Coherency of the time signal for individual species measured by different gear types

Invertebrate Examples from Galveston Bay : 1982-2005
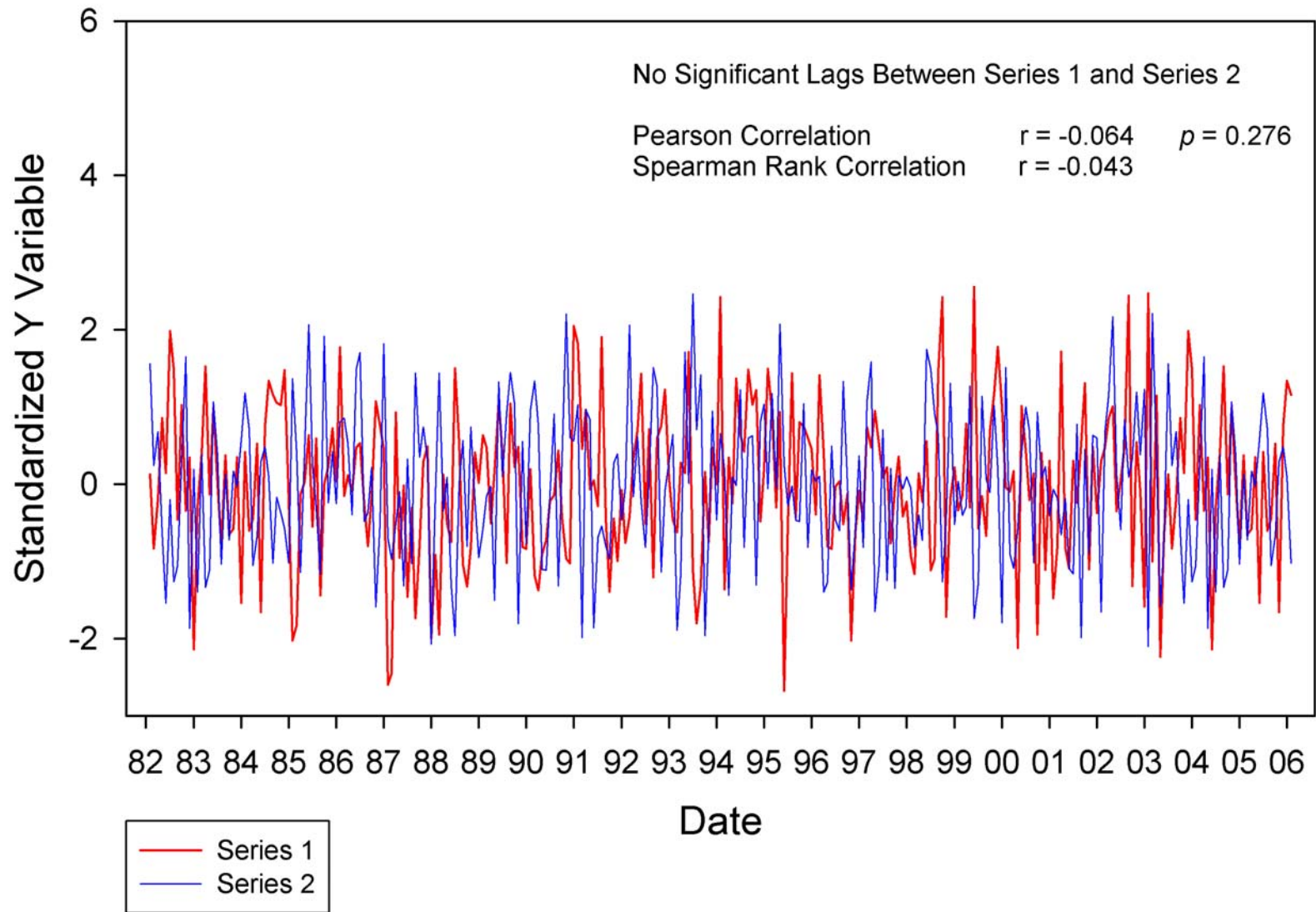
Jim Tolan

TPWD – Coastal Fisheries

Coherency

- The concept of **coherency** in time-series analysis is analogous to correlation.
- *Correlation* is a real scalar. *Coherency* is a complex function of frequency
  - It expresses the frequency dependence of correlation.
- Coherency^2 ranges from 0 – 1
  - The coherency value is the squared correlation between the cyclical components in two series at some respective frequency.
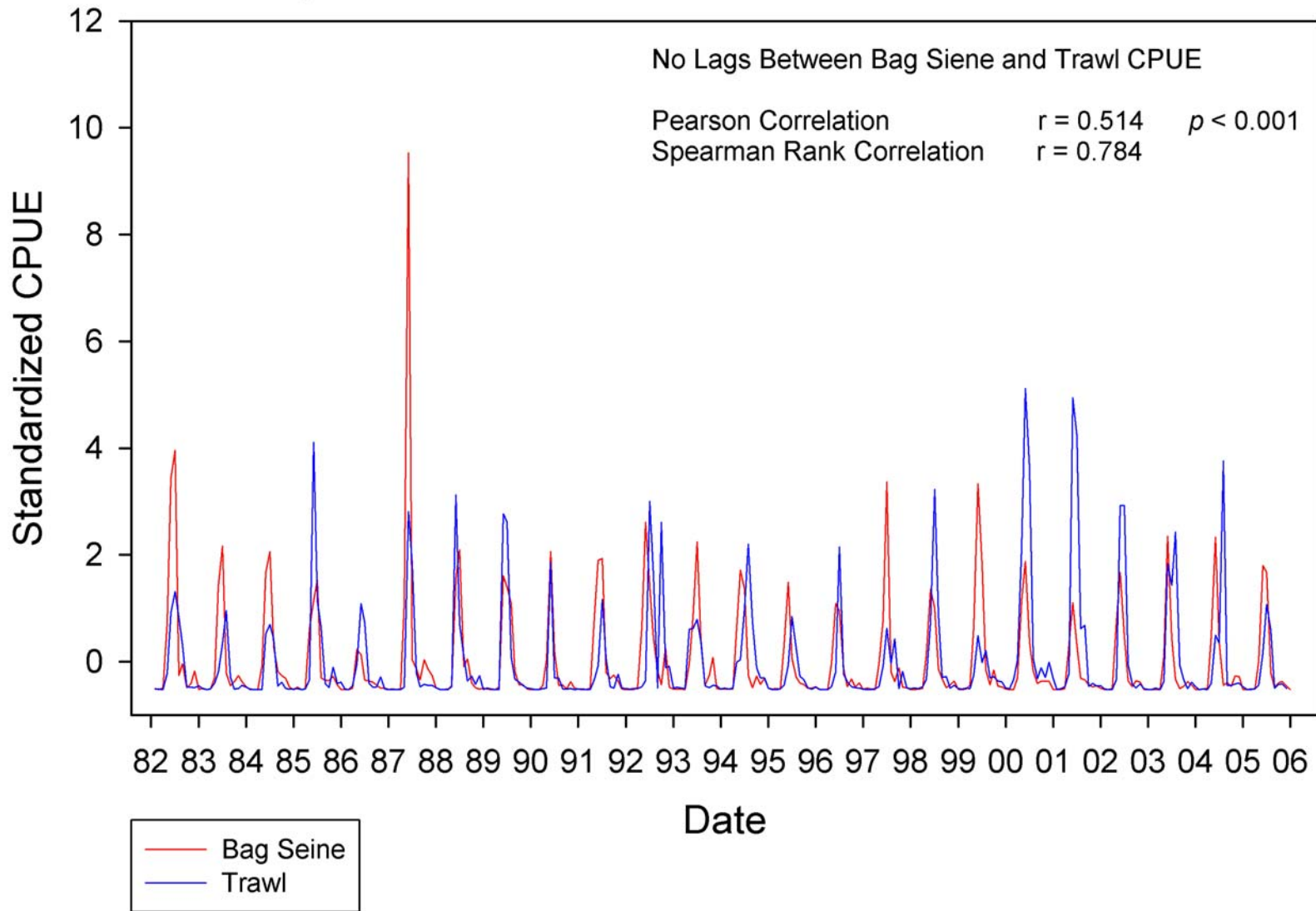
White Noise Example

Coherency^2 = 0.099

No Significant Lags Between Series 1 and Series 2

Pearson Correlation $\quad\quad\quad$ r = -0.064 $\quad$ p = 0.276
Spearman Rank Correlation $\quad$ r = -0.043

Series 1
Series 2

White Noise Test $\quad$ – $\quad$ Series 1 p = 0.202 $\quad$ Series 2 p = 0.620

Brown Shrimp

Coherency^2 = 0.620

No Lags Between Bag Siene and Trawl CPUE

Pearson Correlation   r = 0.514   p < 0.001
Spearman Rank Correlation   r = 0.784

Bag Seine
Trawl

White Noise Test   –   Bag Seine p < 0.001   Trawl p < 0.001

White Shrimp

Coherency^2 = 0.172

Trawl CPUE Lagged 1 Month from Bag Siene CPUE

Pearson Correlation $r = 0.514$ $p < 0.001$
Spearman Rank Correlation $r = 0.516$
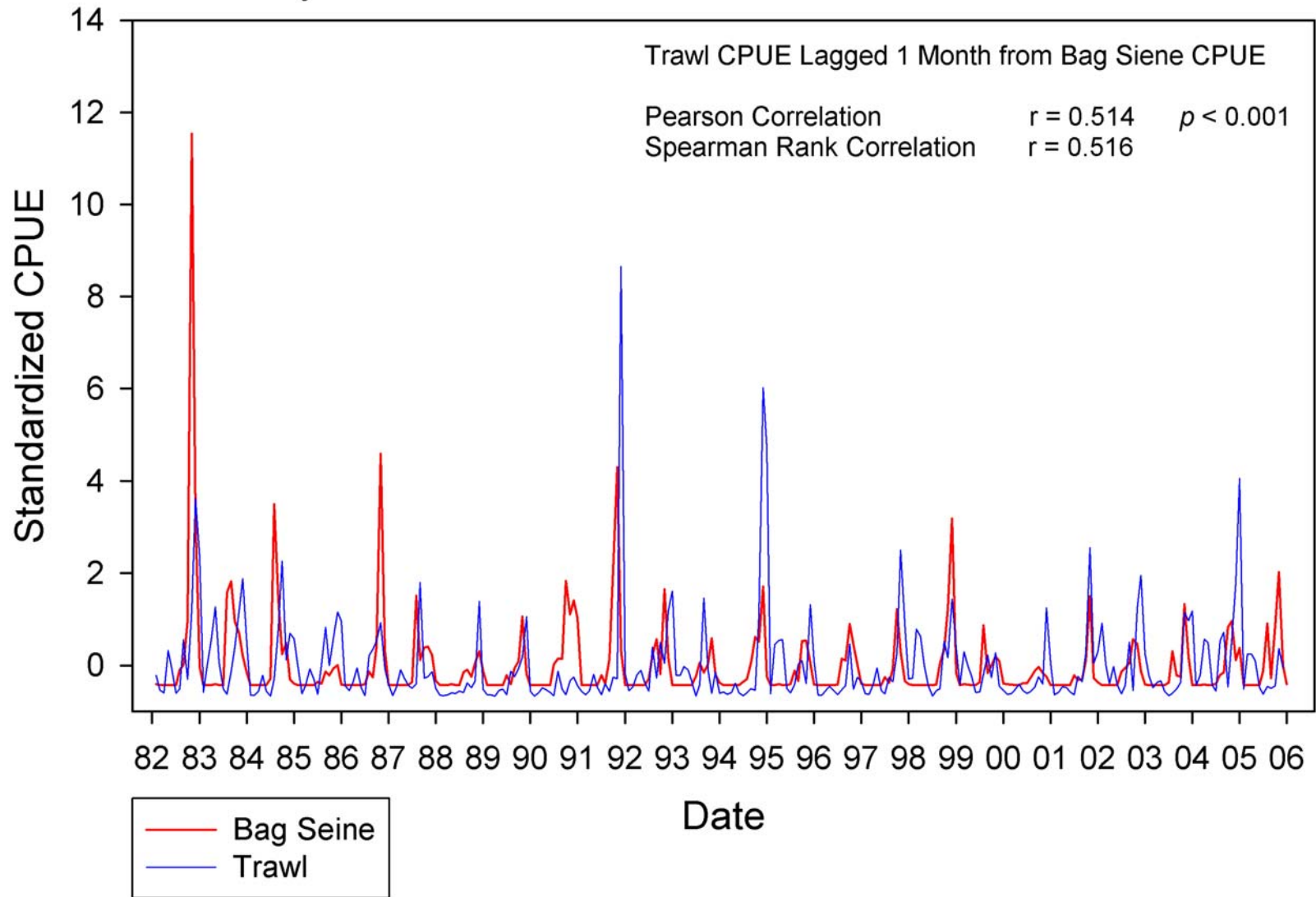
Bag Seine
Trawl

White Noise Test   –   Bag Seine $p < 0.001$ Trawl $p < 0.001$

Blue Crab

Coherency^2 = 0.936

Trawl CPUE Lagged 2 Months from Bag Siene CPUE

Pearson Correlation $\quad$ r = 0.429 $\quad$ $p < 0.001$
Spearman Rank Correlation $\quad$ r = 0.357
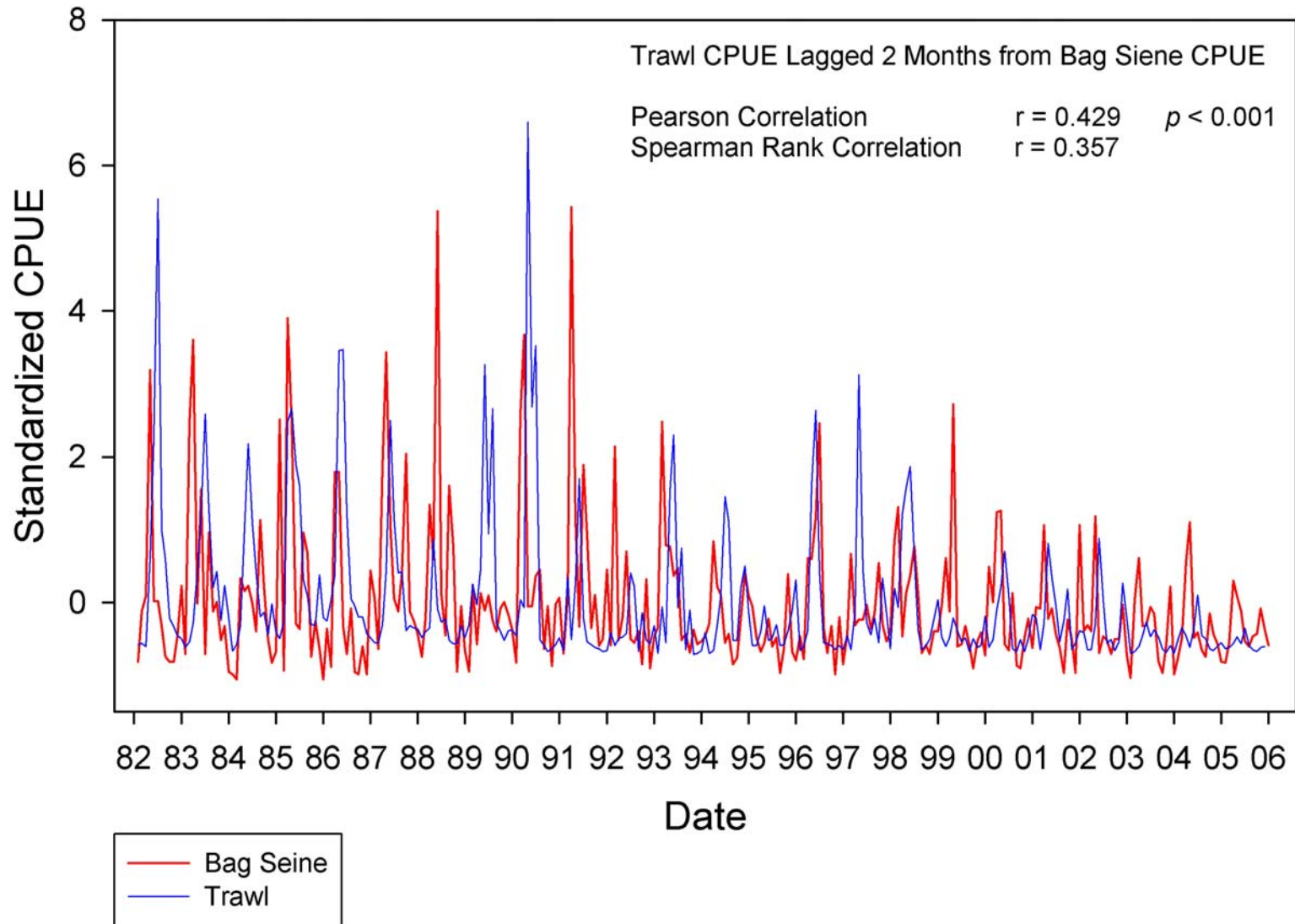
White Noise Test $\quad$ – $\quad$ Bag Seine $p < 0.001$ $\quad$ Trawl $p < 0.001$

Galveston Bay - Blue Crab
Mar - June Period

Analysis of Covariance
- Parallel
- Common Intercepts
- Level

Yearly Standardized CPUE

Date

Bag Seine
Trawl
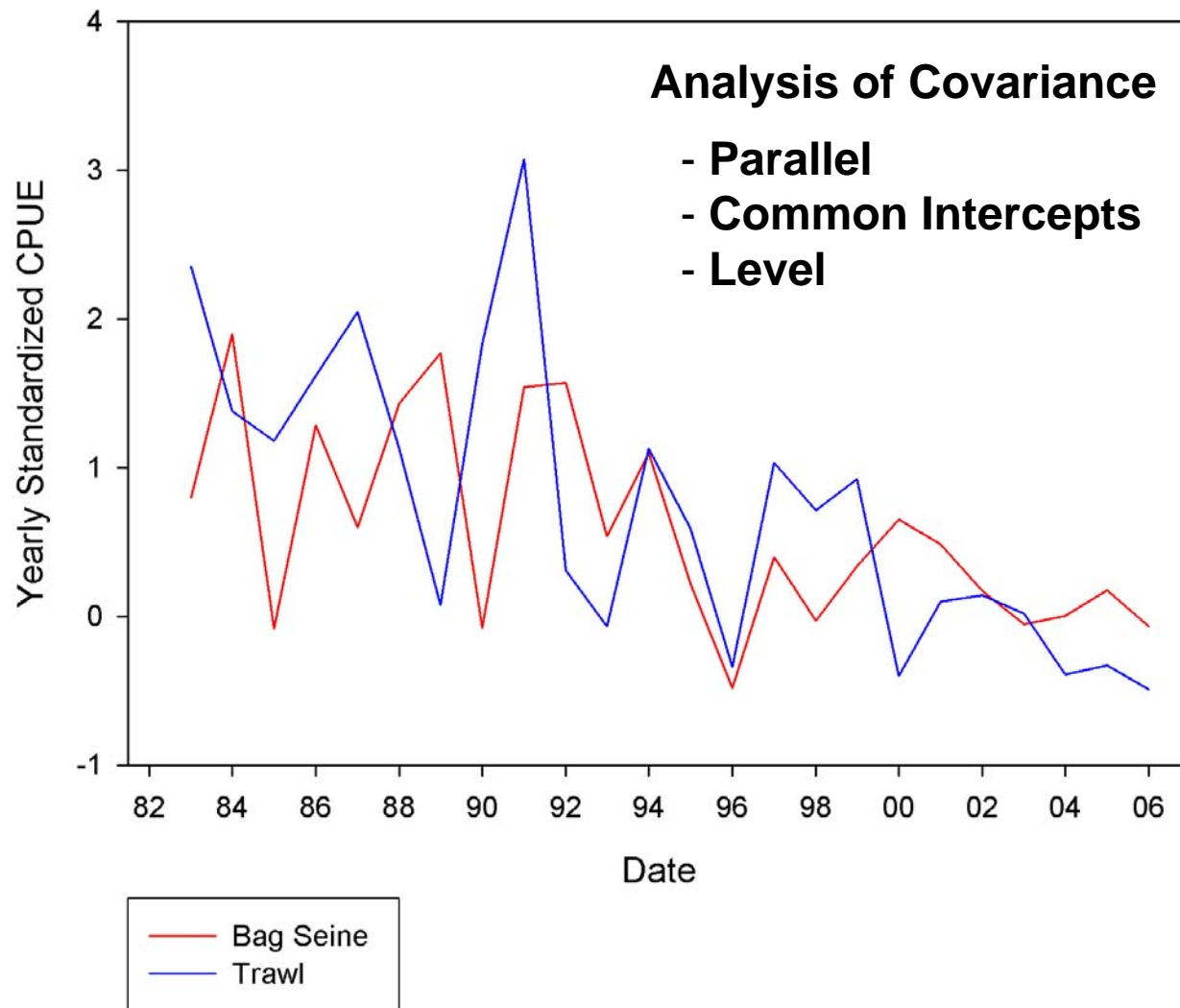
Galveston Bay - Blue Crab
March - Jun Period

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
YEAR	13.561	1	13.561	33.660	0.0001
GEAR	1.149	1	1.149	2.852	0.098
YEAR*GEAR	1.145	1	1.145	2.843	0.099
Error	17.727	44	0.403		

ANCOVA
$r^2 = 0.458$

Bag Seine
Trawl
Regression
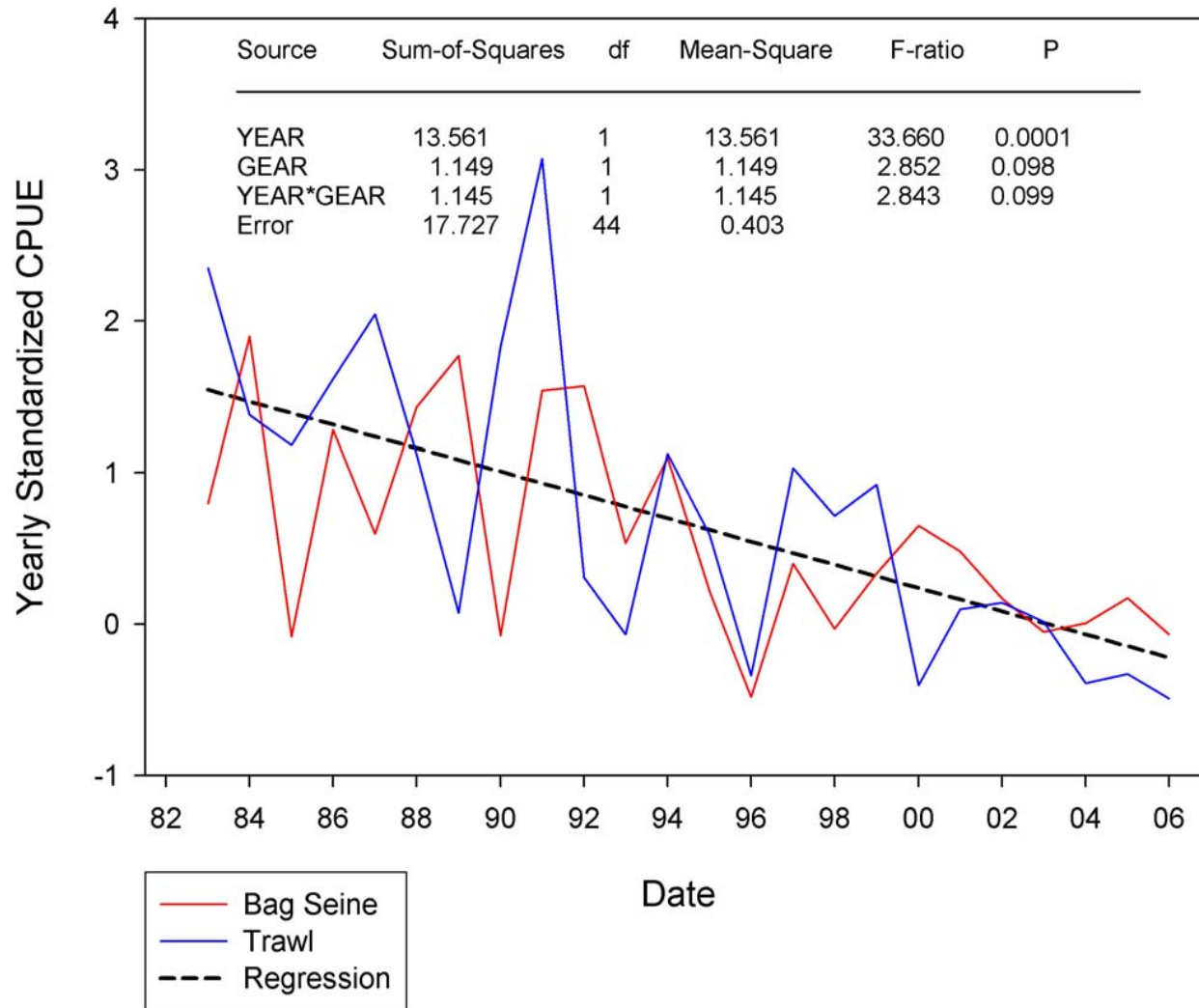
Summary

- Are there coherent time signals for individual species measured by different gear types?

- Are there consistencies of the annual signal of counts for individual species over time?

- Are there statistically significant correlations (0.05 level of significance) between abundances of populations as measured by different sampling methods, i.e. bag seine, trawl, gill net, landings within individual bay systems?