

The CANCERR Procedure

FRA traits	4
Tang traits	4
Observations	9

Means and Standard Deviations

Variable	Mean	Standard Deviation
totalarea	2088.888889	1958.663093
reefwidth	1.211111	1.182629
reefarea	957.777778	1146.917366
fingercoral	30.455556	12.390557
recruits	52.555556	50.179954
juvs	243.555556	151.654304
adults	726.222222	301.164730
densitychange	0.500000	4.075843

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Correlations Among the Original Variables

Correlations Among the FRA traits

	totalarea	reefwidth	reefarea	fingercoral
totalarea	1.0000	0.9542	0.9129	0.1779
reefwidth	0.9542	1.0000	0.9553	0.2531
reefarea	0.9129	0.9553	1.0000	0.2321
fingercoral	0.1779	0.2531	0.2321	1.0000

R_{11}

Correlations Among the Tang traits

	recruits	juvs	adults	densitychange
recruits	1.0000	0.7358	-0.4180	-0.4557
juvs	0.7358	1.0000	-0.4253	-0.0761
adults	-0.4180	-0.4253	1.0000	0.7435
densitychange	-0.4557	-0.0761	0.7435	1.0000

R_{22}

Correlations Between the FRA traits and the Tang traits

	recruits	juvs	adults	densitychange
totalarea	-0.2765	-0.2496	0.6229	0.5532
reefwidth	-0.1954	-0.0634	0.4607	0.5114
reefarea	-0.0862	-0.0188	0.2858	0.3369
fingercoral	-0.3938	0.2307	0.0674	0.3819

$R_{12} = R_{21}$

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Canonical Correlation Analysis

	R Canonical Correlation	Adjusted Canonical Correlation	Approximate Standard Error	Squared Canonical Correlation
1	0.981180	0.966596	0.013182	0.962714
2	0.949297	0.936021	0.034944	0.901165
3	0.357689	0.074074	0.308319	0.127941
4	0.048992	.	0.352705	0.002400

Test of H0: The canonical correlations in the
Eigenvalues of Inv(E)*H
current row and all that follow are zero = CanRsqr/(1-CanRsqr)

Eigenvalue	Difference	Proportion	Cumulative	Likelihood Ratio	Approximate F Value	Num DF	Den DF	Pr >
1	16.7021	0.7359	0.7359	0.00320595	1.28	16	3.6927	0.454
2	8.9711	0.2599	0.9958	0.08598342	0.97	9	5.0181	0.544
3	0.1443	0.0042	0.9999	0.86996546	0.11	4	6	0.975
4	0.0024	0.0001	1.0000	0.99759981	0.01	1	4	0.926

→
H₀: R₁₁ independent of R₂₂
H_A: R₁₁ not independent of R₂₂

Multivariate Statistics and F Approximations

S=4 M=-0.5 N=-0.5

Statistic	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda	0.00320595	1.28	16	3.6927	0.4547
Pillai's Trace	1.99422049	0.99	16	16	0.5045
Hotelling-Lawley Trace	35.08688658	.	16	-2	.
Roy's Greatest Root	25.81994012	25.82	4	4	0.0041

Different
tests on
H₀ for
axis 1
above

NOTE: F Statistic for Roy's Greatest Root is an upper bound.

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Canonical Correlation Analysis

Raw Canonical Coefficients for the FRA traits

	MPA1	MPA2	MPA3	MPA4
totalarea	-0.000575366	-0.001140498	-0.001101838	0.0004663867
reefwidth	1.2898205491	-0.155905581	2.8809288847	-2.470572214
reefarea	-0.000546773	0.0017189687	-0.000489975	0.0022844443
fingercoral	0.0702839388	-0.017038281	-0.038357766	0.0248589093

2 eigenvectors

Raw Canonical Coefficients for the Tang traits

	ZF1	ZF2	ZF3	ZF4
recruits	-0.036300579	0.0054999614	0.0252003522	0.0089609628
juvs	0.0125199969	-0.000471291	-0.003539459	-0.009232979
adults	0.0016571043	-0.002944817	-0.002793277	-0.005978681
densitychange	-0.189739485	-0.001646653	0.406635511	0.409986698

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Canonical Correlation Analysis

Standardized Canonical Coefficients for the FRA traits

	MPA1	MPA2	MPA3	MPA4
totalarea	-1.1269	-2.2339	-2.1581	0.9135
reefwidth	1.5254	-0.1844	3.4071	-2.9218
reefarea	-0.6271	1.9715	-0.5620	2.6201
fingercoral	0.8709	-0.2111	-0.4753	0.3080

2 standardized eigenvectors

Standardized Canonical Coefficients for the Tang traits

	ZF1	ZF2	ZF3	ZF4
recruits	-1.8216	0.2760	1.2646	0.4497
juvs	1.8987	-0.0715	-0.5368	-1.4002
adults	0.4991	-0.8869	-0.8412	-1.8006
densitychange	-0.7733	-0.0067	1.6574	1.6710

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Canonical Structure

Correlations Between the FRA traits and Their Canonical Variables

	MPA1	MPA2	MPA3	MPA4
totalarea	-0.0889	-0.6475	0.4955	0.5722
reefwidth	0.0713	-0.4860	0.6906	0.5309
reefarea	0.0034	-0.2930	0.6123	0.7343
fingercoral	0.9108	-0.1976	-0.1275	0.3393

Correlations Between the Tang traits and Their Canonical Variables

	ZF1	ZF2	ZF3	ZF4
recruits	-0.2806	0.5971	0.4659	-0.5896
juvs	0.4049	0.5093	0.6253	-0.4308
adults	-0.1221	-0.9768	0.0908	-0.1505
densitychange	0.2833	-0.7865	0.4965	0.2339

Correlations Between the FRA traits and the Canonical Variables of the Tang traits

	ZF1	ZF2	ZF3	ZF4
totalarea	-0.0873	-0.6146	0.1772	0.0280
reefwidth	0.0699	-0.4614	0.2470	0.0260
reefarea	0.0034	-0.2782	0.2190	0.0360
fingercoral	0.8937	-0.1876	-0.0456	0.0166

The CANCERR Procedure

Canonical Structure

Correlations Between the Tang traits and the Canonical Variables of the FRA traits

	MPA1	MPA2	MPA3	MPA4
recruits	-0.2753	0.5669	0.1667	-0.0289
juvs	0.3973	0.4835	0.2237	-0.0211
adults	-0.1198	-0.9273	0.0325	-0.0074
densitychange	0.2779	-0.7466	0.1776	0.0115

Component correlations (Use this!)

Intersect Component correlations

The CANCERR Procedure
 Canonical Redundancy Analysis

Raw Variance of the FRA traits Explained by

Canonical Variable Number	Their Own Canonical Variables		Canonical R-Square	The Opposite Canonical Variables	
	Proportion	Cumulative Proportion		Proportion	Cumulative Proportion
1	0.0059	0.0059	0.9627	0.0057	0.0057
2	0.3341	0.3400	0.9012	0.3011	0.3068
3	0.2785	0.6185	0.1279	0.0356	0.3424
4	0.3815	1.0000	0.0024	0.0009	0.3433

$\Sigma = 1$

$\Sigma = 0.343$

Raw Variance of the Tang traits Explained by

Canonical Variable Number	Their Own Canonical Variables		Canonical R-Square	The Opposite Canonical Variables	
	Proportion	Cumulative Proportion		Proportion	Cumulative Proportion
1	0.0458	0.0458	0.9627	0.0441	0.0441
2	0.8037	0.8495	0.9012	0.7243	0.7684
3	0.0886	0.9381	0.1279	0.0113	0.7797
4	0.0619	1.0000	0.0024	0.0001	0.7798

$\Sigma = 1$

$\Sigma = 0.780$

The CANCERR Procedure

Canonical Redundancy Analysis

Standardized Variance of the FRA traits Explained by

Canonical Variable Number	Their Own Canonical Variables		Canonical R-Square	The Opposite Canonical Variables	
	Proportion	Cumulative Proportion		Proportion	Cumulative Proportion
1	0.2106	0.2106	0.9627	0.2028	0.2028
2	0.1951	0.4057	0.9012	0.1758	0.3786
3	0.2784	0.6841	0.1279	0.0356	0.4142
4	0.3159	1.0000	0.0024	0.0008	0.4150

$\Sigma = 1$

$\Sigma = 0.415$

Standardized Variance of the Tang traits Explained by

Canonical Variable Number	Their Own Canonical Variables		Canonical R-Square	The Opposite Canonical Variables	
	Proportion	Cumulative Proportion		Proportion	Cumulative Proportion
1	0.0845	0.0845	0.9627	0.0813	0.0813
2	0.5472	0.6316	0.9012	0.4931	0.5744
3	0.2157	0.8474	0.1279	0.0276	0.6020
4	0.1526	1.0000	0.0024	0.0004	0.6024

$\Sigma = 1$

$\Sigma = 0.602$

Raw Data

Standardized Data
 (use this!)

The CANCELL Procedure

Canonical Redundancy Analysis

Squared Multiple Correlations Between the FRA traits and the First M Canonical Variables of the Tang traits

M	1	2	3	4
totalarea	0.0076	0.3854	0.4168	0.4176
reefwidth	0.0049	0.2178	0.2788	0.2794
reefarea	0.0000	0.0774	0.1254	0.1266
fingercoral	0.7986	0.8338	0.8359	0.8362

Squared Multiple Correlations Between the Tang traits and the First M Canonical Variables of the FRA traits

M	1	2	3	4
recruits	0.0758	0.3971	0.4249	0.4257
juvs	0.1579	0.3916	0.4416	0.4421
adults	0.0144	0.8742	0.8753	0.8753
densitychange	0.0772	0.6346	0.6662	0.6663

Relationship between MPA characteristics and Yellow Tang abundance

