Appendix

TABLE A1. Summary of the statistical power of the sampling effort at CR1.

Parameters	97-I	97-II	97-III	98-I	98-II	98-III	99-I	99-II	99-III	01-I	01-II	01-III	02-I	02-II	02-III
Species richness	1.0000	0.8918	0.9555	0.8000	0.8822	0.9302	1.0000	0.8977	0.9660	0.8571	0.8333	0.8906	0.9359	0.7888	0.8966
Colony abundance	0.7895	0.8836	0.9363	0.7619	0.9235	0.8768	0.7561	0.9685	0.9654	0.9344	0.8870	0.9438	0.9193	0.8424	0.8901
% coral cover	0.6486	0.9025	0.9374	0.6608	0.9083	0.8699	0.6788	0.9314	0.9174	0.8876	0.9473	0.9454	0.8678	0.9310	0.8438
% total algae	0.6420	0.7652	0.8560	0.7022	0.8326	0.8984	0.7774	0.9150	0.9165	0.9346	0.9694	0.9610	0.8919	0.9333	0.9206
% macroalgae	0.6606	0.2256	0.8156	0.5169	0.8353	0.7013	0.4860	0.5878	0.8940	0.8354	0.9179	0.7533	0.7541	0.7698	0.7568
% filamentous algae	0.3743	0.6981	0.8503	0.5328	0.8737	0.7779	0.5505	0.8140	0.8235	0.8397	0.9142	0.8885	0.9193	0.9126	0.7218
% calcareous algae	N.D.*	N.D.	N.D.	0.6667	0.4000	0.4056	0.4444	0.7635	0.8827	N.D.	0	0.3288	N.D.	0.0867	0
% Halimeda	0.4384	0.3948	0.3241	0.4407	0.5763	0	0.7200	0.6628	0	0.4169	0.6860	0.4110	0.4227	0.4000	0
% encrusting algae	0.6727	0.1524	0.3943	0.8750	0.4979	0.5555	0.7347	0.7171	0.8082	0.5306	0.7482	0.8744	0.7028	0.6371	0.3421
% cyanobacteria	0.4651	0.0961	0.5137	0.4889	0.5120	0.5869	0.6500	0.7326	0.7219	0.5232	0.5404	0.2721	0.3683	0.8743	0.6083
% sponges	0	0.3747	0.7007	0	0.4896	0.7860	0.3077	0.6324	0.6199	0.4317	0.6495	0.7744	0.5559	0.5675	0.7681
H'n	0.9396	0.9319	0.9340	0.7566	0.9070	0.8699	0.6788	0.9308	0.9647	0.8482	0.7930	0.9177	0.9494	0.8049	0.9202
J'n	0.9396	0.9675	0.9519	0.8546	0.9515	0.9762	0.8710	0.9738	0.9740	0.9341	0.8754	0.9846	0.9819	0.9016	0.9535
H'c	0.7732	0.8553	0.8250	0.6045	0.7617	0.9524	0.8927	0.8112	0.8941	0.8272	0.7269	0.7915	0.8263	0.7012	0.8463
J'c	0.8328	0.8479	0.8244	0.6590	0.7598	0.9490	0.9471	0.8079	0.8870	0.8354	0.7248	0.7857	0.8170	0.6975	0.8399

*N.D.= Not documented.

FIGURE A1. Draftman plot of coral species diversity indices at CR1 (1997).

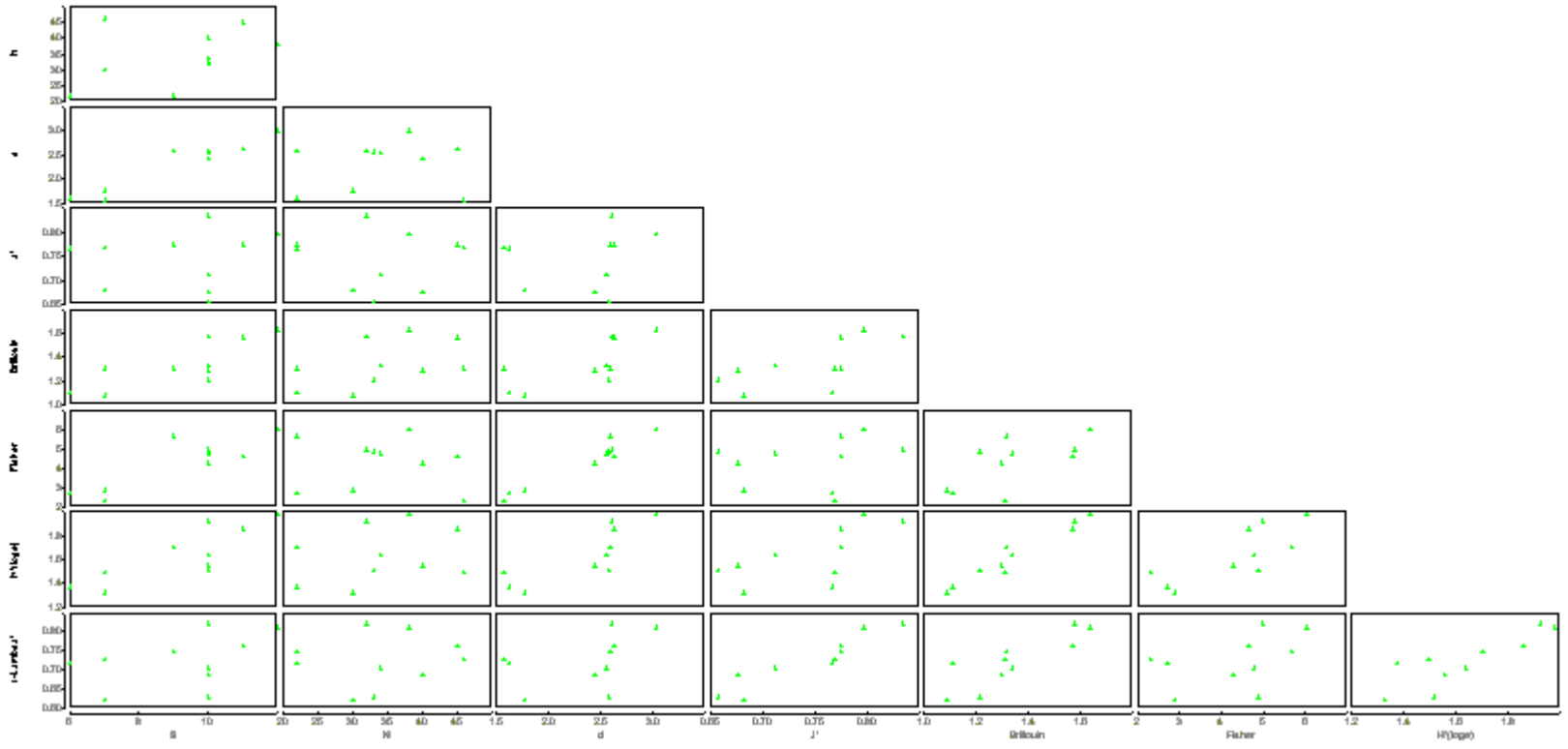

FIGURE A2. Draftman plot of coral species diversity indices at CR1 (1998).

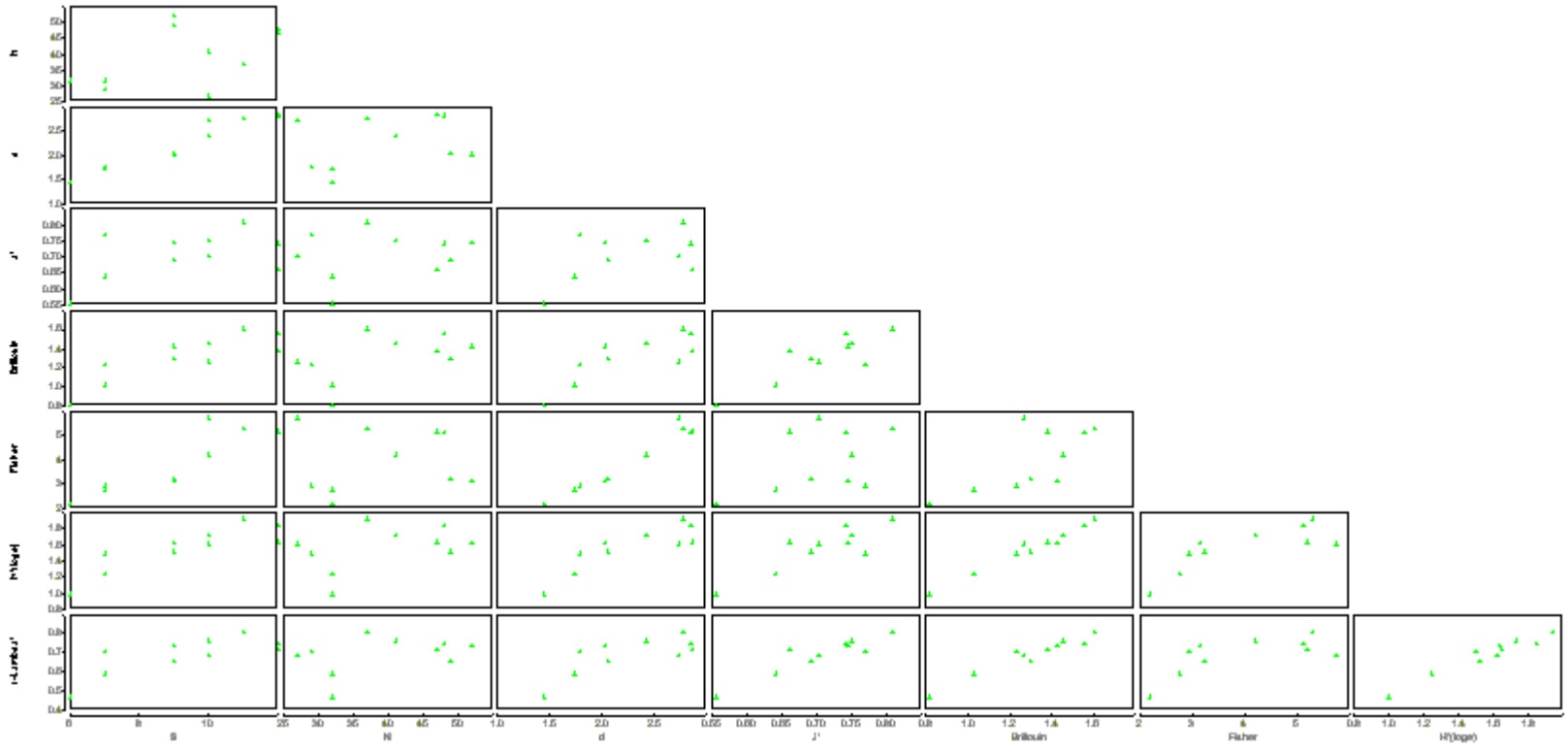

FIGURE A3. Draftman plot of coral species diversity indices at CR1 (1999).

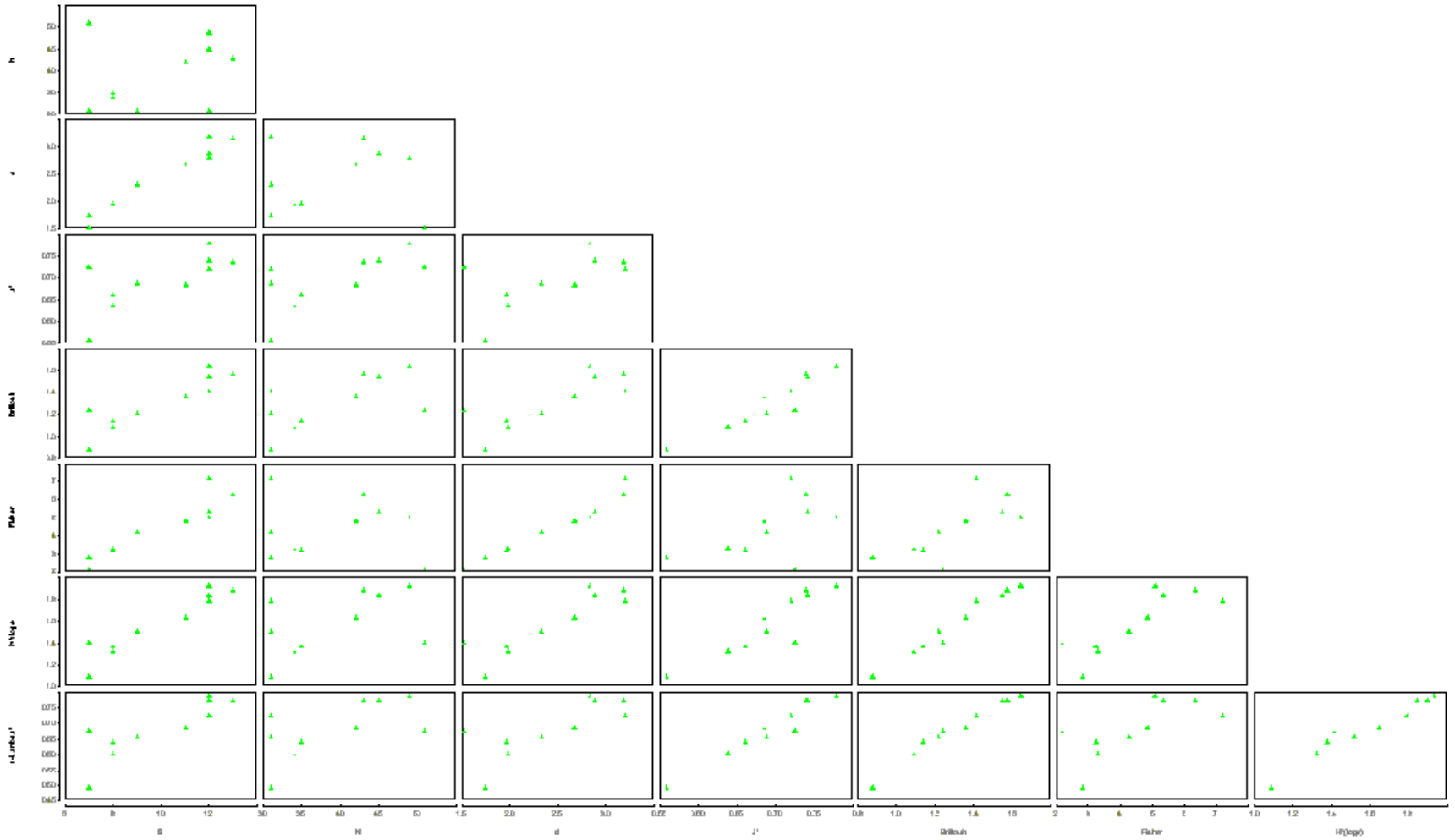

FIGURE A4. Draftman plot of coral species diversity indices at CR1 (2001).

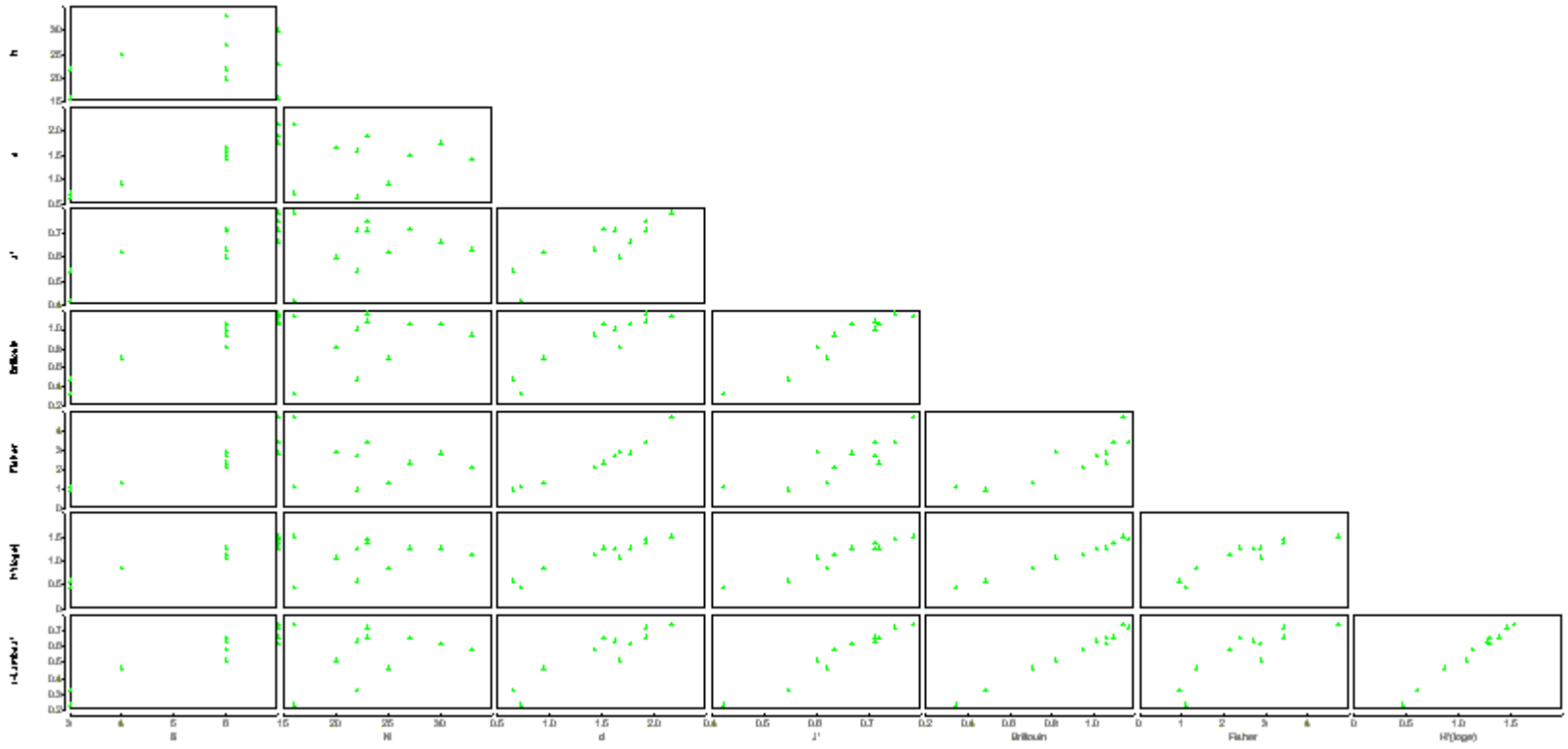

FIGURE A5. Draftman plot of coral species diversity indices at CR1 (2002).

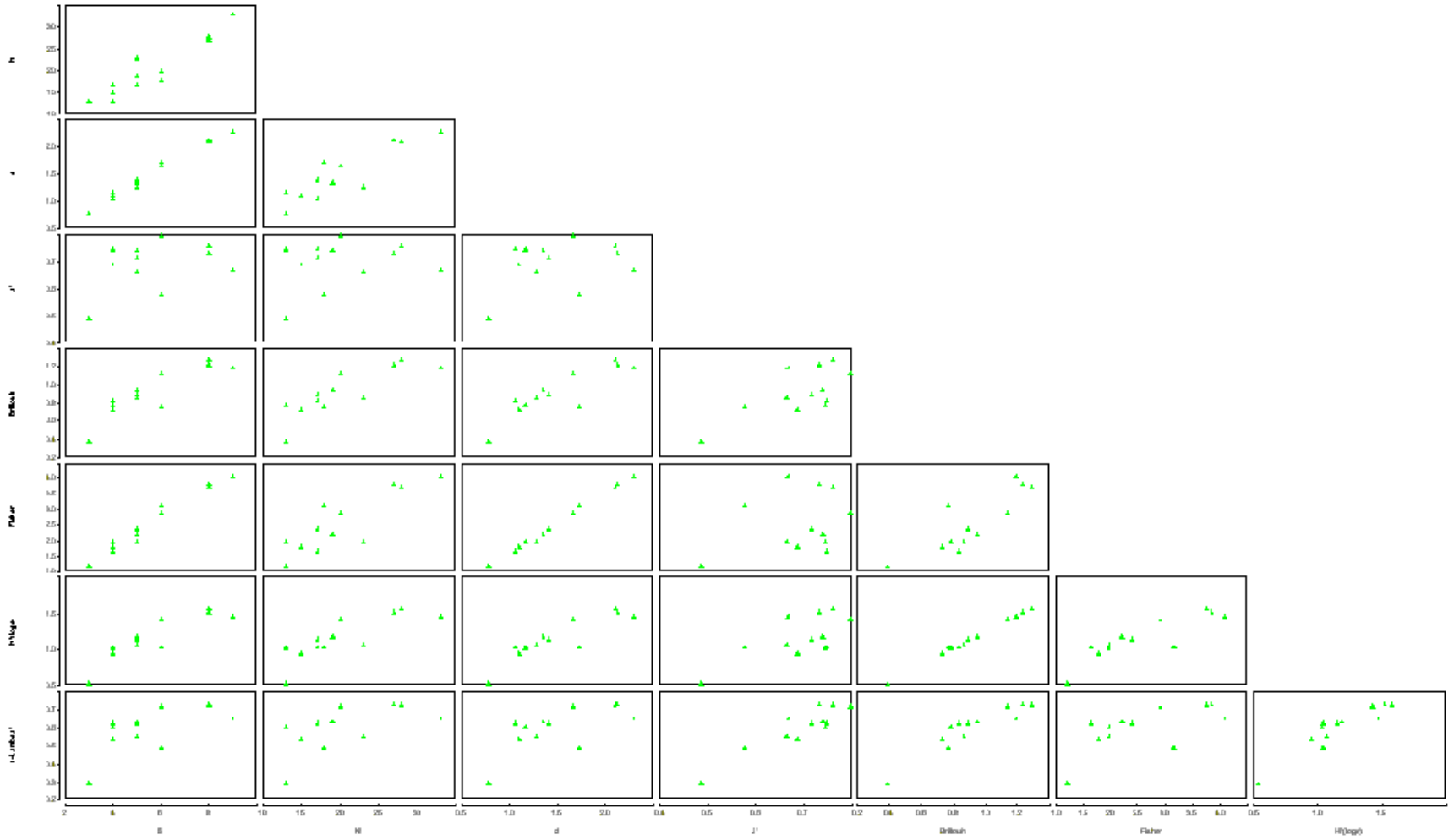

TABLE A2. Summary of the statistical power of the sampling effort at CR2.

Parameters	97-I	97-II	97-III	98-I	98-II	98-III	01-I	01-II	01-III	02-I	02-II	02-III
Species richness	0.8889	0.7789	0.8733	0.9231	0.8723	0.9465	0.8874	0.9475	0.8473	0.8202	0.8515	0.8889
Colony abundance	0.8947	0.7976	0.7708	0.9524	0.8824	0.9204	0.9091	0.9019	0.8306	0.9419	0.9208	0.9021
% coral cover	0.9375	0.9017	0.9158	0.8376	0.8828	0.9438	0.8378	0.8033	0.8841	0.8652	0.8254	0.8999
% total algae	0.4911	0.9192	0.8821	0.6528	0.8961	0.9467	0.8913	0.8932	0.9581	0.8671	0.8859	0.9004
% macroalgae	0.4859	0.7295	0.4110	0.4948	0.8303	0.9163	0.7883	0.9024	0.9292	0.9124	0.8549	0.9268
% filamentous algae	0.4000	0.6778	0.6714	0.5815	0.8129	0.9899	0.8406	0.8680	0.7828	0.7615	0.7550	0.7458
% calcareous algae	N.D.*	N.D.	N.D.	0.9048	0.2293	0	0	0	0.6464	0.5419	0.7959	0.4709
% Halimeda	0	0.2929	0.2788	0.1376	0.6291	0	0.5828	0.1524	0.2097	0.3812	0	0
% encrusting algae	0	0	0	0.1132	0.1354	0.3762	0.4681	0.4556	0.6319	0.7398	0.7279	0.0896
% cyanobacteria	0	0.1391	0.4110	0.1029	0.9050	0.7794	0	0.4213	0	0.7918	0.8264	0.7587
% sponges	0	0	0.4081	0.7500	0.4862	0.7892	0.3164	0.6567	0.6889	0.6505	0.6558	0.4881
H'n	0.9640	0.8881	0.9561	0.9402	0.9024	0.9646	0.7721	0.8877	0.9328	0.7487	0.8617	0.9148
J'n	0.9615	0.9361	0.9842	0.8991	0.9430	0.9708	0.8308	0.8900	0.9114	0.8589	0.9247	0.9370
H'c	0.8994	0.8557	0.9206	0.7188	0.8717	0.9450	0.6822	0.7994	0.9233	0.5870	0.7865	0.8850
J'c	0.8768	0.8688	0.9301	0.6874	0.8755	0.9384	0.6653	0.7940	0.9210	0.5795	0.7745	0.8771

*N.D.= Not documented.

FIGURE A6. Draftman plot of coral species diversity indices at CR2 (1997).

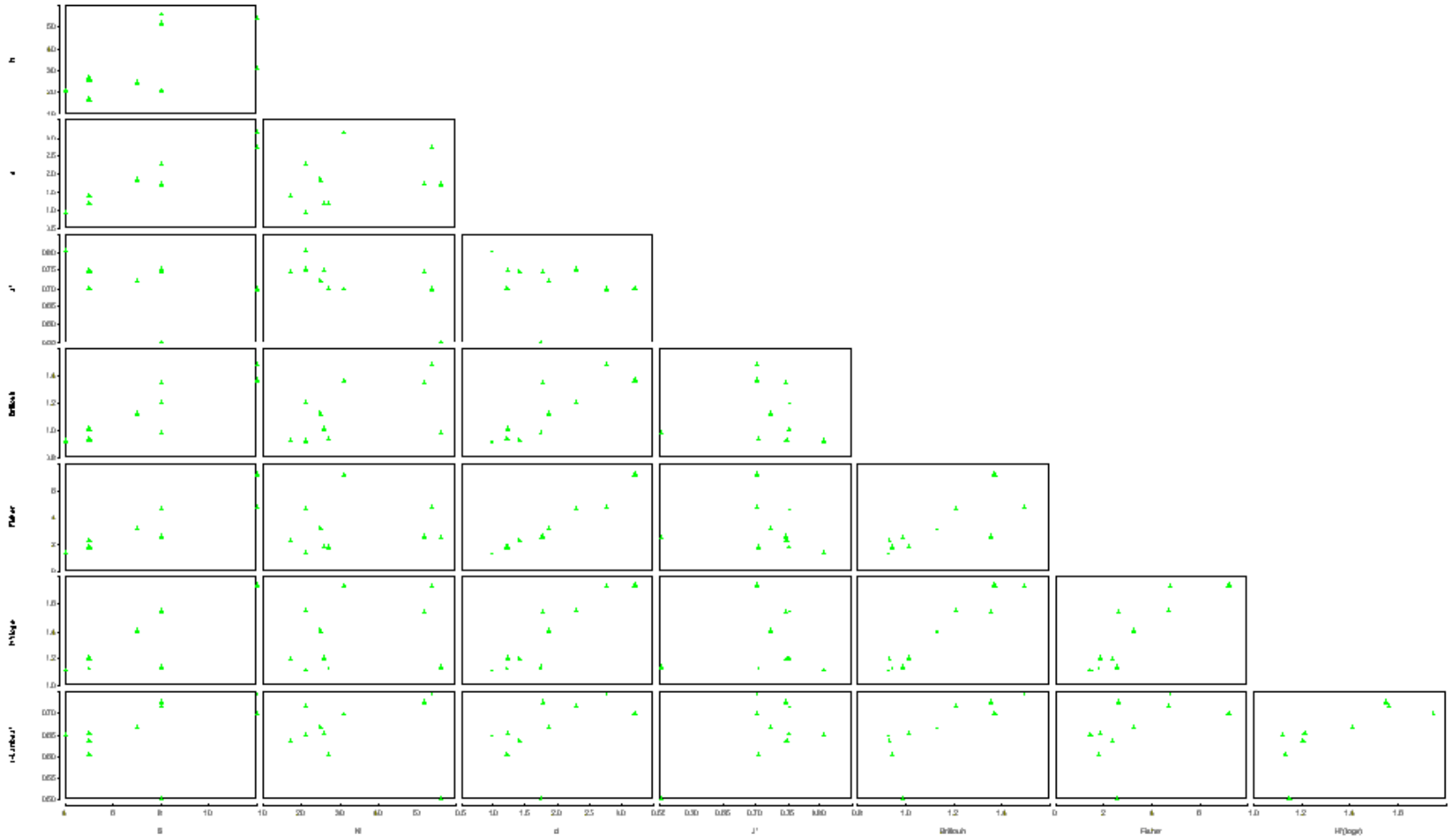

FIGURE A7. Draftman plot of coral species diversity indices at CR2 (1998).

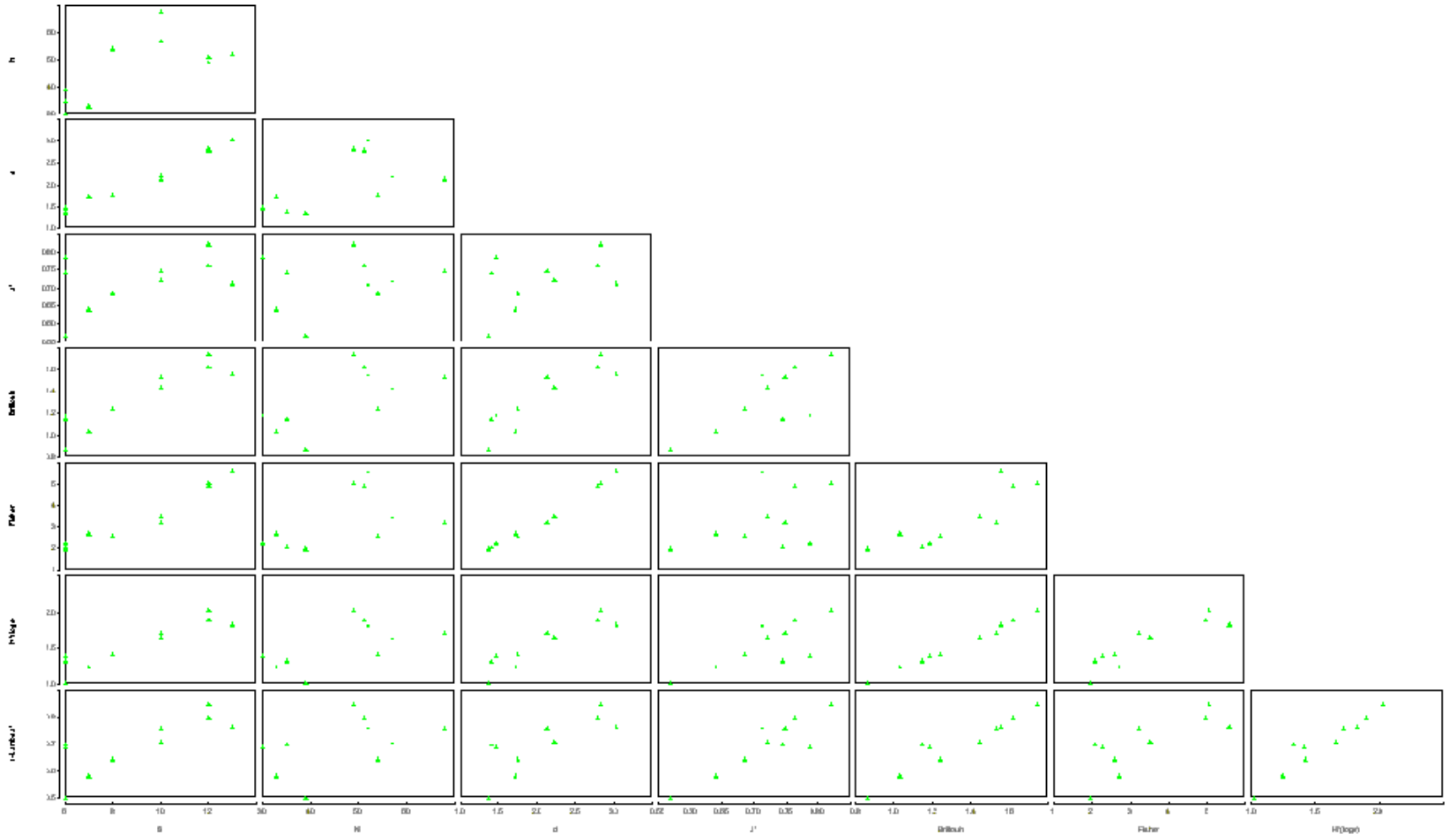

FIGURE A8. Draftman plot of coral species diversity indices at CR2 (2001).

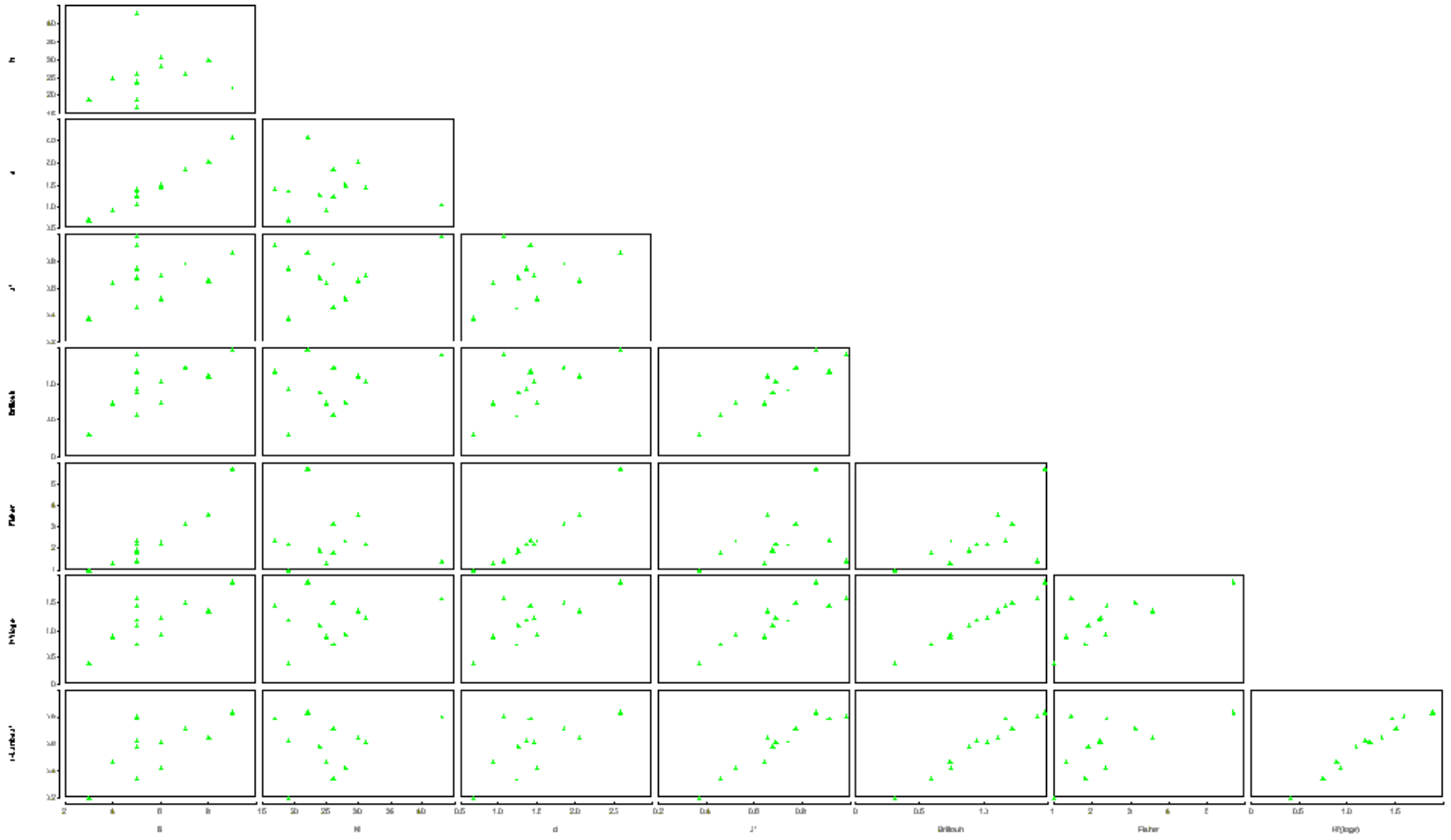

FIGURE A9. Draftman plot of coral species diversity indices at CR2 (2002).

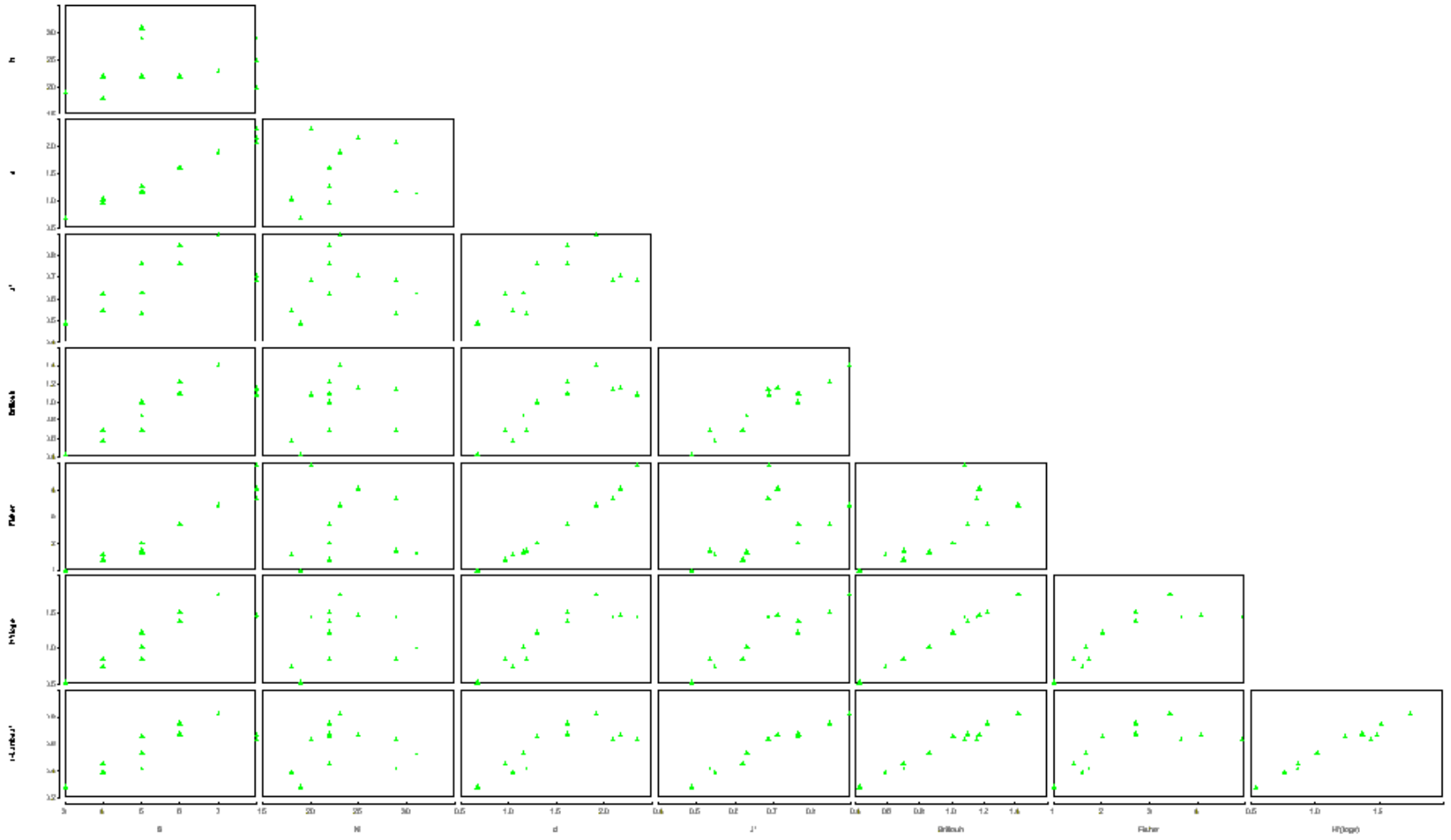

TABLE A3. Magnitude of changes in coral reef epibenthic parameters for the period of 1997 to 2002 at CR1 per each depth zone.

Parameter	I	II	III
Species richness	-35.7%	-40.0%	-32.6%
Colony abundance	-57.9%	-31.8%	-33.3%
% Coral cover	-55.2%	-49.8%	-41.1%
% Total algal cover	+20.6%	+72.9%	+45.2%
% Macroalgal cover	+349.1%	+559.8%	+307.7%
% Filamentous algal cover	-21.8%	+14.5%	-38.2%
% Erect calcareous algal cover	-100.0%*	+188.5%*	-40.0%*
% Halimeda spp. cover	-91.8%	-16.7%	-88.5%
% Encrusting algal cover	+13.6%	+30.9%	+161.2%
% Cyanobacterial cover	-1.7%	+883.3%	+293.7%
% Sponge cover	+112.5%	+94.1%	-18.4%
Coral H'n	-23.3%	-37.7%	-19.8%
Coral J'n	-0.45%	-17.5%	-0.62%
Coral H'c	-34.6%	-33.9%	-26.4%
Coral J'c	-27.8%	-25.1%	-17.8%

*% of change calculated between years 1998 and 2002.

TABLE A4. Magnitude of changes in coral reef epibenthic parameters for the period of 1997 to 2002 at CR2 per each depth zone.

Parameter	I	II	III
Species richness	+5.6%	-23.3%	-22.9%
Colony abundance	+7.9%	-27.1%	-35.5%
% Coral cover	-54.0%	-36.5%	-48.0%
% Total algal cover	+106.7%	+12.2%	+16.3%
% Macroalgal cover	-22.1%	+25.2%	+231.4%
% Filamentous algal cover	+3895.0%	-64.0%	-66.4%
% Erect calcareous algal cover	-78.6%*	+17.7%*	N.D.**
% Halimeda spp. cover	-97.1%*	-88.2%	-100.0%
% Encrusting algal cover	+5.2%*	+75.4%	+123.1%
% Cyanobacterial cover	+183.5%*	+300.6%	+3200.0%
% Sponge cover	+212.5%*	+560%	+78.0%
Coral H'n	-7.9%	-13.6%	-13.1%
Coral J'n	-13.2%	-3.7%	-1.54%
Coral H'c	-1.6%	-19.5%	-9.9%
Coral J'c	+16.5%	-8.5%	+2.7%

*% of change calculated between years 1998 and 2002.
**N.D.= Not Determined.

TABLE A5. Summary of some examples of rate of changes in the % of coral cover through the Caribbean during the last three decades (modified after Gardner, 2002)*.

Study	Region	Location	Period (y)	Duration (y)	Depth (m)	Initial % cover	End % cover	Rate of change in coral cover
Keller (2001), Wheaton et al. (2001), Porter et al. (2002)	Florida	Admiral	96-01	6	2	30.03	21.17	-4.92
		Jaap Reef	96-01	6	3	31.80	16.02	-8.27**
		W.Washer Woman	96-01	6	8	28.24	23.40	-2.86**
		Western Head	96-01	6	10.25	26.96	23.25	-2.29**
		Western Sambo	96-01	6	4	22.77	5.33	-12.77**
Porter (1989), Porter and Meier (1992)		Looe Key (LR01)	84-91	8	5.5	30.28	18.49	-4.87**
		Looe Key (LR02)	84-91	8	7.7	30.67	26.65	-1.64**
Meier (1996)		Ball Buoy Reef	89-94	6	3.1	24.45	30.58	+4.18**
		Ball Buoy Reef	89-94	6	3	37.92	27.55	-4.56**
Dustan & Halas (1987)		Carysfort Reef	75-82	8	0.3	36.67	40.67	+1.36
		Carysfort Reef	75-82	8	1.275	26.75	33.00	+2.92
		Carysfort Reef	75-82	8	6.1	22.75	31.83	+4.99
Smith (1998)	Bermuda	Hog Breaker Reef	93-98	6	8	22.26	21.19	-0.80
		Twin Breaker Reef	93-98	6	8	24.24	21.19	-2.09
Hughes (1994), Hughes & Connell (1999)	Jamaica	Rio Bueno	77-93	17	7	62.00	3.00	-5.59**
		Rio Bueno	77-93	17	10	72.00	4.00	-5.55**
Hughes (1994)		Negril	77-93	17	10	40.00	8.94	-4.56**
		Chalet Caribe	77-93	17	10	79.00	6.71	-5.38**
		Montego Bay	77-93	17	10	48.00	4.47	-5.33**
		Rio Bueno	77-93	17	10	64.00	4.47	-5.47**
		Discovery Bay	77-93	17	10	62.00	4.47	-5.45**
		Pear Tree Bottom	77-93	17	10	72.00	4.47	-5.51**
		Port Maria	77-93	17	10	41.00	2.23	-5.56**
		Port Antonio	77-93	17	10	52.00	4.47	-5.37**
		Port Royal Cays	77-93	17	10	22.00	8.94	-3.49**
Hughes (1993)		DBML *Zoanthus* zone	76-90	15	1	77.00	0.26	-6.64**
		DBML Crosby Patch	75-90	16	2	39.00	7.64	-5.02**
		DBML	73-90	18	2	36.00	2.55	-5.16**

		Stills Patch						
		DBML *A. palmata* zone	78-90	13	1	56.70	0.25	-7.65**
		DBML *A. cervic.* zone	78-90	13	10	42.00	2.82	-7.17**
Knowlton et al. (1990)		Montego Bay (west)	82-87	6	10.5	37.00	5.50	-14.18
		Central 2 (Pear Tree Bottom)	82-87	6	10.5	30.50	8.00	-12.29
Steneck (1994)		DBML	78-87	10	3	38.50	0.50	-9.87**
		DBML	78-87	10	10	32.00	11.50	-6.40**
Garrison et al. (2000)	Puerto Rico	Culebra Carlos Rosario Beach	91-98	8	6	36.30	37.10	+0.27**
		Culebra Dewey	91-98	8	6	9.00	16.00	+9.72**
		Culebra Los Corchos	91-98	8	6	19.00	25.00	+3.94**
Hernández-Delgado (2000, 2001), This study		**Culebra CR1**	**97-02**	**6**	**4**	**49.80**	**22.30**	**-11.04****
		Culebra CR1	**97-02**	**6**	**4-8**	**75.50**	**37.90**	**-9.96****
		Culebra CR1	**97-02**	**6**	**8**	**59.70**	**35.20**	**-8.21****
		Culebra CR2	**97-02**	**6**	**4**	**82.40**	**37.90**	**-10.80****
		Culebra CR2	**97-02**	**6**	**4-8**	**50.90**	**32.30**	**-7.31****
		Culebra CR2	**97-02**	**6**	**8-11**	**44.20**	**23.0**	**-9.59****
García et al. (1998)		Parguera Media Luna	94-98	5	10	39.73	46.30	+3.31**
		Parguera Turrumote	94-98	5	10	45.11	45.71	+0.26**
Rogers et al. (1991, 1997)	USVI	Yawzi Point	89-95	7	11	20.00	10.50	-6.78**
Bythell et al. (2000)		BUIS-BI4	90-00	12	4	31.82	39.75	+2.04**
		BUIS-BI2	90-00	12	7	25.44	15.39	-3.29**
		BUIS-BI3 (inner)-Rf	76-90	15	3	52.30	6.80	-5.79**
		BUIS-BI3 pr-Bg	76-90	15	11	26.90	9.40	-4.33**
Edmunds & Witman (1991), Edmunds (in review, as cited by Gardner, 2000)		Yawzi Point	87-98	12	9	45.00	20.00	-4.62**
Witman (1992)		Cabritte Horn (Exposed)	85-91	6	4	55.00	56.00	+0.30**
		Cabritte Horn (Sheltered)	85-91	6	4	25.00	22.00	-2.00**
Steneck (1994)		Teague Bay	82-88	7	3	33.00	17.00	-6.92
		Teague Bay/Salt River	82-88	7	10	20.00	14.50	-3.92
Ruíz-Rentería et al. (1998)	México	Puerto Morelos	78-93	16	2	28.40	4.60	-5.23**
		Puerto	78-93	16	0.8	27.10	6.40	-4.77**

		Morelos						
McClanahan y Muthiga (1998), McClanahan et al. (1999)	Belize	*Montastrea* zone	71-96	27	1	92.00	21.50	-2.83**
Aronson et al. (2002)		Channel Cay	86-01	16	3-15	86.9	4.2	-5.94
Cortés (1993)	Costa Rica	Cahuita	81-93	13	5	40.40	11.20	-5.55
Shulman & Robertson (1996)	Panamá	Point 23 Shallow	83-90	8	1	42.00	21.00	-6.25
		Wichubhuala 24 Shallow	83-90	8	1	42.00	18.00	-7.14
		Wichubhuala 14 Shallow	83-87	5	1	42.00	23.50	-8.80
		Wichubhuala 17	86-90	5	3.5	34.00	26.00	-4.70
		Porvenir 26N	83-87	5	5	32.00	18.00	-8.75
Garzón-Ferreira y Kielman (1993	Colombia	Islas del Rosario	83-90	8	varies	41.8	21.3	-6.13**
Garzón-Ferreira (1998)		Chengue Bay 1	93-98	6	10.5	26.61	28.16	+0.96
		Chengue Bay 2	93-98	6	10.5	42.46	40.82	-0.64
Laydoo et al. (1998)	Trinidad & Tobago	Eastern Buccoo 1	94-98	5	10	24.10	21.62	-2.05
		Outer Buccoo	94-98	5	10	23.61	45.56	+18.59
Bak & Lukhurst (1980); Bak & Nieuwland (1995)	Netherland Antilles	-	73-91	21	10	30.74	19.00	-1.818

*Based on the existing data from CR1 and CR2, and on the maximum depth of our permanent transects, this data set was limited to studies that met the following criteria: 1) longer than 5 years; 2) depth zones not exceeding 11 m; and 3) initial % coral cover higher than 20%.

**= A site has been impacted by at least one hurricane (categories 1-5) during the period of study (after Gardner, 2002).

DBML= Discovery Bay Marine Laboratory, Jamaica.

TABLE A6. Coral:algal ratios at CR1.

Year	Depth zone	Coral:algal ratio
1997	I	0.996
	II	2.706
	III	1.605
1998	I	1.030
	II	1.807
	III	1.555
1999	I	0.788
	II	1.130
	III	1.027
2001	I	0.641
	II	0.758
	III	0.672
2002	I	0.370
	II	0.785
	III	0.652

TABLE A7. Coral:algal ratios at CR2.

Year	Depth zone	Coral:algal ratio
1997	I	4.162
	II	1.109
	III	0.834
1998	I	2.092
	II	0.853
	III	0.834
2001	I	0.729
	II	0.512
	III	0.382
2002	I	0.929
	II	0.627
	III	0.373