



Diversity and Distribution of Associated Fauna of Commercial Scallop Grounds in the Lower Bay of Fundy

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ABSTRACT

Magee, S., E. Kenchington, D. Roddick, D. Davis and M. Butler. 1999. Diversity and Distribution of Associated Fauna of Commercial Scallop Grounds in the Lower Bay of Fundy. *Can. Tech. Rep. Fish. Aquat. Sci.* 2285: iv + 79 p.

The invertebrate and urochordate fauna associated with commercial scallop beds in the lower Bay of Fundy was examined through the bycatch of scallop fishing drags. Bycatch of these species was observed during the 1997 Department of Fisheries and Oceans inshore scallop stock assessments of Scallop Production Areas 4 and 1 (off Digby, Nova Scotia), Area 3 (below Brier Island and near Yarmouth, Nova Scotia) and Area 6 (Grand Manan, New Brunswick). A total of 234 tows were made and 261 species observed including representatives from 13 phyla. Field identification was only possible for 83 taxa, and their distribution was mapped using the tow location data derived from the ship's dGPS. The associated fauna are listed according to phylum. A brief overview of the characteristics of the phyla are also provided.

RÉSUMÉ

Magee, S., E. Kenchington, D. Roddick, D. Davis and M. Butler. 1999. Diversity and Distribution of Associated Fauna of Commercial Scallop Grounds in the Lower Bay of Fundy. *Can. Tech. Rep. Fish. Aquat. Sci.* 2285: iv + 79 p.

Nous avons examiné la faune d'invertébrés et d'urochordés associée aux gisements commerciaux de pétoncles dans la partie inférieure de la baie de Fundy en étudiant les prises accessoires des dragues à pétoncles. Les prises accessoires ont été observées pendant les évaluations des stocks de pétoncles effectuées en 1997 par le ministère des Pêches et des Océans dans les zones de production de pétoncles 4 et 1 (devant Digby, Nouvelle-Écosse), dans la zone 3 (au sud de l'île Brier et près de Yarmouth, Nouvelle-Écosse) et dans la zone 6 (Grand Manan, Nouveau-Brunswick). Au total, 234 traits ont été effectués, et 261 espèces, représentant 13 phylums, ont été observées. L'identification sur le terrain a été possible pour 83 taxons seulement, et nous avons cartographié leur distribution à l'aide des données sur la localisation des traits tirées du système dGPS du bateau. La faune associée a été classée par phylum. Nous présentons aussi un bref survol des caractéristiques des phylums.

INTRODUCTION

Until the 1960's and 1970's when Caddy (1970, 1984) began cataloging fauna on local fishing grounds, few studies had been conducted in the lower Bay of Fundy on invertebrate bycatch associated with scallop fishing. Caddy (1970) also provided one of the first comprehensive lists of marine fauna in the lower Bay of Fundy.

In 1997 researchers re-visited Caddy's study area near Digby, Nova Scotia, as well as other parts of the Bay of Fundy, and surveyed the associated fauna of the commercial scallop grounds (Fuller et al., 1998). This not only allowed an opportunity to look at benthic fauna diversity changes over time in heavily fished areas but also an opportunity to look more closely at population distributions and associations throughout the lower Bay of Fundy.

In this report the location of field identified specimens collected in 1997 have been mapped according to taxonomic grouping (phylum). The three study areas encompass broad areas within the lower Bay of Fundy and are all located on commercial scallop grounds.

METHODS

Associated fauna of the lower Bay of Fundy scallop grounds were cataloged by sorting faunal bycatch during the Department of Fisheries and Oceans 1997 inshore scallop population survey. Full details of tow location, depth and bottom type can be found in Fuller et al. (1998). All cruises were made on the government research vessel *J.L. Hart*. Scallop grounds off of Digby were examined in June, off of Yarmouth and Brier Island in August and off Grand Manan in September. A total of 234 tows were completed. Tows were made with Digby gear, consisting of four drags, each 1m across. Tows were 8 minutes each, and covered a standardized distance of 800 m. Two drags were lined with 1-inch mesh.

Occurrence of all species observed was recorded and relative abundance was noted. As this study was incidental to the main objective of collecting scallop population data, time available to sort through bycatch was not always optimal. When possible, organisms were identified in the field. Others were preserved in 4% buffered formalin in seawater and taken back to the lab for identification. Specimens were then transferred to a 70% ethanol solution or in some cases dried for preservation. Representative specimens are in the Invertebrate collection of the Nova Scotia Museum of Natural History. A total of 261 species were identified (Fuller et al., 1998).

As each tow was conducted at a known location, the distributions of the various taxa could be plotted; information not previously documented for this area. As not all 261 species could be identified in the field, information on distribution is only available for a subset of those listed in Fuller et al. (1998). Distributions were mapped using the

software program ACON Data Visualization Software (1995) developed by Jerry Black, Department of Fisheries and Oceans, Dartmouth and available at: <http://www.maritimes.dfo.ca/science/acon/index.html>

Phylum Porifera

Porifera is a large phylum with about 9,000 described species and can be found around the world (Brusca and Brusca, 1990). The Porifera, or more commonly “sponges”, are sessile suspension feeding organisms that thrive in benthic environments with high current velocity. Sponges range in form from simple encrustations to more definite upright forms, such as fans or branches, and large masses (Gosner, 1971). Some species such as the large branching forms may be quite vulnerable to dragging while other forms such as the genus *Polymastia*, can be fairly resilient. Many sponges provide habitat for commensal invertebrate species and in turn can be found living on other organisms such as bivalves and bryozoans as well as on abiotic substrates (Gosner, 1971).

Twenty-four sponge taxa were identified from the Digby, Yarmouth/Brier Island and Grand Manan study areas in the Lower Bay of Fundy by Fuller et al. (1998). However, only 5 of these were identified in the field and could be mapped according to tow location. The distributions of the Porifera, and of these five taxa (*Haliclona* spp., *Halichondria* spp., *Cliona* spp., *Polymastia robusta*, *P. infrapilosa*) are shown in Figure 1. *Cliona* spp. and *Polymastia infrapilosa* were found at all three locations surveyed. *Haliclona* spp. were not found in the Grand Manan survey, while *Halichondria* spp. were not found in the Digby area. *P. robusta* was found only twice in the Grand Manan area. Some sponges are difficult to identify without microscopic observation of the spicule shape and experience. Dr. Ole Tendal (Zoological Museum, Copenhagen, Denmark) identified many of the sponge taxa recorded in the annotated list found in Fuller et al. (1998).

Table 1. Representatives of the Phylum Porifera collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field.

Class	Order	Family	Genus	Species			
Desmospongiae	Haplosclerida	Desmacionidae	<i>Isodictya</i>	<i>deichmannae</i>			
				<i>palmata</i>			
				<i>Esperiopsis</i>	<i>normani</i>		
				<i>Haliclona</i> *	<i>urceola</i>		
					<i>oculata</i>		
	Poecilosclerida	Tedaniidae		<i>Tedania</i>	<i>suctorica</i>		
				<i>Lissodendoryx</i>	<i>fibrexilis</i>		
		Myxillidae		<i>Myxilla</i>	<i>incrustans</i>		
					<i>fimbriata</i>		
				<i>Iophon</i>	sp.		
				Mycalidae	<i>Mycale</i>	<i>fibrexilis</i>	
						<i>lingua</i>	
				Halichondrida	Halichondridae	<i>Halichondria</i> *	<i>genitrix</i>

Table 1. Representatives of the Phylum Porifera collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field.

			<i>Halichondria*</i>	<i>panicea</i>
			<i>Eumastia</i>	<i>sitiens</i>
	Hadromerida	Suberitidae	<i>Polymastia</i>	<i>robusta*</i>
				<i>mammilaris</i>
				<i>infrapilosa*</i>
			<i>Suberites</i>	<i>ficus</i>
			<i>Pseudosuberites</i>	<i>sulphureus</i>
			<i>Pseudosuberites</i>	sp.
		Clionidae	<i>Cliona*</i>	<i>celata</i>
				<i>vastifica</i>
	Dendroceratida	Dysidae	<i>Dysidea</i>	<i>fragilis</i>

Phylum Coelenterata

The Phylum Coelenterata, also called Cnidaria, is a very large and diverse group including organisms such as sea anemones, corals, and hydrozoans, all of which we find in the Bay of Fundy. The phylum contains about 9,000 extant species, all very diverse (Brusca and Brusca, 1990). Cnidarians commonly form colonies and are dimorphic with two different morphologies during their lives: the planktonic medusoid form and the sessile polypoid form (Brusca and Brusca, 1990). Organisms can range from microscopic hydrozoan polyps to large colonial corals with feeding strategies ranging from carnivorous hunting to suspension feeding. The vulnerability of this phylum to dragging ranges greatly. Hydrozoans and anemones are less likely to sustain damage from trawling than corals or gorgons.

Nineteen coelenterate taxa were identified from the Digby, Yarmouth/Brier Island and Grand Manan study areas in the Lower Bay of Fundy by Fuller et al. (1998). Seven of these were identified in the field and are mapped according to tow locations. The distributions of the Coelenterata and of these eight taxa (*Tubularia* spp., *Obelia* sp., Sertularidae spp., *Hydrallmania falcata*, *Sertularella polyzonias*, *Sertularia pumila*, Anenome spp., *Gersemia rubiformis*) plus all anenome species are shown in Figure 2. *Tubularia* spp., *Sertularella polyzonias*, and *Hydrallmania falcata* are found at all three study sites. Sertulariidae spp. are found only in Grand Manan while *Obelia* spp. is seen only in the Digby area. *Sertularia pumila* was found in Digby and in Yarmouth but not in Grand Manan. Anemones were found at all study locations however the soft coral, *Gersemia rubiformis*, was found in only a few locations in Digby and Yarmouth. Most of the organisms identified in the field were the more common hydrozoans seen in the area. Anemones are difficult to identify due to the defensive strategy of folding in their tentacles when taken from the water and identification then requires dissection.

Table 2. Representatives of the Phylum Coelenterata collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field.

Class	Order	Family	Genus	Species		
Hydromedusae	Athecata	Tubulariidae	<i>Tubularia</i> *	<i>couthouyi</i>		
				<i>larynx</i>		
		Hydractiniidae	<i>Hydractinia</i>	<i>echinata</i>		
			Bougainvillidae	<i>Bougainvillia</i>	sp.	
	Thecata	Campanularidae	<i>Eucopella</i>	<i>caliculata</i>		
			<i>Obelia</i>	sp.*		
			<i>Clytia</i>	<i>minuta</i>		
				sp.		
				Sertularidae*	<i>Hydrallmania</i>	<i>falcata</i> *
					<i>Sertularella</i>	<i>polyzonias</i> *
					<i>Sertularia</i>	<i>pumila</i> *
			<i>Thuiaria</i>	sp.		
			<i>Diphasia</i>	<i>fallax</i>		
			<i>rosacea</i>			
Anthozoa	Alcyonacea	Alcyoniidae	<i>Alcyonium</i>	<i>digitatum</i>		
		Nephtheidae	<i>Gersemia</i>	<i>rubiformis</i> *		
	Zoanthidea		<i>Epizoanthus</i>	<i>incrustedus</i>		
	Actiniaria	Actinidae	<i>Tealia</i>	<i>felina</i>		
		Actinostolidae	<i>Stomphia</i>	<i>coccinae</i>		

Phylum Platyhelminthes

The Phylum Platyhelminthes, meaning “flatworms”, is a large phylum with approximately 20,000 species that can be found in a wide range of environments (Brusca and Brusca, 1990). Platyhelminthes are unsegmented worms including parasitic flukes and tapeworms, free-living marine and freshwater organisms, terrestrial species and some symbiotic species. Most members of this phylum are flattened dorsoventrally and lengths range from less than 1mm (free-living worm) to meters in length (tapeworm) (Brusca and Brusca, 1990).

Only one representative of this phylum was observed and placed in the Class Turbellaria although further identification was not possible. Most Turbellarians are carnivorous predators or scavengers, others are herbivorous, and they are found predominantly in benthic habitats (Brusca and Brusca, 1990). No locations are available and therefore a distribution map was not possible for this taxon.

Table 3. Representatives of the Phylum Platyhelminthes collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field.

Class	Order	Family	Genus	Species
Turbellaria				sp.

Phylum Rhynchocoela

Members of the Phylum Rhynchocoela are also known more commonly as nemerteans or ribbon worms. These are unsegmented worms found mostly in benthic marine environments but are also seen in freshwater and terrestrial environments. The phylum is relatively small with only about 900 described species worldwide that range in size from less than 1 cm to several meters long (Brusca and Brusca, 1990). Some ribbon worms are predators while others scavenge for food or feed on plant material. Nemerteans were seen highly associated with the sponge *Halichondria panicea* during this study. Their vulnerability depends on the stability of the organisms they inhabit be it a sponge or bivalve.

Only one taxa was identified from the Digby, Yarmouth/Brier Island and Grand Manan study areas in the Lower Bay of Fundy by Fuller et al. (1998). Although *Amphiporous groenlandicus* was identified, all nemerteans are mapped together according to tow location. The distribution of the nemerteans is shown in Figure 3. Nemerteans seemed to have a fairly uniform distribution within all three-study sites. Ribbon worms are very difficult to identify once dead or preserved as they quickly lose their colour which is a very important characteristic used in the identification process. Once the colour has disappeared, microscopic analysis is required for accurate identification.

Table 4. Representatives of the Phylum Rhynchocoela collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field.

Class	Order	Family	Genus	Species
Enopola	Hoplonemertea	Amphiporidae	<i>Amphiporus</i>	<i>groenlandicus</i> *

Phylum Aschelminthes

Only one organism from this phylum was observed during this study, *Priapulus caudatus*. This organism is the only local representative of the class Priapulida (Gosner, 1971). There is debate over the taxonomy of this phylum and some prefer to separate this class into it's own phylum. Priapulids are benthic, wormlike organisms that prefer soft bottomed habitats and sublittoral depths. They are predaceous and use a proboscis to aid in hunting soft-bodied invertebrates (Brusca and Brusca, 1990).

The sample was identified as *Priapulus caudatus*, and no locations are available to be mapped. This species is known to obtain 8 mm in length but has contractile abilities. There is not much known about the distribution of Priapulids in this part of the world which may suggest a low abundance of these organisms in our waters.

Table 5. Representatives of the Phylum Priapula collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field.

Class	Order	Family	Genus	Species
Priapulida		Priapulidae	<i>Priapulus</i>	<i>caudatus</i>

Phylum Bryozoa

Bryozoans are sessile, colonial organisms found worldwide, the largest measuring less than 1 meter (Gosner, 1971). With approximately 4,000 known species, the phylum is not uncommon and there are potentially new species not yet described (Hayward and Ryland, 1979). Bryozoans are split into two broad categories based on their morphology; encrusting and branching, and attach themselves to both animate and inanimate objects, from rocks to hydrozoans and molluscs.

Seventeen bryozoan species were identified from the Digby, Yarmouth/Brier Island and Grand Manan study areas in the Lower Bay of Fundy by Fuller et al. (1998). The animals were placed into two categories based on their morphologies and the locations of these groupings, as well as the species *Flustra foliacea*, are mapped according to tow locations. The distributions of the encrusting bryozoa, branching bryozoa and the species *Flustra foliacea* are shown in Figure 4. Branching and encrusting bryozoans are found evenly distributed throughout all three-study areas. However the bushy bryozoan *Flustra foliacea*, was only seen in the Digby area. Due to their microscopic size, bryozoans are very difficult to identify in the field, however *Flustra foliacea* is quite abundant and is known in the area for its lemon like smell which aids in identification.

Table 6. Representatives of the Phylum Bryozoa collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field. B denotes branching bryozoans. E denotes encrusting bryozoans.

Class	Order	Family	Genus	Species	
Stenolaemata	Cyclostomata	Crisiidae	<i>Crisia</i>	<i>eburnea</i>	B
				<i>denticulata</i>	B
Gymnolaemata	Ctenostomata	Tubuliporidae	<i>Idmidronea</i>	<i>atlantica</i>	B
		Alcyonidiidae	<i>Alcyonidium</i>	sp.	B
		Flustrellidridae	<i>Flustrellidra</i>	<i>hispidula</i>	B
		Cheilostomata	Eucrateidae	<i>Eucratea</i>	<i>loricata</i>

Table 6. Representatives of the Phylum Bryozoa collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field. B denotes branching bryozoans. E denotes encrusting bryozoans.

		Membraniporidae	<i>Membranipora</i>	<i>membranacea</i>	B/E
		Flustridae	<i>Flustra</i>	<i>foliacea*</i>	B
		Calloporidae	<i>Callopora</i>	<i>dumerili</i>	E
			<i>Amphiblestrum</i>	<i>flemigii</i>	E
		Bugulidae	<i>Bugula</i>	<i>simplex</i>	B
		Scrupocellariidae	<i>Caberea</i>	<i>ellisi</i>	B
		Umbonulidae	<i>Umbonulidae</i>	spp.	E
		Hippothoidae	<i>Hippothoa</i>	<i>divaricata</i>	E
		Microporellidae	<i>Microporella</i>	<i>ciliata</i>	E
		Smittinidae	<i>Parasmittina</i>	<i>trispinosa</i>	E
		Cheiloporinidae	<i>Cryptosula</i>	<i>pallasiana</i>	E

Phylum Brachiopoda

Members of the Phylum Brachiopoda are called the lamp shells. All are benthic, marine organisms and most are sessile, attached to the substrate by a pedicle (Brusca and Brusca, 1990). Brachiopods are similar to molluscs in that they are bivalved, however the shells are dorsal and ventral rather than lateral. Another significant characteristic that separates brachiopods from molluscs is the possession of a lophophore, a ring of tentacles surrounding the mouth that aids in feeding (Brusca and Brusca, 1990). In the past more than 12,000 species of brachiopods existed, however, only about 335 species are still living. Brachiopods are known to inhabit all ocean depths but are most abundant on the continental shelf and range in size from 1mm to 9cm (Brusca and Brusca, 1990).

One brachiopod species was identified from the Digby, Yarmouth/Brier Island and Grand Manan study areas in the Lower Bay of Fundy by Fuller et al. (1998). *Terebratulina septentrionalis* was identified in the field and its distribution can be mapped according to tow location (Figure 5). *Terebratulina septentrionalis* is fairly distinct and very abundant so easily identifiable and was seen evenly distributed throughout all three study sites by Fuller et al. (1998).

Table 7. Representatives of the Phylum Brachiopoda collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field.

Class	Order	Family	Genus	Species
Articulata	Terebratulida	Cancellothyrididae	<i>Terebratulina</i>	<i>septentrionalis*</i>

Phylum Mollusca

The Phylum Mollusca encompasses a diverse range of organisms that inhabit all environments from the polar seas to the terrestrial tropics. They are also some of the

more well known marine organisms with over 100,000 living and about 60,000 fossil species described (Brusca and Brusca, 1990). Within the Phylum Mollusca there are eight classes of extant species; five of which have representatives in the study areas.

Polyplacophora are also known as chitons and are flattened, marine herbivorous molluscs (Brusca and Brusca, 1990). About 600 species are known worldwide and four were found in the Digby, Yarmouth/Brier Island and Grand Manan study areas. Frequently observed representatives of the Class Gastropoda are the snails and slugs. These are probably some of the best known marine organisms as they are predominant in marine, freshwater and terrestrial environments and include about 40,000 living species (Brusca and Brusca, 1990). Class Bivalvia includes molluscs that are laterally compressed and have two valves hinged together, such as clams, oysters, scallops and mussels (Brusca and Brusca, 1990). Bivalves can be found in both marine and freshwater habitats and are suspension and/or deposit feeders. Most are sedentary, however, a few are somewhat motile (Gosner, 1971). With over 8,000 living species, bivalves inhabit all depths and all environments (Brusca and Brusca, 1990). The Class Scaphopoda are also known as tusk shells, and comprise a small portion of the Phylum Mollusca. Tusk shells are tubular shells that house benthic, burrowing, marine molluscs. There are about 350 species ranging in size from 5 to 90 mm, and there is one species most common in this area, *Antalis entale occidentale* (Gosner, 1971). The Class Cephalopoda include the nautilus, squid, cuttlefish and octopus. These animals can be benthic or pelagic, are found only in marine environments and consist of about 650 living species (Brusca and Brusca, 1990). They are predatory on small fish and invertebrates and are found at all depths (Gosner, 1971).

Fifty-two molluscan taxa were identified from the Digby, Yarmouth/Brier Island and Grand Manan study areas in the Lower Bay of Fundy by Fuller et al. (1998). However, only 34 of these were identified in the field and could be mapped according to tow location. The distributions of the five classes and the 34 taxa marked in Table 8 with an asterisk, are shown in Figure 6. *Stenosemus albus*, *Tonicella rubra*, *Margarites* sp., *Crucibulum striatum*, *Neptunea lyrata decemcostata*, *Colus* spp., *Turridae* spp., *Modiolus modiolus*, *Musculus discors*, *Chlamys islandicus*, *Placopecten magellanicus*, *Anomia* spp., *Astarte undata*, *Astarte subaequilatera*, *Cyclocardia borealis*, *Cerastoderma pinnulatum*, and *Hiatella arctica* were found at all three locations surveyed. *Calliostoma occidentale*, *Bulbus smithii*, *Yoldia myalis*, and *Buccinum undatum* were found predominantly in the Digby area with a few specimens seen in Yarmouth and Grand Manan. *Boreoscala groenlandica*, *Mytilus edulis*, *Nucula proxima*, *Onchidorus muricata*, *Euspira heros*, *Velutina* spp., and *Spisula solidissima* were only seen in the Digby area. *Euspira trisersata*, *Semirossia tenera*, and *Ensis directus* were found in both Digby and Yarmouth, while *Dendronotus frondosus* was seen in Digby and Grand Manan. *Arctica islandica* and *Antalis entale occidentale* were observed having even distributions in both Grand Manan and Yarmouth.

Table 8. Representatives of the Phylum Mollusca collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field.

Class	Order	Family	Genus	Species		
Polyplacophora	Neoloricata	Hanleyidae	<i>Hanleya</i>	<i>hanleyi</i>		
		Ishnochitonidae	<i>Stenosemus</i>	<i>albus</i> *		
			<i>Tonicella</i>	<i>marmorea</i>		
				<i>rubra</i> *		
Gastropoda	Archaeogastropoda	Fissurellidae	<i>Puncturella</i>	<i>noachina</i>		
		Trochidae	<i>Calliostoma</i>	<i>occidentale</i> *		
			<i>Margarites</i> *	<i>costalis</i>		
				<i>groenlandicus</i>		
	Mesogastropoda	Turritellidae	<i>Tachyrhynchus</i>	sp.		
		Epitonidae	<i>Boreoscala</i>	<i>groenlandica</i> *		
			<i>Crucibulum</i>	<i>striatum</i> *		
		Aporrhaidae	<i>Aporrhais</i>	<i>occidentalis</i>		
		Velutinidae	<i>Velutina</i>	spp.*		
			<i>Euspira</i>	<i>heros</i> *		
					<i>trisersata</i> *	
				<i>Bulbus</i>	<i>smithii</i> *	
		Neogastropoda	Muricidae	<i>Boreotrphon</i>	<i>clathratus</i>	
			Buccinidae	<i>Buccinum</i>	<i>undatum</i> *	
				<i>Neptunea</i>	<i>lyrata</i>	
					<i>decemcostata</i> *	
				<i>Colus</i> *	<i>stimpsoni</i>	
					<i>pygmeus</i>	
				Turbinellidae	<i>Ptychatractus</i>	<i>ligatus</i>
				Turridae		spp.*
Cephalaspidae	Scaphandridae		<i>Cylichna</i>	<i>alba</i>		
Nudibranchia	Lamellidorididae		<i>Onchidorus</i>	<i>muricata</i> *		
	Dendronotidae	<i>Dendronotus</i>	<i>frondosus</i> *			
Scaphopoda		Dentaliidae	<i>Antalis</i>	<i>entale</i>		
				<i>occidentale</i> *		
Bivalvia		Nuculidae	<i>Nucula</i>	<i>proxima</i> *		
		Nuculanidae	<i>Nuculana</i>	<i>tenuisulcata</i>		
			<i>Yoldia</i>	<i>myalis</i> *		
Pterconchida		Mytilidae	<i>Mytilus</i>	<i>edulis</i> *		
			<i>Modiolus</i>	<i>modiolus</i> *		
			<i>Musculus</i>	<i>discors</i> *		
				<i>niger</i>		
				<i>Crenella</i>	<i>glandula</i>	
			Pectinidae	<i>Chlamys</i>	<i>islandicus</i> *	
				<i>Placopecten</i>	<i>magellanicus</i> *	
			Anomiidae	<i>Anomia</i> *	<i>aculeata</i>	
					<i>simplex</i>	
			Astartidae	<i>Astarte</i>	<i>castanea</i>	
					<i>undata</i> *	
					<i>subaequilatera</i> *	
				Carditidae	<i>Cyclocardia</i>	<i>borealis</i> *
				Arcticidae	<i>Arctica</i>	<i>islandica</i> *

Table 8. Representatives of the Phylum Mollusca collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field

		Cardiidae	<i>Cerastoderma</i>	<i>pinnulatum*</i>
		Mactridae	<i>Spisula</i>	<i>solidissima*</i>
		Solenidae	<i>Ensis</i>	<i>directus*</i>
		Hiatellidae	<i>Hiatella</i>	<i>arctica*</i>
	Eudesmodontida	Pandoridae	<i>Pandora</i>	<i>gouldiana</i>
		Thracidae	<i>Thracia</i>	sp.
Cephalapoda	Sepilda	Sepiolidae	<i>Semirossia</i>	<i>tenera*</i>
		Octopodidae	<i>Bathypolypus</i>	<i>arcticus</i>

Phylum Annelida

The members of the Phylum Annelida are also known as the segmented worms and are about 15,000 species strong. Annelids are very adaptive organisms and are found in almost all environments where enough water is available (Brusca and Brusca, 1990). Annelids include leeches, earthworms and many varieties of marine and freshwater worms. Their sizes range greatly from microscopic to 3 m in length (Brusca and Brusca, 1990).

Thirty-three annelid taxa were identified from the Digby, Yarmouth/Brier Island and Grand Manan study areas in the Lower Bay of Fundy by Fuller et al. (1998). However only 10 of these were identified in the field and could be mapped according to tow location. The distributions of the Annelida, and of these 11 taxa (*Lepidonotus squamatus*, *Harmothoe* spp., *Harmothoe imbricata*, *Harmothoe oerstedii*, *Spirorbis borealis*, *Spirorbis spirorbis*, *Pseudopotamilla reniformis*, Terebellidae sp., *Nereis* sp., *Pectinaria* spp., *Filograna implexa*) are shown in Figure 7. All annelid species identified in this study belonged to the Class Polycheta. *Lepidonotus squamatus*, *Spirorbis borealis*, *Pseudopotamilla reniformis*, Terebellidae sp, *Nereis* sp. and *Pectinaria* spp. are found in all three study areas although *Pectinaria* spp. had a very low abundance in all areas. *Harmothoe imbricata* and *Harmothoe oerstedii* are found only in Digby while *Harmothoe* spp. are seen in Yarmouth and Grand Manan but not in Digby. *Spirorbis spirorbis* was observed a few times in Grand Manan but is principally located in Digby and Yarmouth. *Filograna implexa* was observed in Grand Manan and Yarmouth in large abundance but not at all in Digby. Most polychaetes identified in the field possess very distinct characteristics. Due to the methods of preservation, the specimens collected for identification in the laboratory were not in ideal condition, and as a result many could not be identified.

Table 9. Representatives of the Phylum Annelida collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field.

Class	Order	Family	Genus	Species		
Polychaeta	Phyllodocida	Phyllodocidae	<i>Phyllodoce</i>	<i>groenlandica</i>		
				sp.		
				<i>Eteone</i>	<i>trilineata</i>	
				<i>Eulalia</i>	sp.	
					sp.	
				Aphroditidae	<i>Aphrodita</i>	<i>hastata</i>
				Polynoidae	<i>Harmathoe</i> *	<i>oerstedii</i> *
						<i>extenuata</i>
						<i>imbricata</i> *
					<i>Lepidonotus</i>	<i>squamatus</i> *
			Glyceridae	<i>Glycera</i>	<i>capitata</i>	
			Nephtyidae	<i>Nephtys</i>	sp.	
			Nereidae	<i>Nereis</i>	<i>zonata</i>	
					<i>pelagica</i>	
					sp. *	
		Capitellida	Opheliidae	<i>Ophelina</i>	<i>acuminata</i>	
					sp.	
		Eunicida	Eunicidae	<i>Eunice</i>	<i>pennata</i>	
			Lumbrinereidae	<i>Lumbrineris</i>	<i>tenuis</i>	
			Lumbrinereidae		sp.	
			Arabellidae	<i>Arabella</i>	<i>iricolor</i>	
		Amphinomidae	Euprosinidae	<i>Euprosine</i>	<i>borealis</i>	
		Terebellida	Pectinariidae	<i>Pectinaria</i> *	<i>granulata</i>	
		Ampharetidae	<i>Anobothrus</i>	<i>gracilis</i>		
		Terebellidae*	<i>Amphitrite</i>	<i>cirrata</i>		
			<i>Neoamphitrite</i>	<i>figulus</i>		
			<i>Thelepus</i>	<i>cinnacinatus</i>		
	Flabelligerida	Flabelligeridae	<i>Brada</i>	<i>granosa</i>		
	Sabellida	Sabellidae	<i>Pseudopotamilla</i>	<i>reniformis</i> *		
			<i>Potamilla</i>	<i>neglecta</i>		
		Serpulidae	<i>Filograna</i>	<i>implexa</i> *		
			<i>Spirorbis</i>	<i>borealis</i> *		
				<i>spirorbis</i> *		

Phylum Sipuncula

Sipunculans are unsegmented, wormlike animals sometimes called peanut worms. There are only a small number of species within this phylum, about 250, and only one species was identified in this study (Brusca and Brusca, 1990). Sipunculans are either burrowing or benthic, sedentary worms that only occur in marine systems (Gosner, 1971). Although little work has been done on sipunculans, it is believed that most are nonselective deposit feeders.

Only one sipunculan taxa was identified from the Digby, Yarmouth/Brier Island and Grand Manan study areas in the Lower Bay of Fundy by Fuller et al. (1998). This one taxon, *Phascolion strombi*, was identified in the field and can be mapped according to tow location. *Phascolion* lives bored into rock, or in empty mollusc shells or annelid tubes. The distribution of *Phascolion strombi* is shown in Figure 8. This species was found in all three study areas but was seen in higher abundances in Digby and Yarmouth. Sipunculans are fairly distinct organisms so identification in the field should be feasible as in this case.

Table 10. Representative of the Phylum Sipuncula collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field.

Genus	Species
<i>Phascolion</i>	<i>strombi</i> *

Phylum Arthropoda

The Phylum Arthropoda is the most abundant group of metazoa today (Brusca and Brusca, 1990). Existing in every habitat and ranging in size from less than 1 mm to greater than 4 m's, Arthropoda is a very diverse group of organisms (Brusca and Brusca, 1990). Approximately 1 million species of arthropods exist today with many more waiting to be discovered. Several features shared by all arthropods are the segmented body, jointed appendages and exoskeleton. Save for three species of sea spiders, all arthropods observed in this study belong to the Crustacea. There are about 30,000 species of crustaceans living today, and they are found in all marine, brackish and freshwater environments and at all depths (Brusca and Brusca, 1990). Some crustaceans have been able to live in terrestrial environments as well. Crustaceans can be sessile, living on rocks or other invertebrates, or motile. The exoskeleton and mobility of many crustaceans allow them to have some resistance to the impacts of scallop dragging.

Forty-eight arthropod taxa were identified from the Digby, Yarmouth/Brier Island and Grand Manan study areas in the Lower Bay of Fundy by Fuller et al. (1998). However, only 9 of these were identified in the field and could be mapped according to tow location. The distributions of the Arthropoda, and of these 10 taxa (*Pycnogonum littorale*, *Balanus balanus*, *Balanus crenatus*, Amphipoda spp., Caprellidae spp., *Pandalus* spp., *Homarus americanus*, *Pagurus* sp., *Cancer* sp., *Hyas* sp.) are shown in Figure 9. *Balanus balanus*, *Balanus crenatus*, Amphipoda spp., *Pandalus* spp., and *Pagurus* sp. were all observed to have even distributions throughout all three-study sites. *Pycnogonum littorale* was only observed on four occasions but was seen in all three study areas. Caprellidae spp. and *Homarus americanus* were observed in Grand Manan and Yarmouth only, with fairly even distributions throughout these two areas. *Hyas* sp. were seen in all three study areas, but had a greater abundance in Digby. The smaller the

arthropod the harder it is to identify in the field. As a result many species had to be identified in the laboratory.

Table 11. Representatives of the Phylum Arthropoda collected from the lower Bay of Fundy (Fuller et al. 1998) and identified in the laboratory. * denotes taxa identified in the field.

Class	Order	Family	Genus	Species
Pantopoda		Nymphonidae	<i>Nymphon</i>	<i>stromi</i>
				<i>macrum</i>
		Pycnogonidae	<i>Pycnogonum</i>	<i>littorale*</i>
Crustacea	Thoracia	Balanidae	<i>Balanus</i>	<i>balanus*</i>
				<i>crenatus*</i>
				<i>hameri</i>
	Cumacae	Diastylidae	<i>Diastylis</i>	sp.
	Isopoda	Idoteidae	<i>Idotea</i>	<i>balthica</i>
			<i>Chiridotea</i>	<i>coeca</i>
	Amphipoda*	Acanthonotosomidae		sp.
		Ampeliscidae	<i>Ampelisca</i>	<i>macrocephala</i>
			<i>Haploops</i>	<i>tubicola</i>
		Ampithoidae	<i>Ampithoe</i>	<i>rubricata</i>
				<i>longimana</i>
		Aoridae	<i>Microdeutopus</i>	<i>gryllotalpa</i>
			<i>Lembos</i>	<i>smithi</i>
		Aoridae		spp.
		Bateidae		sp.
		Corophiidae	<i>Erichthonius</i>	<i>rubricornis</i>
			<i>Unicola</i>	<i>irroratus</i>
		Melitidae	<i>Melita</i>	<i>dentata</i>
		Ischyroceridae		sp.
		Photidae	<i>Photis</i>	<i>pollex</i>
			<i>Leptocheirus</i>	<i>pinguis</i>
		Podoceridae	<i>Dulchia</i>	<i>porrecta</i>
			<i>Podocerus</i>	sp.
	Caprellida	Caprellidae*	<i>Aeginina</i>	<i>longicornis</i>
			<i>Caprella</i>	<i>linearis</i>
				<i>septentrionalis</i>
				<i>unica</i>
	Decapoda	Hippolytidae	<i>Eualus</i>	<i>pusiolus</i>
			<i>Spirontocaris</i>	<i>lilieborgi</i>
				<i>spinus</i>
			<i>Lebbeus</i>	<i>microcerus</i>
				<i>groenlandicus</i>
		Pandalidae	<i>Pandalus*</i>	<i>montagui</i>
				<i>borealis</i>
		Crangonidae	<i>Sclerocrangon</i>	<i>boreas</i>
		Nephropsidae	<i>Homarus</i>	<i>americanus*</i>
		Axiidae	<i>Axius</i>	<i>serratus</i>

Table 11. Representatives of the Phylum Arthropoda collected from the lower Bay of Fundy (Fuller et al. 1998) and identified in the laboratory. * denotes taxa identified in the field.

		Paguridae	<i>Pagurus*</i>	<i>pubescens</i>
				<i>acadianus</i>
		Lithodidae	<i>Lithodes</i>	<i>maja</i>
		Cancridae	<i>Cancer*</i>	<i>irroratus</i>
				<i>borealis</i>
		Majidae	<i>Hyas*</i>	<i>coarctatus</i>
				<i>areneus</i>

Phylum Echinodermata

The Phylum Echinodermata includes among others the sea stars, brittle stars, sand dollars, sea urchins and sea cucumbers. There are about 7,000 living species of echinoderms. They are strictly marine organisms with the exception of a few that can survive in brackish water (Brusca and Brusca, 1990). All local forms of echinoderms are motile and benthic with sizes ranging from small brittle stars, less than 1 cm, to sea stars greater than 1 m in diameter (Gosner, 1971). Feeding strategies differ within the phylum; sea stars are aggressive predators and scavengers; sea urchins use these as well as suspension feeding, herbivory and detritivory; while sea cucumbers and sand dollars are deposit or suspension feeders (Brusca and Brusca, 1990). Many echinoderms are soft-bodied organisms that are easily harmed by scallop dragging gear. However, all echinoderms share the ability to regenerate lost or damaged parts which could help them survive in fished areas (Gosner, 1971).

Twenty-two echinoderm taxa were identified from the Digby, Yarmouth/Brier Island and Grand Manan study areas in the Lower Bay of Fundy by Fuller et al. (1998). However, only 13 of these were identified in the field and could be mapped according to tow location. The distributions of all the Echinodermata, and of thirteen common taxa (*Cucumaria frondosa*, *Strongylocentrotus droebachiensis*, *Echinarachnius parma*, *Hippasteria* spp., *Solaster endeca*, *Solaster papposus*, *Pteraster militaris*, *Henricia* spp., *Asterias* spp., *Leptasterias* spp., *Ophiura* spp., *Ophiopholis aculeata*, *Amphiopholus squamata*) are shown in Figure 10. *Cucumaria frondosa*, *Strongylocentrotus droebachiensis*, *Solaster endeca*, *Solaster papposus*, *Pteraster militaris*, *Henricia* spp., *Asterias* spp., *Ophiura* spp., *Ophiopholis aculeata*, and *Amphiopholus squamata* are found within all three study areas. *Echinarachnius parma* were observed in Digby and Yarmouth. *Hippasteria* spp. were seen in Yarmouth and Grand Manan with a few sightings at the southernmost survey stations in Digby. *Leptasterias* spp. were only observed in Grand Manan. The identification of echinoderms in the field is very feasible, to the genus level for most specimens and at times to the species level as well.

Table 12. Representatives of the Phylum Echinodermata collected from the Lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field.

Class	Order	Family	Genus	Species
Holothuroidea	Dendrochirotida	Psolidae	<i>Psolus</i>	<i>fabricii</i>
				sp.
		Cucumaridae	<i>Cucumaria</i>	<i>frondosa*</i>
	Molpadidae		<i>Molpadia</i>	<i>oolitica</i>
Echinoidea	Echinoidea	Strongylocentrotidae	<i>Strongylocentrotus</i>	<i>droebachiensis*</i>
	Clypeasteroidea	Echinarachnidae	<i>Echinarachnius</i>	<i>parma*</i>
	Spatagoida	Shizasteridae	<i>Brisaster</i>	<i>fragilis</i>
Stellaroidea	Paxillosida	Gonopectinidae	<i>Ctenodiscus</i>	<i>crispatus</i>
	Valvatida	Goniasteridae	<i>Hippasteria*</i>	<i>phrygiana</i>
	Spinulosida	Solasteridae	<i>Solaster</i>	<i>endeca*</i>
			<i>(Crossaster)</i>	<i>papposus*</i>
		Pterasteridae	<i>Pteraster</i>	<i>militaris*</i>
		Poraniidae	<i>Porania</i>	<i>insignis</i>
				sp.
		Echinasteridae	<i>Henricia*</i>	<i>sanguinolenta</i>
	Forcipulatida	Asteriidae	<i>Asterias*</i>	<i>vulgaris</i>
				<i>forbesii</i>
			<i>Leptasterias*</i>	<i>tenera</i>
	Phrynophiurida	Gorgonocephalida	<i>Gorgonocephalus</i>	<i>arcticus</i>
	Ophiurida	Ophiuridae	<i>Ophiura*</i>	<i>sarsi</i>
		Ophiactidae	<i>Ophiopholis</i>	<i>aculeata*</i>
		Amphiuridae	<i>Amphiopholus</i>	<i>squamata*</i>

Phylum Chordata

Invertebrate chordates belong to the subphylum Urochordata. Urochordates or tunicates, can be sessile organisms which occur on a wide range of substrata such as sand, rock, plants, animal exoskeletons or as pelagic organisms, rarely leaving oceanic waters to come into the coastal zone (Gosner, 1971). There are about 3,000 species within the Urochordata and almost all are marine suspension feeders (Brusca and Brusca, 1990). All Chordates seen in these three study areas belong to the class Ascidiacea. Ascidians can be solitary or colonial and are found in all depths of water. Individuals can be mm or cm in size while some colonies will be meters across (Brusca and Brusca, 1990).

Seven Chordata taxa were identified from the Digby, Yarmouth/Brier Island and Grand Manan study areas in the Lower Bay of Fundy by Fuller et al. (1998). However, only 2 of these were identified in the field and could be mapped according to tow location. The distributions of the Chordata, and of these two taxa (*Dendrodoa carnea* and *Boltenia* spp.) are shown in Figure 11.

Dendrodoa carnea was found only in the Grand Manan area. However, *Boltenia* spp. were found predominantly in Digby and Grand Manan with a few observed

individuals in Yarmouth. Ascidians are very difficult to identify without looking at their internal structure and therefore identification in the field is restricted. Fish species were also observed but are not documented here (Fuller et al., 1998).

Table 13. Representatives of the Phylum Chordata collected from the lower Bay of Fundy (Fuller et al., 1998) and identified in the laboratory. * denotes taxa identified in the field.

Class	Order	Family	Genus	Species
Ascidiacea	Enterogona	Polyclinidae	<i>Amaroucium</i>	sp.
		Cionidae	<i>Ciona</i>	<i>intestinalis</i>
	Pleurogona	Styelidae	<i>Dendrodoa</i>	<i>carnea</i> *
		Pyuridae	<i>Boltenia</i> *	<i>ovifera</i>
				<i>echinata</i>
			<i>Halocynthia</i>	<i>pyriformis</i>
		Mogulidae	<i>Mogula</i>	sp.

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FIGURES

The location of field identified specimens collected in 1997 have been mapped according to taxonomic grouping in Figures 1-11. Maps are of three fishing areas within the lower Bay of Fundy; including Digby, Yarmouth and Grand Manan/Brier Island. Tow locations within each area are plotted in Figures 12-14. All tows were categorized according to bottom type and these are provided in Figure 15 (Fuller et al., 1998). A transparent overlay can be made of Figure 15 and used to examine relationships between bottom type and fauna distribution.

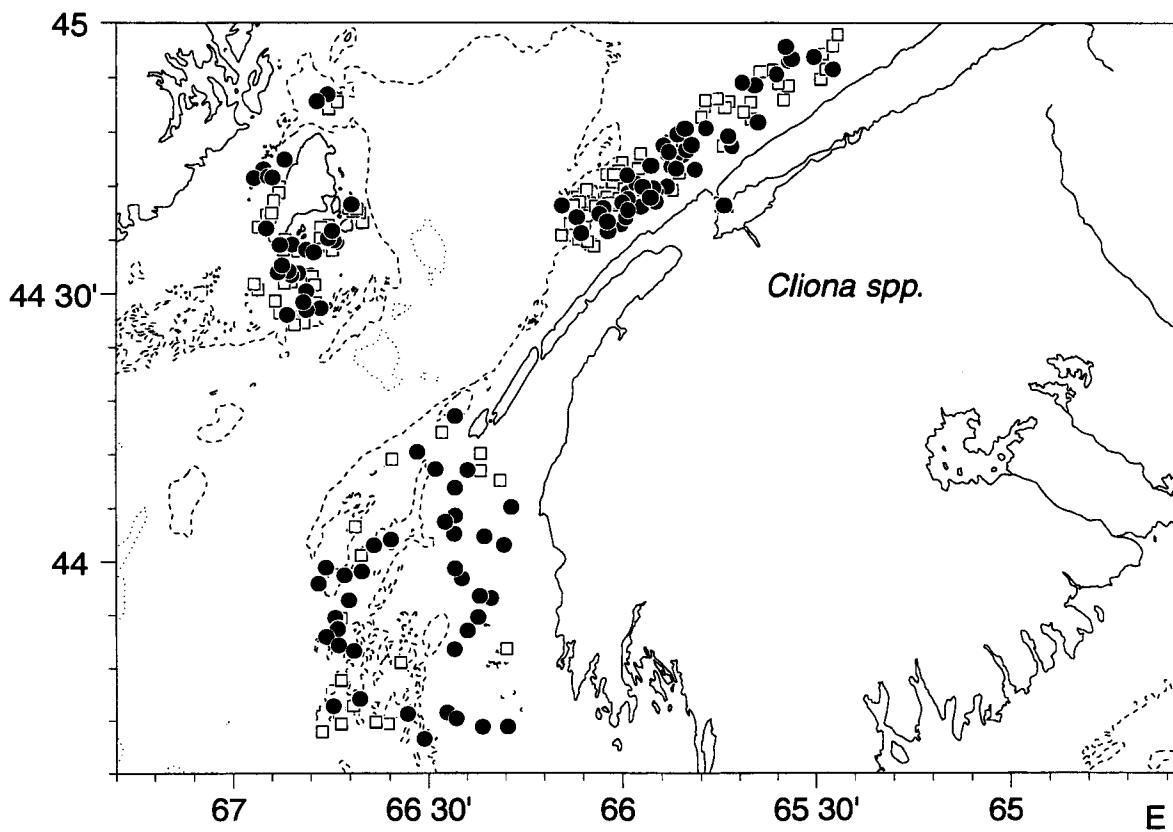
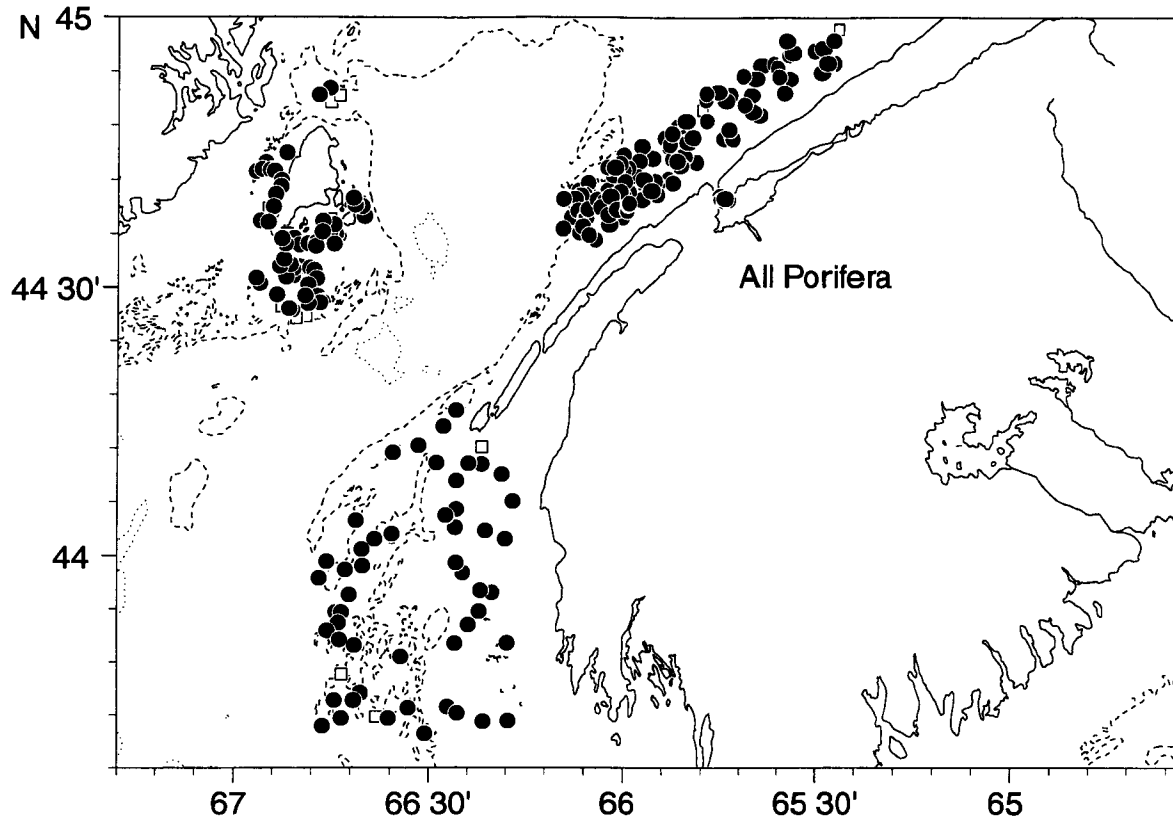


Figure 1. Distribution of representatives of the Phylum Porifera in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

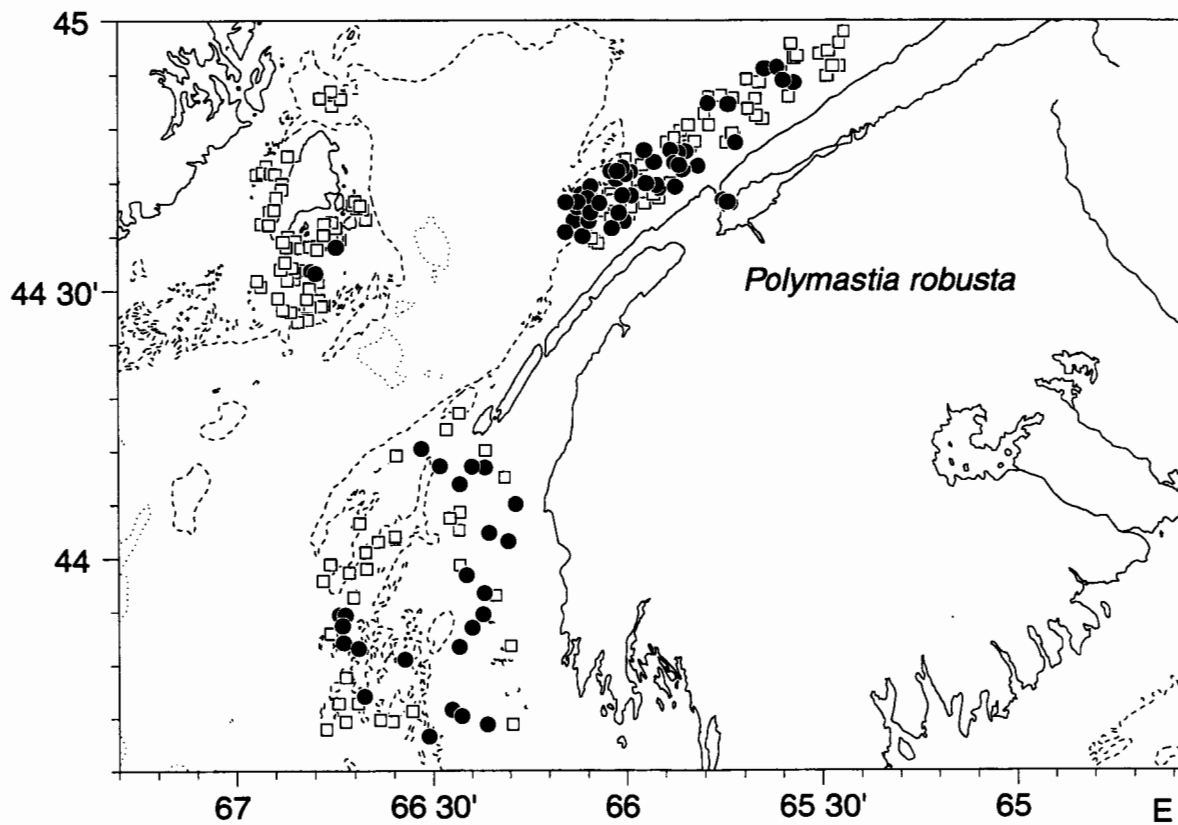
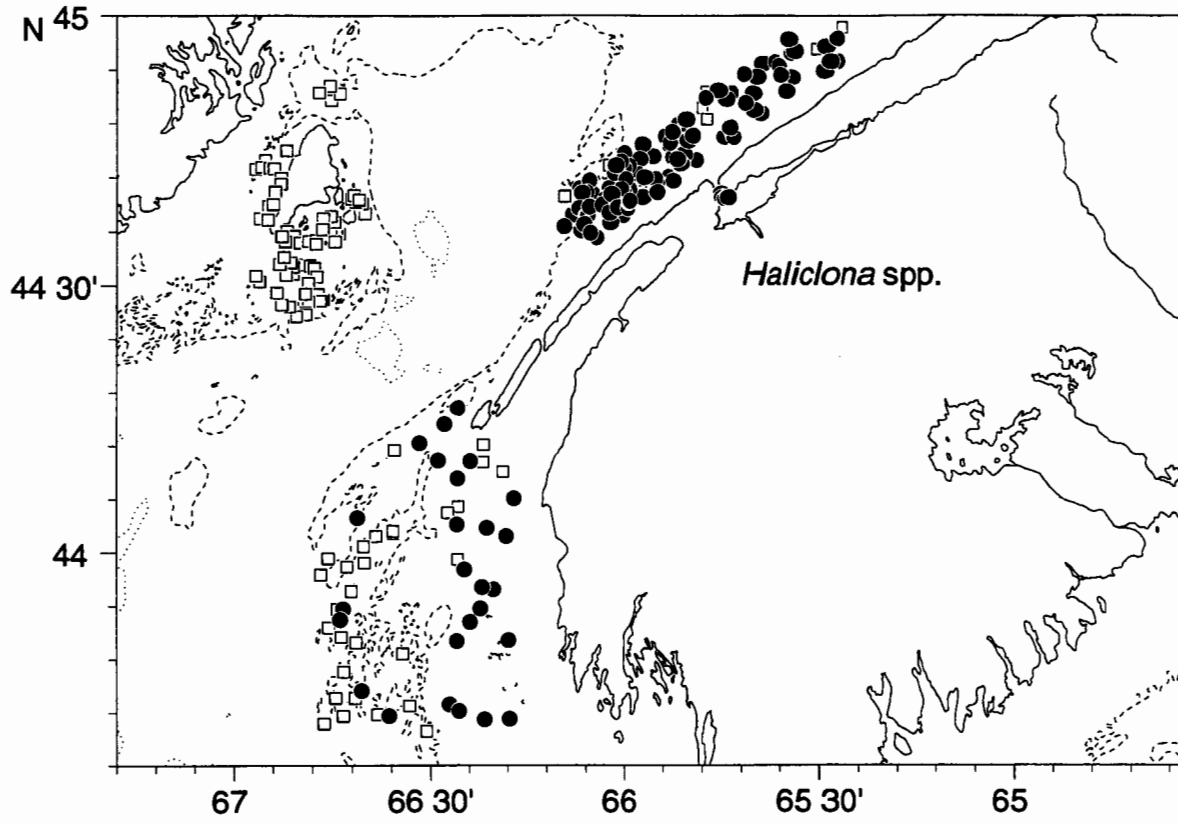


Figure 1 cont'd. Distribution of representatives of the Phylum Porifera in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

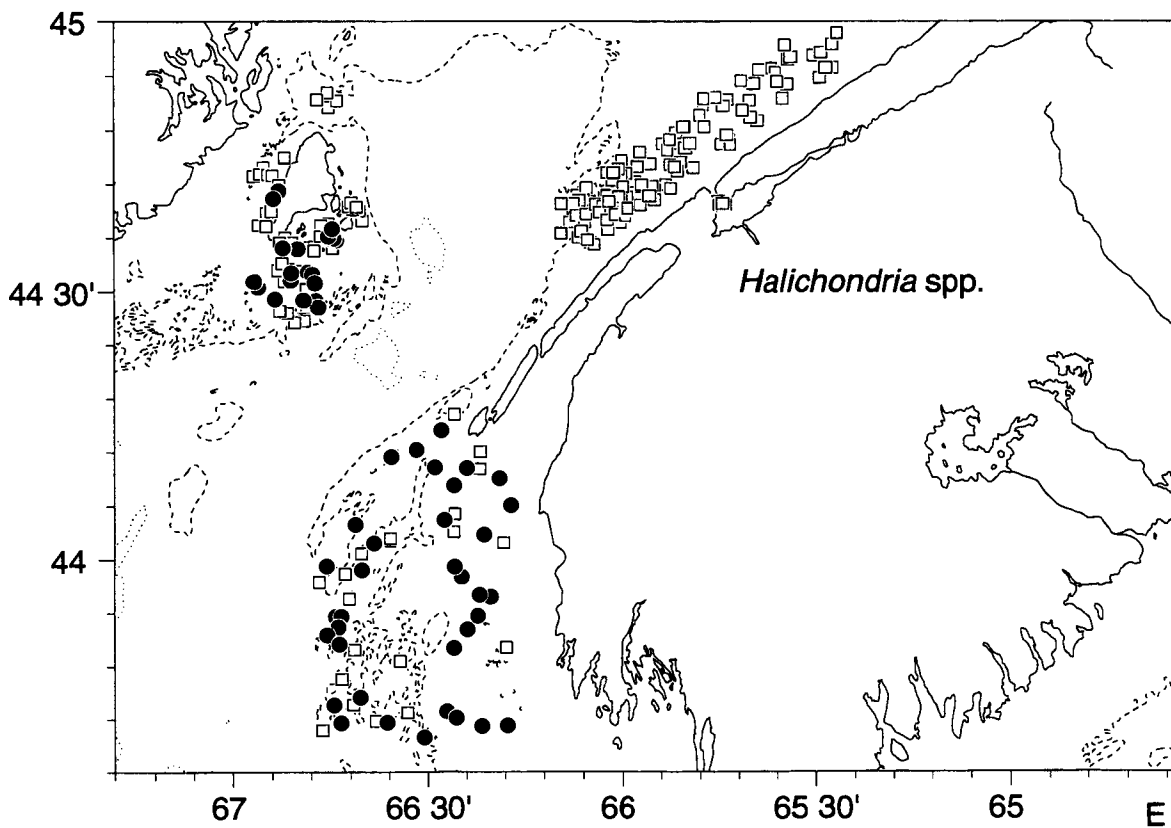
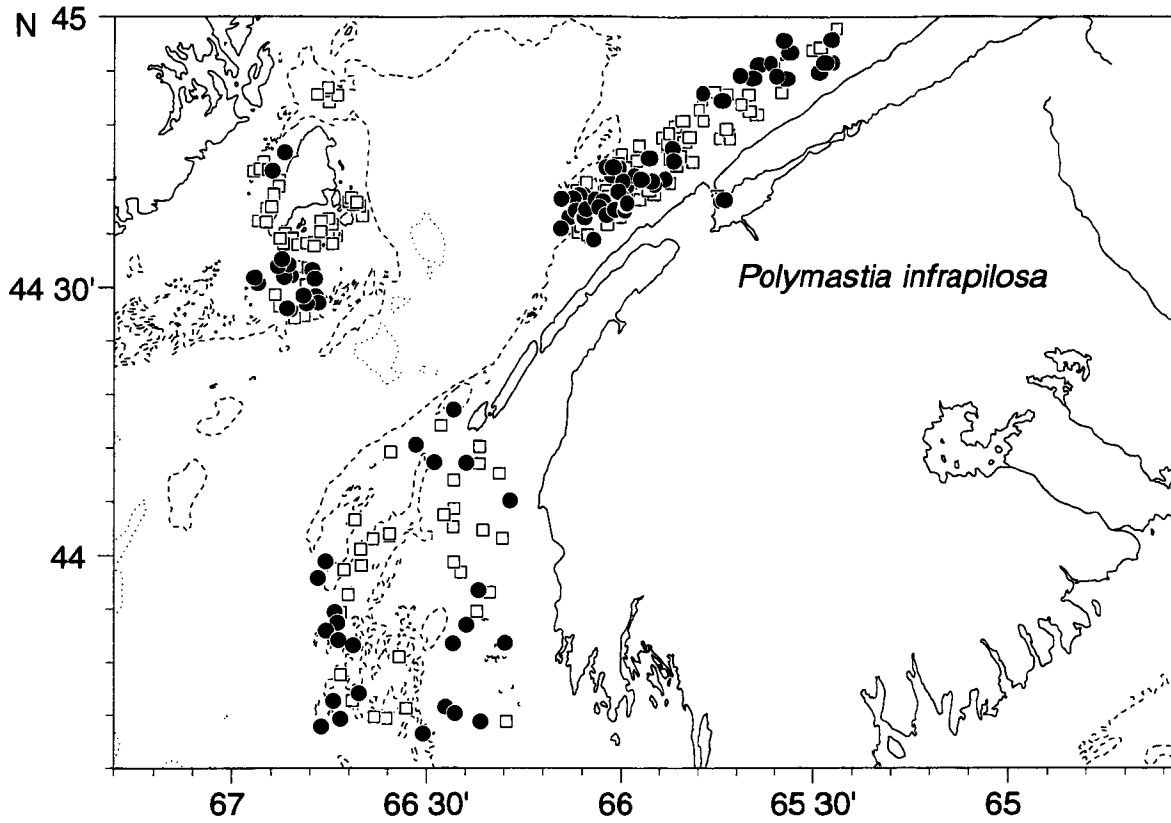


Figure 1 cont'd. Distribution of representatives of the Phylum Porifera in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

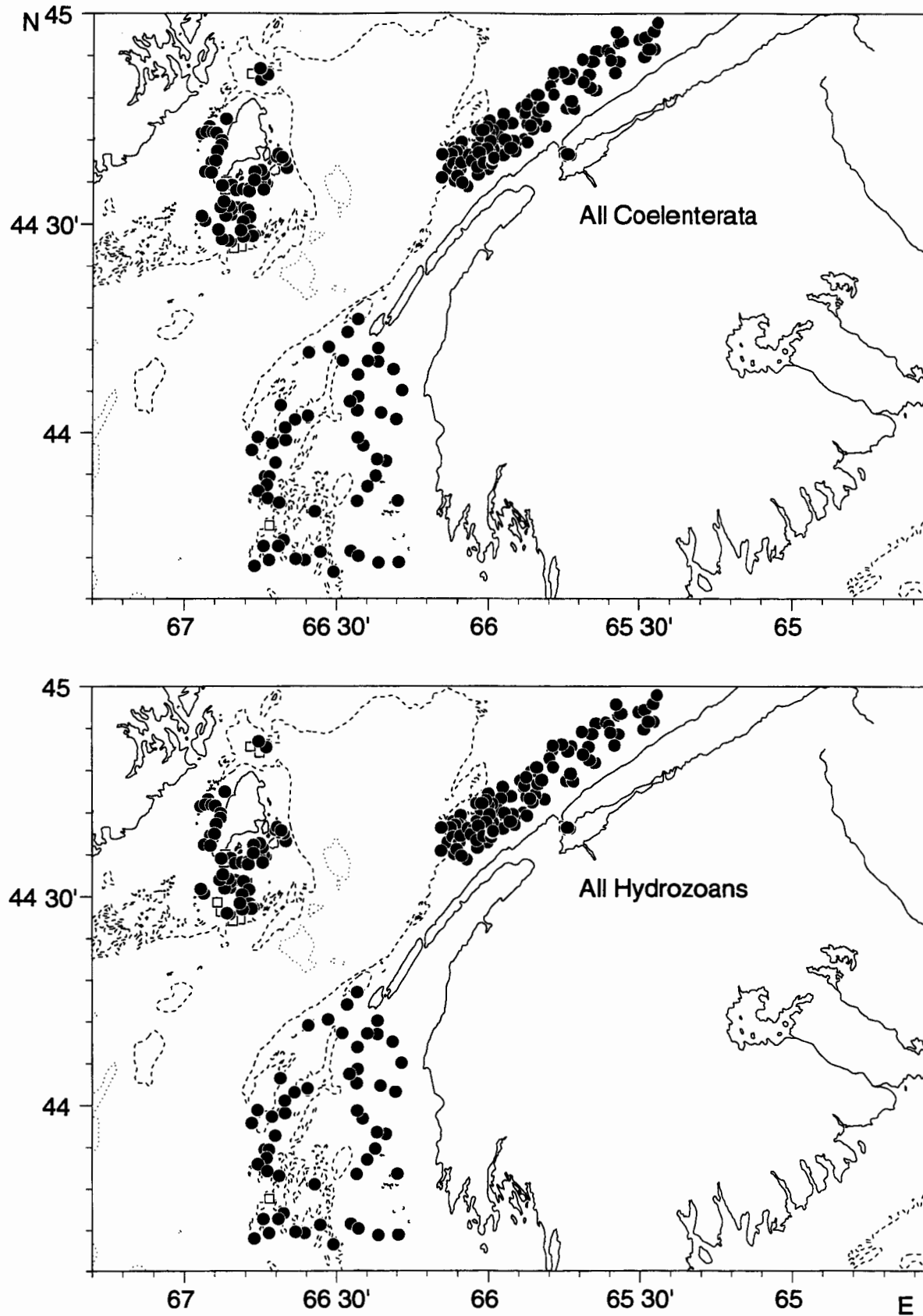


Figure 2. Distribution of representatives of the Phylum Coelenterata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

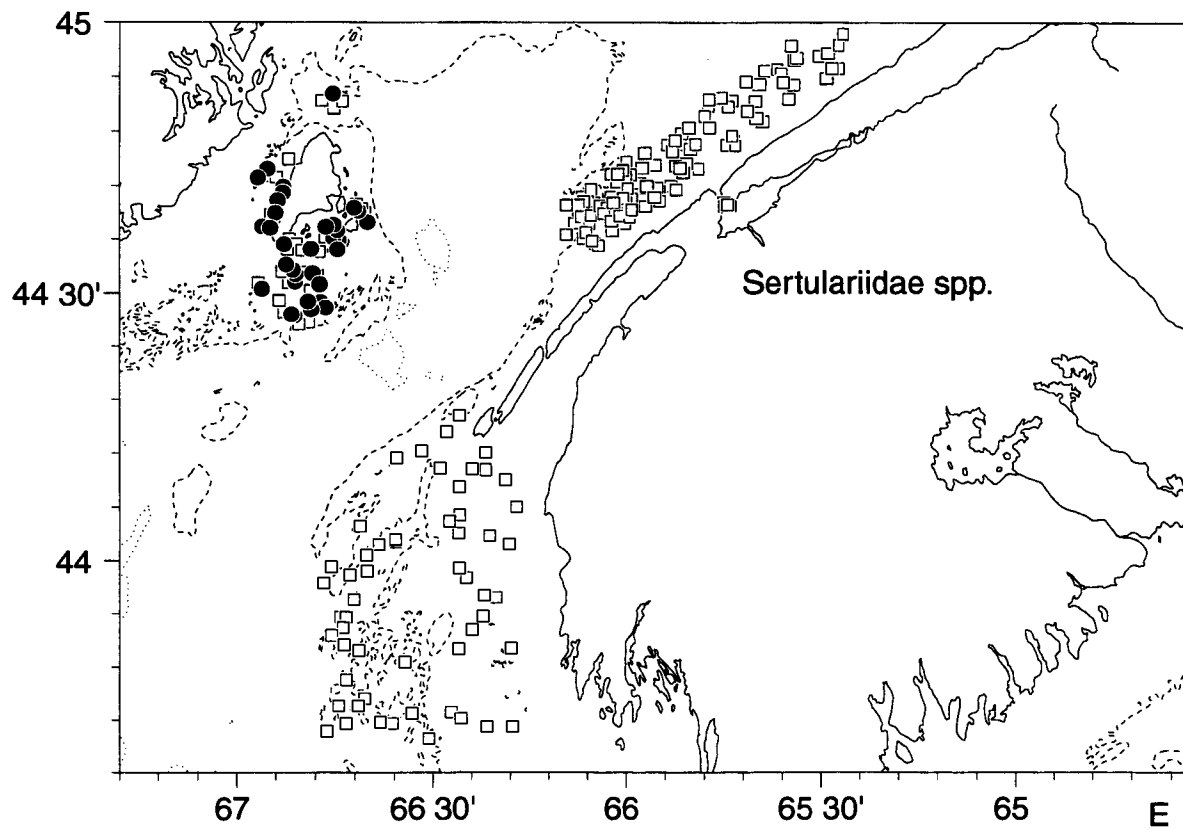
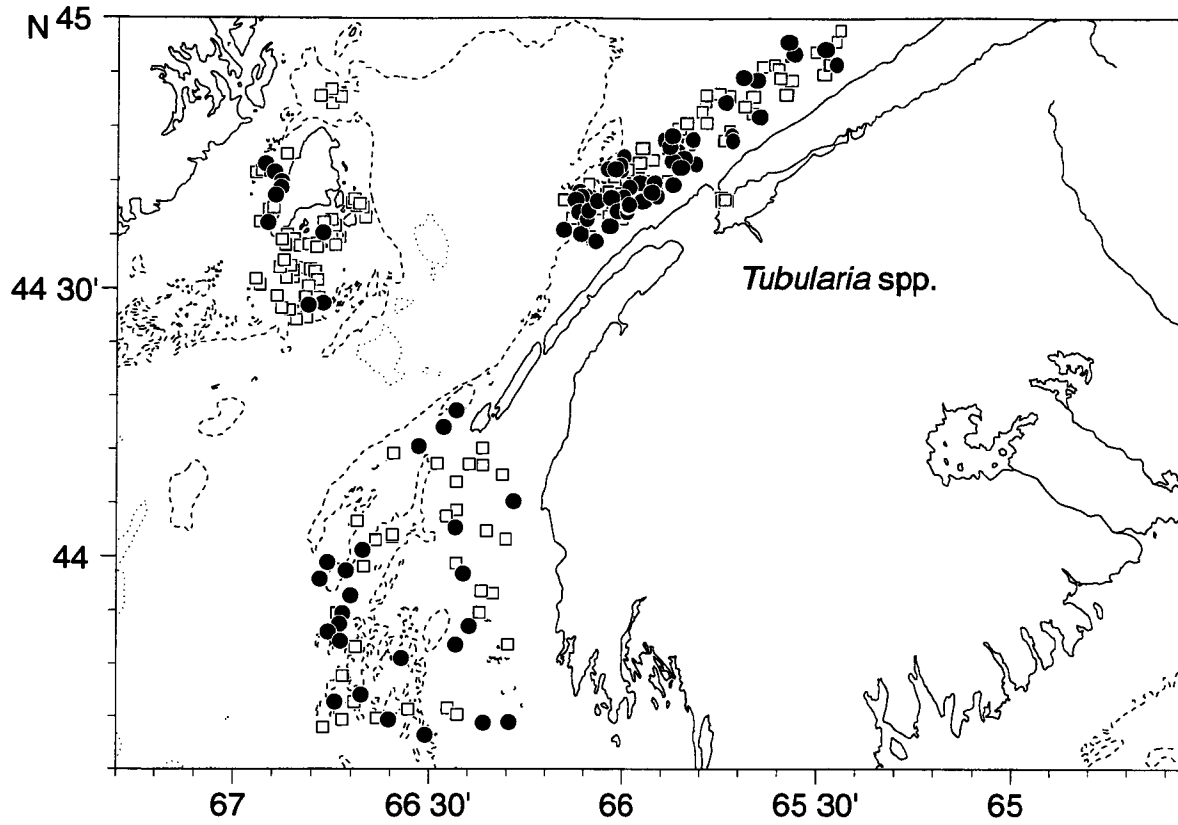


Figure 2 cont'd. Distribution of representatives of the Phylum Coelenterata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

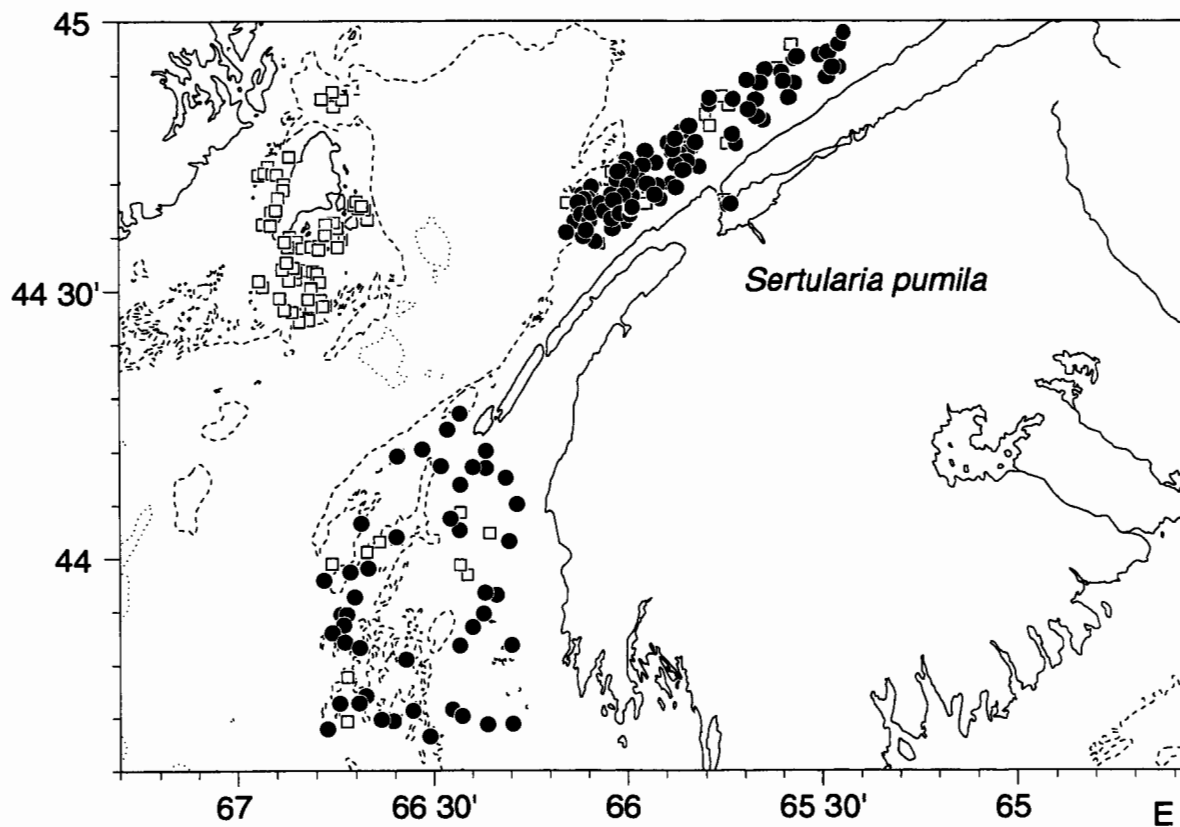
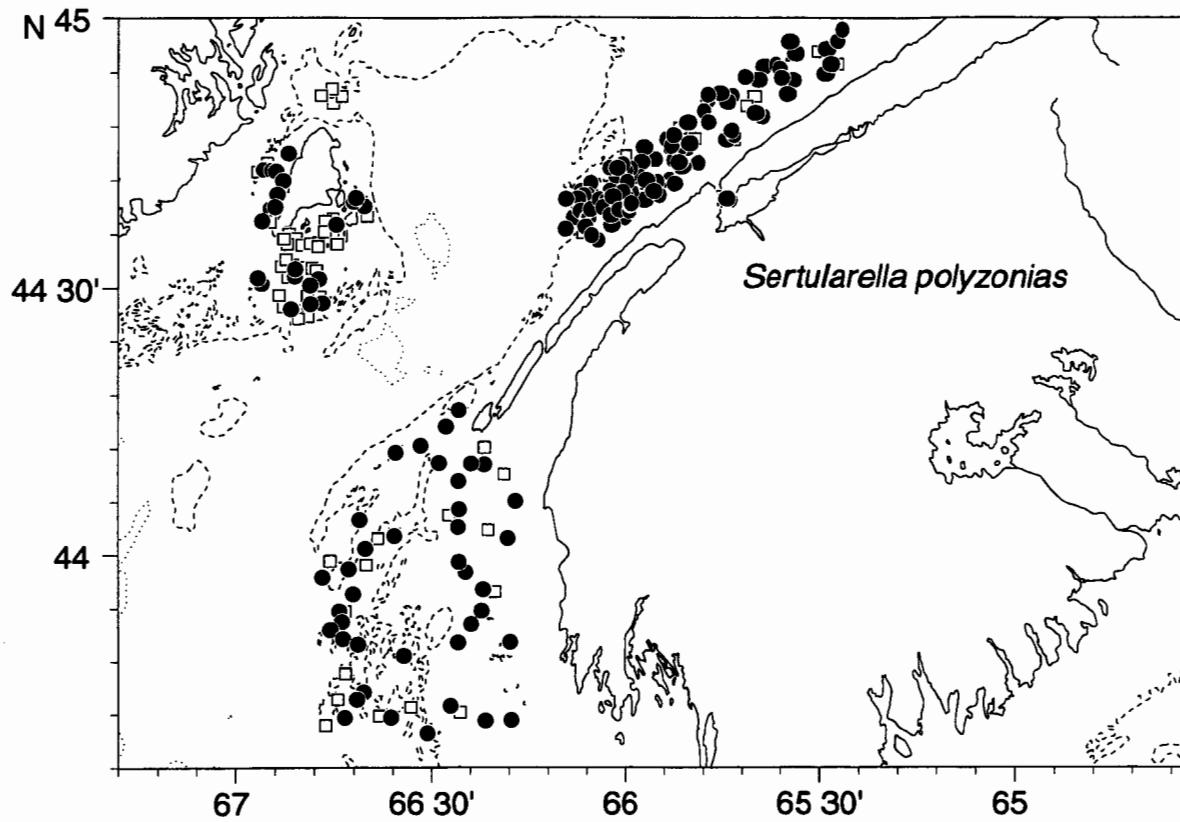


Figure 2 cont'd. Distribution of representatives of the Phylum Coelenterata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

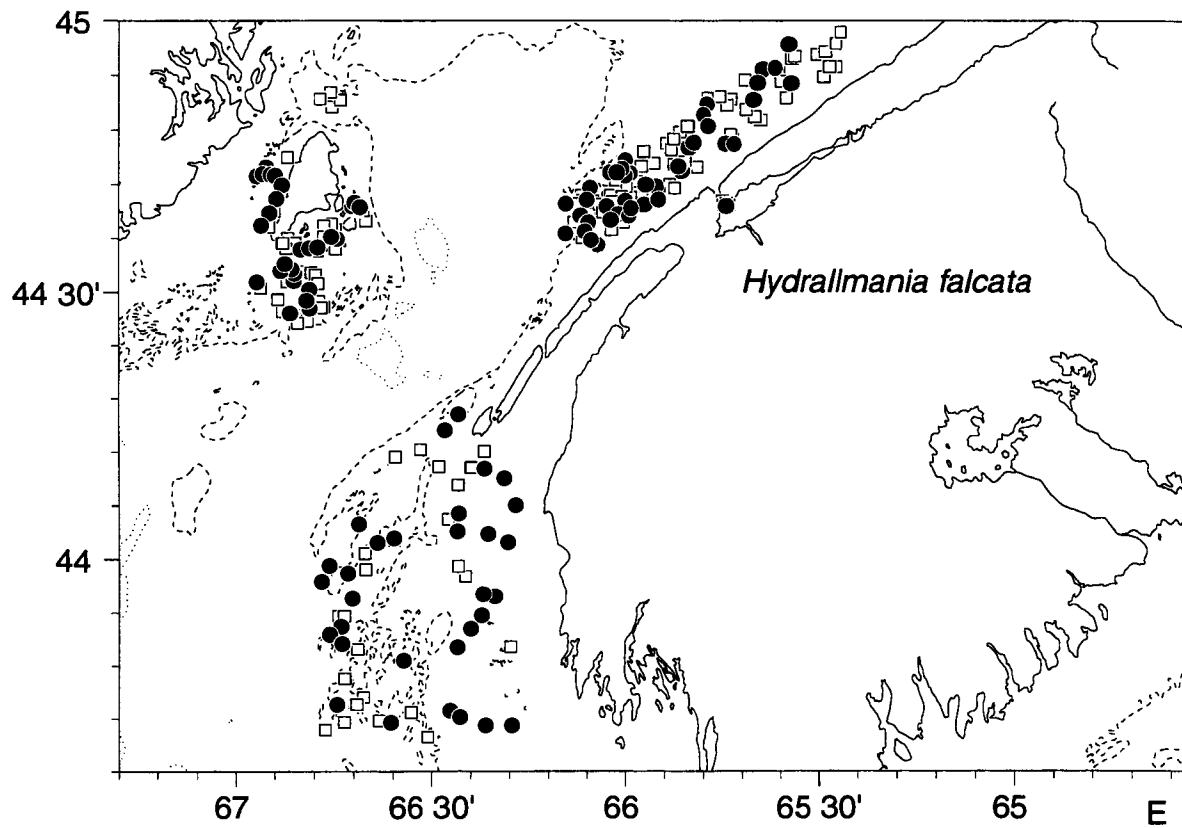
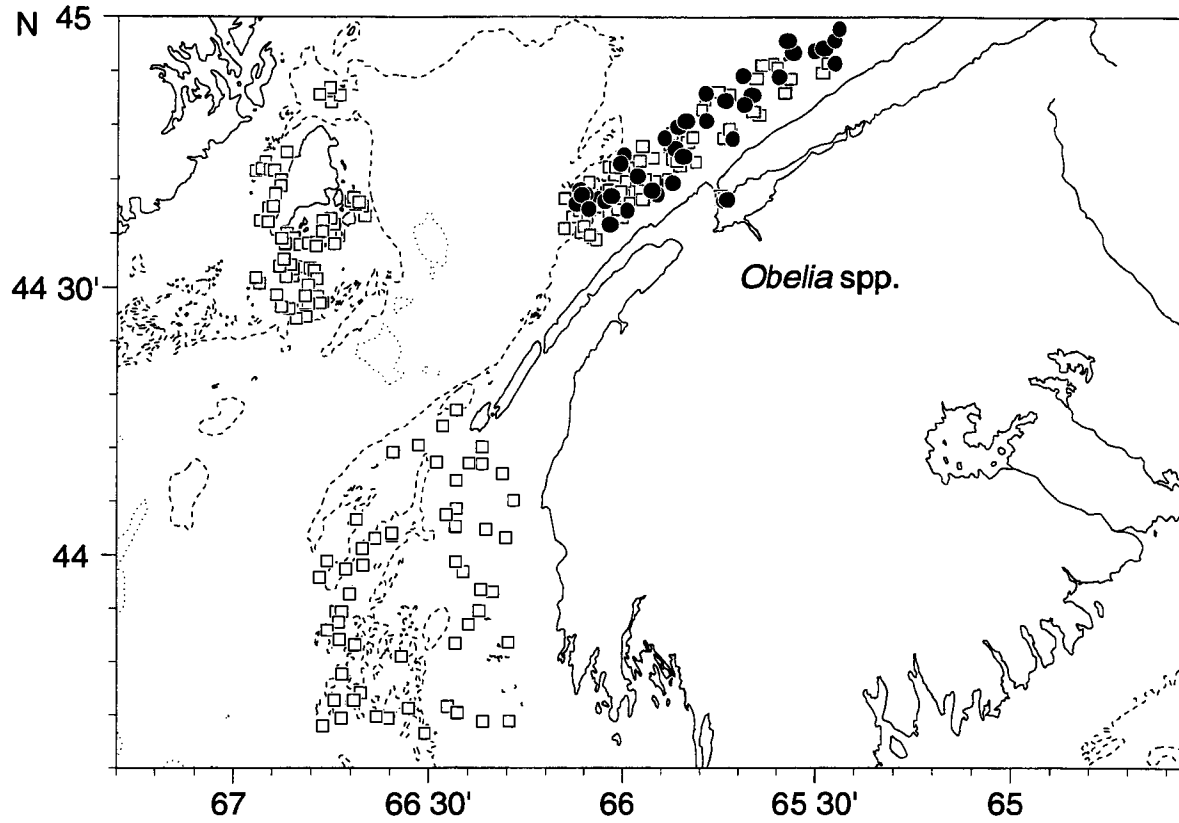


Figure 2 cont'd. Distribution of representatives of the Phylum Coelenterata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

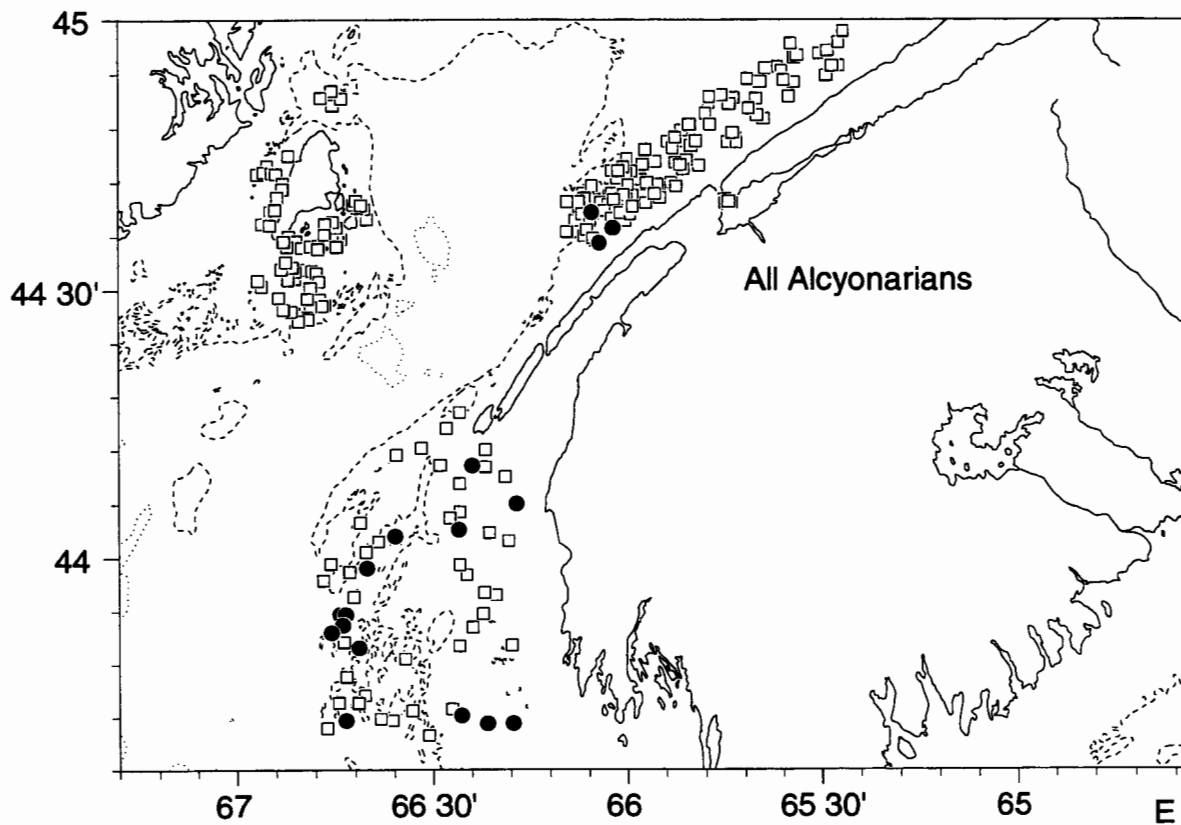
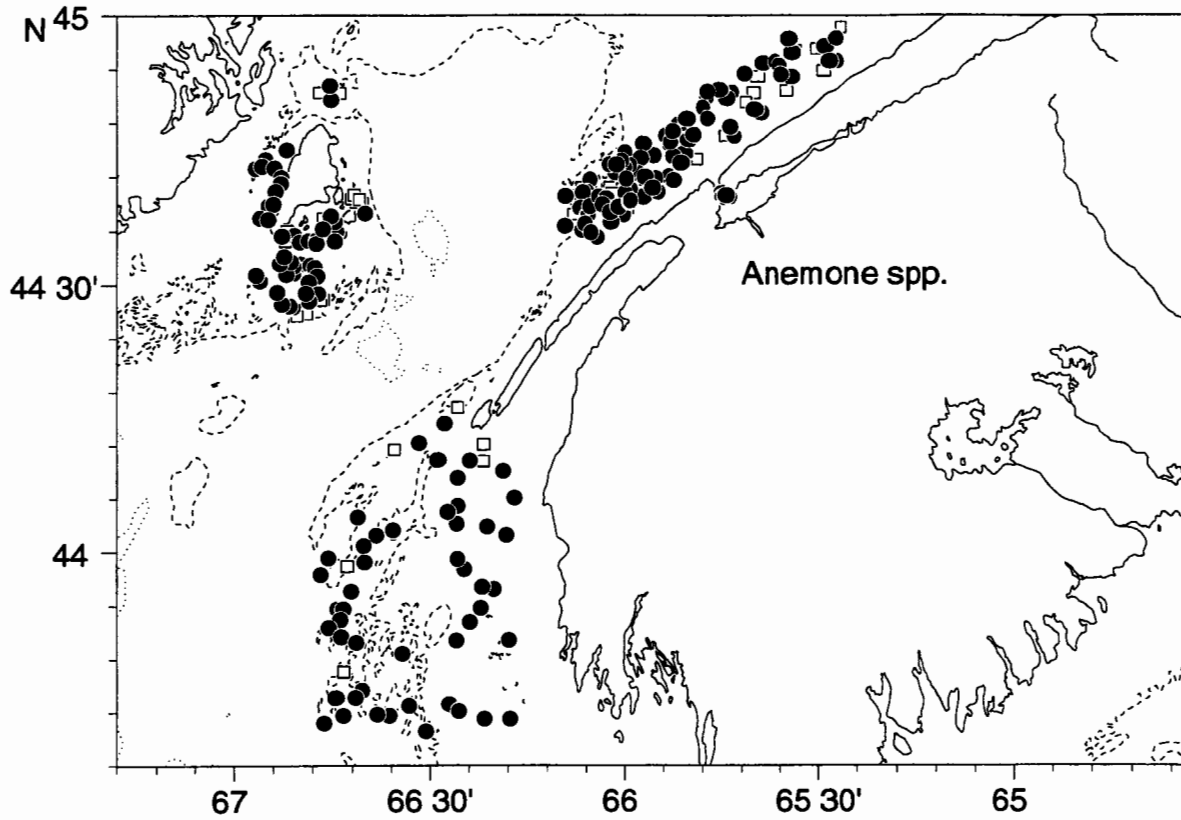


Figure 2 cont'd. Distribution of representatives of the Phylum Coelenterata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

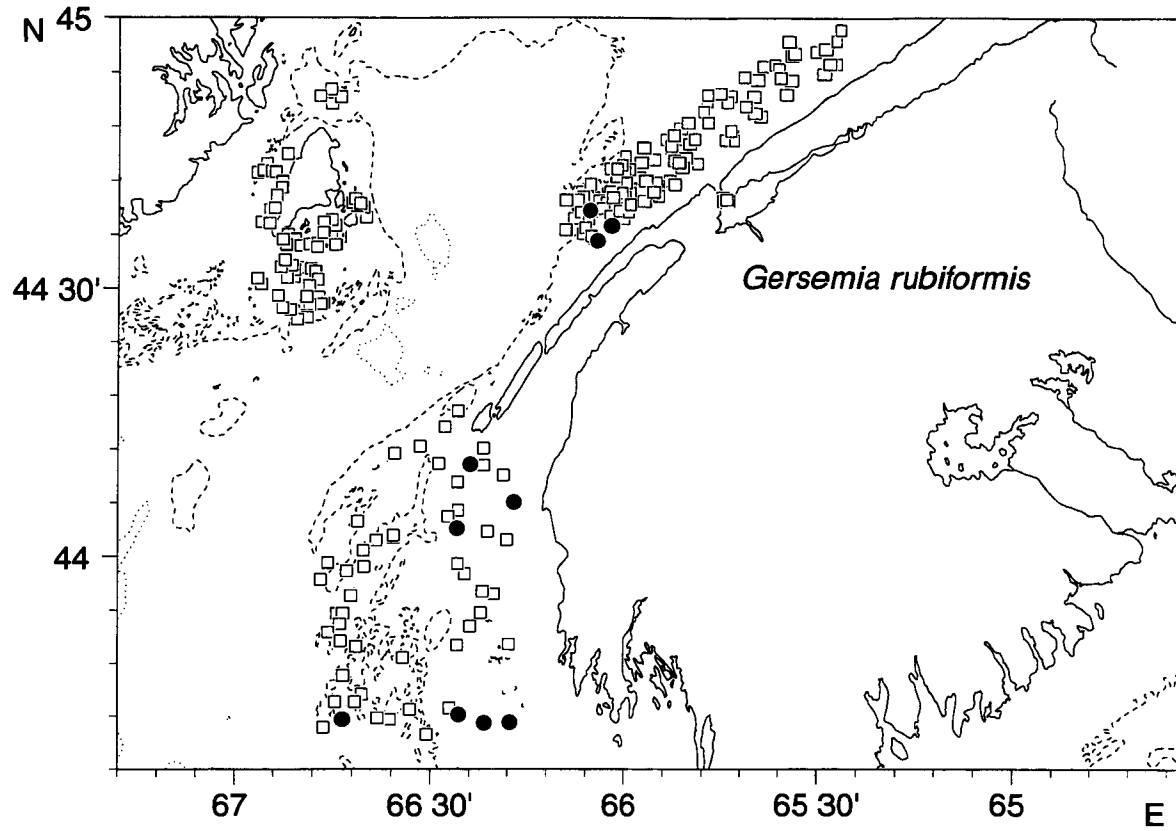


Figure 2 cont'd. Distribution of representatives of the Phylum Coelenterata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

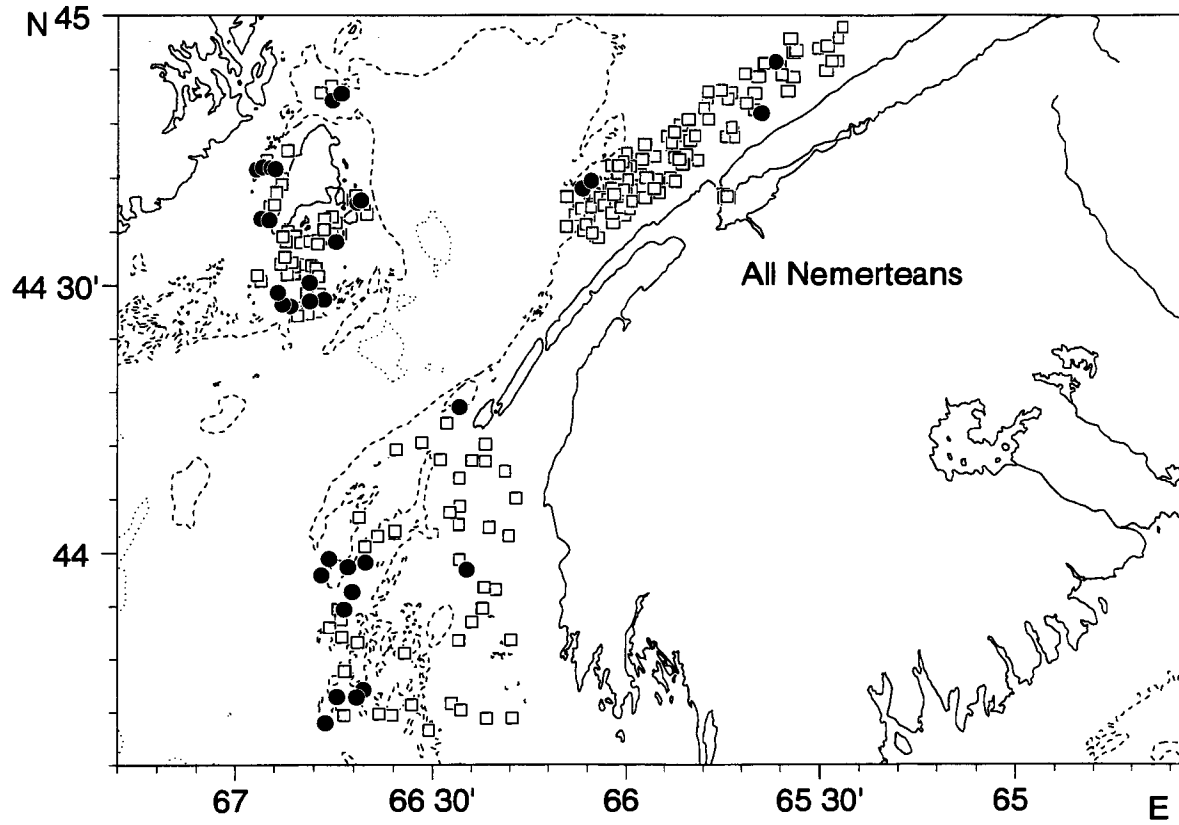


Figure 3. Distribution of representatives of the Phylum Rhynchocoela in the Lower Bay of Fundy as recorded in Fuller et al. (1998).
● Denotes presence, □ Denotes absence

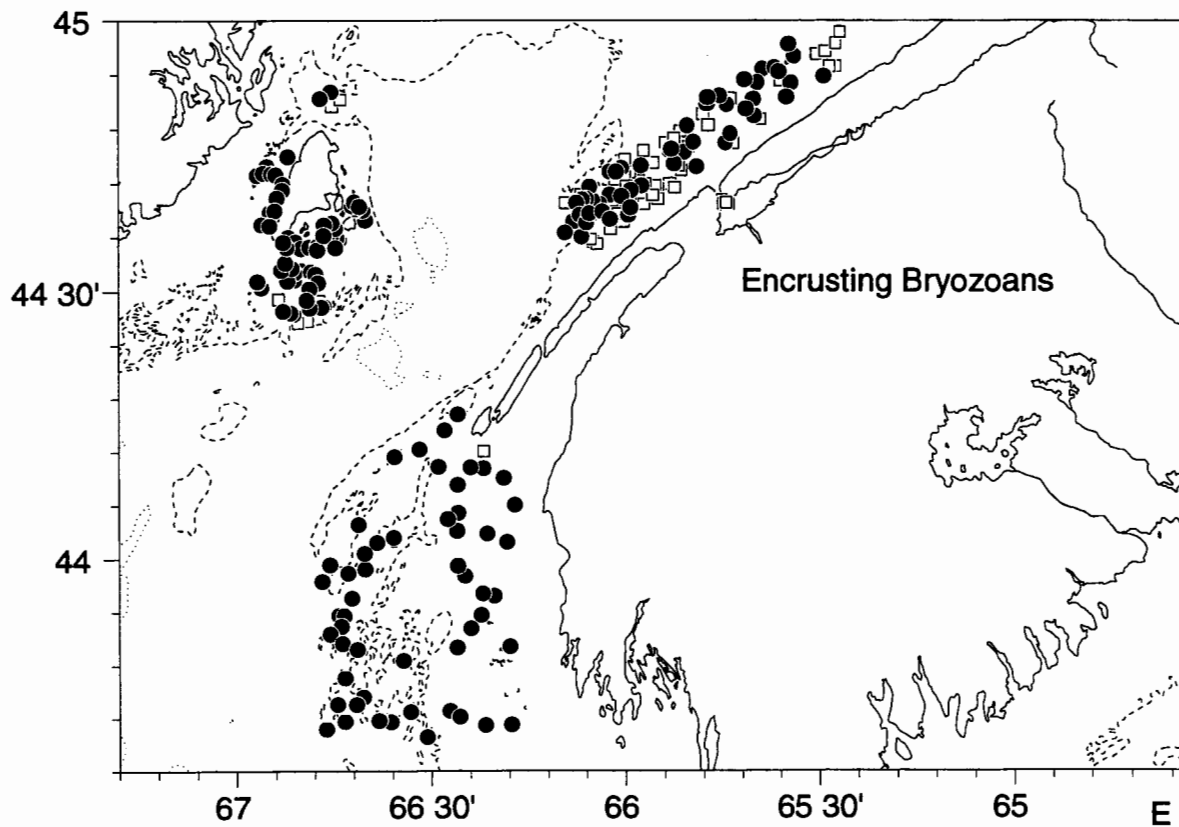
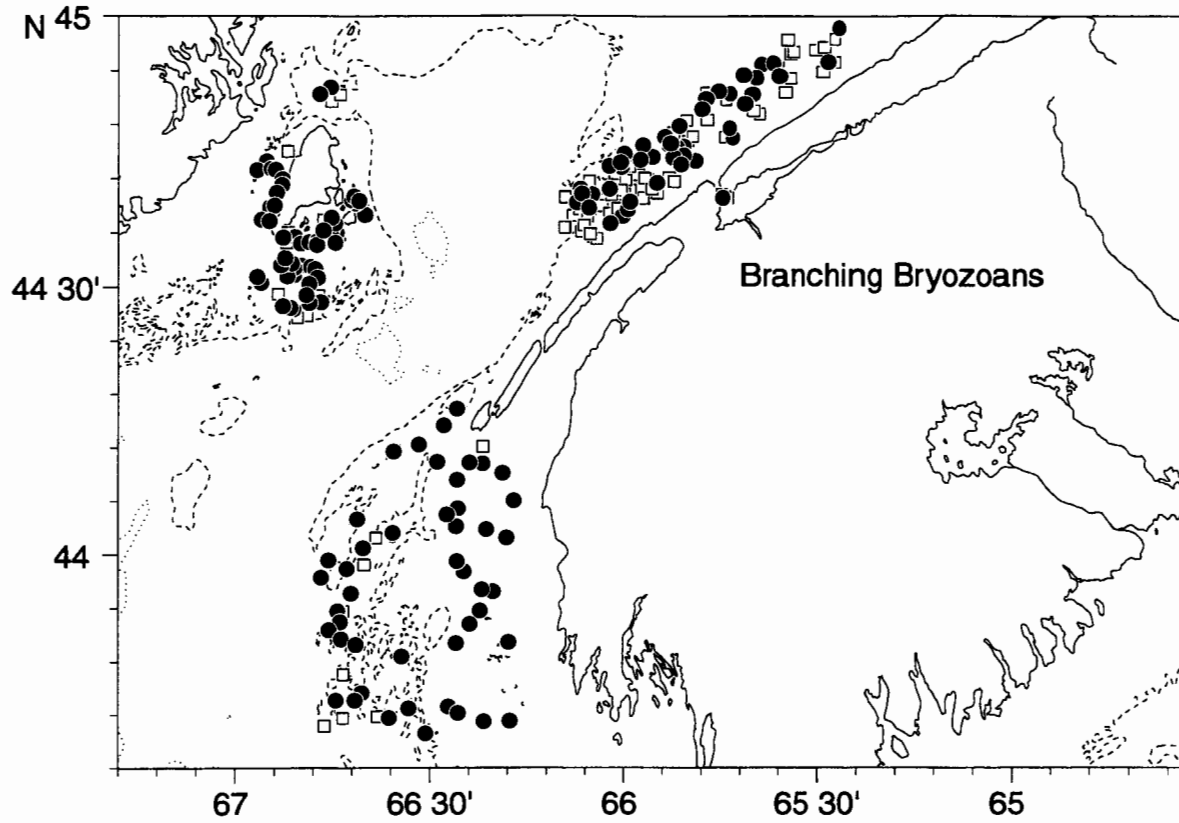


Figure 4. Distribution of representatives of the Phylum Bryozoa in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

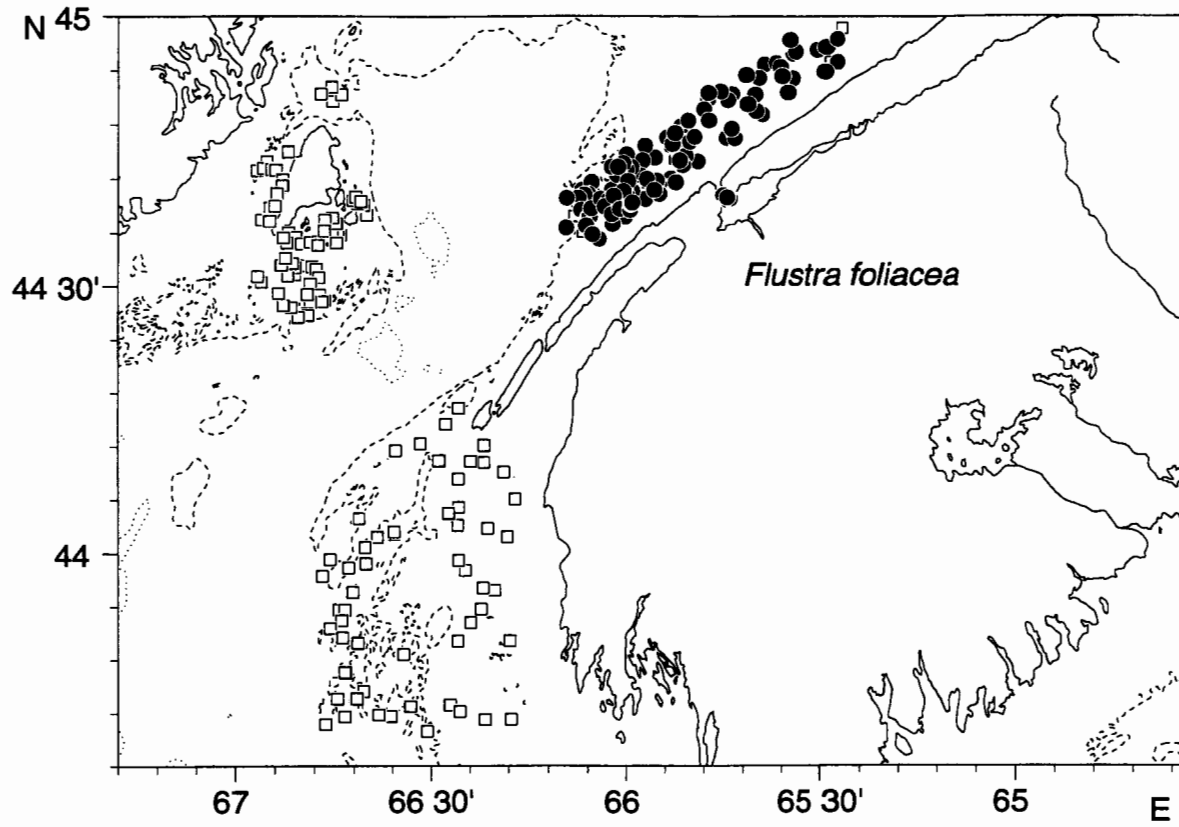


Figure 4 cont'd. Distribution of representatives of the Phylum Bryozoa in the Lower Bay of Fundy as recorded in Fuller et al. (1998).
● Denotes presence, □ Denotes absence

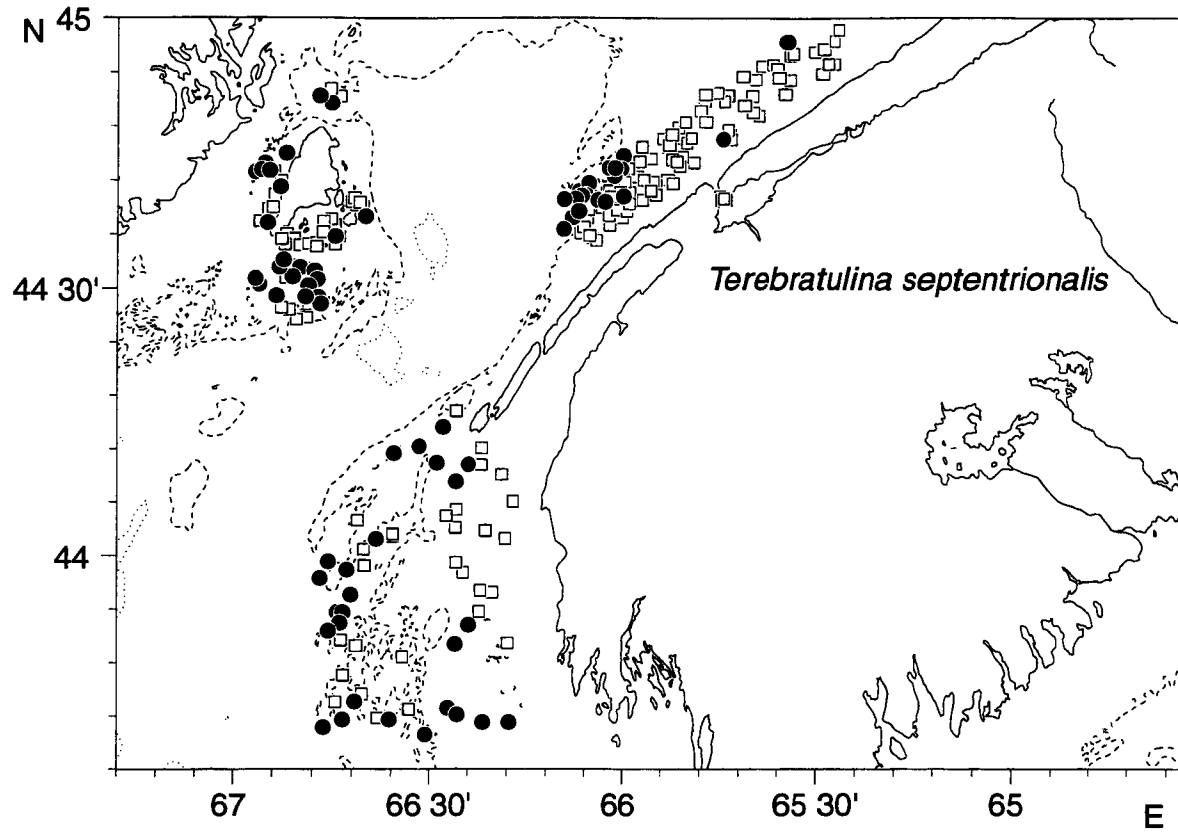


Figure 5. Distribution of representatives of the Phylum Brachiopoda in the Lower Bay of Fundy as recorded in Fuller et al. (1998).
● Denotes presence, □ Denotes absence

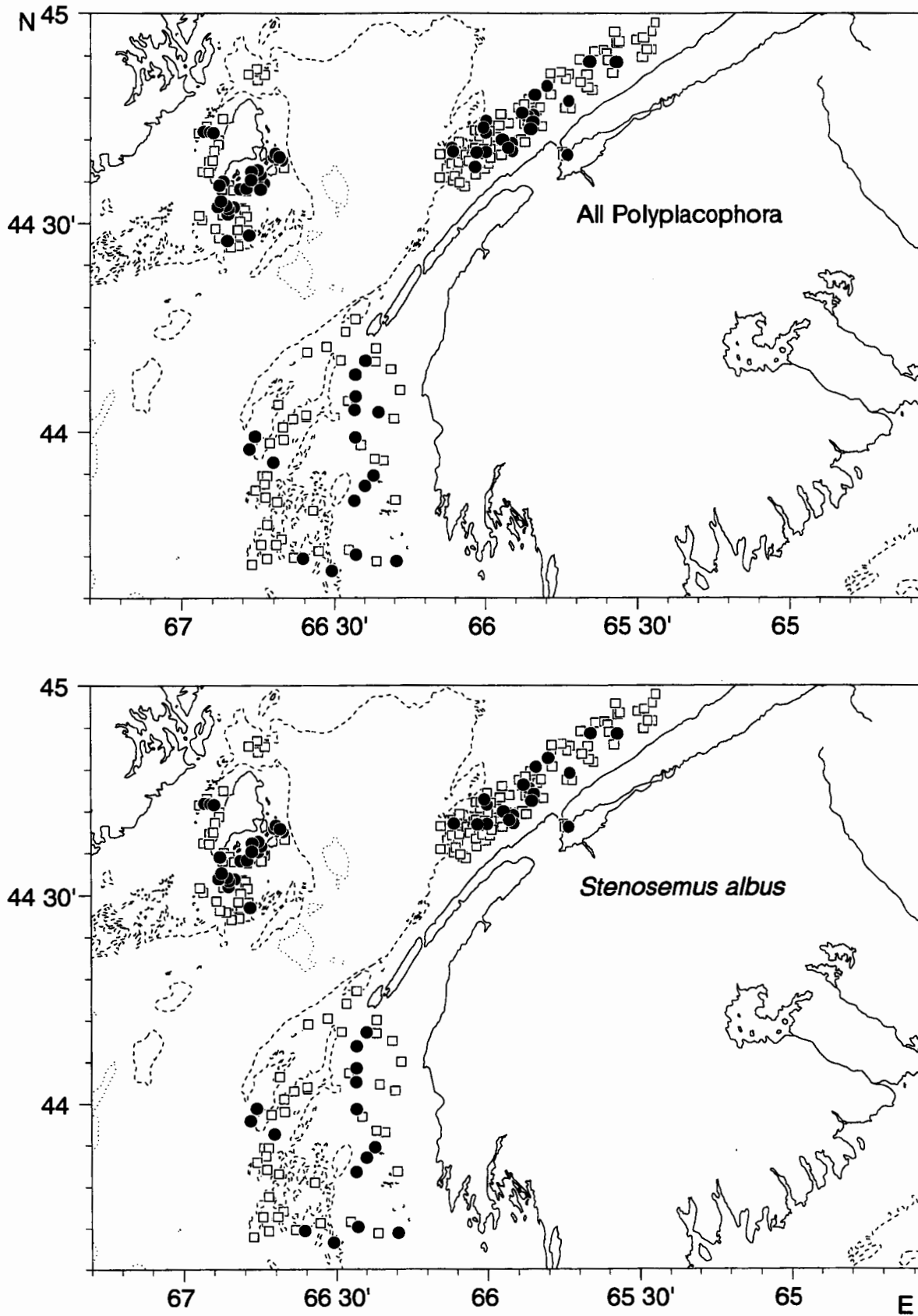


Figure 6. Distribution of representatives of the Phylum Mollusca in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

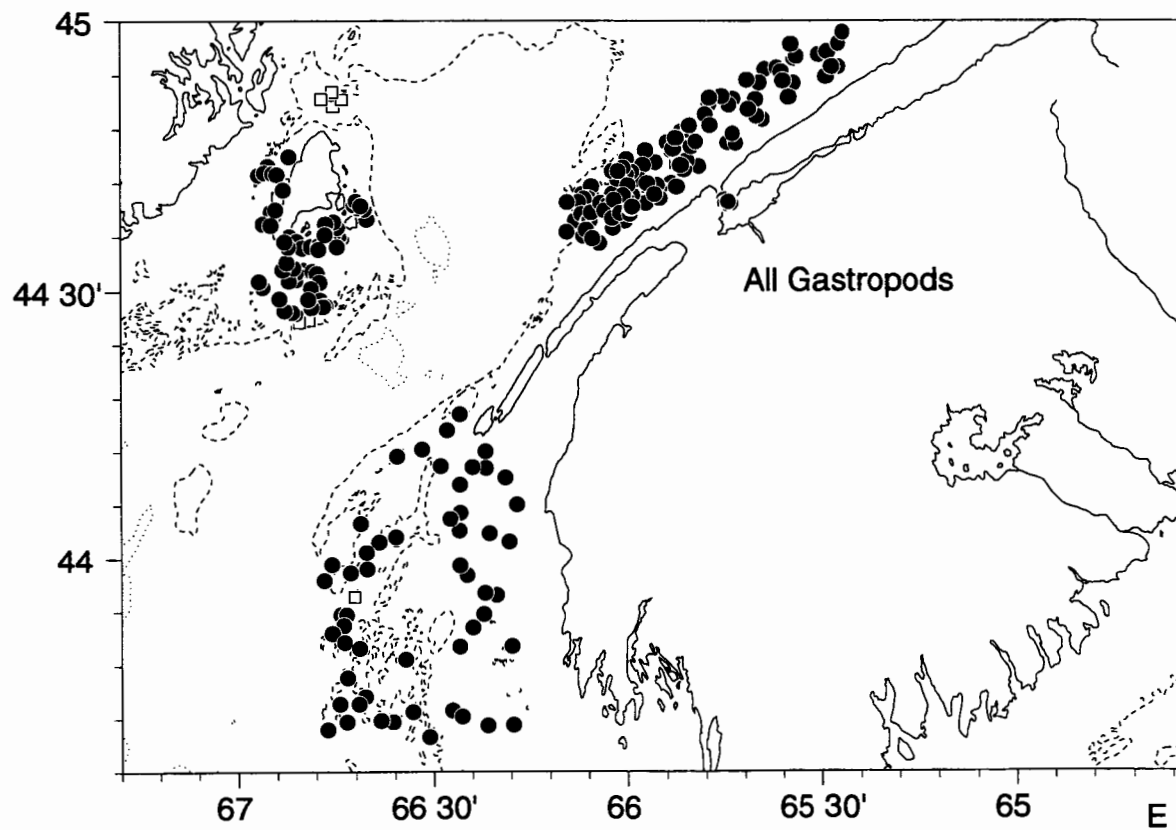
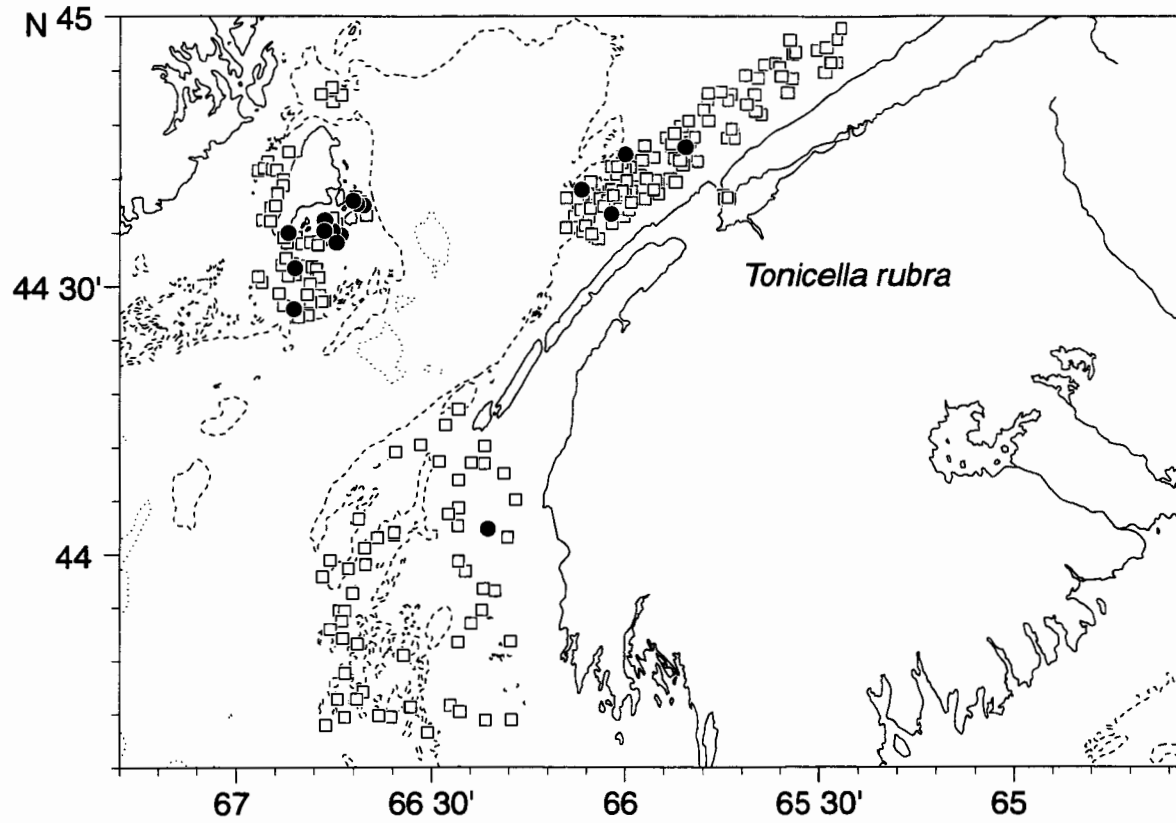


Figure 6 cont'd. Distribution of representatives of the Phylum Mollusca in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

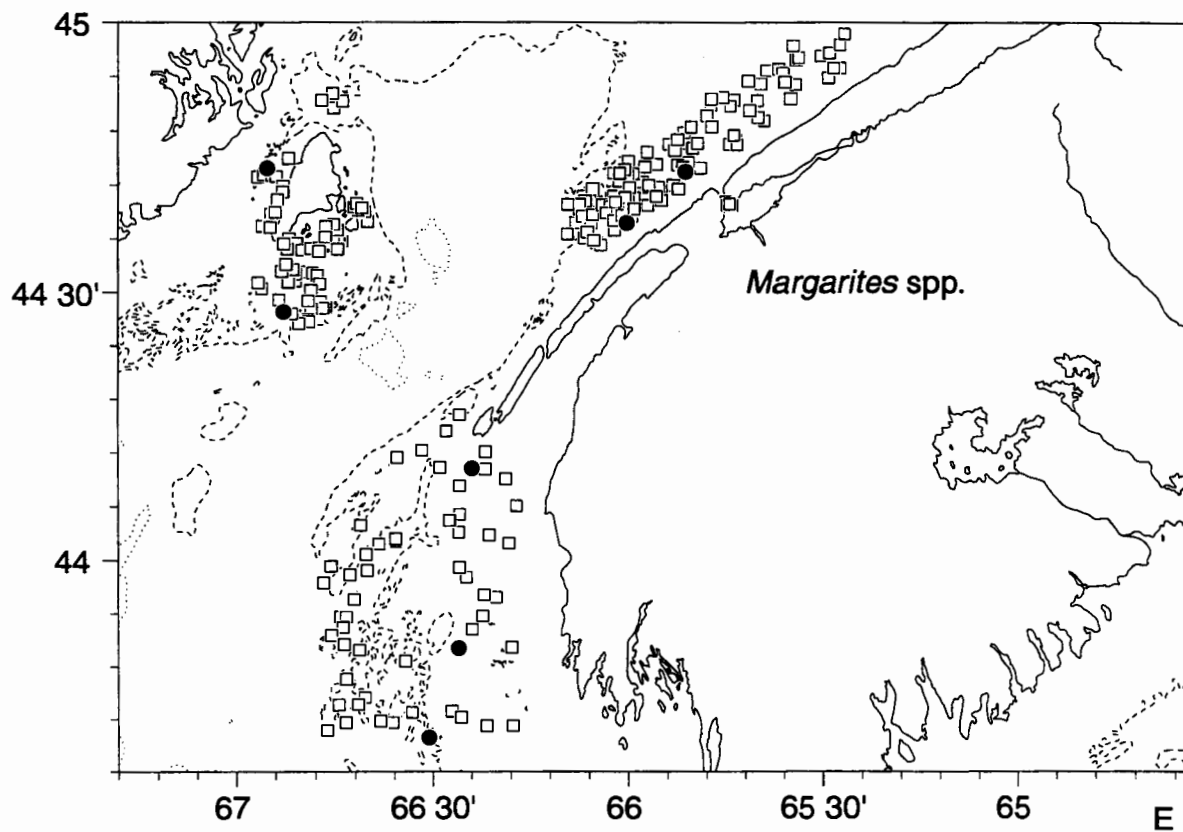
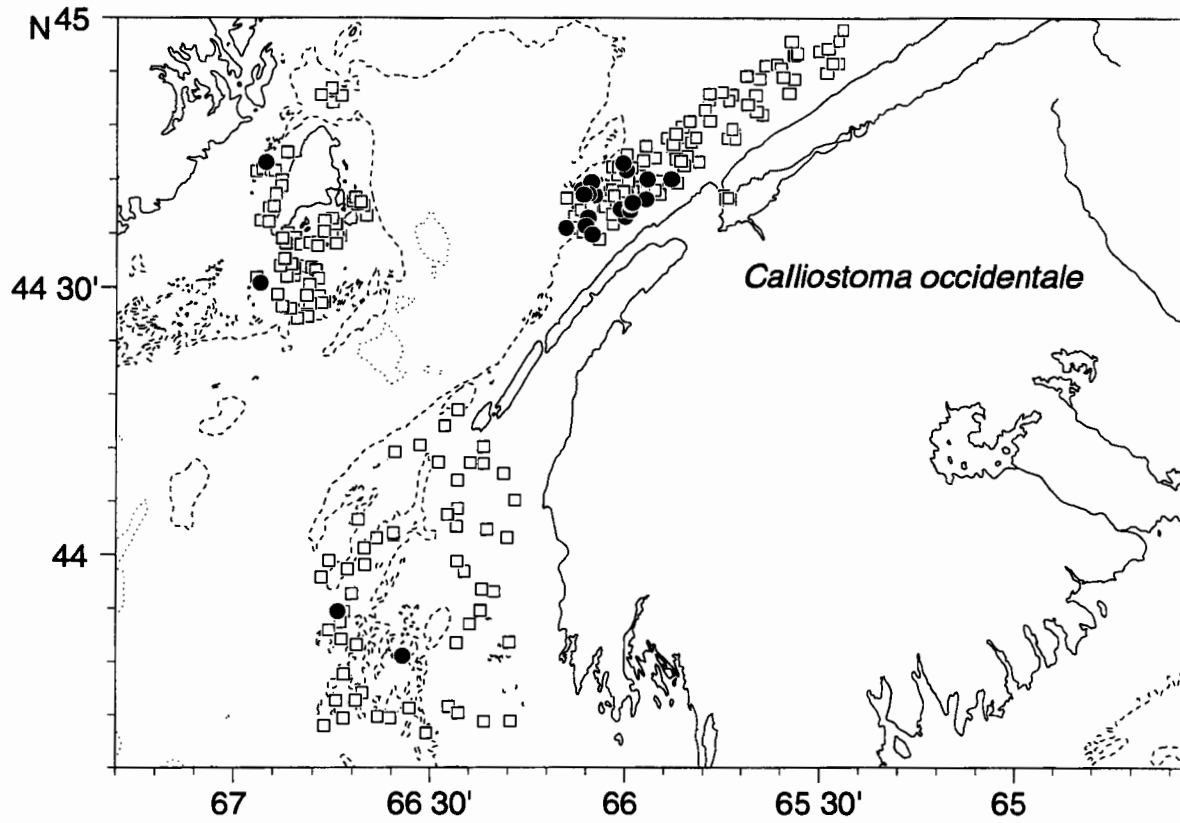


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● Denotes presence, □ Denotes absence

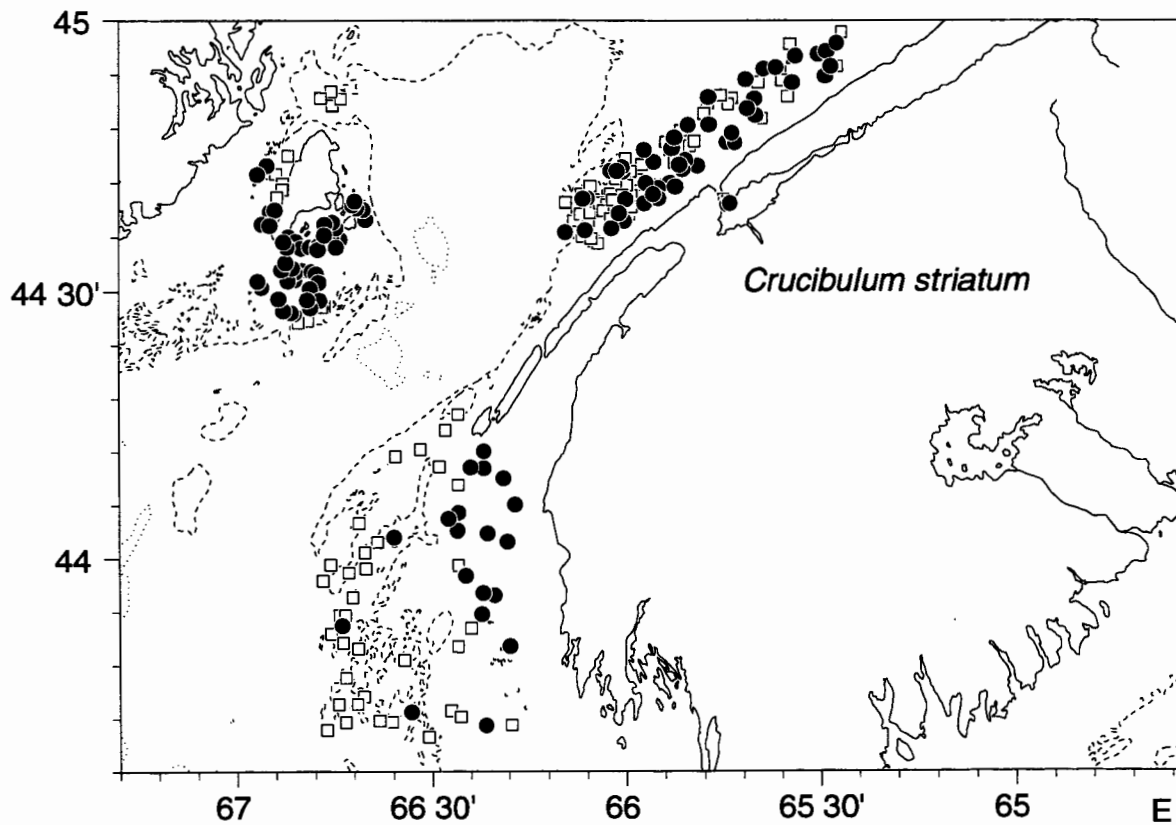
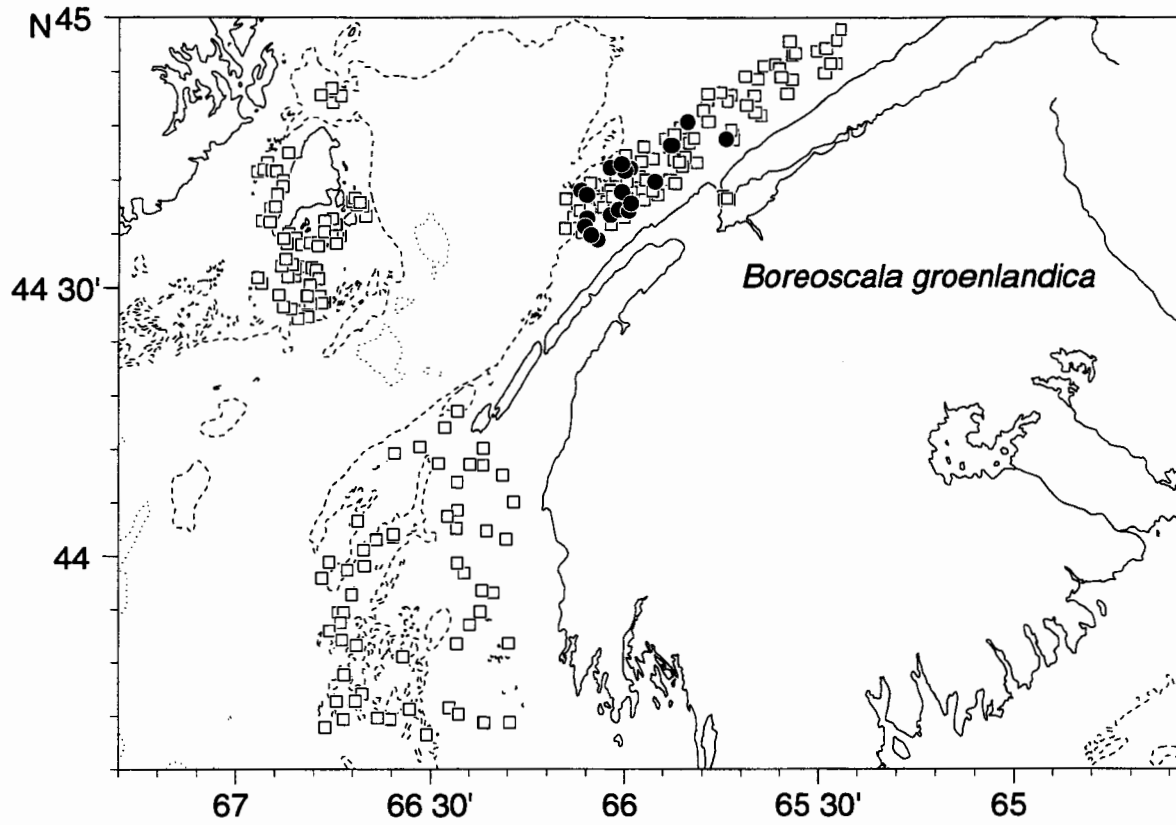


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● Denotes presence, □ Denotes absence

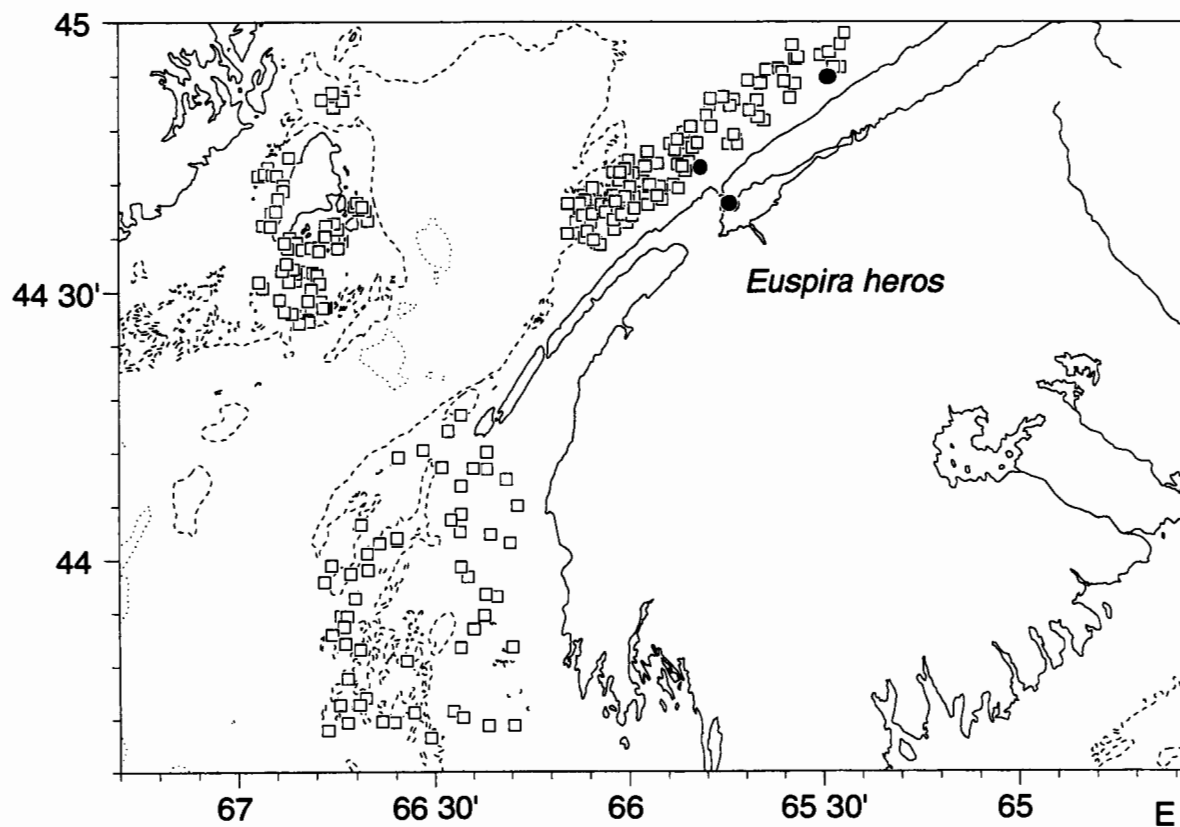
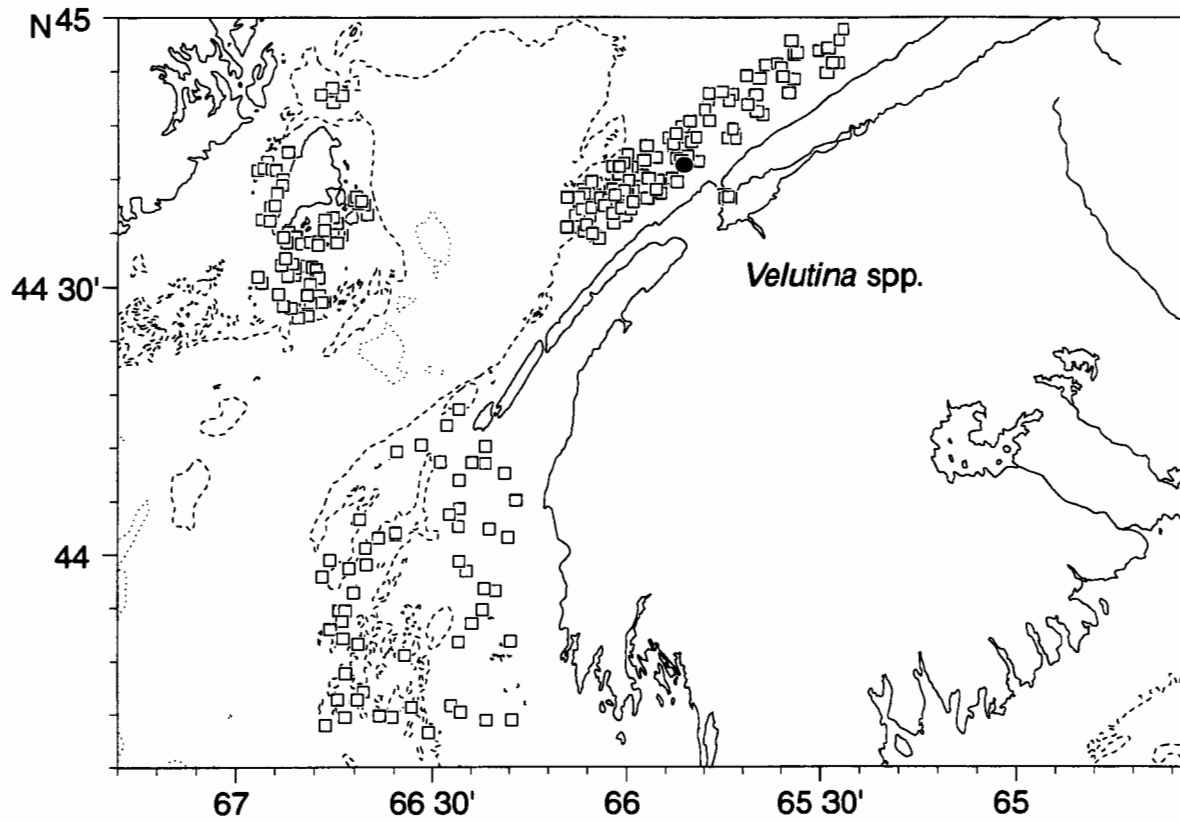


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● Denotes presence, □ Denotes absence

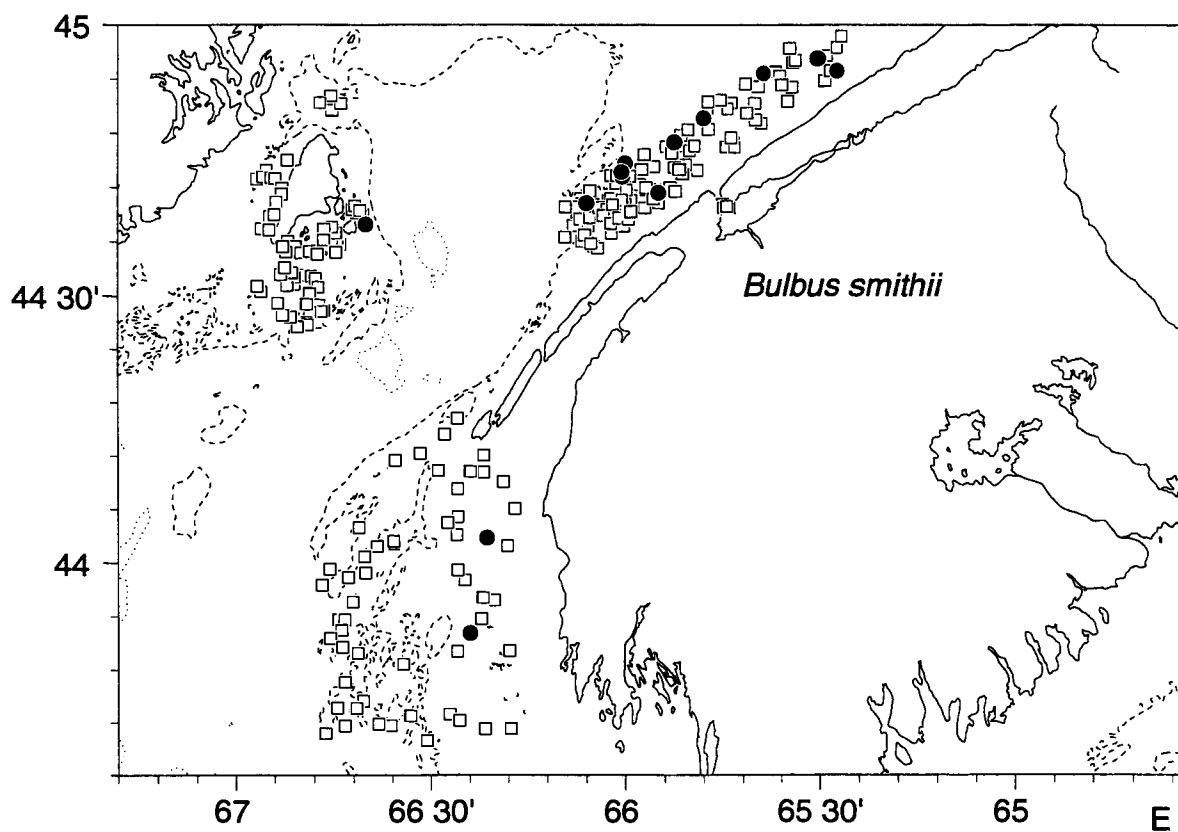
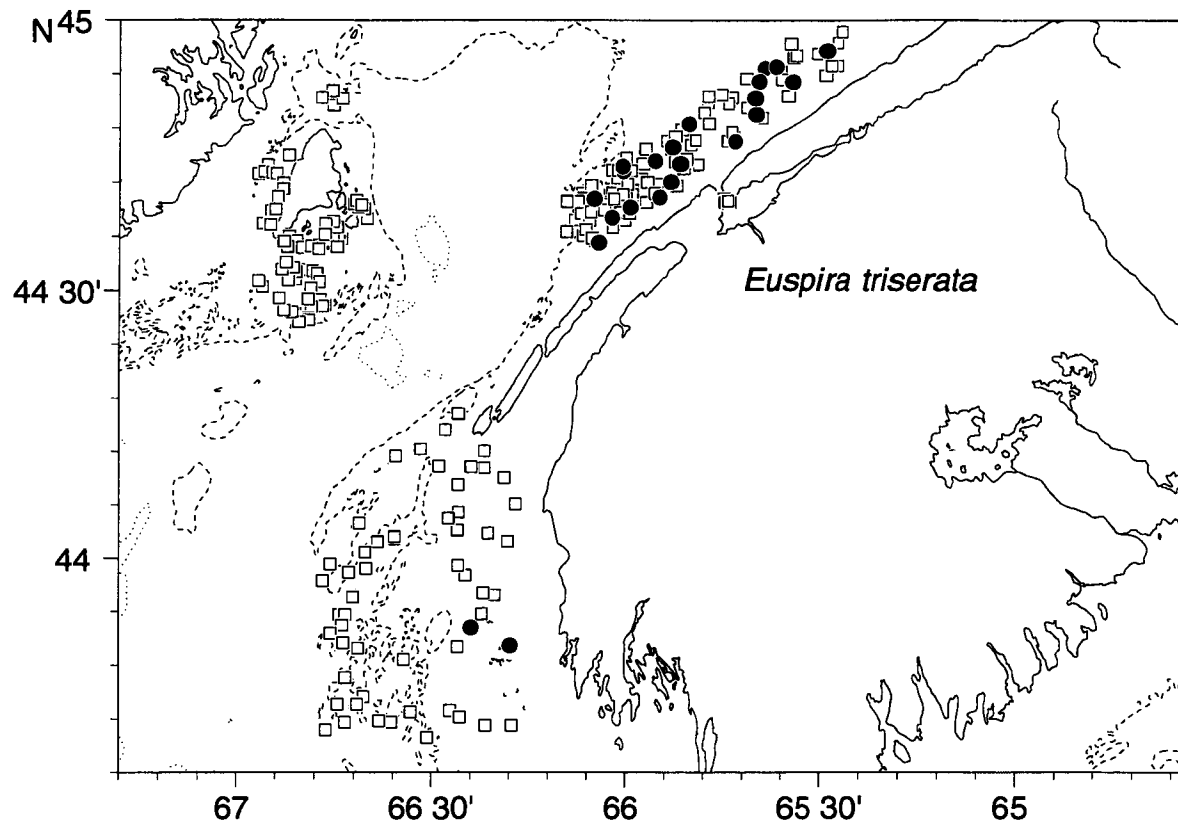


Figure 6 cont'd. Distribution of representatives of the Phylum Mollusca in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

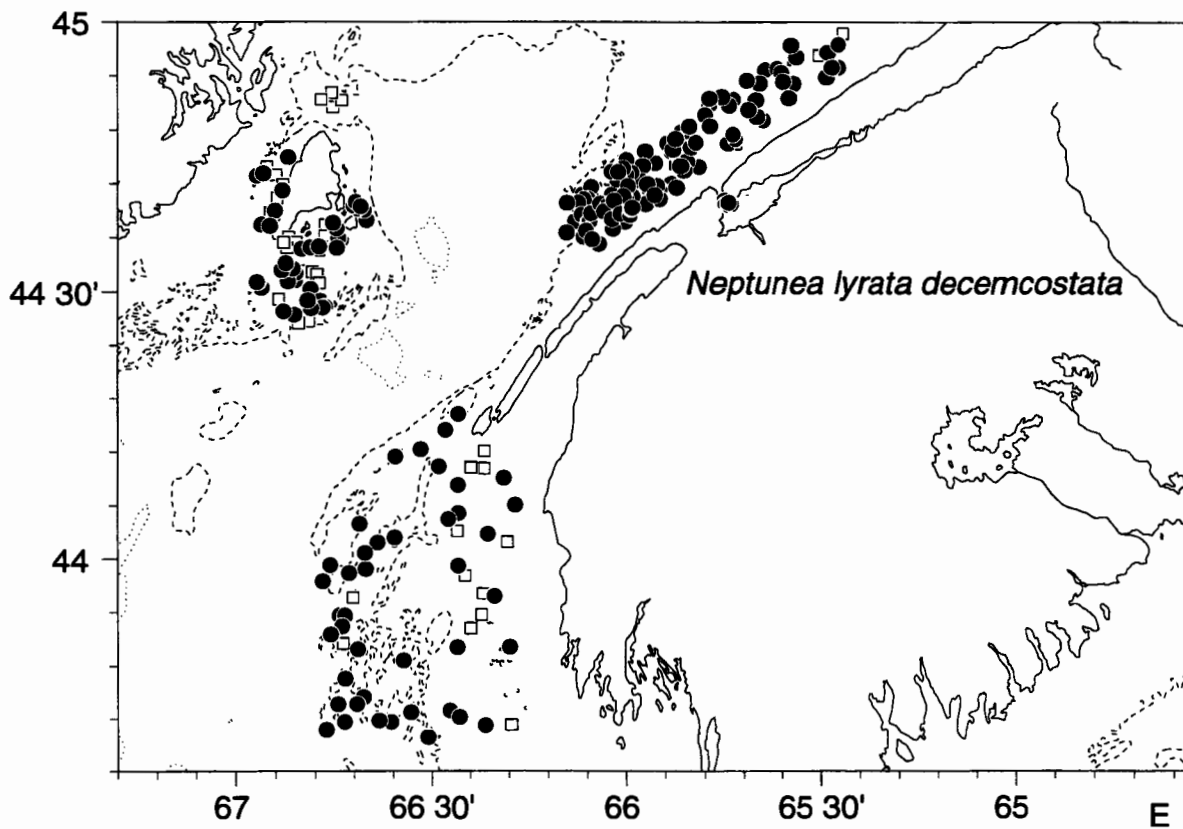
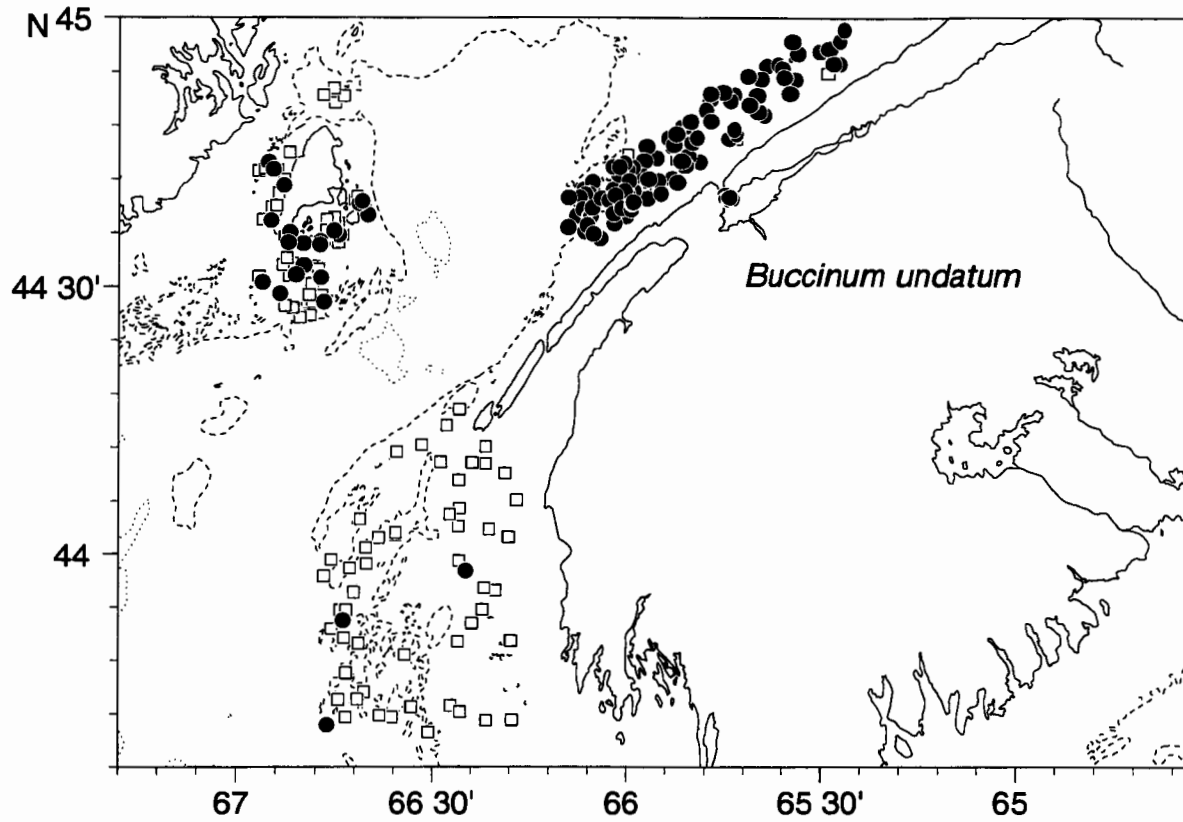


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● Denotes presence, □ Denotes absence

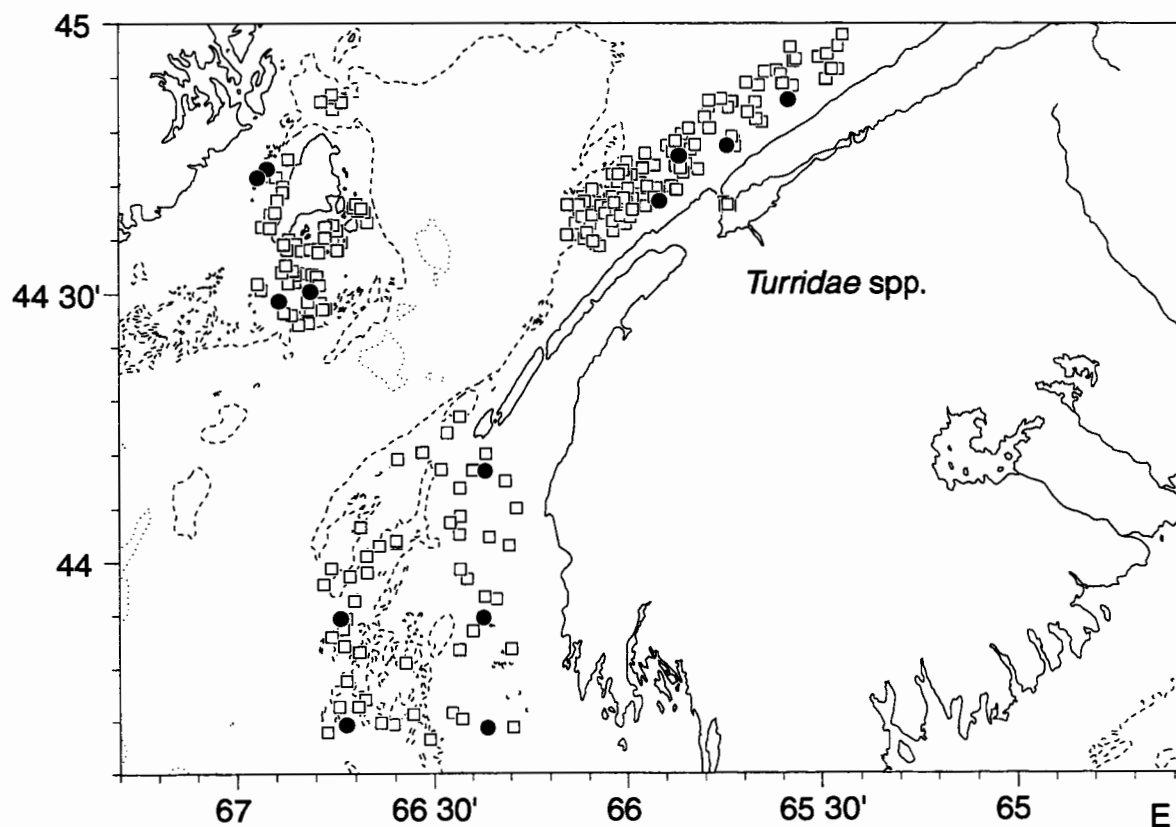
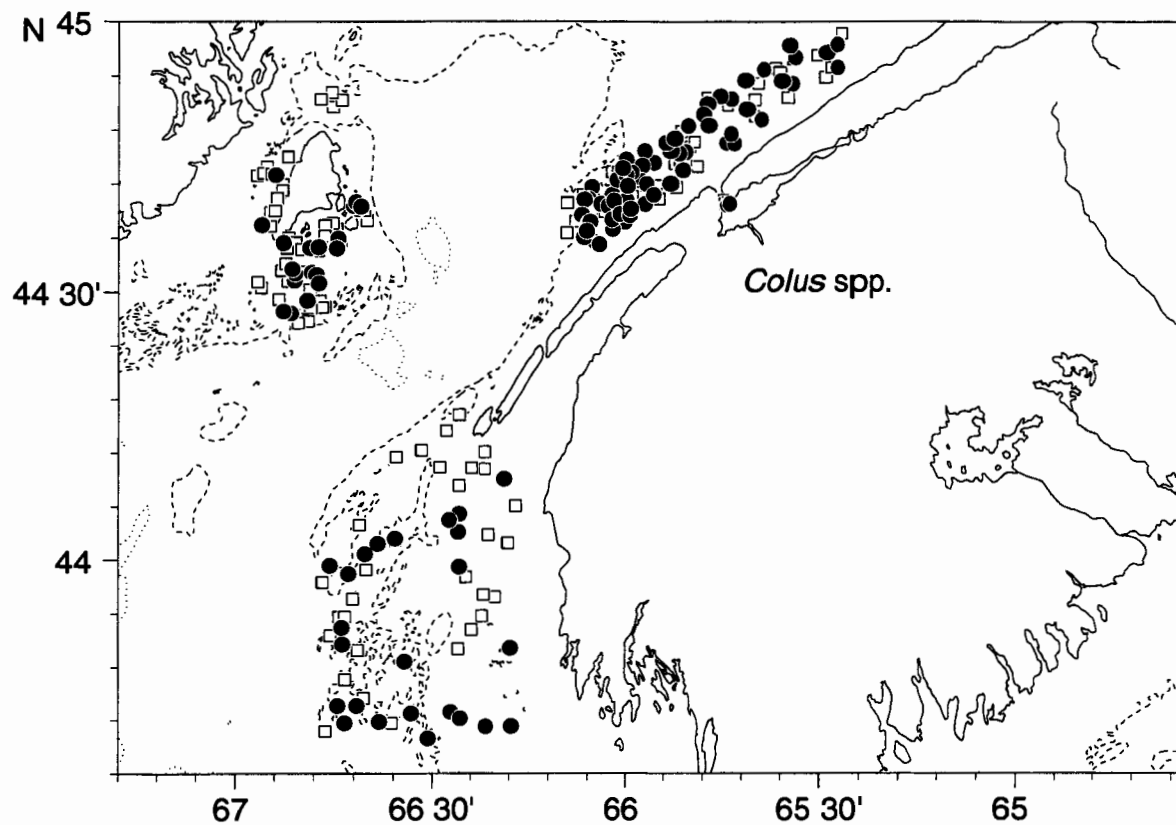


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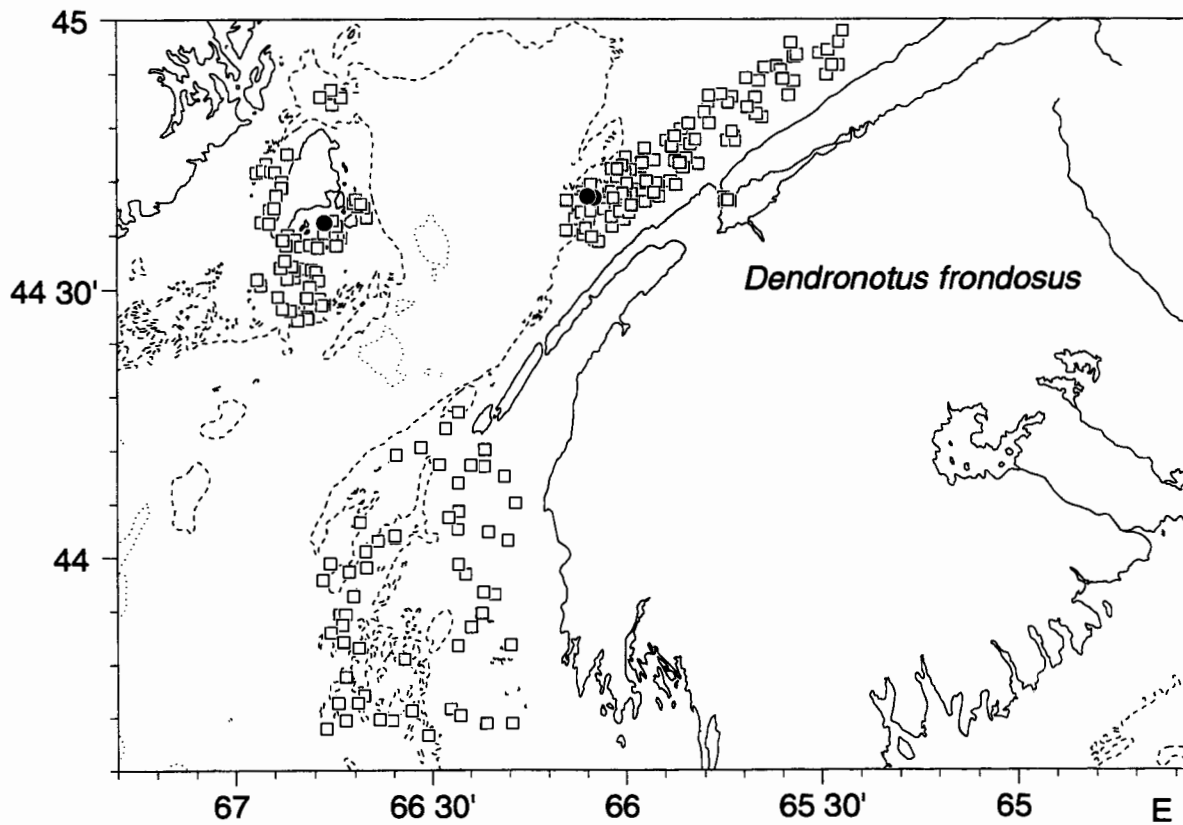
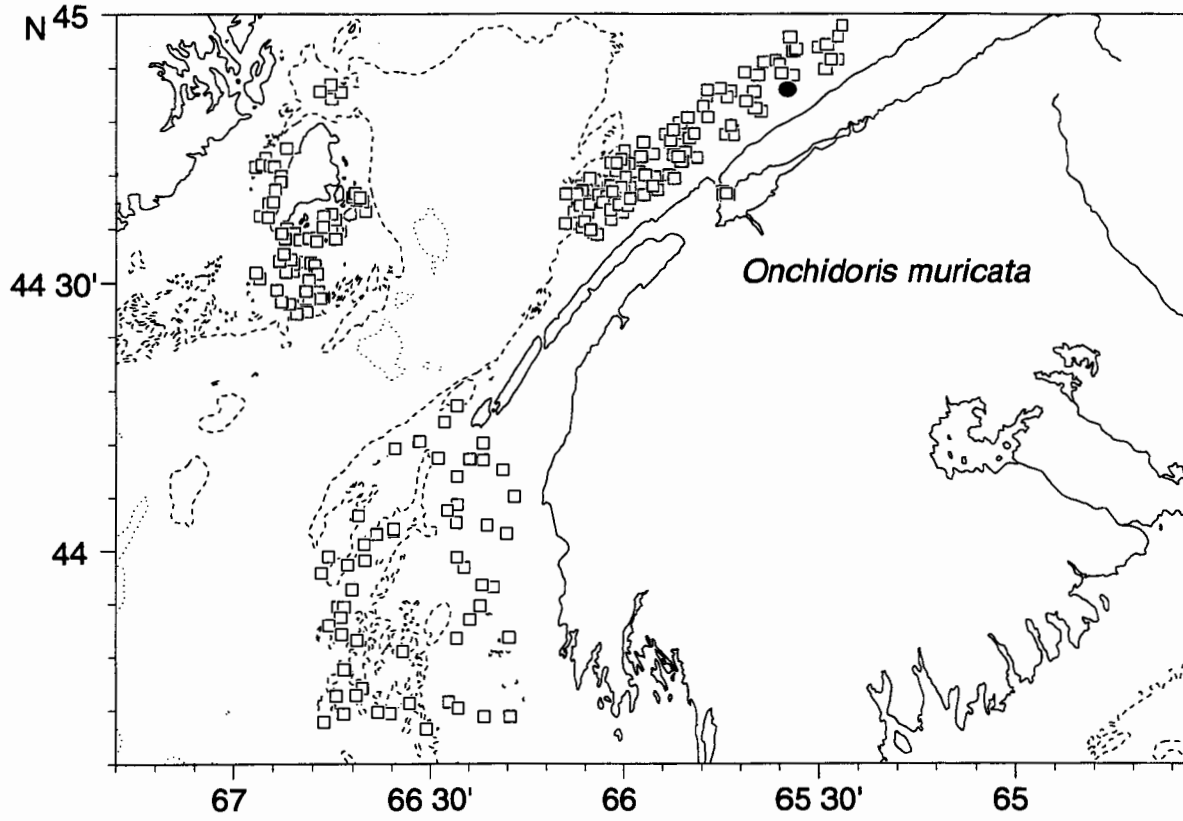


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● Denotes presence, □ Denotes absence

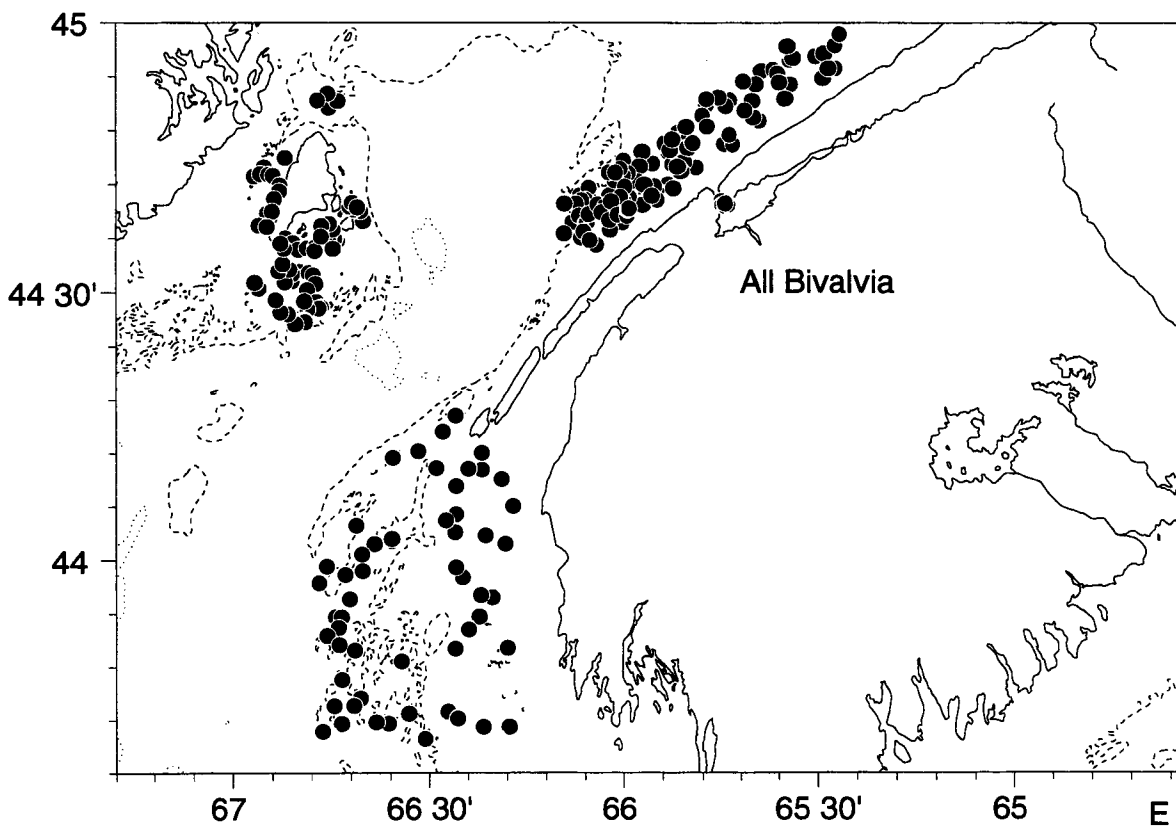
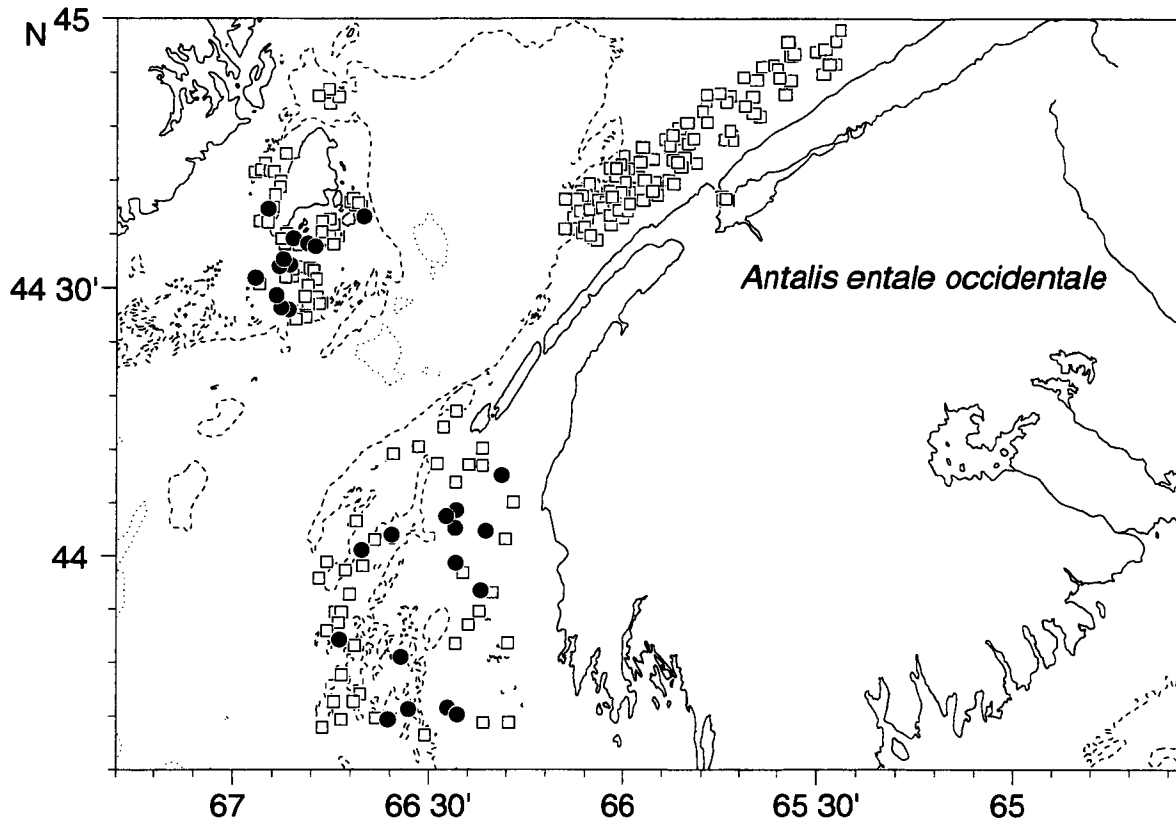


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● Denotes presence, □ Denotes absence

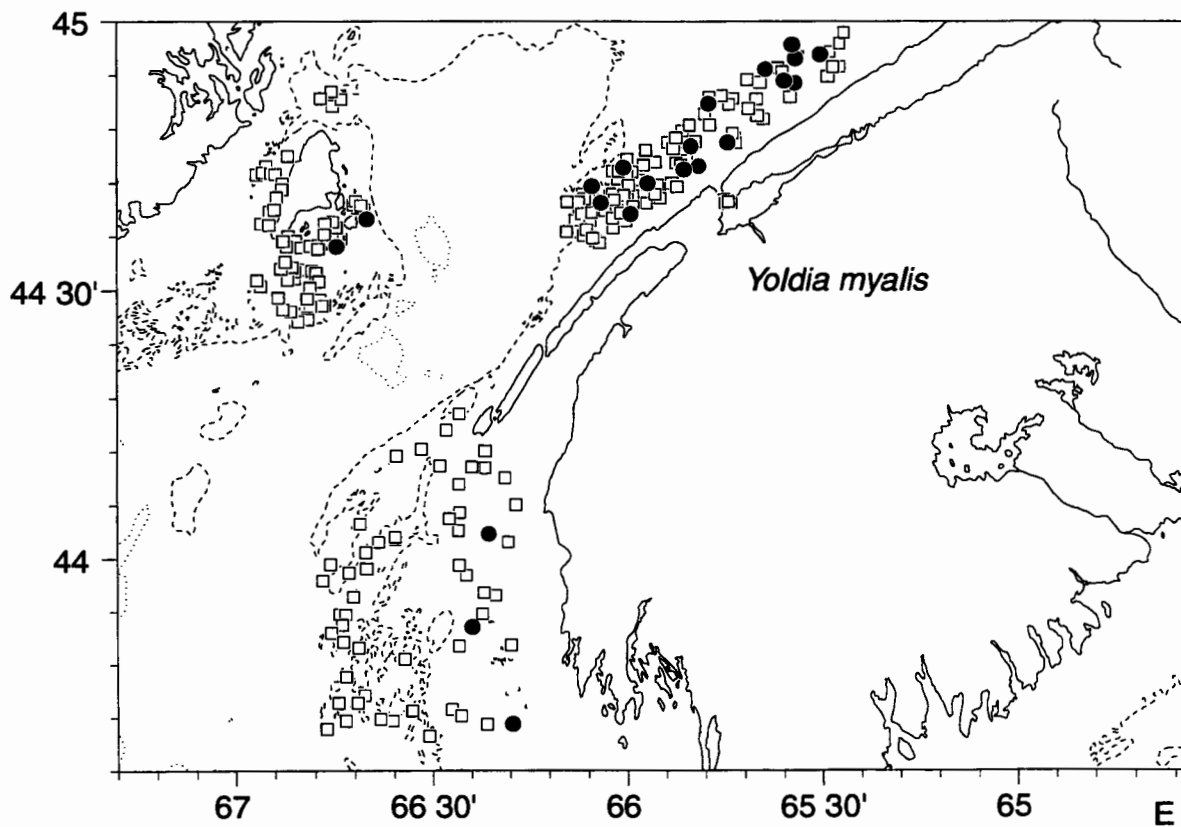
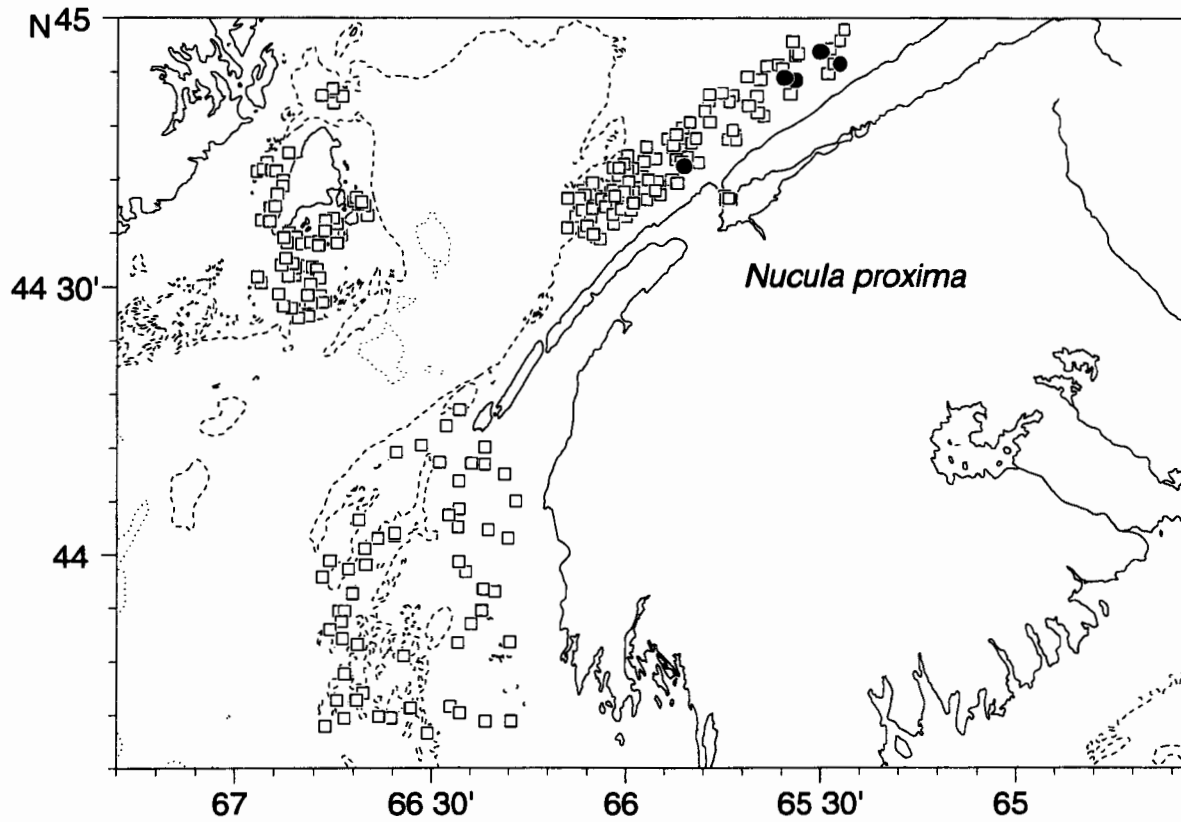


Figure 6 cont'd. Distribution of representatives of the Phylum Mollusca in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

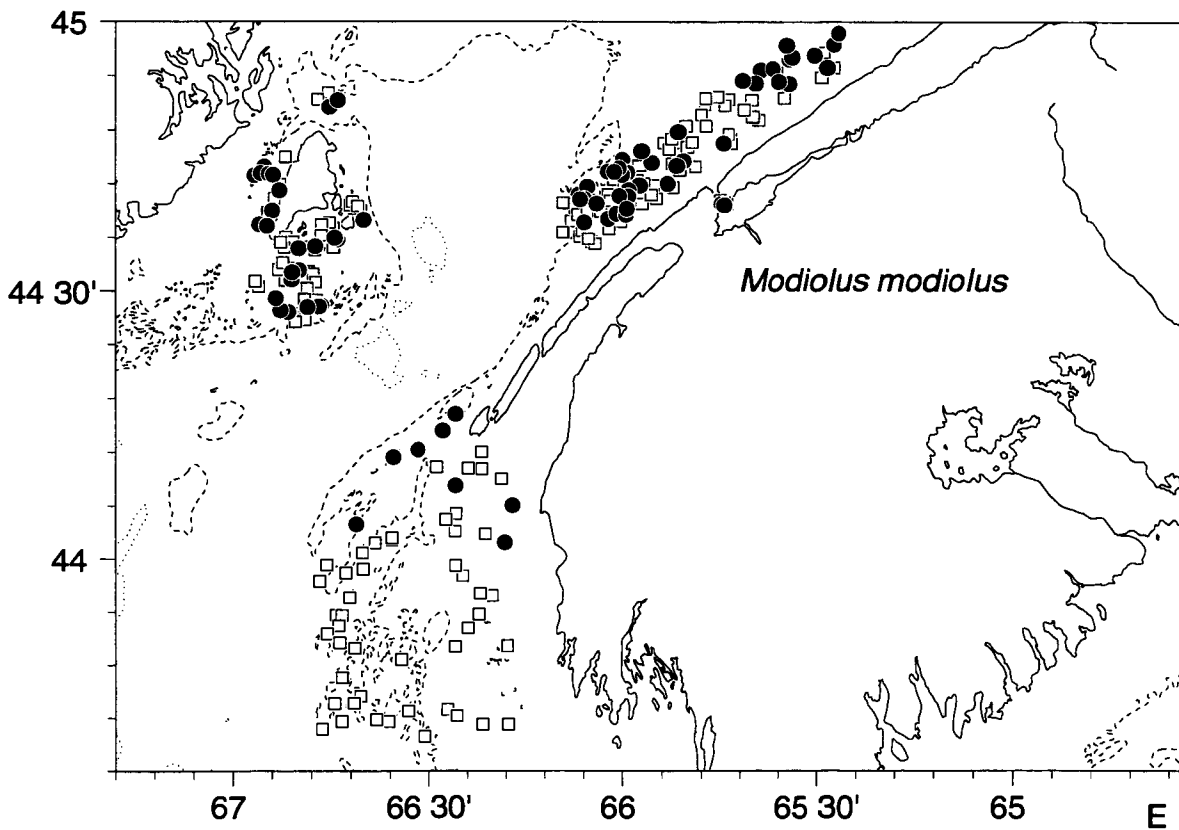
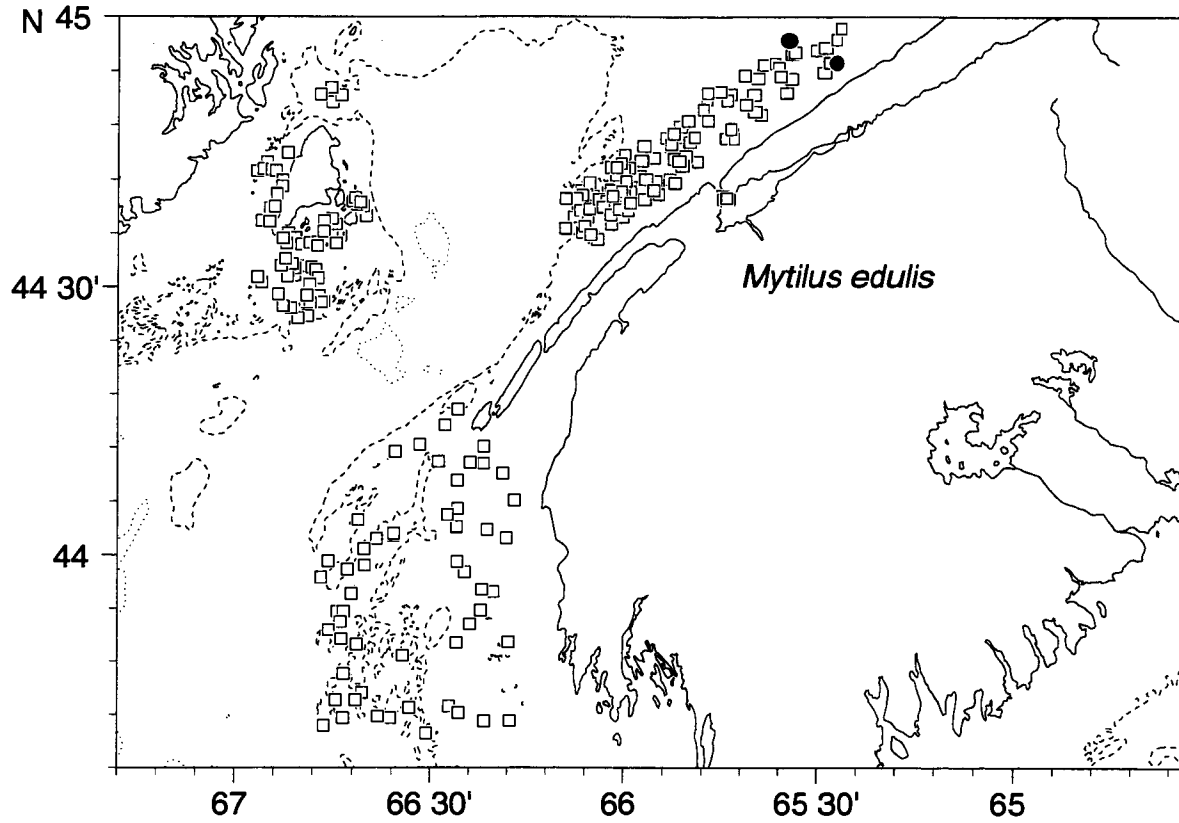


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● Denotes presence, □ Denotes absence

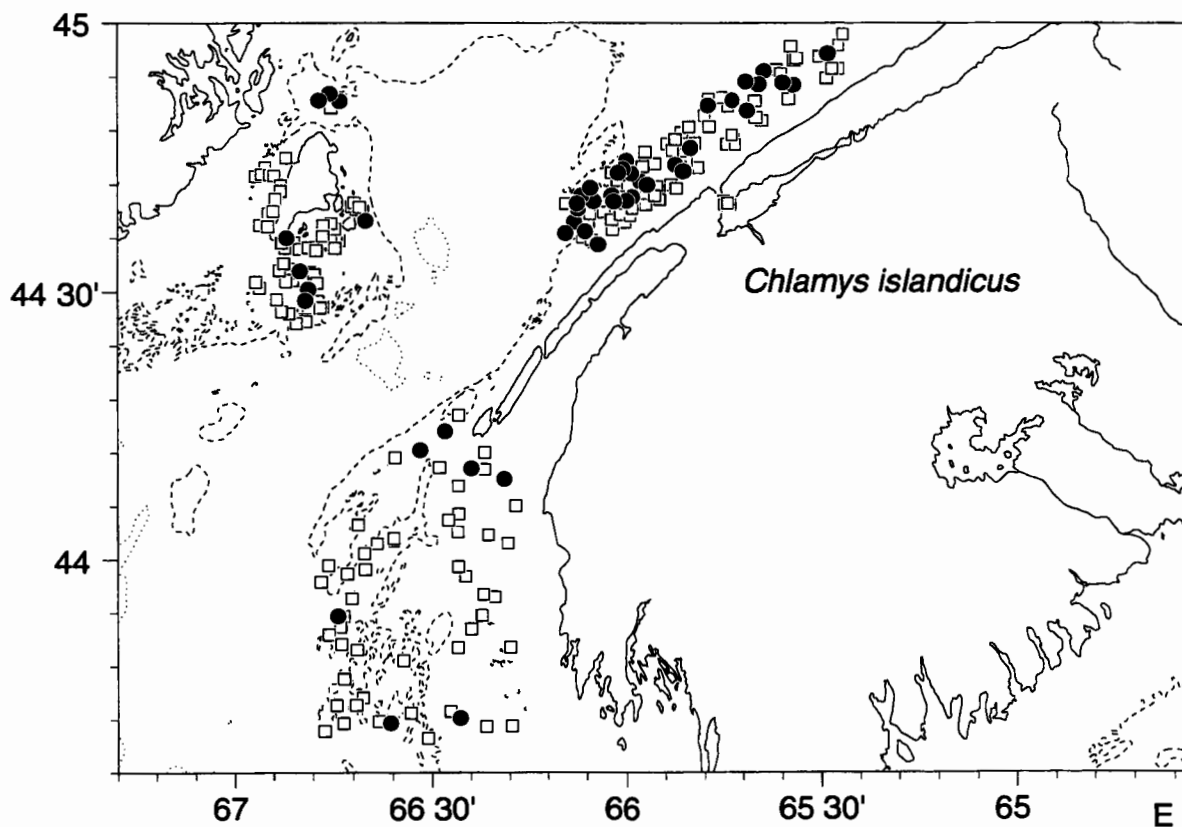
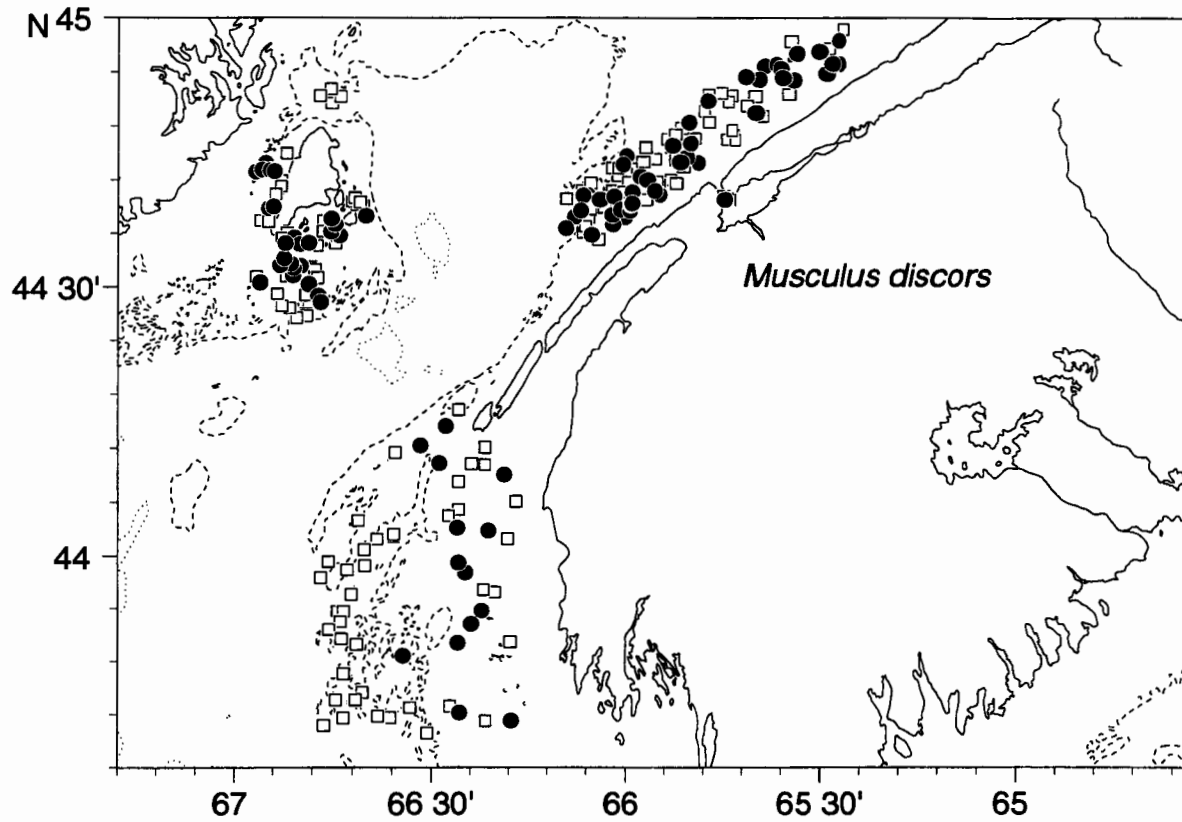


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● Denotes presence, □ Denotes absence

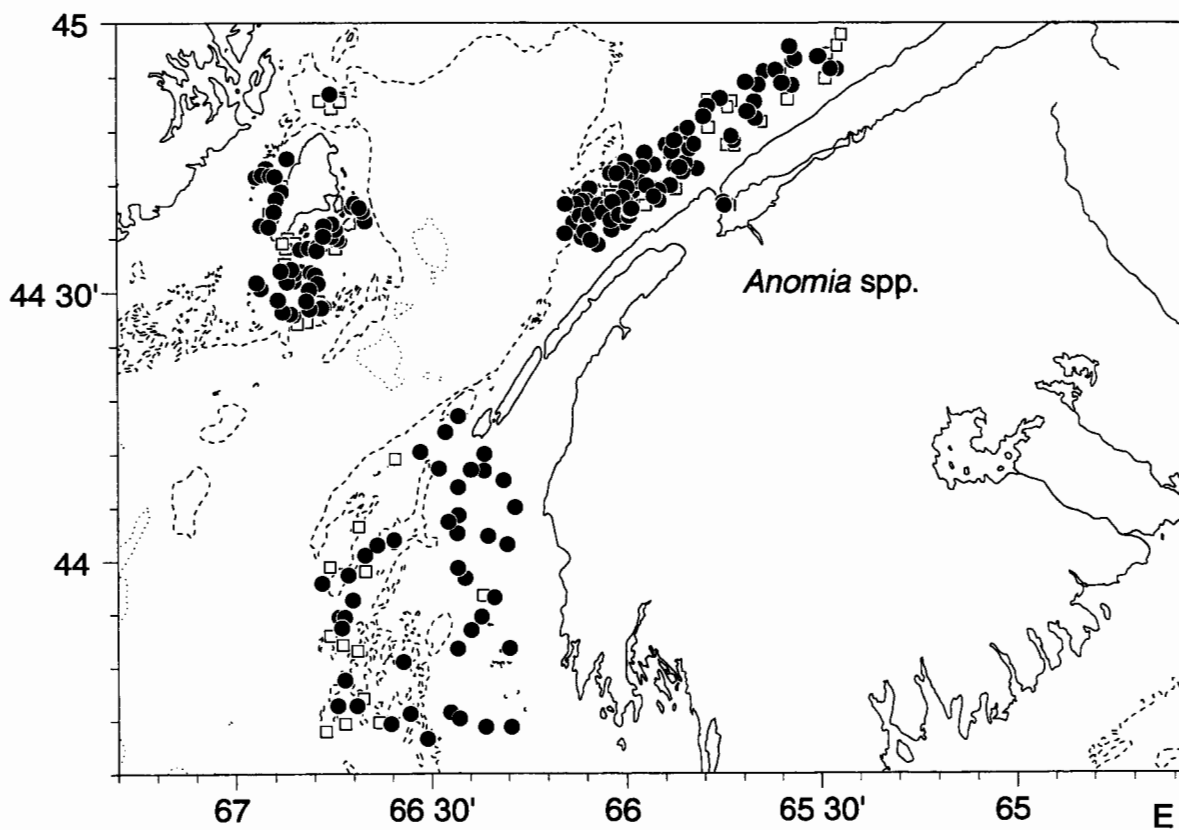
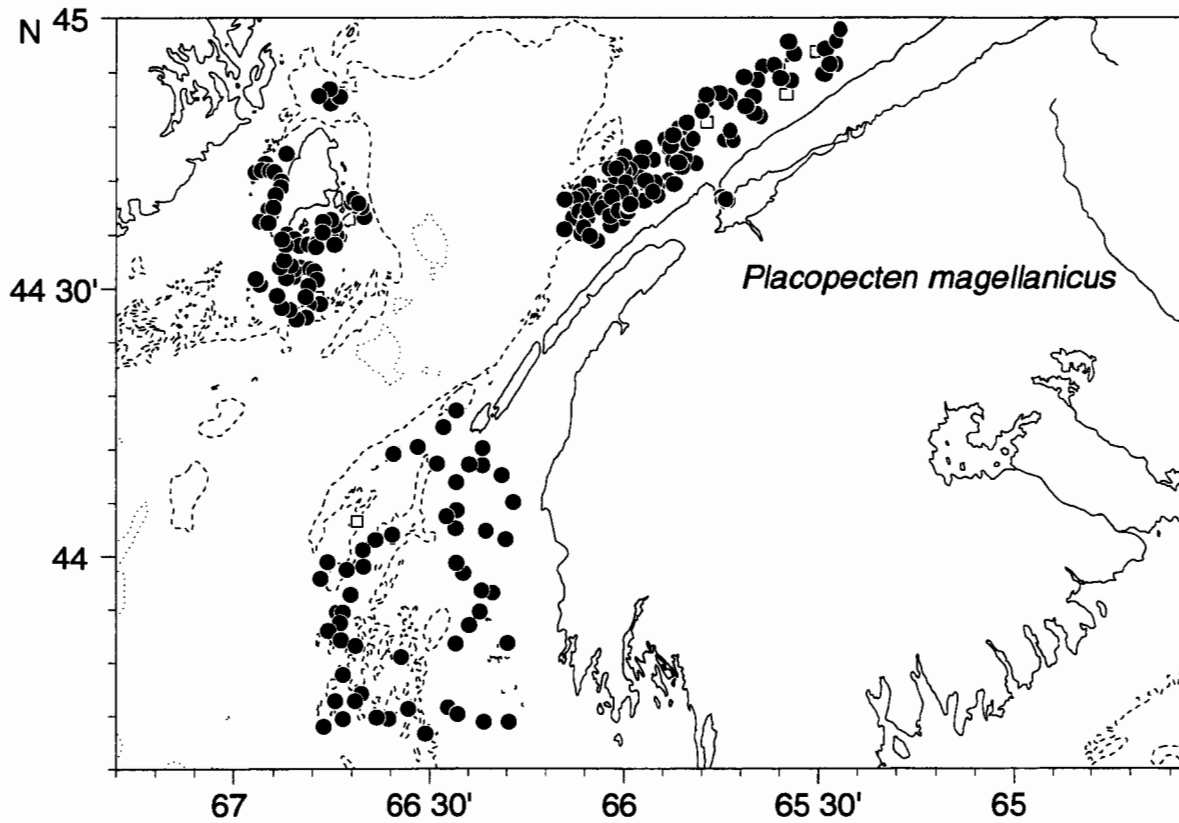


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● Denotes presence, □ Denotes absence

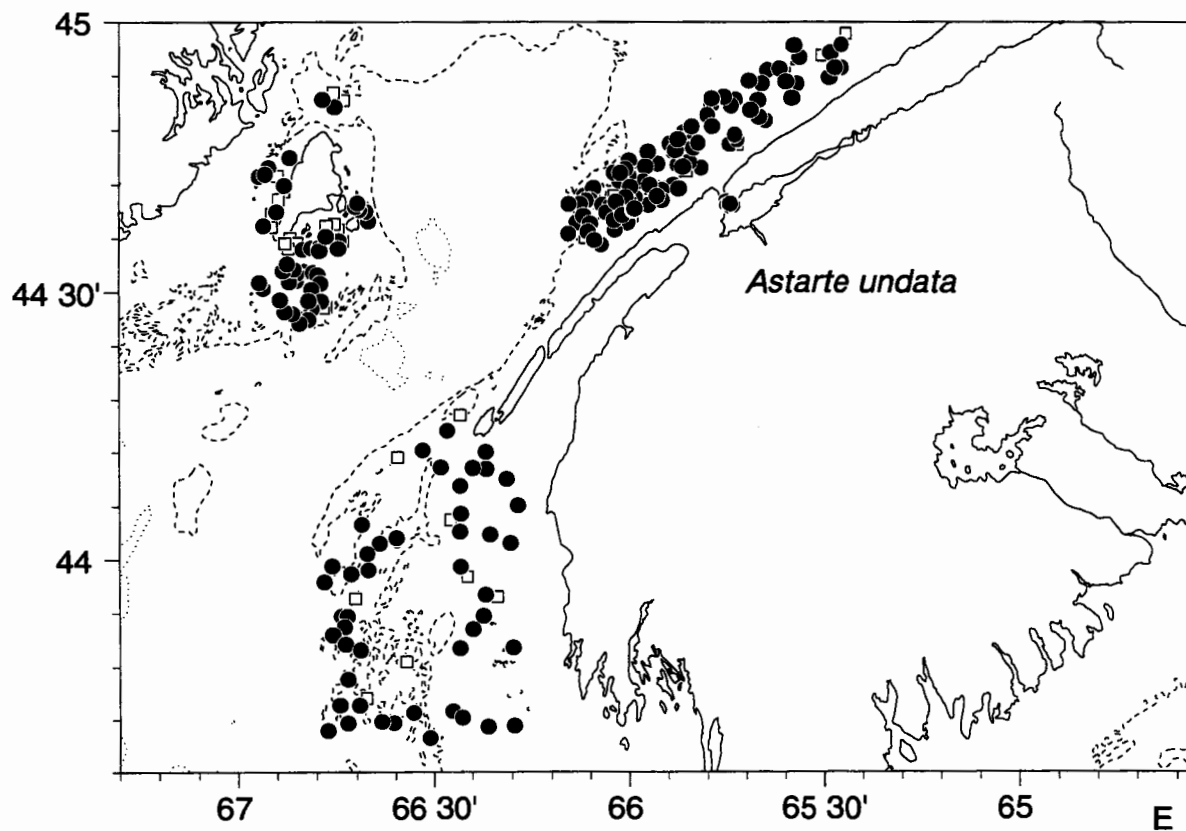
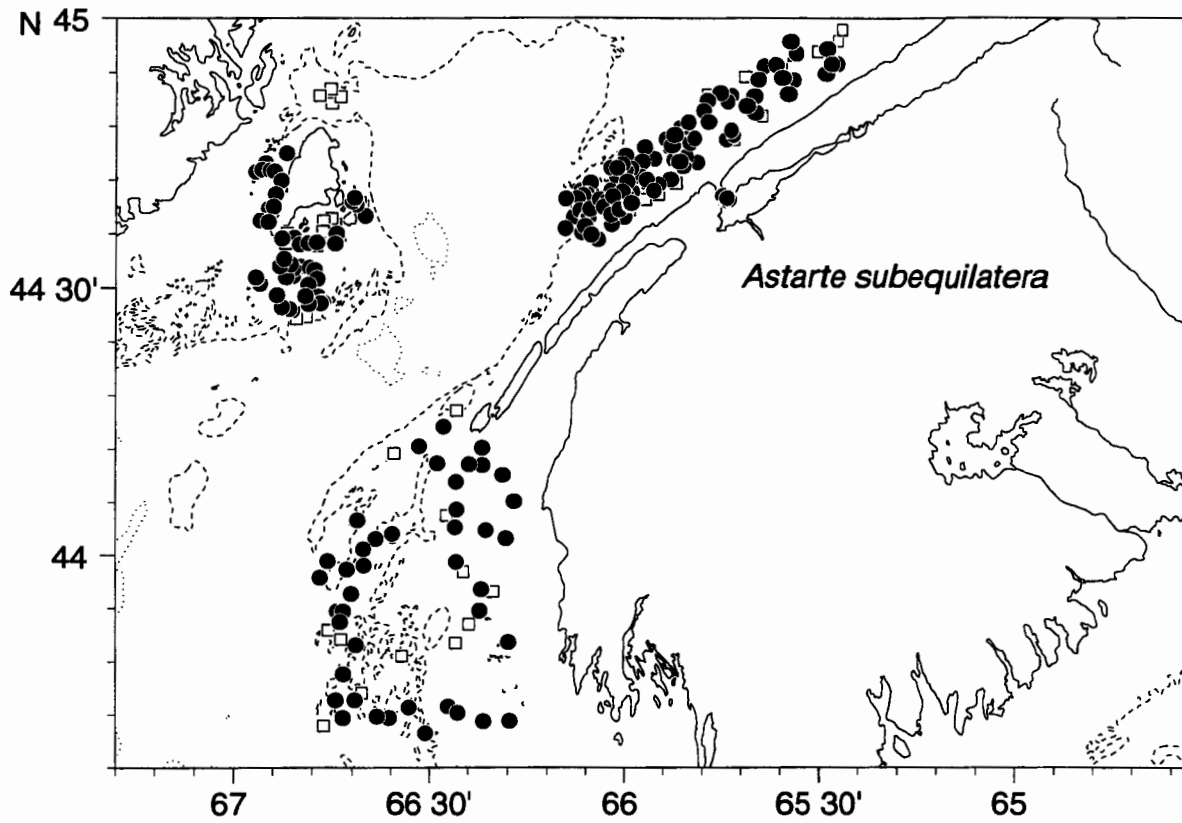


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● Denotes presence, □ Denotes absence

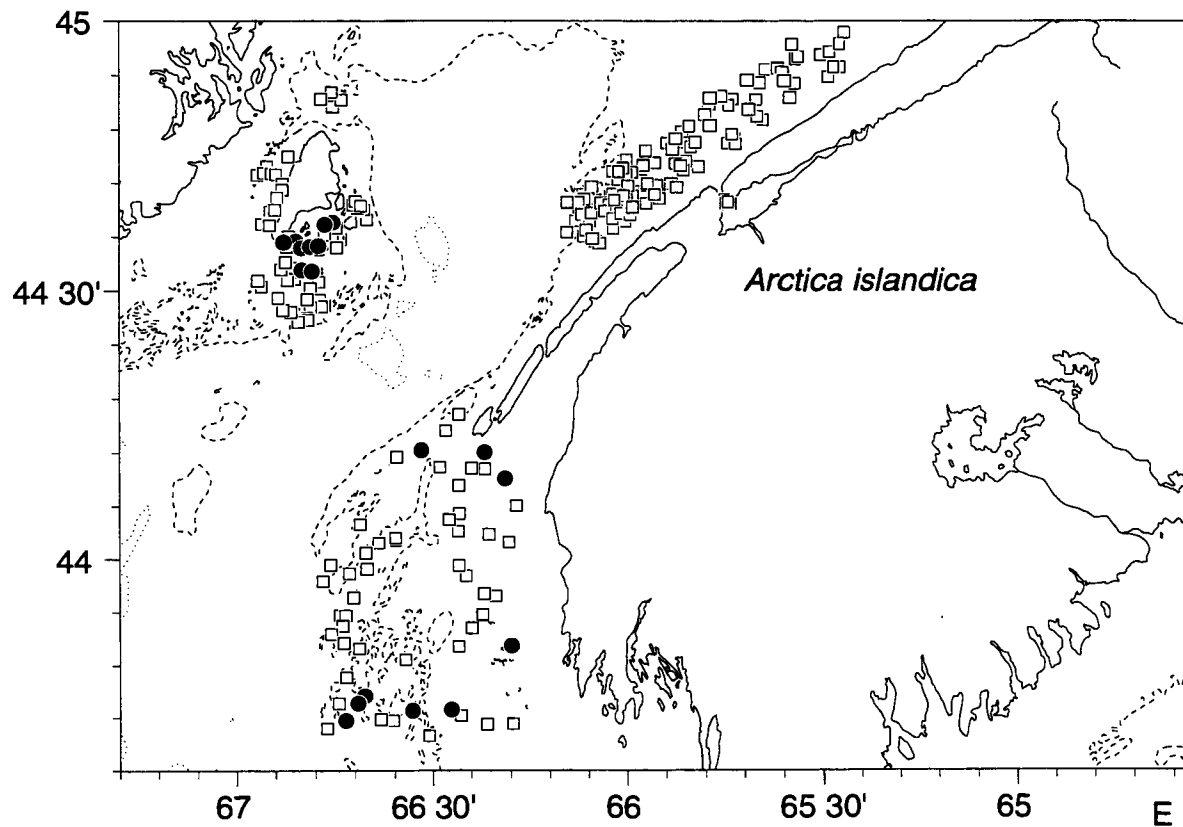
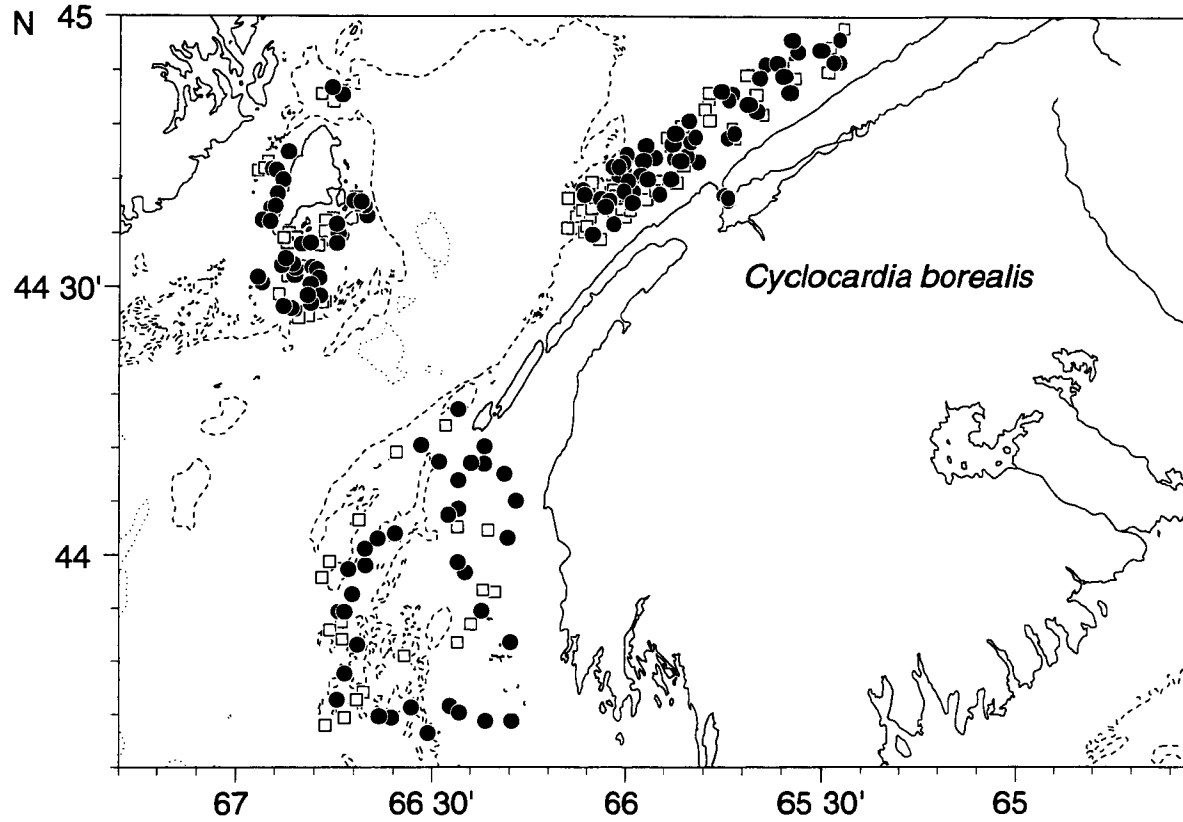


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● Denotes presence, □ Denotes absence

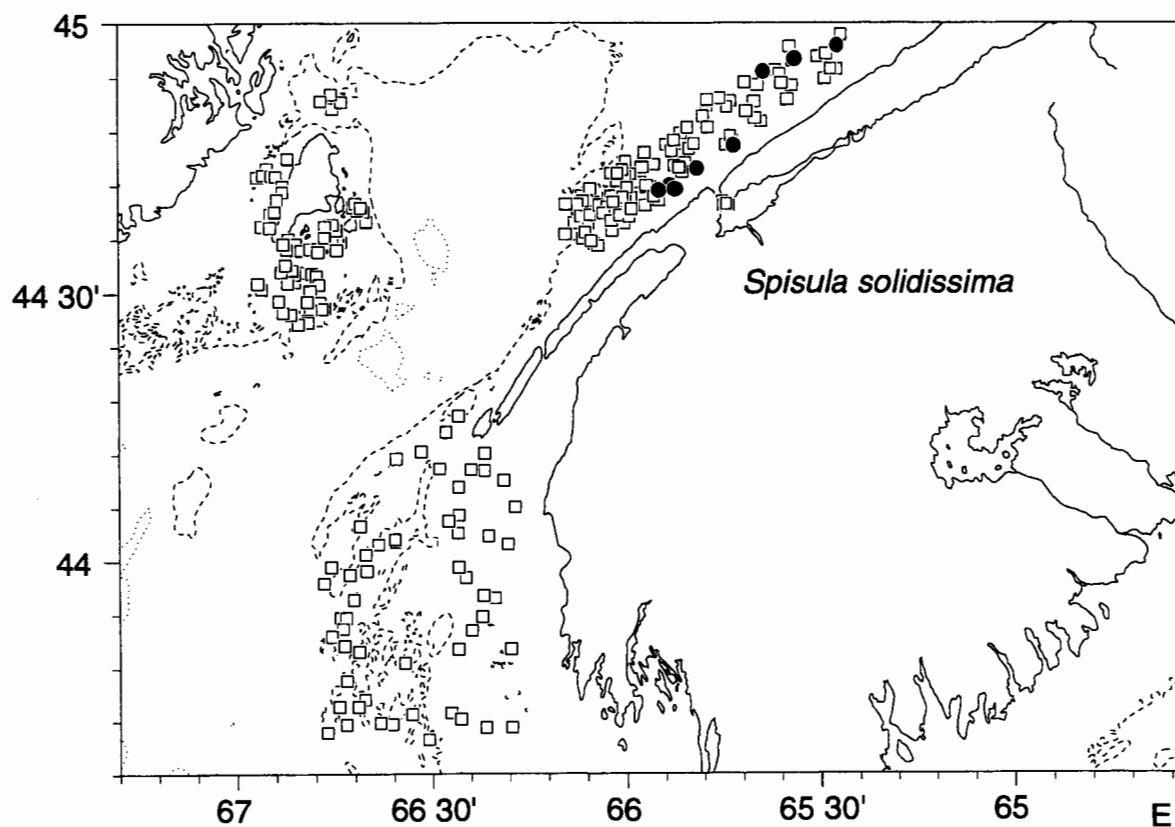
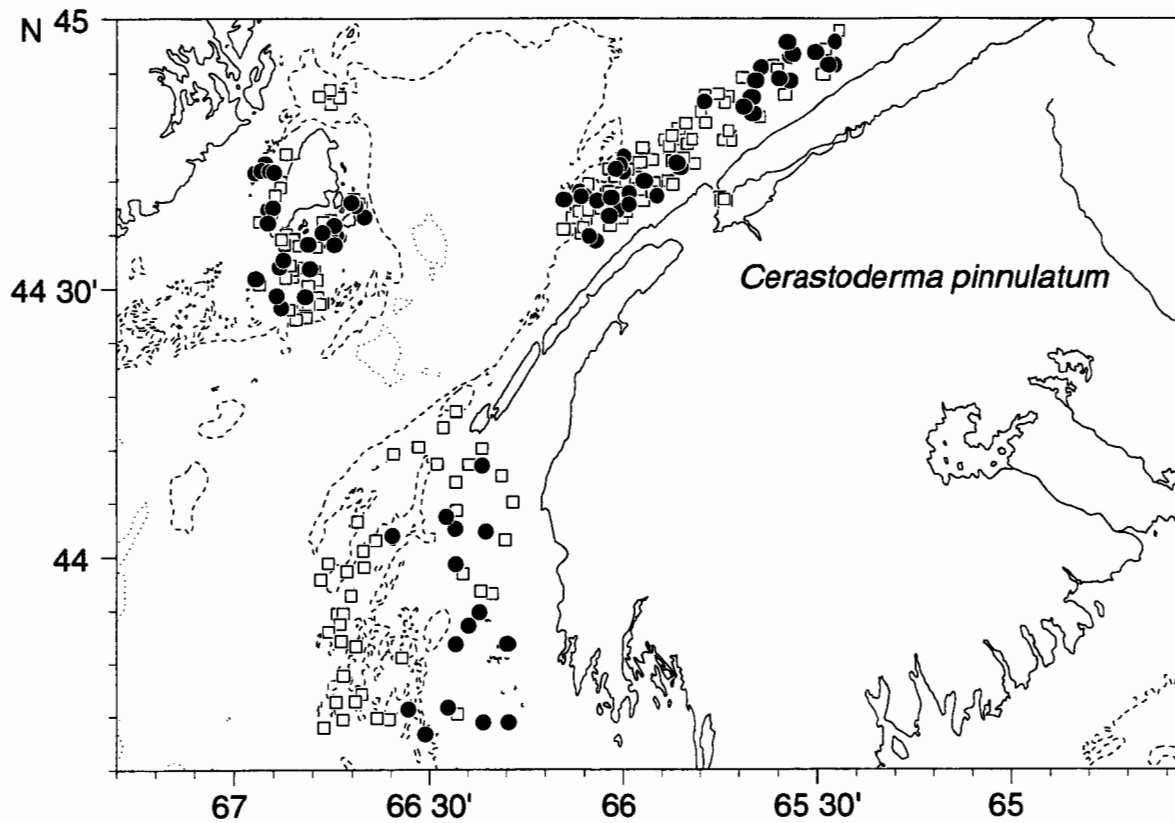


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● Denotes presence, □ Denotes absence

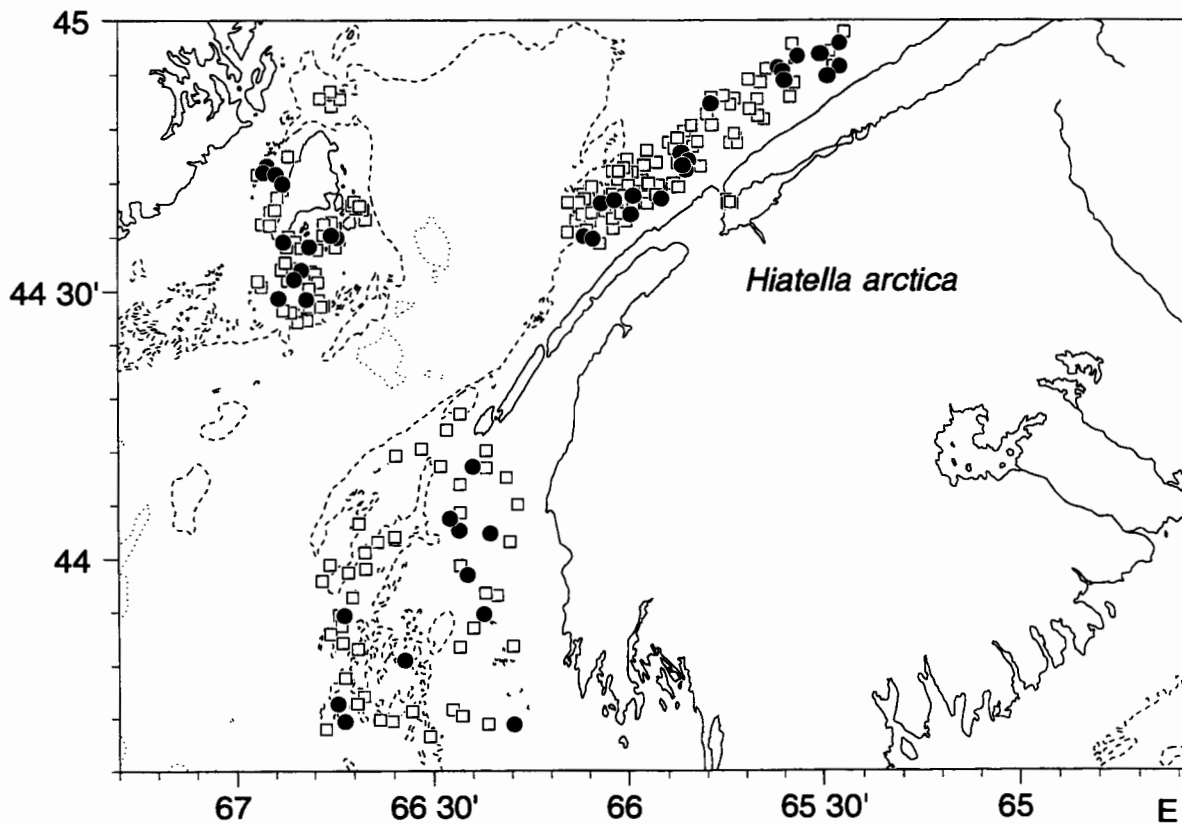
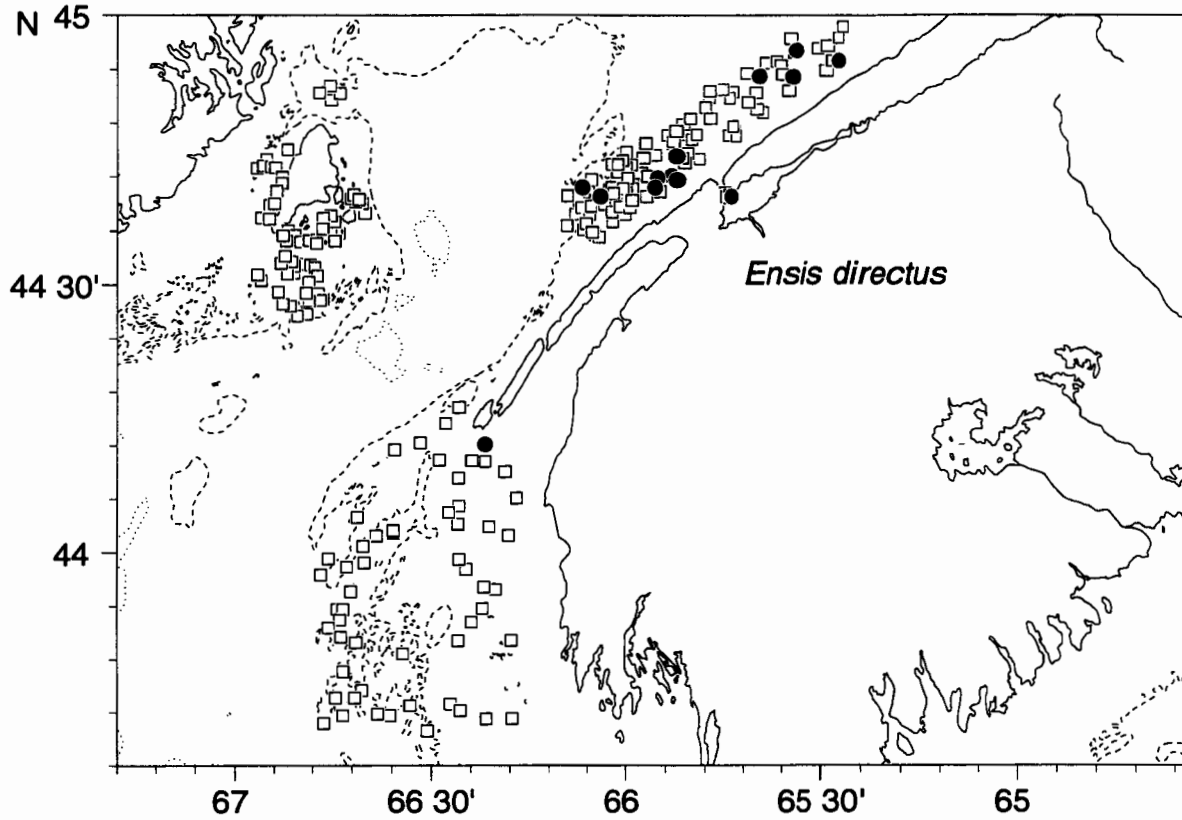


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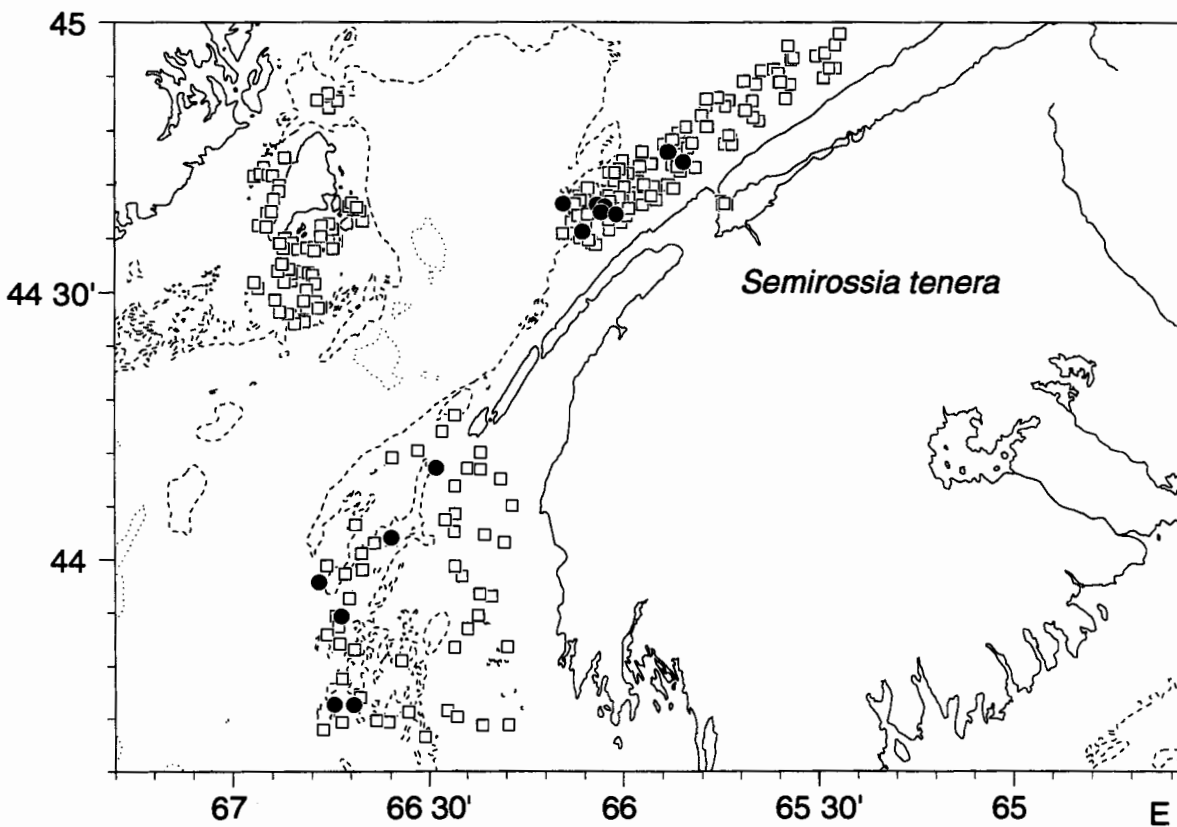
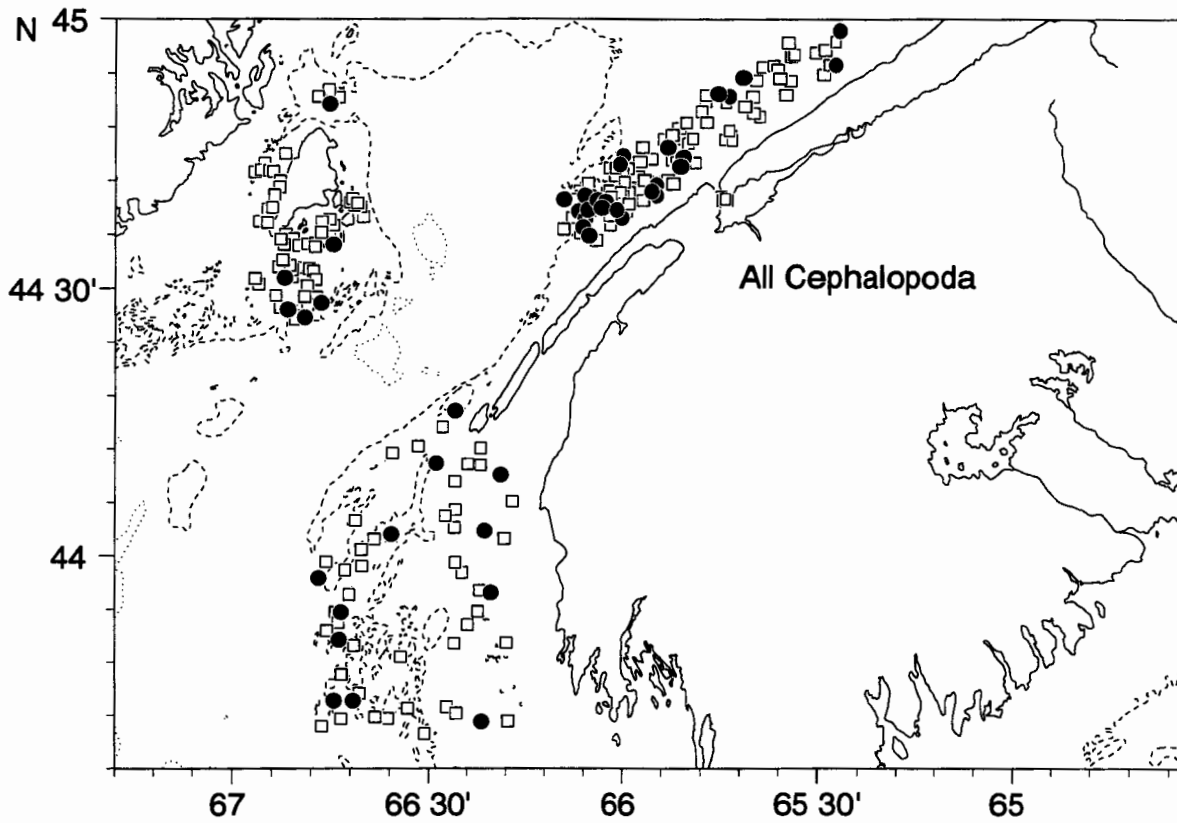


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● Denotes presence, □ Denotes absence

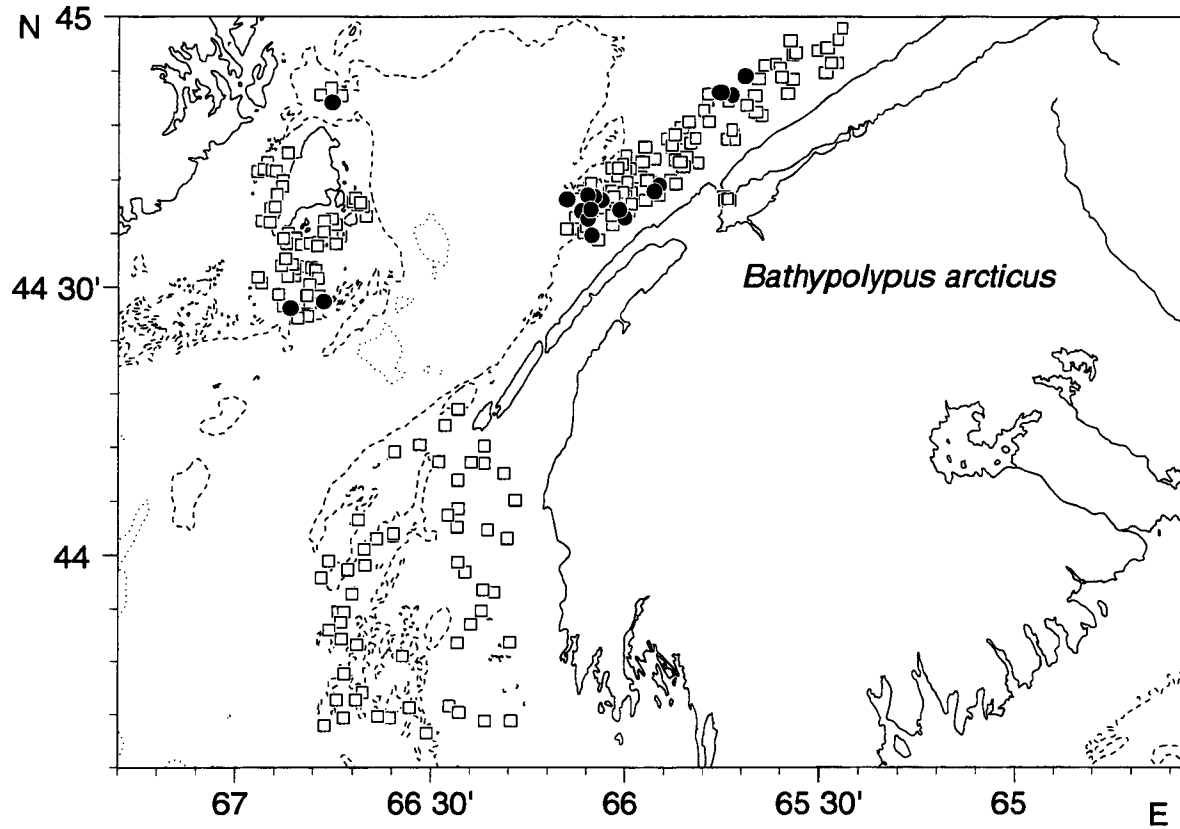


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● Denotes presence, □ Denotes absence

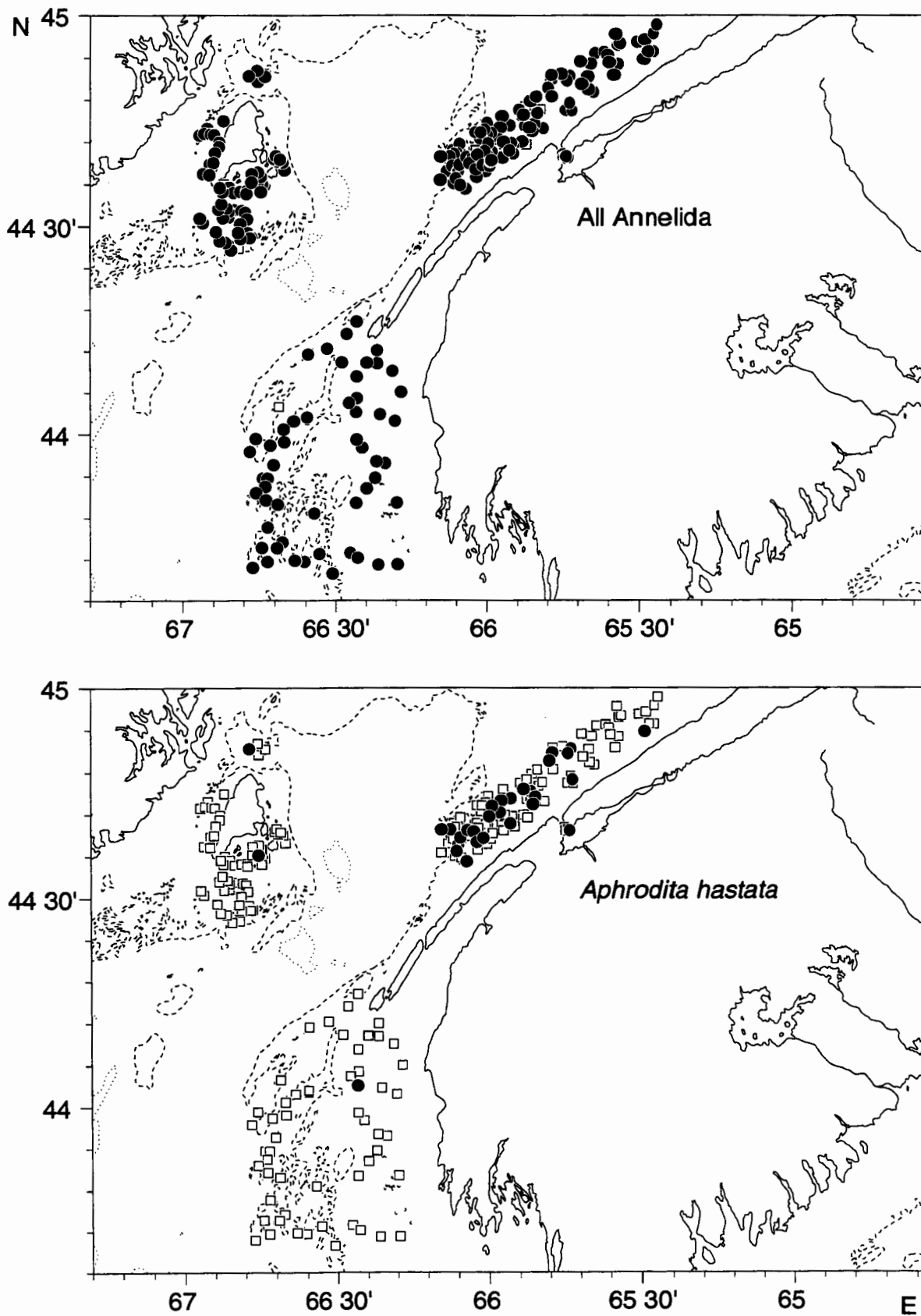


Figure 7. Distribution of representatives of the Phylum Annelida in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

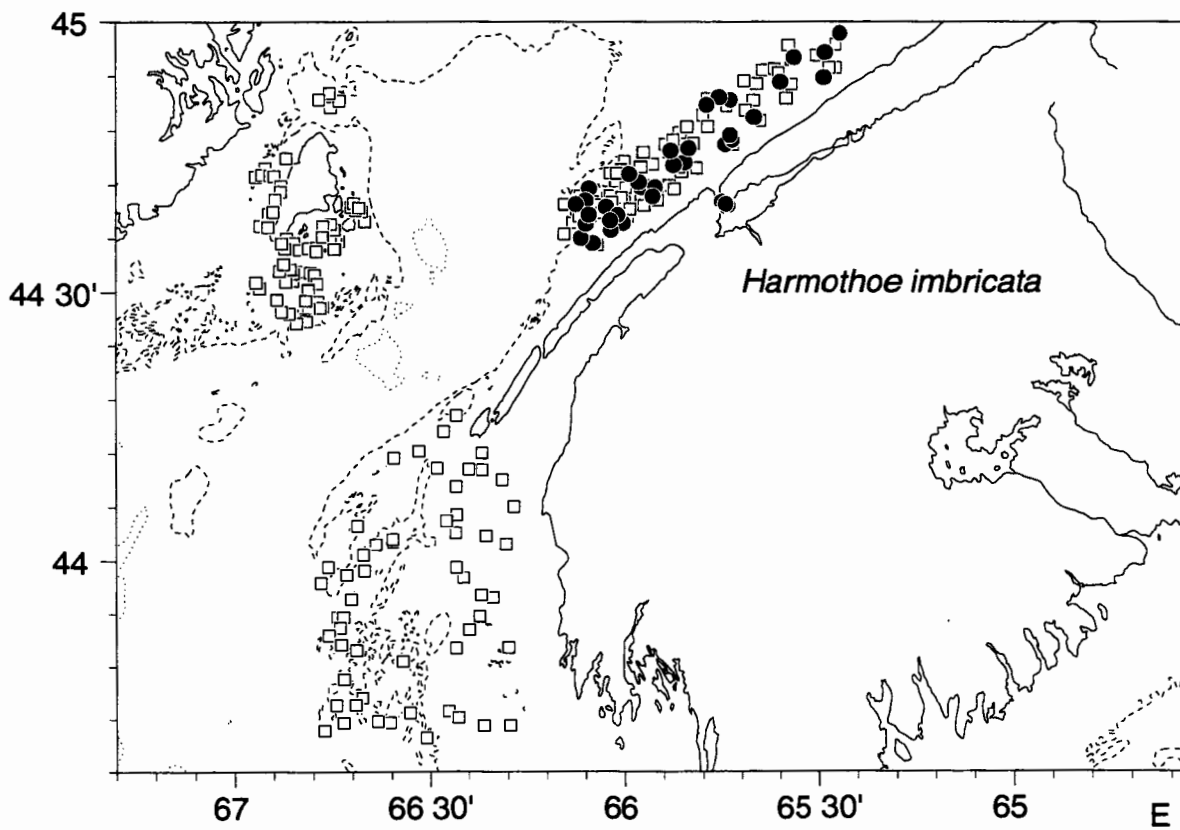
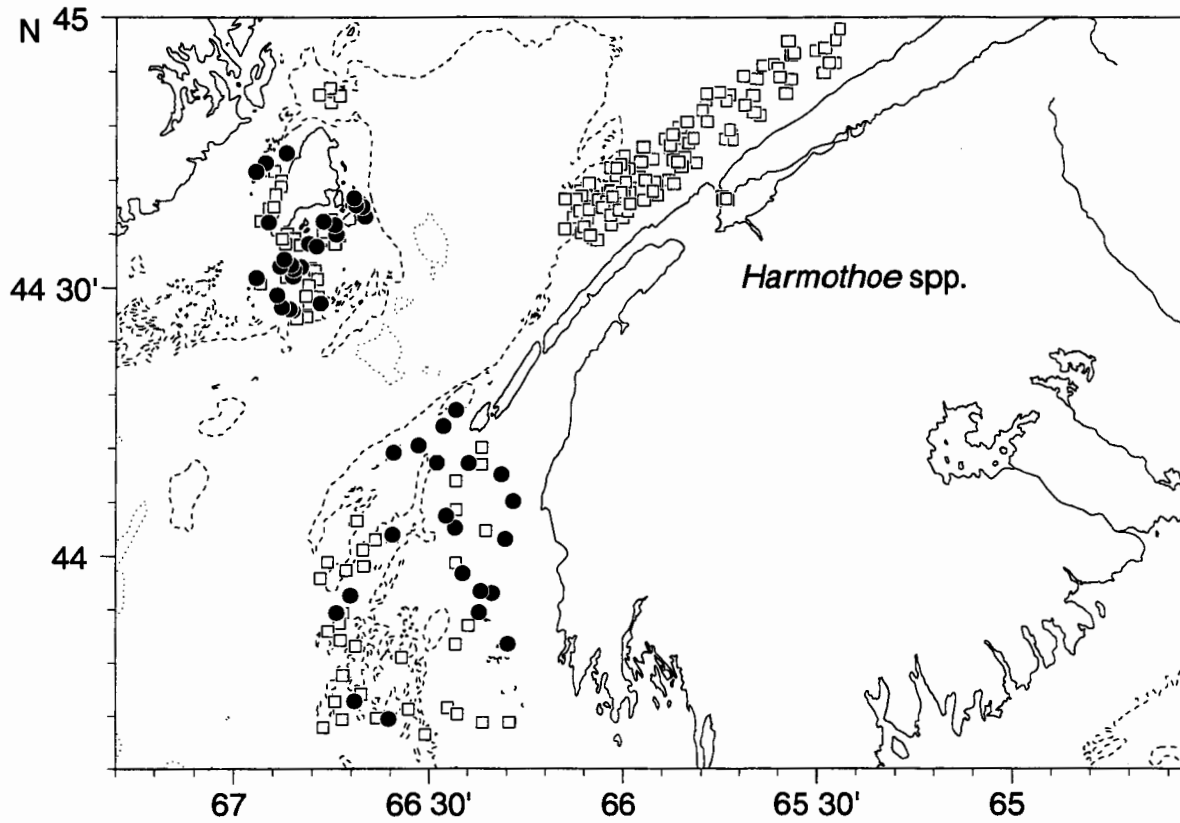


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● Denotes presence, □ Denotes absence

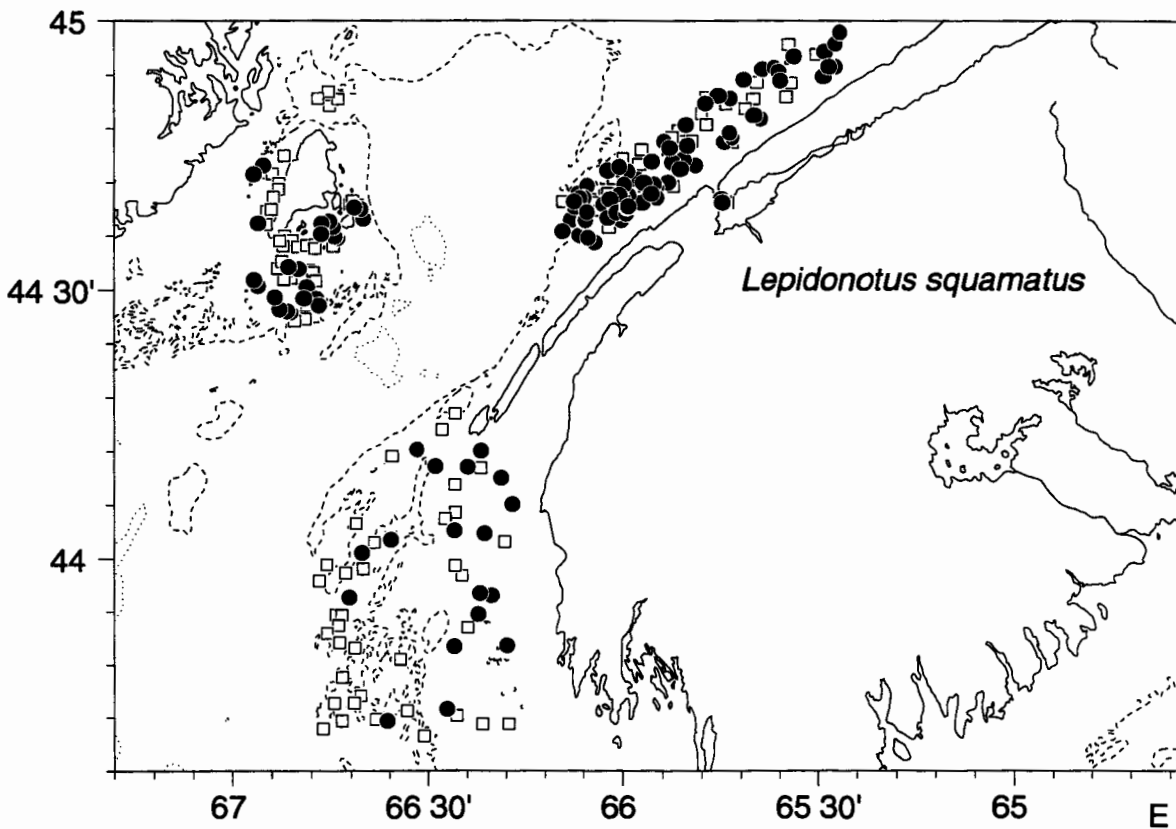
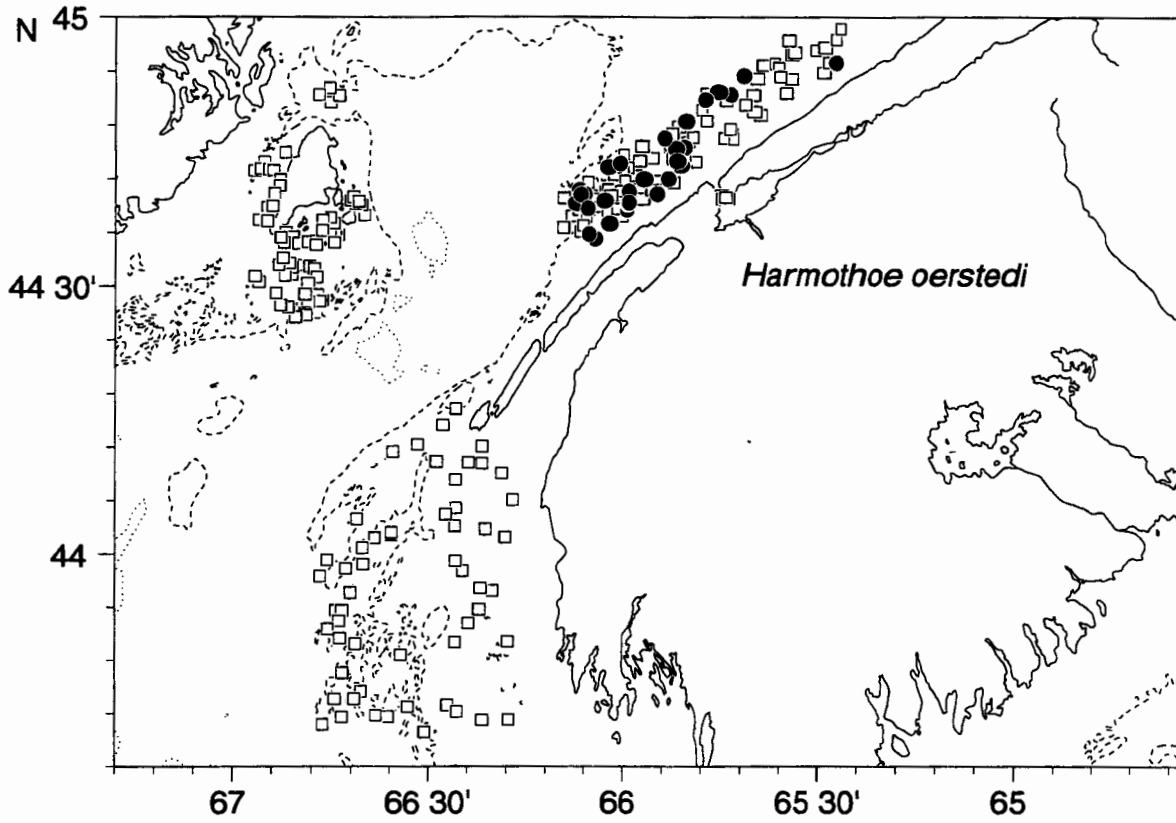


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● Denotes presence, □ Denotes absence

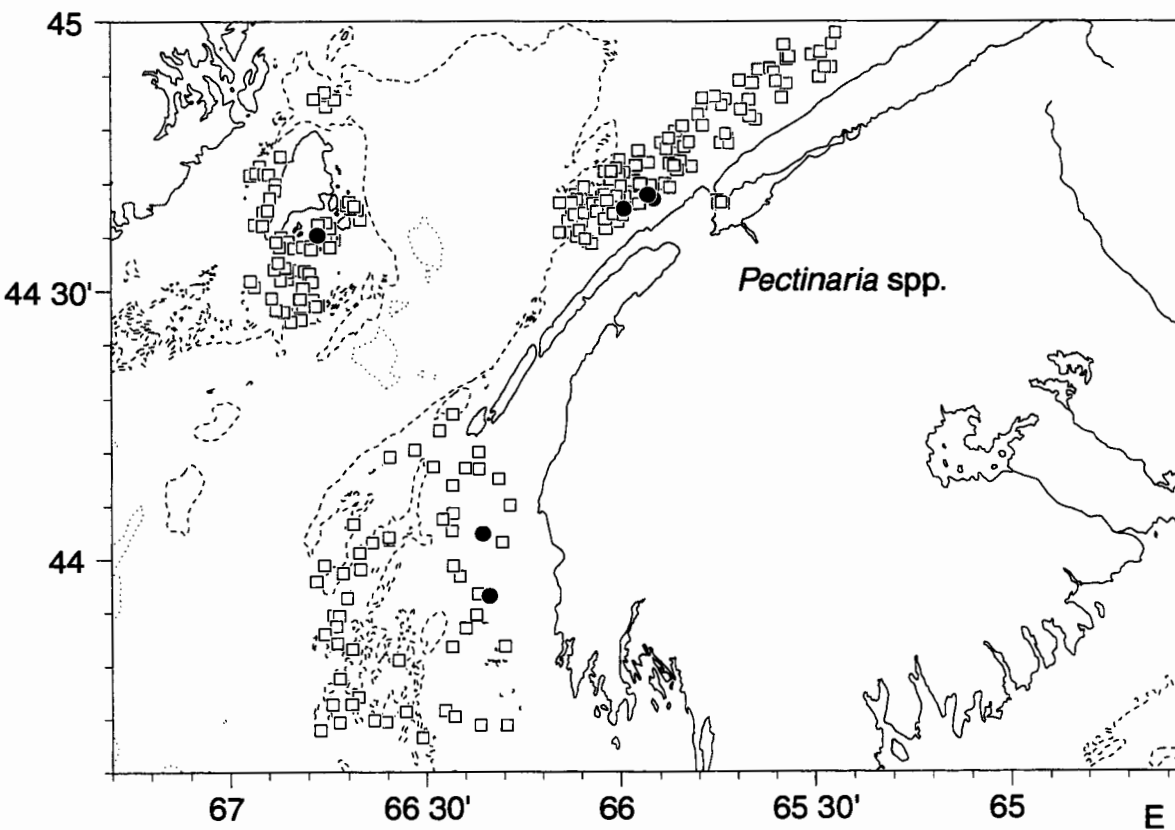
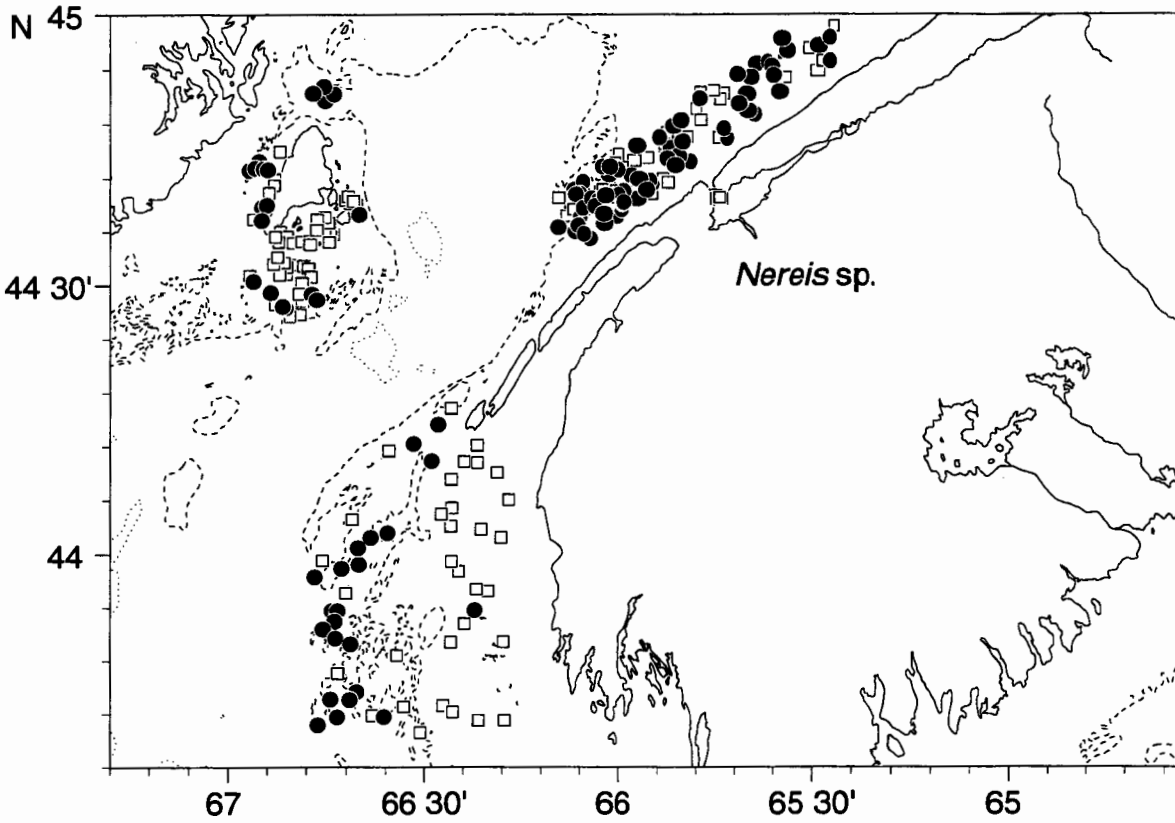


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● Denotes presence, □ Denotes absence

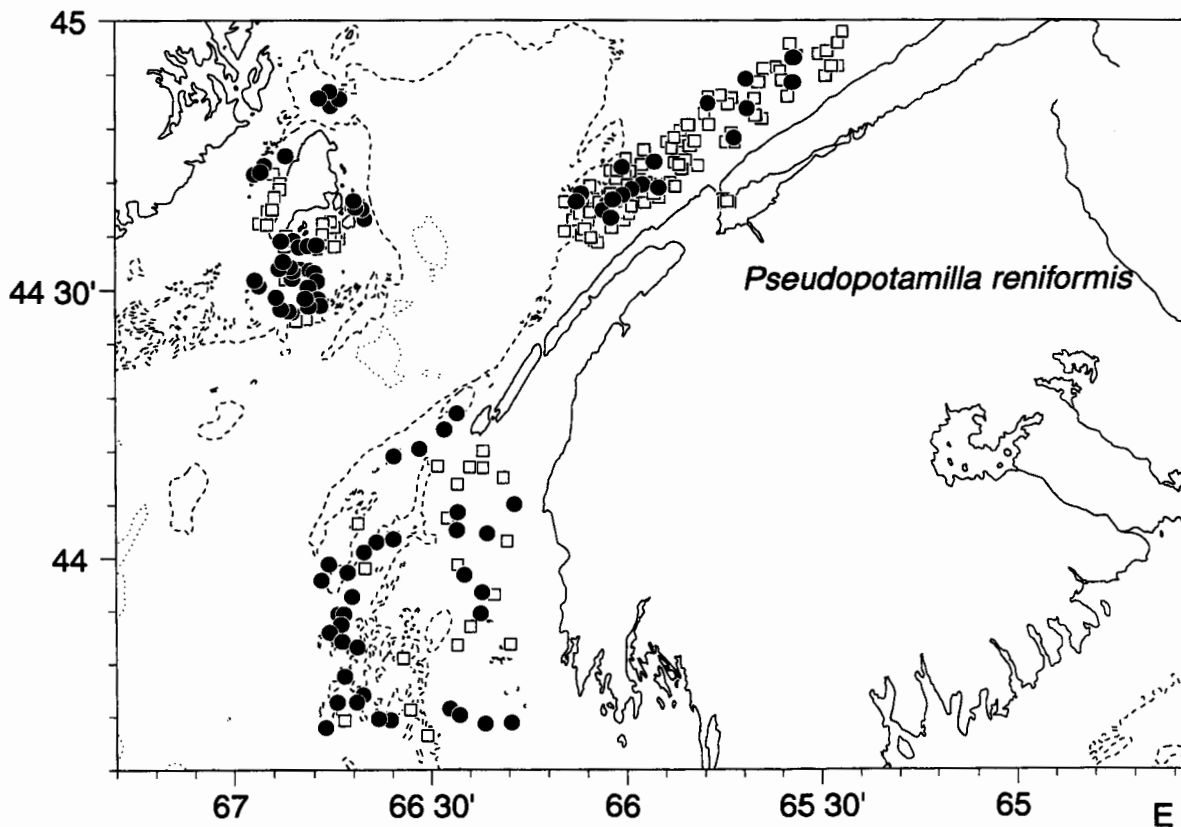
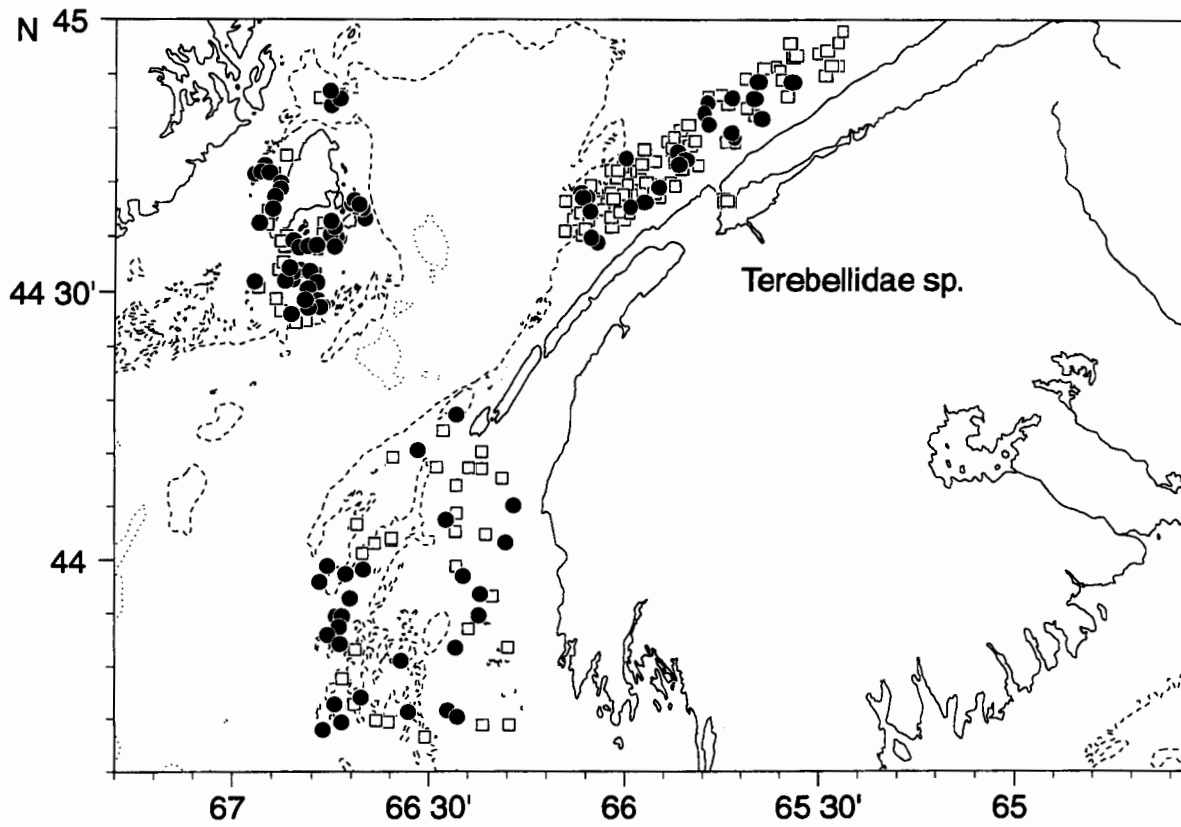


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● Denotes presence, □ Denotes absence

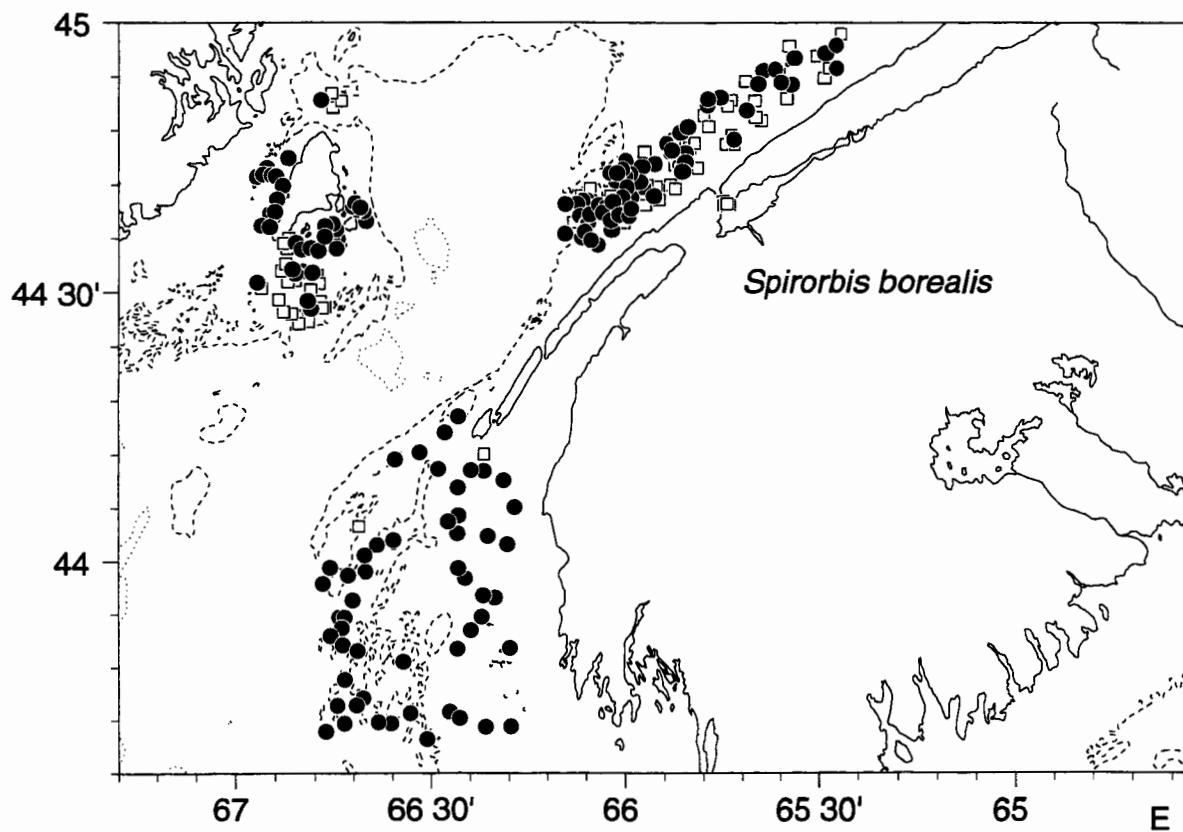
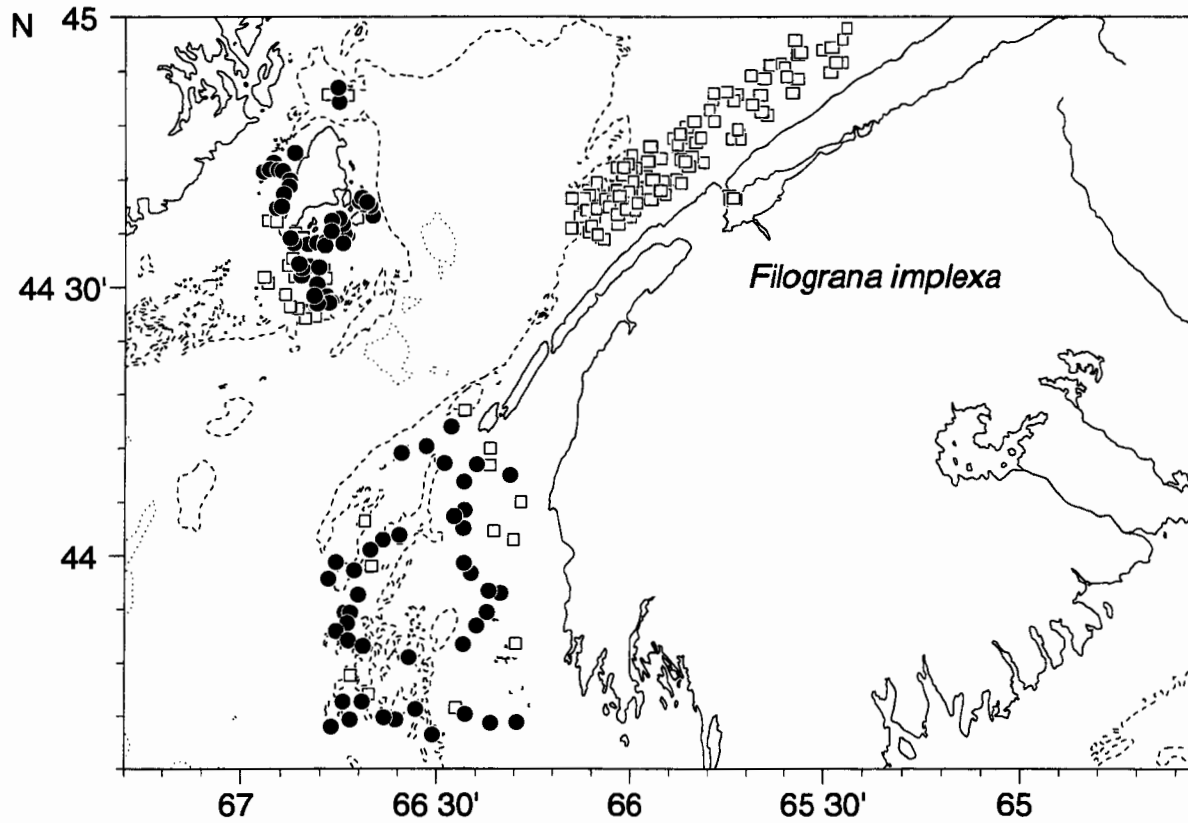


Figure 7 cont'd. Distribution of representatives of the Phylum Annelida in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

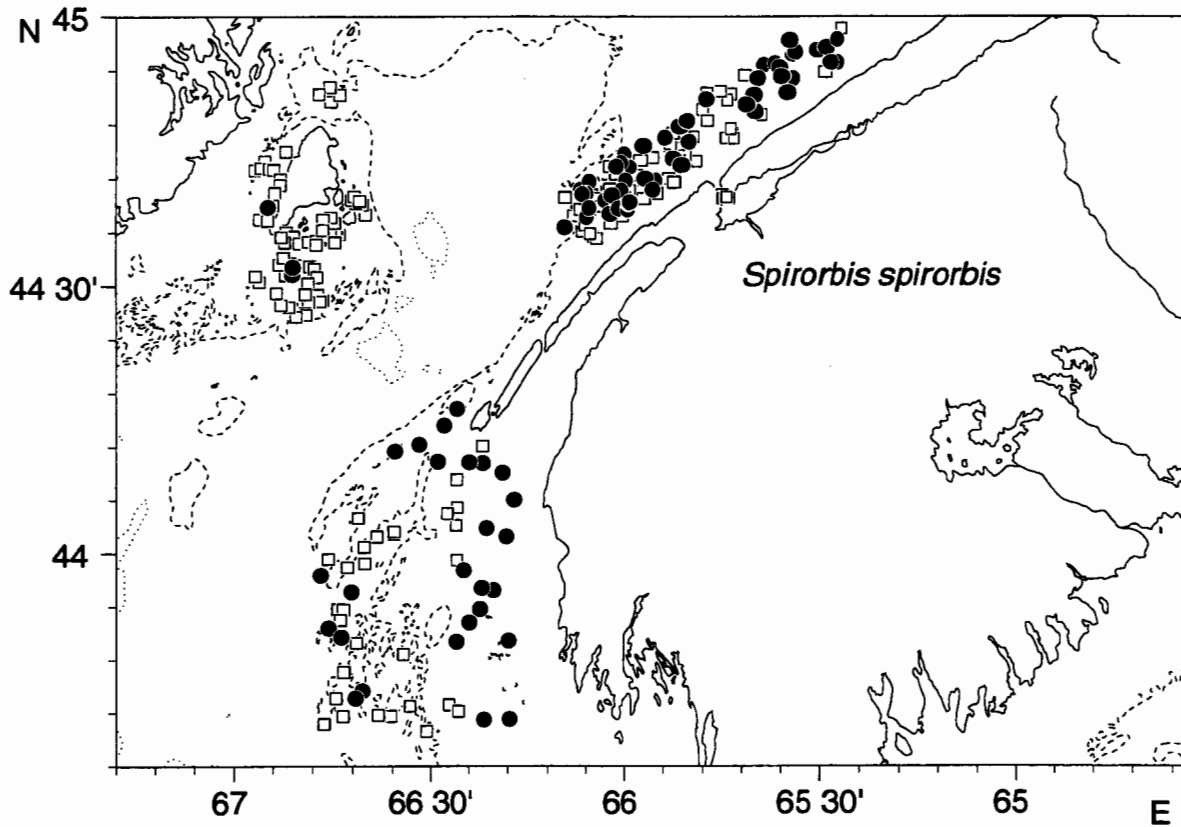


Figure 7 cont'd. Distribution of representatives of the Phylum Annelida in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

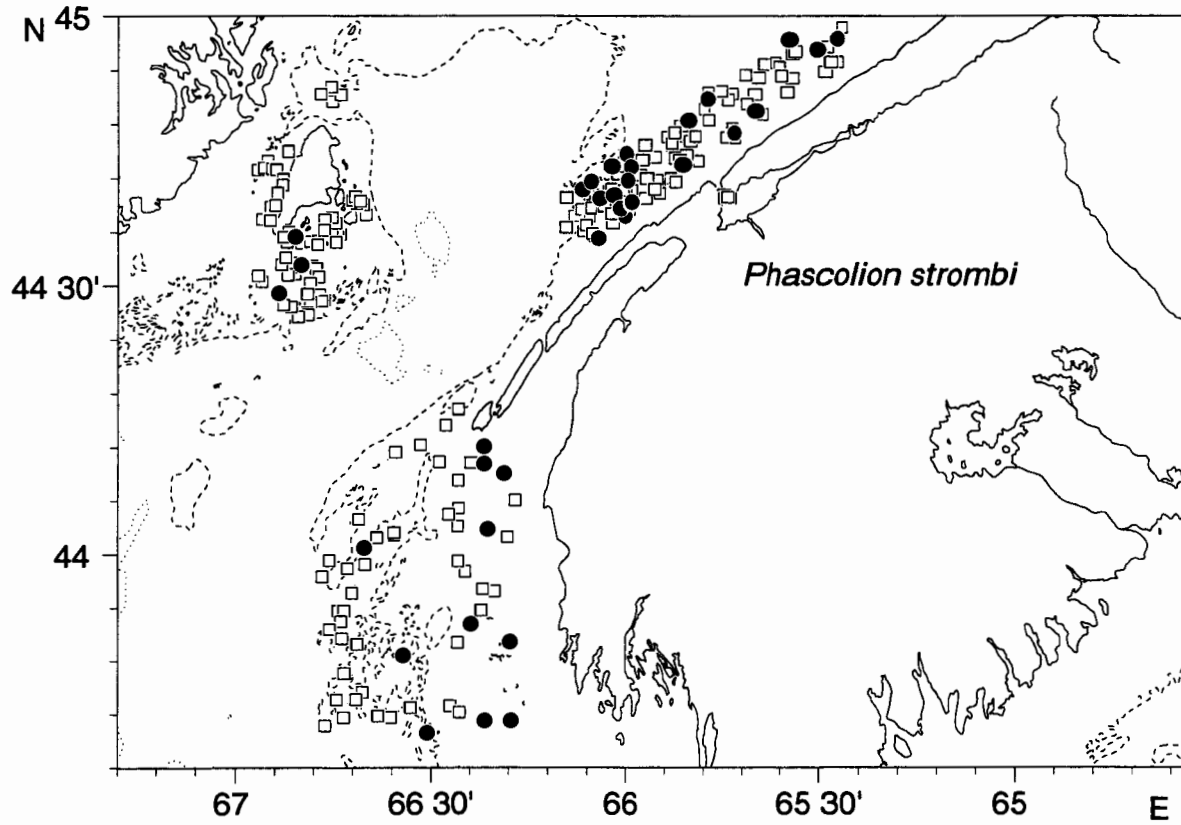


Figure 8. Distribution of representatives of the Phylum Sipuncula in the Lower Bay of Fundy as recorded in Fuller et al. (1998).
● Denotes presence, □ Denotes absence

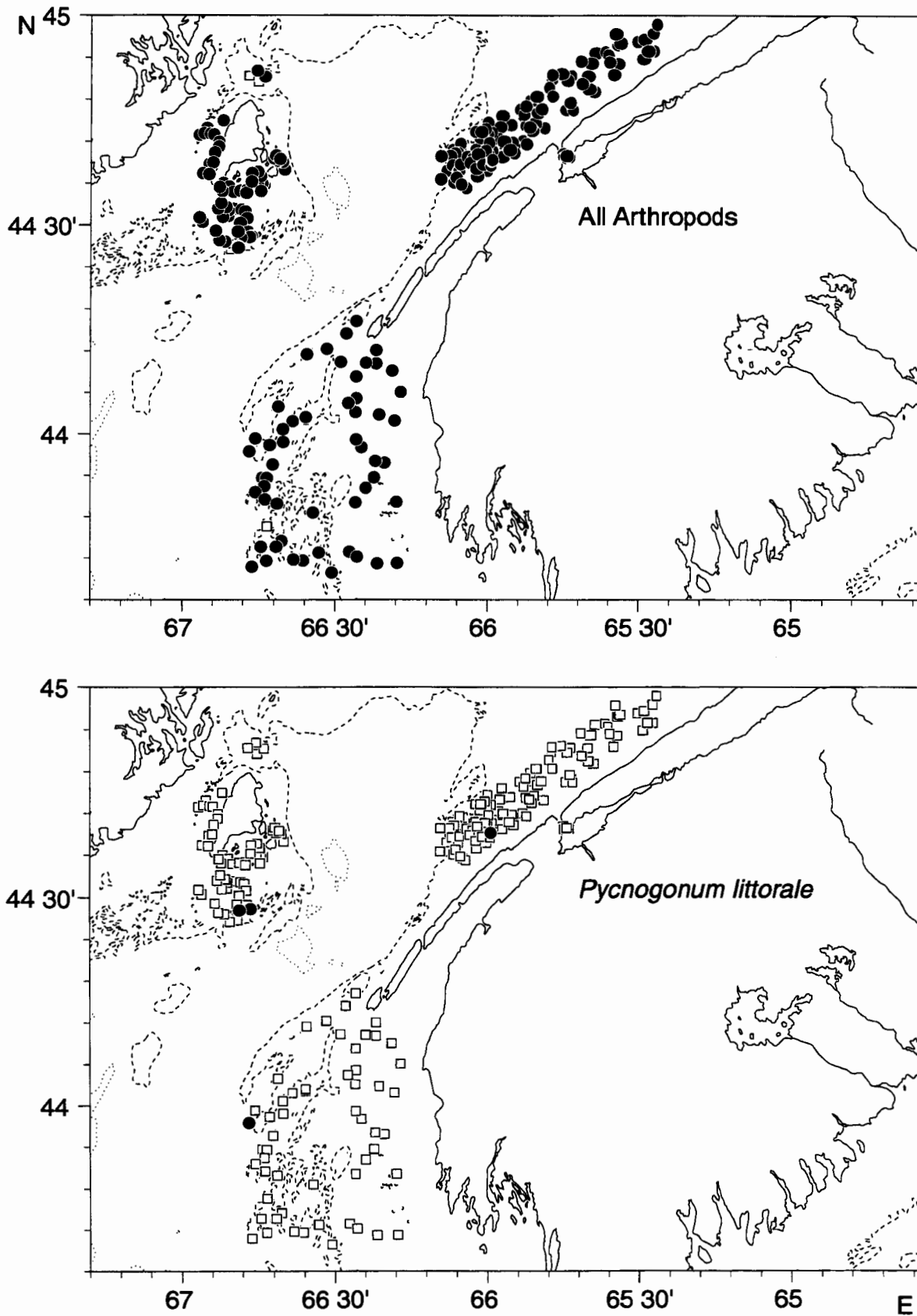


Figure 9. Distribution of representatives of the Phylum Arthropoda in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

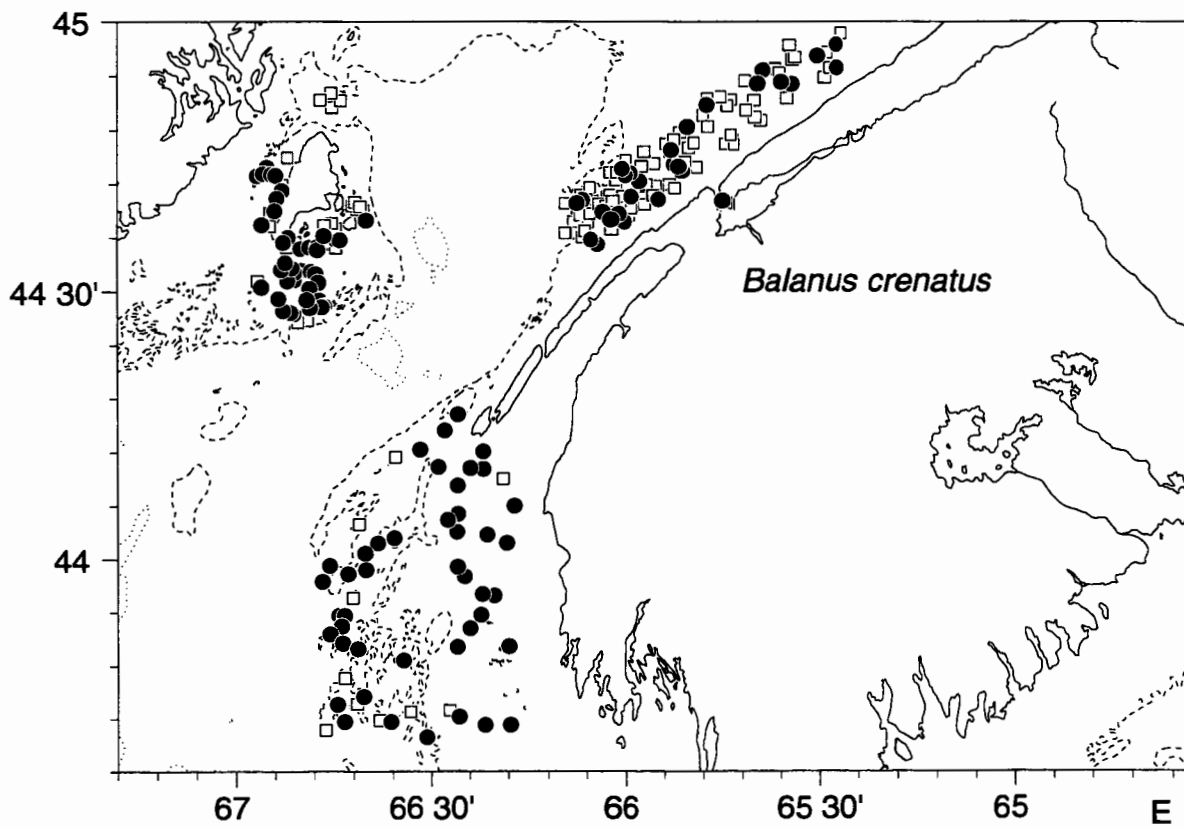
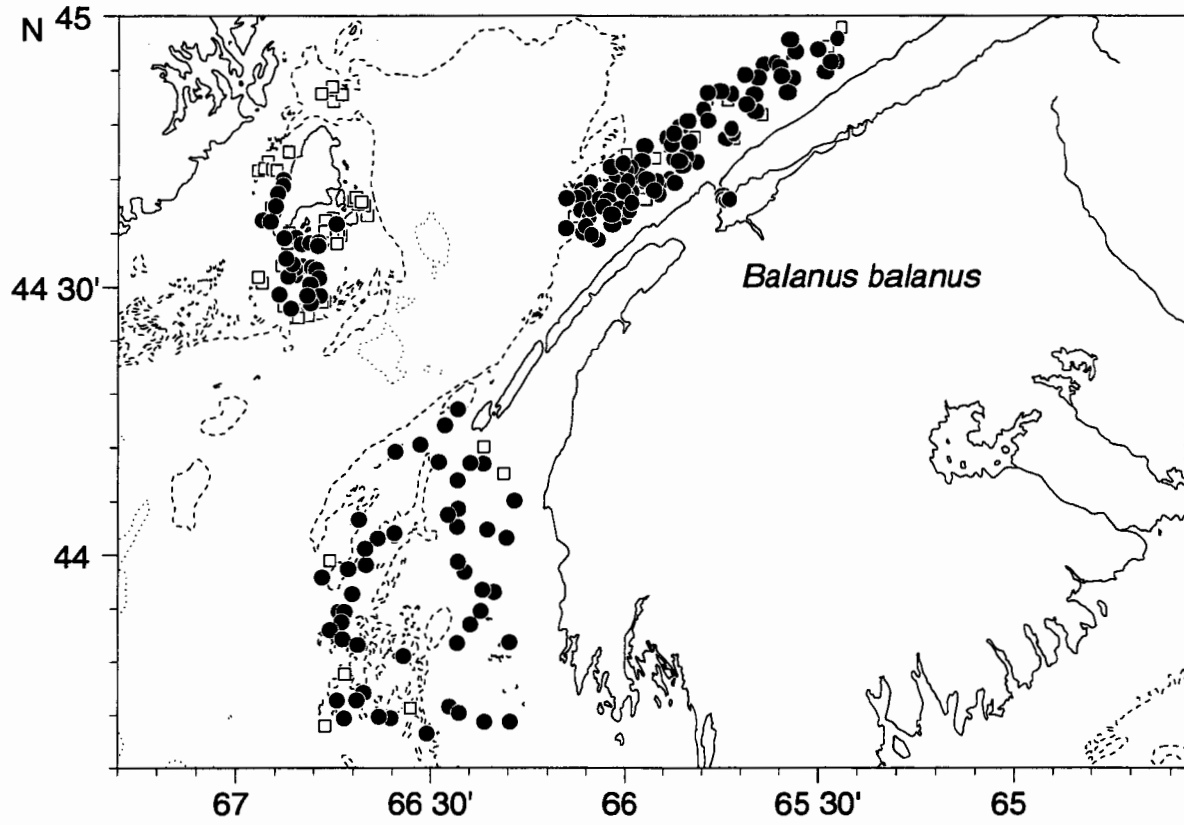


Figure 9 cont'd. Distribution of representatives of the Phylum Arthropoda in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

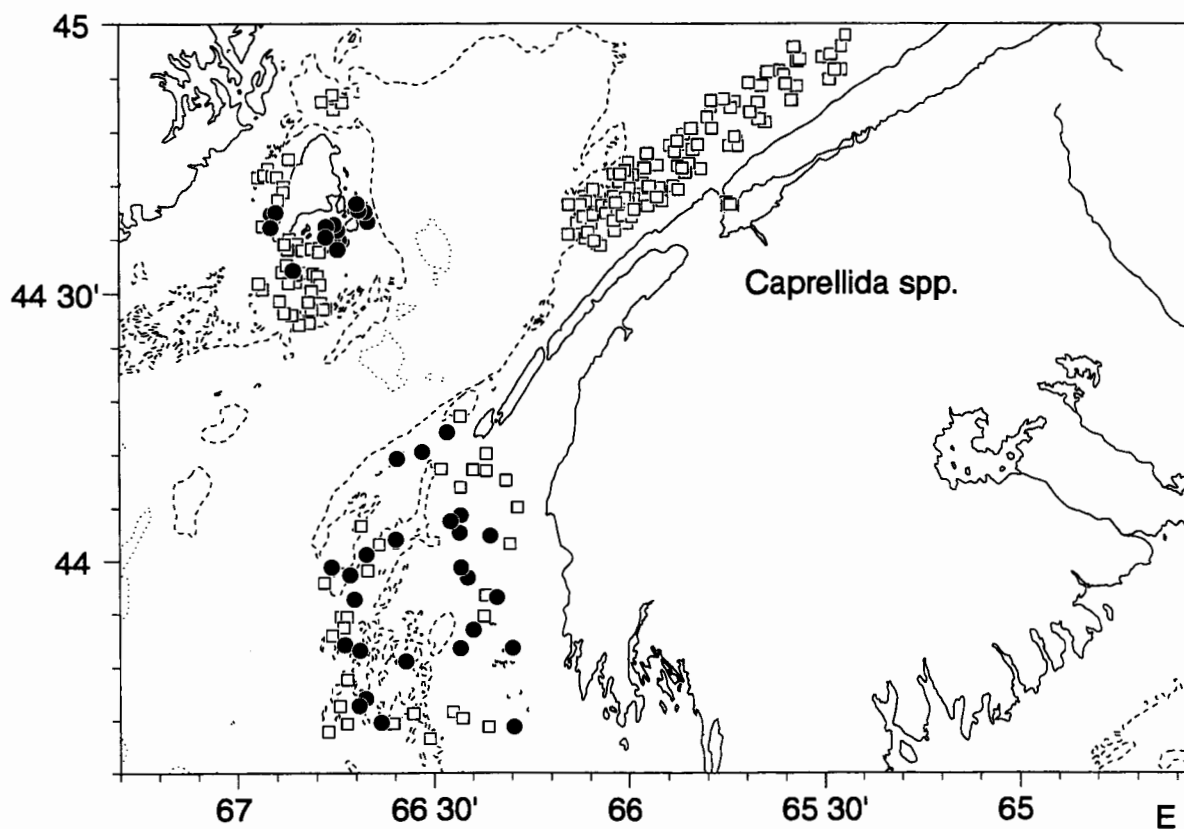
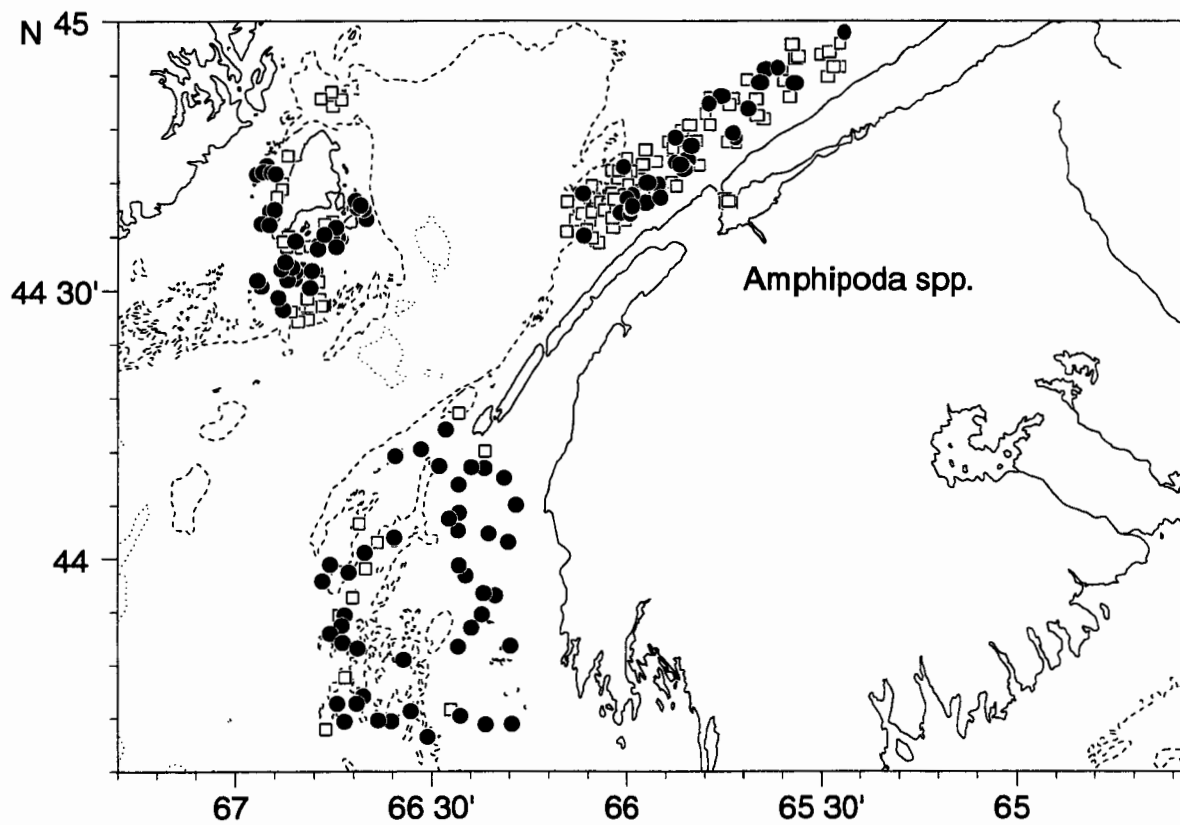


Figure 9 cont'd. Distribution of representatives of the Phylum Arthropoda in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

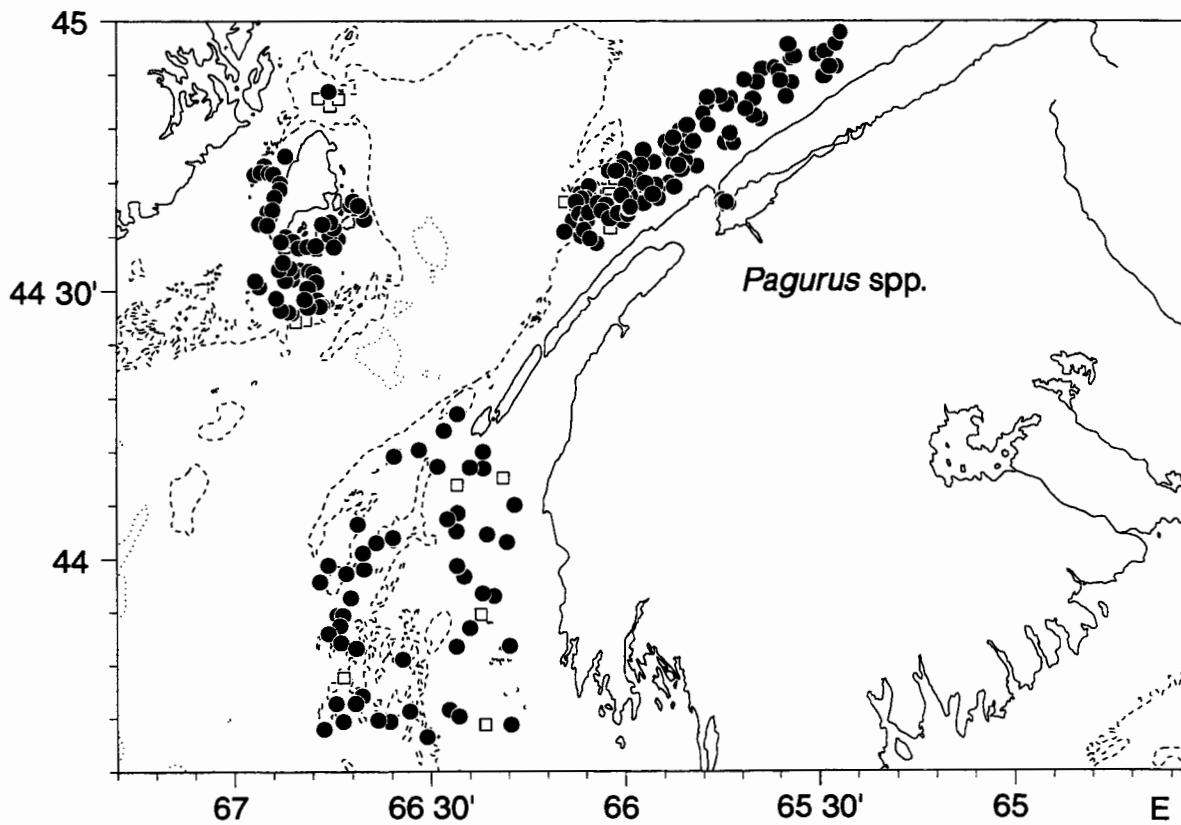
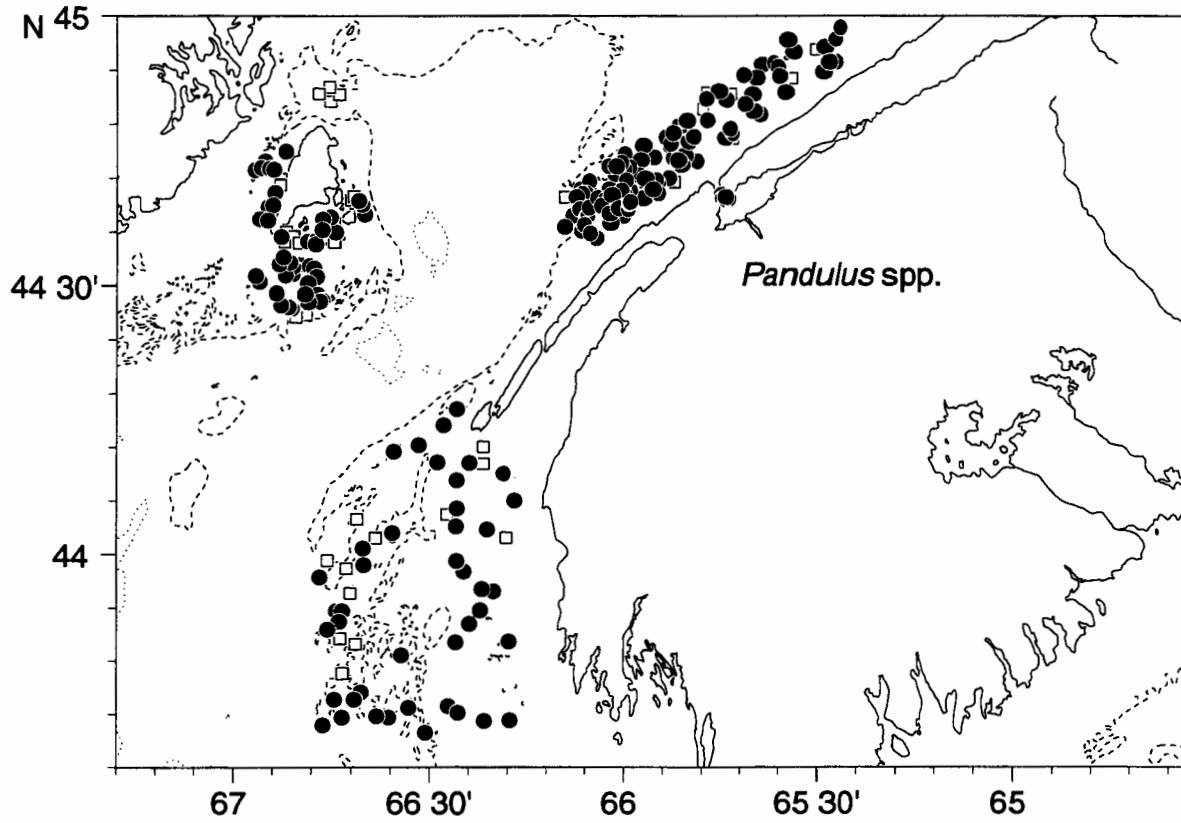


Figure 9 cont'd. Distribution of representatives of the Phylum Arthropoda in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

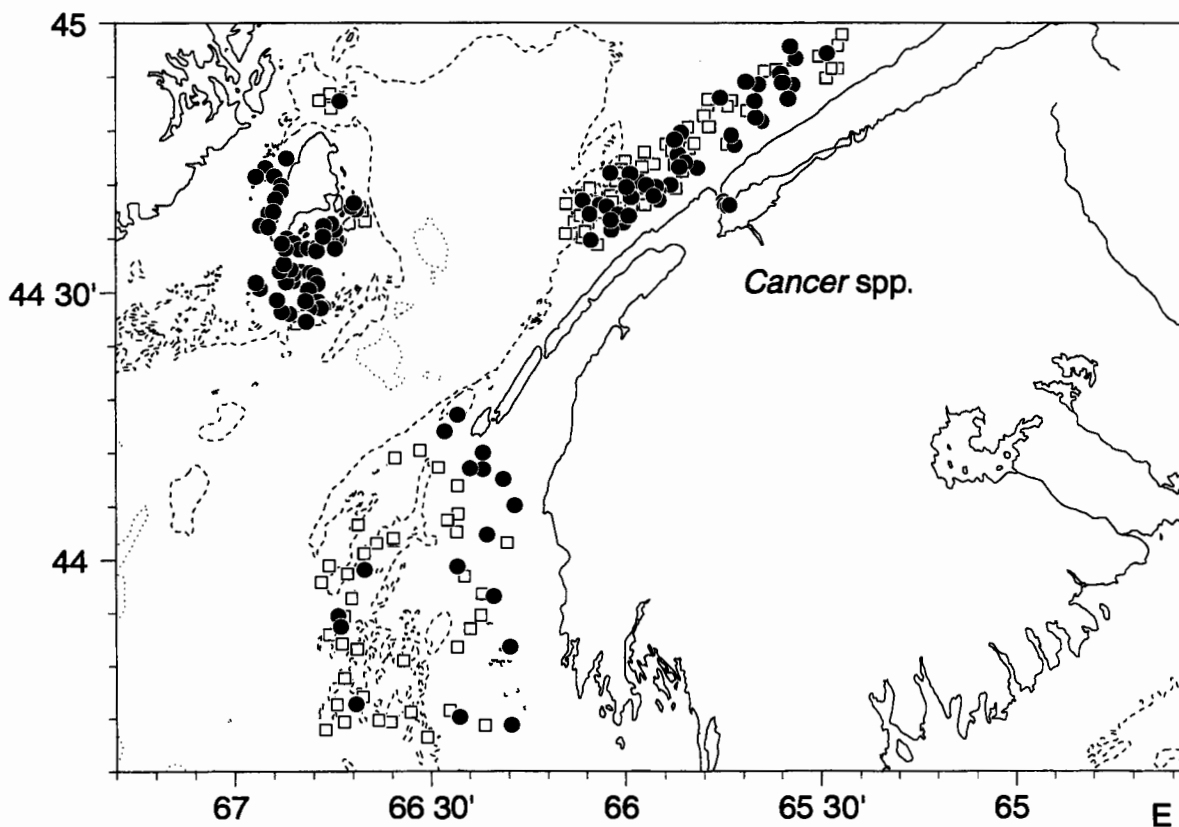
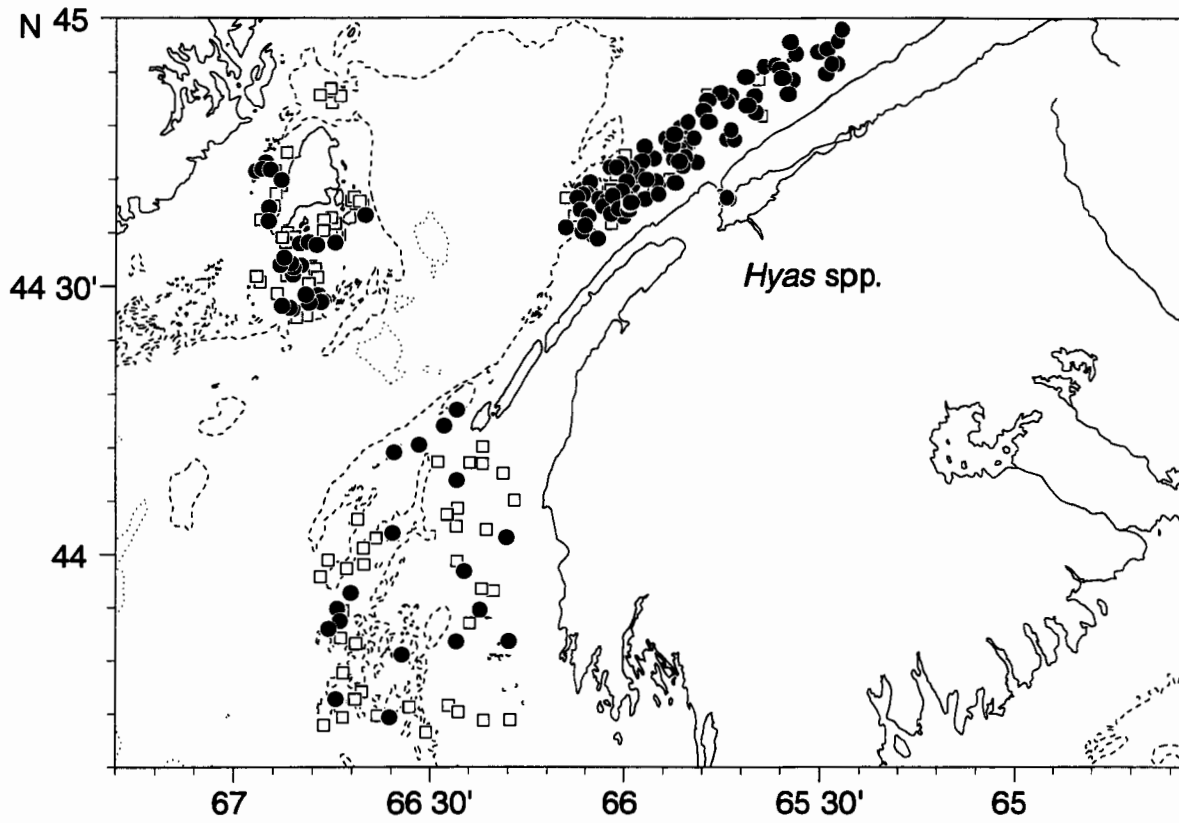


Figure 9 cont'd. Distribution of representatives of the Phylum Arthropoda in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

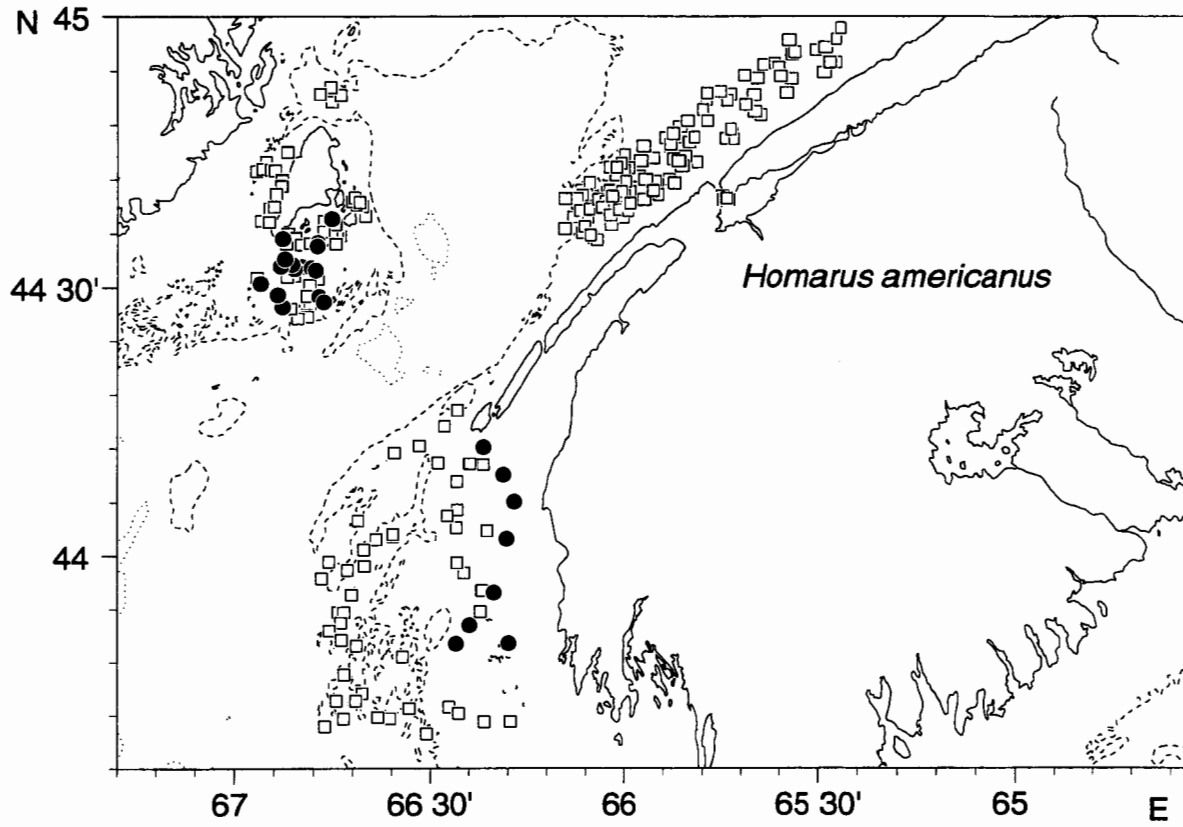


Figure 9 cont'd. Distribution of representatives of the Phylum Arthropoda in the Lower Bay of Fundy as recorded in Fuller et al. (1998).
● Denotes presence, □ Denotes absence

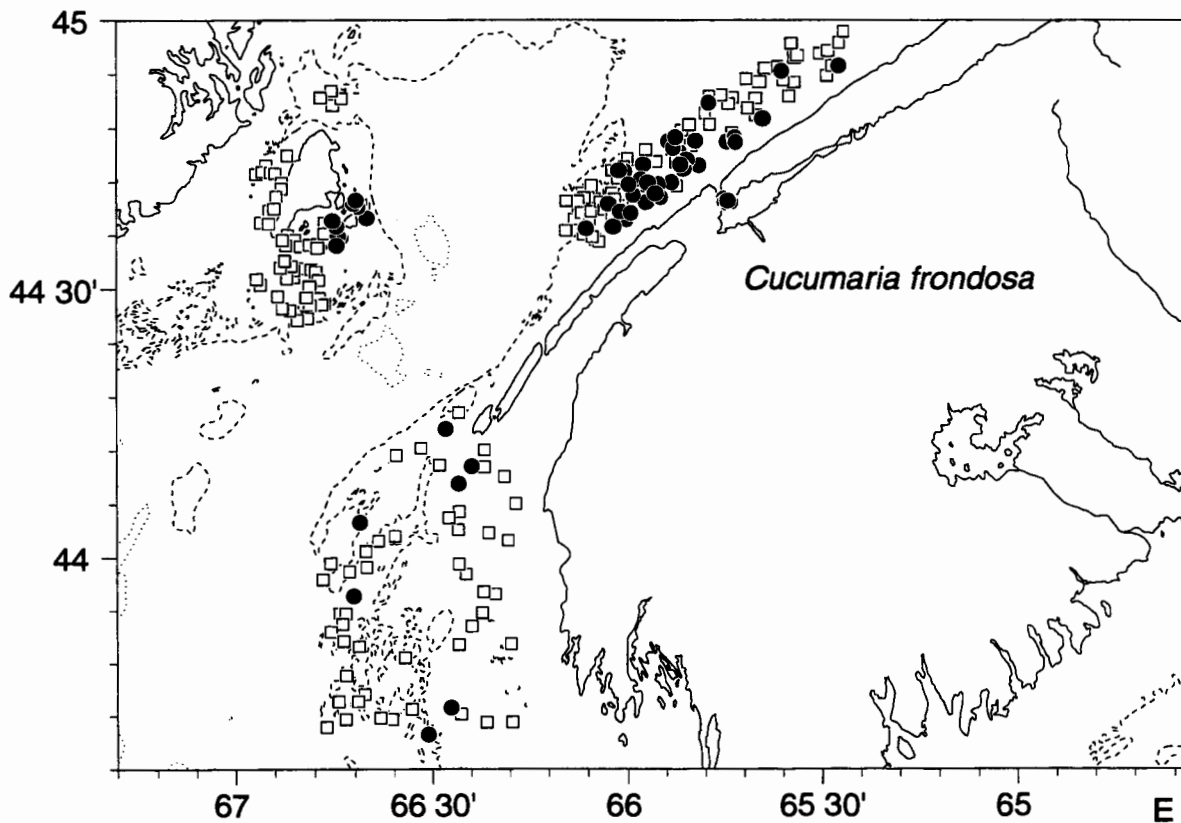
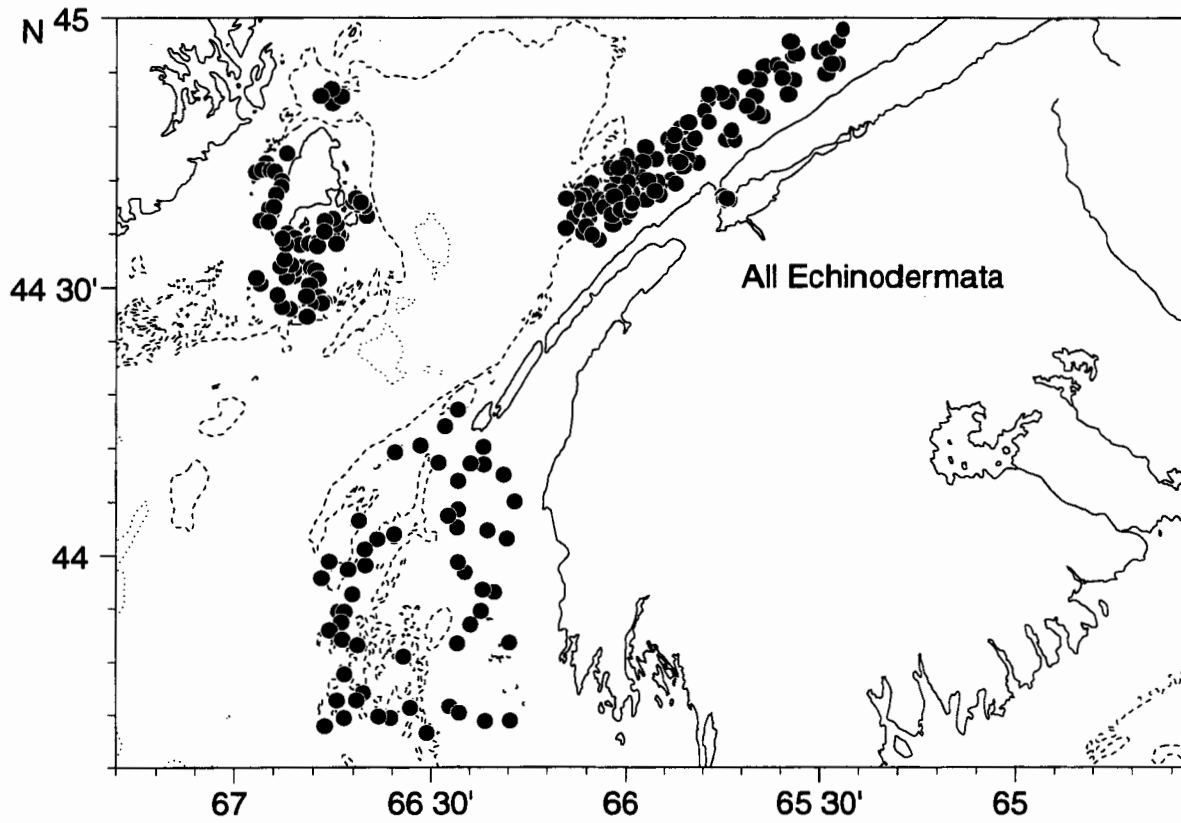


Figure 10. Distribution of representatives of the Phylum Echinodermata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

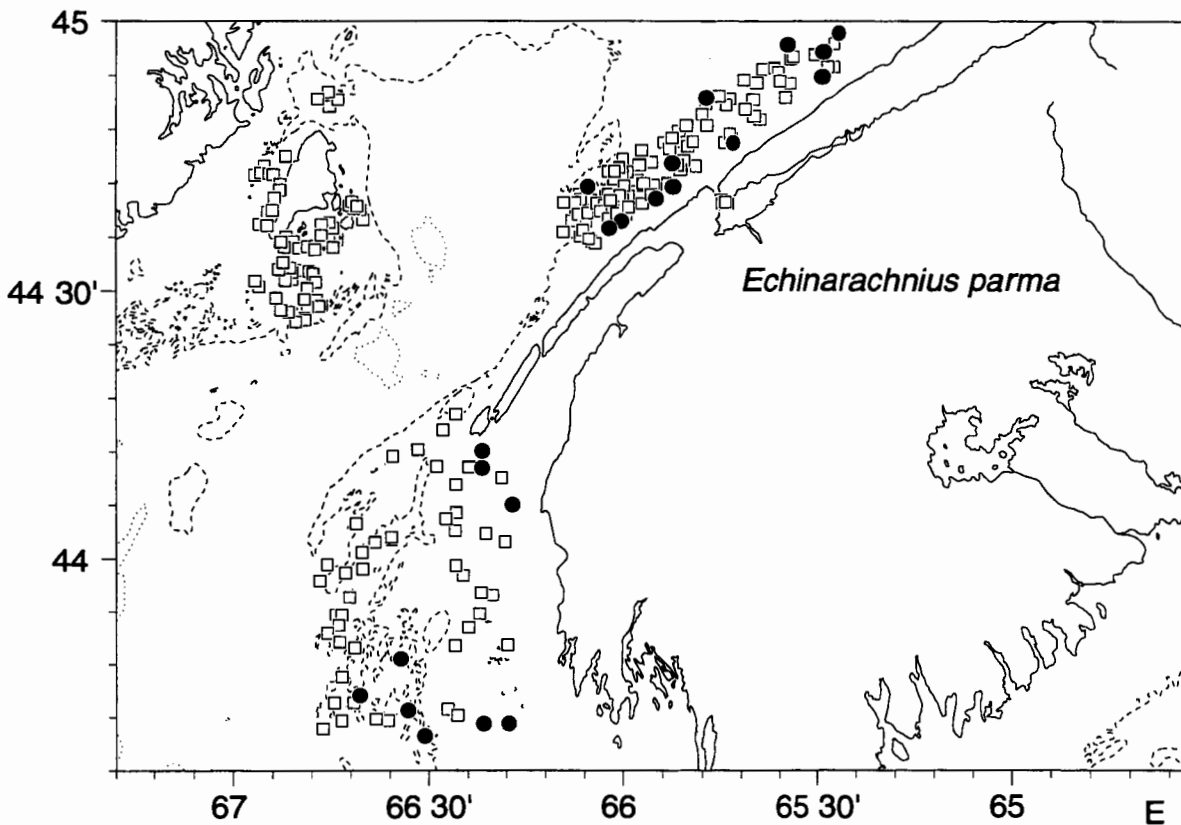
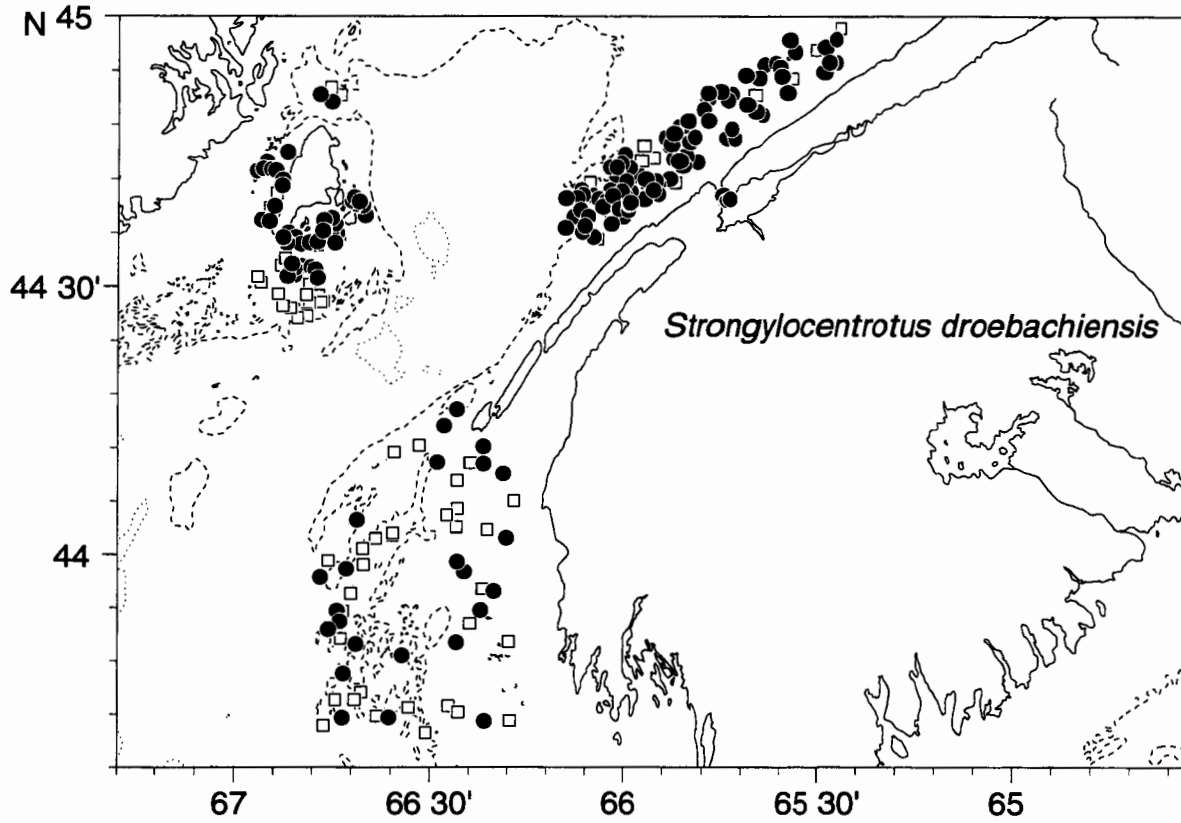


Figure 10 cont'd. Distribution of representatives of the Phylum Echinodermata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

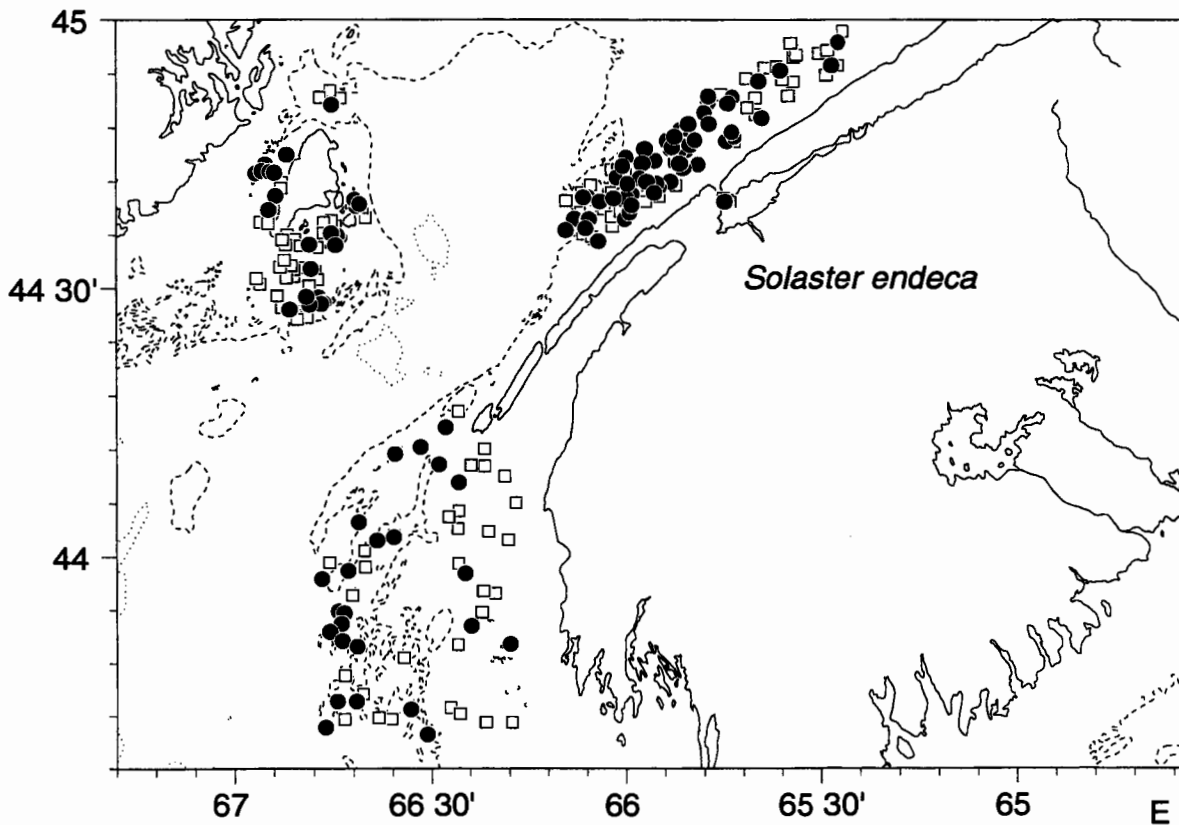
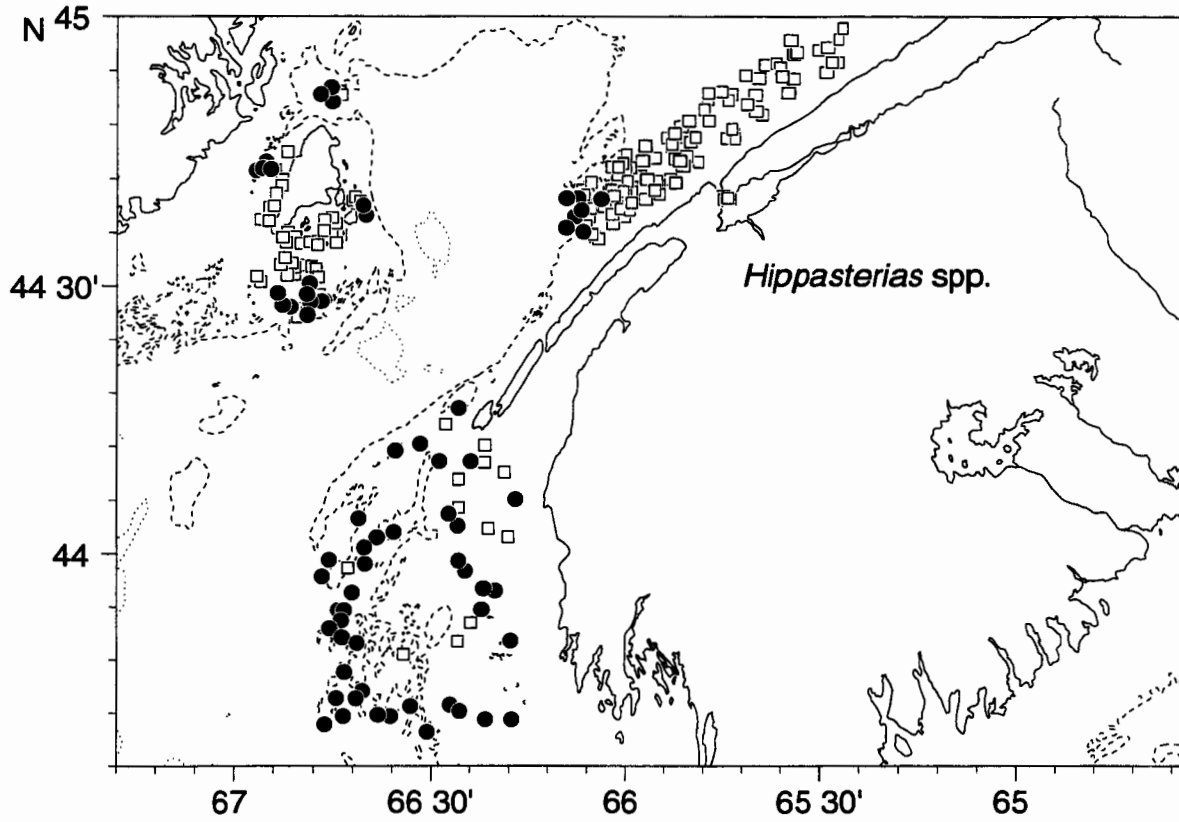


Figure 10 cont'd. Distribution of representatives of the Phylum Echinodermata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

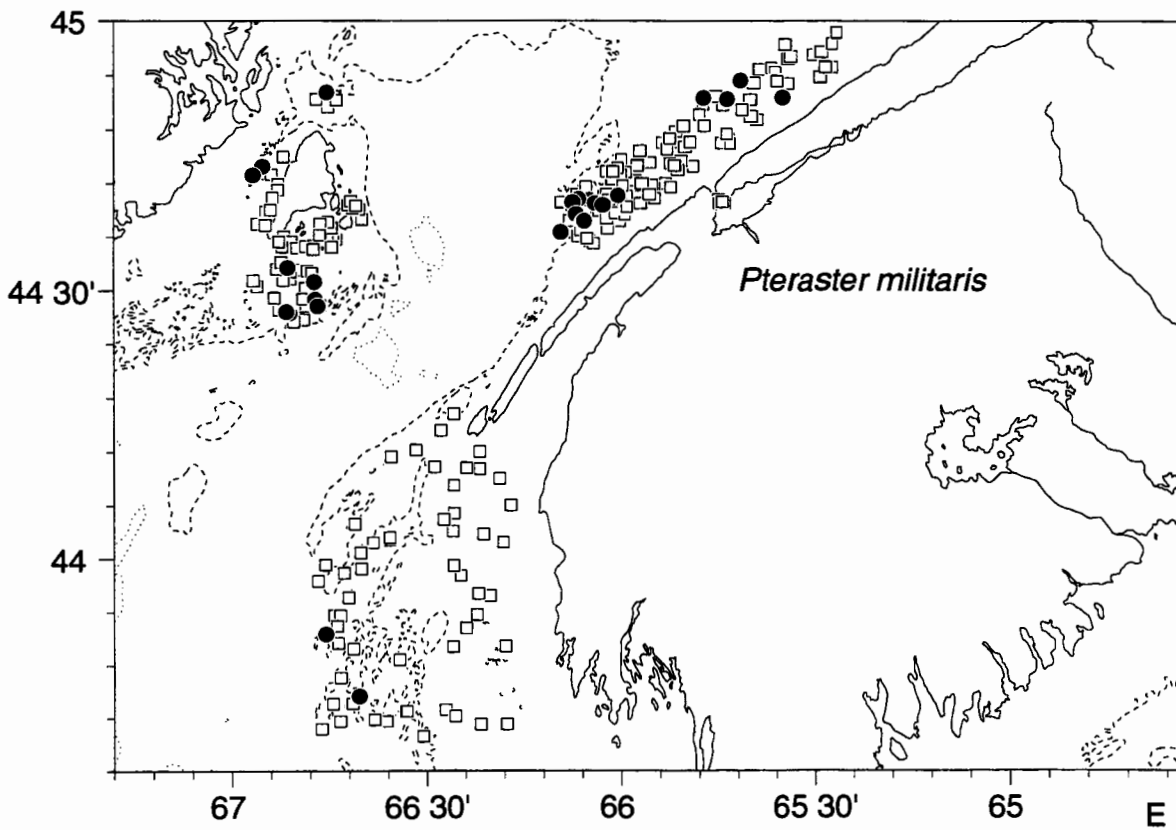
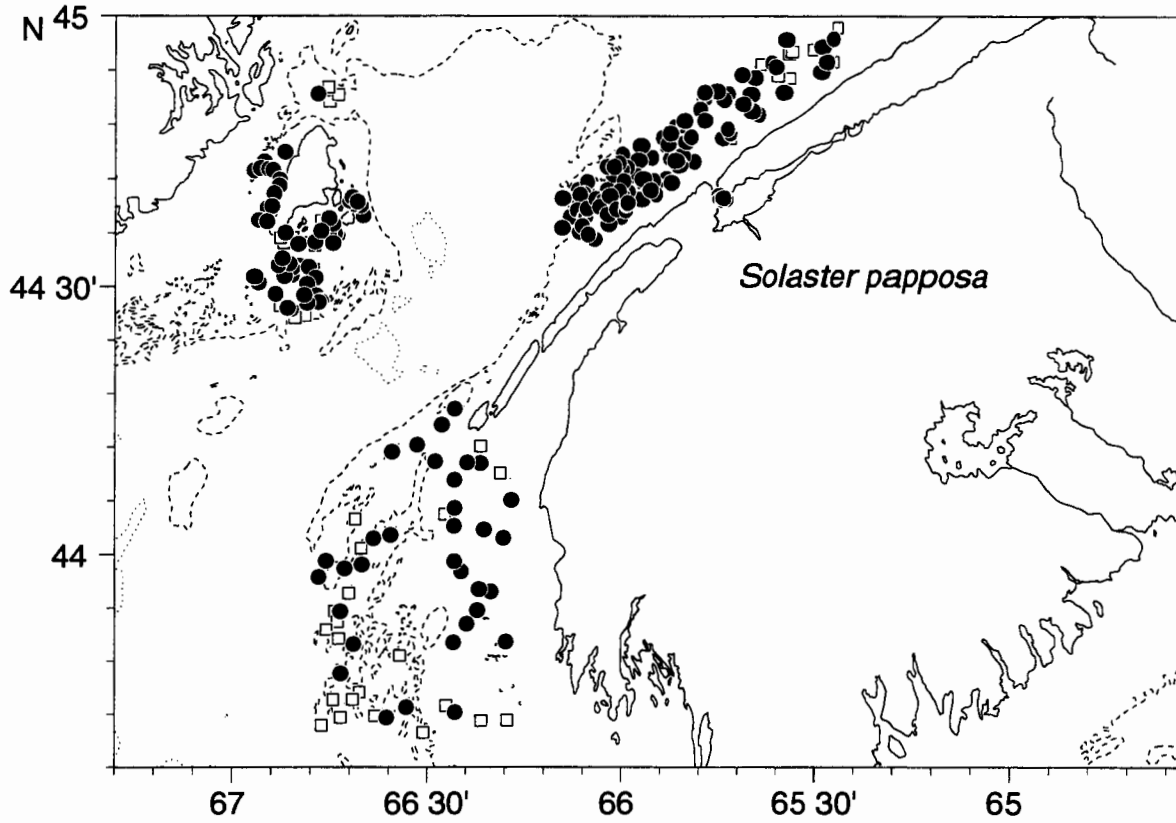


Figure 10 cont'd. Distribution of representatives of the Phylum Echinodermata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

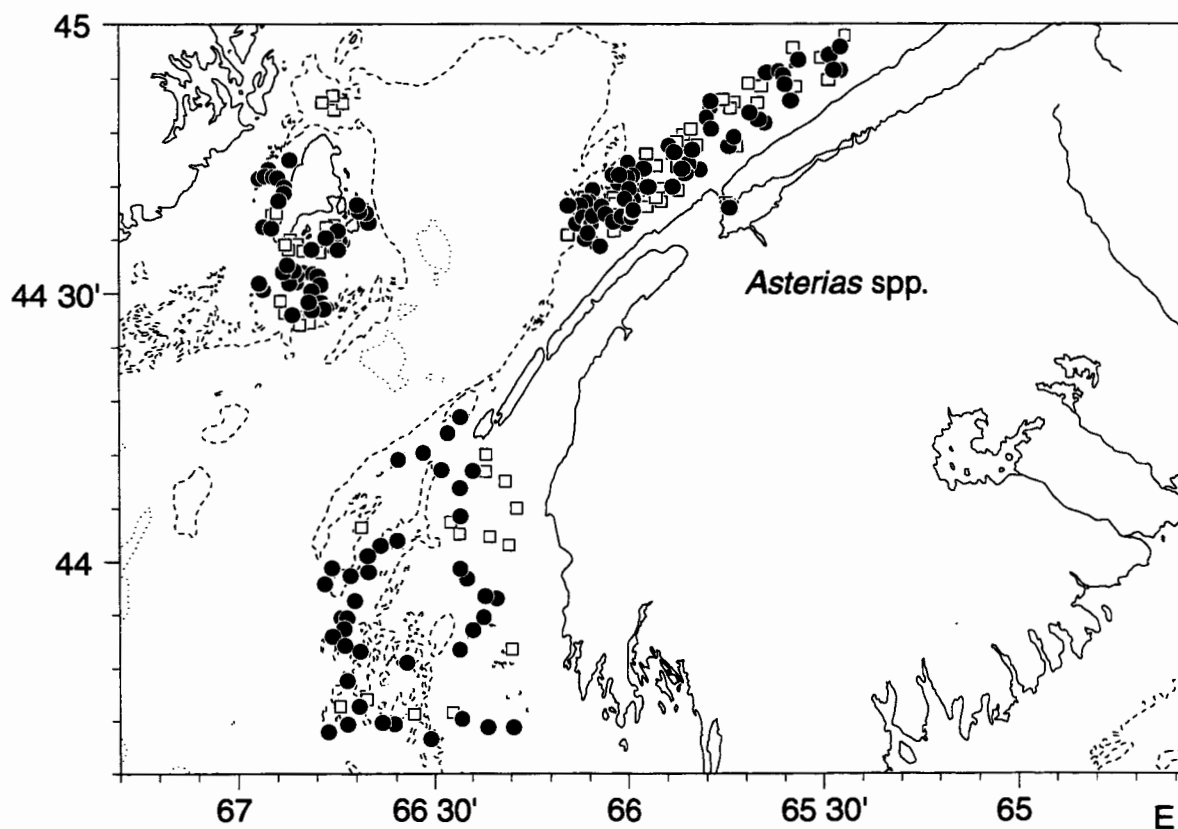
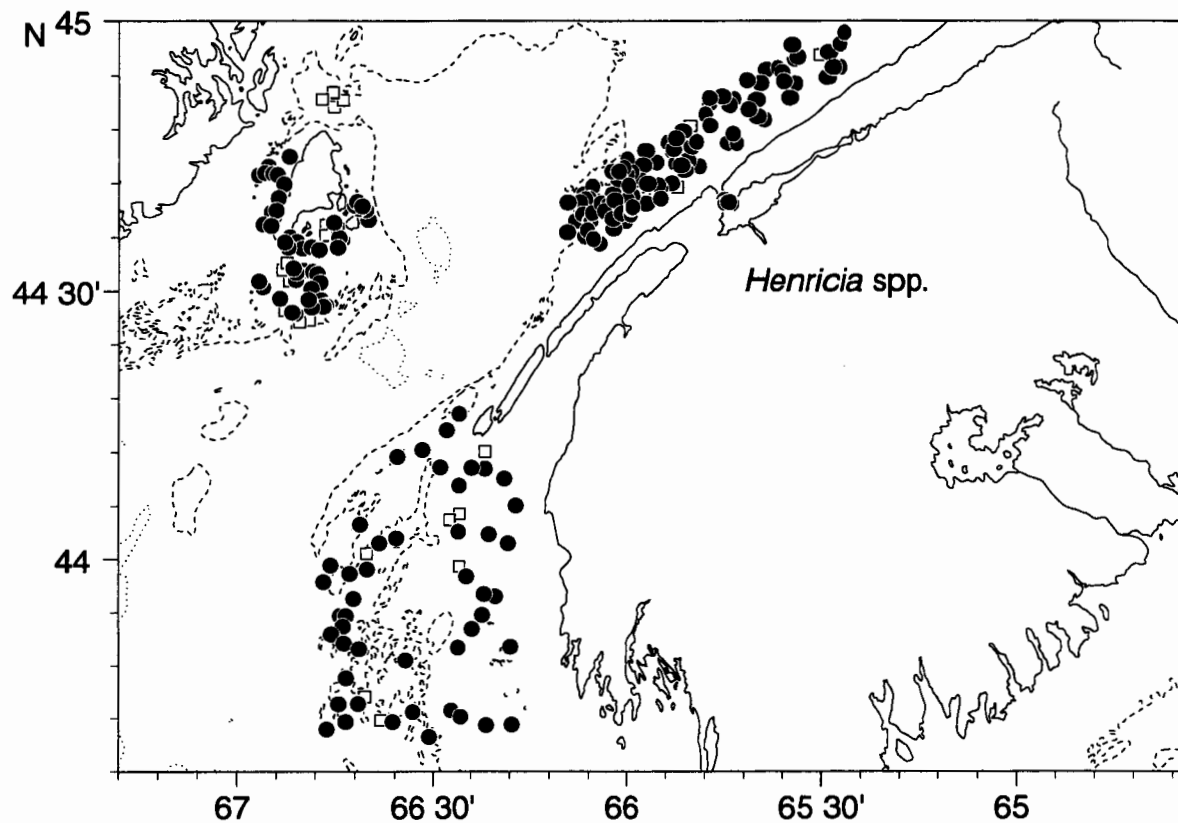


Figure 10 cont'd. Distribution of representatives of the Phylum Echinodermata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

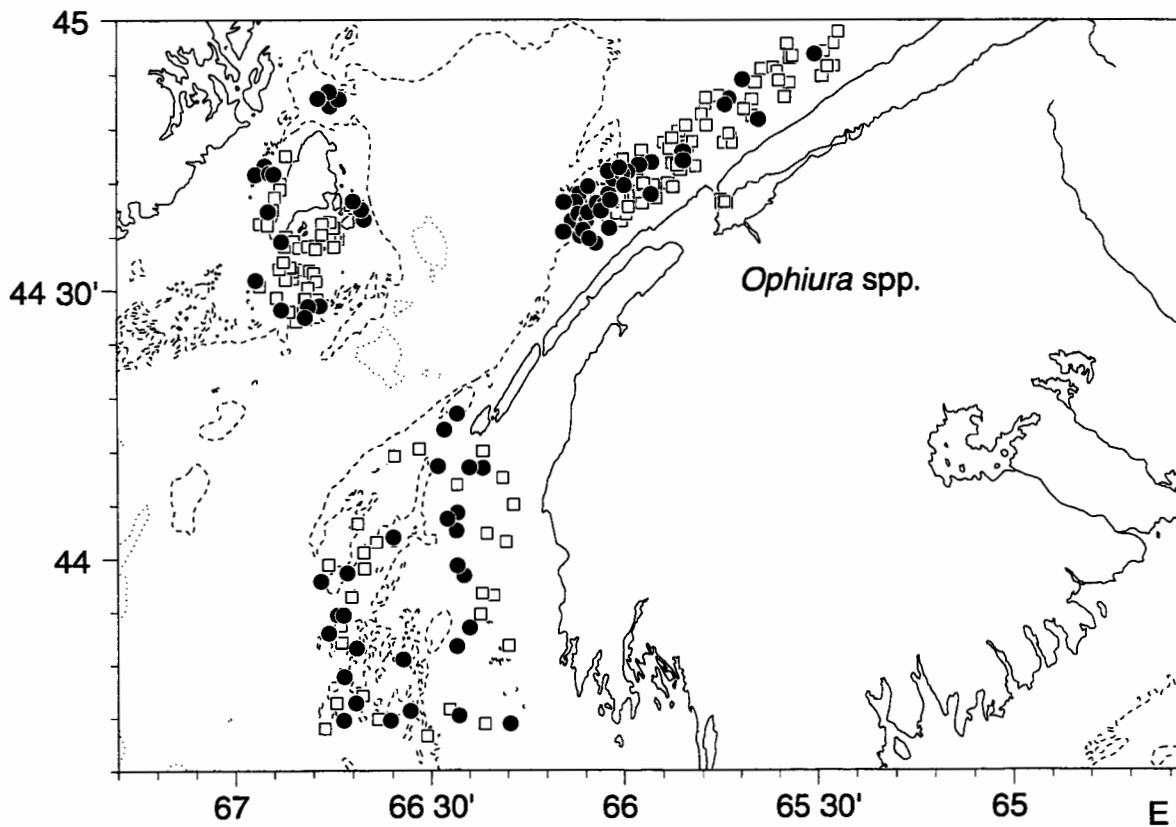
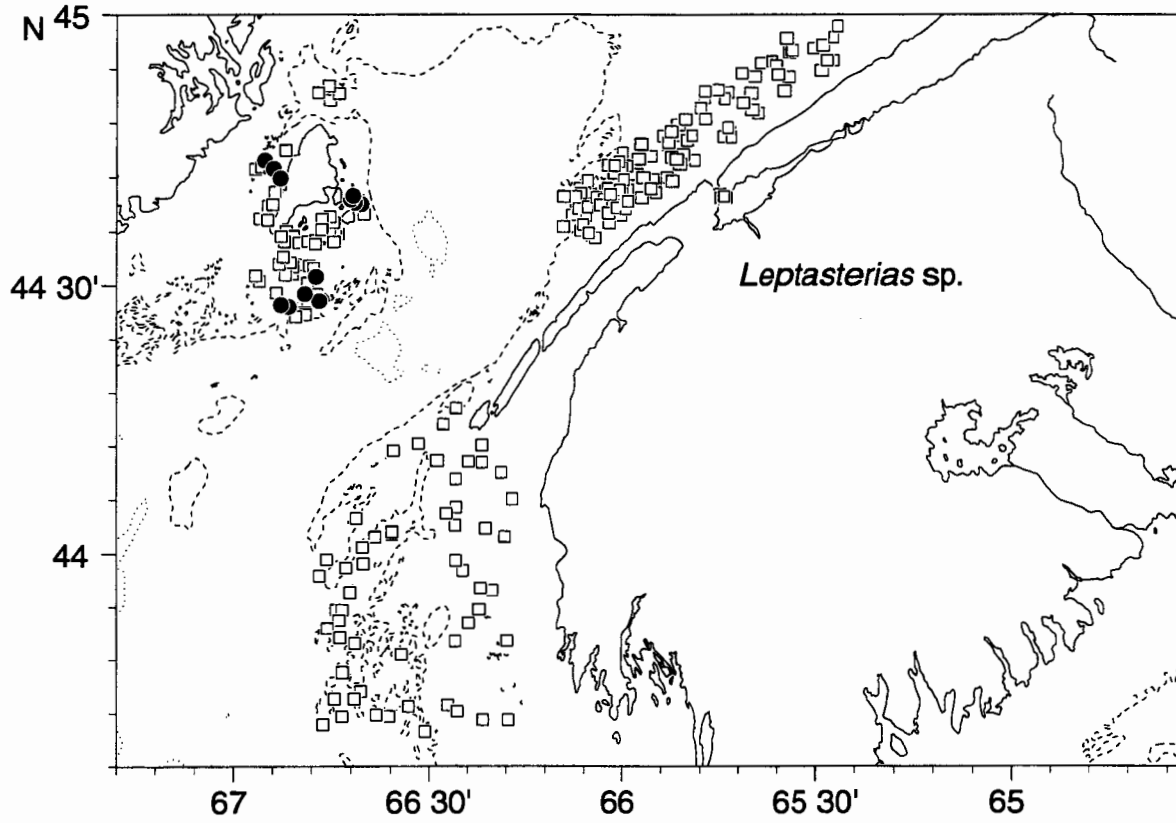


Figure 10 cont'd. Distribution of representatives of the Phylum Echinodermata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

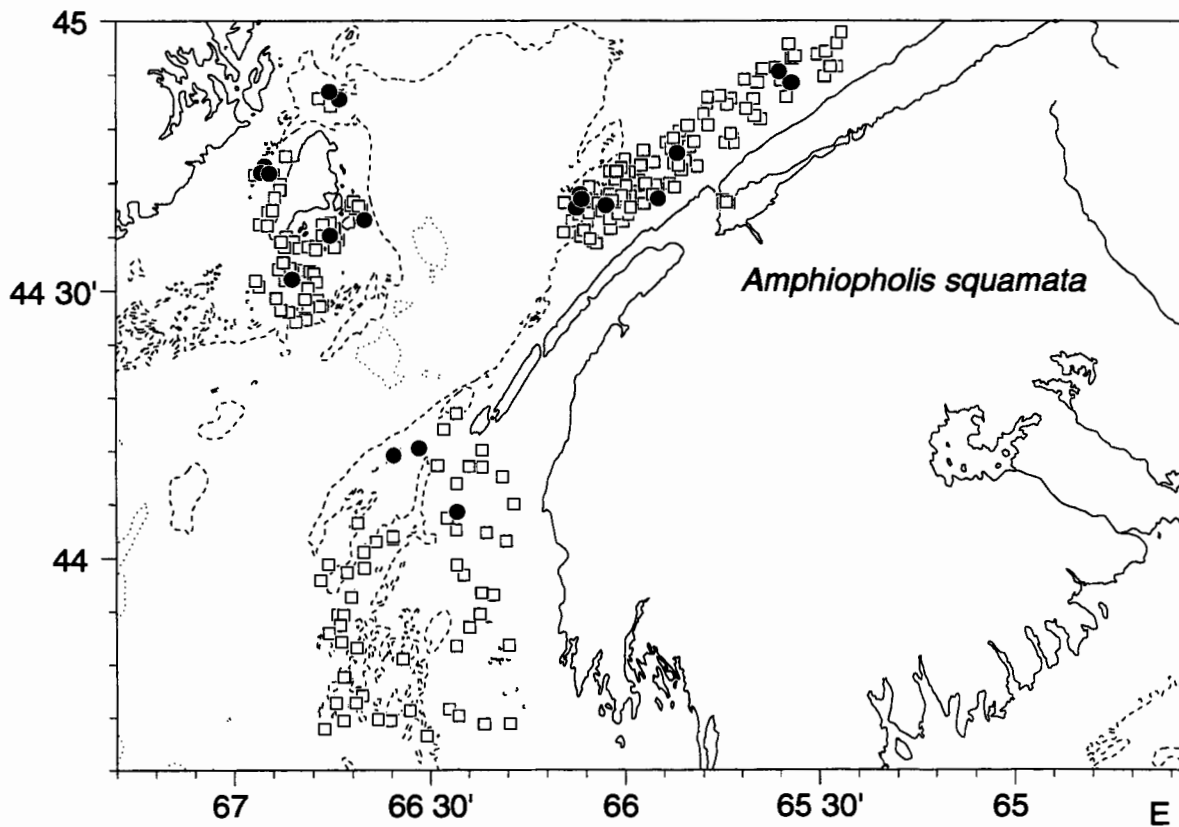
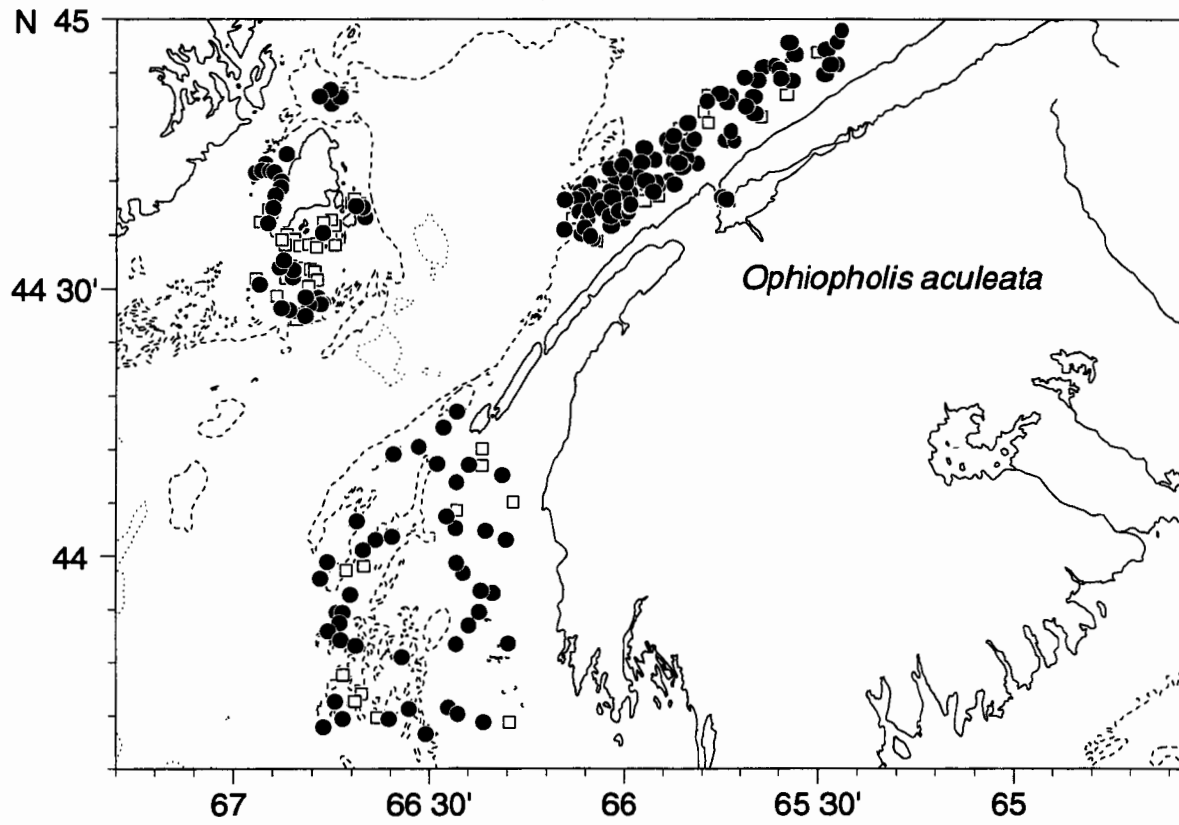


Figure 10 cont'd. Distribution of representatives of the Phylum Echinodermata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

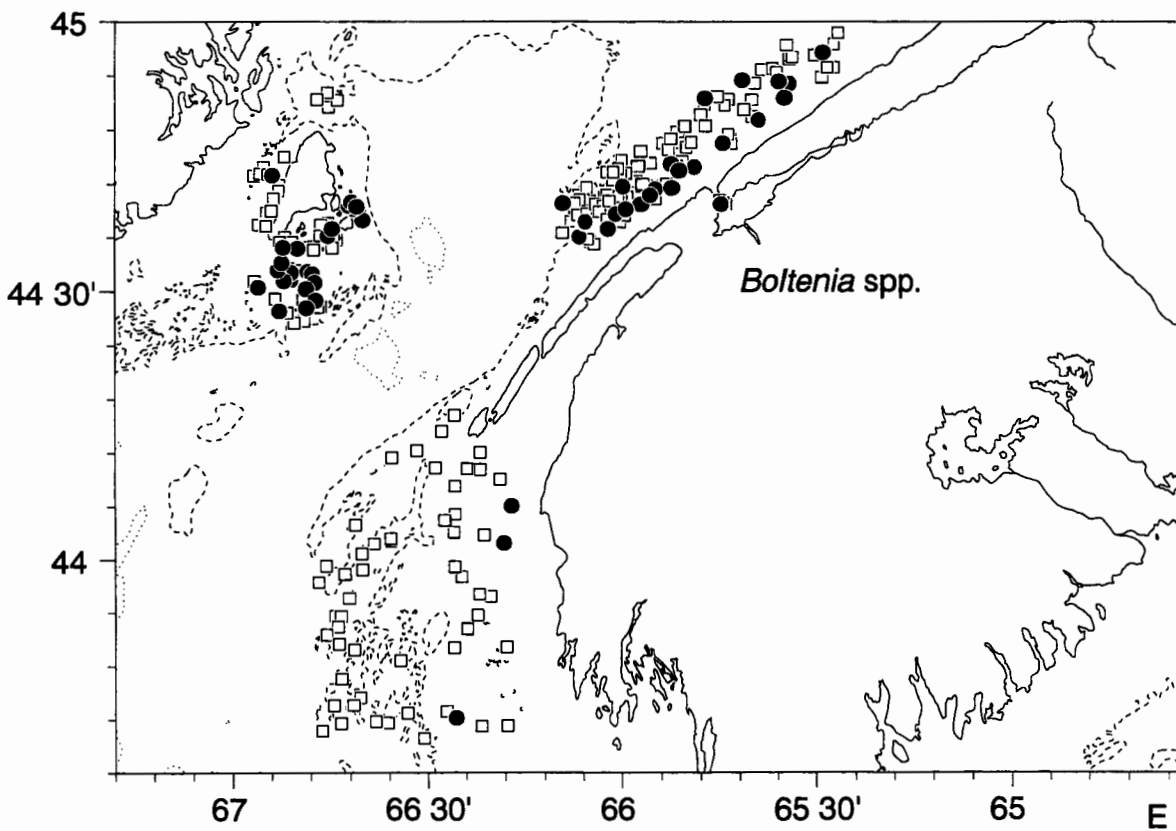
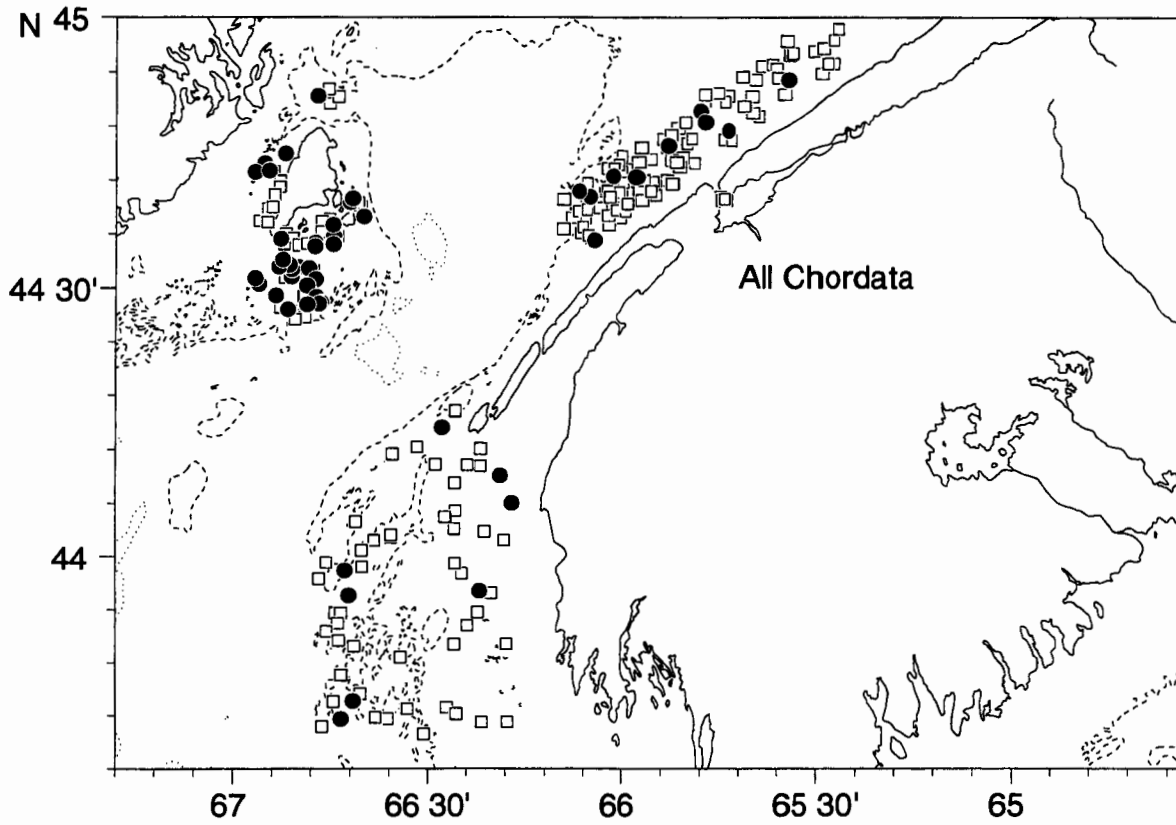


Figure 11. Distribution of representatives of the Phylum Chordata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).

● Denotes presence, □ Denotes absence

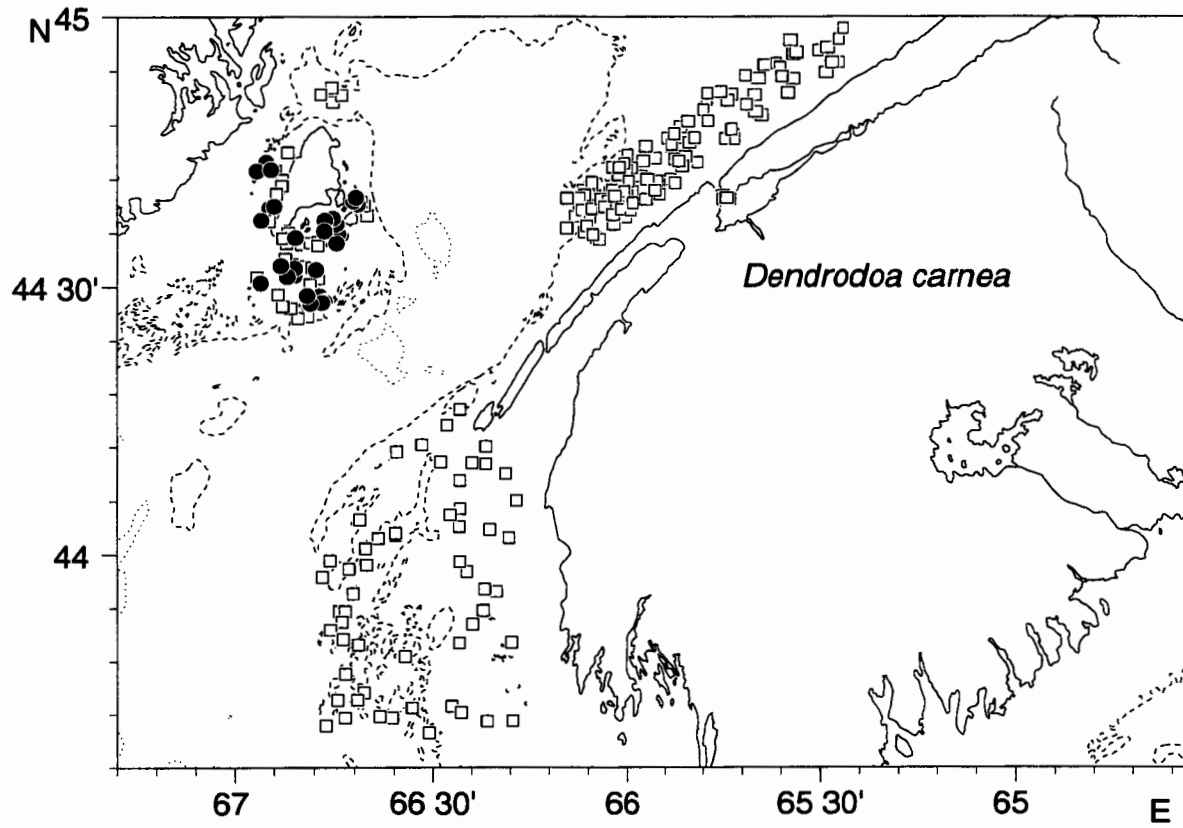


Figure 11 cont'd. Distribution of representatives of the Phylum Chordata in the Lower Bay of Fundy as recorded in Fuller et al. (1998).
● Denotes presence, □ Denotes absence

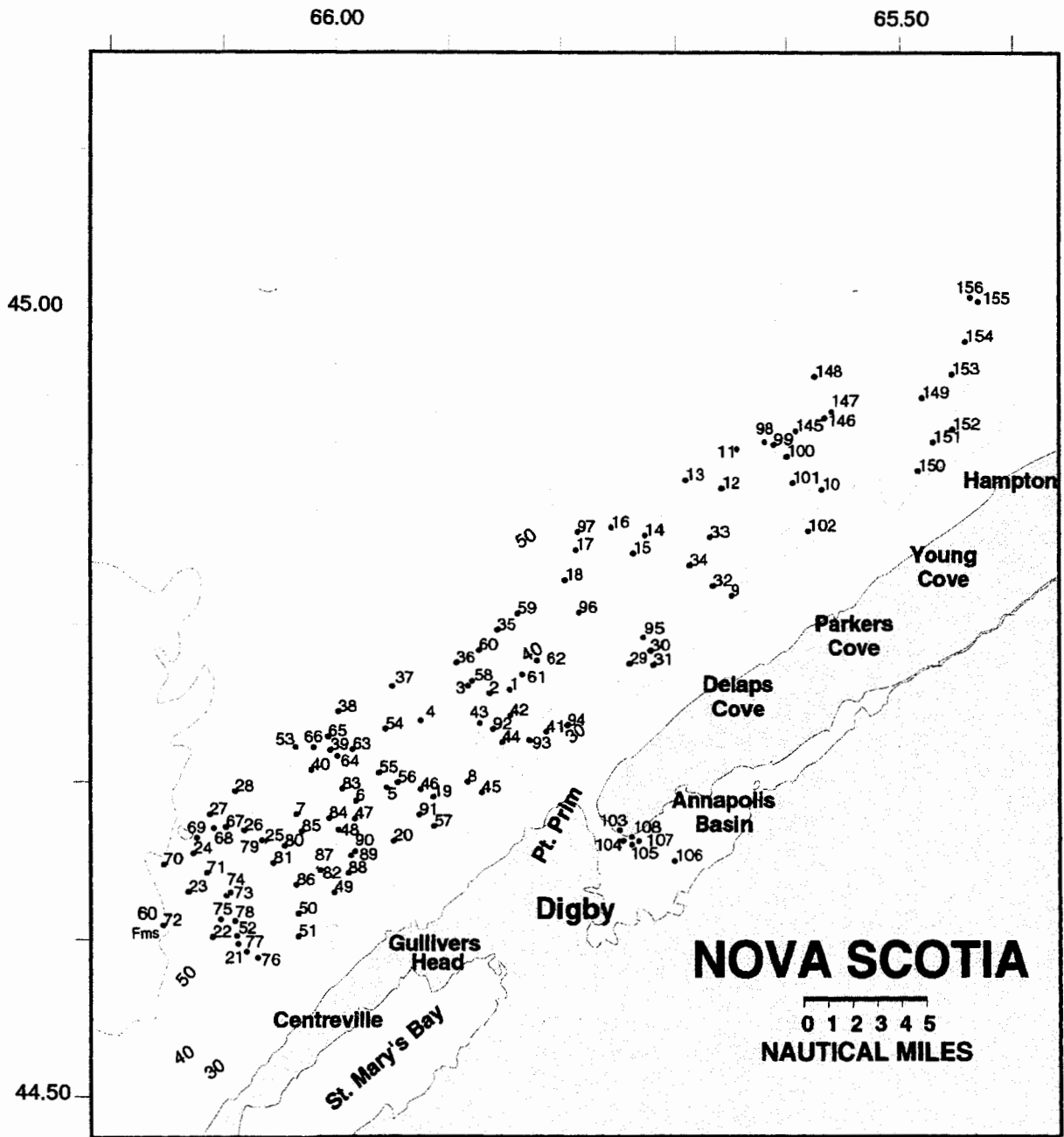


Figure 12. Tow locations for the Digby, Nova Scotia study area.

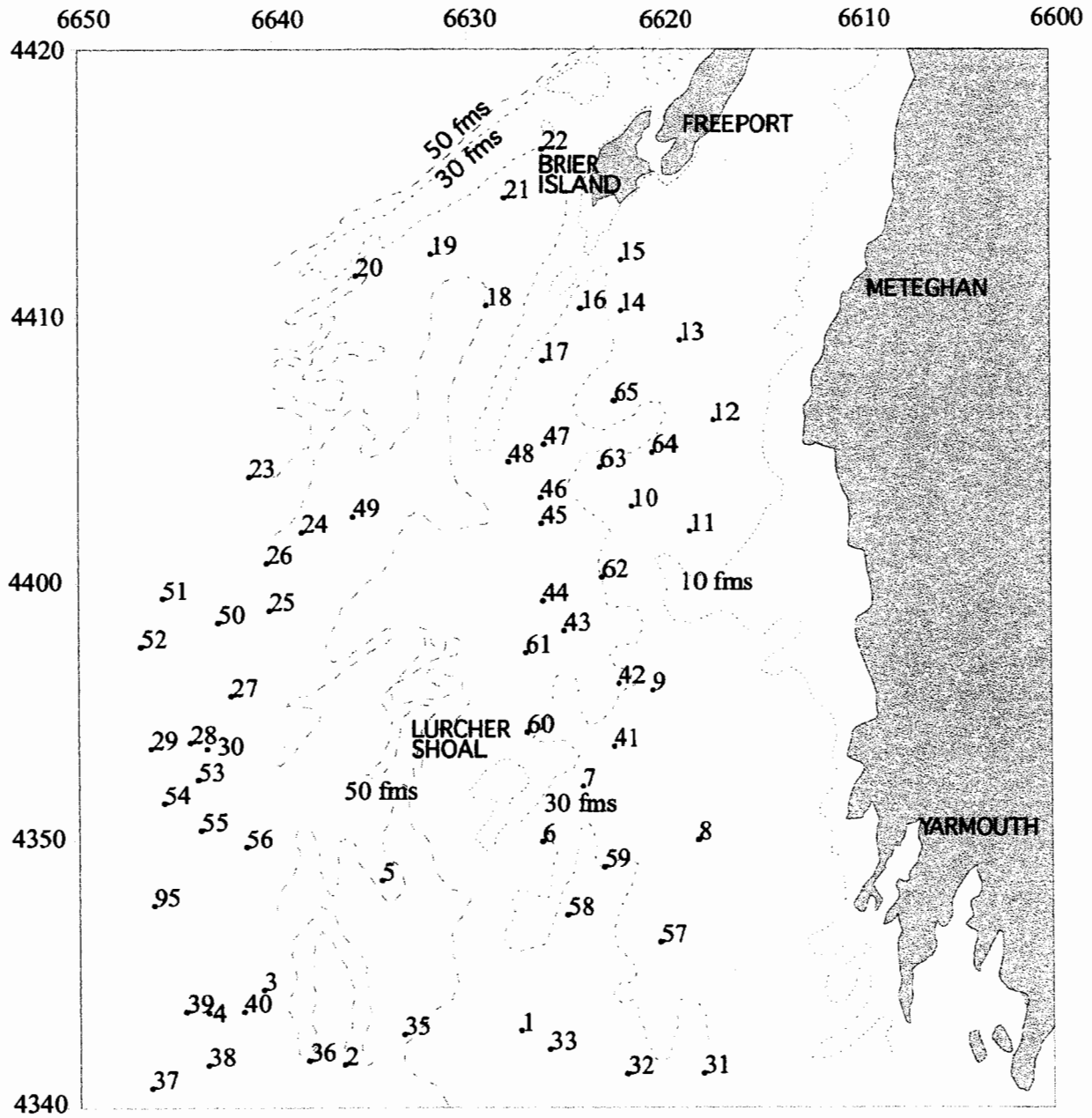


Figure 13. Tow locations for the Yarmouth/Brier Island, Nova Scotia study area.

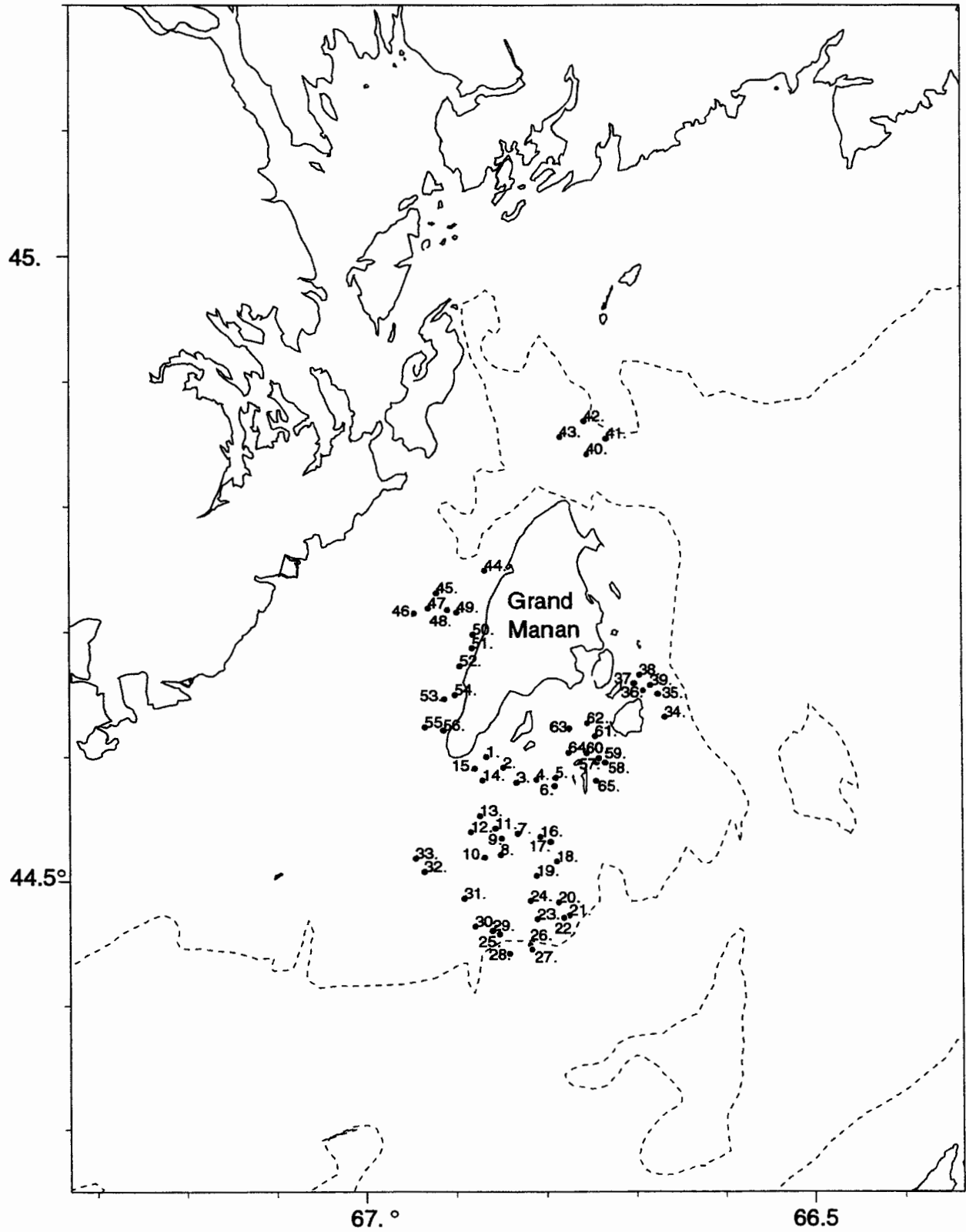


Figure 14. Tow locations in the Grand Manan, New Brunswick study area.

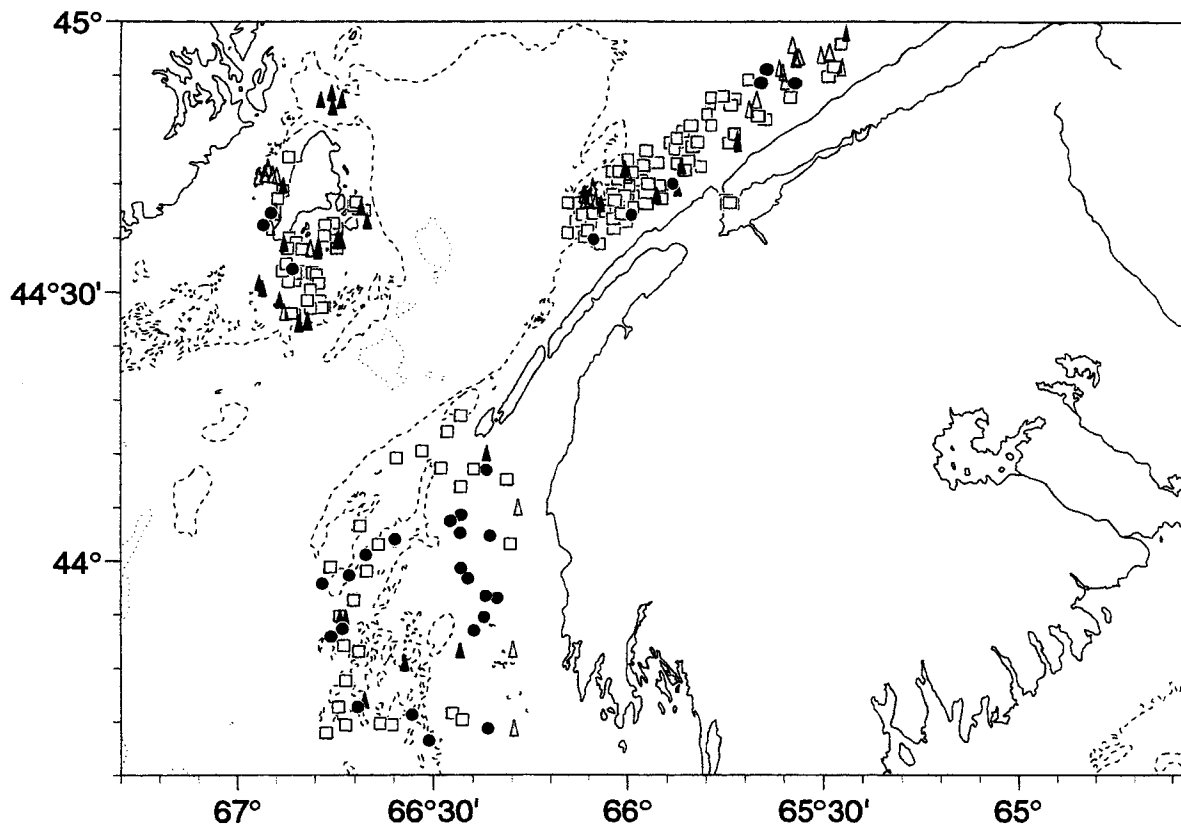


Figure 15. Bottom type in the Lower Bay of Fundy. Open squares denote rock bottoms, open triangles denote a mud or sand bottom with some gravel and shell debris, filled circles denote coarse sand with gravel and rocks, and filled triangles represent a predominantly mud bottom.