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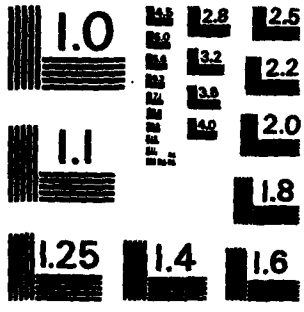

Species Composition, Abundance and Biomass of Macrobenthos at the PROJECT WEAP Site, Block Island Sound, May 1982

(NORDA Contract Number N 00014-82-K0008)

Submitted to:

Naval Ocean Research and Development Activity
NSTL Station, MS 39529

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Introduction

The objective of this research was to provide qualitative and quantitative information of the distribution of macrobenthic animals in the experimental test site of Project WEAP, located in Block Island Sound. Correlations of the acoustical properties of the sediments with animal distributions will be made at a future date.

Methods

Twelve samples were taken aboard the USNS Lynch on 25 May 1982 with a 0.025 m^2 box corer. The location of the Project WEAP site was 41° 04' N, 71° 35' W. Sediments were washed on board ship through a 0.500 mm mesh sieve, and preserved in 5% buffered sea water-formalin. Identifications were made to lowest identifiable taxon. Wet weights of the animals were measured by blotting individual animals in paper towels, and then weighing them on a Mettler HS microbalance (± 1 µg).

Results and Discussion

The estimated population densities per m^2 (observed · 0.025 m^{-2} x 40) and relative abundances of all animals identified are given in Table 1. Population densities per m^2 ranged from 440 (Station 13 to 6000 (Station 12). Annelids and arthropods were the most abundant phyla at most stations, but echinoderms (specifically the sand dollar, Echinarachnius parma) were dominant at Stations 4 and 7, and an important contributor to total faunal density at Stations 3, 8 and 10 (Table 2).

Biomass (g wet wt. m^{-2}) of the macrofauna is given in Table 3. Because of their large average weight (2.62 gm), Echinarachnius parma individuals contributed significantly to benthic biomass at those stations at which they were present. At Station 4, for example, where they numbered 680 per m^2, sand dollar

biomass was 1572 gm. m^{-2}. At Stations 3, 8 and 10, their contribution to macrofaunal biomass averaged 92% of the total. Arthropods, represented mainly by ampeliscid and haustoriid amphipods, while dominant numerically, were not very important in terms of biomass. Annelids (especially Clymenella torquata) were important contributors to biomass at those stations where E. parma populations were low or absent (Stations 6, 11, 12, 13). Other large animals which contributed significantly to macrofauna biomass were Mercenaria mercenaria at Station 1, Edwardsia sp at Stations 5 and 12, and the hemichordate Stereobalanus canadensis at Stations 5, 6, and 10.

Twenty species had mean relative abundances of more than 1%; these are listed in Table 4. The sand dollar Echinarachnius parma appears to exert a dominant effect of the macrofauna of the area. An inverse correlation (Kendall's tau) between E. parma abundance, and polychaete ($T = -0.80$, $p < .01$) and and crustacean ($T = -0.69$, $p < .05$) abundances existed at the study site. Furthermore, at those stations where E. parma accounted for more than 3% of the total individuals present (Stations 1, 3, 4, 7, 8, 10), the densities of polychaetes and crustaceans were significantly lower than at those stations (Stations 6, 11, 12, 13) where E. parma densities were less than 1% (Mann-Whitney U test, $p < .05$). Given the average wet weight (2.62 gm) and surface area (18 cm^2) of the E. parma individuals collected in the study area, their dominant position in the macrofaunal community is apparent.

Faunal affinities among the stations were examined using the Bray and Curtis (1957) similarity coefficient (Figure 1). At least two major clusters of stations exist; those at which Echinarachnius parma densities are less than 1% (Stations 6, 11, 12, 13) and those at which E. parma population densities are greater than 1% (Stations 1, 3, 4, 5, 7, 8, 9, 10). Within the latter group, Stations 5 and 9 form a subgroup, based on the high abundances of Amphiuma vexillis and

A. agassizi shared by both stations (Table 4).

Station 12 was also dominated by amphipods, but the dominant species were different (Orchomonella minuta and Stenothoe minuta).

In summary, the sediments in the area of Project WEAP were dominated numerically by the sand dollar Echinarachnius parma, ampeliscid and haustoriid amphipods, and several polychaete species (Clymenella torquata, Goniada maculata, Laonice cirrata, and Glycera capitata). An inverse relationship between sand dollar abundance, and the abundances of crustaceans and polychaetes, was evident, and served to separate the sediments in the Project WEAP area into two major groups.

Table 1. Species composition of the macrobenthos at each station in the Project WEAP site, 25 May 1982. First number represents number per m^2 (observed • 0.025 m^2 X 40), number in parenthesis represents percent of total.

Species	STATION 1	3	4	5	6	7	8	9	10	11	12	B
[illegible]												
Ferronia sp	40(1.5)			40(1.0)	40(0.8)			40(0.9)	80(5.6)		40(0.7)	
Unidentified spp											40(0.7)	
[illegible]												
Nemertia sp	40(1.5)			40(1.0)							40(0.7)	
[illegible]												
Unidentified sp		40(2.4)							40(2.8)			
[illegible]												
Nereimyra nereimyria	80(3.1)											
Ilyia mortimeri			40(2.8)									
Nephtys corrugatus								40(0.9)		120(2.2)		
[illegible]												
Glycymeris terquata	200(7.7)	40(2.4)	80(8.6)	160(3.9)	520(10.6)	40(7.7)	120(7.3)	40(0.9)	40(2.8)	1680(31.6)	120(2.0)	80(18.2)
Mulinia sp	80(3.1)			40(1.0)						120(2.2)	40(0.7)	120(27.3)
Mulinia lenga	160(6.2)				1120(22.9)							
Tellina lutea	40(1.5)							80(1.7)		40(0.8)	80(1.3)	
Cumella maculata	40(1.5)				960(19.7)					1240(23.3)	240(4.0)	40(9.1)
Ophis gracilis	40(1.5)											
Haustorius labriosus	40(1.5)											

Table 1 (Continued)

Species	STATION											
	1	3	4	5	6	7	8	9	10	11	12	13
[illegible]	40(1.5)			40(1.0)		80(15.3)	40(2.4)	40(0.9)		880(16.5)	320(5.4)	40(9.1)
[illegible]	40(1.5)	120(7.1)	200(14.3)	160(3.9)	440(9.0)	40(7.7)	120(7.3)	80(1.7)	120(8.3)			
[illegible]		40(2.4)			80(1.6)							
[illegible]			40(2.8)	40(1.0)				40(0.9)				
[illegible]					240(4.9)							
[illegible]					40(0.8)							
[illegible]					40(0.8)			40(0.9)				
[illegible]					40(0.8)	40(7.7)					40(0.7)	
[illegible]					40(0.8)					40(0.8)		
[illegible]					160(3.3)					40(0.8)		40(9.1)
[illegible]						40(7.7)						
[illegible]							40(2.4)	40(0.9)			200(3.3)	40(9.1)
[illegible]											40(0.7)	
[illegible]											160(2.7)	
[illegible]											40(0.7)	
[illegible]												80(18.2)
[illegible]										40(0.8)		
[illegible]					40(0.8)							
[illegible]	80(3.1)	40(2.4)	160(11.4)				160(2.4)	120(2.6)	40(2.8)			
[illegible]	40(1.5)											

Table 1 (Continued)

Species	STATION 1	3	4	5	6	7	8	9	10	11	12	13
Leptostylis ampullacea	40(1.5)											
Diastylis quadrispinosa			40(2.8)									
Edotea triloba	80(3.1)				40(0.8)					120(2.2)		
Cyathura burbancki	40(1.5)	80(4.8)		80(2.0)			120(7.3)	120(2.6)				
Cirolana polita		40(2.4)		40(1.0)				80(1.7)		40(0.8)		
Ampelisca verrilli	200(7.7)			800(19.6)			120(7.3)	1080(23.3)	120(8.3)	40(0.8)		
Ampelisca vadorum	80(3.1)			40(1.0)				120(2.6)	120(8.3)			
Ampelisca agassizi	120(4.6)			1240(30.4)			120(7.3)	1280(27.6)	160(11.1)			
Byblis serrata			120(8.6)	400(9.8)				80(1.7)				
Orchomenella minuta	160(6.2)	120(7.1)	40(2.8)	480(11.8)	840(17.2)		160(9.8)	320(6.9)			1480(24.8)	
Anonyx sarsi					40(0.8)						80(1.3)	
Acanthohaustorius millsi	120(4.6)	280(16.7)					320(19.5)		240(16.7)			
Protohaustorius wigleyi	600(23.1)								120(8.3)		40(0.7)	
Parahaustorius attenuatus		200(11.9)										
Pseudohaustorius carolinensis			80(5.7)	40(1.0)				240(5.2)				
Corophium bonelli	40(1.5)	80(4.8)		200(4.9)				80(1.7)			160(2.7)	
Unciola irrorata								200(4.3)		40(0.8)	360(6.0)	
Calliopius laeviusculus											200(3.3)	
Stenothoe minuta				80(2.0)	40(0.8)			360(7.8)		560(10.5)	1280(21.5)	
Trichophoxus epistomus		80(4.8)										
Microdeutopus gryllotalpa					120(2.4)				40(2.8)	80(1.5)	400(6.7)	
Casco bigelowi										120(2.2)		
Stenopleustes inermis											560(8.7)	

Table 1 (Continued)

Species	STATION											
	1	3	4	5	6	7	8	9	10	11	12	13
Echinodermata												
Echinarachnius parma	80(3.1)	360(21.4)	600(42.9)	80(2.0)		280(53.8)	280(17.1)	80(1.7)	240(16.7)	40(0.8)		
Annelida												
Cirrin churnea								40(0.9)		80(1.5)	40(0.7)	
Unidentified sp	80(3.1)	80(4.8)		40(1.0)			40(2.4)		40(2.8)			
Sipunculida												
Phascolosoma canadensis		40(2.4)		40(1.0)	40(0.8)				40(2.8)			

Table 2. Quantitative distribution of population densities (observed • 0.025 m^2 X 40) of major benthic invertbrate phyla at each station in the Project MEAP site, 25 May 1982. Numbers in parenthesis represent percent of total.

	S T A T I O N											
Phylum	1	3	4	5	6	7	8	9	10	11	12	13
Cnidaria	120 (4.5)			80 (2.0)	40 (0.8)			40 (0.9)	80 (5.6)		120 (2.0)	
Nemertinea		40 (2.4)							40 (2.8)			
Mollusca	80 (3.0)		40 (2.8)					40 (0.9)		120 (2.3)		
Annelida	680 (25.8)	200 (11.9)	320 (22.8)	440 (10.8)	3680 (75.4)	240 (46.2)	320 (20.0)	360 (7.7)	160 (11.1)	3960 (75.6)	1280 (21.3)	440 (100)
Sipunculida										40 (0.8)		
Arthropoda	1600 (60.6)	920 (54.8)	440 (31.4)	3400 (83.3)	1120 (23.0)		1000 (61.0)	4080 (87.9)	840 (58.3)	1000 (19.1)	4560 (76.0)	
Bryozoa	80 (3.0	80 (4.8)		40 (1.0)			40 (2.4)	40 (0.9)	40 (2.8)	80 (1.5)	40 (0.7)	
Echinodermata	80 (3.0)	360 (21.4)	600 (42.8)	80 (2.0)		280 (53.8)	280 (17.1)	80 (1.7)	240 (16.7)	40 (0.8)		
Hemichordata		80 (4.8)		40 (1.0)	40 (0.8)				40 (2.8)			
Total	2640	1680	1400	4080	4880	520	1640	4640	1440	5240	6000	440

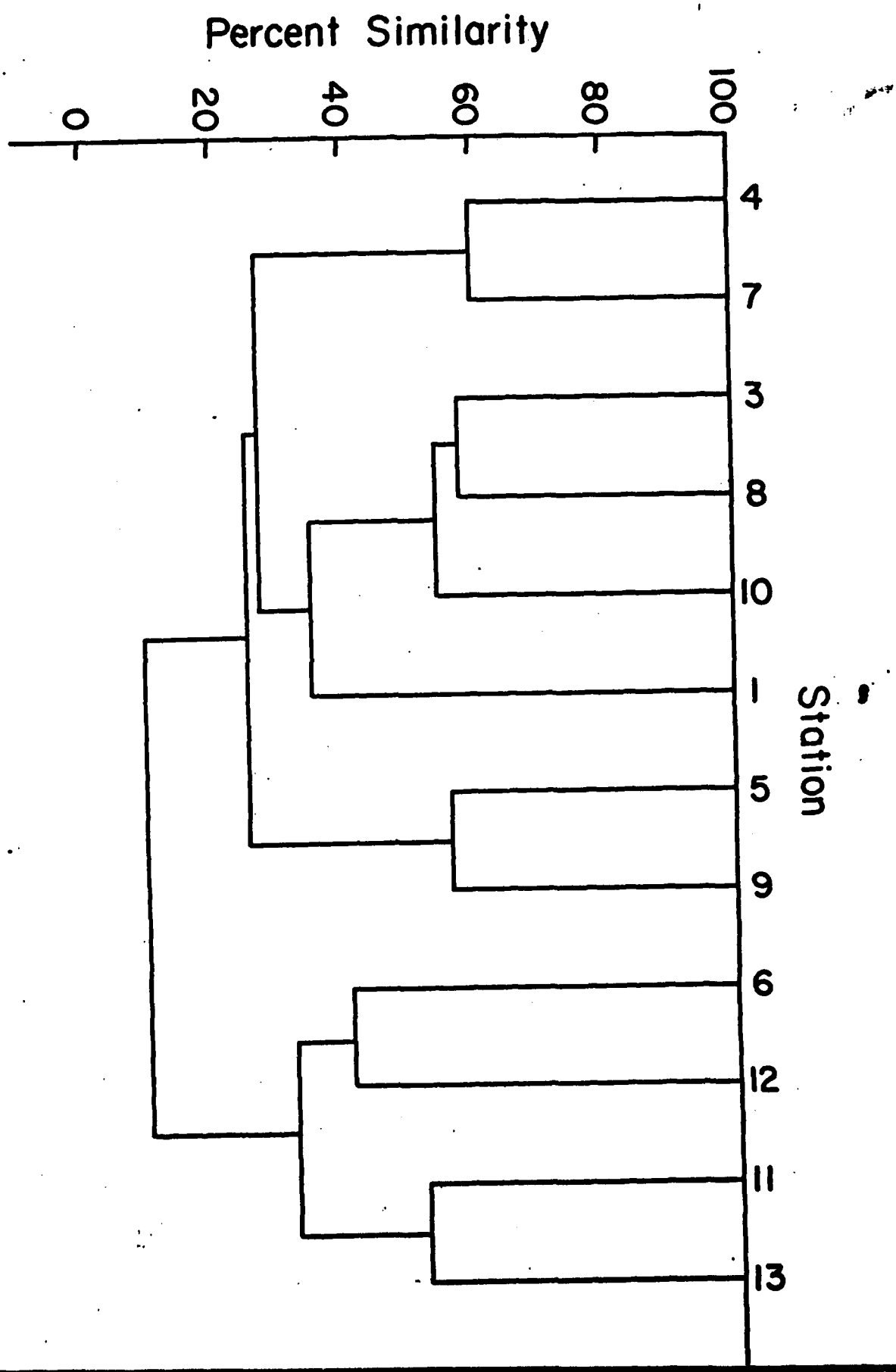
Table 3. The distribution of biomass (grams wet weight per m^2) of major benthic invertebrate phyla at each station in the Project WEAP site, 25 May 1982. Numbers in parenthesis represent percent of total.

	STATION											
Phylum	1	3	4	5	6	7	8	9	10	11	12	13
Cnidaria	464.0 (6.3)			172.8 (33.0)	<1			<1	<1		185.2 (49.4)	
Sipunculida		3.3 (0.3)							3.7 (0.5)			
Mollusca	6560.0 (89.2)		144.0 (8.2)					40.4 (19.5)		121.2 (14.1)		
Annelida	103.3 (1.4)	20.2 (2.0)	34.9 (2.0)	67.6 (12.9)	382.2 (87.2)	33.8 (4.4)	40.3 (5.2)	34.1 (16.5)	17.8 (2.5)	601.1 (70.0)	158.5 (42.3)	491.1 (100.0)
Sipunculida										21.5 (2.5)		
Arthropoda	11.0 (0.1)	6.6 (0.6)	2.1 (0.1)	21.9 (4.2)	5.0 (1.1)		5.4 (0.7)	27.1 (13.1)	6.6 (0.9)	6.5 (0.7)	30.6 (8.2)	
Bryozoa	<1	<1		<1			<1				<1	
Echinodermata	209.6 (2.8)	943.2 (92.1)	1572.0 (89.7)	209.6 (40.1)		733.6 (95.6)	729.5 (94.1)	104.8 (50.1)	628.6 (88.5)	107.6 (12.5)		
Hemichordata		51.2 (5.0)		50.3 (9.6)	51.2 (11.7)				53.5 (7.5)			
Total	7347.9	1024.5	1753.0	522.2	438.4	767.4	775.2	206.4	710.2	857.9	374.3	491.1

macrofauna occurring in the sediments at the Project WEAP site, 25 May 1982.

Species	STATION 1	3	4	5	6	7	8	9	10	11	12	13
Glycinella torquata	200(7.7)	40(2.4)	80(5.7)	160(3.9)	520(10.6)	40(7.7)	120(7.3)	40(0.9)	40(2.8)	1680(31.6)	120(2.0)	80(18.2)
Unidentified sp.	80(3.1)			40(1.0)						120(2.2)	40(0.7)	120(27.3)
Unidentified sp.	160(6.2)				1120(22.9)							
Goniada maculata					960(19.7)					1240(23.3)	240(4.0)	40(9.1)
Glycera capitata				40(1.0)		80(15.3)	40(2.4)	40(0.9)		880(16.5)	320(5.4)	40(9.1)
Leanira cirrata		120(7.1)	200(14.3)	160(3.9)	440(9.0)	40(7.7)	120(7.3)	80(1.7)	120(8.3)			
Pygospio elegans												
Aricidea catherinae												
Unidentified sp.	80(3.1)	40(2.4)	160(11.4)				160(9.7)	120(2.6)	40(2.8)			
Cyathura burbancki		80(4.8)	80(5.7)	80(2.0)			120(7.3)	120(2.6)				
Ampelisca verrilli	200(7.7)			800(19.6)			120(7.3)	1080(23.3)	120(8.3)	40(0.8)		
Ampelisca vadorum	80(3.1)			40(1.0)				120(2.6)	120(8.3)			
Ampelisca agassizi	120(4.6)			1240(30.4)			120(7.3)	1280(27.6)	160(11.1)			
Crassinella minuta	160(6.2)	120(7.1)		480(11.8)	840(17.2)		160(9.7)	320(6.9)			1480(24.8)	
Acanthohaustorius millsi	120(4.6)	280(16.7)					320(19.5)		240(16.7)			
Protohaustorius wigleyi	600(23.1)	200(11.9)							120(8.3)		40(0.7)	
Caecum pulchellum		80(4.8)		200(4.9)				80(1.7)			160(2.7)	
Unidentified sp.				80(2.0	40(0.8)			360(7.8)		560(10.5)	1280(21.5)	
Syllis cornuta			120(8.6)	400(9.8)				80(1.7)				
Unidentified sp.	80(3.1)	360(21.4)	600(42.9)	80(2.0)		280(53.8)	280(17.1)	80(1.7)	240(16.7)	40(0.8)		

Figure 1. Dendrogram formed by the Bray-Curtis similarity coefficient for all stations sampled for PROJECT WEAP, Block Island Sound, May 1982. Scale is percent similarity.


Percent Similarity
0
20
40
60
80
100
4
7
3
8
10
1
5
9
6
12
11
13
Station