

A SURVEY OF BECHE-DE-MER OF VANUATU

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ABSTRACT

Eighteen species of beche-de-mer were recorded in a survey of reef flats and seagrass areas in Vanuatu. Composition and diversity was variable in different habitats, and densities were generally low. It is unlikely that present stocks could support recommended harvesting quotas.

INTRODUCTION

There is little published information on the ecology, distribution and economic potential of beche-de-mer in Vanuatu. In the only published ecological study, Baker (1929) examined the beche-de-mer of the shallow fringing reef lagoon at Gaua Island. He found 4 species arranged in clear zones, with *Stichopus chloronatus* and *Holothuria atra* each occurring at very high densities of up to about 5 per square meter.

In Vanuatu, beche-de-mer are a nationally small but locally important source of income. From 1983 to 1985 10 tonnes with an approximate value of US\$45,000 were exported (Anon, in press). Areas from which beche-de-mer are harvested include Cook's Reef, the Maskelyne Islands, Atchin Island and the Port Vila lagoons. Harvesting is usually carried out intermittently at periods of one or more years, thus allowing stocks to recover and build up between successive harvests.

AIMS AND OBJECTIVES

The study of beche-de-mer was not one of the major objectives of the Marine Resources Survey. However, as the animals were readily visible in areas where the author was already spending large amounts of time on a survey of seagrasses (Chambers et al., this volume), it was decided to make a limited study on them. The aim of the study was to generally increase the available information on the presence and distribution of shallow water holothurians throughout the Vanuatu archipelago. Specifically, this would be done by noting the species present at each site, and in some areas by collecting quantitative data on species abundance.

METHODS

At most sites visited during the seagrass survey, all species of beche-de-mer were recorded. About 30-120 minutes were spent at each sampling site and identifications were made by reference to Feral and Cherbonnier (1986). About 30-120 minutes were spent at each sampling site. Other information recorded was habitat type (reef, bay, lagoon or intertidal), dominant substrate type and water depth. Holothurians were looked for at depths greater than the limits of seagrass growth at sites where such deeper waters were present. Maximum depths examined were up to about 6 m.

In the Maskelyne Islands region and at Atchin Island, line transects were set up and the numbers of holothurians recorded. At each locality, 5 transects were examined, each usually 5 x 40 m in size.

The precise locations of most sites examined are given in Appendix 4 of the seagrass section. In addition, two extra sites, 3.6.b and 3.6.c were examined for beche-de-mer. These were on the western and northern shores, respectively, of Atchin Island off the northeast coast of Malakula.

RESULTS AND DISCUSSION

The summaries of site details together with the number of beche-de-mer species found are given in Table 1. A total of 49 sites were examined, of which 35 had one or more species of beche-de-mer. Table 2 gives the species composition at each of these 35 sites.

Occurrence and distribution of species

A total of 18 species of beche-de-mer were recorded. The most commonly occurring were *Holothuria (Halodeima) atra* and *Stichopus chloronatus*, found at 20 and 14 sites respectively. The dominance of these two species is characteristic of Indo-west Pacific reef flats (Bakus, 1973). All other species were present at less than 25% of sites with beche-de-mer. Thus 6 species were found at only a single site, 1 species at 2 sites, 3 species at 3 sites, 2 species at 4 sites, 1 species at 5 and 7 sites and 2 species at 8 sites. In shallow sites most species occurred infrequently. More species would probably be present in these areas, but many reef species are small, strongly cryptic, burrowing or nocturnal (Hammond *et al.*, 1985) and none of these were found in this survey.

Generally, the diversity of species at the study sites was low. Eleven sites had only a single species, 11 sites had 2 species, 7 sites with 3 species, 2 sites with 4 species, 3 sites with 6 species and a single site with 7 species recorded. The most diverse sites were the three sampling stations at Cook Reef (6 species each) and the intertidal reef crest and sand flats east of Metai Island in the Maskelyne Islands (7 species).

Overall, the beche-de-mer showed no preference for the major habitat types of reef, lagoon or intertidal zones, with averages of 2.1, 2.5 and 2.4 species per site respectively. Within these habitats, the exposed sites may have higher diversity than the sheltered sites: lagoon - 3.0:1.3 species, intertidal - 2.6:1.8 species and reef - 2.8:1.5 respectively (calculated from the data in Table 1). However, as the data are highly variable more sites would need to be evaluated to confirm this apparent trend.

Abundance of beche-de-mer

The densities of beche-de-mer species were recorded at 8 sites in the Maskelyne Islands and Atchin Island during Phase 3 (Table 3). Densities were generally low, rarely exceeding 1 per 100 m² and were probably typical for most of the sites examined in both phases 2 and 3 of the survey. Clear exceptions were higher densities of *Stichopus chloronatus* at site 2.2 (Moso Island) and *H. (Mertensiothuria) leucospilota* at 3.6.b (in rock pools on the north shore of Atchin Island). These are non-commercial species.

Although low densities may be typical for much of Vanuatu, very much higher densities have been recorded at some localities close to Port Vila (Chambers, unpublished data). At various sites in Port Vila Harbour and the Ekasuvat Lagoon, the following densities (per 100 m²) were recorded in 1987: *A. miliaris*, 785; *H. (Halodeima) atra*, 214; *H. (Halodeima) edulis*, 21; *H. (Metriatryla) scabra*, 43. These high numbers were thought to be associated with artificially eutrophic waters, caused by seepage of enriched groundwaters into enclosed lagoons and bays. However, the high densities recorded by Baker (1929) were from (presumably) unpolluted reefs on Gaua Island.

Management of beche-de-mer

Beche-de-mer are rarely if ever eaten by Ni-Vanuatu and there is no local market for them. There is only a small export trade, though locally this may provide a significant cash income on occasion.

The main commercial species of beche-de-mer are: *H. (Microthele) nobilis*, *A. miliaris*, *A. echinites*, *A. mauritiana*, *T. anas*, *H. (Metriartyla) scabra* and *H. (Halodeima) atra* (SPC, 1979). All of these were recorded on the present survey, but always at low densities (Table 3). Higher densities of some were recorded around Port Vila (Section 4.2).

The present policy of the Fisheries Department is to allow an annual export quota of 35 tonnes of cured beche-de-mer. At the present time however, annual exports are around 3-5 tonnes. Given the generally low densities of beche-de-mer, their slow growth rate and the small area of suitable habitat, it is doubtful if the quota could ever be attained and then maintained. The very high densities around Port Vila occur in only small areas and would not support continuous harvesting at commercial export levels.

The correct strategy with regard to beche-de-mer harvesting in Vanuatu is to collect intermittently from sites which are both large enough and support sufficient densities of commercial species to be economic.

Stocks should then be left for however long it takes them to recover to economic levels. There are probably few such areas in Vanuatu.

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Table 1. Details of beche-de-mer sites surveyed during the Marine Resources Survey, Vanuatu, March-April 1988. Forams = accumulations of dead foraminifera shells. E = exposed to prevailing winds. S = sheltered. Water depth = maximum depth of water searched; some sites included both intertidal and sublittoral areas. Int = Intertidal.

Location	Site No.	Habitat-Substrate	No. of bech-de-mer spp.	Water depth (m)	Exposed (E) or Sheltered (S)
ANEITYUM					
Inyeug platform reef	2.9.a	Lagoon behind reef; coarse sand	1	1.0-1.5	E
Inyeug platform reef	2.9.b	Lagoon behind reef; coarse sand	3	1.0-1.5	E
Aneighowhat Bay	2.10	Bay; fine sand	1	0.5-3.0	S
Port Patrick	2.11	Lagoon behind reef; coarse sand	2	4.0	E
EFATE AND OFFSHORE ISLANDS					
Moso, southwest shore	2.2	Intertidal; coarse-gravelly sand	2	Int	E
Moso, east side	2.3	Lagoon behind reef; muddy-coarse sand	2	Int-1.0	S
COOK REEF					
Platform reef, west side	2.14.a	Lagoon behind reef; sand-rubble	6	4.0	E
Platform reef, centre	2.14.b	Lagoon behind reef; sand-rubble	6	3.0	E
Platform reef, northeast	2.14.c	Lagoon behind reef; sand-rubble	6	3.0	E
MALAKULA AND OFFSHORE ISLANDS					
Metai	3.2.a	Intertidal and reef crest; coarse sand	7	Int	E
Metai	3.2.b	Lagoon behind reef; coarse sand	3	2	E
Sakao, south	3.3.a	Intertidal; sand, forams, rubble	2	Int	E
Sakao, south	3.3.b	Reef crest; sand, rubble	2	Int	E
Sakao, north	3.3.c	Intertidal; coarse sand, forams	2	Int	S
Sakao, north	3.3.d	Reef crest; coarse sand, rubble	3	1.0-1.5	S
Cook Bay	3.4.a	Intertidal; coarse sand, forams	3	Int	E
Cook Bay	3.4.b	Reef crest; sand, forams, rubble	3	1.5	E
Gaspard Bay	3.5	Intertidal; coarse sand	4	Int	S
Atchin	3.6.a	Lagoon behind reef; sand, rubble	1	3	E
Atchin	3.6.b	Intertidal; rock shelf; rock pools	1	Int	S
Atchin	3.6.c	Reef crest; reef shelf	2	8.0	E
Port Sandwich	3.7.a	Bay; gravel, coarse sand	0	2	S
Port Sandwich	3.7.b	Bay; coarse sand	0	2	S
Port Sandwich	3.7.c	Bay; coarse sand	0	4	S
Port Sandwich	3.7.d	Lagoon behind reef; sand, rubble	2	3	S
Port Sandwich	3.7.e	Lagoon behind reef; sand, rubble	0	3	S
Port Sandwich	3.7.f	Bay; deep, soft mud	0	1	S
Port Sandwich	3.7.g	Bay; deep, soft mud	0	1	S
Port Sandwich	3.7.h	Bay; deep, soft mud	0	1	S
PENTECOST					
Wanuru	2.15.a	Lagoon behind reef; sand, rubble	0	4	S
Wanuru	2.15.b	Reef outer slope	1	5	S
Banmaumat	2.15.c	Lagoon behind reef; sand, rubble	1	1	S
Loltong	2.16	Bay; sand, forams, rubble	0	2	S
SANTO AND OFFSHORE ISLANDS					
Big Bay	2.22	Bay; coarse sand, rubble	0	3	S
Hog Harbour	2.23.a	Bay; fine sand, turbid	0	3	S
Hog Harbour, Champagne Beach	2.23.b	Bay; fine sand	3	3	S
Turtle Bay	2.25.a	Bay; coarse sand, rubble	0	2	E
Turtle Bay	2.25.b	Bay; rubble; organic detritus	1	2	E
Turtle Bay	2.25.d	Reef; coarse sand, rubble	2	4	E
Palikulo Bay	2.26	Bay; coarse shelly sand	1	2	S
GAUA					
Lesalau Bay	2.17.a	Reef; sand, rubble	4	2	E
Lesalau Lagoon	2.17.c	Lagoon behind reef; sand, rubble	3	4	E
REEF ISLANDS					
Platform reef, south	2.19.a	Lagoon (blue hole); fine sand	2	2	E
Platform reef, south	2.19.b	Lagoon behind reef; fine sand	1	2	E
Platform reef, northwest	2.19.d	Reef outer slope; coarse sand	1	5	S
Enwut and Watansa	2.19.e	Lagoon behind reef; sand	2	1	E
UREPARAPARA					
Lorup Bay, south	2.20.a	Intertidal; fine sand, turbid	0	1	E
Lorup Bay, north	2.20.b	Intertidal; coarse sand	1	2	E
Lorup Bay, village	2.20.c	Bay; fine sand	0	1	S

Table 2. Beche-de-mer found at the sampling sites surveyed during the Marine Resources Survey; Vanuatu, March-April 1988. Site codes indicate whether Phase 2 or Phase 3 of survey (to left of decimal point) and location - as indicated in Done and Navin, Figure 1 (this volume) to the right.

SPECIES	SITE NO.										
	2.9.a	2.9.b	2.10	2.11	2.2	2.3	2.14.a	2.14.b	2.14.c	3.2.a	3.2.b
<i>Actinopyga echinites</i>										X	
<i>A. mauritiana</i>			X				X	X	X		
<i>A. miliaris</i>											X
<i>A. palauensis</i>										X	
<i>Bohadschia argus</i>		X					X	X	X	X	X
<i>B. similis</i>										X	
<i>B. vitiensis</i>										X	X
Holothuria											
(<i>Acanthotrapeza</i>) <i>coluber</i>											
<i>H. (Halodeima) atra</i>		X			X	X	X	X	X	X	
<i>H. (Halodeima) edulis</i>											
<i>H. (Mertensiothuria) leucospilota</i>											
<i>H. (Metriatyla) scabra</i>							X	X	X		
<i>H. (Microthele) nobiliis</i>							X	X	X		
<i>H. (Microthele) fuscopunctata</i>											
<i>Stichopus chloronatus</i>	X	X		X	X		X	X	X		
<i>S. variegatus</i>						X					
<i>Synapta maculata</i>			X							X	
<i>Theinota ananas</i>							X	X	X		
SITE TOTALS	1	3	1	2	2	2	6	6	6	7	3

SPECIES	SITE NO.										
	3.3.a	3.3.b	3.3.c	3.3.d	3.4.a	3.4.b	3.5	3.6.a	3.6.b	3.6.c	3.7.d
<i>Actinopyga echinites</i>											
<i>A. mauritiana</i>										X	
<i>A. miliari</i>											
<i>A. palauensis</i>											
<i>Bohadschia argus</i>		X									
<i>B. similis</i>											
<i>B. vitiensis</i>					X						
Holothuria											
(<i>Acanthotrapeza</i>) <i>coluber</i>					X						
<i>H. (Halodeima) atra</i>	X		X	X	X	X	X				X
<i>H. (Halodeima) edulis</i>				X		X	X				
<i>H. (Mertensiothuria) leucospilota</i>								X	X		
<i>H. (Metriatyla) scabra</i>							X				
<i>H. (Microthele) nobiliis</i>	X										
<i>H. (Microthele) fuscopunctata</i>											
<i>Stichopus chloronatus</i>		X		X			X				X
<i>S. variegatus</i>						X					
<i>Synapta maculata</i>			X								
<i>Theinota ananas</i>										X	
SITE TOTALS	2	2	2	3	3	3	4	1	1	2	2

Table 2. Continued

SPECIES	SITE NO.													
	2.15.b	2.15.c	2.23.b	2.25.b	2.25.d	2.26	2.17.a	2.17.c	2.19.a	2.19.b	2.19.d	2.19.e	2.20.b	
Actinopyga echinites														
A. mauritiana	X										X			
A. miliaris														X
A. palauensis														
Bohadschia argus									X					
B. similis														
B. vitiensis														
Holothuria (Acanthotrapeza) coluber														
H. (Halodeima) atra		X	X			X	X	X					X	
H. (Halodeima) edulis							X							
H. (Mertensiothuria) leucospilota													X	
H. (Metriatyla) scabra														
H. (Microthele) nobilis			X					X	X	X				
H. (Microthele) fuscopunctata					X									
Súchopus chloronatus					X			X	X					
S. variegatus				X				X						
Synapta maculata														
Thelenota ananas			X											
SITE TOTALS	1	1	3	1	2	1	4	3	2	1	1	2	1	

Table 3. Densities (nos/100 m²) of beche-de-mer recorded during the Marine Resources Survey, Vanuatu March-April 1988.

Species	Site and beche-de-mer density (nos/100 m ²)							
	3.2.a	3.3.a	3.3.b	3.3.c	3.3.d	3.4.a	3.4.b	3.6.c
Actinopyga echinites	0.1							
A. mauritiana	0.1							1.6
A. palauensis	0.1							
Bohadschia argus			0.1					
B. similis	2.2							
B. vitiensis	0.1					<0.1		
Holothuria (Acanthotrapeza) coluber						<0.1		
H. (Halodeima) atra	0.7	0.4		1.5	0.1	0.9	0.3	
H. (Halodeima) edulis					0.9		0.2	
H. (Microthele) nobilis		0.1						
Súchopus chloronatus			4.9		0.7			
S. variegatus							0.2	
Synapta maculata	0.1			0.1				
Thelenota ananas							<0.1	