

Go over Homeworks 1 & 2

➤ *Objectives:*

Review problematic issues in Hw 1 and Hw 2

➤ *Learning Outcomes:*

Everyone revised Hw1 and Hw 2 – submit for Hw 3

Statistical Significance - Procedure

Every significance test involves comparing a **test result** we have calculated to some **critical value** for the statistic.

It doesn't matter what type of statistic we are calculating (e.g., a t-statistic, a chi-square statistic, an F-statistic), the procedure to test for significance is the same.

1. Decide on the critical alpha level we will use (i.e., the type-I error rate you are willing to accept). *For this class, we will use the widely-accepted $\alpha = 0.05$ significance level.*
2. Calculate the statistic (e.g., correlation coefficient)
3. Compare the statistic to a critical value obtained from a distribution (table) using the correct degrees of freedom.

Statistical Significance - Tables

“r critical” - threshold for statistical significance

**1 km
resolution**

r = 0.74

df = 28

(p < 0.01)

**10 km
resolution**

r = 0.91

df = 1

(p > 0.10)

df= n-2 n = number of pairs of data	Level of significance for two-tailed test (alpha)			
	.10	.05	.02	.01
1	.988	.997	.9995	.9999
2	.900	.950	.980	.990
3	.805	.878	.934	.959
4	.729	.811	.882	.917
5	.669	.754	.833	.874
25	.323	.381	.445	.487
26	.317	.374	.437	.479
27	.311	.367	.430	.471
28	.306	.361	.423	.463
29	.301	.355	.416	.456
30	.296	.349	.409	.449
35	.275	.325	.381	.418
40	.257	.304	.358	.393
45	.243	.288	.338	.372
50	.231	.273	.322	.354



Statistical Significance - Interpretation

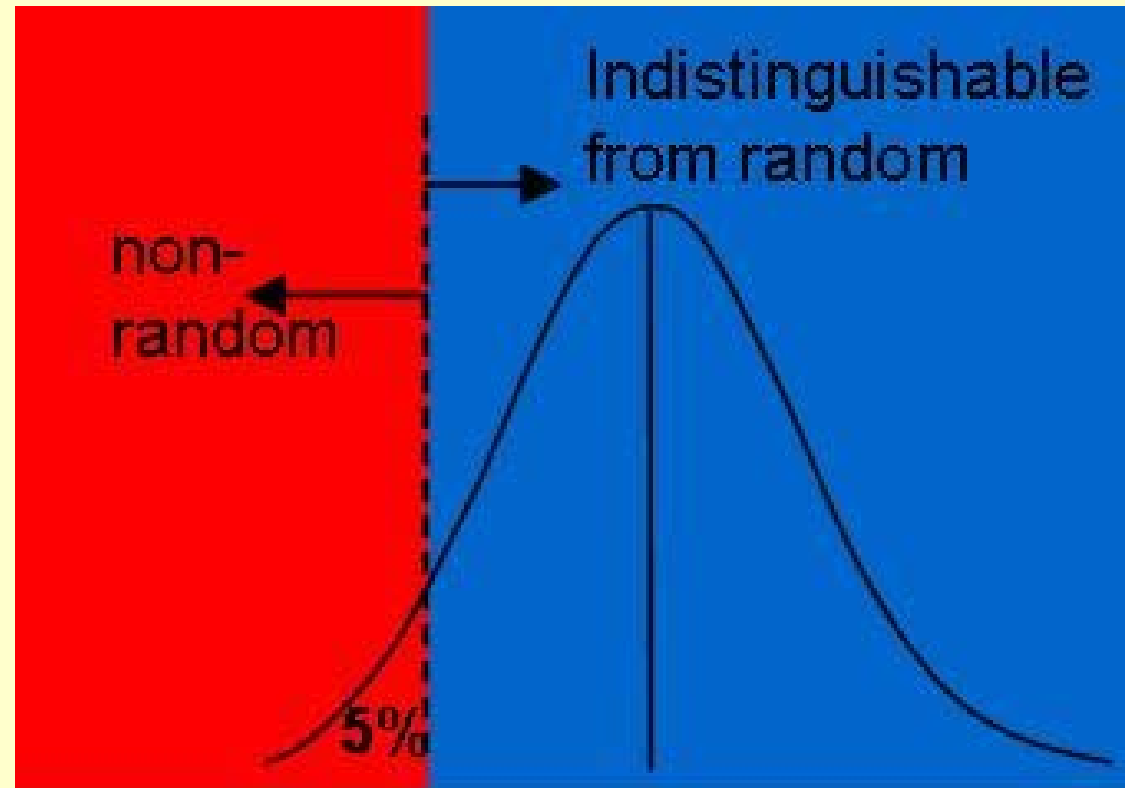
If your statistic is higher than the critical value from table:

- There is a low probability that the pattern you observed happened purely by chance.
- Your finding is significant.
- You reject the null hypothesis.

If your statistic is lower than the critical value from table:

- There is a high probability that the pattern you observed happened purely by chance.
- Your finding is not significant.
- You fail to reject the null hypothesis.

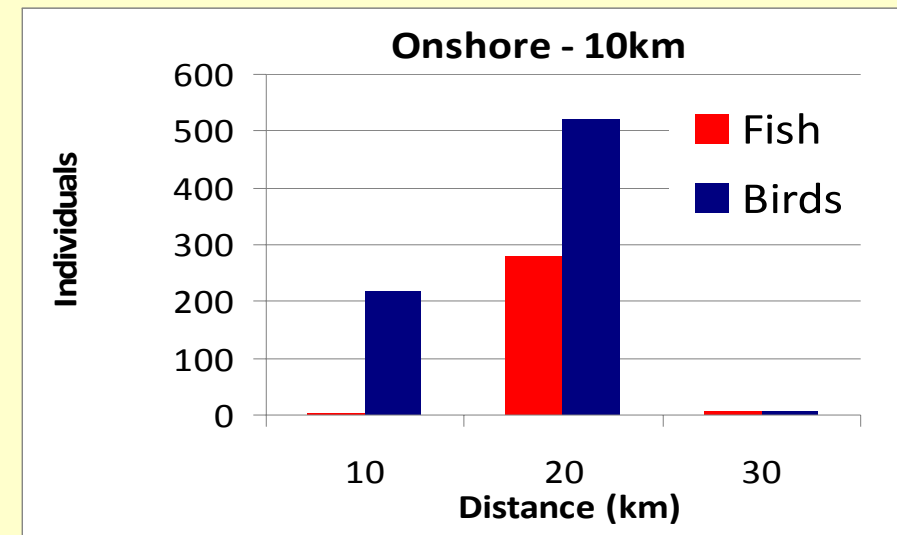
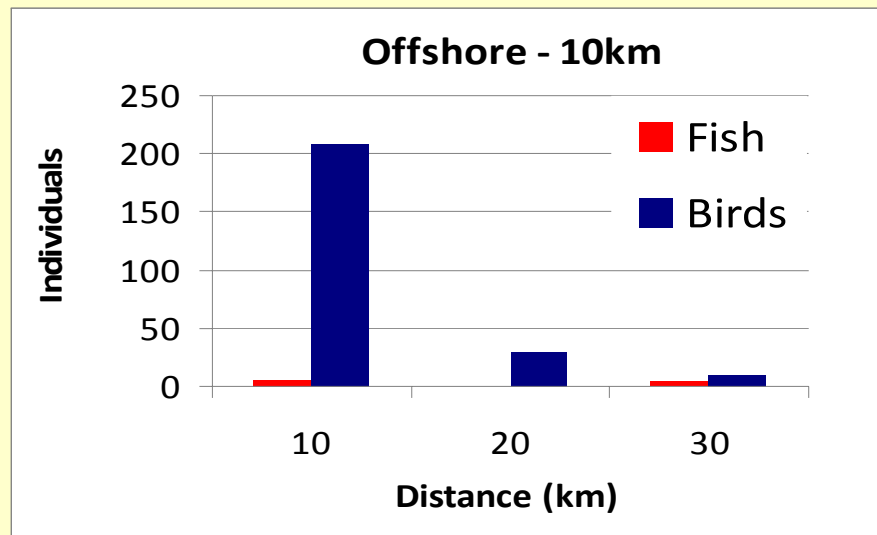
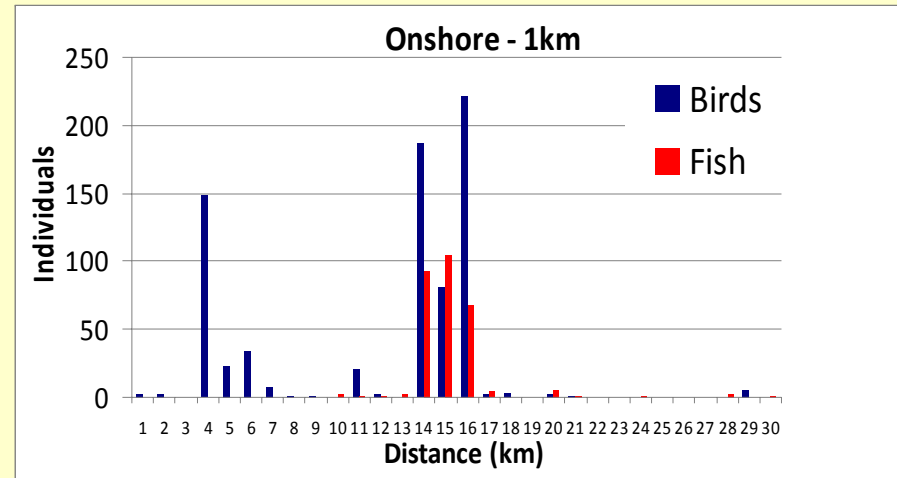
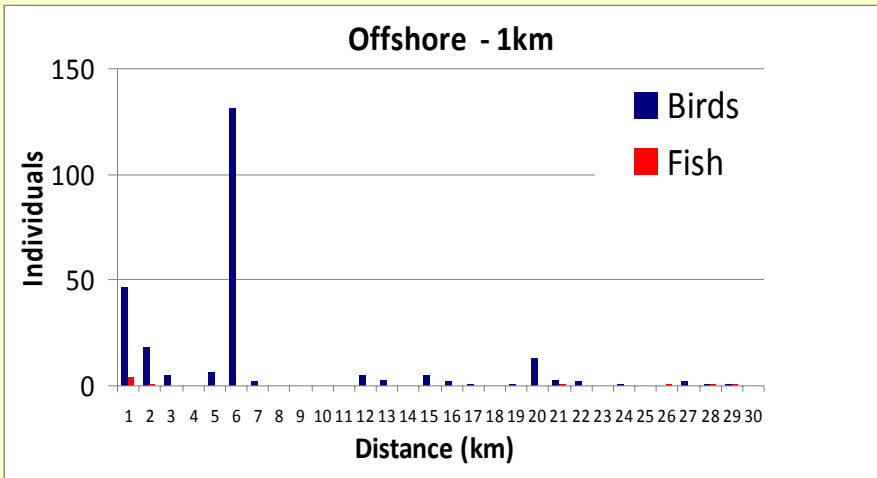
Statistical Significance - Interpretation



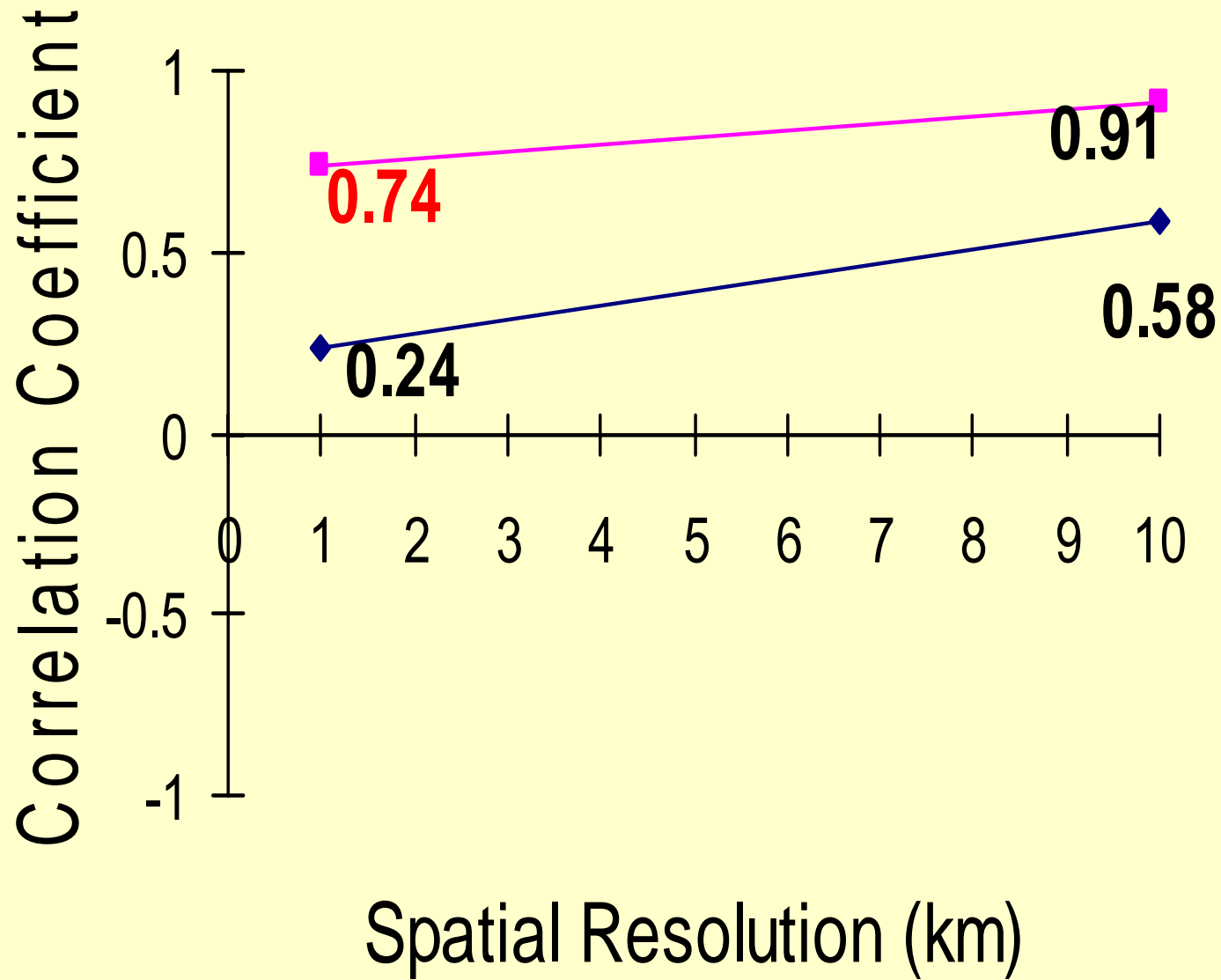
alpha

DF	0.01	0.05	0.10
1	0.999	0.997	0.988
28	0.463	0.361	0.306

Homework 1 – Scale Dependency



Homework 1 – Scale Dependency



Statistical Significance - Interpretation

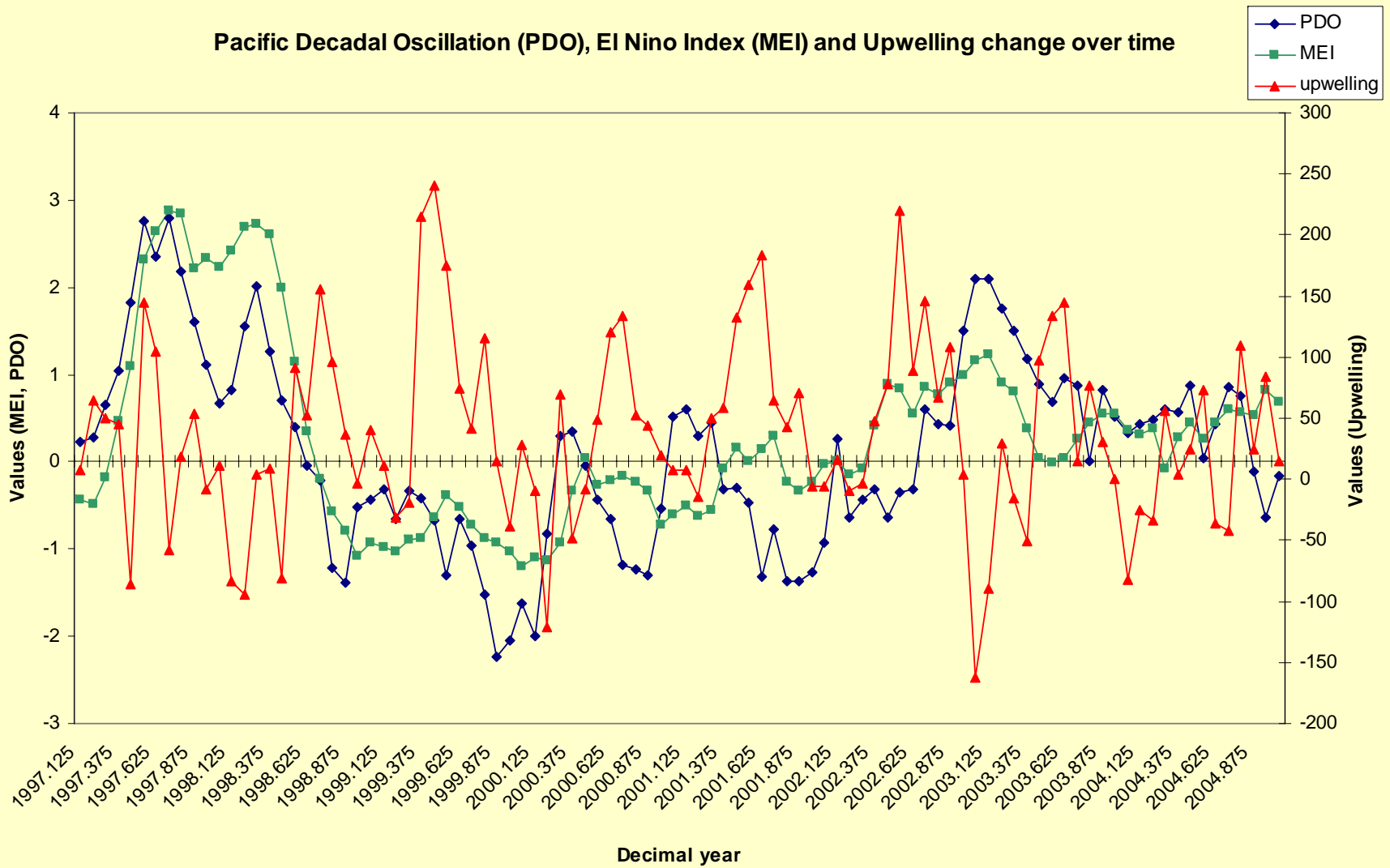
DF	0.10	0.05	0.02	0.01
1	0.988	0.997	0.9995	0.9999
28	0.306	0.361	0.423	0.463

<u>Habitat</u>	<u>n</u>	<u>r</u>	<u>DF</u>	<u>P-value</u>	<u>Sign.</u>
Onshore	30	0.74	28	p < 0.001	Y
Onshore	3	0.91	1	p > 0.10	N
Offshore	30	0.24	28	p > 0.10	N
Offshore	3	0.58	1	p > 0.10	N

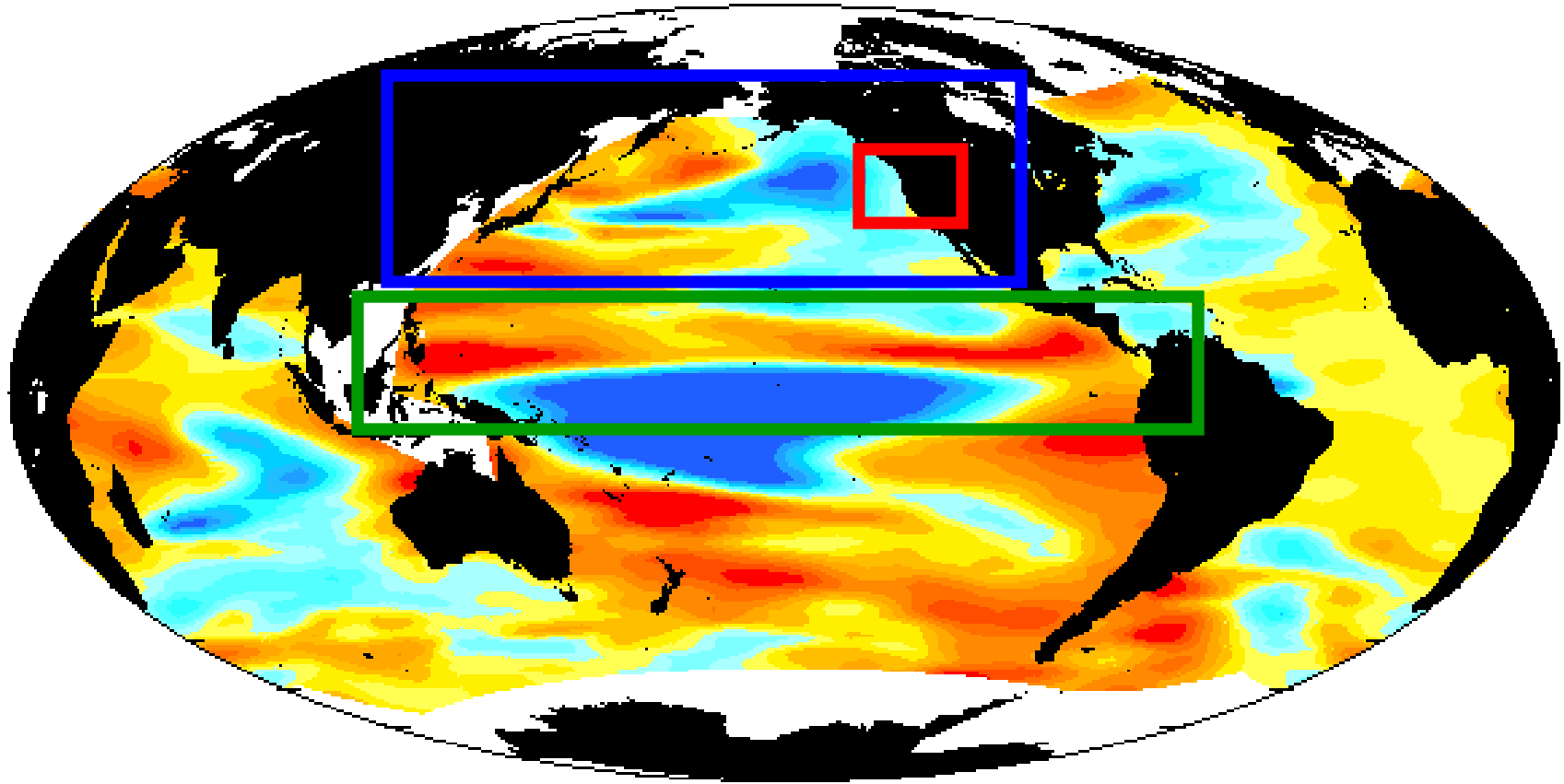
Take-Home Message:

The changing df creates a problem when testing statistical significance, since large magnitude r values (which may be biologically meaningful) may not be statistically significant.

Homework 2 – Correlations



Homework 2 – Correlations



Homework 2 – Significance

Report p values in the upper part of the matrix

$$df = n - 2 = 94$$

Report correlation coefficients in the lower part of the matrix

	mei	pdo	upwelling
mei	-	< 0.01	0.10 – 0.05
pdo	+0.75	-	< 0.01
upwelling	- 0.17	- 0.27	-

Note: Significant results (alpha = 0.05) are shown in red font

Homework 2 – Interpolation

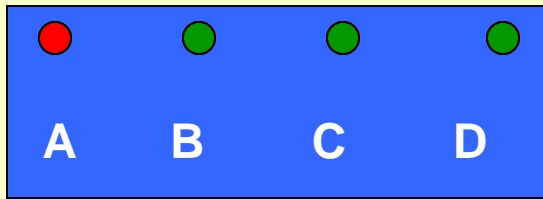
<u>df</u>	<u>0.1</u>	<u>0.05</u>	<u>0.02</u>	<u>0.01</u>
80	0.183	0.217	0.256	0.284
90	0.173	0.205	0.242	0.267
94	0.169	0.201	0.237	0.262
100	0.164	0.195	0.230	0.254

- 0.17

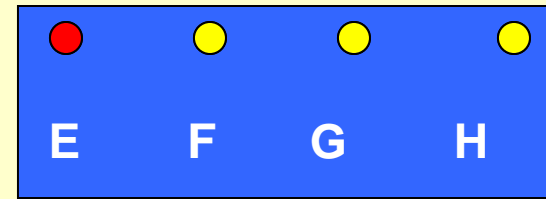
- 0.27 + 0.75

Homework 2 - Connectedness

Rook



Bishop



The rule of connectedness determine which samples are *potentially connected*.

The lag determines which samples *are connected* at each spatial scale. Connected samples are used in the calculation of autocorrelation at that spatial scale.

Lag1: A-B, Lag2: A-C, Lag3: A-D

Homework 2 – “Ecological Scale”

Scale of spatial / temporal autocorrelation (i.e. characteristic ecological scale) is defined in two ways:

- **L0 (L-zero):**

Point at which correlogram first crosses the x-axis

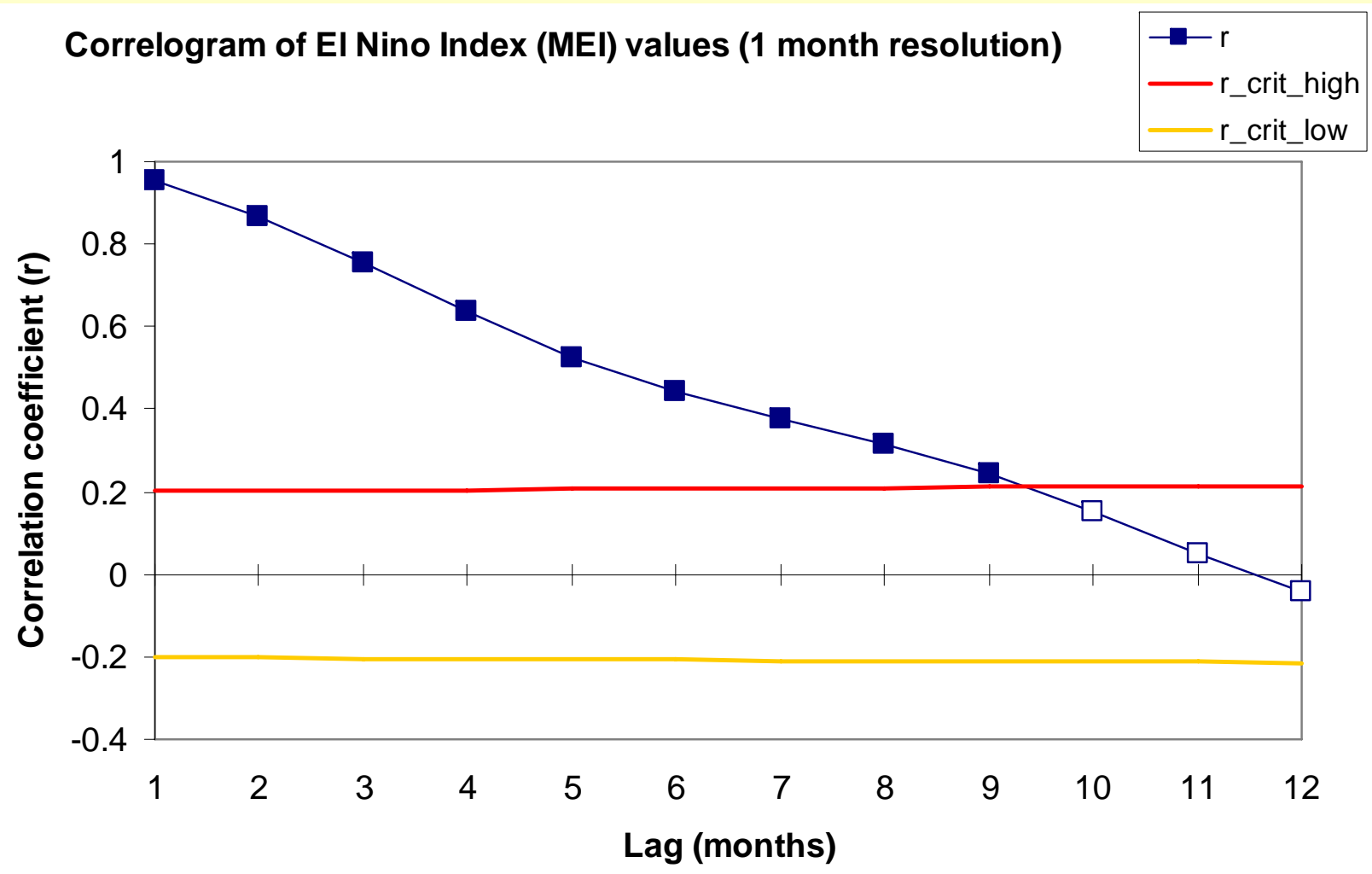
(Epperson, 1990)

- **I0 (I-zero):**

Shortest lag where correlogram not significantly different from 0

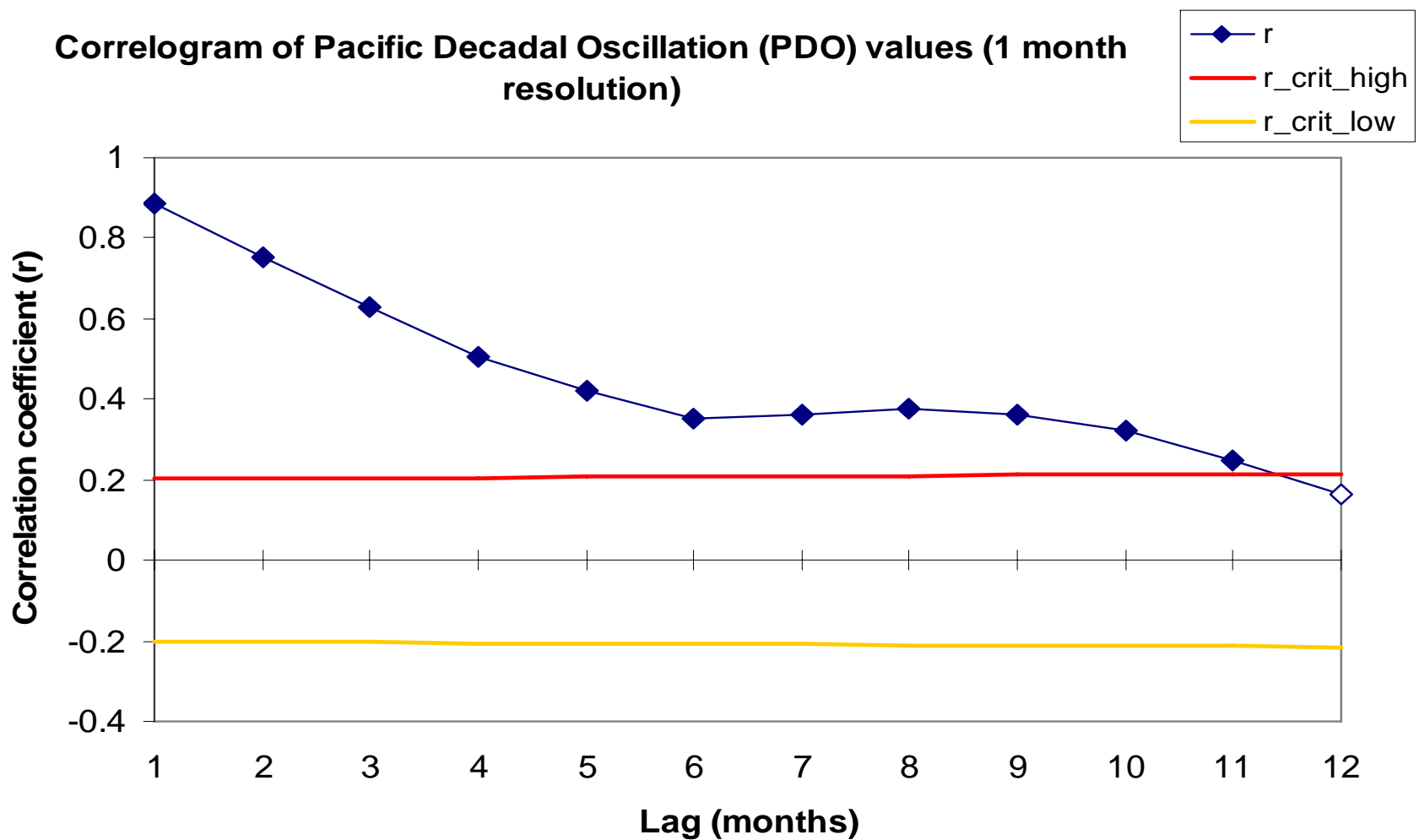
(Sokal & Wartenberg, 1983)

Homework 2 – MEI Scales

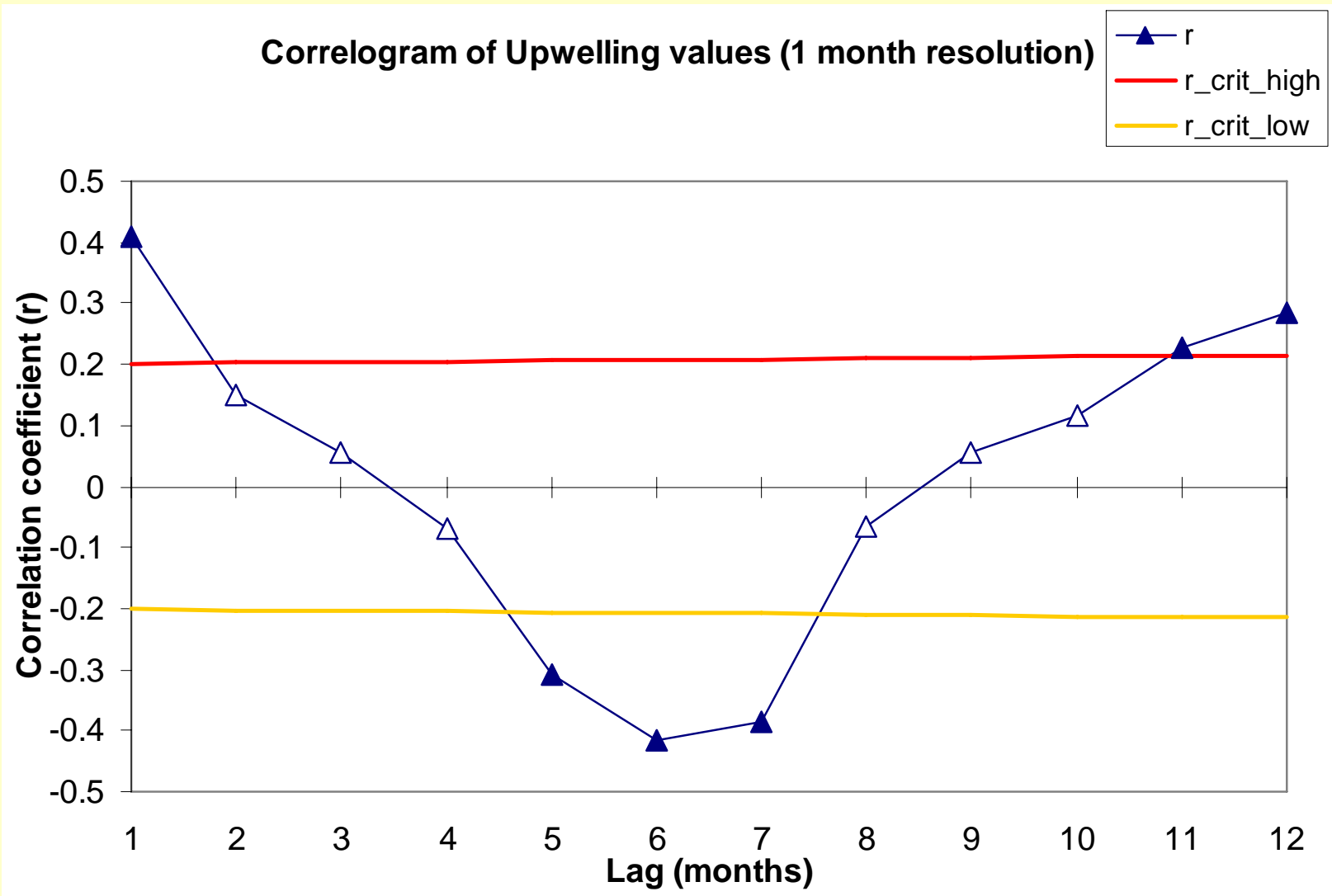


Homework 2 – PDO Scales

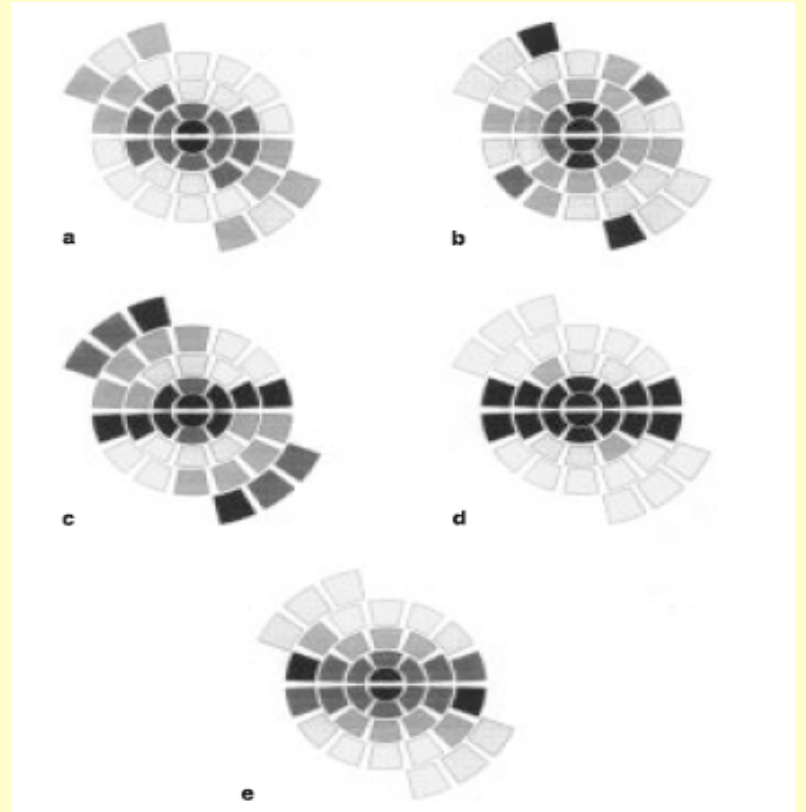
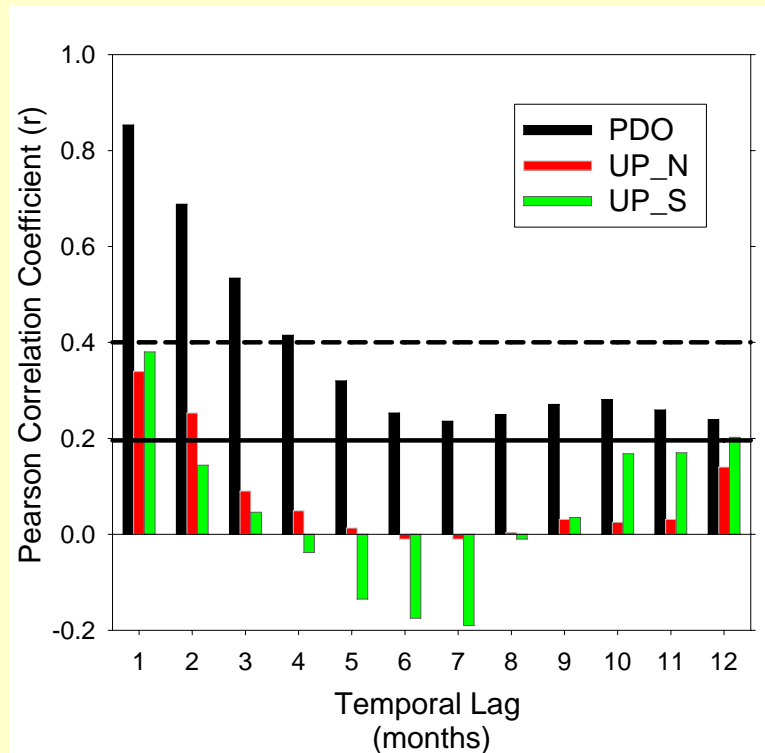
Correlogram of Pacific Decadal Oscillation (PDO) values (1 month resolution)



Homework 2 – Upwelling Scales



Take-Home Messages – Reporting Results



Make scales (resolution / extent) explicit

Analyze all data at same scales (multiple)

Allow readers to determine “significance”

Report statistics (correlation coefficient, Moran’s I)