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Cover Photo: Dr. Lynn Margulis, Symposium Keynote Speaker, describes the structure and ecology of living stromatolites. Some, visible as grayish mounds near her feet, line the shore of Storrs Lake whereas others occur farther out in deep water. (See paper by D. C. Edwards, this volume).

Back Cover Photo: Group photo of the 6th Symposium participants and speakers.

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CHANGING ABUNDANCES OF *CASSIS TUBEROSA* AND ITS ECHINOID PREY ON SAN SALVADOR, 1973-1995

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ABSTRACT

The populations of the main sources of food for the helmet, *Cassis tuberosa*, (*Meoma*, *Mellita*, *Plagiobrissus*, *Lytechinus*) have exhibited wide fluctuations at a number of sites in the coastal waters of San Salvador over the past 22 years. In some cases two of the prey species occupied the same area and fluctuated independently. Polaris Bay has exhibited such a variation in population numbers of *Meoma* and *Mellita* over the years, and the population of *Cassis* there has varied as well. Fluctuations in numbers of these two echinoderms and in *Cassis* have also been observed at Bamboo Point.

INTRODUCTION

Cassis tuberosa (L.) feeds exclusively on sea urchins. On San Salvador, it eats *Meoma ventricosa* Lam., *Mellita sexiesperforata* (Leske), *Lytechinus variegatus* (Leske), *Plagiobrissus grandis* (Gmelin), *Echinometra* spp., *Diadema antillarum* (Philippi), and probably any other sea urchin it might encounter (Lyman 1937, Moore 1956, Hughes and Hughes 1971, Lindsay and Gerace 1991). Moore (1956) reports that *C. tuberosa* is a solitary species, while *C. madagascarensis* Lam. is often found in large numbers. Although *C. tuberosa* usually occurs singly in sand bottom areas or in *Thalassia* beds, it has on five occasions been found in bar bottom areas and in tide pools that have populations of *Echinometra* spp. (Storr 1964, Lindsay and Gerace 1991).

It has previously been reported that two individuals of *Cassis madagascarensis* migrated between 5 and 8 miles in 4 to 6 months in search of food (Lindsay et al., 1994), and *C. tuberosa* might also be capable of migration over considerable distances. Other

factors might account for changes in occurrence of the species around San Salvador as well. Transport of specimens from the Field Station to nearby Graham's Harbor may account for occurrence of the species there. Other kinds of human influence must also be considered, because the local population is exploiting the *Cassis* shell as an item to sell to tourists. Three shells were seen on one doorstep in 1994.

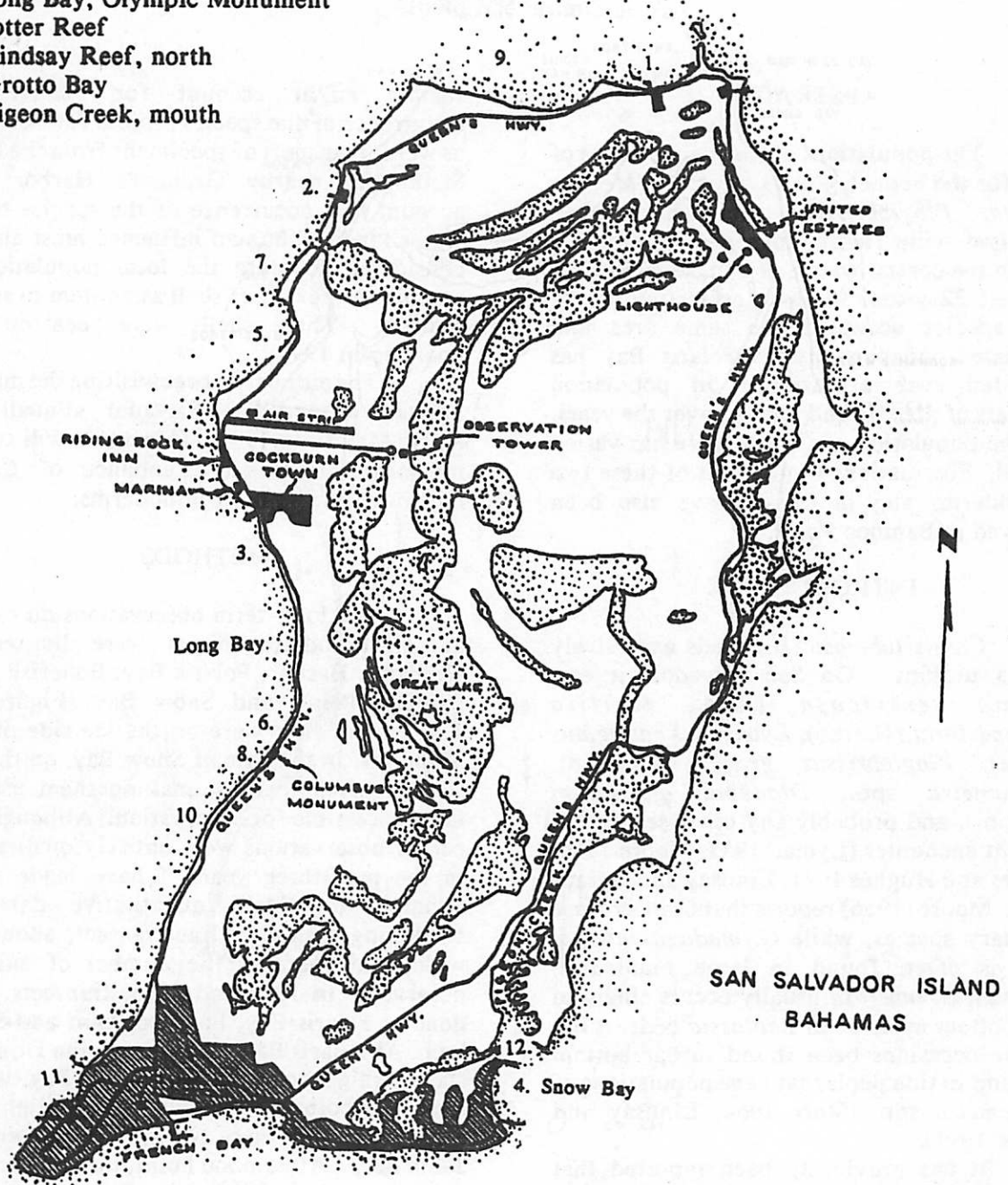
The author has been visiting the marine habitats around San Salvador annually in April-May since 1973. This paper will report my observations on abundance of *Cassis tuberosa* and its prey echinoderms.

METHODS

The long-term observations on *Cassis* and its food organisms were limited to Graham's Harbor, Polaris Bay, Bonefish Bay, Bamboo Point, and Snow Bay (Figure 1). These main sites were on the lee side of the island, or, in the case of Snow Bay, on the lee side of offshore cays, making them usually more accessible for observation. Although my earlier observations were entirely qualitative, in the past three years, I have made some attempts to obtain quantitative data by swimming a straight line transect, about 9m wide, and counting the number of animals observed. In 1994 and 1995, transects were done at Polaris Bay, Bamboo Point and Snow Bay. At Polaris Bay, the transect ran from the stairs straight to the reef; at Snow Bay, it was from the point at the "hut" to the High Cay sandy point. At these two sites the water was 2-3m deep. At Bamboo Point, the transect ran north to south, parallel to the shore, about 20m from shore, in water that was 6-7m deep.

In May 1994 and 1995, I collected the *Cassis* that were seen, and returned them to the Bahamian Field Station where I measured

1. Grahams Harbour
2. Polaris Bay
3. Bamboo Point
4. Snow Bay
5. Bonefish Bay
6. Long Bay, Cross
7. Sue Point
8. Long Bay, Olympic Monument
9. Potter Reef
10. Lindsay Reef, north
11. Grotto Bay
12. Pigeon Creek, mouth



G. R. BARTZ NOV. 18, 1974

Figure 1. Map of San Salvador Island showing the location of sites.

the height and width of the shield. I marked them by cleaning and drying the area of the shell around the last two or three spines and numbering each with a permanent black marker. After photographing each individual, I returned it to the site from which it had been

collected.

RESULTS

The observations summarized in Table 1 are for sites 1-5 that were observed over many years, whereas sites 6-12 have been

Table 1. Distribution of *Cassia tuberosa* and its prey organisms, *Meoma*, *Mellita*, *Lytechinus* and *P. grandis* at various sites around San Salvador Island, Bahamas from 1973 to 1995.

Note: 0 = none found, - = no observations, * = few (1-4), ** = some (5-9), *** = many (10 or more); left of / = live animals; right of / = dead tests

SITE	Animal	YEAR											
		73	75	76	78	88	89	90	91	92	93	94	95
1. Graham's Harbor													
a. <i>Cassia</i>		0	0	0	0				1	0	2	0	1
b. <i>Meoma</i>		0	0	0	0	0	0	0	0	0	0	0	0
c. <i>Mellita</i>		0	0	0	0	0	0	0	0	0	0	0	0
d. <i>Lytechinus</i>		*	*						*** /*	-	*** /**	0	4
2. Polaris Bay													
a. <i>Cassia</i>		**	*	*					0	0	0	0	1
b. <i>Meoma</i>		***	**	*	0	0	0	0	0	0	0	20/6	40/3
c. <i>Mellita</i>		***	**	*	*	*	*	*	*	*	*	*/4	**/4
d. <i>P. grandis</i>		0	0	0	0	0	0	0	0	0	0	0	0/2
3. Bamboo Point													
a. <i>Cassia</i>						*	26	-	1	-	6	3	2
b. <i>Meoma</i>						*	/**	-	0	-	0	50	***
c. <i>Mellita</i>						***	**	-	**	-	***	-	***
d. <i>P. grandis</i>							0/2					0/1	0
4. Snow Bay													
a. <i>Cassia</i>		*	*	*	*	*	*	*	*	2	6	*	2
b. <i>Meoma</i>		/*	/*	/*	/*	/*	/*	0	0	*/2	*	*	*
c. <i>Mellita</i>						/*	/*	/*	/*	*/8	/*	/*	/*
d. <i>P. grandis</i>						/*	-	-	-	/2	0	/*	/*
5. Bonefish Bay													
a. <i>Cassia</i>						0	-	-	0	3	-	-	-
b. <i>Meoma</i>						*	-	-	/2	/2	-	-	-
c. <i>Mellita</i>						*	-	-	/**	*	-	-	-
d. <i>P. grandis</i>						/1	-	-	/1	/2	-	-	-

observed only once or twice (Table 2).

Only once were a large number of *C. tuberosa* found at a site; that was at Bamboo Point in 1989 when 26 were counted, and 18 of them were feeding or were within 2 feet of a recent kill. The next highest number was 6 individuals found both at Snow Bay and Bamboo Point in 1993. The rest of the time, no more than three individuals were seen at the same site (Tables 1, 2).

At Graham's Harbor, a *Thalassia* bed, *Meoma* and *Mellita* were seldom found. Large

populations of *Lytechinus* in 1991 and 1993 coincided with the appearance of *Cassia* and many bored tests were found.

In 1973, Polaris Bay had very heavy populations of both *Meoma* and *Mellita*; three years later both populations had decreased sharply. Between 1978 and 1993 only *Mellita* was seen here. In February 1994 a large population (estimated in the hundreds) of *Meoma* was found again, but no *Cassia* were seen. In 1995, a single huge *Cassia* was found with the large population of *Meoma* and

Table 2. Distribution of *Cassia tuberosa* and its prey organisms, *Meoma*, *Mellita*, *Lytechinus* and *P. grandis* at additional sites around San Salvador Island, Bahamas from 1989 to 1995.

Note: 0 = none found, - = no observations, * = few (1-4), ** = some (5-9), *** = many (10 or more); left of / = live animals; right of / = dead test

SITE	Animal	YEAR					94	95
		89	90	91	92	93		
6. Long Bay (Cross)								
	a. <i>Cassia</i>					0		
	b. <i>Meoma</i>						0	
	c. <i>Mellita</i>					/***		
7. Sue Point								
	a. <i>Cassia</i>						0	
	b. <i>Meoma</i>						***/*	
8. Long Bay (Olympic Monument)								
	a. <i>Cassia</i>					1	1	
	b. <i>Meoma</i>					0	/3	
	c. <i>Mellita</i>					/**	?**	
9. Potter Reef to shore								
	a. <i>Cassia</i>					0		
10. Lindsay Reef North								
	a. <i>Cassia</i>					0		
11. Grotto Bay								
	a. <i>Cassia</i>						0	
	b. <i>Meoma</i>						0	
12. Pigeon Creek, Mouth								
	a. <i>Cassia</i>	1						
	b. <i>Meoma</i>	/*						
	c. <i>Mellita</i>	/**						

Mellita. This area will be monitored for future population increases of *Cassid* and possible crashes in the numbers of *Meoma*.

Bamboo Point at the northern end of Long Bay is the deepest site where *Cassid* and *Meoma* have been found. It slopes steeply to the top of the Wall at 60 ft. Here in 1989, a very large population of *Cassid tuberosa* was seen with relatively large populations of both *Meoma* and *Mellita* and two tests of *Plagiobrissus*. In 1991, one *Cassid* and no *Meoma* were found. In 1993, there were six *Cassid* feeding on *Mellita*; no *Meoma* were found. In 1994 there was a very large population of *Meoma* (50), but few *Mellita*. In 1995, only two *Cassid* were at the site with some *Meoma* and *Mellita*.

The bottom at Snow Bay is more like that of Graham's Harbor, but it is silting in fast, and the sea grasses are not very dense. A few *Cassid* were found each year; *Meoma* and *Mellita* tests were found as well as one to three *Plagiobrissus* tests.

Only a few observations have been recorded at the rest of the sites over the last 5-6 years. Long Bay had *Cassid* but few *Meoma* and *Mellita*. Sue Point may be a potential site for *Cassid* in the future. Potters Reef and Grotto Bay do not seem to have the food resources for them.

DISCUSSION

The one exceptional finding of 26 individuals feeding on *Meoma* and *Mellita* indicates that individuals may find emerging populations of *Meoma* and *Mellita* and move into the sandy bottomed areas where they occur, wiping out the population first of *Meoma* and then of *Mellita*. My other observations of smaller numbers of *Cassid* with large populations of *Meoma* and *Mellita* show that this is not always the case, however. Moore (1956) reported that *Meoma* and *Mellita* did not occur together in Florida and the Gulf Coast. If *Meoma* and *Mellita* are not available, *Cassid* will also feed on *Lytechinus* or on *Echinometra* (Lindsay and Gerace, 1991).

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