

A PRELIMINARY SURVEY OF THE SUBTIDAL MACROBENTHOS  
OF COBSCOOK BAY, MAINE

by

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### FOREWORD

The following technical report has been prepared to serve as an archive of data supporting the Northeastern Naturalist publication entitled "A Preliminary Survey of the Subtidal Macrobenthic Invertebrates of Cobscook Bay, Maine" by P.F. Larsen and E. Gilfillan. It consists of the manuscript itself, supporting tables and figures and summary tables of faunal data. Investigators needing more detailed information may contact Peter F. Larsen at the Bigelow Laboratory.

## ABSTRACT

Cobscook Bay, a boreal, macrotidal embayment in the northeastern Gulf of Maine is noted for its species richness and has been the site of extensive natural history investigations. In spite of this level of investigative activity, no quantitative survey of the subtidal, macroinvertebrate communities exist. Here we present the results of a 1975, benthic grab survey of outer Cobscook Bay prior to recent salmon aquaculture and port development. The limited 11 station survey resulted in the identification of 172 taxa. Densities ranged from 870 to 12,970 m<sup>-2</sup>. Multivariate and qualitative analyses clearly dissected the station set into sandy cove stations and coarse sediment channel stations. Cove stations were characterized by burrowing and tube-dwelling infauna while channel station fauna was epifaunal. Community distribution is controlled by strong tidal currents and resulting sharp geological discontinuities. Because 70% of the bay bottom is floored by gravel, the epifaunal community characterizing the channel stations may be the most representative of the bay. The grab sampler certainly underestimated large filter feeders that may be important in the nutrient budget of the bay. Future surveys need to be more extensive and use a combination sampling methods to quantitatively measure all components of the community.

## INTRODUCTION

The Gulf of Maine ranks among the world's most productive and rich marine ecosystems. Many of the Gulf's most remarkable examples of dynamic physical processes, species richness and natural abundance are concentrated in the northern Gulf of Maine around the mouth of the Bay of Fundy. The region contains North America's only boreal, macrotidal estuaries, which include some of the least impacted estuaries in the United States. Cobscook Bay is a preeminent example of such an estuary.

The biodiversity of Cobscook Bay was recognized early and much of the Northwest Atlantic invertebrate fauna was described from here (e.g. Verrill 1871; Webster and Benedict 1887). In subsequent decades, Cobscook Bay became a collecting destination for professionals and student groups, which has produced a solid qualitative database of the macroinvertebrates (Trott 2004). Additional information on invertebrates was generated during investigations related to fisheries, tidal power development, oil refinery proposals and salmon aquaculture monitoring (Larsen and Webb 1997). Nevertheless, no quantitative investigations of the subtidal macrobenthos of Cobscook Bay are available in the published literature. In this communication we present the results of a 1975 preliminary macrobenthic sampling survey in outer Cobscook Bay. The stations occupied are in the precise location of subsequent salmon aquaculture operations and port development (Sowles and Churchill 2004).

## PHYSICAL ENVIRONMENT

Cobscook Bay is located in extreme eastern Maine on the U.S.-Canadian border near the mouth of the Bay of Fundy (Fig. 1). Together with Passamaquoddy Bay and the enveloping islands the area is known as the Quoddy region. Cobscook Bay is a rock-framed, glaciated, tidally dominated estuary (Kelley and Kelley 2004). The large tidal range, with a mean value of 5.7 m, is a dominating ecological forcing function. Freshwater input is small, <1% of the intertidal volume, whereas the tidal flow over the narrow outer portion of the bay where our study area is located, is equivalent to the mean outflow of the Mississippi River over the duration of both the ebb and flood tides (Brooks et al. 1999). Peak current speeds are on the order of 2m/sec. Mean depth of the outer bay is about 30 m with pockets to about 45 m. The well-mixed nature of the tidal waters results in moderated seasonal ranges of temperature and salinity. Mean temperature variation is less than 10 °C, while salinity variation is only about 1 ppt (Shenton and Horton 1973). More information on the Cobscook Bay region can be found in the comprehensive bibliography of Larsen and Webb (1997).

## METHODS

Eleven stations located in the vicinity of Broad Cove, Shackford Head and Deep Cove in the eastern portion of outer Cobscook Bay were sampled with a 0.1 m<sup>2</sup> Smith-McIntyre grab (Figs. 1 and 2). Multiple casts of the grab were required often to obtain the planned two replicates per station because of the coarseness of the sediments and/or bedrock outcroppings. In spite of this effort, only one sample was recovered successfully from Stations 23 and 31. A small subsample was removed from the first grab at each station for use in sediment analyses. The contents of the grab samples were sieved on a 1.0 mm screen. The residue was fixed in a 5% buffered formaldehyde solution and later transferred to 70% ethanol. Surface water samples were taken for temperature and salinity determinations at Stations 29 and 32 at slack low water.

In the laboratory, the sediment grain size distributions were determined using nested series sieves based on the Wentworth scale. Particles in the silt and clay size range were negligible.

All organisms were removed from the sample residue, identified to the lowest practical taxonomic level using a low-powered dissecting microscope, and counted. Oligochaetes and colonial species were not treated quantitatively. Statistical analyses was completed with the aid of PRIMER software (Clarke and Warwick 1994) and standard diversity formulas (Margalef 1958, Pielou 1970).

## RESULTS

### Abiotic Factors

Sediments ranged from very fine sand to granule with a marked gradient from the inner cove stations to the main tidal channel (Table 1). Sediments at the four stations in interior of Broad and Deep Coves, i.e. stations 22, 29, 32 and 33, consisted of 79% or higher fine and very fine sands (Table 1, Fig. 2). The outer stations along the tidal

channel, 23, 25, 26, 27, 28 and 31, all were dominated by granule-sized particles, i.e. gravel and cobble. Station 24, with the sediment grain size mode in the medium sand class, was the only station not dominated by sediments on the ends of the observed grain size spectrum. Low water surface temperature and salinity measured at station 29 in Broad Cove were 12.5° C and 31.98 ppt, respectively. Corresponding values at station 32 in Deep Cove were 11.0° C and 31.95 ppt.

### Species Composition

One hundred and seventy-two taxa from 12 phyla were identified from the 20 grab samples; 142 of them were identified to the genus or species level (Table 2). Annelids were the most diverse group with 59 putative species followed by arthropods and molluscs with 47 and 44 taxa, respectively.

### Cluster Analysis

The dendrogram based on a group-average sorting classification using the Bray-Curtis similarity measure on square root transformed species data resulted in branching revealing a clear-cut spatial pattern (Fig. 3). The primary dichotomy (A) separated stations into those in the tidal channel, stations 23, 24, 25, 26, 27, 28 and 31, and those in the coves, stations 22, 29, 32 and 33. Dichotomy B segregated station 26A, the only channel replicate containing no *Spirorbis borealis* (Larsen 2004), from the other channel stations. All other channel samples exhibited similarities in the 40-60% range. Dichotomy C separated station 29, containing the finest sediments, from the three mixed sand cove stations. Finally, both Deep Cove stations were separated from the outer, homogenous Broad Cove station 22 by dichotomy D. The sensitivity of the analysis was further reflected by the pair-grouping of replicates of five of the nine multiple replicate stations, i.e. stations 22, 24, 29, 32 and 33.

The biological relationships amongst the 20 samples were investigated further using a non-metric multidimensional scaling (MDS) ordination with the Bray-Curtis similarity measure calculated on square root transformed abundance data. The two-dimensional MDS ordination produced distinct separation of channel stations, 23, 24, 25, 26, 27, 28, 31, and cove stations, 22, 29, 32 and 33 (Fig. 4), thus matching the cluster analysis results. The agreement of the classification and ordination was further reflected by the outlying positions of samples 26a, 29a and 29b. The goodness-of-fit of the two-dimensional ordination was measured by calculating a stress value. The observed stress value of 0.09 “corresponds to a good ordination with no real prospect of misleading interpretation” (Clarke and Warwick 1994). ANOSIM confirmed the strength of the analysis and yielded a Global R value of 0.577 at a significance level of  $p < 0.2\%$ .

One hundred and four putative species were found at the four cove stations and 135 were identified from the seven channel stations (Table 2). Thirty-eight and 68 species were limited to the cove and channel stations, respectively, and 66 species were common to both areas. Fifty-three taxa were limited to a single station. Cnidarians, bryozoans and echinoderms, with the exception of the brittle star *Ophiura robustus*, were found only at channel stations. Other species which were found exclusively or more abundantly at the channel stations include: the chitons *Lepidopleurus cancellotus* and *Puncturella noachina*; the limpet *Acmaea testudinalis*, the jingle shells *Anomia aculeata* and *A. simplex*, the cockle *Cerastoderma pinnulatum*, the gastropod *Margarites costalis*; and the

scaleworms *Harmothoe imbricata*, *H. extenuata* and *Lepidonotus squamata*, the serpulids *Hydroides dianthus*, *Spirorbis borealis* and *S. spirillum*; the pycnogonids *Achelia spinosa*, *Nymphon hirtipes* and *Phoxochilidium* sp.? and the epifaunal pericarids *Aeginina longicornis* and *Melita dentata*. Few numerically important species were limited to or had their centers of abundance at the cove stations. These few included the isopod *Edotia triloba*, the amphipods *Haploops spinosa*, *Leptocheirus pinguis* and *Unciola irrorata* and the deposit feeding polychaete *Nephtys bucera*.

### Community Structure

The numbers of species, density, informational diversity and numerical dominance were measured at each station (Table 3). Numbers of species per station ranged from 28 to 70 with a mean of 50. Lowest number of species occurred at station 29, the most inshore station in Broad Cove that also exhibited the finest sediments (Table 1). The two single sample channel stations also exhibited below average numbers of species. The most species rich stations were located in Deep Cove.

Abundance ranged between 870 and 12,970/m<sup>2</sup> with an overall mean of 3,730 individuals/m<sup>2</sup> (Table 3). Lowest density was found at station 27. The other six channel stations exhibited similar densities with a mean and standard deviation of 2,792 +/- 497. The highest densities occurred at the outer cove stations, 22 and 33, which exhibited densities of 12,970 and 6,880 individuals/m<sup>2</sup>, respectively. Unpaired t-tests indicated that there were no statistically significant differences for any of the community parameters between the cove and channel stations.

## DISCUSSION

This first published quantitative account of the subtidal benthos of the macrotidal Cobscook Bay is remarkable for the sharp faunal contrasts revealed over relatively short distances. Two distinct communities, one occupying the cove stations and the other located at the channel stations, are clearly defined by both multivariate and qualitative analyses.

The four nearshore stations located in Broad Cove and Deep Cove are characterized by various grades of sand and are dominated by burrowing or tube-dwelling infauna. The highest densities encountered occur at the outer of the cove stations (stations 22 and 32) that have slightly coarser sediments than the more landward inner stations (Tables 1 and 3). The outer, coarse-bottomed stations in the tidal channel have high species richness with 135 taxa identified from only 12 grab samples. All channel stations are numerically dominated by epifaunal, filter feeding tube-worms of the genus *Spirorbis*. A study of the feeding habits of three coexisting chiton species in Deep Cove also emphasizes the epifaunal nature of the community (Langer 1983).

Cobscook Bay is a rock-framed, tidally dominated estuary and the community distribution mirrors the geological parameters of the sites and the underlying physical forcing functions. Cobscook Bay is subject to a semi-diurnal M-2 tide with a mean range of 5.7 m (Brooks et. al. 1999). The relatively large tidal range combined with the shallow nature of the bay results in the exchange of 38% of the high tide volume on each mean tide which produces currents of up to 2 m/sec (Brooks 2004). These high tidal flows winnow out fine landward-derived sediments and result in gravel being the most

abundant seafloor material in each arm of the bay (Kelley and Kelley 2004). Overall gravel and rock account for 70% of the subtidal bay bottom with 90% of the outer bay, 54% of the middle bay and 83 % of the inner bay being floored by gravel (Kelley and Kelley 2004). Kelley and Kelley (2004) also note the abrupt changes between the fine landward sediments and the dominant gravel. The origin of the sandy sediments is the eroding bluffs at the interior of the coves and the grain size increases toward the main tidal channel (Kelley and Kelley 2004).

The linkages between the physical and biological attributes are unusually clear in this energetic estuary. Overlying the modeled currents on the station map demonstrates the relationships between currents, sediments and fauna (Figs. 5 and 6). The inner cove stations (29, 32) have the lowest current levels and the finest sediments most recently eroded from the bluffs. The outer cove stations have higher currents, slightly coarser sediments and highest faunal densities. All cove stations are dominated by infaunal species. The channel stations (23, 24, 25, 26, 27, 28 and 31) experience high currents, are characterized by granule-sized sediments (Table 1, Fig. 6) and are dominated by filter-feeding epifauna. Given that 70% of the bay is floored by this sediment type (Kelley and Kelley 2004) and the very minor freshwater input that results in only very narrow ranges of temperature and salinity throughout the bay (Brooks et. al. 1999), the epifaunal community described in the vicinity of Shackford Head may be the most extensive subtidal community in the bay. Further exploratory sampling is indicated.

The Smith-McIntyre grab is not ideal for sampling the coarse sediments occurring in the bay; no sampler is (Holme and McIntyre, 1984). Larger and motile macrofauna may be missed or underestimated by the grab and thus the exploratory results presented here are incomplete. This may be significant because a remarkable feature of the Cobscook Bay ecosystem is the degree that ammonium plays in the nutrient budget (Garside and Garside 2004). These authors conclude that the tidal exchange of ammonium is up to 14.9 metric tons per day. Furthermore, the seasonal pattern of ammonium in the bay's waters, high in the spring and fall when primary production is low, indicates that the principal source of the ammonium must be regeneration by long-lived filter feeders and grazers. Since the gravel community described here covers 70% of the bay bottom (Kelley and Kelley 2004), it seems likely that some component of the community would be involved in the regeneration process. The numerically dominant filter feeders identified in the present study are the serpulid worms *Spirorbis borealis* and *S. spirillum*. It has been reported that small, epifaunal suspension feeders, including spirorbid polychaetes, occurring in high densities may constitute filtering capacities on the same order of magnitude as macro suspension feeders (Lemmens 1996, Lemmens et al. 1996). Using filtering rates given by Dales (1957) and areas and volumes provided by Kelley and Kelley (2004) and Brooks et. al. (1999), it can be estimated that these small spirobids filter  $1.55 \times 10^5 \text{ m}^3/\text{tide}$ , i.e. well less than 1% of the tidal prism. More likely candidates, suggested by Garside and Garside (2004), are the sea scallop, *Placopecten magellanicus*, and blue mussel, *Mytilus edulis*, which filter  $2.1 \text{ L g}^{-1} \text{ h}^{-1}$  (Bacon et al. 1998) and  $2.0 \text{ L g}^{-1} \text{ h}^{-1}$  (Newell et al 1989), respectively. Dredge sampling reveals that the highest densities of *P. magellanicus* in the State of Maine occur in Cobscook Bay (Schick et al. 2004). Although density figures for *M. edulis* in Cobscook Bay are not available, a commercial dragging fishery does exist indicating high abundance. These species, however, would not be adequately sampled by a Smith-McIntyre grab. Future work needs

to be focussed on the larger filter-feeders and grazers to get fuller understanding of the functional components of the ecosystem.

Cobscook Bay stands apart from other Maine estuaries and embayments because of the coarse nature of the bottom sediments. Although deposits of sand and gravel do occur along the Maine coast as a result of the reworking of glacial sediments, glaciomarine muds are probably predominant in most areas (Belknap et al. 1987). It is our experience that the interior of Maine estuaries are characterized by mud and sand, and even sawdust, bottoms (Larsen 1979; Larsen et al. 1983; Larsen and Johnson 1985; Shorey 1973; several unpublished data sets). For this reason, as well as the small number of sand samples involved, comparisons of the present results with previous studies are of little value. Likewise, investigations of rock and cobble substrates in the region have used different methodologies making comparisons inappropriate (Logan et al. 1983; Scheibling and Raymond 1990).

In conclusion, the distribution of macroinvertebrate communities of Cobscook Bay are closely linked to hydrographic and geological attributes. The subtidal areas of the outer Cobscook Bay are characterized by infaunal and tube-dwelling species in the protected sandy coves and a rich epifaunal community in the extensive current-swept channel areas. The latter areas comprise 70% of the subtidal areas of the bay which is unusual for a Maine estuary. It also suggests that filter-feeding components of this community may play an important role in the nutrient budget of the bay that is characterized by high levels of ammonium (Garside and Garside 2004). While these implications are intriguing, this study is preliminary and limited in spatial coverage and in the adequacy of the sampling gear. Future surveys need to be more extensive and use a combination of sampling methods to quantitatively assess all components of the community. The cove stations, however, provide a good benchmark with which to evaluate the affects of subsequent aquaculture and port development.

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TABLES

Table 1. Grain size distributions at 11 stations in Cobscook Bay.

Station #	% Dry Weight			
	Granule	Coarse/Very Coarse Sand	Medium Sand	Fine/Very Fine Sand
22	4	4	3	89
23	100	0	0	0
24	4	19	46	31
25	59	20	12	9
26	62	26	9	5
27	41	24	23	10
28	48	13	26	13
29	0	0	0	100
31	72	12	4	12
32	1	2	2	95
33	5	9	7	79

Table 2. List of subtidal macrobenthic invertebrates collected at 11 stations in outer Cobscook Bay. Species listed in alphabetical order within higher taxa.

Phylum	Species	Number of Occurrences at:	
		Cove Stations	Channel Stati
Porifera	<i>Polymastia robusta</i> (Bowerbank, 1816)		1
	Porifera sp.		1
Cnidaria	Actiniaria sp.		1
	<i>Drifa glomerata</i> (Verrill, 1869)		1
	Hydrozoa		5
	<i>Metridium senile</i> (Linnaeus, 1767)		1
Nemertea	Nemertea	4	3
Priapula	<i>Priapulus caudatus</i> Lamarck, 1816	2	
Bryozoa	Bryozoa		6
Brachiopoda	<i>Terebratulina septentrionalis</i> (Couthoy, 1838)		1
Mollusca	<i>Anomia simplex</i> d'Orbigny, 1842		2
	<i>Anomia squamula</i> Linnaeus, 1758		3
	<i>Astarte borealis</i> (Schumacher, 1817)	2	
	<i>Astarte castanea</i> (Say, 1822)	1	
	<i>Astarte undata</i> Gould, 1841	2	2
	<i>Astyris lunata</i> (Say, 1826)	2	2
	Bivalve sp. juv.		1
	<i>Buccinum ciliatum</i> (Fabricius, 1780)		2
	<i>Buccinum polaris</i> Gray, 1839	1	2
	<i>Calliostoma occidentale</i> (Mighels and Adams, 1842)		1
	<i>Cerastoderma pinnulatum</i> (Conrad, 1831)	3	7
	<i>Clinocardium ciliatum</i> (Fabricius, 1780)	1	
	<i>Colus pubescens</i> (Verrill, 1882)	2	
	<i>Crenella decussata</i> (Montagu, 1808)	2	4
	<i>Crepidula fornicata</i> (Linnaeus, 1758)		2
	<i>Cyclocardita borealis</i> (Conrad, 1831)	3	2
	<i>Cylichna alba</i> (T. Brown, 1827)	3	1
	<i>Euspira immaculata</i> (Verrill, 1880)	2	2
	<i>Hiatella arctica</i> (Linnaeus, 1767)	1	1
	<i>Lepeta caeca</i> (Müller, 1776)		2
<i>Lepidopleurus cancellotus</i> (Sowerby, 1839)		7	

<i>Lyonsia arenosa</i> (Müller, 1842)	4	
<i>Macoma balthica</i> (Linnaeus, 1758)	1	
<i>Margarites costalis costalis</i> (Gould, 1841)		5
<i>Margarites</i> sp.	1	2
<i>Musculus discors</i> (Linnaeus, 1767)	1	
<i>Musculus niger</i> (Gray, 1824)	1	2
<i>Mya arenaria</i> Linnaeus, 1758	1	2
Mytilidae sp. juv.		2
<i>Neptunea lyrata decemcostata</i> (Say, 1826)		1
<i>Nucula delphinodonta</i> Mighels and Adams, 1842	2	1
<i>Nucula proxima</i> Say, 1822	3	1
<i>Onoba mighelsi</i> (Stimpson, 1851)	1	1
<i>Pandora gouldiana</i> Dall, 1886	1	
<i>Puncturella noachina</i> (Linnaeus, 1771)		4
<i>Scabrotrophon fabricii</i> (Möller, 1842)		1
<i>Solariella</i> sp.	1	2
<i>Tectura testudinalis</i> (Müller, 1776)		4
<i>Tellina agilis</i> Stimpson, 1857	1	1
<i>Thyasira flexuosa</i> (Montagu, 1803)	3	2
<i>Tonicella marmorea</i> (Fabricius, 1780)		1
<i>Tonicella rubra</i> (Linnaeus, 1767)		3
Unidentified Gastropod	1	1
<i>Yoldia sapotilla</i> (Gould, 1841)	3	3

#### Annelida

Ampharetid sp.	1	1
<i>Aphrodita hastata</i> Moore, 1905	2	
Aricidae sp.		1
<i>Aricidea catherinae</i> Laubier, 1967	2	2
<i>Brada granosa</i> Stimpson, 1854	1	
<i>Brada villosa</i> (Rathke, 1843)	1	
Cirratulid sp.	1	2
<i>Drilonereis magna</i> Webster and Benedict, 1887		1
<i>Eteone longa</i> (Fabricius, 1780)	1	2
<i>Eteone</i> sp.	1	
<i>Eteone trilineata</i> Webster and Benedict, 1887	1	
<i>Exogone dispar</i> (Webster, 1879)		2
<i>Exogone verugera</i> (Claparède, 1868)	2	1
<i>Flabelligera affinis</i> Sars, 1829	2	1
<i>Glycera capitata</i> Örsted, 1843		1
<i>Harmothoe imbricata</i> (Linnaeus, 1767)	3	7
<i>Harmothoe</i> sp.	1	2
<i>Hydroides dianthus</i> (Verrill, 1873)		1
<i>Lagisca extenuata</i> (Grube, 1840)	1	5
<i>Lepidonotus squamatus</i> (Linnaeus, 1767)		6
<i>Levinsenia gracilis</i> (Tauber, 1879)	3	5
<i>Lumbrineris fragilis</i> (Müller, 1776)	3	3
<i>Lumbrineris</i> sp.	2	
<i>Lumbrineris tenuis</i> (Verrill, 1873)	1	





Maldanid sp.	2	5
<i>Neanthes diversicolor</i> (Müller, 1776)	1	1
Nephtyidae	1	
<i>Nephtys buccera</i> Ehlers, 1868	4	2
<i>Nephtys</i> sp.	2	1
<i>Nereis</i> sp.		1
<i>Nereis zonata</i> Malmgren, 1867	1	2
<i>Ninoe nigripes</i> Verrill, 1873	3	1
Oligochaeta	3	5
<i>Ophelina acuminata</i> Örsted, 1843	2	5
<i>Owenia fusiformis</i> Delle Chiaje, 1844	3	4
<i>Paraonis</i> sp.	2	1
<i>Pectinaria gouldii</i> (Verrill, 1873)	2	1
<i>Pectinaria</i> sp.		2
<i>Pholoe minuta</i> (Fabricius, 1780)	4	7
<i>Phyllodoce groenlandica</i> (Örsted, 1842)		2
<i>Phyllodoce maculata</i> (Linnaeus, 1767)	2	1
<i>Phyllodoce</i> sp.		1
Polychaete A	1	2
Polychaete B		2
Polychaete C		3
<i>Polycirrus</i> sp.		2
Polynoidae sp.		2
<i>Scoloplos ?acutus</i> (Verrill, 1873)	1	
<i>Scoloplos</i> sp.	4	
Spionid sp.	4	5
<i>Spirorbis borealis</i> Daudin, 1800		7
<i>Spirorbis spirillum</i> (Linnaeus, 1758)		6
<i>Sternaspis scutata</i> (Renier, 1807)	2	
Syllidae sp.		3
<i>Syllis gracilis</i> Grube, 1840	3	6
Terebellid sp.	4	7
<i>Travisia carnea</i> Verrill, 1873		1
Unidentified Polychaete	2	4
Sipuncula		
<i>Phascolion strombus strombus</i> (Montagu, 1804)	2	1
Arthropoda		
<i>Achelia spinosa</i> (Stimpson, 1853)		6
<i>Aeginina longicornis</i> (Kröyer, 1842-43)		5
<i>Ampelisca macrocephala</i> (Liljeborg, 1852)	3	
<i>Ampelisca vadorum</i> (Mills, 1963)	1	
<i>Anonyx liljeborgi</i> (Boeck, 1871)	4	1
<i>Caprella linearis</i> (Linnaeus, 1767)		1
<i>Casco bigelowi</i> (Blake, 1929)	3	1
<i>Chiridotea tuftsi</i> (Stimpson, 1853)	1	
<i>Corophium bonelli</i> (Milne-Edwards, 1830)	1	4
<i>Corophium crassicorne</i> (Bruzellius, 1859)	2	



<i>Corophium</i> sp.	1	
<i>Cyathura polita</i> (Stimpson, 1856)	1	
<i>Deflexilodes intermedius</i> (Shoemaker, 1930)		1
<i>Dexamine thea</i> (Sars, 1893)	1	
<i>Diastylis quadrispinosa</i> Sars, 1871	3	2
<i>Diastylis</i> sp.	4	2
<i>Edotia triloba</i> (Say, 1818)	4	
<i>Erichthonius rubricornis</i> Smith, 1873	1	
<i>Eualus pusiolus</i> (Kröyer, 1841)		1
<i>Eudorella</i> sp.	1	
Eusirid sp. A		2
Eusirid sp. B	1	2
<i>Gnathia</i> sp.		1
<i>Haploops spinosa</i> (Shoemaker)	3	
<i>Harpinia propinqua</i> (Sars, 1895)		2
<i>Harpinia</i> sp.		1
<i>Hippomedon serratus</i> (Holmes, 1905)	1	
<i>Ischyrocerus anguipes</i> Kröyer, 1838		1
<i>Jaera albifrons</i> Leach, 1814		1
Lafystiidae? Sp.		1
<i>Lebbeus groenlandicus</i> (Fabricius, 1775)	1	
<i>Leptocheirus pinguis</i> (Stimpson, 1853)	3	5
<i>Megamaera dentata</i> (Kröyer, 1842)		5
<i>Nymphon hirtipes</i> Bell, 1853		2
<i>Orchomenella minuta</i> (Kröyer, 1842)	4	1
<i>Orchomenella pinguis</i> (Boeck, 1861)	2	
<i>Pagurus pubescens</i> Kröyer, 1842		1
<i>Pandalus montagui</i> Leach 1814	1	1
<i>Photis</i> sp.	1	
<i>Phoxocephalus holbolli</i> (Kröyer, 1842)	2	4
<i>Phoxochilidium</i> sp.?		2
<i>Pycnogonum littorale</i> (Storm, 1762)	1	2
<i>Spirontocaris phippisii</i> (Kroyer 1841)		1
<i>Stenopleustes inermis</i> Shoemaker, 1949	1	
Tanaid sp.		2
<i>Unciola irrorata</i> Say, 1818	3	3
Unidentified Amphipod	1	
Echinodermata		
<i>Asterias</i> sp.		1
<i>Crossaster papposus</i> (Linnaeus, 1766)		2
<i>Ctenodiscus crispatus</i> (Retzius, 1806)		1
<i>Echinarachnius parma</i> (Lamarck, 1816)		2
<i>Edwardsia</i> sp.		2
<i>Henricia</i> sp.		3
<i>Ophura robusta</i> (Ayres, 1861)	2	7
<i>Strongylocentrotus droebachiensis</i> (Müller, 1776)		7
Chordata		

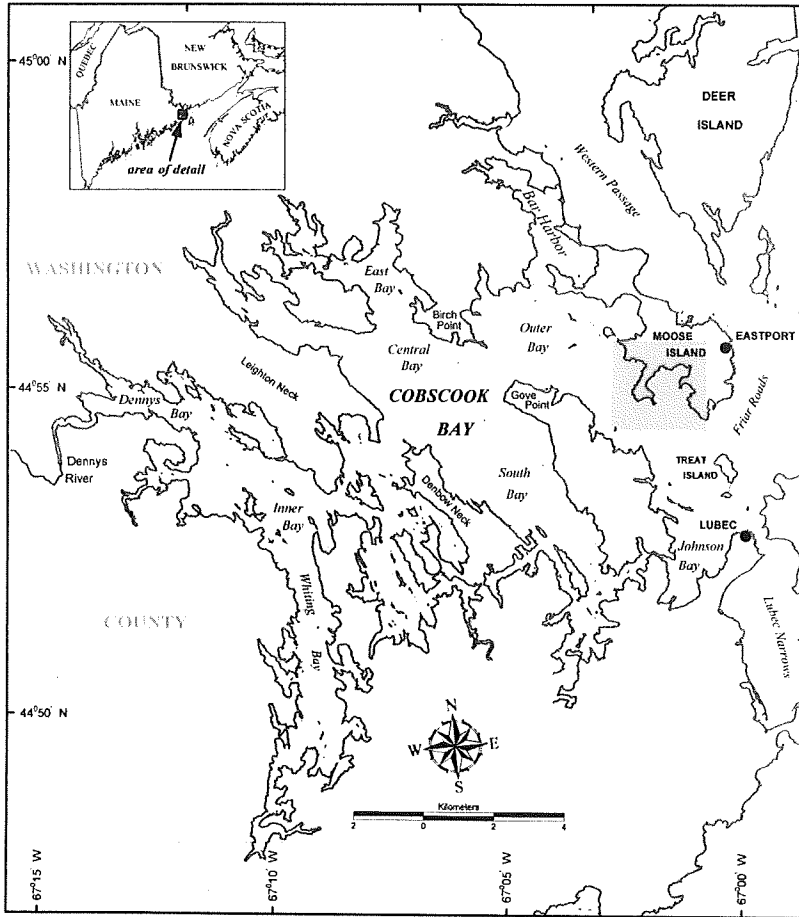
	<i>Molgula complanata</i> Alder and Hancock, 1870	1	3
	Unid. Stalked Ascidiacea	1	3
Phylum unknown		1	1
TOTALS		104	135

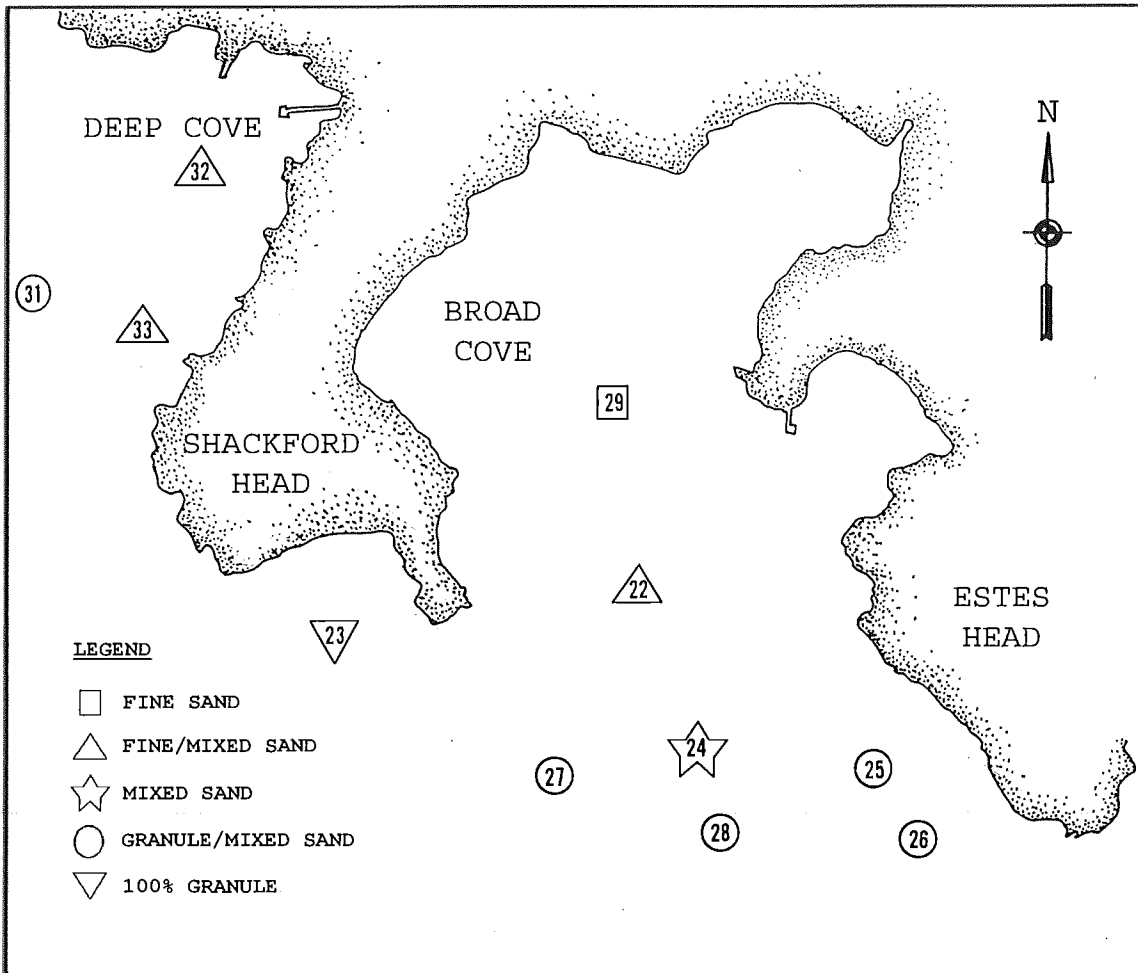
Table 3. Community parameters and numerical dominance.

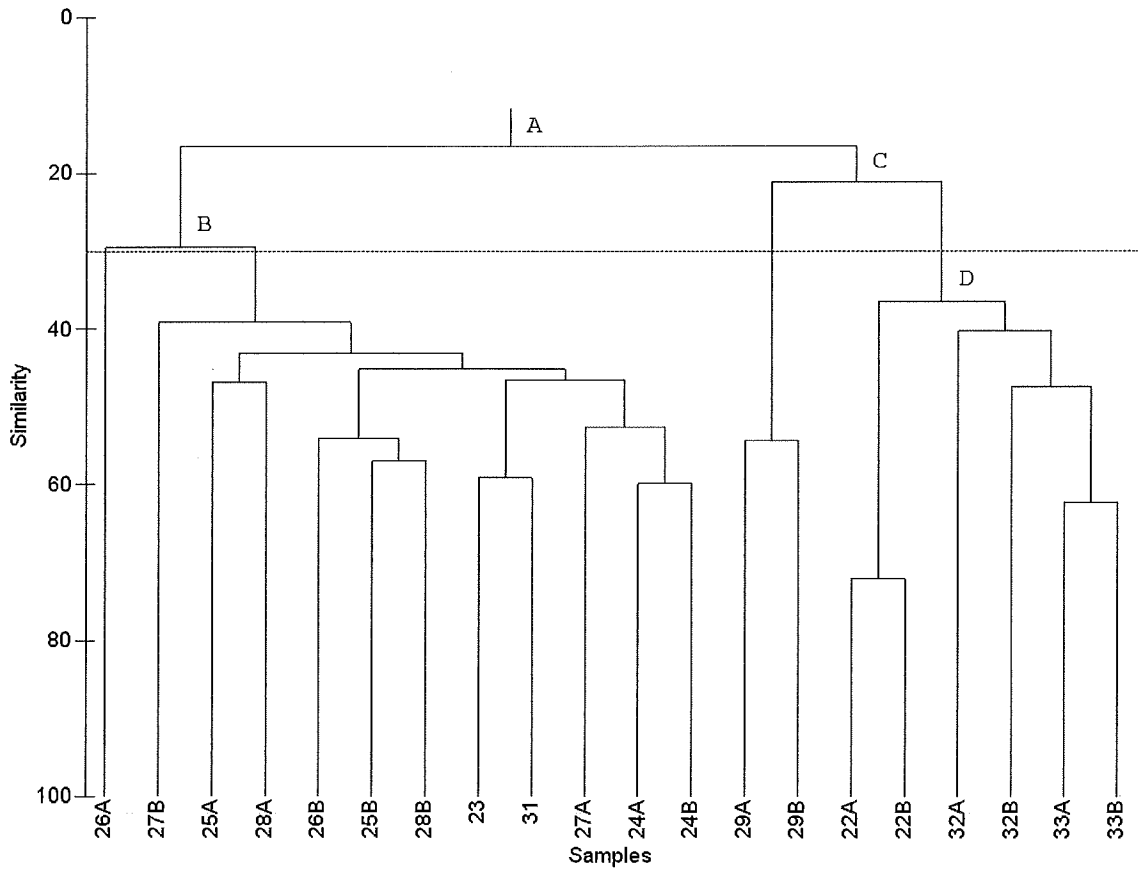
	Number of Replicates	Number of Species	Density (m <sup>2</sup> )	Diversity (H <sup>1</sup> )	Numerical Dominance
Channel Stations					
23	1	39	3,380	1.62	<i>Spirorbis borealis</i> 68%
24	2	54	2,195	2.32	<i>Spirorbis borealis</i> 52%
25	2	59	2,470	2.11	<i>Spirorbis borealis</i> 60%
26	2	50	2,460	1.57	<i>Spirorbis borealis</i> 70%
27	2	48	870	3.03	<i>Spirorbis borealis</i> 28%
28	2	52	3,345	1.55	<i>Spirorbis borealis</i> 72%
31	1	29	2,900	1.89	<i>Spirorbis borealis</i> 46% <i>S. spirillum</i> 23%
Cove Stations					
22	2	54	12,970	1.15	<i>Unciola irrorata</i> 80%
29	2	28	1,330	2.34	<i>Diastylis</i> sp. 26% <i>Edotia triloba</i> 17% <i>Scoloplos</i> sp. 15% <i>Nephtys bucera</i> 12%
32	2	70	2,235	3.40	<i>Casco bigelowi</i> 15%, <i>Haploops spinosa</i> 15%
33	2	62	6,880	2.59	<i>Haploops</i> sp. 28%, <i>Leptocheirus pinguis</i> 18%, <i>Unciola irrorata</i> 14%
All Stations	Mean	50	3,730	2.14	
	Min	28	870	1.15	
	Max	70	12,970	3.40	

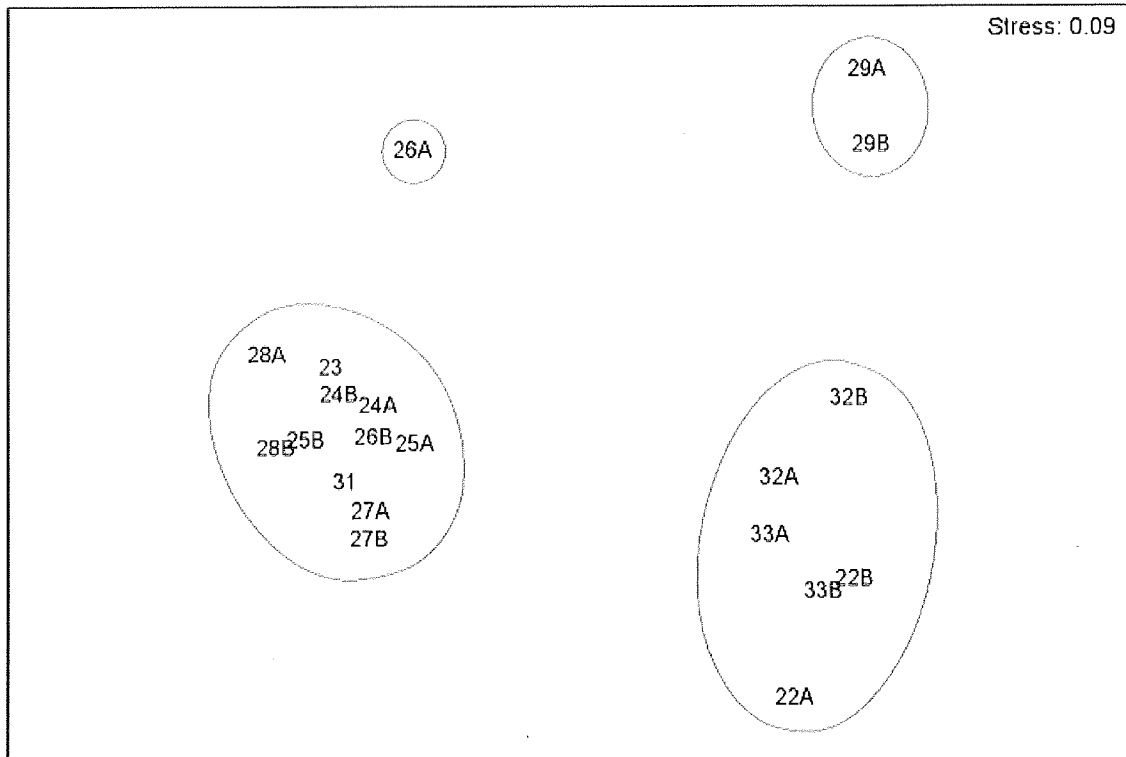
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- Fig. 1. Map of Cobscook Bay. Box indicates the study area.
- Fig. 2. Locations of the 11 subtidal stations sampled in 1975 in outer Cobscook Bay.
- Fig. 3. Dendrogram based on a group-average sorting classification using the Bray-Curtis similarity measure on non-transformed species data.
- Fig. 4. MDS ordination of the 20 replicate samples based on non-transformed species abundances and Bray-Curtis similarities (stress = 0.08)
- Fig. 5. Stations overlain on surface currents from hydrographic model simulation. Longer arrows indicate currents of 2 m/sec. (Modified from Brooks, et al. 1999).
- Fig. 6. Stations overlain bottom types. (Modified from Kelley and Kelley 2004).













## **DATA APPENDICES**

EP-22 BROAD  
COVE

Number of 54  
Species:  
Density (m<sup>-2</sup>): 12,970  
Diversity (H'): 1.153

Species	Rep. A	Rep. B	Total	Cum. Tot.	%	Cum. %
<i>Unciola irrorata</i>	1229	845	2074	2074	79.95	79.95
<i>Mogula complanata</i>	41	49	90	2164	3.47	83.42
<i>Leptocheirus pinguis</i>	28	28	56	2220	2.16	85.58
<i>Cerastoderma pinnulatum</i>	25	18	43	2263	1.66	87.24
<i>Owenia fusiformis</i>	14	15	29	2292	1.12	88.36
<i>Harpinia propinqua</i>	5	20	25	2317	0.96	89.32
<i>Terebellid sp.</i>	12	10	22	2339	0.85	90.17
<i>Lyonsia arenosa</i>	13	9	22	2361	0.85	91.02
<i>Ampelisca macrocephala</i>	9	8	17	2378	0.66	91.67
<i>Hippomedon serratus</i>	12	3	15	2393	0.58	92.25
<i>Orchomenella minuta</i>	15	0	15	2408	0.58	92.83
<i>Edotea triloba</i>	0	12	12	2420	0.46	93.29
<i>Haploops spinosa</i>	5	6	11	2431	0.42	93.72
<i>Diastylis sp.</i>	0	10	10	2441	0.39	94.10
<i>Nephtys picta</i>	3	7	10	2451	0.39	94.49
<i>Thyasira flexuosa</i>	1	9	10	2461	0.39	94.87
<i>Phoxocephalus holbolli</i>	10	0	10	2471	0.39	95.26
<i>Paraonis gracilis</i>	7	2	9	2480	0.35	95.61
<i>Cylichna alba</i>	4	4	8	2488	0.31	95.91
<i>Cyathura polita</i>	0	8	8	2496	0.31	96.22
<i>Mitrella dissimilis</i>	1	6	7	2503	0.27	96.49
<i>Maldanid sp.</i>	4	2	6	2509	0.23	96.72
<i>Orchomenella pinguis</i>	0	6	6	2515	0.23	96.95
<i>Spionid sp.</i>	4	2	6	2521	0.23	97.19
<i>Scoloplos ?acutus</i>	5	0	5	2526	0.19	97.38

Scoloplos sp.	0	5	5	2531	0.19	97.57
Cardita borealis	2	3	5	2536	0.19	97.76
Nucula annulata	4	1	5	2541	0.19	97.96
Aphrodita hastata	2	2	4	2545	0.15	98.11
Polinices immaculata	3	1	4	2549	0.15	98.27
Anonyx lilljeborgi	2	2	4	2553	0.15	98.42
Unidentified- off page	0	4	4	2557	0.15	98.57
Mya arenaria	0	3	3	2560	0.12	98.69
Astarte castanea	0	3	3	2563	0.12	98.80
Nemertea	0	3	3	2566	0.12	98.92
Diastylis	0	3	3	2569	0.12	99.04
quadrispinosa						
Phyllodoce maculata	2	0	2	2571	0.08	99.11
Corophium bonelli	2	0	2	2573	0.08	99.19
Ostracoda	2	0	2	2575	0.08	99.27
Pholoe minuta	0	2	2	2577	0.08	99.34
Ninoe nigripes	1	1	2	2579	0.08	99.42
Syllis gracilis	1	1	2	2581	0.08	99.50
Chiridotea tuftsi	0	2	2	2583	0.08	99.58
Eteone sp.	1	0	1	2584	0.04	99.61
Astarte borealis	1	0	1	2585	0.04	99.65
Pandora gouldiana	1	0	1	2586	0.04	99.69
Yoldia sapotilla	1	0	1	2587	0.04	99.73
Aeginina longicornis	1	0	1	2588	0.04	99.77
Pectinaria gouldii	0	1	1	2589	0.04	99.81
Colus pubescens	0	1	1	2590	0.04	99.85
Achelia spinosa	0	1	1	2591	0.04	99.88
Ampelisca vadorum	0	1	1	2592	0.04	99.92
Eteone trilineata	0	1	1	2593	0.04	99.96
Phylum unknown	0	1	1	2594	0.04	100.00

EP-23 OFF SHACKFORD  
HEAD

Number of Species: 39  
Density (m<sup>-2</sup>): 3,380  
Diversity (H'): 1.620

Species	Rep. A	Tota l	Cum. Tot.	%	Cum. %
<i>Spirobis borealis</i>	230	230	230	68.0	68.05
				5	
<i>Spirorbis spirillum</i>	25	25	255	7.40	75.44
<i>Achelia spinosa</i>	7	7	262	2.07	77.51
<i>Mogula complanata</i>	7	7	269	2.07	79.59
<i>Lepidopleurus cancellotus</i>	7	7	276	2.07	81.66
<i>Terebellid sp.</i>	6	6	282	1.78	83.43
<i>Ophuira robusta</i>	5	5	287	1.48	84.91
<i>Strongylocentrotus droebachiensis</i>	4	4	291	1.18	86.09
<i>Syllis gracilis</i>	3	3	294	0.89	86.98
<i>Harmothoe sp.</i>	3	3	297	0.89	87.87
<i>Polychaete A</i>	3	3	300	0.89	88.76
<i>Polychaete B</i>	3	3	303	0.89	89.64
<i>Cerastoderma pinnulatum</i>	2	2	305	0.59	90.24
<i>Pholoe minuta</i>	2	2	307	0.59	90.83
<i>Lepidonotus squamatus</i>	2	2	309	0.59	91.42
<i>Musculus niger</i>	2	2	311	0.59	92.01
<i>Crepidula fornicata</i>	2	2	313	0.59	92.60
<i>Tellina agilis</i>	2	2	315	0.59	93.20
<i>Travisia carnea</i>	2	2	317	0.59	93.79
<i>Nereis sp.</i>	2	2	319	0.59	94.38
<i>Aeginina longicornis</i>	1	1	320	0.30	94.67
<i>Maldanid sp.</i>	1	1	321	0.30	94.97
<i>Nemertea</i>	1	1	322	0.30	95.27
<i>Paraonis gracilis</i>	1	1	323	0.30	95.56
<i>Harmothoe imbricata</i>	1	1	324	0.30	95.86
<i>Glycera capitata</i>	1	1	325	0.30	96.15
<i>Drilonereis magna</i>	1	1	326	0.30	96.45
<i>Lumbrineris fragilis</i>	1	1	327	0.30	96.75

Syllidae sp.	1	1	328	0.30	97.04
Bivalve sp. juv.	1	1	329	0.30	97.34
Acmaea testudinalis	1	1	330	0.30	97.63
Lepeta caeca	1	1	331	0.30	97.93
Nymphon hirtum	1	1	332	0.30	98.22
Unid. Stalked Ascidiacea	1	1	333	0.30	98.52
Tonicella marmorea	1	1	334	0.30	98.82
Owenia fusiformis	1	1	335	0.30	99.11
Ammotrypane aulogaster	1	1	336	0.30	99.41
Aricidae sp.	1	1	337	0.30	99.70
Polychaete C	1	1	338	0.30	100.0
					0
Nematoda	+				
Bryozoa	+				
Oligochaeta	+				

EP-24 OUTER BROAD  
COVE

Number of Species: 54  
Density (m<sup>-2</sup>): 2,195  
Diversity (H'): 2.319

Species	Rep. A	Rep. Total		Cum.	%	Cum.
		B	I	Tot.		%
<i>Spirobis borealis</i>	112	117	229	229	52.1	52.16
					6	
<i>Paraonis gracilis</i>	30	2	32	261	7.29	59.45
<i>Lepidopleurus cancellotus</i>	14	0	14	275	3.19	62.64
<i>Syllis gracilis</i>	12	1	13	288	2.96	65.60
<i>Ischnochitin ruber</i>	7	6	13	301	2.96	68.56
<i>Leptocheirus pinguis</i>	8	1	9	310	2.05	70.62
<i>Harmothoe extenuata</i>	7	2	9	319	2.05	72.67
<i>Spionid sp.</i>	0	8	8	327	1.82	74.49
<i>Spirorbis spirillum</i>	5	3	8	335	1.82	76.31
<i>Aeginina longicornis</i>	5	2	7	342	1.59	77.90
<i>Pholoe minuta</i>	6	1	7	349	1.59	79.50
<i>Ophuira robusta</i>	2	4	6	355	1.37	80.87
<i>Strongylocentrotus droebachiensis</i>	3	3	6	361	1.37	82.23
<i>Phoxocephalus holbolli</i>	3	2	5	366	1.14	83.37
Unidentified Polychaete	2	3	5	371	1.14	84.51
Cirratulid sp.	5	0	5	376	1.14	85.65
<i>Ammotrypane aulogaster</i>	2	2	4	380	0.91	86.56
<i>Lepidonotus squamatus</i>	1	3	4	384	0.91	87.47
<i>Melita dentata</i>	2	2	4	388	0.91	88.38
<i>Exogone dispar</i>	4	0	4	392	0.91	89.29
<i>Cerastoderma pinnulatum</i>	2	1	3	395	0.68	89.98
<i>Harmothoe imbricata</i>	3	0	3	398	0.68	90.66
<i>Unciola irrorata</i>	2	1	3	401	0.68	91.34
<i>Aricidea jeffreysii</i>	3	0	3	404	0.68	92.03
<i>Paraonis sp.</i>	3	0	3	407	0.68	92.71
<i>Acmaea testudinalis</i>	1	1	2	409	0.46	93.17
<i>Crepidula fornicata</i>	2	0	2	411	0.46	93.62
<i>Lumbrineris fragilis</i>	1	1	2	413	0.46	94.08

Syllidae sp.	0	2	2	415	0.46	94.53
Terebellid sp.	1	1	2	417	0.46	94.99
Anomia aculeata	2	0	2	419	0.46	95.44
Puncturella noachina	1	1	2	421	0.46	95.90
Achelia spinosa	0	1	1	422	0.23	96.13
Diastylis quadrispinosa	0	1	1	423	0.23	96.36
Lepeta caeca	1	0	1	424	0.23	96.58
Maldanid sp.	1	0	1	425	0.23	96.81
Mogula complanata	1	0	1	426	0.23	97.04
Owenia fusiformis	1	0	1	427	0.23	97.27
Polinices immaculata	1	0	1	428	0.23	97.49
Thyasira flexuosa	0	1	1	429	0.23	97.72
Lafystiidae? sp.	1	0	1	430	0.23	97.95
Asterias sp.	1	0	1	431	0.23	98.18
Ctenodiscus crispatus	1	0	1	432	0.23	98.41
Nereis ?zonata	1	0	1	433	0.23	98.63
Pectinaria sp.	1	0	1	434	0.23	98.86
Margarites ?costalis	1	0	1	435	0.23	99.09
Phoxochilidium sp.?	1	0	1	436	0.23	99.32
?Eusirid sp. A	0	1	1	437	0.23	99.54
Polycirrus sp.	0	1	1	438	0.23	99.77
Echinarchnius parma	0	1	1	439	0.23	100.0
						0
Bryozoa	+	+				
Nematoda		+				
Oligochaeta		+				
Hydrozoa	+	+				



EP-25 BROAD COVE

Number of Species: 59

Density (m<sup>-2</sup>): 2,47

0

Diversity (H'): 2.11

3

Species	Rep. A	Rep. B	Tota I	Cum. Tot.	%	Cum. %
Spirobis borealis	17	279	296	296	59.9	59.92
					2	
Cerastoderma pinnulatum	13	4	17	313	3.44	63.36
Leptocheirus pinguis	10	4	14	327	2.83	66.19
Corophium bonelli	4	9	13	340	2.63	68.83
Lepidopleurus cancellotus	5	8	13	353	2.63	71.46
Ophura robusta	11	0	11	364	2.23	73.68
Syllis gracilis	7	4	11	375	2.23	75.91
Pholoe minuta	7	2	9	384	1.82	77.73
Spirorbis spirillum	1	7	8	392	1.62	79.35
Aeginina longicornis	5	2	7	399	1.42	80.77
Spionid sp.	7	0	7	406	1.42	82.19
Harmothoe extenuata	4	1	5	411	1.01	83.20
Anomia aculeata	1	3	4	415	0.81	84.01
Lepidonotus squamatus	2	2	4	419	0.81	84.82
Strongylocentrotus droebachiensis	2	2	4	423	0.81	85.63
Terebellid sp.	4	0	4	427	0.81	86.44
Eteone longa	2	2	4	431	0.81	87.25
Monoculodes intermedius	4	0	4	435	0.81	88.06
Achelia spinosa	2	1	3	438	0.61	88.66
Melita dentata	2	1	3	441	0.61	89.27
Terebratulina septentrionalis	0	3	3	444	0.61	89.88
Diastylis sp.	1	1	2	446	0.40	90.28
Exogone dispar	0	2	2	448	0.40	90.69
Margarites ?costalis	0	2	2	450	0.40	91.09
Nereis ?zonata	0	2	2	452	0.40	91.50
Nymphon hirtum	1	1	2	454	0.40	91.90
Owenia fusiformis	2	0	2	456	0.40	92.31

Polychaete A	2	0	2	458	0.40	92.71
Unidentified- off page	1	1	2	460	0.40	93.12
Ischyrocerus anguipes	2	0	2	462	0.40	93.52
Pycrogonum littorale	2	0	2	464	0.40	93.93
Buccinium totteni	0	2	2	466	0.40	94.33
Metridium senile	0	2	2	468	0.40	94.74
?Eusirid sp. A	0	1	1	469	0.20	94.94
Acmaea testudinalis	1	0	1	470	0.20	95.14
Aricidea jeffreysii	0	1	1	471	0.20	95.34
Diastylis quadrispinosa	0	1	1	472	0.20	95.55
Harmothoe imbricata	0	1	1	473	0.20	95.75
Mitrella dissimilis	1	0	1	474	0.20	95.95
Musculus niger	0	1	1	475	0.20	96.15
Mya arenaria	1	0	1	476	0.20	96.36
Nemertea	1	0	1	477	0.20	96.56
Nephtys picta	0	1	1	478	0.20	96.76
Ninoe nigripes	1	0	1	479	0.20	96.96
Orchomenella minuta	0	1	1	480	0.20	97.17
Phoxocephalus holbolli	1	0	1	481	0.20	97.37
Polinices immaculata	1	0	1	482	0.20	97.57
Thyasira flexuosa	0	1	1	483	0.20	97.77
Unciola irrorata	0	1	1	484	0.20	97.98
Unid. Stalked Ascidiacea	1	0	1	485	0.20	98.18
Tanaid sp.	1	0	1	486	0.20	98.38
Nephtys sp.	1	0	1	487	0.20	98.58
Nereis ?diversicolor	1	0	1	488	0.20	98.79
Eusirid sp. B	1	0	1	489	0.20	98.99
Henricia sp.	1	0	1	490	0.20	99.19
Crenella decussata	0	1	1	491	0.20	99.39
Mytilidae sp. juv.	0	1	1	492	0.20	99.60
Hydroides dianthus	0	1	1	493	0.20	99.80
Neptunea decemcostata	0	1	1	494	0.20	100.0
						0
Bryozoa	+	+				
Hydrozoa	+					
Nematoda	+					
Oligochaeta	+					

EP-26 BROAD COVE

Number of Species: 50  
 Density (m<sup>-2</sup>): 2,46  
 0  
 Diversity (H'): 1.56  
 6

Species	Rep. A	Rep. B	Tota I	Cum. Tot.	%	Cum. %
<i>Spirobis borealis</i>	0	429	429	429	69.76	69.76
<i>Spirorbis spirillum</i>	10	25	35	464	5.69	75.45
Terebellid sp.	5	15	20	484	3.25	78.70
<i>Aeginina longicornis</i>	0	12	12	496	1.95	80.65
<i>Lepidopleurus cancellotus</i>	0	11	11	507	1.79	82.44
<i>Ophuira robusta</i>	1	10	11	518	1.79	84.23
<i>Paraonis gracilis</i>	10	0	10	528	1.63	85.85
Unidentified Polychaete	1	8	9	537	1.46	87.32
<i>Lepidonotus squamatus</i>	2	4	6	543	0.98	88.29
Maldanid sp.	1	5	6	549	0.98	89.27
<i>Harmothoe extenuata</i>	1	4	5	554	0.81	90.08
<i>Leptocheirus pinguis</i>	1	4	5	559	0.81	90.89
<i>Unciola irrorata</i>	0	5	5	564	0.81	91.71
Nemertea	2	2	4	568	0.65	92.36
<i>Cerastoderma pinnulatum</i>	0	3	3	571	0.49	92.85
<i>Corophium bonelli</i>	0	3	3	574	0.49	93.33
<i>Pholoe minuta</i>	2	1	3	577	0.49	93.82
<i>Puncturella noachina</i>	0	3	3	580	0.49	94.31
<i>Strongylocentrotus droebachiensis</i>	2	1	3	583	0.49	94.80
<i>Cylichna alba</i>	0	2	2	585	0.33	95.12
Spionid sp.	0	2	2	587	0.33	95.45
Unid. Stalked Ascidiacea	1	1	2	589	0.33	95.77
<i>Caprella linearis</i>	0	2	2	591	0.33	96.10
Polynoidae sp.	0	2	2	593	0.33	96.42
<i>Edwardsia</i> sp.	0	2	2	595	0.33	96.75
<i>Ammotrypane aulogaster</i>	0	1	1	596	0.16	96.91
<i>Anomia aculeata</i>	0	1	1	597	0.16	97.07
<i>Eteone longa</i>	0	1	1	598	0.16	97.24

Harmathoe sp.	1	0	1	599	0.16	97.40
Harmothoe imbricata	0	1	1	600	0.16	97.56
Melita dentata	0	1	1	601	0.16	97.72
Mitrella dissimilis	0	1	1	602	0.16	97.89
Nereis ?zonata	1	0	1	603	0.16	98.05
Pectinaria sp.	1	0	1	604	0.16	98.21
Phoxocephalus holbolli	1	0	1	605	0.16	98.37
Polychaete C	1	0	1	606	0.16	98.54
Polycirrus sp.	0	1	1	607	0.16	98.70
Syllidae sp.	1	0	1	608	0.16	98.86
Yoldia sapotilla	0	1	1	609	0.16	99.02
Solariella sp.	0	1	1	610	0.16	99.19
Margarites sp.	0	1	1	611	0.16	99.35
Drifa glomerata	0	1	1	612	0.16	99.51
Solaster papposus	0	1	1	613	0.16	99.67
Phascolion strombi	0	1	1	614	0.16	99.84
Harpinia sp.	0	1	1	615	0.16	100.00
Bryozoa		+				
Hydrozoa		+				
Nematoda		+				
Oligochaeta	+	+				
Polymastia robusta		+				

EP-27 BROAD COVE

Number of Species: 48  
 Density (m<sup>-2</sup>): 870  
 Diversity (H'): 3.03  
 3

Species	Rep. A	Rep. B	Tota l	Cum. Tot.	%	Cum. %
<i>Spirobis borealis</i>	25	24	49	49	28.16	28.16
<i>Lepidopleurus cancellotus</i>	11	6	17	66	9.77	37.93
<i>Paraonis gracilis</i>	5	5	10	76	5.75	43.68
<i>Strongylocentrotus droebachiensis</i>	7	2	9	85	5.17	48.85
<i>Cerastoderma pinnulatum</i>	1	6	7	92	4.02	52.87
<i>Ischnochitin ruber</i>	6	1	7	99	4.02	56.90
<i>Aeginina longicornis</i>	5	0	5	104	2.87	59.77
Maldanid sp.	1	4	5	109	2.87	62.64
Spionid sp.	4	1	5	114	2.87	65.52
<i>Syllis gracilis</i>	4	1	5	119	2.87	68.39
Terebellid sp.	2	2	4	123	2.30	70.69
<i>Cardita borealis</i>	3	0	3	126	1.72	72.41
<i>Pholoe minuta</i>	0	3	3	129	1.72	74.14
<i>Ammotrypane aulogaster</i>	1	1	2	131	1.15	75.29
Cirratulid sp.	2	0	2	133	1.15	76.44
<i>Corophium bonelli</i>	2	0	2	135	1.15	77.59
<i>Harmothoe extenuata</i>	2	0	2	137	1.15	78.74
<i>Harmothoe imbricata</i>	2	0	2	139	1.15	79.89
<i>Leptocheirus pinguis</i>	1	1	2	141	1.15	81.03
<i>Melita dentata</i>	0	2	2	143	1.15	82.18
<i>Nucula annulata</i>	1	1	2	145	1.15	83.33
<i>Ophuira robusta</i>	2	0	2	147	1.15	84.48
<i>Phoxocephalus holbolli</i>	0	2	2	149	1.15	85.63
<i>Buccinum ciliatum</i>	1	1	2	151	1.15	86.78
<i>Exogone verugera</i>	0	2	2	153	1.15	87.93
<i>Achelia spinosa</i>	1	0	1	154	0.57	88.51
<i>Acmaea testudinalis</i>	0	1	1	155	0.57	89.08
<i>Anonyx lilljeborgi</i>	0	1	1	156	0.57	89.66
<i>Crenella decussata</i>	0	1	1	157	0.57	90.23

Echinarchnius parma	1	0	1	158	0.57	90.80
Eusirid sp. B	0	1	1	159	0.57	91.38
Henricia sp.	1	0	1	160	0.57	91.95
Lepidonotus squamatus	1	0	1	161	0.57	92.53
Lumbrineris fragilis	1	0	1	162	0.57	93.10
Mya arenaria	1	0	1	163	0.57	93.68
Phoxochilidium sp.?	1	0	1	164	0.57	94.25
Phyllodoce maculata	1	0	1	165	0.57	94.83
Puncturella noachina	1	0	1	166	0.57	95.40
Solariella sp.	1	0	1	167	0.57	95.98
Tanaid sp.	1	0	1	168	0.57	96.55
Yoldia sapotilla	0	1	1	169	0.57	97.13
Ampharetid sp.	1	0	1	170	0.57	97.70
Calliostoma occidentale	1	0	1	171	0.57	98.28
Margarites costalis	1	0	1	172	0.57	98.85
Anomia simplex	1	0	1	173	0.57	99.43
Phyllodoce groenlandica	0	1	1	174	0.57	100.00
Bryozoa	+	+				
Hydrozoa		+				

EP-28 BROAD COVE

Number of Species: 52

Density (m<sup>-2</sup>): 3,34

5

Diversity (H'): 1.55

3

Species	Rep. A	Rep. B	Tota I	Cum. Tot.	%	Cum. %
Spirobis borealis	62	418	480	480	71.75	71.75
Strongylocentrotus droebachiensis	8	9	17	497	2.54	74.29
Corophium bonelli	0	13	13	510	1.94	76.23
Lepidonotus squamatus	9	4	13	523	1.94	78.18
Ophuira robusta	12	1	13	536	1.94	80.12
Harmothoe extenuata	10	2	12	548	1.79	81.91
Anomia simplex	7	4	11	559	1.64	83.56
Spirorbis spirillum	9	0	9	568	1.35	84.90
Syllis gracilis	7	2	9	577	1.35	86.25
Terebellid sp.	4	4	8	585	1.20	87.44
Lepidopleurus cancellotus	0	7	7	592	1.05	88.49
Unid. Stalked Ascidiacea	7	0	7	599	1.05	89.54
Nereis zonata	3	4	7	606	1.05	90.58
Cerastoderma pinnulatum	4	1	5	611	0.75	91.33
Crenella decussata	0	4	4	615	0.60	91.93
Harmothoe imbricata	0	4	4	619	0.60	92.53
Maldanid sp.	0	4	4	623	0.60	93.12
Pholoe minuta	1	3	4	627	0.60	93.72
Henricia sp.	2	1	3	630	0.45	94.17
Melita dentata	2	1	3	633	0.45	94.62
Puncturella noachina	0	3	3	636	0.45	95.07
Achelia spinosa	2	0	2	638	0.30	95.37
Mytilidae sp. juv.	0	2	2	640	0.30	95.67
Polynoidae sp.	2	0	2	642	0.30	95.96
Actinaria sp.	0	2	2	644	0.30	96.26
Eualus pusiolus	1	1	2	646	0.30	96.56
Gnathia sp.	0	2	2	648	0.30	96.86
Buccinum ciliatum	0	1	1	649	0.15	97.01

Buccinum totteni	0	1	1	650	0.15	97.16
Diastylis sp.	0	1	1	651	0.15	97.31
Harpinia propinqua	1	0	1	652	0.15	97.46
Leptocheirus pinguis	0	1	1	653	0.15	97.61
Nephtys picta	0	1	1	654	0.15	97.76
Pectinaria gouldii	0	1	1	655	0.15	97.91
Phyllodoce groenlandica	0	1	1	656	0.15	98.06
Solaster papposus	1	0	1	657	0.15	98.21
Unidentified Polychaete	0	1	1	658	0.15	98.36
Nucula delphinodonta	1	0	1	659	0.15	98.51
Spirontocaris phippsi	1	0	1	660	0.15	98.65
Phyllodoce sp.	1	0	1	661	0.15	98.80
Jaera marina	1	0	1	662	0.15	98.95
Flabelligera affinis	0	1	1	663	0.15	99.10
Astarte undata	0	1	1	664	0.15	99.25
Hiatella arctica	0	1	1	665	0.15	99.40
Boreotrophon craticulatum	0	1	1	666	0.15	99.55
Alvania castanea	0	1	1	667	0.15	99.70
Pandalus montagui	0	1	1	668	0.15	99.85
Pagurus pubescens	0	1	1	669	0.15	100.00
Bryozoa	+	+				
Hydrozoa		+				
Nematoda	+					
Oligochaeta	+					



EP-29 BROAD  
COVE

Number of 28  
Species:  
Density (m<sup>-2</sup>): 1,33  
0  
Diversity (H'): 2.33  
8

Species	Rep. A	Rep. B	Tota I	Cum. Tot.	%	Cum. %
Diastylis sp.	15	54	69	69	25.94	25.94
Edotea triloba	43	3	46	115	17.29	43.23
Scoloplos sp.	18	21	39	154	14.66	57.89
Nephtys picta	12	20	32	186	12.03	69.92
Terebellid sp.	4	12	16	202	6.02	75.94
Phoxocephalus holbolli	11	4	15	217	5.64	81.58
Nucula delphinodonta	9	0	9	226	3.38	84.96
Ninoe nigripes	5	2	7	233	2.63	87.59
Casco bigelowi	1	4	5	238	1.88	89.47
Nemertea	0	3	3	241	1.13	90.60
Sternapsis scutata	2	1	3	244	1.13	91.73
Eteone sp.	0	2	2	246	0.75	92.48
Harmothoe imbricata	2	0	2	248	0.75	93.23
Lumbrineris fragilis	0	2	2	250	0.75	93.98
Pholoe minuta	2	0	2	252	0.75	94.74
Unidentified	0	2	2	254	0.75	95.49
Polychaete Corophium crassicorne	0	2	2	256	0.75	96.24
Anonyx lilljeborgi	0	1	1	257	0.38	96.62
Harmothoe extenuata	0	1	1	258	0.38	96.99
Lyonsia arenosa	1	0	1	259	0.38	97.37
Orchomenella	0	1	1	260	0.38	97.74

minuta						
Paraonis sp.	0	1	1	261	0.38	98.12
Spionid sp.	0	1	1	262	0.38	98.50
Tellina agilis	1	0	1	263	0.38	98.87
Nereis diversicolor	0	1	1	264	0.38	99.25
Nephtyidae	0	1	1	265	0.38	99.62
Eudorella sp.	0	1	1	266	0.38	100.00
Oligochaeta		+				

EP-31 DEEP COVE

Number of Species: 29  
 Density (m<sup>-2</sup>): 2,90  
 0  
 Diversity (H'): 1.89  
 2

Species	Rep. A	Tota I	Cum. Tot.	%	Cum. %
Spirorbis borealis	134	134	134	46.21	46.21
Spirorbis spirillum	66	66	200	22.76	68.97
Cardita borealis	25	25	225	8.62	77.59
Crenella decussata	8	8	233	2.76	80.34
Terebellid sp.	7	7	240	2.41	82.76
Ischnochitin ruber	6	6	246	2.07	84.83
Lepidopleurus cancellotus	6	6	252	2.07	86.90
Astarte undata	5	5	257	1.72	88.62
Ophuira robusta	5	5	262	1.72	90.34
Syllis gracilis	4	4	266	1.38	91.72
Cerastoderma pinnulatum	3	3	269	1.03	92.76
Achelia spinosa	2	2	271	0.69	93.45
Harmothoe imbricata	2	2	273	0.69	94.14
Spionid sp.	2	2	275	0.69	94.83
Strongylocentrotus droebachiensis	2	2	277	0.69	95.52
Ammotrypane aulogaster	1	1	278	0.34	95.86
Casco bigelowi	1	1	279	0.34	96.21
Harpinia propinqua	1	1	280	0.34	96.55
Margarites sp.	1	1	281	0.34	96.90
Mogula complanata	1	1	282	0.34	97.24
Owenia fusiformis	1	1	283	0.34	97.59
Paraonis gracilis	1	1	284	0.34	97.93
Pholoe minuta	1	1	285	0.34	98.28
Phylum unknown	1	1	286	0.34	98.62
Polychaete B	1	1	287	0.34	98.97
Polychaete C	1	1	288	0.34	99.31
Yoldia sapotilla	1	1	289	0.34	99.66
Unidentified Gastropod	1	1	290	0.34	100.00

Porifera sp.

+

EP-32 DEEP COVE

Number of 70

Species:

Density (m<sup>-2</sup>): 2,23

5

Diversity (H'): 3.40

0

Species	Rep.	Rep.	Tota	Cum.	%	Cum. %
	A	B	I	Tot.		
Casco bigelowi	3	64	67	67	14.99	14.99
Haploops spinosa	3	63	66	133	14.77	29.75
Terebellid sp.	8	23	31	164	6.94	36.69
Thyasira flexuosa	31	0	31	195	6.94	43.62
Lumbrineris sp.	13	5	18	213	4.03	47.65
Harpinia propinqua	8	6	14	227	3.13	50.78
Diastylis sp.	0	12	12	239	2.68	53.47
Ammotrypane	9	2	11	250	2.46	55.93
aulogaster						
Aricidea jeffreysii	10	0	10	260	2.24	58.17
Sternapsis scutata	7	3	10	270	2.24	60.40
Unciola irrorata	0	10	10	280	2.24	62.64
Paraonis gracilis	0	9	9	289	2.01	64.65
Cardita borealis	8	0	8	297	1.79	66.44
Leptocheirus pinguis	5	3	8	305	1.79	68.23
Nemertea	7	1	8	313	1.79	70.02
Ampelisca	1	6	7	320	1.57	71.59
macrocephala						
Nephtys picta	3	4	7	327	1.57	73.15
Spionid sp.	7	0	7	334	1.57	74.72
Aeginina longicornis	5	0	5	339	1.12	75.84
Edotea triloba	0	5	5	344	1.12	76.96
Exogone verugera	4	1	5	349	1.12	78.08
Harmothoe imbricata	3	2	5	354	1.12	79.19
Nephtys sp.	0	5	5	359	1.12	80.31
Pholoe minuta	1	4	5	364	1.12	81.43
Syllis gracilis	0	5	5	369	1.12	82.55
Cylichna alba	4	0	4	373	0.89	83.45

Lyonsia arenosa	4	0	4	377	0.89	84.34
Phascolion strombi	0	4	4	381	0.89	85.23
Phyllodoce maculata	0	4	4	385	0.89	86.13
Nucula annulata	3	0	3	388	0.67	86.80
Owenia fusiformis	2	1	3	391	0.67	87.47
Lumbrineris tenuis	3	0	3	394	0.67	88.14
Anonyx lilljeborgi	0	2	2	396	0.45	88.59
Astarte undata	2	0	2	398	0.45	89.04
Crenella decussata	2	0	2	400	0.45	89.49
Diastylis	0	2	2	402	0.45	89.93
quadrispinosa						
Harmothoe sp.	2	0	2	404	0.45	90.38
Hiatella arctica	1	1	2	406	0.45	90.83
Lumbrineris fragilis	1	1	2	408	0.45	91.28
Margarites sp.	2	0	2	410	0.45	91.72
Musculus niger	2	0	2	412	0.45	92.17
Ninoe nigripes	0	2	2	414	0.45	92.62
Paraonis sp.	2	0	2	416	0.45	93.06
Polinices immaculata	2	0	2	418	0.45	93.51
Scoloplos sp.	1	1	2	420	0.45	93.96
Solariella sp.	2	0	2	422	0.45	94.41
Unid. Stalked	2	0	2	424	0.45	94.85
Ascidacea						
Yoldia sapotilla	2	0	2	426	0.45	95.30
Brada villosa	1	1	2	428	0.45	95.75
Ampharetid sp.	1	0	1	429	0.22	95.97
Aphrodita hastata	0	1	1	430	0.22	96.20
Buccinum totteni	1	0	1	431	0.22	96.42
Cerastoderma	1	0	1	432	0.22	96.64
pinnulatum						
Colus pubescens	1	0	1	433	0.22	96.87
Flabelligera affinis	0	1	1	434	0.22	97.09
Nereis zonata	1	0	1	435	0.22	97.32
Ophuira robusta	1	0	1	436	0.22	97.54
Orchomenella minuta	0	1	1	437	0.22	97.76
Pandalus montagui	1	0	1	438	0.22	97.99
Polychaete A	0	1	1	439	0.22	98.21
Unidentified	0	1	1	440	0.22	98.43
Gastropod						
Unidentified	1	0	1	441	0.22	98.66

Polychaete						
Musculus discors	1	0	1	442	0.22	98.88
Lebbeus	1	0	1	443	0.22	99.11
groenlandicus						
Macoma balthica	1	0	1	444	0.22	99.33
Erichthonius	0	1	1	445	0.22	99.55
rubricornis						
Corophium sp.	0	1	1	446	0.22	99.78
Priapulus caudatus	0	1	1	447	0.22	100.00
Nematoda	+	+				
Oligochaeta	+	+				





EP-33 DEEP COVE

Number of 62

Species:

Density (m<sup>-2</sup>): 6,88

0

Diversity (H'): 2.59

3

Species	Rep. A	Rep. B	Tota I	Cum. Tot.	%	Cum. %
Haploops spinosa	81	304	385	385	27.98	27.98
Leptocheirus pinguis	68	178	246	631	17.88	45.86
Unciola irrorata	46	151	197	828	14.32	60.17
Crenella decussata	3	68	71	899	5.16	65.33

<i>Cardita borealis</i>	3	66	69	968	5.01	70.35
<i>Thyasira flexuosa</i>	23	31	54	1022	3.92	74.27
<i>Terebellid sp.</i>	31	9	40	1062	2.91	77.18
<i>Syllis gracilis</i>	21	10	31	1093	2.25	79.43
<i>Cerastoderma</i> <i>pinnulatum</i>	4	20	24	1117	1.74	81.18
<i>Exogone verugera</i>	6	16	22	1139	1.60	82.78
<i>Mitrella dissimilis</i>	1	20	21	1160	1.53	84.30
<i>Orchomenella pinguis</i>	0	21	21	1181	1.53	85.83
<i>Astarte undata</i>	0	18	18	1199	1.31	87.14
<i>Harpinia propinqua</i>	4	12	16	1215	1.16	88.30
<i>Orchomenella minuta</i>	10	4	14	1229	1.02	89.32
<i>Paraonis gracilis</i>	9	5	14	1243	1.02	90.33
<i>Ammotrypane</i> <i>aulogaster</i>	5	7	12	1255	0.87	91.21
<i>Aricidea jeffreysii</i>	5	3	8	1263	0.58	91.79
<i>Diastylis sp.</i>	3	5	8	1271	0.58	92.37
<i>Nemertea</i>	1	7	8	1279	0.58	92.95
<i>Harmothoe imbricata</i>	3	4	7	1286	0.51	93.46
<i>Photis sp.</i>	3	2	5	1291	0.36	93.82
<i>Alvania castanea</i>	0	4	4	1295	0.29	94.11
<i>Corophium</i> <i>crassicorne</i>	1	3	4	1299	0.29	94.40
<i>Cylichna alba</i>	0	4	4	1303	0.29	94.69
<i>Diastylis</i> <i>quadrspinosa</i>	1	3	4	1307	0.29	94.99
<i>Flabelligera affinis</i>	4	0	4	1311	0.29	95.28
<i>Lumbrineris fragilis</i>	2	2	4	1315	0.29	95.57
<i>Nephtys picta</i>	2	2	4	1319	0.29	95.86
<i>Nephtys sp.</i>	1	3	4	1323	0.29	96.15
<i>Pholoe minuta</i>	2	2	4	1327	0.29	96.44
<i>Edotea triloba</i>	1	2	3	1330	0.22	96.66
<i>Lyonsia arenosa</i>	0	3	3	1333	0.22	96.88
<i>Ophuira robusta</i>	0	3	3	1336	0.22	97.09
<i>Pectinaria gouldii</i>	1	2	3	1339	0.22	97.31
<i>Phascolion strombi</i>	3	0	3	1342	0.22	97.53
<i>Stenopleustes inermis</i>	1	2	3	1345	0.22	97.75
<i>Aeginina longicornis</i>	2	0	2	1347	0.15	97.89
<i>Ampelisca</i> <i>macrocephala</i>	0	2	2	1349	0.15	98.04

Anonyx lilljeborgi	1	1	2	1351	0.15	98.18
Nucula annulata	1	1	2	1353	0.15	98.33
Owenia fusiformis	0	2	2	1355	0.15	98.47
Priapulid caudatus	2	0	2	1357	0.15	98.62
Scoloplos sp.	1	1	2	1359	0.15	98.76
Unidentified	1	1	2	1361	0.15	98.91
Polychaete						
Astarte borealis	1	0	1	1362	0.07	98.98
Casco bigelowi	0	1	1	1363	0.07	99.06
Cirratulid sp.	1	0	1	1364	0.07	99.13
Eusirid sp. B	0	1	1	1365	0.07	99.20
Lumbrineris sp.	1	0	1	1366	0.07	99.27
Maldanid sp.	1	0	1	1367	0.07	99.35
Nucula delphinodonta	1	0	1	1368	0.07	99.42
Ostracoda	0	1	1	1369	0.07	99.49
Pycrogonum littorale	0	1	1	1370	0.07	99.56
Spionid sp.	1	0	1	1371	0.07	99.64
Yoldia sapotilla	0	1	1	1372	0.07	99.71
Brada grarosa	1	0	1	1373	0.07	99.78
Dexamine thea	0	1	1	1374	0.07	99.85
Unidentified	0	1	1	1375	0.07	99.93
Amphipod						
Clinocardium ciliatum	0	1	1	1376	0.07	100.00
Nematoda	+					
Oligochaeta		+				