8-Offshore Borrow Area Benthos

Introduction

Mining of borrow areas for sand to be used as beach fill may have deleterious effects on the abundance and standing crop of resident infaunal assemblages. These effects may, in turn, may affect commercially and ecologically important finfish species which utilize these assemblages as forage. In this chapter the infaunal assemblages of the three borrow areas are described, impacts related to dredging identified, and the rates of assemblage recovery estimated.

Previous studies of sand borrowing operations describe sites where a bathymetric depression is generated in the seascape, i.e. a borrow pit. The depression may arise from excavation of a previously flat area or by deepening of an existing pit. Infauna display two different responses to the dredging of such pits; rapid recovery (~1 year) or development of a depauperate, soft-bottom assemblage. The first response, rapid recovery, seems to occur at new borrow areas (e.g., Saloman et al. 1982, Scott and Kelley, 1998) where the pits are relatively shallow or where sand movement acts to refill the pit. Wilber and Stern (1992) have challenged these results after re-analysis of much of the data from Florida-based studies. They point out that while diversity and abundance recover quickly, the functional structure of the assemblages can take longer to recover. Specifically, large, deeper-burrowing infauna can require as much as 3 years to reach pre-disturbance abundance. The second response, development of a depauperate soft-sediment community occurs in older, presumably deeper pits. If there is little sand movement, the pit can become a depositional area for fine sediments, which in turn, support a community that is qualitatively different from the surrounding undisturbed sands. If water movement within the bathymetric depression is sufficiently restricted, poor water quality conditions may develop, causing periodic deterioration in the benthic community.

Borrow areas utilized in the present dredging operation differ fundamentally from those of previous studies in that they are bathymetric peaks on the seascape rather than depressions or level sea bottom. Since all are in areas of strong currents and sand movement, it is assumed that any depression resulting from sand borrowing will be ephemeral and water quality will remain unaltered. Under these conditions recovery of the infaunal assemblages should be rapid, although the absolute recovery time is uncertain.

In previous reports, baseline conditions (USACE, 1998) and post-dredging impacts for the first dredging operation (USACE, 1999) at the three Belmar Borrow Areas have been described. In this chapter, these data and information from the second dredging operation are analyzed and compared to determine what impacts occurred and how long these impacts persisted.

Methods

Monitoring Plan and Overall Execution: The sampling plan called for 60 samples with standard Smith-McIntyre grab distributed as follows: 3 borrow areas x 20

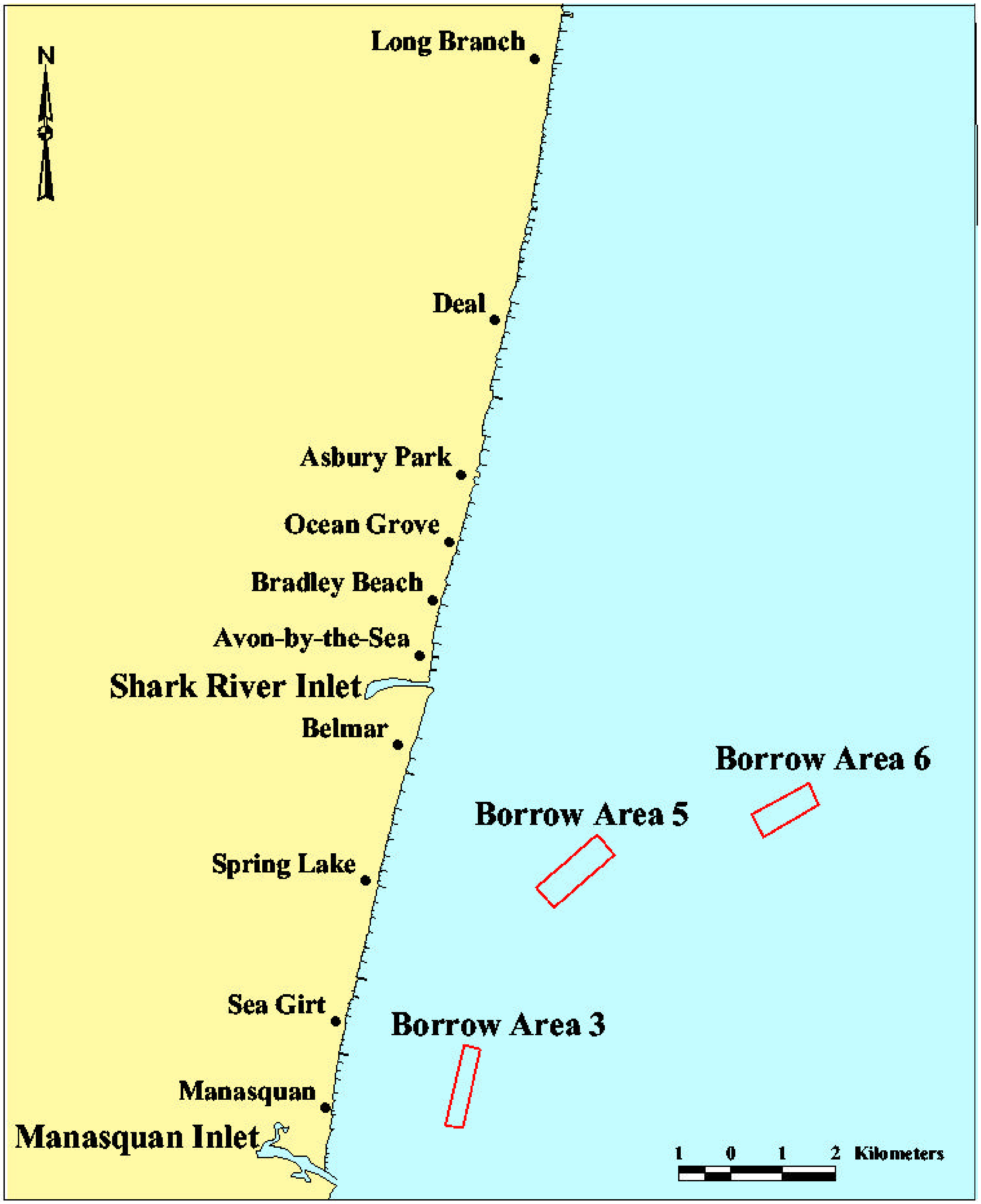

Figure 8-1. Locations of Belmar Borrow Areas.

Table 8-1. Summary Biological Results for Borrow Area Infauna

Data / Area	BBA3 Dredged	BBA3 Undredged	BBA3 Total	BBA5	BBA6	Total
Total Taxa	244	242	294	272	287	391
Total Animals	82,738	33,692	116,430	53,417	95,875	265,722
Total Biomass (g)	1546.667	2306.307	3852.974	1625.492	5041.612	10520.078
Taxa/0.1m2	27.2	28.5	27.9	22.8	27.0	25.9
Abundance/m2	7050	3062	5056	2226	3994	3759
Biomass g/m2	128.889	192.192	160.541	67.729	210.067	146.112
Annelid g/m2	7.442	4.258	5.850	3.072	5.350	4.757
Crustacea g/m2	1.670	2.094	1.882	1.712	1.103	1.566
Mollusc g/m2	7.669	6.060	6.865	4.657	13.985	8.502
Echinoderm g/m2	111.476	179.081	145.278	57.735	187.640	130.218
Misc. g/m2	0.631	0.700	0.666	0.597	2.111	1.124
% Annelid Biomass	5.77	2.22	3.99	4.53	2.55	3.25
% Crustacean Biomass	1.30	1.09	1.19	2.53	0.52	1.07
% Mollusc Biomass	5.95	3.15	4.55	6.87	6.65	5.82
% Echinoderm Biomass	86.49	93.18	89.83	85.19	89.27	89.09
% Misc. Biomass	0.49	0.36	0.43	0.88	1.00	0.77

Appendix Table 8-1. Offshore Borrow Area Station Locations

BBA3				BBA5			BBA6		
Station	Subsite in BBA3	Longitude	Latitude	Station	Longitude	Latitude	Station	Longitude	Latitude
1	Undredged	-74.0049	40.1111	21	-73.9829	40.1529	41	-73.9343	40.1626
2	Undredged	-74.0046	40.1122	22	-73.9817	40.1534	42	-73.9353	40.1637
3	Undredged	-74.0042	40.1144	23	-73.9806	40.1547	43	-73.9327	40.1640
4	Undredged	-74.0038	40.1156	24	-73.9789	40.1553	44	-73.9309	40.1645
5	Undredged	-74.0034	40.1170	25	-73.9784	40.1560	45	-73.9300	40.1657
6	Dredged	-74.0032	40.1179	26	-73.9764	40.1560	46	-73.9287	40.1573
7	Dredged	-74.0031	40.1193	27	-73.9747	40.1570	47	-73.9274	40.1659
8	Dredged	-74.0025	40.1215	28	-73.9731	40.1578	48	-73.9265	40.1669
9	Dredged	-74.0018	40.1226	29	-73.9715	40.1584	49	-73.9250	40.1671
10	Dredged	-74.0017	40.1238	30	-73.4705	40.1594	50	-73.9234	40.1682
11	Undredged	-74.0035	40.1107	31	-73.9820	40.1500	51	-73.9341	40.1611
12	Undredged	-74.0033	40.1122	32	-73.9797	40.1519	52	-73.9319	40.1610
13	Undredged	-74.0025	40.1137	33	-73.9793	40.1528	53	-73.9316	40.1618
14	Undredged	-74.0025	40.1152	34	-73.9779	40.1532	54	-73.9299	40.1637
15	Undredged	-74.0022	40.1165	35	-73.9760	40.1540	55	-73.9284	40.1635
16	Dredged	-74.0009	40.1181	36	-73.9741	40.1547	56	-73.9287	40.1628
17	Dredged	-74.0008	40.1192	37	-73.9729	40.1539	57	-73.9264	40.1652
18	Dredged	-74.0008	40.1207	38	-73.9716	40.1555	58	-73.9258	40.1656
19	Dredged	-74.0002	40.1218	39	-73.9698	40.1571	59	-73.9240	40.1661
20	Dredged	-74.9997	40.1230	40	-73.9690	40.1568	60	-73.9233	40.1668

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Acanthohaustorius (LPIL)			20		50			20	20			
Acanthohaustorius millsi			78	170	74	93	209	30	78	63	104	30
Acanthohaustorius shoemakeri	10	10										
Acanthohaustorius similis	159	50										
Actiniaria (LPIL)				10	10	10			28	20	32	30
Aedicira (LPIL)												
Aeginellidae (LPIL)											10	
Aeginina longicornis												
Aglaophamus circinata						15				23		
Aleutha depressa												
Amastigos caperatus												
Americamysis bigelowi					18							
Americhelidium americanum						40						
Ameroculodes edwardsi						20				10		
Ampelisca abdita												10
Ampharete (LPIL)												
Ampharete americana				20		23		10	30			
Ampharete finmarchica	10	10									20	
Ampharetidae (LPIL)				10		40	16	14	175	46	60	33
Amphipoda (LPIL)	10		10			10						
Anadara transversa							10					
Ancistrosyllis hartmanae												
Anonyx liljeborgi												
Anthozoa (LPIL)	60											
Aoridae (LPIL)			40									
Arabellidae (LPIL)												
Archiannelida (LPIL)	405	288										
Aricidea (LPIL)	10	10	24	30	58	17	13	105	20	10	30	25
Aricidea catherinae	27	19	59	42	10	20		10		40	55	29
Aricidea cerrutii		42		10				220				
Aricidea wassi	27	12	13	20	22	18	23	10	10	10	20	

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Armadillidae (LPIL)						20						
Armandia intermedia												
Asabellides oculata	10	12						13	147	53	349	50
Ascidiacea (LPIL)		94								243	20	95
Astarte castanea	10	13	10	30		15		10	10	10	10	
Asterias forbesi									10		10	
Asteroidea (LPIL)							10		15			
Autolytus prolifera												
Bathyporeia parkeri												
Bathyporeia quoddyensis												
Bivalvia (LPIL)	14	30				63	50	40	10	30	10	80
Bodotriidae (LPIL)												
Branchiostoma (LPIL)					10							
Brania wellfleetensis			10									
Calyptraeidae (LPIL)												
Cancer irroratus	15		10						18		10	
Capitella (LPIL)												10
Capitella capitata	13									70		
Capitella jonesi										15		
Capitellidae (LPIL)						10	10	10	27	10		10
Caprella penantis	10										10	
Caprellidae (LPIL)												
Caridea (LPIL)												
Caulleriella (LPIL)												
Caulleriella killariensis	32	27	183	99	45	47	40	28	47	33	40	94
Caulleriella sp. E				10								
Caulleriella sp. K												
Cerastoderma pinnulatum												
Ceriantheopsis americanus												
Chaetopteridae (LPIL)												
Chaetozone (LPIL)												

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Chaetozone setosa												
Chaetozone sp. J												
Chione cancellata												
Chiridotea tuftsi	48	22	40	17	40	24	23	27	43	18	20	
Chordata (LPIL)												
Cirolanidae (LPIL)												
Cirratulidae (LPIL)	10	27	44	58	86	310		101	181	81	1027	30
Cirrophorus (LPIL)			30	70	30	140		30		10	40	20
Cirrophorus armatus												
Cirrophorus furcatus		15										
Cirrophorus ilvana				100		65						
Cirrophorus lyra												10
Cladocera (LPIL)												
Cnidaria (LPIL)												
Corophium (LPIL)												10
Corophium insidiosum												
Cossura cf. laeviseta												
Crangon septemspinosa	10	10			10				20			
Crenella decussata												
Crepidula (LPIL)							30					
Crepidula fornicata											10	
Crepidula plana	10					10	90		160	10		
Crustacea (LPIL)							10					
Cumacea (LPIL)			10									10
Decapoda (LPIL)	10											
Decapoda Natantia (LPIL)			20		10							
Decapoda Reptantia (LPIL)												
Dentalium (LPIL)							10					
Diastylidae (LPIL)			10			10			10	10		
Diastylis (LPIL)							10					
Diastylis polita								101	23	85	10	

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Diastylis quadrispinosa												
Diastylis sculpta	10											
Diopatra cuprea								10			60	
Dipolydora (LPIL)							10					
Dipolydora socialis	10						30				10	
Dispio uncinata			30		10	20			10	10		
Dissodactylus mellitae												10
Donax variabilis								20				10
Dorvilleidae (LPIL)									10			
Drilonereis longa												
Dyopedos monacanthus												
Echinarachnius parma	28	29	59	32	18	36	28	25	40	578	481	767
Echinodea (LPIL)				13		10	40		10		10	
Echinodermata (LPIL)												40
Edotia triloba	20	38	25	10	10	33	20	61	136	49	26	35
Enchytraeidae (LPIL)												630
Ensis directus	10	10						20	10	20	10	
Enteropneusta (LPIL)												
Epitonium (LPIL)										10		
Euclymene sp. D												
Euclymene zonalis												
Eumida sanguinea												
Eusarsiella zostericola												
Euspira heros	15	10						15	10		20	17
Euspira triseriata												
Exogene (LPIL)						13						
Exogene dispar			10									
Exogene hebes			20		10					10		
Exogene rolani												
Flabelligeridae (LPIL)												
Gammaridae (LPIL)					50							

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged
Taxa Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Gammarus (LPIL)			10		35							
Gammarus annulatus					15							
Gastropoda (LPIL)				10	13	10				10		
Gemma gemma												
Glycera (LPIL)	10	10			50				15	40	23	275
Glycera americana	10									40	20	150
Glycera capitata												
Glycera dibranchiata									10	15	72	20
Glycera robusta												
Glyceridae (LPIL)			400	20		10		10		20	10	
Glycinde solitaria						20						
Goniada teres			450	130						10		10
Goniadella gracilis		53				450		20	20		1110	480
Goniadidae (LPIL)				10	620						220	20
Goniadides carolinae												
Haminoea solitaria												
Harmothoe (LPIL)											10	
Harmothoe extenuata												
Harmothoe imbricata			10						10	10		
Harpacticoida (LPIL)												
Haustoriidae (LPIL)	19	23	40	13	50		10		33	10		10
Haustorius (LPIL)												
Hemipodus roseus			10	140		65		10				
Hesionidae (LPIL)	10											
Hesionura coineaui												
Hesionura elongata												
Heteromastus filiformis						10						
Hippomedon serratus		10							10			
Holothuroidea (LPIL)												
Hydracarina (LPIL)												
Hydrozoa (LPIL)												

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged
Taxa Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Hypereteone heteropoda											10	
Idoteidae (LPIL)												
Ilyanassa (LPIL)												
Ilyanassa obsoleta							10					10
Ilyanassa trivittata	10	10		10	30	10		10	12	10	23	10
Ischyroceridae (LPIL)												
Ischyrocerus anguipes												
Isopoda (LPIL)												
Leitoscoloplos (LPIL)	10						20	17	53	10	10	17
Leitoscoloplos robustus								33		12	23	10
Lepidonotus sublevis												
Leptochelia rapax												
Leucon americanus							10					
Levinsenia gracilis	10											10
Libinia (LPIL)												
Libinia emarginata												
Lineidae (LPIL)												20
Listriella barnardi												
Lumbrineridae (LPIL)	10	10		13			10	10			10	
Lumbrinerides acuta		27	120	50	10	15			10			
Lyonsia hyalina hyalina		10								20		
Lysianassidae (LPIL)									10			10
Macoma (LPIL)												
Macoma yoldiformis				10								
Mactridae (LPIL)					100							
Magelona (LPIL)	15	15	15		18	10	15			10		
Magelona papillicornis	63	40	292	149	99	81	30	13	31	24	10	10
Magelona pettiboneae												
Magelona rosea										10		
Majidae (LPIL)					10						13	
Maldanidae (LPIL)			13		10	40					10	

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged
Taxa Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Maldanidae Genus A (LPIL)												
Mediomastus (LPIL)				10							10	
Mediomastus ambiseta										10		
Melitidae (LPIL)												
Mercenaria mercenaria												
Microdeuptopus gryllotalpa												
Microphthalmus (LPIL)												
Microphthalmus hartmanae												
Microphthalmus sczelkowii				10								
Molgula (LPIL)												
Mollusca (LPIL)												
Molpadiidae (LPIL)												
Monoculodes sp. I				10								
Montacutidae (LPIL)												
Monticellina dorsobranchialis		17		30								45
Mulinia lateralis						10						
Mya arenaria												
Mysella planulata		10								10		
Mysidacea (LPIL)												
Mysidae (LPIL)					30	10						
Mytilidae (LPIL)										10		
Mytilis edulis				40						10		10
Nassariidae (LPIL)									10			
Natica pusilla		10										
Naticidae (LPIL)												10
Nematoda (LPIL)	10	23										
Neomysis americana					10							
Nephtys (LPIL)							10					10
Nephtys bucera	14	13	17	10	10	25	15	14	10	25	15	15
Nephtys incisa												
Nephtys picta	13	10	20	40			17	26	78	50	57	23

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged
Taxa Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Nephtys simoni												
Nepthytidae (LPIL)	34	10	10		68	15	33	60	40	23	23	116
Nereidae (LPIL)					20							
Nereididae (LPIL)												
Nereis (LPIL)												
Nereis pelagica												
Nereis succinea							10					
Neverita duplicata				10	10							
Notomastus (LPIL)					10						10	
Notomastus hemipodus												
Notomastus latericeus												
Nucula (LPIL)	10											
Nucula proxima	35	10	20	20	25	30	15	30	37	56	28	15
Nuculana (LPIL)												
Obelia dichotoma												
Odostomia (LPIL)												
Odostomia dealbata												
Odostomia gibbosa												
Oedicerotidae (LPIL)	10	10				10						10
Oenonidae (LPIL)												
Oligochaeta (LPIL)	13	33	73	100	123	70	10	90	20	25		
Olividae (LPIL)												
Onuphidae (LPIL)					10		20		30		23	
Onuphis eremita							10	10	45		20	10
Ophelia denticulata	10	10				10			20			
Opheliidae (LPIL)	10	10										
Ophiuroidea (LPIL)												23
Ophryotrocha (LPIL)												
Orbinia (LPIL)	10	10										
Orbinia americana												
Orbinia swani	10	10										

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Orbiniidae (LPIL)	10		10				10	15		10		
Ostracoda (LPIL)	20	10	17		30		20		57	10		
Ovalipes (LPIL)												
Ovalipes ocellatus							10				18	
Owenia fusiformis												
Oxyurostylis smithi			15			10	14		10		10	16
Paguridae (LPIL)			10			55	15					
Pagurus (LPIL)			20		10		15			20	10	10
Pagurus politus	47				15		10		20	20	10	
Pagurus pollicaris										10		
Pandora (LPIL)										20		
Pandora glacialis												
Pandora gouldiana								30			10	10
Pandora inflata		10										
Pandoridae (LPIL)												10
Paracaprella tenuis												
Parahaustorius attenuatus			20		10	10	30		10	60	20	10
Parahaustorius longimerus												
Parametopella cypris												
Paranaitis speciosa	10	20				20		23		10		10
Parandalia ocularis												
Paraonidae (LPIL)	10		10			10	13	30		10		15
Paraonis (LPIL)												
Paraonis fulgens												
Paraonis pygoenigmatica		10	10									
Parapionosyllis longicirrata			70		0	10		10		20		
Parapionosyllis sp. D						10						
Parougia caeca		10								50	30	
Pectinaria gouldii												
Pelecypoda (LPIL)			10	13	50							
Pellucistoma (LPIL)											25	

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Periploma (LPIL)												
Periploma leanum		10			10							
Petricola pholadiformis											10	
Pherusa affinis	10								15			
Pherusa plumosa											10	
Phoronida (LPIL)												
Phoronis architecta										10		
Photis (LPIL)										10		
Photis macrocoxa										15		
Photis pollex												
Phoxocephalidae (LPIL)			15	10	40	10	30					
Phyllodoce (LPIL)									30		10	
Phyllodoce arenae									25			
Phyllodoce mucosa												
Phyllodocidae (LPIL)							10					
Pisione remota												
Pitar (LPIL)										30		
Pitar morrhuanus		10								10		
Platysquilla enodis											10	
Pleurobranchaea tarda												
Podocopida (LPIL)												38
Politolana polita	16	18	15	15	27	42	10	10	15	94	17	10
Polydora (LPIL)									10			
Polydora caulleryi												
Polydora cornuta												
Polygordius (LPIL)			1919	593	2552	3881		1020	1254	4507	7552	27911
Polynicinae												
Polynoidae (LPIL)			10				10		10	10		
Prionospio steenstrupi												
Proboloides holmesi	10											
Proceraea cornuta												

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged
Taxa Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Protodorvillea kefersteini			20						10			
Protohaustorius (LPIL)			78	20	43	10	20		18			
Protohaustorius cf. deichmannae	20	10										
Protohaustorius sp. B				98	122	53	109		67			
Protohaustorius wigleyi	85	104	179			84		23	15	38	98	33
Psammobiidae (LPIL)												
Psammonyx nobilis												
Pseudohaustorius borealis												
Pseudohaustorius caroliniensis												
Pseudoleptocuma minor	15	13		15	10	20	20	44		29	13	59
Pseudunciola obliquua	461	241	2572	129	274	130	225	20	133	25	208	73
Rhepoxynius hudsoni	61	73	146	74	80	67	121	33	89	33	149	34
Rhynchocoela (LPIL)	29	12	18	27	32	55	20	413	98	68	46	112
Rithropanopeus harrisii												
Sabaco americanus												
Sabellaria vulgaris							10	10				
Scalibregma inflatum												
Scaphopoda (LPIL)											10	
Schistomeringos rudolphi												18
Schizaster orbignyanus												
Scolelepis squamata	23	10					13	35				10
Scoletoma (LPIL)											10	
Scoletoma acicularum	11	13	15	14	20	10		10	20	18	325	63
Scoletoma hebes												
Scoloplos (LPIL)									25			
Scoloplos rubra								10	18	10		
Serpulidae (LPIL)												
Sigalion arenicola	16	26	29	26	17	21	18	13	20	10	13	22
Sigalionidae (LPIL)	10	10		10	10	46	27	36		13	10	10
Sigambra bassi												
Siliqua costata	13							25	10			15

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Sipuncula (LPIL)		80										
Sipunculus (LPIL)												
Solemya (LPIL)												
Solen viridis										20		
Solenidae (LPIL)					10		25	10		13		
Sphaerodoropsis sp. G				20								
Sphaerosyllis (LPIL)			10					10				
Spio (LPIL)												
Spio setosa									85	10	260	20
Spiochaetopterus oculatus			10						10			
Spionidae (LPIL)	10		10		20	20	10	10	10		25	
Spiophanes bombyx	18	11	16	25	24	24		2031	1315	38	26	22
Spisula solidissima	66	44	176	20	64	44	414	284	40	93	21	40
Stenothoidae (LPIL)												
Sthenelais (LPIL)												
Sthenelais articulata												
Sthenelais limicola	10	10			10			10	23	13	26	10
Stomatopoda (LPIL)							10				10	
Streblospio benedicti												20
Streptosyllis arenae				10								
Streptosyllis pettiboneae							15					
Streptosyllis varians	21	10	33	13	23	10		10	10	10	10	10
Syllidae (LPIL)	10								10	10		
Syllides convoluta												
Syllides sp. B												
Tagelus divisus												
Tanaidacea (LPIL)			10									
Tanaissus psammophilus	67	147	336	137	98	45	50	40	47	15	17	44
Tectonatica pusilla					10					20	63	20
Tellina (LPIL)				107	10	40	10	56	83			
Tellina agilis	79	54	117	53	32	20	23	246	285	475	202	314

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged	Dredged
Taxa Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Tellina versicolor												
Tellinidae (LPIL)	10					20	82					
Terebellidae (LPIL)						10						
Tharyx acutus	10	20				100		15	78	13	2070	10
Thraciidae (LPIL)												
Trachyleberididae (LPIL)												
Travisia carnea	10	10		12		16		10				10
Tubificidae (LPIL)											505	347
Tubulanus (LPIL)			10							10		10
Tubulariidae (LPIL)												
Turbellaria (LPIL)	10					10					10	10
Turbonilla interrupta												
Unciola (LPIL)					10			10	10			
Unciola irrorata								13	60	26	33	
Unciola serrata						10						
Upogebia (LPIL)												
Veneridae (LPIL)										20		
Yoldia (LPIL)												

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Acanthohaustorius (LPIL)			30		47		93		10	10		
Acanthohaustorius millsi			166	237	178	134	201	84	203	223	360	291
Acanthohaustorius shoemakeri	47	56										
Acanthohaustorius similis	173	103										
Actiniaria (LPIL)			10	10		10	20		10	15	10	
Aedicira (LPIL)												
Aeginellidae (LPIL)												
Aeginina longicornis												
Aglaophamus circinata	10					17				10		
Aleutha depressa												
Amastigos caperatus	254											
Americamysis bigelowi			10		13							
Americhelidium americanum												
Ameroculodes edwardsi	20					15				10		
Ampelisca abdita												
Ampharete (LPIL)	10			10								
Ampharete americana						40						
Ampharete finmarchica	10											
Ampharetidae (LPIL)	35		10	20	10	20	1684	10	23	38		23
Amphipoda (LPIL)	17	10	35	10					20			
Anadara transversa												
Ancistrosyllis hartmanae												
Anonyx liljeborgi												
Anthozoa (LPIL)	119											
Aoridae (LPIL)			30		10		20					20
Arabellidae (LPIL)	10											
Archiannelida (LPIL)	499	119										
Aricidea (LPIL)	25	10	54	70	90	23	37	13	72	40	25	18
Aricidea catherinae	97	63	103	33	13	26	30	23		43	40	63
Aricidea cerrutii		10							23			
Aricidea wassi	39	22	49	102	59	60	77	60	33	55	18	31

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Armadillidae (LPIL)												
Armandia intermedia												
Asabellides oculata	25	20					100	20	105	28	68	17
Ascidiacea (LPIL)		10								117	10	
Astarte castanea		10					63					
Asterias forbesi												
Asteroidea (LPIL)							10		40			
Autolytus prolifera												
Bathyporeia parkeri												
Bathyporeia quoddyensis								10				
Bivalvia (LPIL)	17	10				18	10		10	20		21
Bodotriidae (LPIL)			10				10					
Branchiostoma (LPIL)												
Brania wellfleetensis												
Calyptraeidae (LPIL)					15		15					
Cancer irroratus	24		40				20		15			
Capitella (LPIL)												
Capitella capitata	55	20	10							10		
Capitella jonesi										10		10
Capitellidae (LPIL)	15	10				10	20			10	10	10
Caprella penantis											10	
Caprellidae (LPIL)												
Caridea (LPIL)												
Caulleriella (LPIL)	20		10									
Caulleriella killariensis	25	31	126	101	78	37	17	41	31	58	32	74
Caulleriella sp. E												
Caulleriella sp. K												
Cerastoderma pinnulatum												
Ceriantheopsis americanus	50											
Chaetopteridae (LPIL)												
Chaetozone (LPIL)												

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged
Taxa Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Chaetozone setosa												
Chaetozone sp. J												
Chione cancellata												
Chiridotea tuftsi	40	31	182	31	50	31	25	33	27	20	30	44
Chordata (LPIL)												
Cirolanidae (LPIL)												
Cirratulidae (LPIL)	109	10	30	103	84	10	27	12	10	10	33	10
Cirrophorus (LPIL)												
Cirrophorus armatus												
Cirrophorus furcatus												
Cirrophorus ilvana												
Cirrophorus lyra												
Cladocera (LPIL)												
Cnidaria (LPIL)												
Corophium (LPIL)		10										
Corophium insidiosum												
Cossura cf. laeviseta												
Crangon septemspinosa	13			10	10		10		10			
Crenella decussata												
Crepidula (LPIL)					10						10	
Crepidula fornicata							30					
Crepidula plana							58		130			
Crustacea (LPIL)												
Cumacea (LPIL)												
Decapoda (LPIL)	10						10					
Decapoda Natantia (LPIL)								10				
Decapoda Reptantia (LPIL)				10								
Dentalium (LPIL)												
Diastylidae (LPIL)			10				10	10	10	10		10
Diastylis (LPIL)							10					
Diastylis polita								60	20	17		10

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Diastylis quadrispinosa							15					
Diastylis sculpta	30											
Diopatra cuprea				10			10				280	
Dipolydora (LPIL)							10					
Dipolydora socialis	10								20		30	
Dispio uncinata			10	10	10	20		10	22		13	
Dissodactylus mellitae										10		23
Donax variabilis								60	27	10	15	
Dorvilleidae (LPIL)					10							
Drilonereis longa	10						15					
Dyopedos monacanthus						10						
Echinarachnius parma	23	30	70	41	48	43	27	21	18	552	187	145
Echinodea (LPIL)				32		30	25		15	10		40
Echinodermata (LPIL)												10
Edotia triloba	68	14	20	13		10	10	23	30	29	10	12
Enchytraeidae (LPIL)												
Ensis directus	10		10		10							
Enteropneusta (LPIL)												
Epitonium (LPIL)												
Euclymene sp. D												
Euclymene zonalis												
Eumida sanguinea												
Eusarsiella zostericola												
Euspira heros	15					20		10			10	
Euspira triseriata												
Exogene (LPIL)						10						
Exogene dispar												
Exogene hebes	17	10			10			10	30		10	10
Exogene rolani								10				
Flabelligeridae (LPIL)												
Gammaridae (LPIL)					30							

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Gammarus (LPIL)			10		13					10		
Gammarus annulatus	10		10									
Gastropoda (LPIL)					10		10			10	10	
Gemma gemma												
Glycera (LPIL)	10				15				20		23	
Glycera americana	10											
Glycera capitata												
Glycera dibranchiata		10	10				10				35	23
Glycera robusta												
Glyceridae (LPIL)	10											
Glycinde solitaria												
Goniada teres					10							
Goniadella gracilis												10
Goniadidae (LPIL)	10											
Goniadides carolinae												
Haminoea solitaria												
Harmothoe (LPIL)												
Harmothoe extenuata												
Harmothoe imbricata												
Harpacticoida (LPIL)	10											
Haustoriidae (LPIL)	21	38	79	32	77	37	33	10	54	20	20	35
Haustorius (LPIL)												
Hemipodus roseus			20									
Hesionidae (LPIL)												
Hesionura coineaui												
Hesionura elongata												
Heteromastus filiformis					10							
Hippomedon serratus		67	10							20		
Holothuroidea (LPIL)	50				10							
Hydracarina (LPIL)												
Hydrozoa (LPIL)											10	

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Hypereteone heteropoda												
Idoteidae (LPIL)												
Ilyanassa (LPIL)												
Ilyanassa obsoleta												10
Ilyanassa trivittata	17	10	25	10	15	10	20	10	17	20	17	
Ischyroceridae (LPIL)									10			
Ischyrocerus anguipes												
Isopoda (LPIL)												
Leitoscoloplos (LPIL)	10	20	10				45		10	20	35	20
Leitoscoloplos robustus	16	20									10	10
Lepidonotus sublevis												
Leptochelia rapax												
Leucon americanus							10					
Levinsenia gracilis												10
Libinia (LPIL)												
Libinia emarginata												
Lineidae (LPIL)									25		10	
Listriella barnardi									10			
Lumbrineridae (LPIL)	10				10	10	30	10				
Lumbrinerides acuta		10										
Lyonsia hyalina hyalina		10					10			25		
Lysianassidae (LPIL)												
Macoma (LPIL)				18								
Macoma yoldiformis												
Mactridae (LPIL)					40							10
Magelona (LPIL)	17	23	10		20							10
Magelona papillicornis	66	42	347	368	194	56	17	10	10	13	10	16
Magelona pettiboneae										10	10	
Magelona rosea										15		
Majidae (LPIL)				20			10					
Maldanidae (LPIL)	10											

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Maldanidae Genus A (LPIL)			10									
Mediomastus (LPIL)				10	10		1380					
Mediomastus ambiseta	13											
Melitidae (LPIL)												
Mercenaria mercenaria												
Microdeuptopus gryllotalpa												
Microphthalmus (LPIL)												
Microphthalmus hartmanae												
Microphthalmus sczelkowii												
Molgula (LPIL)												
Mollusca (LPIL)												
Molpadiidae (LPIL)				10								
Monoculodes sp. I				10								
Montacutidae (LPIL)												
Monticellina dorsobranchialis		10										
Mulinia lateralis						57						
Mya arenaria												
Mysella planulata												
Mysidacea (LPIL)				10								
Mysidae (LPIL)			10		41			10				
Mytilidae (LPIL)	20	10								20		
Mytilis edulis				10			10					
Nassariidae (LPIL)												
Natica pusilla		10					10					
Naticidae (LPIL)									10			
Nematoda (LPIL)		10										
Neomysis americana					10							
Nephtys (LPIL)							70				40	
Nephtys bucera	15	14	22	42	35	20		23	10	18	15	10
Nephtys incisa	10		10									
Nephtys picta	21	20	40	10		10	50	33	54	28	69	10

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged
Taxa Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Nephtys simoni												
Nepthytidae (LPIL)	48	25	13	28	51		15	15	73	57	20	83
Nereidae (LPIL)					10							
Nereididae (LPIL)							15					
Nereis (LPIL)												
Nereis pelagica												
Nereis succinea												
Neverita duplicata				10			10					
Notomastus (LPIL)					10							
Notomastus hemipodus												
Notomastus latericeus	10	10										
Nucula (LPIL)												
Nucula proxima	78	20	22	19	32	18	3050	15	10	25	13	50
Nuculana (LPIL)				10	10							
Obelia dichotoma												
Odostomia (LPIL)							85			10		
Odostomia dealbata												
Odostomia gibbosa							255					
Oedicerotidae (LPIL)	10	15										
Oenonidae (LPIL)												
Oligochaeta (LPIL)	73	25	32	67	33	30	52	44	48	37		
Olividae (LPIL)							10					
Onuphidae (LPIL)					10		22				15	
Onuphis eremita							10			10	30	
Ophelia denticulata								10	25			
Opheliidae (LPIL)	15											
Ophiuroidea (LPIL)				10								17
Ophryotrocha (LPIL)												
Orbinia (LPIL)	10											
Orbinia americana										10		
Orbinia swani	10											

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Taxa / Area / Date	BBA3 Undredged June-94	BBA3 Undredged May-95	BBA3 Undredged Sept.- 95	BBA3 Undredged May-96	BBA3 Undredged Sept.- 96	BBA3 Undredged May-97	BBA3 Undredged Sept.- 97	BBA3 Undredged May-98	BBA3 Undredged Sept.- 98	BBA3 Undredged May-99	BBA3 Undredged Sept.- 99	BBA3 Undredged May-00
Orbiniidae (LPIL)	10											
Ostracoda (LPIL)	157	44	83	13	27		76	63	76	36		
Ovalipes (LPIL)			10									
Ovalipes ocellatus							10		20		10	
Owenia fusiformis										10		
Oxyurostylis smithi			10				10				10	17
Paguridae (LPIL)			20		30		10					
Pagurus (LPIL)				12	15		10	10			10	17
Pagurus politus	10	10			10	10	10				20	
Pagurus pollicaris												
Pandora (LPIL)										20		
Pandora glacialis												
Pandora gouldiana								10			10	
Pandora inflata												
Pandoridae (LPIL)												
Paracaprella tenuis		20									10	
Parahaustorius attenuatus						40			10	30	20	20
Parahaustorius longimerus						125						
Parametopella cypris												
Paranaitis speciosa	23			10				13		10		10
Parandalia ocularis												
Paraonidae (LPIL)	10		15		10	10	190	10	10	17	10	
Paraonis (LPIL)												
Paraonis fulgens												
Paraonis pygoenigmatica			20							10		
Parapionosyllis longicirrata								20				
Parapionosyllis sp. D												
Parougia caeca	10					10				20		
Pectinaria gouldii												
Pelecypoda (LPIL)			70	14	41							
Pellucistoma (LPIL)											84	

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Periploma (LPIL)												
Periploma leanum												
Petricola pholadiformis												
Pherusa affinis	18			10			20					
Pherusa plumosa											20	
Phoronida (LPIL)												
Phoronis architecta												
Photis (LPIL)										10		
Photis macrocoxa	20									10		
Photis pollex		10										
Phoxocephalidae (LPIL)			40	20	44		17		20	10		
Phyllodoce (LPIL)												
Phyllodoce arenae							50					
Phyllodoce mucosa					10							
Phyllodocidae (LPIL)				10			20			10		
Pisione remota												
Pitar (LPIL)										40		
Pitar morrhuanus	10	13					105			10	10	40
Platysquilla enodis						10						
Pleurobranchaea tarda												
Podocopida (LPIL)												166
Politolana polita	26	12	20	15	15	20	10	10	13	22	10	50
Polydora (LPIL)												
Polydora caulleryi												
Polydora cornuta					10		10					
Polygordius (LPIL)			336	261	572	80		60	1284	204	572	732
Polynicinae												
Polynoidae (LPIL)							20			10		
Prionospio steenstrupi	43											
Proboloides holmesi												
Proceraea cornuta	10											

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Protodorvillea kefersteini												
Protohaustorius (LPIL)	20		81	20	25	25	55		25	10		
Protohaustorius cf. deichmannae	10	10										
Protohaustorius sp. B			185	126	170	120	196		100			
Protohaustorius wigleyi	122	101	126			35		48	45	75	179	163
Psammobiidae (LPIL)												
Psammonyx nobilis				20		85						
Pseudohaustorius borealis		10										
Pseudohaustorius caroliniensis	10	10										
Pseudoleptocuma minor	29	15	10	13	13	33	10	47	18	24	24	52
Pseudunciola obliquua	219	132	1289	78	613	109	97	20	106	49	260	145
Rhepoxynius hudsoni	52	56	107	119	89	58	80	30	130	133	172	125
Rhynchocoela (LPIL)	18	17	27	20	40	28	51	63	35	33	29	81
Rithropanopeus harrisii												
Sabaco americanus												
Sabellaria vulgaris							15					
Scalibregma inflatum												
Scaphopoda (LPIL)							10					
Schistomeringos rudolphi				10								15
Schizaster orbignyanus												
Scolelepis squamata	20					10		10	10			10
Scoletoma (LPIL)							10					
Scoletoma acicularum	16	13	15	19	10	15	15	10		10	10	46
Scoletoma hebes												
Scoloplos (LPIL)									10			
Scoloplos rubra				10	20			10	10	13		
Serpulidae (LPIL)												
Sigalion arenicola	18	15	32	23	20	17	16	10	20	13	23	22
Sigalionidae (LPIL)	10		10	10		13	38	14		12	10	
Sigambra bassi												
Siliqua costata	15	13				10		20	10			30

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged
Taxa Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Sipuncula (LPIL)												
Sipunculus (LPIL)												
Solemya (LPIL)	10											
Solen viridis							20					
Solenidae (LPIL)										13		10
Sphaerodoropsis sp. G												
Sphaerosyllis (LPIL)												
Spio (LPIL)												
Spio setosa	10											
Spiochaetopterus oculatus					10		10				10	
Spionidae (LPIL)	20			10	18	10		13	30			
Spiophanes bombyx	28	13	15	35	30	18		28	28	43	30	16
Spisula solidissima	61	49	151	38	78	30	190	29	191	90	20	23
Stenothoidae (LPIL)												
Sthenelais (LPIL)			10									
Sthenelais articulata										20		
Sthenelais limicola	15	12	13	10	15			30	16	20	19	17
Stomatopoda (LPIL)							10					
Streblospio benedicti										40		
Streptosyllis arenae												
Streptosyllis pettiboneae												
Streptosyllis varians	10	10	26	20	17	10		10	13		10	15
Syllidae (LPIL)								10				
Syllides convoluta												
Syllides sp. B												
Tagelus divisus					10							
Tanaidacea (LPIL)												
Tanaissus psammophilus	90	67	129	69	105	37	43	40	70	48	72	94
Tectonatica pusilla										15	45	12
Tellina (LPIL)				214	37	30	80	60				
Tellina agilis	96	71	188	41	132	43	88	62	169	259	161	200

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3	BBA3
	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged	Undredged
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Tellina versicolor							10					
Tellinidae (LPIL)				30		53	1325					
Terebellidae (LPIL)												
Tharyx acutus	329	10	10			10		10	30		43	
Thraciidae (LPIL)												
Trachyleberididae (LPIL)												
Travisia carnea	10	10	10	17		17		35	10	47		10
Tubificidae (LPIL)											37	50
Tubulanus (LPIL)				13	10	20			25	42	60	77
Tubulariidae (LPIL)												
Turbellaria (LPIL)				10	10			10		10	10	10
Turbonilla interrupta							10			10	10	
Unciola (LPIL)		10						10				
Unciola irrorata	15	10		30					15	18		10
Unciola serrata												
Upogebia (LPIL)												
Veneridae (LPIL)												
Yoldia (LPIL)							10					

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Acanthohaustorius (LPIL)			34	10	77			20				
Acanthohaustorius millsi			264	217	233	94	128	120	382	172	27	23
Acanthohaustorius shoemakeri	63	18										
Acanthohaustorius similis	156	137										
Actiniaria (LPIL)			23	27	30	25	10			16	19	
Aedicira (LPIL)	10											
Aeginellidae (LPIL)												
Aeginina longicornis	10											
Aglaophamus circinata	10					25						
Aleutha depressa	10											
Amastigos caperatus	10											
Americamysis bigelowi					12						20	
Americhelidium americanum						13						
Ameroculodes edwardsi						15		10				10
Ampelisca abdita						10						10
Ampharete (LPIL)												
Ampharete americana			10			12						
Ampharete finmarchica	14											
Ampharetidae (LPIL)				10		20	37	10	50	20	15	10
Amphipoda (LPIL)	13		17	10		10						
Anadara transversa												
Ancistrosyllis hartmanae												
Anonyx liljeborgi												
Anthozoa (LPIL)	68	10										
Aoridae (LPIL)			45							10		10
Arabellidae (LPIL)												
Archiannelida (LPIL)	323	156										
Aricidea (LPIL)	26	10	28	64	56	19	43	60	13	30	30	10
Aricidea catherinae	45	28	54	37	30	30	10	28	35	28	20	
Aricidea cerrutii	30	13	20					160	30			
Aricidea wassi	61	22	24	15	44	28	83	23	29	22	10	110

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Armadillidae (LPIL)												
Armandia intermedia		10										
Asabellides oculata	14	10						10		18	144	14
Ascidiacea (LPIL)		81		15				10		65	135	10
Astarte castanea	100	13	43	15	10	10	20		10			
Asterias forbesi												
Asteroidea (LPIL)												
Autolytus prolifera												
Bathyporeia parkeri												
Bathyporeia quoddyensis												
Bivalvia (LPIL)	19	24				33	13	17	20	20	20	23
Bodotriidae (LPIL)												
Branchiostoma (LPIL)												
Brania wellfleetensis												
Calyptraeidae (LPIL)				10	10							
Cancer irroratus	10		10						10	10		
Capitella (LPIL)												20
Capitella capitata	53	10										25
Capitella jonesi											105	10
Capitellidae (LPIL)	10	10		20					40		10	15
Caprella penantis												
Caprellidae (LPIL)	13									10		
Caridea (LPIL)	10											
Caulleriella (LPIL)												
Caulleriella killariensis	27	20	56	21	33	28	26	45	23	40	50	93
Caulleriella sp. E												
Caulleriella sp. K												
Cerastoderma pinnulatum	20											
Ceriantheopsis americanus	13	26										
Chaetopteridae (LPIL)												
Chaetozone (LPIL)												

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Taxa / Area / Date	BBA5 June-94	BBA5 May-95	BBA5 Sept.- 95	BBA5 May-96	BBA5 Sept.- 96	BBA5 May-97	BBA5 Sept.- 97	BBA5 May-98	BBA5 Sept.- 98	BBA5 May-99	BBA5 Sept.- 99	BBA5 May-00
Chaetozone setosa												
Chaetozone sp. J												
Chione cancellata												
Chiridotea tuftsi	25	26	38	18	18	16	20	17	18	28	10	
Chordata (LPIL)	26											
Cirolanidae (LPIL)			10									
Cirratulidae (LPIL)	39	16	21	18	38	20	40	100	12	22	30	23
Cirrophorus (LPIL)								40				10
Cirrophorus armatus												
Cirrophorus furcatus												
Cirrophorus ilvana												
Cirrophorus lyra												
Cladocera (LPIL)												
Cnidaria (LPIL)					10							
Corophium (LPIL)				10								
Corophium insidiosum										10		
Cossura cf. laeviseta												
Crangon septemspinosa	10			10			13	10	10			
Crenella decussata												
Crepidula (LPIL)					10							
Crepidula fornicata						10						
Crepidula plana									50		30	
Crustacea (LPIL)												
Cumacea (LPIL)						10						
Decapoda (LPIL)	10	10										
Decapoda Natantia (LPIL)												
Decapoda Reptantia (LPIL)			10		10							
Dentalium (LPIL)												
Diastylidae (LPIL)										10		
Diastylis (LPIL)							10					
Diastylis polita		10					15	10	17	10		10

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Diastylis quadrispinosa												
Diastylis sculpta	20											
Diopatra cuprea											10	
Dipolydora (LPIL)											20	
Dipolydora socialis	10											
Dispio uncinata			11		16	13			14	10		
Dissodactylus mellitae												
Donax variabilis									25	23	212	
Dorvilleidae (LPIL)									10			
Drilonereis longa	10						10					
Dyopedos monacanthus												
Echinarachnius parma	28	40	61	25	26	39	16	15	24	489	255	10
Echinodea (LPIL)				13	10	58	12	25	23	10	10	
Echinodermata (LPIL)												
Edotia triloba	27	24	13	13	10	16	15	13	10	42	10	19
Enchytraeidae (LPIL)												10
Ensis directus	17	10		10							10	
Enteropneusta (LPIL)												
Epitonium (LPIL)												
Euclymene sp. D												
Euclymene zonalis	10											
Eumida sanguinea					10							
Eusarsiella zostericola												
Euspira heros	16	10	10						13	10	10	
Euspira triseriata			10									
Exogene (LPIL)				20		10			10			
Exogene dispar			25									
Exogene hebes	15	10	18	25	17	16		14	28	28		
Exogene rolani												
Flabelligeridae (LPIL)												
Gammaridae (LPIL)												

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Taxa / Area / Date	BBA5 June-94	BBA5 May-95	BBA5 Sept.- 95	BBA5 May-96	BBA5 Sept.- 96	BBA5 May-97	BBA5 Sept.- 97	BBA5 May-98	BBA5 Sept.- 98	BBA5 May-99	BBA5 Sept.- 99	BBA5 May-00
Gammarus (LPIL)			26		17		10					
Gammarus annulatus	10											
Gastropoda (LPIL)	10			10	10	10	15		10	10		
Gemma gemma	10											
Glycera (LPIL)									43	23		
Glycera americana	15			10	10			10		20		
Glycera capitata												
Glycera dibranchiata	10	10		10	10					10	13	10
Glycera robusta	10											
Glyceridae (LPIL)	23			10		10	10	15				16
Glycinde solitaria												
Goniada teres					17							
Goniadella gracilis	24			60		30					10	
Goniadidae (LPIL)				10								
Goniadides carolinae												
Haminoea solitaria							10					
Harmothoe (LPIL)	10											
Harmothoe extenuata												
Harmothoe imbricata										30		
Harpacticoida (LPIL)												
Haustoriidae (LPIL)	26	29	139	12	50	46	15	20	50	23		10
Haustorius (LPIL)												
Hemipodus roseus						37		60				
Hesionidae (LPIL)												
Hesionura coineaui						30						
Hesionura elongata								10		10		
Heteromastus filiformis	10											
Hippomedon serratus		10							10	10	10	60
Holothuroidea (LPIL)								10				
Hydracarina (LPIL)	20											
Hydrozoa (LPIL)												

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Taxa / Area / Date	BBA5 June-94	BBA5 May-95	BBA5 Sept.- 95	BBA5 May-96	BBA5 Sept.- 96	BBA5 May-97	BBA5 Sept.- 97	BBA5 May-98	BBA5 Sept.- 98	BBA5 May-99	BBA5 Sept.- 99	BBA5 May-00
Hypereteone heteropoda												10
Idoteidae (LPIL)			10		10							
Ilyanassa (LPIL)												
Ilyanassa obsoleta				10								18
Ilyanassa trivittata	10	10	10		10	10	10	10		13	30	
Ischyroceridae (LPIL)												
Ischyrocerus anguipes												
Isopoda (LPIL)								10				
Leitoscoloplos (LPIL)	10	20					10	10		20	15	13
Leitoscoloplos robustus	10									10		50
Lepidonotus sublevis											10	
Leptochelia rapax	10											
Leucon americanus												
Levinsenia gracilis	10											
Libinia (LPIL)												
Libinia emarginata												
Lineidae (LPIL)					10	10					10	
Listriella barnardi												
Lumbrineridae (LPIL)	10		10	10	10	10	20	10	17	10		
Lumbrinerides acuta		17	30	53	28	10	10	55	17	10		
Lyonsia hyalina hyalina								10		21		
Lysianassidae (LPIL)									10			27
Macoma (LPIL)												
Macoma yoldiformis												
Mactridae (LPIL)					83							
Magelona (LPIL)	18	13		10	27	55		10	10	10		
Magelona papillicornis	86	80	172	134	325	262	57	14	13	22	30	10
Magelona pettiboneae												
Magelona rosea										10		
Majidae (LPIL)											10	
Maldanidae (LPIL)		10	10									

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Taxa / Area / Date	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5
	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Maldanidae Genus A (LPIL)												
Mediomastus (LPIL)							10					
Mediomastus ambiseta												
Melitidae (LPIL)												
Mercenaria mercenaria				10								
Microdeuptopus gryllotalpa			10									
Microphthalmus (LPIL)												
Microphthalmus hartmanae					10							
Microphthalmus sczelkowii												
Molgula (LPIL)		20										
Mollusca (LPIL)			10									
Molpadiidae (LPIL)												
Monoculodes sp. I				10								
Montacutidae (LPIL)												
Monticellina dorsobranchialis	10		10									30
Mulinia lateralis												
Mya arenaria												
Mysella planulata										15		
Mysidacea (LPIL)			10									
Mysidae (LPIL)					38	20						
Mytilidae (LPIL)	16	10								20		
Mytilis edulis						10				10		
Nassariidae (LPIL)												
Natica pusilla												
Naticidae (LPIL)												
Nematoda (LPIL)	17	26										
Neomysis americana					13							
Nephtys (LPIL)			10							25		
Nephtys bucera	10	13	13	15	13	25	10	14	30	16	10	30
Nephtys incisa												
Nephtys picta	66	15	83	10			81	20	53	27	63	17

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Nephtys simoni				10								
Nepthytidae (LPIL)	83	10	10	15	48	18	44	10	46	21	10	42
Nereidae (LPIL)	25				10					10		
Nereididae (LPIL)							10					
Nereis (LPIL)					10							
Nereis pelagica												
Nereis succinea												
Neverita duplicata				10	10		10					
Notomastus (LPIL)												
Notomastus hemipodus										10		
Notomastus latericeus	10											
Nucula (LPIL)	10											
Nucula proxima	100	18	70	10	20	23	258	10	10	13		147
Nuculana (LPIL)				20	17							
Obelia dichotoma	10											
Odostomia (LPIL)												
Odostomia dealbata												
Odostomia gibbosa												
Oedicerotidae (LPIL)	15	13										10
Oenonidae (LPIL)												
Oligochaeta (LPIL)	31	31	109	100	110	192	18	382	85	80		
Olividae (LPIL)												
Onuphidae (LPIL)							20				15	
Onuphis eremita		10	10		10		10				15	
Ophelia denticulata		10		10	15			10	15			
Opheliidae (LPIL)	10											
Ophiuroidea (LPIL)												15
Ophryotrocha (LPIL)												
Orbinia (LPIL)	18											
Orbinia americana									10	15		10
Orbinia swani	10	10	10									

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area / Taxa / Date	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5
	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Orbiniidae (LPIL)	10		10									
Ostracoda (LPIL)	97	42	76	20	40	17	37	20	25	34		
Ovalipes (LPIL)							10					
Ovalipes ocellatus			10								10	
Owenia fusiformis												
Oxyurostylis smithi											10	12
Paguridae (LPIL)							10					
Pagurus (LPIL)		10	24	10	10				13			10
Pagurus politus	14				10				10		10	
Pagurus pollicaris												
Pandora (LPIL)	10									13		
Pandora glacialis										10		
Pandora gouldiana							15				10	
Pandora inflata		20							10			
Pandoridae (LPIL)												
Paracaprella tenuis		10										
Parahaustorius attenuatus									18	10		
Parahaustorius longimerus												
Parametopella cypris												
Paranaitis speciosa	15									10		10
Parandalia ocularis												
Paraonidae (LPIL)		11	10		13	10	22		13			20
Paraonis (LPIL)						20						
Paraonis fulgens									13			
Paraonis pygoenigmatica		10		10						10		
Parapionosyllis longicirrata			10					30	17			
Parapionosyllis sp. D						10						
Parougia caeca	13								10	10		
Pectinaria gouldii											10	
Pelecypoda (LPIL)			20	39	19							
Pellucistoma (LPIL)											55	

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Taxa / Area / Date	BBA5 June-94	BBA5 May-95	BBA5 Sept.- 95	BBA5 May-96	BBA5 Sept.- 96	BBA5 May-97	BBA5 Sept.- 97	BBA5 May-98	BBA5 Sept.- 98	BBA5 May-99	BBA5 Sept.- 99	BBA5 May-00
Periploma (LPIL)	10											
Periploma leanum		10										
Petricola pholadiformis												100
Pherusa affinis	11				10		10					
Pherusa plumosa									10			10
Phoronida (LPIL)												
Phoronis architecta										10		
Photis (LPIL)										10		
Photis macrocoxa	62							30		54		
Photis pollex		26										
Phoxocephalidae (LPIL)				10	33				30			
Phyllodoce (LPIL)												
Phyllodoce arenae	10									10	10	
Phyllodoce mucosa												
Phyllodocidae (LPIL)	10				10				10			
Pisione remota	30											
Pitar (LPIL)										10		
Pitar morrhuanus	64		10				10					105
Platysquilla enodis											10	
Pleurobranchaea tarda												
Podocopida (LPIL)												90
Politolana polita	10	15	20	14	28	23	20	28	33	39	10	20
Polydora (LPIL)					23							
Polydora caulleryi												
Polydora cornuta					10							
Polygordius (LPIL)			262	137	622	669		746	417	240	255	1307
Polynicinae												
Polynoidae (LPIL)					10							
Prionospio steenstrupi	16											
Proboloides holmesi	10											
Proceraea cornuta	10											

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Taxa / Area / Date	BBA5 June-94	BBA5 May-95	BBA5 Sept.- 95	BBA5 May-96	BBA5 Sept.- 96	BBA5 May-97	BBA5 Sept.- 97	BBA5 May-98	BBA5 Sept.- 98	BBA5 May-99	BBA5 Sept.- 99	BBA5 May-00
Protodorvillea kefersteini												
Protohaustorius (LPIL)			49	10	22	22		16	60	10		
Protohaustorius cf. deichmannae	13	17										
Protohaustorius sp. B				85	127	171	99		83			
Protohaustorius wigleyi	43	93	216			73	20	88	45	75	48	55
Psammobiidae (LPIL)							10					
Psammonyx nobilis												
Pseudohaustorius borealis		10										
Pseudohaustorius caroliniensis												
Pseudoleptocuma minor	11	21	10	13	21	32		27	16	21	17	38
Pseudunciola obliquua	211	212	3121	141	348	164	219	16	110	25	43	16
Rhepoxynius hudsoni	23	48	83	53	80	52	108	50	155	93	52	
Rhynchocoela (LPIL)	15	15	20	33	45	28	36	108	32	32	24	13
Rithropanopeus harrisii				20								
Sabaco americanus												
Sabellaria vulgaris												
Scalibregma inflatum												
Scaphopoda (LPIL)												
Schistomeringos rudolphi												
Schizaster orbignyanus										10		
Scolelepis squamata	23	12		10			10	38	30			
Scoletoma (LPIL)								10				
Scoletoma acicularum	17	12	10	11	13	10	26	10	10	12	10	27
Scoletoma hebes		10										
Scoloplos (LPIL)		30										
Scoloplos rubra				10	10			15				
Serpulidae (LPIL)	10											
Sigalion arenicola	14	15	39	16	22	16	23	27	24	15	10	10
Sigalionidae (LPIL)	10	30	10	17	10	71	17	39		25		10
Sigambra bassi							10					
Siliqua costata	12	10										40

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5	BBA5
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Sipuncula (LPIL)	25	10										
Sipunculus (LPIL)						20						
Solemya (LPIL)												
Solen viridis												
Solenidae (LPIL)	10						10			10		
Sphaerodoropsis sp. G												
Sphaerosyllis (LPIL)												
Spio (LPIL)										10		
Spio setosa	10									10	10	
Spiochaetopterus oculatus			20		13		10		10	10	10	
Spionidae (LPIL)	10	10	13	10	20		10	10	17		13	
Spiophanes bombyx	23	15	19	24	39	26	32	57	17	19	43	214
Spisula solidissima	39	52	412	28	144	46	278	62	159	96	29	29
Stenothoidae (LPIL)	30											
Sthenelais (LPIL)										10		
Sthenelais articulata												
Sthenelais limicola	11	15	17	10	15	10		10	10	22	30	10
Stomatopoda (LPIL)										10		
Streblospio benedicti												
Streptosyllis arenae												
Streptosyllis pettiboneae							13		60			
Streptosyllis varians	30	20	31	17	22	25		25	37	11		
Syllidae (LPIL)								10				
Syllides convoluta			10									
Syllides sp. B												
Tagelus divisus										20		
Tanaidacea (LPIL)	10			10	10							
Tanaissus psammophilus	89	137	179	112	79	75	228	52	138	51	30	13
Tectonatica pusilla								10		17	20	
Tellina (LPIL)				96	20	23	262	20		10		
Tellina agilis	49	47	138	64	59	31	36	43	36	150	61	212

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Taxa / Area / Date	BBA5 June-94	BBA5 May-95	BBA5 Sept.- 95	BBA5 May-96	BBA5 Sept.- 96	BBA5 May-97	BBA5 Sept.- 97	BBA5 May-98	BBA5 Sept.- 98	BBA5 May-99	BBA5 Sept.- 99	BBA5 May-00
Tellina versicolor												
Tellinidae (LPIL)					10		35					
Terebellidae (LPIL)												
Tharyx acutus	14	20	10						10	15	13	10
Thraciidae (LPIL)										10		
Trachyleberididae (LPIL)												
Travisia carnea	32	23	10	41	10	26	10	20		20		
Tubificidae (LPIL)											20	30
Tubulanus (LPIL)			25	20	33	10	10		10	15		20
Tubulariidae (LPIL)	10											
Turbellaria (LPIL)		10							10	10		10
Turbonilla interrupta							10	10		10		15
Unciola (LPIL)		10		10						10		
Unciola irrorata	13	10								26	10	10
Unciola serrata					10	10						10
Upogebia (LPIL)												
Veneridae (LPIL)												
Yoldia (LPIL)												50

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Acanthohaustorius (LPIL)												
Acanthohaustorius millsi			125	20	10				20			
Acanthohaustorius shoemakeri												
Acanthohaustorius similis		133										
Actiniaria (LPIL)			20	14	35	10	50		40	34	17	17
Aedicira (LPIL)												
Aeginellidae (LPIL)												
Aeginina longicornis	678											
Aglaophamus circinata	12	10				20				18		
Aleutha depressa	10											
Amastigos caperatus	23											
Americamysis bigelowi												
Americhelidium americanum						13						
Ameroculodes edwardsi	10					18				10		17
Ampelisca abdita						10		20				
Ampharete (LPIL)												
Ampharete americana						10		10	10			
Ampharete finmarchica	15			10							28	
Ampharetidae (LPIL)	10			10	15	18	10	33	10	33	34	27
Amphipoda (LPIL)	10	15	10	10		10						
Anadara transversa												
Ancistrosyllis hartmanae			10									
Anonyx liljeborgi	10	10										
Anthozoa (LPIL)	50	10										
Aoridae (LPIL)				10			30					
Arabellidae (LPIL)												
Archiannelida (LPIL)	878	280										
Aricidea (LPIL)	22	15	40	82	57	27		36	33	25	27	37
Aricidea catherinae	37	25	51	19	17			25	19	29	50	10
Aricidea cerrutii	13	24	10	42		28		10				10
Aricidea wassi	25	15	33	32	49	28	15	10	10	67	20	38

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area / Taxa / Date	BBA6 June-94	BBA6 May-95	BBA6 Sept.- 95	BBA6 May-96	BBA6 Sept.- 96	BBA6 May-97	BBA6 Sept.- 97	BBA6 May-98	BBA6 Sept.- 98	BBA6 May-99	BBA6 Sept.- 99	BBA6 May-00
Armadillidae (LPIL)						15						
Armandia intermedia												
Asabellides oculata	14	10				10			27	24	937	33
Ascidiacea (LPIL)		46		150		20				151		48
Astarte castanea	15	24	26	31	25	30	60	10		10	10	10
Asterias forbesi									10			
Asteroidea (LPIL)							10					
Autolytus prolifera	170											
Bathyporeia parkeri						10						
Bathyporeia quoddyensis												
Bivalvia (LPIL)	18	19				26	17	31	18	12	20	28
Bodotriidae (LPIL)												
Branchiostoma (LPIL)					10		10					
Brania wellfleetensis												
Calyptraeidae (LPIL)					17		10					
Cancer irroratus	11		16		13		10		13		15	
Capitella (LPIL)												
Capitella capitata	27	25			10		58	240				
Capitella jonesi										10	10	10
Capitellidae (LPIL)					10		18	120	20			10
Caprella penantis												
Caprellidae (LPIL)	10											
Caridea (LPIL)	10											
Caulleriella (LPIL)	10	10		10								
Caulleriella killariensis	41	13	37	45	57	59		56	29	31	15	47
Caulleriella sp. E												
Caulleriella sp. K			20									
Cerastoderma pinnulatum	10										57	
Ceriantheopsis americanus	33	12										
Chaetopteridae (LPIL)							10					
Chaetozone (LPIL)	10									10	10	

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Chaetozone setosa	10											
Chaetozone sp. J										13	10	
Chione cancellata								10				
Chiridotea tuftsi		10	13		10	10		10	12	10	23	
Chordata (LPIL)	15											
Cirolanidae (LPIL)												
Cirratulidae (LPIL)	98	10	24	44	47	55	10	75	48	30	70	13
Cirrophorus (LPIL)			20	72		50		150				15
Cirrophorus armatus			15									
Cirrophorus furcatus		13										
Cirrophorus ilvana						15						
Cirrophorus lyra					38							
Cladocera (LPIL)				10								
Cnidaria (LPIL)												
Corophium (LPIL)											20	
Corophium insidiosum												
Cossura cf. laeviseta	50											
Crangon septemspinosa	11	10		10	10		10	10	14		10	
Crenella decussata											10	
Crepidula (LPIL)											15	
Crepidula fornicata											15	
Crepidula plana			10		10	20	10					
Crustacea (LPIL)							10					
Cumacea (LPIL)	10		10									
Decapoda (LPIL)	10										15	
Decapoda Natantia (LPIL)					10							
Decapoda Reptantia (LPIL)												
Dentalium (LPIL)												
Diastylidae (LPIL)										10		
Diastylis (LPIL)												
Diastylis polita							16	13	20	12	20	

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6
Taxa Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Diastylis quadrispinosa												
Diastylis sculpta	10											
Diopatra cuprea	10										185	10
Dipolydora (LPIL)												
Dipolydora socialis	13								10	10	305	20
Dispio uncinata			16	10	13	15						
Dissodactylus mellitae												
Donax variabilis											43	30
Dorvilleidae (LPIL)		10	10		40				10			
Drilonereis longa	10			10								
Dyopedos monacanthus	10	10								10		
Echinarachnius parma	53	41	62	64	60	107	85	61	26	186	85	70
Echinodea (LPIL)			20	15		34	10	17	28	25		
Echinodermata (LPIL)												
Edotia triloba	21	18	10	13	10	17	30	68	25	24	20	16
Enchytraeidae (LPIL)												
Ensis directus	16	13	10							10	15	
Enteropneusta (LPIL)	10											
Epitonium (LPIL)											10	
Euclymene sp. D				20	15							
Euclymene zonalis												
Eumida sanguinea												
Eusarsiella zostericola											20	
Euspira heros	10	10							10	10	10	10
Euspira triseriata												
Exogene (LPIL)												
Exogene dispar												
Exogene hebes	32	32	79	35	86	62		34	29	32	61	50
Exogene rolani												
Flabelligeridae (LPIL)											10	
Gammaridae (LPIL)			10									10

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Gammarus (LPIL)			10		10							
Gammarus annulatus											10	10
Gastropoda (LPIL)		10				10	23	10	10	10	10	
Gemma gemma												
Glycera (LPIL)	10			55	44				34	10	15	
Glycera americana	10				93	10		10			10	
Glycera capitata									56			
Glycera dibranchiata	11	10						10		28	35	24
Glycera robusta												
Glyceridae (LPIL)			102	18		37	17	10			10	729
Glycinde solitaria						10						
Goniada teres			10	113	25							
Goniadella gracilis	19	23				34		220				
Goniadidae (LPIL)	10		65	20	20	30		10				
Goniadides carolinae					10							
Haminoea solitaria							20					
Harmothoe (LPIL)	20			155								10
Harmothoe extenuata	10					10		130				
Harmothoe imbricata								10		10	20	
Harpacticoida (LPIL)	15											
Haustoriidae (LPIL)	18	36	30	30	70	13	10		13			10
Haustorius (LPIL)									70			
Hemipodus roseus				107		54		10				
Hesionidae (LPIL)			10	20				10				
Hesionura coineaui												
Hesionura elongata												
Heteromastus filiformis												
Hippomedon serratus		10			10		10	16	15	10	10	50
Holothuroidea (LPIL)	10											
Hydracarina (LPIL)												
Hydrozoa (LPIL)												

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Hypereteone heteropoda								10	13		10	10
Idoteidae (LPIL)												
Ilyanassa (LPIL)												10
Ilyanassa obsoleta												24
Ilyanassa trivittata	14	10	10	10	20	10	10	10	10	16	39	10
Ischyroceridae (LPIL)												
Ischyrocerus anguipes	13	10										
Isopoda (LPIL)												
Leitoscoloplos (LPIL)		10					35	80	20	10	23	15
Leitoscoloplos robustus	10							10	33	33	10	35
Lepidonotus sublevis												
Leptochelia rapax												
Leucon americanus							10					
Levinsenia gracilis		10										
Libinia (LPIL)												10
Libinia emarginata												10
Lineidae (LPIL)				10				10	17	10	10	10
Listriella barnardi												
Lumbrineridae (LPIL)	10	10	10	13	17	13	10	10				
Lumbrinerides acuta	25	27	44	159	38	55		45				20
Lyonsia hyalina hyalina		10				10				15	10	17
Lysianassidae (LPIL)								10				40
Macoma (LPIL)												
Macoma yoldiformis												
Mactridae (LPIL)				10	42	10	10	15			160	
Magelona (LPIL)	10	10	28	10	27	10	10					10
Magelona papillicornis	10	35	38	68	39	49	20	16	18	26	10	13
Magelona pettiboneae												
Magelona rosea												
Majidae (LPIL)							10			10	37	
Maldanidae (LPIL)	10	13	13	35	30	60					10	17

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area / Taxa / Date	BBA6 June-94	BBA6 May-95	BBA6 Sept.- 95	BBA6 May-96	BBA6 Sept.- 96	BBA6 May-97	BBA6 Sept.- 97	BBA6 May-98	BBA6 Sept.- 98	BBA6 May-99	BBA6 Sept.- 99	BBA6 May-00
Maldanidae Genus A (LPIL)												
Mediomastus (LPIL)				13			53				60	10
Mediomastus ambiseta												
Melitidae (LPIL)				10								
Mercenaria mercenaria												
Microdeuptopus gryllotalpa												
Microphthalmus (LPIL)				30	15					10		10
Microphthalmus hartmanae			10	120	20				10			
Microphthalmus sczelkowii												
Molgula (LPIL)												
Mollusca (LPIL)												
Molpadiidae (LPIL)												
Monoculodes sp. I				10								10
Montacutidae (LPIL)						10						
Monticellina dorsobranchialis	13		20	10	5			10			10	15
Mulinia lateralis							53					
Mya arenaria										50	50	
Mysella planulata										10	10	
Mysidacea (LPIL)												
Mysidae (LPIL)					10	10						
Mytilidae (LPIL)	110			10						20		10
Mytilis edulis				20				10		10		10
Nassariidae (LPIL)												
Natica pusilla												
Naticidae (LPIL)						10						
Nematoda (LPIL)	44	76										
Neomysis americana												
Nephtys (LPIL)							10			10		
Nephtys bucera	12	12	13	14	19	24	10	18	35	24	21	26
Nephtys incisa	36										10	
Nephtys picta	12	14	10	16		10	10	38	101	64	31	84

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Taxa / Area / Date	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6
	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Nephtys simoni												
Nepthytidae (LPIL)	27	12	18	10	56	21	29	80	101	21	46	53
Nereidae (LPIL)	10				10							
Nerelididae (LPIL)							93					
Nereis (LPIL)											170	
Nereis pelagica											70	
Nereis succinea											10	
Neverita duplicata				10		10						
Notomastus (LPIL)					10							
Notomastus hemipodus												
Notomastus latericeus	10	10										
Nucula (LPIL)												
Nucula proxima	182	12	10	15	13	12		46	33	47	298	38
Nuculana (LPIL)												
Obelia dichotoma												
Odostomia (LPIL)												
Odostomia dealbata	10											
Odostomia gibbosa												
Oedicerotidae (LPIL)	10	10		40		13						10
Oenonidae (LPIL)							10					
Oligochaeta (LPIL)	81	83	386	299	407	231	10	117	33	20		20
Olividae (LPIL)												
Onuphidae (LPIL)							10				55	
Onuphis eremita										10	10	
Ophelia denticulata	10	10		13	10	10			10			
Opheliidae (LPIL)	10	10	10		10							
Ophiuroidea (LPIL)												10
Ophryotrocha (LPIL)				10								
Orbinia (LPIL)												10
Orbinia americana									10	13	10	
Orbinia swani		10										

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Orbiniidae (LPIL)	10						30	22	10		15	10
Ostracoda (LPIL)	63	10	13	17	14	10		10	43	23		
Ovalipes (LPIL)												
Ovalipes ocellatus							10				10	
Owenia fusiformis											10	
Oxyurostylis smithi											27	13
Paguridae (LPIL)			10				10					
Pagurus (LPIL)	10	10	35	10	12	20	10	10	11	10	18	10
Pagurus politus					10	45		20		10	10	
Pagurus pollicaris												
Pandora (LPIL)						13				10		
Pandora glacialis	10											
Pandora gouldiana											13	12
Pandora inflata			10			10						
Pandoridae (LPIL)				10								
Paracaprella tenuis											10	
Parahaustorius attenuatus									10			
Parahaustorius longimerus												
Parametopella cypris						10				10		
Paranaitis speciosa	10							10			10	10
Parandalia ocularis					10							
Paraonidae (LPIL)	13	15	13	10	31	20	10	10	10	10	10	25
Paraonis (LPIL)												
Paraonis fulgens												10
Paraonis pygoenigmatica	14		11	15							20	16
Parapionosyllis longicirrata		13	28	10				40	45	20	47	10
Parapionosyllis sp. D						15						
Parougia caeca	15	13				17		10	27	24		26
Pectinaria gouldii							10				10	
Pelecypoda (LPIL)			10	58	26							
Pellucistoma (LPIL)											116	

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Taxa — Area / Date	BBA6 June-94	BBA6 May-95	BBA6 Sept.- 95	BBA6 May-96	BBA6 Sept.- 96	BBA6 May-97	BBA6 Sept.- 97	BBA6 May-98	BBA6 Sept.- 98	BBA6 May-99	BBA6 Sept.- 99	BBA6 May-00
Periploma (LPIL)												
Periploma leanum		13		10								
Petricola pholadiformis											323	
Pherusa affinis	13											
Pherusa plumosa											35	
Phoronida (LPIL)	10											
Phoronis architecta	13								10	20	80	
Photis (LPIL)												
Photis macrocoxa	42							205		42	10	
Photis pollex		20										
Phoxocephalidae (LPIL)												
Phyllodoce (LPIL)												
Phyllodoce arenae	10						10		165		130	
Phyllodoce mucosa												
Phyllodocidae (LPIL)	10					10	17	10	10		10	
Pisione remota				115	45	15						10
Pitar (LPIL)										18		
Pitar morrhuanus	69	10	10							55	14	45
Platysquilla enodis												
Pleurobranchaea tarda							23				20	
Podocopida (LPIL)												63
Politolana polita	13	16	10	17	16	25	10	11	15	13	10	16
Polydora (LPIL)					25							
Polydora caulleryi	13											
Polydora cornuta					20						15	
Polygordius (LPIL)			612	1831	2670	1807		243	1365	1117	3060	3443
Polynicinae	10											
Polynoidae (LPIL)				30	40		10	20				
Prionospio steenstrupi	88											
Proboloides holmesi												
Proceraea cornuta	140											

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Protodorvillea kefersteini			10						10			
Protohaustorius (LPIL)			47	16	10	30	10			10		
Protohaustorius cf. deichmannae	10	15										
Protohaustorius sp. B				81	147	23	25		17			
Protohaustorius wigleyi	65	91	165			135	10	20		30	34	34
Psammobiidae (LPIL)												
Psammonyx nobilis												90
Pseudohaustorius borealis												
Pseudohaustorius caroliniensis												
Pseudoleptocuma minor	13	15	26	20	15	25	13	45	10	23	15	34
Pseudunciola obliquua	173	286	1443	111	319	95	72	35	95	23	64	23
Rhepoxynius hudsoni	27	26	49	26	25	23	30	10	10		10	10
Rhynchocoela (LPIL)	17	14	21	81	37	21	15	91	81	77	61	202
Rithropanopeus harrisii												
Sabaco americanus	10										30	
Sabellaria vulgaris				10								
Scalibregma inflatum	10										20	
Scaphopoda (LPIL)												
Schistomeringos rudolphi				10	30							
Schizaster orbignyanus												
Scolelepis squamata	17	10				10		13	10			
Scoletoma (LPIL)				10	30							
Scoletoma acicularum	18	12	17	18	22	17		17	23	23	74	55
Scoletoma hebes												
Scoloplos (LPIL)												
Scoloplos rubra								10	10			
Serpulidae (LPIL)												
Sigalion arenicola	11	25	24	20	24	16	10	10	15	10	10	25
Sigalionidae (LPIL)	10	13		13	10	28	25	24			18	10
Sigambra bassi												
Siliqua costata	10	10						10				18

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Taxa — Area / Date	BBA6 June-94	BBA6 May-95	BBA6 Sept.- 95	BBA6 May-96	BBA6 Sept.- 96	BBA6 May-97	BBA6 Sept.- 97	BBA6 May-98	BBA6 Sept.- 98	BBA6 May-99	BBA6 Sept.- 99	BBA6 May-00
Sipuncula (LPIL)	10	10										
Sipunculus (LPIL)												
Solemya (LPIL)												
Solen viridis										10		
Solenidae (LPIL)	18								20	10		
Sphaerodoropsis sp. G												
Sphaerosyllis (LPIL)												
Spio (LPIL)												
Spio setosa	25								85	10	10	13
Spiochaetopterus oculatus							43				10	
Spionidae (LPIL)	10		10	10			10	20	10	10	10	10
Spiophanes bombyx	14	12	17	19	11	19	10	1915	2255	18	52	11
Spisula solidissima	22	41	145	36	53	29	131	67	35	52	213	28
Stenothoidae (LPIL)	10	10										
Sthenelais (LPIL)										10		10
Sthenelais articulata												
Sthenelais limicola	17	16	10		13	10		13	20	26	24	10
Stomatopoda (LPIL)												
Streblospio benedicti												
Streptosyllis arenae												
Streptosyllis pettiboneae						10						30
Streptosyllis varians	16	18	41	19	45	26		10	11	10	20	13
Syllidae (LPIL)	10	10		10					10			10
Syllides convoluta			20									
Syllides sp. B				10								
Tagelus divisus												
Tanaidacea (LPIL)												
Tanaissus psammophilus	594	532	997	387	414	243	86	198	109	45	129	133
Tectonatica pusilla				10							28	20
Tellina (LPIL)				37	14	15	198	43				
Tellina agilis	35	34	34	25	19	26	40	93	75	111	169	66

Appendix Table 8-2. Abundance of Borrow Area Taxa (Numbers of Animals/m^2) (Continued)

Area	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6	BBA6
Taxa / Date	June-94	May-95	Sept.- 95	May-96	Sept.- 96	May-97	Sept.- 97	May-98	Sept.- 98	May-99	Sept.- 99	May-00
Tellina versicolor												
Tellinidae (LPIL)				40					10			
Terebellidae (LPIL)				10	10	10						
Tharyx acutus	149	14				20			12	13	100	
Thraciidae (LPIL)												
Trachyleberididae (LPIL)											10	
Travisia carnea	14	20	10	13	10	17	10	10	12	13	10	22
Tubificidae (LPIL)											58	23
Tubulanus (LPIL)			10	15	13	10		10		34	320	17
Tubulariidae (LPIL)												
Turbellaria (LPIL)	10	10			10			13		10	10	10
Turbonilla interrupta												30
Unciola (LPIL)		10	10	20		20			30			10
Unciola irrorata	10	10		40	70	20	15	100	29	13	86	10
Unciola serrata						20				10		10
Upogebia (LPIL)											10	
Veneridae (LPIL)					10		40			10		
Yoldia (LPIL)	10											

Appendix Table 8-3. Tukey Test Results for Abundance

	BBA3NS4	BBA3DS4	BBA5S4	BBA6S4	BBA3NS5	BBA3DS5	BBA5S5	BBA6S5	BBA3NF5	BBA3DF5	BBA5F5	BBA6F5	BBA3NS6	BBA3DS6	BBA5S6	BBA6S6
BBA3NS4	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA3DS4	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA5S4	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA6S4	-	-	-	-	-	-	X	-	-	-	-	-	X	X	X	X
BBA3NS5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DS5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5S5	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
BBA6S5	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA3NF5	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA3DF5	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA5F5	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA6F5	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA3DS6	X	X	X	X	-	-	-	X	X	X	X	X	-	-	-	-
BBA3NS6	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
BBA5S6	X	X	X	X	-	-	-	X	X	X	X	X	-	-	-	-
BBA6S6	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DF6	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA3NF6	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA5F6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
BBA6F6	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA3NS7	X	X	-	X	-	-	-	X	X	X	X	X	-	-	-	-
BBA3DS7	X	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-
BBA5S7	X	-	-	X	-	-	-	-	-	-	X	X	-	-	-	-
BBA6S7	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-

	BBA3NF6	BBA3DF6	BBA5F6	BBA6F6	BBA3NS7	BBA3DS7	BBA5S7	BBA6S7	BBA3NF7	BBA3DF7	BBA5F7	BBA6F7	BBA3NS8	BBA3DS8	BBA5S8	BBA6S8
BBA3NS4	-	-	-	-	X	X	X	-	-	X	X	X	X	-	X	X
BBA3DS4	-	-	-	-	X	-	-	-	-	X	X	X	X	-	X	-
BBA5S4	-	-	-	-	-	-	-	-	-	X	-	X	X	-	X	-
BBA6S4	-	-	-	-	X	X	X	X	-	X	X	X	X	-	X	X
BBA3NS5	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-
BBA3DS5	-	-	-	-	-	-	-	-	-	-	-	X	X	-	X	-
BBA5S5	-	-	-	-	-	-	-	-	-	-	-	X	X	-	X	-
BBA6S5	-	-	-	-	X	-	-	-	-	X	X	X	X	-	X	-
BBA3NF5	-	-	-	-	X	-	-	-	-	X	X	X	X	-	X	-
BBA3DF5	-	-	-	-	X	-	-	-	-	X	-	X	X	-	X	-
BBA5F5	-	-	-	-	X	-	X	-	-	X	X	X	X	-	X	-
BBA6F5	-	-	-	-	X	X	X	-	-	X	X	X	X	-	X	X
BBA3DS6	X	X	-	X	-	-	-	-	-	-	-	X	-	-	-	-
BBA3NS6	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA5S6	X	X	X	X	-	-	-	-	-	-	-	X	-	X	-	-
BBA6S6	-	-	-	-	-	-	-	-	-	-	-	X	X	-	X	-
BBA3DF6	-	-	-	-	X	-	-	-	-	X	X	X	X	-	X	-
BBA3NF6	-	-	-	-	X	-	-	-	-	X	-	X	X	-	X	-
BBA5F6	-	-	-	-	-	-	-	-	-	-	-	X	X	-	X	-
BBA6F6	-	-	-	-	X	-	-	-	-	X	X	X	X	-	X	-
BBA3NS7	X	X	-	X	-	-	-	-	-	-	-	X	-	-	-	-
BBA3DS7	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA5S7	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA6S7	-	-	-	-	-	-	-	-	-	-	-	X	X	-	X	-

	BBA3NF8	BBA3DF8	BBA5F8	BBA6F8	BBA3NS9	BBA3DS9	BBA5S9	BBA6S9	BBA3NF9	BBA3DF9	BBA5F9	BBA6F9	BBA3NS0	BBA3DS0	BBA5S0	BBA6S0
BBA3NS4	-	-	X	-	-	-	X	X	-	-	X	-	-	-	X	-
BBA3DS4	-	-	-	-	-	-	X	-	-	-	X	-	-	X	X	-
BBA5S4	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA6S4	-	-	X	-	X	-	X	X	-	-	X	-	-	-	X	X
BBA3NS5	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA3DS5	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA5S5	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA6S5	-	-	-	-	-	-	X	-	-	-	X	-	-	X	X	-
BBA3NF5	-	-	-	-	-	-	X	X	-	-	X	-	-	X	X	-
BBA3DF5	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA5F5	-	-	X	-	-	-	X	X	-	-	X	-	-	X	X	-
BBA6F5	-	-	X	-	-	-	X	X	-	-	X	-	-	X	X	-
BBA3DS6	-	-	-	-	-	X	-	-	-	X	-	X	-	X	-	-
BBA3NS6	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA5S6	-	X	-	X	-	X	-	-	-	X	-	X	-	X	-	-
BBA6S6	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA3DF6	-	-	-	-	-	-	X	-	-	-	X	-	-	X	X	-
BBA3NF6	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA5F6	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA6F6	-	-	-	-	-	-	X	-	-	-	X	-	-	X	-	-
BBA3NS7	-	-	-	-	-	X	-	-	-	X	-	-	-	X	-	-
BBA3DS7	-	-	-	-	-	-	-	-	-	X	X	-	-	X	-	-
BBA5S7	-	-	-	-	-	X	-	-	-	X	X	-	-	X	-	-
BBA6S7	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-

X=Significant Difference, - = No Significant Difference, S = Spring (May), F=Fall (Sept), 4=1994, 5=1995, 6=1996, 7=1997, 8=1998, 9=1999, 0=2000

Appendix Table 8-3. Tukey Test Results for Abundance

	BBA3NS4	BBA3DS4	BBA5S4	BBA6S4	BBA3NS5	BBA3DS5	BBA5S5	BBA6S5	BBA3NF5	BBA3DF5	BBA5F5	BBA6F5	BBA3NS6	BBA3DS6	BBA5S6	BBA6S6	BBA3NF6	BBA3DF6	BBA5F6	BBA6F6	BBA3NS7	BBA3DS7	BBA5S7	BBA6S7
BBA3NF7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DF7	X	X	X	X	-	-	-	X	X	X	X	X	-	-	-	-	X	X	-	X	-	-	-	-
BBA5F7	X	X	-	X	-	-	-	X	X	-	X	X	-	-	-	-	-	X	-	X	-	-	-	-
BBA6F7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BBA3NS8	X	X	X	X	X	X	X	X	X	X	X	X	-	-	-	X	X	X	X	X	-	-	-	X
BBA3DS8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
BBA5S8	X	X	X	X	-	X	X	X	X	X	X	X	-	-	-	X	X	X	X	X	-	-	-	X
BBA6S8	X	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
BBA3NF8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DF8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
BBA5F8	X	-	-	X	-	-	-	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-
BBA6F8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
BBA3NS9	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DS9	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	X	-	X	-
BBA5S9	X	X	-	X	-	-	-	X	X	-	X	X	-	-	-	-	-	X	-	X	-	-	-	-
BBA6S9	X	-	-	X	-	-	-	-	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-
BBA3NF9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DF9	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	X	X	X	-
BBA5F9	X	X	X	X	X	X	X	X	X	X	X	X	X	-	-	X	X	X	X	X	-	X	X	X
BBA6F9	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	-	-	-
BBA3NS0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DS0	-	X	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BBA5S0	X	X	-	X	-	-	-	X	X	-	X	X	-	-	-	-	-	X	-	-	-	-	-	-
BBA6S0	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	BBA3NF7	BBA3DF7	BBA5F7	BBA6F7	BBA3NS8	BBA3DS8	BBA5S8	BBA6S8	BBA3NF8	BBA3DF8	BBA5F8	BBA6F8	BBA3NS9	BBA3DS9	BBA5S9	BBA6S9	BBA3NF9	BBA3DF9	BBA5F9	BBA6F9	BBA3NS0	BBA3DS0	BBA5S0	BBA6S0
BBA3NF7	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA3DF7	-	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	X	-	X	-	-
BBA5F7	-	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	X	-	-	X	-	-
BBA6F7	X	X	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X
BBA3NS8	X	-	-	-	-	X	-	-	X	X	-	X	-	X	-	-	X	X	-	X	X	X	-	X
BBA3DS8	-	-	-	X	X	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA5S8	-	-	-	X	-	X	-	-	-	X	-	X	-	X	-	-	-	X	-	X	-	X	-	X
BBA6S8	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	X	-	-
BBA3NF8	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA3DF8	-	-	-	X	X	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA5F8	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	X	-	-
BBA6F8	-	-	-	X	X	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA3NS9	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA3DS9	-	X	X	X	X	-	X	-	-	-	-	-	-	-	X	X	-	-	X	-	-	X	X	-
BBA5S9	-	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	X	-	-	X	-	-
BBA6S9	-	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	X	-	-	X	-	-
BBA3NF9	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA3DF9	-	X	X	X	X	-	X	X	-	-	X	-	-	-	X	X	-	-	X	-	-	-	X	-
BBA5F9	X	-	X	-	-	X	-	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X
BBA6F9	-	X	-	X	X	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA3NS0	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-
BBA3DS0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	-	X	X
BBA5S0	-	-	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	X	-	-	X	-	-
BBA6S0	-	-	-	X	X	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-

X=Significant Difference, - = No Significant Difference, S = Spring (May), F=Fall (Sept), 4=1994, 5=1995, 6=1996, 7=1997, 8=1998, 9=1999, 0=2000

Appendix Table 8-4. Tukey Test Results for Biomass

	BBA3NS4	BBA3DS4	BBA5S4	BBA6S4	BBA3NS5	BBA3DS5	BBA5S5	BBA6S5	BBA3NF5	BBA3DF5	BBA5F5	BBA6F5	BBA3NS6	BBA3DS6	BBA5S6	BBA6S6
BBA3DS4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3NS4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5S4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA6S4	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3NS5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DS5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5S5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA6S5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3NF5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DF5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5F5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA6F5	-	-	-	X	-	-	-	-	-	-	-	-	-	-	X	-
BBA3NS6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DS6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5S6	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA6S6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3NF6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DF6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5F6	-	-	-	-	X	-	-	X	X	-	-	X	-	-	-	-
BBA6F6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3NS7	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3DS7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5S7	-	-	-	-	X	-	X	X	X	-	-	X	X	-	-	X
BBA6S7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	BBA3NF6	BBA3DF6	BBA5F6	BBA6F6	BBA3NS7	BBA3DS7	BBA5S7	BBA6S7	BBA3NF7	BBA3DF7	BBA5F7	BBA6F7	BBA3NS8	BBA3DS8	BBA5S8	BBA6S8
BBA3DS4	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3NS4	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA5S4	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
BBA6S4	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
BBA3NS5	-	-	X	-	-	-	X	-	-	-	X	X	-	-	X	X
BBA3DS5	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
BBA5S5	-	-	-	-	-	-	X	-	-	-	-	X	-	-	X	X
BBA6S5	-	-	X	-	-	-	X	-	-	-	X	X	-	-	X	X
BBA3NF5	-	-	X	-	-	-	X	-	-	-	X	X	-	-	X	X
BBA3DF5	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
BBA5F5	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
BBA6F5	-	-	X	-	X	-	X	-	-	X	X	X	X	X	X	X
BBA3NS6	-	-	-	-	-	-	X	-	-	-	-	X	-	-	X	X
BBA3DS6	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA5S6	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA6S6	-	-	-	-	-	-	X	-	-	-	-	X	-	-	X	X
BBA3NF6	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
BBA3DF6	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
BBA5F6	-	-	-	X	-	-	-	X	-	-	-	X	-	-	-	-
BBA6F6	-	-	X	-	-	-	X	-	-	-	X	X	X	-	X	X
BBA3NS7	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3DS7	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA5S7	-	-	-	X	-	-	-	X	-	-	-	X	-	-	-	-
BBA6S7	-	-	X	-	-	-	X	-	-	-	X	X	X	-	X	X

	BBA3NF8	BBA3DF8	BBA5F8	BBA6F8	BBA3NS9	BBA3DS9	BBA5S9	BBA6S9	BBA3NF9	BBA3DF9	BBA5F9	BBA6F9	BBA3NS0	BBA3DS0	BBA5S0	BBA6S0
BBA3DS4	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3NS4	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5S4	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA6S4	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3NS5	-	-	-	X	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DS5	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5S5	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA6S5	-	-	-	X	-	-	X	-	-	-	X	-	-	-	X	-
BBA3NF5	-	-	-	X	-	-	X	-	-	-	X	-	-	-	X	-
BBA3DF5	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5F5	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA6F5	-	-	X	X	-	-	X	X	-	-	X	X	-	-	X	X
BBA3NS6	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DS6	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5S6	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA6S6	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3NF6	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DF6	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5F6	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA6F6	-	-	-	X	-	-	X	-	-	-	X	-	-	-	X	-
BBA3NS7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
BBA3DS7	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5S7	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA6S7	-	-	-	X	-	-	X	-	-	-	X	-	-	-	X	-

X=Significant Difference, - = No Significant Difference, S = Spring (May), F=Fall (Sept), 4=1994, 5=1995, 6=1996, 7=1997, 8=1998, 9=1999, 0=2000

Appendix Table 8-4. Tukey Test Results for Biomass

	BBA3NS4	BBA3DS4	BBA5S4	BBA6S4	BBA3NS5	BBA3DS5	BBA5S5	BBA6S5	BBA3NF5	BBA3DF5	BBA5F5	BBA6F5	BBA3NS6	BBA3DS6	BBA5S6	BBA6S6
BBA3NF7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DF7	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA5F7	-	-	-	-	X	-	-	X	X	-	-	X	-	-	-	-
BBA6F7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BBA3NS8	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3DS8	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA5S8	-	-	-	-	X	-	X	X	X	-	-	X	X	-	-	X
BBA6S8	-	-	X	X	X	X	X	X	X	X	X	X	X	-	-	X
BBA3NF8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DF8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5F8	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA6F8	-	-	-	-	X	-	-	X	X	-	-	X	-	-	-	-
BBA3NS9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DS9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5S9	-	-	-	-	-	-	-	X	X	-	-	X	-	-	-	-
BBA6S9	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3NF9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DF9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5F9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BBA6F9	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3NS0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DS0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5S0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BBA6S0	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-

	BBA3NF6	BBA3DF6	BBA5F6	BBA6F6	BBA3NS7	BBA3DS7	BBA5S7	BBA6S7	BBA3NF7	BBA3DF7	BBA5F7	BBA6F7	BBA3NS8	BBA3DS8	BBA5S8	BBA6S8
BBA3NF7	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3DF7	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA5F7	-	-	-	X	-	-	-	X	-	-	-	X	-	-	-	-
BBA6F7	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X
BBA3NS8	-	-	-	X	-	-	-	X	-	-	-	X	-	-	-	-
BBA3DS8	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA5S8	-	-	-	X	-	-	-	X	-	-	-	X	-	-	-	-
BBA6S8	X	-	-	X	-	-	-	X	-	-	-	X	-	-	-	-
BBA3NF8	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
BBA3DF8	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA5F8	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA6F8	-	-	-	X	-	-	-	X	-	-	-	X	-	-	-	-
BBA3NS9	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
BBA3DS9	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA5S9	-	-	-	X	-	-	-	X	-	-	-	X	-	-	-	-
BBA6S9	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3NF9	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
BBA3DF9	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
BBA5F9	X	X	-	X	-	X	-	X	X	-	-	X	-	-	-	-
BBA6F9	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
BBA3NS0	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X
BBA3DS0	-	-	X	-	-	-	X	-	-	X	X	X	X	-	X	X
BBA5S0	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	-
BBA6S0	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X

	BBA3NF8	BBA3DF8	BBA5F8	BBA6F8	BBA3NS9	BBA3DS9	BBA5S9	BBA6S9	BBA3NF9	BBA3DF9	BBA5F9	BBA6F9	BBA3NS0	BBA3DS0	BBA5S0	BBA6S0
BBA3NF7	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DF7	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA5F7	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA6F7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X
BBA3NS8	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA3DS8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
BBA5S8	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA6S8	X	-	-	-	X	-	-	-	X	X	-	X	X	X	-	X
BBA3NF8	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DF8	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5F8	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA6F8	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA3NS9	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DS9	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5S9	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-
BBA6S9	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3NF9	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DF9	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5F9	X	X	X	-	X	X	-	X	X	X	-	X	X	X	-	X
BBA6F9	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3NS0	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DS0	-	-	-	X	-	-	X	-	-	-	X	-	-	-	X	-
BBA5S0	X	X	X	X	X	X	X	X	X	X	-	X	X	X	-	X
BBA6S0	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-

X=Significant Difference, - = No Significant Difference, S = Spring (May), F=Fall (Sept), 4=1994, 5=1995, 6=1996, 7=1997, 8=1998, 9=1999, 0=2000

Appendix Table 8-5. Tukey Test Results for Taxa Richness

	BBA3NS4	BBA3DS4	BBA5S4	BBA6S4	BBA3NS5	BBA3DS5	BBA5S5	BBA6S5	BBA3NF5	BBA3DF5	BBA5F5	BBA6F5	BBA3NS6	BBA3DS6	BBA5S6	BBA6S6	BBA3NF6	BBA3DF6	BBA5F6	BBA6F6	BBA3NS7	BBA3DS7	BBA5S7	BBA6S7
BBA3NS4	-	-	-	-	-	-	-	-	-	-	X	-	-	X	X	-	-	-	-	-	X	-	X	-
BBA3DS4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA6S4	-	-	-	-	-	-	-	-	-	-	X	X	-	X	X	-	-	-	-	-	X	-	X	-
BBA5S4	-	-	-	-	-	-	-	-	-	-	X	-	-	X	X	-	-	-	-	-	X	-	X	-
BBA3NS5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DS5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5S5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA6S5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3NF5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DF5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5F5	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA6F5	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3NS6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DS6	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-
BBA5S6	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-
BBA6F6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3NF6	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	-	X	-
BBA3DF6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5F6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA6S6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3NS7	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DS7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5S7	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-
BBA6S7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	BBA3NF7	BBA3DF7	BBA5F7	BBA6F7	BBA3NS8	BBA3DS8	BBA5S8	BBA6S8	BBA3NF8	BBA3DF8	BBA5F8	BBA6F8	BBA3NS9	BBA3DS9	BBA5S9	BBA6S9	BBA3DF9	BBA3NF9	BBA5F9	BBA6F9	BBA3NS0	BBA3DS0	BBA5S0	BBA6S0
BBA3NS4	-	X	X	X	X	X	X	X	-	-	X	X	-	-	X	-	-	-	X	-	-	-	X	-
BBA3DS4	-	X	X	X	X	-	X	X	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA6S4	-	X	X	X	X	X	X	X	-	-	X	X	-	-	X	X	-	-	X	-	-	-	X	-
BBA5S4	-	X	X	X	X	X	X	X	-	-	X	X	-	-	X	-	-	-	X	-	-	-	X	-
BBA3NS5	-	X	X	X	-	-	X	X	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DS5	-	-	-	X	-	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5S5	-	X	X	X	-	-	X	X	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA6S5	-	X	X	X	-	-	X	X	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3NF5	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DF5	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5F5	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA6F5	-	-	-	X	-	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3NS6	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DS6	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
BBA5S6	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	X
BBA6F6	-	X	X	X	-	-	X	X	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3NF6	-	X	X	X	X	-	X	X	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DF6	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5F6	-	-	X	X	-	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA6S6	-	-	X	X	-	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3NS7	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DS7	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5S7	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	X
BBA6S7	-	-	X	X	-	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-

X=Significant Difference, - = No Significant Difference, S = Spring (May), F=Fall (Sept), 4=1994, 5=1995, 6=1996, 7=1997, 8=1998, 9=1999, 0=2000

Appendix Table 8-5. Tukey Test Results for Taxa Richness

	BBA3NS4	BBA3DS4	BBA5S4	BBA6S4	BBA3NS5	BBA3DS5	BBA5S5	BBA6S5	BBA3NF5	BBA3DF5	BBA5F5	BBA6F5	BBA3NS6	BBA3DS6	BBA5S6	BBA6S6
BBA3NF7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DF7	X	X	X	X	X	-	X	X	-	-	-	-	-	-	-	-
BBA5F7	X	X	X	X	X	-	X	X	-	-	-	-	-	-	-	X
BBA6F7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BBA3NS8	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DS8	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-
BBA5S8	X	X	X	X	X	X	X	X	-	-	-	X	-	-	-	X
BBA6S8	X	X	X	X	X	-	X	X	-	-	-	-	-	-	-	-
BBA3NF8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DF8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5F8	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-
BBA6F8	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-
BBA3NS9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DS9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5S9	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-
BBA6S9	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
BBA3NF9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DF9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5F9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BBA6F9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3NS0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA3DS0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BBA5S0	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X
BBA6S0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-

	BBA3NF6	BBA3DF6	BBA5F6	BBA6F6	BBA3NS7	BBA3DS7	BBA5S7	BBA6S7	BBA3NF7	BBA3DF7	BBA5F7	BBA6F7	BBA3NS8	BBA3DS8	BBA5S8	BBA6S8
BBA3NF7	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3DF7	X	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-
BBA5F7	X	-	X	X	-	-	-	X	-	-	-	X	-	-	-	-
BBA6F7	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X
BBA3NS8	X	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3DS8	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA5S8	X	-	X	X	-	-	-	X	-	-	-	X	-	-	-	-
BBA6S8	X	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-
BBA3NF8	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3DF8	-	-	-	-	-	-	-	-	-	-	X	X	-	-	X	-
BBA5F8	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA6F8	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3NS9	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-
BBA3DS9	-	-	-	-	-	-	-	-	-	-	X	X	-	-	X	-
BBA5S9	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA6S9	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-
BBA3NF9	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3DF9	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-
BBA5F9	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X
BBA6F9	-	-	-	-	-	-	-	-	-	X	X	X	-	-	X	X
BBA3NS0	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
BBA3DS0	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-
BBA5S0	X	X	X	X	X	X	X	X	X	-	X	-	-	X	-	X
BBA6S0	-	-	-	-	-	-	X	-	-	X	X	X	X	-	X	X

	BBA3NF8	BBA3DF8	BBA5F8	BBA6F8	BBA3NS9	BBA3DS9	BBA5S9	BBA6S9	BBA3DF9	BBA3NF9	BBA5F9	BBA6F9	BBA3NS0	BBA3DS0	BBA5S0	BBA6S0
BBA3NF7	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DF7	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	X
BBA5F7	-	X	-	-	-	X	-	-	-	-	X	X	-	-	X	X
BBA6F7	X	X	X	X	X	X	X	X	X	X	-	X	X	X	-	X
BBA3NS8	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	X
BBA3DS8	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5S8	-	X	-	-	X	X	-	X	X	-	X	X	-	X	-	X
BBA6S8	-	-	-	-	-	-	-	-	-	-	X	X	-	-	X	X
BBA3NF8	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DF8	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5F8	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA6F8	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3NS9	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DS9	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5S9	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA6S9	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3NF9	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DF9	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5F9	X	X	X	X	X	X	X	X	X	X	-	X	X	X	-	X
BBA6F9	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3NS0	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA3DS0	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-
BBA5S0	X	X	X	X	X	X	X	X	X	X	-	X	X	X	-	X
BBA6S0	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-

X=Significant Difference, - = No Significant Difference, S = Spring (May), F=Fall (Sept), 4=1994, 5=1995, 6=1996, 7=1997, 8=1998, 9=1999, 0=2000

Appendix Table 8-6. Guild Assignments

Taxon	Trophic	Dispersal	Taxon	Trophic	Dispersal
Acanthohaustorius (LPIL)	SSDF	VARIABLE	*Astarte castanea*	FF	WIDE
Acanthohaustorius intermedius	SSDF	VARIABLE	*Asterias forbesi*	CARN	WIDE
Acanthohaustorius millsi	SSDF	VARIABLE	Asteroidea (LPIL)	CARN	WIDE
Acanthohaustorius shoemakeri	SSDF	VARIABLE	*Autolytus prolifera*	CARN	VARIABLE
Acarina (LPIL)	CARN	VARIABLE	*Bathyporeia* (LPIL)	SSDF	VARIABLE
Actiniaria (LPIL)	FF	VARIABLE	*Bathyporeia parkeri*	SSDF	VARIABLE
Aedicira (LPIL)	SDF	LIMITED	*Bathyporeia quoddyensis*	SSDF	VARIABLE
Aeginina longicornis	CARN	VARIABLE	Bivalvia (LPIL)	XXX	XXX
Aglaophamus circinata	CARN	WIDE	Bodotriidae (LPIL)	FF/SDF	VARIABLE
Albunea paretii	OMNI	WIDE	Branchiopoda (LPIL)	FF	WIDE
Aleutha depressa	FF	WIDE	*Branchiostoma* (LPIL)	FF	WIDE
Amastigos caperatus	SSDF	VARIABLE	*Brania wellfleetensis*	CARN	VARIABLE
Americamysis bigelowi	FF/SDF	VARIABLE	*Callinectes similis*	OMNI	WIDE
Americhelidium americanum	SDF/SSDF	VARIABLE	*Calyptraea centralis*	FF	WIDE
Ameroculodes (LPIL)	SDF/SSDF	VARIABLE	Calyptraeidae (LPIL)	FF	WIDE
Ameroculodes edwardsi	SDF/SSDF	VARIABLE	Cancer (LPIL)	OMNI	WIDE
Ameroculodes sp. I	SDF/SSDF	VARIABLE	*Cancer irroratus*	OMNI	WIDE
Ampelisca (LPIL)	FF/SDF	LIMITED	*Capitella capitata*	SSDF	VARIABLE
Ampelisca abdita	FF/SDF	LIMITED	Capitellidae (LPIL)	SSDF	VARIABLE
Ampharete (LPIL)	SDF	LIMITED	*Caprella* (LPIL)	CARN	VARIABLE
Ampharete americana	SDF	LIMITED	Caprellidae (LPIL)	CARN	VARIABLE
Ampharete finmarchica	SDF	LIMITED	*Carraziella hobsonae*	FF/SDF	LIMITED
Ampharetidae (LPIL)	SDF	LIMITED	*Caulleriella* (LPIL)	SDF	LIMITED
Amphipoda (LPIL)	XXX	XXX	*Caulleriella killariensis*	SDF	LIMITED
Amphiporeia gigantea	SSDF	VARIABLE	*Caulleriella sp. E*	SDF	LIMITED
Ampithoe valida	SDF	LIMITED	*Cerastoderma pinnulatum*	FF	WIDE
Anadara (LPIL)	FF	WIDE	*Ceriantheopsis americanus*	FF	VARIABLE
Anadara ovalis	FF	WIDE	Chaetopteridae (LPIL)	SDF	LIMITED
Anadara transversa	FF	WIDE	*Chaetozone* (LPIL)	SDF	LIMITED
Ancistrosyllis hartmanae	CARN	WIDE	*Chaetozone setosa*	SDF	LIMITED
Anonyx liljeborgi	SDF	VARIABLE	*Chione cancellata*	FF	WIDE
Anthozoa (LPIL)	FF	VARIABLE	*Chiridotea tuftsi*	SSDF	VARIABLE
Aoridae (LPIL)	SDF	VARIABLE	Chordata (LPIL)	XXX	XXX
Apoprionospio pygmae	FF/SDF	WIDE	Cirolanidae (LPIL)	SSDF	VARIABLE
Arabellidae (LPIL)	CARN	LIMITED	Cirratulidae (LPIL)	SDF	LIMITED
Archiannelida (LPIL)	CARN	WIDE	*Cirrophorus* (LPIL)	SDF	LIMITED
Arcidae (LPIL)	FF	WIDE	*Cirrophorus ilvana*	SDF	LIMITED
Aricidea (LPIL)	SDF	LIMITED	*Cirrophorus lyra*	SDF	LIMITED
Aricidea catherinae	SDF	LIMITED	Cladocera (LPIL)	FF	WIDE
Aricidea cerrutii	SDF	LIMITED	Cnidaria (LPIL)	FF	VARIABLE
Aricidea wassi	SDF	LIMITED	*Corophium* (LPIL)	SDF	LIMITED
Armadillidae (LPIL)	XXX	XXX	*Corophium insidiosum*	SDF	LIMITED
Armandia intermedia	SSDF	VARIABLE	*Corophium tuberculatum*	SDF	LIMITED
Asabellides oculata	SDF	LIMITED	*Cossura cf. laeviseta*	SDF	VARIABLE
Ascidiacea (LPIL)	FF	WIDE	*Crangon septemspinosa*	OMNI	WIDE

Appendix Table 8-6. Guild Assignments

Taxon	Trophic	Dispersal
Crepidula (LPIL)	FF	LIMITED
Crepidula fornicata	FF	LIMITED
Crepidula plana	FF	LIMITED
Crustacea (LPIL)	XXX	XXX
Cumacea (LPIL)	FF/SDF	VARIABLE
Decapoda (LPIL)	XXX	XXX
Decapoda Natantia (LPIL)	XXX	XXX
Decapoda Reptantia (LPIL)	XXX	XXX
Dentalium (LPIL)	SSDF	WIDE
Diastylidae (LPIL)	FF/SDF	VARIABLE
Diastylis (LPIL)	FF/SDF	VARIABLE
Diastylis polita	FF/SDF	VARIABLE
Diastylis quadrispinosa	FF/SDF	VARIABLE
Diastylis sculpta	FF/SDF	VARIABLE
Diopatra cuprea	CARN	LIMITED
Dipolydora (LPIL)	FF/SDF	VARIABLE
Dipolydora socialis	FF/SDF	VARIABLE
Dispio uncinata	FF/SDF	WIDE
Donacidae (LPIL)	FF	WIDE
Donax variabilis	FF	WIDE
Dorvilleidae (LPIL)	SDF	LIMITED
Drilonereis longa	CARN	LIMITED
Dyopedos monacanthus	FF	XXX
Echinarachnius parma	SDF	WIDE
Echinodea (LPIL)	SDF	WIDE
Edotia triloba	SSDF	VARIABLE
Elasmopus levis	SDF	VARIABLE
Emerita talpoida	OMNI	WIDE
Ensis directus	FF	WIDE
Enteropneusta (LPIL)	SDF	WIDE
Ericthonius rubricornis	SDF	VARIABLE
Eusarsiella zostericola	XXX	VARIABLE
Euspira heros	CARN	LIMITED
Exogene (LPIL)	CARN	VARIABLE
Exogene dispar	CARN	VARIABLE
Exogene hebes	CARN	VARIABLE
Exogene rolani	CARN	VARIABLE
Flabelligeridae (LPIL)	SDF	WIDE
Gammaridae (LPIL)	SDF	VARIABLE
Gammarus (LPIL)	SDF	VARIABLE
Gammarus annulatus	SDF	VARIABLE
Gastropoda (LPIL)	XXX	XXX
Gemma gemma	FF	LIMITED
Glycera (LPIL)	CARN	WIDE
Glycera americana	CARN	WIDE
Glycera capitata	CARN	WIDE
Glycera dibranchiata	CARN	WIDE
Glycera robusta	CARN	WIDE
Glyceridae (LPIL)	CARN	WIDE
Glycinde solitaria	CARN	WIDE
Goneplacidae (LPIL)	OMNI	WIDE
Goniada teres	CARN	WIDE
Goniadella gracilis	CARN	WIDE
Goniadidae (LPIL)	CARN	WIDE
Goniadides carolinae	CARN	WIDE
Haminoea solitaria	CARN	WIDE
Harmothoe (LPIL)	CARN	WIDE
Harmothoe extenuata	CARN	WIDE
Harmothoe imbricata	CARN	WIDE
Harpacticoida (LPIL)	FF	VARIABLE
Haustoriidae (LPIL)	SSDF	VARIABLE
Haustorius canadensis	SSDF	VARIABLE
Haustorius sp. A	SSDF	VARIABLE
Haustorius sp. C	SSDF	VARIABLE
Hemipodus roseus	CARN	WIDE
Hesionidae (LPIL)	CARN	LIMITED
Hesionura coineaui	CARN	LIMITED
Hesionura elongata	CARN	LIMITED
Heteromastus filiformis	SSDF	VARIABLE
Hippomedon serratus	SDF	VARIABLE
Hirudinea (LPIL)	CARN	LIMITED
Holothuroidea (LPIL)	SDF	WIDE
Hydracarina (LPIL)	CARN	VARIABLE
Hydrobiidae (LPIL)	CARN	WIDE
Hypereteone heteropoda	CARN	WIDE
Idotea balthica	SSDF	VARIABLE
Idoteidae (LPIL)	SSDF	VARIABLE
Ilyanassa obsoleta	SDF/CAR	LIMITED
Ilyanassa trivittata	SDF/CAR	LIMITED
Isaeidae (LPIL)	SDF	VARIABLE
Ischyroceridae (LPIL)	FF/SDF	LIMITED
Ischyrocerus anguipes	FF/SDF	LIMITED
Isopoda (LPIL)	SSDF	VARIABLE
Jassa falcata	FF/SDF	LIMITED
Leitoscoloplos (LPIL)	SSDF	LIMITED
Leitoscoloplos robustus	SSDF	LIMITED
Leptochelia rapax	XXX	VARIABLE
Leucon americanus	FF/SDF	VARIABLE
Levinsenia gracilis	SDF	LIMITED
Libinia dubia	OMNI	WIDE

Appendix Table 8-6. Guild Assignments

Taxon	Trophic	Dispersal	Taxon	Trophic	Dispersal
Lineidae (LPIL)	CARN	LIMITED	*Nephtys incisa*	CARN	WIDE
Listriella barnardi	SSDF	VARIABLE	*Nephtys picta*	CARN	WIDE
Litocorsa antennataI	CARN	WIDE	*Nephtys simoni*	CARN	WIDE
Lumbrineridae (LPIL)	CARN	LIMITED	Nepthytidae (LPIL)	CARN	WIDE
Lumbrinerides acuta	CARN	LIMITED	Nereidae (LPIL)	SDF	WIDE
Lyonsia hyalina hyalina	FF	WIDE	*Nereis* (LPIL)	SDF	WIDE
Lysianassidae (LPIL)	SDF	VARIABLE	*Nereis succinea*	SDF	WIDE
Macoma (LPIL)	FF	WIDE	*Neverita duplicata*	CARN	LIMITED
Macoma yoldiformis	FF	WIDE	*Notomastus* (LPIL)	SSDF	VARIABLE
Mactridae (LPIL)	FF	WIDE	*Notomastus latericeus*	SSDF	VARIABLE
Magelona (LPIL)	SDF	WIDE	*Nucula* (LPIL)	FF	WIDE
Magelona papillicornis	SDF	WIDE	*Nucula proxima*	FF	WIDE
Majidae (LPIL)	OMNI	WIDE	*Nuculana* (LPIL)	FF	WIDE
Maldanidae (LPIL)	SSDF	LIMITED	*Odostomia* (LPIL)	XXX	LIMITED
Marenzellaria viridis	FF/SDF	WIDE	*Odostomia dealbata*	XXX	LIMITED
Mediomastus (LPIL)	SSDF	VARIABLE	*Odostomia gibbosa*	XXX	LIMITED
Mediomastus ambiseta	SSDF	VARIABLE	Oedicerotidae (LPIL)	SDF/SSD	VARIABLE
Melita (LPIL)	SDF	VARIABLE	Oenonidae (LPIL)	CARN	LIMITED
Mercenaria mercenaria	FF	WIDE	Oligochaeta (LPIL)	SSDF	LIMITED
Microdeuptopus gryllotalpa	SDF	VARIABLE	Olividae (LPIL)	CARN	LIMITED
Microphthalmus (LPIL)	CARN	LIMITED	Onuphidae (LPIL)	CARN	LIMITED
Microphthalmus aberrans	CARN	LIMITED	*Onuphis eremita*	CARN	LIMITED
Microphthalmus hartmanae	CARN	LIMITED	*Ophelia denticulata*	SSDF	VARIABLE
Microphthalmus listensis	CARN	LIMITED	Opheliidae (LPIL)	SSDF	LIMITED
Microphthalmus sczelkowii	CARN	LIMITED	Ophiuroidea (LPIL)	SDF	WIDE
Microphthalmus sp. G	CARN	LIMITED	*Ophryotrocha* (LPIL)	SDF	LIMITED
Molgula (LPIL)	FF	WIDE	*Orbinia* (LPIL)	SSDF	LIMITED
Mollusca (LPIL)	XXX	XXX	*Orbinia americana*	SSDF	LIMITED
Molpadiidae (LPIL)	SDF	WIDE	*Orbinia swani*	SSDF	LIMITED
Montacutidae (LPIL)	SDF	WIDE	Orbiniidae (LPIL)	SSDF	LIMITED
Monticellina dorsobranchialis	SDF	LIMITED	Ostracoda (LPIL)	XXX	VARIABLE
Mulinia lateralis	FF	WIDE	*Ovalipes ocellatus*	OMNI	WIDE
Mya arenaria	FF	WIDE	*Owenia fusiformis*	SSDF	WIDE
Mysella planulata	FF	WIDE	*Oxyurostylis* (LPIL)	FF/SDF	VARIABLE
Mysidacea (LPIL)	FF/SDF	VARIABLE	*Oxyurostylis smithi*	FF/SDF	VARIABLE
Mysidae (LPIL)	FF/SDF	VARIABLE	Paguridae (LPIL)	OMNI	WIDE
Mytilidae (LPIL)	FF	WIDE	*Pagurus* (LPIL)	OMNI	WIDE
Mytilis edulis	FF	WIDE	*Pagurus politus*	OMNI	WIDE
Nassariidae (LPIL)	SDF/CARN	LIMITED	*Pandora* (LPIL)	FF	WIDE
Naticidae (LPIL)	CARN	LIMITED	*Pandora arenosa*	FF	WIDE
Nematoda (LPIL)	SDF/SSDF	LIMITED	*Pandora glacialis*	FF	WIDE
Neomysis americana	FF/SDF	VARIABLE	*Pandora gouldiana*	FF	WIDE
Neopanope sayi	OMNI	WIDE	Pandoridae (LPIL)	FF	WIDE
Nephtys (LPIL)	CARN	WIDE	*Paracaprella tenuis*	CARN	VARIABLE
Nephtys bucera	CARN	WIDE	*Parahaustorius* (LPIL)	SSDF	VARIABLE

Appendix Table 8-6. Guild Assignments

Taxon	Trophic	Dispersal	Taxon	Trophic	Dispersal
Parahaustorius attenuatus	SSDF	VARIABLE	*Protohaustorius sp. B*	SSDF	VARIABLE
Parahaustorius holmesi	SSDF	VARIABLE	*Protohaustorius wigleyi*	SSDF	VARIABLE
Parahaustorius longimerus	SSDF	VARIABLE	Psammobiidae (LPIL)	CARN	VARIABLE
Parametopella cypris	OMNI	VARIABLE	*Psammonyx nobilis*	CARN	VARIABLE
Paranaitis speciosa	CARN	WIDE	*Pseudohaustorius borealis*	SSDF	VARIABLE
Parandalia ocularis	CARN	WIDE	*Pseudohaustorius caroliniensis*	SSDF	VARIABLE
Paraonidae (LPIL)	SDF	LIMITED	*Pseudoleptocuma minor*	FF/SDF	VARIABLE
Paraonis (LPIL)	SDF	LIMITED	*Pseudunciola obliquua*	FF/SDF	LIMITED
Paraonis fulgens	SDF	LIMITED	Pyramidellidae (LPIL)	XXX	LIMITED
Paraonis pygoenigmatica	SDF	LIMITED	*Rhepoxynius hudsoni*	CARN	VARIABLE
Parapionosyllis longicirrata	CARN	LIMITED	*Rithropanopeus harrisii*	OMNI	WIDE
Parapionosyllis sp. D	CARN	LIMITED	Rhynchocoela (LPIL)	CARN	LIMITED
Paraprionospio pinnata	FF/SDF	WIDE	*Sabaco americanus*	SSDF	LIMITED
Parougia caeca	SDF	LIMITED	*Sabellaria vulgaris*	FF	WIDE
Pectinaria gouldii	SSDF	WIDE	Sabellidae (LPIL)	SDF	LIMITED
Pelecypoda (LPIL)	XXX	XXX	*Scalibregma inflatum*	SSDF	WIDE
Periploma (LPIL)	FF	WIDE	Scaphopoda (LPIL)	SSDF	WIDE
Periploma leanum	FF	WIDE	*Scolelepis squamata*	FF/SDF	WIDE
Pherusa affinis	SDF	WIDE	*Scoletoma* (LPIL)	CARN	LIMITED
Pherusa plumosa	SDF	WIDE	*Scoletoma acicularum*	CARN	LIMITED
Phoronis architecta	FF	WIDE	*Scoletoma hebes*	CARN	LIMITED
Photis macrocoxa	SDF	VARIABLE	*Scoloplos* (LPIL)	SSDF	LIMITED
Photis pollex	SDF	VARIABLE	*Scoloplos rubra*	SSDF	LIMITED
Phoxocephalidae (LPIL)	CARN	VARIABLE	Serpulidae (LPIL)	FF	WIDE
Phyllodoce (LPIL)	CARN	WIDE	*Sigalion arenicola*	CARN	VARIABLE
Phyllodoce arenae	CARN	WIDE	Sigalionidae (LPIL)	CARN	VARIABLE
Phyllodoce mucosa	CARN	WIDE	*Sigambra bassi*	CARN	WIDE
Phyllodocidae (LPIL)	CARN	WIDE	*Siliqua costata*	FF	WIDE
Pisione remota	SSDF	WIDE	*Sipuncula* (LPIL)	SDF/SSD	WIDE
Pitar morrhuanus	FF	WIDE	*Sipunculus* (LPIL)	SDF/SSD	WIDE
Platysquilla enodis	CARN	WIDE	*Solen* (LPIL)	FF	WIDE
Pleurobranchaea tarda	HERB/SCR	WIDE	*Solen viridis*	FF	WIDE
Politolana polita	XXX	VARIABLE	Solenidae (LPIL)	FF	WIDE
Polydora (LPIL)	FF/SDF	VARIABLE	*Sphaerodoropsis sp. G*	SSDF	VARIABLE
Polydora caulleryi	FF/SDF	VARIABLE	*Sphaerosyllis* (LPIL)	CARN	LIMITED
Polydora cornuta	FF/SDF	VARIABLE	*Spio* (LPIL)	FF/SDF	WIDE
Polygordius (LPIL)	CARN	WIDE	*Spio setosa*	FF/SDF	WIDE
Polynicinae	XXX	LIMITED	*Spiochaetopterus oculatus*	FF	WIDE
Polynoidae (LPIL)	CARN	WIDE	Spionidae (LPIL)	FF/SDF	WIDE
PORTUNIDAE (LPIL)	OMNI	WIDE	*Spiophanes bombyx*	FF/SDF	WIDE
Prionospio steenstrupi	FF/SDF	WIDE	*Spisula* (LPIL)	FF	WIDE
Proboloides holmesi	OMNI	VARIABLE	*Spisula solidissima*	FF	WIDE
Proceraea cornuta	CARN	LIMITED	*Stenothoe minuta*	OMNI	VARIABLE
Protodorvillea kefersteini	SDF	LIMITED	Stenothoidae (LPIL)	OMNI	VARIABLE
Protohaustorius (LPIL)	SSDF	VARIABLE	*Sthenelais* (LPIL)	CARN	WIDE

Appendix Table 8-6. Guild Assignments

Taxon	Trophic	Dispersal
Sthenelais limicola	CARN	WIDE
Stomatopoda (LPIL)	CARN	WIDE
Streblospio benedicti	FF/SDF	VARIABLE
Streptosyllis pettiboneae	CARN	LIMITED
Streptosyllis varians	CARN	LIMITED
Syllidae (LPIL)	CARN	LIMITED
Syllides convoluta	CARN	LIMITED
Syllides sp. B	CARN	LIMITED
Tagelus divisus	FF	WIDE
Tanaidacea (LPIL)	XXX	VARIABLE
Tanaissus psammophilus	XXX	VARIABLE
Tectonatica pusilla	CARN	WIDE
Tellina (LPIL)	FF	WIDE
Tellina agilis	FF	WIDE
Tellina versicolor	FF	WIDE
Tellinidae (LPIL)	FF	WIDE
Terebellidae (LPIL)	SDF	WIDE
Tharyx acutus	SDF	LIMITED
Travisia carnea	SSDF	VARIABLE
Tubulanus (LPIL)	CARN	LIMITED
Turbellaria (LPIL)	CARN	LIMITED
Turbonilla interrupta	XXX	LIMITED
Unciola (LPIL)	FF/SDF	LIMITED
Unciola irrorata	FF/SDF	LIMITED
Unciola serrata	FF/SDF	LIMITED
Upogebia (LPIL)	OMNI	WIDE
Veneridae (LPIL)	FF	WIDE
Xanthidae (LPIL)	OMNI	WIDE
Yoldia (LPIL)	FF	WIDE

Trophic/Feeding Type
SDF = Surface Deposit Feeder
SSDF = Subsurface Deposit Feeder
FF = Filter Feeder
OMNI = Omnivore
CARN = Carnivore
SDF/SSDF = Surface & Subsurface Deposit Feeder
FF/SDF = Filter Feeder & Surface Deposit Feeder
SDF/CARN = Surface Deposit Feeder & Carnivore
HERB/SCRP = Herbivore/Scraper
Dispersal
LIMITED = Benthic Larva/Brooded
WIDE = Planktonic Larva
VARIABLE = Both or attached to Mobile Adult
XXX = Unknown

Table 8-2. Relative Abundance and Occurrence of Dominant Borrow Area Infauna

Area / Taxa	Total		BBA3 Dredged		BBA3 Undredged		BBA5		BBA6	
	Abund.	Occur.	Abund.	Occur.	Abund.	Occur.	Abund.	Occur.	Abund.	Occur.
Polygordius (LPIL)	35.54	69.86	60.18	69.17	11.31	65.83	16.06	67.50	33.66	74.58
Pseudunciola obliquua	9.61	100.00	6.64	100.00	9.63	100.00	19.11	100.00	6.86	100.00
Archiannelida (LPIL)	5.96	51.67	2.96	58.33	5.99	48.33	4.79	43.33	9.20	58.33
Tanaissus psammophilus	5.14	90.42	1.37	88.33	2.07	77.50	4.32	88.75	9.92	99.58
Spiophanes bombyx	4.40	67.78	4.23	75.00	0.74	80.00	1.38	67.08	7.52	58.75
Spisula solidissima	2.80	100.00	1.83	134.17	3.37	125.00	5.67	120.83	1.82	114.17
Tellina agilis	2.71	100.00	2.48	100.00	5.42	100.00	3.50	100.00	1.52	100.00
Echinarachnius parma	2.42	91.94	2.55	98.33	3.73	120.00	3.02	82.08	1.52	84.58
Magelona papillicornis	1.99	78.06	1.12	99.17	3.53	83.33	5.22	98.33	0.40	44.58
Oligochaeta (LPIL)	1.88	50.69	0.30	34.17	0.77	45.00	2.80	52.08	3.11	60.42
Acanthohaustorius millsi	1.61	34.31	0.64	42.50	5.16	70.83	3.70	42.92	0.04	3.33
Rhepoxynius hudsoni	1.60	86.53	1.44	100.00	3.58	100.00	2.66	83.75	0.45	61.67
Nucula proxima	1.58	38.06	0.15	33.33	6.91	50.00	1.13	27.08	1.20	45.42
Protohaustorius wigleyi	1.48	59.03	0.84	65.00	2.75	70.83	2.31	58.33	1.12	50.83
Rhynchocoela (LPIL)	1.16	83.61	1.00	82.50	1.08	85.83	0.94	66.67	1.44	100.00
Cirratulidae (LPIL)	1.07	49.31	1.68	51.67	0.94	49.17	0.49	35.00	0.90	62.50
Caulleriella killariensis	0.98	85.42	0.84	107.50	1.88	104.17	1.07	76.67	0.74	73.75
Asabellides oculata	0.94	21.39	0.58	32.50	0.36	27.50	0.19	10.83	1.86	23.33
Protohaustorius sp. B	0.86	28.33	0.41	29.17	1.94	38.33	1.71	35.00	0.38	16.25
Nepthytidae (LPIL)	0.68	54.86	0.37	53.33	0.98	62.50	1.09	46.25	0.60	60.42
Ampharetidae (LPIL)	0.59	17.22	0.22	30.00	3.67	25.00	0.10	9.58	0.09	14.58
Nephtys picta	0.53	42.92	0.25	42.50	0.67	51.67	0.81	36.25	0.56	45.42
Aricidea wassi	0.52	52.78	0.12	44.17	1.14	68.33	1.05	55.83	0.35	46.25
Aricidea catherinae	0.50	46.11	0.19	43.33	1.44	62.50	0.60	38.33	0.38	47.08
Acanthohaustorius similis	0.47	13.33	0.36	22.50	0.82	18.33	1.16	17.92	0.06	1.67
Tharyx acutus	0.45	17.92	0.32	13.33	1.25	19.17	0.12	17.50	0.47	20.00
Haustoriidae (LPIL)	0.44	42.36	0.15	43.33	0.99	65.83	0.98	44.58	0.20	27.92
Sigalion arenicola	0.41	74.58	0.25	80.00	0.47	69.17	0.76	85.42	0.32	63.75
Edotia triloba	0.40	50.14	0.42	60.00	0.57	57.50	0.47	45.00	0.29	46.67
Anthozoa (LPIL)	0.40	20.56	0.12	14.17	1.17	27.50	0.54	17.92	0.28	22.92
Pseudoleptocuma minor	0.39	60.69	0.20	56.67	0.72	74.17	0.54	54.58	0.36	62.08
Scoletoma acicularum	0.38	51.39	0.38	50.00	0.30	50.00	0.23	33.33	0.49	70.83
Exogene hebes	0.34	32.22	0.00	2.50	0.04	7.50	0.18	23.33	0.83	68.33
Chiridotea tuftsi	0.31	38.19	0.24	55.00	1.14	74.17	0.38	38.75	0.04	11.25
Nephtys bucera	0.21	42.08	0.11	44.17	0.28	33.33	0.18	27.50	0.30	60.00

*Taxa in **bold** excluded from final analyses (see text)

Table 8-3. Offshore Borrow Area Anova Results

Abundance

Source	DF	Sum of Squares	F Ratio	Prob > F
Area	3	0.9110	3.1061	0.0397
Date	11	2.0825	1.9364	0.0703
Area X Date	33	29.7563	9.2229	<.0001
Error	672	65.7002		

Biomass

Source	DF	Sum of Squares	F Ratio	Prob > F
Area	3	5.59992	4.033	0.0151
Date	11	5.43524	1.0676	0.4151
Area X Date	33	127.12773	8.3232	<.0001
Error	672	311.03111		

Taxa Richness

Source	DF	Sum of Squares	F Ratio	Prob > F
Area	3	516.7037	4.4963	0.0094
Date	11	1697.2628	4.0280	0.0009
Area X Date	33	7504.3344	5.9365	<.0001
Error	672	25741.6840		

Table 8-4. Selected Tukey Test Results for Abundance, Biomass, and Taxa Richness

Abundance

	Site	BBA3N	BBA3D	BBA5	BBA6
94 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
95 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
95 Sept	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
96 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
96 Sept	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
97 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
97 Sept	BBA3N	-	-	-	X
	BBA3D	-	-	-	X
	BBA5	-	-	-	X
	BBA6	X	X	X	-
98 May	BBA3N	-	X	-	-
	BBA3D	X	-	X	-
	BBA5	-	X	-	-
	BBA6	-	-	-	-
98 Sept	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
99 May	BBA3N	-	-	-	-
	BBA3D	-	-	X	X
	BBA5	-	X	-	-
	BBA6	-	X	-	-
99 Sept	BBA3N	-	-	X	-
	BBA3D	-	-	X	-
	BBA5	X	X	-	X
	BBA6	-	-	X	-
00 May	BBA3N	-	X	-	-
	BBA3D	X	-	X	X
	BBA5	-	X	-	-
	BBA6	-	X	-	-

Biomass

	Site	BBA3N	BBA3D	BBA5	BBA6
94 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
95 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
95 Sept	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
96 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
96 Sept	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	X
	BBA6	-	-	X	-
97 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	X
	BBA6	-	-	X	-
97 Sept	BBA3N	-	-	-	X
	BBA3D	-	-	-	X
	BBA5	-	-	-	X
	BBA6	X	X	X	-
98 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
98 Sept	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
99 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
99 Sept	BBA3N	-	-	X	-
	BBA3D	-	-	X	-
	BBA5	X	X	-	X
	BBA6	-	-	X	-
00 May	BBA3N	-	-	X	-
	BBA3D	-	-	X	-
	BBA5	X	X	-	X
	BBA6	-	-	X	-

Taxa

	Site	BBA3N	BBA3D	BBA5	BBA6
94 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
95 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
95 Sept	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
96 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
96 Sept	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
97 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
97 Sept	BBA3N	-	-	-	X
	BBA3D	-	-	-	-
	BBA5	-	-	-	X
	BBA6	X	-	X	-
98 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
98 Sept	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
99 May	BBA3N	-	-	-	-
	BBA3D	-	-	-	-
	BBA5	-	-	-	-
	BBA6	-	-	-	-
99 Sept	BBA3N	-	-	X	-
	BBA3D	-	-	X	-
	BBA5	X	X	-	X
	BBA6	-	-	X	-
00 May	BBA3N	-	-	X	-
	BBA3D	-	-	X	-
	BBA5	X	X	-	X
	BBA6	-	-	X	-

*X = significant difference, - = No Significant difference, BBA3D= Dredged, BBA3N = Undredged

Table 8-5. Offshore Nonmetric Dimensional Scaling Test Results

Stress in relation to dimensionality

	Stress in real data (40 runs)			Stress in randomized data, (Monte Carlo test-50 runs)			
Axes	Minimum	Mean	Maximum	Minimum	Mean	Maximum	p
1	34.198	43.901	56.489	41.956	51.392	56.505	0.0196
2	17.177	19.128	24.823	25.082	27.533	30.887	0.0196
3	11.261	11.346	12.681	17.365	19.139	21.012	0.0196

Table 8-6. Offshore Nonmetric Dimensional Scaling Test Results

Coefficients of determination for correlations between ordination distances and distances in original n-dimensional space

	R	Squared
Axis	Increment	Cumulative
1	0.456	0.456
2	0.051	0.507
3	0.331	0.838

Table 8-7. Correlations Between Taxa and MDS Axes*

Taxa	Axis 1	Axis 2	Axis 3
Acanthohaustorius millsi	**-0.450**	0.042	**0.669**
Acanthohaustorius similis	**0.605**	-0.286	-0.343
Anthozoa (LPIL)	**0.542**	-0.233	-0.390
Aricidea catherinae	0.071	-0.176	-0.185
Aricidea wassi	0.128	0.151	0.225
Asabellides oculata	-0.247	**-0.794**	**-0.489**
Caulleriella killariensis	**-0.567**	-0.064	-0.008
Chiridotea tuftsi	0.055	-0.179	0.361
Echinarachnius parma	-0.214	-0.297	-0.236
Edotia triloba	-0.006	-0.314	-0.356
Exogene hebes	0.007	0.396	-0.373
Magelona papillicornis	0.228	**0.435**	**0.431**
Nephtys bucera	-0.301	0.244	-0.300
Nephtys picta	-0.058	**-0.524**	-0.269
Nucula proxima	-0.112	-0.265	-0.055
Oligochaeta (LPIL)	0.226	**0.664**	0.227
Polygordius (LPIL)	**-0.862**	0.115	-0.065
Protohaustorius sp. B	-0.041	**0.497**	**0.820**
Protohaustorius wigleyi	0.122	**-0.474**	**-0.573**
Pseudoleptocuma minor	-0.180	-0.075	-0.365
Pseudunciola obliquua	0.348	0.219	0.331
Rhepoxynius hudsoni	0.197	-0.049	**0.605**
Rhynchocoela (LPIL)	**-0.611**	-0.050	-0.086
Scoletoma acicularum	**-0.431**	-0.312	**-0.407**
Sigalion arenicola	0.042	0.235	0.373
Spiophanes bombyx	**-0.510**	-0.043	-0.314
Spisula solidissima	0.174	0.147	0.371
Tanaissus psammophilus	0.388	**0.554**	-0.035
Tellina agilis	**-0.464**	**-0.588**	-0.251
Tharyx acutus	-0.049	**-0.640**	**-0.472**

*Values in bold considered to be signfiicant correlations

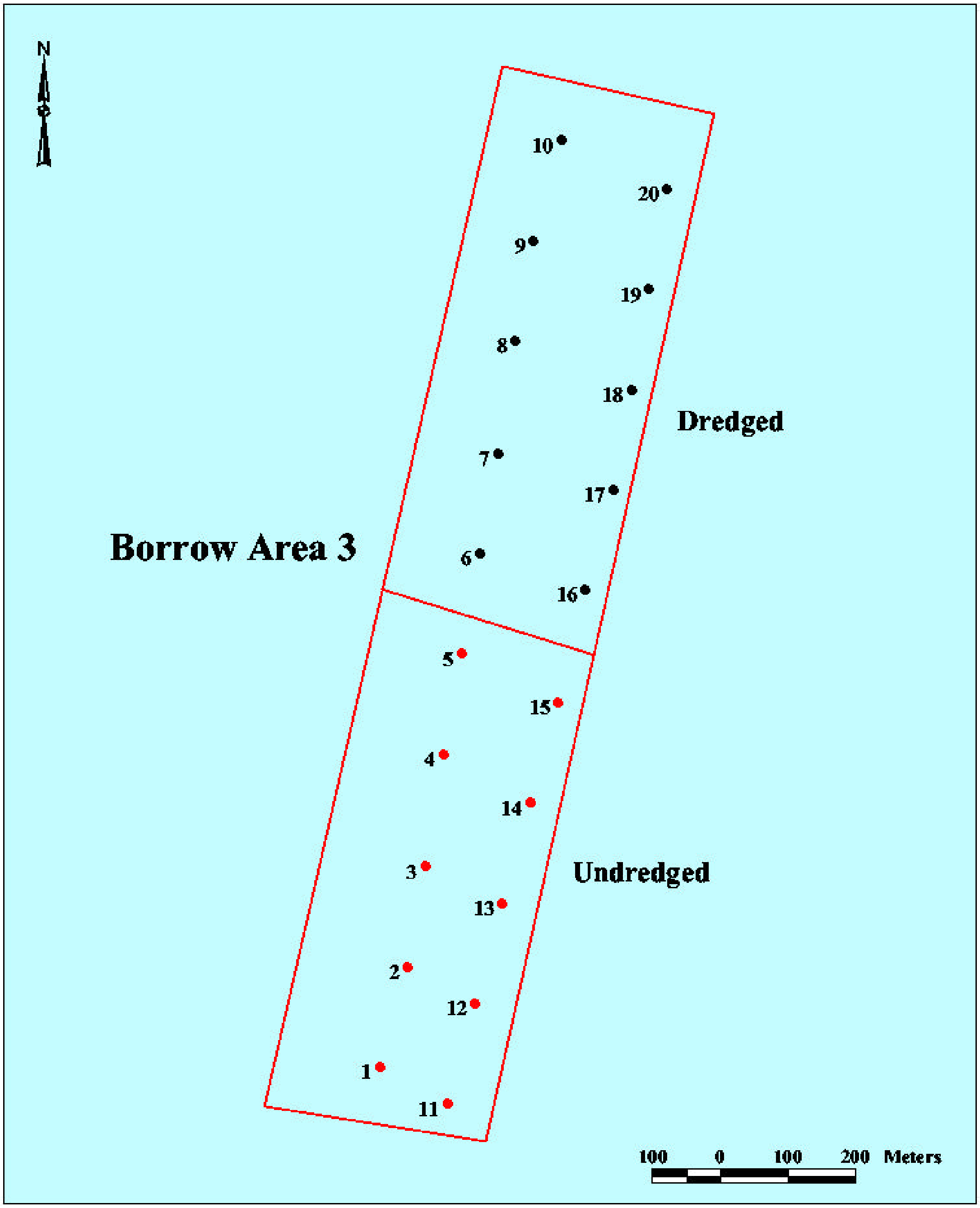

Figure 8-2. Locations of Belmar Borrow Area 3 Sampling Stations.

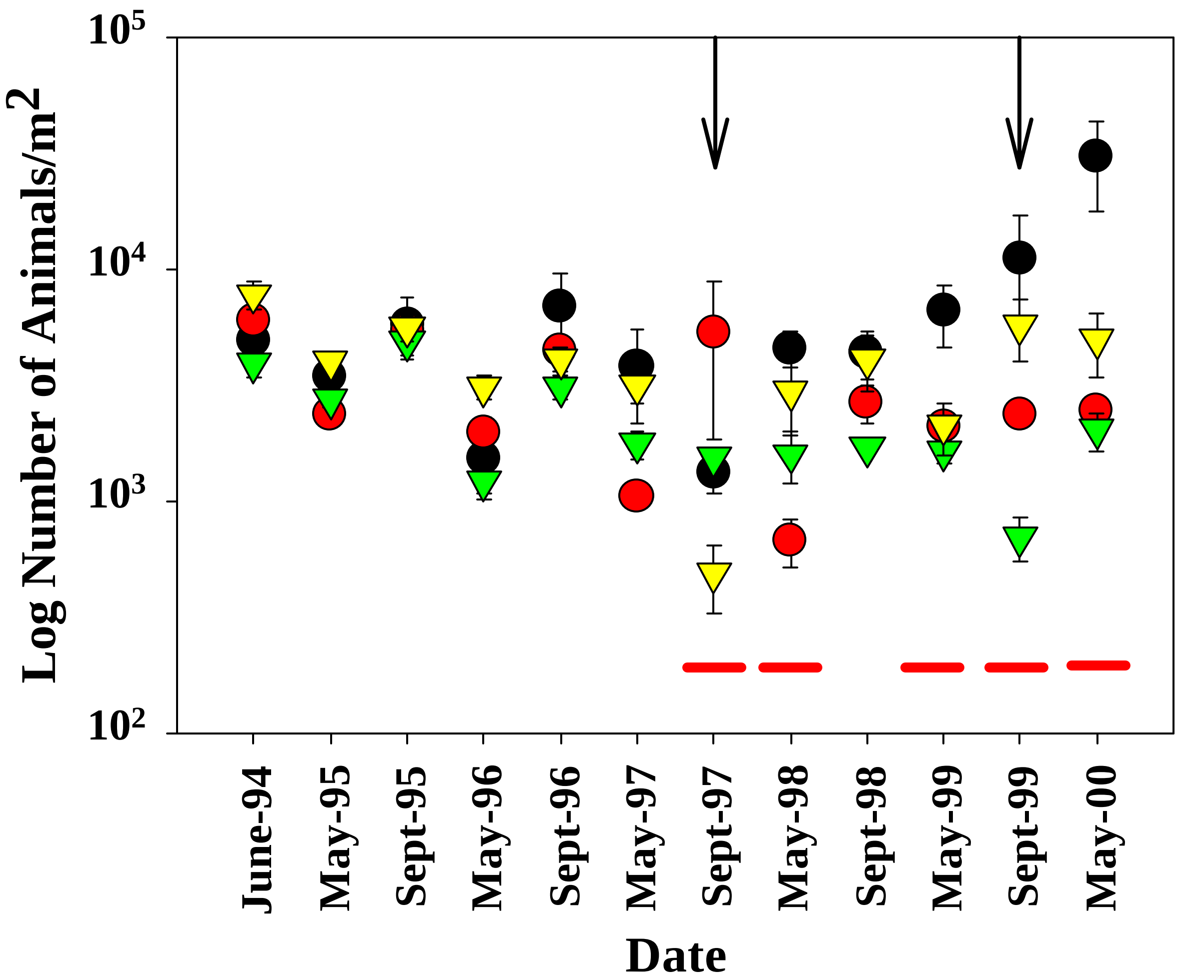

Figure 8-3. Offshore Borrow Area Abundance (Mean No. Animals/m^2 $\pm$ SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred, Red bars indicate where Tukey's test detected differences between means.

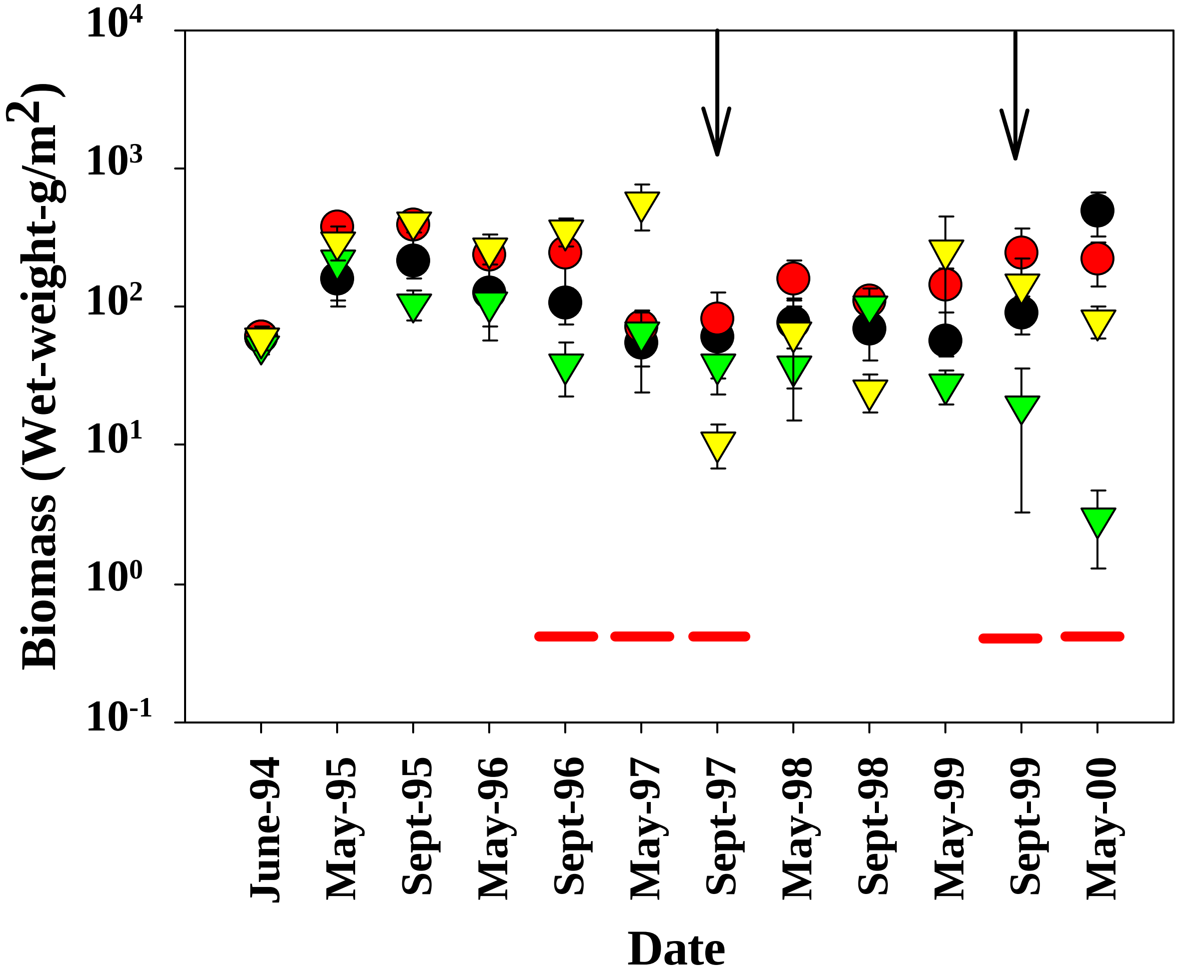

Figure 8-4. Offshore Borrow Area Biomass (Mean g/m^2 $\pm$ SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred, Red bars indicate where Tukey's test detected differences between means.

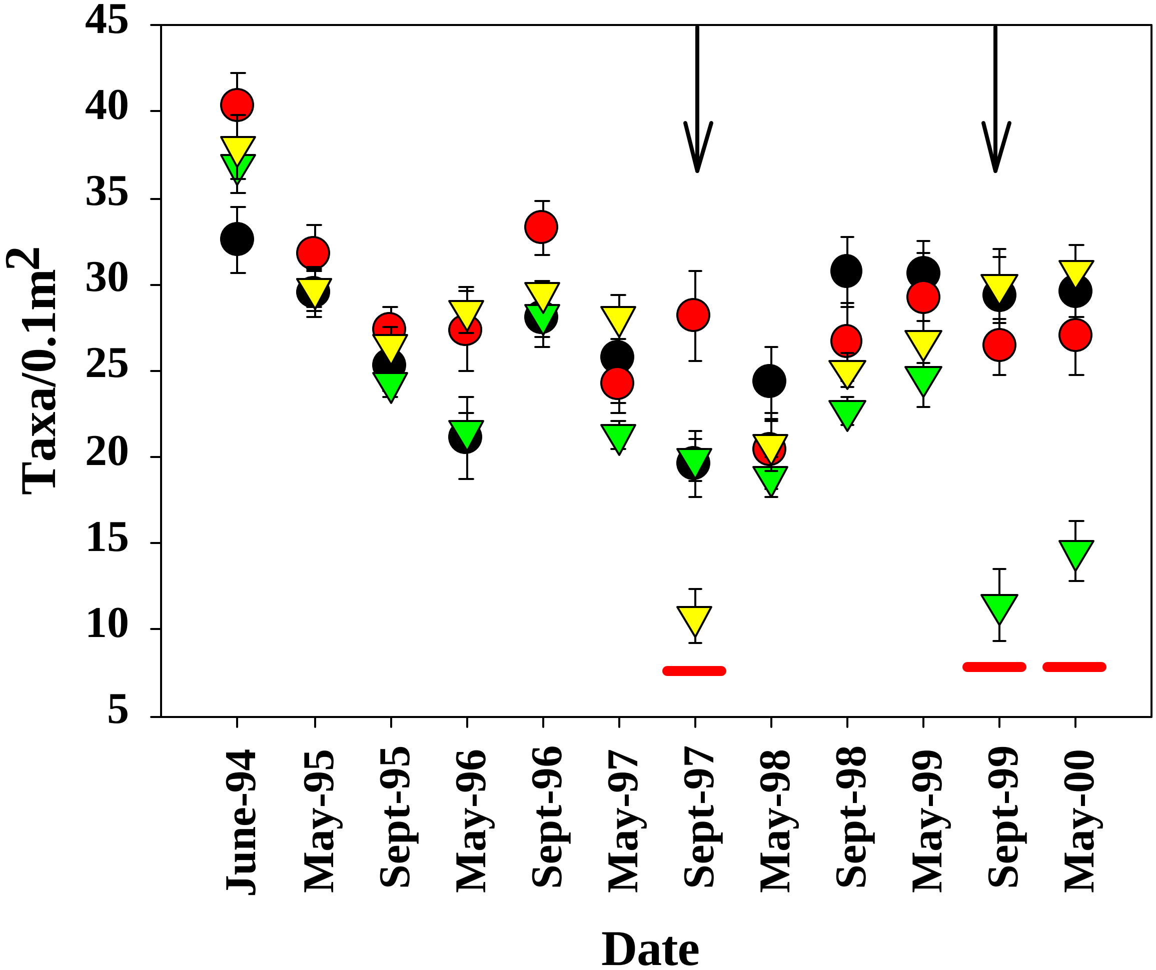

Figure 8-5. Offshore Borrow Area Taxa Richness (Mean Taxa/Core ± SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred, Red bars indicate where Tukey's test detected differences between means.

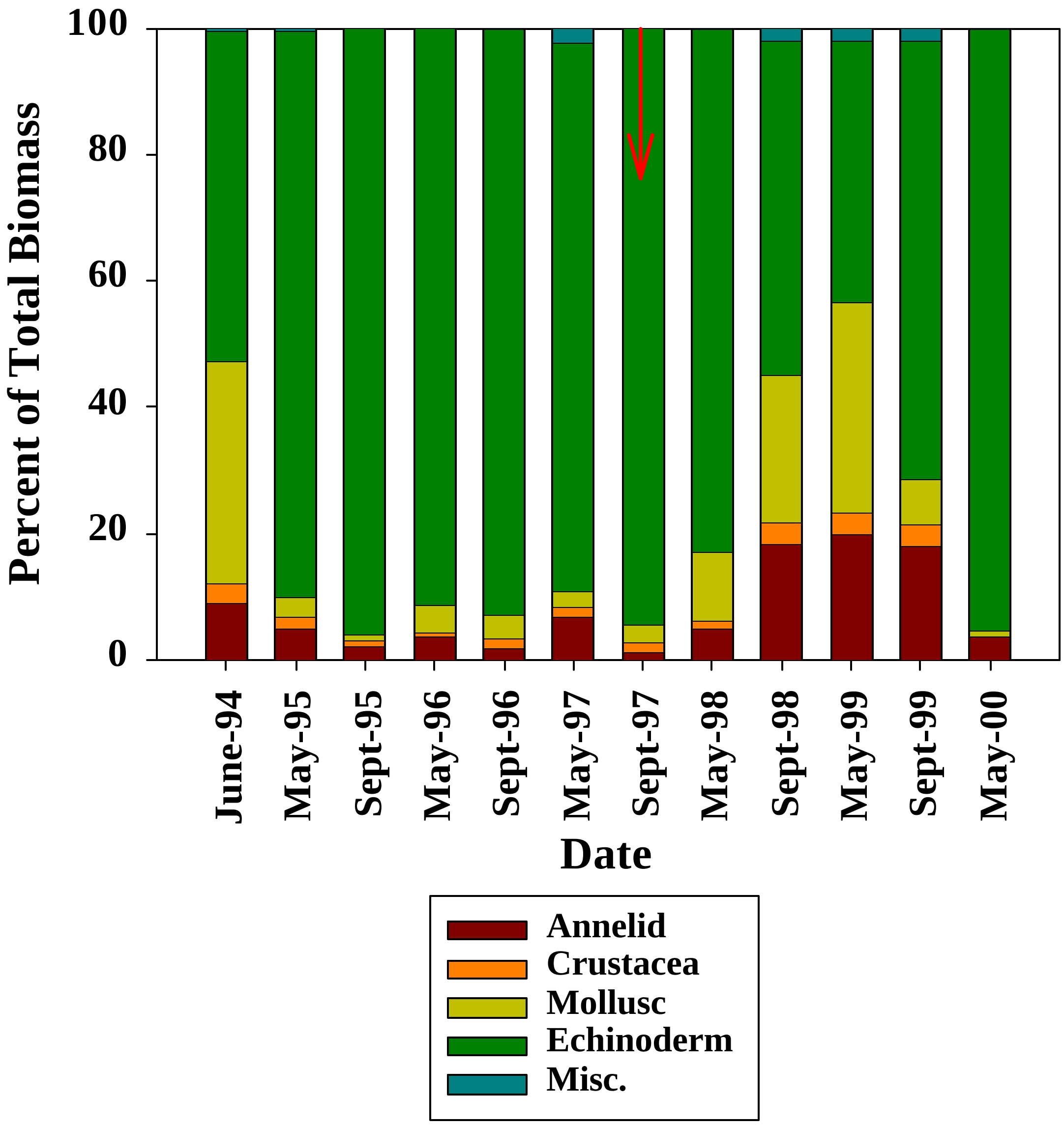

Figure 8-6. Biomass Composition of Borrow Area 3- Dredged Portion. Arrow indicates when dredging occurred.

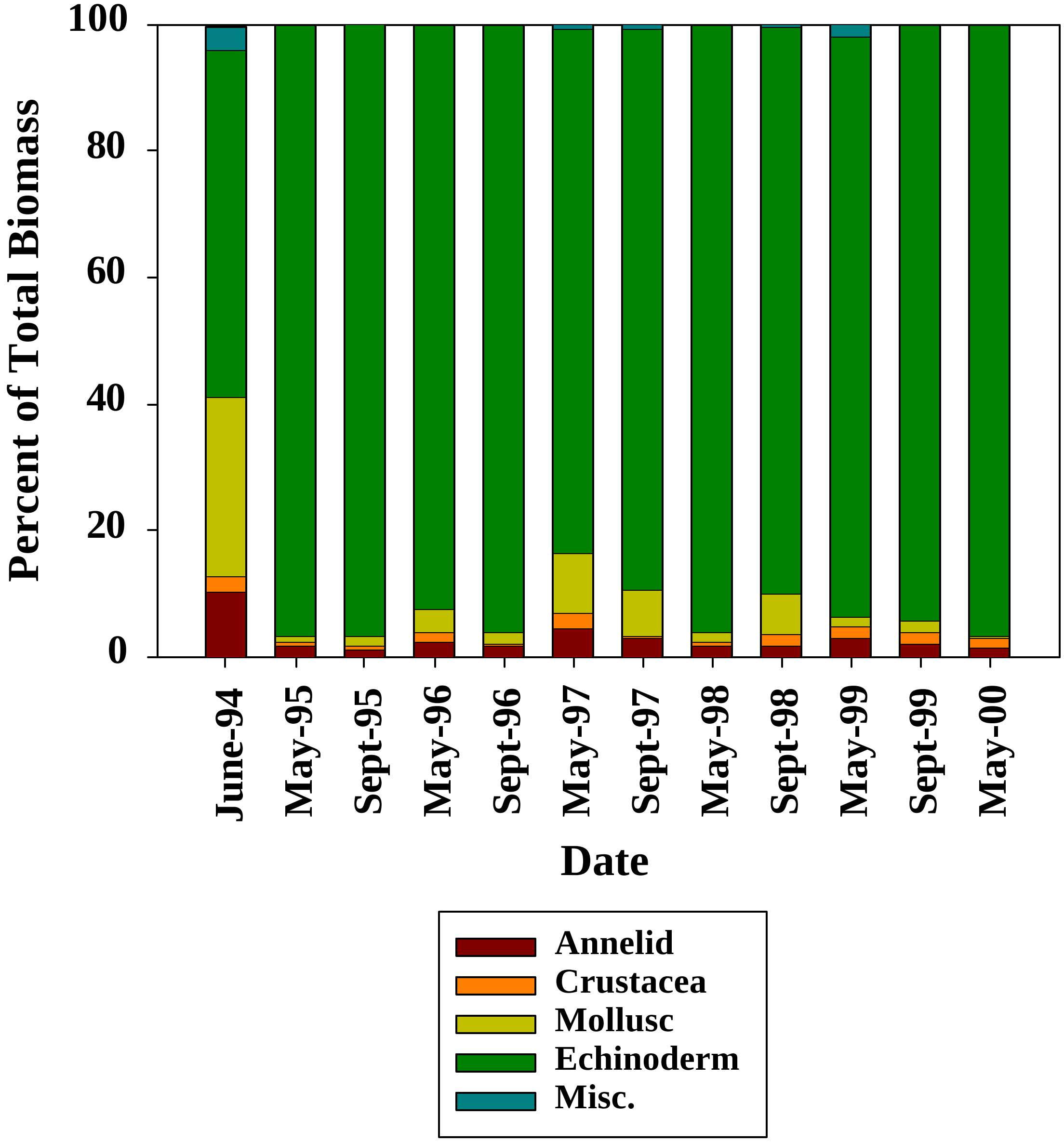

Figure 8-7. Biomass Composition of Borrow Area 3- Undredged Portion.

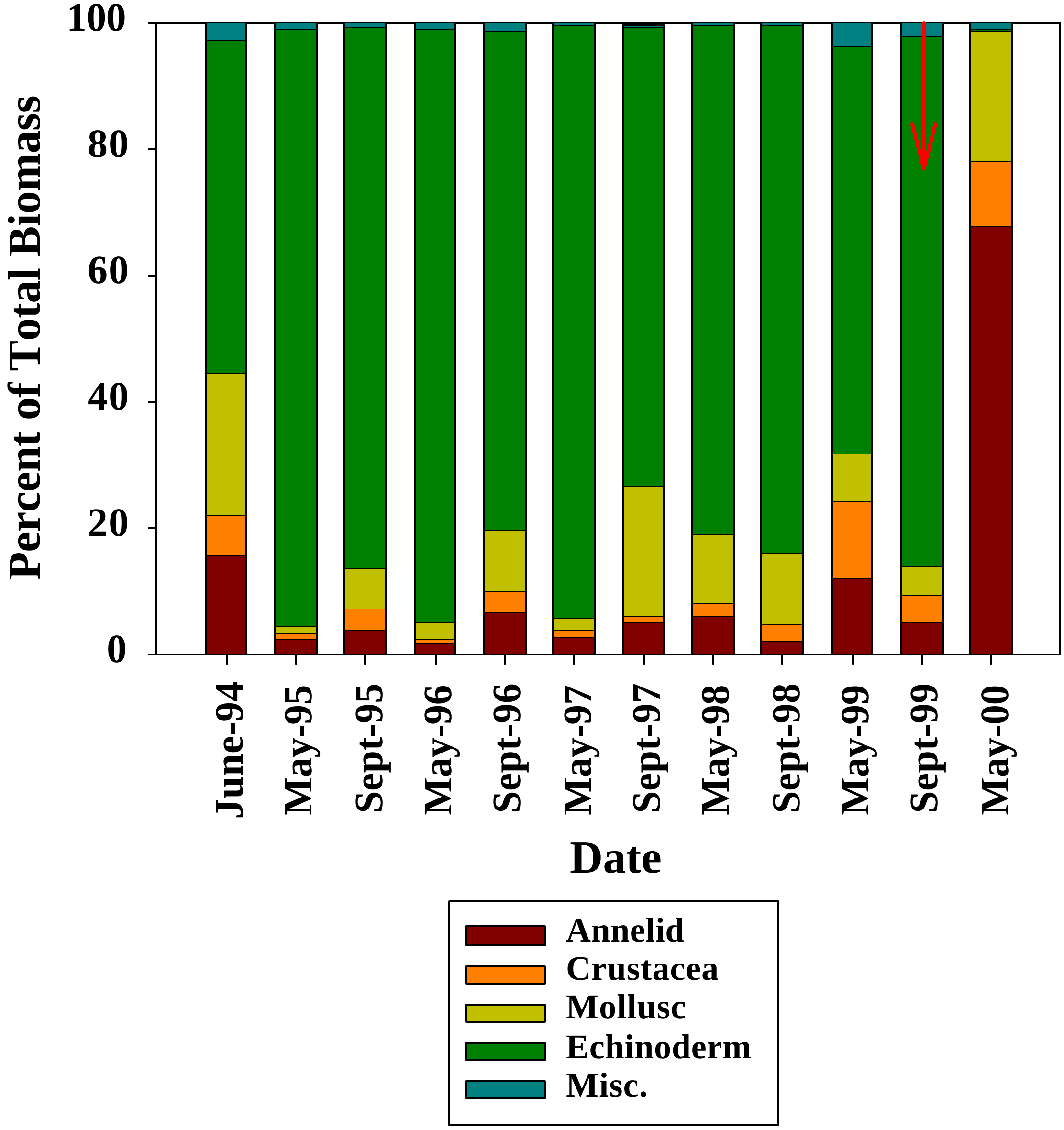

Figure 8-8. Biomass Composition of Borrow Area 5. Arrow indicates when dredging occurred.

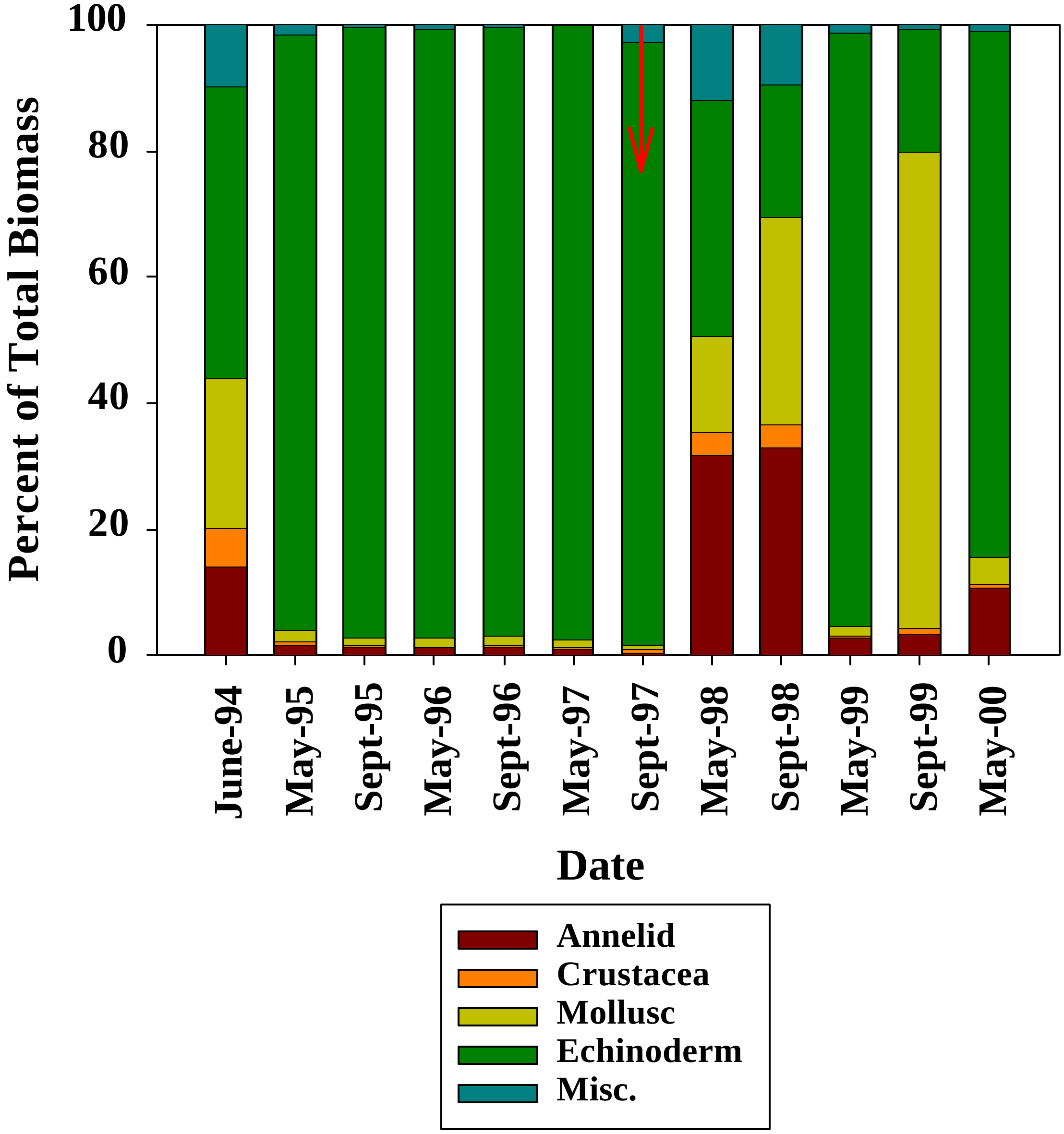

Figure 8-9. Biomass Composition of Borrow Area 6. Arrow indicates when dredging occurred.

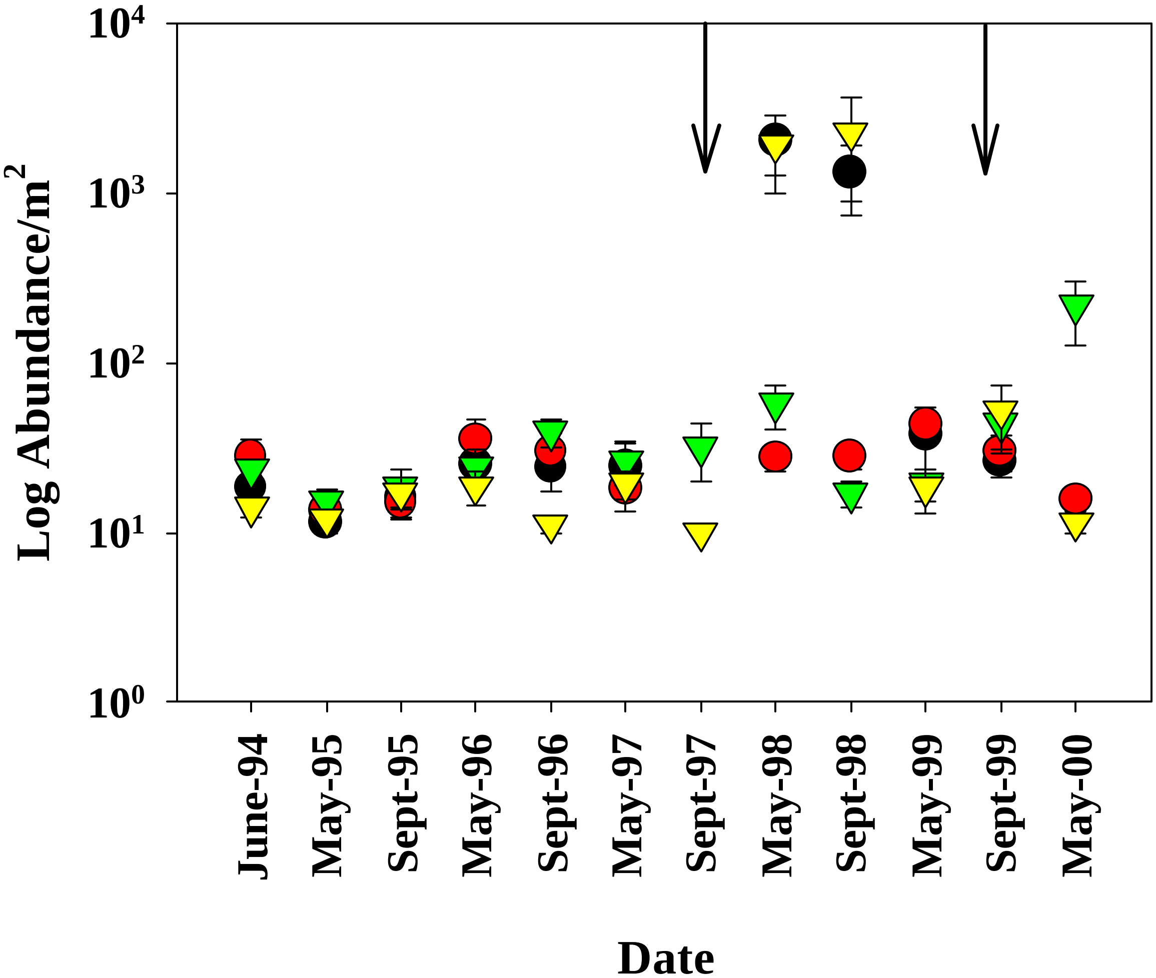

Figure 8-10. *Spiophanes bombyx* Abundance (Mean No. Animals/m^2 ± SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

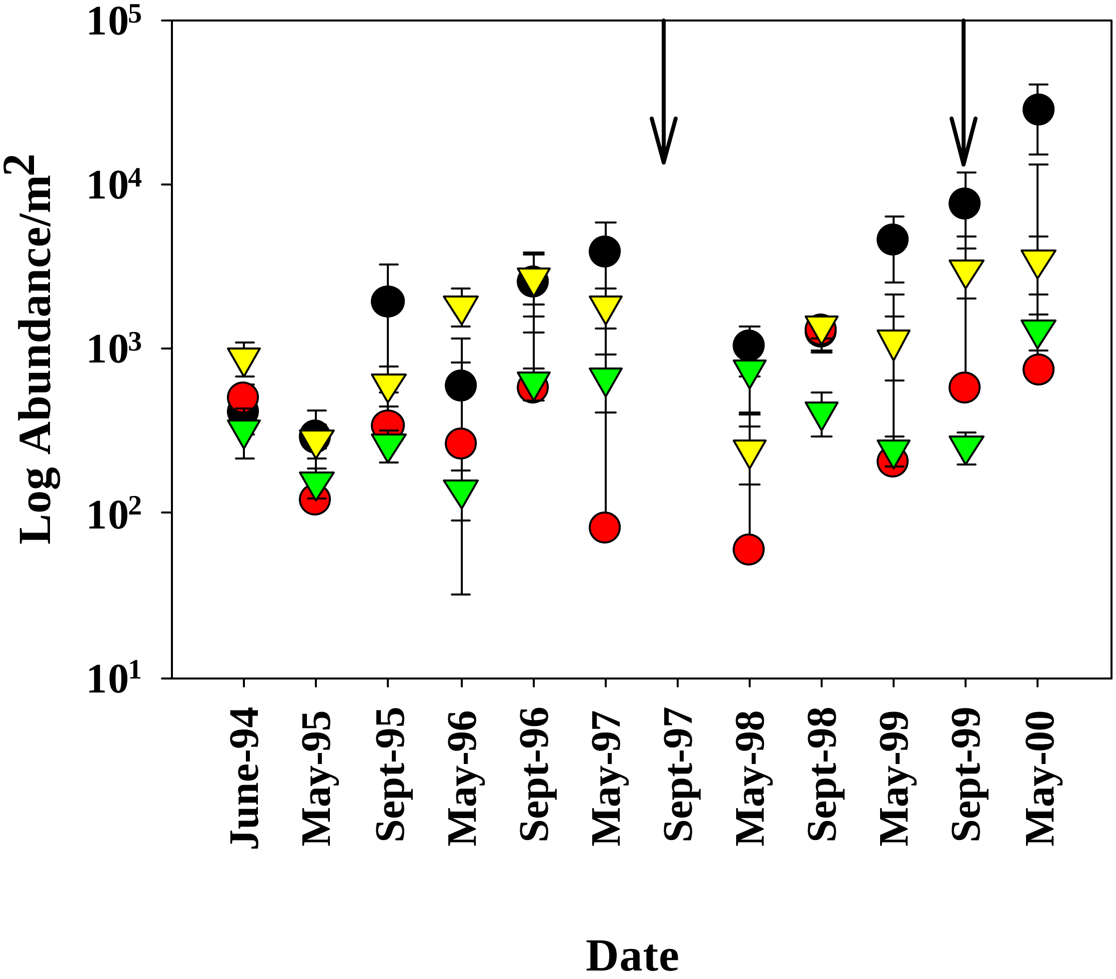

Figure 8-11. *Polygordius* (LPIL) Abundance (Mean No. Animals/m^2 $\pm$ SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

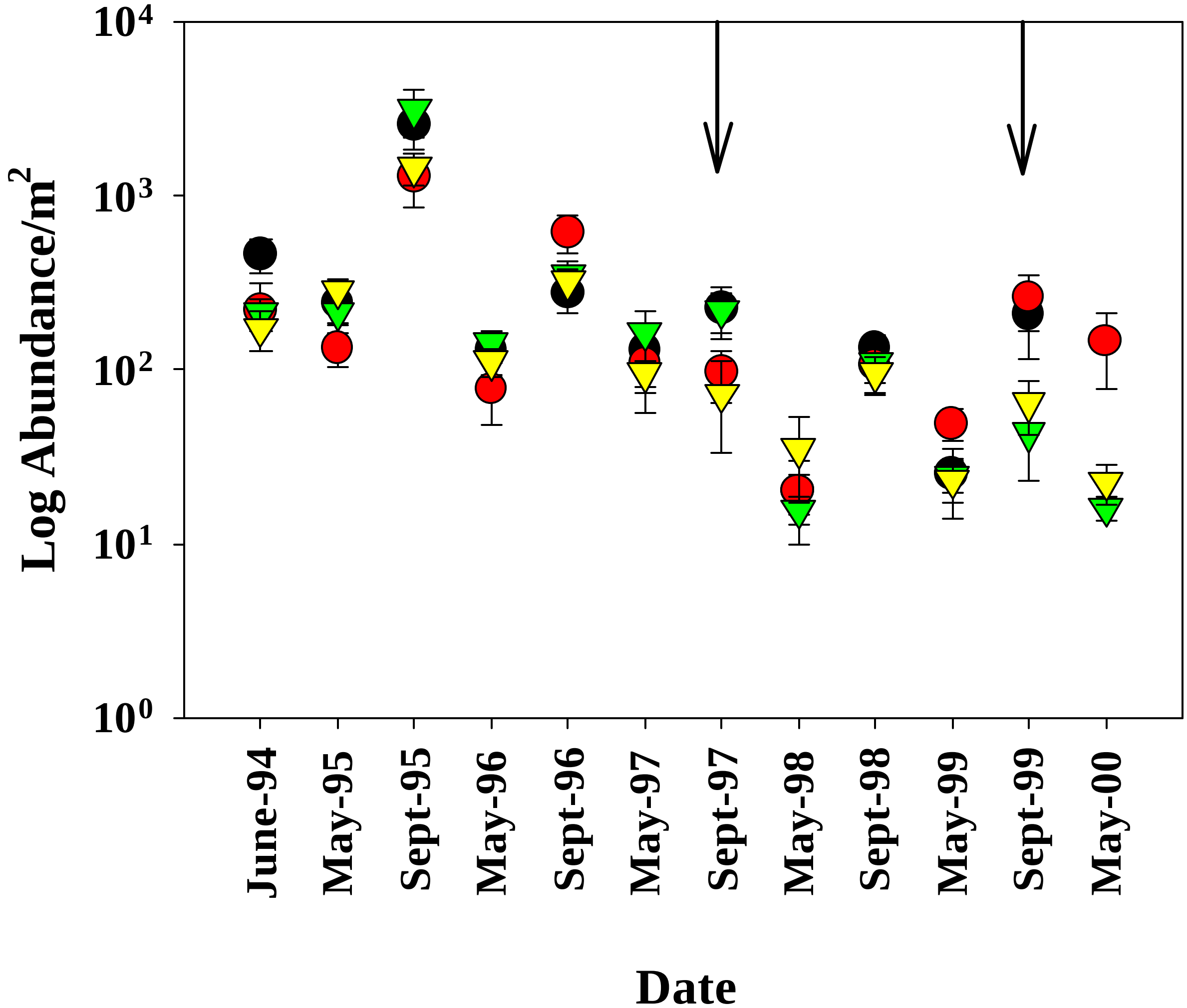

Figure 8-12. *Pseudunciola obliquua* Abundance (Mean No. Animals/m^2 ± SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

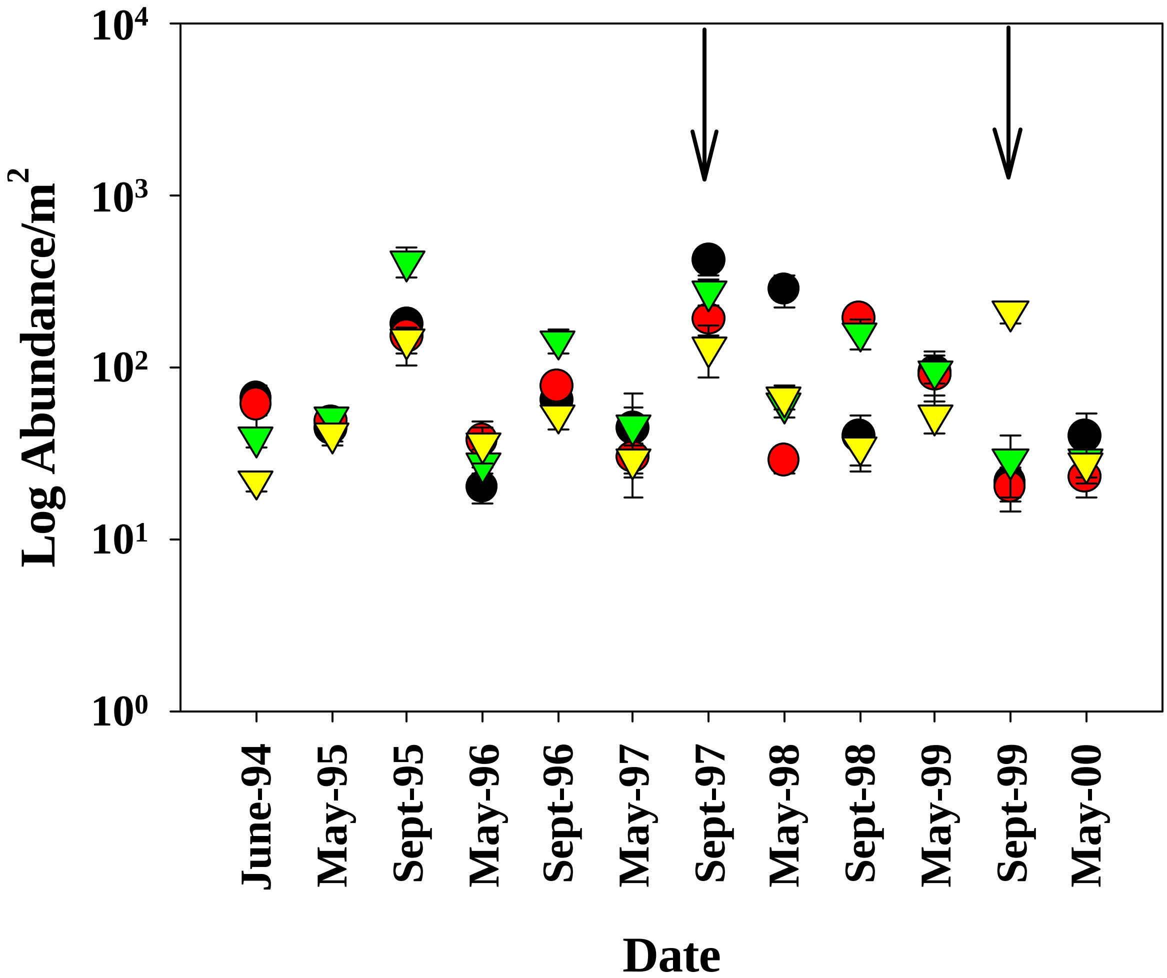

Figure 8-13. *Spisula solidissima* Abundance (Mean No. Animals/m^2 ± SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

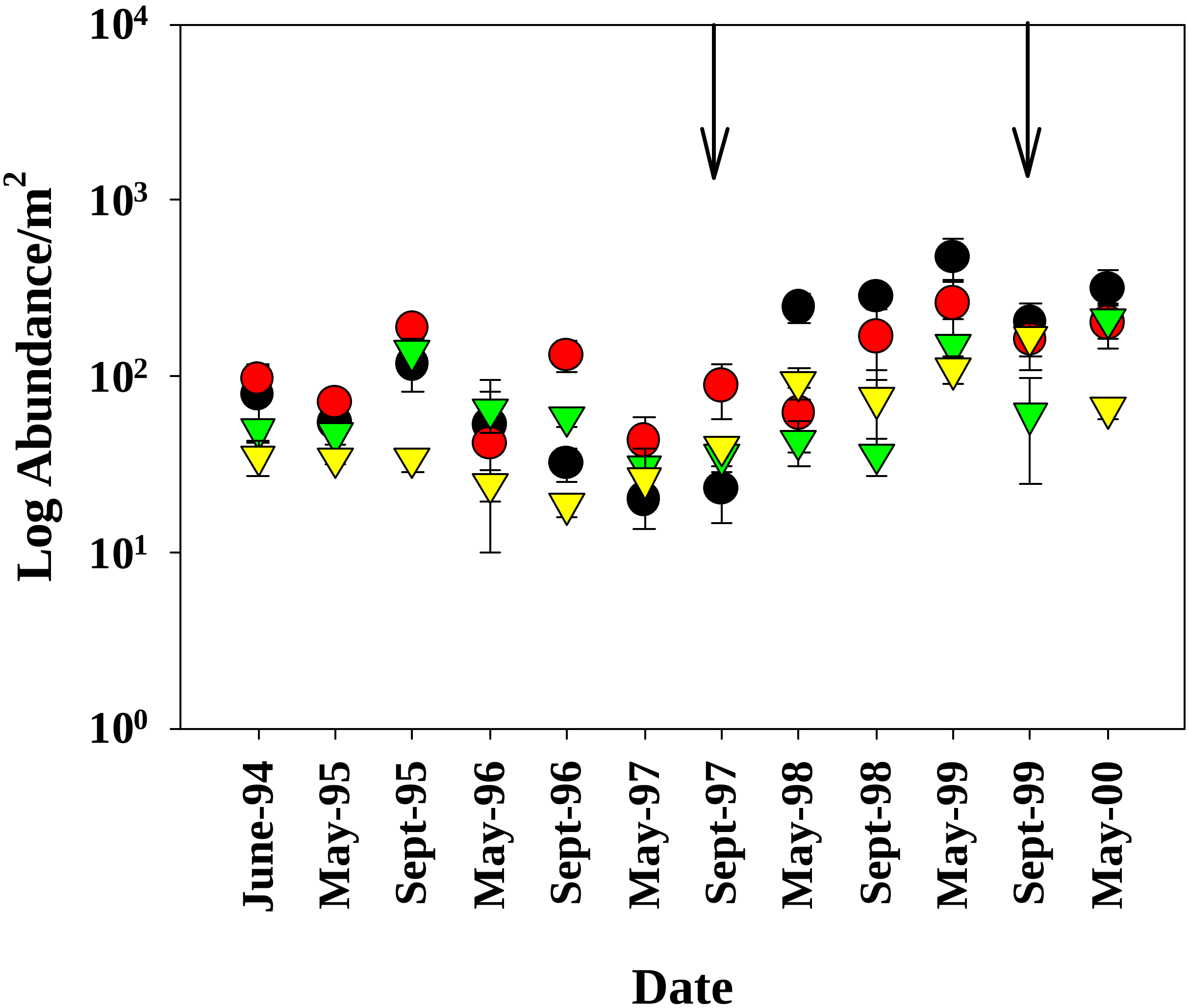

Figure 8-14. *Tellina agilis* Abundance (Mean No. Animals/m^2 ± SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

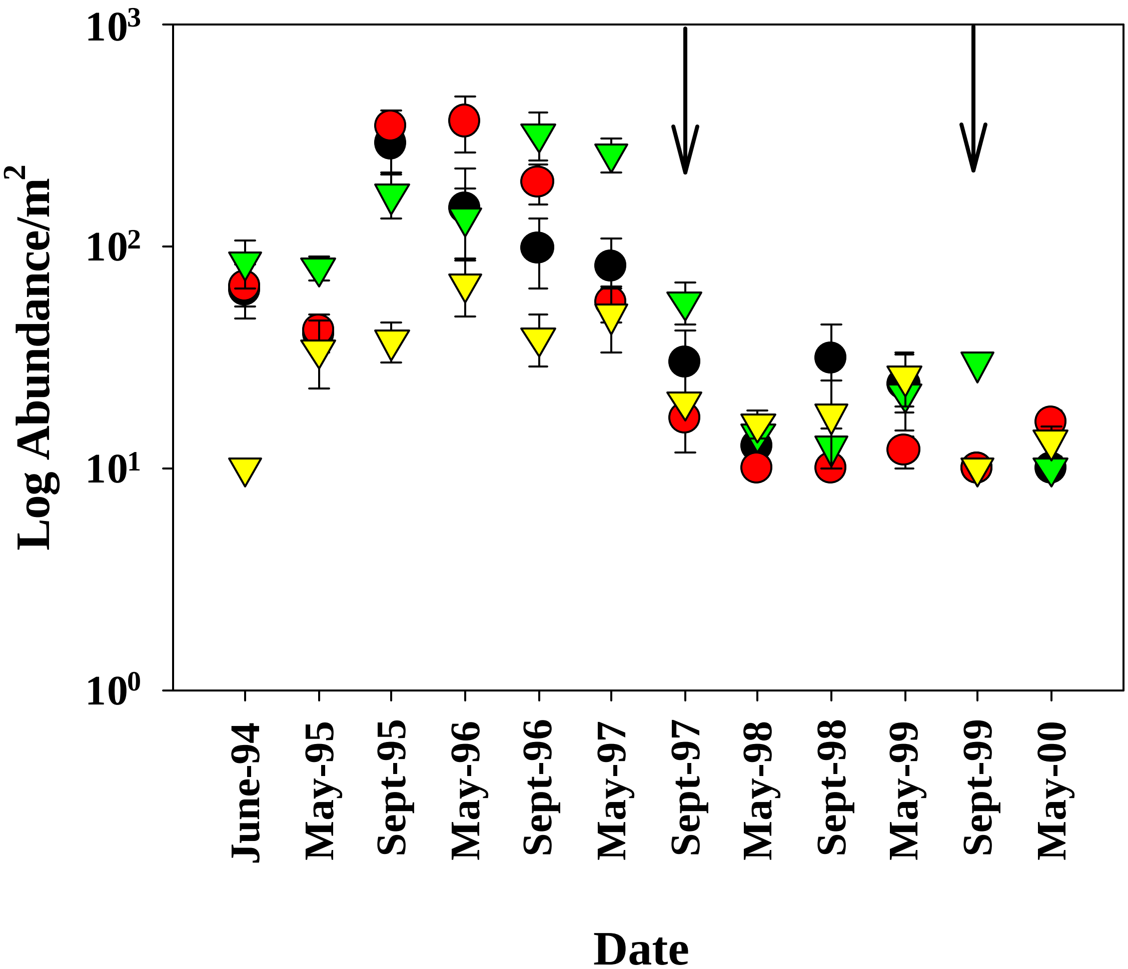

Figure 8-15. *Magelona papillicornis* Abundance (Mean No. Animals/m^2 $\pm$ SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

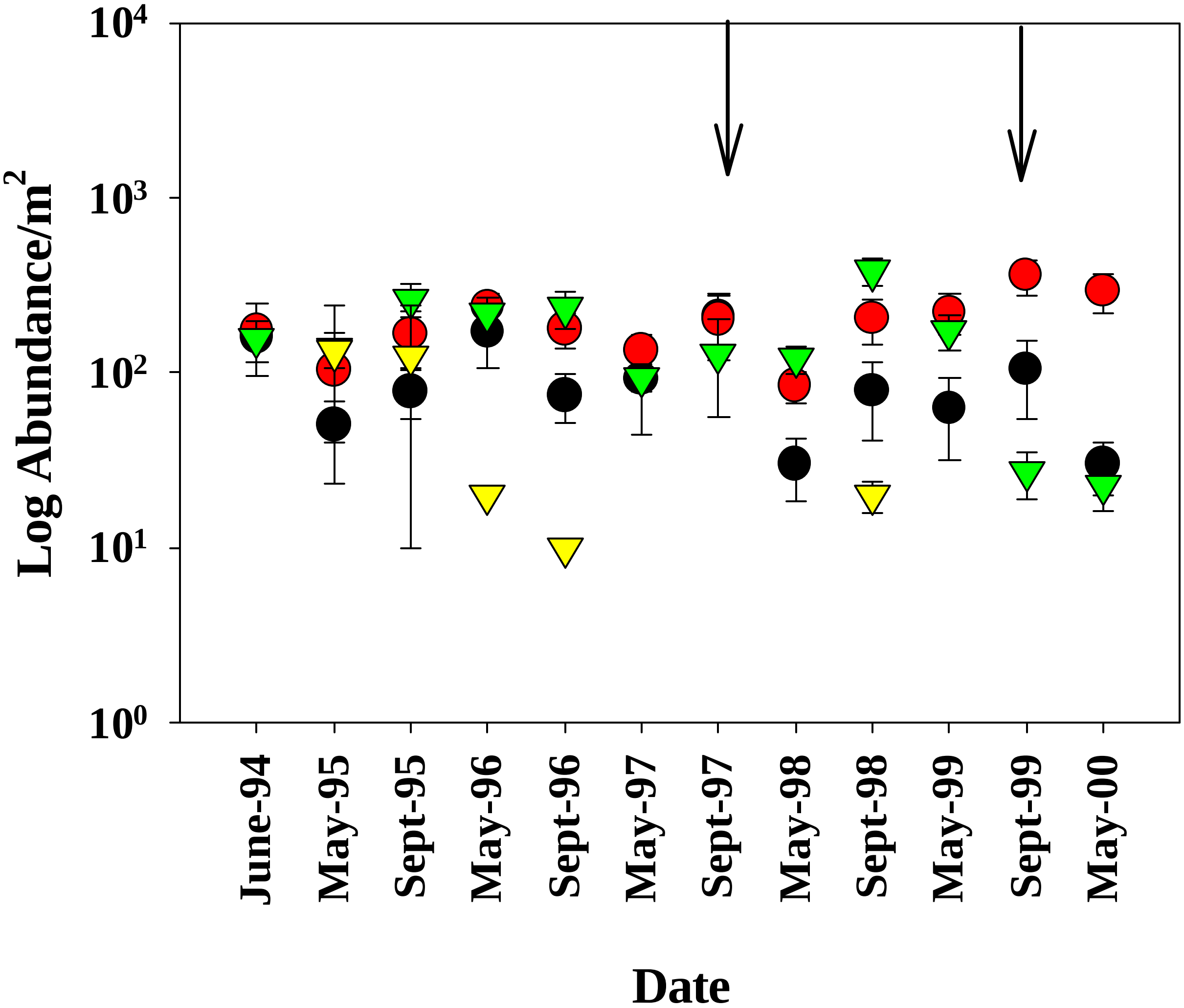

Figure 8-16. *Acanthohasutorius millsi* Abundance (Mean No. Animals/m^2 $\pm$ SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

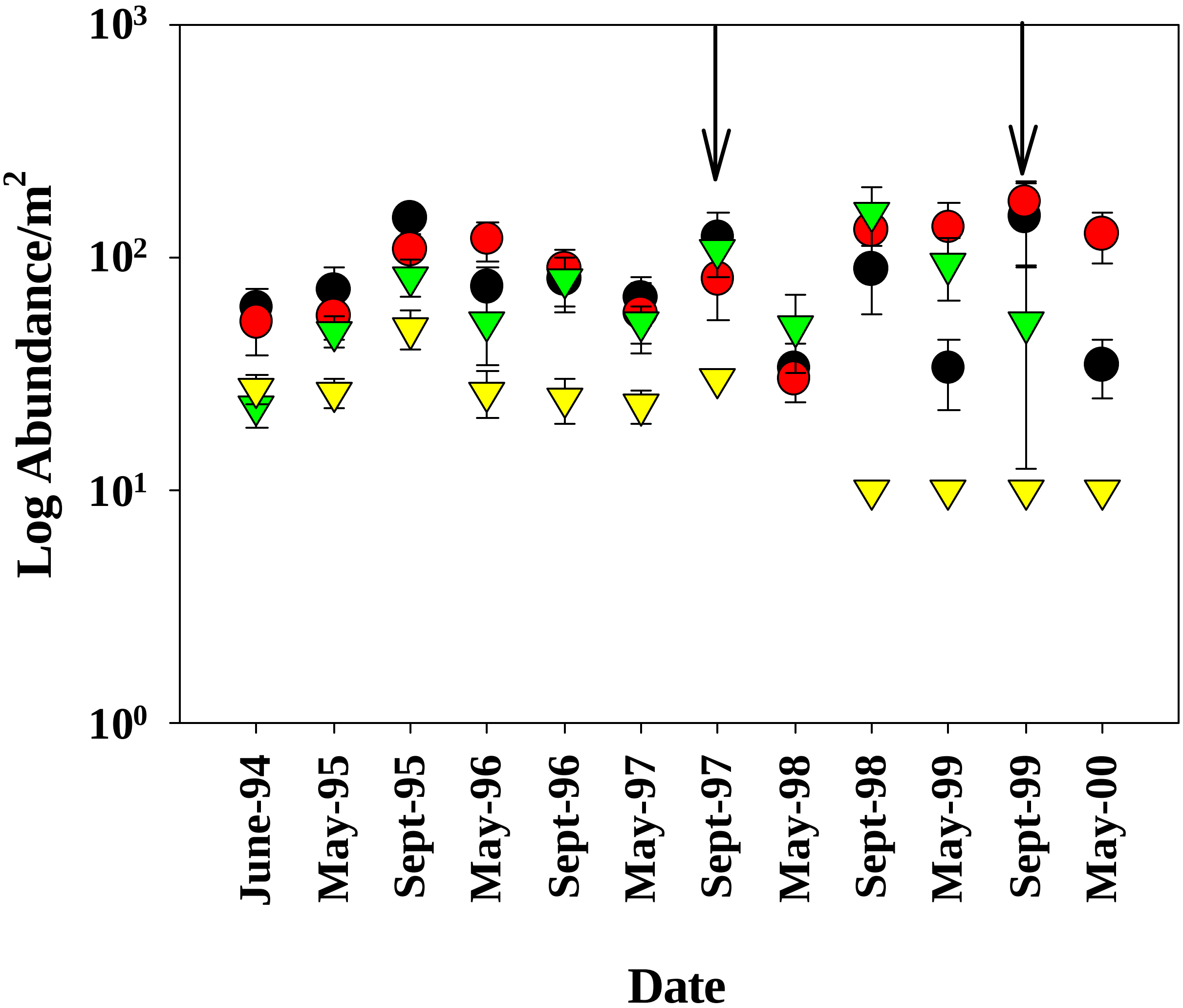

Figure 8-17. *Rhepoxynius hudsoni* Abundance (Mean No. Animals/m^2 $\pm$ SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

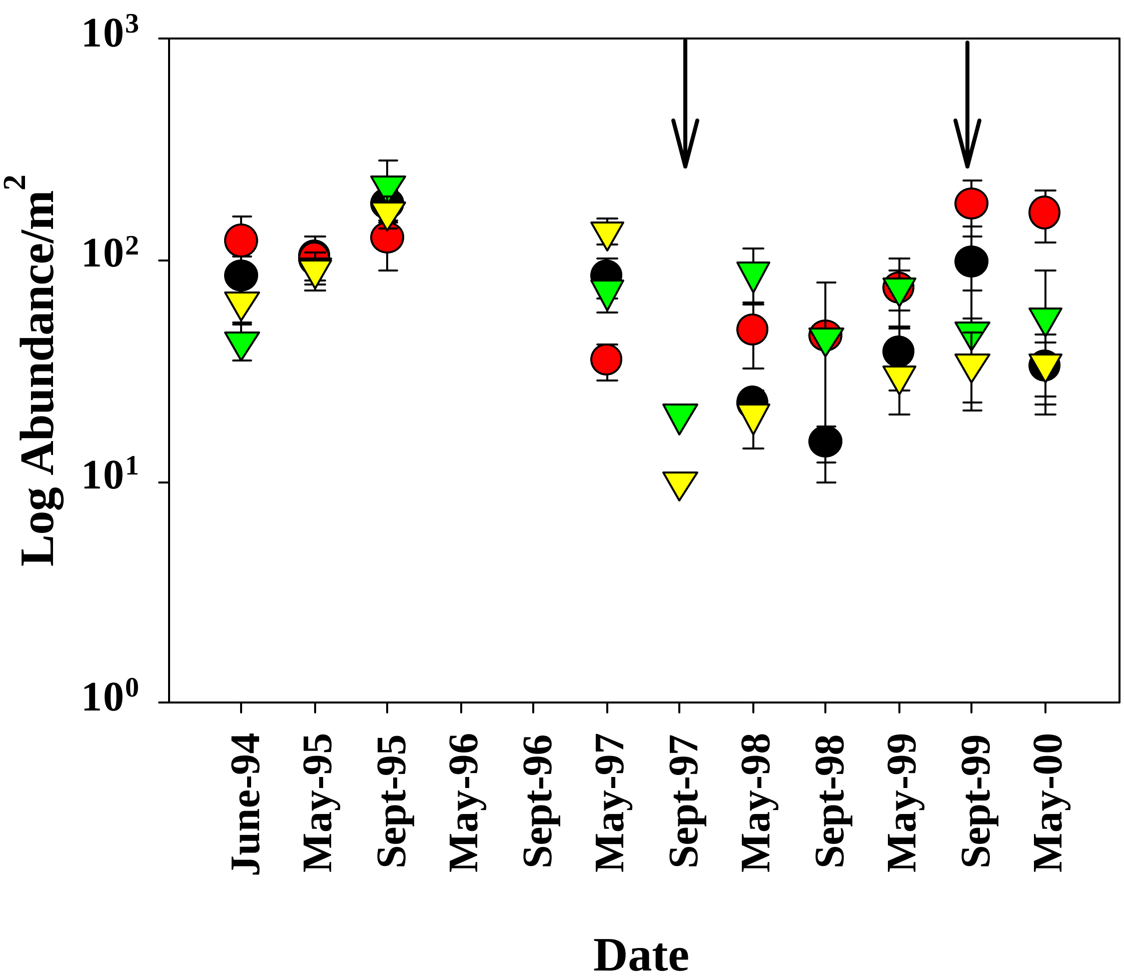

Figure 8-18. *Parahaustorius wigleyi* Abundance (Mean No. Animals/m^2 ± SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

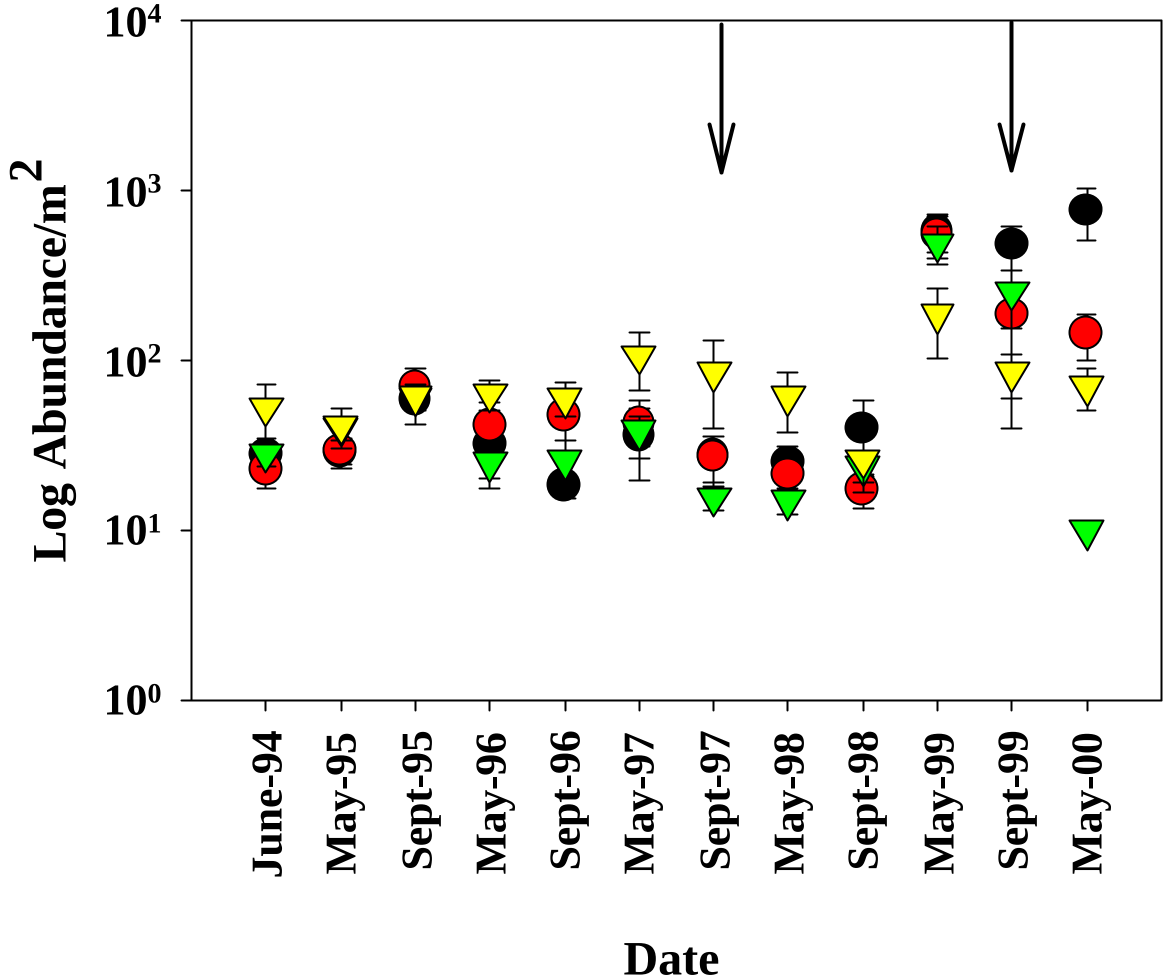

Figure 8-19. *Echinarachnius parma* Abundance (Mean No. Animals/m^2 ± SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

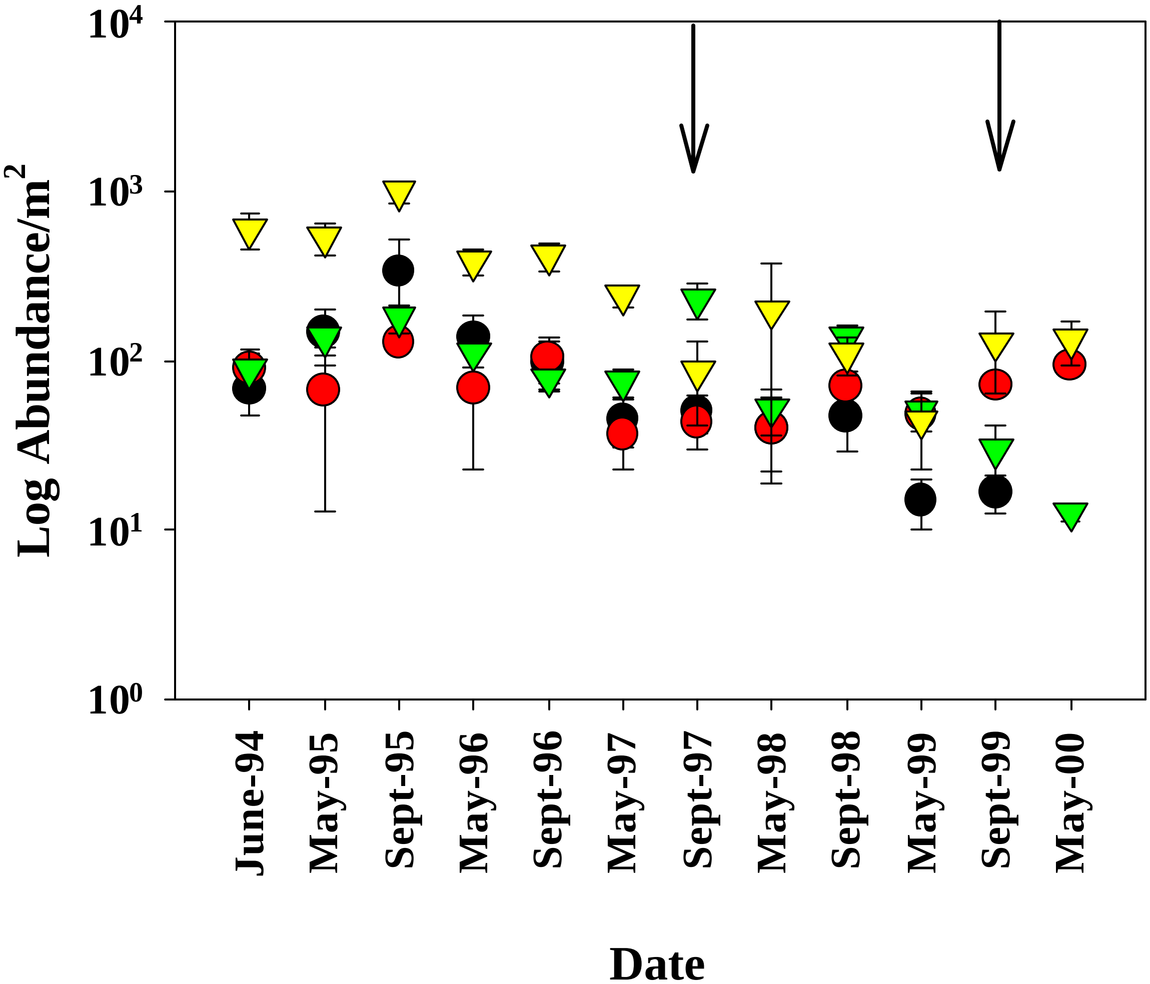

Figure 8-20. *Tanaissus psammophilus* Abundance (Mean No. Animals/m^2 $\pm$ SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

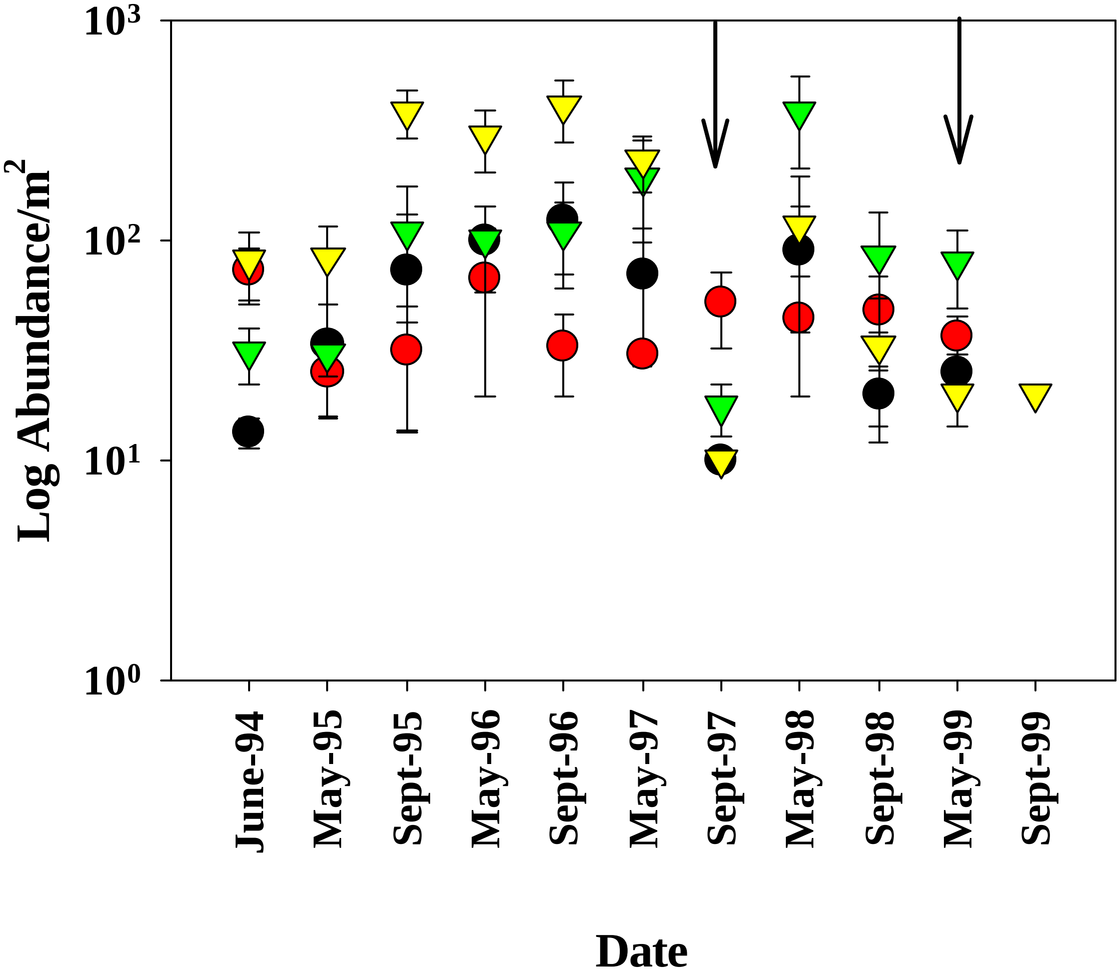

Figure 8-21. Oligochaete Abundance (Mean No. Animals/m^2 $\pm$ SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

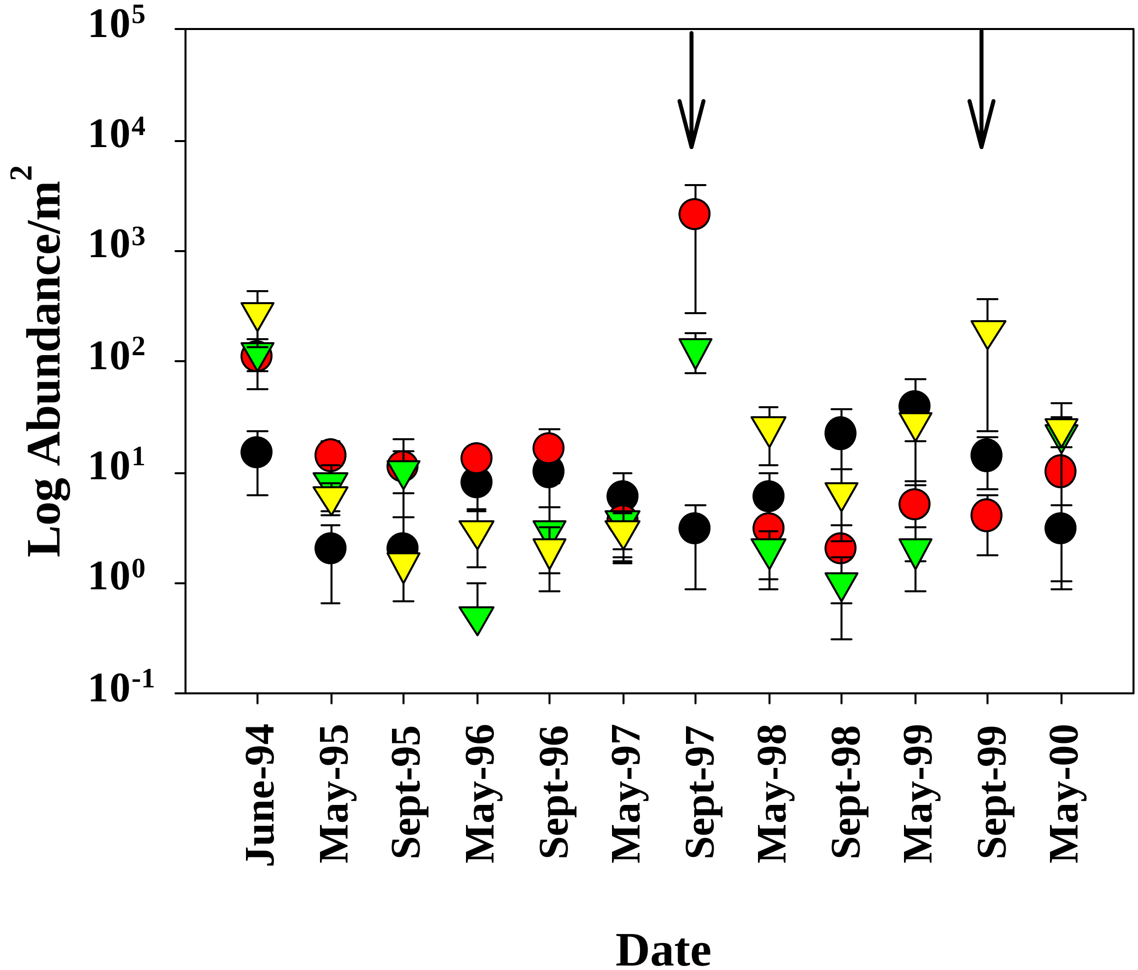

Figure 8-22. *Nucula proxima* Abundance (Mean No. Animals/m^2 $\pm$ SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

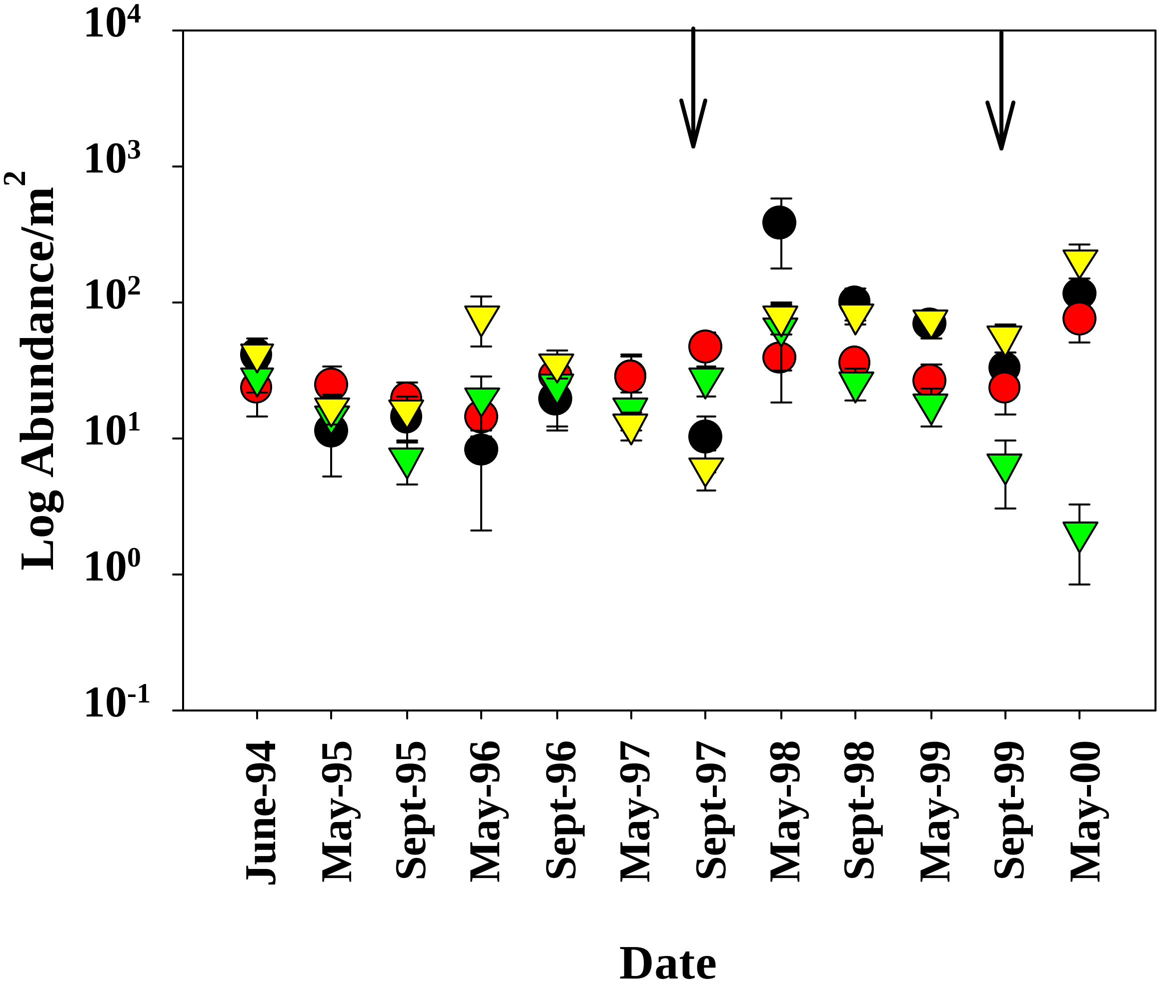

Figure 8-23. Rhynchocoela (LPIL) Abundance (Mean No. Animals/m^2 ± SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

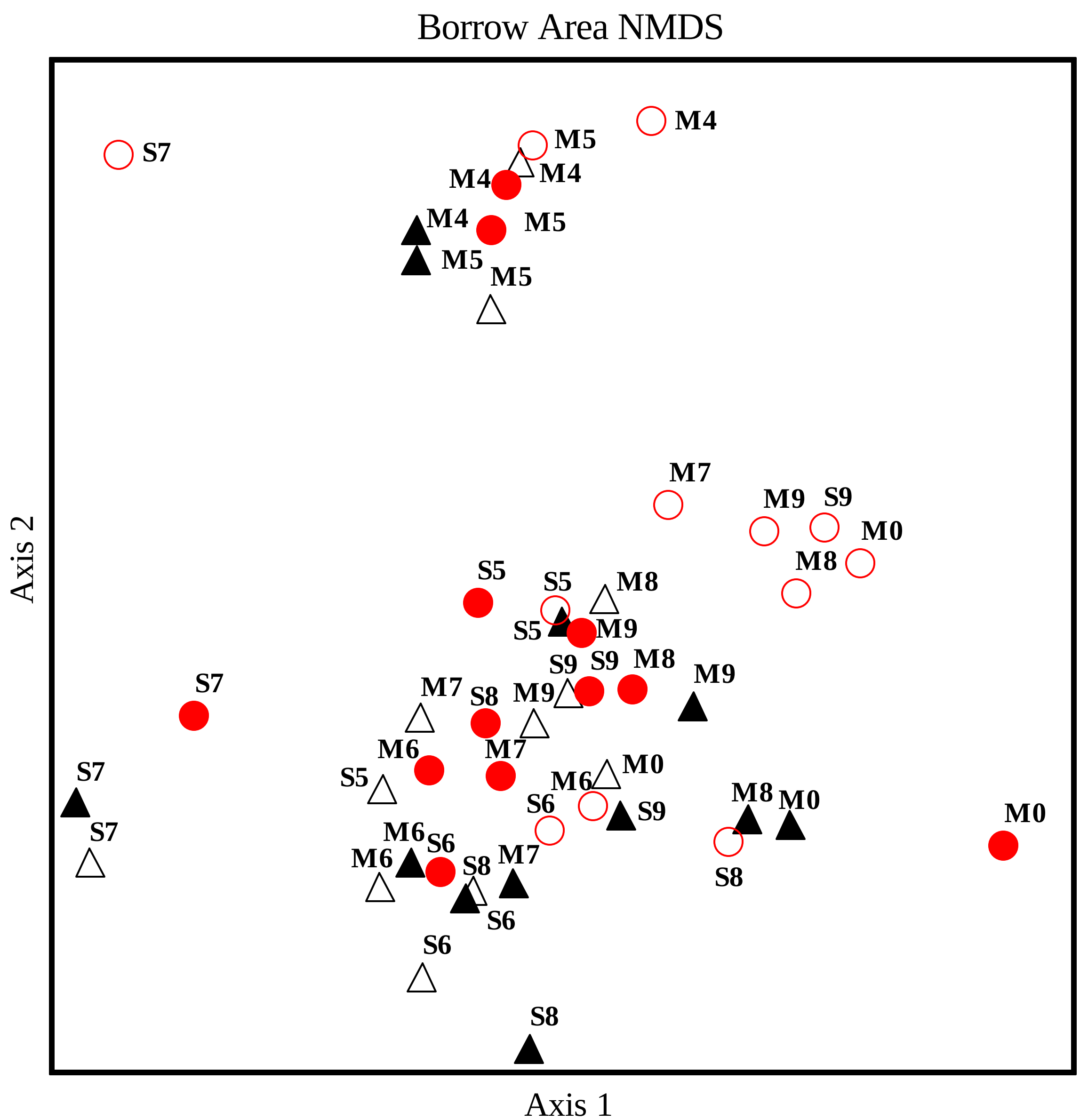

Figure 8-24. Nonmetric Dimensional Scaling (NMDS) Plot for Offshore Borrow Area Data: Axes 1 & 2. Stress = 0.11 for 3 axes. Filled triangle = BBA3-Dredged, Open triangle = BBA3- Undredged, Filled circle = BBA5, Open circle = BBA6; M = May, S = September; 4 = 1994, 5 = 1995. 6 = 1996, 7 = 1997, 8 = 1998, 9 = 1999, 0= 2000.

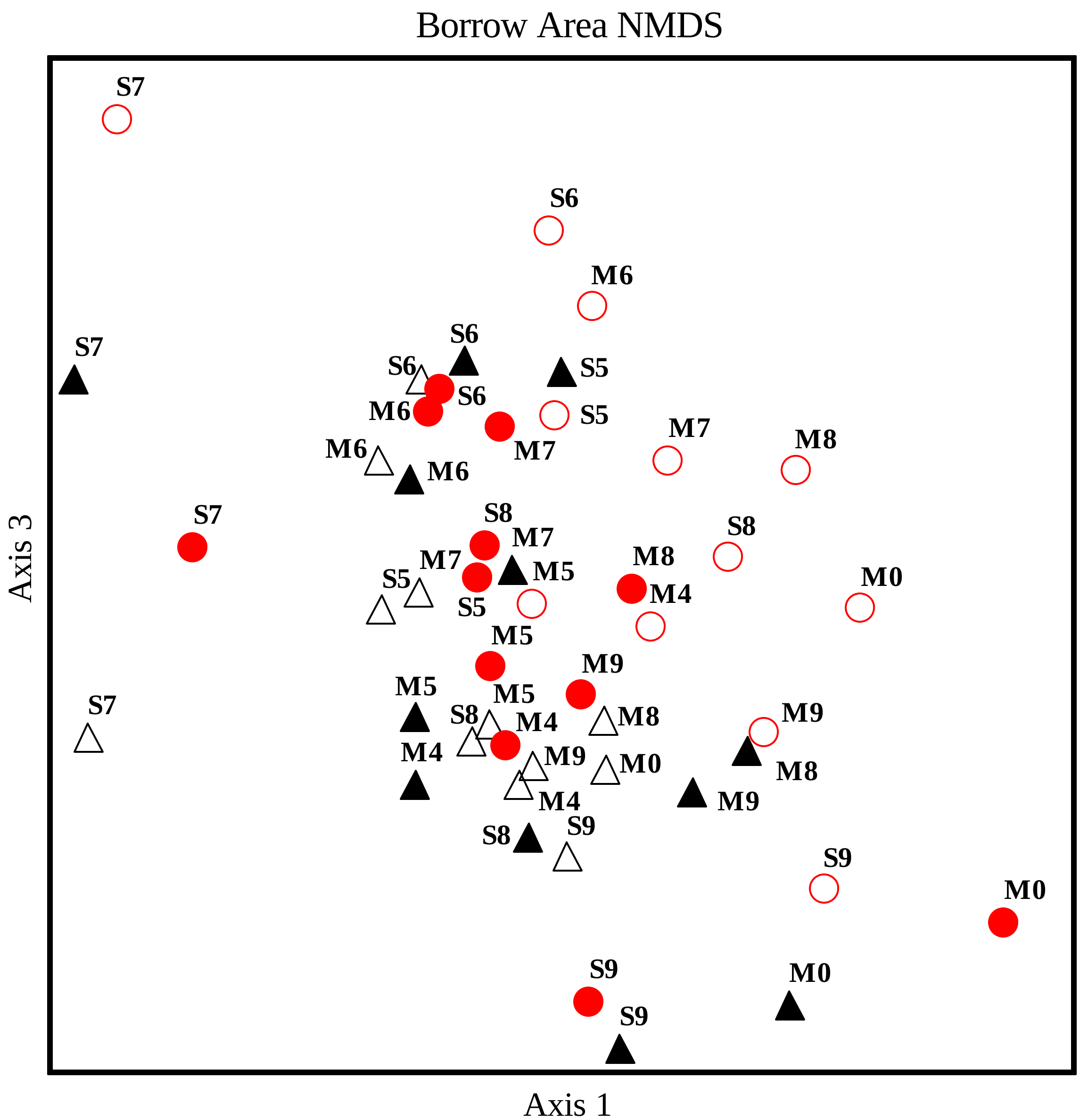

Figure 8-25. Nonmetric Dimensional Scaling (NMDS) Plot for Offshore Borrow Area Data: Axes 1 & 3. Stress = 0.11 for 3 axes. Filled triangle = BBA3-Dredged, Open triangle = BBA3- Undredged, Filled circle = BBA5, Open circle = BBA6; M = May, S = September; 4 = 1994, 5 = 1995. 6 = 1996, 7 = 1997, 8 = 1998, 9 = 1999, 0= 2000.

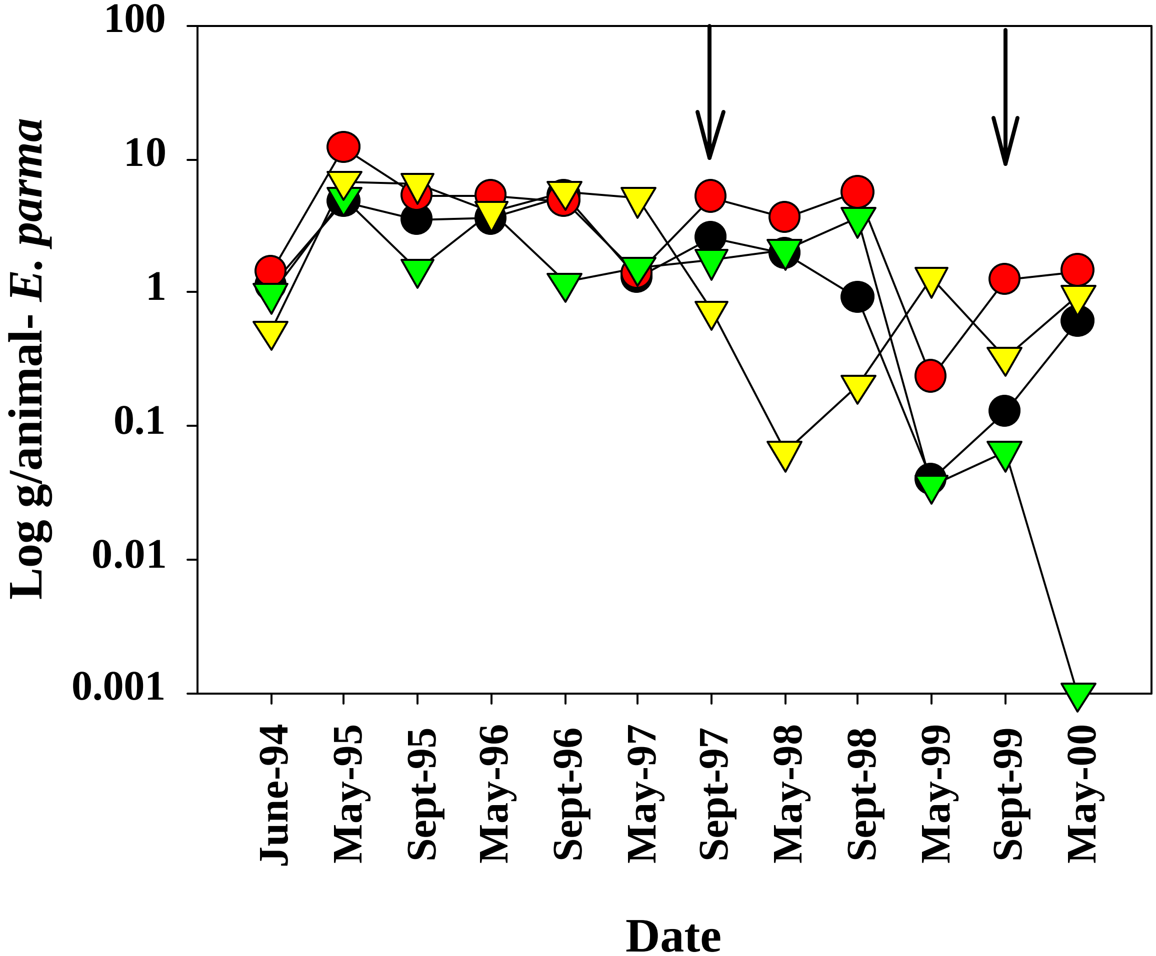

Figure 8-26. Average weight (g) per *Echinarachnius parma*. Black circle = BBA3-Dredged, Red circle = BBA3-Undredged, Green inverted triangle = BBA5, Yellow inverted triangle = BBA6. Arrows indicate when dredging occurred.

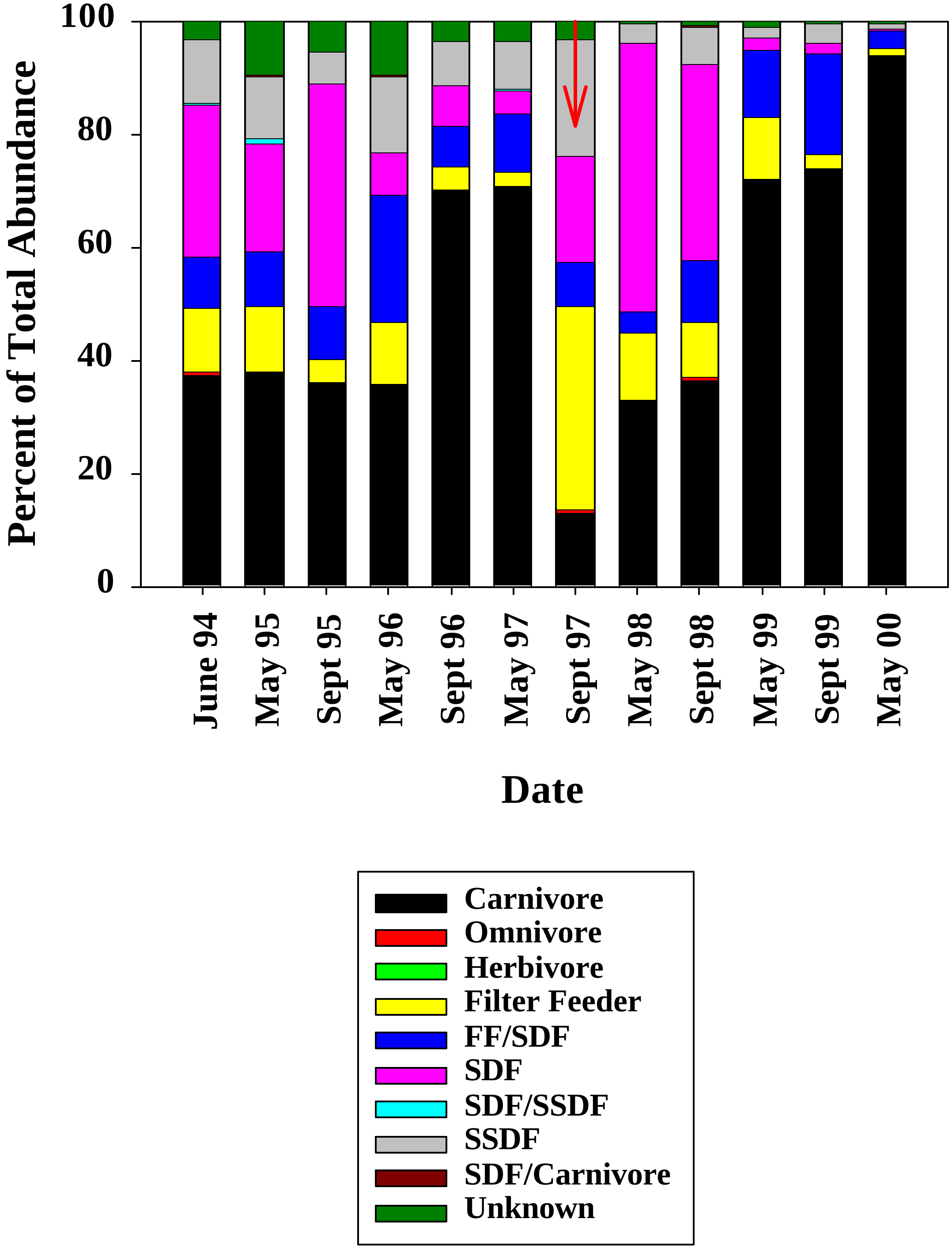

Figure 8-27. Borrow Area BBA3-Dredged Trophic Guilds. Arrows indicate when dredging occurred.

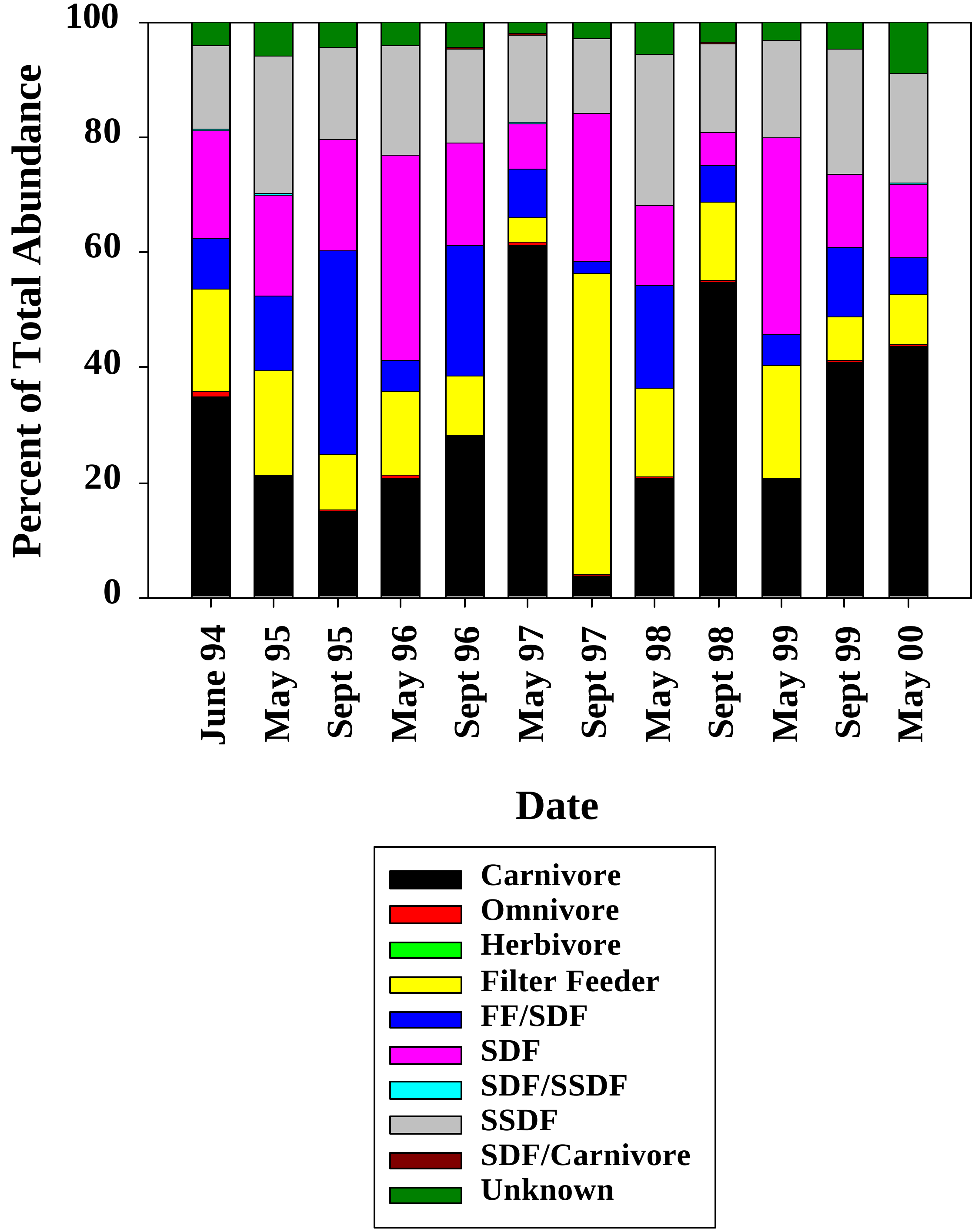

Figure 8-28. Borrow Area BBA3-Undredged Trophic Guilds. Arrows indicate when dredging occurred.

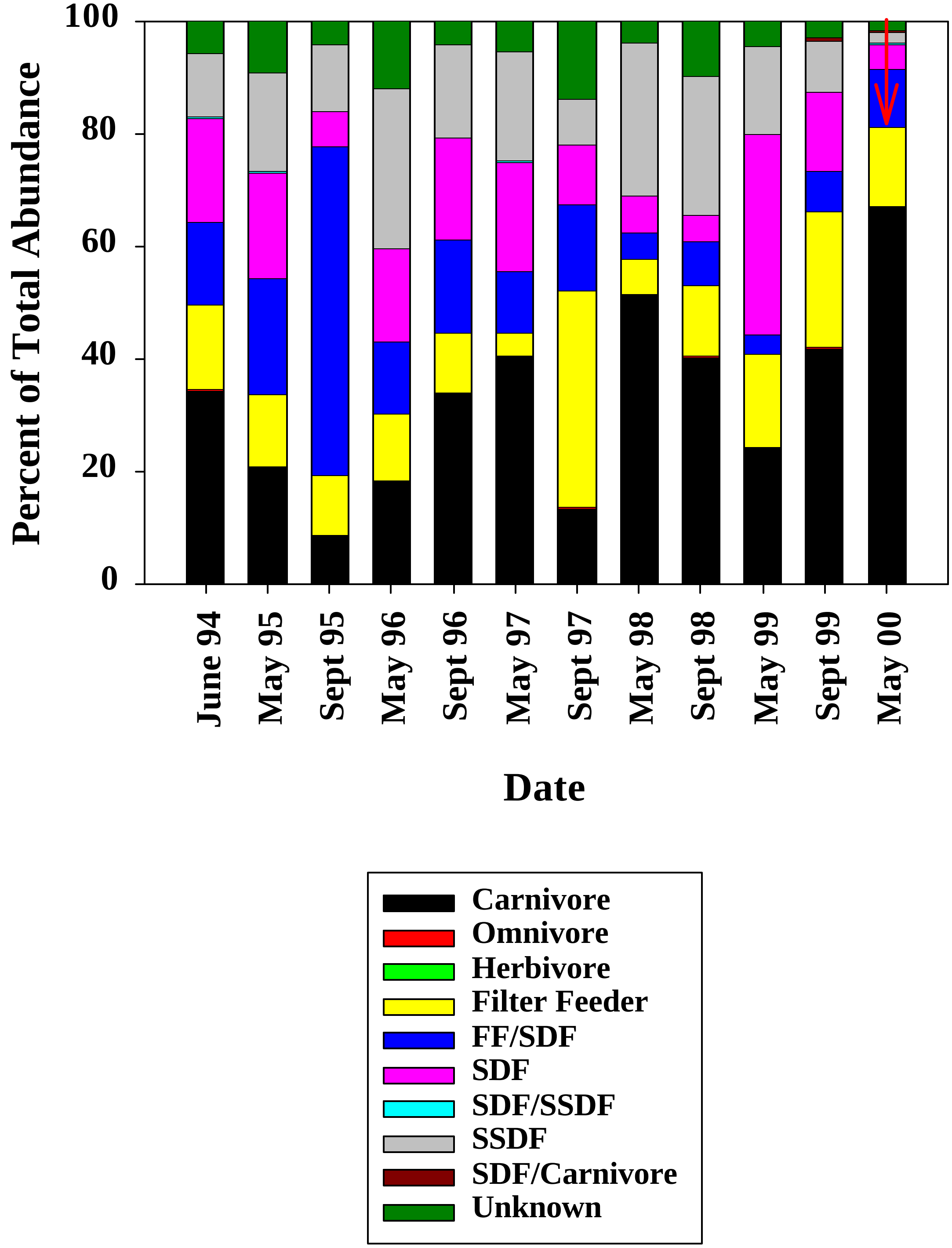

Figure 8-29. Borrow Area BBA5 Trophic Guilds. Arrows indicate when dredging occurred.

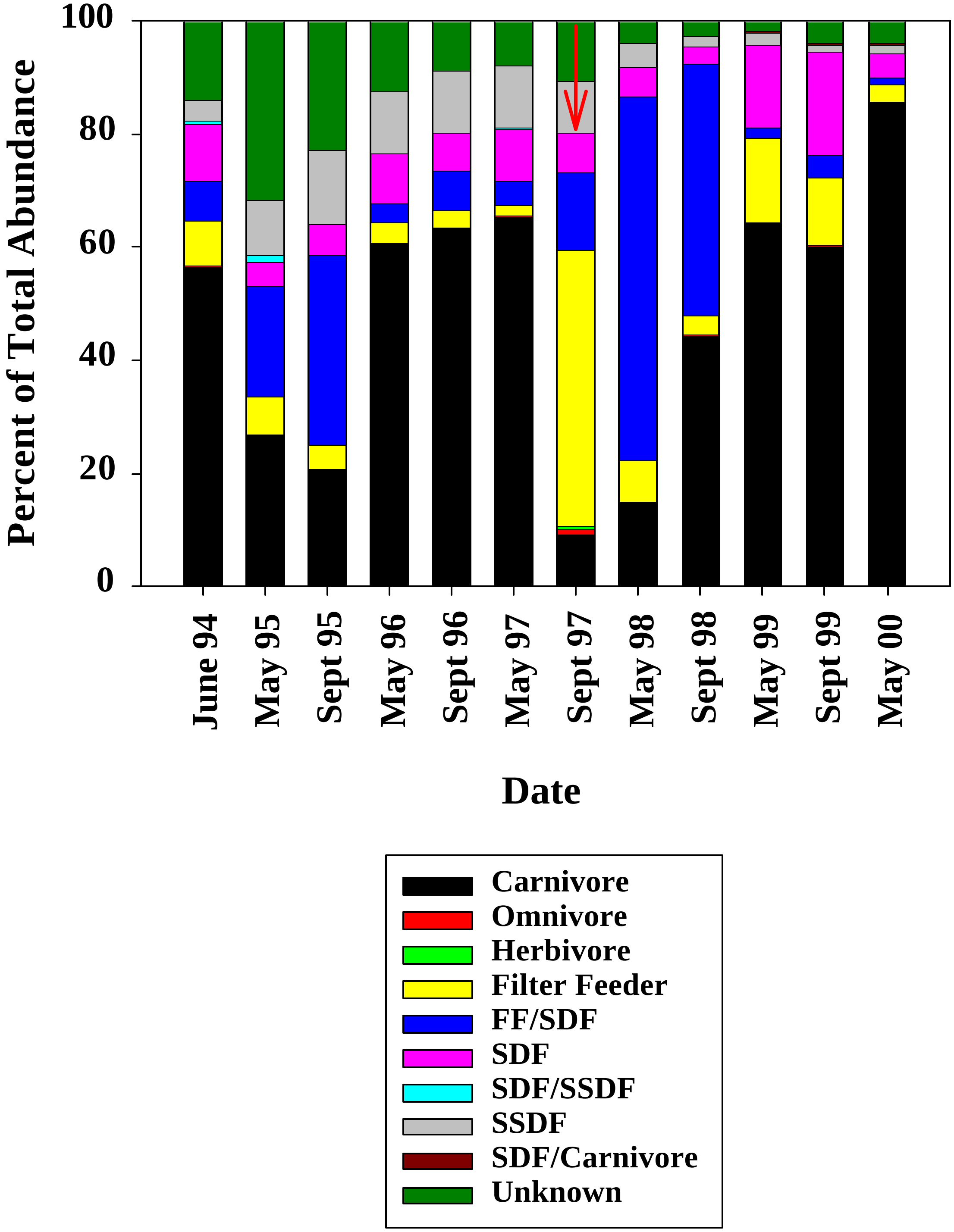

Figure 8-30. Borrow Area BBA6 Trophic Guilds. Arrows indicate when dredging occurred.

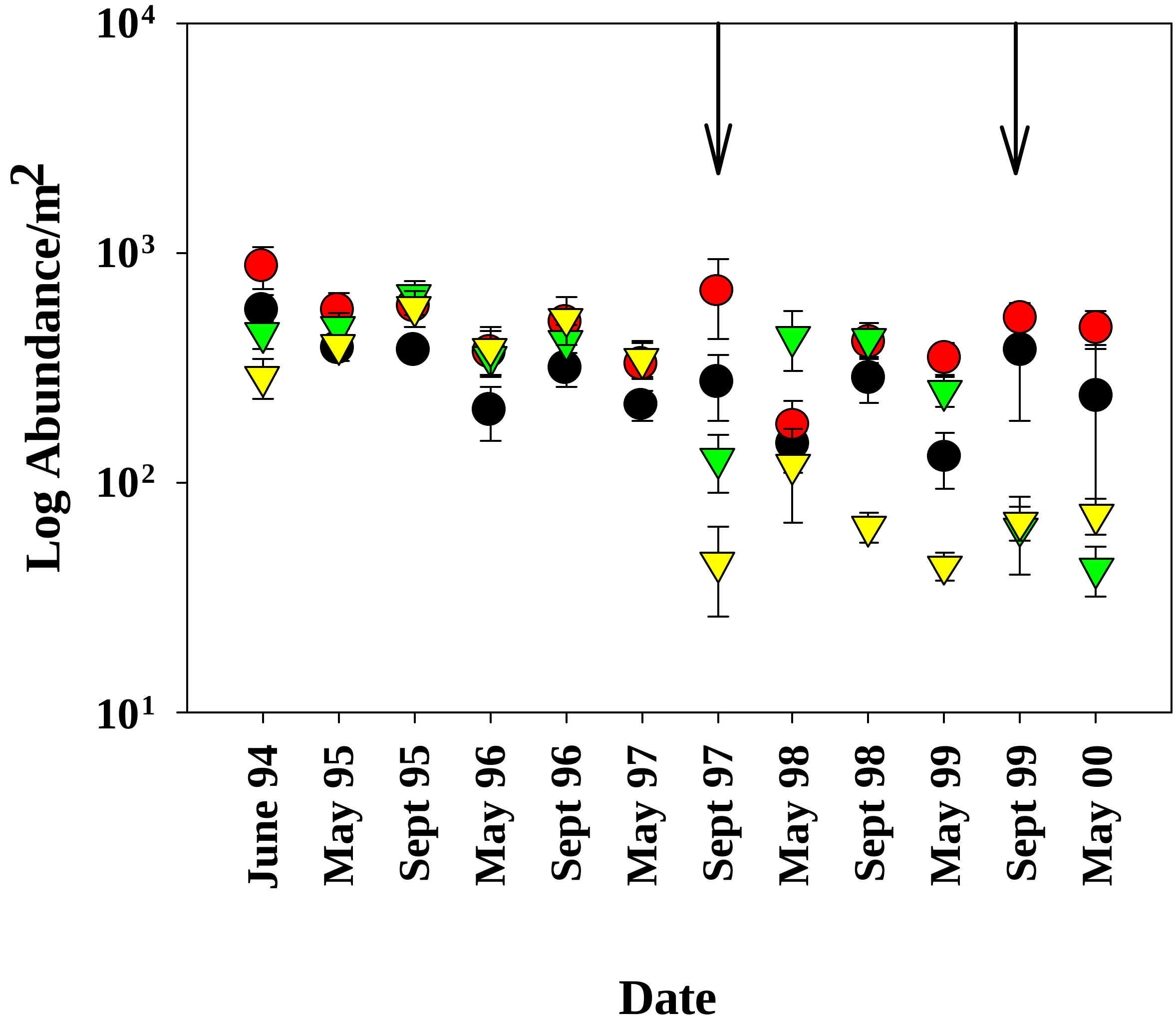

Figure 8-31. Subsurface Deposit-Feeder Abundance (Mean No. Animals/m^2 $\pm$ SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

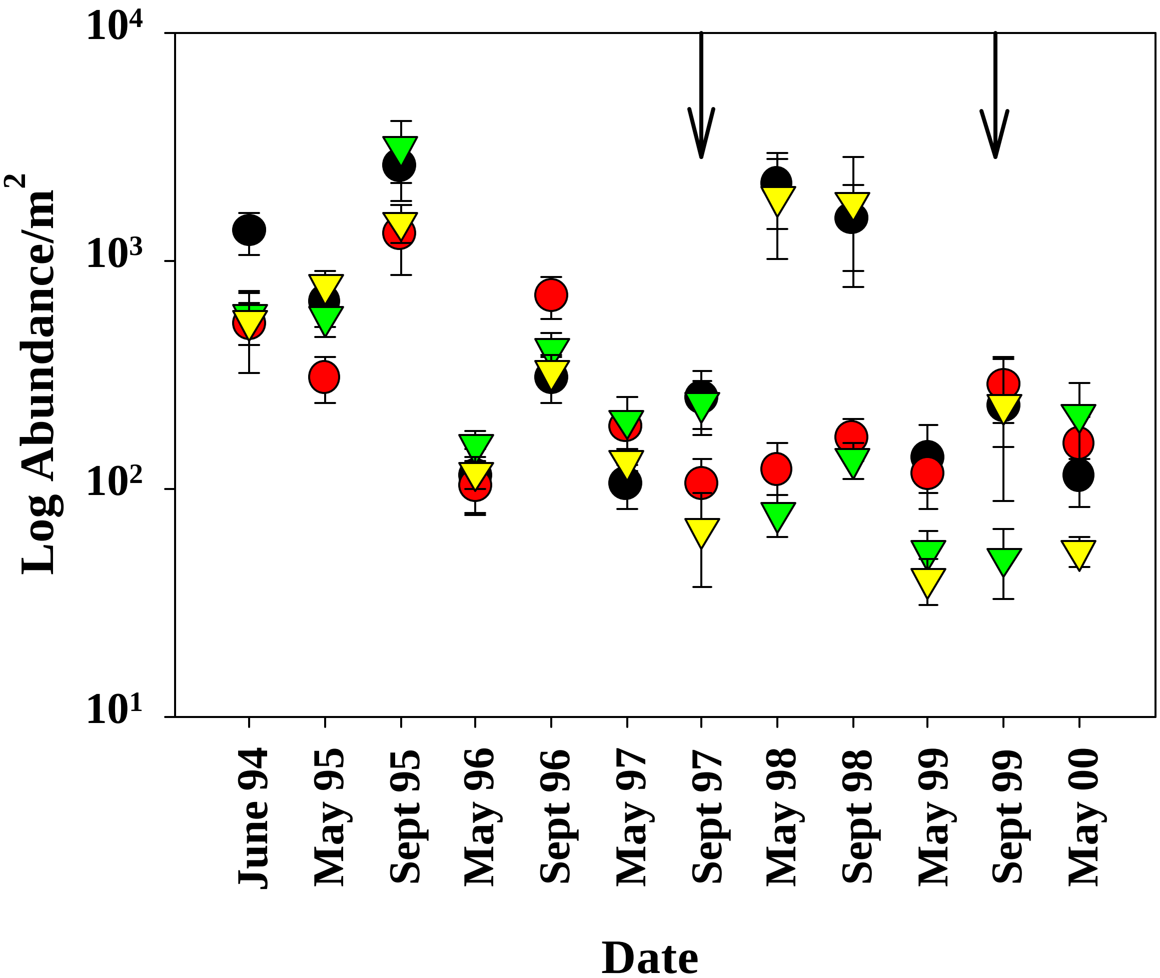

Figure 8-32. Filter Feeder/Surface Deposit-Feeder Abundance (Mean No. Animals/m^2 $\pm$ SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

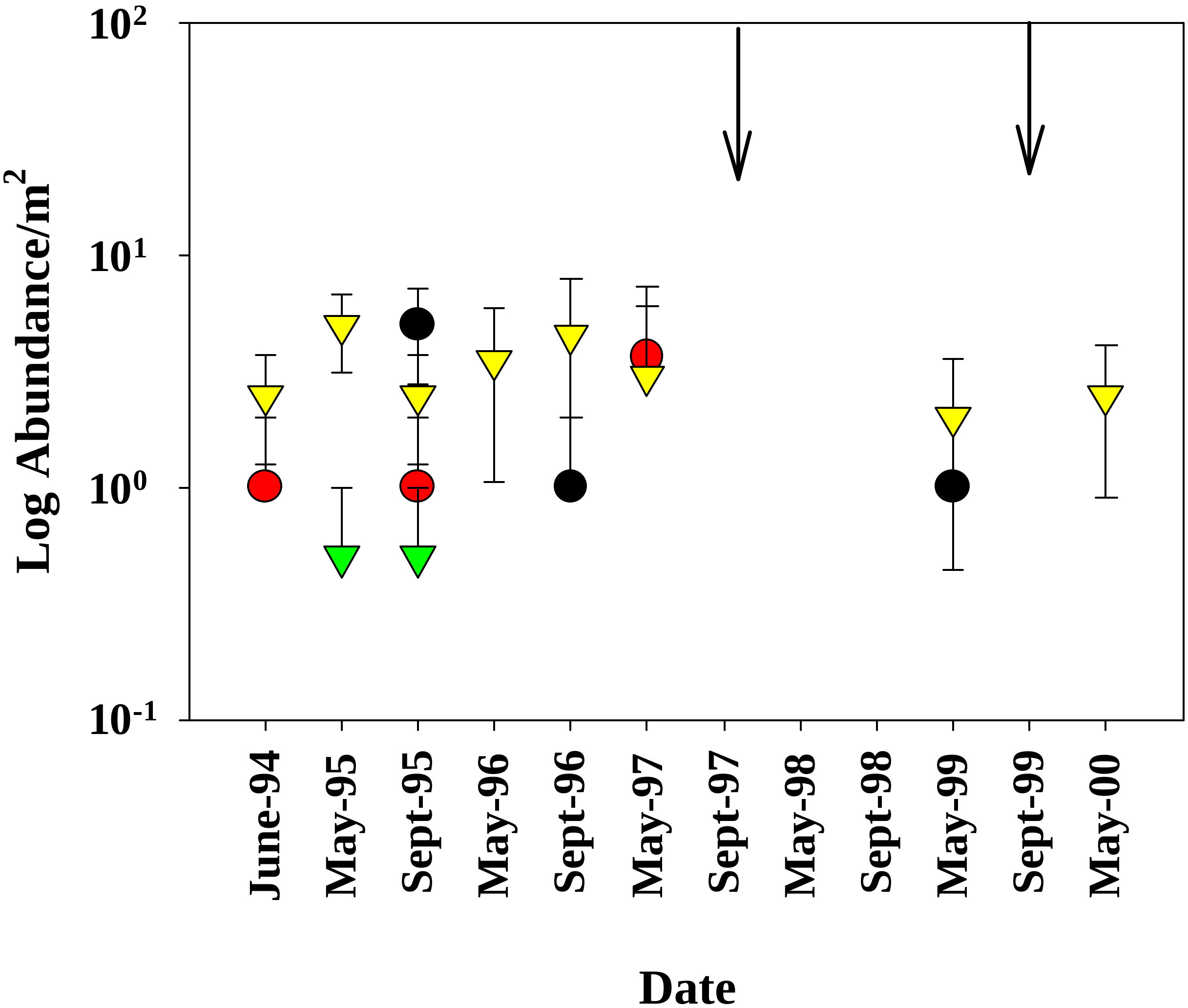

Figure 8-33. Maldanid Polychaete Abundance (Mean No. Animals/m^2 ± SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

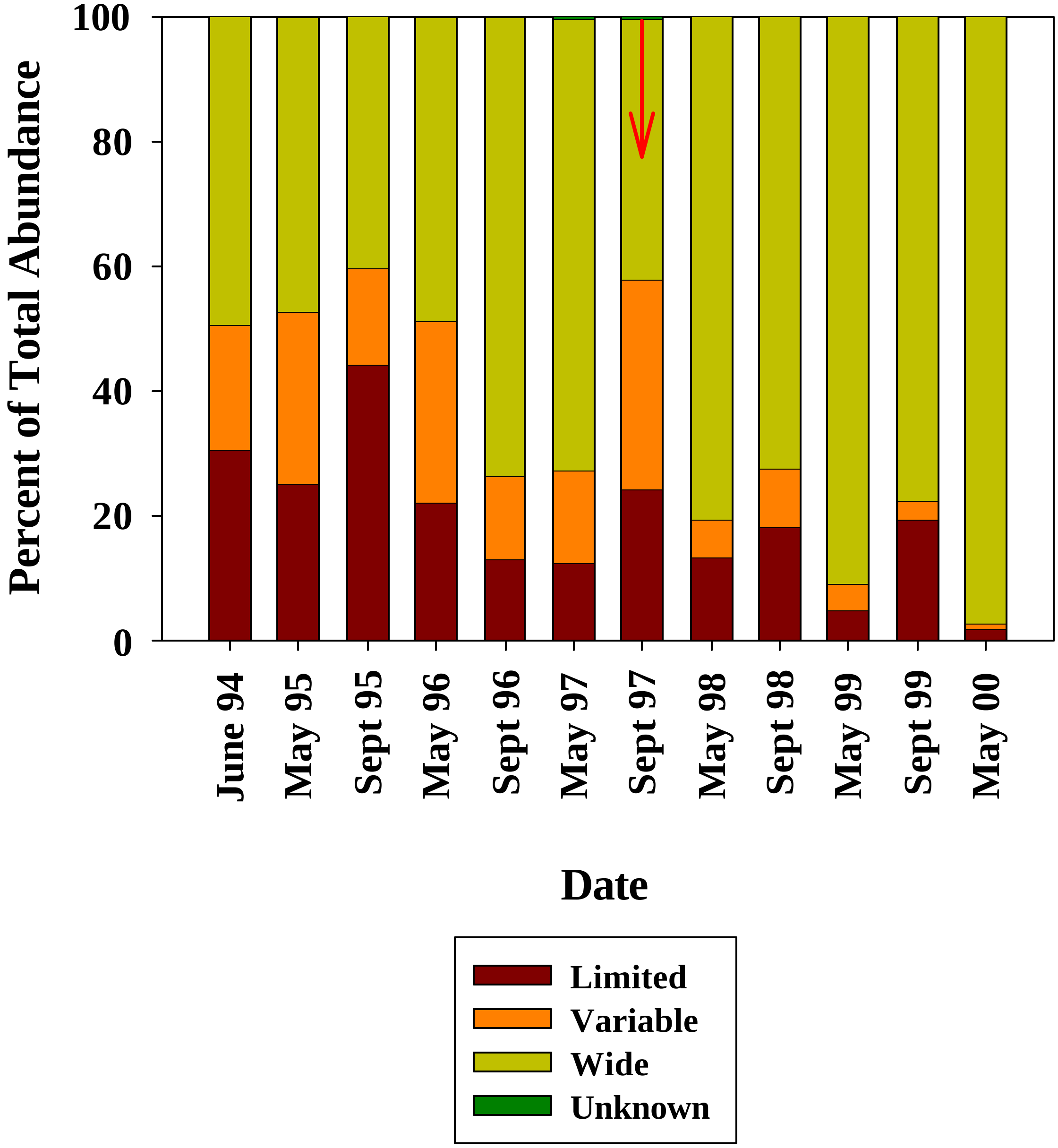

Figure 8-34. Borrow Area BBA3-Dredged Dispersal Guilds. Arrows indicate when dredging occurred.

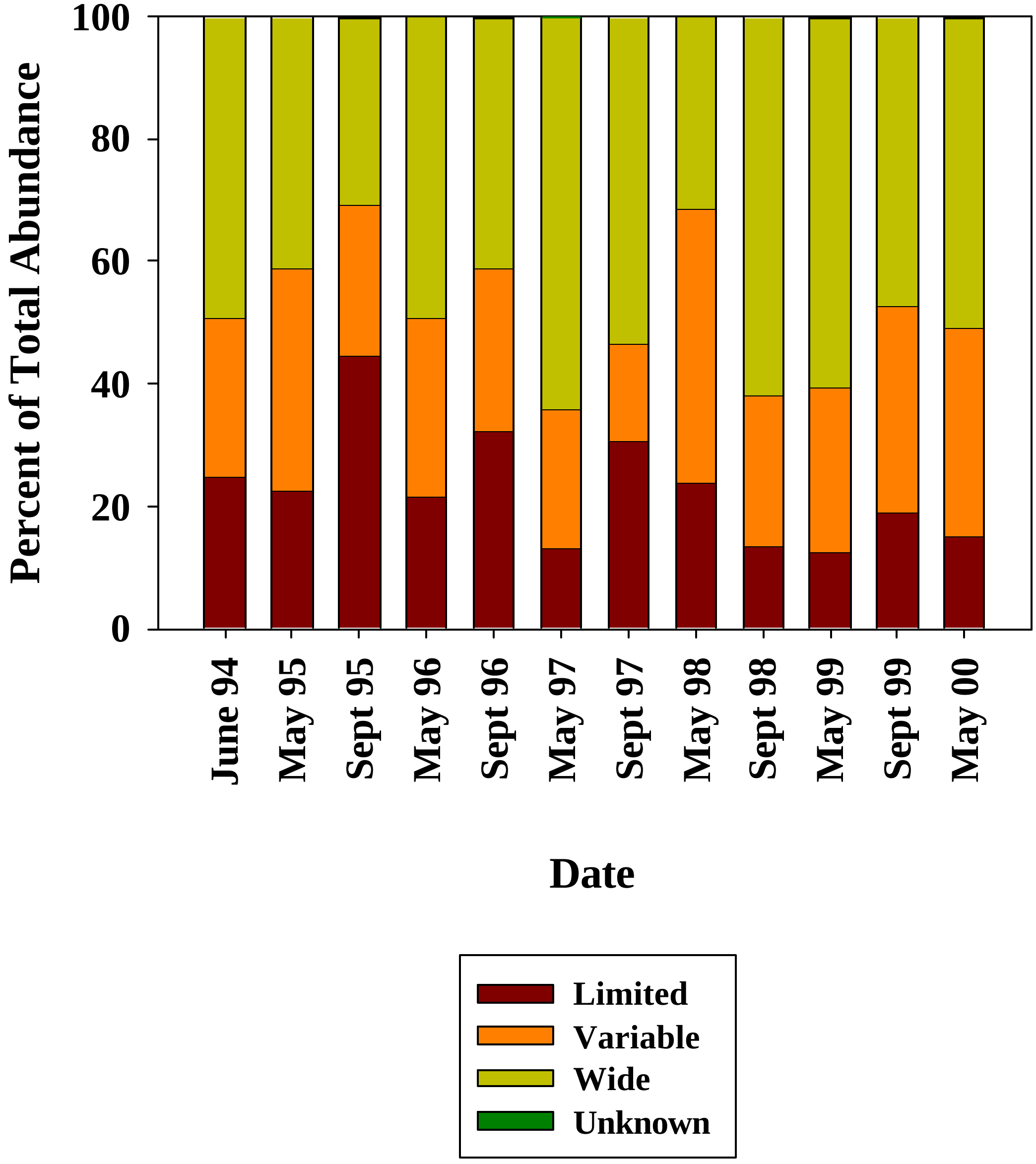

Figure 8-35. Borrow Area BBA3-Undredged Dispersal Guilds. Arrows indicate when dredging occurred.

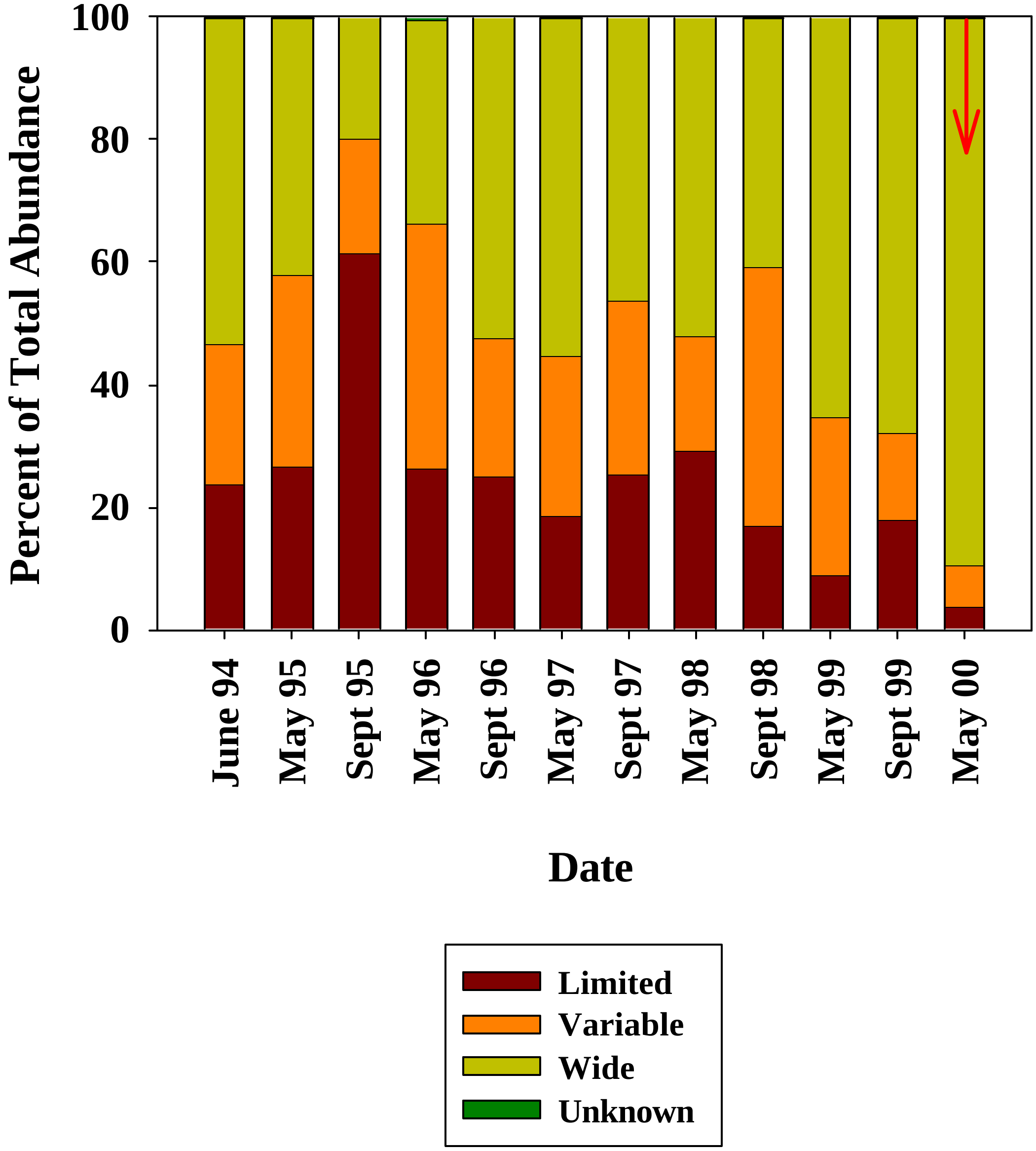

Figure 8-36. Borrow Area BBA5 Dispersal Guilds. Arrows indicate when dredging occurred.

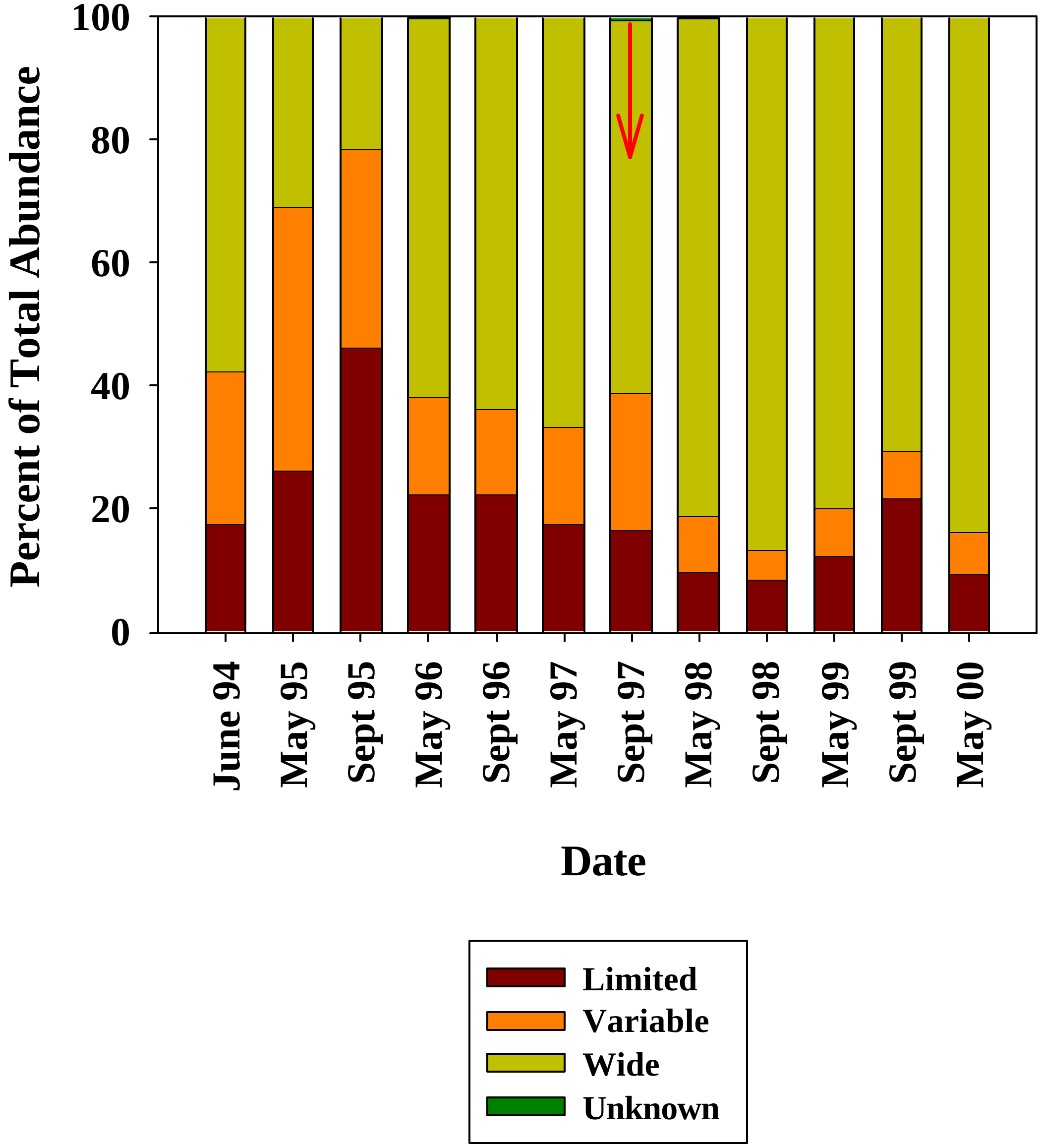

Figure 8-37. Borrow Area BBA6 Dispersal Guilds. Arrows indicate when dredging occurred.

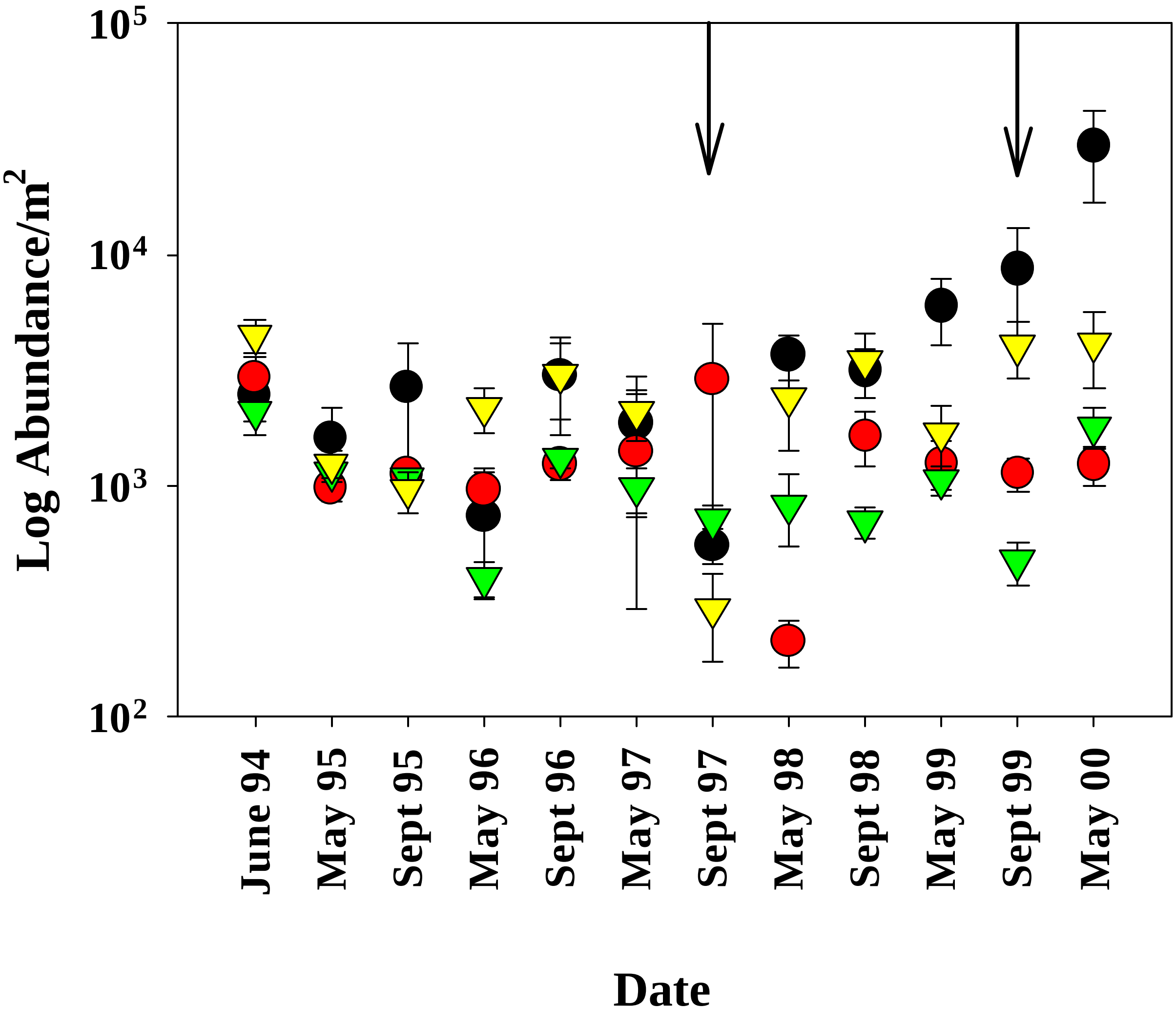

Figure 8-38. Wide-Dispersal Guild Abundance (Mean No. Animals/m^2 $\pm$ SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

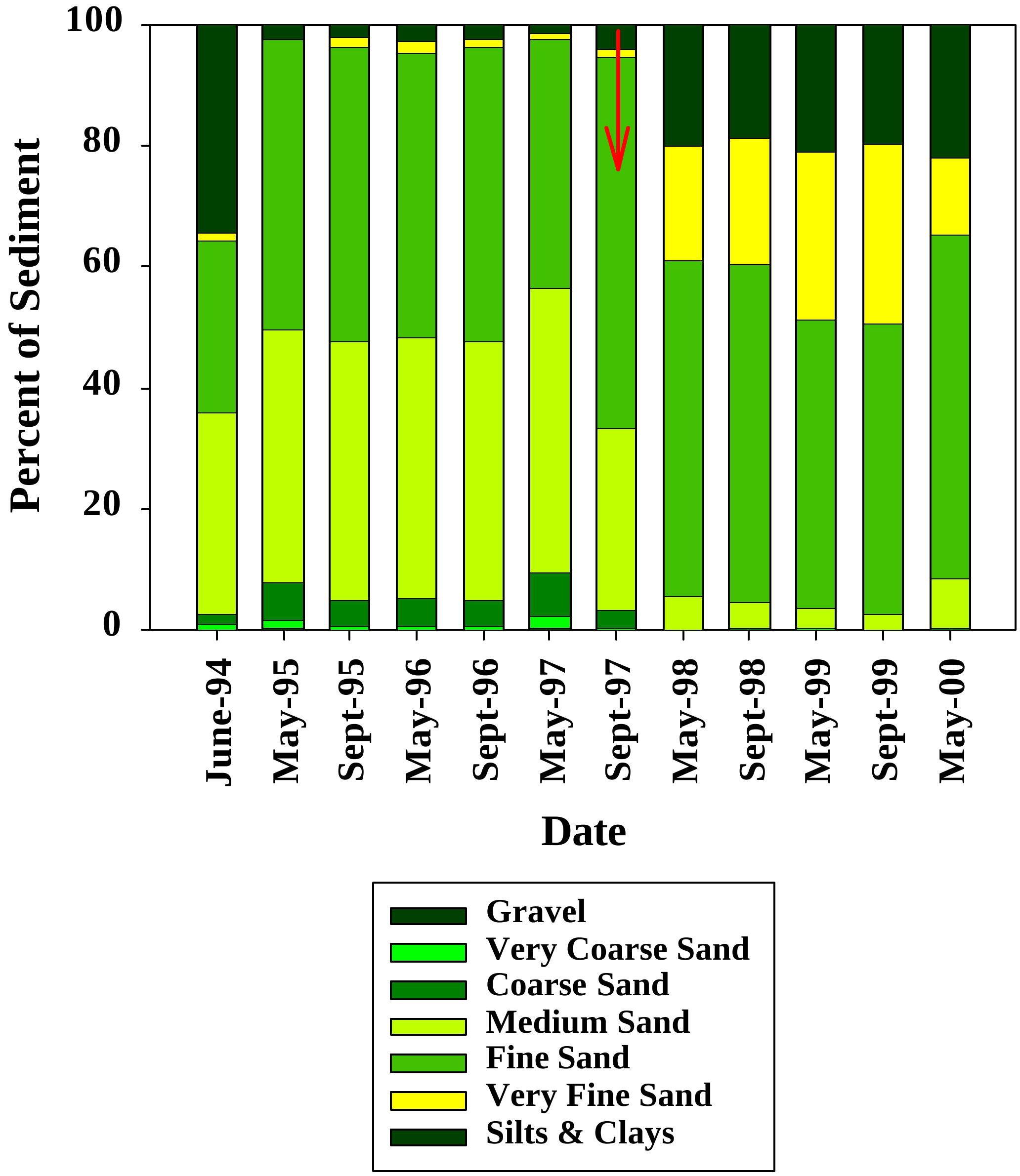

Figure 8-39. Sediment Composition of Borrow Area 3- Dredged Portion. Arrow indicates when dredging occurred.

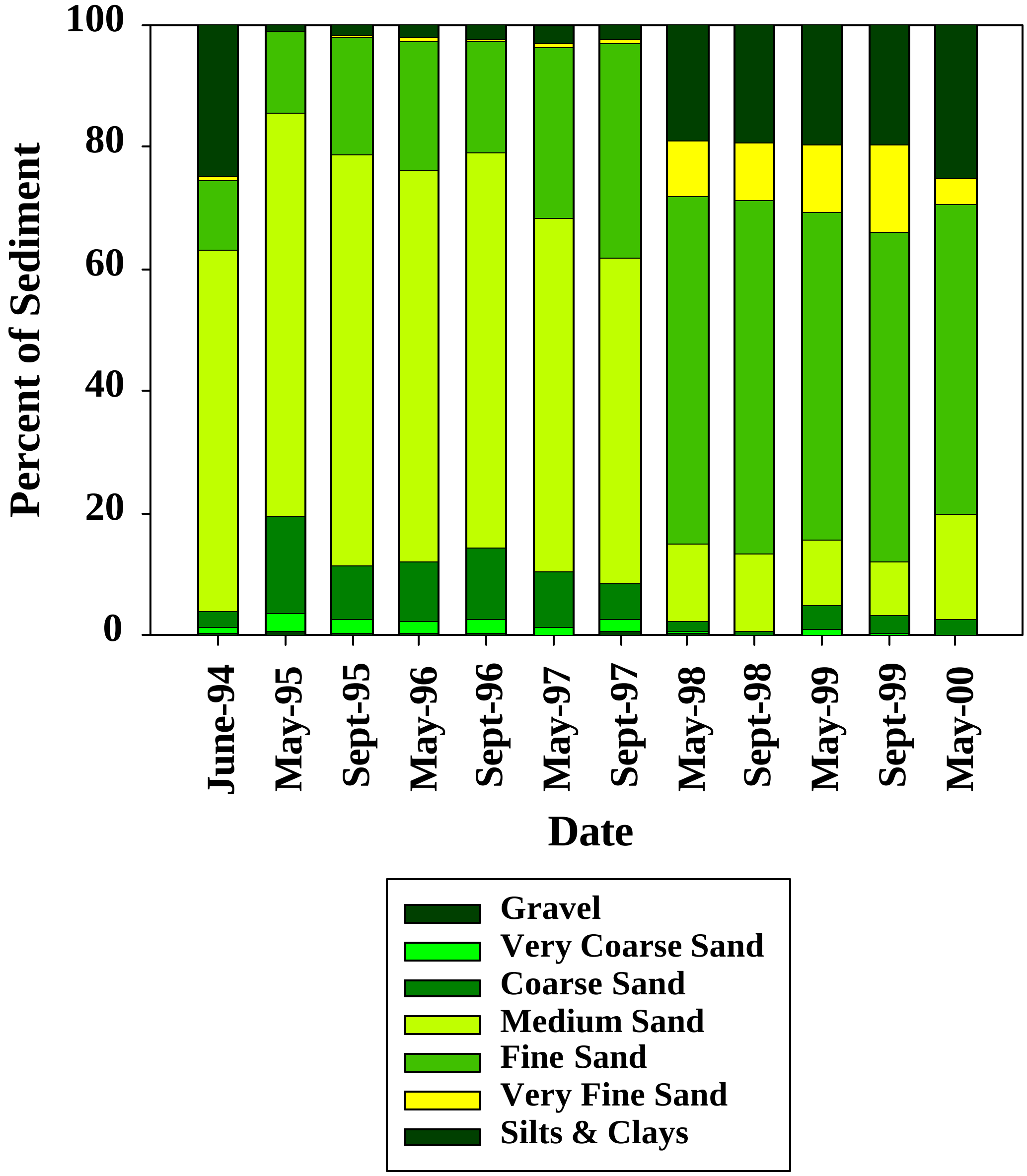

Figure 8-40. Sediment Composition of Borrow Area 3- Undredged Portion.

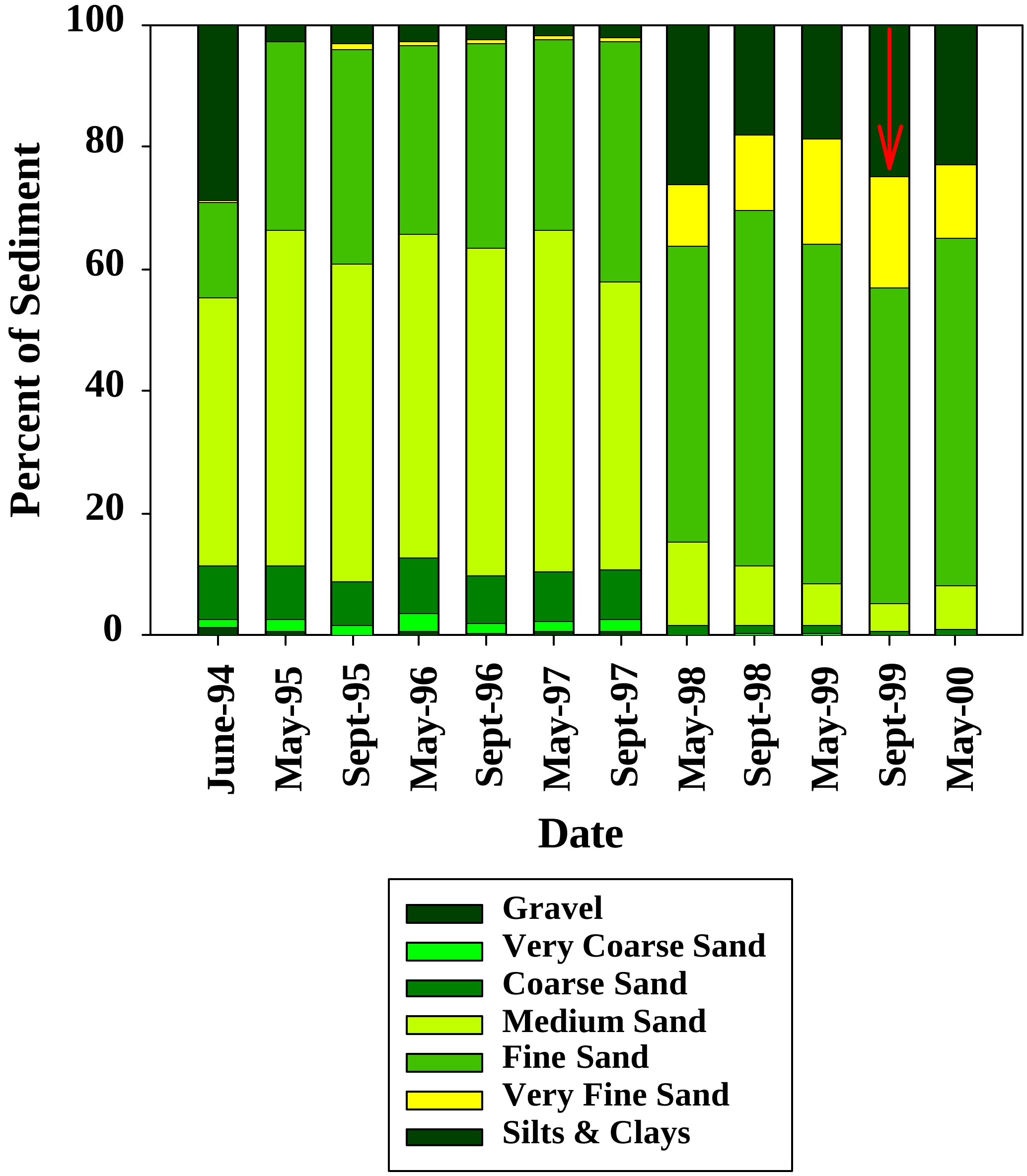

Figure 8-41. Sediment Composition of Borrow Area 5. Arrow indicates when dredging occurred.

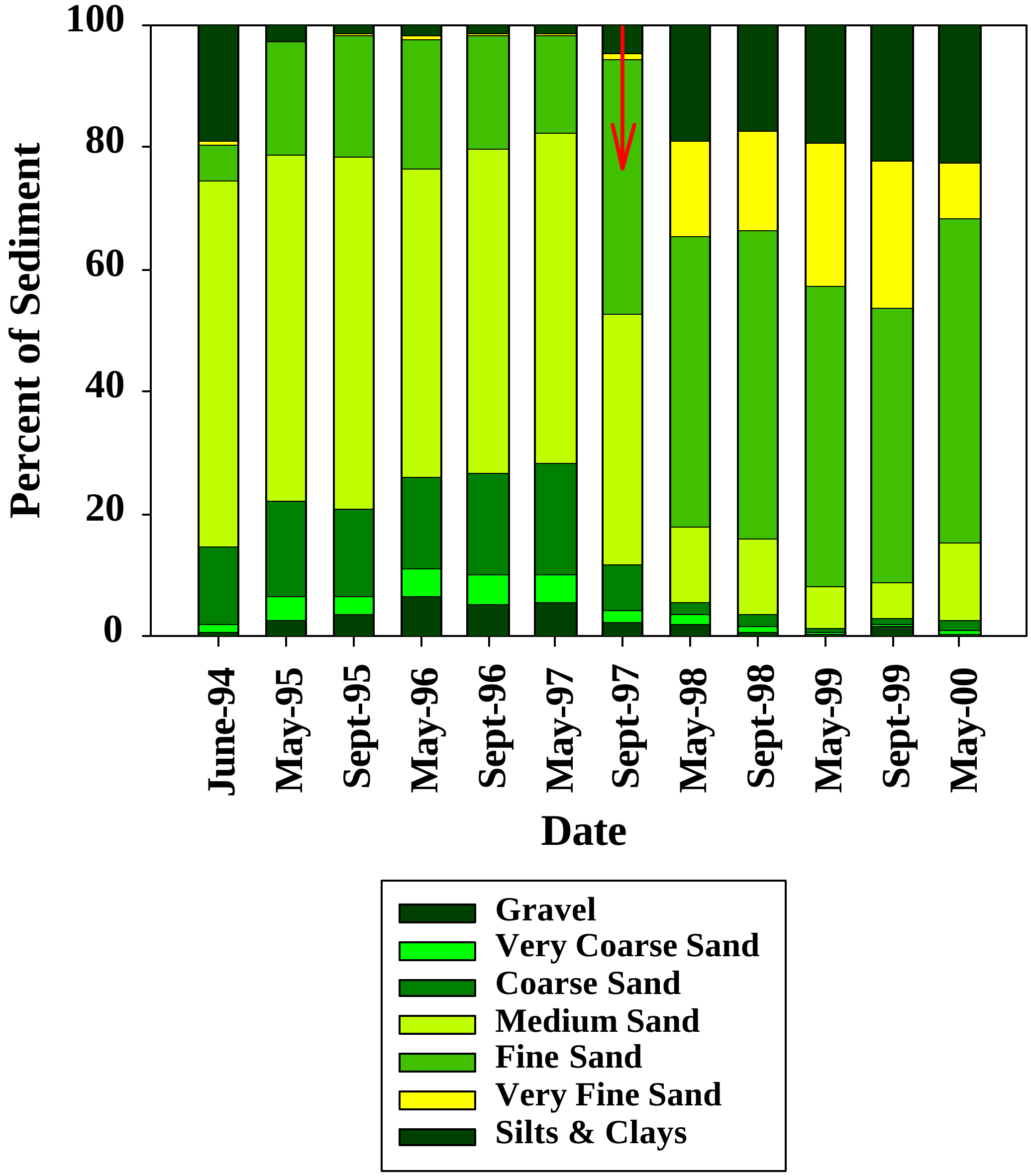

Figure 8-42. Sediment Composition of Borrow Area 6. Arrow indicates when dredging occurred.

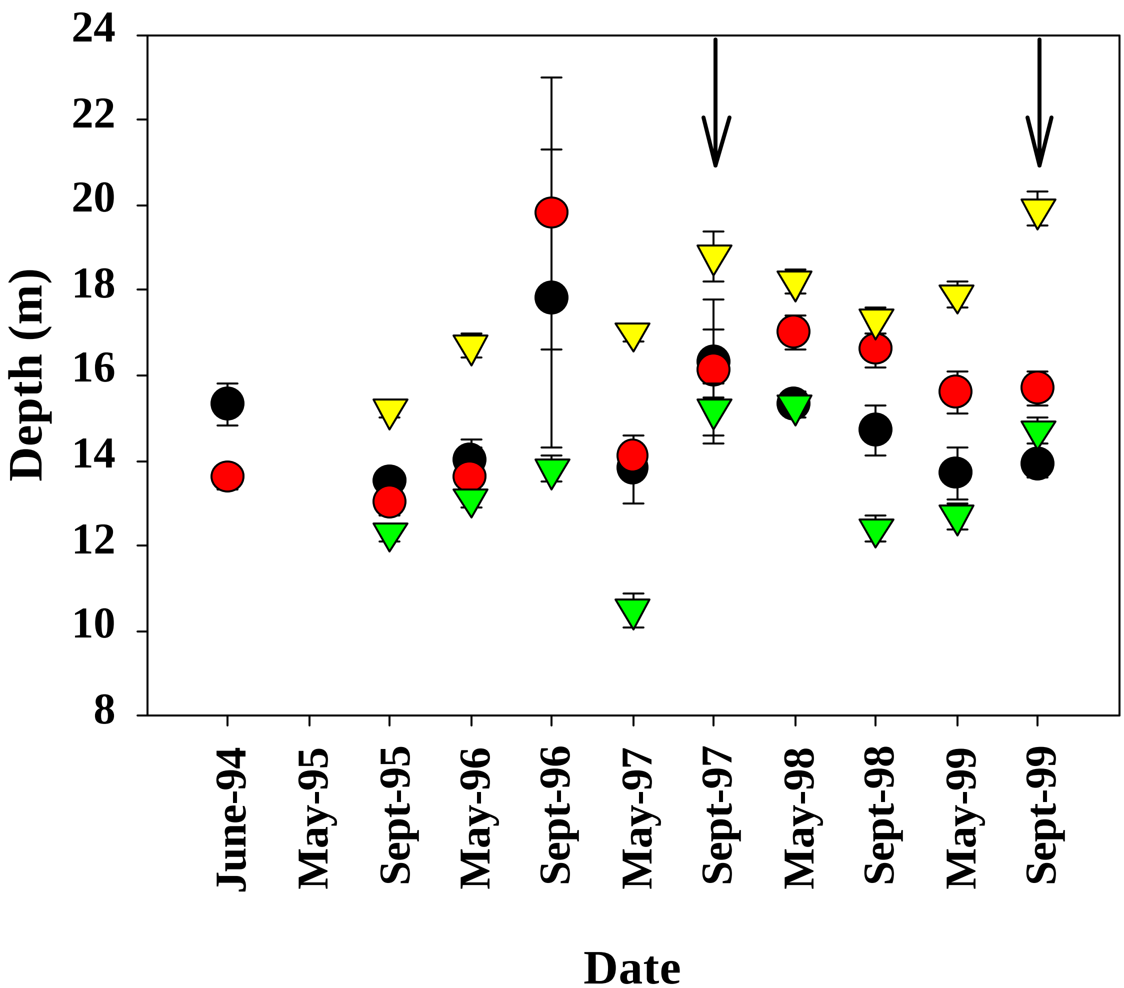

Figure 8-43. Depth of Borrow Areas. Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

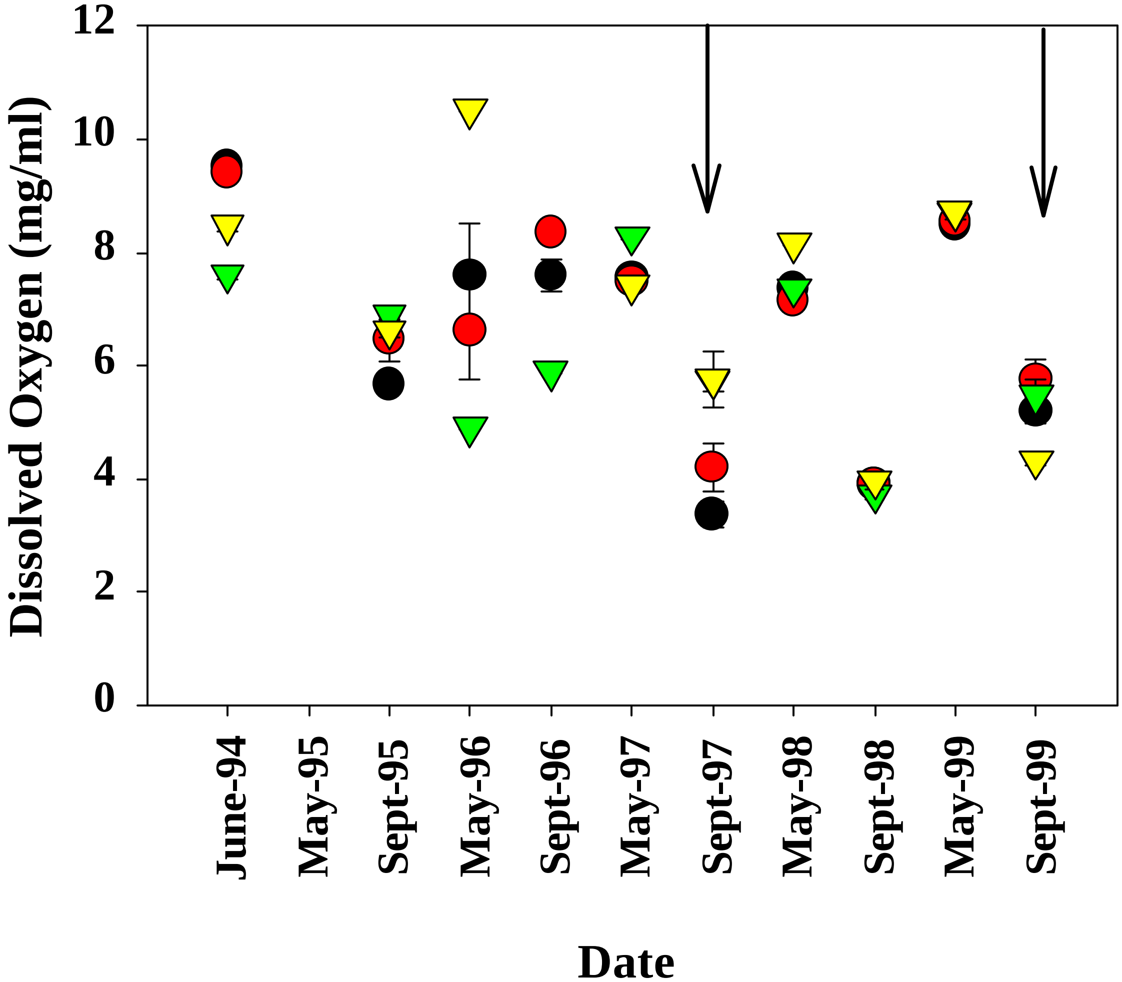

Figure 8-44. Dissolved Oxygen Content of Borrow Area Bottom Waters (Mg/l±SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

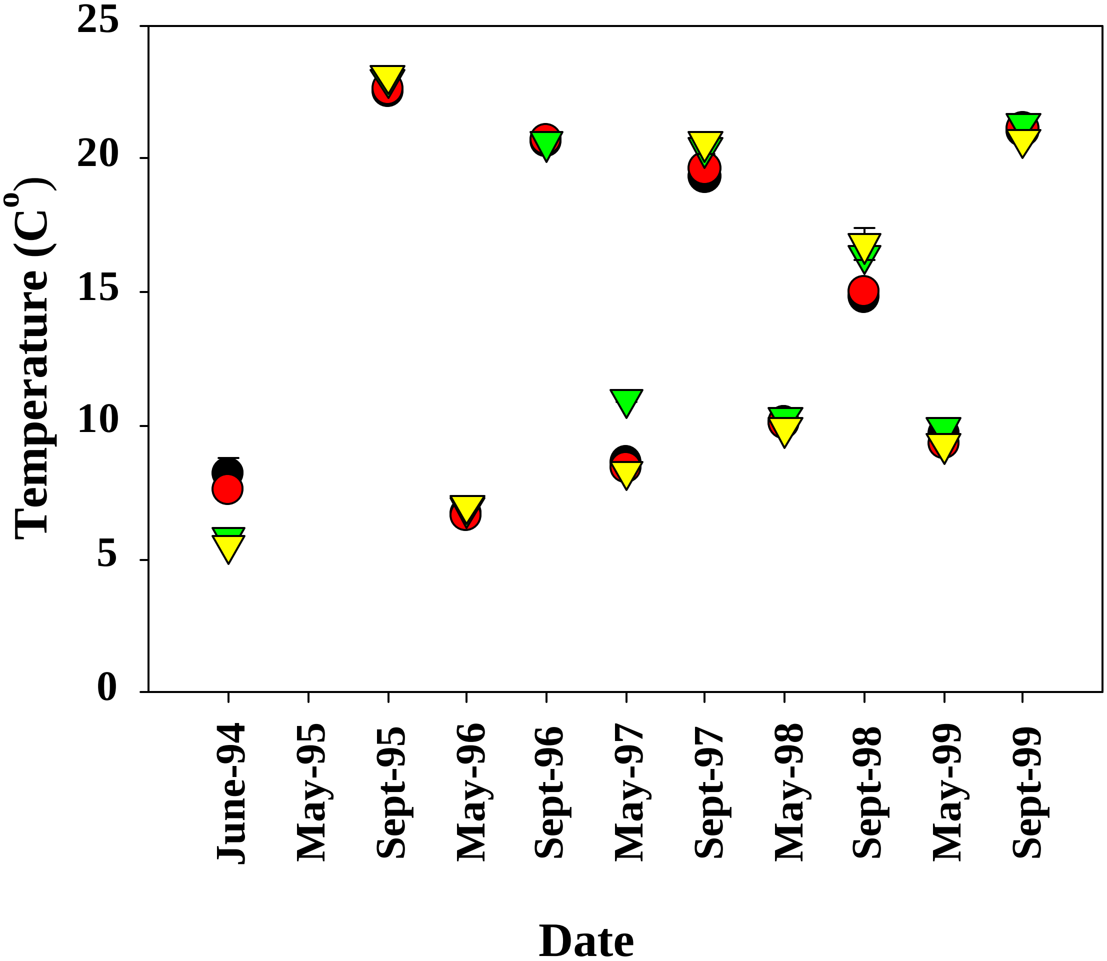

Figure 8-45. Temperature of Borrow Area Bottom Waters ($C^0 \pm SE$). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

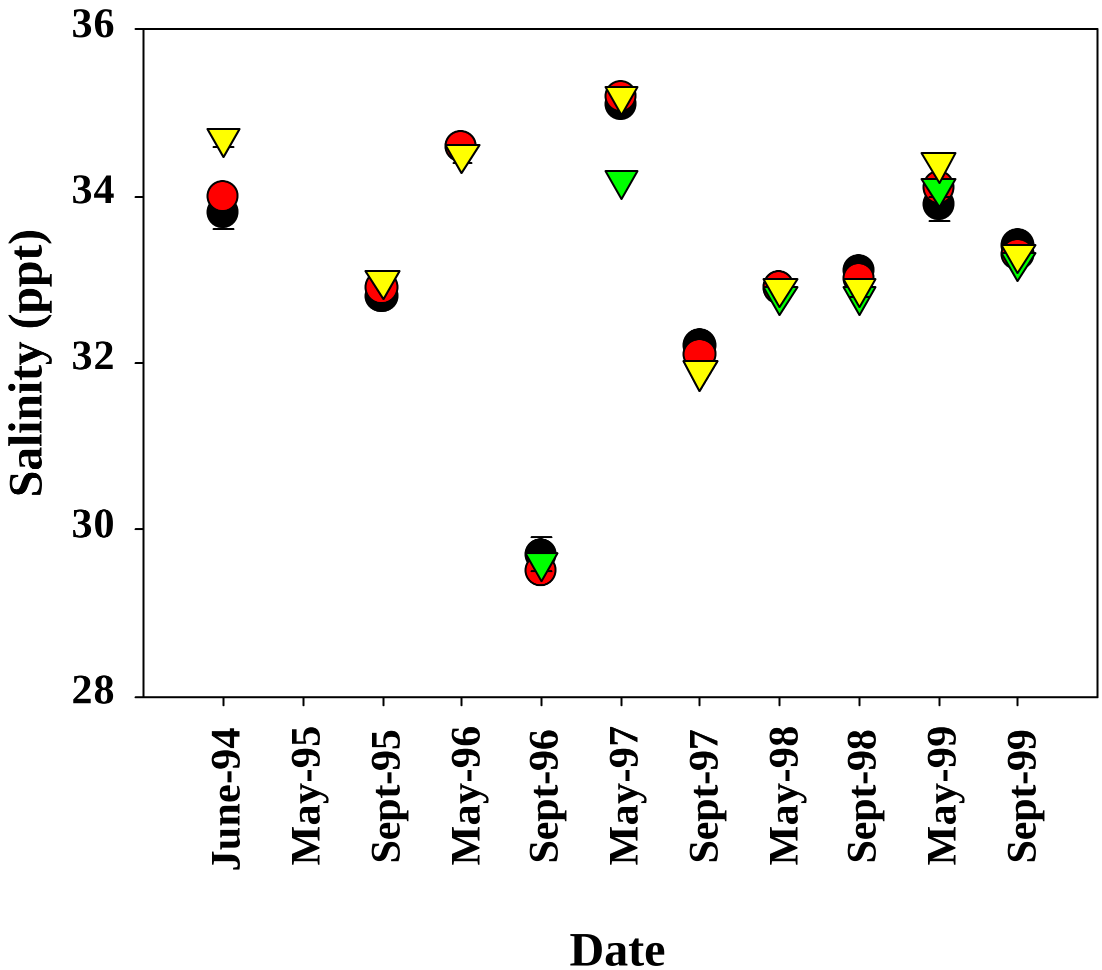

Figure 8-46. Salinity of Borrow Area Bottom Waters (ppt±SE). Black circles = BBA3-Dredged, Red circles = BBA3-Undredged, Green inverted triangles = BBA5, yellow inverted triangles = BBA6; Arrows indicate when dredging occurred.

stations/area x 1 sample/station. Station locations were determined by dividing each borrow area into two equal-sized subareas along the longitudinal axis and then locating 10 stations at equidistant intervals along the center of each subarea (Appendix Table 8-1). Sampling was initiated in June 1994 using a standard Smith McIntyre grab (0.1 m^2) and was successfully performed biannually (Spring and Fall) beginning in May 1995 and ending in May 2000.

Three borrow areas, Belmar Borrow Areas (BBA) 3, 5, and 6, were sampled on each date (Figure 8-1). Samples were sieved (0.5 mm mesh) on the boat and preserved in buffered 10% formalin. In the laboratory, samples were sieved again for the fish food habits analysis (6.35, 3.35, 2.0, 1.0, and 0.5 mm mesh), stained with 1% Rose Bengal and transferred to 70% ethanol. Organisms were sorted from the sediments and enumerated by LPIL taxa. The complete taxonomic list, abundance, and occurrence data are presented in Appendix Table 2. Wet-weight biomass also was determined after combining LPIL taxa into higher-order taxa. Both Barry Vittor and Associates (BVA) of Mobile, Alabama and Normadeau Associates, Inc. (Bedford, New Hampshire) were involved in processing of the infaunal samples at different times during the study. Taxonomic identifications from the two firms were verified by BVA in 1997.

Each grab was also subsampled in the field for 150-250 g of material for sediment characterization. Grain-size distribution was determined as previously described using both wet-sieving and pipette methods (see Chapter 2). Water quality data including temperature (^oC), salinity (ppt), dissolved oxygen concentrations (mg/l) and depth (m) were collected with a HydroLab water quality meter at the time of sampling. Values were obtained from one or more stations during all of the sampling efforts except May 1995.

Descriptive and Statistical Analyses: Analysis of sand borrowing operation impacts was originally designed to be a direct comparison of the first borrow area (BBA3) with the remaining two areas acting as reference sites for the first nourishment operation (1997). For the second nourishment operation, a second borrow area (BBA6) would be compared with BBA5 (Reference) and BBA3 (Recovering). Unfortunately, there was an accident involving the dredge pipeline during the operations at BBA3 in 1997, making it necessary to prematurely dredge BBA6. Only half of BBA 3 had been dredged, permitting division of the dataset into dredged (BBA3D) and undredged (BBA3N) stations (Figure 8-2). Proximity of the dredged and undredged portions of BBA3, however, resulted in some question as to the appropriateness of BBA3N as a reference site. To resolve this issue each site was treated independently, that is the Area factor changed from a comparison of Dredged and Reference for the first dredging operation and Dredged versus Recovering and Reference for the second operation, to a comparison of BBA3D, BBA3N, BBA5, and BBA6 for both operations. The effect of this change in design was minor for the first dredging operation since BBA5 was still available as a reference site. However, interpretation of results from the second operation, where only BBA3N remained as a potential reference site, is more tentative.

Numerical abundance, total biomass, and taxa richness data were analyzed using Analysis of Variance (ANOVA) and employing a two-way repeated measures design (Area x Date). Prior to testing, abundance and biomass data were converted to a per-m^2

basis and examined for normality and homogeneity of variance. Data were transformed (log (x+1) or 4th-root) where appropriate. Because multiple analyses were performed on data from each depth, it was necessary to adjust p values for multiple tests using the Bonferroni correction ($p = 0.5/n$ where n = number of tests). The total of three tests (abundance, biomass, and taxa richness) resulted in a p value of 0.0167 to indicate the presence of statistically significant differences. If a significant difference ($p<0.0167$) was not detected for an effect, an *a posteriori* statistical power of the test was calculated. A power level of 75-80% was assumed to be necessary to indicate that no statistical difference was present. Where the interaction factor (e.g., Area x Date) was significant ($p<0.0167$), main effects could not be directly interpreted (Zar, 1996). In these cases, the Tukey-Kramer HSD (honestly significant difference) multiple range test (referred to subsequently as the Tukey test) was employed to test for differences among all means. The complete Tukey test results are presented in Appendix Tables 3 to 5.

Patterns in community species composition were examined using the multivariate ordination technique Nonmetric Multidimensional Scaling (NMDS). Only taxa contributing 1.0% or more to total abundance or present in 10% or more of all samples were incorporated into the analyses. Abundances were logarithmically transformed (log x+1) to reduce the influence of high dominance by one or more taxa. Prior to estimation of the contributions of individual taxa, the list of LPIL taxa was consolidated to remove duplicative listings as described for the intertidal and nearshore infaunal data. Abundances (mean $\pm$ se) of taxa making up 1% or more of total abundance were plotted.

Because of the importance of the sand dollar, *Echinarachnius parma*, to numerical abundance and biomass, the relationship between these parameters was examined in greater detail. Specifically, total echinoderm biomass was divided by total sand dollar abundance for each of the sampling periods and sites. Since there are few if any other echinoderms present, this should yield a reasonable value for average sand dollar weight.

In addition, the relative importance (percent composition) and abundance of two guild or functional groupings have been plotted. Guilds included trophic level/feeding type (e.g., carnivore, filter-feeder, surface deposit feeder) and dispersal capability (wide, limited, and variable). Trophic guilds were based on types described in Gaston et al. (1995) and Rakocinski et al. (1997), while assignment of individual taxa-specific guilds was based on listings found in these two papers along with information from Fauchald and Jumars (1979), Pearse et al. (1981), Caracciola and Steimle (1983), and other references. A complete listing of guild assignments is provided in Appendix Table 8-6.

Results and Discussion

Infaunal Abundance: A total of 256, 722 specimens was collected during sampling of the offshore borrow areas (Table 8-1). Abundance was dominated by the archiannelid *Polygordius* (LPIL) and the amphipod *Pseuodunciola obliquua*, which accounted for 35.5% and 9.6%, respectively, of all animals encountered (Table 8-2). Borrow Area 3 had the highest total number of animals (116,430) and Borrow Area 5 the lowest total (53,417). ANOVA of abundance data detected a significant ($p<0.017$) Area x Date interaction (Table 8-3). Subsequent Tukey tests of abundance means identified significant ($p<0.05$) declines at BBA6 during dredging (September 1997) and at BBA3N (Undredged) in May 1998 (Table 8-4 and Figure 8-3). Abundance at BBA3D was higher than either BBA5 or BBA6 in May 1999. During the second dredging operation (September 1999), abundance declined at BBA5. By May 2000 abundance at BBA5 was not significantly different ($p<0.05$) than BBA3N or BBA6, while values at BBA3D were higher than any of the other sites (Table 8-4 and Figure 8-3).

Infaunal Biomass: More than 10.5kg of wet-weight biomass was collected between June 1994 and May 2000 at the three borrow areas (Table 8-1). BBA6 had a total of more than 5kg, BBA3 had 3.8kg and BBA5 had 1.6kg. Echinoderms were the biomass dominant followed by molluscs and annelids. ANOVA of the biomass data detected a significant Area x Date interaction ($p<0.0167$) (Table 8-3). Tukey tests indicated that biomass was significantly lower at BBA5 than BBA6 in September 1996 and May 1997, but significantly lower at BBA6 than any of the other sites during dredging in September 1997 (Table 8-4 and Figure 8-4). There was no difference between sites from May 1998 to May 1999, but after the second dredging operation, biomass at BBA5 was significantly lower that any of the other sites (Figure 8-4).

Infaunal Taxa Richness: A total of 391 taxa was collected between June 1994 and May 2000; numbers of taxa ranged from 272 at BBA5 to 294 at BBA3 (combined). Seventeen taxa contributed 1% or more to total numerical abundance and collectively made up 81.9% of all animals collected (Table 8-2). An additional 18 taxa were present in at least 1% of the samples. Only four of the total of 35 dominant taxa were excluded from further analyses (Table 8-2). In each case, the taxon was at the family level and represented a group where one or more taxa in that family were already among the dominants. ANOVA of taxa richness data detected a significant ($p<0.0167$) Area x Date interaction (Tables 8-3). Tukey tests indicated that taxa richness was significantly lower ($p<0.05$) at BBA6 than the remaining areas in September 1997 (Figure 8-5 and Table 8-4). The same was true for BBA5 in September 1999 and May 2000.

Infaunal Biomass Composition: Biomass composition was also clearly impacted at all three dredged sites (Figures 8-6 and 8-9). In each case the relative importance of echinoderms, the biomass dominant, was substantially reduced while the proportion of annelid and mollusc biomass increased. Echinoderm biomass at BBA3D fell from an average of more than 90% of total biomass prior to as little as 41% in May 1999, although by May 2000 echinoderms once more made up 95% of total biomass (Figure 8-6). Echinoderm biomass at BBA3N (Undredged) made up more than 82% of total biomass during all collections except June 1994 (Figure 8-7). Echinoderm biomass at BBA5 generally exceeded 70% of biomass prior to September 1999, but in May 2000 was less than 1% of total biomass (Figure 8-8). At BBA6 echinoderm biomass fell from an average of approximately 90% of total biomass to 21% in May 1998 and 19% in September 1999 (Figure 8-9). Echinoderms constituted more than 90% of total biomass in May of 1999 and again in May 2000.

Infaunal Species Composition. As previously mentioned, the two most abundant taxa were the archiannelid *Polygordius* (35.5%) and the amphipod *Pseudunciola obliquua* (9.6%). The third most abundant taxon was the tanaid *Tanaissus psammophilus*, which constituted 6.0% of total abundance. Other dominant taxa contributing 1% or more to total abundance included the polychaetes *Spiophanes bombyx*, *Magelona papillicornis,* and *Caulleriella killariensis;* Oligochaeta (LPIL); the molluscs *Spisula solidissima* (surf clam), *Tellina agilis* and *Nucula proxima*; the amphipods *Acanthohaustorius millsi, Rhepoxynius hudsoni, and Protohaustorius wigleyi*; the sand dollar *Echinarachnius parma*; and rhynchocoels.

Distribution of taxa among the four areas can be classified into three types: highest relative abundance (%) at BBA3D and BBA6, highest relative abundance at BBA3N and BBA5, and no apparent difference in relative abundance among the areas (Table 8-2). Only two taxa, *Polygordius* (LPIL) and *Spiophanes bombyx* were found in greatest relative abundance at BBA3D and BBA6. The abundance of *Spiophanes bombyx* was clearly related to dredging since it was present in high numbers only after dredging not only at BBA3D and BBA6 in 1997 but also at BBA5 in May 2000 (Figure 8-10). The abundance of *Polygordius* (LPIL) was not related to dredging since abundance was highest at BBA3D and BBA6 before as well as after dredging (Figure 8-11). Taxa found in greatest relative abundance at BBA3N and BBA5 included *P. obliquua, S. solidissima, T. agilis, E. parma, M. papillicornis, A. millsi, R. hudsoni, and P. wigleyi,* although there were no obvious relationships between dredging and the abundance of any of these taxa (Figures 8-12 to 8-19). Of the four taxa that did not display any difference in relative abundance among areas, *Tanaissus psammophilus*, Oligochaeta (LPIL), *Nucula proxima,* and Rhynchocoela (LPIL), only Rhynchocoela (LPIL) was found in lower abundance after dredging both in 1997 and 1999 (Figures 8-20 to 8-23).

Although an adequate solution for nonnmetric dimensional scaling (NMDS) was reached in two axes (stress = 0.19), a three-axis solution provided a far more robust result (stress = 0.11) (Table 8-5). The difference between the 2- and 3-axis solutions is pointed out by the higher correlation coefficient for the 3-axis solution (Table 8-6). In the two-axis NMDS plot the impact of dredging is clear from the separation of the September 1997 BBA6 sample and the September 1999 BBA5 sample from the remaining data points (Figure 8-24). The BBA5 sample ordinated high on the first axis while the BBA6 sample ordinated high on the second axis. Two other groups of samples are also appear to cluster together in the two-axis solution: 1) samples for all areas in June 1994 and May 1995 and 2) the post-dredging samples from BBA6. The first group ordinated high on Axis 2, while the second group ordinated mid-way on Axis 2 and high on Axis 1. There is also some indication of an increase in the degree of separation of the post-dredging BBA3D samples from the undredged samples for the same time periods. In both cases (BBA6 and BBA3D) the distinctiveness of the samples is associated most strongly with the first axis. The taxon most positively correlated with the first axis was *A. millsi,* while *Polygordius* (LPIL) was the most negatively correlated (Table 8-7). Axis 2 was most positively correlated with Oligochaeta (LPIL) and most negatively correlated with *Asabellides oculata.*

The 3-axis NMDS solution repeated the separation of the BBA5 and BBA6 September 1997 samples from the remaining data indicated a much greater difference between the dredged and undredged sides of BBA3 during dredging in September 1997 (Figure 8-25). The BBA3D (Dredged) sample from September 1997 ordinated far higher on Axis 3 (as did BBA6) than the undredged sample from this date. The June 1994 and

May 1995 samples as well as the post-dredging BBA6 samples do not form distinctive clusters along the third axis. This axis was most positively correlated with the haustoriid amphipods *Protohaustorius* Sp. B and *A. millsi* and most negatively correlated with *A. oculata.*

Sand Dollar Abundance/Biomass Relationships: Although there was no evidence of a change in abundance of the sand dollar *E. parma* due to dredging (Figure 8-19), there is an obvious relationship between dredging and average sand dollar weight (Figure 8-26). Total numbers of the sand dollar did not differ substantially among areas except in May 2000 when densities at BBA5 were exceptionally low. Sand dollar weights (g/animal) varied somewhat among areas over time, but the sharpest differences occurred at BBA6 and BBA5 immediately following dredging (Figure 8-26). At BBA3 the average sand dollar was slightly lower at the dredged area than the undredged site prior to dredging but was consistently lower after dredging (September 1997). Average weight per animal at BBA6 did not achieve values similar to the undredged areas until May 1999, while at BBA3D it was May 2000 before values began to be similar to those of BBA3N. The results for BBA6 and BBA3D suggest that dredging either selectively removed older, larger specimens or that the sites were recolonized by younger, smaller animals. In both cases, it was 2.5 years before population size structure resembled that of undredged conditions. At BBA5 a somewhat different result occurred with both total sand dollar abundance and size being affected. The general decline in sand dollar size at this time (all sites except BBA6 reached low values for the study in May 1999) may have exacerbated the impact of the dredging on sand dollar populations (Figure 8-19).

Infaunal Guild Composition: Two different community guild structures were examined: trophic level/feeding type and dispersal mode. Trophic level/feeding guild structure varied over time but to a great extent was consistent among areas: carnivores, surface deposit feeders, and subsurface deposit feeders dominated the assemblages with filter feeders and filter feeder/surface deposit feeders becoming important periodically (Figures 8-27 to 8-30). At BBA3D carnivores made up 40% of total abundance between June 1994 and May 1996, increased to 70% of abundance between September 1996 and May 1997, declined to less than 40% from September 1997 to September 1998, then increased to more than 70% for the remainder of the study (Figure 8-27). Surface deposit feeders made up more than 19% of total abundance between June 1994 and September 1995 and again between September 1997 and September 1998. Subsurface deposit feeders (SSDF) were the only trophic/feeding type to demonstrate a clear response to dredging. Prior to dredging, SSDF supplied 6-20% of total of abundance while after dredging, it provided less than 6% of total abundance. Examination of abundance indicates that the decline in numbers of animals following dredging was slight (Figure 8-31). Filter feeders comprised less than 10% of total abundance except September 1997 when they made up 36% of total numbers of animals (Figure 8-27). Filter feeder/surface deposit feeders consistently supplied 10% or more of total abundance except for the period during and immediately following dredging. Examination of total abundance indicates that that the total numbers of animals of this guild were actually higher after than before dredging (Figure 8-32), most likely as a result of the increase in *Spiophanes bombyx* abundance (Figure 8-10). At BBA3N and BBA5, carnivores were far less important with proportional increases in the importance of surface and subsurface deposit feeders. Changes in the relative abundance of filter feeders were similar to those at

BBA3D. Filter feeder/surface deposit feeders made up an unusually large proportion of total abundance at both areas in September 1995. Both the relative and total abundance of subsurface deposit feeders declined at BBA5 after dredging in September 1999 (Figures 8-29 and 8-31). At BBA6 subsurface deposit feeders declined in both relative and total abundance after dredging while both relative and total abundance of filter feeder/surface deposit feeders (primarily *S. bombyx*) increased immediately after dredging (Figure 8-30). The decline in subsurface deposit feeders at BBA3D, BBA5 and BBA6 after dredging was due to impacts to shallow burrowing taxa such as oligochaetes and paraonid polychaetes. Deep burrowing taxa such as the maldanid polychaetes were not present in large numbers and there is no evidence of a decline in their abundance after dredging (Figure 8-33).

Dispersal mode guild structure also varied over time but remained relatively stable among areas. Taxa with wide dispersal capabilities (those producing planktonic larvae) dominated total abundance, usually supplying more than 40% of the total number of animals (Figures 8-34 to 8-37). This proportion increased to more than 75% after dredging at BBA3D and BBA6 (1997) and BBA5 (1999). Absolute abundance of this guild also increased at BBA3D and BBA6 after dredging (Figure 8-38). Most of the increase is attributable to high densities of *Polygordius* (LPIL) and *S. bombyx* (Figure 8-11). The increase in abundance of this guild during May 2000 at BBA5 is attributable to large numbers of *S. bombyx* (Figure 8-10).

Sediment Texture: Sediments in all four areas followed similar trends in grain size composition. At the beginning of the study (June 1994) all areas were dominated by medium and fine sands with a substantial proportion of silts and clays (Figures 8-39 to 8-42). By May 1995 the silt/clay fraction had decreased to insignificance while the relative importance of medium and fine sands had increased. Sediment composition remained relatively stable until May 1998 when all sites experienced a substantial "fining" of the sediments; the contribution of fine sands increased to about 50% in all sediments regardless of borrow area or whether or not the site had been dredged (Figures 8-39 to 8-42). Silts and clays increased to approximately 20% in all sediments and remained stable until May 2000. The similarity in the proportions of silt/clays present in June 1994 to those of 1998-2000 suggests there may be a wide-scale, periodic phenomenon occurring. One hypothesis put forward to explain these results is the potential effect of changes in the position of the Hudson River plume. The plume carries large amounts of fine sediments with it and a movement towards the shore could impact surface sediment composition over a wide area. Unfortunately, there is presently no information available to confirm or deny this or hypothesis. The most obvious conclusion from the sediment data is that dredging had little or no effect on grain size composition. Changes in the proportions of sediment fractions occurred simultaneously at both dredged and undredged sites in 1997 and no change at all was detected at BBA5 in 1999.

Water Quality: Water quality was uniform throughout the borrow areas and consistent among years. Depths ranged from 10m to 20 m with BBA6 generally being the deepest (Figure 8-43). There was no obvious change in depths related to dredging. Dissolved oxygen concentrations in bottom waters were highest in the spring and lowest in the fall (Figure 8-44) corresponding to periods of low and high water temperatures respectively (Figure 8-45). Particularly low dissolved oxygen concentrations ($\leq$4 mg/l) were detected in September of 1997, 1998, and 1999. As with depth, there was no clear link between the low dissolved oxygen concentrations and dredging since similar values were found at both dredged and undredged sites (1997 and 1999) and during periods when there was no dredging occurring (1998). Bottom water temperatures ranged from 5°C to 22°C with lowest temperatures measured during the spring and highest values in the fall (Figure 8-45). There were no major differences in temperature between any of the sites during any sample period. Likewise, bottom water salinity varied between 28 ppt and 35 ppt with the lowest values occurring in September 1996. Salinity ranged from 32-25 ppt during all other sampling periods and differences among sites were limited to less than 2 ppt (Figure 8-46).

Summary: A single assemblage characterized the infaunal community of the offshore borrow areas. Three taxa, the archiannelid *Protodrilus* (LPIL), the amphipod *P. obliquua*, and the tanaid *T. psammophilus* made up more than 50% of all animals collected. If the taxon Archiannelida (LPIL) is assumed to be predominately made up of *Protodrilus* (as is likely), this total increases to 56%. Along with the remaining 11 taxa that constituted 1% or more of total abundance, a grand total of more than 80% of all animals are accounted for by 15 taxa (Table 8-2). Biomass was dominated by the sand dollar *Echinarachnius parma* and to a lesser extent by the bivalves *Spisula solidissima* and *Tellina agilis*.

Abundance, biomass, and species composition of the three borrow area were similar to other infaunal communities described for medium sand habitats in coastal New Jersey and the New York Bight. Clarke et al. (1991) have reported a community characterized by *T. agilis, P. obliquua*, and *S. solidissima* associated with borrow and reference areas in the vicinity of Sea Bright, New Jersey. Previous studies of prospective borrow areas along the south shore of Long Island have also encountered similar communities (CEB, 1996). Two sites near West Hampton, NY had abundances of 3,700-4,000 animals/m^2 and biomass between 50 and 83 g wet weight/m^2. The sites were dominated by the same taxa found at the New Jersey borrow areas, although relative abundances varied. Garlo (1980) has described benthic assemblages in the vicinity of Little Egg Harbor, New Jersey, whose dominants include most of the same taxa reported in this study, including *S. solidissima*, *T. agilis*, and *S. bombyx*. Stone and Webster (1991) examined offshore borrow areas near Ocean City, New Jersey, and found a community dominated by surf clams, the gastropod *Ilynassa trivittatus*, haustoriid amphipods, and magelonid polychaetes. In a follow-up study, Scott and Kelley (1998) sampled the Ocean City borrow areas and other representative areas as far south as North Wildwood, New Jersey. These sites tended to be dominated by medium sands with small percentages of silts and clays. Dominant benthic taxa included *Polygordius*, the polychaetes *Sabellaria vulgaris* and *Streblospio benedicti*, tanaids, surf clams, blue mussels, and crepidulid gastropods. Elsewhere in the New York Bight, Steimle and Stone (1973) described a medium sand assemblage characterized by high densities of *T. agilis, Protohaustorius deichmannae, U. irrorata, E. parma*, and *S. solidissima* with an average density of 2,030 animals/m^2. Wigley and Theroux (1981) reported biomass of 800g/m^2 for sandy habitats in depths of less than 24 m. The communities were dominated by bivalves, sand dollars, and annelids (as summarized by Pearse et al. 1981).

As noted in the introduction, previous studies of sand borrowing operations generally describe sites where a topographic depression is created in the seascape, i.e. a borrow pit, or took place geographically distant from the New Jersey area. Saloman (1974) reported that borrow pits created three years prior to a study on the west coast of Florida (Treasure Island) had filled with gelatinous mud and contained a depauperate benthic community. In a study of a newly dredged, fine-sand borrow pit on the Gulf coast of Florida (Panama City), Saloman et al. (1982) reported that benthic community recovery was complete in less than a year. The site was initially defaunated, but by the end of three months there was evidence of considerable recolonization, and at the end of a year there was essentially complete recovery. After dredging, sediments in the borrow pit had somewhat greater amounts of silts and clays due to deposition, but were similar to ambient sediments by the end of a year due to refilling of the pit by natural sand movement. Longer-term monitoring of the same area by Culter and Madadevan (1982) indicated that the borrow pit assemblages were less abundant and diverse than undisturbed control stations. Turbeville and Marsh (1982) examined a five year old, fine sand borrow area off the east coast of Florida (Hillsboro Beach) and could find few differences between infaunal assemblages of the pit and nearby undisturbed sediments. Bowen and Marsh (1988) studied a newly created borrow pit and a five-year old pit near Delray Beach, Florida. Recolonization of the new pit was rapid with recovery occurring within a year. The new and old pits were similar at the end of one year, however, no comparison was made with undisturbed areas. Van Dolah et al. (1994) followed changes in a borrow area at Folly Beach, South Carolina, and found that the new pit filled with fine sediments with the result that the infaunal assemblage changed from one dominated by haustoriid amphipods (pre-dredging) to one dominated by capitellid and nepthyid polychaetes and the clam *Mulina lateralis* (post-dredging).

Representative borrow pit studies in the New York/New Jersey region include Great Egg Harbor and Ocean City, New Jersey (Scott and Kelley, 1998) and Coney Island, New York (Coastal Ecology Branch, 1997). Scott and Kelley (1998) reported that the benthic community and commercially important surf clam populations rapidly recovered at the Great Egg Harbor/Ocean City borrow site. In the case of the Coney Island study (Coastal Ecology Branch, 1997), there were persistent differences in the borrow area and reference site benthic communities due to altered sediment texture at the borrow area.

As pointed out in the introduction, there appear to be two infaunal responses to the dredging of borrow pits: rapid recovery or development of a depauperate, soft-bottom assemblage. Rapid recovery (~1 year) occurs where the pits are relatively shallow or where sand movement acts to refill the pit (e.g., Saloman et al. 1982; Scott and Kelley, 1998). These recovery rates have been challenged by Wilber and Stern (1992), who point out that the functional structure of the assemblages may take longer to recover. In particular, they suggest that large, deeper-burrowing infauna (such as maldanid polychaetes) can take as much as 3 years to reach pre-disturbance abundance. The second response, development of a depauperate soft-sediment community tends to occur in deeper pits. The pits become depositional areas where fine sediments accumulate, causing the sand-associated infaunal assemblages to be replaced by soft-bottom fauna. If the pit is deep enough that water movement is restricted, poor water quality conditions may result. In particular, hypoxic or anoxic conditions may develop resulting in reductions in abundance, biomass and diversity and altered species composition.

The borrow areas examined in the present dredging operation began as bathymetric high points on the seascape rather than depressions or level sea bottom and are in areas of strong currents and sand movement. It was assumed that any depression resulting from sand borrowing will be short-lived and water quality would remain high. Results from water quality measurements including depth and dissolved oxygen concentrations support this conclusion. Depths did not differ appreciably during the course of the study and while dissolved oxygen concentrations were low (<4mg/l) at times, there was no link between these values and the dredging operations. Likewise, sediment composition in the study area changed over time, but changes were consistent among both dredged and undredged areas. This suggests that the change was a response to larger scale or longer-term processes such as fluctuations in the position of the Hudson River plume. Collectively, the water quality and sediment composition data indicate that the dredging operations had relatively little effect on the physical and chemical characteristics of the borrow area environments.

Dredging of the borrow areas had obvious impacts on the infaunal assemblage. Abundance, biomass, taxa richness and the average size of the biomass dominant, the sand dollar *E. parma* declined immediately after dredging. There were also changes in both species and biomass composition. Abundance, biomass, and taxa richness recovered quickly after the first dredging operation with no detectable difference between dredged and undisturbed areas by the following spring. Abundance also recovered quickly after the 1999 dredging operation (BBA5), although both biomass and taxa richness were still impacted in May 2000. Species and biomass composition were altered in similar manners by each operation. Specifically, immediately after dredging the relative contribution of echinoderm biomass declined and the abundance of the spionid polychaete *Spiophanes bombyx* increased. The increase in the abundance of *S. bombyx* was temporary with densities similar to undisturbed levels reoccurring within a year. Rhynchocoela (LPIL), the only other taxon to display a distinct response to dredging, declined in abundance during dredging in 1997 but recovered by May 1998. It also dropped in abundance during the second dredging operation in 1999 and continued to be low in May 2000. The change in biomass composition was longer lasting with the assemblage taking 1.5 to 2.5 years to return to undredged conditions. Not surprisingly this is the same time period required for sand dollar size structure to recover. Guild structure of the assemblage was also affected by dredging with a decline in the relative and total abundance of subsurface deposit feeding taxa and an increase in taxa with wide dispersal capabilities. The decline in subsurface deposit feeder abundance was unusual in that those taxa most expected to be affected, the deep subsurface forms such as maldanid polychaetes, were present in very low abundance and failed to show a response to disturbance. It was the shallow subsurface feeders such as paraonid and capitellid polychaetes and oligochaetes that declined in abundance. The importance of this decline is minimal since the impact was restricted to BBA5 and BBA6 and the guild formed a relatively small proportion of the total community. Likewise, the influence of the increase in the proportion of taxa with wide dispersal capabilities is small since it was in large part due to fluctuations in the normally dominant *Polygordius* (LPIL) and because this guild already dominated the assemblage.

Estimation of a recovery rate for the borrow area infaunal assemblage is based on results from BBA3D and BBA6 since there was insufficient time after dredging at BBA5 to follow recovery. Essentially all assemblage parameters except those related to sand dollar biomass recovered within one year of disturbance. These results are similar to those reported for other new borrow areas (e.g., Saloman et al., 1982; Turbeville and Marsh 1982; Bowen and Marsh, 1988). Recovery of average sand dollar weight and biomass composition, however required 2.5 years, a value similar to the 3-year estimate made by Wilber and Stern (1992) for recovery of assemblage guild structure in Florida borrow areas.

Literature Cited

Bowman, P. R. and G. A. Marsh. 1988. Benthic faunal colonization of an offshore borrow pit in Southeastern Florida. Miscellaneous Paper D-88-5, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 43 pp. & appendices.

Caracciolo, J. V. and F. W. Steimle. 1983. An atlas of the distribution and abundance of dominant benthic invertebrates in the New York Bight Apex with reviews of their life histories. NOAA Technical Report NMFS-SSRF-766. 58pp.

Clarke, D., Ray, G., Wilber, P., and J. Simms. 1991. A baseline characterization of benthic resources and their use by demersal fishes at a proposed beach renourishment borrow site in New Jersey coastal waters. Report to the Environmental Analysis Branch, US Army Engineer District, New York. Coastal Ecology Branch, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. pp.55.

Coastal Ecology Branch. 1996. General investigation of infauna from the West Hampton Borrow areas. Report to the Environmental Analysis Branch, US Army Engineer District, New York. Coastal Ecology Branch, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Coastal Ecology Branch. 1997. Characterization of benthic resources at a beach renourishment borrow area site in the vicinity of Coney Island, New York. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Culter, J. K. and S. Madadevan. 1982. Long-term effects of beach renourishment on the benthic fauna of Panama City Beach, Florida. Miscellaneous Report MR-82-2, U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA.

Fauchald, K. and P. Jumars. 1979. The diet of worms: A study of polychaete feeding guilds. Oceanography and Marine Biology: An Annual Review 17: 193-284.

Garlo, E. 1980. Abundance and distribution of benthic macroinvertebrates near Little Egg Inlet, New Jersey, from 1972-1974. Internationale Revue gesamten Hydrobiologie 65, 345-356.

Gaston, G. R., S. S. Brown, C. F. Rakocinski, R. W. Heard, and J. K. Summers. 1995. Trophic structure of macrobenthic communities in Northern Gulf of Mexico estuaries. Gulf Research Reports 9: 111-116.

Pearce, J. B., D. J. Radosh, J. V. Carracciola, and F. W. Steimle. 1981. Benthic Fauna. MESA New York Bight Atlas Monograph 14. New York Sea Grant Institute, Albany, NY.

Rakocinski, C. F., Brown, S. S., Gaston, G. R., Heard, R. W., Walker, W. W., and J. K. Summers. 1997. Macrobenthic responses to natural and contaminant related gradients in Northern Gulf of Mexico estuaries. Ecological Applications 7: 1278-1298.

Saloman, C. H. 1974. Physical, chemical, and biological characteristics of the nearshore zone of Sand Key, Florida, prior to beach restoration. Vols. 1 & 2. National Marine Fisheries Service, Gulf Coast Fisheries Center, Panama City, FL.

Saloman, C. H., S. P. Naughton, and J. L. Taylor. 1982. Benthic community response to dredging borrow pits, Panama City Beach, Florida. Miscellaneous Report MR-82-3, U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA.

Scott, L. C. and F. S. Kelley. 1998. An evaluation and comparison of benthic community assemblages and surf clam populations within the offshore borrow area site for the Great Egg Harbor Inlet and Peck Beach, Ocean City, New Jersey Project. Prepared by Versar, Inc. Columbia MD for U.S. Army Corps of Engineers, Philadelphia, PA.

Steimle, F. W. and R. B. Stone. 1973. Abundance and distribution of inshore benthic fauna off southwestern Long Island, NY. NOAA Technical Report NMFS-SSRF-673. pp. 50.

Stone and Webster Environmental Services. 1991. Environmental monitoring of the sand borrow site for the Great Egg Harbor Inlet and Peck Beach, Ocean City, New Jersey Project. Final Report. Prepared for U.S. Army Corps of Engineers, Philadelphia, PA

Turbeville, D. B. and G. A. Marsh. 1982. Benthic fauna of an offshore borrow area in Broward County, Florida. Miscellaneous Paper MP-82-1, U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA.

USACE, 1998. The New York District's Biological Monitoring Program for the Atlantic Coast of New Jersey, Asbury to Manasquan Section Beach Erosion Control Project. Phase I. Pre-Construction Baseline Studies. U.S. Army Engineer District, New York and U. S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

USACE, 1999. The New York District's biological monitoring program for the Atlantic coast of New Jersey, Asbury Park to Manasquan Section beach erosion control project. Phases II-III. During construction and 1st year post-construction studies. U.S. Army Engineer District, New York.

Van Dolah, R. F., R. M. Martore, A. E. Lynch, P. H. Wendt, M. V. Levisen, D. J. Whitaker, and W. D. Anderson. 1994. Final Report. Environmental evaluation of the Folly Beach nourishment project. South Carolina Department of Natural Resources, Marine Resources Division, Charleston SC. Prepared for the U. S. Army Corps of Engineers, Charleston District, Charleston, SC.

Wigley, R. L. and R. B. Theroux. 1981. Atlantic Continental Shelf and Slope of the United States- Macrobenthic invertebrate fauna of the Middle Atlantic Bight region-Faunal composition and quantitative distribution. Geological Survey Professional Paper 529-N. U. S. Geological Survey, Department of the Interior, Washington, DC.

Wilber, P. and M. Stern. 1992. A re-examination of infaunal studies that accompany beach renourishment studies. pp. 242-257 in *New Directions in Beach Management*.

Proceedings of the 5th Annual National Conference on Beach Preservation Technology. The Florida Shore and Beach Preservation Association, Tallahassee, FL.

Zar, J. H., 1996. *Biostatistical Analysis*. 3d Ed. Prentice-Hall. 662p.