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BIANNUAL REPORT ON THE
LONG-TERM MONITORING OF CORAL REEF ORGANISMS
IN BISCAYNE NATIONAL PARK, PHASE I
(Second Line Transect Survey)

Cooperative Agreement CA-5000-4-8005-No. 25

Submitted to: The National Park Service

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Submitted for: 1-January-1990 to 1-July-1990

Previous surveys of two coral reefs in the Florida Keys (Porter, in prep.) have shown an alarming decline in coral cover of 4% per year. Our National Park Service study is meant to (1) expand the coverage of coral reef surveys in the Florida Keys, streamline and automate the process of censusing coral reef communities, and (3) if possible, identify the causes for their decline.

Two coral reefs in the Biscayne National Park (see Maps 1 and 2; Figures 3 - 6) were chosen for an intensive survey involving species counts, line transects, and photostations. Each area consists of one photostation with 36 frames covering a total of 13.5 m² (each station is photographed in black and white, color, and video), five 25 m line transects (each line is counted three times), and three 20 m long video transects (each transect is filmed once at 45° and once at 90° from horizontal). These areas were surveyed in 1898 and resurveyed in 1990. In 1990, we also initiated a new video image analysis system in an attempt to streamline the process of acquiring and analyzing data on coral reef communities.

Our first resurvey was finished on June 2, 1990. While the chain transect method has the advantage of being the most rapidly analyzed (results comparing 1989 to 1990 are already available, Tables 1 - 5), it is also the least sensitive. The data show that within a margin of error of $\pm 10\%$, neither the percent cover of coral (Table 1), nor the relative abundance of different coral species (Table 2) has changed between 1989 and 1990. There has been a slight decrease in the relative abundance of fleshy algae (Table 1) with a concomitant increase in the calcareous algae (Table 1). We believe that this small shift from fleshy algae to calcareous algae is caused by the return to these reefs of the herbivorous sea urchin, Diadema antillarum, which is just now recovering from a major Caribbean-wide die-off. The remaining figures present the 1990 data that is summarized in Tables 1-5, plus data on the two new transects at each site.

Using the photostation method, we identified and labeled more than 400 individual coral colonies. We will follow these individuals through time in subsequent surveys to assess their longevity and growth. The results comparing the photostation data for 1989 and 1990 will be fully analyzed by November, 1990.

Tables 6 and 7 compare the relative abundance of different coral species utilizing each of the four methods: (1) swim survey (10,000 m²), (2) random survey (100 m²), (3) photostation survey (13.5 m²), and the line transect survey (0.075 m²). The results show that while the random survey and the photostation survey methods compare well, the line transect method gives different results for rarer coral species, perhaps because its sample size is so small.

Figure 7 presents a species-area curve for Floridian corals. These data are important since they demonstrate that the minimum size of a wildlife preserve that would include all of the 52 coral species presently known from the Florida Keys is 1000 km². This is the same area proposed by Florida U.S. House of Representative Dante Fascell in his bill to establish additional coral reef sanctuaries in the Florida Keys. Our study should lend considerable scientific support for his proposal.

We are working to perfect a video image analysis system for monitoring the health of coral reefs. The reason this effort is so important is that most conservation agencies have neither the time nor technical expertise for labor intensive field studies. If we can develop algorithms that accurately interpret remote sensing data, such as could be acquired by an underwater video camera, then rapid detection and response to changes in coral reef resources can be quicker and more effective. Our underwater videos were taken in exactly the same place as our still photographs and line transect counts. This will allow a rigorous calibration of the new image analysis system by comparison against a well established standard. We are considerably ahead of schedule with this project. Specifically, the video system proposed for development in 1991 has already been acquired and tested in Biscayne National Park this year. Therefore, 1991 will be a results year rather than a start-up year.

Our work on the photostations and videostations this year will form the basis for a 1991 resurvey of these stations as part of Phase II of this study.

We have written two manuals on the most effective means of coral reef surveys, one on the chain transect method, the other on the photostation method. Each manual is accompanied by well-tested, user-friendly computer software. Although these manuals have been ready for distribution for only three months, we have already sent out 15 copies to places such as the Seychelles, Jamaica, Egypt, and the British Virgin Islands.

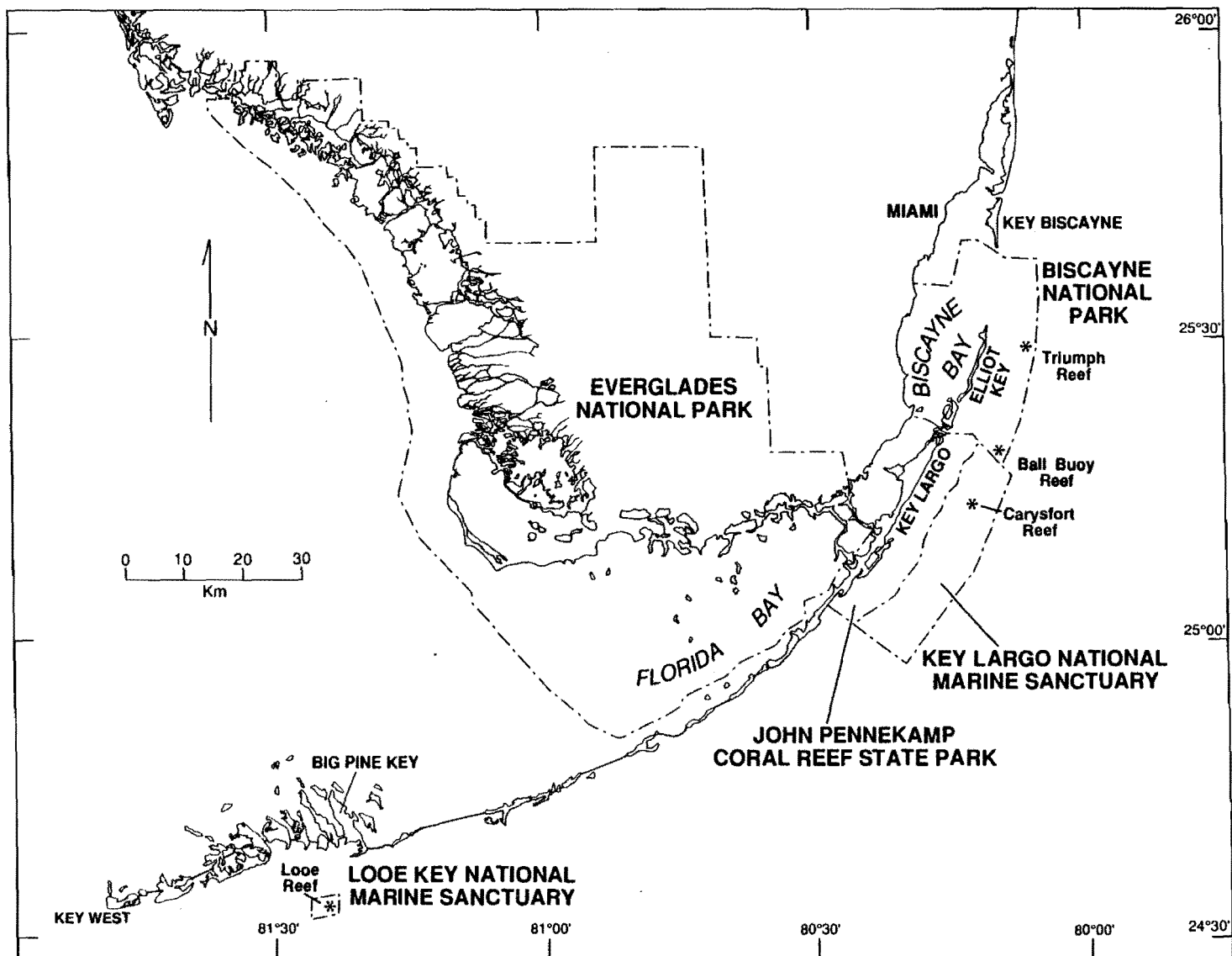


Figure 1

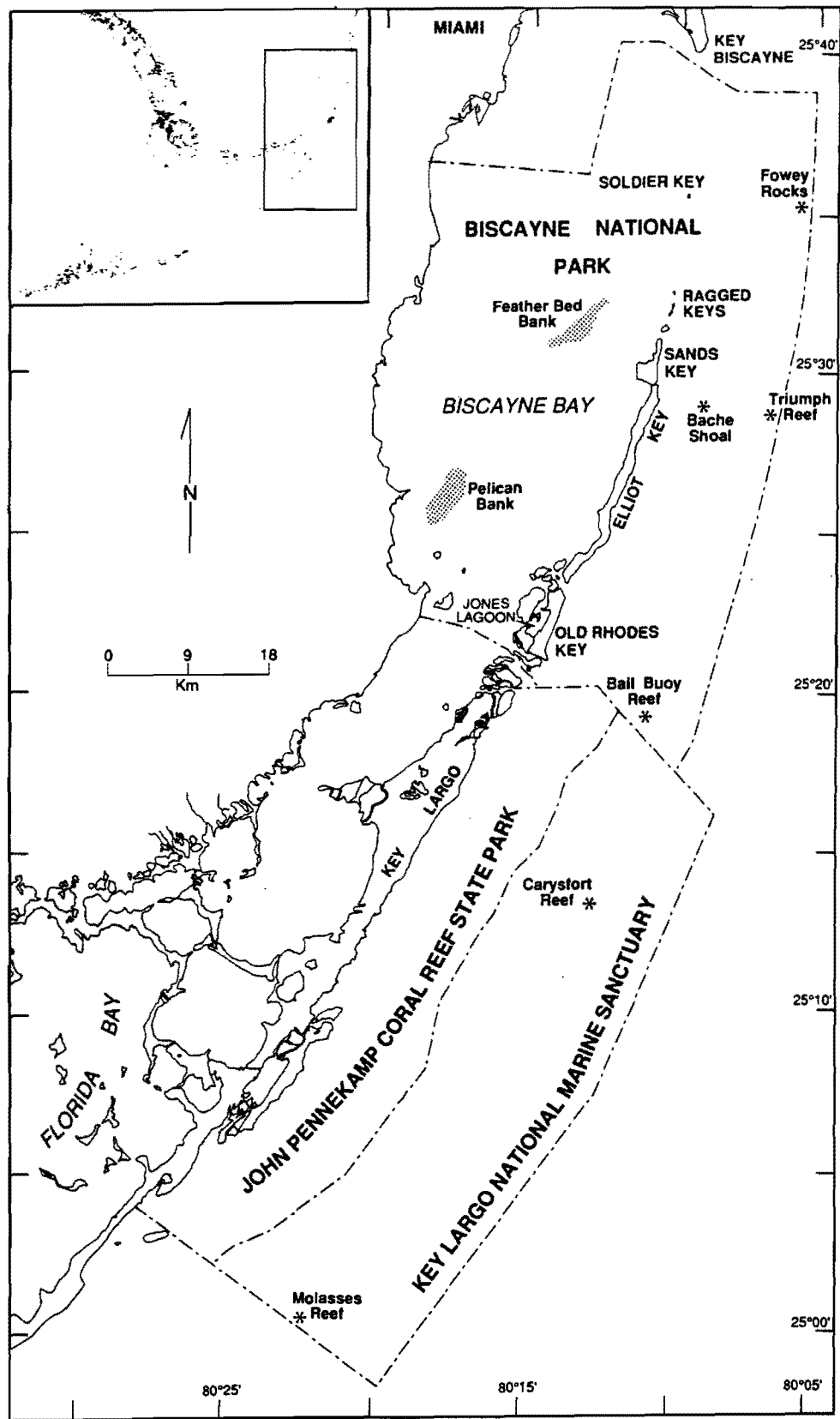
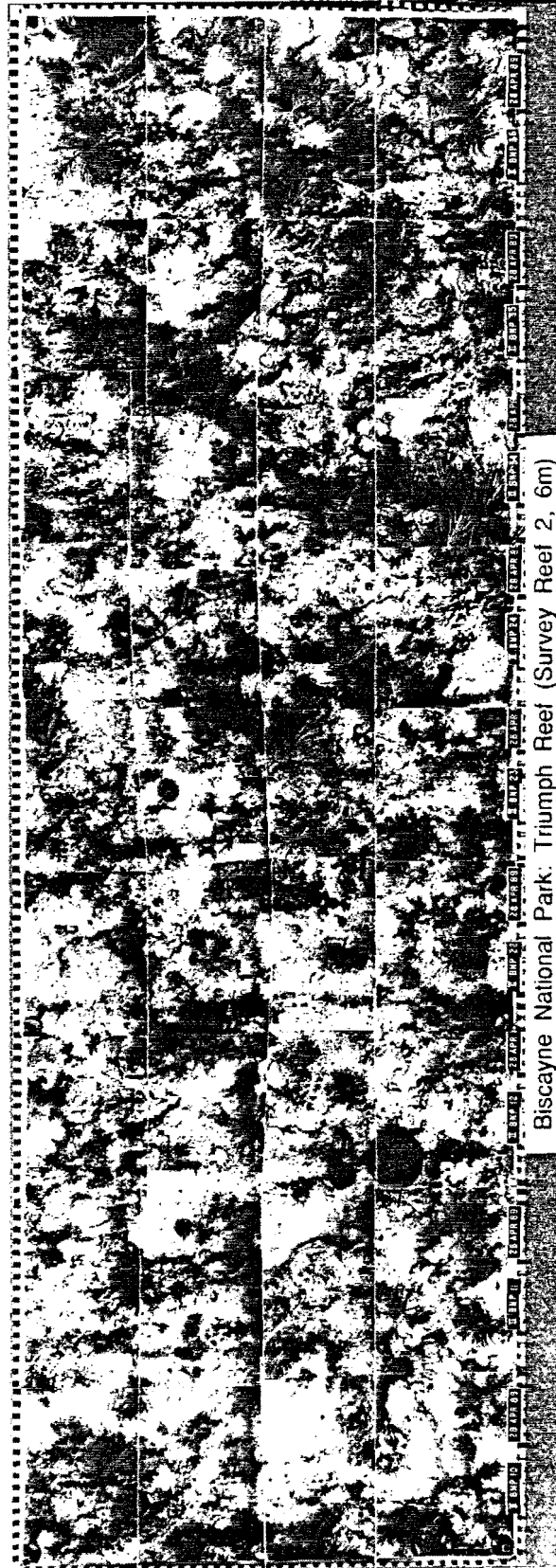


Figure 2



Biscayne National Park: Triumph Reef (Survey Reef 2, 6m)

Biscayne National Park

Ball Buoy Reef

Photostation 1 Line Transects 1-5

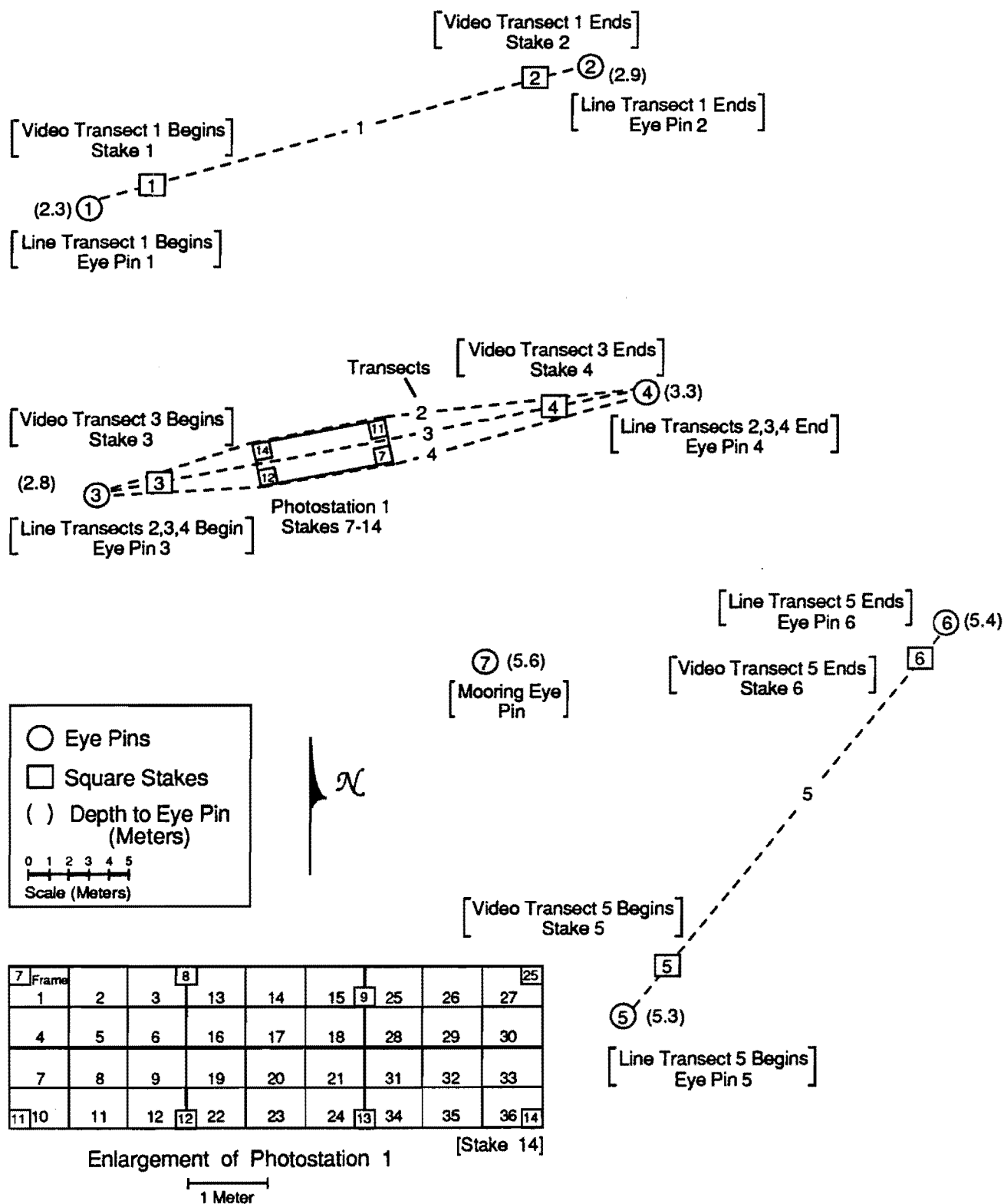
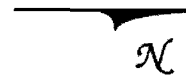
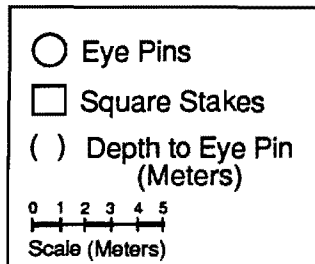


Figure 4



Biscayne National Park Triumph Reef

Photostation 2 Line Transects 6-10



22	Frame			23			24		25
1	2	3	13	14	15	25	26	27	
4	5	6	16	17	18	28	29	30	
7	8	9	19	20	21	31	32	33	
26	10	11	12	27	22	23	24	28	34
									35
									36
									29

Enlargement of Photostation 2

1 Meter

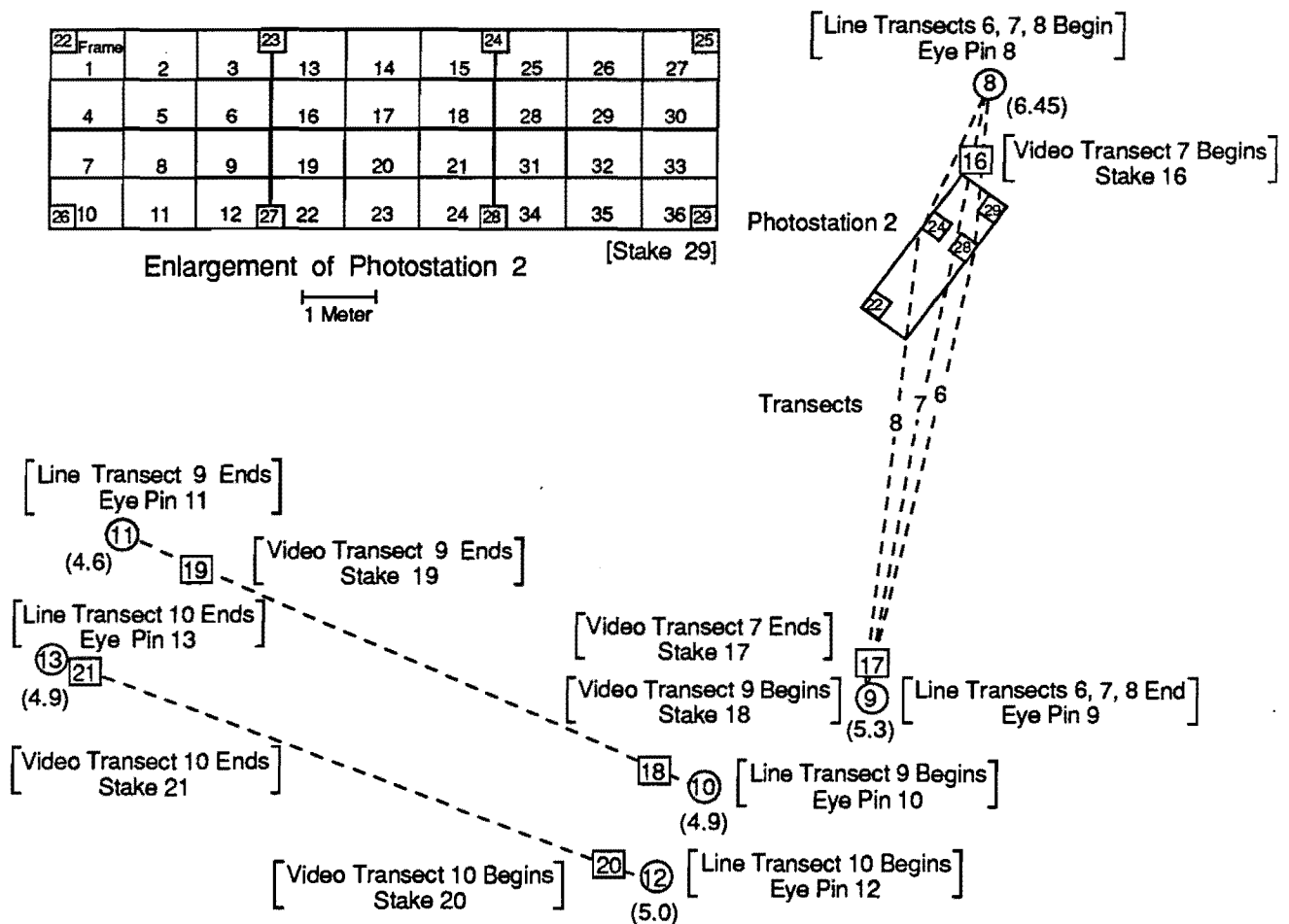


Figure 6

Species / Area Curve (95% C.I.)

Biscayne National Park (Triumph Reef)

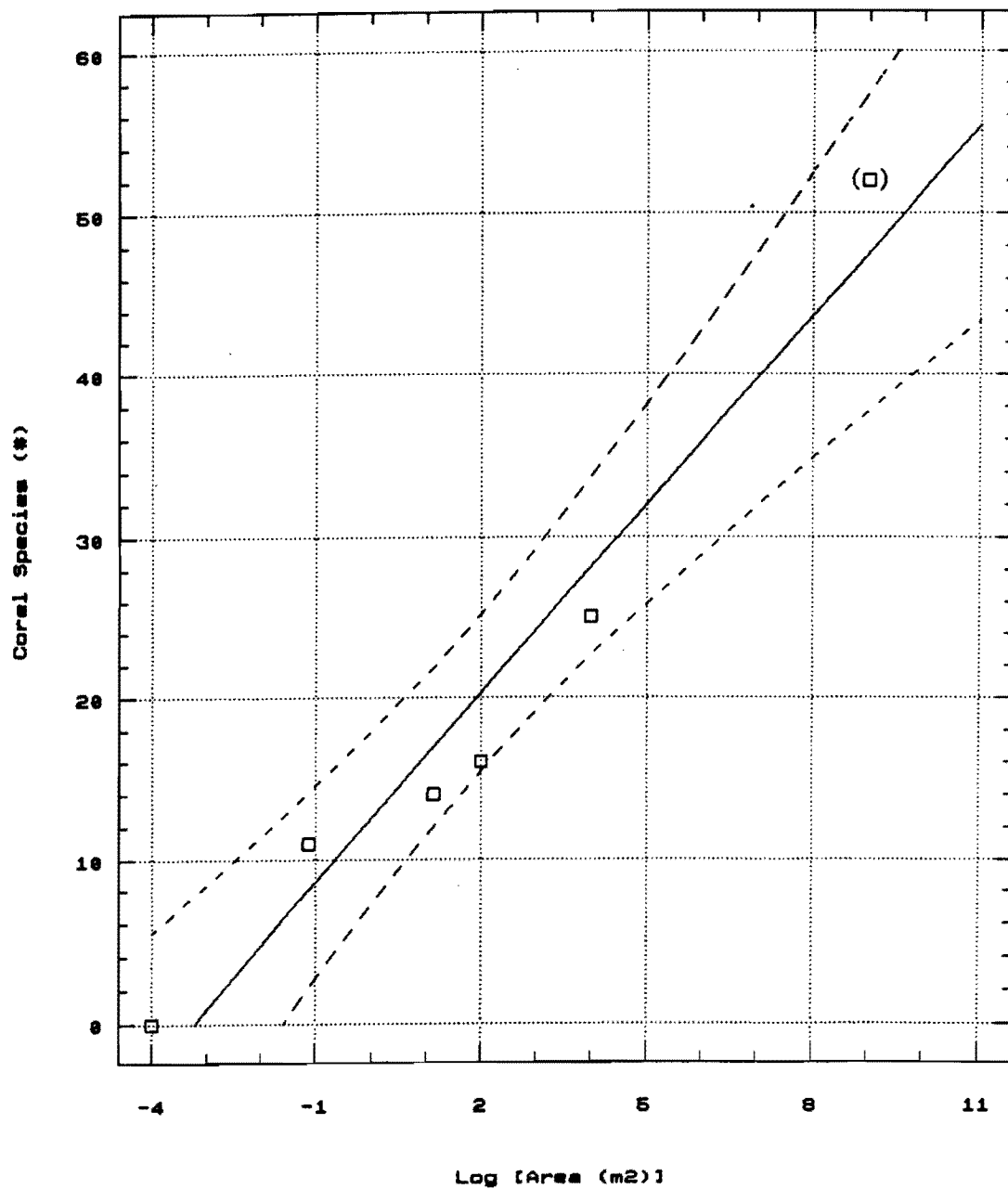


Figure 7

Table 1

Biscayne National Park
Substrate Types 1989-1990

($\bar{X} \pm S.D.$; $N=3$; $*p \leq 0.05$)

Subs. Types	Yr	Reef 1 (Ball Buoy Reef)			Reef 2 (Triumph Reef)		
		Trans. 1	Trans. 2-4	Trans. 5	Trans. 6-8	Trans. 9	Trans. 10
Cora	89	---	37.92 $\pm$ 1.47	---	3.42 $\pm$ 0.64	---	---
	90	13.41 $\pm$ 1.10	38.97 $\pm$ 2.47	7.10 $\pm$ 0.17	3.16 $\pm$ 0.53	2.13 $\pm$ 0.57	4.00 $\pm$ 0.85
alga	89	---	0.96 $\pm$ 0.18	---	13.82 $\pm$ 1.06*	---	---
	90	0.79 $\pm$ 0.46	0.64 $\pm$ 0.12	0.12 $\pm$ 0.21	4.24 $\pm$ 1.22*	2.63 $\pm$ 0.47	3.52 $\pm$ 2.53
anem	89	---	0.05 $\pm$ 0.09	---	---	---	---
	90	---	---	---	---	---	---
dcwa	89	---	5.19 $\pm$ 0.11*	---	0.16 $\pm$ 0.14	---	---
	90	0.68 $\pm$ 1.08	0.38 $\pm$ 0.34*	0.80 $\pm$ 0.10	0.05 $\pm$ 0.04	0.02 $\pm$ 0.03	0.03 $\pm$ 0.05
gorg	89	---	1.19 $\pm$ 0.18	---	1.65 $\pm$ 0.09	---	---
	90	1.66 $\pm$ 0.27	1.53 $\pm$ 0.52	2.14 $\pm$ 0.96	2.00 $\pm$ 0.16	1.29 $\pm$ 0.12	2.05 $\pm$ 0.66
othe	89	---	---	---	---	---	---
	90	---	0.04 $\pm$ 0.05	---	0.03 $\pm$ 0.04	0.08 $\pm$ 0.13	0.02 $\pm$ 0.03
pave	89	---	50.48 $\pm$ 1.94	---	78.28 $\pm$ 0.55*	---	---
	90	78.01 $\pm$ 1.61	54.16 $\pm$ 1.92	80.14 $\pm$ 1.24	87.25 $\pm$ 1.41*	88.80 $\pm$ 2.93	86.10 $\pm$ 5.03
rock	89	---	---	---	---	---	---
	90	---	0.12 $\pm$ 0.09	---	---	0.11 $\pm$ 0.18	0.05 $\pm$ 0.08
sand	89	---	---	---	0.43 $\pm$ 0.36	---	---
	90	0.64 $\pm$ 0.81	---	6.31 $\pm$ 3.37	0.64 $\pm$ 0.36	0.45 $\pm$ 0.40	0.93 $\pm$ 0.70
spon	89	---	1.52 $\pm$ 0.65	---	1.59 $\pm$ 0.47	---	---
	90	2.84 $\pm$ 0.69	1.57 $\pm$ 0.20	3.23 $\pm$ 1.26	1.99 $\pm$ 0.14	3.44 $\pm$ 1.33	2.41 $\pm$ 0.80
zoan	89	---	2.70 $\pm$ 0.14	---	0.66 $\pm$ 0.05	---	---
	90	1.96 $\pm$ 0.18	2.60 $\pm$ 0.14	0.15 $\pm$ 0.05	0.64 $\pm$ 0.16	1.05 $\pm$ 0.60	0.90 $\pm$ 0.60

Table 2a

Biscayne National Park
Coral Species 1989-1990

($\bar{X} \pm S.D.$; $N=S$; $*p \leq 0.05$)

Coral	Yr	Reef 1 (Ball Buoy Reef)			Reef 2 (Triumph Reef)		
		Trans. 1	Trans. 2-4	Trans. 5	Trans. 6-8	Trans. 9	Trans. 10
Aaga	89	---	2.16 $\pm$ 0.19	---	30.01 $\pm$ 9.43	---	---
	90	4.10 $\pm$ 2.69	3.22 $\pm$ 1.72	12.75 $\pm$ 6.34	26.28 $\pm$ 4.73	8.62 $\pm$ 4.39	22.00 $\pm$ 6.45
Acer	89	---	---	---	---	---	---
	90	---	---	---	---	---	0.62 $\pm$ 1.07
Afra	89	---	---	---	---	---	---
	90	1.38 $\pm$ 1.21	---	0.21 $\pm$ 0.36	---	3.88 $\pm$ 6.71	---
Apal	89	---	80.48 $\pm$ 2.89	---	---	---	---
	90	77.97 $\pm$ 3.92	76.09 $\pm$ 4.99	---	---	---	---
Dcli	89	---	0.15 $\pm$ 0.10	---	---	---	---
	90	---	0.54 $\pm$ 0.34	---	---	1.11 $\pm$ 1.92	---
Dste	89	---	---	---	4.61 $\pm$ 3.70	---	---
	90	---	0.07 $\pm$ 0.13	19.21 $\pm$ 8.71	5.52 $\pm$ 4.28	3.65 $\pm$ 4.26	---
Dsto	89	---	---	---	---	---	---
	90	---	---	4.82 $\pm$ 8.35	---	---	---
Dstr	89	---	---	---	---	---	---
	90	---	---	30.01 $\pm$ 4.47	0.30 $\pm$ 0.52	1.55 $\pm$ 2.68	---
Efas	89	---	---	---	3.11 $\pm$ 2.71	---	---
	90	---	---	---	6.71 $\pm$ 4.53	---	---
Ffra	89	---	0.25 $\pm$ 0.08	---	1.68 $\pm$ 1.00	---	---
	90	0.19 $\pm$ 0.32	0.45 $\pm$ 0.44	---	3.12 $\pm$ 1.73	5.29 $\pm$ 2.35	---
Malc	89	---	3.09 $\pm$ 0.26	---	11.28 $\pm$ 1.98	---	---
	90	4.14 $\pm$ 2.49	2.42 $\pm$ 0.65	2.33 $\pm$ 1.80	10.46 $\pm$ 3.93	14.05 $\pm$ 5.18	14.45 $\pm$ 4.05

Table 2b

(continue)

Biscayne National Park
Coral Species 1989-1990

($\bar{X} \pm S.D.$; $N=S$; $*p \leq 0.05$)

Coral	Yr	Reef 1 (Ball Buoy Reef)			Reef 2 (Triumph Reef)		
		Trans. 1	Trans. 2-4	Trans. 5	Trans. 6-8	Trans. 9	Trans. 10
Mann	89	---	---	---	3.94 $\pm$ 1.42	---	---
	90	---	---	---	2.58 $\pm$ 2.25	---	---
Mcav	89	---	0.40 $\pm$ 0.45	---	7.69 $\pm$ 3.96	---	---
	90	---	0.16 $\pm$ 0.14	8.11 $\pm$ 1.79	13.00 $\pm$ 6.37	4.21 $\pm$ 4.71	0.76 $\pm$ 1.31
Mcom	89	---	4.33 $\pm$ 1.95	---	23.58 $\pm$ 12.49	---	---
	90	1.96 $\pm$ 0.81	5.48 $\pm$ 1.73	---	14.79 $\pm$ 6.59	26.84 $\pm$ 30.84	1.23 $\pm$ 2.14
Mlam	89	---	---	---	---	---	---
	90	---	0.18 $\pm$ 0.03	---	---	---	---
Mmea	89	---	---	---	---	---	---
	90	---	---	---	---	---	31.16 $\pm$ 8.63
Past	89	---	7.79 $\pm$ 1.44	---	---	---	---
	90	9.24 $\pm$ 1.65	10.45 $\pm$ 1.85	---	2.88 $\pm$ 1.08	5.10 $\pm$ 4.47	15.59 $\pm$ 11.80
Ppor	89	---	0.93 $\pm$ 1.02	---	9.48 $\pm$ 6.02	---	---
	90	0.47 $\pm$ 0.81	0.38 $\pm$ 0.14	12.35 $\pm$ 0.70	10.19 $\pm$ 6.40	---	9.04 $\pm$ 4.71
Smic	89	---	---	---	4.08 $\pm$ 3.72	---	---
	90	---	---	---	4.14 $\pm$ 3.80	---	---
Srad	89	---	---	---	---	---	---
	90	0.55 $\pm$ 0.44	---	0.42 $\pm$ 0.73	---	---	0.62 $\pm$ 1.07
Ssid	89	---	0.41 $\pm$ 0.36	---	0.55 $\pm$ 0.95	---	---
	90	---	0.57 $\pm$ 0.17	9.78 $\pm$ 0.49	---	25.68 $\pm$ 18.65	4.52 $\pm$ 4.98

Tables 3 - 5

Biscayne National Park
Cumulative % Coral Cover 1989-1990

($\bar{X} \pm S.D.$; $N=3$; $*p \leq 0.05$)

Year	Reef 1 (Ball Buoy Reef)			Reef 2 (Triumph Reef)		
	Trans. 1	Trans. 2-4	Trans. 5	Trans. 6-8	Trans. 9	Trans. 10
89	---	37.92 $\pm$ 1.47	---	3.42 $\pm$ 0.64	---	---
90	7.33 $\pm$ 1.53	38.97 $\pm$ 2.47	7.10 $\pm$ 0.17	3.16 $\pm$ 0.53	2.13 $\pm$ 0.57	4.00 $\pm$ 0.85

Biscayne National Park
Cumulative # of Coral Species (S) 1989-1990

($\bar{X} \pm S.D.$; $N=3$; $*p \leq 0.05$)

Year	Reef 1 (Ball Buoy Reef)			Reef 2 (Triumph Reef)		
	Trans. 1	Trans. 2-4	Trans. 5	Trans. 6-8	Trans. 9	Trans. 10
89	---	9.67 $\pm$ 0.58	---	10.33 $\pm$ 0.58	---	---
90	7.33 $\pm$ 1.53	11.00 $\pm$ 1.00	8.00 $\pm$ 0.00	10.67 $\pm$ 1.53	7.67 $\pm$ 1.53	7.00 $\pm$ 1.73

Biscayne National Park
Cumulative Diversity ($H' \ln$) 1989-1990

($\bar{X} \pm S.D.$; $N=3$; $*p \leq 0.05$)

Year	Reef 1 (Ball Buoy Reef)			Reef 2 (Triumph Reef)		
	Trans. 1	Trans. 2-4	Trans. 5	Trans. 6-8	Trans. 9	Trans. 10
89	---	0.80 $\pm$ 0.08	---	1.88 $\pm$ 0.04	---	---
90	0.85 $\pm$ 0.16	0.92 $\pm$ 0.15	1.81 $\pm$ 0.07	2.07 $\pm$ 0.10	1.65 $\pm$ 0.36	1.66 $\pm$ 0.19

Table 6

BISCAYNE NATIONAL PARK
Coral Species List: BALL BOUY REEF (1989)

Species Name	Swim Survey 10,000 m ²	Random Photos 100 m ²	Photo Station 13.5 m ²	Chain Transect 0.075 m ²	Rel Ab Random Photos	Rel Ab Photo Stat.	Rel. Abun. Chain Transect
1. <i>Stephanocoenia michelinii</i>	X	0	0	0	0	0	0
2. <i>Acropora palmata</i>	X	X	X	X	82.2	82.2	80.5
3. <i>Acropora cervicornis</i>	X	0	0	0	0	0	0
4. <i>Madracis decactis</i>	X	0	0	0	0	0	0
5. <i>Leptoseris cucullata</i>	X	0	0	0	0	0	0
6. <i>Agaricia agaricites</i>	X	X	X	X	0.2	0.2	2.2
7. <i>Agaricia fragilis</i>	X	X	X	0	0.1	0.1	0 **
8.* <i>Agaricia humilis</i>	X	0	0	0	0	0	0
9. <i>Siderastrea siderea</i>	X	X	X	X	0.4	1.4	0.4
10. <i>Siderastrea radians</i>	X	0	0	0	0	0	0
11. <i>Porites porites</i>	X	X	X	X	0.2	0.2	0.9
12. <i>Porites astreoides</i>	X	X	X	X	5.1	6.8	7.8
13. <i>Montastraea annularis</i>	X	X	X	0	0.2	0.1	0 **
14. <i>Montastraea cavernosa</i>	X	X	X	X	0.1	0.7	0.4
15. <i>Favia fragum</i>	X	X	X	X	0.1	0.1	0.2
16. <i>Diploria clivosa</i>	X	X	X	X	1.9	2.5	0.1 **
17. <i>Diploria labyrinthiformis</i>	X	0	0	0	0	0	0
18. <i>Diploria strigosa</i>	X	X	X	0	0.4	0.1	0 **
19. <i>Colpophyllia natans</i>	X	X	0	0	0.1	0	0
20. <i>Oculina diffusa</i>	X	0	0	0	0	0	0
21. <i>Dichocoenia stokesi</i>	X	0	0	0	0	0	0
22. <i>Dichocoenia stellaris</i>	X	X	0	0	0.1	0	0
23. <i>Meandrina meandrites</i>	X	X	0	0	0.1	0	0
24. <i>Mycetophyllia lamarkiana</i>	X	0	X	0	0	0.1	0 **
25. <i>Scolymia cubensis</i>	X	0	0	0	0	0	0
26. <i>Eusmilia fastigiata</i>	X	0	0	0	0	0	0
27. <i>Millepora alcicornis</i>	X	X	X	X	2.2	2.3	3.2
28. <i>Millepora complanata</i>	X	X	X	X	6.6	3.2	4.3
Total	28	16	14	10	100	100	100

* New state record for Florida

** Large discrepancy between % cover values measured by the Chain Transect Method versus both Photographic Methods.

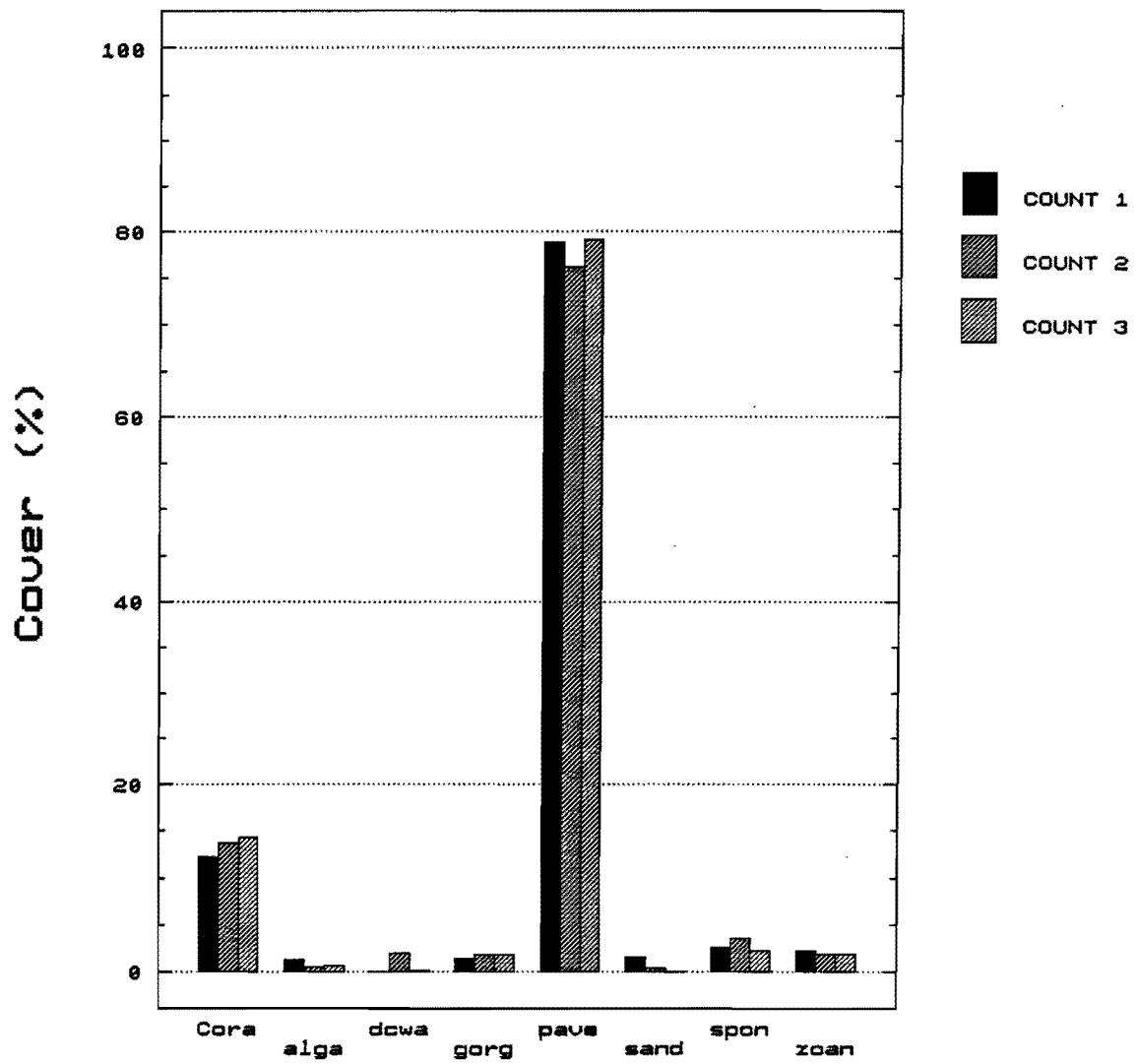
Table 7

BISCAYNE NATIONAL PARK
Coral Species List: TRIUMPH REEF (1989)

Species Name	Swim Survey 10,000 m ²	Random Photos 100 m ²	Photo Station 13.5 m ²	Chain Transect 0.075 m ²	Rel Ab Random Photos	Rel Ab Photo Stat.	Rel. Abun. Chain Transect
1. <i>Stephanocoenia michelinii</i>	X	X	X	X	3	7	4
2. <i>Acropora cervicornis</i>	X	0	0	0	0	0	0
3. <i>Madracis decactis</i>	X	0	0	0	0	0	0
4. <i>Leptoseris cucullata</i>	X	0	0	0	0	0	0
5. <i>Agaricia agaricites</i>	X	X	X	X	5	8	30 *
6. <i>Agaricia fragilis</i>	X	0	0	0	0	0	0
7. <i>Siderastrea siderea</i>	X	X	X	X	3	1	1
8. <i>Siderastrea radians</i>	X	0	0	0	0	0	0
9. <i>Porites porites</i>	X	X	X	X	0.5	1	9 *
10. <i>Porites astreoides</i>	X	X	X	0	5	9.8	0 *
11. <i>Montastraea annularis</i>	X	X	X	X	18	16	4 *
12. <i>Montastraea cavernosa</i>	X	X	X	X	16	18	8 *
13. <i>Favia fragum</i>	X	X	X	X	0.3	0.1	2
14. <i>Diploria clivosa</i>	X	X	X	0	5	2	0
15. <i>Diploria labyrinthiformis</i>	X	X	0	0	1	0	0
16. <i>Diploria strigosa</i>	X	X	X	0	0.2	0.1	0
17. <i>Colpophyllia natans</i>	X	0	0	0	0	0	0
18. <i>Dichocoenia stokesi</i>	X	X	0	0	1	0	0
19. <i>Dichocoenia stellaris</i>	X	X	X	X	17	16	5 *
20. <i>Meandrina meandrites</i>	X	X	X	0	16	10	0 *
21. <i>Mycetophyllia lamarkiana</i>	X	0	0	0	0	0	0
22. <i>Scolymia cubensis</i>	X	0	0	0	0	0	0
23. <i>Eusmilia fastigiata</i>	X	0	0	X	0	0	3
24. <i>Millepora alcicornis</i>	X	X	X	X	8	9	11
25. <i>Millepora complanata</i>	X	X	X	X	1	2	23 *
Total	25	16	14	11	100	100	100

* Large discrepancy between % cover values measured by the Chain Transect Method versus both Photographic Methods.

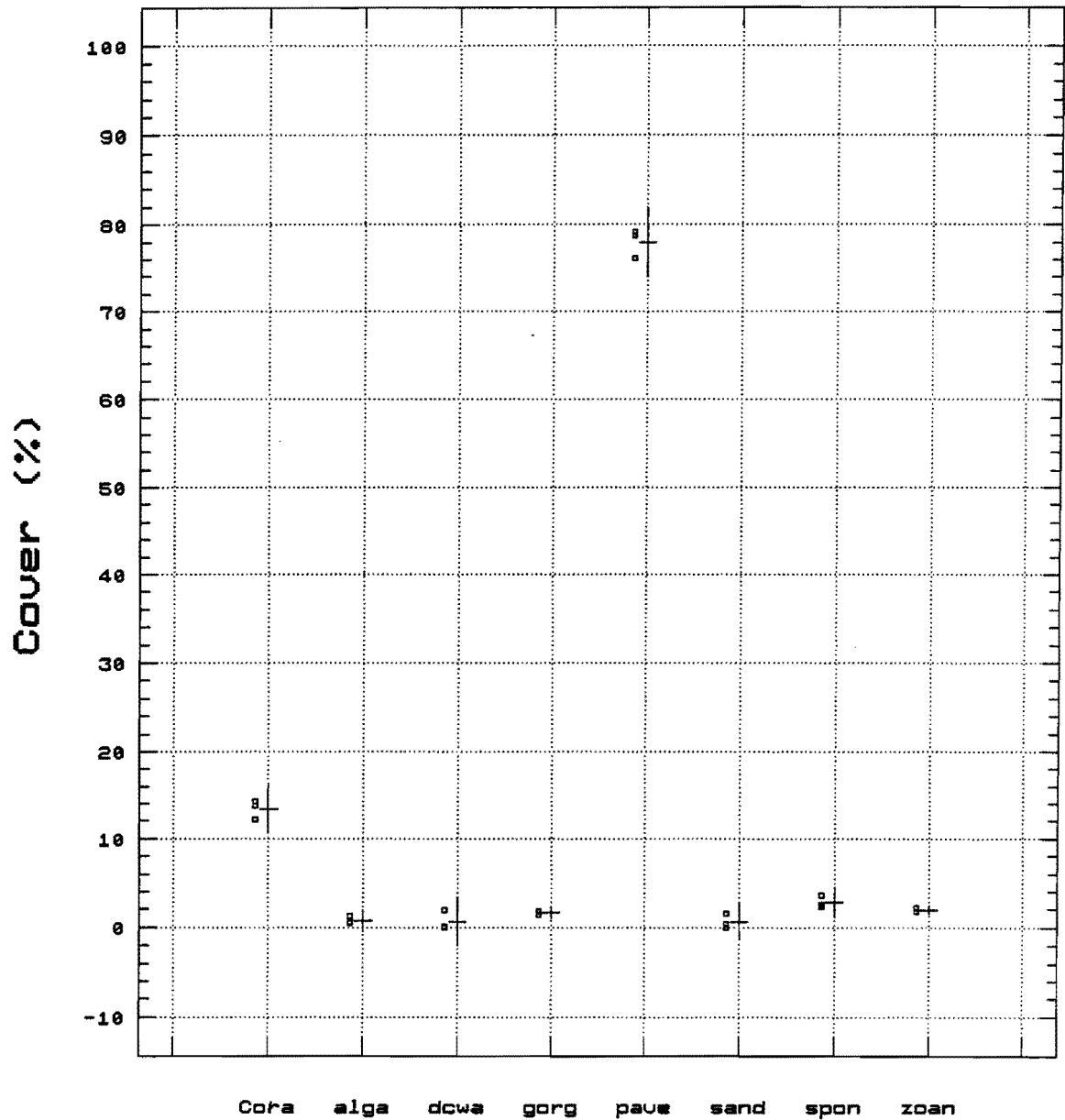
Biscayne National Park
Reef I, Trs. 1, Cts. 1-3, 1990



Substrate Types

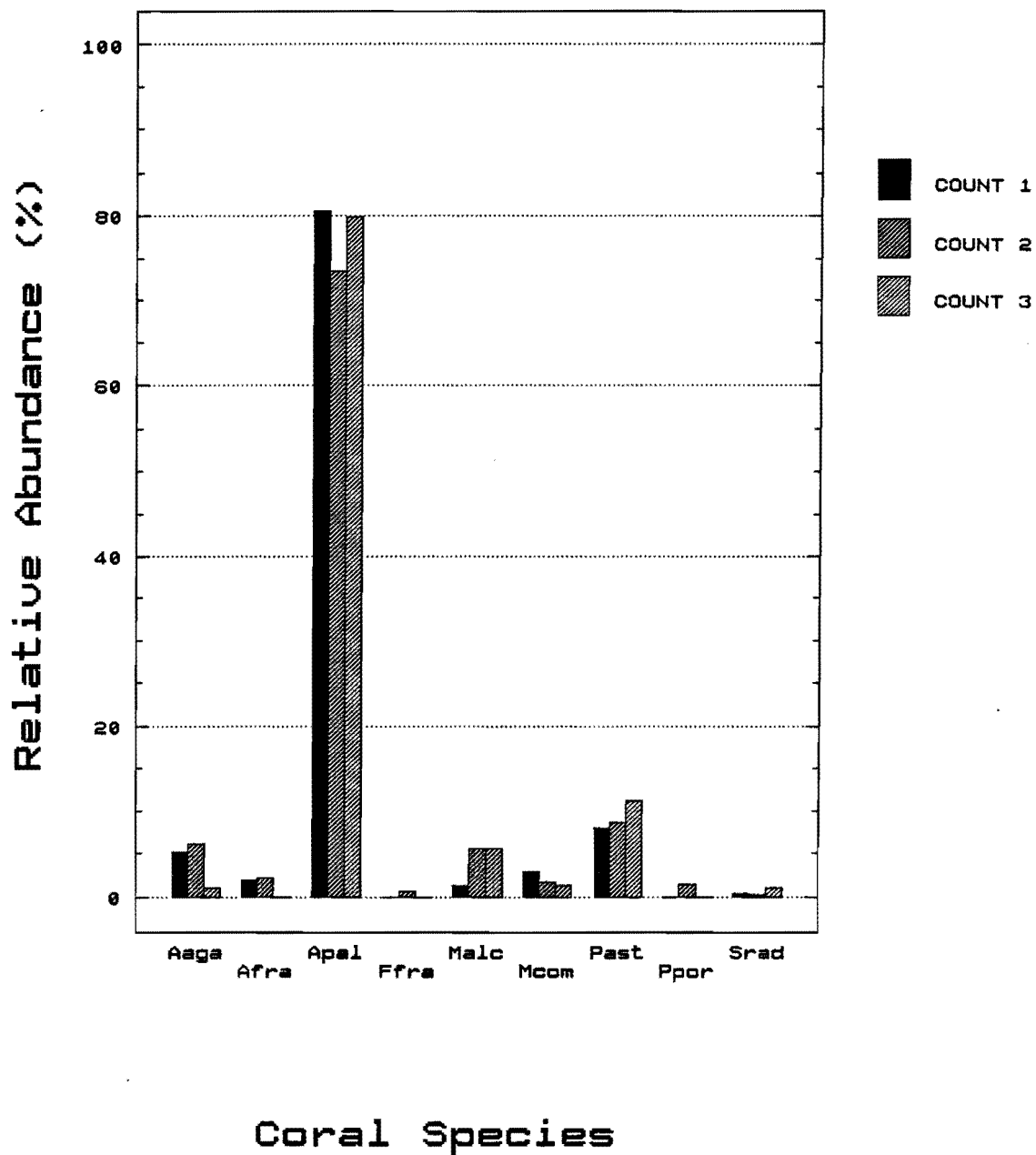
Biscayne National Park

Reef I, Trs. 1, 1990



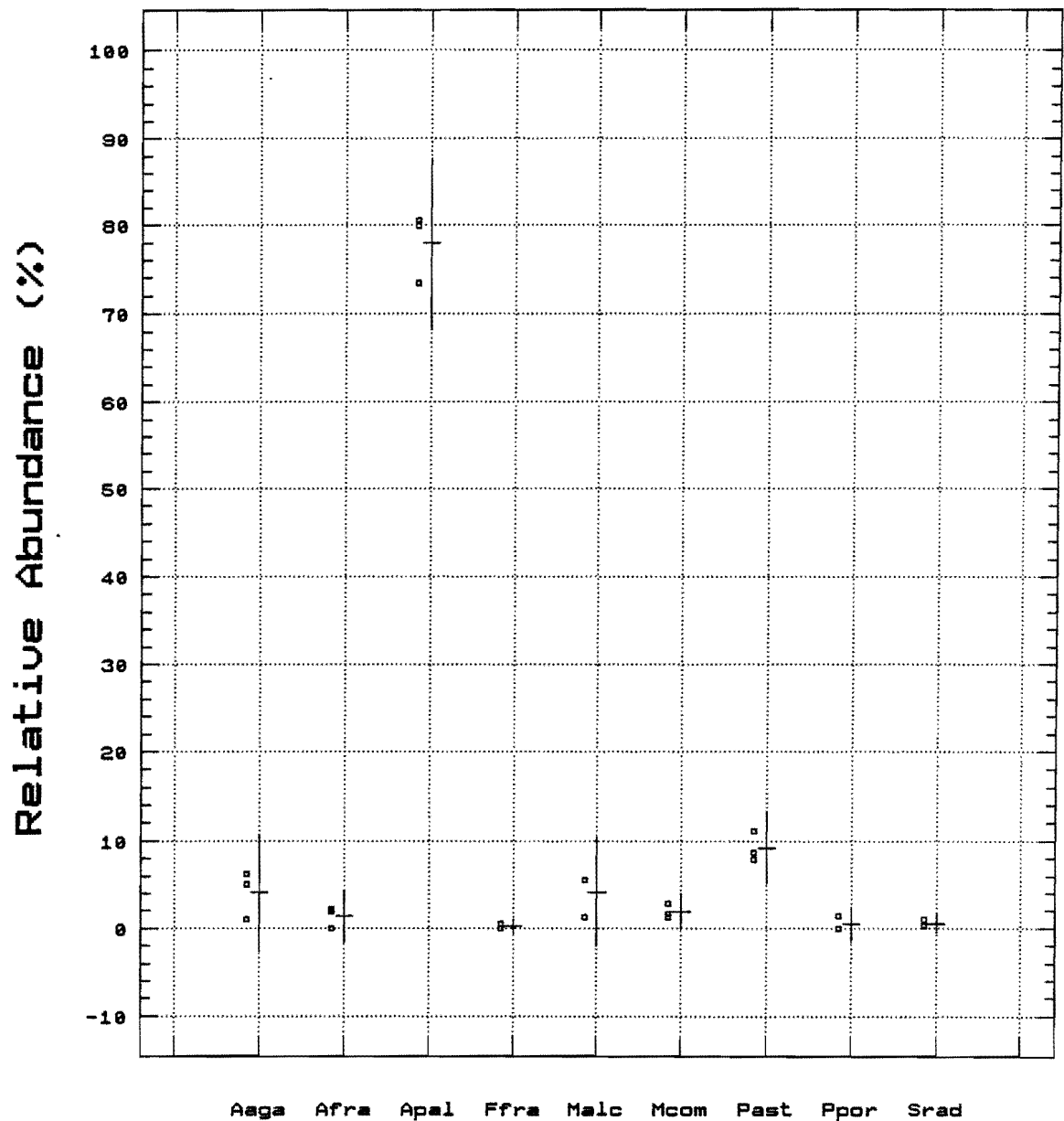
Substrate Types (N = 3; 95% C.I.)

Biscayne National Park
Reef I, Trs. 1, Cts. 1-3, 1990



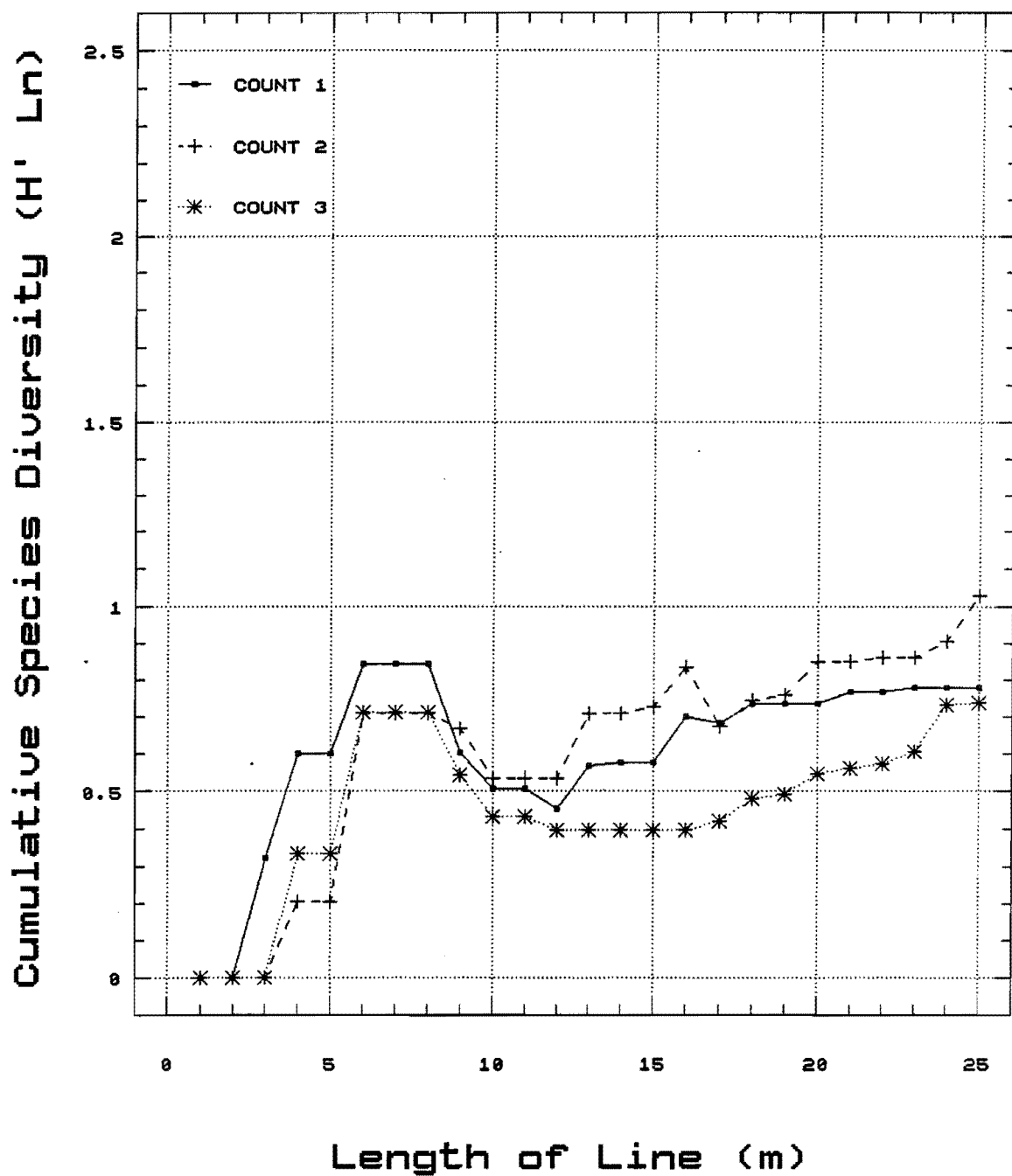
Biscayne National Park

Reef I, Cts. 1, 1990



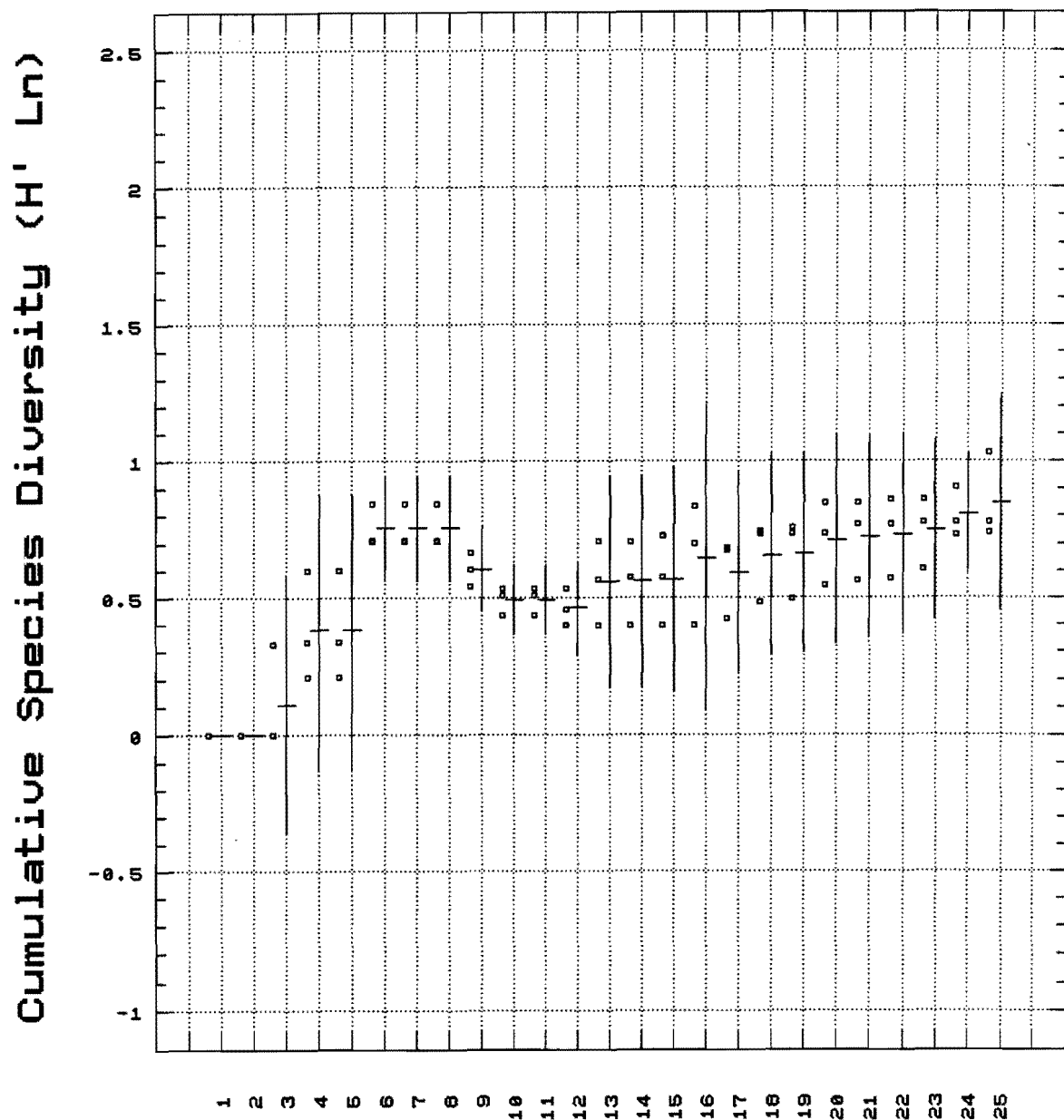
Coral Species (N = 3; 95% C.I.)

Biscayne National Park
Reef I, Trs. 1, Cts. 1-3, 1990



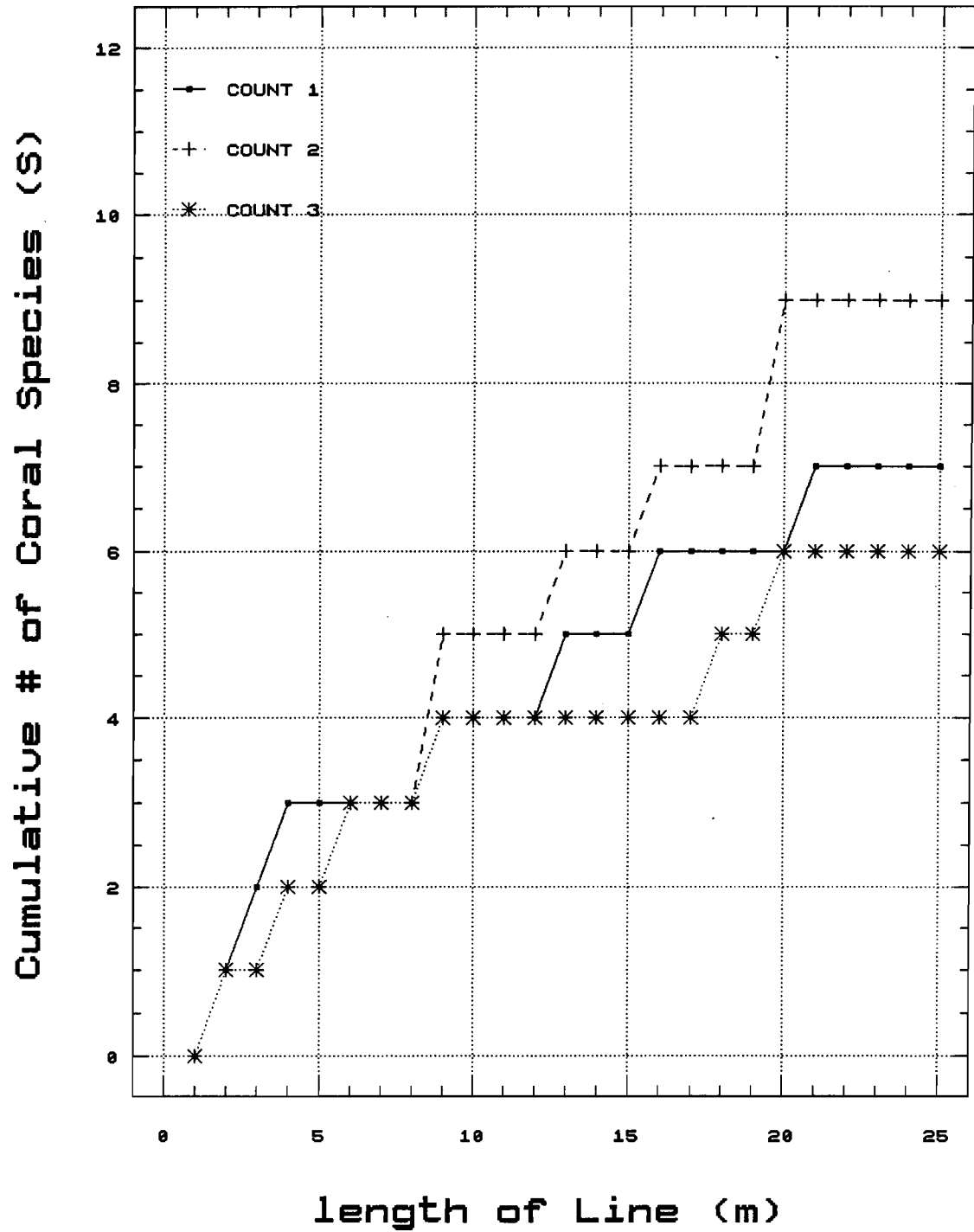
Biscayne National Park

Reef I, Trs. 1, 1990



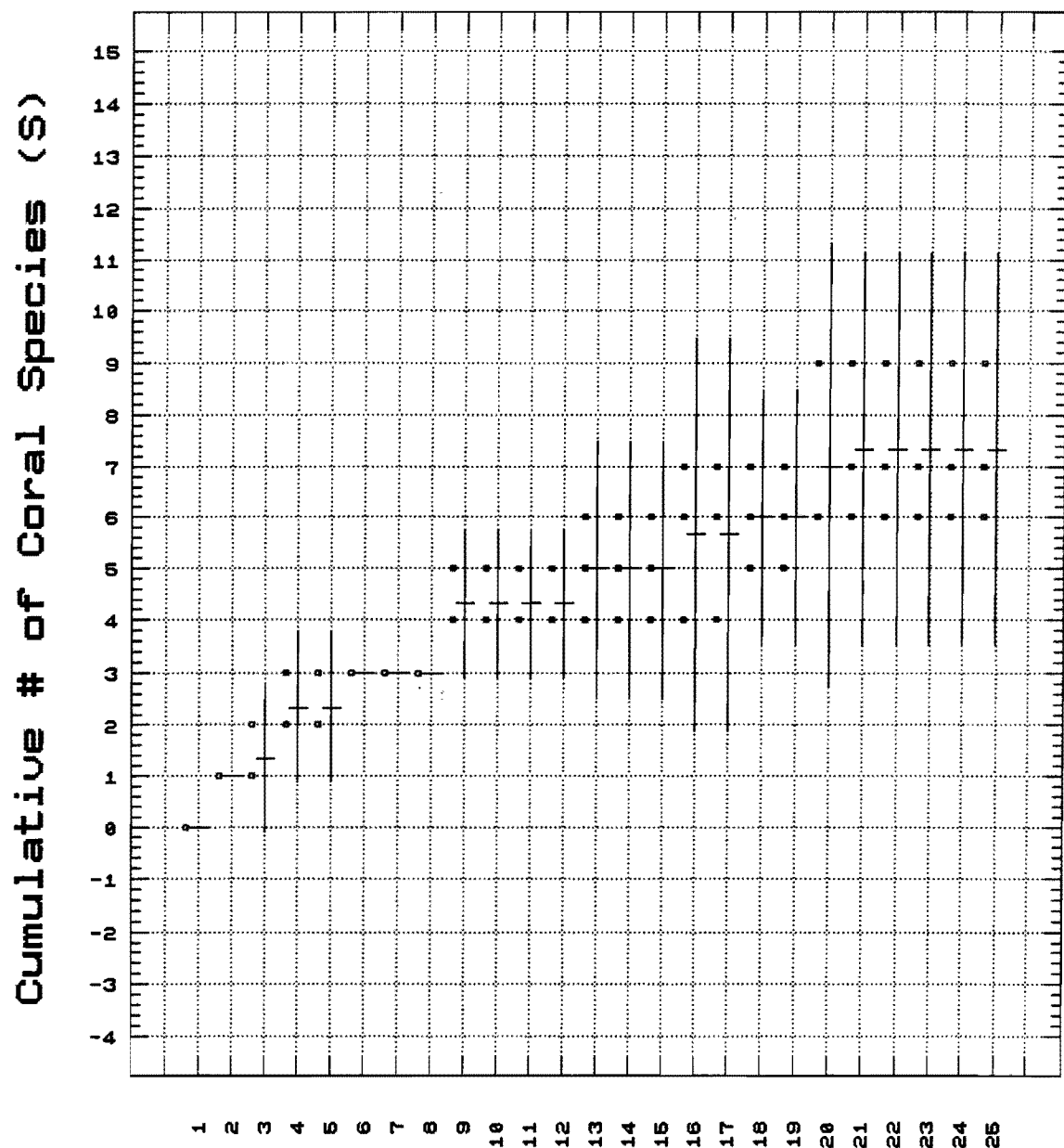
Length of Line (m) (N = 3; 95% C.I.)

Biscayne National Park
Reef I, Trs. 1, Cts. 1-3, 1990



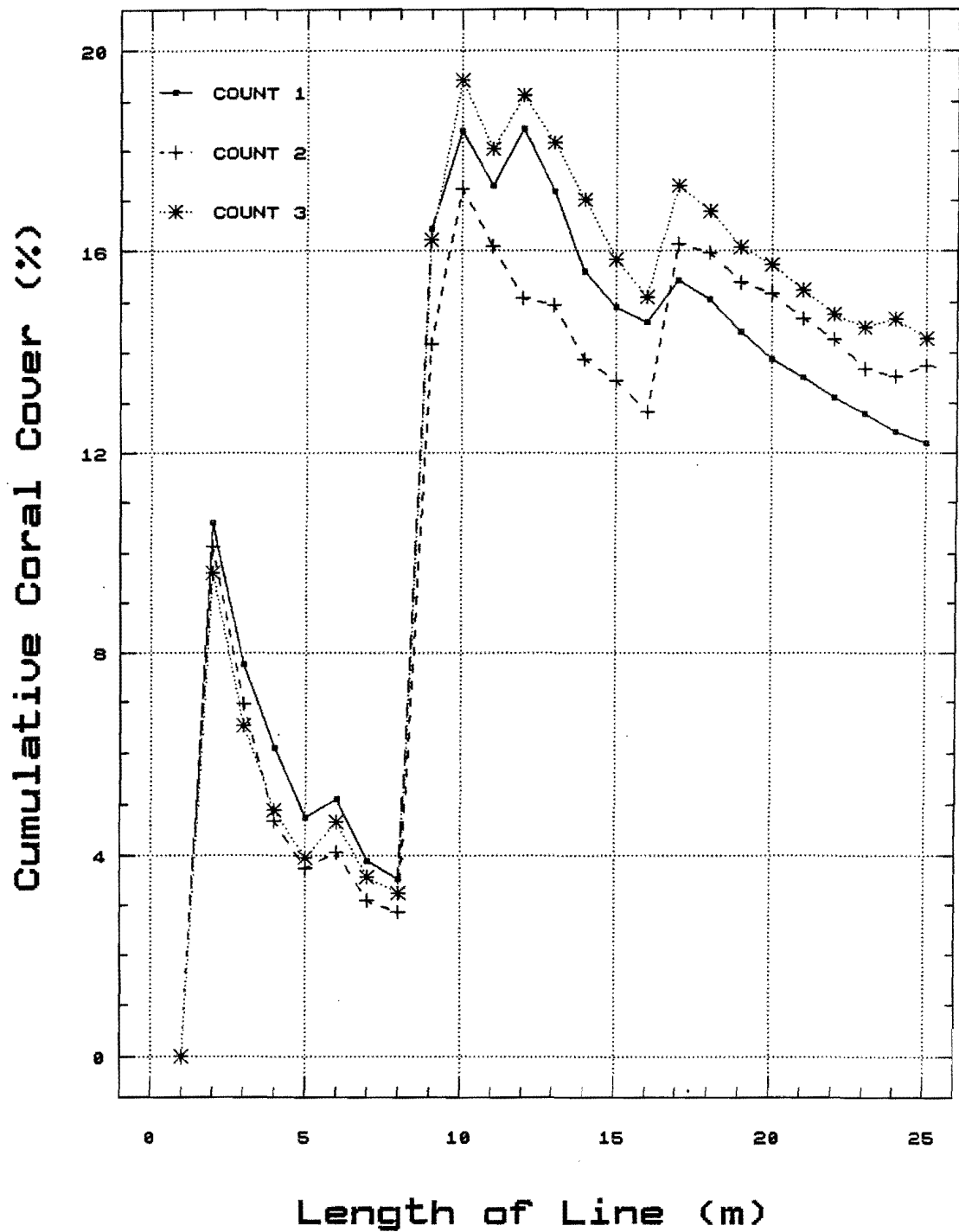
Biscayne National Park

Reef I, Trs. 1, 1990



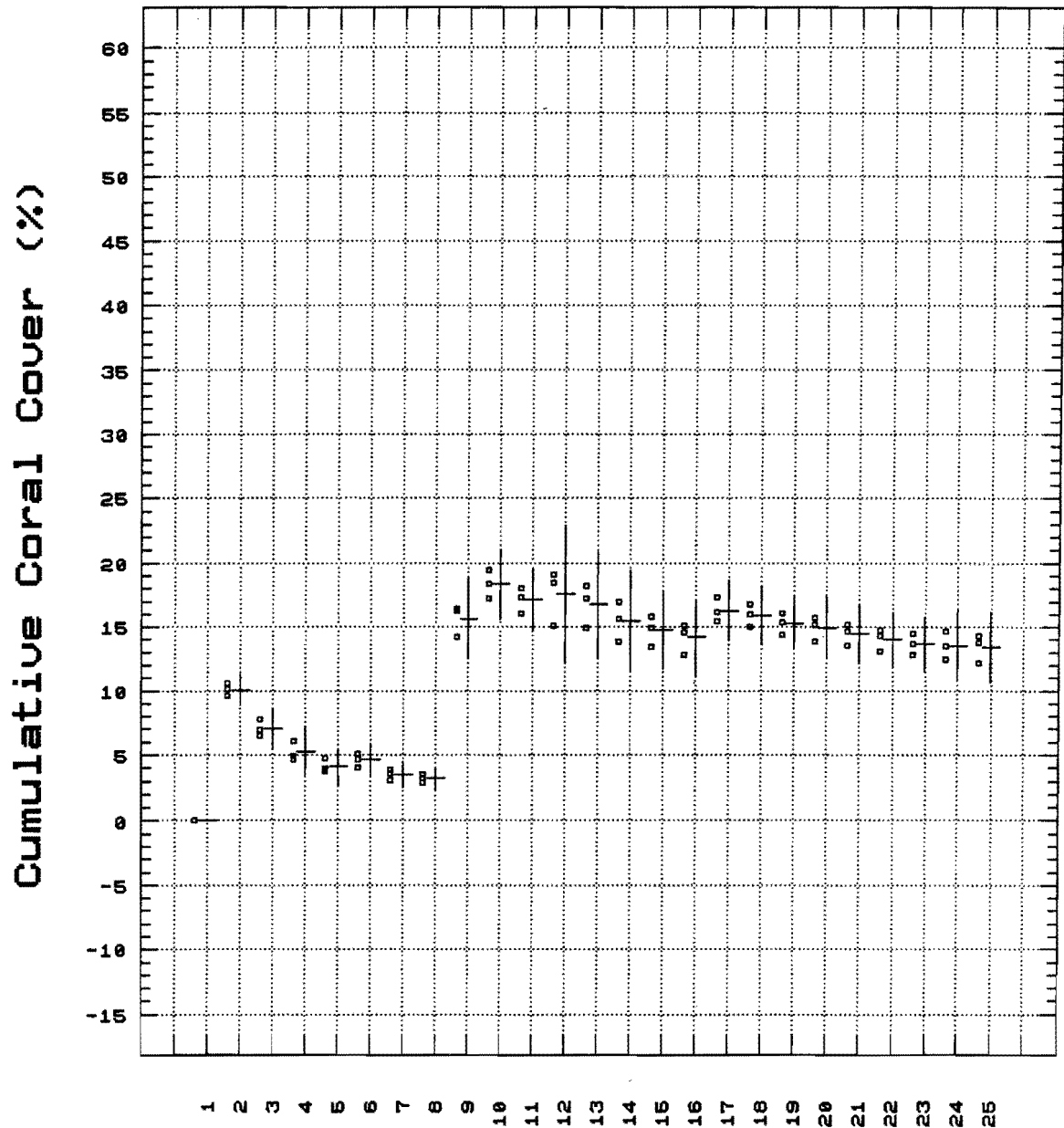
Length of Line (m) (N = 3; 95% C.I.)

Biscayne National Park
Reef I, Trs. 1, Cts. 1-3, 1990



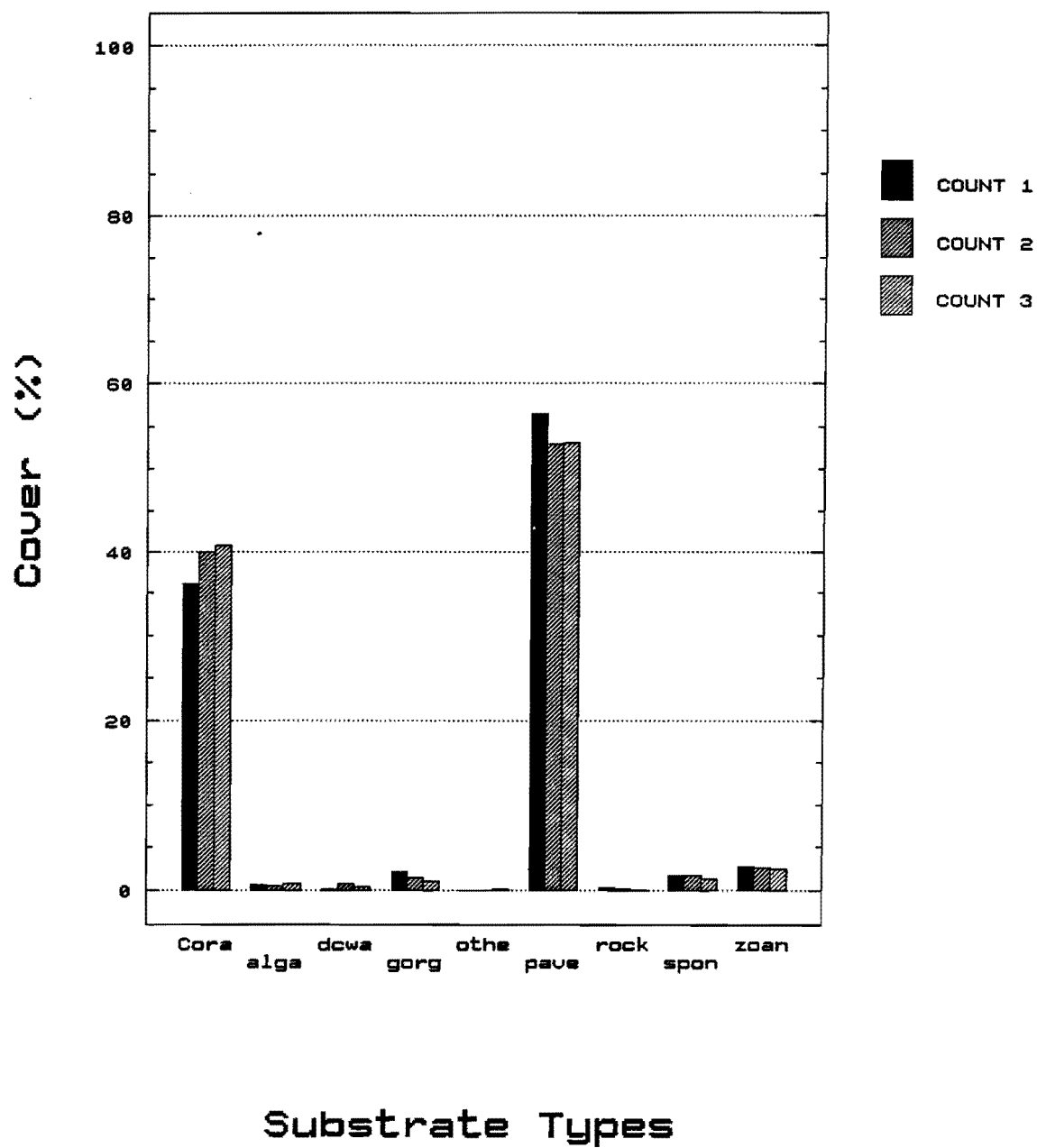
Biscayne National Park

Reef I, Trs. 1, 1990



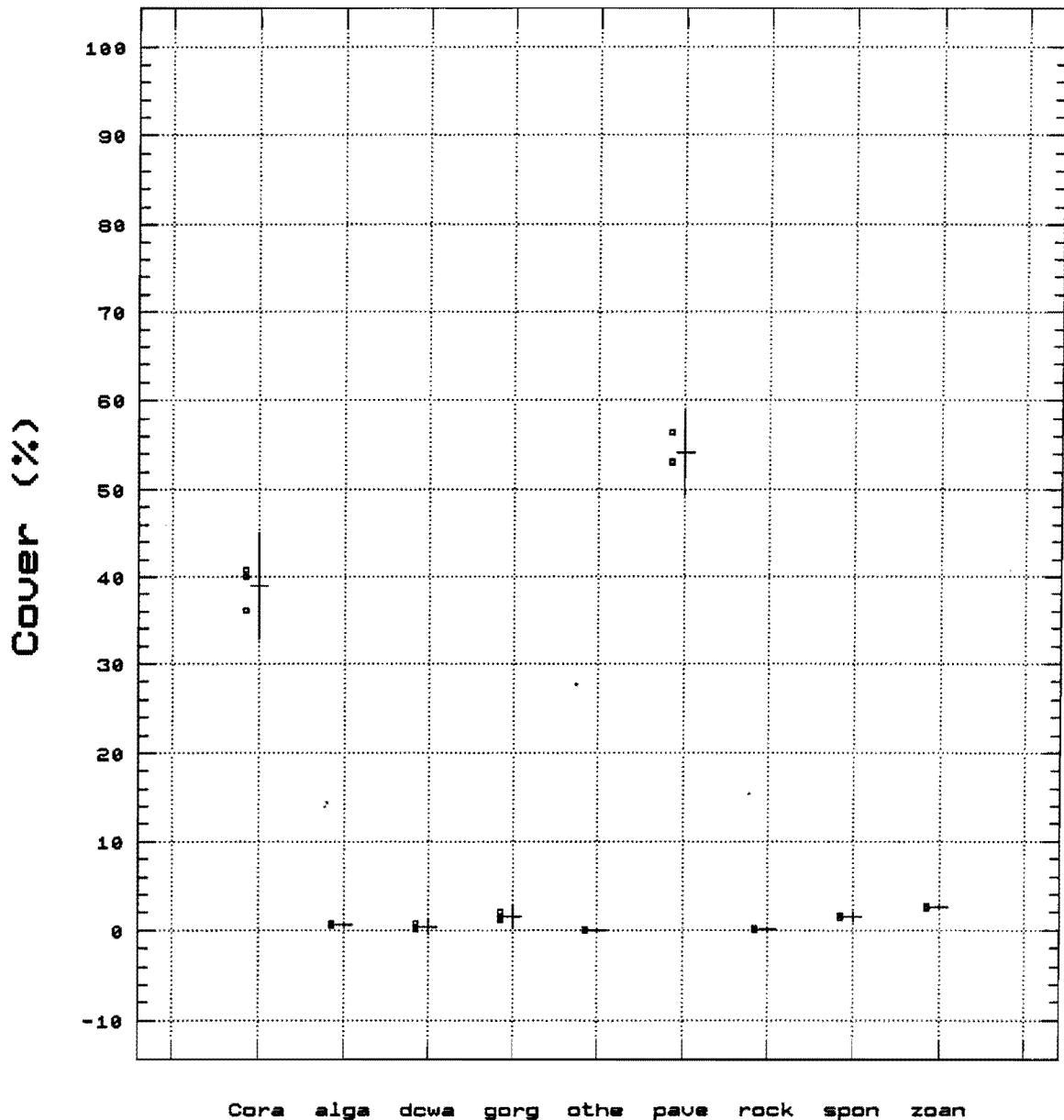
Length of Line (m) (N = 3; 95% C.I.)

Biscayne National Park
Reef I, Trs. 2-4 Comb., Cts. 1-3, 1990



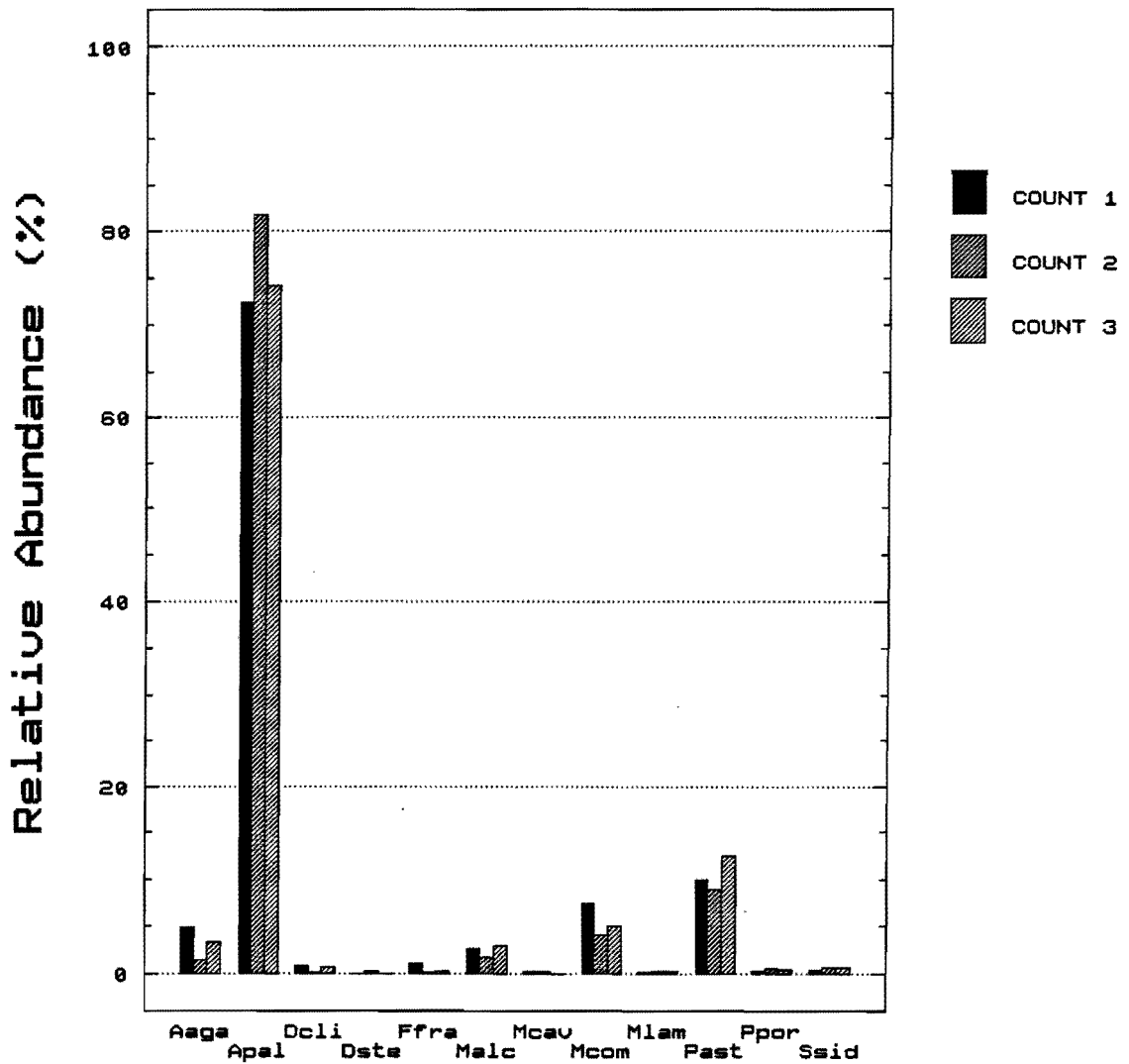
Biscayne National Parks

Reef I, Trs. 2-4 Comb., 1990



Substrate Types (N = 3; 95% C.I.)

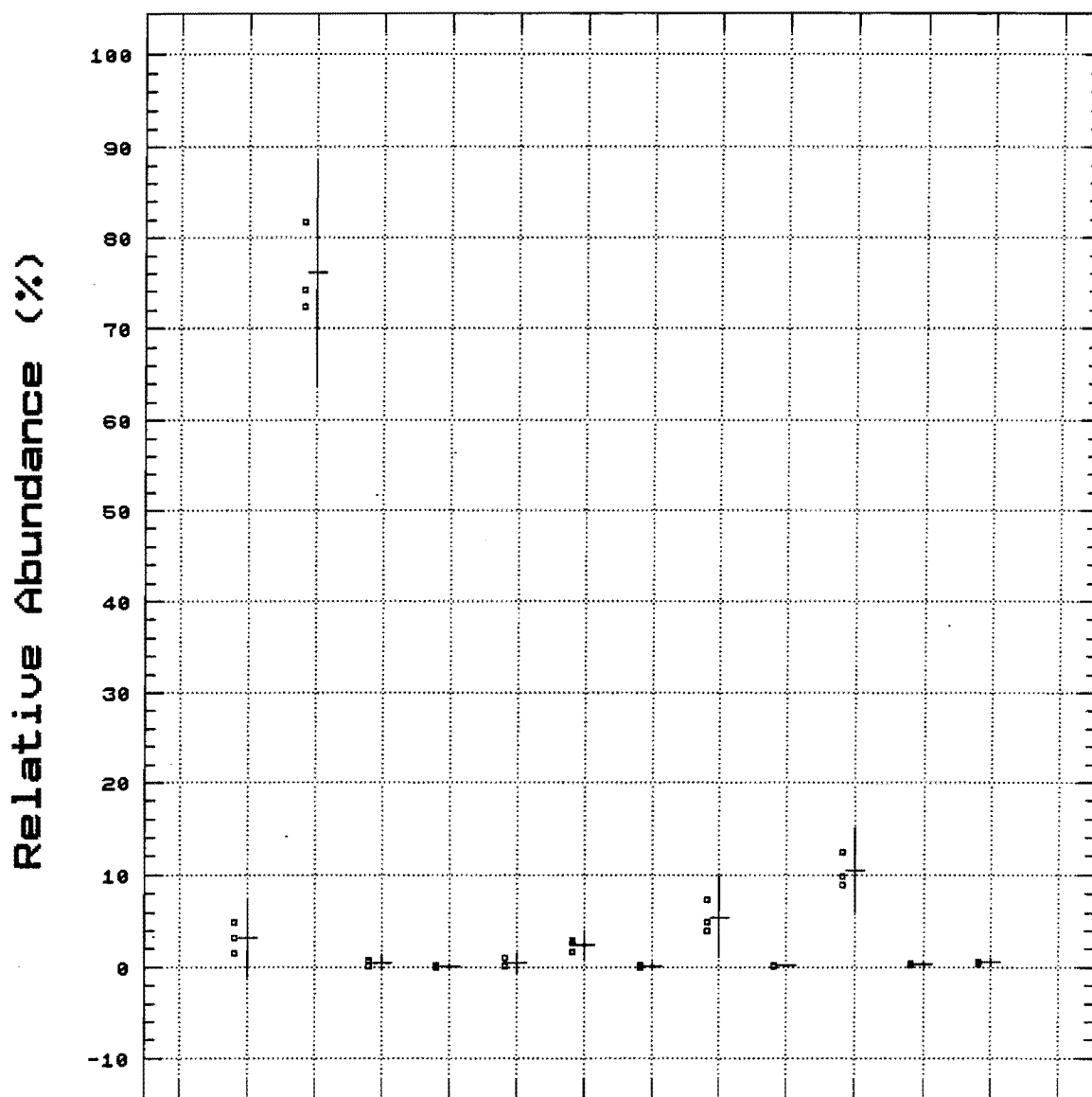
Biscayne National Park
Reef I, Trs. 2-4 Comb., Cts. 1-3, 1990



Coral Species

Biscayne National Park

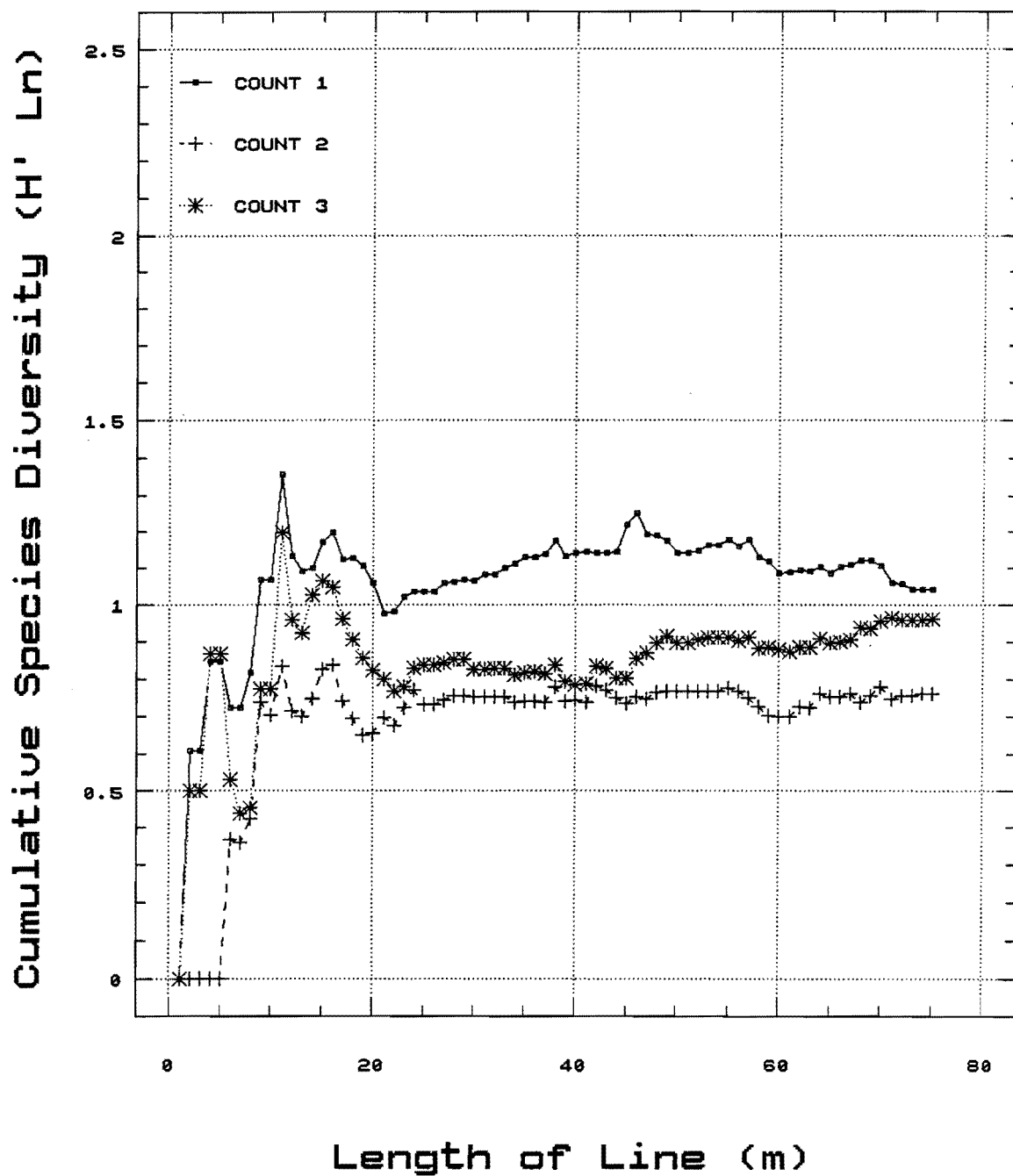
Reef I, Trs. 2-4 Comb., 1990



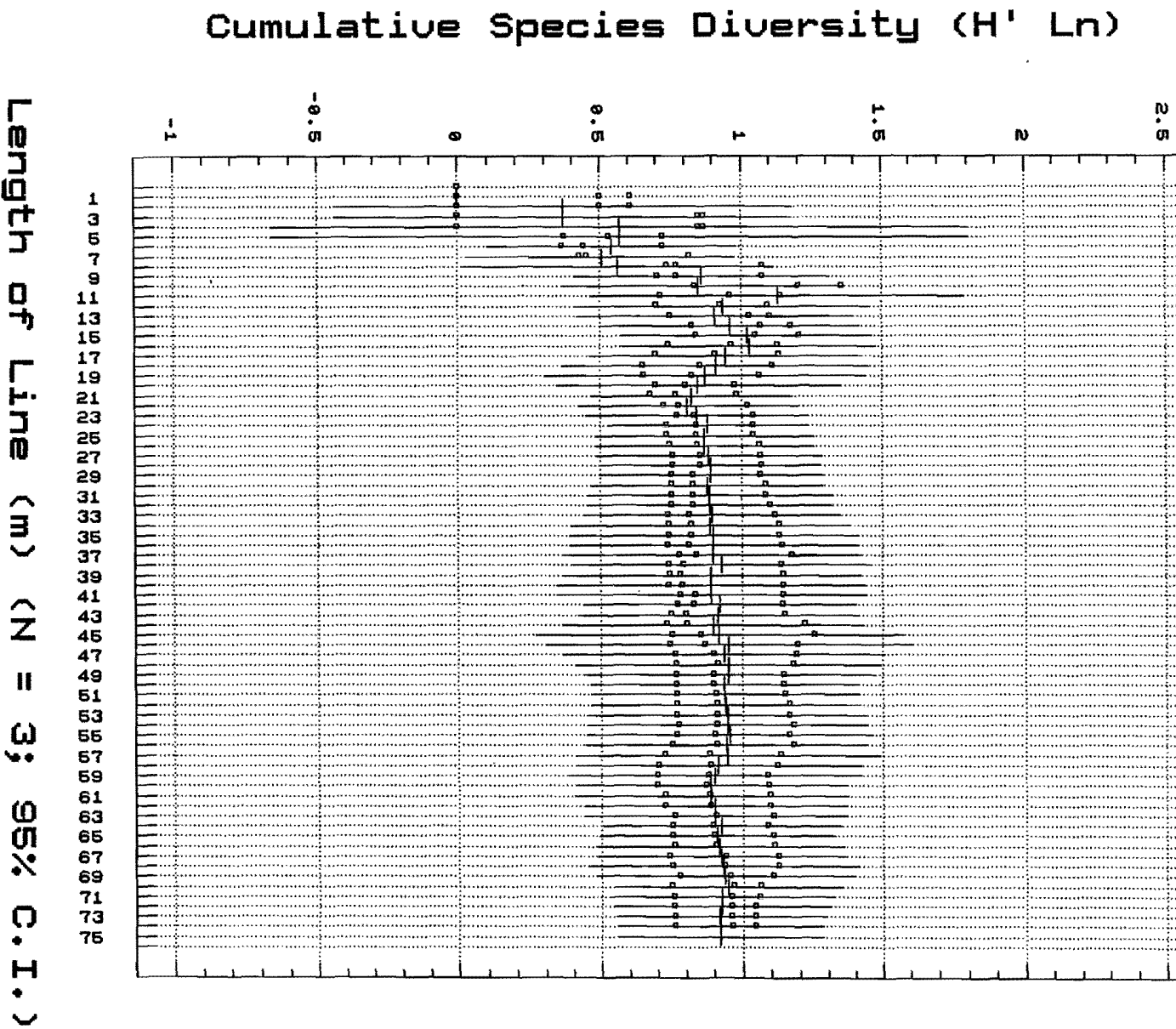
Aaga Apal Dcli Dste Ffra Malc Mcau Mcom Mlam Past Ppor Ssid

Coral Species (N = 3; 95% C.I.)

Biscayne National Park
Reef I, Trs. 2-4 Comb., Cts. 1-3, 1990

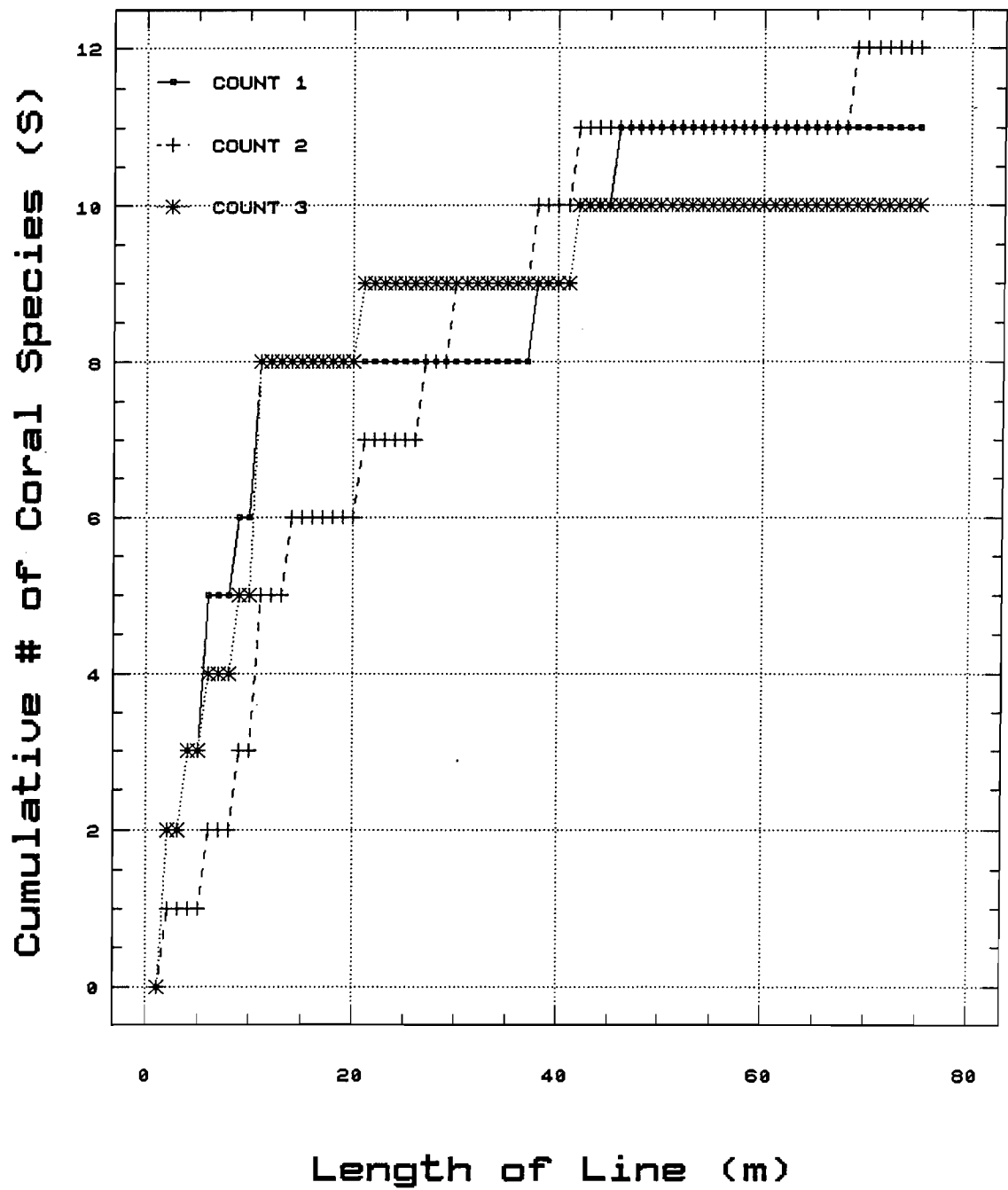


Biscayne National Park
Reef I, Trs. 2-4 Comb., 1990

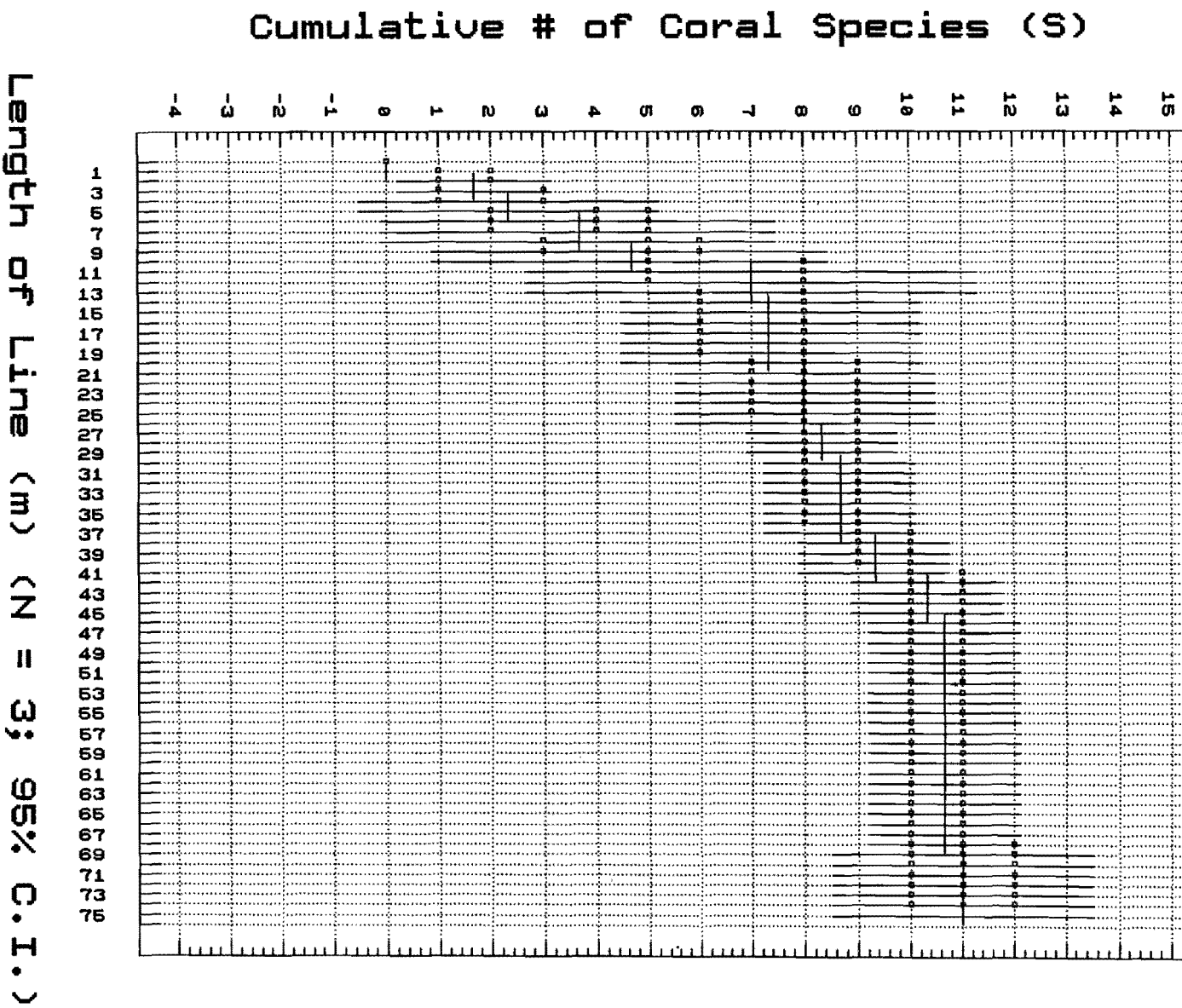


Biscayne National Park

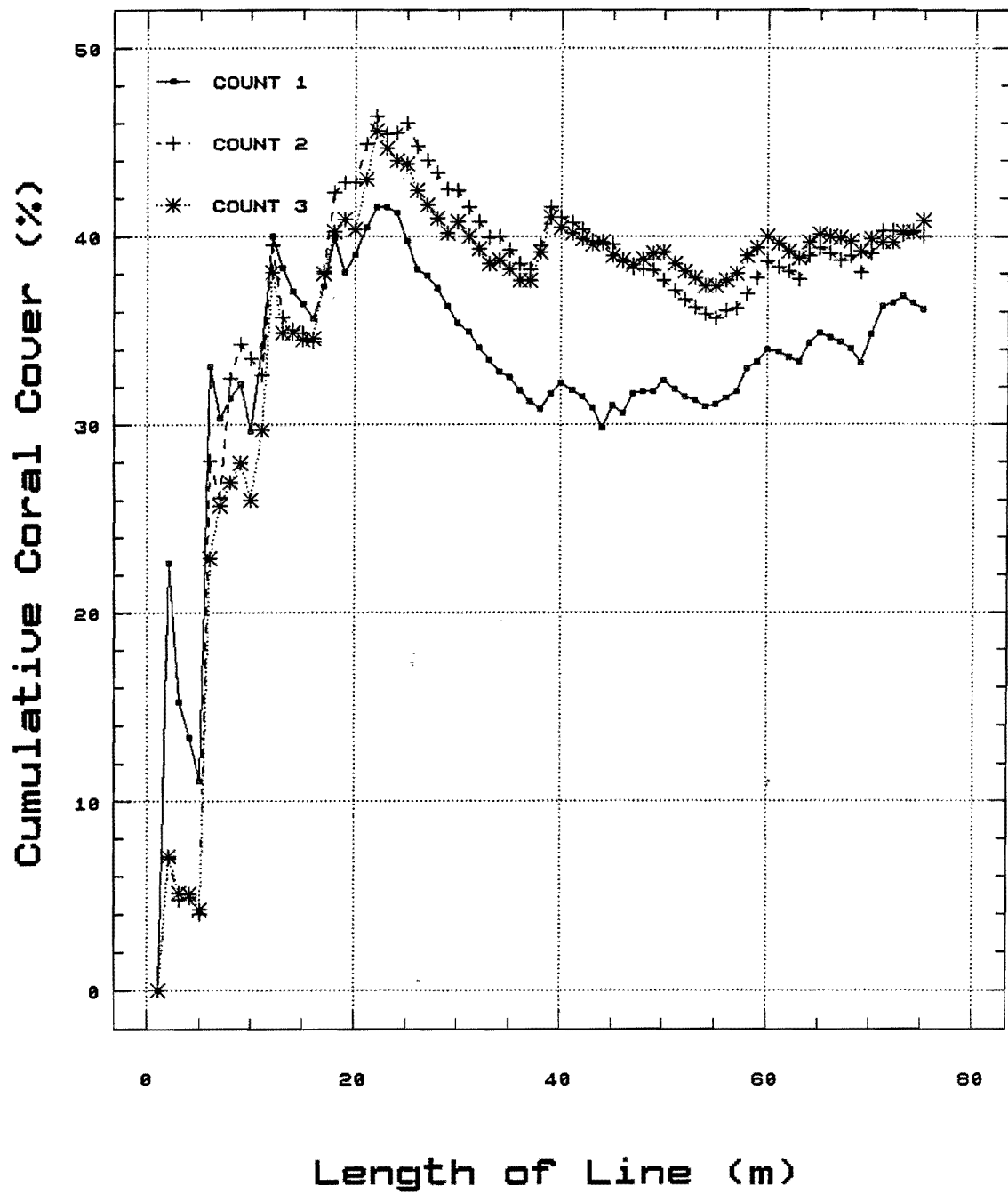
Reef I, Trs. 2-4 Comb., Cts. 1-3, 1990



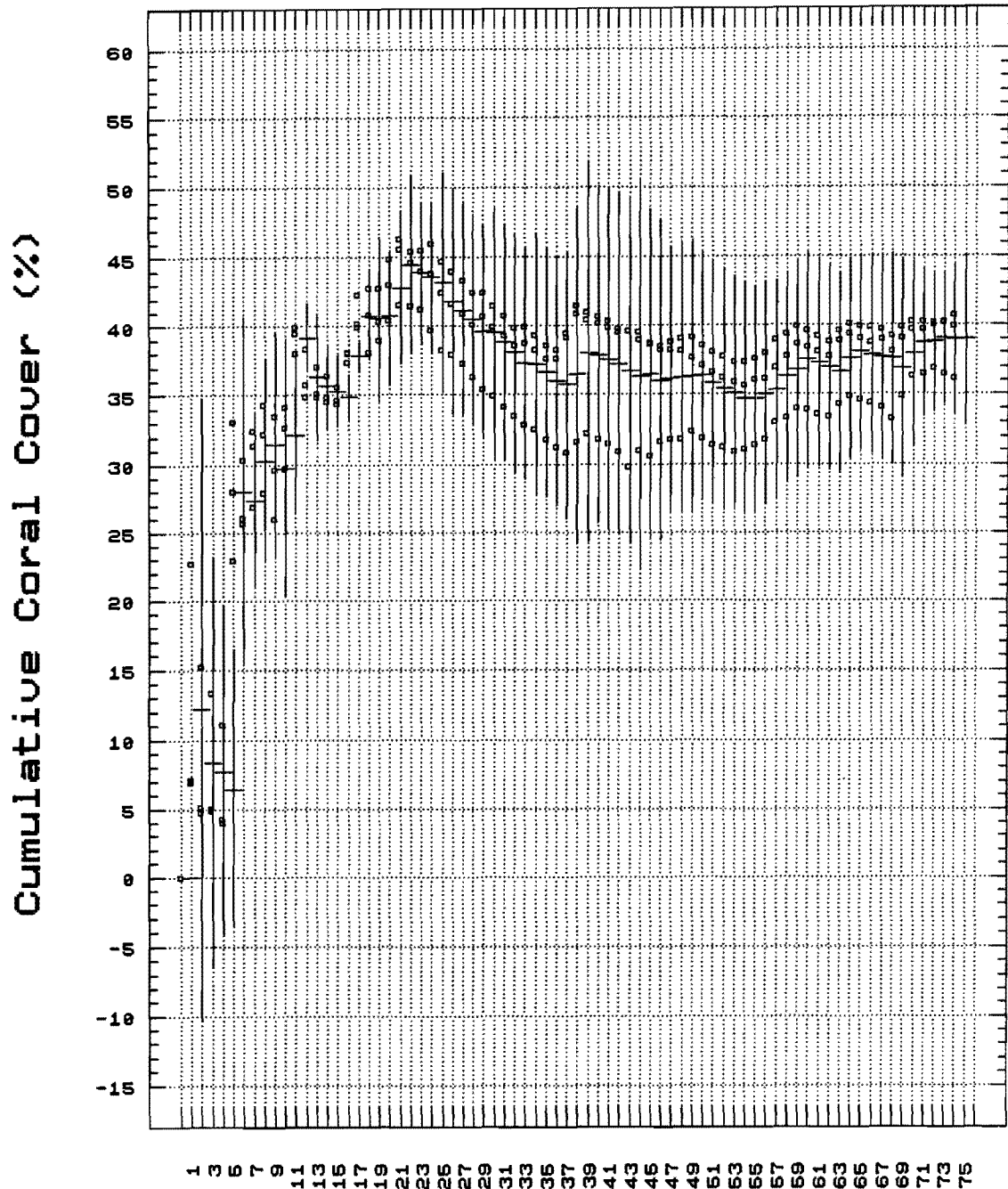
Biscayne National Park
Reef I, Trs. 2-4 Comb., 1990



Biscayne National Park
Reef I, Trs. 2-4 Comb., Cts. 1-3, 1990

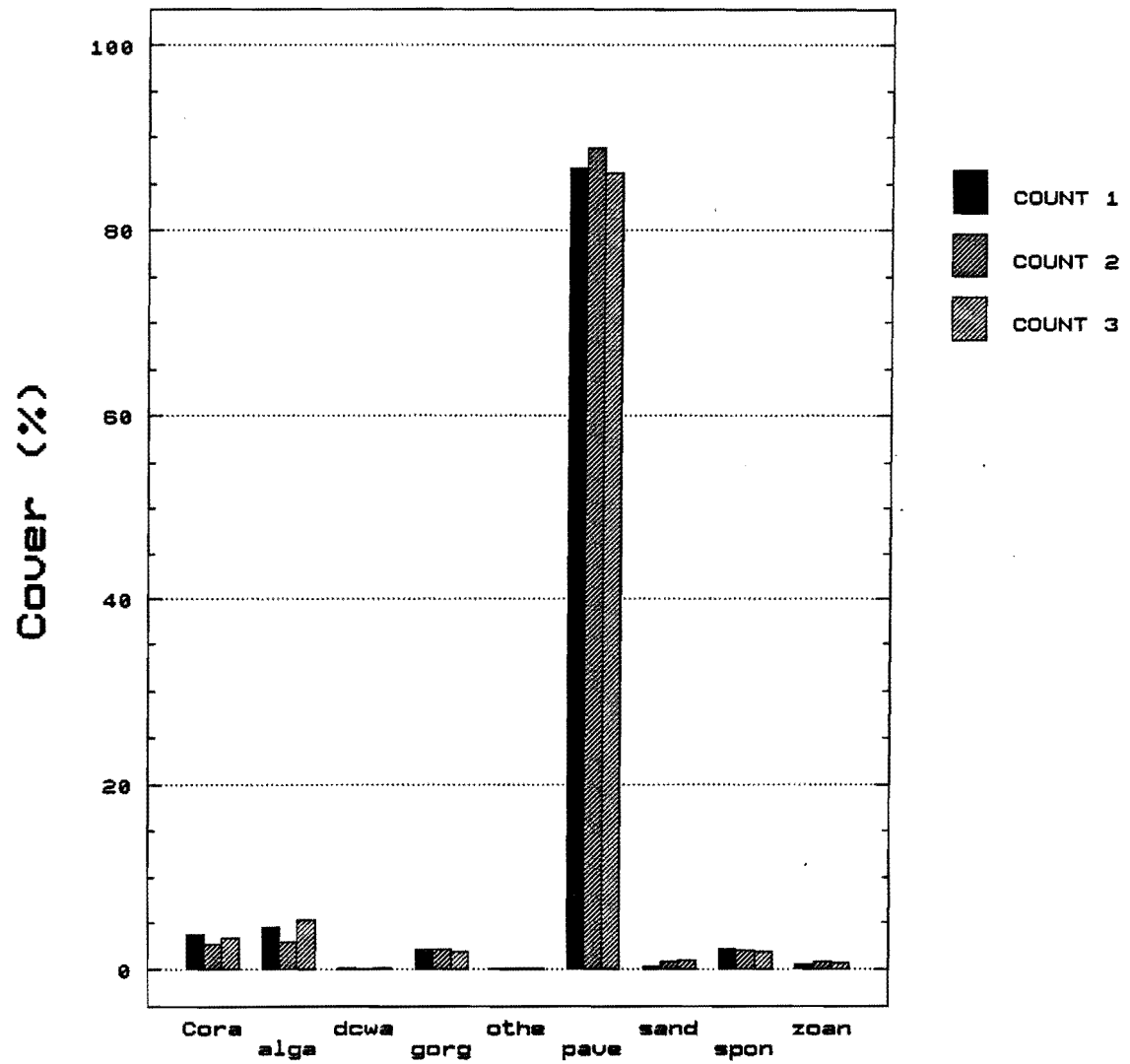


Biscayne National Park
Reef I, Trs. 2-4 Comb., 1990



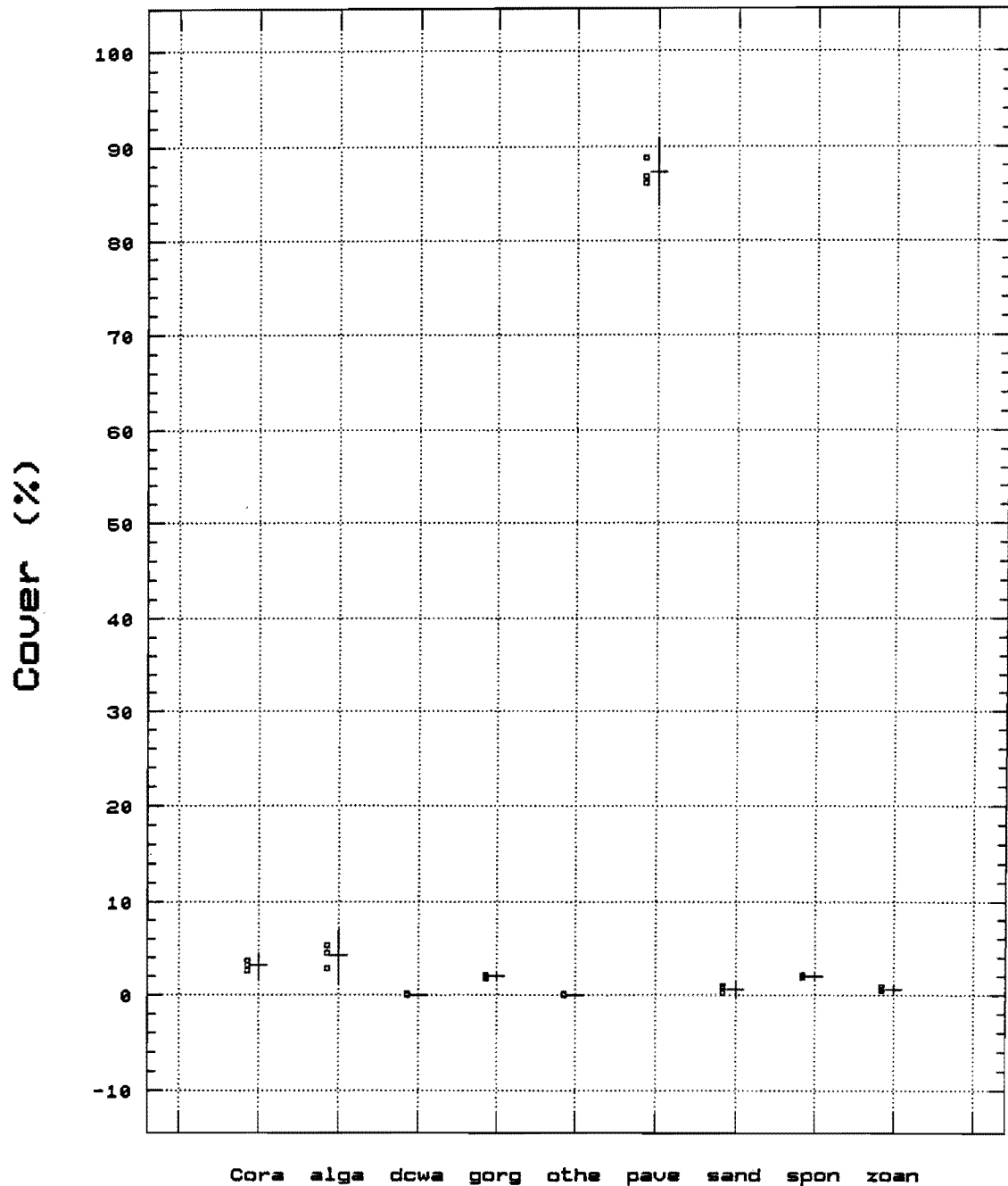
Length of Line (m) (N = 3; 95% C.I.)

Biscayne National Park
Reef II, Trs. 6-8 Comb., Cts. 1-3, 1990



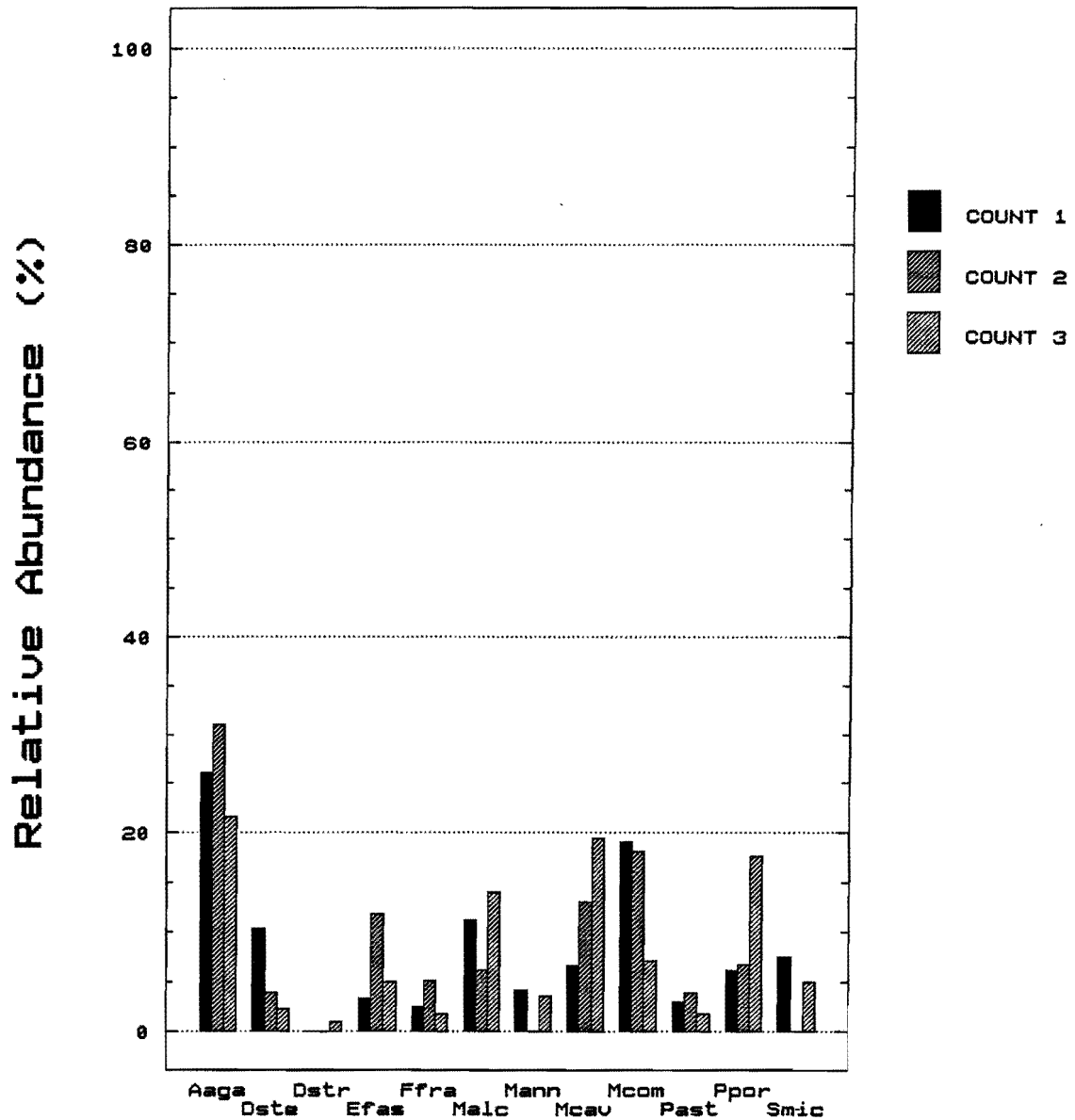
Substrate Types

Biscayne National Park
Reef II, Trs. 6-8 Comb., 1990



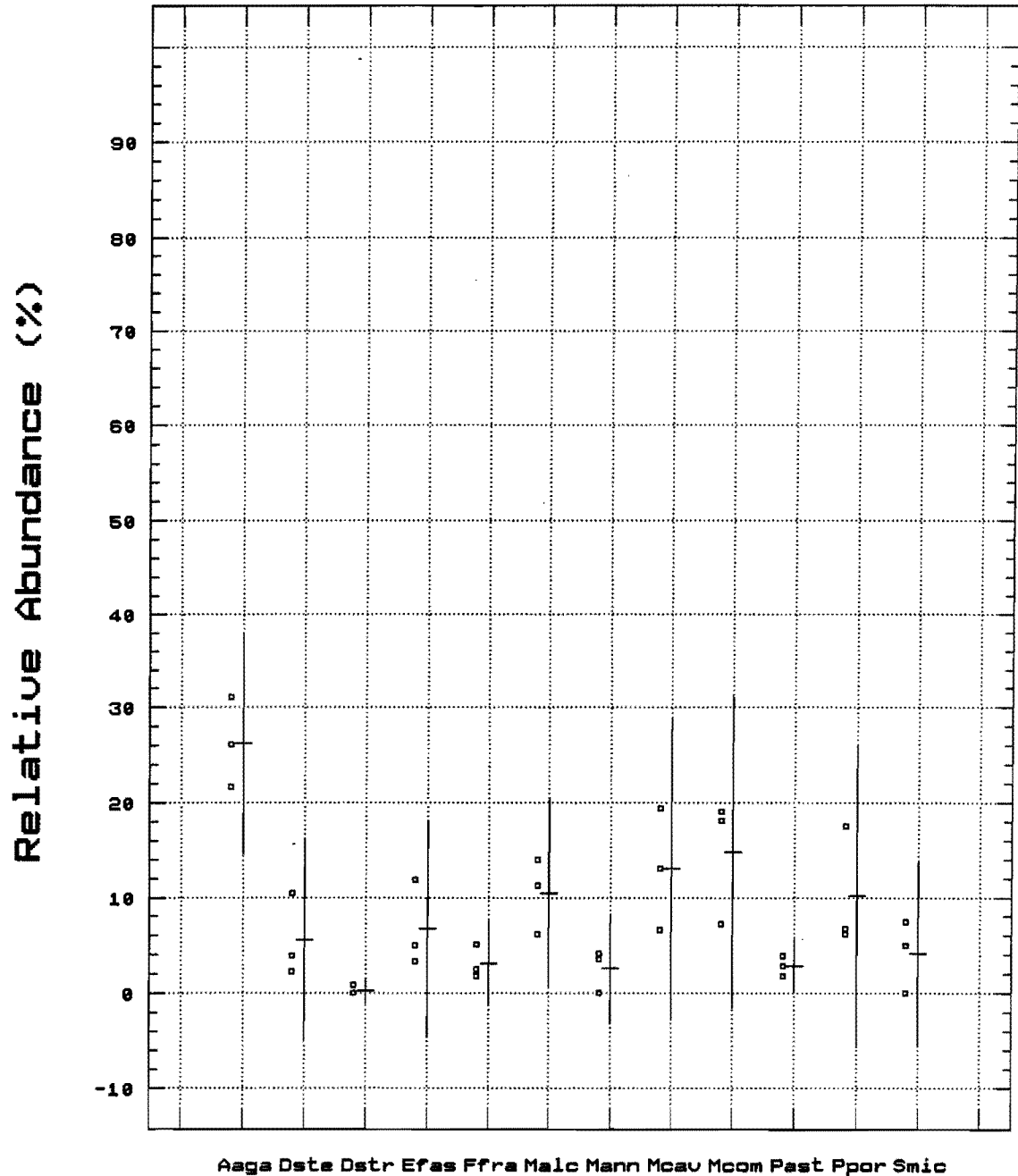
Substrate Types (N = 3; 95% C.I.)

Biscayne National Park
Reef II, Trs. 6-8 Comb., Cts. 1-3, 1990



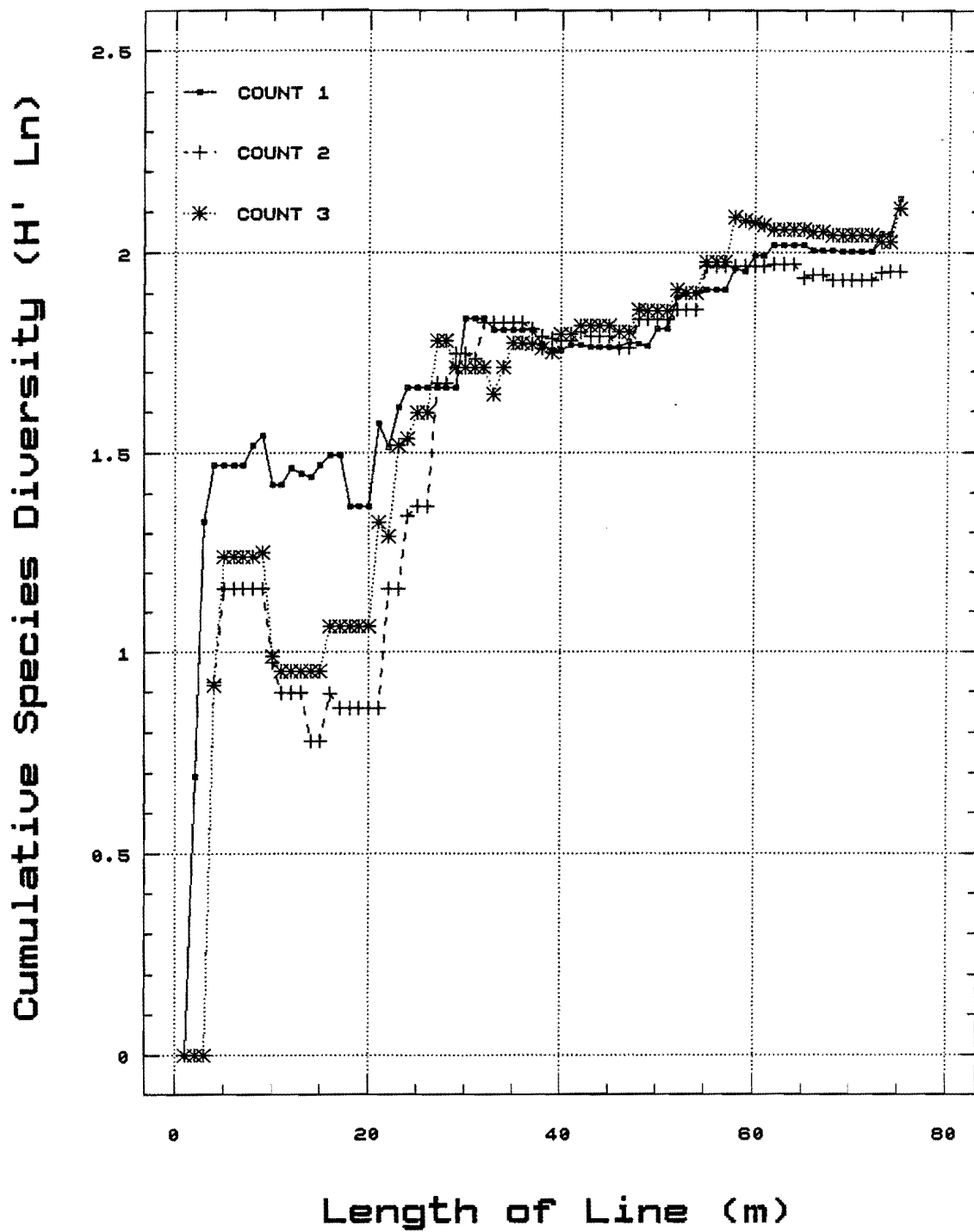
Coral Species

Biscayne National Park
Reef II, Trs. 6-8 Comb., 1990

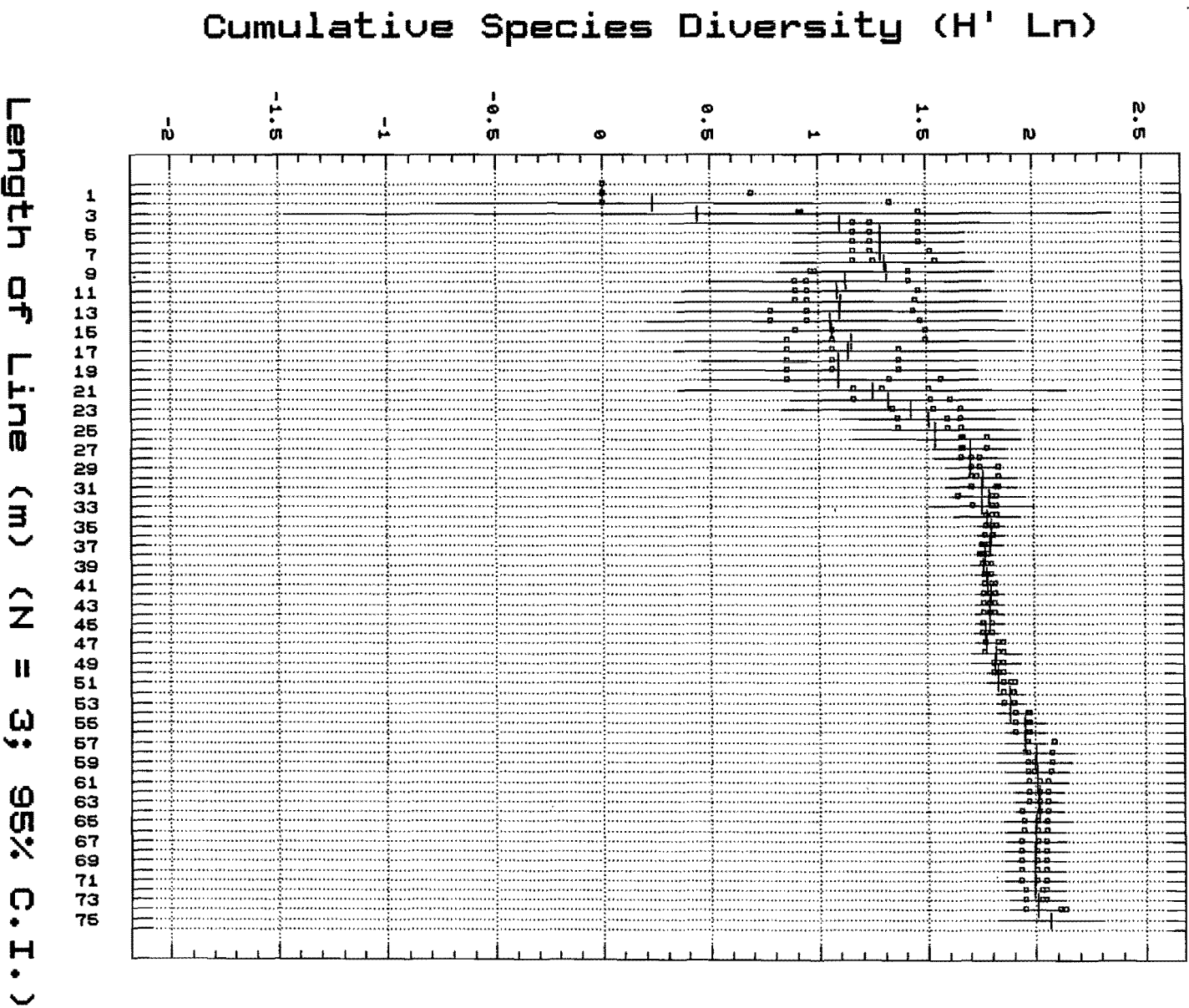


Coral Species (N = 3; 95% C.I.)

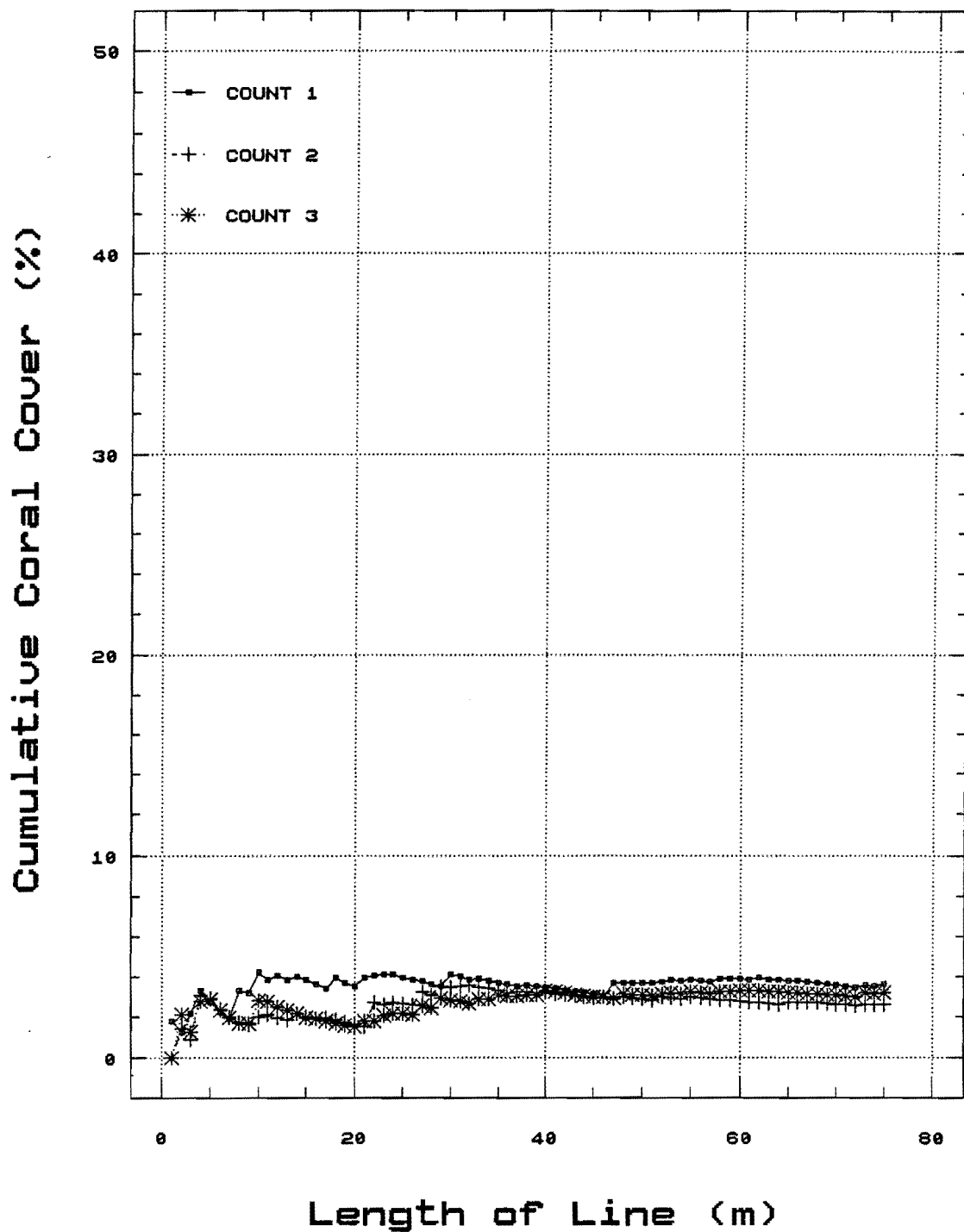
Biscayne National Park
Reef II, Trs. 6-8 Comb., Cts. 1-3, 1990



Biscayne National Park
Reef II, Trs. 6-8 Comb., 1990

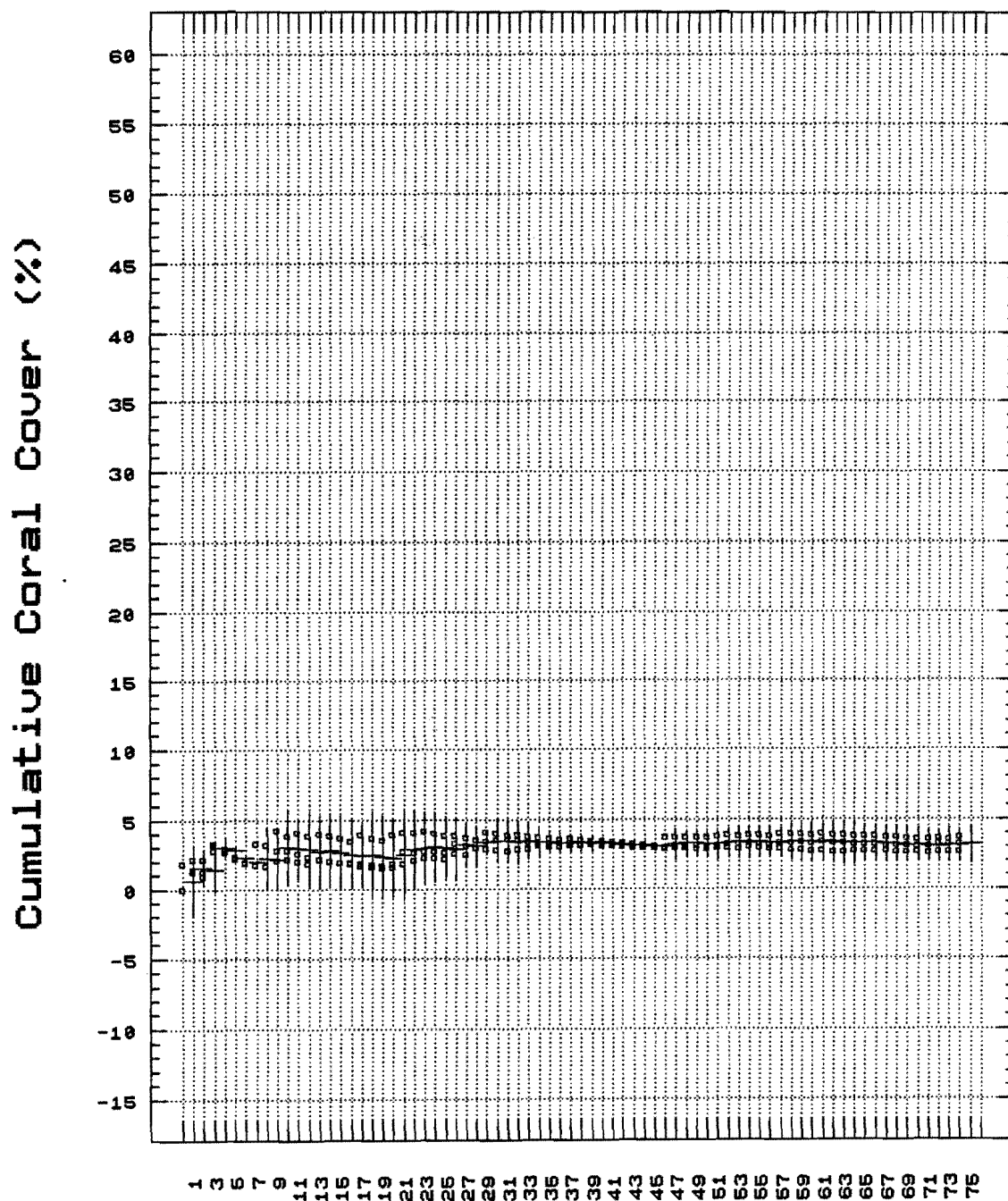


Biscayne National Park
Reef II, Trs. 6-8 Comb., Cts. 1-3, 1990



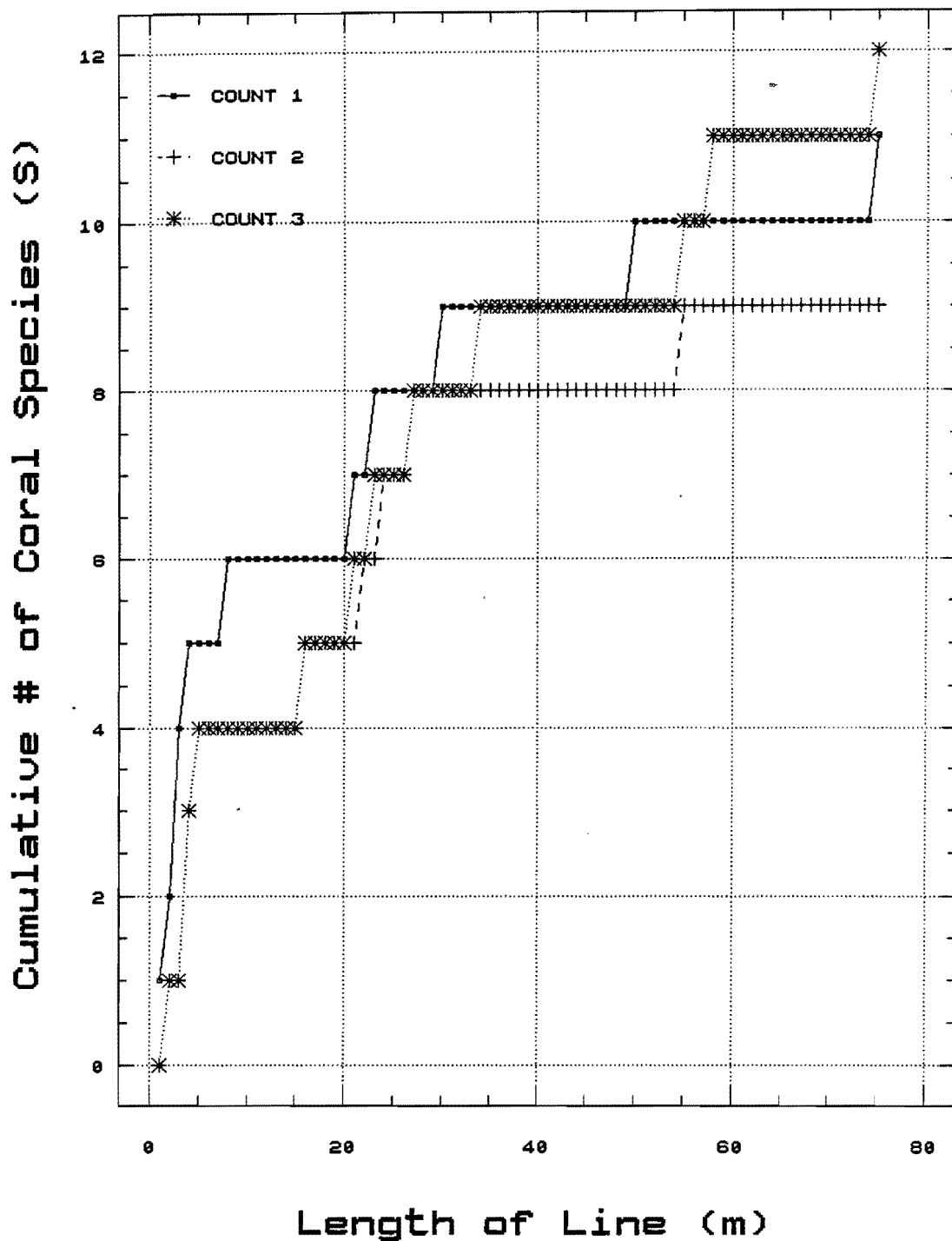
Biscayne National Park

Reef II, Trs. 6-8 Comb., 1990

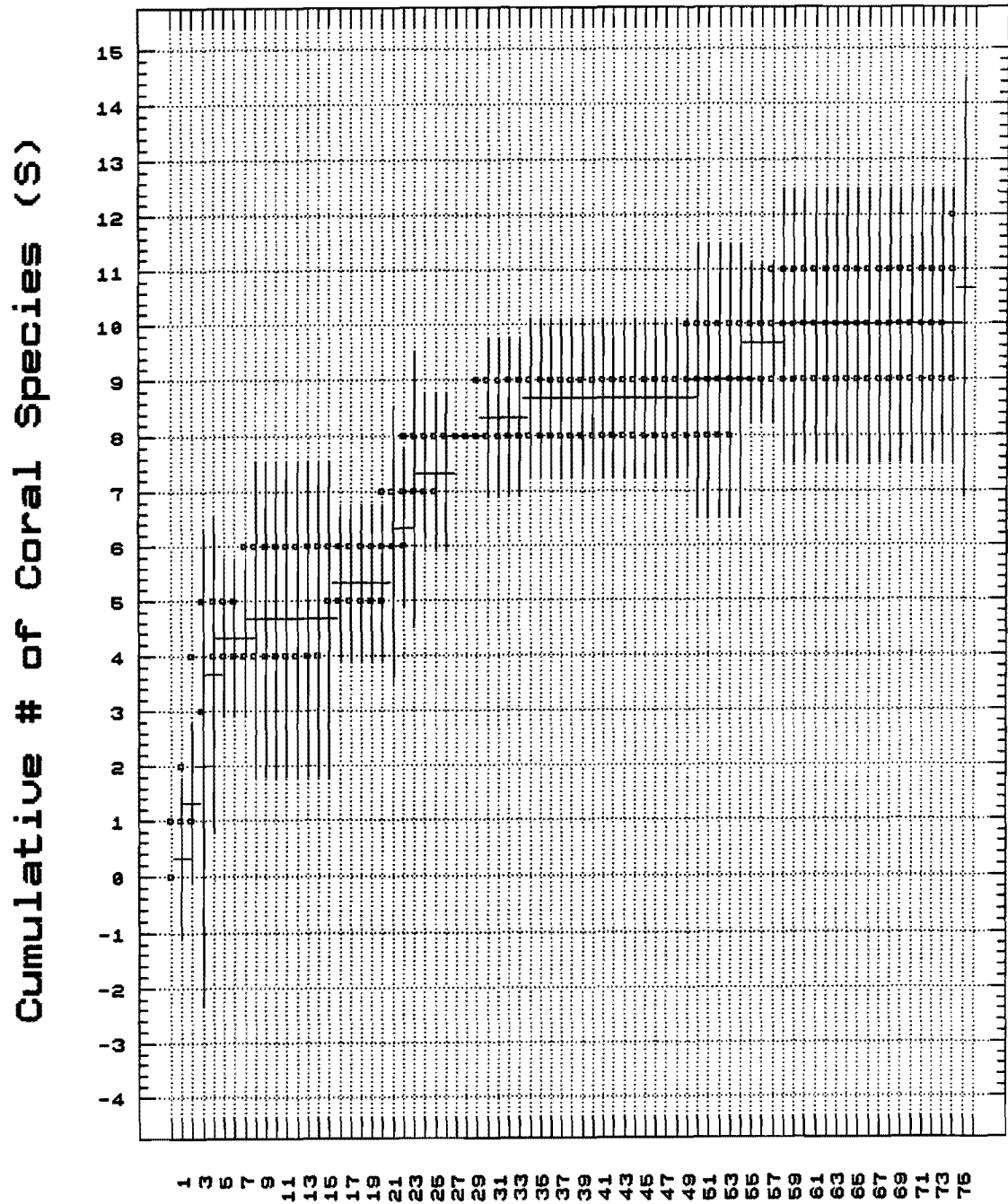


Length of Line (m) (N = 3; 95% C.I.)

Biscayne National Park
Reef II, Trs. 6-8 Comb., Cts. 1-3, 1990

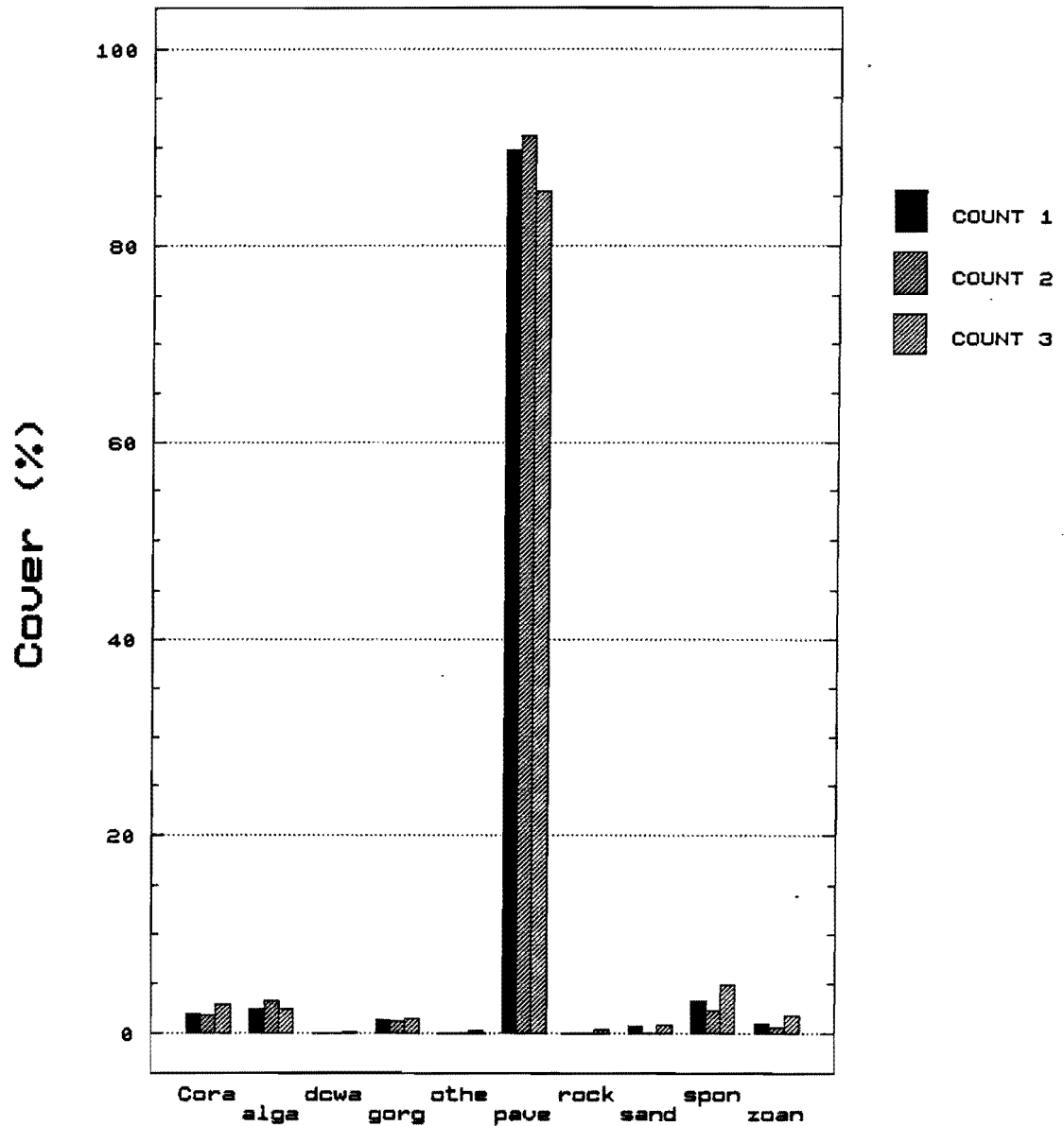


Biscayne National Park
 Reef II, Trs. 6-8 Comb., 1990



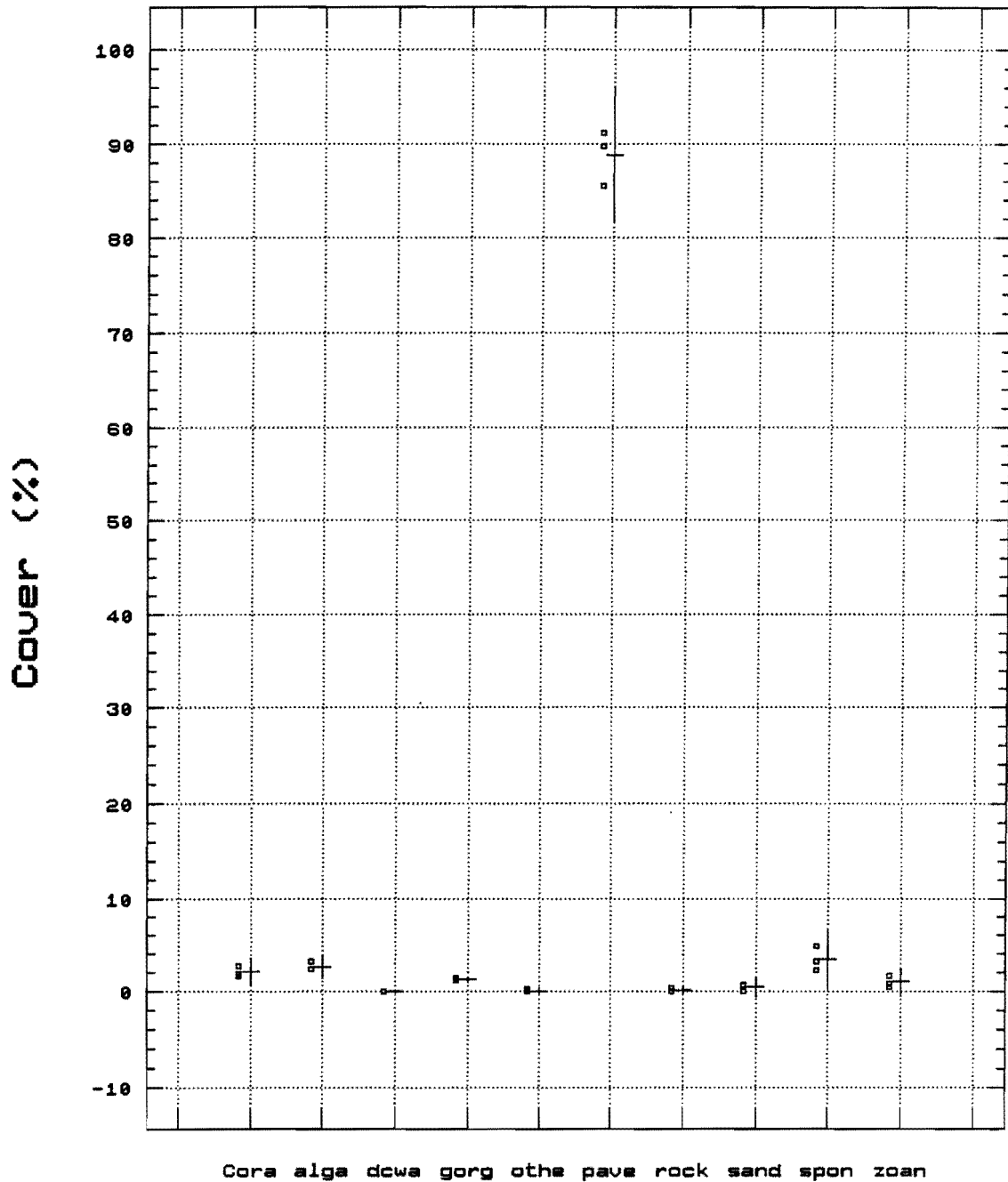
Length of Line (m) (N = 3; 95% C.I.)

Biscayne National Park
Reef II, Trs. 9, Cts. 1-3, 1990



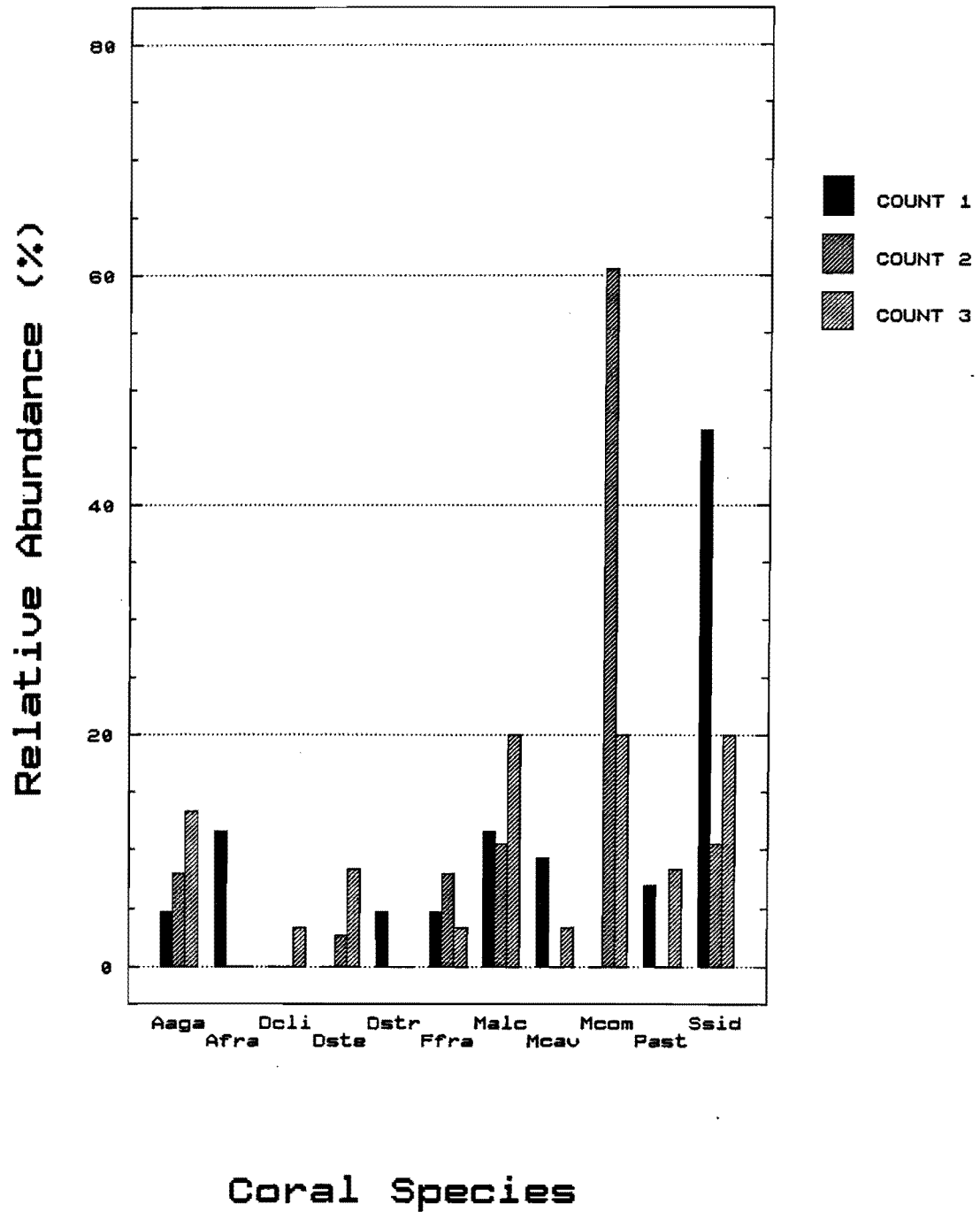
Substrate Types

Biscayne National Park Reef II, Trs. 9, 1990

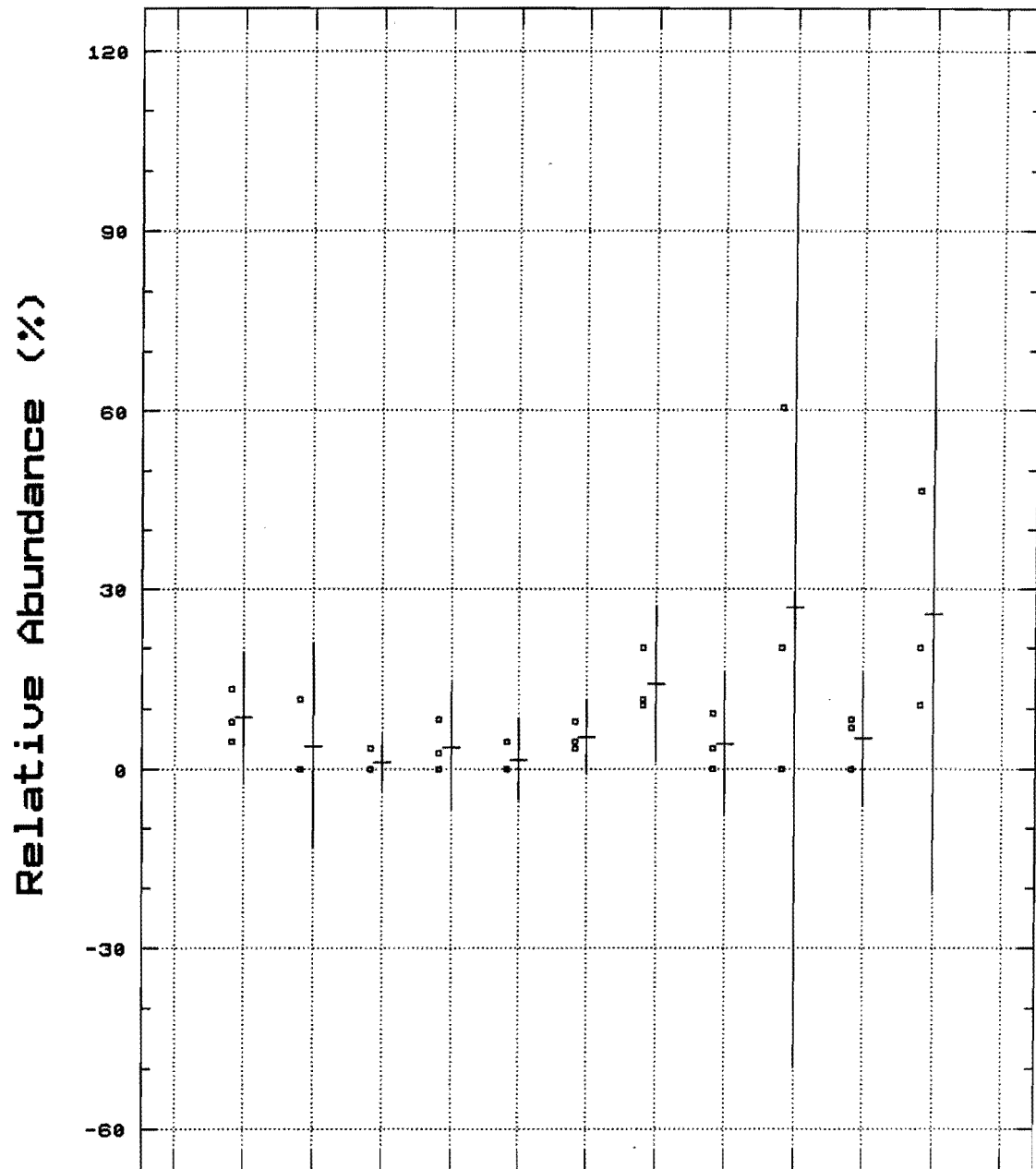


Substrate Types (N = 3; 95% C.I.)

Biscayne National Park
 Reef II, Trs. 9, Cts. 1-3, 1990



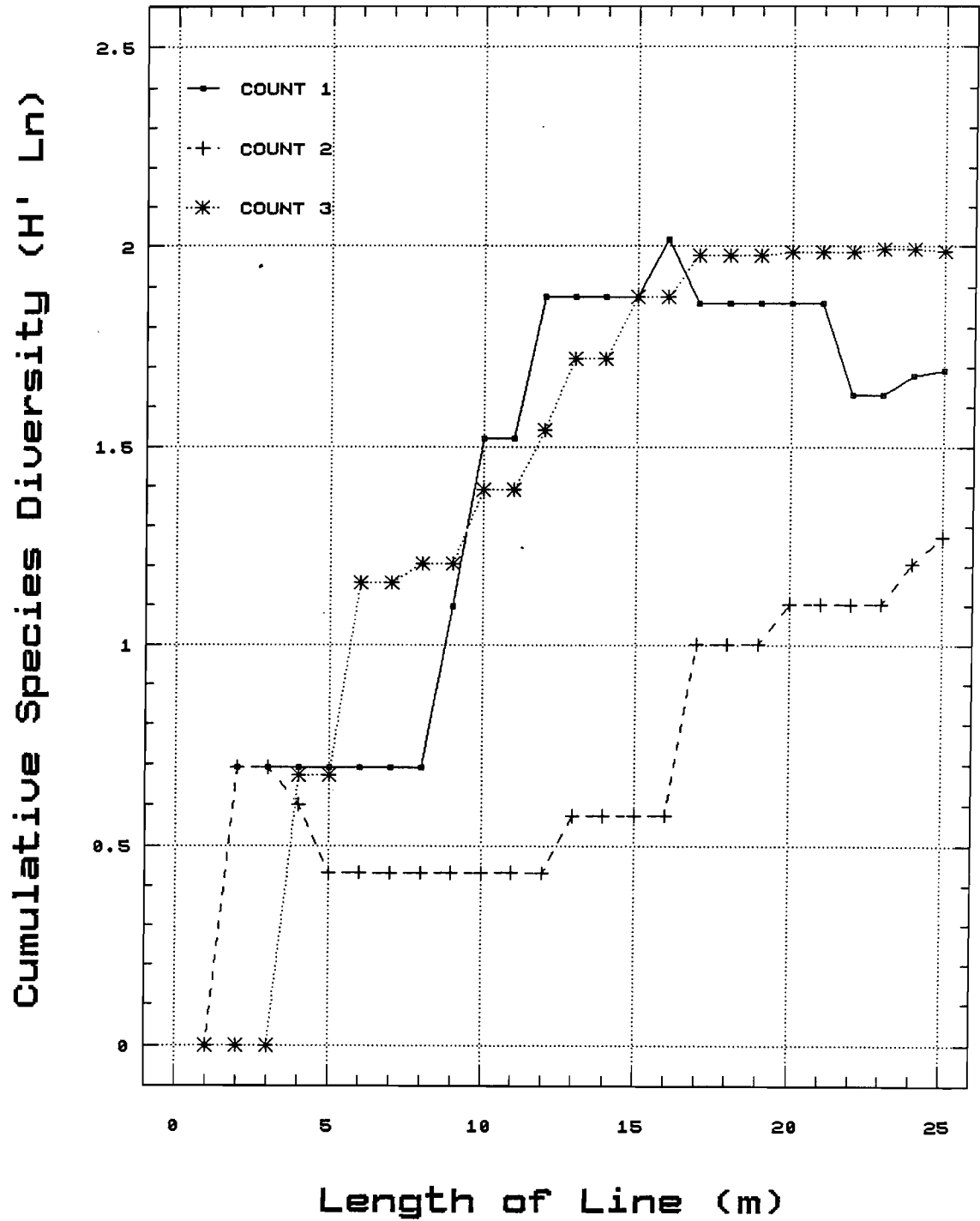
Biscayne National Park Reef II, Cts. 9, 1990



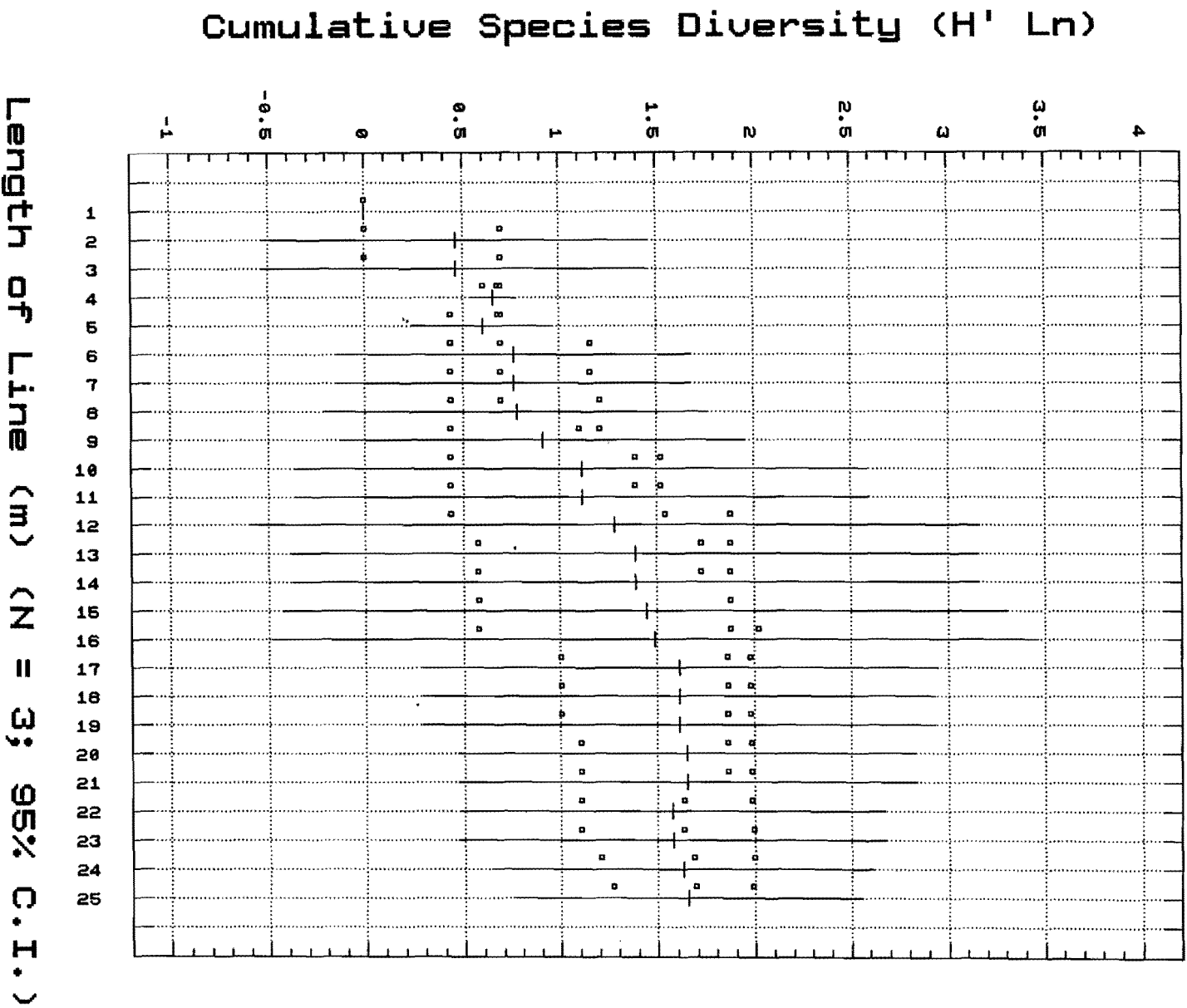
Aaga Afra Dcli Dste Dstr Ffra Malc Mcau Mcom Past Ssid

Coral Species (N = 3; 95% C.I.)

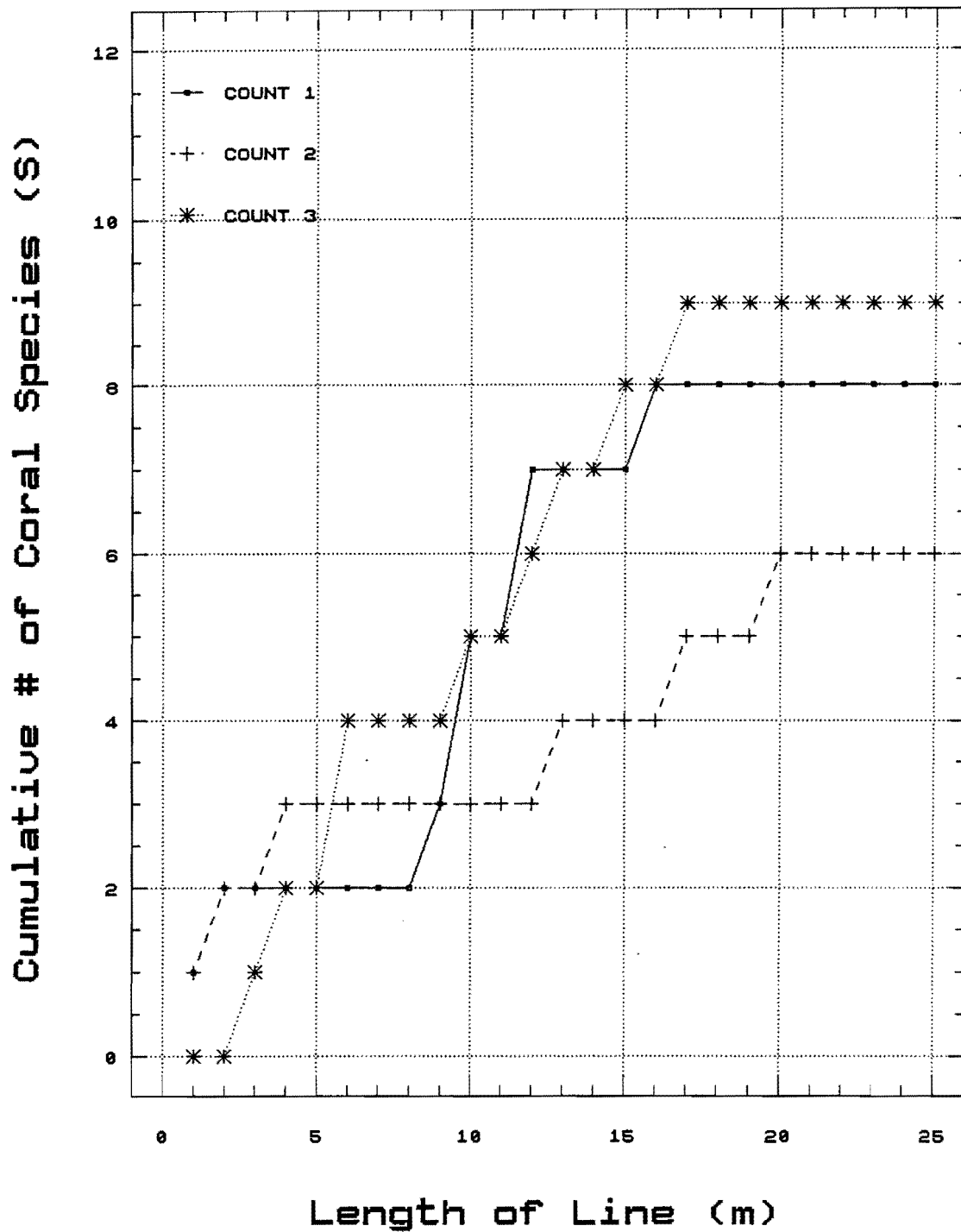
Biscayne National Park
Reef II, Trs. 9, Cts. 1-3, 1990



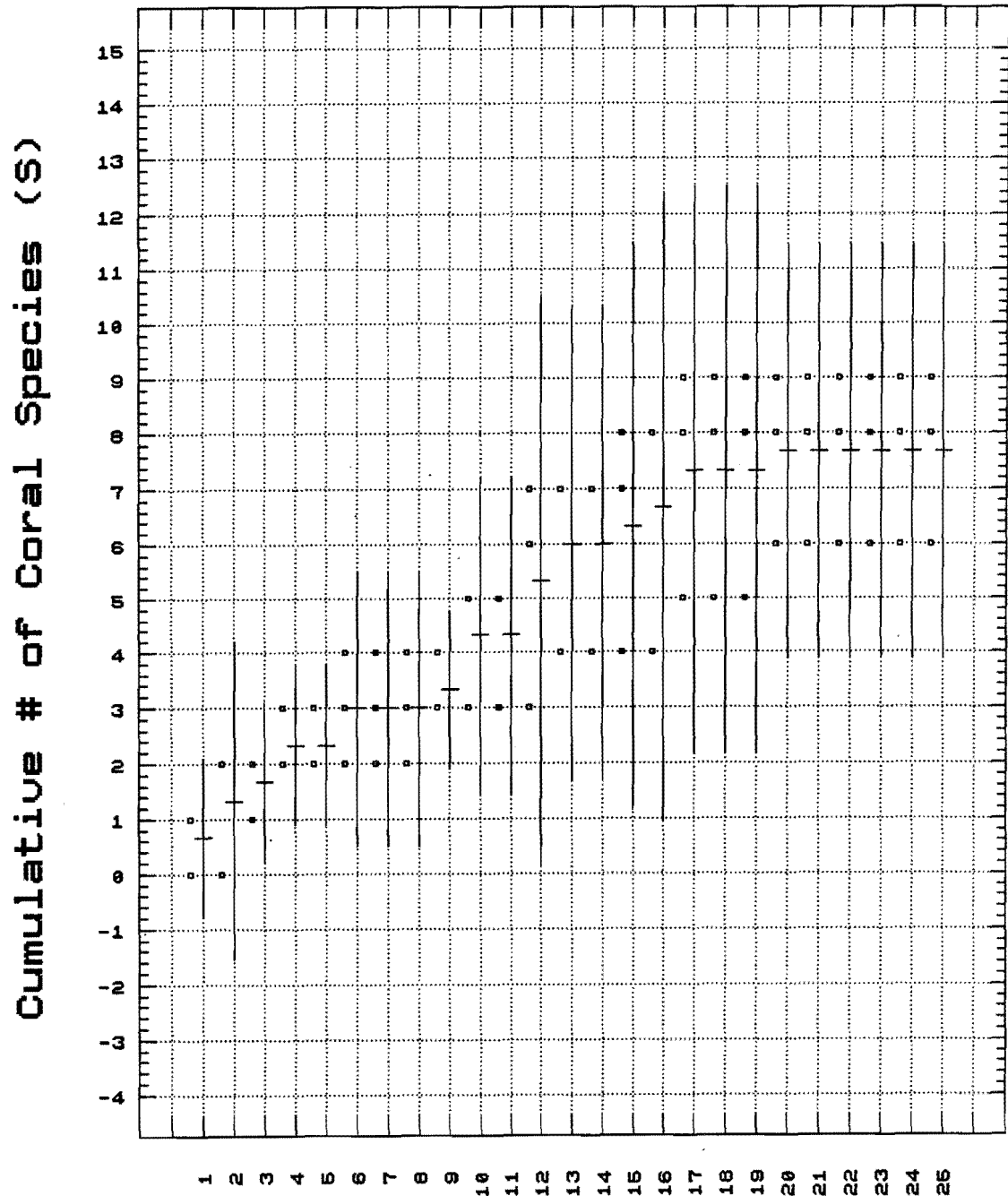
Biscayne National Park
Reef II, Trs. 9, 1990



Biscayne National Park
Reef II, Trs. 9, Cts. 1-3, 1990

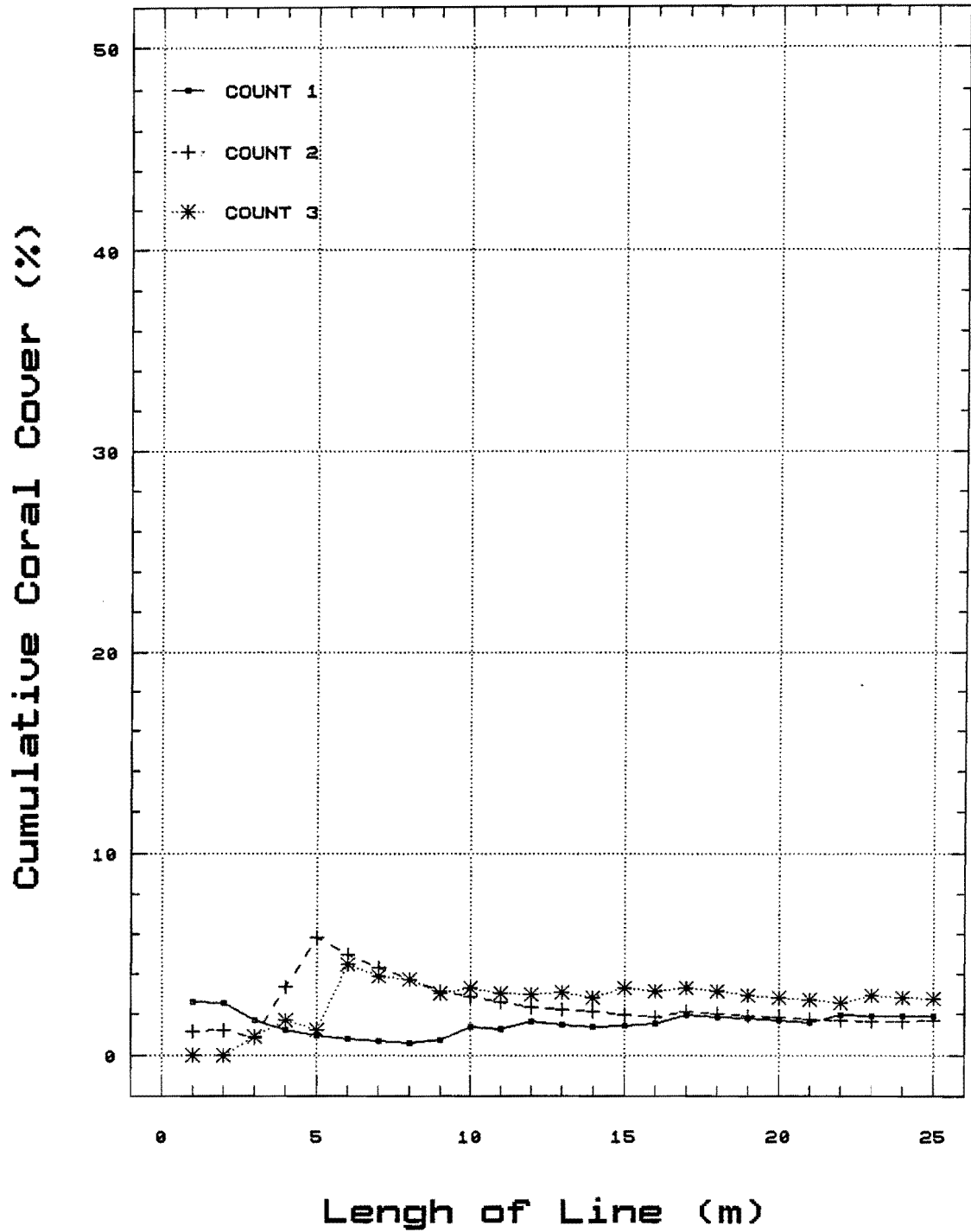


Biscayne National Park
Reef II, Trs. 9, 1990

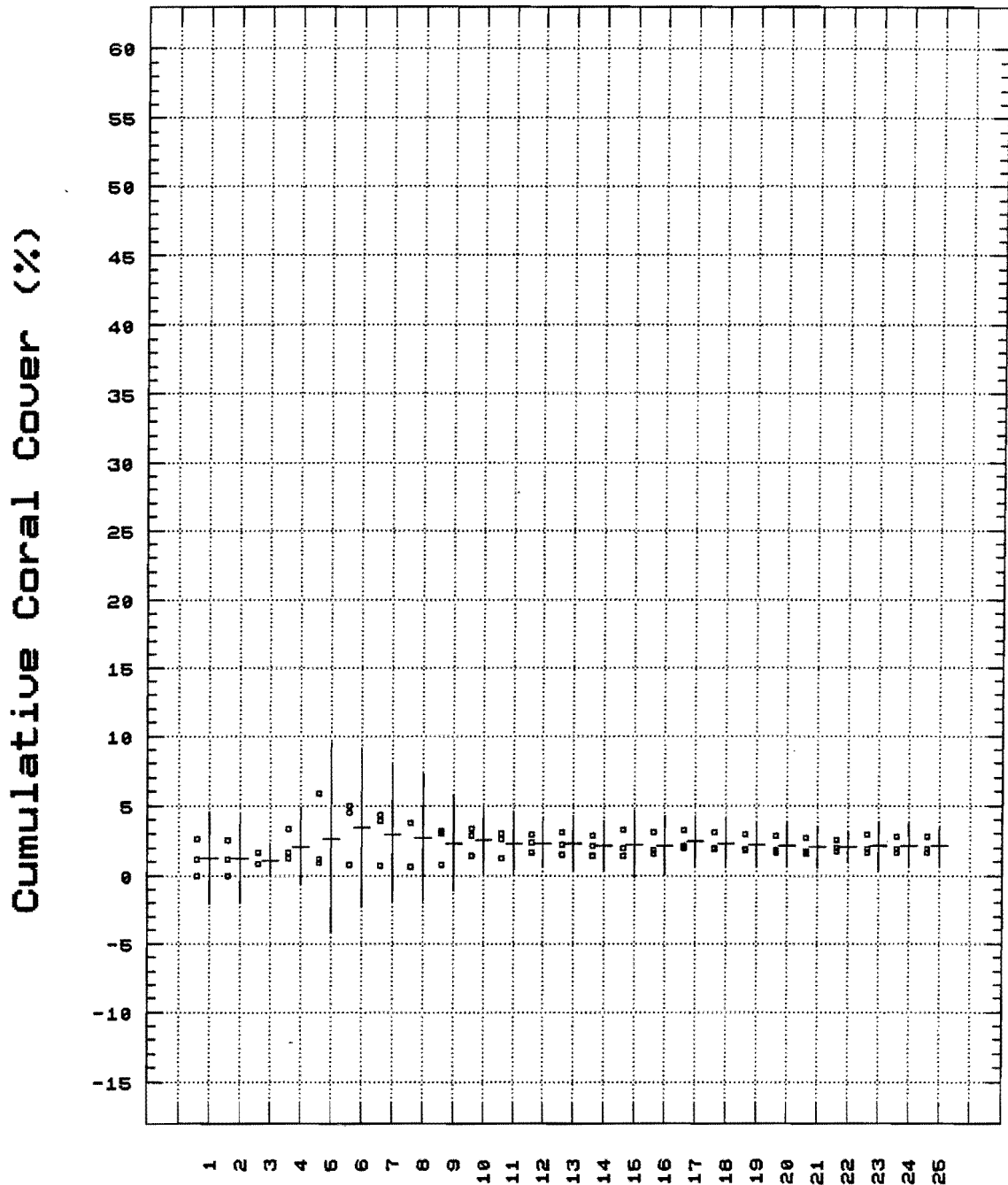


Length of Line (m) (N = 3; 95% C.I.)

Biscayne National Park
Reef II, Trs. 9, Cts. 1-3, 1990



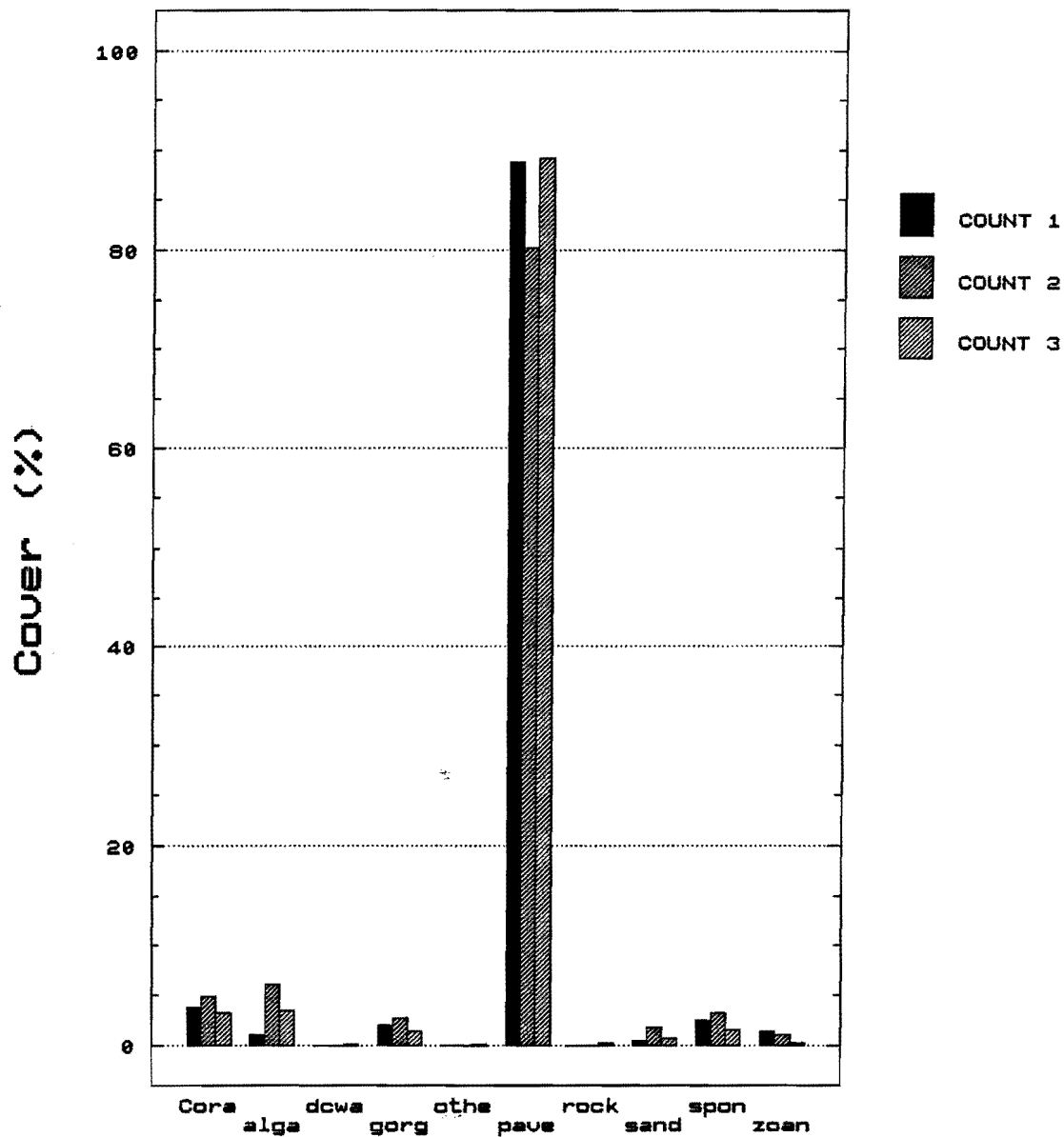
Biscayne National Park
Reef II, Trs. 9, 1990



Length of Line (m) (N = 3; 95% C.I.)

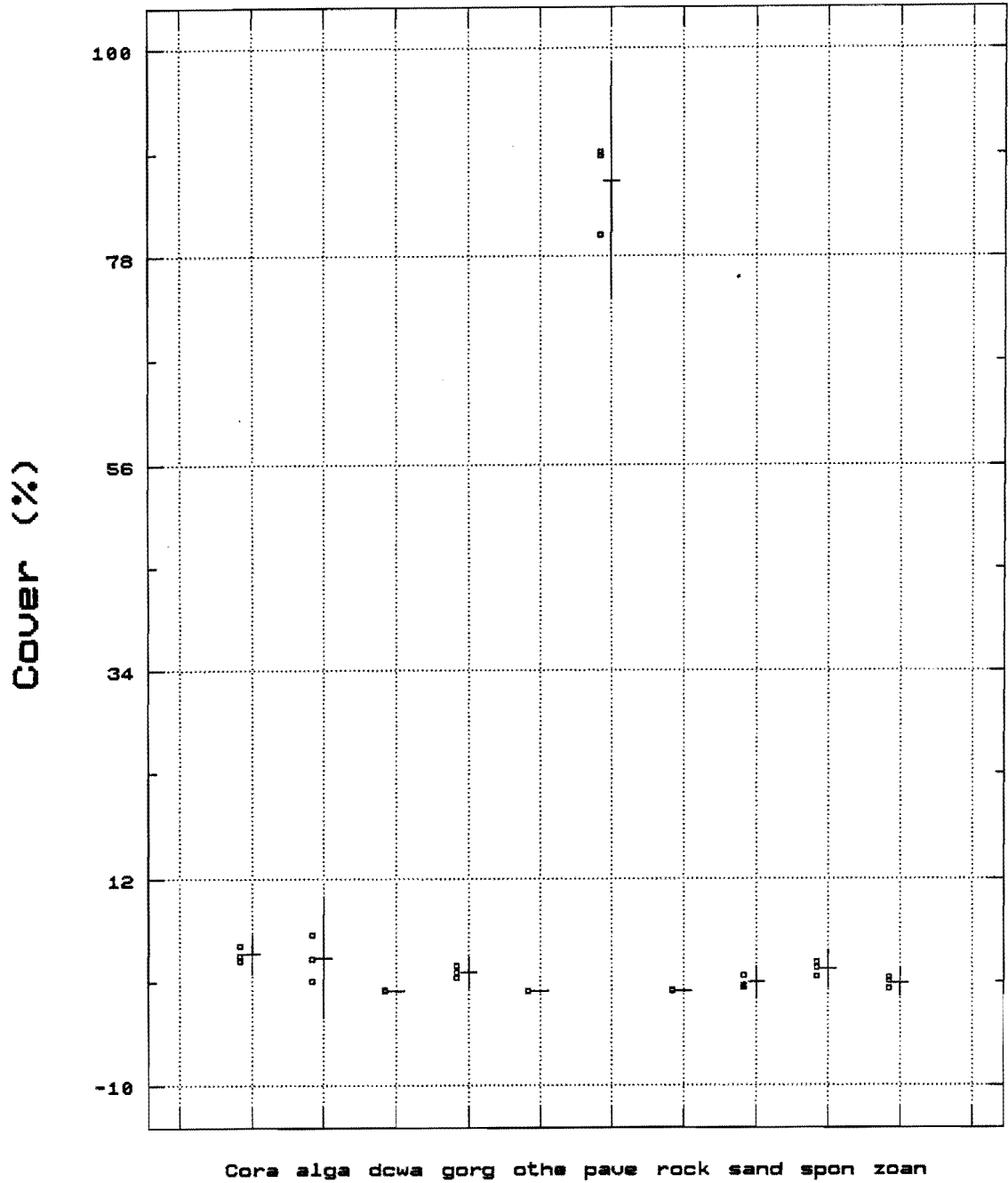
Biscayne National Park

Reef II, Trs. 10, Cts. 1-3, 1990



Substrate Types

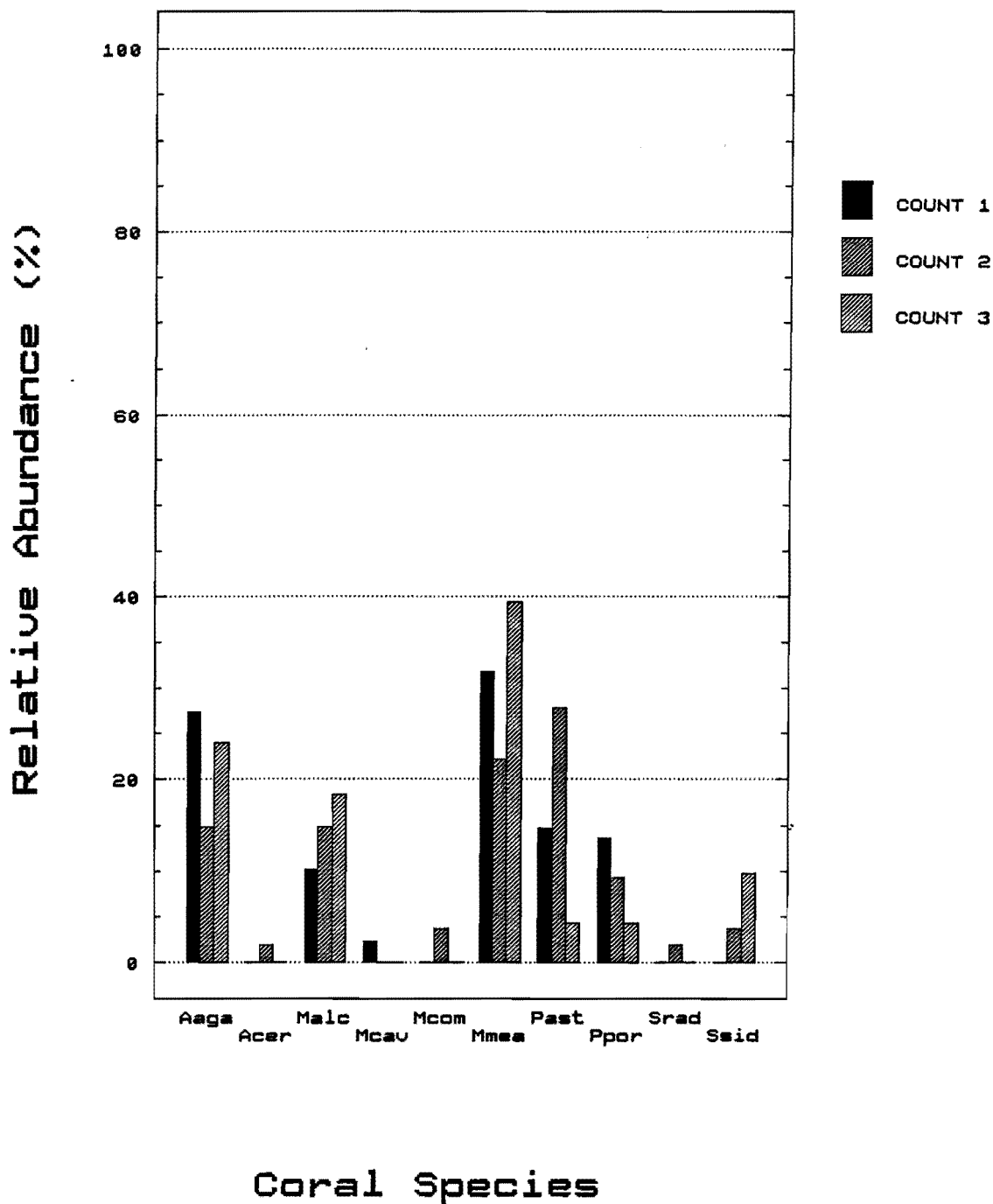
Biscayne National Park Reef II, Trs. 10, 1990



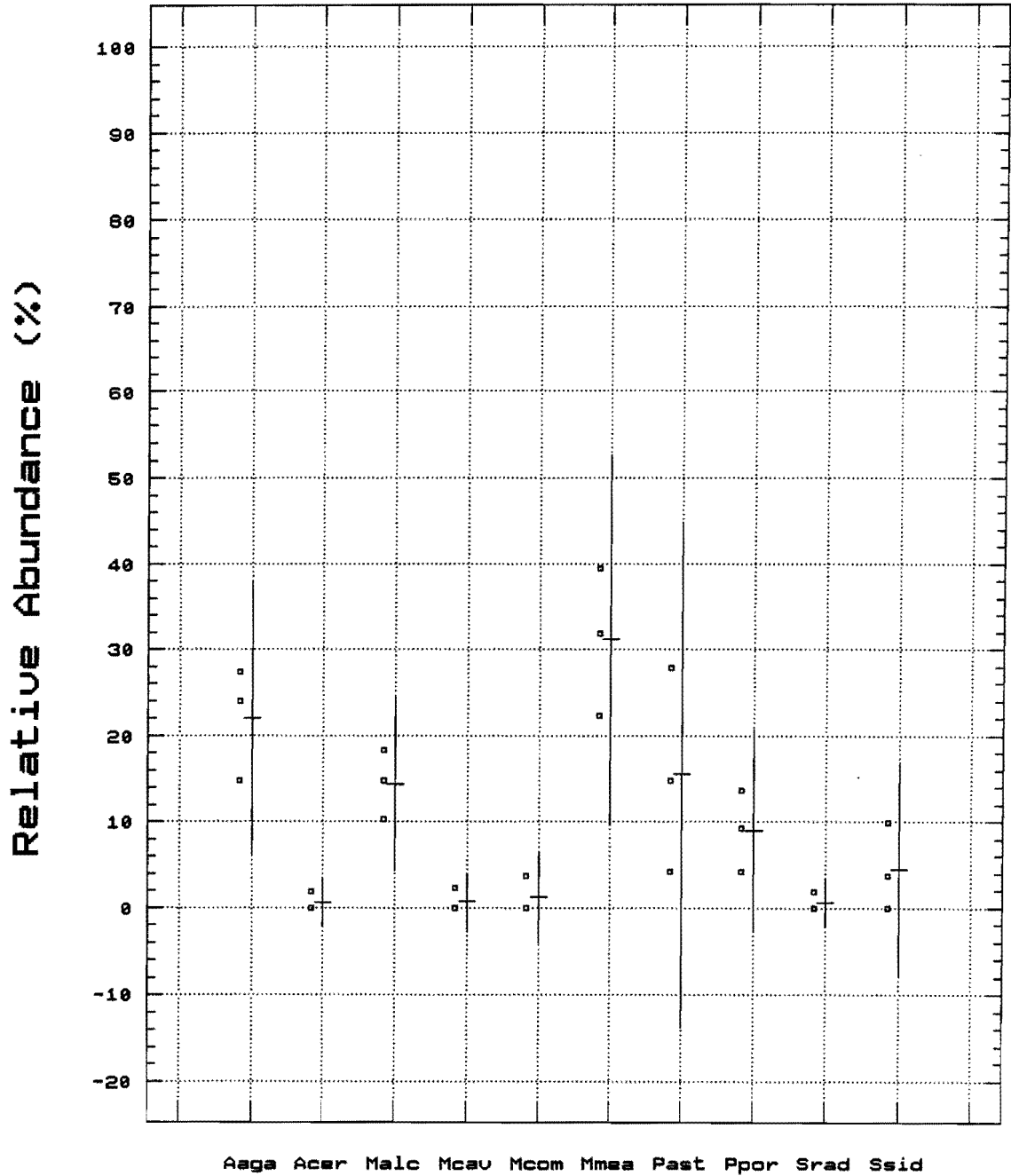
Substrate Types (N = 3; 95% C.I.)

Biscayne National Park

Reef II, Trs. 10, Cts. 1-3, 1990

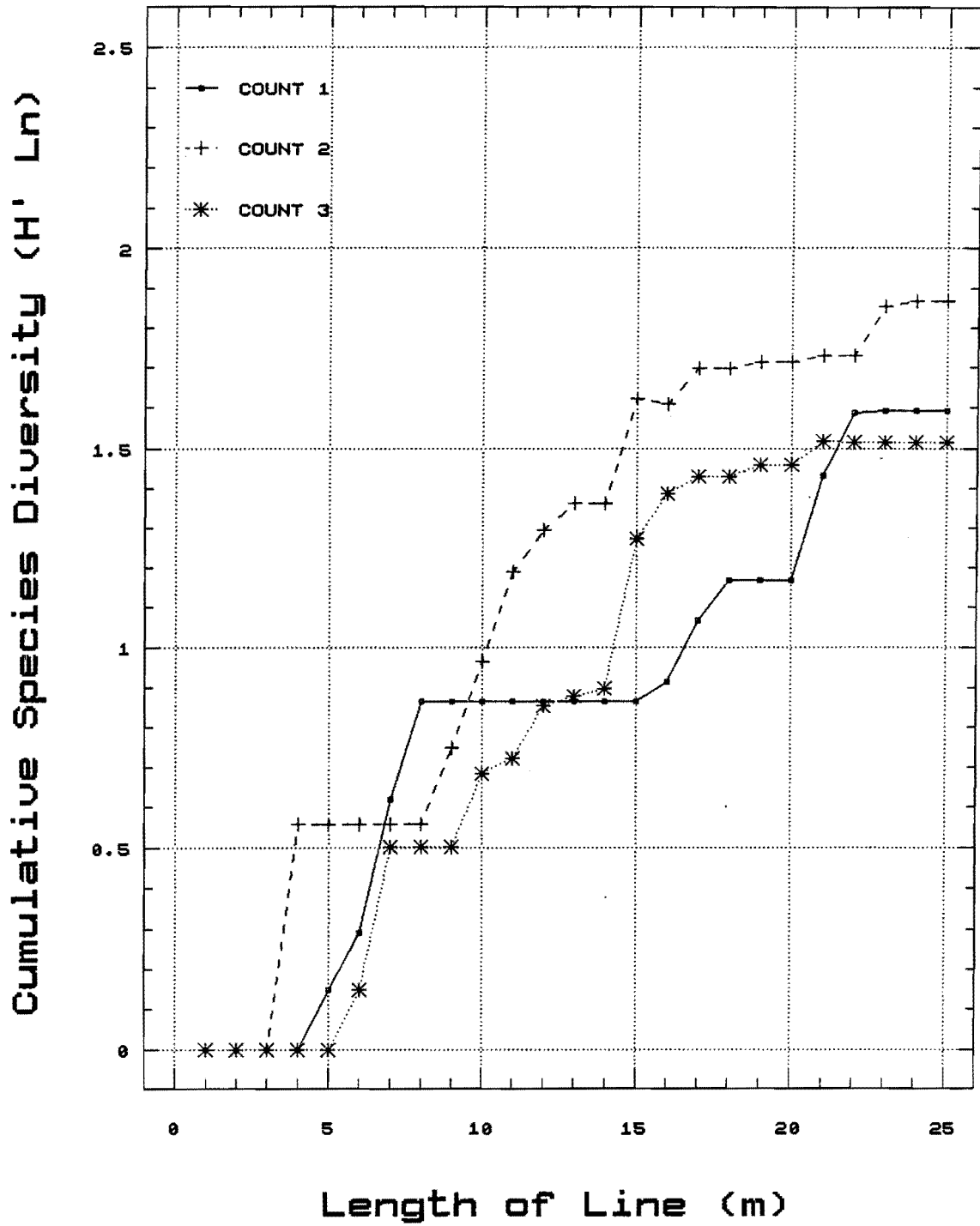


Biscayne National Park Reef II, Trs. 10, 1990

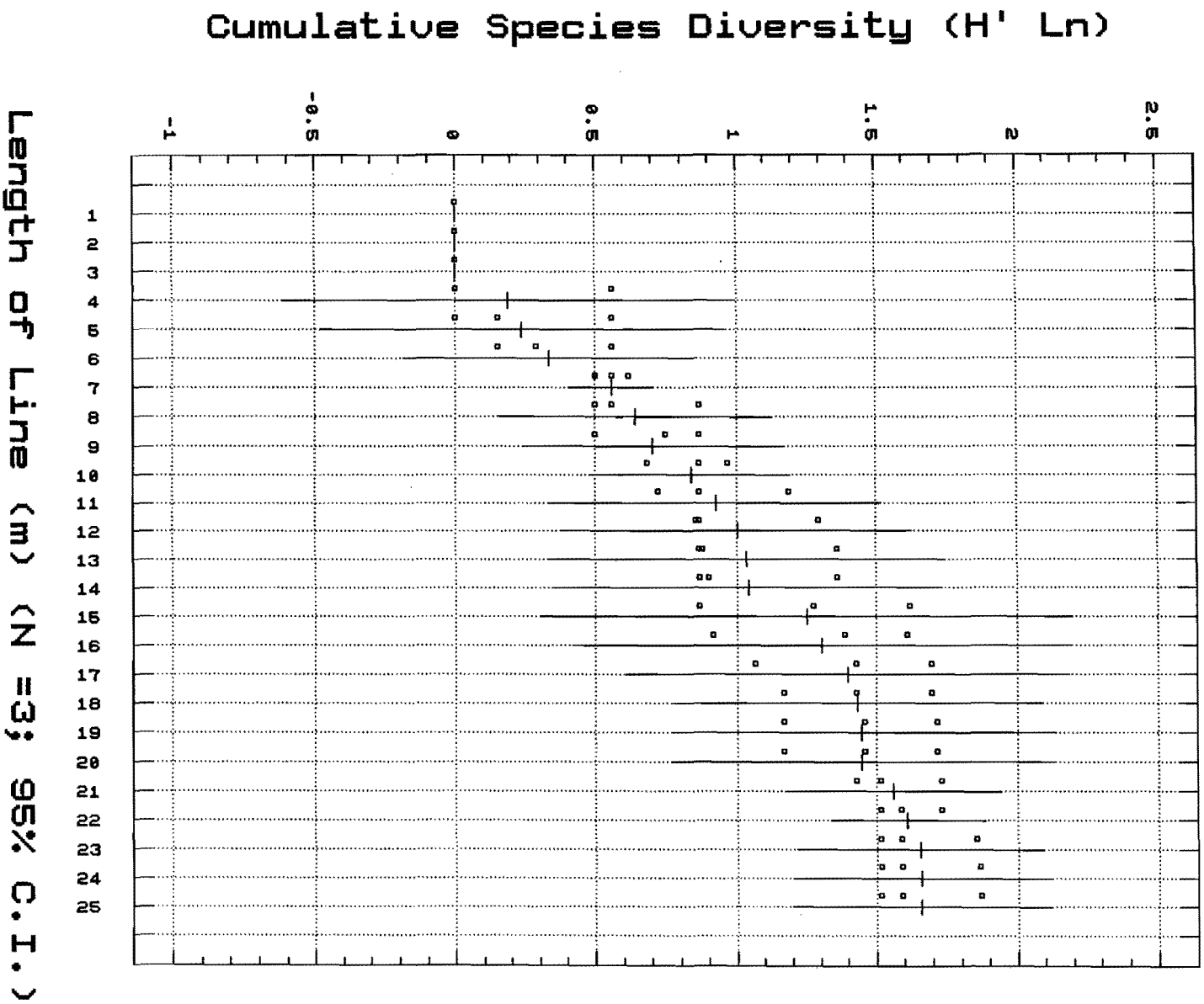


Coral Species (N = 3; 95% C.I.)

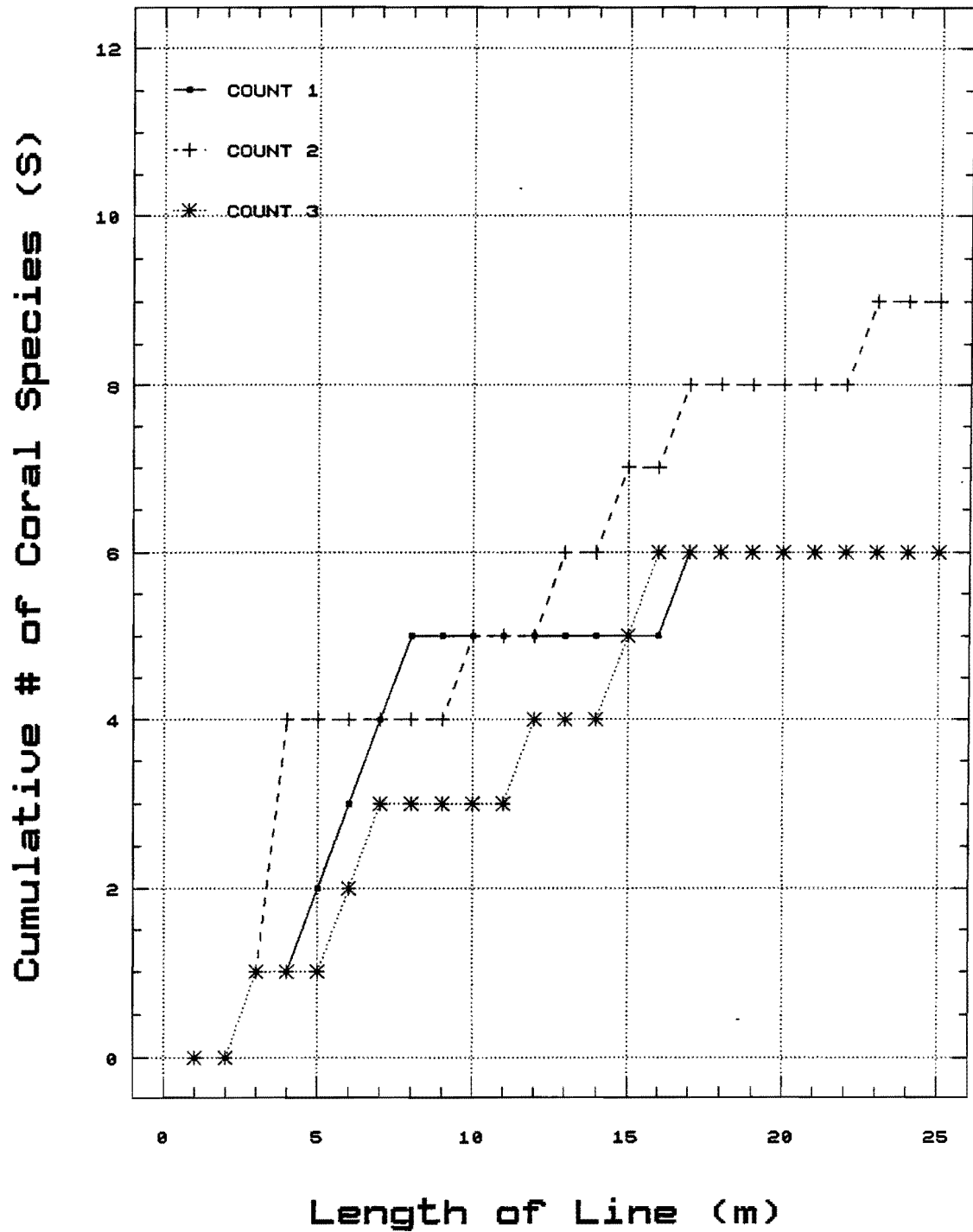
Biscayne National Park
Reef II, Trs. 10, Cts. 1-3, 1990



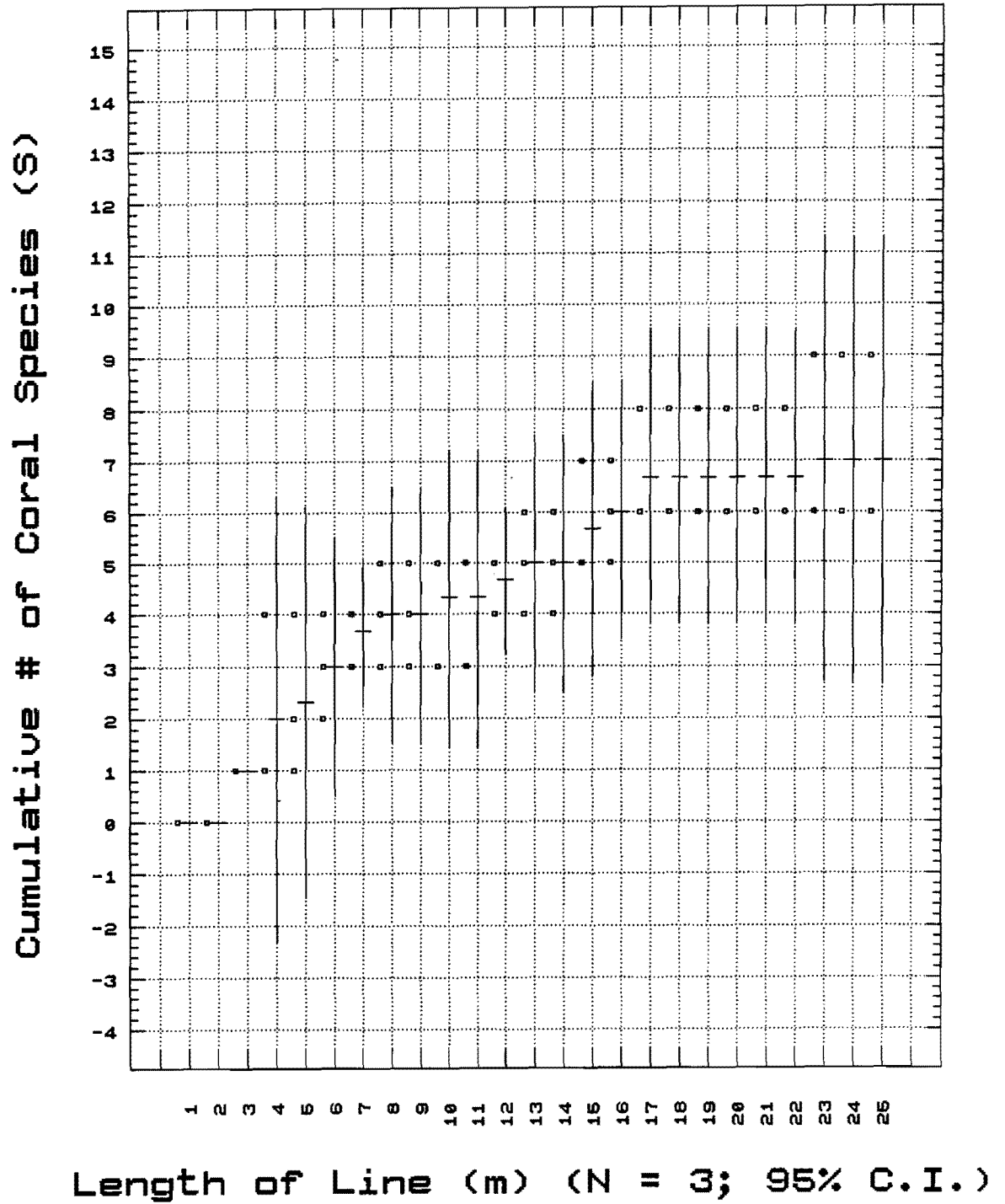
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Reef II, Trs. 10, 1990



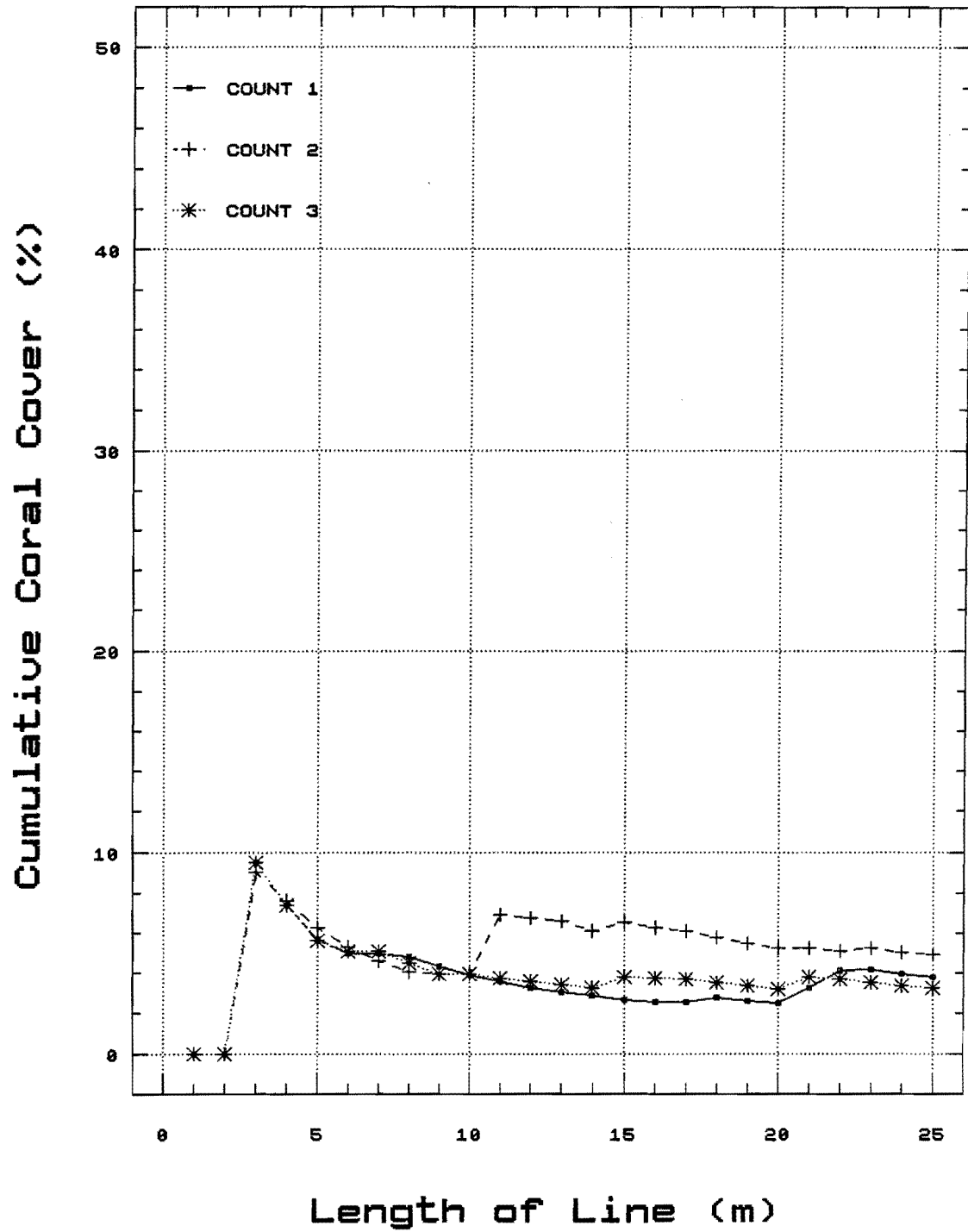
Biscayne National Park
Reef II, Trs. 10, Cts. 1-3, 1990



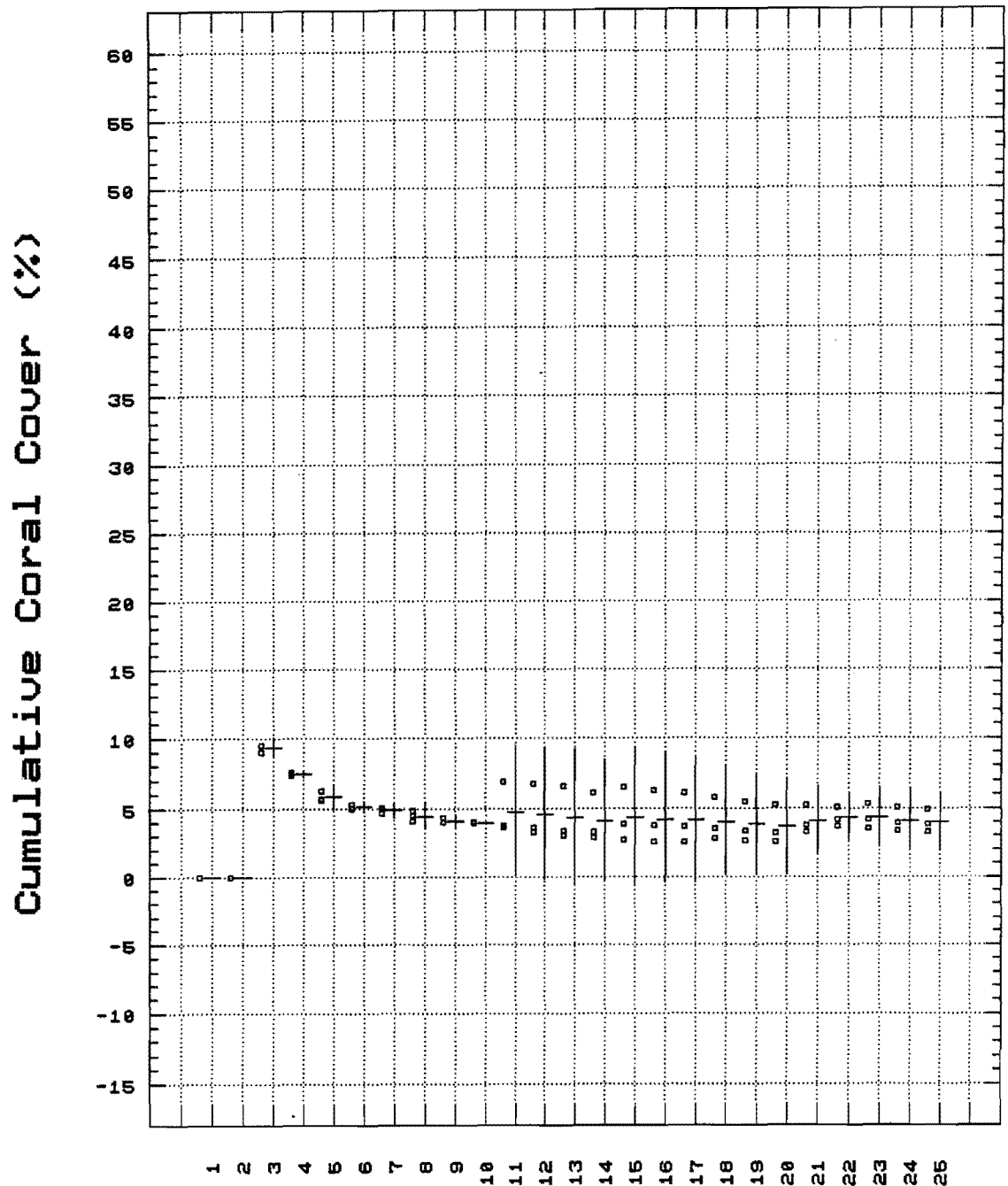
Biscayne National Park
Reef II, Trs. 10, 1990



Biscayne National Park
Reef II, Trs. 10, Cts. 1-3, 1990



Biscayne National Park
Reef II, Trs. 10, 1990



Length of Line (m) (N = 3; 95% C.I.)

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