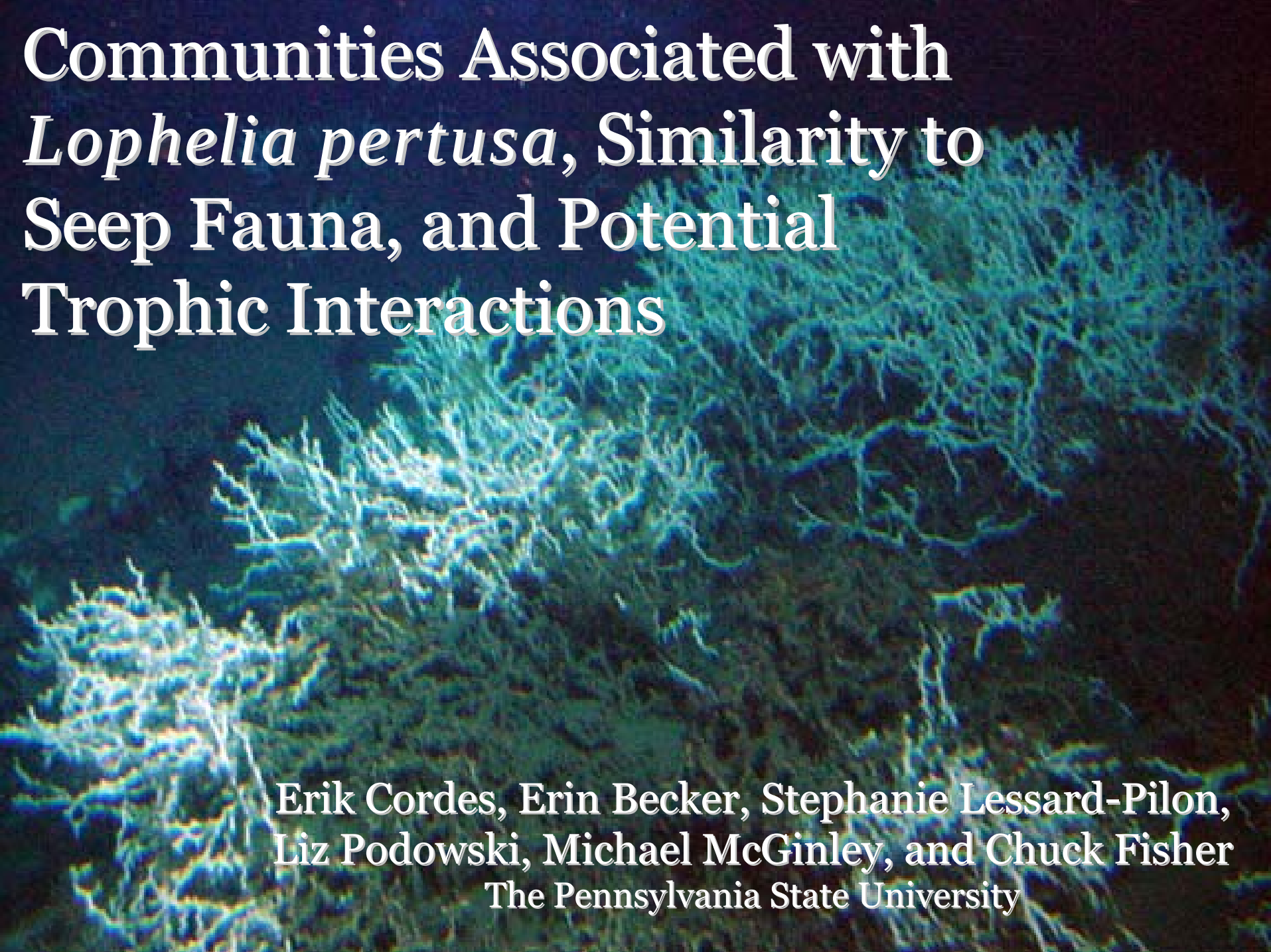
Communities Associated with *Lophelia pertusa*, Similarity to Seep Fauna, and Potential Trophic Interactions

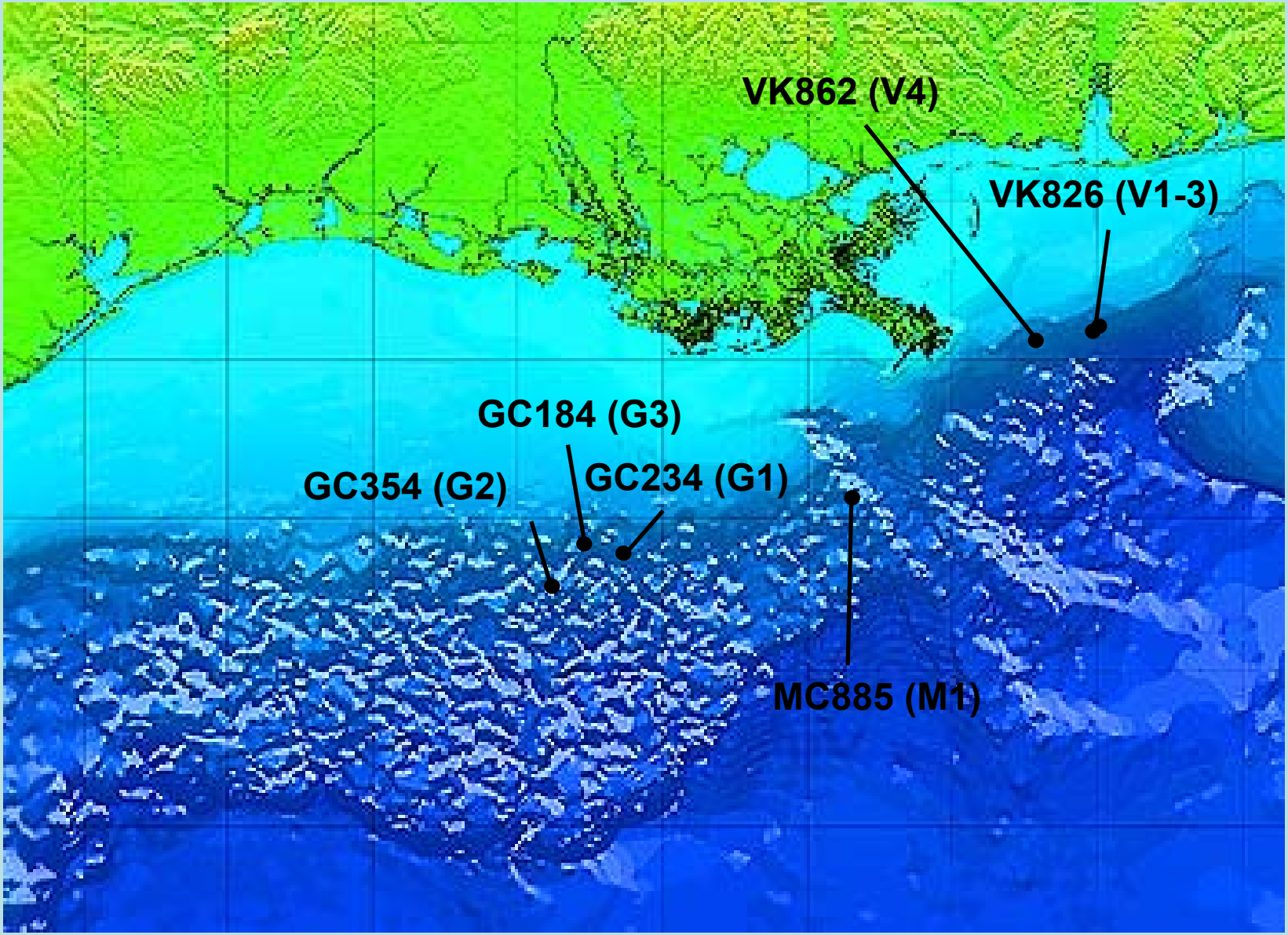


Erik Cordes, Erin Becker, Stephanie Lessard-Pilon, Liz Podowski, Michael McGinley, and Chuck Fisher
The Pennsylvania State University

Gulf of Mexico Hardgrounds

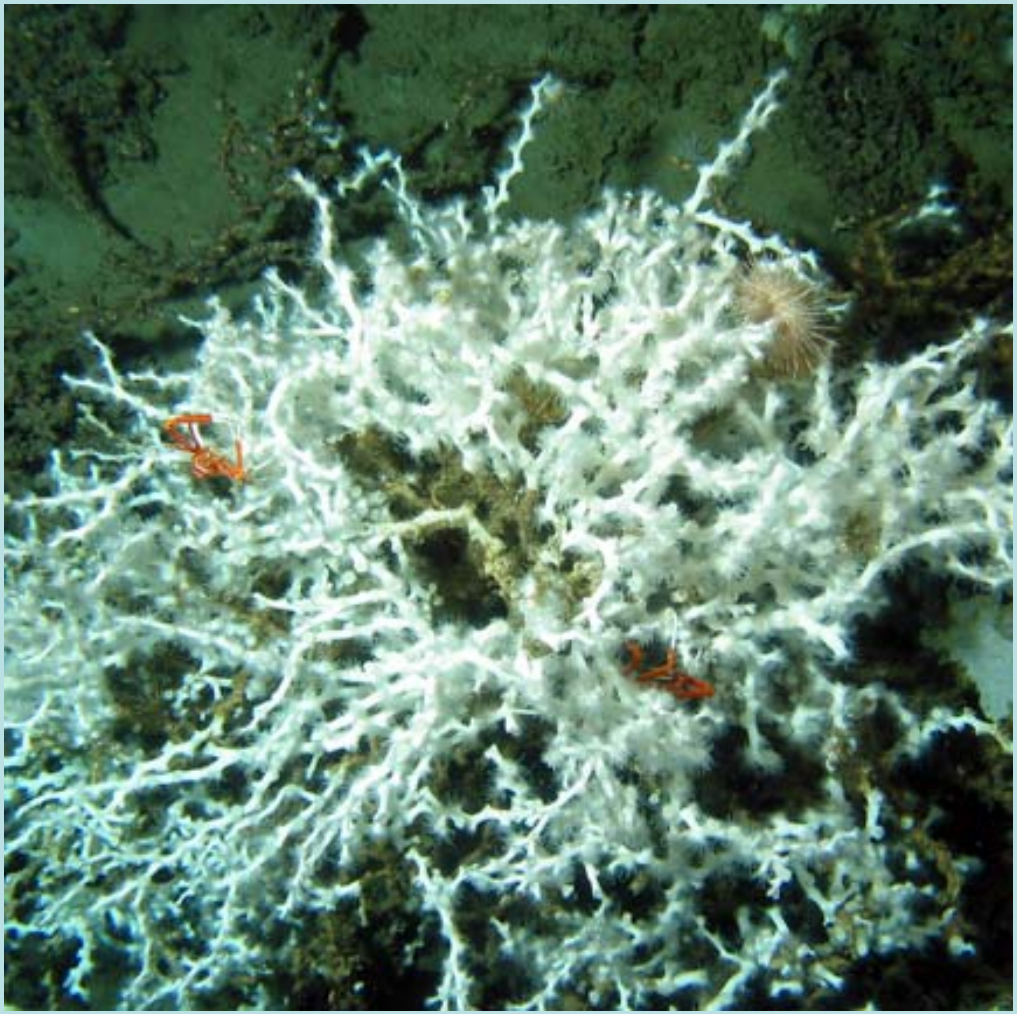
- Authigenic carbonates
- Biogenic habitats
- Succession in seep communities
- Corals as final stage of succession?
  - overlap in communities
  - overlap in food source

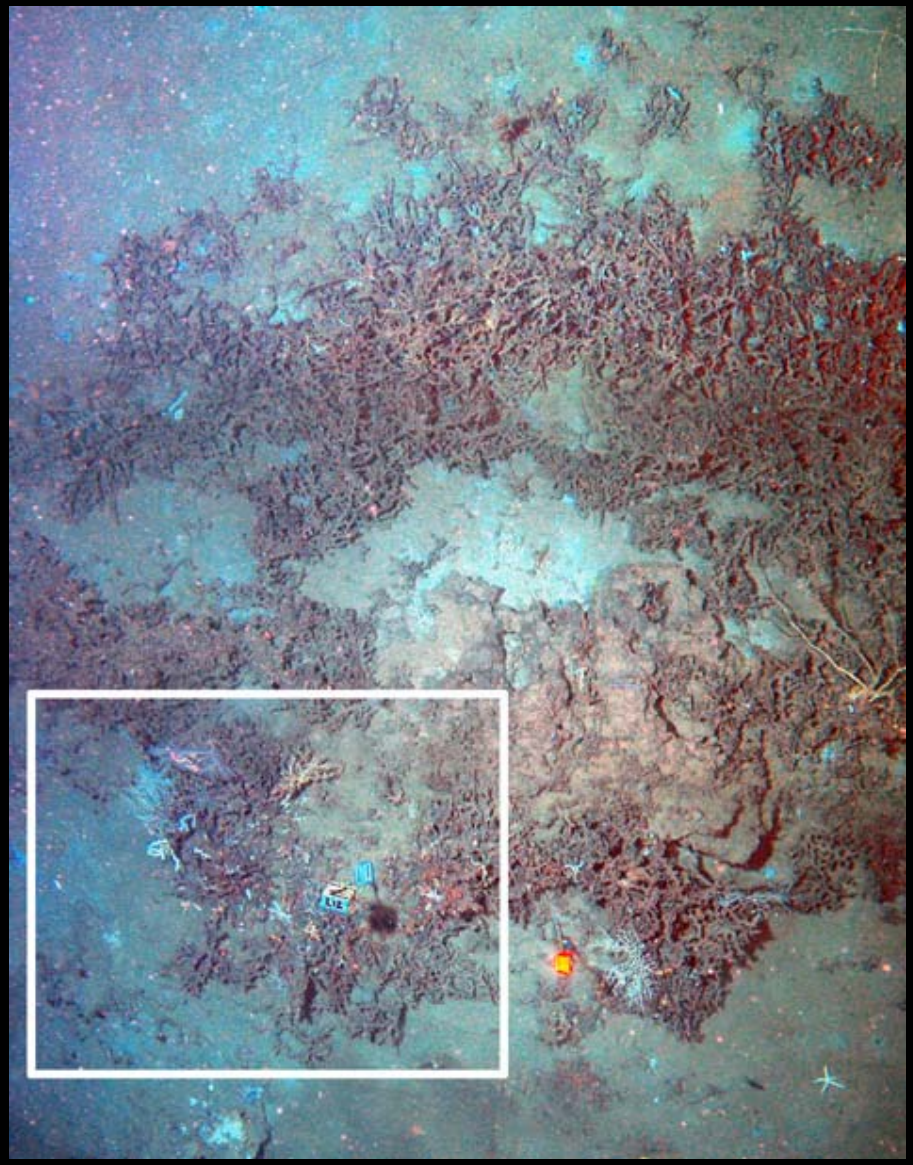
Gulf of Mexico Study Sites

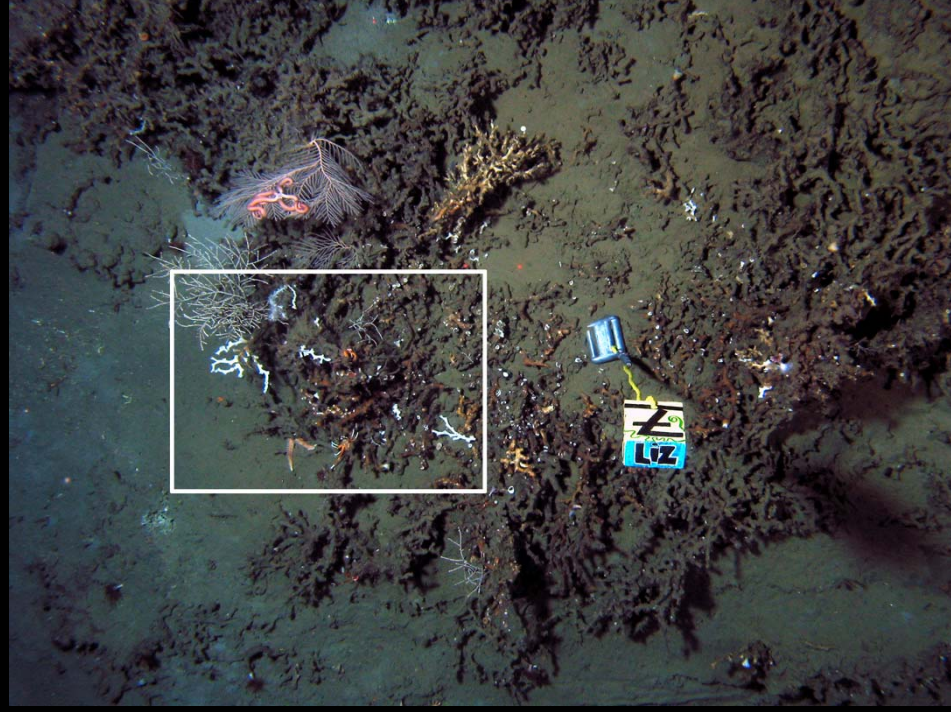


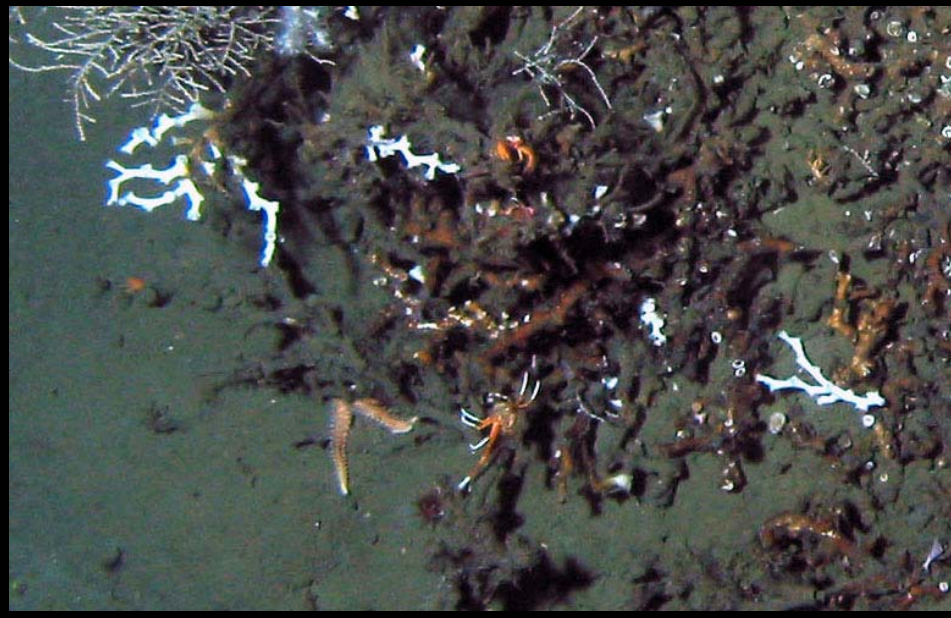
Community Sampling

- Photomosaics
  - diversity
  - habitat associations
- Physical collections
  - diversity
  - trophic relationships









Photomosaic Results

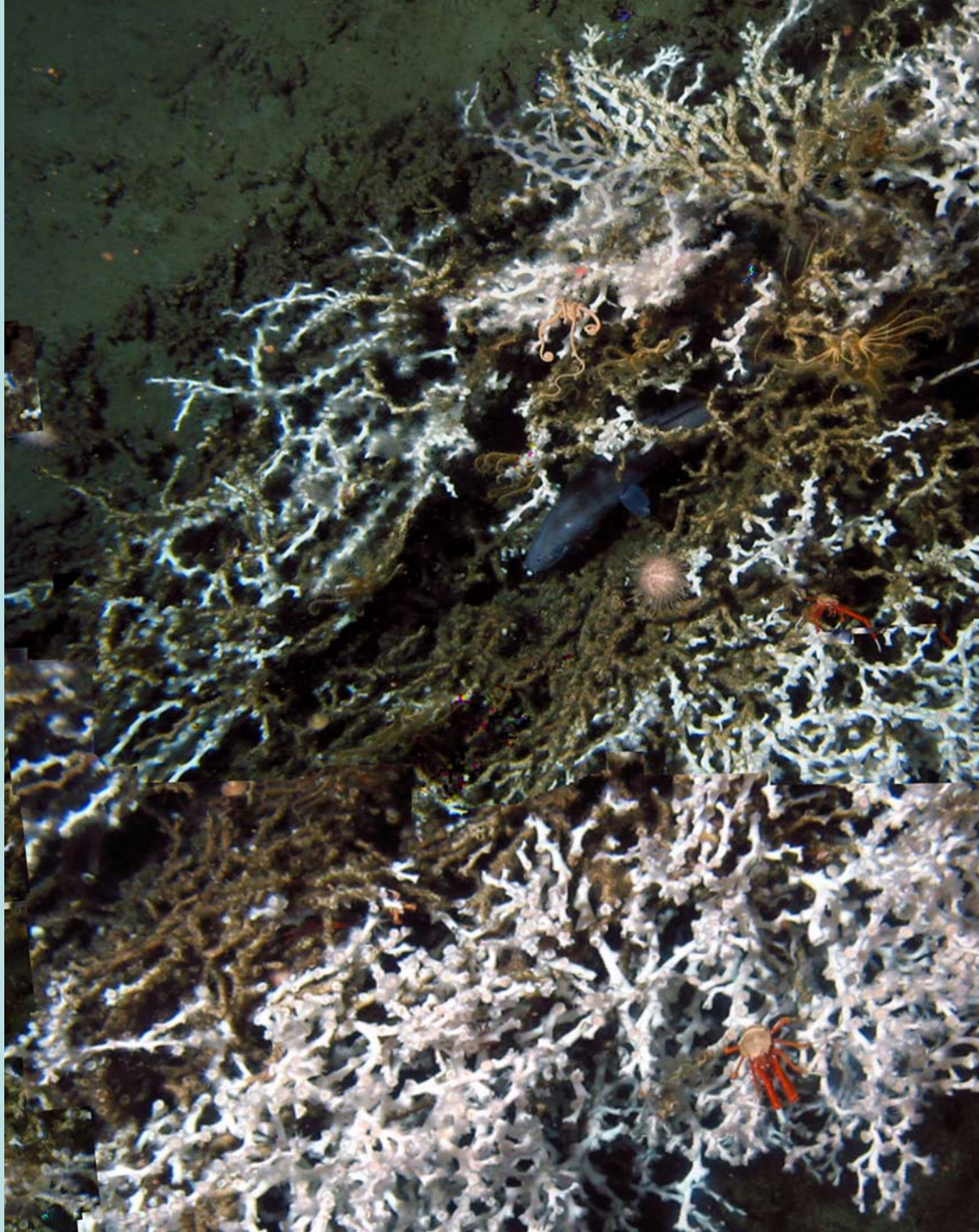
12 mosaics

substrata:

1. dead coral
2. rubble
3. live coral
4. carbonate

mobile fauna:

1. *Munidopsis* spp.
2. *Eumunida picta*
3. ophiuroids
4. crinoids
5. fishes



Significant Habitat Associations Among Megafauna and Substrata

Eumunida picta:
on dead or other cnidarians
near live or carbonate

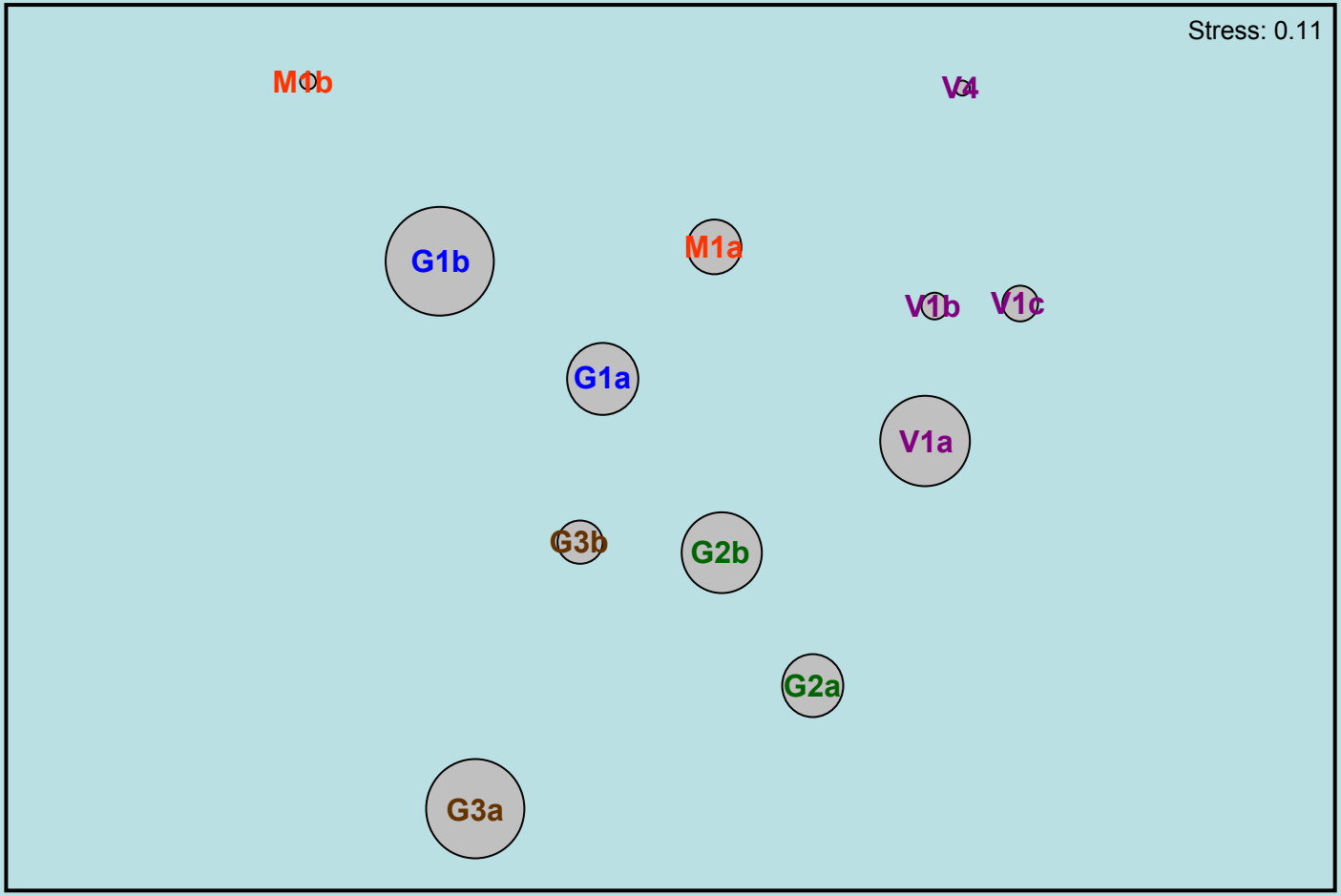
ophiuroids:
on other colonial cnidarians

crinoids:
on dead or mixed near live

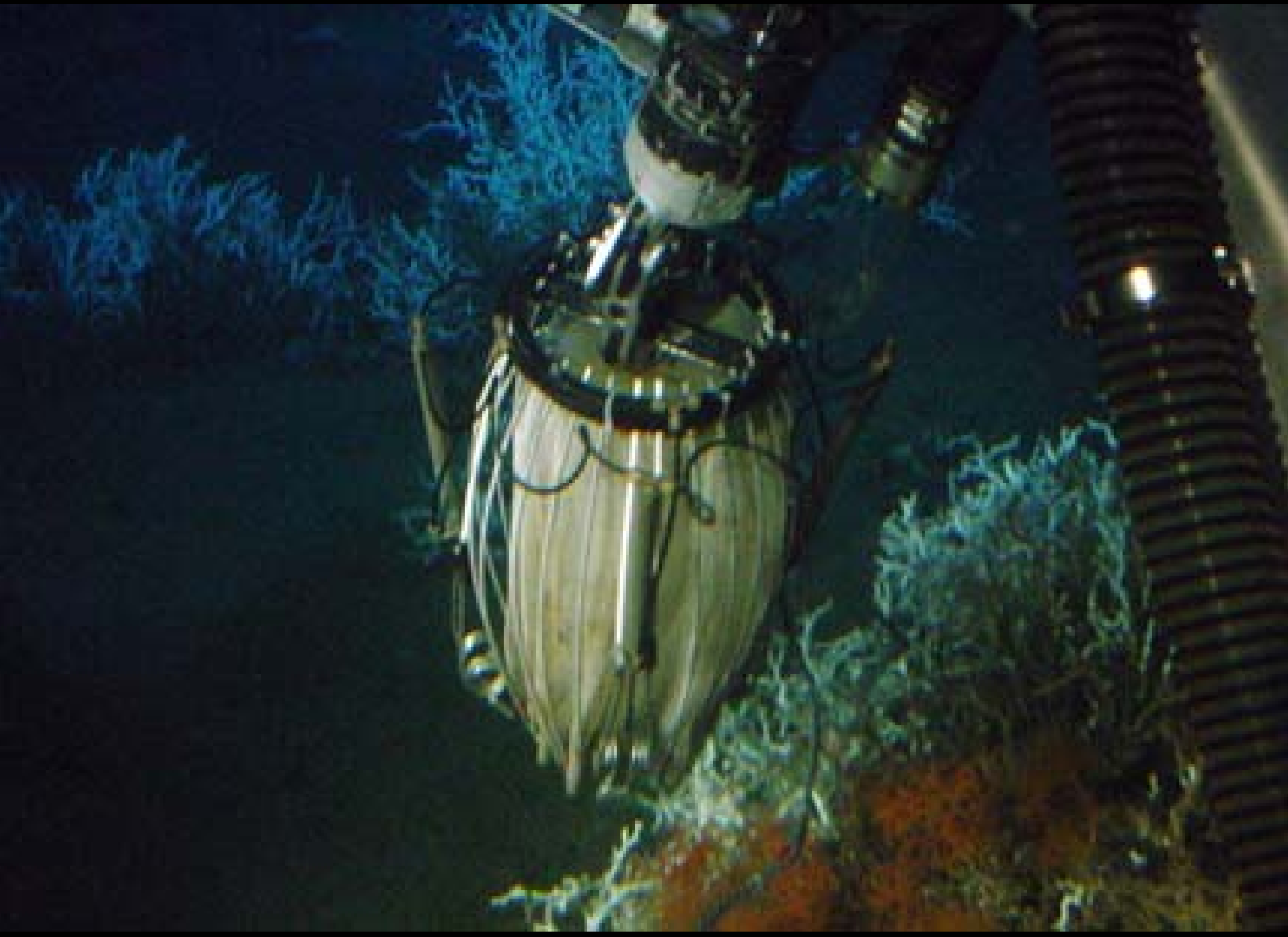
Munidopsis spp:
on live or seep away from dead

fishes: near live, mixed, or carbonate

Megafauna Similarity Determined by Location, Depth and Proportion of Dead Coral

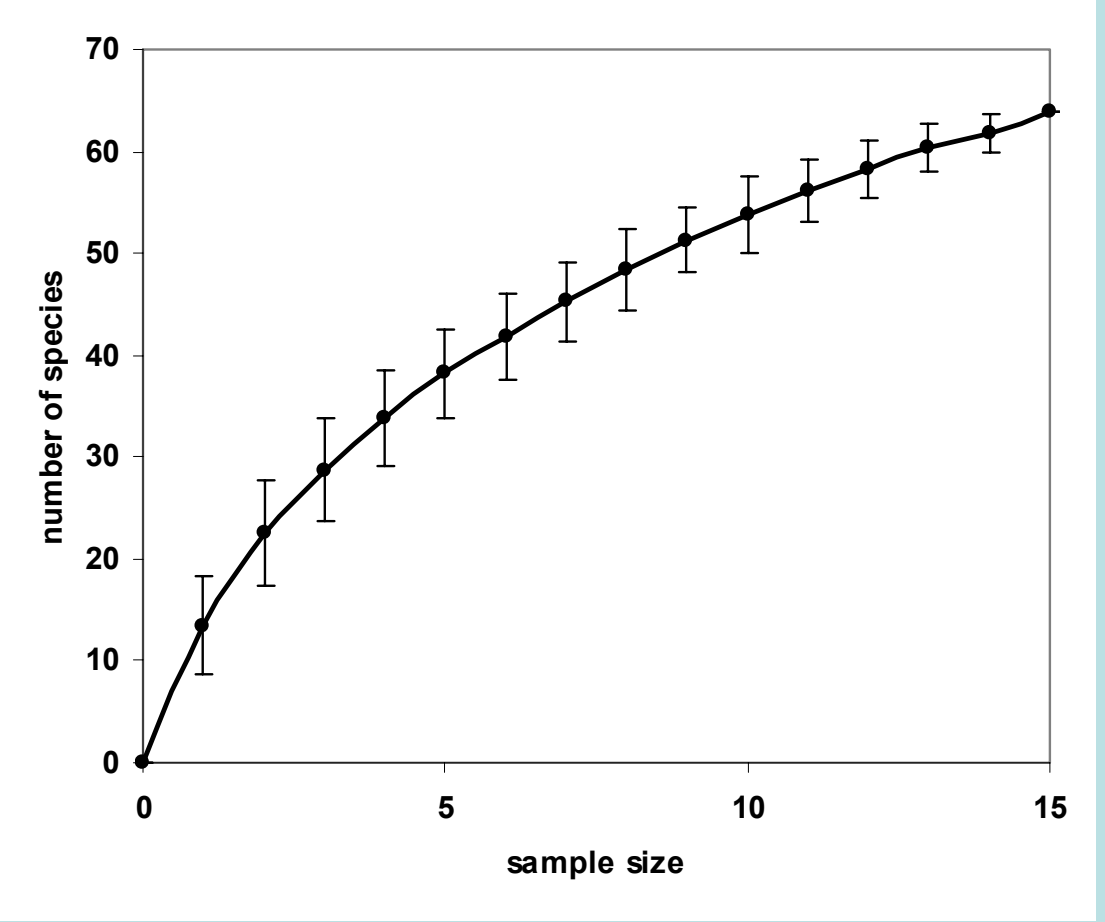


Circle size represents relative proportion of dead coral in bushmaster collection.



Bushmaster Sampling

- 15 collections
- 64 species
  - 6 to 23 per sample
- *H*' 0.67 to 2.54
- *J*' 0.41 to 0.98



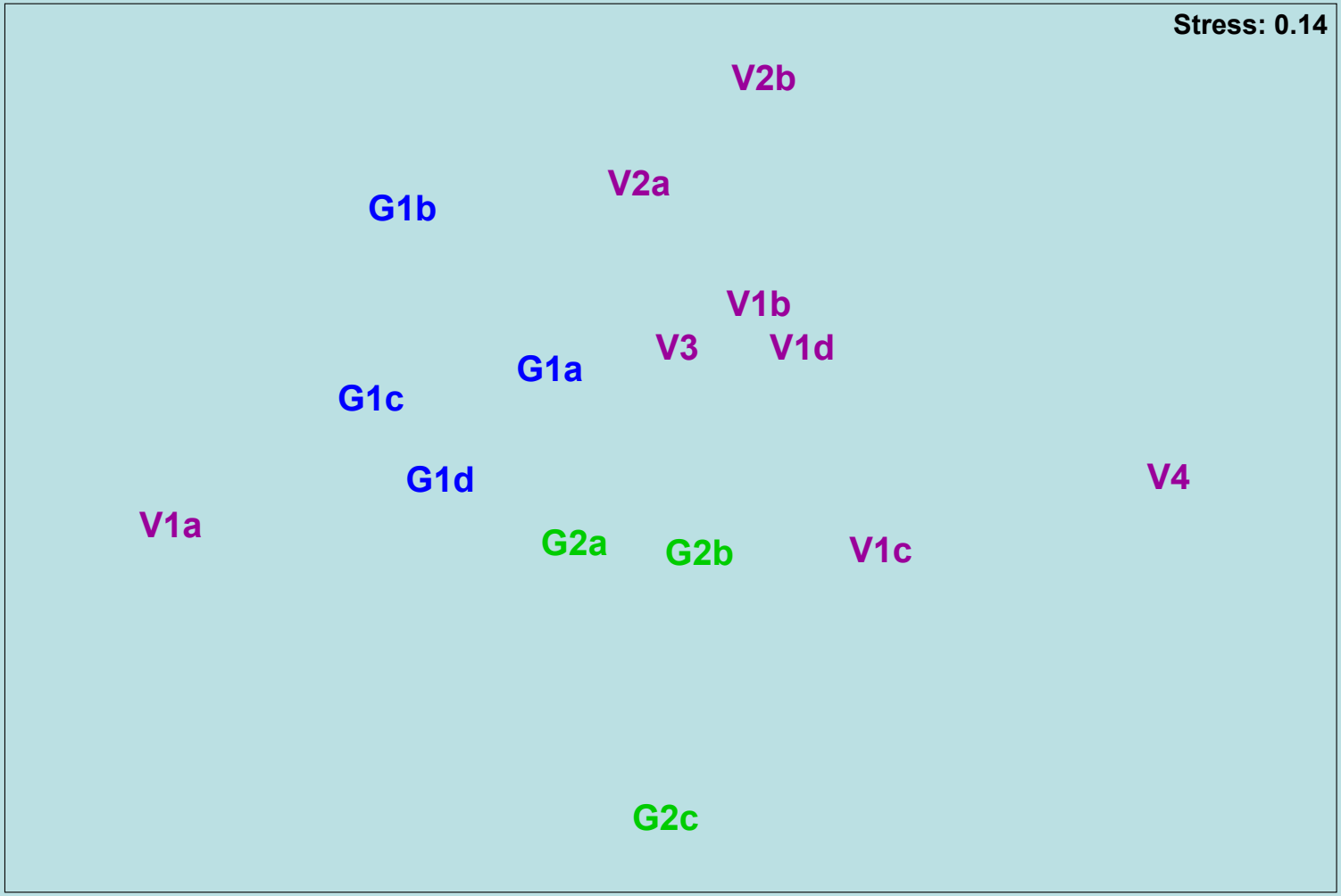
Possible Coral-Endemic Species

Coralliophila sp.

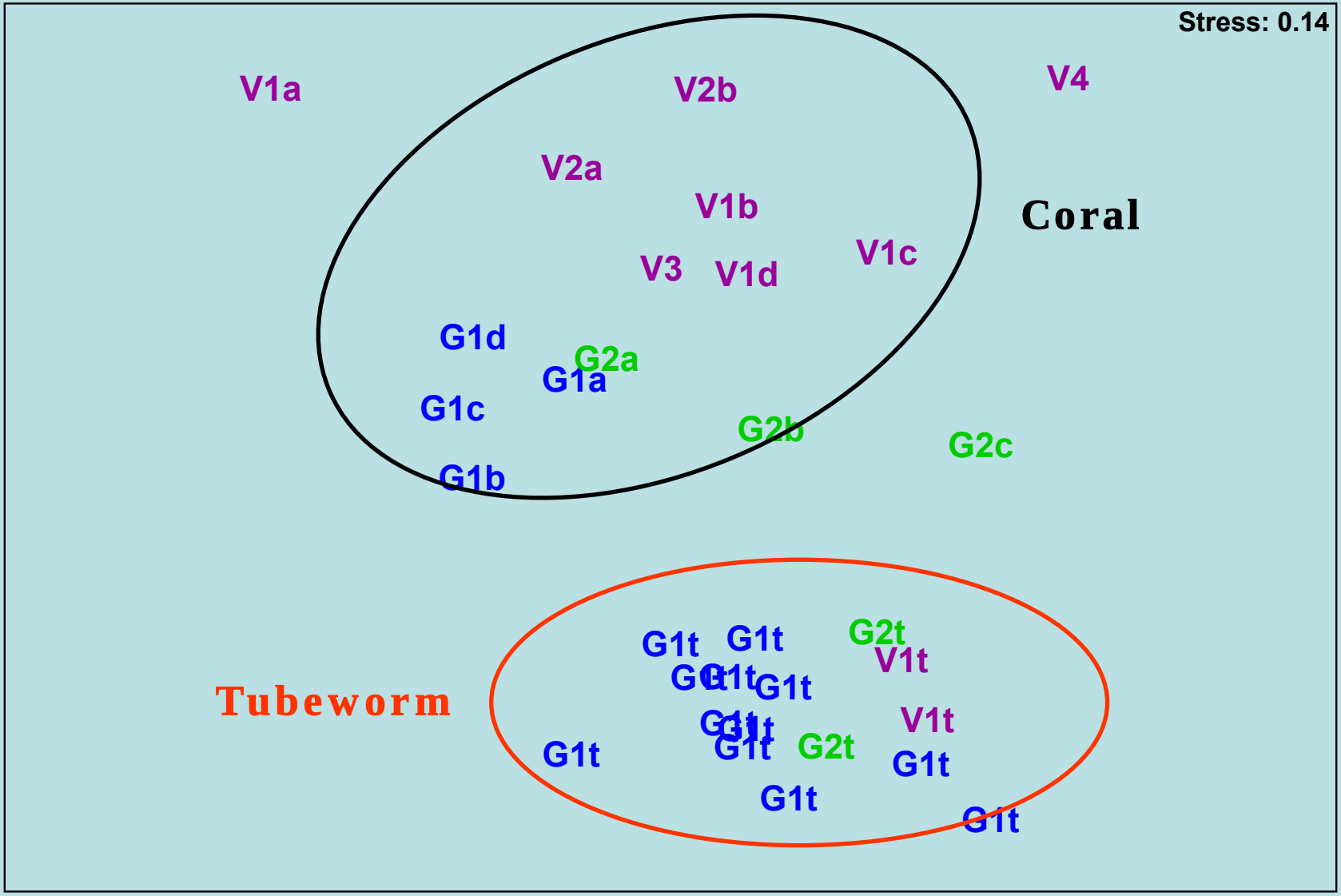
Stenopus sp.

Eunice sp.

Coral-Associated Communities Are Similar within Sites



Lophelia and Tubeworm Communities Are Distinct



Food webs reconstructed from stable isotope data

- only VK826 shown here
- most species generalists within one trophic level
- a few notable outliers:

  Euratella sp.

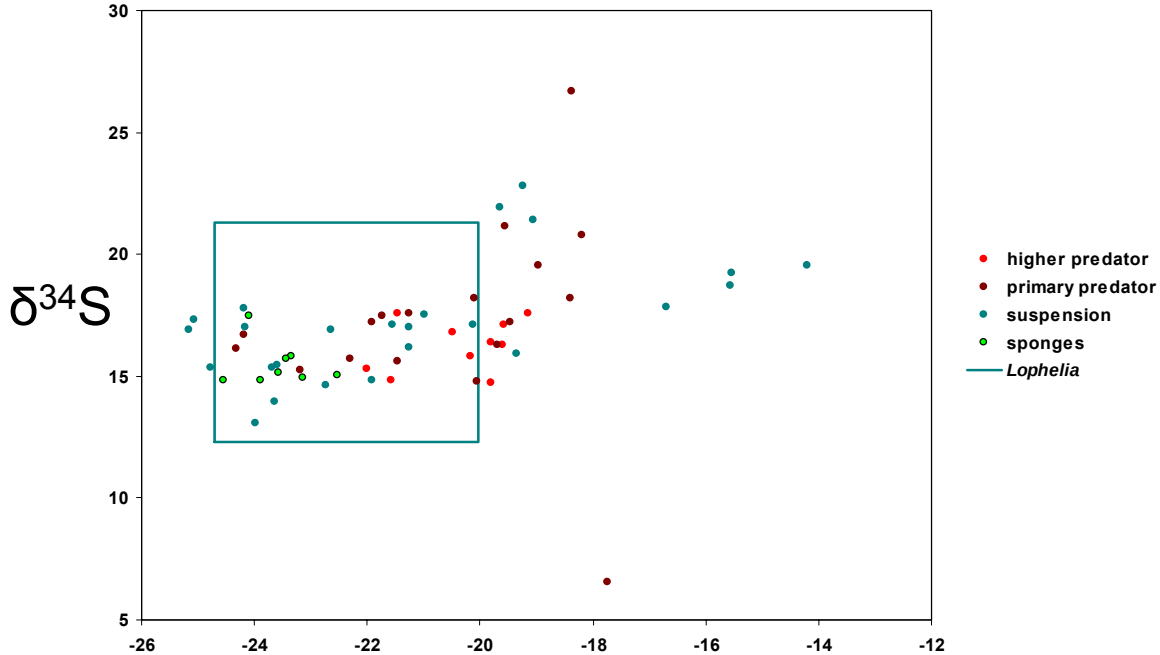
  -14 to -17‰ $\delta^{13}C$

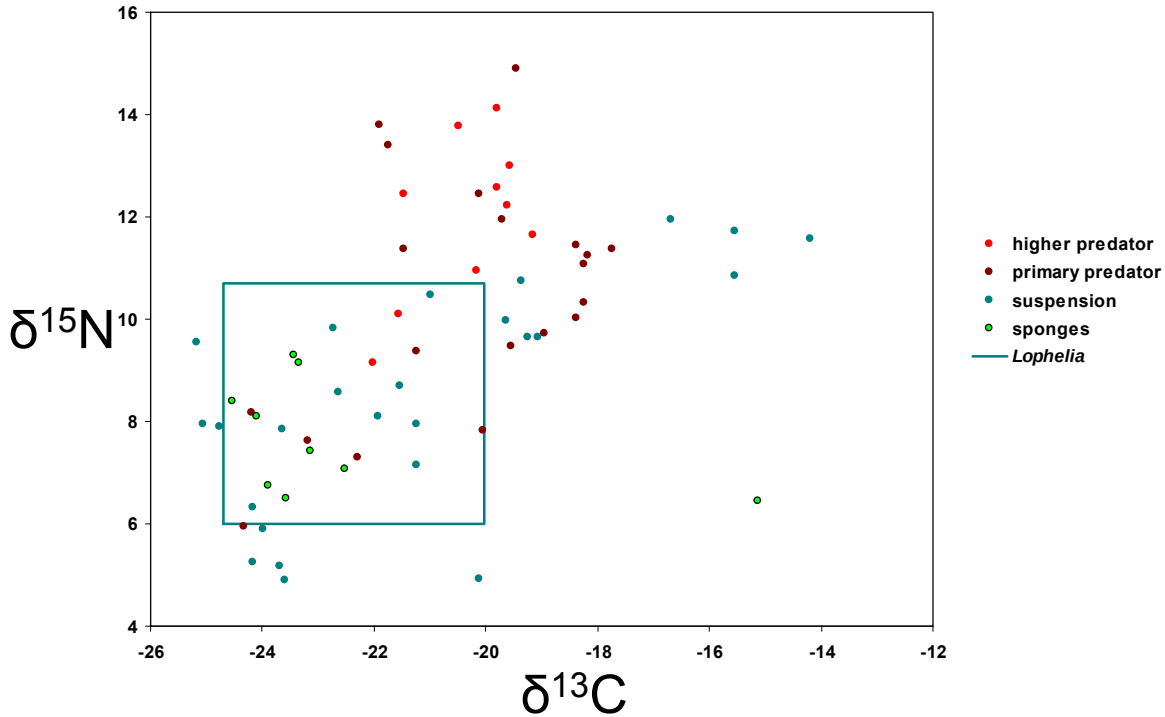
  hydroids

  4 to 5‰ $\delta^{15}N$

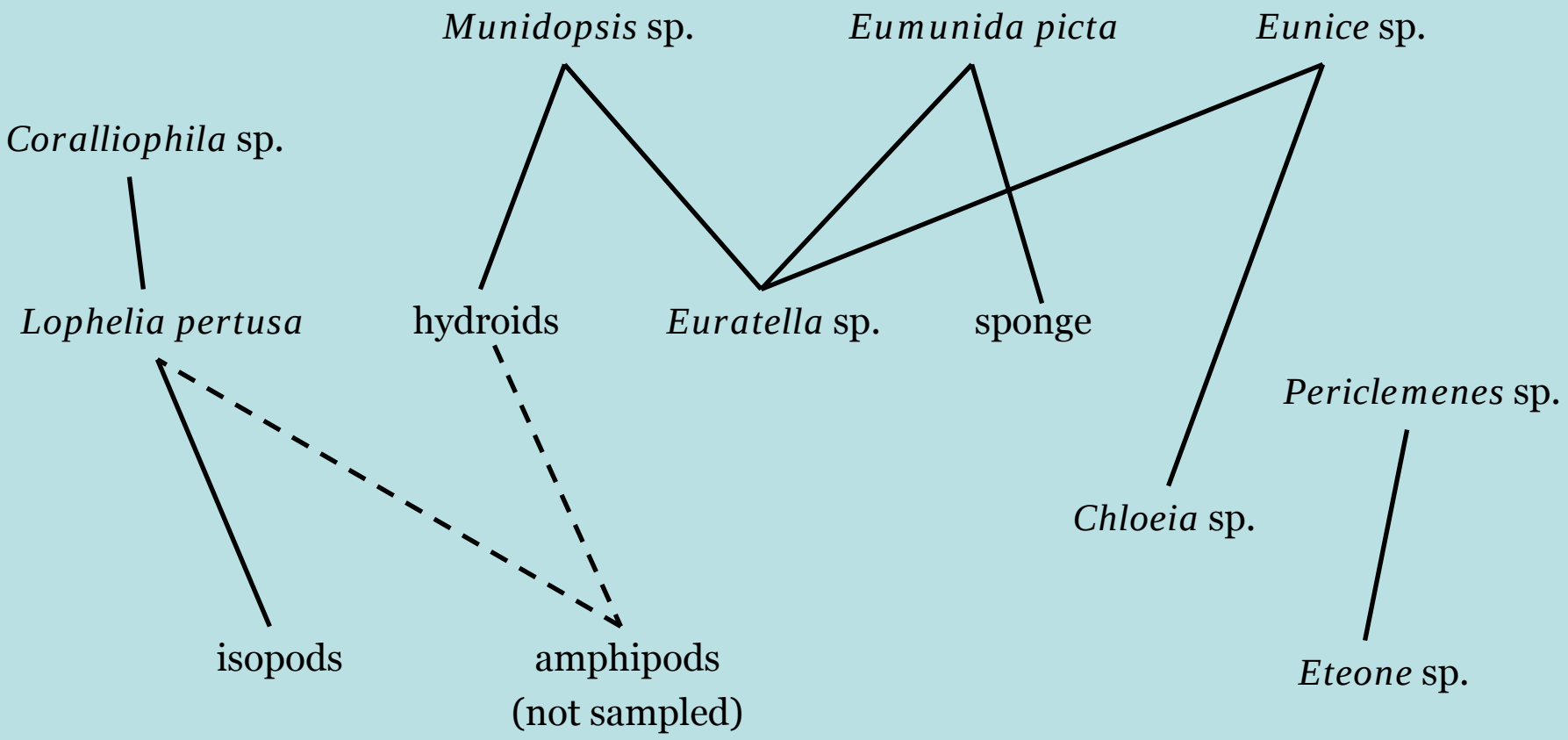
  Stenopus sp.

  6.6, 26.7‰ $\delta^{34}S$



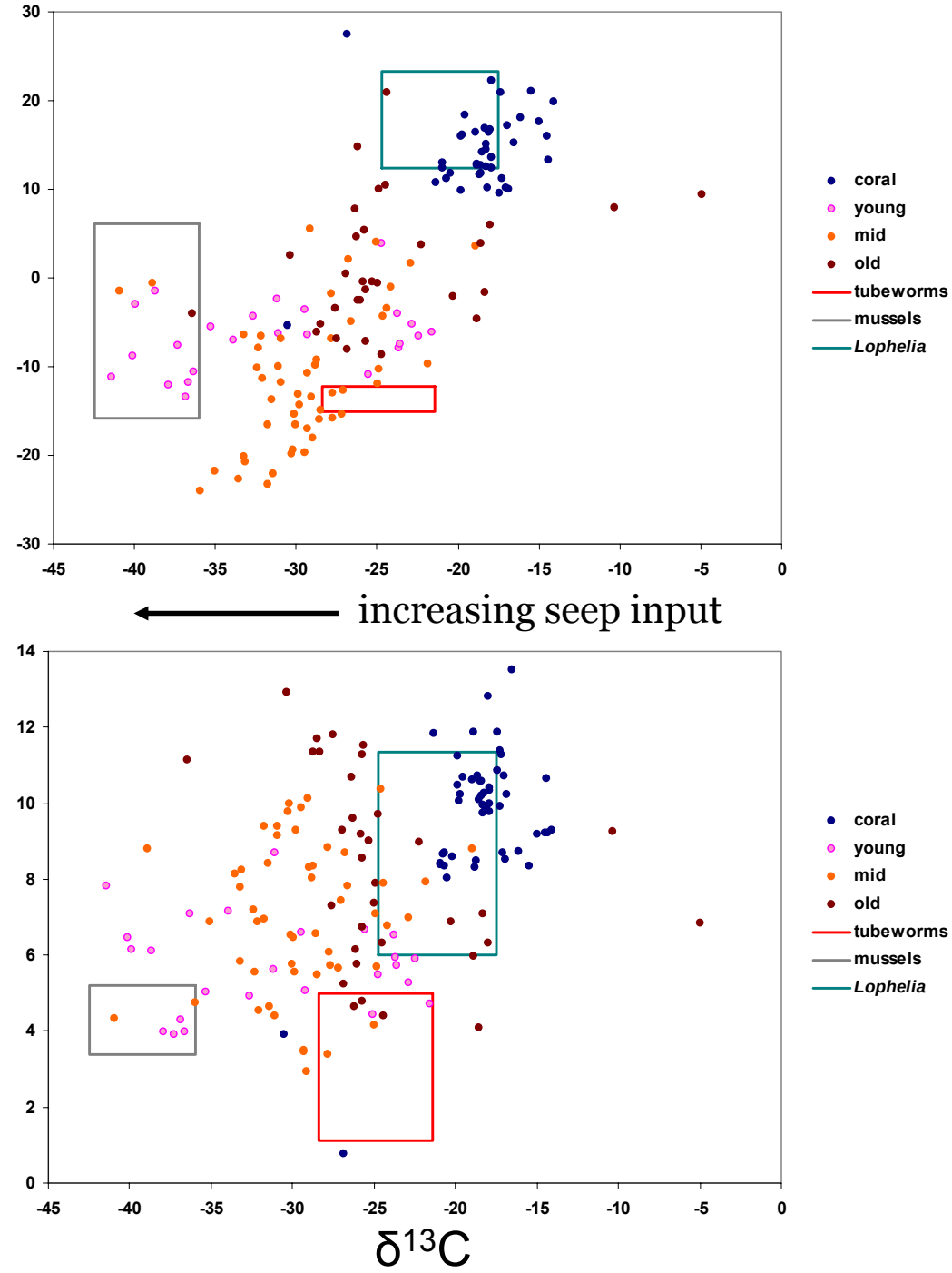


Potential Trophic Relationships from Stable Isotope Data



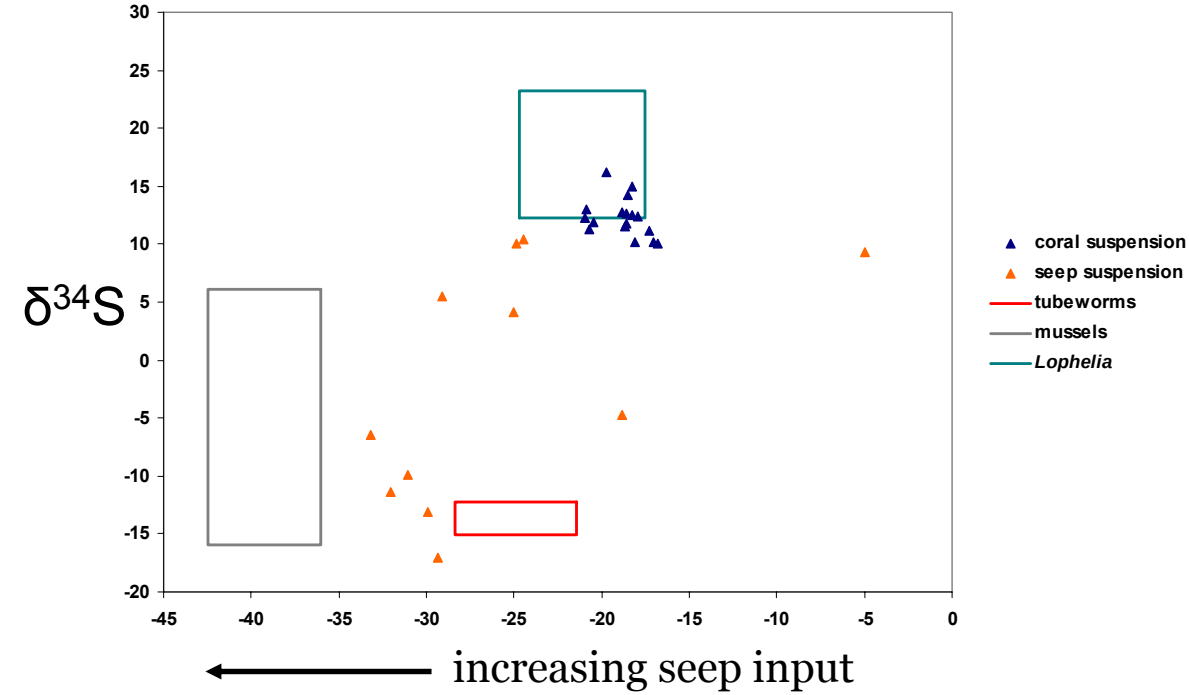
Trophic succession in stable isotope values from GC234

- Shift in isotope values from young to old tubeworm communities
- Lack of seep input to coral communities
- Still some outliers:
  - *Provanna*
  - *Caryophila*

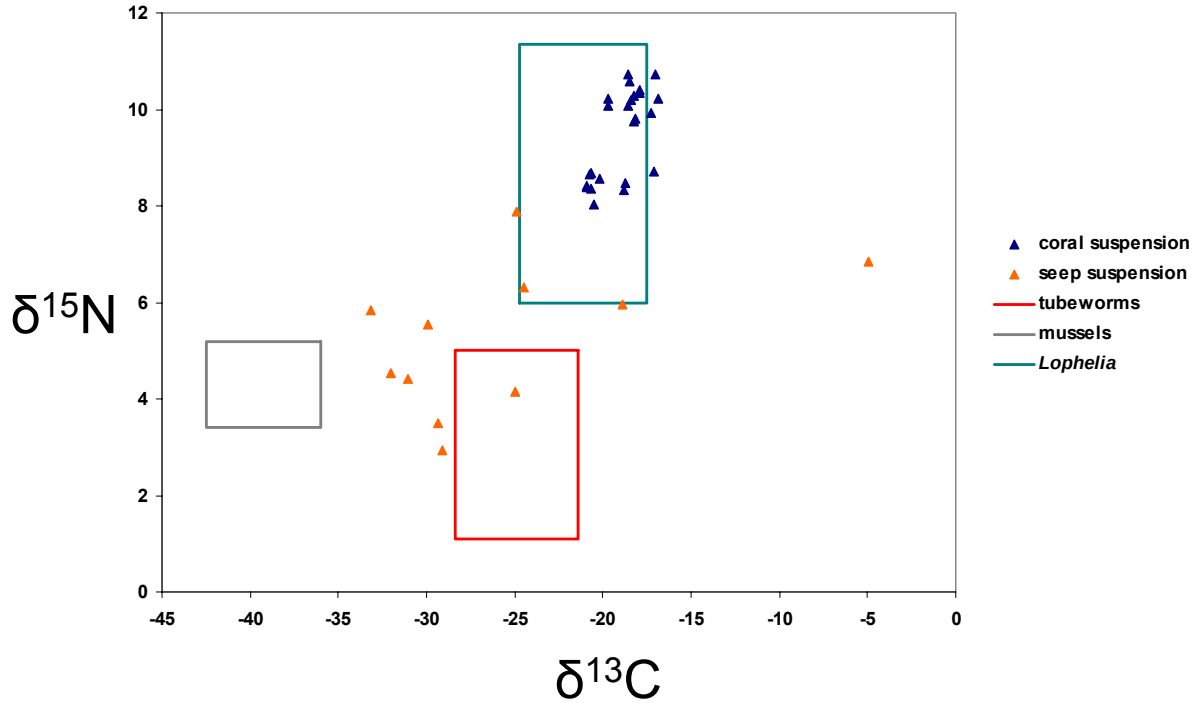


Suspension feeding species only from GC234

- different prey items near seeps and corals
- some species in old aggregations similar to *Lophelia*

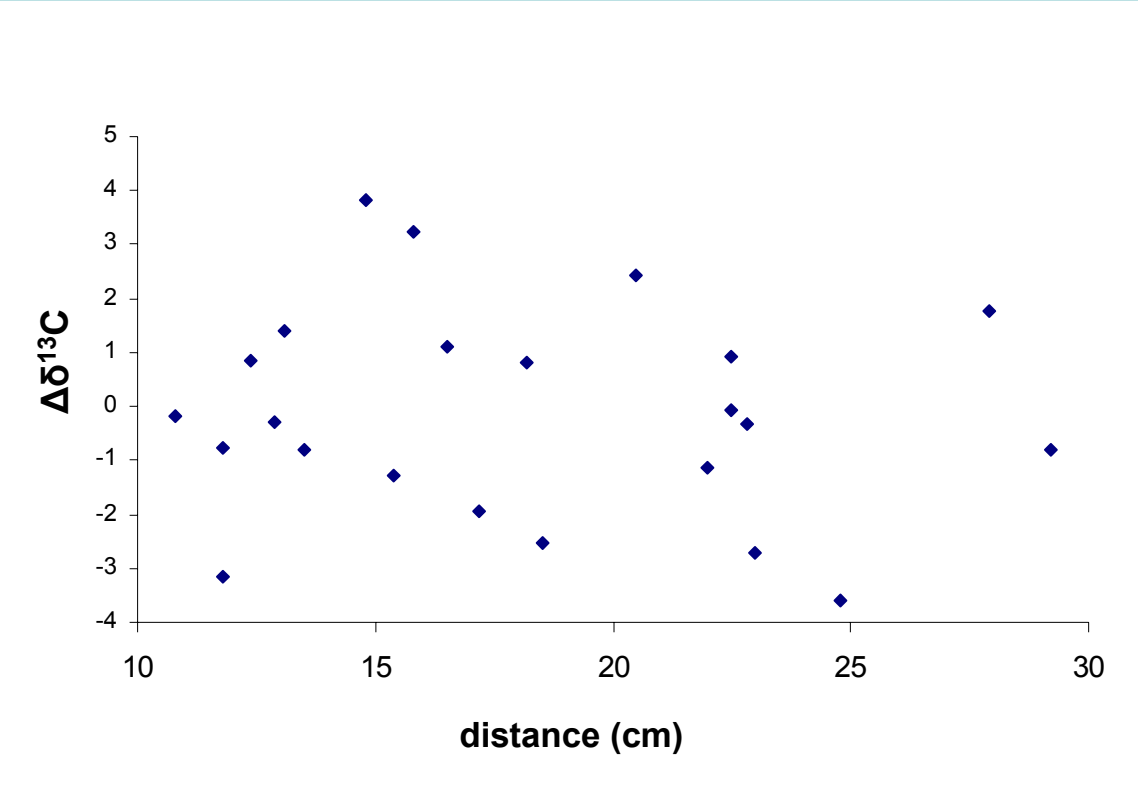


increasing seep input



No Change in Isotopic Signature of *Lophelia pertusa* Skeleton over Time

- no apparent signal from seepage in the DIC pool at the time of settlement

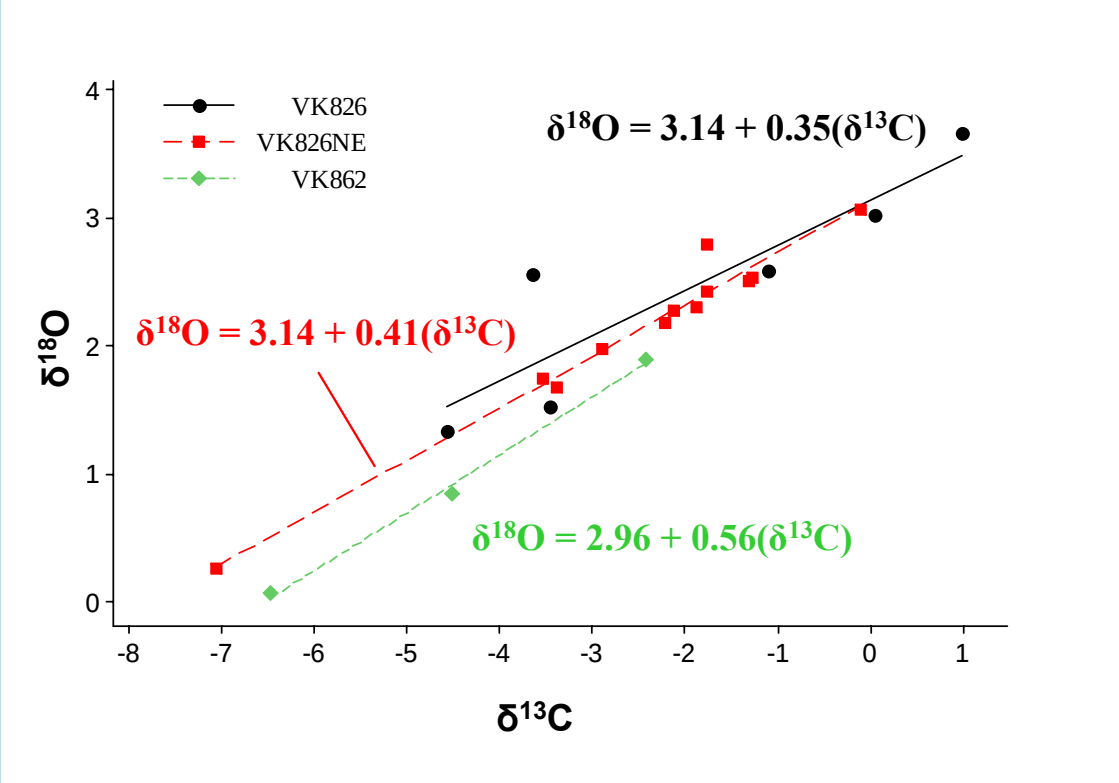


Potential for Climate Reconstruction from *Lophelia pertusa* Skeleton Samples

- temperature calculation

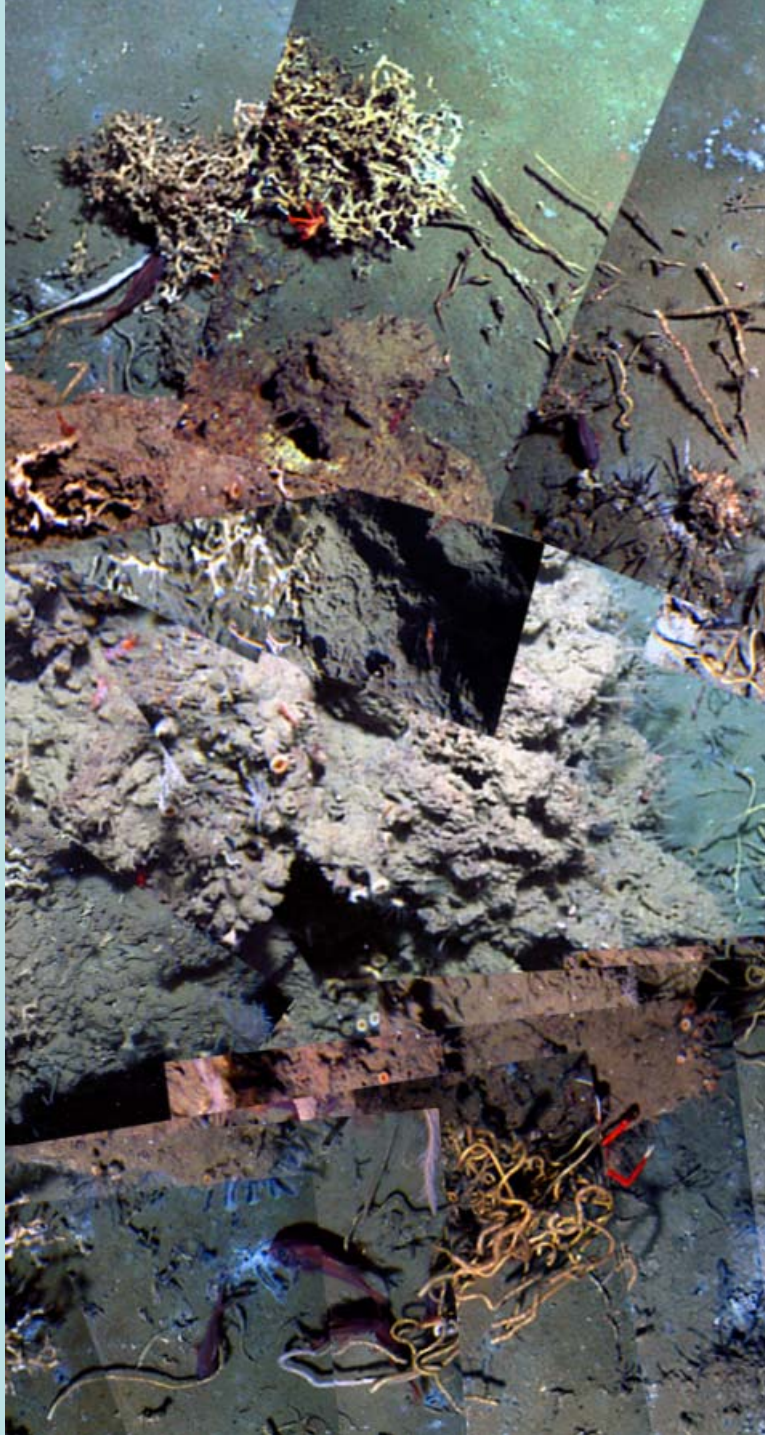
$\delta^{18}O = -0.25T + 4.97$

VK862 (315 m) T = 8.04°C
VK826 (465 m) T = 7.32°C



Lophelia pertusa Communities on the Upper Slope

- Community mainly composed of background species
  - depth, site, proportion of dead coral
  - some specific habitat associations
  - potential coral endemic species
  - little overlap with tubeworm communities
- Generalists dominate food web
  - few specific trophic relationships
  - little / no seep input
- Potential for climate research

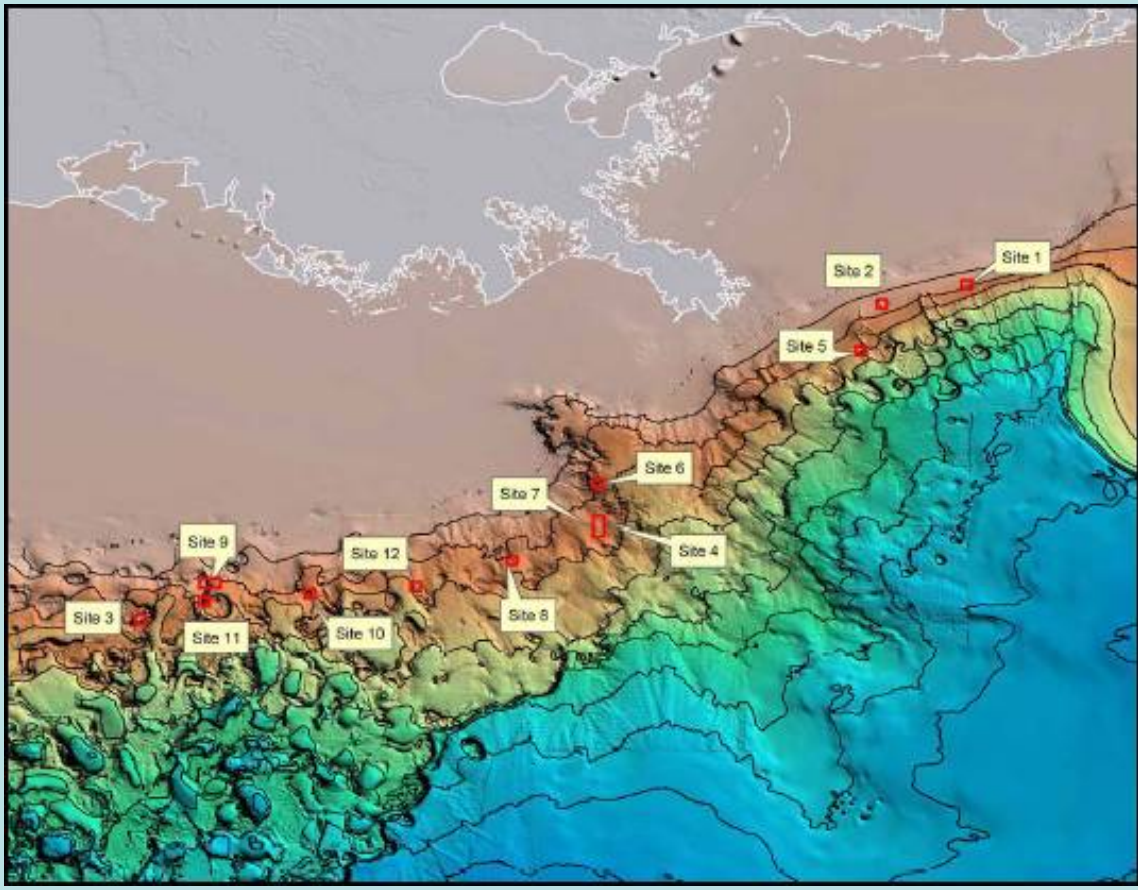


Summary and Some Thoughts on *Lophelia* Distribution in the Gulf

- Regional scale
- Local scale
- Significance to the ecology of the upper slope

Regional Distribution

- Upper limits
  - temperature < 13°C
  - currents, sedimentation
  - biological interactions?
- Lower limits
  - food supply
  - biological interactions?
- Lateral distribution
  - dispersal
  - substrate

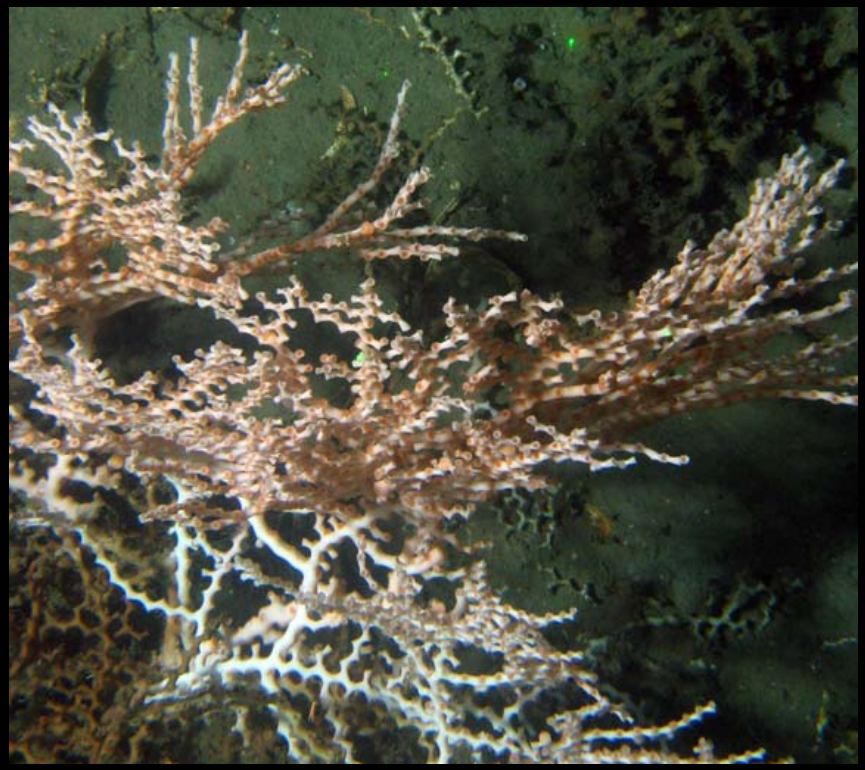


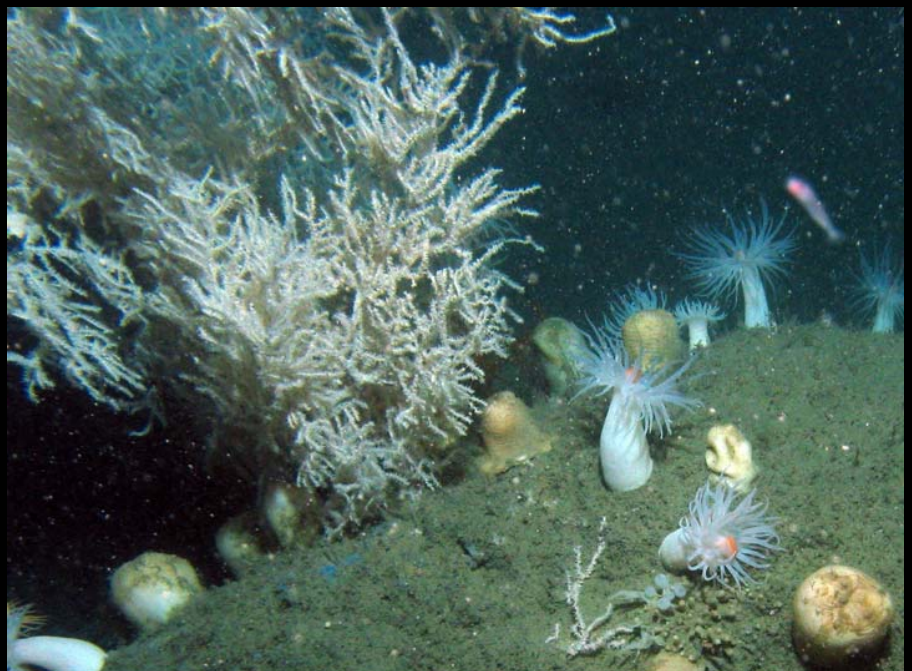
Local Distribution

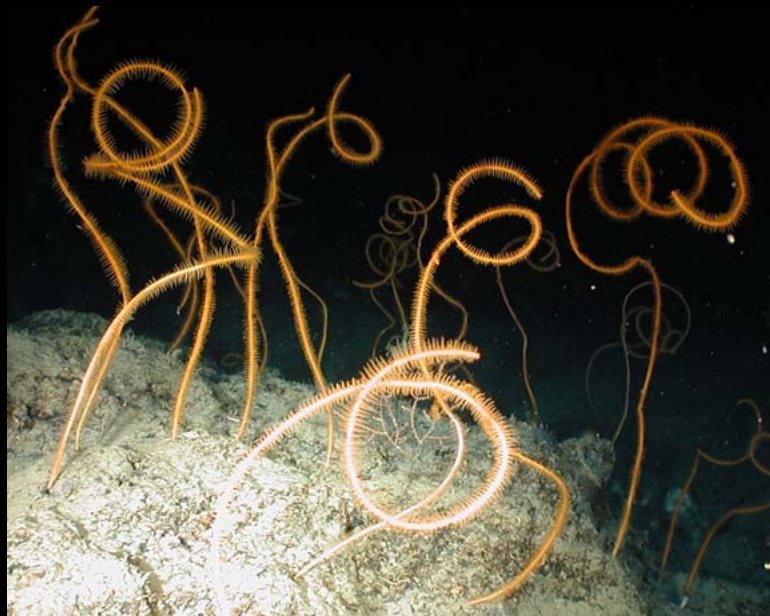
- Substrate
  - link to seeps
- Nutrients
  - local topographic high
- Seepage
  - sulfide / anoxic tolerance?
- Biological interactions?

Significance to Gulf Deep-Water Systems

- complex habitat
  - increased abundance of background species
  - some endemics
  - final stage of succession
- regional abundance
  - 13 to 90% cover in dense areas
  - dominates large area of VK826
  - locally abundant at GC234
  - other areas?
- other corals







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