

Nearshore Epifaunal Community of South Biscayne Bay Past, Present, and Future

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Epifaunal Community: Past



Species List of W. F. McCormick of Coconut Grove

- Cited in Smith (1896)
- 95 species, but not the smaller epifaunal species
- Some more notable species:
 - Gag, Black grouper, Scamp, Goliath grouper, Sheepshead, Atlantic croaker
 - Mullet, Pinfish, several flounder species

Epifaunal Community: Present

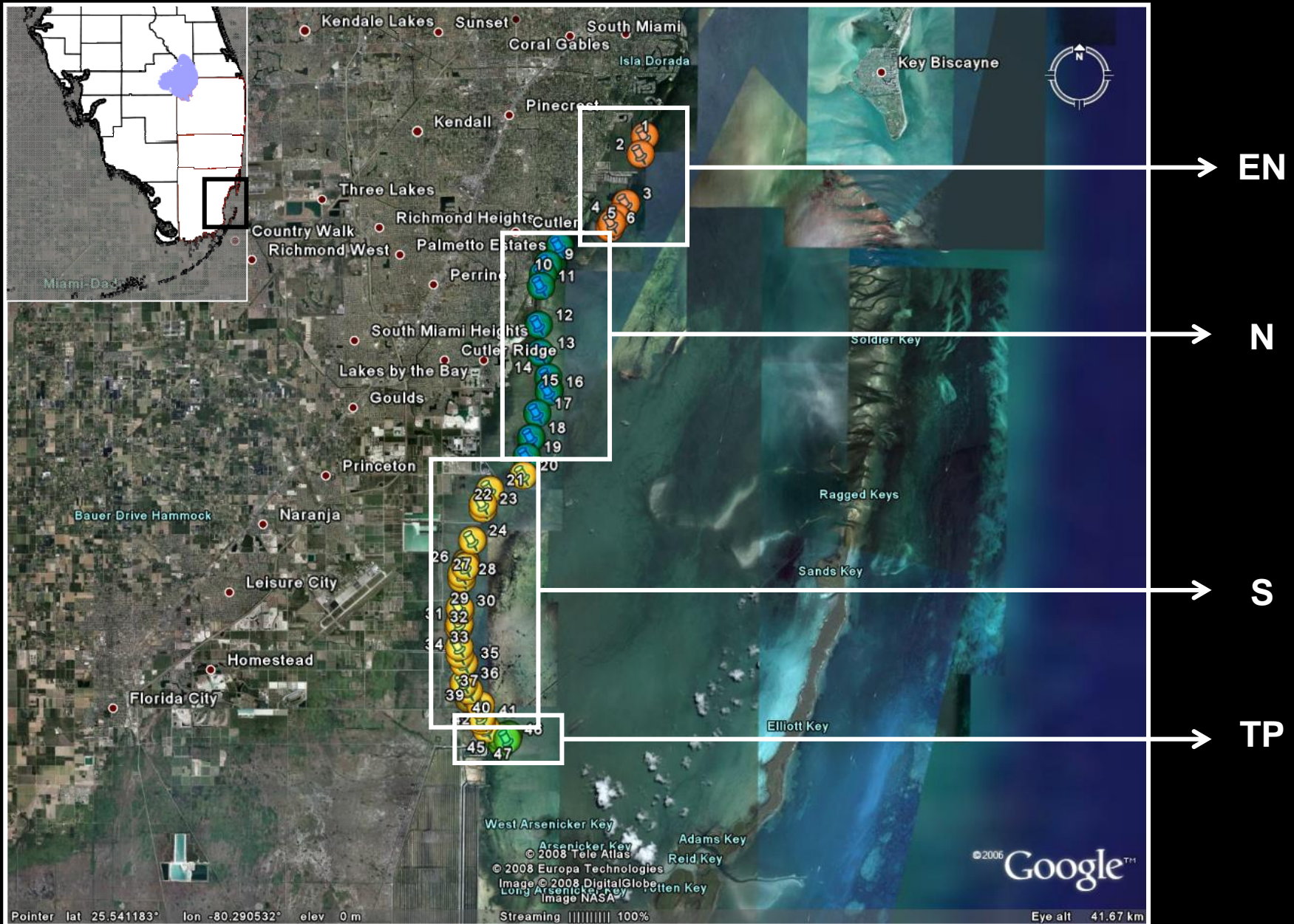


Throw-trap sampling of epifauna

»Field Project Description

- Sampling twice a year, dry (Jan.-Feb.) and wet (July-Aug.) seasons, 2005-2007, at 47 sites.
- Expanded in 2007 to cover 72 sites.
- Sampling sites located along the shoreline in conjunction with randomly-sited shoreline- fish transects.
- 3 samples at each site with 1-m² throw-trap.
- 4 sweeps to clear the trap for each sample.
- Environmental (T, S, pH, and DO), water depth, sediment depth, and SAV data also collected at each site on each visit.

→ Site overview in Biscayne Bay incl. 'Strata' classification:



→ Overview about dominating species:



Rainwater Killifish
Lucania parva



Goldspotted Killifish
Floridichthys carpio



Gulf Pipefish
Sygnathus scovelli



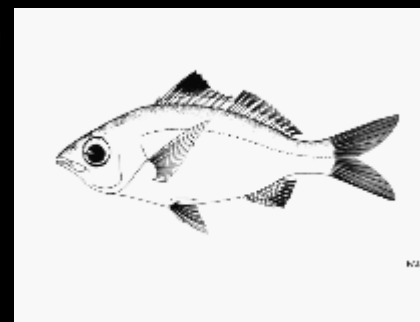
Gulf Toadfish
Opsanus beta



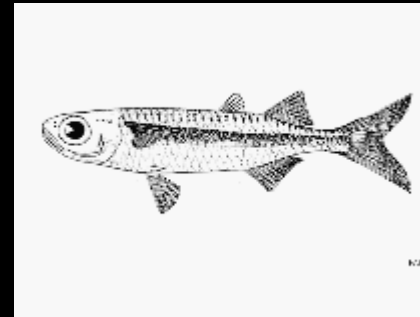
Clown Goby
Microgobius gulosus



Pinfish
Lagodon rhomboides



Bigeye Mojarra
Eucinostomus havana



Hardhead Silverside
Atherinomorus stipes



Code Goby
Gobiosoma robustum

→ Overview about dominating species:



Pink Shrimp
Farfantepenaeus duorarum



Blue Crab
Callinectes sapidus



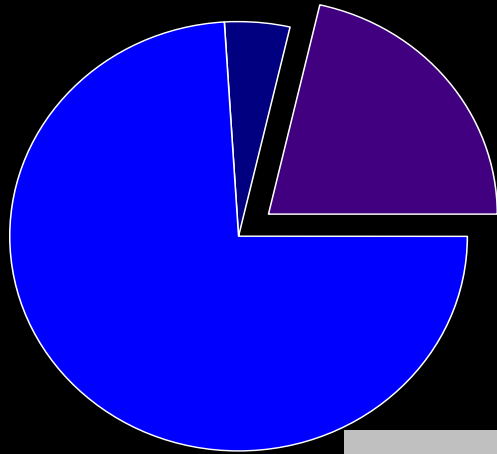
Hermit Crab



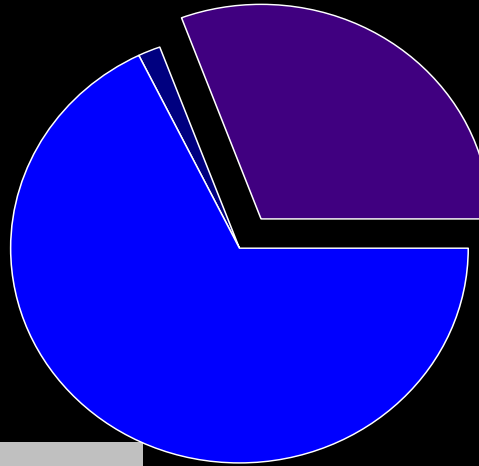
Caridean Shrimp

→ Overview about Total number (%) of each Taxa in each collection:

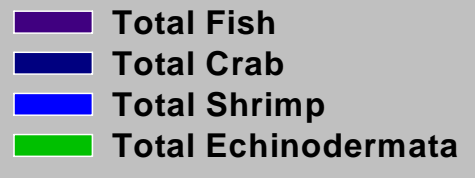
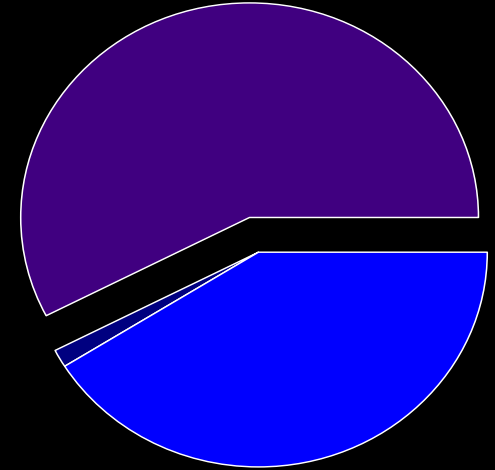
Dry 2005



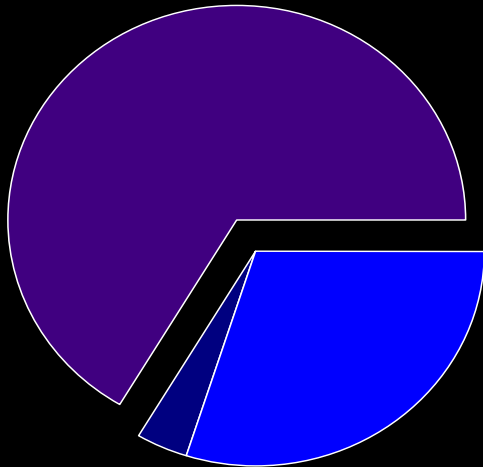
Dry 2006



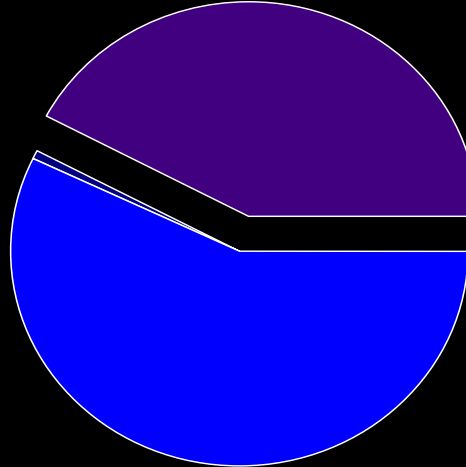
Dry 2007



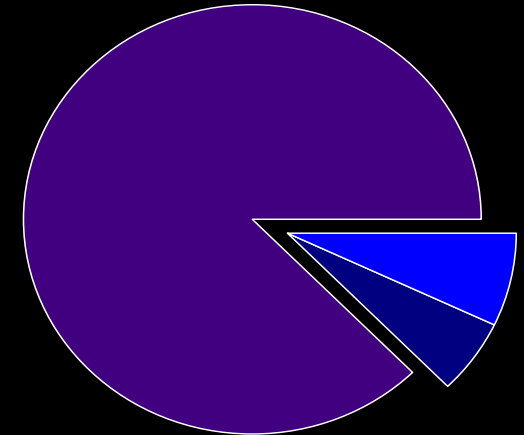
Wet 2005



Wet 2006



Wet 2007

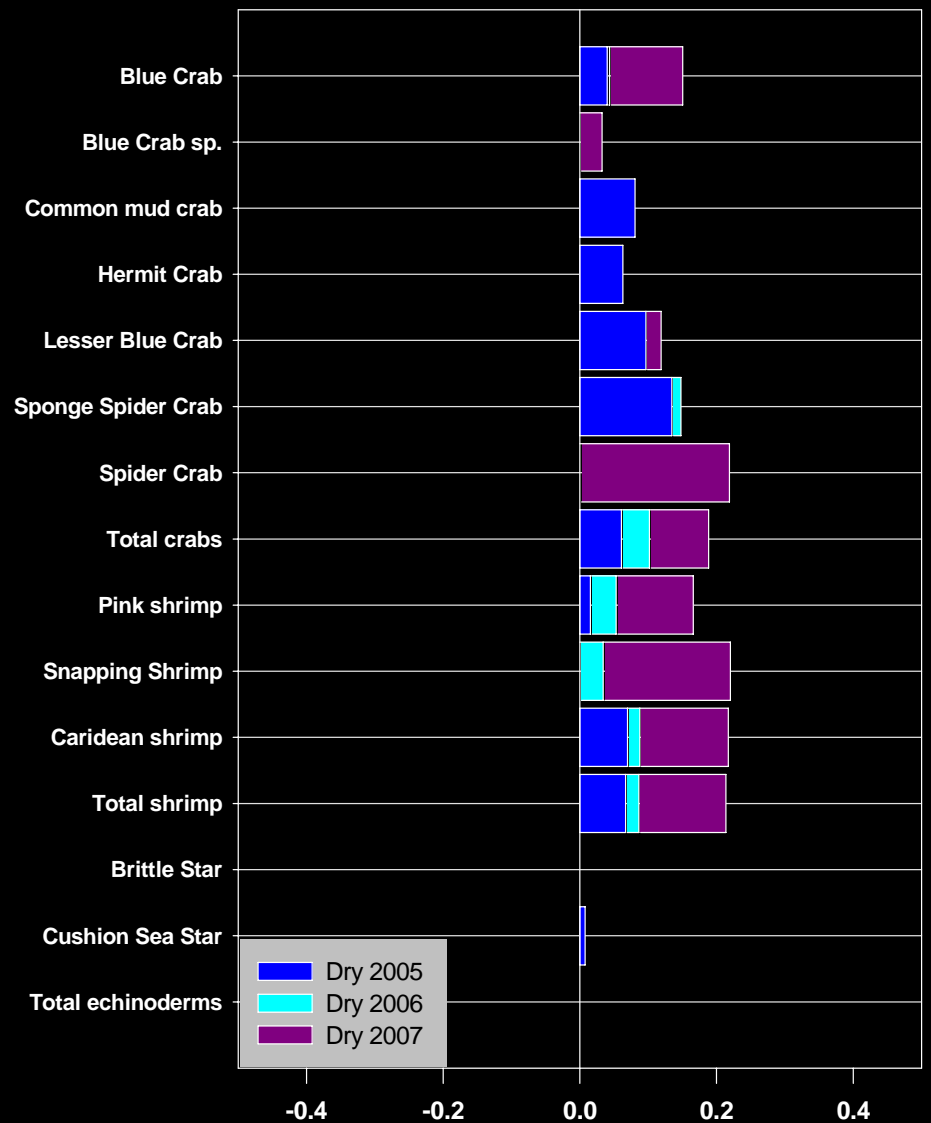
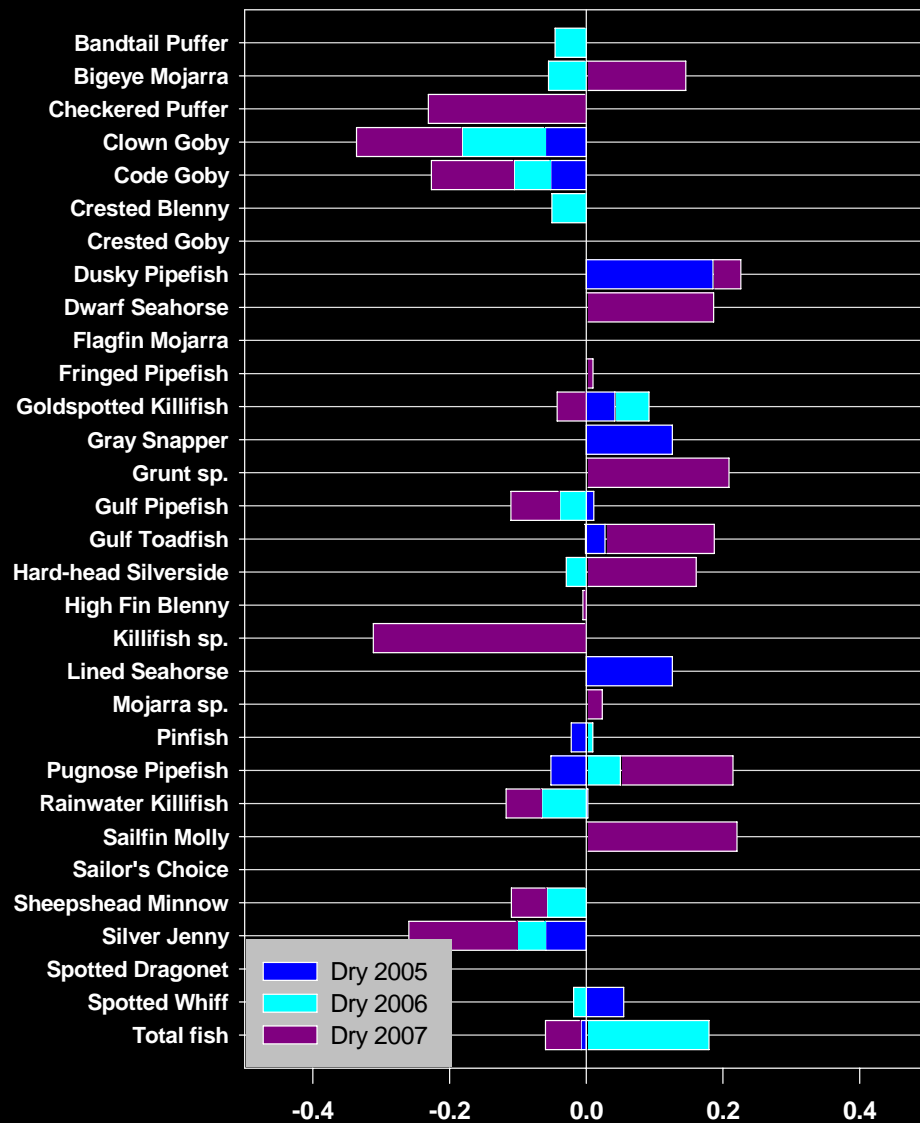


» Focus: species composition in relation to salinity

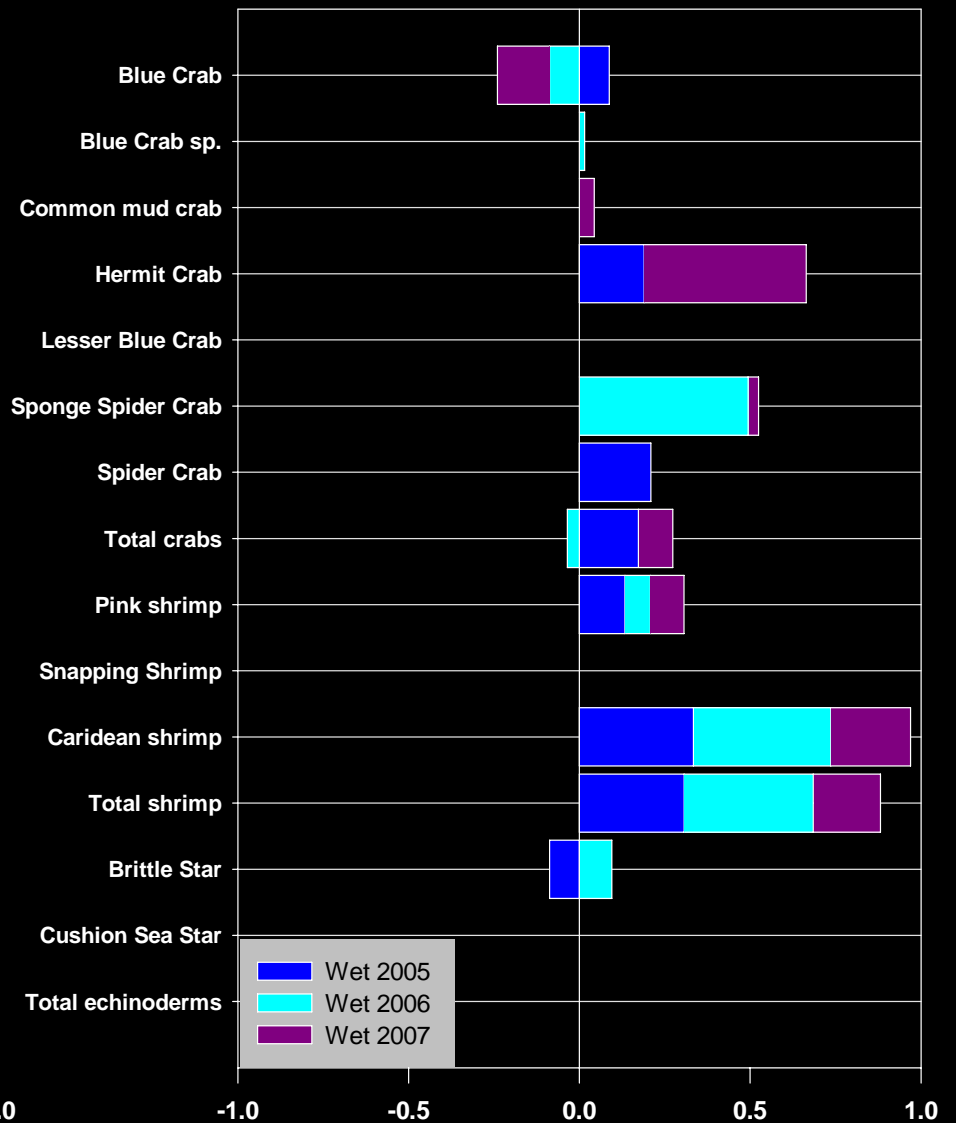
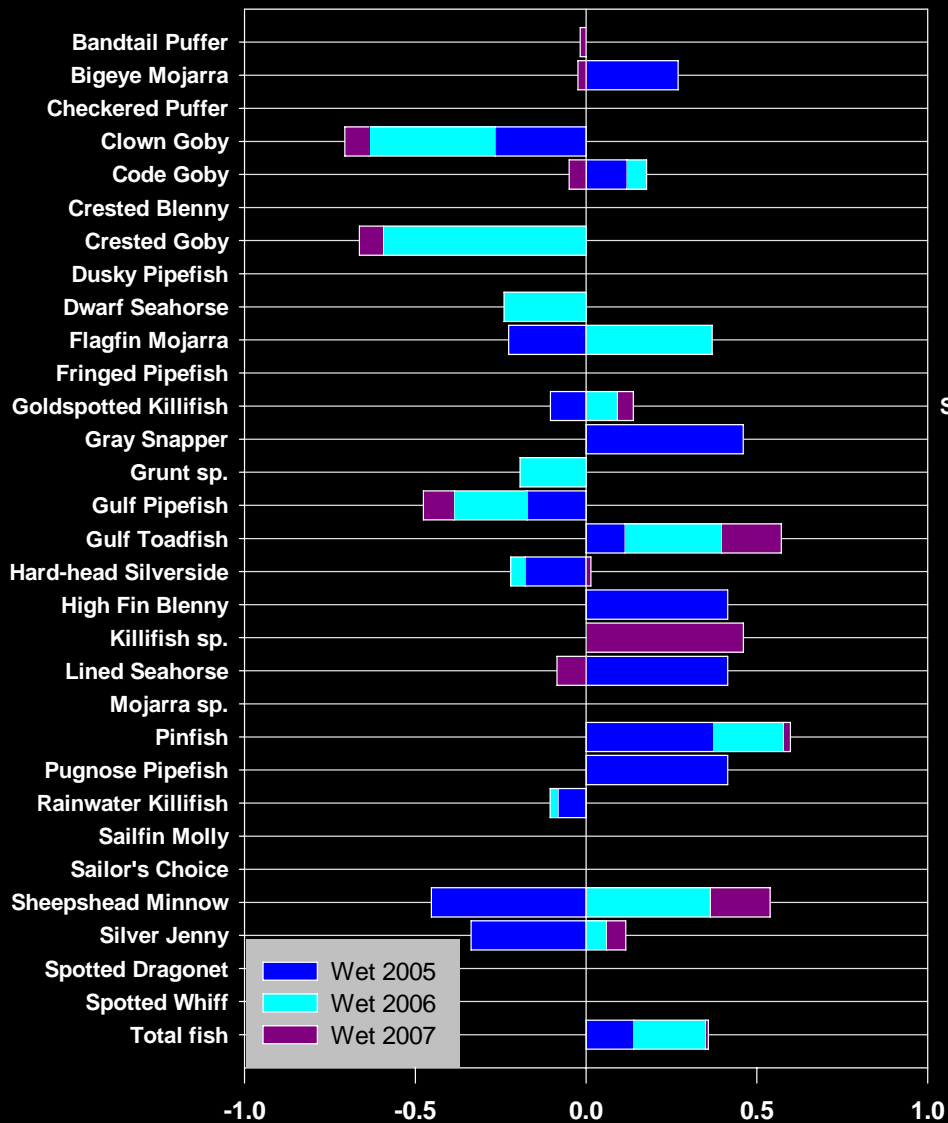
- Density-weighted salinity of individual species
- Site distance analysis – cluster analysis
- Species halo-habitat groups – MDS analysis

Based on six collections—three dry season and three wet season--and 47 sampling sites

→ *Density-weighted average Salinity, by taxa, standardized by the average salinity across sites during dry season:*



→ *Density-weighted average Salinity, by taxa, standardized by the average salinity across site during wet season:*



- Site Distance Analysis -

Premises:

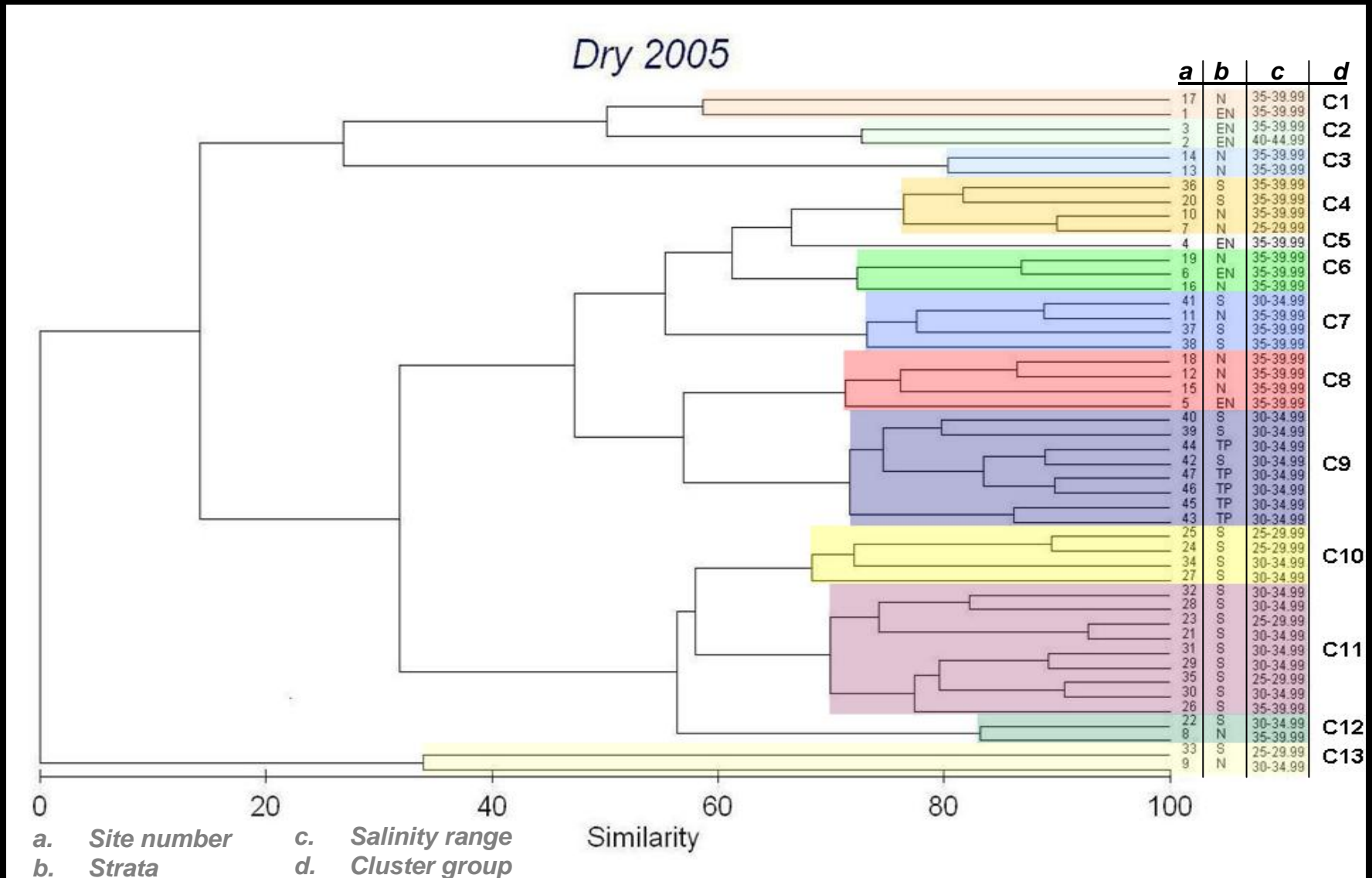
- Sites located nearest to each other geographically will have the most similar species composition.
- Interruption of the salinity pattern by freshwater inflow can interfere with this relationship.
- Changing from point-source discharge (from canals) to distributed flow across wetlands might change the relationship of inter-site distance to freshwater discharge.

Approach: Determine within-cluster pair-wise similarity of sites

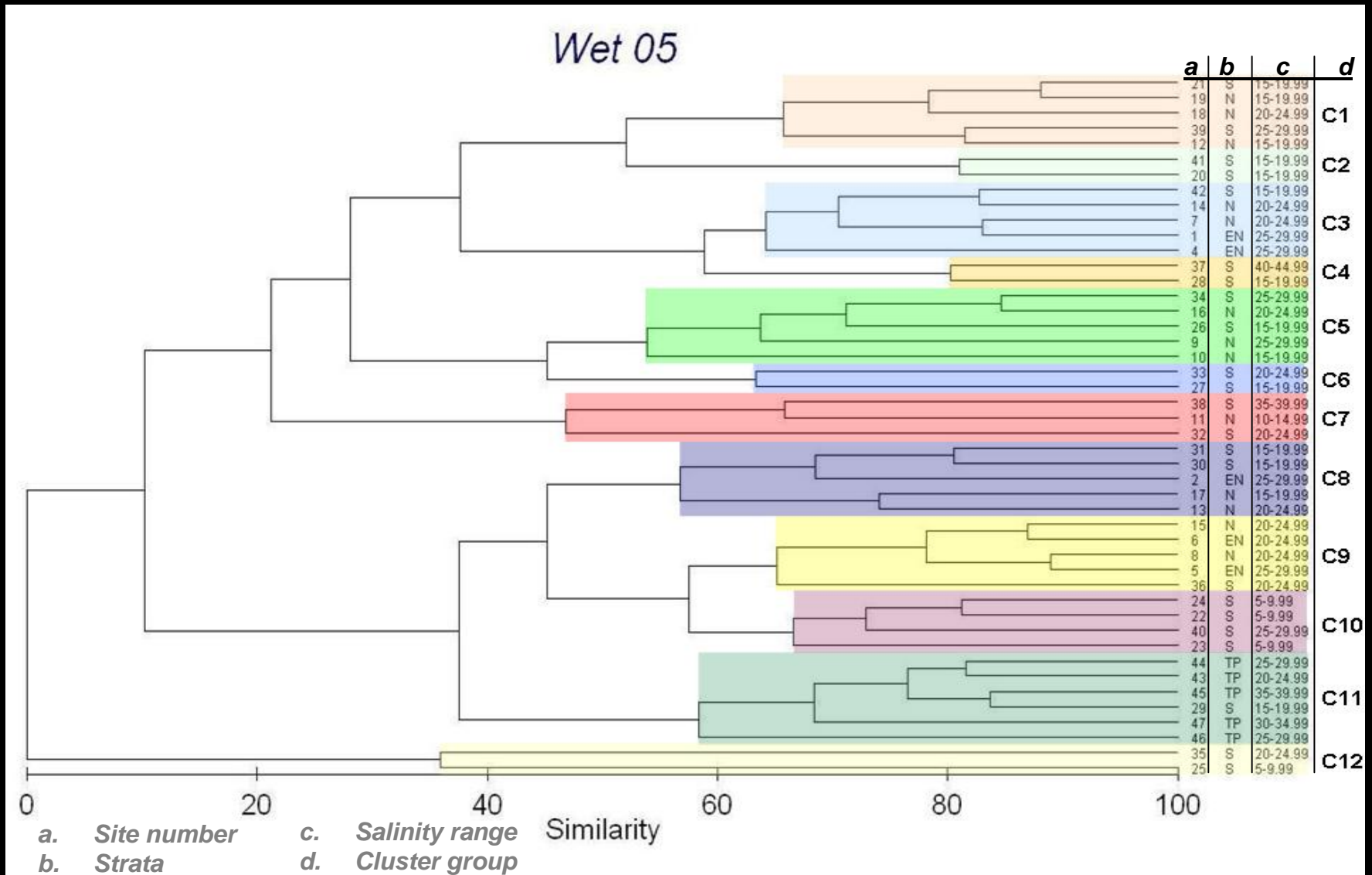
Steps:

- Identify clusters of sites based on similarity of species composition (dendrogram).
- Determine pair-wise geographic distance between sites within each cluster
- Calculate average within-cluster pair-wise distance between sites for each collection.
- Examine distance in relation to salinity (used as an index of freshwater inflow)

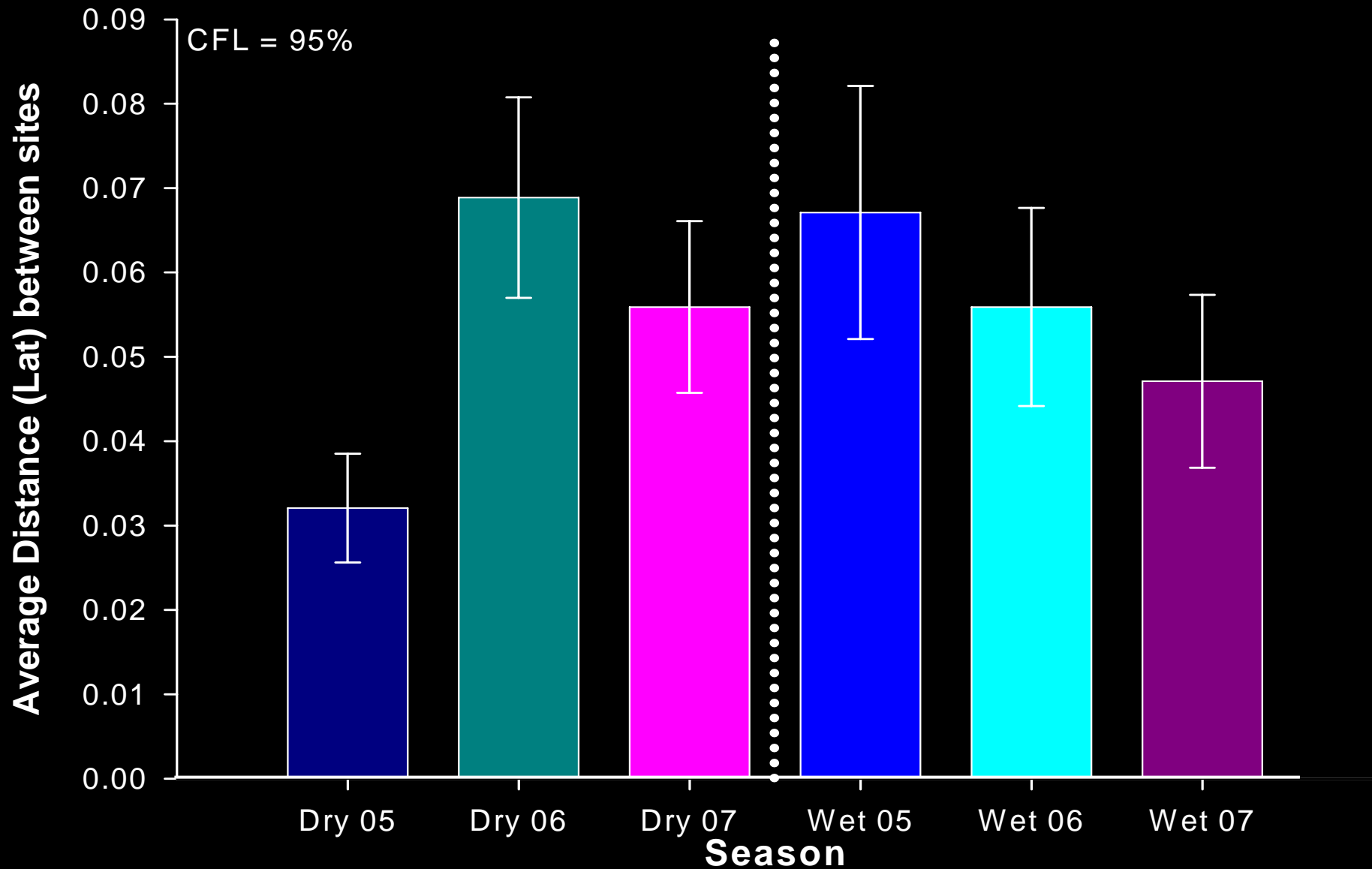
→ Example for cluster analysis results for sites (Dry Season):



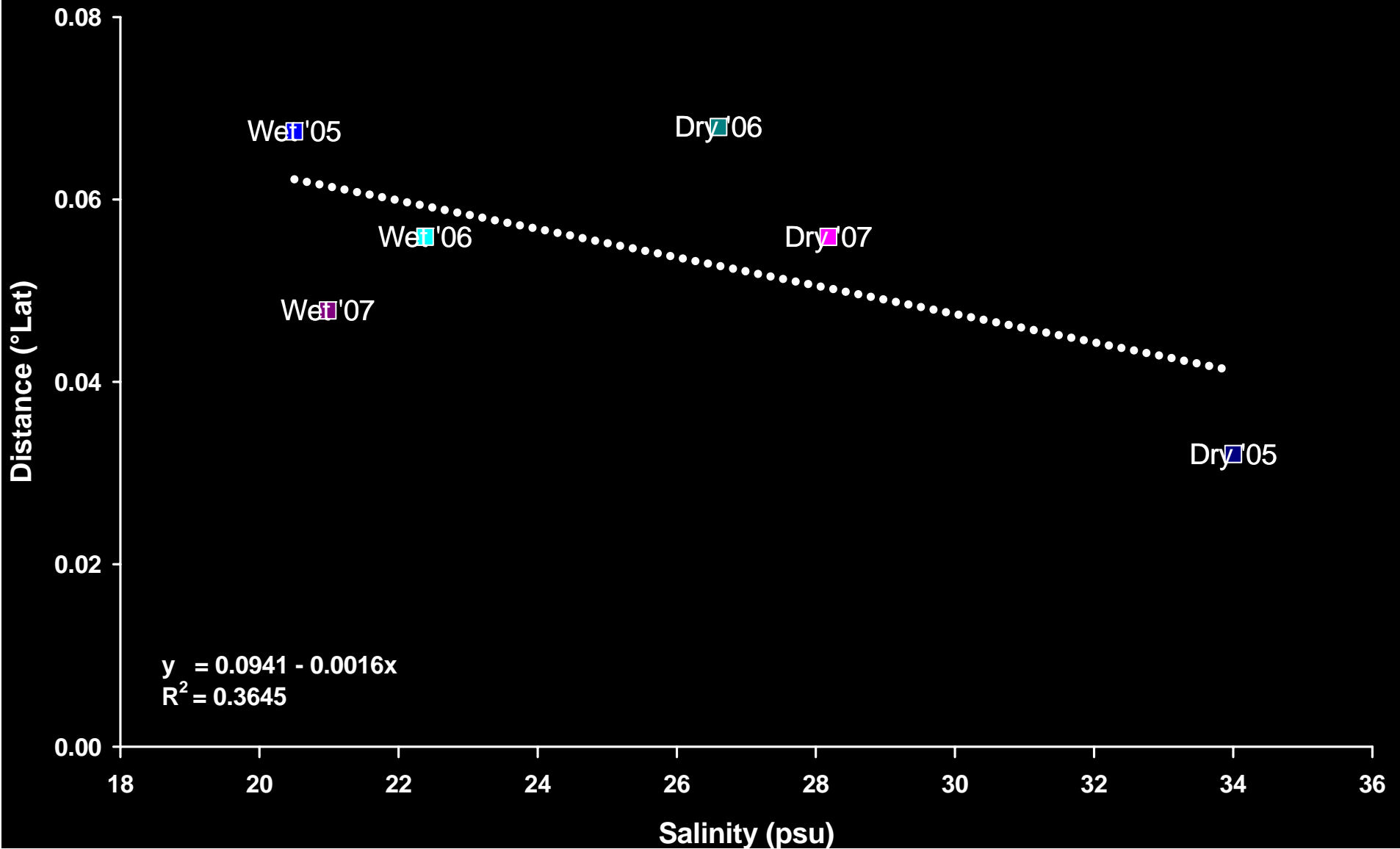
→ Example for cluster analysis results for sites (Wet Season):



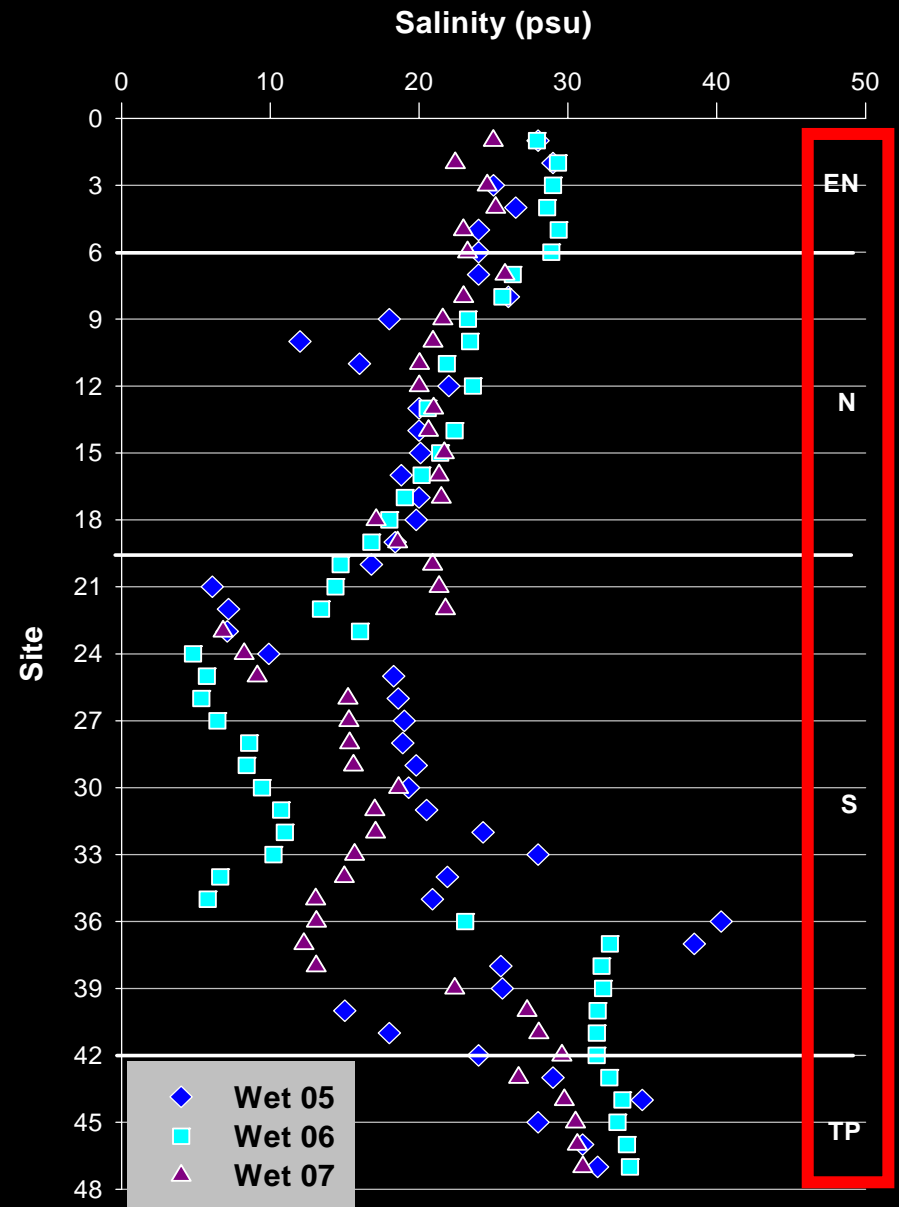
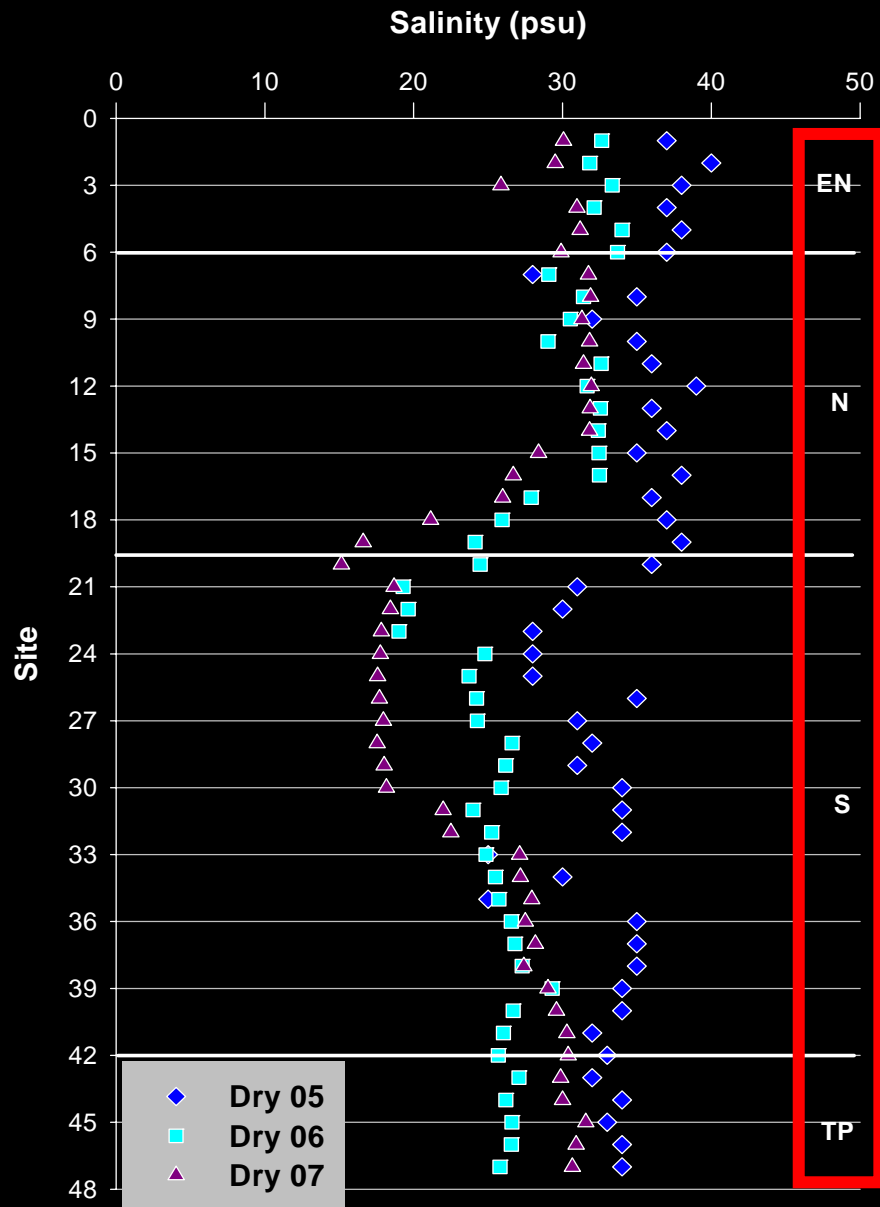
→ Average within cluster distances between site pairs ($^{\circ}$ Lat), by Collection, with 95% confidence intervals:



→ Average geographic distance vs. median measured salinity, by collection:



→ Salinity overview for each site and collection:



- SPECIES ANALYSIS -

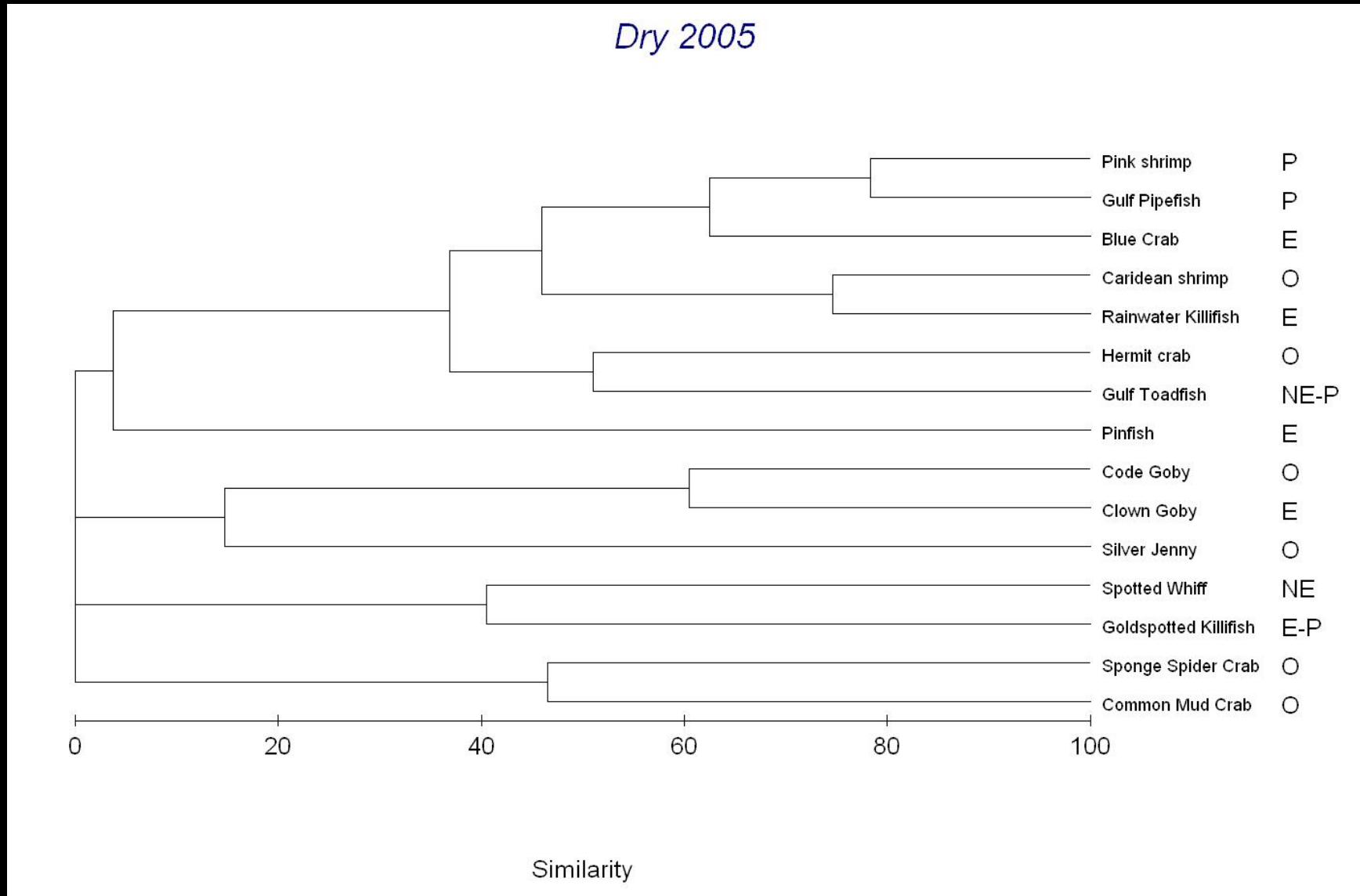
Premise:

- Species with similar “halo-habitat” would be grouped because they would have similar geographic distributions.
- MDS groups species based on geographic distributions—i.e., similar patterns of abundance across sites.

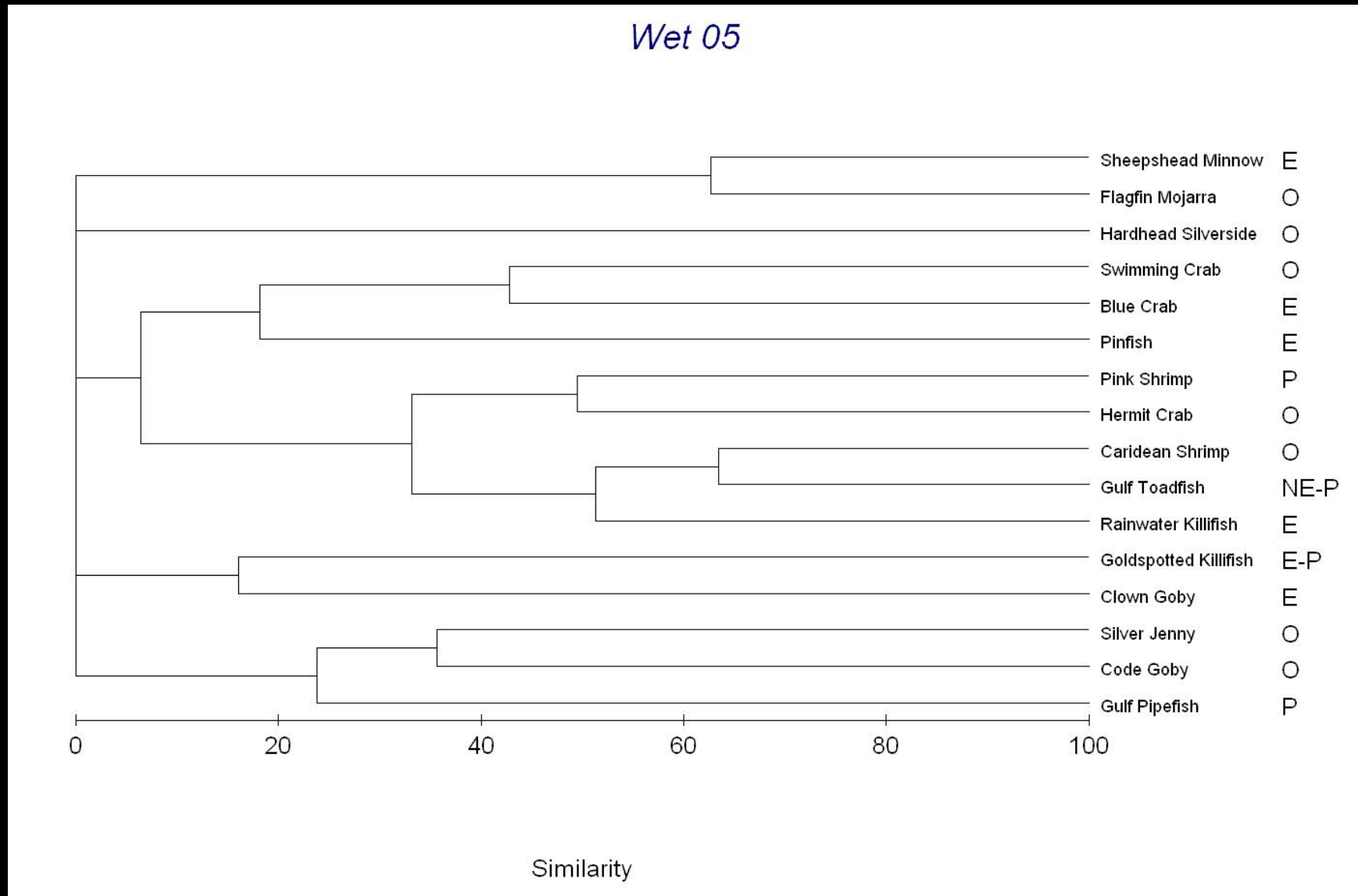
- SPECIES GROUP -

- All fish and crustacean species occurring at more than one site (in specific collection) were included
- Species were categorized based on halo-habitat as
 - estuarine (E)
 - non-estuarine (NE)
 - polyhaline (P)
 - estuarine-polyhaline (E-P)
 - non-estuarine-polyhaline (NE-P)
 - and unknown/other (O).
- MDS analysis for each of the six collections
 - 2005 wet and dry
 - 2006 wet and dry
 - 2007 wet and dry (sites 1-47)

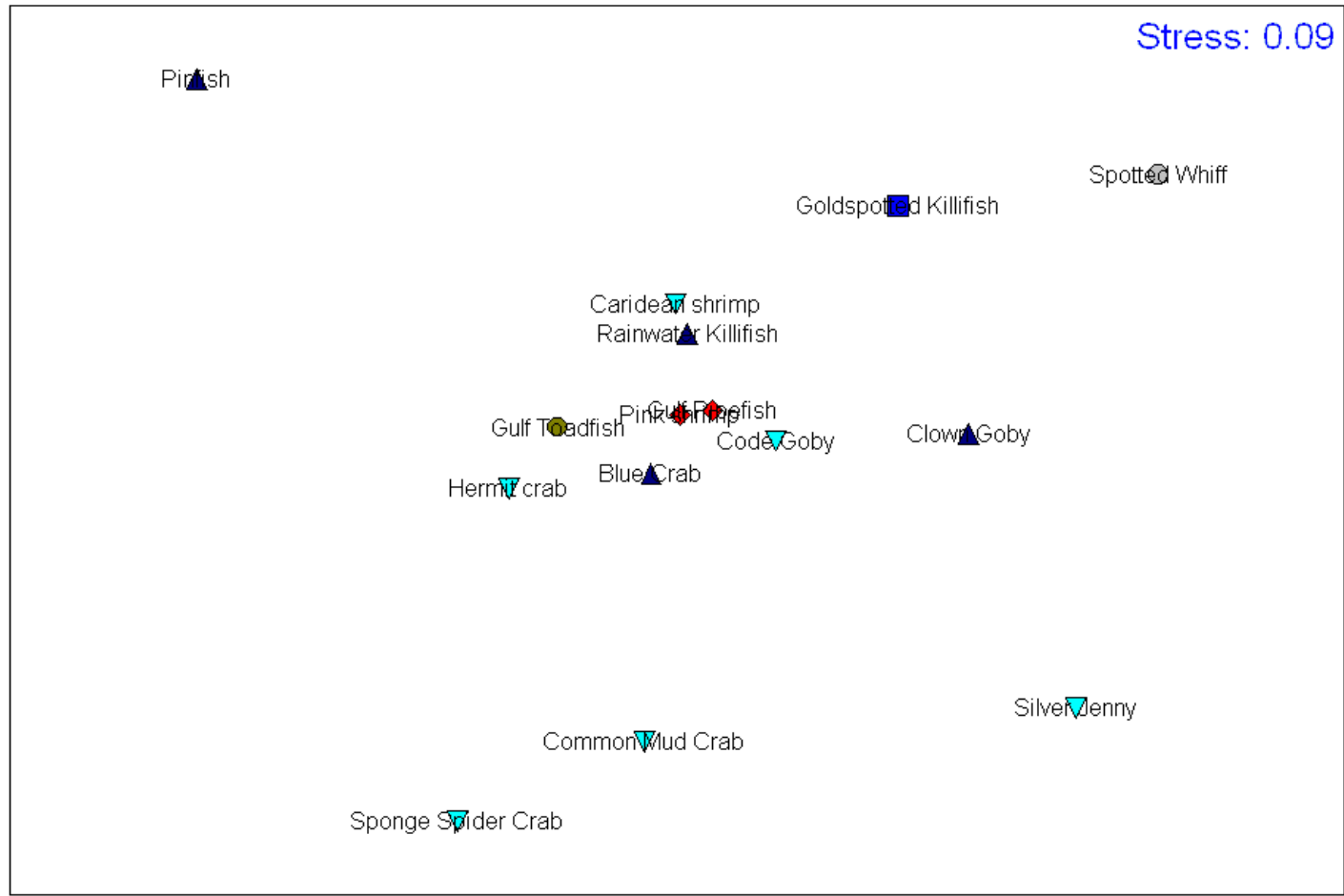
→ Example for cluster analysis results for variables (Dry Season):



→ Example for cluster analysis results for variables (Wet Season):



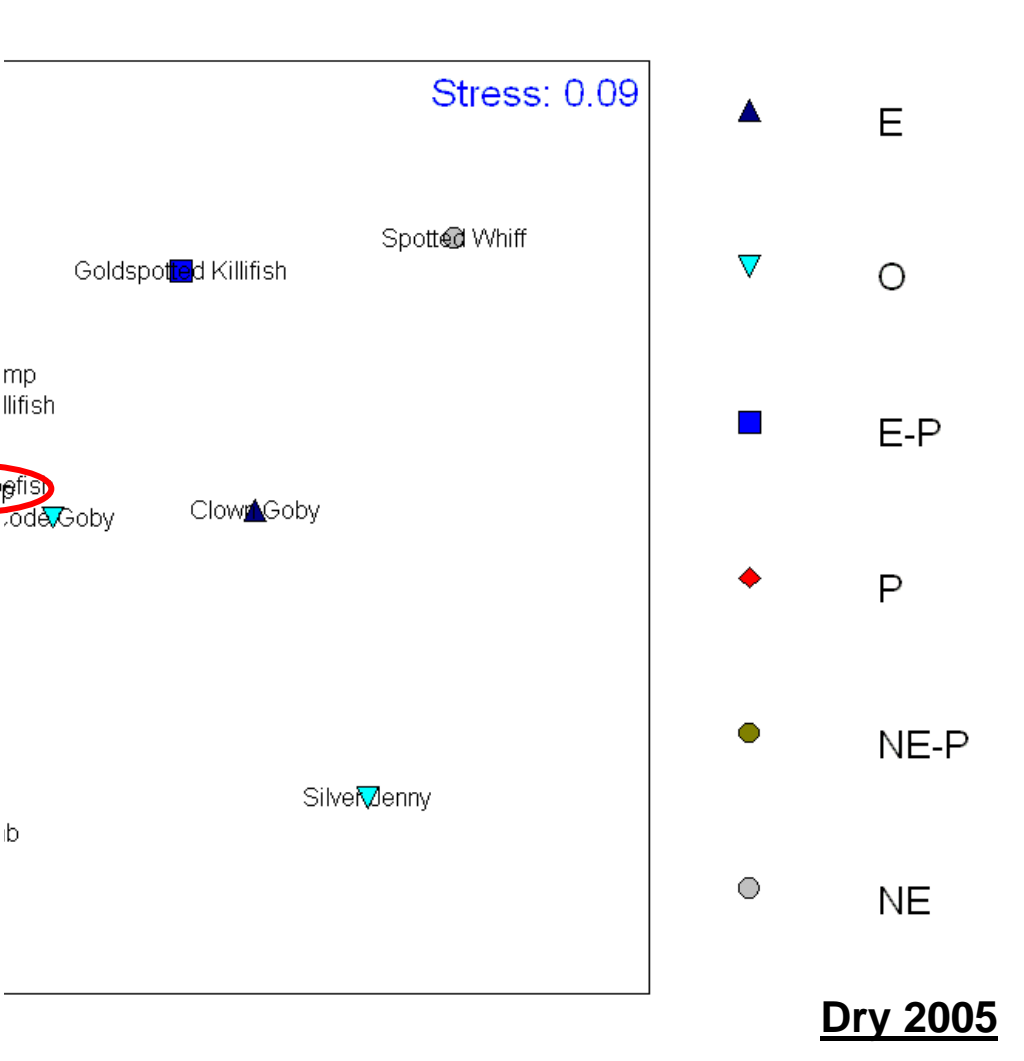
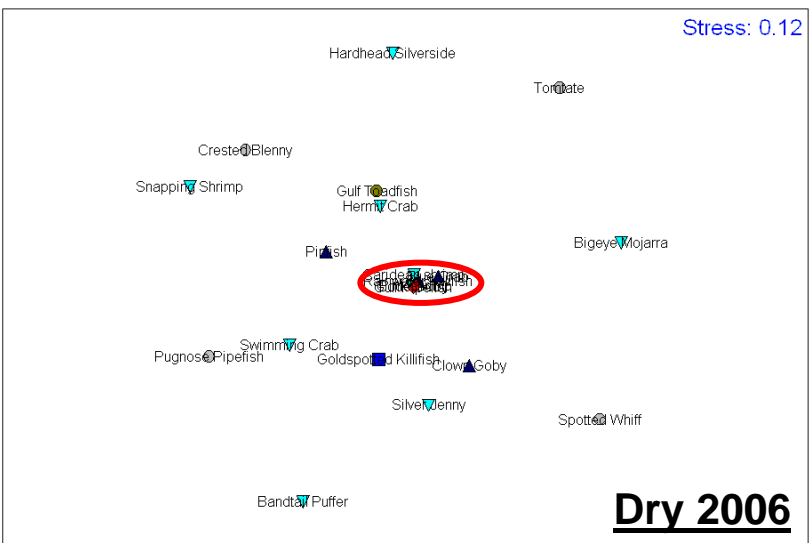
→ Example for MDS analysis results for variables (Dry Season):



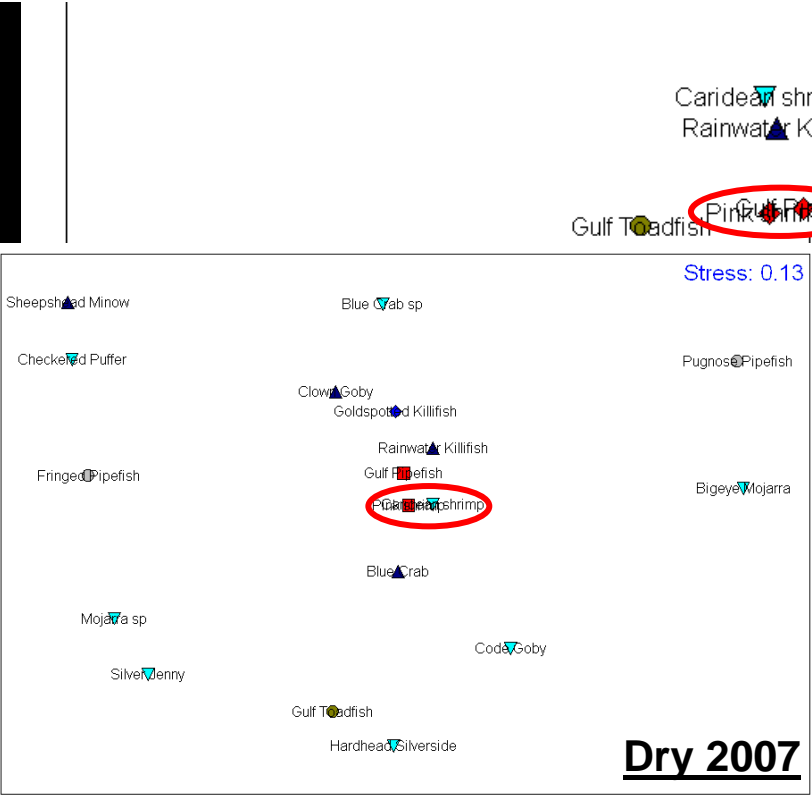
- ▲ E
- ▼ O
- E-P
- ◆ P
- NE-P
- NE

Dry 2005

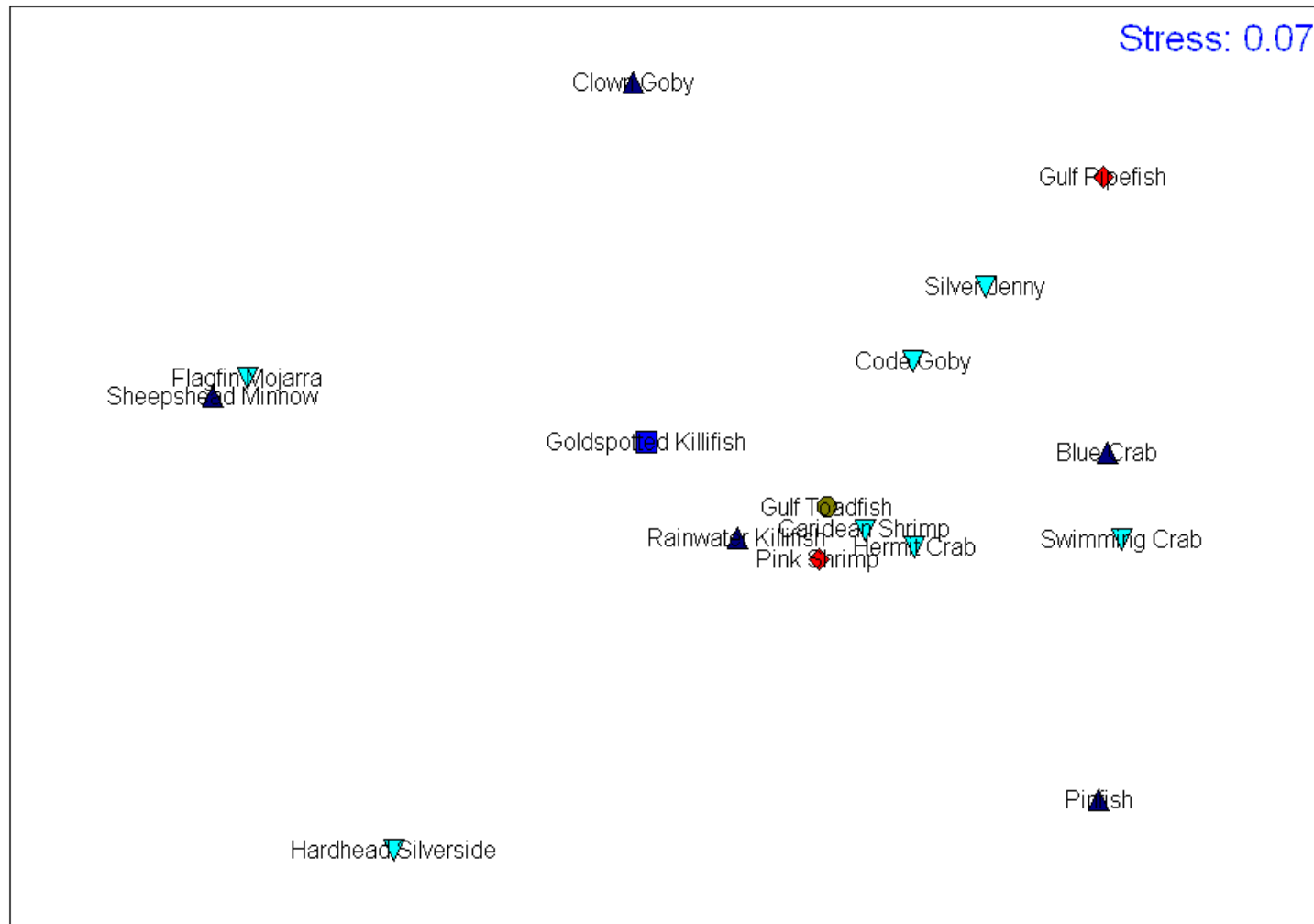
→ Example for MDS analysis results for variables (Dry Season):



- ▲ E
- ▼ O
- E-P
- ◆ P
- NE-P
- NE



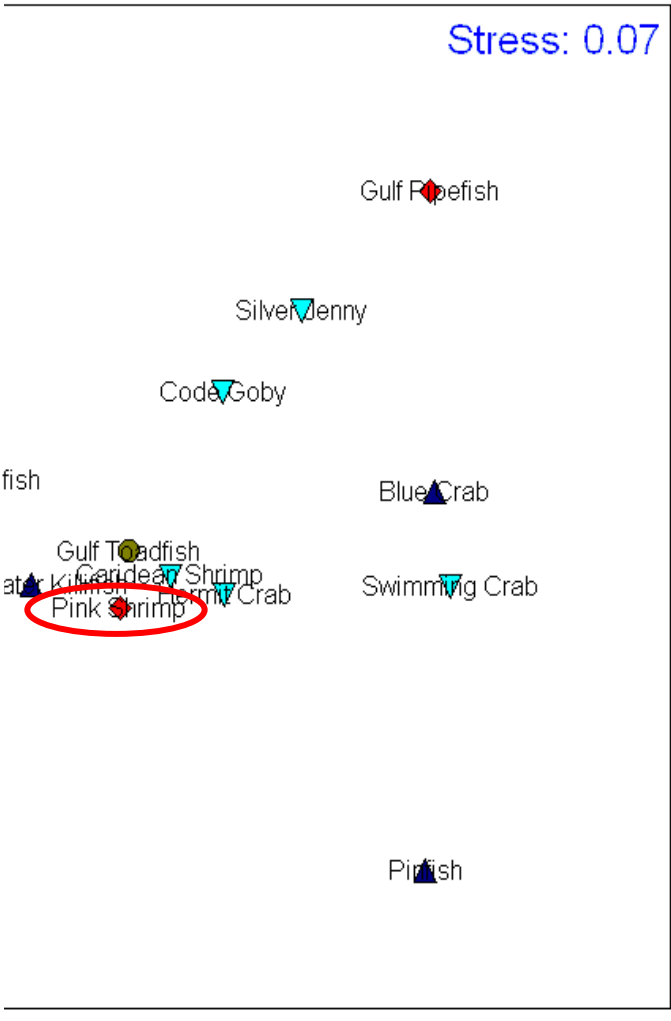
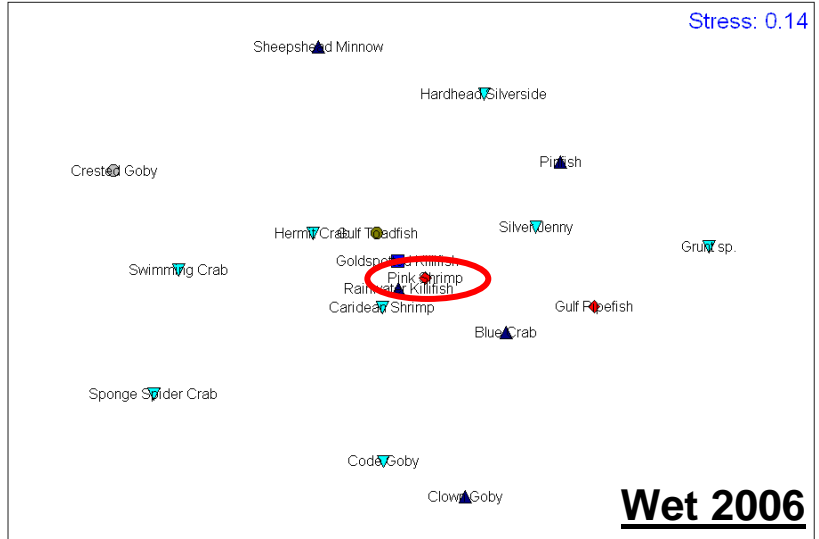
→ Example for MDS analysis results for variables (Wet Season):



- ▲ E
- ▼ O
- E-P
- ◆ P
- NE-P

Wet 2005

→ Example for MDS analysis results for variables (Wet Season):



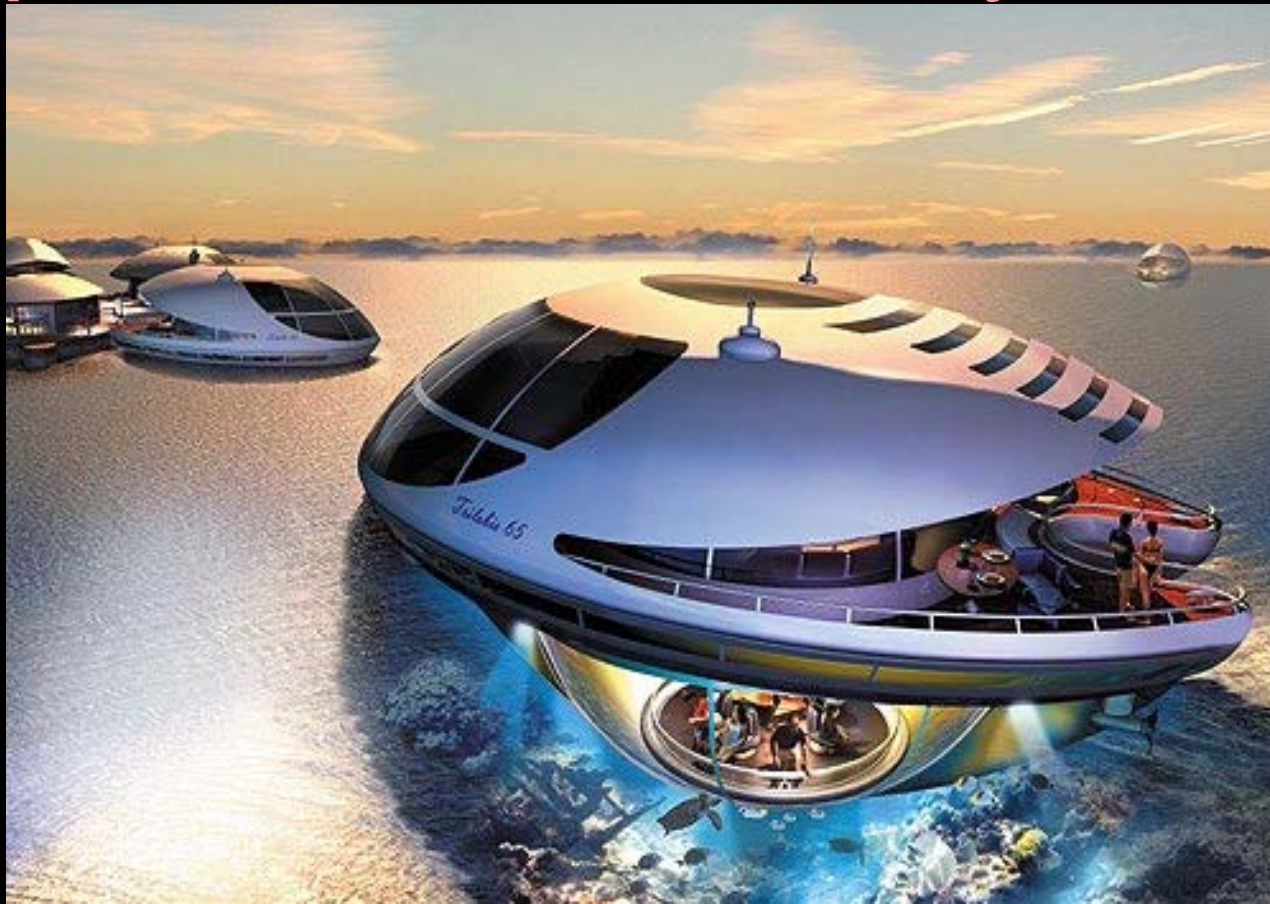
- ▲ E
- ▼ O
- E-P
- ◆ P
- NE-P

Summary of MDS Results:

Species occurring in the main cluster

<u>Species</u>	<u>Dry 2005</u>	<u>Dry 2006</u>	<u>Dry 2007</u>	<u>Wet 2005</u>	<u>Wet 2006</u>	<u>Wet 2007</u>
<u>Clown Goby</u>			X			X
<u>Code Goby</u>	X	X				X
<u>Goldspotted Killifish</u>			X		X	X
<u>Gulf Pipefish</u>	X	X	X			X
<u>Gulf Toadfish</u>	X			X	X	X
<u>Rainwater Killifish</u>	X	X	X	X	X	X
<u>Blue crab</u>	X	X				X
<u>Blue Crab sp.</u>			X			
<u>Hermit Crab</u>	X			X	X	
<u>Caridean Shrimp</u>	X	X	X	X	X	X
<u>Pink Shrimp</u>	X	X	X	X	X	X

Epifaunal Community: Future



Building the Universe: List of Potential Estuarine Species to Populate a Restored Nearshore

- Based on selected papers and reports
 - Grant Gilmore's (1996) dominant species of marginal tidal wetlands and oligohaline zone
 - Lorenz and Serafy's 2006 species classified as found in oligohaline, mesohaline, and polyhaline waters
 - Browder et al.'s 1986 and 1988 species list's (combined) from trawl collections and ichthyoplankton tows in Faka Union, Fakahatchee, and Pumpkin bays and associated passes
 - Ley et al. 1999
- With help in classification to "halo-habitat" from FISHBASE.ORG ("environmental habitat")

Analysis Results

- Species occurring along the shoreline are found, on average, both below and above the average salinity across sites.
- Pink shrimp is distributed along the Biscayne Bay shoreline similarly to many other species, supporting its designated role of an indicator species.
- Average within-cluster pair-wise salinity is roughly correlated with average salinity across sites—supporting the hypothesis that point-source freshwater inflow interrupts the similarity of species composition at nearby sites—and providing a potential indicator of ecological change with changed freshwater inflow.

Prediction

- At least 51 species—many that probably could be captured in the throw trap—represent a universe of species that could eventually be found along the shoreline of Biscayne Bay—if a suitable salinity regime were established.

Acknowledgments

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