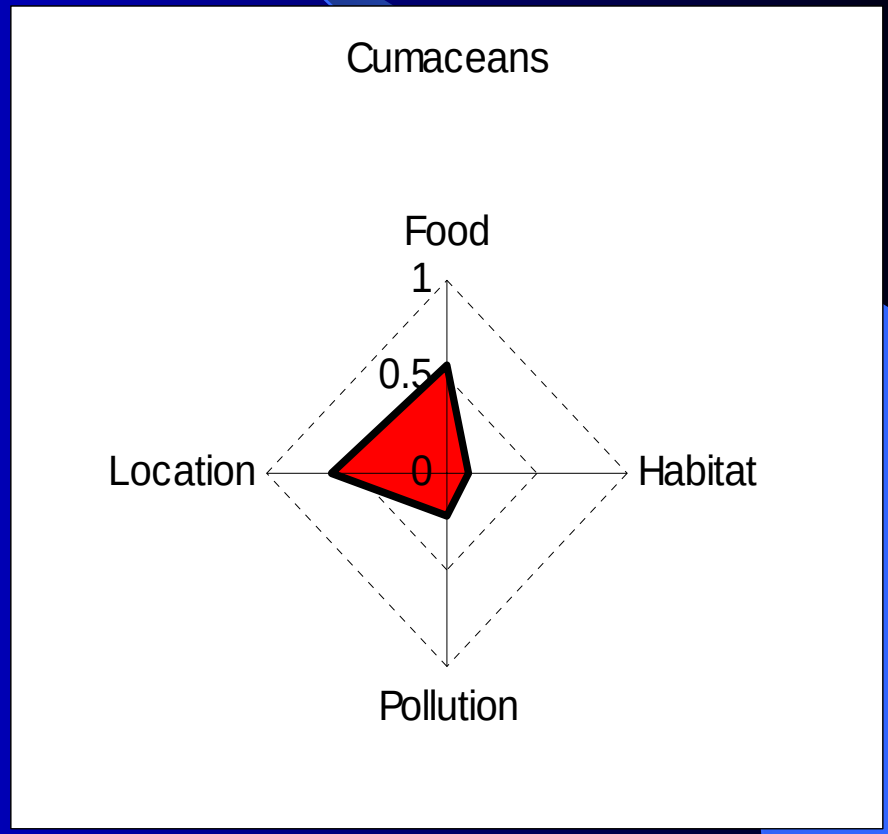
New Conclusions

- Richness patterns of all groups are non-random
- Looking for causal relationships is justified
- Food? Location? Habitat? Pollution?

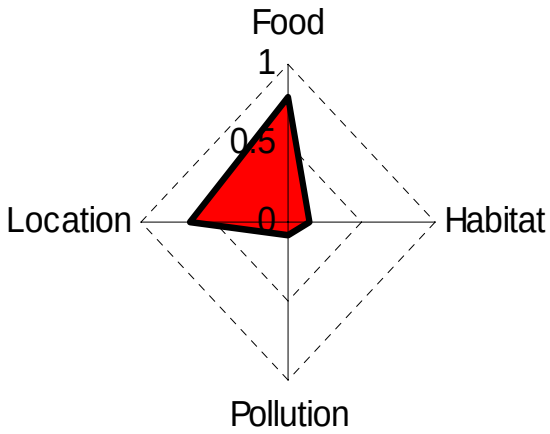
Polychaetes



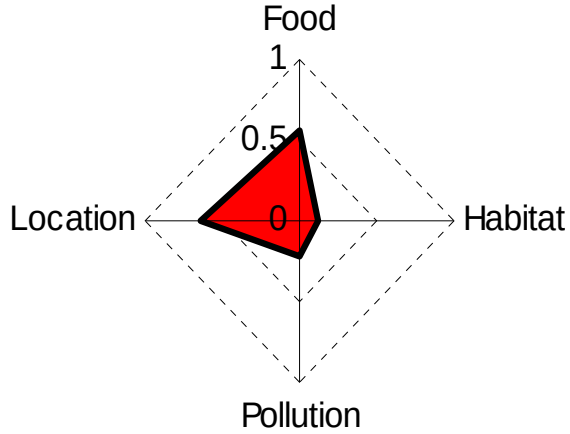

Polychaetes
Food
1
0.5
0
Location
Habitat
Pollution


Cumaceans
Food
1
0.5
0
Location
Habitat
Pollution

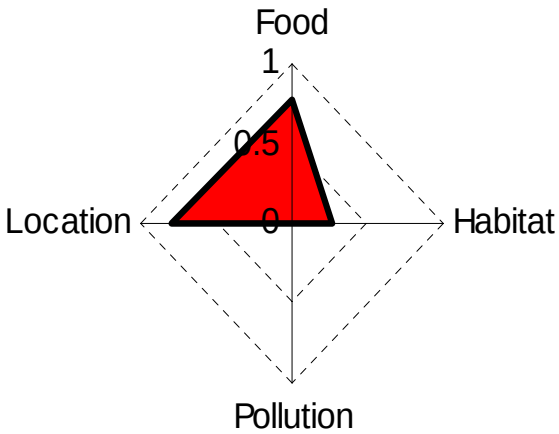
Polychaetes



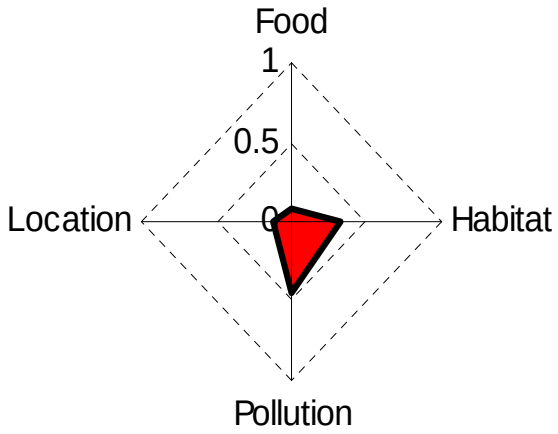
Cumaceans

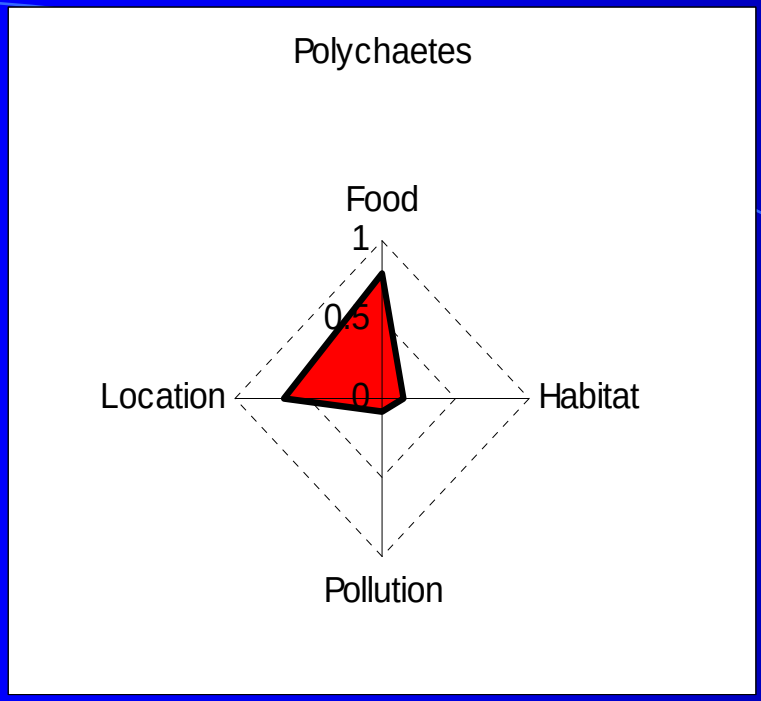


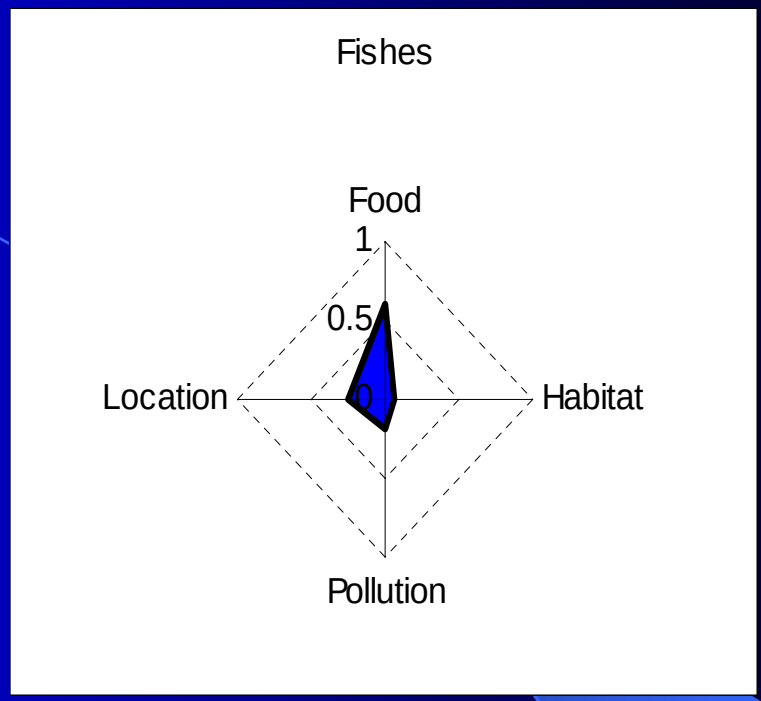
Amphipods

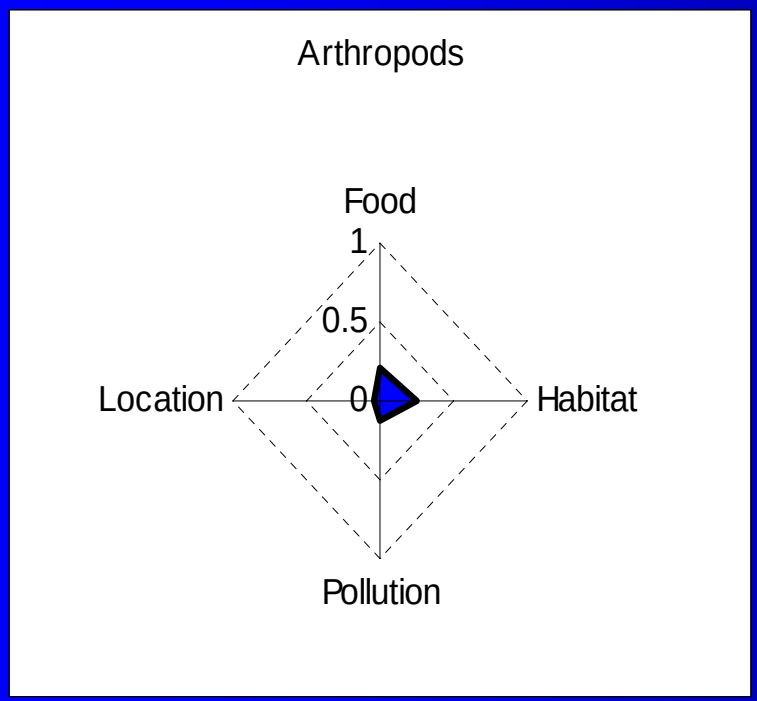


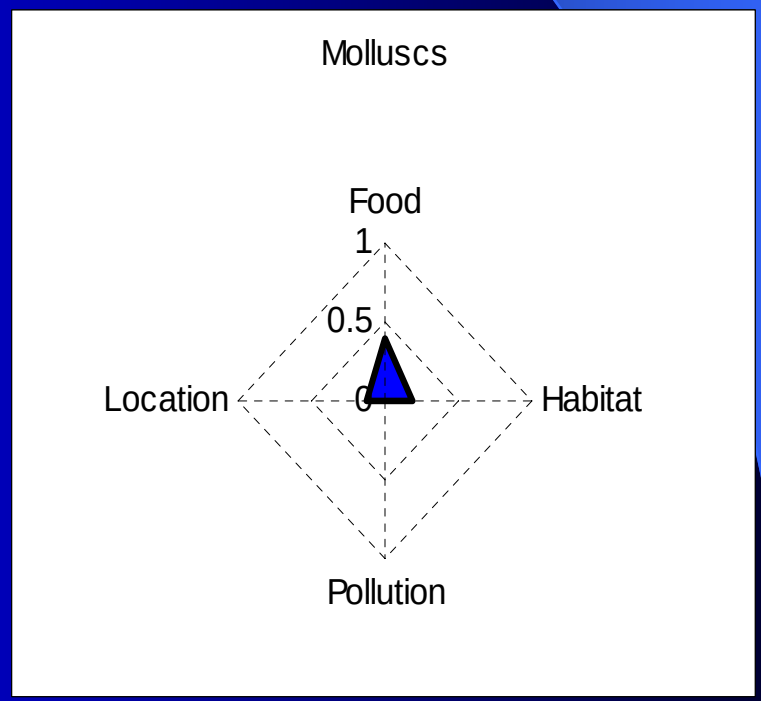
Bivalves

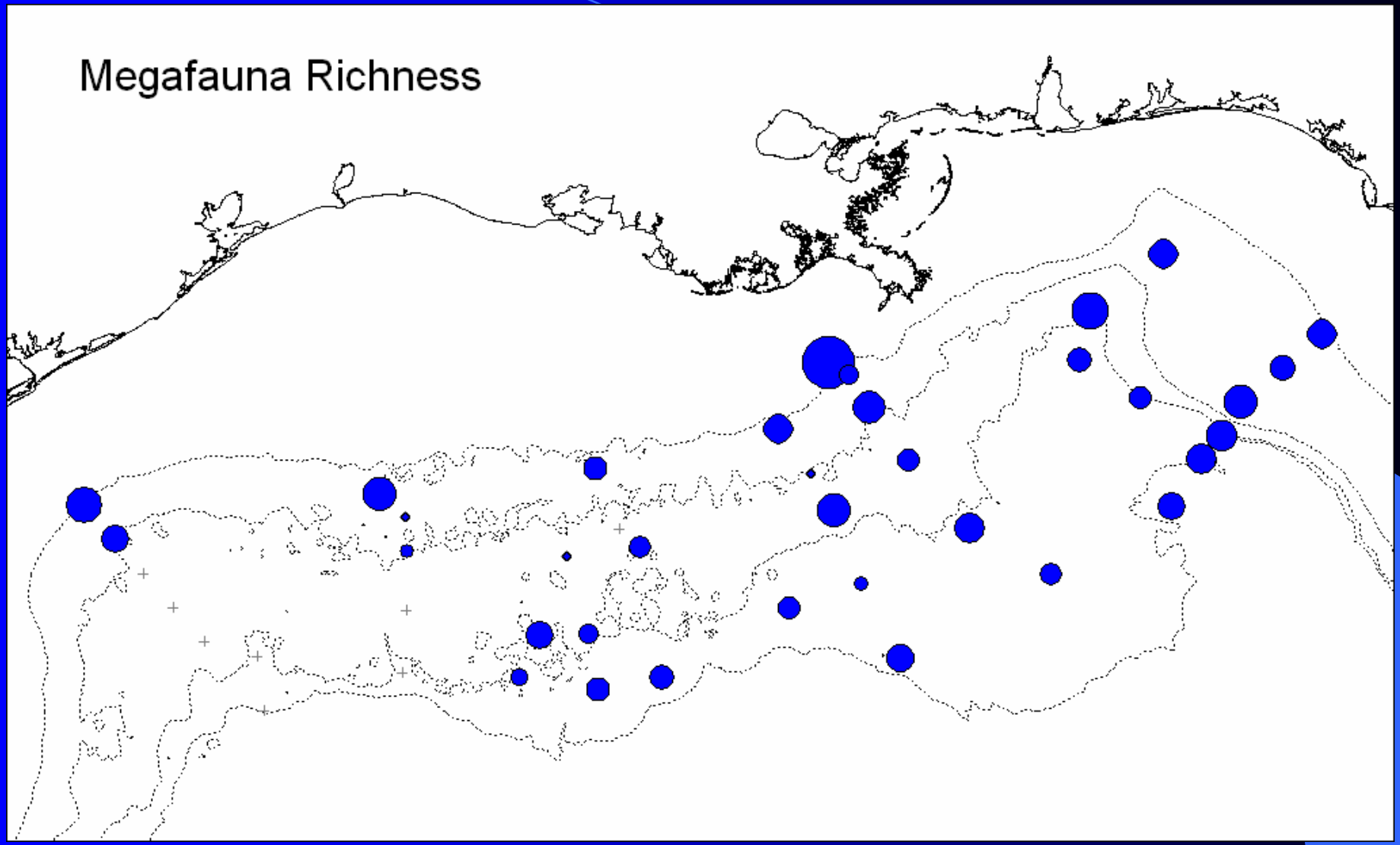


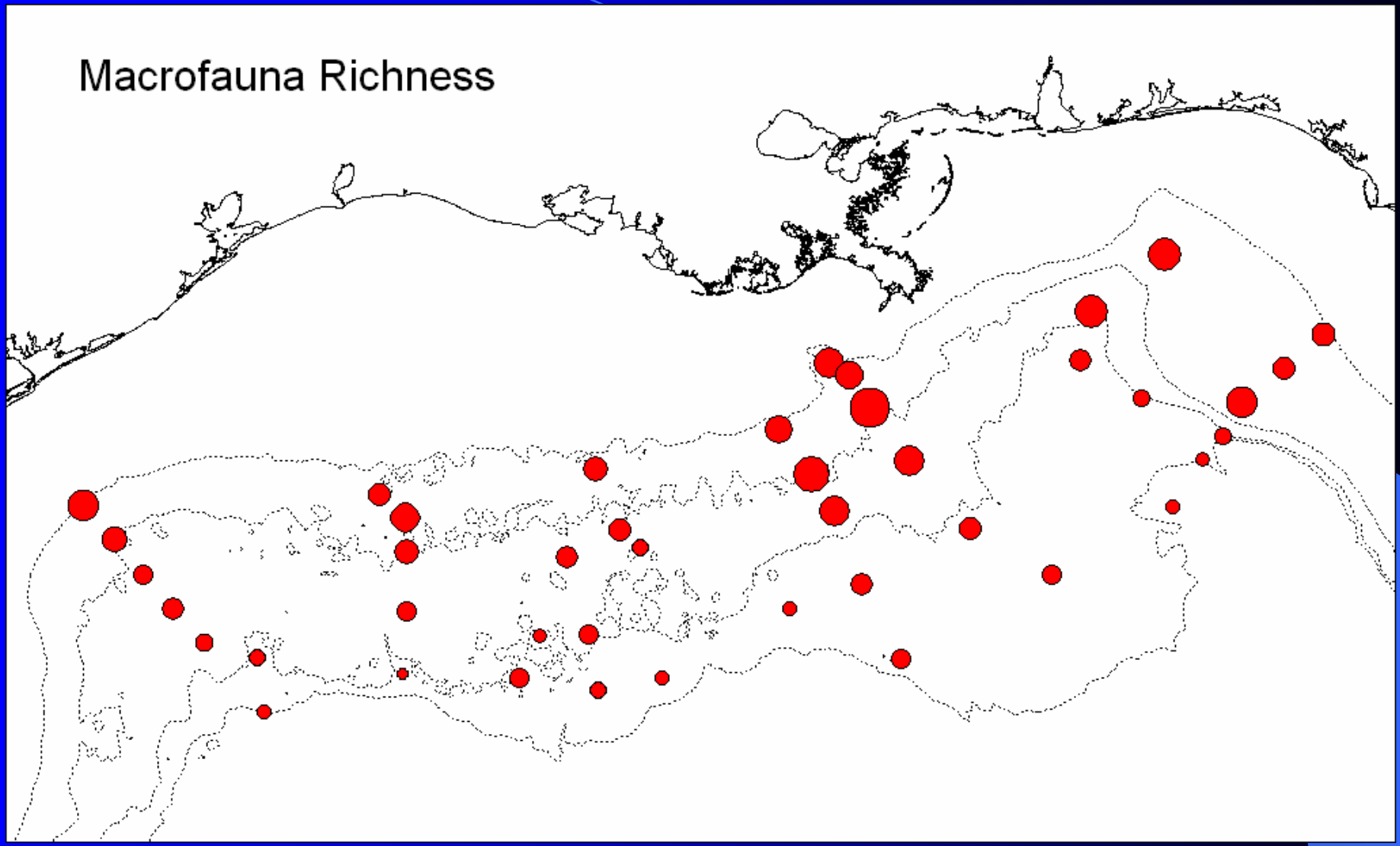

Polychaetes
Food
1
0.5
0
Location
Habitat
Pollution

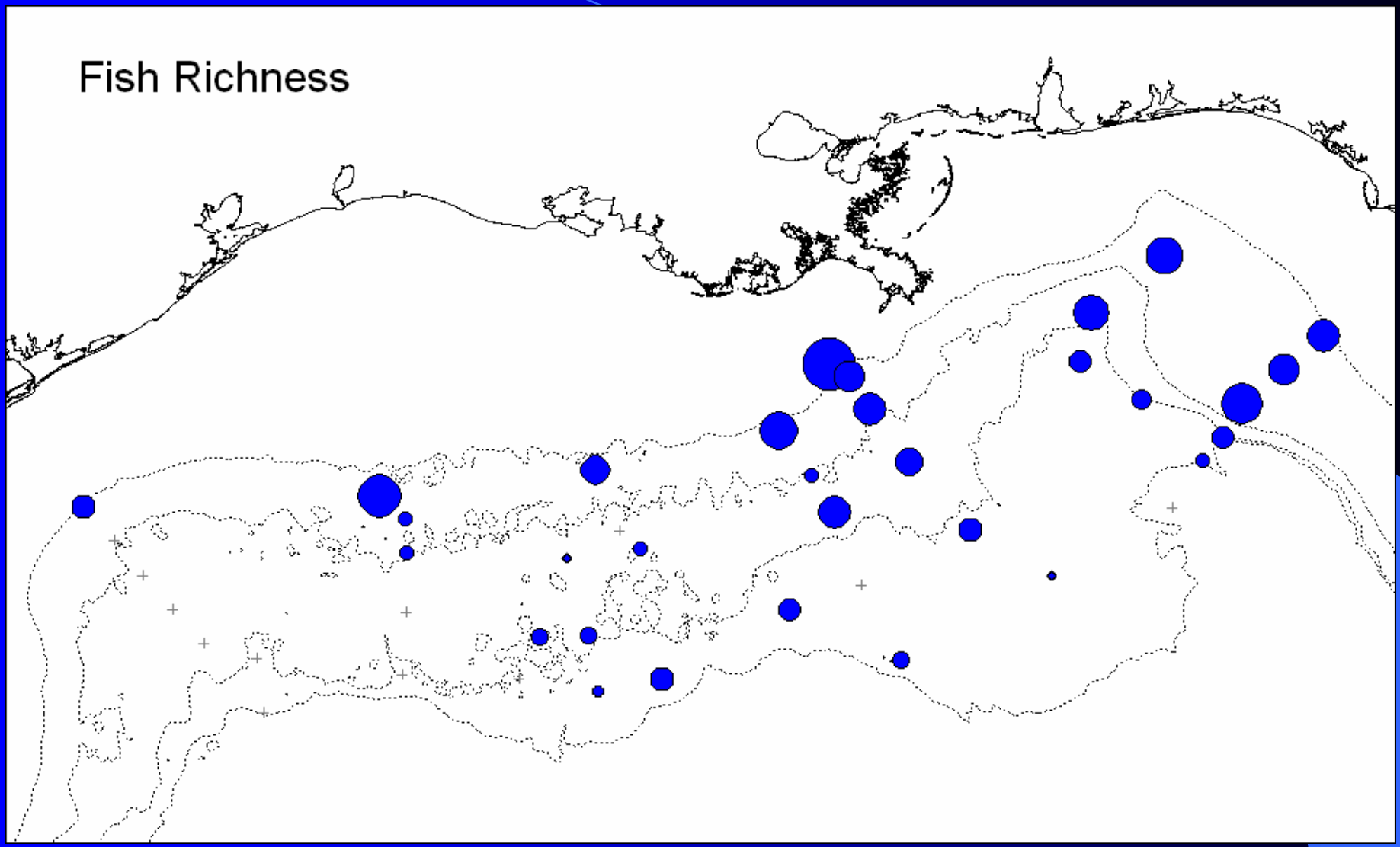

Fishes
Food
1
0.5
0
Location
Habitat
Pollution

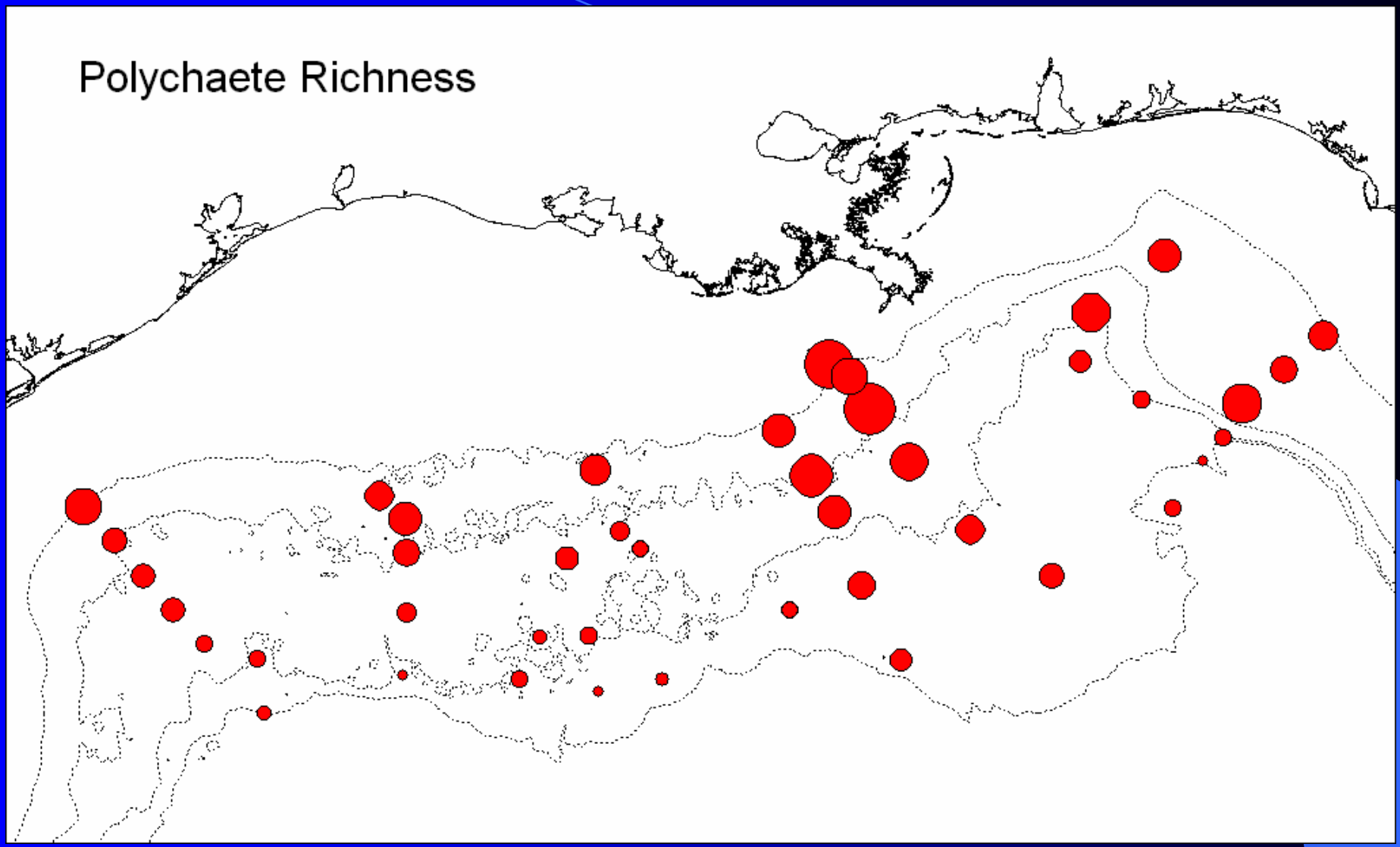

Arthropods
Food
1
0.5
0
Location
Habitat
Pollution

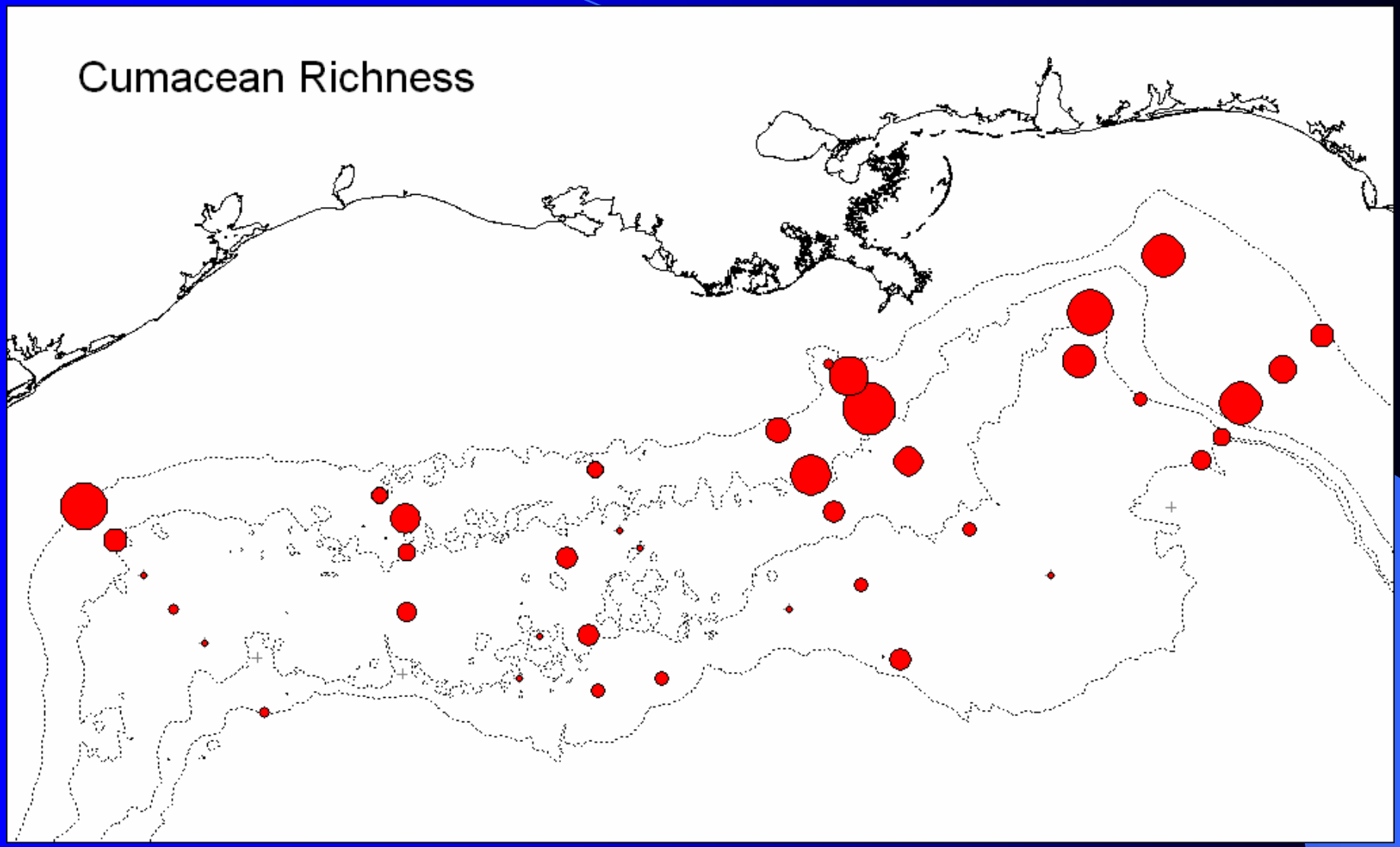

Molluscs
Food
1
0.5
0
Location
Habitat
Pollution

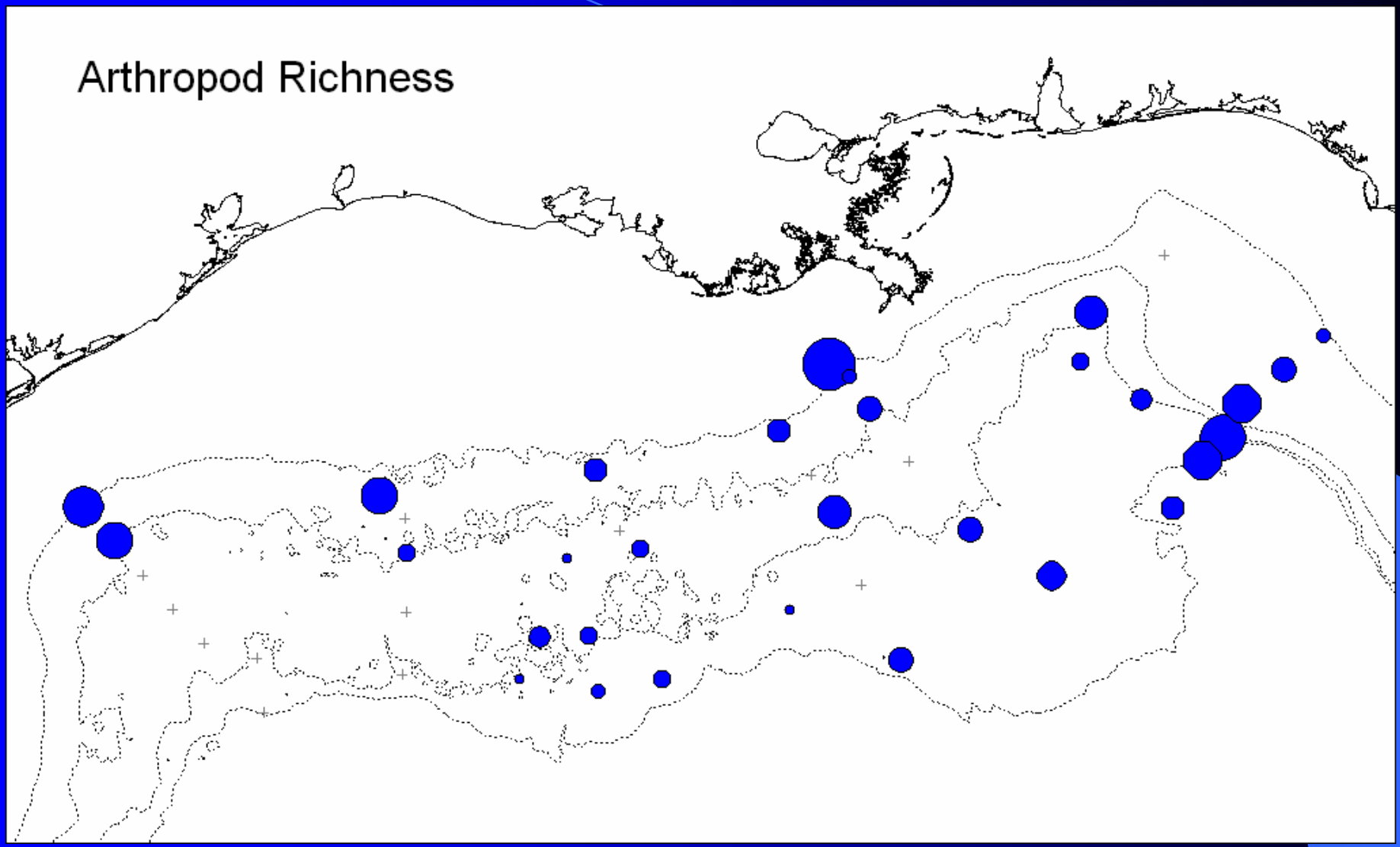

Megafauna Richness


Macrofauna Richness


Fish Richness

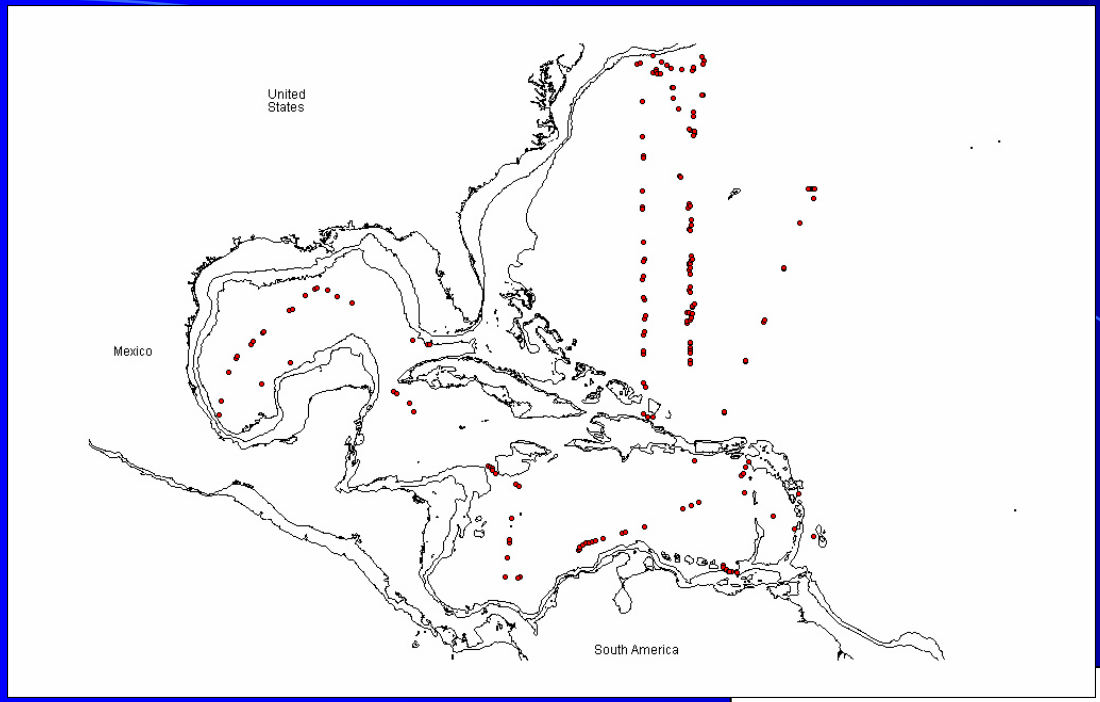

Polychaete Richness

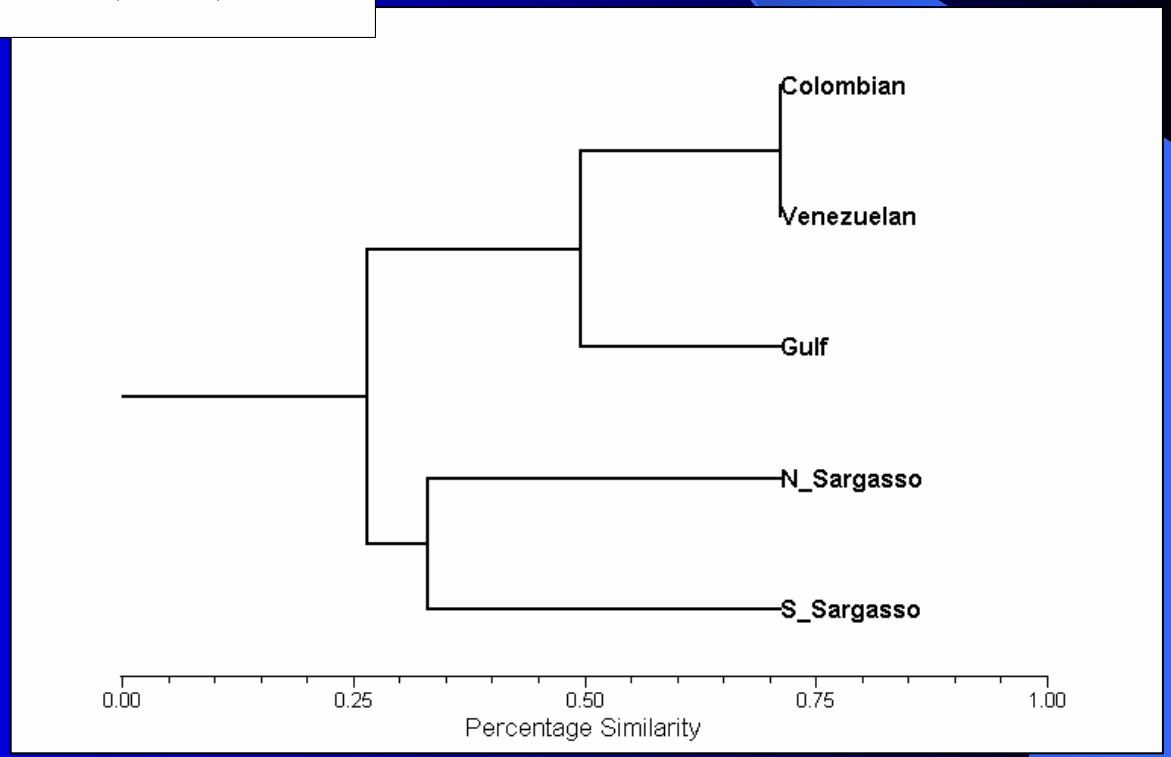

Cumacean Richness


Arthropod Richness

Recent Conclusions

- No one factor explains richness patterns, but food supply seems always important.
- Mapping richness itself is informative.
- The Mississippi Trough is probably an area worthy of special consideration and protection.
- Patterns for each group appear unique – why?


United States
Mexico
South America


Colombian
Venezuelan
Gulf
N_Sargasso
S_Sargasso
0.00
0.25
0.50
0.75
1.00
Percentage Similarity

Recent Conclusions

- No one factor explains richness patterns, but food supply seems always important.
- Mapping richness itself is informative.
- The Mississippi Trough is an area worthy of special consideration and protection.
- The Gulf fauna is derived from multiple sources.

Orphan Basin, 2338 m, Labrador Sea – What You Can Learn from Good Photographs