

Long-term Region-wide Declines in Caribbean Corals

Toby A. Gardner, Isabelle M. Côté, Jennifer A. Gill, Alastair Grant &
Andrew R. Watkinson

Methods

Data sources

Data describing coral cover change over time were sourced through electronic and manual literature searches, and personal communications with reef scientists, site managers and institutional librarians.

Data selection

To avoid bias in the selection process, the only restriction criteria employed were that each study reported at least percent hard coral cover from a site within the region, had observed the same site over more than one year, and had replicated measurements within year. Sites were deemed separate as defined by each study, apart from the few instances when a single site crossed a steep depth contour, in which case transects were re-pooled into groups of similar depth.

Annual rates of change in coral cover

The overall annual rate of change in coral cover, C_R , was calculated as:

$$C_R = 100 * ((PC_A - PC_B) / PC_B) / d$$

where PC_A and PC_B are % coral cover at the end and start of the study period, respectively, and d is the study duration in years.

To calculate the year-on-year annual rate of change in coral cover, we used the procedure described by J.E. Houlahan, C. S. Findlay, B. R. Schidt, A. H. Meyer, S. L. Kuzmin, *Nature* **404**, 752 (2000). The method calculates ΔN for successive yearly intervals as described by:

$$\Delta N = \log(N + 1)_{t+1} - \log(N + 1)_t$$

where N is % coral cover and t is year of study. For this analysis, only studies having at least 2 consecutive years of data could be used.

Weighting individual studies

To give relatively more weight to larger studies, we weighted each study's estimate of percent cover by the inverse of the sample variance to obtain yearly weighted means. This procedure was carried out only in the calculation of year-on-year change in absolute coral cover, where different studies contributed data in different years. The repeated measurements of coral cover at the same sites, upon which the meta-analyses of C_A and C_R are based, effectively precluded effect size weighting because of the lack of a reliable measure of pooled variance for each effect size.

Spatial and temporal analyses

To explore spatial and temporal heterogeneity in coral cover change, the overall dataset was divided into classes based on geographic region and five-year intervals (in reference to the mid-point of each study), and the mean effect size and confidence intervals were recalculated for both absolute coral cover and annual rate of change. To maintain a minimum sample size of 10 studies per group, data were pooled into six regional categories: Florida, US Virgin Islands and Puerto Rico, Jamaica, Northern Central America, Southern Central America, and the Leeward Netherlands Antilles and Venezuela. Differences in coral cover change among groups were estimated using the statistic Q_B . The significance of Q_B was tested against a distribution generated from 5000 iterations of a randomisation test.

Excluded data

In both meta-analyses of C_A and C_R , one outlier (*Table S1*, site #166) was omitted owing to the very high (2100%) rate of increase in percent coral cover recorded between 1994 and 1997. Coral cover at this site increased from 0.2% to 17%; this very low initial coral cover and possible associated sampling error are likely to have influenced this extreme value.

Tests of non-independence

We carried out a number of tests of non-independence within studies. First, when using only one randomly chosen site from each study into the overall meta-analyses, the effect size for both rate of change and change in absolute percent coral cover remained negative and significantly different from zero ($\overline{C_R} = -4.2$, $CI = -7.0$ to -1.3 , and $\overline{C_A} = -9.7$, $CI = -11.7$ to -7.8). Second, the removal from the analysis of the largest study, the Florida Keys Coral Reef Monitoring Project (*Table S1*; study #1), also had little effect on the overall result ($\overline{C_R} = -6.3$, $CI = -8.8$ to -3.6 , and $\overline{C_A} = -10.8$, $CI = -13.1$ to -8.6 ; Fig. 2A). Furthermore, when considering non-independence between studies, both differences in study duration and survey method failed to explain a significant level of variation in annual rate of change in percent cover ($Q_B = 5.6$, $p = 0.98$, and $Q_B = 5.84$, $p = 0.17$, respectively).

Table S1: Supplementary site information from across the regional database. In cases where a site did not run parallel to the depth contour, the depth measurement given is the average across the gradient. Survey method code: 1 = Videotransects (with point-count analysis), 2 = photoquadrats (including both pointcount and photogrammetric analysis), 3 = Line-intercept transects (varying intervals), and 4 = chain transects. N = sample size (number of replicates). NA = data not available.

Study	Site No.	Region	Location	Period	Duration	Surveys /year	Depth (m)	Survey method	N
1. Porter et al. (2002); Keller (2001); Wheaton et al. (2001), and personal communication with W Jaap and K Hackett	1	Florida	Admiral	96-01	6	1	2	1	4
	2	“ “	Alligator Deep	96-01	6	1	12	1	4
	3	“ “	Alligator Shallow	96-01	6	1	4.5	1	4
	4	“ “	Bird Key	99-01	3	1	12.5	1	4
	5	“ “	Black Coral Rock	99-01	3	1	22.75	1	4
	6	“ “	Carysfort Deep	96-01	6	1	15	1	4
	7	“ “	Carysfort Shallow	96-01	6	1	3.5	1	4
	8	“ “	Cliff Green	96-01	6	1	8	1	4
	9	“ “	Conch Deep	96-01	6	1	17	1	4
	10	“ “	Conch Shallow	96-01	6	1	6.5	1	4
	11	“ “	Content Keys	96-01	6	1	6	1	4
	12	“ “	Dove Key	96-01	6	1	3	1	4
	13	“ “	Dustan Rocks	96-01	6	1	6	1	4
	14	“ “	Eastern Sambo Deep	96-01	6	1	15	1	4
	15	“ “	Eastern Sambo Shallow	96-01	6	1	3	1	4
	16	“ “	El Radabob	96-01	6	1	3	1	4
	17	“ “	Grecian Rocks	96-01	6	1	5.5	1	4
	18	“ “	Jaap Reef	96-01	6	1	3	1	4
	19	“ “	Long Key	96-01	6	1	4	1	4
	20	“ “	Looe Key Deep	96-01	6	1	13.5	1	4
	21	“ “	Looe Key Shallow	96-01	6	1	7.5	1	4
	22	“ “	Molasses Deep	96-01	6	1	14.5	1	4
	23	“ “	Molasses Keys	96-01	6	1	7.25	1	4
	24	“ “	Molasses Shallow	96-01	6	1	4	1	4
	25	“ “	Moser Channel	96-01	6	1	4	1	4
	26	“ “	Porter Patch	96-01	6	1	5	1	4
	27	“ “	Rattlesnake	96-01	6	1	3	1	4
	28	“ “	Rock Key Deep	96-01	6	1	13	1	4
	29	“ “	Rock Key Shallow	96-01	6	1	4.5	1	4
	30	“ “	Sand Key Deep	96-01	6	1	11	1	4
	31	“ “	Sand Key Shallow	96-01	6	1	7	1	4
	32	“ “	Smith Shoal	96-01	6	1	8	1	4
	33	“ “	Sombrero Deep	96-01	6	1	15.5	1	4
	34	“ “	Sombrero Shallow	96-01	6	1	5.25	1	4

Study	Site No.	Region	Location	Period	Duration	Surveys /year	Depth (m)	Survey method	N
	35	“ “	Tennessee Deep	96-01	6	1	14	1	4
	36	“ “	Tennessee Shallow	96-01	6	1	6	1	4
	37	“ “	Turtle	96-01	6	1	6.5	1	4
	38	“ “	W.Turtle Rocks	96-01	6	1	7	1	4
	39	“ “	W.Washer Woman	96-01	6	1	8	1	4
	40	“ “	Western Head	96-01	6	1	10.25	1	4
	41	“ “	Western Sambo Deep	96-01	6	1	10.5	1	4
	42	“ “	Western Sambo Shallow	96-01	6	1	4	1	4
	43	“ “	White Shoal	99-01	3	1	6.75	1	4
2. Keller (2001), and personal communication with T Murdoch and R Aronson	44	Florida	South Carysfort Shallow	98-01	4	1	9	1	10
	45	“ “	South Carysfort Deep	98-01	4	1	15.5	1	10
	46	“ “	Eastern Sambo Shallow	98-01	4	1	9	1	10
	47	“ “	Eastern Sambo Deep	98-01	4	1	15.5	1	10
	48	“ “	Western Sambo Shallow	98-01	4	1	9	1	10
	49	“ “	Western Sambo Deep	98-01	4	1	15.5	1	10
	50	“ “	Maitland Shallow	98-01	4	1	9	1	10
	51	“ “	Maitland Deep	98-01	4	1	15.5	1	10
	52	“ “	Middle Sambo Shallow	98-01	4	1	9	1	10
	53	“ “	Middle Sambo Deep	98-01	4	1	15.5	1	10
	54	“ “	Pelican Shoal Shallow	98-01	4	1	9	1	10
	55	“ “	Pelican Shoal Deep	98-01	4	1	15.5	1	10
3. Porter (1989); Porter & Meier (1992); Meier (1996)	56	Florida	Looe Key (LR01)	84-91	8	0.5	5.5	2	24
	57	“ “	Looe Key (LR02)	84-91	8	0.5	7.7	2	24
	58	“ “	Carysfort Reef (CR01)	84-91	8	0.62	4	2	24
	59	“ “	Carysfort Reef (CR02)	84-91	8	0.62	14.5	2	24
								2	
4. Porter (1989); Porter & Meier (1992); Meier (1996)	60	Florida	Ball Buoy Reef	89-94	6	1	3.1	2	36
	61	“ “	Triumph Reef	89-94	6	1	6	2	36
	62	“ “	Ball Buoy Reef	89-91	6	1	NA	2	3
	63	“ “	Triumph Reef	89-91	6	1	NA	2	3

Study	Site No.	Region	Location	Period	Duration	Surveys /year	Depth (m)	Survey method	N
5. Dustan & Halas (1987)	64	Florida	Carysfort - shallow	75-82	8	0.25	0.3	3	5
	65	“ “	Carysfort - shallow	75-82	8	0.25	1.275	3	4
	66	“ “	Carysfort - deep	75-82	8	0.25	6.1	3	4
	67	“ “	Carysfort - deep	75-82	8	0.25	15	3	7
6. Jaap et al. (1989), and personal communication with W Jaap	68	Florida	Bird Key Reef	76-77	2	1	3.2	3	9
	69	“ “	Bird Key Reef	76-77	2	1	5.8	3	6
	70	“ “	Bird Key Reef	76-77	2	1	7.6	3	5
	71	“ “	Bird Key Reef	76-77	2	1	11.8	3	10
7. Jaap & Wheaton (1992); Jaap et al. (1991)	72	Florida	Bird Key Reef	89-91	3	1	10.5	4	3
	73	“ “	Loggerhead Key	89-91	3	1	7	4	3
	74	“ “	Pulaski Shoal	89-91	3	1	10	4	3
	75	“ “	Texas Rock	89-91	3	1	13	4	3
	76	“ “	White Shoal	89-91	3	1	5	4	3
8. Lirman & Fong (1996, 1997a, b)	77	Florida	Elkhorn Reef	93-94	2	2	1.7	2	5
	78	“ “	Elkhorn Reef	93-94	2	2	1.2	2	5
	79	“ “	Elkhorn Reef	93-94	2	1	3.1	2	5
9. Rogers et al. (1983)	80	USVI	Flat Cay	79-81	3	1	4	4	8
	81	“ “	Brewers Middle	79-81	3	1	5.5	4	9
	82	“ “	Brewers West	79-81	3	1	5.5	4	8
	83	“ “	Perseverance	79-81	3	1	6	4	8
	84	“ “	Salt River	80-81	2	1	13	4	10
	85	“ “	Robin Bay	78-79	2	1	4	4	5
10. Rogers & Zullo (1987)	86	USVI	Fish Bay	84-85	2	1	11	4	10
	87	“ “	Reef Bay	84-85	2	1	7	4	10
	88	“ “	Hawksnest Bay	84-85	1	2	3	4	3
11. Rogers et al. (1991,1997)	89	USVI	Yawzi Point	89-95	13	1.62	11	4	5
12. Personal communication with C Rogers	90	USVI	Newfound	90-99	12	1.25	7.6	4	10
13. Personal communication with D Catanzaro and J. Miller	91	USVI	Yawzi Point	99-01	3	1	11	1	20
	92	“ “	Newfound	99-02	4	1	10	1	20
	93	“ “	BUIS	00-01	2	1	12	1	20
	94	“ “	Mennebeck	00-01	2	1	9	1	20

Study	Site No.	Region	Location	Period	Duration	Surveys /year	Depth (m)	Survey method	N
14. Bythell et al. (1993a, b, c); Bythell (1998) Bythell et al. (2000a,b), and personal communication with J. Bythell	95	USVI	BUIS - BI 5	90-00	12	0.92	3	4	4
	96	“ “	BUIS - BI 4	89-00	12	0.92	4	4	4
	97	“ “	BUIS - BI 2	89-00	12	0.58	7	4	4
15. Gladfelter et al. (1977); Bythell et al. (1989); Gladfelter et al. (1991)	98	USVI	BUIS - BI 2; Rb	88-90	3	1	1	2	10
	99	“ “	BUIS - BI 2; Rc	76-90	15	0.27	1	2	10
	100	“ “	BUIS - BI 2; Rf	88-90	3	1	5	2	10
	101	“ “	BUIS - BI 2; Bg	88-90	3	1	10.5	2	10
	102	“ “	BUIS - BI 3 (inner); Rb	88-90	3	1	3	2	10
	103	“ “	BUIS - BI 3 (inner); Rc	88-90	3	1	1	2	10
	104	“ “	BUIS - BI 3 (inner); Rf	76-90	15	0.27	3	2	15
	105	“ “	BUIS - BI (inner); Bg	88-90	3	1	6	2	15
	106	“ “	BUIS - BI 3pr; Rb	88-90	3	1	4	2	10
	107	“ “	BUIS - BI 3pr; Rc	88-90	3	1	2	2	15
108	“ “	BUIS - BI 3pr; Rf	88-90	3	1	7	2	10	
109	“ “	BUIS - BI 3pr; Bg	76-90	15	0.27	11	2	15	
16. Edmunds & Witman (1991); Edmunds (2002), and personal communication with P Edmunds	110	USVI	Yawzi Point	87-98	12	1.17	9	2	3
	111	“ “	Tektite	87-98	12	1.17	14	2	3
17. Edmunds (2002), and personal communication with P Edmunds	112	USVI	2	92-98	7	1	9	2	20
	113	“ “	5	92-98	7	1	9	2	20
	114	“ “	6	92-98	7	1	9	2	20
	115	“ “	9	92-98	7	1	7	2	20
	116	“ “	11	92-98	7	1	9	2	20
	117	“ “	15	92-98	7	1	9	2	20
18. Witman (1992)	118	USVI	Cabritte Horn - Exposed	85-91	6	0.33	4	2	8
	119	“ “	Cabritte Horn - Exposed	85-91	6	0.33	12	2	8
	120	“ “	Cabritte Horn - Sheltered	85-91	6	0.33	4	2	8
	121	“ “	Cabritte Horn - Sheltered	85-91	6	0.33	12	2	8

Study	Site No.	Region	Location	Period	Duration	Surveys /year	Depth (m)	Survey method	N
19. Aronson et al. (1993)	121	USVI	Salt River - East Slope	88-90	3	0.67	8	1	NA
	122	“ “	Salt River - East Slope	88-90	3	0.67	12	1	NA
	123	“ “	Salt River - East Slope	88-90	3	0.67	15	1	NA
	124	“ “	Salt River - East Slope	88-90	3	0.67	21	1	NA
	125	“ “	Salt River - East Slope	88-90	3	0.67	27	1	NA
	126	“ “	Salt River - East Slope	88-90	3	0.67	33	1	NA
20. Nemeth (1999); Nemeth & Nowlis (2001); Nemeth (2001), and personal communication with R Nemeth	127	USVI	Caret Bay - West 2	97-99	3	0.67	8.4	2	24
	128	“ “	Caret Bay - West 1	97-99	3	0.67	8.7	2	24
	129	“ “	Caret Bay - Central	97-99	3	0.67	7.7	2	24
	130	“ “	Caret Bay - East 1	97-99	3	0.67	7.3	2	24
	131	“ “	Caret Bay - East 2	97-99	3	0.67	5.8	2	24
21. Steneck (1994)	132	USVI	Teague Bay	82-88	7	0.29	3	3	NA
	133	“ “	Teague Bay & Salt River pooled	82-88	7	0.29	10	3	NA
	134	“ “	Salt River	82-88	7	0.29	30	3	NA
22. Liddell & Ohlhorst (1986); Liddell & Oldhorst (1992)	135	Jamaica	Zingorro Reef (WFR)	82-84	3	1	5	3	11
	136	“ “	Zingorro Reef (WFR)	82-84	3	1	10	3	11
	137	“ “	Zingorro Reef (WFR)	80-97	18	0.61	15	3	11
	138	“ “	Zingorro Reef (WFR)	82-84	3	1	22	3	11
23. Hughes & Jackson (1985); Hughes (1989,1993,1994,1996); Hughes & Connell (1999)	139	Jamaica	Depth 7 (Rio Bueno)	77-93	17	1	7	2	15
	140	“ “	Depth 10 (Rio Bueno)	77-93	17	1	10	2	15
	141	“ “	Depth 15-20 (Rio Bueno)	77-93	17	1	17	2	15
	142	“ “	Pinnacle Reef (DBML)	77-93	17	1	35	2	15
24. Hughes (1994)	143	Jamaica	Negril	77-93	17	0.12	10	3	10
	144	“ “	Chalet Caribe	77-93	17	0.12	10	3	10
	145	“ “	Montego Bay	77-93	17	0.12	10	3	10
	146	“ “	Rio Bueno	77-93	17	0.12	10	3	10

Study	Site No.	Region	Location	Period	Duration	Surveys /year	Depth (m)	Survey method	N
	147	“ “	Discovery Bay	77-93	17	0.12	10	3	10
	148	“ “	Pear Tree Bottom	77-93	17	0.12	10	3	10
	149	“ “	Port Maria	77-93	17	0.12	10	3	10
	150	“ “	Port Antonio	77-93	17	0.12	10	3	10
	151	“ “	Port Royal Cays	77-93	17	0.12	10	3	10
25. Hughes (1993)	152	Jamaica	Zoanthus zone (DBML)	76-90	15	0.13	1	3	NA
	153	“ “	Crosby Patch (DBML)	75-90	16	0.13	2	3	NA
	154	“ “	Stills Patch Reef (DBML)	73-90	18	0.11	2	3	NA
	155	“ “	A.palmata zone (DBML)	78-90	13	0.15	1	3	NA
	156	“ “	A.cervicornis zone (DBML)	78-90	13	0.15	10	3	NA
	157	“ “	Depth 20 m (DBML)	78-90	13	0.15	20	3	NA
26. Aronson & Precht (2000)	158	Jamaica	LTS (WFR)	93-99	7	0.86	5	3	6
27. Aronson & Precht (2001)	159	Jamaica	West Fore Reef	93-97	5	0.6	6	3	10
28. Knowlton et al. (1981); Knowlton et al. (1990)	160	Jamaica	West (Montego Bay)	82-87	6	1.5	10.5	3	10
	161	“ “	Central 1 (Pear Tree Bottom)	82-87	6	1.5	10.5	3	10
	162	“ “	Central 2 (Pear Tree Bottom)	82-87	6	1.5	10.5	3	10
	163	“ “	East (Priory-St Annes)	82-87	6	1.5	10.5	3	10
29. Steneck (1994)	164	Jamaica	1 (DBML)	78-87	10	0.3	3	3	NA
	165	“ “	2 (DBML)	78-87	10	0.3	10	4	NA
30. Edmunds & Bruno (1996); Cho & Woodley (in press)	166	Jamaica	Kinzie's Reef (WFR)	94-97	4	0.5	10	3	NA
	167	“ “	Dairy Bull (EFR)	94-97	4	0.5	10	3	NA
31. Andres & Witman (1995); Cho & Woodley (in press)	168	Jamaica	LTS (WFR)	92-97	6	0.33	5	3	NA
	169	“ “	LTS (WFR)	92-97	6	0.33	10	3	NA
	170	“ “	LTS (WFR)	92-97	6	0.33	15	3	NA
32. Gayle & Woodley (1998)	171	Jamaica	West Fore Reef	93-97	4	1.25	7	4	10

Study	Site No.	Region	Location	Period	Duration	Surveys /year	Depth (m)	Survey method	N
33. McClanahan et al. (1999); McClanahan & Muthiga (1998)	172	Belize	Porites Zone	71-96	27	0.07	1	3	6
	173	“ “	Acropora Zone	71-96	27	0.07	1	3	6
	174	“ “	Montastrea Zone	71-96	27	0.07	1	3	6
34. McClanahan (2001); McClanahan et al. (2001), and personal communication with T McClanahan	175	Belize	General Use Zone	96-01	6	1	1.5	3	NA
	176	“ “	Conservation Zone	96-01	6	1	1.5	3	NA
35. McField (2001)	177	Belize	Bacalar Chico	97-99	3	0.67	15	1	10
	178	“ “	Tackel Box	97-99	3	0.67	15	1	10
	179	“ “	Hol Chan	97-99	3	0.67	15	1	10
	180	“ “	Gallows Reef	97-99	3	0.67	15	1	10
	181	“ “	Goffs Caye	97-99	3	0.67	15	1	10
	182	“ “	South Water	97-99	3	0.67	15	1	10
	183	“ “	Pompion Caye	97-99	3	0.67	15	1	10
	184	“ “	Nicholas Caye	97-99	3	0.67	15	1	10
	185	“ “	Half Moon	97-99	3	0.67	15	1	10
	186	“ “	Calabash	97-99	3	0.67	15	1	10
	187	“ “	Middle Caye	97-99	3	0.67	15	1	10
188	“ “	Spur and Groove	97-99	3	0.67	15	1	10	
36. Afzal et al. (2001); Harborne & Raines (2001)	189	Honduras	Shallow	97-99	3	1	5	3	27
	190	“ “	Medium	97-99	3	1	15	3	12
	191	“ “	Deep	97-99	3	1	25	3	9
37. Aronson et al. (2002a, b); Aronson & Precht (2001); Aronson et al. (1998a), and personal communication with R Aronson	192	Belize	Channel Cay	86-01	16	0.88	3 to 15	3	3
38. Personal communication L Kellogg	193	Belize	Northeast Cay	97-99	3	0.67	7	3	7
39. Koltjes et al. (1998); Rutzler & Macintyre (1982)	194	Belize	Site 1	78-97	20	0.2	13	4	5
	195	“ “	Site 2	94-97	4	1	13	4	5

Study	Site No.	Region	Location	Period	Duration	Surveys /year	Depth (m)	Survey method	N
40. Garrison et al. (2000); Shinn & Halley (1992), and personal communication with G Garrison and E Shinn	196	Puerto Rico - Culebra	Punta Tamarindo (Carlos Rosario Beach)	91-98	8	0.38	2 to 11	2	9
	197	“ “	Dewey	91-98	8	0.38	6	2	13
	198	“ “	Windward	91-98	8	0.38	6	2	13
41. Hernandez-Delgado (2000, 2001), and personal communication with E Hernandez-Delgado	199	Puerto Rico - Culebra	Carlos Rosario Beach Site 1	97-01	5	0.8	6	3	10
	200	“ “	Carlos Rosario Beach Site 2	97-01	5	0.6	7	3	10
42. Garcia et al. (1998)	201	Puerto Rico	Media Luna	94-98	5	1	10	4	10
	202	Puerto Rico	Turramote	93-98	5	1	10	4	10
43. Ruiz-Renteria et al. (1998)	203	Mexico	Puerto Morelos Reef	93-98	6	1	10	4	5
44. Ruiz-Renteria et al. (1998)	204	Mexico	Puerto Morelos Reef	78-93	16	0.13	3	3	
	205	“ “	Puerto Morelos Reef	78-93	16	0.13	2	3	NA
	206	“ “	Puerto Morelos Reef	78-93	16	0.13	0.8	3	NA
	207	“ “	Puerto Morelos Reef	78-93	16	0.13	2.5	3	NA
	208	“ “	Puerto Morelos Reef	78-93	16	0.13	5	3	NA
	209	“ “	Puerto Morelos Reef	78-93	16	0.13	10	3	NA
	210	“ “	Puerto Morelos Reef	78-93	16	0.13	15	3	NA
	211	“ “	Puerto Morelos Reef	78-93	16	0.13	20	3	NA
45. Rodriguez & Jordan-Dahlgren (1996)	212	Mexico	A	94-95	2	1	6	1	8
	213	“ “	B	94-95	2	1	6	1	8
	214	“ “	C	94-95	2	1	6	1	8
	215	“ “	D	94-95	2	1	6	1	8
	216	“ “	E	94-95	2	1	6	1	8
	217	“ “	Z-I	94-95	2	1	6	1	8
	218	“ “	Z-II	94-95	2	1	6	1	8
46. Garza-Perez & Arias Gonzalez (2001)	219	Mexico	Mahahual	97-98	2	1.5	10	1	10
47. Bak & Luckhurst (1980); Bak & Nieuwland (1995), and personal communication with R Bak	220	Netherlands Antilles	10 m	73-91	21	0.14	10	2	3
	221	“ “	20 m	73-92	21	0.14	20	2	3
	222	“ “	30 m	73-92	21	0.14	30	2	3
	223	“ “	40 m	73-92	21	0.14	40	2	3

Study	Site No.	Region	Location	Period	Duration	Surveys /year	Depth (m)	Survey method	N
48. De Meyer (1998)	224	Netherlands Antilles	Barcadera Reef 1	94-97	4	1	11	4	5
	225	“ “	Barcadera Reef 2	94-97	4	1	11	4	5
49. Personal communication with C Glendinning	226	Netherlands Antilles	Slagbaai Reserve; Twin Peaks 1	97-01	4	0.75	3	3	NA
	227	“ “	Slagbaai Reserve; Twin Peaks 1	97-01	4	0.75	10	3	NA
	228	“ “	Slagbaai Reserve; Twin Peaks 2	97-01	4	0.75	10	3	NA
50. Hawkins et al. (1999)	229	Netherlands Antilles	Jerry's Jam	91-94	4	0.5	7	2	30
	230	“ “	Carl's Hill	91-94	4	0.5	7	2	30
	231	“ “	Forest	91-94	4	0.5	7	2	30
	232	“ “	Slagbaai	91-94	4	0.5	7	2	30
	233	“ “	Boca Canon	91-94	4	0.5	7	2	30
	234	“ “	Karpata	91-94	4	0.5	7	2	30
51. Gerace et al. (1998); Ostrander et al. (2000)	235	Bahamas	Fernandez Bay 1	94-98	5	1.4	16.5	4	5
	236	“ “	Fernandez Bay 2	94-98	5	1.4	16.5	4	5
52. Mah & Stearn (1986); Scoffin (1993)	237	Barbados	North Bellairs Reef	74-92	20	0.15	5	3	6
53. Smith (1998)	238	Bermuda	Hog Breaker Reef	93-98	6	0.83	8	4	5
	239	“ “	Twin Breaker Reef	93-98	6	0.83	8	4	5
54. Garzon-Ferreira & Kielman (1993)	240	Colombia	Islas del Rosario	83-90	8	0.5	varies	2	NA
	241	“ “	Islas de San Bernardo	87-89	3	0.67	varies	2	NA
55. Garzon-Ferreira (1998)	242	Colombia	Chengue Bay 1	93-98	6	1	10.5	4	5
	243	“ “	Chengue Bay 2	93-98	6	1	10.5	4	5
56. Cortes (1993)	244	Costa Rica	Cahuita	81-93	13	0.15	5	3	16
57. Alcolado et al. (1998)	245	Cuba	Cayo Coco A	94-97	4	1	11	4	5
	246	“ “	Cayo Coco B	94-97	4	1	11	4	5
58. Geraldles (1998), and personal communication with F Geraldles	247	Dominican Republic	El Penon	94-01	6	0.83	10.5	4	5

Study	Site No.	Region	Location	Period	Duration	Surveys /year	Depth (m)	Survey method	N
59. Gittings et al. (1993)	248	Gulf of Mexico	West Flower Garden Bank	78-91	14	0.14	15	4	NA
	249	“ “	East Flower Garden Bank	78-91	14	0.14	15	4	NA
60. Bush (1998)	250	Cayman Islands	Andres Reef	95-97	3	0.67	10	4	5
	251	“ “	Pinnacle Reef	95-97	3	0.67	10	4	5
61. Ryan et al. (1998)	252	Nicaragua	Great Corn Island	93-98	6	0.67	13	4	5
62. Shulman & Robertson (1996)	253	Panama	Point 23 Shallow	83-90	8	1.38	1	2	
	254	“ “	Wichubwala 24 Shallow	83-90	8	1.38	1	2	5
	255	“ “	Wichubwala 14 Shallow	83-87	5	1.6	1	2	5
	256	“ “	Wichubwala 17 Mid-depth	86-90	5	1.6	3.5	2	5
	257	“ “	Porvenir 26N-Deep	83-87	5	1.6	5	2	5
63. Buchan (1998)	258	Saba	Ladder Labyrinth 1	93-98	5	1	10	4	10
	259	“ “	Ladder Labyrinth 2	93-98	3	1	10	4	10
64. Laydoo et al. (1998)	260	Trinidad & Tobago	Eastern Buccoo Reef 1	94-98	5	0.6	10	4	5
	261	“ “	Outer Buccoo Reef	94-98	5	0.6	10	4	5
65. Bone et al. (1998)	262	Venezuela	Cayo Sombrero	94-98	3	1	10	4	5
	263	“ “	Olaya Caiman	94-98	3	0.67	10	4	5

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