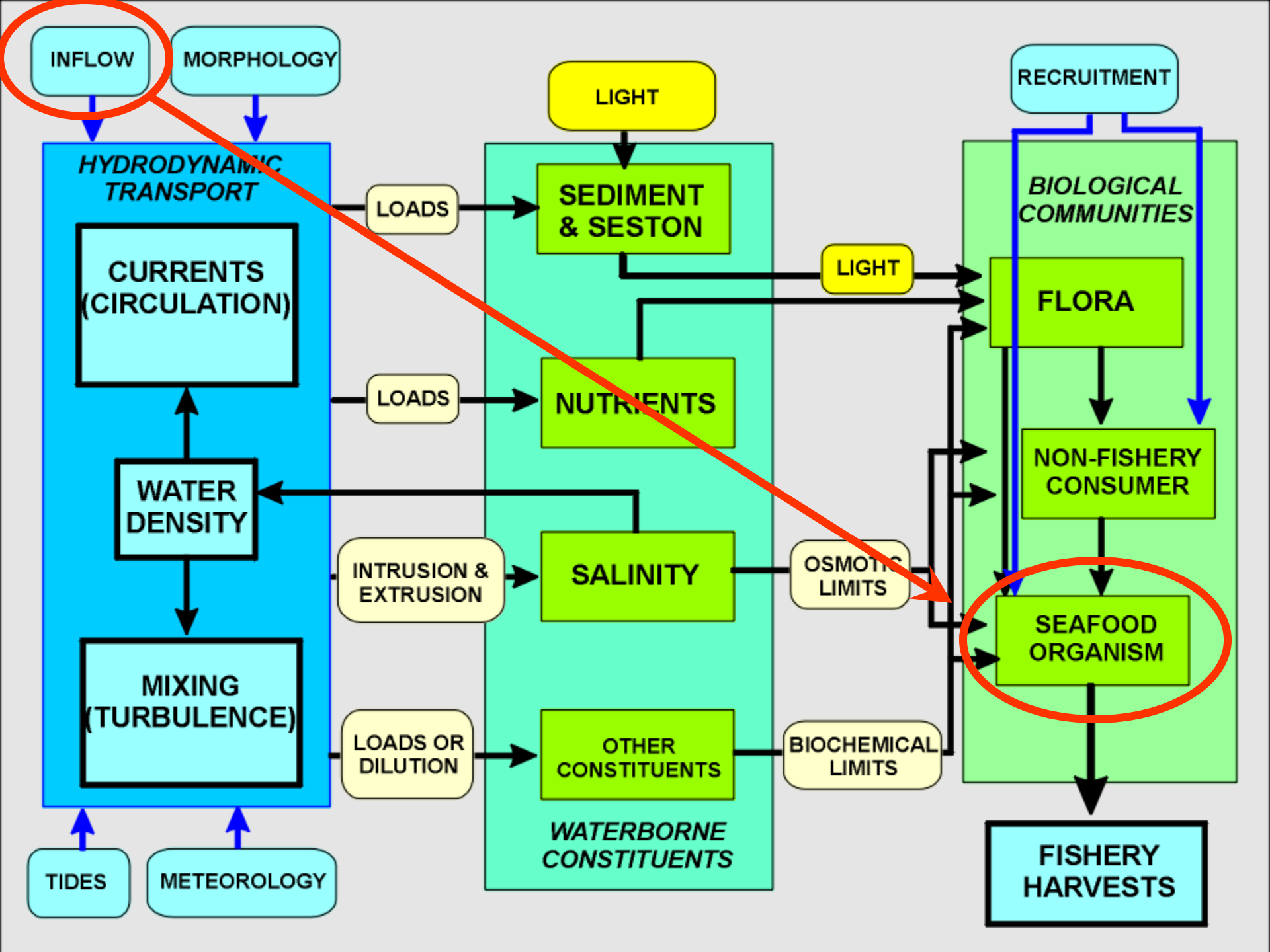
How Much Does the Color Blue Weigh?

Trinity / San Jacinto
BBEST Workgroup
13 AUG 09

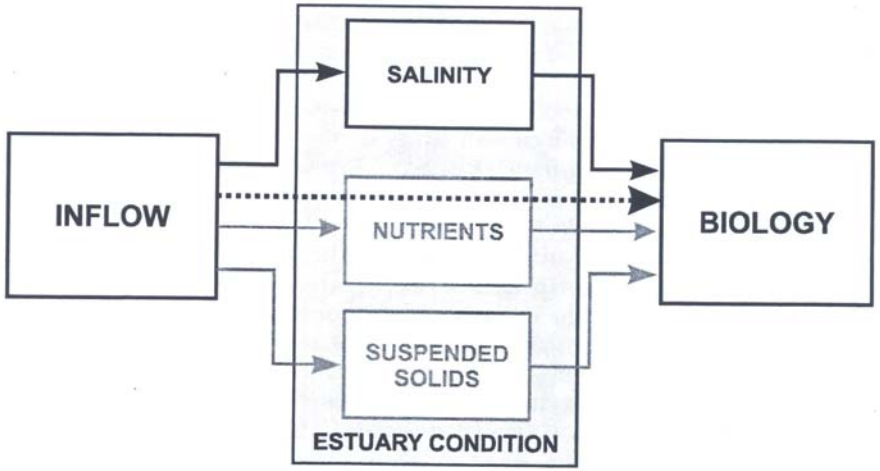
Jim Tolan

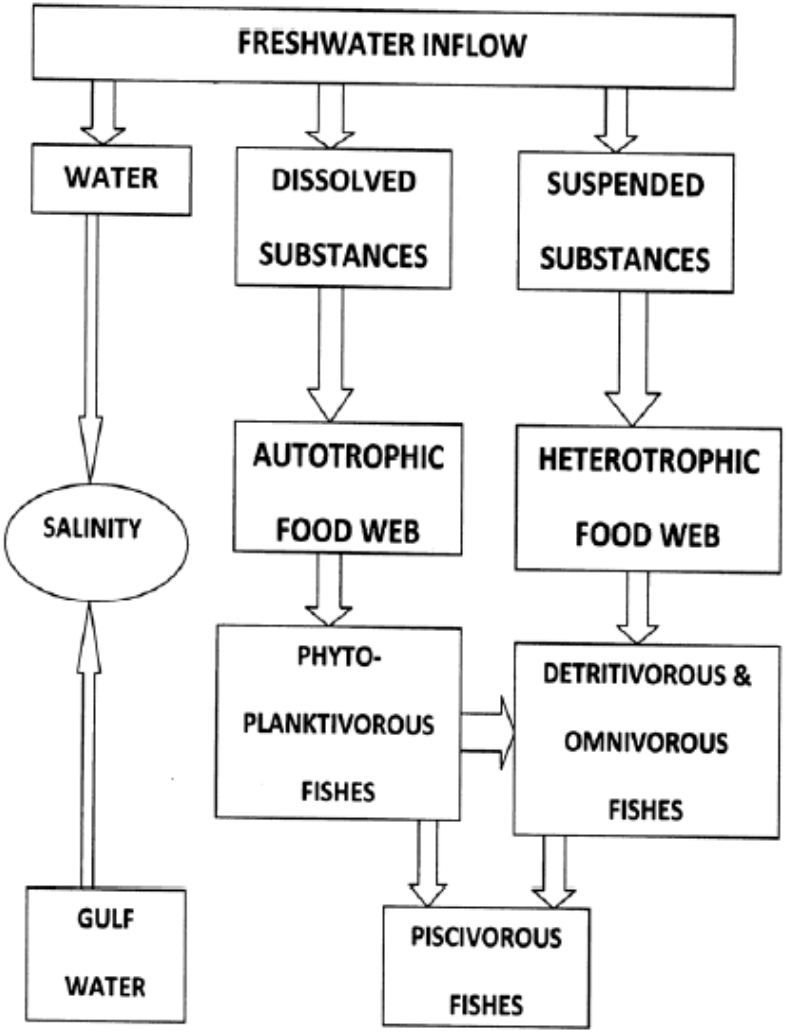
Overview

- Conceptual Model of the Ecosystem
  - Species – Inflow Relationships
- Community Analysis
  - Functional role of FWI
- Examples Showing Frequency Mis-Match
  - Difficulties in relating the two variables
- Management Scale – Temporal & Spatial

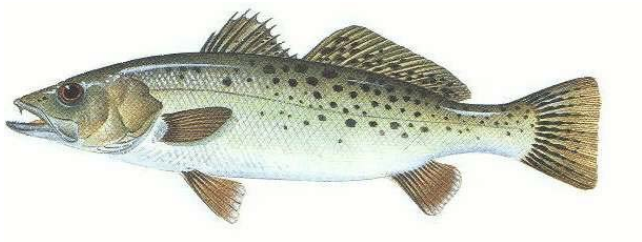

INFLOW
MORPHOLOGY
HYDRODYNAMIC TRANSPORT
CURRENTS (CIRCULATION)
WATER DENSITY
MIXING (TURBULENCE)
TIDES
METEOROLOGY
LOADS
LOADS
INTRUSION & EXTRUSION
LOADS OR DILUTION
LIGHT
SEDIMENT & SESTON
NUTRIENTS
SALINITY
OTHER CONSTITUENTS
WATERBORNE CONSTITUENTS
LIGHT
OSMOTIC LIMITS
BIOCHEMICAL LIMITS
RECRUITMENT
BIOLOGICAL COMMUNITIES
FLORA
NON-FISHERY CONSUMER
SEAFOOD ORGANISM
FISHERY HARVESTS

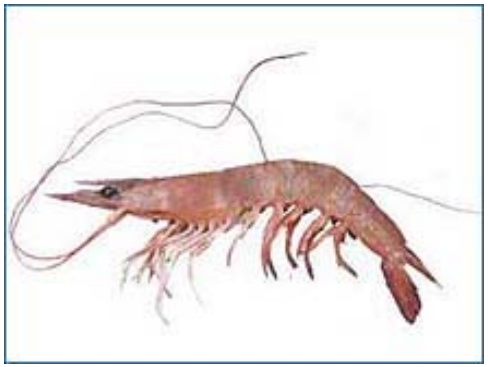
Other versions of the ecosystem model

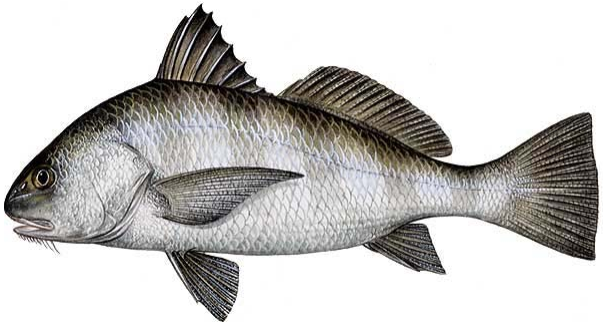


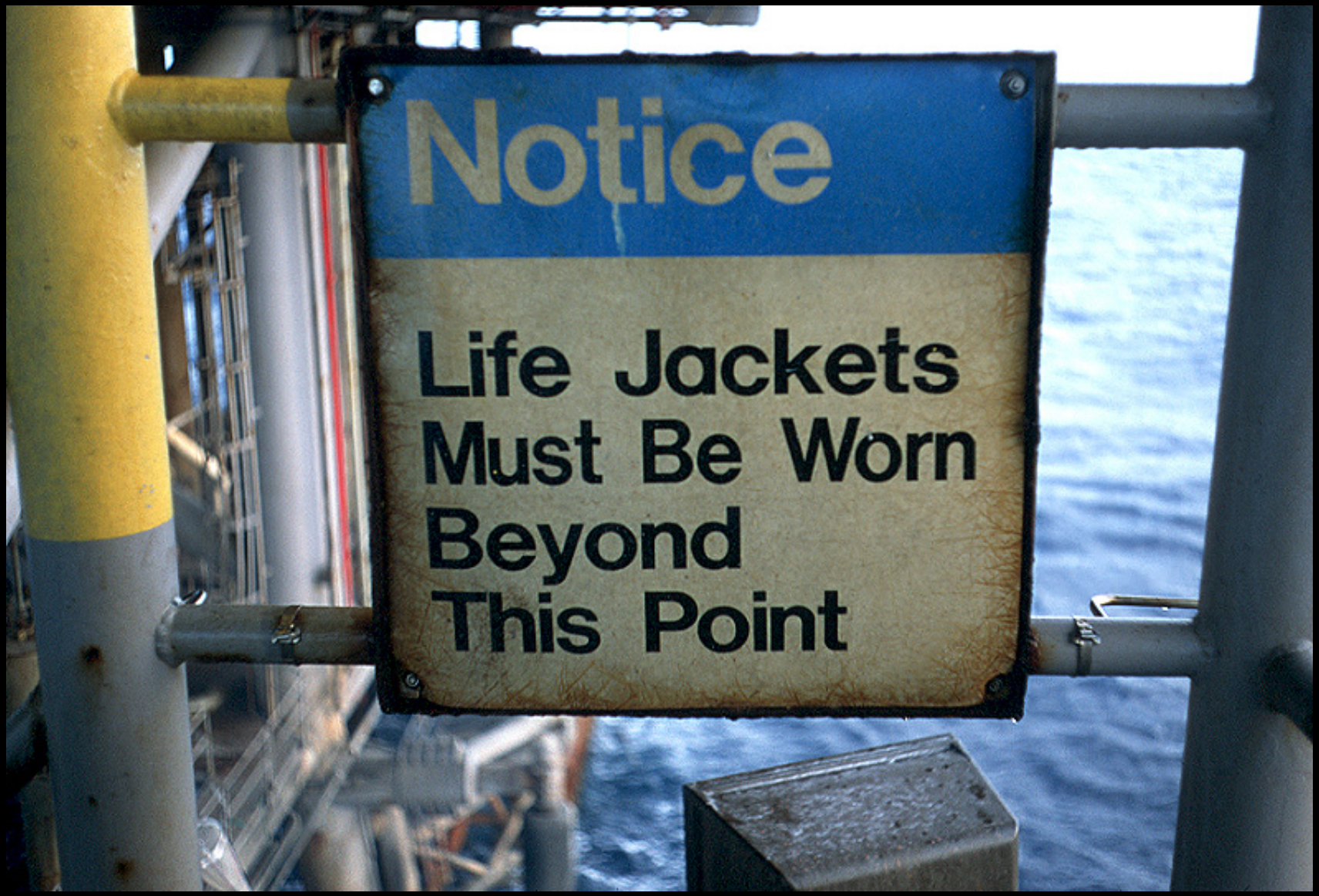


Freshwater Inflows Analysis





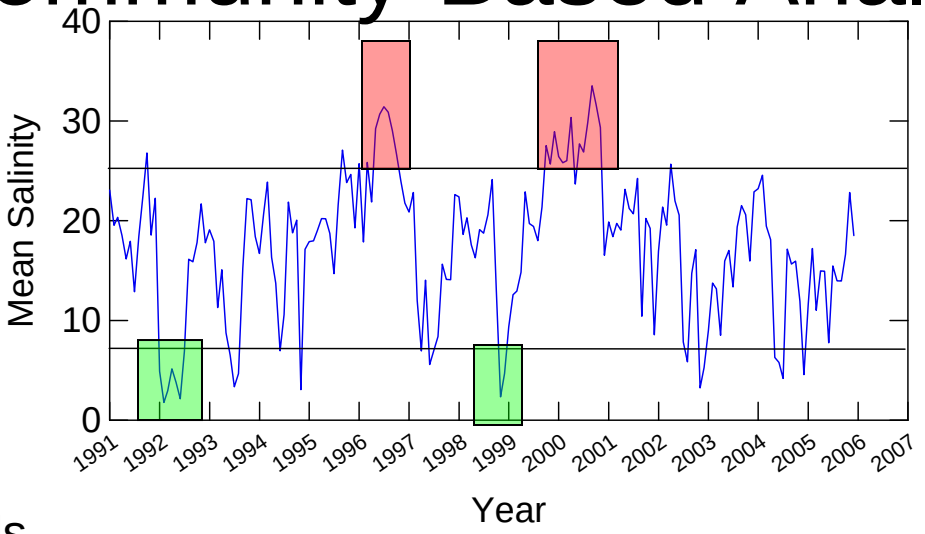



Notice
Life Jackets
Must Be Worn
Beyond
This Point

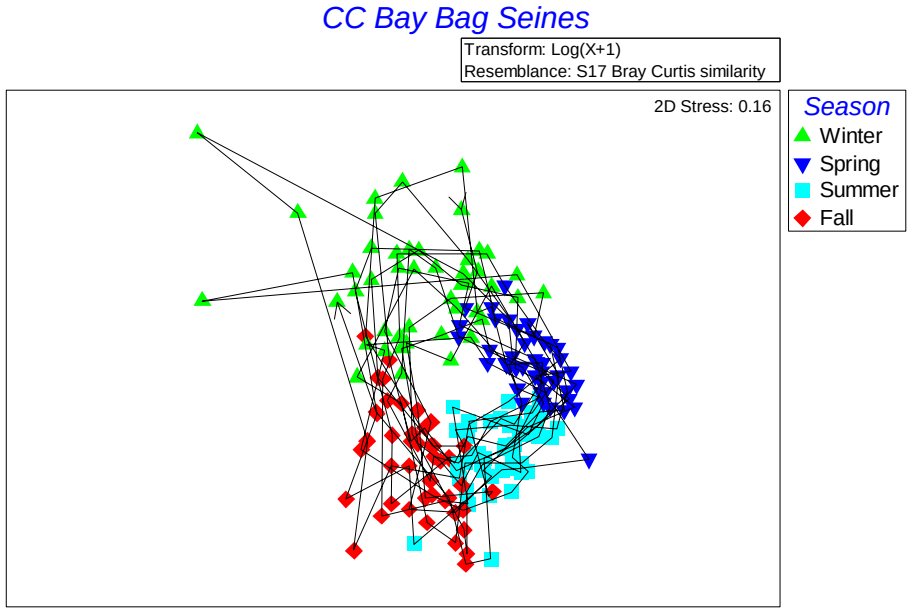
Methods

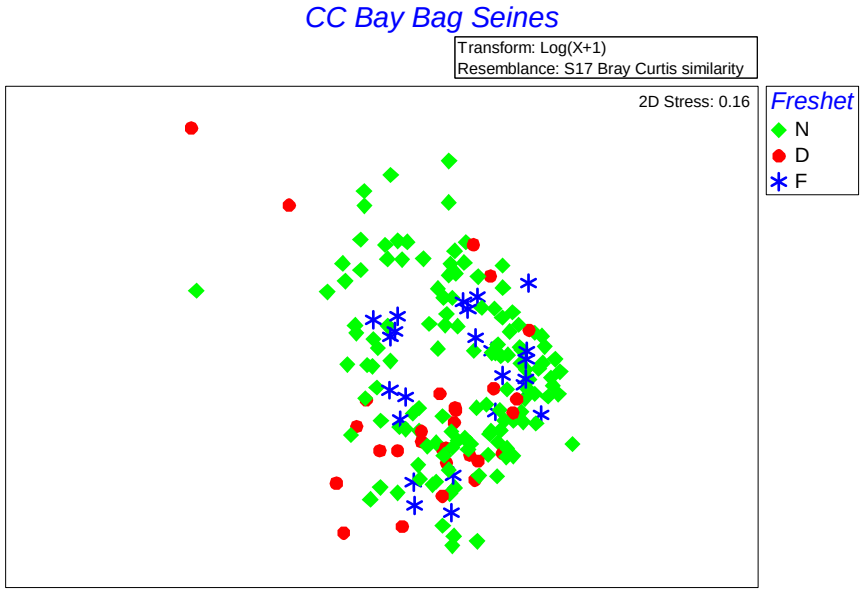
- Sum all Bag Seine Collections (20) and Use as a Time Series (n = 180 months)
- Average all Environmental Measurements
- Factors include Month, Season, Year, Freshet Condition
  - Derived as Drought (>85th percentile), Flood (<15th percentile), and Normal Flow

Community-Based Analysis

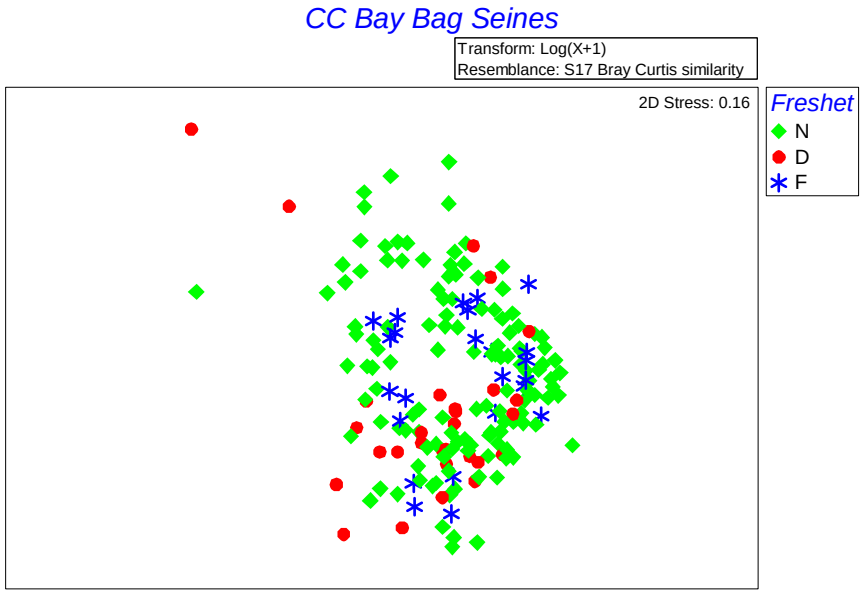


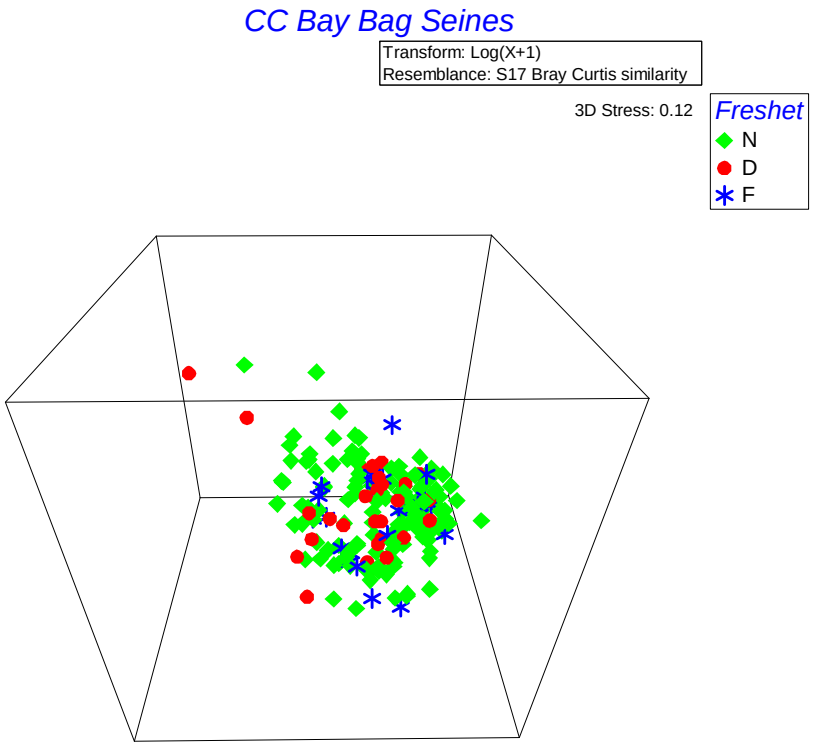
1992 - 2006
177 Taxa
392,363 Individuals





FWI Signal on the Biota





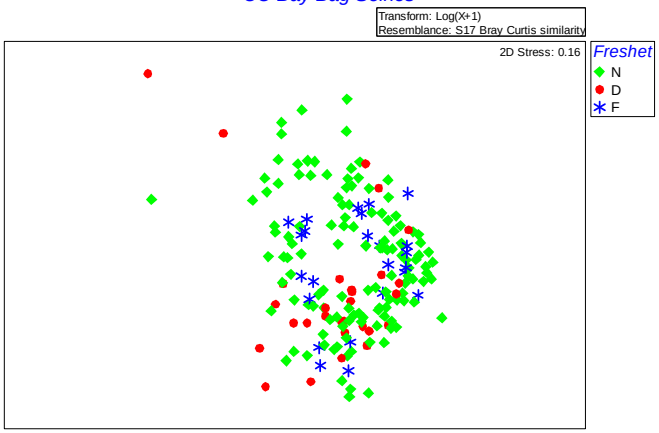
Global Test
Sample statistic **(Global R): 0.005**
Significance level of sample statistic: **0.442**
Number of permutations: 999 (Random sample from a large number)
Number of permuted statistics greater than or equal to Global R: 441

Pairwise Tests

Groups	R Statistic	Significance Level	Possible Permutations	Actual Permutations	Number >= Observed
N, D	0.067	0.096	Very large	999	95
N, F	-0.085	0.977	Very large	999	976
D, F	0.149	0.002	Very large	999	1

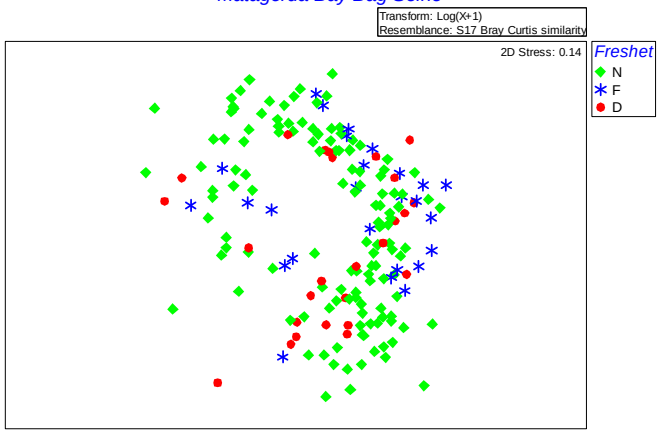
Community Structure

CC Bay Bag Seines



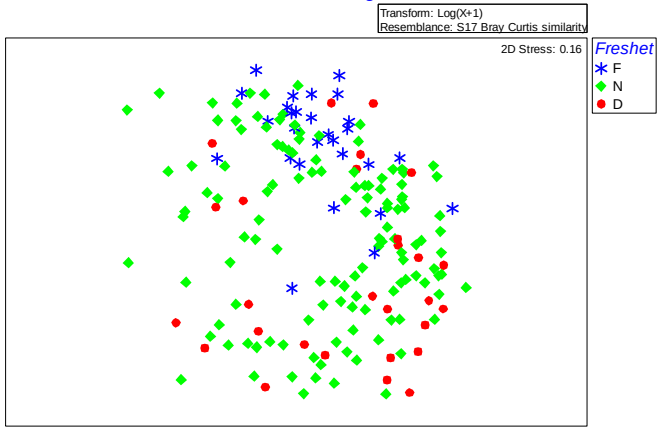
Global R = 0.005 *p* = 0.442

Matagorda Bay Bag Seine



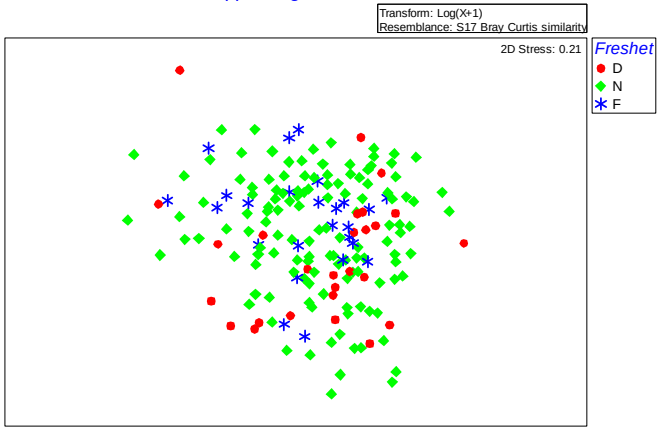
Global R = -0.01 *p* = 0.654

Sabine Lake Bag Seine



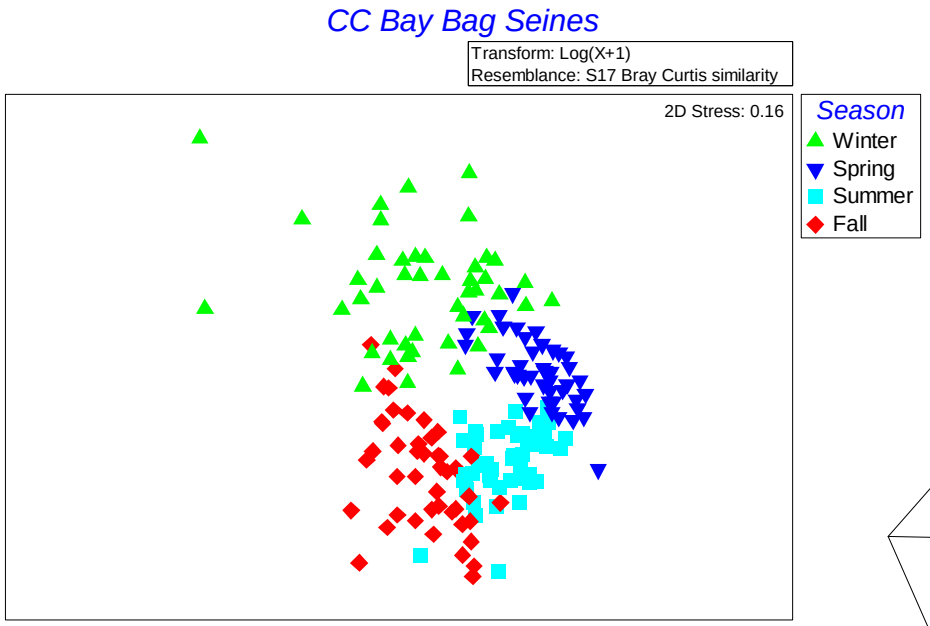
Global R = 0.089 *p* = 0.003
(F vs D : R = 0.520 *p* = 0.001)

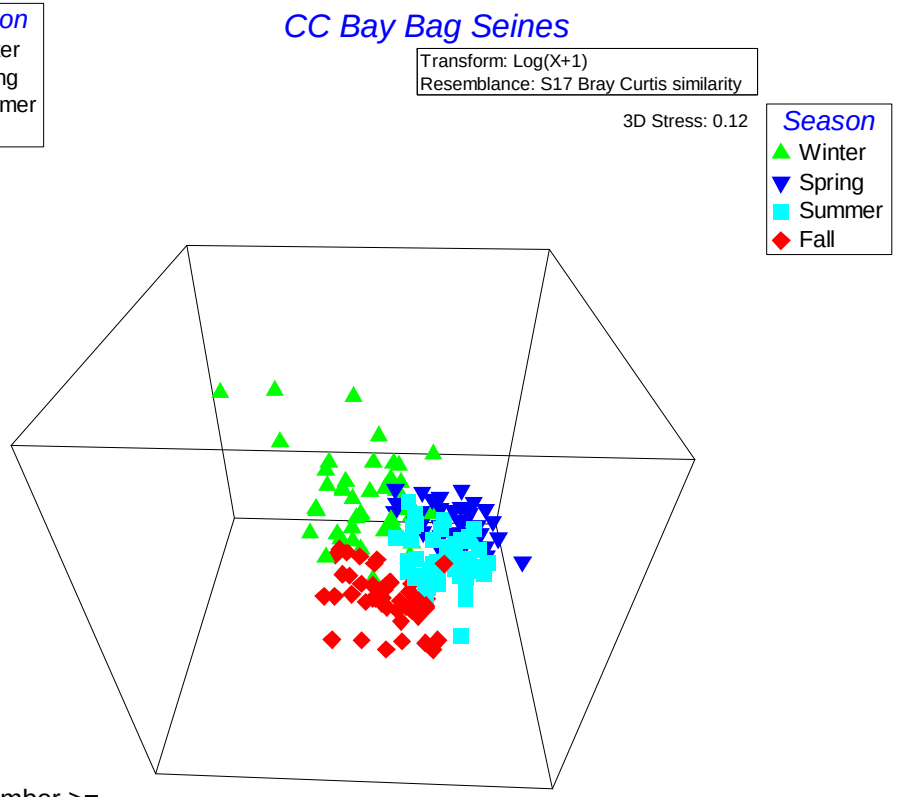
Upper Laguna Madre Catch



Global R = 0.031 *p* = 0.215

Seasonal Signal on the Biota





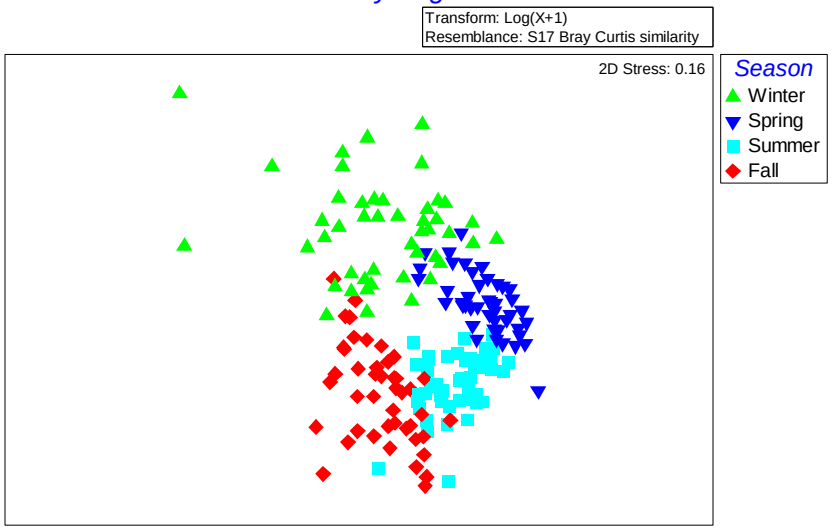
Global Test
Sample statistic **(Global R): 0.647**
Significance level of sample statistic: **0.001**
Number of permutations: 999 (Random sample from a large number)
Number of permuted statistics greater than or equal to Global R: 0

Pairwise Tests

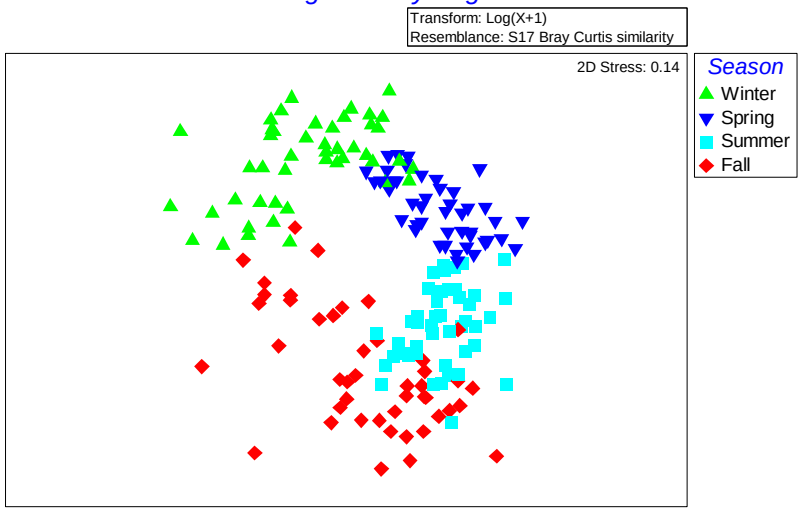
Groups	R Statistic	Significance Level	Possible Permutations	Actual Permutations	Number >= Observed
WInter, Spring	0.565	0.001	Very large	999	0
WInter, Summer	**0.802**	0.001	Very large	999	0
WInter, Fall	**0.700**	0.001	Very large	999	0
Spring, Summer	0.627	0.001	Very large	999	0
Spring, Fall	**0.873**	0.001	Very large	999	0
Summer, Fall	0.450	0.001	Very large	999	0

Community Structure

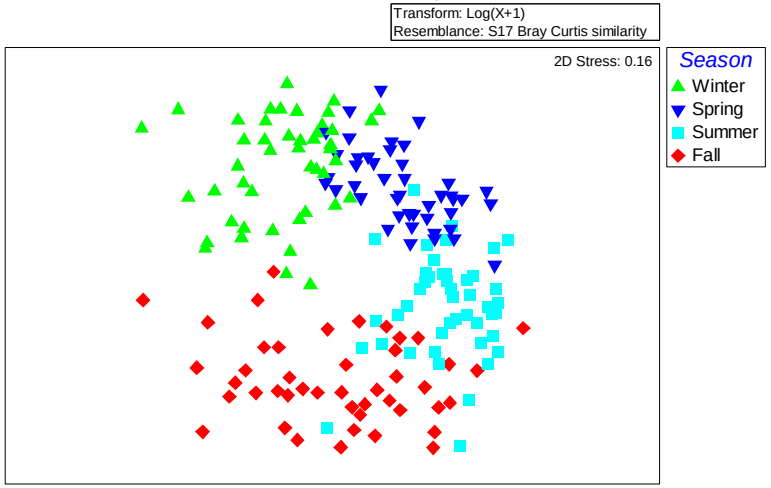
CC Bay Bag Seines



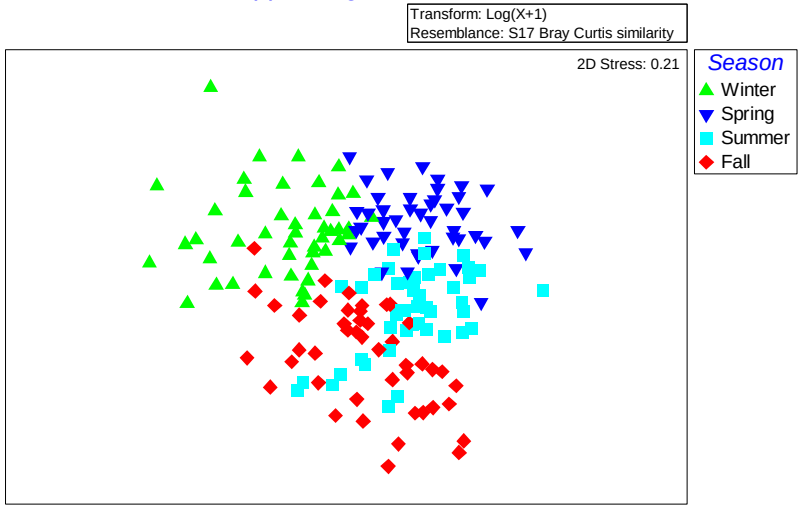
Matagorda Bay Bag Seine



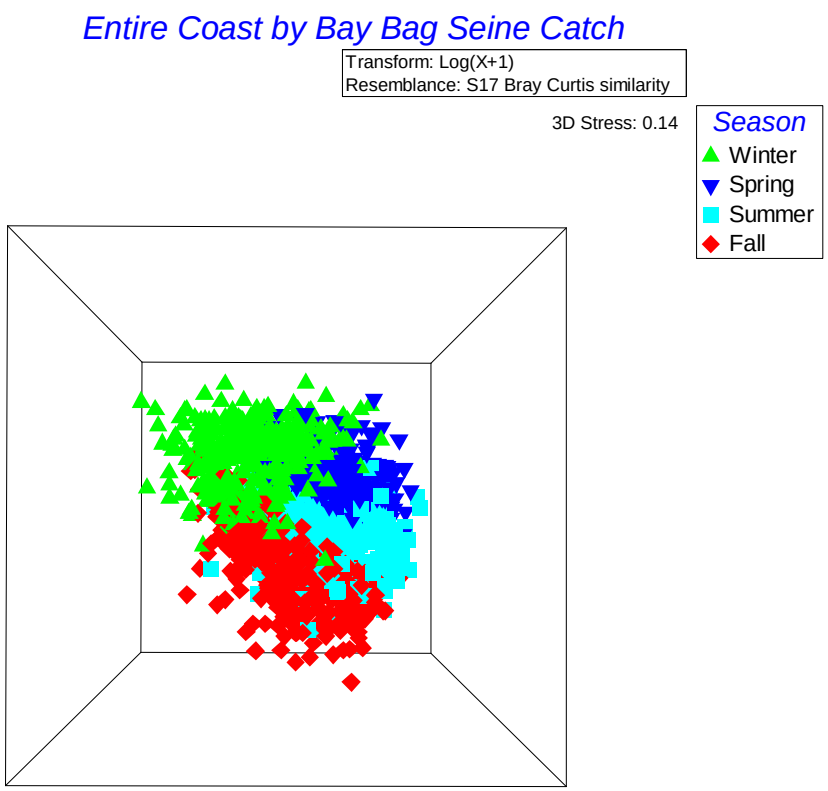
Sabine Lake Bag Seine

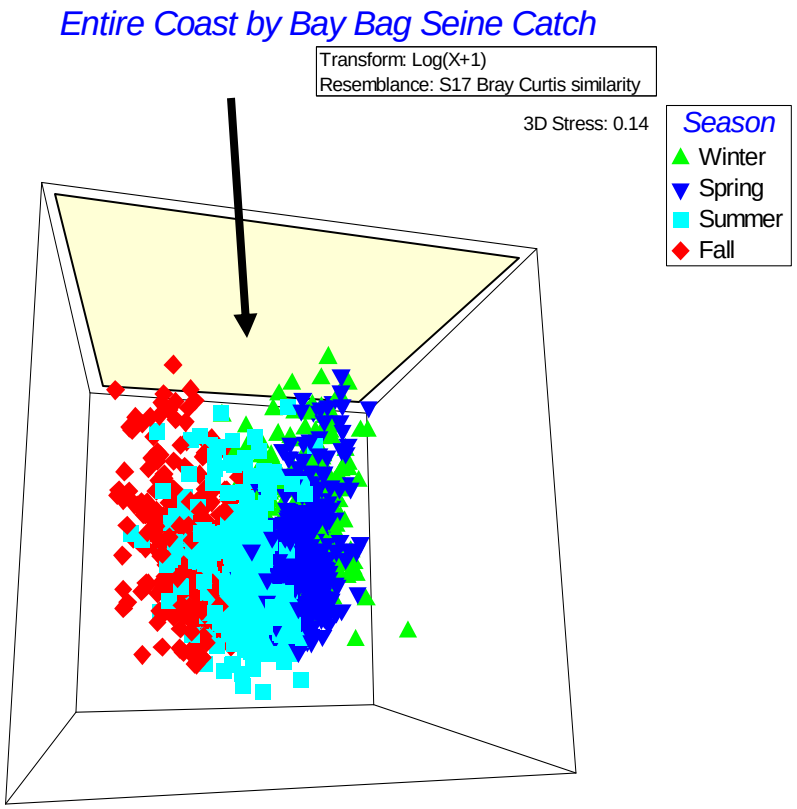


Upper Laguna Madre Catch



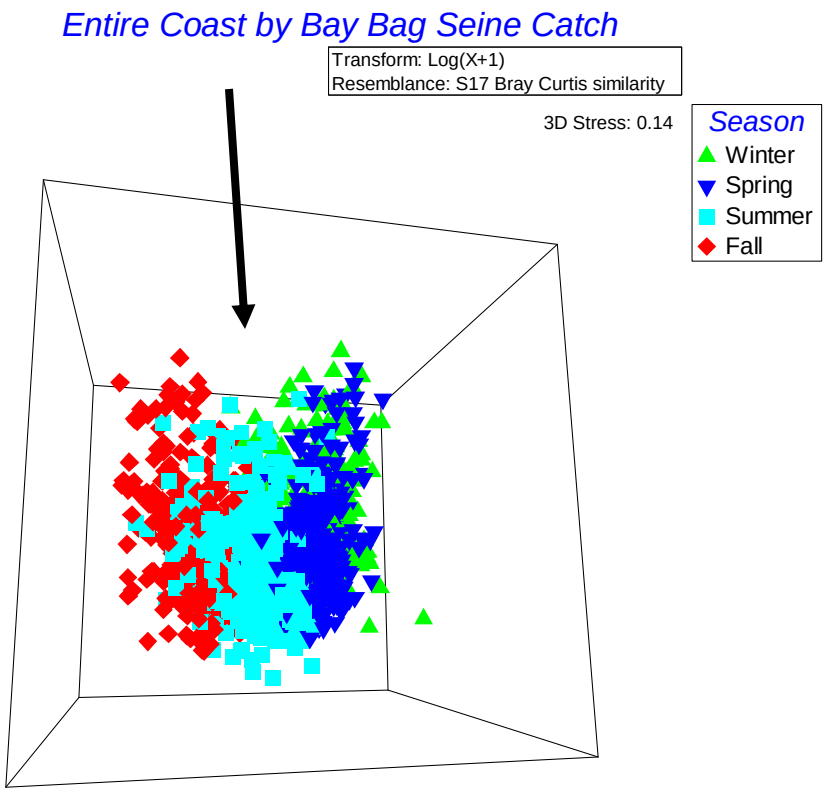
Community Structure

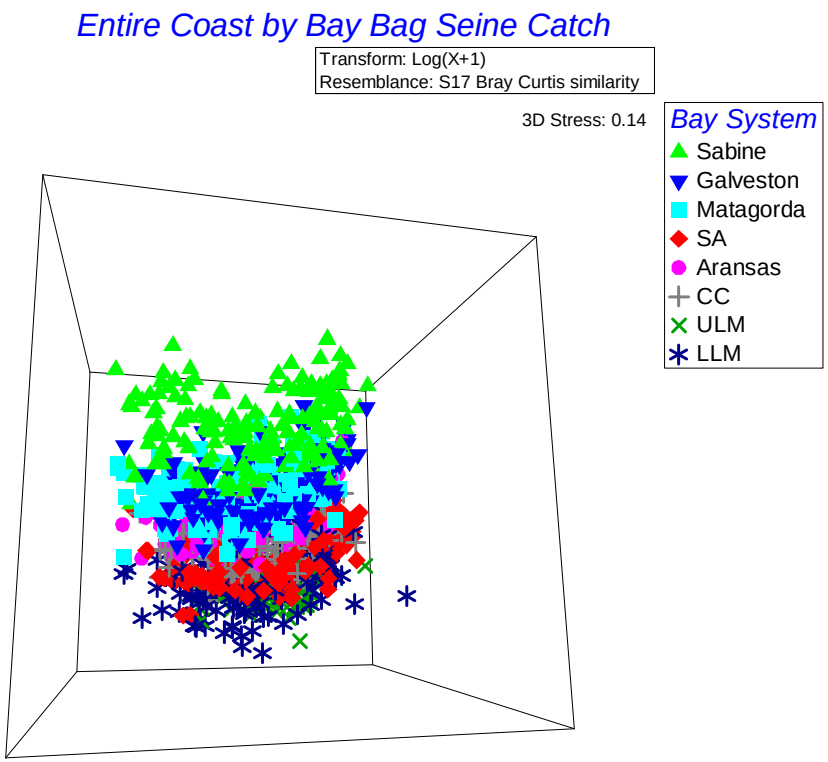




388 Taxa and 3,592,434 Individuals

Community Structure



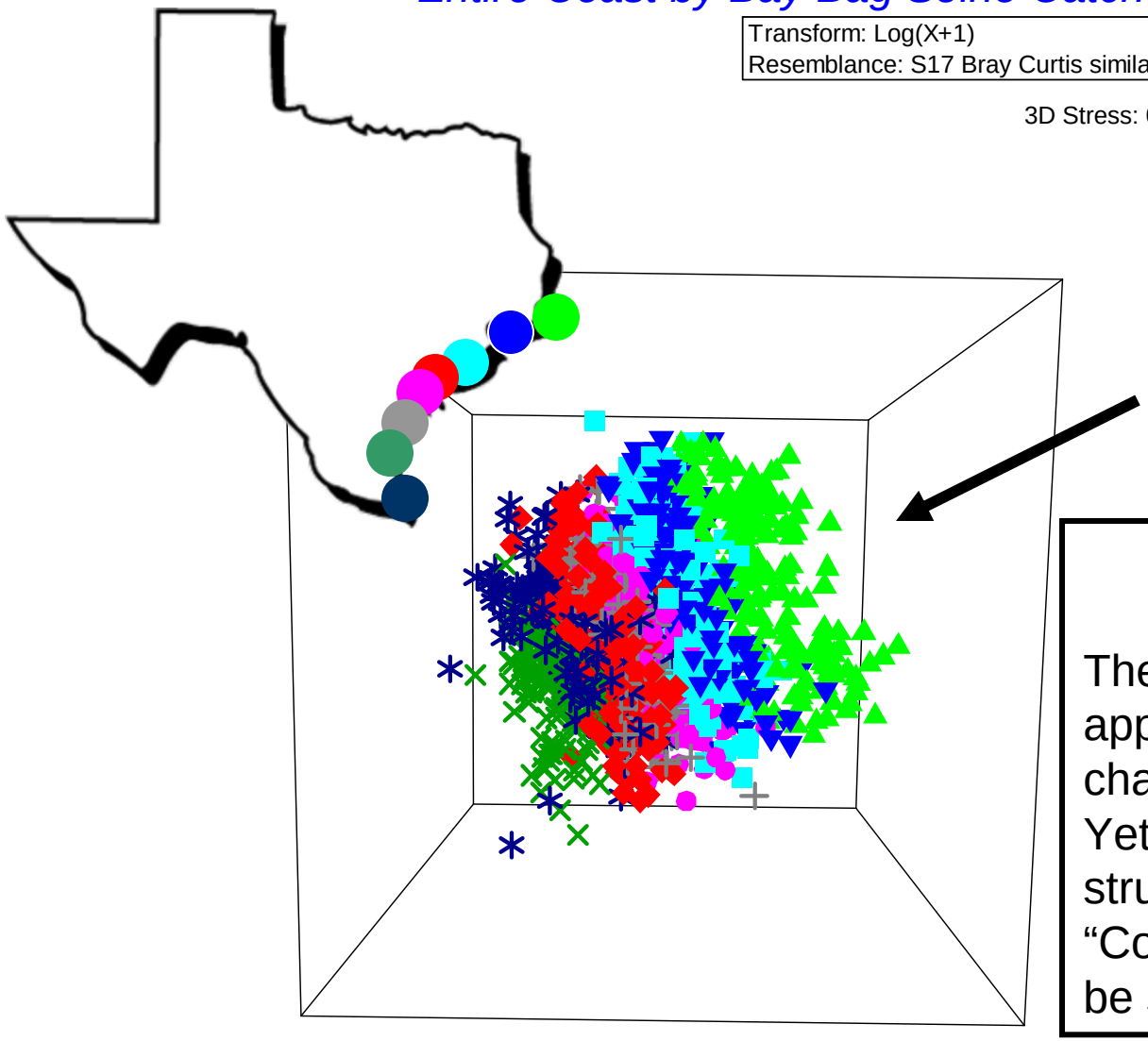


Coast-Wide Community Structure

Entire Coast by Bay Bag Seine Catch

Transform: Log(X+1)
Resemblance: S17 Bray Curtis similarity

3D Stress: 0.14

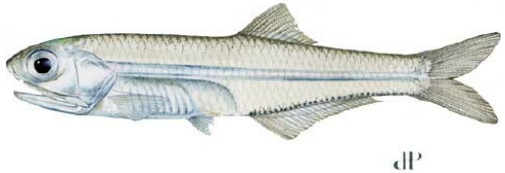
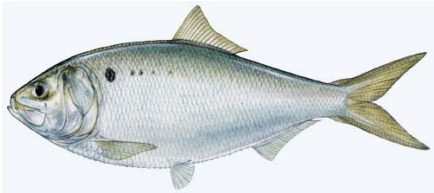


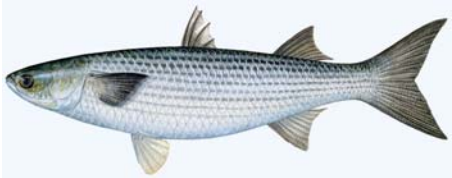
Bay System
- Sabine
- Galveston
- Matagorda
- SA
- Aransas
- CC
- ULM
- LLM

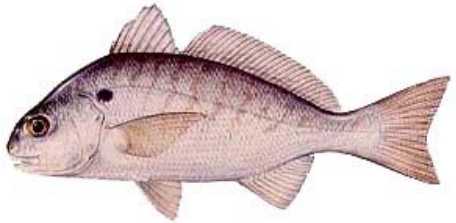
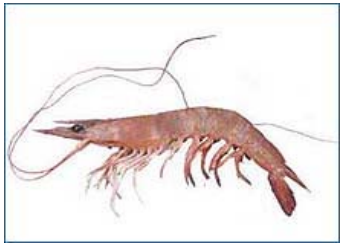
The FWI Paradox :

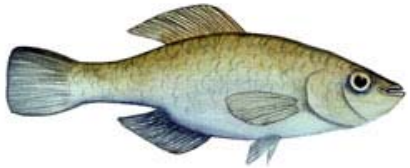
The “Community” doesn’t appear to respond to *temporal* changes in salinity, …
Yet the underlying factor structuring overall “Communities” appears to be salinity.

Changes in Relative Abundance

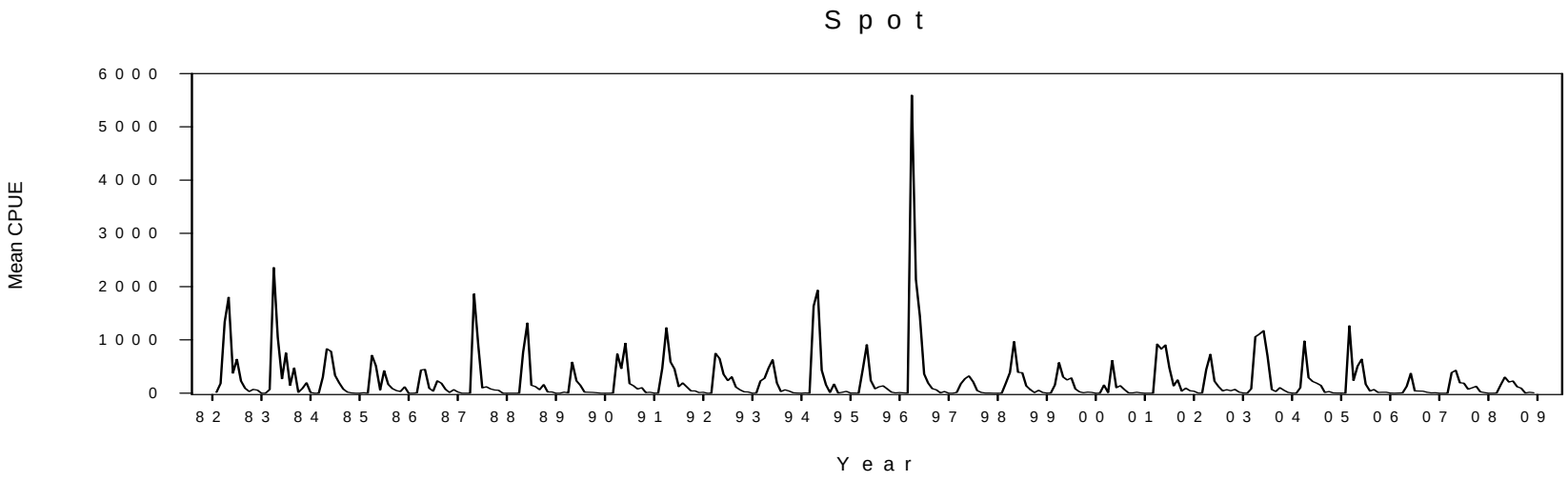



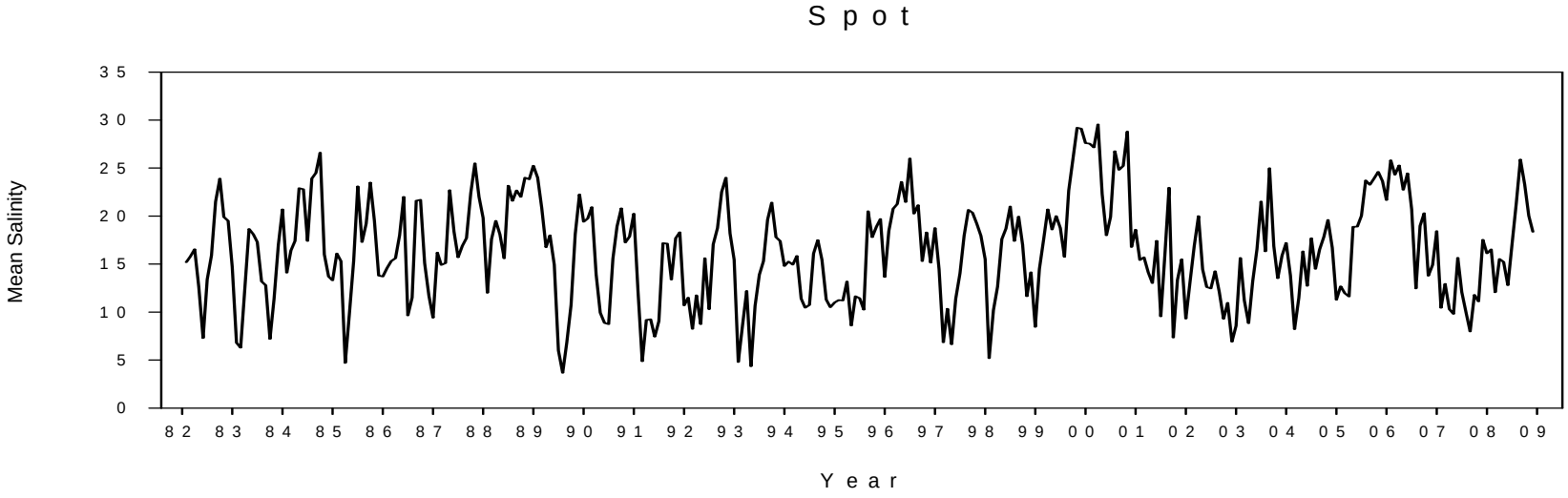




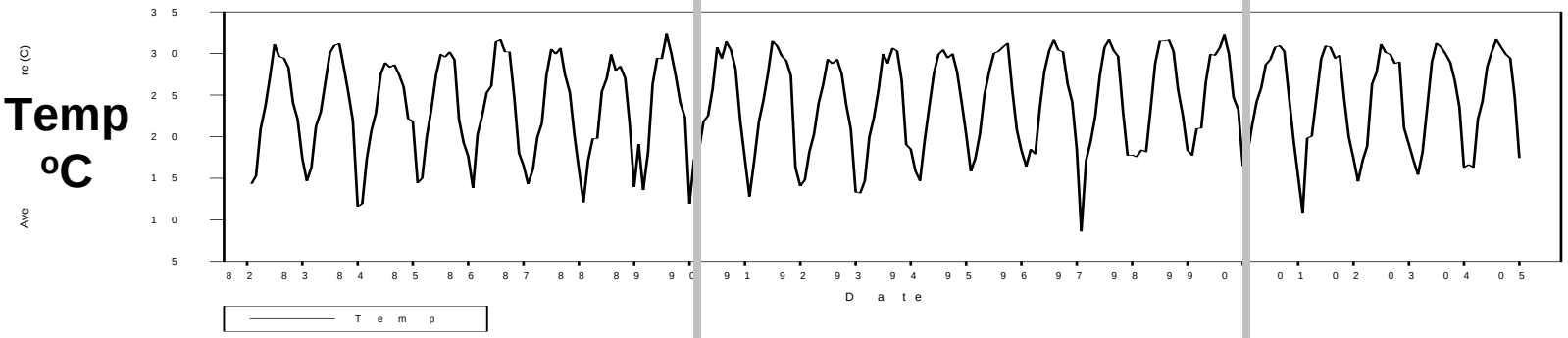
Mean CPUE and Salinity





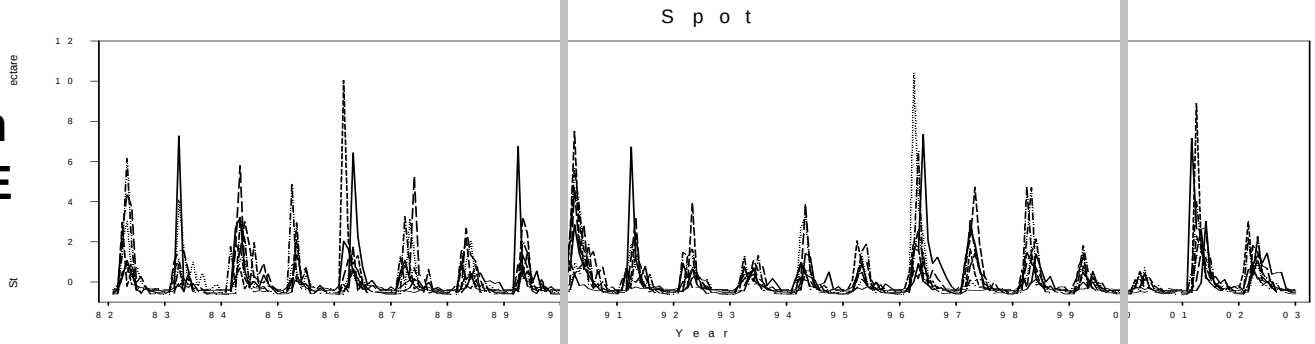
Inherent Periodicities

Temp °C



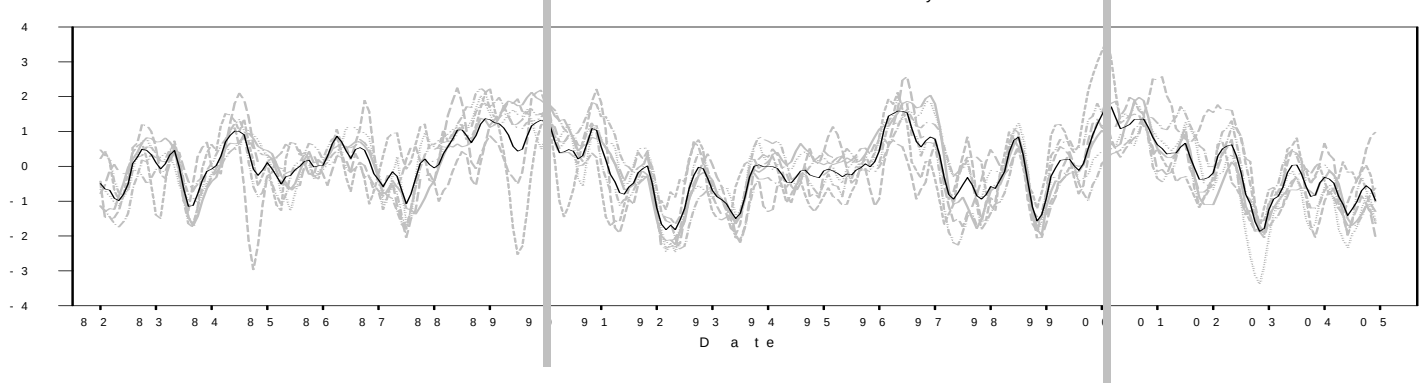
12 m

Mean CPUE (Z)



12 m

Sal (Z)

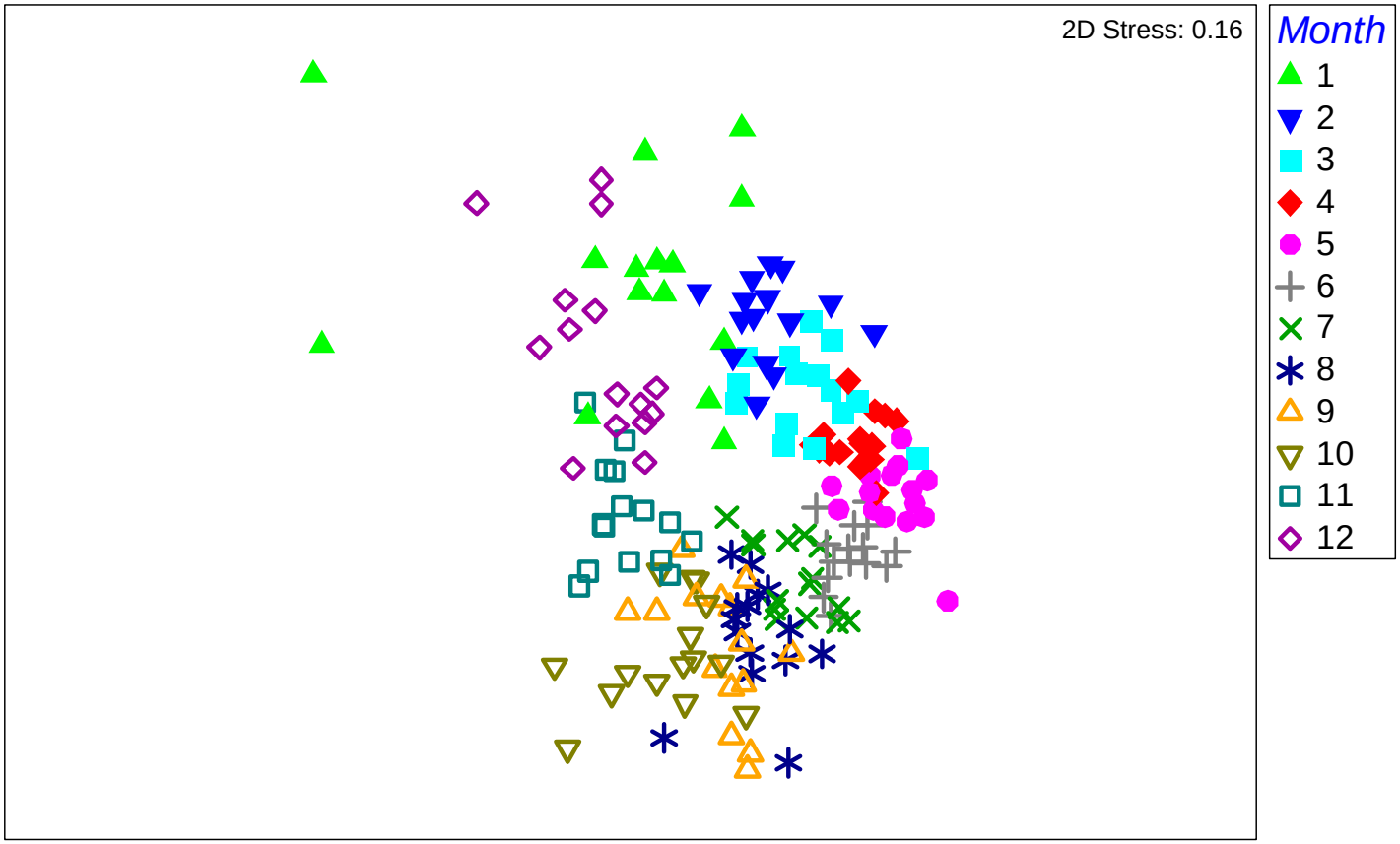


60 m

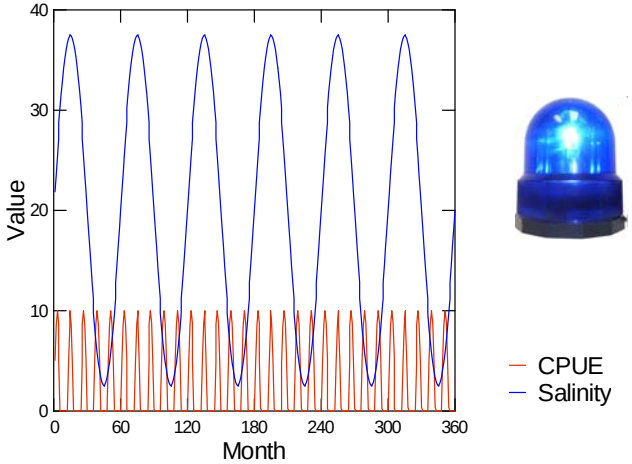
Community Structure

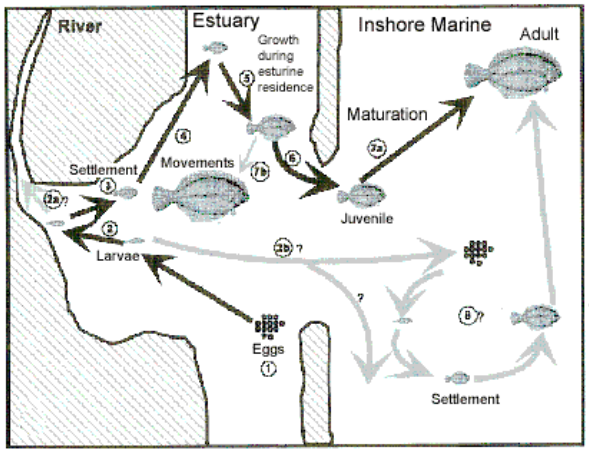
CC Bay Bag Seines

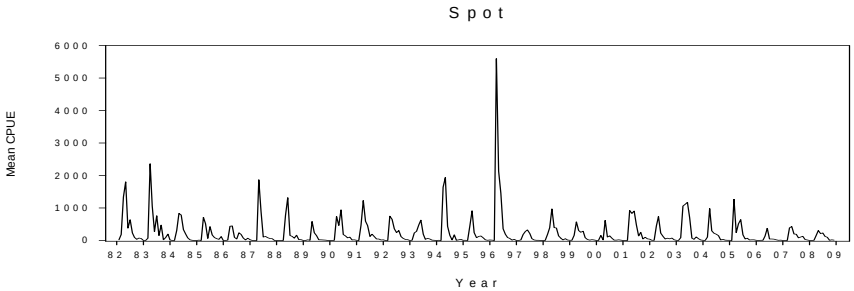
Transform: Log(X+1)
Resemblance: S17 Bray Curtis similarity



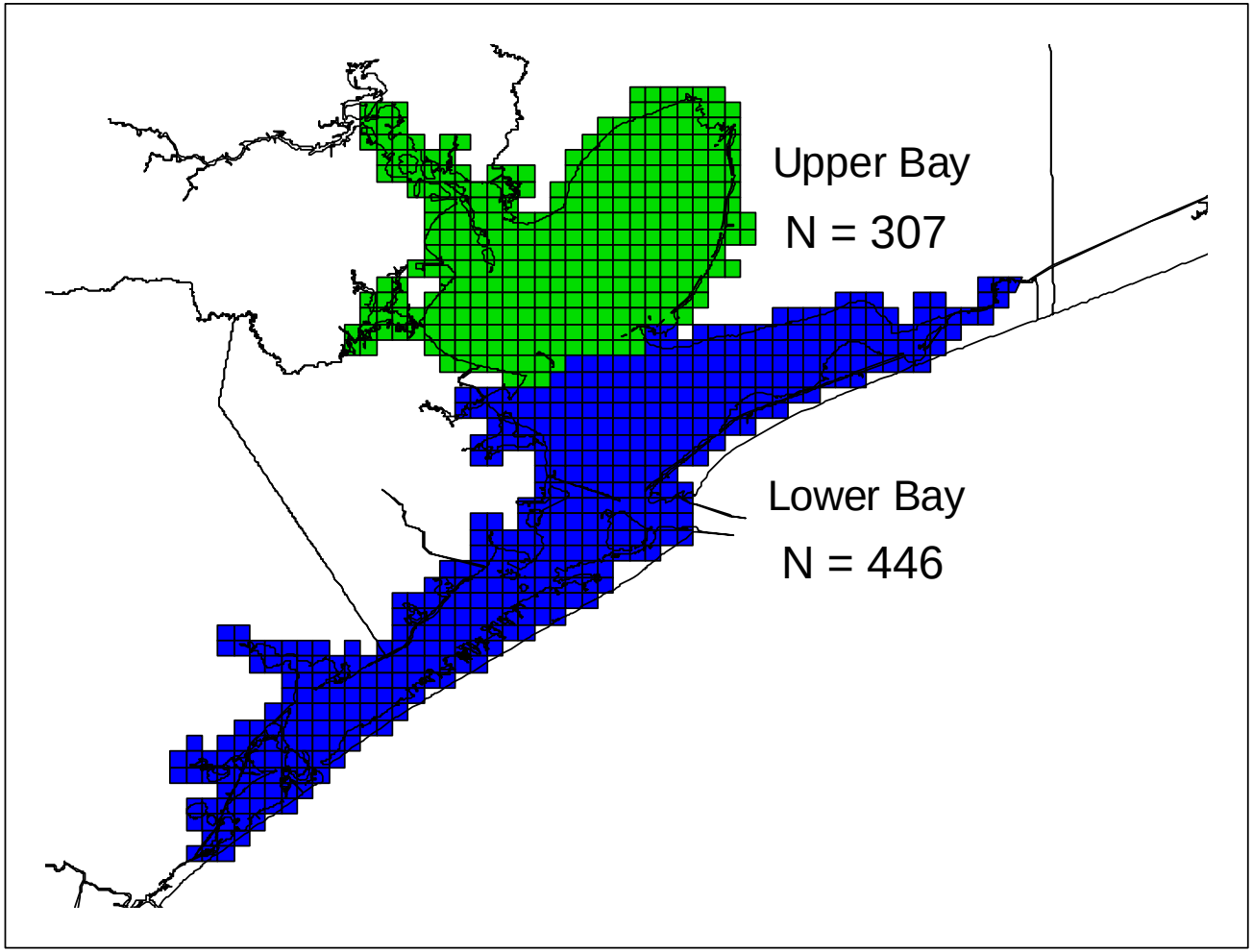
- Evolutionary Perspective
  - Lottery Hypothesis
- Seasonal Timing
  - Reproduction and Tides
- FWI and Habitat



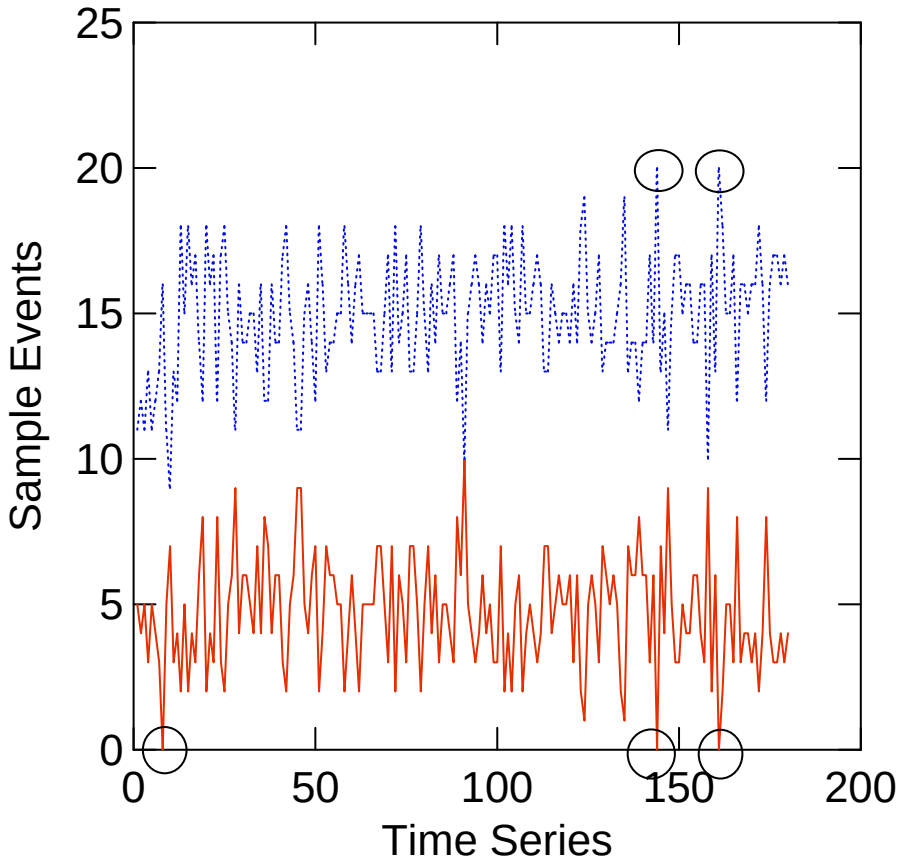




Correct Experimental Unit ???



Correct Experimental Unit ???

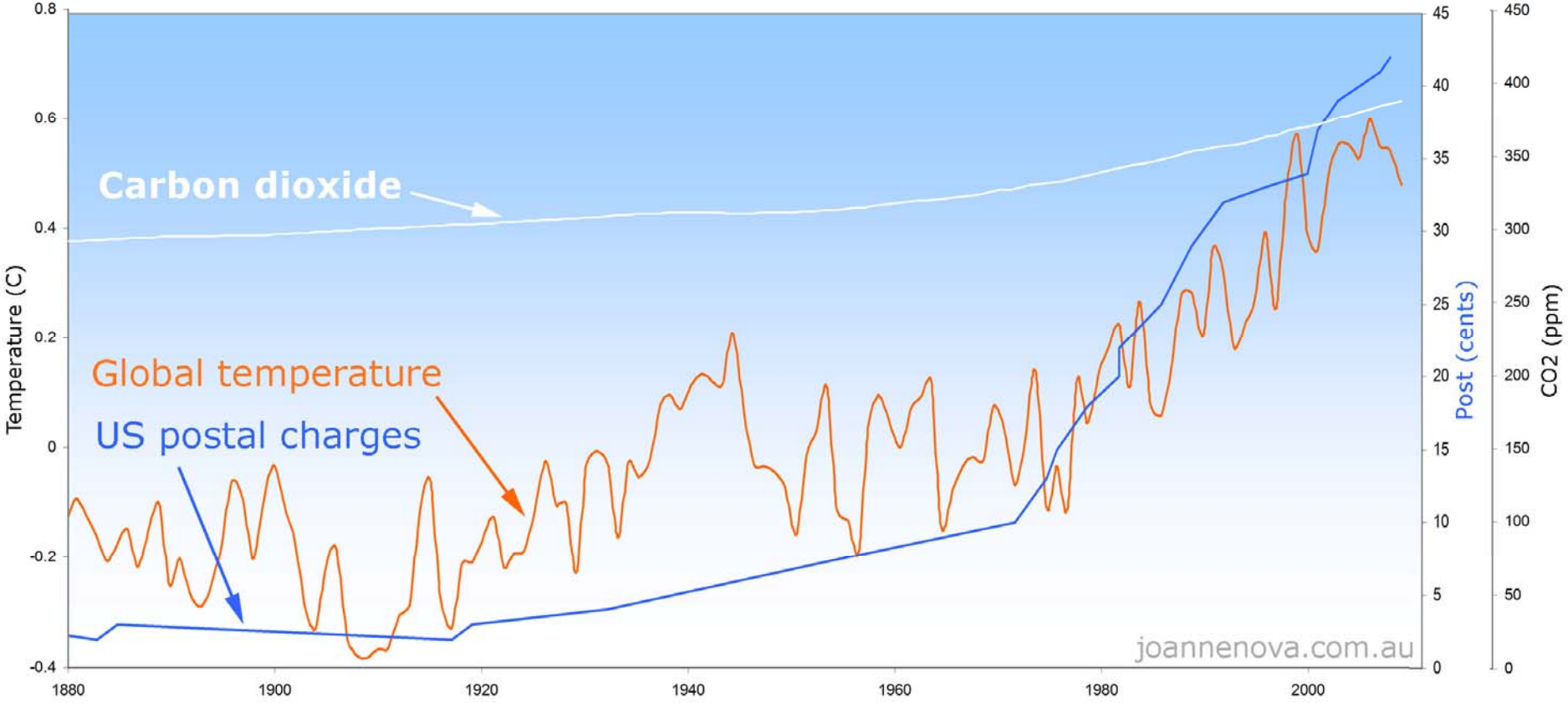


Sample size problem when calculating an average

GAL_UPPER
GAL_LOWER

1991-2005 : 3 Months had 0 Samples from Upper Galveston Bay

Conclusions

- FWI is important in maintaining the underlying "conditions" of each Bay.
  - However, the relationship between FWI and individual species abundance is indirect and complex and therefore difficult to demonstrate *statistically*
  - Lack of coherent frequencies makes quantifying a FWI-effect very difficult
  - On top of the year-to-year variability in CPUE
- BBEST Tasks – identify species that are key to community ecology *and* responsive to changes in FWI

US Postal charges drive Global Warming