T11.17 MARINE INVERTEBRATES

This Topic deals with the occurrence of marine invertebrates in Nova Scotia waters. The marine environment includes the diverse intertidal habitats (H2.1–H2.5), the ocean bottom (H1.2) and water of the open sea (H1.1). Common species are included in the habitat descriptions.

The Canadian Atlantic marine fauna is generally well known, since it has been studied for more than a century. Early studies have been listed by Whiteaves in his catalogue of the marine invertebrates of the region.[1] Significantly more effort has been expended on studies in intertidal and shallow nearshore habitats than in offshore areas. Marine research in Atlantic Canada has always had a strong relationship with fisheries, and to a great extent the study of invertebrates and marine plants for their own sake was neglected. In recent years, however, much new information has been obtained through the efforts of universities and government research agencies. This reflects the realization that all commercial species interact with other species to maintain balanced ecosystems.

DIVERSITY

Nearshore marine areas include the Atlantic Coast (Region 800, Units 911, 915), Bay of Fundy (Regions 600, 700, and Units 912, 913) and the Gulf of St. Lawrence (Region 500, Unit 914). The Bras d'Or Lakes (District 560, Unit 916) form a distinct inland marine area. Within each area there is a wide range of habitats, and consequently the fauna is diverse (see Figure T11.17.1).

A general review of the literature indicates that there are approximately 1600 species present in the fauna, of which at least 400 spend some stage of their life as plankton. Table 11.17.1 lists the main groups with the approximate number of species. In several cases, the species numbers are considered to be conservative.

GROUP	APPROXIMATE NUMBER OF SPECIES
Protozoa (Foraminifera, Radiolaria)	Less than 300
Porifera (sponges)	400
Cnidaria (medusae, hydroids, sea anemones)	100
Platyhelminthes (flat worms, flukes)	Less than 20
Nemertea	10
Aschelminthes	Less than 30
Bryozoa and Brachiopoda	30
Polychaeta (Bristleworms)	300
Oligochaeta and Hirudinea (Leeches)	Less than 10
Lower crustacea (copepods, barnacles)	200
Malacostraca (shrimp, crabs)	200
Pycnogonida (sea spiders)	20
Mollusca (snails, clams, squid)	150
Echinodermata (starfish, sea urchins)	70
Chordata (salps, tunicates)	40

Table T11.17.1: Approximate number of species of marine invertebrates recorded from Canadian Atlantic waters.

DISTRIBUTION

The fauna of the Atlantic Coast of North America can be subdivided into regions influenced largely by water temperature: subarctic, boreal, temperate, and tropical. The temperate region, which lies largely south of Cape Cod, is divided into two provinces: Virginian and Carolinian. The Caribbean province lying to the south is tropical (Figure T11.17.2).

Although Nova Scotia lies completely within the boreal region, the local fauna has associations with all of the regions mentioned due partly to the nature of post-glacial colonization (see T4.3).

Subarctic Fauna

The subarctic fauna is found along the Atlantic coast as far south as northern Labrador, but during the last glacial period it extended along the edge of the ice sheet as far south as Cape Cod. The subsequent withdrawal of cold water and asso-

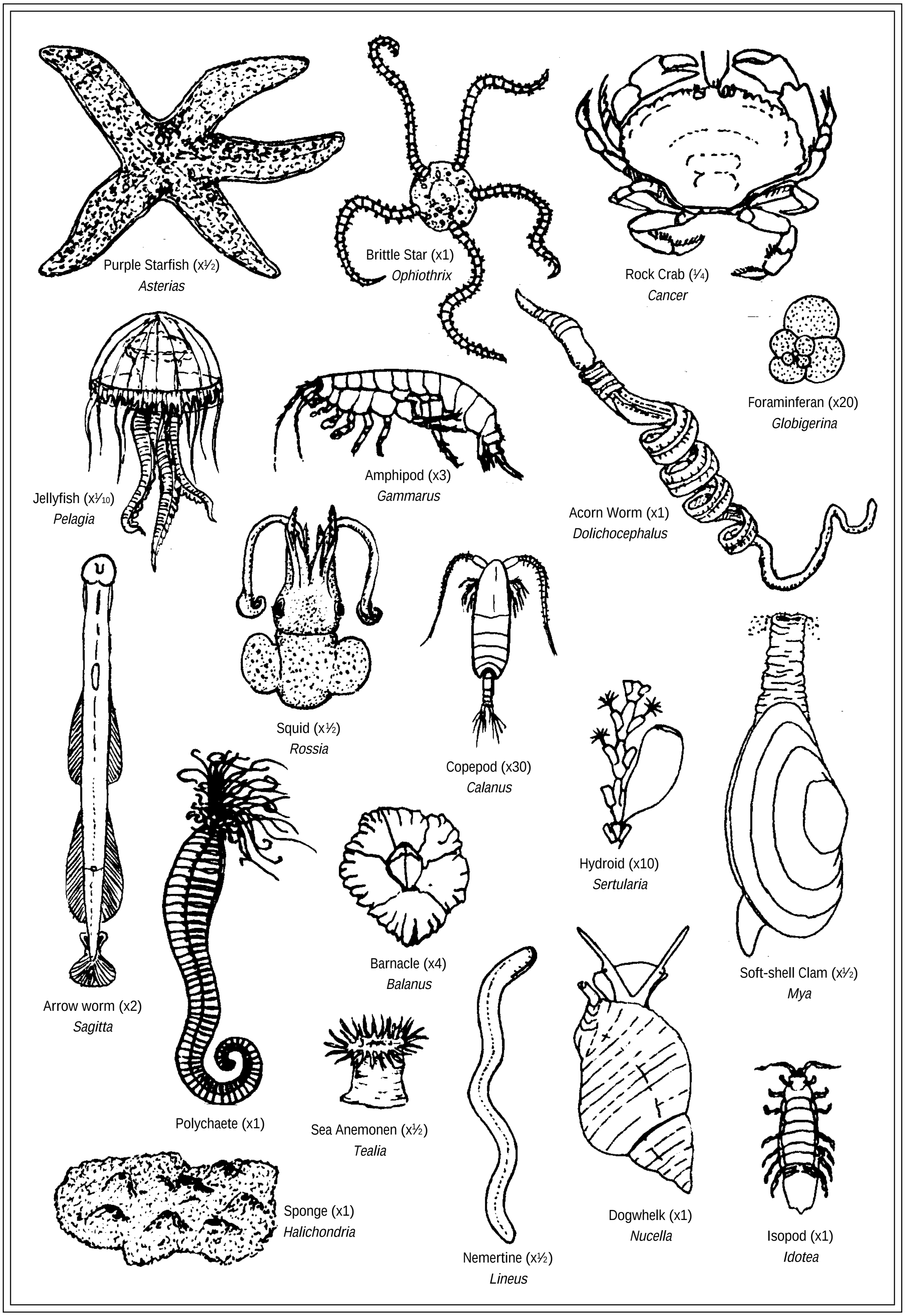


Figure T11.17.1: Examples of marine invertebrates found in Nova Scotia waters (note: enlargements or reductions are approximate).

ciated fauna to the north left small residual pockets in the Bay of Fundy, northern and southwestern Cape Breton (Districts 590, 860, 870) and the St. Lawrence estuary. An example of subarctic indicator species is the Mysid Shrimp, *Mysis gaspensis* (see Figure T11.17.3).

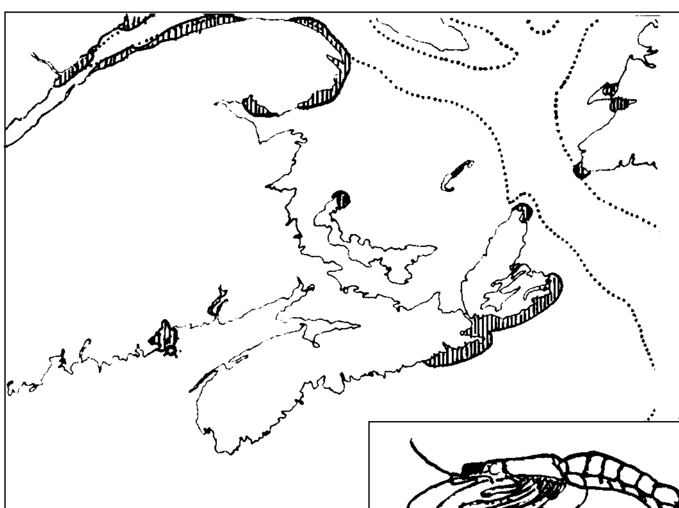
Boreal Fauna

The cold-water fauna dominates the region, especially in exposed situations and in offshore areas. The majority of the characteristic species of rocky shores, benthic habitats and plankton belong to this group. The Sand Dollar (shown in Figure T11.17.4) occurs from just below low water down to 150 m on sandy bottoms. Many cold-water species occur at depth at the southern end of their ranges (see Figure T11.17.4).

Temperate Fauna

During the post-glacial hypsithermal period, warm water extended northwards along the coast and adjacent continental shelf and into the Gulf of St. Lawrence. At this time, a warm-water fauna characteristic of the Virginian province of the temperate region occupied the Nova Scotia shoreline. As the temperature cooled towards the present, the warm-water fauna was largely replaced by a boreal fauna. However, the temperate fauna remains in shallow-water areas of the southern Gulf of St. Lawrence (District 520, Unit 914) and Minas Basin (Unit 913), with pockets in the Bras d'Or Lake and in the bays of the Atlantic coast (Units 833, 911).

The controlling factor for survival of this "oyster bed" fauna is a summer water temperature in excess of 20°C. The distribution of the American Oyster is



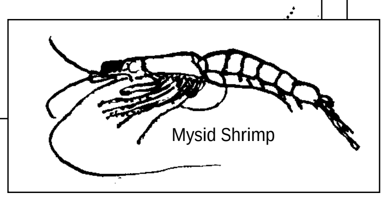


Figure T11.17.3: Distribution of the subarctic species *Mysis gaspensis* (Mysid Shrimp).

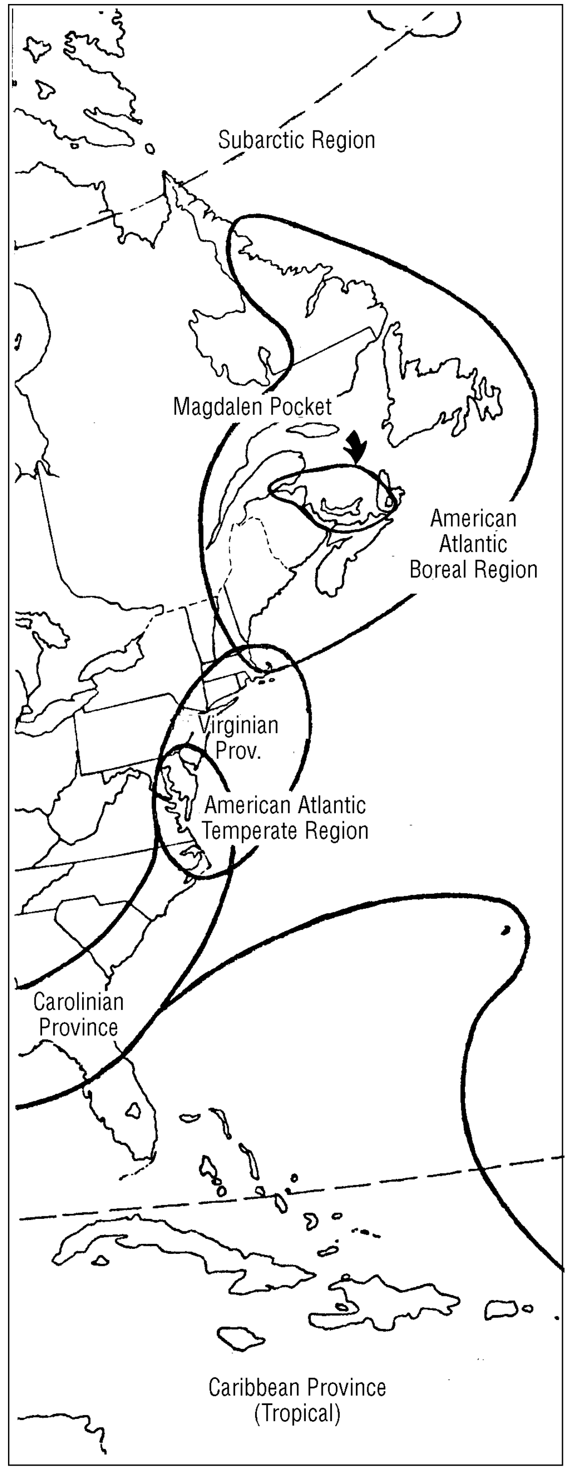


Figure T11.17.2: Faunal regions and provinces of Atlantic North America.

typical for these species (see Figure T11.17.5).

The occurrence of shells, but not living populations, in Minas Basin, Atlantic shore bays, Sable Island (District 890) and the Magdalen Islands is an indication of the wider distribution of the warm-water fauna in the past. The Minas Basin has a warm-water fauna that is slightly different from that of the Northumberland Strait, associated partly with the general absence of Eel Grass.

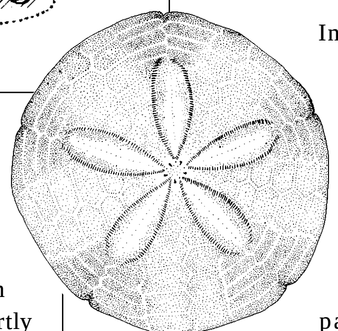


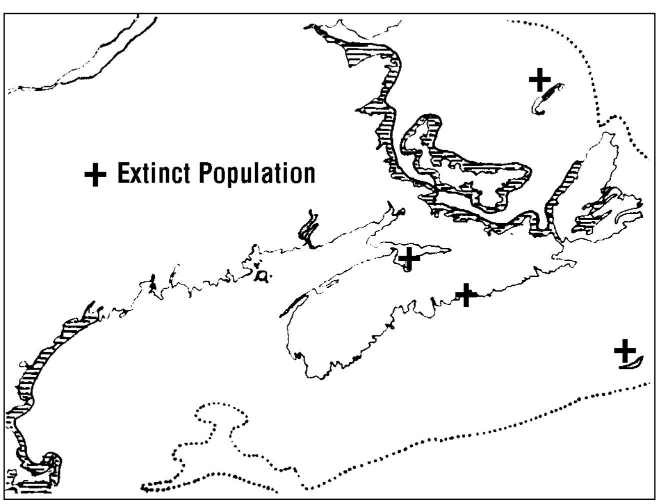
Figure T11.17.4: Distribution of the boreal species *Echinarachnius parma* (Sand Dollar).

Warm Temperate and Tropical Fauna

The larvae of many warm-water fish and invertebrates are carried northwards by the Gulf Stream from the southern coast of the United States and the Caribbean. The animals reach the south shore of Nova Scotia in the late summer, through the process of slope-water exchange, metamorphose and settle. The occasional occurrences of Blue Crab and Calico Crab are due to this phenomenon. These populations are generally short-lived, as water temperatures are too low for reproduction. Associated also with the slope-water exchange and surface-water movements during the tropical-storm season are the occurrences of pelagic salps and fauna associated with Gulf Weed (*Sargassum*), including Sea Turtles, Portuguese Man-of-war and various jellyfish, Goose Barnacles and Gulf Weed Crab. These animals can often be seen inshore during August and September from Cape Sable to Halifax (Units 832, 841, 851).

ECOLOGICAL RELATIONSHIP

In the last twenty-five years, three major alterations in community state have been documented along the Atlantic coast of Nova Scotia, and there are anecdotal reports from lobster fishers of similar shifts in the more distant past.[2] In the late 1960s and early 1970s, sea urchin populations increased in St. Margarets Bay (sub-District 460b), resulting in the destruction of kelp beds and the formation of urchin-dominated barren grounds.[3] Surveys in 1979 revealed that these barren grounds extended along the entire Atlantic coast, presumably due to previous episodes of destructive grazing by sea urchins[4] (see Figure T11.17.6). In the early 1980s, recurrent outbreaks of a disease caused by an



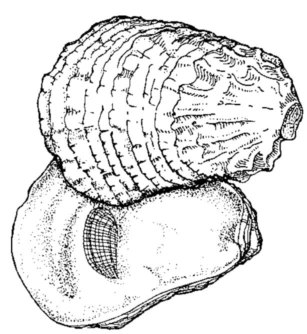
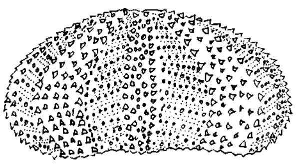


Figure T11.17.5: Distribution of the temperate species *Crassostrea virginica* (America Oyster).

In the early 1930s, large areas of Eelgrass in eastern North America and Europe were wiped out by disease. The cause of the "wasting disease", which first appeared as brownish-grey spots on the leaves and roots, was never determined, although fungal growth and water-temperature changes were investigated. The "wasting disease" and loss of Eelgrass beds led to the extinction in Nova Scotia of the Eelgrass Limpet, which lived on the blades and is the only recorded case of a marine invertebrate species extinction in the North Atlantic.

amoeba (*Paramoeba invadens*) decimated these sea urchin populations.[5] In the southwestern and central regions of the coast, sea urchins were totally eliminated in the subtidal zone, resulting in the development of kelp beds by the mid-1980s.[6] In the early 1990s, however, sea urchin populations became re-established and began to graze the kelp beds once again. The rapid increase in sea urchin abundance in recent years has led to the development of a growing commercial fishery for the roe of this invertebrate in Nova Scotia.



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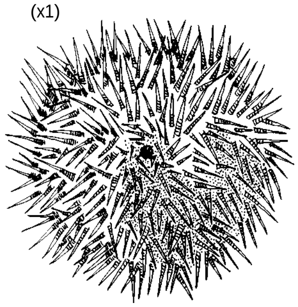

Figure T11.17.6: The Green Sea Urchin.

Disease appears to be the only type of perturbation that can cause the mass mortality of sea urchins necessary for the transition from the barren ground to the kelp-bed state. Outbreaks of disease in the early 1980s were associated with usually high seawater temperatures, which aided in the rapid progression of the disease along the coast.[7] The causes of sea urchin increase, which leads to the destructive grazing of kelp beds, are less clear. It was initially thought that the sea urchin outbreaks in the late 1960s[8] related to lobster fishing, which reduced predation on the urchins. There is little direct evidence to support this hypothesis,[2] however, and recent outbreaks have occurred during a period of lobster abundance. An alternative hypothesis is that sea urchin outbreaks occur as a result of major recruitment events that swamp predatory controls on population growth.[9]

SPECIAL FEATURES

1. **Changes in the fauna:** Although the distribution patterns of the fauna are reasonably well established, new range extensions are always being found. Our knowledge of the true range of some species is improving through research, but some species can readily disperse and thereby extend their ranges. One is the Common Periwinkle, first detected in Pictou in 1840 and progressively reported as it extended southward, eventually reaching the mouth of Chesapeake Bay in 1978. The Green Crab (see Figure T11.17.7), originally introduced from Europe, has been spreading northwards from Cape Cod since about 1900. It reached Minas Basin in the late 1950s (1958–1960), has since reached Halifax and has spread northwards along the Eastern Shore and into the Northumberland Strait. The Awning Clam occurs along the central Atlantic coast of Nova Scotia and elsewhere only in New England, possibly moved between the two areas by humans.

2. **Rare species:** Warm-water species that occur in the Northumberland Strait and Minas Basin, and in sheltered bays, are isolated from main populations further south. The local extinction of any of these species would not be remedied through natural recolonization. The warm-water fauna of Minas Basin is a similar situation, but in addition some disjunct species have recently been discovered there. The only Canadian population of the Truncate Borer Clam (Angel Wing), a warm-water species, occurs in the Minas Basin (Region 600, Unit 913) (see Figure T11.17.8).

3. **Jellyfish:** The larger jellyfish are the only marine invertebrates that are of major concern to people using beaches. These are all pelagic animals belonging to the phylum Cnidaria and are radially symmetrical animals which possess stinging cells (nematocysts). Only five of the fifty-six species of jellyfish that occur in

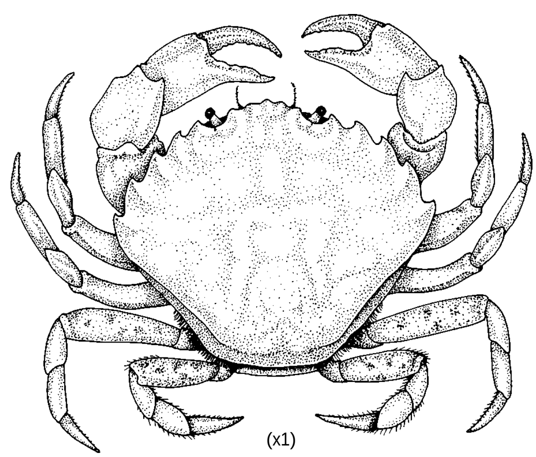

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Figure T11.17.7: The Green Crab.

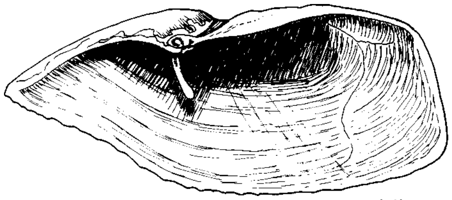

Figure T11.17.8: Angel Wing *Barnea truncata.*

Canadian Atlantic waters are known to be harmful to man. These are Portuguese Man-of-war (*Physalia physalis*), Lion's Mane (*Cyanea capillata*), Moon Jelly and Mauve Stinger (*Pelagia noctiluca* and *Sarsia tubulosa*). The Portuguese Man-of-war, rare in Nova Scotia, is found only at the end of the summer season when specimens are blown inshore from the Gulf Stream and slope water. From the conspicuous blue floats are suspended long-stinging tentacles, which are highly poisonous to humans and pets. In most marine areas, jellyfish occur as large numbers of small individuals in the early summer, or fewer, larger individuals in late summer. The severity of stings varies with the duration of contact with tentacles, general health or age of the victim, and type of jellyfish.[10]

4. **Adaptations:** Some marine invertebrates have streamlined shapes to enable them to exist in high-energy intertidal and subtidal environments. The cone-shaped shells of limpets and the disk shape of sand dollars help these species in this way.

Waves can be felt at some depth in the ocean, and organisms in shallower areas such as the fishing banks must be capable of digging out after burial by bottom sediments moved by ocean storms. Some of the key clam species in the commercial fisheries (Arctic Surf Clam and the Ocean Quahog) have this ability. Species such as the Atlantic Surf Clam can establish themselves in sandy areas where there is heavy surf, due to their ability to burrow rapidly. On Georges Bank, bottom megaripple (sand dune) areas were found to have the lowest species diversity and biomass compared to more stable gravel and shell bottoms.[11]

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Associated Topics

T3.5 Offshore Bottom Characteristics, T4.3 Post-glacial Colonization by Animals, T6.2 Oceanic Environments, T6.3 Coastal Aquatic Environments, T6.4 Estuaries, T11.14 Marine Fishes.

Associated Habitats

H1 Offshore, H2 Coastal

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