

T12.11 ANIMALS AND RESOURCES

Human dependence on other animals is part of the web of life. A reliance on animal populations was instrumental in shaping Mi'kmaq and colonial cultures. To a degree, this still holds true today, as the commercial fishery continues to shape the life and sustenance of many of the province's coastal communities. Our reliance on animal species has influenced populations and diversity, changed habitat structure and, ultimately, contributed to the modification of landscapes in Nova Scotia.

It is possible to link changes in animal communities to the combination of harvesting and conservation practices that comprise wildlife management. It is much more difficult, however, to connect species-population trends directly to other consumptive activities, such as forestry, agriculture and development. In addition, there are many natural factors that affect population dynamics.

The following outlines significant activities that have had documented influences on terrestrial- and aquatic-animal communities in Nova Scotia. A discussion on the historical use of animals as a resource is followed by contemporary activities related to specific groups or species of animals. The Topic concludes with a section on animal species introduced to Nova Scotia after European contact. See T4.3, Colonization by Animals, for information on post-glacial migrations of species into the province.

In the 1990s, the term “wildlife” was officially broadened by environment officials to include all nondomesticated, wild-living organisms, including invertebrates, all plants, and bacteria.¹ Traditionally, “wildlife” referred to the fish, mammal and bird classes. This is the interpretation that is used in this text, bearing in mind the ecological roles that are played by bacteria, algae, fungi and invertebrates as part of ecosystems in the landscape.

HISTORICAL CONTEXT

Prehistory to European Contact

Animals have played a basic sustenance role in human cultures in Nova Scotia for approximately 10 000 years. Blood on stone tools found at the Debert archaeological site indicates that early people hunted Caribou and other large mammals adapted to mi-

gration and tundra-like environments. After glaciation, the tundra changed to dense boreal forests that could not have supported large mammals, thus confining food-gathering and hunting activities to the ocean and shore areas (see T3.3 and T4). Shell middens dating to the Ceramic Period (2500–500 BP) indicate that marine species were a substantial part of diets at that time.

European Contact to the 1800s

Mi'kmaq cultures hunted land and marine mammals and fish for sustenance and some trading until the late sixteenth century, when traditional activities began to change in response to contact with the Europeans. The commercial focus and subsequent trading and market hunting affected some animal populations to the extent that species such as the Sea Mink became extinct. Animal populations and diversity were also influenced by loss of habitat resulting from increased forest fires and land clearing.²

Hunting as a sport emerged gradually as hunting for food became less a part of everyday life. In 1794, the first game law made it unlawful to kill partridge and some species of ducks at certain times of the year.³ In the mid-1800s, a small group of sportsmen and soldiers of the British garrison formed the Nova Scotia Game Society, resulting in the first hunting season to limit the taking of Moose. Beginning in 1874, a three-year closed season to help build up the Moose herd was introduced with the appointment of the first game wardens. During the later half of the nineteenth century, when sport hunting became popular in Nova Scotia, the Mi'kmaq, with their much-revered knowledge of wildlife and wilderness areas,² proved indispensable as guides. The contemporary history of hunting, trapping and fishing in the province was very much influenced by the creation of the Department of Lands and Forests in 1926, which began to monitor animal populations and set up conservation programs.

Commercial exploitation of marine mammals began in the 1500s, when Basque fishermen hunted large numbers of whales in the Gulf of St. Lawrence (Unit 914). Other marine mammals, such as the Atlantic Walrus or “Sea Cow”, were hunted to the point of extinction. French settlers hunted them for their oil and ivory, and by the late 1700s, they had vanished.

As early as the 1500s, fishermen were harvesting cod to be salted and dried for overseas markets. The cod fishery shaped the colonization of Nova Scotia, serving as its basic commodity for international trade (see T12.6). Many people settled to fish—or if they settled for other reasons, they soon turned to fishing as a living. Fishing methods changed as twentieth-century technology replaced canoes, tall ships and schooners with motor-driven trawlers and long-liners. This change allowed fishermen access to offshore fishing grounds. Fishing was usually seasonal, and fishing bases were on cove heads and islands where fish could be salted before returning home when the catch was full or the season ended (see Plate T12.11.1). As truck transport, paved roads and refrigeration became common, the curing process of the salt dry cod was largely overtaken by the demand for fresh and frozen fillets, and the traditional character of the fishery was transformed to meet modern marketplace needs.

1900s

Whaling operations have, over the years, severely reduced populations of several species, including the Right, Humpback, Sei, Sperm, Blue and Fin. After

centuries of exploitation off our shores, the Northern Right Whale is now listed as an endangered species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (see T11.18). Widespread pressure led to international agreements to stop whaling, and in the early 1970s, Canada banned whaling in its waters, shutting down a whaling station in Blandford, Nova Scotia.

Harp and Hooded seals were the focus of a hunt for many years until 1987, when the annual seal hunt in eastern Canadian waters was closed to large vessels.⁴ A bounty system in response to fishery concerns was in operation from 1927 to 1976 and was effective in reducing populations of Harbour Seals. The Grey Seal is the most important host for the sealworm parasite which effects groundfish; however, government bounties have been ineffective in culling their populations.

In 1977, Canada declared a 200-mile economic zone (see map insert in *Volume 2, Theme Regions*), in an effort to prevent overfishing and depletion of the fish stocks by foreign fleets in the northwest Atlantic. This raised expectations that the fishery would finally be on a sound basis, but events proved other-



Plate T12.11.1: Split cod drying on wooden racks. These structures were a typical landscape feature of the makeshift communities set up seasonally on coastal headlands and offshore islands. The camps provided a place to process the fish while allowing fishermen continuous access to the inshore fishery. This picture was taken in the 1970s—the end of an era in the cod fishery. Photo: R. Merrick.

wise, as the effects of advanced fishing technology, overfishing practices, inadequate management and possible environmental factors (weather and oceanographic) contributed to a collapse in cod stocks by the early 1990s. The result was severely cut cod quotas and the institution of fishing moratoriums in Atlantic Canada to allow cod populations to recover.

ANIMALS AND RESOURCES TODAY

Habitat Modification

Habitat modification through human land use has altered wildlife population numbers and distribution patterns. Agriculture, forestry, road corridors and settlements have all created an increase in “edge” habitat, where forests meet clearings. This has been accompanied by an increase of shrub and sapling habitats in the early stages of forest succession. While it has not been good for the Fisher, Marten, Southern Flying Squirrel or birds requiring mature forest habitats, many species have benefited: e.g., mice, squirrels, chipmunks and other small mammals that find an abundance of nuts and fruit in these settings. Hares, Moose and deer also thrive in woodland margins, where browse is plentiful.⁵ As well, birds using these “edge” habitats have increased more than any other group, as exemplified by the Robin, Song Sparrow, Alder Flycatcher and Common Yellowthroat. Since many mature hardwood forests have been replaced by solid coniferous stands, there has also been an increase in birds that prefer this habitat, especially budworm followers, such as Bay-breasted and Cape May warblers.⁶ Apart from altered habitats, wildlife must contend with pressures generated by agricultural and forestry practices, chemical pesticides, toxic contaminants, acidic waters and increased human disturbance in wilderness areas made accessible by logging roads, power-line corridors and all-terrain vehicles.

Habitat Conservation and Management

To protect habitats and wildlife, the Department of Natural Resources and the Canadian Wildlife Service administer sanctuaries, wildlife management areas and ecological reserves. Hunting, fishing and forestry are either prohibited or controlled in these areas. The largest provincial game sanctuaries and wildlife management areas at Waverley (Unit 453), Liscomb (sub-Unit 413b), Tobeatic (sub-Units 412a/440a) and Chignecto (Unit 532) comprise both private and Crown land. Conflicting land uses in the Tobeatic and in Liscomb have led to the initiation of integrated resource management proposals, which

include wildlife habitat management and game harvest controls.

Some conservation and management practices focus on single species conservation. Migratory waterfowl habitats have been protected by coastal wetlands conservation sites throughout the province including the Chignecto and Musquodoboit wetlands. Workers in Piping Plover conservation programs post signs asking beach visitors and all-terrain vehicle drivers to stay close to the water’s edge so that human disturbances will not continue to cause plover nest failures on our beaches. There is growing involvement from private landowners in stewardship programs.

“Eco-tourism”

Many people come into contact with Nova Scotia wildlife through recreational activities such as whale-watching, bird watching, hiking and camping. This burgeoning industry in the province is shaping the value we award wildlife and “wilderness” areas and will require better records and management of habitat to achieve sustainable use.

Hunting

Thirteen per cent of Nova Scotians today are hunters, interested in “game” species ranging from Moose, White-tailed Deer, Black Bear and Snowshoe Hare to migratory birds, such as waterfowl, the Common Snipe and woodcock. Nova Scotia’s Wildlife Act regulates hunting and sport fishing through mandatory license stipulations. In the 1980s, approximately 91,000 deer licenses were issued annually, with an average yearly provincial kill of 46,000 deer.⁷ Wildlife biologists monitor “game” species populations to determine distribution and density throughout Nova Scotia. Traditional relationships to the land remain important to Mi’kmaq culture. In the 1980s, the Mi’kmaq asserted their traditional Moose-hunting rights and won a Supreme Court victory, which upheld their 1752 treaty rights.

According to the results of a 1981 government survey on the value attached to wildlife by Canadians, nearly ninety-six per cent of Nova Scotians participate in some wildlife activity—hunting, fishing, trapping, watching birds, photographing wildlife, reading outdoor and nature books and magazines, or viewing films and television programs on wildlife themes.⁸ Viewed as a resource, animal wildlife provides a wide range of social and economic benefits to Nova Scotians.

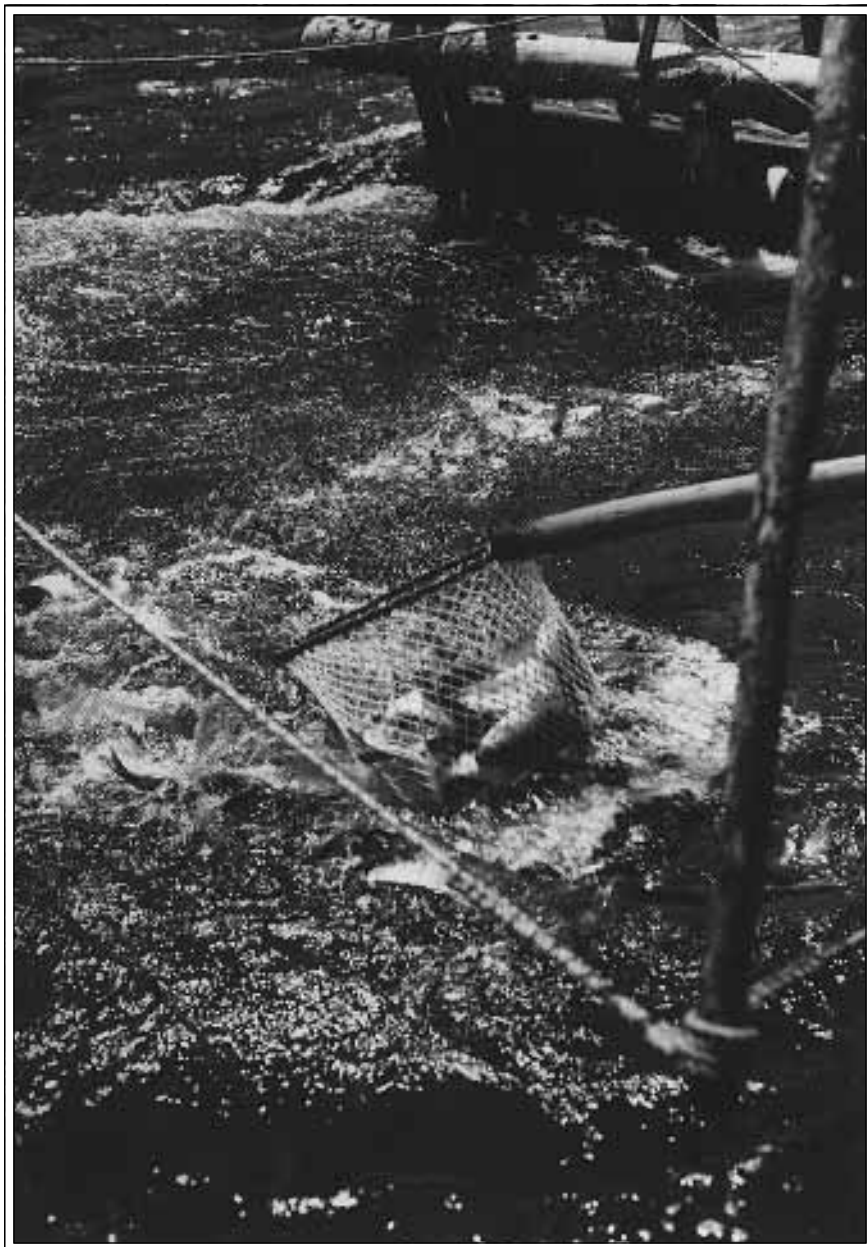


Plate T12.11.2: Square-net fishery for Gaspereau on the Gaspereau River in Kings County (sub-Unit 422b) is an example of traditional knowledge applied to sustainable exploitation of a species. Harvesting Gaspereau is a seasonal occupation, occurring when the anadromous species (see T11.13) travel from the sea to freshwater lakes to spawn. Photo: R. Merrick.

Freshwater Fishing

The freshwater fishery of Nova Scotia has evolved from solely subsistence or commercial use to an increasingly recreational one with an estimated 102,000 anglers. Logging roads and all-terrain vehicles have opened up formerly inaccessible wilderness areas for recreational fishing. The most popular species are, in ranking order, the three trout species (Brown, Speckled or Brook, and Rainbow), Atlantic Salmon and Smallmouth Bass. Five provincial fishing districts have been established by the Nova Scotia Department of Fisheries to manage inland-fishing activities.⁹ Three sport fish—Brook Trout, Atlantic

Salmon and Black Bass—are protected by seasons and/or bag limits under the Fisheries Act.¹⁰

In areas where the underlying geology is predominately sedimentary rock and thick glacial tills, slow-moving gradient streams provide for greater fish production. The Tusket, Medway, Mersey, LaHave, St. Marys, Shubenacadie, Stewiacke, Cornwallis and Annapolis rivers are examples of relatively high-productivity streams. The continuation of freshwater fishing in Nova Scotia is very much dependent on the quality and quantity of freshwater habitats (see Plate T12.11.2).

Stocking:

Close to two dozen Nova Scotia rivers receive almost half a million salmon smolts each year in federal government efforts to enhance salmon populations.¹¹ As well, provincial programs stock Nova Scotia waterways with close to 100 000 Speckled and Rainbow trout annually. (See "Introduced Species" below.)

Acidification of Fresh Waters:

The number of fish species in Nova Scotia lakes surveyed since 1960 has been positively correlated with pH and lake surface area.¹² The pH levels of lakes from which acid-intolerant species (e.g., Brook Trout and White Perch) had disappeared were significantly lower than those of lakes that still supported populations of those species. It has been estimated that approximately seventeen per cent of all fish populations in Nova Scotia lakes before 1960 had become extinct due to acidification. By 1983, this estimate rose to thirty-two per cent of fish populations in lakes with pH below 5.9. (See T12.8 for more information on activities contributing to acidification of fresh water and its effect on Atlantic Salmon.)

Damming:

In addition to atmospheric pollution, a major cause of salmon-habitat destruction in Nova Scotia rivers since 1870 has been construction of dams for mills and hydroelectric power.¹³ Rivers in the province with hydroelectric dams impassable to fish include the Nictaux, the Mersey and the Indian (Halifax County). Rivers with significant fish passage problems caused by dams include the Gaspereaux, the Black and the East (Sheet Harbour). There are policies regulating the passage of migratory fish species in the federal Fisheries Act.

Inshore and Offshore Fishery

Cod is still one of the most important species in the Nova Scotia fishery; however, the commercial catch is diversified, consisting of over two dozen varieties of fish. Almost 60 per cent of the groundfish catch is frozen, about 25 per cent is salted (mainly cod) and less than 10 per cent is sold as fresh fish.¹⁴ The inshore fishery undertaken from many ports around the province, and the offshore fishery conducted by deep-sea vessels, are equally important.

There are 44 fishing districts in the province's waters and various types of fisheries that reflect different species. However, there are three main commercial fish groups: groundfish, pelagic and invertebrates (molluscs and crustaceans). (Refer to T11.14 and T11.17 for natural-history information on the

various groups and species.) Harvesting occurs with fixed gear (baited long lines, lobster traps, gill nets), which remains stationary on the sea bottom, or mobile gear (trawlers, draggers and seiners), which moves through the water to capture fish.

Groundfish Resources:

Groundfish are mainly harvested with otter trawls, baited hooks or gill nets, either inshore or offshore depending on the species. Except for the Northumberland Strait area (Unit 914), where hake and winter flounder are the dominant species, cod has made up the significant tonnage of groundfish landings. Haddock and pollock are also valuable catches, particularly in the Bay of Fundy (Unit 912) and its approaches and on banks of southwestern Nova Scotia (District 930).⁸

Pelagic Fish Resources:

The pelagic fishery includes open ocean species and estuarine species. Herring and mackerel dominate the pelagic group and are caught fairly close to shore with fish traps, gill nets and herring weirs or offshore by the purse seine. Most swordfish vessels operate out of southwestern Nova Scotia, while tuna are caught mainly in the waters off Antigonish (Unit 914) and Guysborough (Unit 911) counties, as well as in St. Margarets Bay (sub-District 460a). Estuarine species, such as salmon and gaspereau, feed near the surface and are harvested with gill nets, purse seines or fish traps.⁸ A marine recreational fishery harvests mainly sharks in large bays around the coast.

Mollusc and Crustacean Resources:

The mollusc and crustacean fishery includes bivalve molluscs (scallops, oysters and mussels) and crustaceans (lobsters and crabs). Scallops are landed in numerous ports in the province with scallop draggers. The main beds, however, are found offshore, on the Canadian side of Georges Bank (sub-Unit 931a), in the Bay of Fundy (Unit 912) and approaches, and in the Northumberland Strait (Unit 914).⁸

Aquaculture

Since the late 1970s, aquaculture has been moving from pilot scale to commercial production, harvesting mussels, oysters, Atlantic Salmon, and Rainbow and Speckled trout, with other resource species in development. Aquaculture operations are located in bays, inlets and estuaries in different parts of the province; however, their development is directly related to the availability of suitable sites, including an assurance of high-quality water.

Environmental Concerns in the Marine Fishery:

The modern fishing methods favoured for the different fish groups are the subject of controversy. The debate centres around the effects of the technologies on the ecology of marine systems and the ability of the fishery to sustain itself. Concern over the potentially destructive effects of trawlers and draggers on seabeds has initiated recent studies that suggest that disturbed seabeds suffer a reduction in bottom fauna¹⁵ that may hurt the survival rate of young fish.¹⁶ Protection of the habitat for fish is a major element in a sustainable fishery.

The effects of the fishery on other species is also important. Fishery wastes (mainly discarded by-catch and offal) are exploited by behaviourally flexible large gulls, which have evolved as shoreline foragers. This food supplement has fueled their increase, and now they are so numerous that they are reducing the reproductive success of, and preying on, other seabird species that share their breeding islands. Terns, eiders and puffins are the species most affected by gulls in Nova Scotia. As mussel culture takes over more of the bays and inlets traditionally used by eiders for feeding and rearing their young, there is an increasing intolerance of wild populations of eiders, which feed on mussels. This conflict can only increase and will undoubtedly limit eider populations.

Catastrophic oil spills are well known as killers of pelagic and coastal seabirds (see T12.3), but these events are less important mortality factors than the chronic oil pollution of the seas from marine traffic. Ships pump oily bilge waters into the sea and tankers discharge tank washings. These operational discharges of oil are the most important environmental threat to pelagic seabirds.

Introduced Species

The introduction of exotic animals can cause the displacement of native animals and pest infestations, diseases and parasites. Species are often introduced without the accompanying diseases, parasites and predators that kept their populations in check. They

can multiply rapidly and gain the reputation of being pests.

Most introductions are inadvertent, a side-effect of transporting people or goods, particularly plant and animal products. The first introductions almost certainly arrived with the first Europeans. Wildlife management has also resulted in the introduction of several species to Nova Scotia, including nonnative animals and the reintroductions of former resident species.

Birds:

Five introduced bird species have become established in Nova Scotia. Two were introduced as game birds: the Grey Partridge and Ring-necked Pheasant. The Grey Partridge is restricted to agricultural areas in the central mainland, principally the eastern Annapolis Valley (District 610) and the north shore of Minas Basin (Districts 620 and 710). Ring-necked Pheasants are widespread in the central and western mainland.

The other three species became established through deliberate releases or accidental escape, possibly both. The Rock Dove is widespread in agricultural, suburban and urban areas throughout the province. The European Starling and House Sparrow, both cavity nesters, are found in all but extensively forested areas. These two are the only introduced species that compete directly with native cavity-nesting birds—the Tree Swallow, Eastern Bluebird and Purple Martin.

The Peregrine Falcon, extirpated from the Maritimes in the 1950s, has been successfully reintroduced in Nova Scotia.¹⁷ Five other species, all game birds, have been introduced in this century but have not become established. (See Erskine⁶ for details of breeding distribution and status of introduced birds.)

Mammals:

Eight mammal species have been introduced to Nova Scotia and five are presently established. The status of one is unknown.

Horses were first introduced to Sable Island (District 890) in 1738,¹⁸ and their wild descendants are still present. Wild Boar from Europe were introduced and have become feral in a fenced private preserve on Roberts Island, Yarmouth County (Unit 831), where they are hunted by the owner and his guests. Stocking of White-tailed Deer, a former resident species, occurred in the late 1800s and early 1900s, although some deer migrated naturally from New Brunswick.¹⁹ They were not present when Europeans first arrived, but their bones have been found in shell middens dating to about 1000 years before present. Moose

were reintroduced on the Cape Breton Highlands (Region 200) from Alberta in 1947 and the American Marten to Kejimikujik National Park (Region 400) in 1986. The Arctic Hare was introduced to Scatarie Island (District 870) in 1975. A population did become established, but it is not known if it is still there. Other species introductions occurred when completion of the Canso Causeway in 1955 allowed the Bobcat to migrate to Cape Breton Island.

Reintroductions and transplants of beaver were begun in 1933, those of fishers in the 1940s and 1960s. The Grey Squirrel has been repeatedly introduced, most recently to the Halifax Public Gardens (sub-Unit 451a) in 1992, but has never become established. The nearest wild population is around Fredericton, N.B.

Three rodents of the family Muridae have become cosmopolitan pests. The Black Rat has probably been established at one time or another in all Nova Scotia seaports but has not been able to persist for long, partly because it is too cold here, and partly because it can not compete with the Brown Rat. The population that existed in Halifax died out or was exterminated before 1861.²⁰ The Brown Rat is widespread in urban and agricultural areas and at open landfill sites, as is the House Mouse. Coyotes are the most recent new species resident and have invaded on their own, encouraged by human land-use practices.

Fish:

Five freshwater fish species were introduced around the turn of the century to stock streams and lakes: the Lake Whitefish, Brown Trout, Rainbow Trout, Smallmouth Bass and Chain Pickerel.²¹ The relatively small size of Nova Scotia's lakes allows these aggressive game fish to compete for food and space with native species. It is estimated that the pickerel and bass can eliminate native predators in five generations. Goldfish, released accidentally, have become a problem in some areas where they compete with minnow species. Two anadromous species, the Coho and Chinook salmon, were introduced more recently as escapes from aquaculture operations.

Amphibians and Reptiles:

The Red-eared Slider (turtle), although not legally sold in Nova Scotia, continues to turn up in local ponds, particularly in parks. It can survive our winters in hibernation but so far has not reproduced. They are generally released pets and considered a pest species, as they eat salamander larvae and tadpoles.

Invertebrates:

In Nova Scotia, as elsewhere, the vast majority of introduced animals are invertebrates, largely insects. Most of them end up as pests of some kind. In Nova Scotia, species such as the Winter Moth, Larch Casebearer, aphids, scale insects and sawflies are notorious for damage to trees and shrubs (see T10.1 and T11.16).

Many invertebrate species have been introduced in ships' dry ballast, by the importation of plants for agriculture and horticulture and by transshipment of goods since at least the seventeenth century. These species arrived as land was cleared for agriculture and development, activities that caused the destruction of native habitats and their associated soils, and the decline of native species. The province's history of human settlement and its geographic isolation have resulted in the highest ratio of introduced invertebrate species to native species in Canada. For example, there are nine species of slug recorded from Nova Scotia of which six are definitely introduced. Some of the slugs are very aggressive and colonize native habitats directly or through the course of succession, while others have remained close to the point of introduction. The native slug species of the family Philomicidae are now restricted to undisturbed forest habitats. More than twenty per cent of all terrestrial mollusc species of Nova Scotia are introduced.

Earthworms, ground beetles, click beetles, cellar bugs, centipedes and millipedes are introduced species commonly found in gardens. Familiar urban invertebrates include cockroaches, bedbugs, carpet beetles, flour beetles, clothes moths, flour moths, earwigs, fleas, lice, houseflies and book lice.

The only reported introduced freshwater invertebrate is the Chinese Mystery Snail. It was introduced with aquatic plants to ponds in Yarmouth, Halifax and Lower Sackville as early as 1950. The snails have not yet spread widely in the province. Marine invertebrates include the Green Crab, originally introduced from Europe, which has been spreading northwards from Cape Cod since about 1900. It reached the Minas Basin in the late 1950s (1958–60) 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. European Oysters brought to Nova Scotia for aquaculture production have been raised in quarantine conditions to avoid the introduction of diseases. The snail *Ovatella myosotis*, which occurs in tidal marshes from Nova Scotia to the West Indies, is understood to have been introduced from Europe in historic times.²²

Associated Topics

T3.3 Glaciation, Deglaciation and Sea-level Changes, T4.3 Post-glacial Colonization by Animals, T11.2–T11.7 Birds, T11.10 Ungulates, T11.12 Marine Mammals, T11.13 Freshwater Fishes, T11.14 Marine Fishes, T11.17 Marine Invertebrates, T11.18 Rare and Endangered Animals, T12.3 Geology and Resources, T12.8 Fresh Water and Resources

Associated Habitats

H1 Offshore, H3 Fresh-Water, H6 Forests

References

- 1 Wildlife Advisory Council (1993) *Living with Wildlife: A Strategy for Nova Scotia*. Nova Scotia Dept. of Natural Resources, Halifax.
- 2 Parker, M. (1990) *Guides of the North Woods*. Nimbus, Halifax.
- 3 Nova Scotia Dept. of Lands and Forests (1983) *Submission to the Royal Commission on Forestry*.
- 4 Lavigne, D.M. and K.M. Kovacs (1988) *Harps and Hoods: Ice-breeding Seals of the Northwest Atlantic*. University of Waterloo Press, Waterloo, Ont..
- 5 Freedman, B. (1982) *An Overview of the Environmental Impacts of Forestry, with Particular Reference to the Atlantic Provinces*. Institute for Research and Environmental Studies, Halifax. (*I.R.E.S. Research Report 82-02*).
- 6 Erskine, A. (1992) *Atlas of Breeding Birds of the Maritime Provinces*. Nova Scotia Museum and Nimbus, Halifax.
- 7 Patton, A. (1991) "Nova Scotia deer harvest history, 1916–1990." *N.S. Conservation* 15.
- 8 Nova Scotia Dept. of Development (1986) *Nova Scotia Resource Atlas*. Province of Nova Scotia, Halifax.
- 9 Nova Scotia Dept. of Fisheries (1990) *Nova Scotia's Recreational Fishery Management Plan*. Province of Nova Scotia, Halifax.
- 10 Duke, A. (1981) "Wildlife protection in Nova Scotia." *N.S. Conservation* 5.
- 11 Farmer, G. (1987) "Salmon Enhancement Program." *N.S. Conservation* 11.
- 12 White, W.J. (1992) "Effects of pH on the zoogeographical distribution of freshwater fish in Nova Scotia." In *The Atlantic Region LRTAP Monitoring and Effects Working Group Report for 1991*, edited by B.L. Beattie. Environment Canada.
- 13 Watt, W.D. (1989) "The impact of habitat damage on Atlantic Salmon (*Salmo salar*) Catches." In *Proceedings of the National Workshop on Effects of Habitat Alteration on Salmonid Stocks*. Fisheries and Oceans, Ottawa. (*Can. Spec. Pub. Fish. Aquat. Sci.* 105).
- 14 Nova Scotia Task Force on Atlantic Fisheries (1982) "Navigating troubled waters." *Report on the Task Force on Atlantic Fisheries* no. 7. Halifax.
- 15 Messieh, S.N., Rowell, Peer and Cranford. 1992. "The Effects of Trawling, Dredging and Ocean Dumping on the Eastern Canadian Continental Shelf Seabed." *Continental Shelf Research* II, nos. 8–10.
- 16 Martin, C. (1992) *No Fish and Our Lives. Scientists Voice Fear for the Barren Seabed*.
- 17 Government of Canada (1991) *Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC) Annual Report, v. 14*. Dept. of Fisheries and Oceans, Dartmouth, N.S.
- 18 Wright, B. (1989) *The Fauna of Sable Island*. Nova Scotia Museum, Halifax. (*Curatorial Report No. 68*).
- 19 Benson, D.A. and D.G. Dodds (1977) *Deer of Nova Scotia*. Dept. of Lands and Forests, Halifax.
- 20 Banfield, A.W.F. (1981) *The Mammals of Canada*. University of Toronto Press, Toronto.
- 21 Gilhen, J. (1974) *The Fishes of Nova Scotia's Lakes and Streams*. Nova Scotia Museum, Halifax.
- 22 Abbott, R.T. (1924) *American Seashells*, 2nd ed. Van Nostrand Reinhold, New York.

Additional Reading

- Frank, K.T. et. al. (1988) Changes in the Fisheries of Atlantic Canada Associated with Global Increases in Atmospheric Carbon Dioxide: A Preliminary Report. Supply and Services Canada, Ottawa. (*Can. Tech. Rep. Fish. Aquat. Sci.* no. 1652).
- Gilbert, F.F. and D.G. Dodds (1987) *The Philosophy and Practice of Wildlife Management*. Robert E. Krieger, Malabar, FL.
- Parsons, J., and Associates (1990) *Reduction of Losses of Cultured Mussels to Sea Ducks*. Nova Scotia Dept. of Fisheries: Halifax. (*ERDA Report* no.17).
- Sabeau, B. (1989) "The fisher in Nova Scotia." *N.S. Conservation* 13(2).
- Swan, D., B. Freedman and T. Dilworth (1984) "Effects of various hardwood forest management practices on small mammals in central Nova Scotia." *Can. Field Nat.* 98(3):362-364.
- Williamson, A.M. (1992) Historical Lobster Landings for Atlantic Canada, 1892-1989. Supply and Services, Ottawa. (*Can. Manuscr. Rep. Fish. Aquat. Sci.* 2164).