

INTERTIDAL INVERTEBRATES OF SCATARIE ISLAND: A PRELIMINARY SPECIES INVENTORY AND HABITAT DESCRIPTION

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As intertidal habitats of offshore islands remain relatively undocumented compared with their mainland counterparts, we conducted a survey of intertidal habitats on Scatarie Island, Nova Scotia. Two sites at Northwest Cove on the western side of the island and two sites at Eastern Harbour on the eastern side were classified in terms of their backshore and substrate characteristics. Infauna were collected within quadrates at each site and identified to species when possible. Additional visual searches of the wrack line, intertidal and subtidal zones were conducted to supplement the species inventory. Our survey represents a starting point for the characterization of intertidal habitats and inventory of intertidal fauna within this Protected Wilderness Area. Twenty-two species of marine invertebrates, including sponges, molluscs, echinoderms, arthropods and bryozoans, were identified. The majority of these were collected on the eastern side of the island within a relatively well protected area characterized by rock pools. Sites examined on the western side of the island had lower faunal diversity and less accumulated macroalgae. Differences in the subtidal depth, slope, dominant substrate type and exposure may offer a partial explanation for this finding.

Les habitats intertidaux des îles du large demeurent relativement peu documentés comparativement à ceux du continent. C'est pourquoi nous avons mené une étude des habitats intertidaux de l'île Scatarie, en Nouvelle-Écosse. Nous avons classé deux sites de l'anse Northwest, dans la partie ouest de l'île, et deux sites de la baie Eastern, dans la partie est, en fonction des caractéristiques de leur arrière-côte et de leur substrat. Nous avons quadrillé chaque site et recueilli, dans les carrés ainsi délimités, des organismes benthiques que nous avons classés par espèces dans la mesure du possible. D'autres recherches visuelles dans les cordons de goémon et les zones intertidale et infralittorale ont été effectuées pour enrichir l'inventaire des espèces. Notre étude constitue un point de départ pour la caractérisation des habitats intertidaux et l'élaboration d'un inventaire de la faune intertidale dans cette région sauvage protégée. Vingt-deux espèces d'invertébrés marins, dont des éponges, des mollusques, des échinodermes, des arthropodes

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et des bryozoaires, ont été identifiées. La majorité de ces espèces ont été recueillies dans la partie est de l'île, dans un secteur relativement bien protégé caractérisé par des bassins rocheux. Dans les sites étudiés du côté ouest de l'île, la diversité faunique et les accumulations de macroalgues étaient moindres, ce qui peut s'expliquer partiellement par les différences dans les profondeurs infralittorales, dans la pente, dans le type dominant de substrat et dans l'exposition aux éléments.

INTRODUCTION

The shoreline of Scatarie Island includes habitats ranging from bedrock cliffs to cobble, gravel and sandy beaches, which are typical of habitats over the entire Atlantic coast of Nova Scotia. These habitats have been studied intensively throughout the Gulf of Maine and the Canadian Maritimes (e.g., Bertness 1999, Bousfield & Leim 1960, Ginn et al. 1998, Lubechenco & Menge 1978, Metaxas et al. 1994, Roman et al. 2000). However, the intertidal regions and associated fauna of offshore islands such as Scatarie are largely undocumented.

As illustrated in the introduction to this series, Scatarie is an uninhabited island, located approximately 1 km off the east coast of Cape Breton Island, Nova Scotia and is currently protected under the Nova Scotia Wilderness Areas Protection Act. The marine invertebrate species occurring within this area represents an important part of the island's ecosystem.

We collected invertebrates within the intertidal zone of Scatarie, the area of shore covered and uncovered by the tides. The type of marine invertebrate fauna occurring within this habitat is largely related to tide exposure time and substrate, which are in turn related to tidal range, wave energy and shore source materials (Bertness 1999). The tidal range at Scatarie Island (as estimated from the closest gauging station at Louisburg) is 1.1 m at the lowest neap tide to 1.8 m at the highest spring tide (Canadian Hydrographic Service 2003). The shoreline of the island is dominated by cliffs of Precambrian volcanic rocks which include pyroclastic lapilli tuffs and basalt flows (Barr et al. 1996). Beaches have developed along the shores of the island's bays as a result of wave action, resulting in turn in the rounding and sorting of the source materials derived from these cliffs and from the Quaternary (glacial) till which blankets the island (Roland 1982).

This study was part of the 'bioblitz' (see series Introduction) and was undertaken as the first step toward a description of Scatarie's intertidal habitats and an inventory of the marine invertebrates occurring within and in waters adjacent to these habitats.

METHODS

As the intertidal habitat occurring at the base of Scatarie's cliffs is difficult to access, our study focused on Scatarie's beaches and one accessible rocky shore on the eastern end of the island. In the first week of August, 2005 detailed habitat characterizations were made along four 100 m shore sections on two of Scatarie Island's largest beaches: Northwest Cove on the western side of the island and Eastern Harbour on the eastern side (Fig 1). These sampling

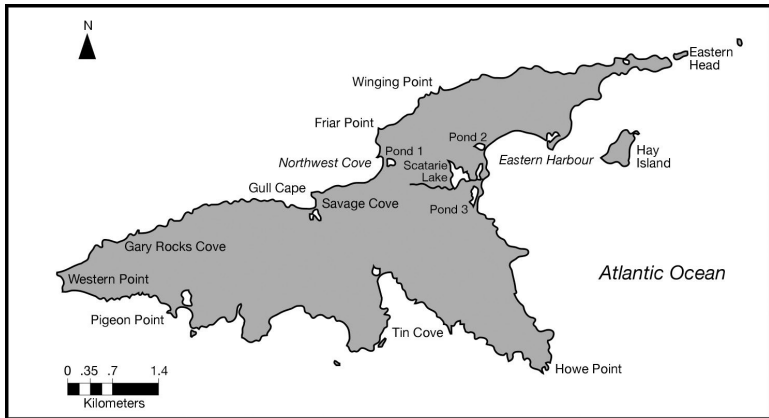


Fig 1 Scatarie Island, Nova Scotia

sites were chosen to represent variations in the island's beach habitat resulting from variations in wave energy and associated substrates. Within the 100 m shore sections, a variety of habitat variables were recorded including backshore characteristics. For this study, the backshore was defined as starting at the top of the shore where vegetation first occurs and to 30 m landwards. Dominant vegetation and land forms were noted within this area. Within the intertidal zone, at each 100 m shore site, habitat characteristics including size of dominant sediment (Wentworth 1922, Cummins 1962) and percent algal cover were visually assessed using six haphazardly placed 1 m² quadrats, three at the mid and three at the low tide level. Infauna was also sampled within each of these six quadrats. Substrate was removed with a shovel to a depth of 15 cm within a 0.25 m² area located at the lower righthand corner of each 1 m² quadrat. The substrate was sieved through a 500 μ m sieve and examined for macroinvertebrates. In July of 2006 additional marine invertebrate collections were made during visual searches of the entire shoreline of Northwest Cove (~ 2 km), East-

ern Harbour (~ 2.5 km) and the rocky shore and tide pools of Rock Point Beach (~ 1 km) at the north eastern tip of the island (Fig 1). Particular attention was paid to wrack line debris as this tends to accumulate dead specimens and shell molts (exuvia) representative of the living invertebrate community in the adjacent intertidal and subtidal areas (Kidwell 2002). Invertebrates were either identified in the field or brought to the laboratory for further study. Live specimens brought back to the laboratory were preserved in 70% ethanol; identification and nomenclature were based on Gosner (1979) and Weiss (1995). Voucher specimens were sent to the Nova Scotia Museum of Natural History to serve as permanent, verifiable records of species identifications.

RESULTS AND DISCUSSION

We identified 22 species of marine invertebrates within the intertidal areas of Scatarie Island (Table 1). Eleven species were collected live while the remaining half were represented by shell molts or dead specimens found in wrackline debris.

The majority of species were found on the south eastern side of the island at Rock Point Beach and Eastern Harbour. The backshore at the Rock Point site was dominated by crowberry shrub (*Empetrum nigrum*) and exposed rock. The intertidal area was rocky with rock pool formations and a small (~ 500 m) beach in the adjacent bay that was dominated by gravel and coarse sand. Rock Point Beach is protected from the southeast and south winds that prevail in the summer by a small island (Hay Island) less than 1 km off its shoreline. On the other hand, the majority of shore at Eastern Harbour is more exposed to the full force of the summer winds and associated waves. The backshore at the Eastern Harbour site is comprised of several coastal lagoons (barachois) surrounded by a treed bog. The shore itself was characterized by an accumulation of cobble just above the high tide mark typical of high energy (waves, swell, storms) glacial till shorelines (Davis & Browne 1996). Middle and lower intertidal zones were dominated by coarse, poorly sorted, gravelly sand.

Live Northern Rock Barnacle (*Balanus balanoides*), Blue Mussel (*Mytilus edulis*) Common Periwinkle (*Littorina litorea*) and Smooth Periwinkle (*Littorina obtusata*) were observed attached to rock outcrops and cobble within the middle and lower intertidal areas at Rock Point. Live Sandhoppers (*Orchestia gammarellus*) were found within the upper shore wrackline debris at both Rock Point and Eastern Harbour beach along with shell molts from Lobster (*Homarus americanus*) and Rock Crab (*Cancer irroratus*). Empty shells

Table 1 Preliminary checklist of marine invertebrates of Scatarie Island, Nova Scotia

 PORIFERA

- Bread Crumb Sponge, *Halichondria panicea* (Pallas, 1766)
 Eye and Finger Sponge, *Haliclona oculata* (Pallas, 1766)
-

MOLLUSCA

- Common Periwinkle, *Littorina littorea* (Hamer, 1920)*
 Smooth Periwinkle, *Littorina obtusata* (Linnaeus, 1758)*
 Atlantic Dog Whelk, *Nucella lapillus* (Linnaeus, 1758)*
 Waved Whelk, *Buccinum undatum* (Linnaeus, 1758)*
 Blue Mussel, *Mytilus edulis* (Linnaeus, 1758)*
 Atlantic Surf Clam, *Spisula solidissima* (Say, 1822)
 Tortoise Shell Limpet, *Tectura testudinalis* (Müller, 1776)
 Wrinkled Rock Borer, *Hiatella arctica* (Linnaeus, 1767)
 Horse Mussel, *Modiolus modiolus* (Linnaeus, 1758)
-

ECHINODERMATA

- Green Sea Urchin, *Strongylocentrotus droebachiensis* (Müller, 1776)
 Purple Sea Star, *Asterias vulgaris* (Verrill, 1866)*
-

POLYCHAETA

- Spiral Tube Worm, *Spirorbis spirillum* (Linnaeus, 1767)
-

ARTHROPODA

- Northern Rock Barnacle, *Balanus balanoides* (Linnaeus, 1767)*
 Scud, *Gammarus* sp.*
 Sand Hopper, *Orchestia gammarellus* (Pallas, 1766)*
 Lobster, *Homarus americanus* (Milne-Edwards, 1837)
 Green Crab, *Carcinus maenas* (Linnaeus, 1758)
 Rock Crab, *Cancer irroratus* (Say, 1817)
 Baltic Isopod, *Idotea balthica* (Pallas, 1772)*
-

BRYOZOA

- Lacy Bryozoa, *Electra pilosa* (Linnaeus, 1767)*
-

* Denotes species observed live; all others were identified from empty shells, molt exuvia or dead individuals collected in wrack debris.

of Waved Whelk (*Buccinum undatum*), Atlantic Surf Clam (*Spisula solidissima*), Green Sea Urchin (*Strongylocentrotus droebachiensis*), Horse Mussel (*Modiolus modiolus*), Tortoise Shell Limpet (*Acmaea testudinalis*), and Wrinkled Rock Borer (*Hiatella arctica*) as well as remains of Eyed Finger Sponge (*Haliclona oculata*) and Bread Crumb Sponge (*Halichondria panicea*) were also observed washed up in the wrackline at both these sites. Waved Whelk egg casings were observed in the wrackline at Eastern Harbour.

The shore along the north western side of the island was noticeably different. The backshore along the inner bay of Northwest Cove Beach lacked the cobble "storm beach" that was a prominent feature of the beaches on the eastern side of the island. Here the backshore was characterized by low (1 – 1.5 m) eroding dunes

dominated by the dune grass *Elymus mollis*. Towards the heads of the bay, the backshore consisted of rocky cliffs between 2 and 4 m high. The middle and lower intertidal area of North Cove beach was dominated by poorly sorted coarse sand and gravel substrate. Rock Crab molts, empty shells of Common Periwinkle and Atlantic Dog Whelk (*Nucella lapillus*) as well as Bread Crumb and Eyed Finger Sponge were collected in wrack line debris at North Cove Beach. Living specimens of Purple Sea Star (*Asterias vulgaris*), Blue Mussel, and Northern Rock Barnacle were found at the lower intertidal. A single empty shell of the invasive species Green Crab (*Carcinus maenas*) was found along the top of the cliffs at Wing-ing Point. This was probably dropped by a gull. Given the distance to the mainland, it seems probable that the live Green Crab was plucked from the shores of Scatarie.

The flora of Scatarie Island's shoreline was not examined in any detail for this study, but the lack of macroalgae at Northwest Cove and the dense accumulation of macroalgae within both the subtidal and intertidal at Eastern Harbour was noteworthy. Differences in near-shore depths and substrate may account for the variation observed. Eastern Harbour is characterized by a shallow sloping subtidal that is less than 5 m deep between 1-2 km from the shoreline; whereas the shore at Northwest cove drops off steeply, with subtidal water depths reaching over 15 m only 200 m from shore and over 25 m at around 1 km from shore (Nautical Data International 2006). The numerous rocky outcrops visible within the subtidal region of Eastern Harbour also indicate a hard bottom substrate that would be optimal for macroalgal attachment. The gale force winds and storm surge associated with Tropical Storm Franklin that passed south of the island the week prior to our 2006 survey of the island may have caused the large accumulation of macroalgae at Eastern Harbour. Serrated Wrack (*Fucus serratus*) formed the bulk of the macroalgae observed. Sugar Kelp (*Laminaria saccharina*), Irish Moss (*Chondrus crispus*), Bladder Wrack (*Fucus vesiculosus*), and Knotted Wrack (*Ascophyllum nodosum*) were also present. An abundance of amphipods (unidentified *Gammarus* sp.) were observed living underneath these algal mats and Lacy Bryozoa (*Electra pilosa*) and Spiral Tube Worm (*Spirorbis spirillum*) were found encrusted on both Serrated Wrack and Irish Moss.

No living invertebrates were found within any of the beach sediment samples taken on Scatarie. The only endobenthic (living within the sediment) organism identified on the island was the Atlantic Surf Clam. Adults of this bivalve tend to prefer the type of high energy shores with coarse-grained sand and gravel sediment that occur on Scatarie Island (Fay et al. 1983). However, most other burrow-

ing animals typical of this region require lower energy habitat with finer sediments, which could account for their absence from our Scatarie sample sites.

Ten of the marine invertebrate species reported in a survey done in the Bras d'Or Lakes of Cape Breton (Tremblay 2002) were also found during our survey of Scatarie. However, sixteen species reported by Tremblay (2002) were not found at our Scatarie sampling sites and twelve species of marine invertebrate found at Scatarie were not recorded in the Bras d'Or Lakes study. Some of the differences in taxa between these two sites are expected based on habitat differences. There is reduced salinity (21 – 23 ppt) within much of the Bras d'Or Lakes compared with the open ocean salinities (31 ppt) of the water surrounding Scatarie Island (Davis & Browne 1996) and the shores of Bras d'Or are far more protected from wave energy and ice scour in comparison with Scatarie. Five of the species reported by Tremblay (2002) (not seen in our samples on Scatarie) are associated with protected bay habitats (e.g. *Crassostrea virginica*, *Mya arenaria*, *Ensis directus*).

Differences in sampling methods between the two studies also likely explain differences in taxa reported. Tremblay's (2002) sampling efforts focused on the subtidal (via trawls and lobster traps) whereas our study of Scatarie focused on intertidal areas and wrackline debris. Our sampling method was likely biased against taxa that do not live intertidally or have visible shell molts or shell remnants that collect in the wrackline. This may explain the absence of shrimp species such as *Pandalus montagui* and *Crangon septempinosus* and the echnionderms *Solaster* sp. and Sea Cucumber from our Scatarie sampling. These species were found in the Bras d'Or Lakes study (Tremblay 2002).

The marine invertebrate species identified on Scatarie Island are consistent with Boreal-Arctic marine fauna characteristic of rocky shore benthic habitats of the region (Bousfield & Thomas 1975). Metaxas et al. (1994) surveyed exposed rocky shores near Halifax, Nova Scotia and reported nine macroinvertebrate species, six of which we also reported for Scatarie Island (*Littorina litorea*, *Littorina obtusata*, *Nucella lapillus*, *Mytilus edulis*, *Strongylocentrotus droebachiensis*, and *Acmaea testudinalis*). Their sampling focused exclusively on live tide pool specimens which would account for the absence from their species list of the subtidal species found in our study (e.g. *Buccinum undatum*, *Homarus americanus*). These species were represented by shell molts or empty shells in our Scatarie samples.

Differences between islands and the mainland have been described and identified mainly for terrestrial organisms (e.g. Sol

2000) with less effort devoted to marine invertebrates. It is possible that differences between islands and the mainland exist because of environmental differences between the two regions. Historical events, physical processes such as local oceanography and climate, natural and anthropogenic disturbance and biotic interaction, may in principle, contribute to differences between the environmental conditions of islands and mainland shores. Further study comparing islands to the mainland may reveal that differences in these environmental conditions result in differences in intertidal species assemblages. Our study represents only a very preliminary inventory of the marine species present on and around Scatarie Island. Continued examination of the island for additional intertidal and subtidal species (both floral and faunal) will provide a more complete database for comparison of the marine species assemblages of the island with those of nearby mainland areas. Such surveys can also be useful in identifying new invasive species that may be a threat to the island as well as identifying species that may be of conservation interest.

Acknowledgements. The authors wish to acknowledge the Atlantic Coastal Action Program of Cape Breton and Cape Breton University for providing the equipment and logistical support required for the field work. Keith Campbell and his colleagues provided invaluable transport to and from the island. Bruce Hatcher's zodiac "taxi service" as well as other support was also especially helpful. Margi Amos, Jennifer Easterly and Emily Mizier-Barre assisted with field work. Comments by David McCorquodale and Fenton Isenor were most useful for improving the manuscript. Finally we would like to thank Rob Cameron for inviting us to take part in the bioblitz project.

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