



MARINE AND FRESHWATER
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26 January 2010

Ms. Susan Herz
ESS Group, Inc.
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**SUBJECT: ADDENDUM
QUANTITATIVE BENTHIC SAMPLING DATA
FALL 2008 & WINTER 2009
SHEFFIELD HARBOR, NORWALK, CT
OSI JOB# 07ES077.2-4B**

Dear Ms. Herz:

During July 2008, October 2008 and January 2009, Ocean Surveys, Inc (OSI), in conjunction with Dr. Robert Whitlatch of the University of Connecticut, conducted various biological tasks in and around Sheffield Harbor. The results were submitted on 8 September 2009 in the report entitled; Final Report, Initial, Three-Month and Six-Month Benthic Biological Surveys, A Component of the Benthic Monitoring Study (Ocean Surveys 2009). However, the report did not include benthic grab sample data from the October 2008 and January 2009 surveys as the data was still being compiled by UCONN. This addendum should be included with the above referenced report. It includes the remaining data required under Task 1a for October 2008 and January 2009. All other material such as sampling protocol, location and schedule can be found in the report submitted on 8 September 2009 (Ocean Surveys 2009).

RESULTS

Benthic Sediment Grab Sampling

October 2008 Survey

The abundance and benthic invertebrate taxa collected at the 23 sampling locations in October 2008 are summarized in Table A4-6 (pp. 6-25). Samples collected north and south of Sheffield Island were commonly dominated by annelid worms (polychaetes and oligochaetes), bivalve and gastropod molluscs, and a variety of arthropods (e.g., crabs, amphipods). Other taxa included several species of nemertine worms.

The average number of individuals per Station ranged from 366 to 1314, the average number of species per Station ranged from 15 to 29 and the average species diversity varied from

1.34 to 2.17 (Table A4-7, p. 26). Most samples were dominated by polychaete and oligochaete worms, where the average number of individuals per Station ranged from 245 to 982 and 39 to 481, respectively. Molluscs (primarily bivalves) were typically the second-most abundant taxa and the number of individuals per Station ranged from 5 to 846. The average number of arthropods per Station varied from 2 to 50 (Table A4-8, p.27)

Results of the classification analysis, which illustrates the degree of sample similarity among the sampling Stations, is shown in Figure A4-9 (p. 28). In general, there was considerable clustering within and between variations in samples taken at the different Stations. For example, while all the samples taken along Transect 1 and 5 generally clustered together, those taken at Transects 2, 3 and 4, were often clustered together with different sites (Figure A4-9, p. 28). The MDS plot revealed similar patterns of Station separation, with most of the samples collected north of Sheffield Island grouped together and samples collected south of Sheffield Island grouped together in the ordination plot (Figure A4-10, p. 29).

Samples collected along Transect 1 were typically dominated by four species of polychaete worms (*Mediomastus ambiseta*, *Leitoscoloplos robustus*, *Streblospio benedicti*, *Cossura longocirrata*.) and an oligochaete worm. Samples taken from Transect 2 were also dominated by the same four polychaete species and oligochaetes, and a lesser degree by three species of bivalves (*Nucula annulata*, *Mullinea lateralis* and *Tellina agilis*). Samples collected from Transect 3 showed relatively high numbers the bivalves *Nucula*, the slipper limpet, *Crepidula fornicata*, as well as oligochaetes, and the polychaetes *Streblospio*, *Cossura*, *Mediomastus*, *Thyax acutus*, and *Leitoscoloplos*. Transect 4 samples were highly variable; several had high abundances of *Nucula* and *Crepidula*. Similarly, oligochaete abundances varied considerably between Stations (95 to 531 individuals per grab). All the samples from this transect typically had high numbers of *Mediomastus* and *Cossura*. Transect 5, located on the south side of Sheffield Island was also reasonably variable. For example, Station 5A had very high densities of *Nucula* (194 to 316 individuals per grab) while none were found at Station 5D. Similar variability was seen in *Nucula*, *Crepidula* and *Tellina agilis*. Polychaete taxa that were dominant at this site included *Cossura*, *Streblospio* and *Mediomastus*.

January 2009 Survey

The abundance of the benthic invertebrate taxa collected at the 23 sampling Stations in January 2009 is summarized in Table A4-11 (pp. 30-44). Similar to the October 2008 survey, benthic samples were dominated by annelid worms (polychaetes and oligochaetes), bivalve and gastropod molluscs and a variety of arthropod species (e.g., amphipods, crabs).

The average number of individuals per Station varied from 173 to 1125, while the average number of species per Station ranged from 8 to 18. Average species diversity estimates ranged from 1.06 to 1.87 (Table A4-12, p.45). All the Stations, except 5A, were dominated by polychaete and oligochaete worms; where the average number of individuals per Station varied from 63 to 680 and 0 to 306, respectively. Bivalve mollusks were typically the third most abundant taxa, except for Station 5A, and the number of individuals per Station varied from 0 to 516. The average number of arthropods per Station varied from 0 to 69 (Table A4-13, p. 46).

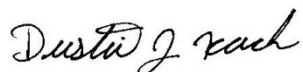
Figure A4-14 (p. 47) presents results of the classification analysis which illustrates the degree of various sampling Stations. Sample clustering patterns indicated a higher degree of within and between Station variation compared with the October 2008 data set. While replicate samples taken at the various Stations tended to cluster together, samples taken at different locations along the transect lines often did not. The MDS ordination plot (Figure A4-15, p. 48)) revealed similar patterns of sampling Station separation.

Samples collected along Transect 1 tended to be dominated by oligochaetes and three species of polychaetes (*Mediomastus ambiseta*, *Cossura longocirrata* and *Leitoscoloplos robustus*). Samples taken from Transect 2 tended to be dominated by the same three polychaete species and oligochaetes, while Transect 3 showed high abundances of slipper limpets (*Crepidula fornicata*), oligochaetes and the polychaetes *Tharyx acutus*, *Cossura lonocirrata*, *Streblospio benedicti*, *Mediomastus ambiseta* and *Leitoscoloplos robustus*. Samples collected from Transect 4 were somewhat more variable, but most were dominated by the mollusks *Nucula annulata* and *Crepidula fornicata*, oligochates and four species of polychaetes (*Leitoscoloplos robustus*, *Cossura longocirrata*, *Streblospio benedicti* and *Mediomastus ambiseta*). Samples collected south of Sheffield Island (Transect 5) were also quite variable in species dominance patterns. For example, samples collected at Station 5A were dominated by the bivalve *Nucula annulata*, the polychaete *Cossura longocirrata* and oligochaetes, while those collected from 5B, 5C and 5D typically were dominated by oligochaetes and the polychaetes *Mediomastus ambiseta* and *Leitoscoloplos robustus*.

DISCUSSION

Quantitative sampling of benthic invertebrate populations revealed many of the same species collected in previous surveys of the study site. All samples collected in October 2008 and January 2009 were dominated by annelid worms, bivalve and gastropod mollusks and amphipod crustaceans. These species are common to southern New England subtidal muddy/sandy benthic habitats (e.g., Pratt 1973, McCall 177, 1978, Rhoads et al. 1978, Whitlatch 1994). Several species collected, notably the polychaetes *Streblospio benedicti* and *Capitella* spp. and *Mediomastus ambiseta*, are considered ‘opportunistic’ and/or ‘indicator’ species (*sensu* Grassle and Grassle 1974). These species tend to be associated with habitats that experience frequent natural and/or human-induced perturbations (e.g., Zajac and Whitlatch, 1982a, b; Whitlatch and Zajac 1985) and are commonly found in shallow water muddy habitats throughout Long Island Sound (e.g., Reid et al. 1979; Whitlatch 1994; Zajac 2001). Increases in the population density of the polychaete *Mediomastus ambiseta* have also been shown to be the result of organically enriched sediments (Grassle et al. 1980).

Sincerely,



Dustin J. Kach
Project Scientist – Coastal Sciences

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Table A4-6. Benthic taxa and their abundances per sample collected from benthic habitat sampling Transect 1, October 2008.

Mollusca	1A1	1A2	1A3	1B1	1B2	1B3	1C1	1C2	1C3	1D1	1D2	1D3
<i>Crepidula plana</i>												
<i>Crepidula fornicata</i>												
<i>Nucula annulata</i>	1		1	1	2		2		1	1	1	2
<i>Tellina agilis</i>	2	5	1	3	2	1	5	6	2	2	2	1
<i>Yoldia limatula</i>					1							
<i>Retusa canaliculata</i>			1									
<i>Turbonilla elegantula</i>	1	2	2		2		2	1	2	1	1	3
<i>Nassarius trivittatus</i>												
<i>Illyanasa obsoleta</i>												
<i>Mercenaria mercenaria</i>		1					1		1			
<i>Petricola pholadiformis</i>												
<i>Retusa punctostriatus</i>												
Bivalve A (juv)												
<i>Crepidula convexa</i>												
<i>Anadara transversa</i>												
Gastropod A (juv)	6	3	1	5	2	6	3	1	2	4	4	1
<i>Odostomia seminuda</i>												
<i>Pandora gouldiana</i>										1		
<i>Busycon sp. (juv.)</i>												
<i>Mullinea lateralis</i>	2		1	5						3		6

Table A4-6 (cont.). Benthic taxa and their abundance per sample found at benthic habitat sampling Transect 1, October 2008.

	1A1	1A2	1A3	1B1	1B2	1B3	1C1	1C2	1C3	1D1	1D2	1D3
Oligochaeta												
Oligochaete A	106	92	112	148	153	187	118	122	131	460	482	497
Oligochaete B										3	1	
Nemertinea												
Nemertea A	1								1			
Nemertea B	2		1	2						1	1	
Arthropoda												
<i>Ampelisca abdita</i>	2	8	6	73	62	3	4	2	9	11	15	6
<i>Microdeutopus gryllotalpa</i>				1			1			1		
<i>Batea catharinensis</i>	1											
<i>Erichthoneis brasiliensis</i>				1	1						1	
<i>Elasmopus levis</i>			1							1		
<i>Corophium</i> spp.				2	1					1		
<i>Leucon americana</i>												
<i>Dyspanopeus sayi</i>				3	2					2	3	1
<i>Panopeus herbstii</i>												
<i>Pagurus</i> sp.												
<i>Nemomysis americana</i>												
<i>Pagurus polycarus</i>												
<i>Caprella</i> spp.												
<i>Unicola irrorata</i>												
<i>Crangon septemspinosa</i>										4	1	3

Table A4-6 (cont). Benthic taxa and their abundance per sample at Transect 1 sampling station October 2008.

Polychaeta	1A1	1A2	1A3	1B1	1B2	1B3	1C1	1C2	1C3	1D1	1D2	1D3
<i>Eteone heteropoda</i>	28	25	18	8	6	2	11	10	6	32	51	41
<i>Eteone longa</i>	1	1		1			3	1			7	1
<i>Tharyx acutus</i>	1	2	10	32	47	28	21	38	16	20	15	13
<i>Polydora cornuta</i>	5	4	1	3	1	6	38	12	22	45	38	17
<i>Nereis succinea</i>	15	12	5	1	7	4	1		2	1		1
<i>Leitoscoloplos robustus</i>	106	92	57	109	91	73	105	51	86	65	42	38
<i>Leitoscoloplos</i> sp. (juv)			2			1			3	21		
<i>Paranitus speciosa</i>	1			1		3			1			
<i>Pectinaria gouldii</i>							1			1		2
<i>Eumida sanguinea</i>	1									4		1
<i>Cossura longocirrata</i>	25	38	16	228	162	261	271	198	245	11	31	16
<i>Streblospio benedicti</i>	37	44	31	94	82	45	6	2	15	165	191	123
<i>Mediomastus ambiseta</i>	24	36	51	95	123	48	10	4	15	165	53	101
<i>Ajsychnis elongata</i>				12	6	8	3	1	3			
<i>Nephtys incisa</i>												
<i>Capitella</i> spp.	2		2		1		1			10	1	6
<i>Exogone dispar</i>	1			2			2			6	1	12
<i>Spiochaetopertus oculatus</i>												
<i>Polycirrus eximius</i>	4	2			1						1	
<i>Nereis</i> spp. (juv)			1					1			1	
<i>Aricidea catherinae</i>												
<i>Spiophanes bombyx</i>												
<i>Brania wellfleetensis</i>	1		1		5		2			6	4	1

<i>Brania clavata</i>	2	1		1		1	3			2		1
<i>Ampharete americana</i>	1									1		
<i>Glycera americana</i>												
<i>Syllides verrilli</i>						4	1	4		5	3	2
<i>Lumbrinereis tenuis</i>	8	6	2	9	21	5		2	1	2		2
<i>Clymenella torquata</i>	1							1				
<i>Odontosyllis fulgens</i>	3		1		1	4				1		1
<i>Goniada maculata</i>			2			2						
<i>Polydora quadrilobata</i>		1	4									
<i>Goniadella gracilis</i>					1		1					
<i>Pholoe minuta</i>		1					1				1	6

Table A4-6 (cont). Benthic taxa and their abundances per sample collected from benthic habitat sampling Transect 2, October 2008.

Mollusca	2A1	2A2	2A3	2B1	2B2	2B3	2C1	2C2	2C3	2D1	2D2	2D3	2E1	2E2	2E3
<i>Crepidula plana</i>								2							
<i>Crepidula fornicata</i>							29	10	19		13	5	3	2	7
<i>Nucula annulata</i>	3	4	12	16	6	20	3	2	9	3	1			1	
<i>Tellina agilis</i>	31	41	16	1	2	10	5			1			2	7	
<i>Yoldia limatula</i>				1	2	4									
<i>Retusa canaliculata</i>				2	3	11	1		1			1	1		1
<i>Turbonilla elegantula</i>															
<i>Nassarius trivittatus</i>															
<i>Illyanasa obsoleta</i>															
<i>Mercenaria mercenaria</i>													1		
<i>Petricola pholadiformis</i>	1														
<i>Retusa punctostriatus</i>	4	7	11												
Bivalve A (juv)															
<i>Crepidula convexa</i>															
<i>Anadara transversa</i>															
Gastropod A (juv)							5	2	1	3	1	1	7	12	19
<i>Odostomia seminuda</i>															
<i>Pandora gouldiana</i>															
<i>Busycon sp. (juv.)</i>															
<i>Mullinea lateralis</i>	18	32	13	1	3	10		1	1			1	1		1
<i>Crassostrea virginica</i>											3				

Table A4-6 (cont.). Benthic taxa and their abundance per sample found at benthic habitat sampling Transect 2, October 2008.

	2A1	2A2	2A3	2B1	2B2	2B3	2C1	2C2	2C3	2D1	2D2	2D3	2E1	2E2	2E3
Oligochaeta															
Oligochaete A	199	282	252	261	283	211	316	412	212	155	121	198	149	51	79
Oligochaete B	1			4				1				3			1
Nemertinea															
Nemertea A	1	6		6	1	4			1						
Nemertea B															
Arthropoda															
<i>Ampelisca abdita</i>	16	31	11	27	15	5	21	6					2	1	7
<i>Microdeutopus gryllotalpa</i>															
<i>Batea catharinensis</i>															
<i>Erichthoneis brasiliensis</i>															
<i>Elasmopus levis</i>															
<i>Corophium</i> spp.															
<i>Leucon americana</i>	1	2		16	6	21									
<i>Dyspanopeus sayi</i>							3			5	1		4	4	4
<i>Panopeus herbstii</i>															
<i>Pagurus</i> sp.															
<i>Nemomysis americana</i>															
<i>Pagurus polycarus</i>															
<i>Caprella</i> spp.															
<i>Unicola irrorata</i>															
<i>Crangon septemspinosa</i>															

Table A4-6 (cont). Benthic taxa and their abundance per sample at Transect 2, October 2008

Polychaeta	2A1	2A2	2A3	2B1	2B2	2B3	2C1	2C2	2C3	2D1	2D2	2D3	2E1	2E2	2E3
<i>Eteone heteropoda</i>	16	3	8	12	13	5	21	11	6	1	13	1	3	2	
<i>Eteone longa</i>		1			1				5	1					
<i>Tharyx acutus</i>	12	21	6	7	1	12	53	69	38	41	29	27	25	12	39
<i>Polydora cornuta</i>		3					16	5	8	1		1		1	
<i>Nereis succinea</i>										3	1				
<i>Leitoscoloplos robustus</i>	77	112	41	138	175	121	30	50	22	17	1	44	29	48	18
<i>Leitoscoloplos</i> sp. (juv)		4						11		1			2		
<i>Paranitus speciosa</i>	5	11	1			1			1			2			
<i>Pectinaria gouldii</i>	1				1		1		6				1		
<i>Eumida sanguinea</i>	2	2	1	3	13	1						2			1
<i>Cossura longocirrata</i>	161	211	197	291	123	145	46	31	11	22	12	45	14	31	55
<i>Streblospio benedicti</i>	87	32	122	3		1	43	28	66	58	33	71	118	82	161
<i>Mediomastus ambiseta</i>	611	506	571	69	80	44	373	222	412	288	210	87	189	76	212
<i>Ajsychis elongata</i>	38	22	22		1		1			1		1		1	
<i>Nephtys incisa</i>	2			2		1						1			
<i>Capitella</i> spp.		1				6	2			3		1	1		1
<i>Exogone dispar</i>	1	3		4			1				31			1	
<i>Spiochaetopertus oculatus</i>															
<i>Polycirrus eximius</i>				1						1					
<i>Nereis</i> spp. (juv)		1					4	1					1	1	
<i>Aricidea catherinae</i>							1						12	6	1
<i>Spiophanes bombyx</i>															
<i>Brania wellfleetensis</i>		3					3	2	1				3		1
<i>Brania clavata</i>		1		1				1				4			
<i>Ampharete americana</i>													1		
<i>Glycera americana</i>						1					1				

<i>Syllides verrilli</i>	1		4			3	1			3		1			1
<i>Lumbrinereis tenuis</i>		1				3		1							
<i>Clymenella torquata</i>															
<i>Odontosyllis fulgens</i>		1		1		2			1	1				1	
<i>Goniada maculata</i>	6	12	2		2	3							6	12	
<i>Polydora quadrilobata</i>				1											
<i>Goniadella gracilis</i>		1			1			3					2		
<i>Pholoe minuta</i>				1											

Table A4-6 (cont.). Benthic taxa and their abundances per sample collected from benthic habitat sampling Transect 3, October 2008. Sample 3B3 was lost.

Mollusca	3A1	3A2	3A3	3B1	3B2	3B3	3C1	3C2	3C3	3D1	3D2	3D3	3E1	3E2	3E3
<i>Crepidula plana</i>			2	1						1	5	6		8	
<i>Crepidula fornicata</i>	24	16	18	26	13		56	60	12	50	61	35	33	64	21
<i>Nucula annulata</i>	2	1	3	2			7	5	1	30	18	41		7	
<i>Tellina agilis</i>	4		6				3		1	8	4	12		7	1
<i>Yoldia limatula</i>															
<i>Retusa canaliculata</i>		1								6	12	7	2	3	
<i>Turbonilla elegantula</i>			1				4		1			1			
<i>Nassarius trivittatus</i>													8	16	2
<i>Illyanasa obsoleta</i>														1	
<i>Mercenaria mercenaria</i>		1												1	
<i>Petricola pholidiformis</i>															
<i>Retusa punctostriatus</i>		1													
Bivalve A (juv)															
<i>Crepidula convexa</i>															
<i>Anadara transversa</i>															
Gastropod A (juv)	12	2	7	2	1		3		2	3	1	2			
<i>Odostomia seminuda</i>															
<i>Pandora gouldiana</i>															
<i>Busycon sp. (juv.)</i>															
<i>Mullinea lateralis</i>		1		1			1		1	14	31	3			
<i>Crassostrea virginica</i>											1				

Table A4-6 (cont.). Benthic taxa and their abundance per sample found at benthic habitat sampling Transect 3, October 2008.

	3A1	3A2	3A3	3B1	3B2	3B3	3C1	3C2	3C3	3D1	3D2	3D3	3E1	3E2	3E3
Oligochaeta															
Oligochaete A	117	251	202	170	231		284	164	211	321	411	275	236	128	211
Oligochaete B		2			1			3			1				
Nemertinea															
Nemertea A	1			2						12	8	1			
Nemertea B															
Arthropoda															
<i>Ampelisca abdita</i>							1					2	5	32	11
<i>Microdeutopus gryllotalpa</i>														2	
<i>Batea catharinensis</i>														1	
<i>Erichthoneis brasiliensis</i>														1	
<i>Elasmopus levis</i>					1										
<i>Corophium</i> spp.	3	12	8	3	1			1					3		
<i>Leucon americana</i>														1	
<i>Dyspanopeus sayi</i>															
<i>Panopeus herbstii</i>	2	1	4												4
<i>Pagurus</i> sp.															
<i>Nemomyxis americana</i>															
<i>Pagurus polycarus</i>													3	20	6
<i>Caprella</i> spp.														3	1
<i>Unicola irrorata</i>															
<i>Crangon septemspinosa</i>							1						1		
<i>Pinnixa</i> sp.	2	1	1		1										

Table A4-6 (cont). Benthic taxa and their abundance per sample at benthic habitat sampling Transect 3, October 2008.

Polychaeta	3A1	3A2	3A3	3B1	3B2	3B3	3C1	3C2	3C3	3D1	3D2	3D3	3E1	3E2	3E3
<i>Eteone heteropoda</i>	4	6	11	3	1		17	3	1				5	6	1
<i>Eteone longa</i>	2		1				1								
<i>Tharyx acutus</i>	65	118	77	9	5		16	2	8	6	1	1	2	10	4
<i>Polydora cornuta</i>	6	1	1	11	8		7	1	2	6	1	7	2		1
<i>Nereis succinea</i>		1		2						1				1	
<i>Leitoscoloplos robustus</i>	19	31	47	5	1		9	2		18	2	7	21	39	33
<i>Leitoscoloplos</i> sp. (juv)			1				1								
<i>Paranitus speciosa</i>		1					1				2				
<i>Pectinaria gouldii</i>											1				
<i>Eumida sanguinea</i>	1		6		1									1	
<i>Cossura longocirrata</i>	2	1	12	19	31		32	11	5	381	311	209	84	53	66
<i>Streblospio benedicti</i>	41	69	53	21	38		36	22	55	2		1	9	22	12
<i>Mediomastus ambiseta</i>	93	141	67	159	182		254	141	237	381	512	467	84	41	66
<i>Ajsychis elongata</i>		1			1						1				
<i>Nephtys incisa</i>			1				1			4		1		4	
<i>Capitella</i> spp.	2	2	6	1										1	
<i>Exogone dispar</i>	3	3	3		1						1				1
<i>Spiochaetopertus oculatus</i>										2					
<i>Polycirrus eximius</i>	1		1				1							1	
<i>Nereis</i> spp. (juv)	3	5	12	2	1		4								
<i>Aricidea catherinae</i>		1		1											
<i>Spiophanes bombyx</i>															
<i>Brania wellfleetensis</i>			6	1										1	
<i>Brania clavata</i>	1	2	5		1					3			1		
<i>Ampharete americana</i>	1		6												
<i>Glycera americana</i> <i>Americana</i>		1			1						1			1	

<i>Syllides verrilli</i>											2			3	
<i>Lumbrinereis tenuis</i>															
<i>Clymenella torquata</i>															
<i>Odontosyllis fulgens</i>		1							1				3		
<i>Goniada maculata</i>								1			1			3	
<i>Polydora quadrilobata</i>															
<i>Goniadella gracilis</i>		1								1					
<i>Pholoe minuta</i>									1						

Table A4-6 (cont). Benthic taxa and their abundances per sample collected from benthic habitat sampling Transect 4, October 2008.

Mollusca	4A1	4A2	4A3	4B1	4B2	4B3	4C1	4C2	4C3	4D1	4D2	4D3	4E1	4E2	4E3
<i>Crepidula plana</i>													4		1
<i>Crepidula fornicata</i>	3		15				3	4	6	11	16	7	62	43	51
<i>Nucula annulata</i>	1			183	112	99	18	7	2			1			
<i>Tellina agilis</i>	2			5		2	9	12	1	4	1	1		1	
<i>Yoldia limatula</i>				1											
<i>Retusa canaliculata</i>				1			6		2		1				
<i>Turbonilla elegantula</i>															
<i>Nassarius trivittatus</i>				13	2	7		1						1	
<i>Illyanasa obsoleta</i>															
<i>Mercenaria mercenaria</i>															
<i>Petricola pholadiformis</i>															
<i>Retusa punctostriatus</i>															
Bivalve A (juv)			1							1					
<i>Crepidula convexa</i>															
<i>Anadara transversa</i>															
Gastropod A (juv)		2			2				1	2	6			1	
<i>Odostomia seminuda</i>															
<i>Pandora gouldiana</i>															
<i>Busycon sp. (juv.)</i>															
<i>Mullinea lateralis</i>				5	1	1	18	21	3						1
<i>Crassostrea virginica</i>													2	6	
<i>Mya arenaria</i>		1			1										

Table A4-6 (cont.). Benthic taxa and their abundance per sample found at benthic habitat sampling Transect 4, October 2008.

	4A1	4A2	4A3	4B1	4B2	4B3	4C1	4C2	4C3	4D1	4D2	4D3	4E1	4E2	4E3
Oligochaeta															
Oligochaete A	140	95	173	222	96	311	531	367	463	243	112	157	337	197	345
Oligochaete B		1					1				1		4		
Nemertinea															
Nemertea A	4	1	1	3		2	4	1	1	10	14	2		1	
Nemertea B	2		2				3	1			3				1
Arthropoda				6	4	1		1			3				1
<i>Ampelisca abdita</i>															
<i>Microdeutopus gryllotalpa</i>															
<i>Batea catharinensis</i>															
<i>Erichthoneis brasiliensis</i>															
<i>Elasmopus levis</i>		1													
<i>Corophium</i> spp.															
<i>Leucon americana</i>				15	7	1			1				4	7	1
<i>Dyspanopeus sayi</i>															
<i>Panopeus herbstii</i>		3					1						1	4	1
<i>Pagurus</i> sp.															
<i>Nemomysis americana</i>		1													
<i>Pagurus polycarus</i>															
<i>Caprella</i> spp.															
<i>Unicola irrorata</i>															
<i>Crangon septemspinosa</i>															

Table A4-6 (cont). Benthic taxa and their abundance per sample at benthic habitat sampling Transect 4, October 2008.

Polychaeta	4A1	4A2	4A3	4B1	4B2	4B3	4C1	4C2	4C3	4D1	4D2	4D3	4E1	4E2	4E3
<i>Eteone heteropoda</i>	8	3	1	15	34	6	11	5	3	9	3	15	10	2	7
<i>Eteone longa</i>											1				
<i>Tharyx acutus</i>	5	5	1	2		1	5	1	1	15	2	29	8		1
<i>Polydora cornuta</i>	3	1	1	2	6	1									
<i>Nereis succinea</i>					1										
<i>Leitoscoloplos robustus</i>	13	11	1	34	21	56	56	12	23	32	15	41	12	10	1
<i>Leitoscoloplos</i> sp. (juv)				2				1				7			
<i>Paranitus speciosa</i>		1									1				
<i>Pectinaria gouldii</i>				5		3					1				
<i>Eumida sanguinea</i>														3	
<i>Cossura longocirrata</i>	92	57	144	471	298	325	532	455	178	84	112	43	6	5	1
<i>Streblospio benedicti</i>	42	12	54	10	21	32	9	9	6	12	2	1	25	17	42
<i>Mediomastus ambiseta</i>	101	210	56	121	39	152	215	312	301	322	216	94	75	38	41
<i>Ajsychis elongata</i>															
<i>Nephtys incisa</i>		1			3				3			1			
<i>Capitella</i> spp.		1					1				1				
<i>Exogone dispar</i>	1							1							
<i>Spiochaetopertus oculus</i>					1										
<i>Polycirrus eximius</i>															
<i>Nereis</i> spp. (juv)							2							1	
<i>Aricidea catherinae</i>															
<i>Spiophanes bombyx</i>															
<i>Brania wellfleetensis</i>													1	1	1
<i>Brania clavata</i>														2	
<i>Ampharete americana</i>															
<i>Glycera americana</i>															

<i>Syllides verrilli</i>															
<i>Lumbrinereis tenuis</i>															
<i>Clymenella torquata</i>															
<i>Odontosyllis fulgens</i>															
<i>Goniada maculata</i>		3				1								1	
<i>Polydora quadrilobata</i>															
<i>Goniadella gracilis</i>															
<i>Pholoe minuta</i>															

Table A4-6. Benthic taxa and their abundances per sample collected from benthic habitat sampling Transect 5, October 2008.

Mollusca	5A1	5A2	5A3	5B1	5B2	5B3	5C1	5C2	5C3	5D1	5D2	5D3
<i>Crepidula plana</i>				4	6	3	1	1				
<i>Crepidula fornicata</i>	2		1	22	19	27	2	2	1			
<i>Nucula annulata</i>	316	288	194	7	1	6	6		1			
<i>Tellina agilis</i>	13	5	7	18	29	6	18	11	23	45	29	33
<i>Yoldia limatula</i>	5		2		2				1			
<i>Retusa canaliculata</i>		5	1			5	2		2			
<i>Turbonilla elegantula</i>				16	8	10	44	17	27			
<i>Nassarius trivittatus</i>				13	9	22	3		1	4	1	1
<i>Illyanasa obsoleta</i>												
<i>Mercenaria mercenaria</i>								1				
<i>Petricola pholadiformis</i>				1	1	1		1				
<i>Retusa punctostriatus</i>												
Bivalve A (juv)	8	1	1	2	17	11						
<i>Crepidula convexa</i>												
<i>Anadara transversa</i>												
Gastropod A (juv)												
<i>Odostomia seminuda</i>												
<i>Pandora gouldiana</i>												
<i>Busycon sp. (juv.)</i>												
<i>Mullinea lateralis</i>	5	10	1	22	49	12	7	14	20			
<i>Crassostrea virginica</i>												
<i>Ensis directus</i>												

Table A4-6 (cont.). Benthic taxa and their abundance per sample found at benthic habitat sampling Transect 5, October 2008.

	5A1	5A2	5A3	5B1	5B2	5B3	5C1	5C2	5C3	5D1	5D2	5D3
Oligochaeta												
Oligochaete A	137	111	241	98	111	211	77	89	145	59	38	136
Oligochaete B				2					2			
Nemertinea												
Nemertea A		4	1		1	9	7	1	5	1		
Nemertea B												
Arthropoda												
<i>Ampelisca abdita</i>	1	7	12		4	2	3	11	3			
<i>Microdeutopus gryllotalpa</i>												
<i>Batea catharinensis</i>												
<i>Erichthoneis brasiliensis</i>												
<i>Elasmopus levis</i>												
<i>Corophium</i> spp.												
<i>Leucon americana</i>		1										
<i>Dyspanopeus sayi</i>					1							
<i>Panopeus herbstii</i>												
<i>Pagurus</i> sp.												
<i>Nemomysis americana</i>						4						
<i>Pagurus polycarus</i>												
<i>Caprella</i> spp.												
<i>Unicola irrorata</i>						1						
<i>Crangon septemspinosa</i>												

Table A4-6 (cont). Benthic taxa and their abundance per sample at benthic habitat sampling Transect 5, October 2008.

Polychaeta	5A1	5A2	5A3	5B1	5B2	5B3	5C1	5C2	5C3	5D1	5D2	5D3
<i>Eteone heteropoda</i>								1			1	
<i>Eteone longa</i>	5	1	5	5	11	2		2		4	8	1
<i>Tharyx acutus</i>		5	1	1	4	1		2		1	7	2
<i>Polydora cornuta</i>											3	
<i>Nereis succinea</i>												
<i>Leitoscoloplos</i> sp.		4		1	9	5	33	25	32	22	15	2
<i>Paranitus speciosa</i>											1	
<i>Pectinaria gouldii</i>	3	1	1		2	1		1				
<i>Eumida sanguinea</i>			1									
<i>Cossura longocirrata</i>	238	127	311	65	78	34	122	176	211	1		1
<i>Streblospio benedicti</i>		1	5	17	1		1	3	1	157	123	222
<i>Mediomastus ambiseta</i>	77	109	211	222	381	412	236	331	98	85	54	123
<i>Ajsychis elongata</i>		3	1		2							
<i>Nephtys incisa</i>		2	1		4	1						
<i>Capitella</i> spp.				1								
<i>Exogone dispar</i>					3						2	
<i>Spiochaetopertus oculatus</i>											1	
<i>Polycirrus eximius</i>												
<i>Nereis</i> spp. (juv)												
<i>Aricidea catherinae</i>		2		3	8	1		1		29	12	11
<i>Spiophanes bombyx</i>								1	1	1	3	1
<i>Brania wellfleetensis</i>												
<i>Brania clavata</i>										1	12	2
<i>Ampharete americana</i>												

<i>Glycera americana</i>					1							
<i>Syllides verrilli</i>					2					3		
<i>Lumbrinereis tenuis</i>												
<i>Clymenella torquata</i>												
<i>Odontosyllis fulgens</i>					1					1		
<i>Goniada maculata</i>					1			9	1	4		
<i>Polydora quadrilobata</i>												
<i>Goniadella gracilis</i>										5		
<i>Pholoe minuta</i>												
Parapionspio sp.			2									

Table A4-7. The average total number of individuals, the average total number of species and the average species diversity per station along Transects 1 through 5 in October 2008.

Station	# of Individuals		# of Species		Species Diversity	
	Average	STD (+/-1)	Average	STD (+/-1)	Average	STD (+/-1)
1A	366	31	25	5	2.16	0.05
1B	772	75	23	3	2.04	0.20
1C	546	82	21	4	1.71	0.16
1D	972	78	29	3	1.77	0.14
2A	1314	37	23	6	1.82	0.14
2B	935	430	22	2	1.77	0.21
2C	891	81	21	2	1.66	0.13
2D	556	55	18	3		0.15
2E	513	140	21	3	1.94	0.18
3A	636	162	27	3	2.17	0.34
3B	479	56	20	0	1.54	0.16
3C	570	167	17	5	1.51	0.21
3D	1237	159	20	3	1.55	0.08
3E	474	34	21	8	1.94	0.47
4A	425	20	18	4	1.54	0.14
4B	923	242	16	1	1.70	0.15
4C	1209	214	16	0	1.38	0.09
4D	551	177	14	3	1.60	0.12
4E	463	109	16	3	1.34	0.25
5A	832	156	17	4	1.58	0.08
5B	691	148	24	5	1.77	0.20
5C	612	76	18	3	1.69	0.09
5D	421	113	15	2	1.71	0.27

Table A4-8: The average total number of individuals and the average total number of species of the major taxa identified at each station along Transects 1 through 5 in October 2008. Due to the occurrence of only one species of oligochaete at Transect 5, the average total number of species was not calculated for this table.

Station	Mollusca				Nemertinea				Arthropoda				Polychaeta				Oligochaeta			
	# of Individuals		# of Species		# of Individuals		# of Species		# of Individuals		# of Species		# of Individuals		# of Species		# of Individuals		# of Species	
	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)
1A	10	3	5	1	1	2	1	1	6	3	2	1	245	36	17	3	103	10	1	0
1B	10	4	4	2	1	1	0	1	50	41	3	2	459	51	15	1	163	21	1	0
1C	10	3	4	1	0	1	0	1	5	4	1	1	407	78	14	3	124	7	1	0
1D	11	3	5	1	1	1	1	1	17	6	4	1	463	91	18	2	481	17	2	1
2A	64	17	4	1	2	3	1	1	20	11	2	1	982	35	15	5	245	41	1	1
2B	31	21	5	0	4	3	1	0	30	12	2	0	618	414	13	2	253	37	1	1
2C	30	13	5	0	0	1	0	1	10	12	1	1	536	87	14	2	314	101	1	1
2D	11	6	4	1	0	0	0	0	2	3	1	1	354	78	13	3	189	30	1	1
2E	22	7	5	1	0	0	1	0	7	3	2	0	390	109	13	3	93	50	1	1
3A	28	9	3	0	1	1	1	1	4	1	2	1	970	103	15	0	153	29	1	1
3B	53	17	6	1	0	0	0	0	6	3	2	1	352	53	12	1	107	23	1	1
3C	83	13	6	1	4	2	1	0	6	4	3	1	432	23	11	1	125	34	1	0
3D	34	24	4	3	1	1	0	1	11	2	3	1	293	52	10	1	291	39	1	1
3E	50	11	7	1	6	5	1	1	6	6	2	2	914	149	13	2	303	150	2	1
4A	5	5	2	2	0	0	0	0	5	7	2	2	328	164	11	5	245	109	1	1
4B	310	42	4	2	13	9	1	0	3	2	1	1	429	73	6	3	189	87	1	1
4C	36	10	4	1	2	3	1	1	3	3	2	2	692	73	6	1	243	74	1	0
4D	28	10	5	1	6	3	2	1	17	2	5	2	514	235	13	4	204	61	1	1
4E	54	14	7	1	0	1	0	1	19	5	4	2	387	50	11	4	187	50	1	0
5A	846	211	8	1	4	2	1	0	20	9	3	1	449	132	11	2	190	26	--	--
5B	44	11	9	2	6	7	1	1	26	5	4	1	320	72	12	1	71	11	--	--
5C	54	12	10	2	0	1	0	1	44	23	5	1	362	79	17	5	56	25	--	--
5D	70	9	7	2	1	1	0	1	15	1	4	1	467	140	18	3	39	17	--	--

Figure A4-9. Dendrogram showing the percent similarity of species composition and abundance of the quantitative benthic samples collected in the study site, October 2008.

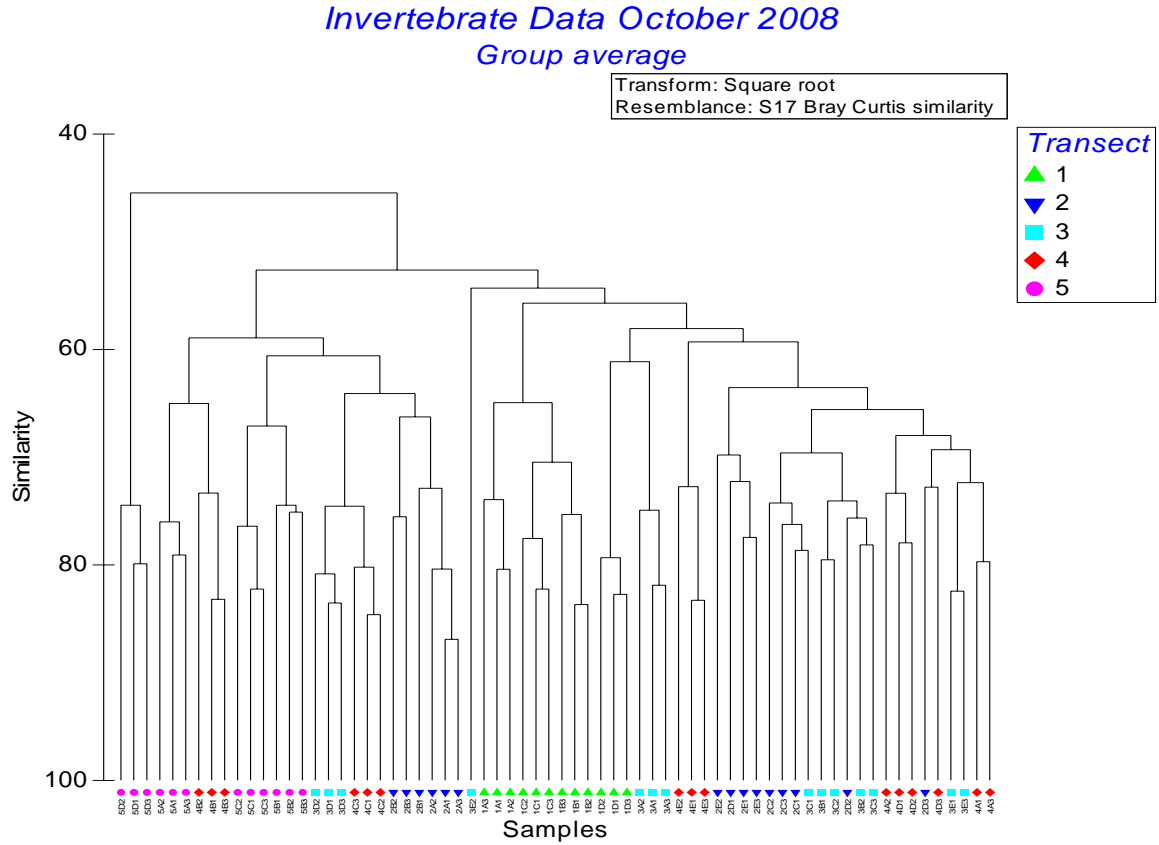


Figure A4-10. Non-metric multidimensional scaling ordination (nMDS) of quantitative benthic samples collected in October 2009 in the study area.

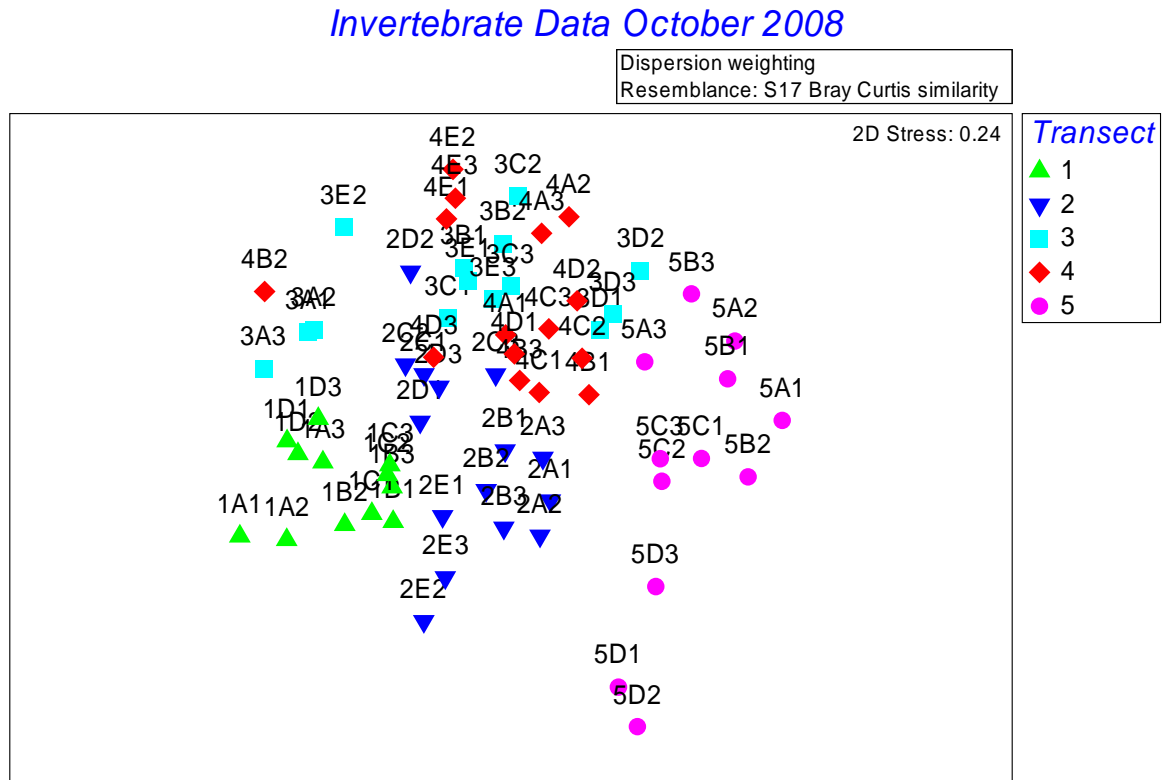


Table A4-11. Benthic taxa and their abundances per sample collected from benthic habitat sampling Transect 1, January 2009

Mollusca	1A1	1A2	1A3	1B1	1B2	1B3	1C1	1C2	1C3	1D1	1D2	1D3
<i>Crepidula plana</i>												
<i>Crepidula fornicata</i>												
<i>Nucula annulata</i>				2	1	7		2			2	
<i>Tellina agilis</i>				7	5	12	1		1			
<i>Yoldia limatula</i>												
<i>Retusa canaliculata</i>												
<i>Turbonilla elegantula</i>											2	1
<i>Nassarius trivittatus</i>											1	
<i>Illyanasa obsoleta</i>												
<i>Mercenaria mercenaria</i>												
<i>Petricola pholadiformis</i>												
<i>Retusa punctostriatus</i>												
Bivalve A (juv)												
<i>Crepidula convexa</i>												
<i>Anadara transversa</i>												
Gastropod A (juv)				4	4	1	4	1	1			
<i>Odostomia seminuda</i>												
<i>Pandora gouldiana</i>												
<i>Busycon</i> sp. (juv.)												
<i>Mullinea lateralis</i>								1				

Table A4-11 (cont.). Benthic taxa and their abundance per sample found at benthic habitat sampling Transect 1, January 2009

	1A1	1A2	1A3	1B1	1B2	1B3	1C1	1C2	1C3	1D1	1D2	1D3
Oligochaeta												
Oligochaete A	91	129	116	67	140	172	102	155	89	121	148	176
Oligochaete B					1		4				12	
Nemertinea												
Nemertea A								1				
Nemertea B		1						2				
Arthropoda												
<i>Ampelisca abdita</i>	5	11	5	32	52	41	40	41	12	5	10	
<i>Microdeutopus gryllotalpa</i>												
<i>Batea catharinensis</i>												
<i>Erichthoneis brasiliensis</i>												
<i>Elasmopus levis</i>												
<i>Corophium</i> spp.												
<i>Leucon americana</i>	4	17	8		2							
<i>Dyspanopeus sayi</i>												
<i>Panopeus herbstii</i>												
<i>Pagurus</i> sp.											4	
<i>Nemomysis americana</i>												
<i>Pagurus polycarus</i>												
<i>Caprella</i> spp.												
<i>Unicola irrorata</i>												
<i>Crangon septemspinosa</i>											2	

Table A4-11 (cont). Benthic taxa and their abundance per sample at benthic habitat sampling Transect 1, January 2009.

Polychaeta	1A1	1A2	1A3	1B1	1B2	1B3	1C1	1C2	1C3	1D1	1D2	1D3
<i>Eteone heteropoda</i>	3	18	6	10	14	2	1		1		1	
<i>Eteone longa</i>					4					1	11	5
<i>Tharyx acutus</i>	1	5	1	5	19	11	2		1	15	16	2
<i>Polydora cornuta</i>										22	10	3
<i>Nereis succinea</i>	4	20	7									
<i>Leitoscoloplos robustus</i>	171	137	52	116	71	87	37	55	89	41	62	111
<i>Leitoscoloplos</i> sp. (juv)		4		11								2
<i>Paranitus speciosa</i>					2		1					
<i>Pectinaria gouldii</i>		1										
<i>Eumida sanguinea</i>												
<i>Cossura longocirrata</i>	12	9	2	111	265	198	101	32	55	1	9	12
<i>Streblospio benedicti</i>		1	1	6	23	12	3		1	55	40	3
<i>Mediomastus ambiseta</i>	33	25	16	67	95	71	106	154	102	47	33	98
<i>Ajsychis elongata</i>					4	3	5	2				
<i>Nephtys incisa</i>												
<i>Capitella</i> spp.		1			1				1			
<i>Exogone dispar</i>					2				6			1
<i>Spiochaetopertus oculatus</i>												
<i>Polycirrus eximius</i>												
<i>Nereis</i> spp. (juv)												
<i>Aricidea catherinae</i>					1		2					
<i>Spiophanes bombyx</i>												
<i>Brania wellfleetensis</i>							1					
<i>Brania clavata</i>							1					
<i>Ampharete americana</i>												
<i>Glycera americana</i>												
<i>Syllides verrilli</i>		2	1	1	6	1	25	11	6			2
<i>Lumbrineris tenuis</i>												
<i>Clymenella torquata</i>												
<i>Odontosyllis fulgens</i>							1					
<i>Goniada maculata</i>			1			1	5	1				
<i>Polydora quadrilobata</i>												
<i>Goniadella gracilis</i>												
<i>Pholoe minuta</i>												

Table A4-11 (cont.). Benthic taxa and their abundances per sample collected from benthic habitat sampling Transect 2, January 2009.

Mollusca	2A1	2A2	2A3	2B1	2B2	2B3	2C1	2C2	2C3	2D1	2D2	2D3	2E1	2E2	2E3
<i>Crepidula plana</i>															
<i>Crepidula fornicata</i>								4		9		6	4		1
<i>Nucula annulata</i>		4	12	20	9	12	26	5	16	4		2	3		1
<i>Tellina aglis</i>		11		5			13	11	4	2			4		11
<i>Yoldia limatula</i>															
<i>Retusa canaliculata</i>		1		9	3	3	3		1		1		4	1	1
<i>Turbonilla elegantula</i>														1	
<i>Nassarius trivittatus</i>														1	
<i>Illyanasa obsoleta</i>													1		
<i>Mercenaria mercenaria</i>															
<i>Petricola pholadiformis</i>															
<i>Retusa punctostriatus</i>															
Bivalve A (juv)															
<i>Crepidula convexa</i>															
<i>Anadara transversa</i>															
Gastropod A (juv)		3	4								1		2		
<i>Odostomia seminuda</i>															
<i>Pandora gouldiana</i>															
<i>Busycon sp. (juv.)</i>															
<i>Mullinea lateralis</i>		2	9			2	13								
<i>Crassostrea virginica</i>												1			

Table A4-11 (cont.). Benthic taxa and their abundance per sample found at benthic habitat sampling Transect 2, January 2009.

	2A1	2A2	2A3	2B1	2B2	2B3	2C1	2C2	2C3	2D1	2D2	2D3	2E1	2E2	2E3
Oligochaeta															
Oligochaete A	55	134	72	146	98	211	261	344	210	220	96	142	120	134	81
Oligochaete B													2		
Nemertinea															
Nemertea A	3	5	2	5	2	1	2		1				4	1	4
Nemertea B															
Arthropoda															
<i>Ampelisca abdita</i>		15	7	10	1	5	29	10		4		11	7	1	
<i>Microdeutopus gryllotalpa</i>															
<i>Batea catharinensis</i>															
<i>Erichthoneis brasiliensis</i>															
<i>Elasmopus levis</i>															
<i>Corophium</i> spp.															
<i>Leucon americana</i>		1				1									1
<i>Dyspanopeus sayi</i>															
<i>Panopeus herbstii</i>		2								1				1	
<i>Pagurus</i> sp.															
<i>Nemomysis americana</i>															
<i>Pagurus polycarus</i>															
<i>Caprella</i> spp.															
<i>Unicola irrorata</i>		1													
<i>Crangon septemspinosa</i>															

Table A4-11 (cont). Benthic taxa and their abundance per sample at benthic habitat sampling Transect 2, January 2009

Polychaeta	2A1	2A2	2A3	2B1	2B2	2B3	2C1	2C2	2C3	2D1	2D2	2D3	2E1	2E2	2E3
<i>Eteone heteropoda</i>	1	7	1	23		4	8	15	11	21	5			1	
<i>Eteone longa</i>			4				2		1	3			4	1	1
<i>Tharyx acutus</i>															
<i>Polydora cornuta</i>															
<i>Nereis succinea</i>															
<i>Leitoscoloplos robustus</i>	12	83	33	160	122	106	97	55	123	20	5	12	51	22	101
<i>Leitoscoloplos</i> sp. (juv)															
<i>Paranitus speciosa</i>															
<i>Pectinaria gouldii</i>								1							
<i>Eumida sanguinea</i>														2	
<i>Cossura longocirrata</i>	201	255	225	267	309	113	497	378	306	23	3	12	18	45	22
<i>Streblospio benedicti</i>		9	2		3	1	4	1		33	17	10	83	99	56
<i>Mediomastus ambiseta</i>	333	219	87	73	44	122	178	255	65	280	128	214	139	198	56
<i>Ajsychis elongata</i>	12	22	10	5		2	1								
<i>Nephtys incisa</i>						6									2
<i>Capitella</i> spp.		1				1									1
<i>Exogone dispar</i>								6	2					2	
<i>Spiochaetopertus oculus</i>															
<i>Polycirrus eximius</i>															
<i>Nereis</i> spp. (juv)		2	1									3		2	
<i>Aricidea catherinae</i>												1	22	61	42
<i>Spiophanes bombyx</i>															
<i>Brania wellfleetensis</i>												1			
<i>Brania clavata</i>												1			
<i>Ampharete americana</i>												1			
<i>Glycera americana</i>												1			
<i>Syllides verrilli</i>														4	
<i>Lumbrineris tenuis</i>	9	16	3												
<i>Clymenella torquata</i>													2		
<i>Odontosyllis fulgens</i>														3	
<i>Goniada maculata</i>															
<i>Polydora quadrilobata</i>															
<i>Goniadella gracilis</i>		2													
<i>Pholoe minuta</i>															

Table A4-11 (cont). Benthic taxa and their abundances per sample collected from benthic habitat sampling Transect 3, January 2009.

Mollusca	3A1	3A2	3A3	3B1	3B2	3B3	3C1	3C2	3C3	3D1	3D2	3D3	3E1	3E2	3E3
<i>Crepidula plana</i>								3		5	3			1	
<i>Crepidula fornicata</i>	53	37	44	47	13	5		17	6	39	60	49	39	22	21
<i>Nucula annulata</i>						4	11	16	5				1	7	2
<i>Tellina agilis</i>		3				1	2	4	1	2	2	2	5	1	7
<i>Yoldia limatula</i>							3	1	1						
<i>Retusa canaliculata</i>								2			1				
<i>Turbonilla elegantula</i>								3	1						
<i>Nassarius trivittatus</i>								3	1						
<i>Illyanasa obsoleta</i>		2				1						4			
<i>Mercenaria mercenaria</i>															
<i>Petricola pholadiformis</i>	1							1							1
<i>Retusa punctostriatus</i>															
Bivalve A (juv)														1	
<i>Crepidula convexa</i>														1	
<i>Anadara transversa</i>															
Gastropod A (juv)		2										3			1
<i>Odostomia seminuda</i>															
<i>Pandora gouldiana</i>															
<i>Busycon sp. (juv.)</i>															
<i>Mullinea lateralis</i>											1				
<i>Crassostrea virginica</i>															

Table A4-11 (cont.). Benthic taxa and their abundance per sample found at benthic habitat sampling Transect 3, January 2009.

	3A1	3A2	3A3	3B1	3B2	3B3	3C1	3C2	3C3	3D1	3D2	3D3	3E1	3E2	3E3
Oligochaeta															
Oligochaete A	111	374	276	98	112	181	185	234	102	140	111	289	270	98	318
Oligochaete B		2			1					6		1			
Nemertinea															
Nemertea A						5	8		3						
Nemertea B														4	
Arthropoda		3							3		1				
<i>Ampelisca abdita</i>											1				4
<i>Microdeutopus gryllotalpa</i>															
<i>Batea catharinensis</i>															
<i>Erichthoneis brasiliensis</i>															
<i>Elasmopus levis</i>												4		7	
<i>Corophium</i> spp.															
<i>Leucon americana</i>														2	
<i>Dyspanopeus sayi</i>															
<i>Panopeus herbstii</i>												1			
<i>Pagurus</i> sp.															
<i>Nemomysis americana</i>															
<i>Pagurus polycarus</i>															
<i>Caprella</i> spp.		2													
<i>Unicola irrorata</i>															
<i>Pinixia</i> sp.										3	1			1	
<i>Crangon septemspinosa</i>															

Table A4-11 (cont). Benthic taxa and their abundance per sample at benthic habitat sampling Transect 3, January 2009.

Polychaeta	3A1	3A2	3A3	3B1	3B2	3B3	3C1	3C2	3C3	3D1	3D2	3D3	3E1	3E2	3E3
<i>Eteone heteropoda</i>	11	8	1	15	10	21				1	6	2	4		4
<i>Eteone longa</i>		1				1					1		1		1
<i>Tharyx acutus</i>	12	32	41	7	11	25	4		11				10	1	4
<i>Polydora cornuta</i>		1			1	5	2		1						
<i>Nereis succinea</i>						3						3			
<i>Leitoscoloplos robustus</i>	35	51	29	41	17	24	59	33	16	26	39	11	31	13	42
<i>Leitoscoloplos</i> sp. (juv)		11								1					1
<i>Paranitus speciosa</i>															
<i>Pectinaria gouldii</i>															
<i>Eumida sanguinea</i>						2									
<i>Cossura longocirrata</i>	7	12	11	22	11	12	263	334	199	6		11	87	111	53
<i>Streblospio benedicti</i>	1	6	4	19	27	46	3		1	14	8	22	23	31	7
<i>Mediomastus ambiseta</i>	76	132	111	99	114	152	162	143	97	94	71	66	248	333	175
<i>Ajsychis elongata</i>		4				1	12	6					6	1	2
<i>Nephtys incisa</i>							3							1	
<i>Capitella</i> spp.						1									
<i>Exogone dispar</i>														2	
<i>Spiochaetopterus oculatus</i>														1	
<i>Polycirrus eximius</i>		3				3									
<i>Nereis</i> spp. (juv)															
<i>Aricidea catherinae</i>														2	1
<i>Spiophanes bombyx</i>						1									
<i>Brania wellfleetensis</i>							1								
<i>Brania clavata</i>															
<i>Ampharete americana</i>															
<i>Glycera americana</i>		1												1	
<i>Syllides verrilli</i>		2				1				1					
<i>Lumbrinereis tenuis</i>															
<i>Clymenella torquata</i>															
<i>Odontosyllis fulgens</i>		4		1	1	5	4	1	2			1	1		2
<i>Goniada maculata</i>															
<i>Polydora quadrilobata</i>															
<i>Goniadella gracilis</i>						1									
<i>Pholoe minuta</i>															

Table A4-11 (cont). Benthic taxa and their abundances per sample collected from benthic habitat sampling Transect 4, January 2009.

Mollusca	4A1	4A2	4A3	4B1	4B2	4B3	4C1	4C2	4C3	4D1	4D2	4D3	4E1	4E2	4E3
<i>Crepidula plana</i>							8	1	5		1		1		3
<i>Crepidula fornicata</i>	8	49	17				40	19	6	45	10	35	29	24	73
<i>Nucula annulata</i>				27	11	41	20	17	44		12				1
<i>Tellina agilis</i>				4		1	5		1		4			1	
<i>Yoldia limatula</i>															
<i>Retusa canaliculata</i>				1				1							
<i>Turbonilla elegantula</i>															
<i>Nassarius trivittatus</i>											1			2	
<i>Ilyanasa obsoleta</i>						1					1				
<i>Mercenaria mercenaria</i>															
<i>Petricola pholadiformis</i>															
<i>Retusa punctostriatus</i>															
Bivalve A (juv)					2			1			1				
<i>Crepidula convexa</i>															
<i>Anadara transversa</i>															
Gastropod A (juv)					1										
<i>Odostomia seminuda</i>															
<i>Pandora gouldiana</i>															
<i>Busycon sp. (juv.)</i>															
<i>Mullinea lateralis</i>					13	22	4		7						
<i>Crassostrea virginica</i>										1	1				
<i>Mya arenaria</i>					2										

Table A4-11 (cont.). Benthic taxa and their abundance per sample found at benthic habitat sampling Transect 4, January 2009.

	4A1	4A2	4A3	4B1	4B2	4B3	4C1	4C2	4C3	4D1	4D2	4D3	4E1	4E2	4E3
Oligochaeta															
Oligochaete A	153	111	265	393	226	300	213	198	56	224	273	156	273	185	190
Oligochaete B															
Nemertinea															
Nemertea A		2		21	5	11					5	4		4	1
Nemertea B								8							
Arthropoda															
<i>Ampelisca abdita</i>				13	1	8					1				
<i>Microdeutopus gryllotalpa</i>															
<i>Batea catharinensis</i>															
<i>Erichthoneis brasiliensis</i>															
<i>Elasmopus levis</i>						2									
<i>Corophium</i> spp.						1								2	
<i>Leucon americana</i>				6	1	1					1				
<i>Dyspanopeus sayi</i>															
<i>Panopeus herbstii</i>	3		1			1					1			2	
<i>Pagurus</i> sp.															
<i>Nemomysis americana</i>															
<i>Pagurus polycarus</i>															
<i>Caprella</i> spp.															
<i>Unicola irrorata</i>															
<i>Crangon septemspinosa</i>					1										

Table A4-11 (cont). Benthic taxa and their abundance per sample at benthic habitat sampling Transect 4, January 2009.

Polychaeta	4A1	4A2	4A3	4B1	4B2	4B3	4C1	4C2	4C3	4D1	4D2	4D3	4E1	4E2	4E3
<i>Eteone heteropoda</i>	5		4					9	2				19	2	12
<i>Eteone longa</i>					5			1			4		1		
<i>Tharyx acutus</i>		7	2	2		1		1					4		1
<i>Polydora cornuta</i>		1	4	2	2			2	1		3	1	4	1	2
<i>Nereis succinea</i>				1	1	1								2	
<i>Leitoscoloplos robustus</i>	37	8	17	59	24	11	26	121	89	11	29	9	19	4	6
<i>Leitoscoloplos</i> sp. (juv)				2				11	1						
<i>Paranitus speciosa</i>								1							
<i>Pectinaria gouldii</i>					3										
<i>Eumida sanguinea</i>									1						
<i>Cossura longocirrata</i>	22	107	65	229	516	461	128	251	333	69	120	76	4		12
<i>Streblospio benedicti</i>	16	33	51	3	15	7		4	1	1	8	5	29	8	11
<i>Mediomastus ambiseta</i>	221	107	46	99	173	125	111	128	87	99	181	154	169	113	150
<i>Aysychnis elongata</i>					3			2			2				
<i>Nephtys incisa</i>															
<i>Capitella</i> spp.															
<i>Exogone dispar</i>															
<i>Spiochaetopertus oculatus</i>															
<i>Polycirrus eximius</i>															
<i>Nereis</i> spp. (juv)														1	
<i>Aricidea catherinae</i>															
<i>Spiophanes bombyx</i>					2										
<i>Brania wellfleetensis</i>															
<i>Brania clavata</i>											1				
<i>Ampharete americana</i>															
<i>Glycera americana</i>															
<i>Syllides verrilli</i>															
<i>Lumbrineris tenuis</i>															
<i>Cllymenella torquata</i>															
<i>Odontosyllis fulgens</i>															
<i>Goniada maculata</i>		2					1								1
<i>Polydora quadrilobata</i>									1						
<i>Goniadella gracilis</i>							1								
<i>Pholoe minuta</i>		1													

Table A4-11 (cont.). Benthic taxa and their abundances per sample collected from benthic habitat sampling Transect 5, January 2009.

Mollusca	5A1	5A2	5A3	5B1	5B2	5B3	5C1	5C2	5C3	5D1	5D2	5D3
<i>Crepidula plana</i>												
<i>Crepidula fornicata</i>					12	53	4					
<i>Nucula annulata</i>	557	611	328		2			5				
<i>Tellina aglis</i>	8		5		6	1	14	1		3	11	26
<i>Yoldia limatula</i>												
<i>Retusa canaliculata</i>	1	9	3		3		2					
<i>Turbonilla elegantula</i>	3		1				19	5	1			
<i>Nassarius trivittatus</i>							1					1
<i>Illyanasa obsoleta</i>												
<i>Mercenaria mercenaria</i>					1							
<i>Petricola pholadiformis</i>												1
<i>Retusa punctostriatus</i>												
Bivalve A (juv)	33	4	18		2							
<i>Crepidula convexa</i>												
<i>Anadara transversa</i>												
Gastropod A (juv)					3	1						
<i>Odostomia seminuda</i>												
<i>Pandora gouldiana</i>												
<i>Busycon sp. (juv.)</i>												
<i>Mullinea lateralis</i>					9	1						
<i>Crassostrea virginica</i>												
<i>Ensis directus</i>												

Table A4-11 (cont.). Benthic taxa and their abundance per sample found at benthic habitat sampling Transect 5, January 2009

	5A1	5A2	5A3	5B1	5B2	5B3	5C1	5C2	5C3	5D1	5D2	5D3
Oligochaeta												
Oligochaete A	208	77	151	103	179	57	81	21	55	116	200	162
Oligochaete B												
Nemertinea												
Nemertea A	21	4	11		2			4				2
Nemertea B												
Arthropoda												
<i>Ampelisca abdita</i>		1			1				3			
<i>Microdeutopus gryllotalpa</i>	1											
<i>Batea catharinensis</i>					1							
<i>Erichthoneis brasiliensis</i>					1							
<i>Elasmopus levis</i>												
<i>Corophium</i> spp.												
<i>Leucon americana</i>												
<i>Dyspanopeus sayi</i>												
<i>Panopeus herbstii</i>								1				
<i>Pagurus</i> sp.					2							
<i>Nemomysis americana</i>												
<i>Pagurus polycarus</i>												
<i>Caprella</i> spp.		1										
<i>Unicola irrorata</i>												
<i>Crangon septemspinosa</i>												

Table A4-11 (cont). Benthic taxa and their abundance per sample at benthic habitat sampling Transect 5, January 2009.

Polychaeta	5A1	5A2	5A3	5B1	5B2	5B3	5C1	5C2	5C3	5D1	5D2	5D3
<i>Eteone heteropoda</i>	5	1	1									
<i>Eteone longa</i>						1						
<i>Tharyx acutus</i>		6	1		4			5				3
<i>Polydora cornuta</i>	11	2	5					1				
<i>Nereis succinea</i>												
<i>Leitoscoloplos</i> sp.	53	39	22	15	11	2	21	33	11	21	3	19
<i>Paranitus speciosa</i>												
<i>Pectinaria gouldii</i>		2										
<i>Eumida sanguinea</i>					1						1	1
<i>Cossura longocirrata</i>	226	435	389	32	107	99	10	1	3		1	
<i>Streblospio benedicti</i>			2		6	2		2		19	34	52
<i>Mediomastus ambiseta</i>	54	53	12	74	155	100	34	116	56	7	1	17
<i>Ajsychis elongata</i>	1	8	4		8	8						
<i>Nephtys incisa</i>	1	5	1		5	2	2	2	1			
<i>Capitella</i> spp.		1										
<i>Exogone dispar</i>			1									
<i>Spiochaetopterus oculatus</i>		1			1							
<i>Polycirrus eximius</i>												2
<i>Nereis</i> spp. (juv)												
<i>Aricidea catherinae</i>		4	1									
<i>Spiophanes bombyx</i>					7	1	2				1	
<i>Brania wellfleetensis</i>												
<i>Brania clavata</i>		1	1									
<i>Ampharete americana</i>												
<i>Glycera americana</i>												
<i>Syllides verrilli</i>												
<i>Lumbrinereis tenuis</i>												
<i>Clymenella torquata</i>												
<i>Odontosyllis fulgens</i>			1									
<i>Goniada maculata</i>		1			4	6					7	
<i>Polydora quadrilobata</i>								1				
<i>Goniadella gracilis</i>												
<i>Pholoe minuta</i>			1					3				
<i>Parapionospio</i> sp.												

Table A4-12: The average total number of individuals, the average total number of species and the average species diversity per station along Transects 1 through 5 in January 2009.

Station	# of Individuals		# of Species		Species Diversity	
	Average	STD (+/-1)	Average	STD (+/-1)	Average	STD (+/-1)
1A	307	84	12	3	1.48	0.23
1B	590	139	16	4	1.86	0.08
1C	422	51	15	4	1.74	0.19
1D	362	54	12	4	1.67	0.28
2A	631	162	15	7	1.54	0.34
2B	635	77	12	3	1.54	0.20
2C	986	215	12	2	1.50	0.07
2D	431	182	12	4	1.29	0.14
2E	477	100	17	2	1.87	0.08
3A	471	197	12	7	1.46	0.25
3B	389	97	14	7	1.77	0.11
3C	658	184	16	1	1.54	0.06
3D	369	88	13	2	1.52	0.14
3E	671	47	18	5	1.54	0.04
4A	456	23	10	2	1.49	0.21
4B	951	78	17	3	1.45	0.08
4C	656	111	15	4	1.63	0.12
4D	517	124	12	8	1.44	0.14
4E	466	104	13	2	1.42	0.17
5A	1125	171	19	3	1.43	0.06
5B	361	145	14	9	1.56	0.18
5C	173	38	11	4	1.47	0.28
5D	237	63	8	3	1.06	0.28

Table A4-13: The average total number of individuals and the average total number of species of the major taxa identified at each station along Transects 1 through 5 in January 2009.

Station	Mollusca				Nemertinea				Arthropoda				Polychaeta				Oligochaeta			
	# of Individuals		# of Species		# of Individuals		# of Species		# of Individuals		# of Species		# of Individuals		# of Species		# of Individuals		# of Species	
	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)	Avg	STD (+/-1)
1A	0	0	0	0	0	1	0	1	17	10	2	0	178	79	9	3	112	19	1	0
1B	14	5	3	0	0	0	0	0	42	11	1	1	407	92	10	3	127	54	1	1
1C	4	2	2	2	1	2	1	2	31	16	1	0	269	19	10	4	117	34	1	1
1D	2	3	1	2	0	0	0	0	7	8	1	2	201	33	8	2	152	28	1	1
2A	15	13	3	3	5	4	1	0	69	67	2	2	520	131	8	2	21	30	1	0
2B	21	12	3	1	1	1	1	0	9	10	1	1	462	92	6	2	0	0	1	0
2C	32	20	3	1	4	8	1	1	6	5	2	1	680	158	7	1	0	0	1	0
2D	9	7	3	1	0	0	0	0	13	15	1	1	267	114	7	3	0	1	1	0
2E	12	8	4	2	0	0	1	0	5	6	1	1	308	64	9	3	1	1	1	1
3A	47	6	2	1	0	0	0	0	3	3	1	1	169	89	8	4	254	133	1	0
3B	24	20	2	2	2	3	0	1	0	0	0	0	233	61	11	5	131	44	1	1
3C	27	20	6	3	4	4	1	1	1	2	0	1	453	108	8	3	174	67	1	0
3D	57	11	4	1	0	0	0	0	3	2	2	1	128	13	6	1	181	96	2	1
3E	39	8	5	2	2	3	0	1	5	7	1	2	454	61	10	1	184	122	1	--
4A	25	22	1	0	1	1	0	1	1	2	0	1	253	58	7	2	176	80	1	--
4B	42	20	4	1	9	11	1	0	12	8	3	2	582	175	8	2	306	84	1	--
4C	60	19	5	0	3	5	0	1	0	0	0	0	438	148	8	3	156	87	1	--
4D	37	8	4	4	3	3	1	1	1	2	1	2	258	85	6	2	218	59	1	--
4E	56	47	3	1	2	2	1	1	1	2	1	1	192	59	8	1	216	49	1	--
5A	516	158	4	1	12	9	1	0	1	1	1	1	451	104	12	4	145	66	1	--
5B	31	21	4	3	1	1	0	1	2	3	1	2	214	94	7	4	113	62	1	--
5C	17	20	3	2	1	2	0	1	1	2	1	1	101	54	6	3	52	30	1	--
5D	14	13	2	1	1	1	0	1	0	0	0	0	63	27	5	2	159	42	1	--

Figure A4-14. Dendrogram showing the percent similarity of species composition and abundance of the quantitative benthic samples collected in the study site, January 2009.

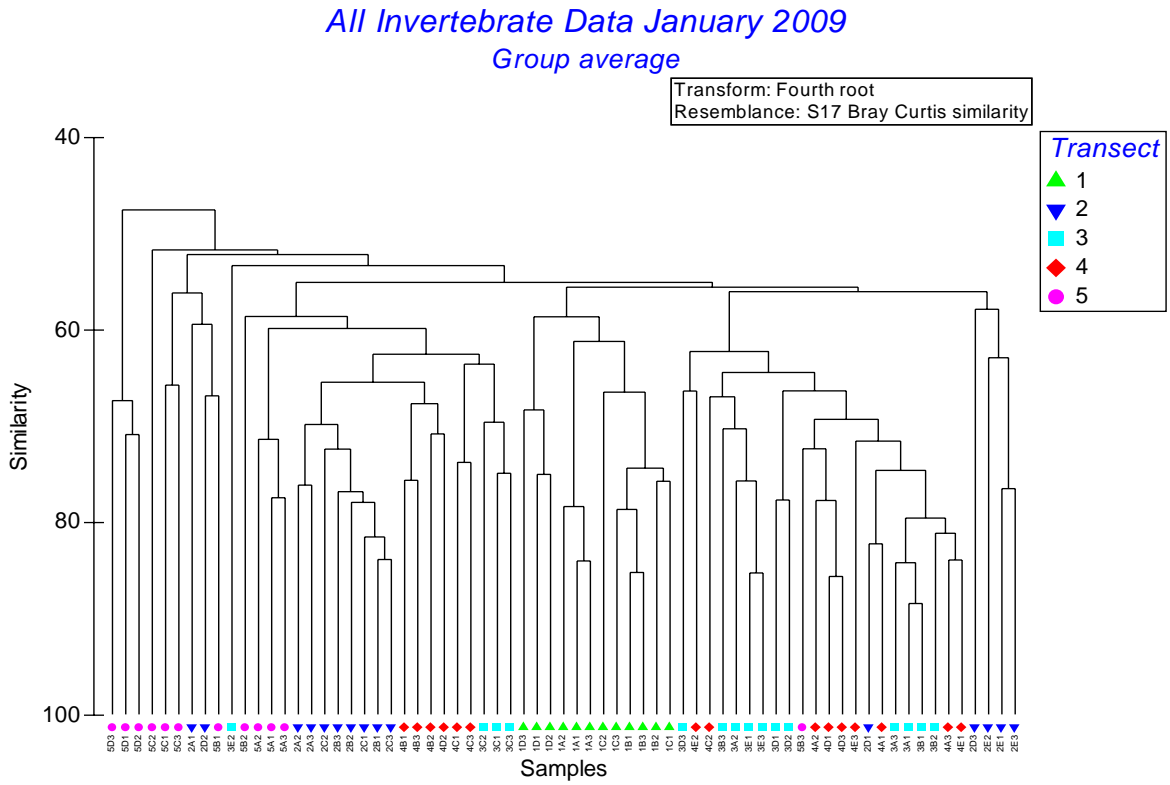


Figure A4-15. Non-metric multidimensional scaling ordination (nMDS) of quantitative benthic samples collected in January 2009 in the study area.

