

## 2.6. Changes in marine mammals

“It is thought that Right whales once roamed the North Atlantic in their tens of thousands. [...] Unfortunately for the whale, its slow swimming made it easy to catch and its thick blubber layer made it float when dead, making it easy to land for processing. The whaling frenzy that followed created great wealth, but by the end of the [19<sup>th</sup>] century had virtually exterminated the population [...].” (Percy 1996e)

“[...] the increased European settlement of the New Brunswick area as a result of the American Revolution impacted the Indians and, by the 19<sup>th</sup> Century, game species had become sparse, and pollution of the Salmon River forced the hunting of porpoise for their economic cash value.” (Prescott & Fiorelli 1980)

“[Harbour seal] numbers were seriously reduced by fisherman and hunters to collect a bounty paid by the Federal Fisheries Department.” (Ingersoll & Gorham 1980)

### 2.6.1. Marine mammals in the outer Bay of Fundy

The Quoddy Region represents a significant nursery and feeding ground for several marine mammals, some of which are under severe threat from historic or recent human activities. Reduced to severely low numbers through whaling and hunting during the last centuries, marine mammals were finally protected in the late 20<sup>th</sup> century.

Much of the change in Right whale populations occurred more than 200 years ago, whereas Fin and Humpback whales were more affected in the last 150 years. However, analyzing changes over time is difficult because of the shortage of adequate historical and recent information on abundance and distribution. After commercial whaling and hunting ceased, most marine mammal populations showed potential for recovery. However in recent decades, many species have become threatened by other human activities such as collisions with ships and entanglement in fishing gear. In the face of low population numbers, low reproductive rates, and high age of maturity, these losses can represent significant threats to the overall population.

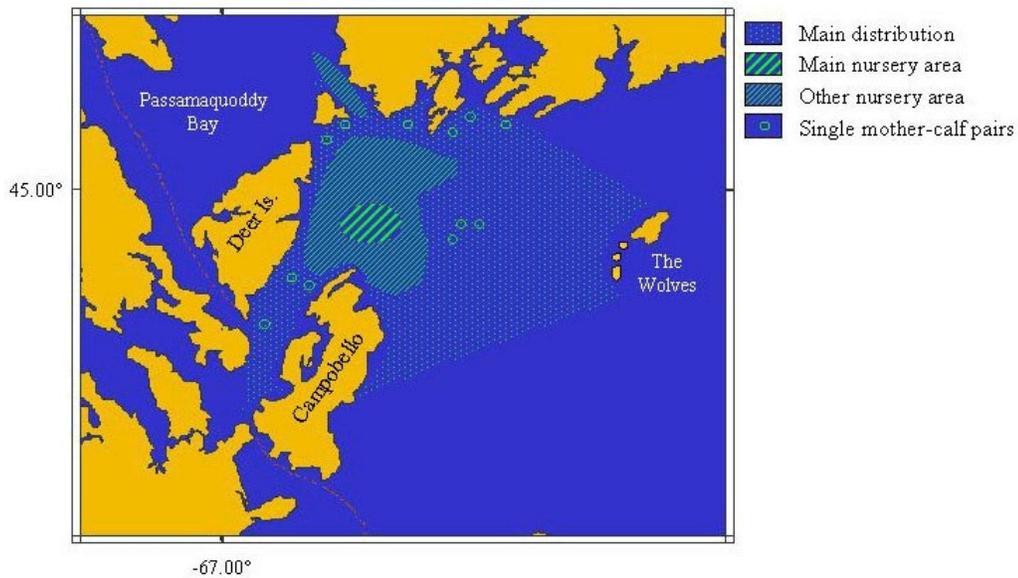
The most abundant marine mammal in the Bay of Fundy is the threatened Harbour porpoise (*Phocoena phocoena*), which forms a distinct Bay of Fundy – Gulf of Maine population. This population, which has a critical nursery ground in the Quoddy Region, is believed to be one of the largest remaining in the world (Gaskin & Smith 1979, NEFSC 1999). The Harbour seal (*Phoca vitulina*) can be found year-round in all parts of the Quoddy Region, while the Grey seal (*Halichoerus grypus*) is less common.

Of the larger baleen whales, Fin or Finback whales (*Balaenoptera physalus*) are common throughout the area and can often be seen in Head Harbour Passage in summer and fall (Gaskin & Smith 1979). Other cetaceans occurring regularly in the area are the Humpback whale (*Megaptera novaeangliae*), the endangered North Atlantic Right whale (*Eubalaena glacialis*), and the Minke whale (*Balaenoptera acutorostrata*). Formerly, White-beaked dolphins (*Lagenorhynchus albirostris*), Killer whales (*Orcinus orca*) and probably Pilot whales (*Globicephala melaena*) were more abundant. In recent years, white-sided dolphins (*Lagenorhynchus acutus*) have been more frequently recorded (Gaskin & Smith 1979, L. Murison, pers. com.). South of Grand Manan the sei whale (*Balaenoptera borealis*) and the Blue whale (*Balaenoptera musculus*) occur quite frequently (Wilder et al. 1974).

All cetacean species and the Harbour seal show a distinct seasonality, entering the Bay of Fundy during late spring and summer and leaving in late fall, except for a few overwintering stragglers (Wilder et al. 1974, Colbourne & Terhune 1991).

### Harbour Porpoise sightings during 1970-79

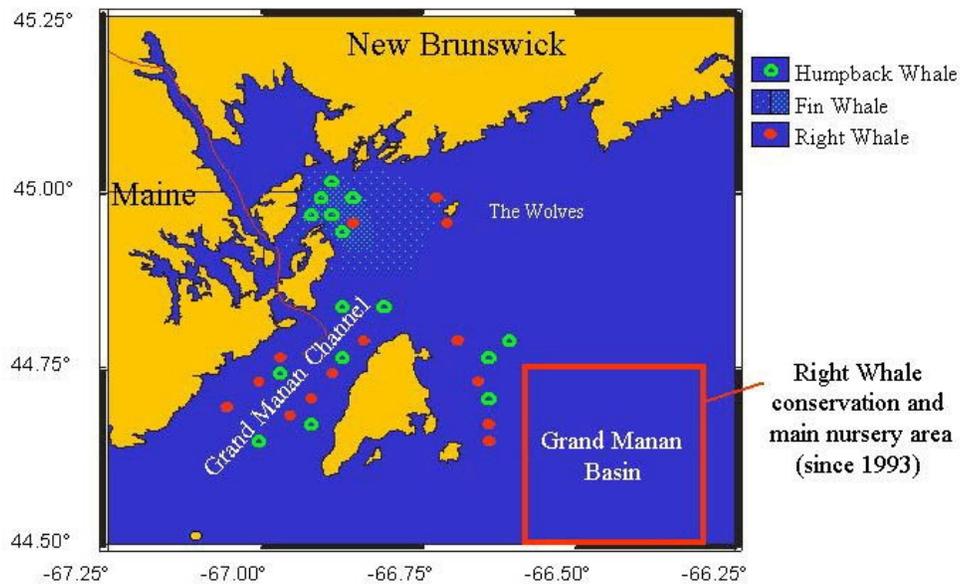
(redrawn from Gaskin & Smith 1979)



**Fig. 2.6.1.** Harbour porpoise sightings in the area during 1970-1979 (redrawn from Gaskin & Smith 1979). In the “main nursery area”, 11-50 mother-calf pairs were counted per year, and in the “other nursery area” 2-10 mother-calf pairs per year. No data were available for the inside of Passamaquoddy Bay, the main coast towards Pt. Lepreau and the Grand Manan area.

### Humpback, Fin and Right Whale records in 1978-1979

(redrawn from Gaskin & Smith 1979)



**Fig. 2.6.2.** Humpback, fin and right whale records in 1978-1979 (redrawn from Gaskin & Smith 1979). For humpback and right whales, symbols indicate single sightings. For fin whales, dense dots indicate the area of most abundant sightings, and sparse dots the area of further sightings.

### 2.6.2. Ecology of marine mammals – habitat and food needs

The areas directly adjacent to the approaches to Head Harbour Passage form a significant nursery area for the threatened Harbour porpoise population (Fig. 2.6.1, Gaskin & Smith 1979). However, there is much spatial variability, associated with opportunistic feeding. The animals frequently travel between the Deer Island – Campobello region, the Wolves, Point Lepreau region and Grand Manan as shown by animals bearing radio transmitters (Gaskin et al. 1975, Gaskin & Smith 1979).

The Grand Manan Basin east of Grand Manan is a critical nursery and feeding area for the endangered North Atlantic Right whales in summer and fall (Fig. 2.6.2, Brown & Kraus 1996). Over 50 percent of the catalogued species have been observed in the Fundy area or in Roseway Basin (between Browns and Baccaro Bank, Southern Scotian Shelf), the second critical habitat for Right whales in Canada. There are no other known locations in the western North Atlantic where such large aggregations of Right whales have been observed on a regular basis in summer and fall (Brown & Kraus 1996). Although most larger whales rather occur offshore in the Grand Manan Basin and Grand Manan Channel, right, minke, fin, and humpback whales can be sighted in the approaches to Deer Island, Campobello and the entrances to Passamaquoddy Bay, as well as around the Wolves and the eastern Grand Manan archipelago (Fig. 2.6.2, Gaskin & Smith 1979).

The habitats of different whale species appear to be characterized primarily by high densities of their principal prey species and the physical conditions that facilitate the accumulation of prey (Woodley & Gaskin 1996). In the Quoddy Region, high concentrations of copepods, euphausiids and herring, can be found. Feeding activity is usually intense, and as the prey concentrations expand and move with tides and currents, their consumers tend to move with them. Thus, aggregations of marine mammals in the area are discontinuous and mobile (Gaskin & Smith 1979). Copepods (*Calanus finmarchicus*) are the principal food for the Right whales, and the whales concentrate in areas with high copepod density (Murison & Gaskin 1989, Woodley & Gaskin 1996). Euphausiids (*Meganyctiphanes norvegica*) are preyed upon by Fin whales (Woodley & Gaskin 1996) and Harbour porpoise calves (Smith & Read 1992). Surface swarms of euphausiids occur annually during late summer months, and have been recorded regularly for the Bay of Fundy since the 1870s (Gaskin & Smith 1979). The euphausiid concentrations attract herring (*Clupea harengus*) schools, which are a major prey item for Humpback, Fin, and Minke whales, and Harbour porpoise. These also eat mackerel, alewife, capelin and other small fish (Gaskin & Smith 1979).

### 2.6.3. Direct human impacts on marine mammals

#### Whaling

Whales were hunted beginning in the 11-12<sup>th</sup> century for their oil, flesh, and baleen (Percy 1996e, WWF 2001). Initially, whaling may have had an insignificant impact on the whale populations given the primitive hunting technology of the time. This changed dramatically with increasing efficiency of hunting methods in the 18<sup>th</sup> and 19<sup>th</sup> century. Over the centuries, increasing European demand for a variety of materials, including lamp fuel, industrial lubricant and stiffeners for clothing, folding fans and other decorative articles, reduced many whale populations to critically low numbers (Gaskin 1983, Katona et al. 1993, Percy 1996e).

Right whales once roamed the North Atlantic probably in the tens of thousands, but were hunted to near extinction because of their high-quality oil and their extremely long baleen (Percy 1996e). Being a slow swimmer that skims the surface of coastal waters, the Right whale was an easy target for whalers. In the 1500s, Basque whalers came across the Atlantic in search of Right whales, once they were nearly eliminated from Europeans waters in the previous centuries (Katona et al. 1993). In the 1600s and early

1700s, Right whales in the western Atlantic were reduced to very low numbers by early colonizers on the east coast of the U.S. (Reeves et al. 1978, Reeves & Barto 1985, Katona et al. 1993). In the first quarter of the 18<sup>th</sup> century, shore whaling in New England ceased because the Right whales had been killed or driven off after 100 years of relentless pursuit (Reeves et al. 1978, Reeves & Barto 1985). By the 1750s, the Right whale was thought to be extinct (Gaskin 1983). However, US whalers seeking other species are assumed to have killed another 250-300 Right whales between 1820-1899 (Reeves & Mitchell 1983). The remnant stock of Right whales that survived was finally protected by the League of Nations in 1935 (Table 2.6.1, Gaskin 1983, WWF 2001).

During the 19<sup>th</sup> century, coastal whaling for Humpback and Fin whales was carried out from New Brunswick ports in the Bay of Fundy and along the Maine coast (Katona et al. 1993). Especially in the 1830s-40s, entrepreneurs in various New Brunswick ports formed whaling companies (Reeves & Barto 1985). Several St. Andrews businessmen tried to start a whale fishery from that port in 1845, presumably involving long-distance voyages (Reeves & Barto 1985). In 1878 a number of citizens of Grand Manan attempted to establish a whale fishery in local waters, but although whales were considered plentiful enough in the area, the venture was never very successful (Reeves & Barto 1985).

In the late 19<sup>th</sup> century, Fin and Humpback whales were the principal targets of whaling operations on the coasts of Maine and New Brunswick (Reeves & Barto 1985). Fin whales were reduced to relatively low numbers by Canadian shore-whaling operations in the 1950s and 60s (Gaskin 1983). Minke, Sei, and Pilot whales were hunted from ports in Nova Scotia and Newfoundland (Katona et al. 1993). Most commercial whaling in Canada ceased in 1972 following the designation of the US Marine Mammals Protection Act (Table 2.6.1, Katona et al. 1993). The International Whaling Commission (IWC) designated an indefinite moratorium on commercial whaling in 1986. Since then, no whales were to be hunted in the North Atlantic Ocean without exemptions for “scientific” and “subsistence” hunting (Katona et al. 1993). However, Fin and Minke whales are still hunted in the northwest Atlantic by Norway.

Although no active hunting of right whales occurred over the last 60 years, population recovery is still slow (Gaskin 1983, Knowlton et al. 1994). In the mid 1960s 15 Right whales were reported in the Bay of Fundy. This number was regarded by some as too high because of the extreme scarcity of Right whales at that time (Reeves & Barto 1985). Today, the North Atlantic Right whale is the most endangered large whale of the world, with approximately 300 animals remaining (Knowlton et al. 1994, Brown & Kraus 1996, COSEWIC 2000, WWF 2001). Modern threats to this species include collisions with ships causing injury or death, accidental entanglement in fishing gear, habitat degradation and inbreeding depression (see below, Brown & Kraus 1996, Percy 1996e, Laist et al. 2001, WWF 2001). Since 1970, 32 percent of all known Right whale deaths along the east coast of Canada and the US were caused by human activities – 20 percent due to collisions with ships and 12 percent due to entanglement in fishing gear (Kraus 1990 in Brown & Kraus 1996).

### **Porpoise hunting**

Passamaquoddy Indians of southwestern New Brunswick and downeast Maine, and Mi'kmaq Indians of the Maritimes were hunters of seal and porpoise, but porpoise hunting was not practised on a large scale until an oil trade developed with Europeans (Anonymous 1880, Prescott & Fiorelli 1980). On a small scale, porpoise oil was traditionally used for treating leather, bear bait in traps, and medical purposes, and the meat was eaten (Anonymous 1880, Leighton 1937).

By the 19<sup>th</sup> century, game species became sparse and pollution of the salmon rivers forced the Indians to hunt porpoises for their economic value (Prescott & Fiorelli 1980). During 1840-1895, about 1000 animals were taken per season. This intense hunting stopped early in the 20<sup>th</sup> century when petroleum products became common and were cheaper than whale oil (Prescott & Fiorelli 1980). Until 1972 however, about 100-150 porpoises were taken each season near Deer Island and Campobello.

Reports of porpoises hunted and taken for human consumption in Passamaquoddy Bay continue, although harvest effort seems to be reduced (Prescott & Fiorelli 1980, NEFSC 1999, L. Murison, *pers. comm.*).

Indirect threats to Harbour porpoise still exist. Because porpoises feed on clupeid and gadoid fishes, which are fished by fixed and towed gear, entanglement and entrapment of harbor porpoises as by-catch is common (see below). The incidental, fishery-related mortality of harbour porpoises in recent decades are considered a major threat to their populations (Caswell et al. 1998).

**Table 2.6.1.** History of human impacts on marine mammals. Data from Squires 1946, Ingersoll & Gorham 1978, Gaskin & Smith 1979, Prescott & Fiorelli 1980, Reeves & Mitchell 1983, Reeves & Barto 1985, Katona et al. 1993, Percy 1996e, NEFSC 1999, WWF 2001.

Time (A.D.)	Activity
1000-1100	Commercial whaling started but with low hunting technology
1500s	Basques whalers hunted Right whales in offshore Canadian waters
1600-1700	Right whales hunted from shore stations by early settlers on the US coast
1700-1900	Increasing whaling pressure in response to increasing demand for oil, flesh and baleen
1720s	Shore whaling in New England ceased because of scarcity of Right whales
1750s	Right whale thought to be extinct
1800s	Indians started extended trade-driven porpoise hunting, because European settlement reduced hunting range and game abundance.
1830s-40s	Whaling companies formed in various New Brunswick ports
1845	An offshore whale fishery started from St. Andrews
1840-1895	Period of peak Indian porpoise hunting (1000 per season), mostly for trade of oil with European settlers
1878	Grand Manan citizens started a whale fishery in local waters
1900s	Porpoise hunting declined with petroleum products becoming abundant and cheap Northern Right whale reduced to a remnant stock
1935	Whale hunt ended under the international convention for the regulation of whaling
late 1960s	US bounty on Harbour seals ended
until 1972	Indian harvest of about 100-150 porpoises per season near Deer Island and Campobello
1972	Commercial whaling in Canada ceased with enactment of the US Marine Mammal Protection Act
1974	Still reports of porpoise hunting in the area
1986	Designation of an indefinite moratorium on commercial whaling by the International Whaling Commission
1993	Designation of North Atlantic Right whale conservation areas in Grand Manan Basin and Roseway Basin, but no regulatory or enforcement framework
2000-2001	A high of 30 Right whale calves born, three died, two from unknown causes, one from a ship strike

### Sealing

Archaeological evidence indicate that there have been wintering grey seals in the Quoddy region that formed rookeries on intertidal ledges near islands, where native people hunted them from land (Black 2000). Historically, the harbour seal was referred to as common in the 17<sup>th</sup> century (LeClerq 1691 in Squires 1946) as well as in the 1940s (Squires 1946). Because this species has rarely been hunted for fur, food, or oil, Squires (1946) assumed that there might have been no marked change in numbers on the New Brunswick coasts. However, Ingersoll & Gorham (1978) mentioned that numbers were seriously reduced by fishermen and hunters around Grand Manan to collect a bounty paid by the Federal Fisheries Department, and that a marked increase in the population could be noted since removal of the bounty. In New England a bounty was paid until the late 1960s (NEFSC 1999). Many fishermen, however, are still believed to routinely shoot seals near their nets and weirs, although no documentation exists to quantify this (Stobo 1996).

Seals have long been accused of damaging fishing gear and reducing commercial fish catches (Stobo 1996). The alleged interactions include damaging or opening lobster traps, damaging gillnets while trying to get the fish caught in the nets, driving herring out of herring weirs in the process of catching them, and recently also damaging aquaculture cages while catching cultured fish (Stobo 1996). Aquaculture operators and fishermen are allowed to kill nuisance seals with the proviso of documentation (Stobo 1996). However, negative public reaction as well as the increasing tourism value of seals may enforce the reduction of seal shootings. Another major concern for both government and industry is that animal rights or conservation groups could start a boycott of fish products in response to the use of lethal deterrents (Stobo 1996).

#### **2.6.4. Indirect human impacts on marine mammals**

##### **Collision with ships**

Historical records suggest that ship strikes fatal to whales first occurred late in the 1800s as ships began to reach speeds of 13-15 knots (Laist et al. 2001). However, ship strikes remained infrequent until about 1950, and then increased during the 1950s-1970s as the number and speed of ships increased (Laist et al. 2001). Most lethal or severe injuries of whales are caused by ships of 80 m and longer or by ships travelling 14 knots and faster (Laist et al. 2001). Since 1970, 20 percent of all known Right whale deaths along the east coast of Canada and the US were the result of collisions with ships (Brown & Kraus 1996). The annual migration routes from winter calving grounds in Florida to summer feeding and nursery grounds in the Bay of Fundy and off Nova Scotia, takes them through some of the busiest shipping lanes in the North Atlantic (Percy 1996e). Once an easy target for whalers, the Right whale now has a high risk of colliding with ships because of its characteristic slow swimming, lolling and skimming at the surface (Percy 1996e).

In the outer Bay of Fundy, one major shipping lane connects the Gulf of Maine with Saint John Harbour. In summer, from eight to 17 ships travel this route per day, making this shipping lane within the highest use category in eastern Canada (Lock et al. 1994). In winter, only 2-4 ships per day were recorded on this route. Results from satellite-monitored telemetry have shown that Right whales often occur in or near shipping lanes (Mate et al. 1997). Fin, Humpback, Sperm and Grey whales are also commonly hit by ships (Laist et al. 2001).

In 1993, the Department of Fisheries and Oceans designated two conservation areas for Right whales, one in the Grand Manan Basin (44°30'-44°45'N, 66°18'-66°35'W, Fig. 2.6.2) and one in the Roseway Basin (42°45'-43°05'N, 65°03'-65°40'W). The areas include about 95 percent of the past Right whale sightings, and may be modified in response to shifts in their spatial distribution (Brown & Kraus 1996). However, there are no legally enforceable regulations for these areas, and compliance with guidelines is strictly voluntary. Thus, many ships heading for Quoddy Region ports in Eastport or the St. Croix River (Bayside) leave shipping lanes and cut through the conservation area (Brown & Kraus 1996). Conservation groups are making efforts to work together with the shipping industry to establish a means of averting fatal collisions with the Northern Right whale by seasonal announcements made by the Coast Guard and by guidelines requesting ships to avoid Right whale areas, and to reduce speed and post a lookout in designated zones (Brown & Kraus 1996, Laist et al. 2001, WWF 2001).

##### **Entanglement in fishing gear**

The Right whale distribution also coincides with areas intensively used by humans for fishing, along bank edges, in basins or along the continental shelf in water <182 m (100 fathoms) deep (Mate et al. 1997). Since 1970, 12 percent of the known Right whales deaths along the east coast of Canada and the US were caused by the accidental entanglement in fishing gear (Brown & Kraus 1996), and about 58

percent of the Right whales have been entangled at least once in their lifetime and bear characteristic scars (Percy 1996e). Humpbacks and to a lesser extent Fin whales are also affected by entanglement in fixed gear (L. Murison, *pers. comm.*)

Small whales such as porpoises and dolphins as well as seals are highly threatened by entangling and drowning in fixed or towed fishing gear (e.g. sink and drift gillnets, Stobo 1996, NEFSC 1999). In the Bay of Fundy, the estimated by-catch of Harbour porpoises in sink gillnets was between 80 and 424 between 1986-1993 (Trippel et al. 1996). The incidental take by sink and drift gillnets in Maine was as high as 1667 animals annually from 1992-1996. This is 3.45 percent of the overall estimated population (48,289) and may just equal the estimated annual productivity of 4 percent (NEFSC 1999). Thus, Harbour porpoises have a limited capacity for population increase, and populations are unlikely to sustain even moderate levels of incidental mortality (4 percent of the population per year) (Woodley & Read 1991). Entrapment of Harbour porpoises also occurs in herring weirs, but many of these animals are released alive (Prescott & Fiorelli 1980, NEFSC 1999). For the Harbour seal, the estimated fishery-related mortality or serious injury from 1992-1998 in Maine was 898 animals per year (NEFSC 1999).

Conservation groups, scientists and fishermen are cooperating to test innovative fishing gear that breaks open under the struggle of an entangled Right whale (WWF 2001). Acoustic alarms effectively reduced the by-catch rates of Harbour porpoises in sink or demersal gill nets by up to 77 percent (Kraus et al. 1997, Trippel et al. 1999). Other efforts to prevent entanglement include the development of fishing-net filaments that can be located by Harbour porpoises (E. Trippel, *pers. comm.*). Attempts to develop seal-resistant gear, however, have not been very successful yet (Stobo 1996). Other conservation efforts include the disentanglement network, a joint effort between Canada and US research organizations, as well as the Harbour porpoise weir release program (L. Murison, *pers. comm.*).

### **Aquaculture**

Aquaculture operators can acquire a Fisheries and Oceans (DFO) permit to kill nuisance seals with the proviso that they document their kills (Stobo 1996). To prevent the killing of seals, acoustic devices were developed and are used to discourage seals from approaching aquaculture cages (Stobo 1996). These devices produce acoustic pulses at a frequency to which Harbour seals and Harbour porpoises are very sensitive. Acoustic devices excluded Harbour porpoises from a 400 m radius of the cage site and reduced their abundance within 2.5 km (Strong et al. 1995). This means that several porpoise areas, especially the approaches to Passamaquoddy Bay may be blocked for these animals or their access limited.

Because most interactions between aquaculture cages and seals occur in winter, Strong et al. (1995) recommended to only use acoustic devices in that period and to not employ them during May – November, when cetacean species are common. It has not been proven yet, however, whether acoustic devices may damage the auditory system of the seals or the hearing or movements of marine mammals or fish in the vicinity. Concerns were raised regarding possible adverse affects of fish farm acoustic devices on herring at adjacent weirs sites (Stobo 1996).

### **Fishery-related food depletion**

In the 1970s, inshore movements of several whales including the Humpback whale increased (Gaskin & Smith 1979). One possible explanation was the related severe depletion of capelin stocks by fishing fleets around Newfoundland, which may have forced the whales to search for other schooling fish such as herring (Gaskin & Smith 1979). Food depletion in their Arctic habitats has been suggested to cause recent increases in sightings of Harp and Hooded seals in the Bay of Fundy, which are usually rare visitors (McAlpine et al. 1999).

### **Pollution / contamination**

Coastal habitats along the entire east coast are being contaminated with industrial and agriculture chemicals, petroleum products, sewage and other discharges (see Chapter 4). In the 1970s high levels of DDT (>500 ppm) and polychlorinated biphenyls (PCB) (>200 ppm), and significant amounts of hexachlorobenzene (HCB) and chlordanes were found in the blubber tissue of Harbour porpoises (Gaskin & Smith 1979). Mercury levels in liver (90 ppm) and brain (8 ppm) tissue suggested that symptoms of mercury poisoning could have been manifested based on clinical studies on other mammals (Gaskin & Smith 1979).

PCBs, total DDT (DDT + DDE + DDD), dieldrin, heptachlor epoxide, chlordanes, and HCBs were found in blubber biopsies from North Atlantic Right whales, but levels were not extremely high (Woodley et al. 1991). Recent studies on Harbour porpoises have shown that levels of heavy metals and organochlorines have declined since the 1970s as a result of their reduced concentration in the environment (Wells et al. 1996). The short and long-term effects of toxins that are routinely observed in marine mammal tissue samples are not fully known. It is expected, however, that survival, growth, reproduction and behaviour are being subtly impaired and that the animals are becoming more susceptible to diseases (Percy 1996e, Wells et al. 1996).

### **Tourism**

The public interest in marine mammals has grown rapidly as indicated by an increasing number of tourists, whale watching operators, and whale adoption programs (Percy 1996e). Whale watching operators expanded rapidly over the last decade, and in 1996, about 30 were operating in the Bay of Fundy. Although the education of thousands of people is beneficial, there are concerns about the increasing disturbance of the whales (Percy 1996e). Because this growing business is largely unregulated, some concerned tour operators are cooperating with the whale research group East Coast Ecosystems to develop voluntary guidelines and a code of ethics for whale watching (Percy 1996e). The increasing tourism value of seals may force aquaculture operators to develop seal-friendly deterrents (Stobo 1996). Seals can be observed in the vicinity of the coast all over the Quoddy Region (Colbourne & Terhune 1991). However, visiting of seal colonies and touching of seals and their pups by tourists needs to be regulated. Kovacs & Innes (1990) reported that virtually all aspects of the behaviour of Harp seal mothers and pups were significantly affected by the presence of tourists in the Gulf of St. Lawrence. Female attendance was significantly reduced and those females that remained with their pups when tourists were present spent significantly more time alert and less time nursing (Kovacs & Innes 1990).

## **2.6.5. Recent status and notes on single species**

### **2.6.5.1 Cetaceans – Toothed Whales**

#### **Harbour porpoise *Phocoena phocoena***

The Harbour porpoise is the most abundant of the whale family in the Bay of Fundy. Genetic diversity analyses suggest that the western North Atlantic sub-populations are not seriously depleted of genetic variation (Wang et al. 1996). However, gene flow seems to be restricted to some degree even among closely adjacent geographical units such as the Quoddy Region porpoises and the southwest Nova Scotia population. Thus, management of this species should aim for conservation of a variety of local stocks (Gao & Gaskin 1996). The Bay of Fundy-Northern Gulf of Maine sub-population has a seasonal population of about 4000 to 8000 animals (Gaskin 1992), while the entire Bay of Fundy – Gulf of Maine population counts about 48,000 animals (Table 2.6.2, NEFSC 1999). Harbour porpoises can be found year-round, but most species arrive in coastal areas in late spring and leave them in fall, to stay further

offshore during winter where temperatures are higher (Gaskin & Smith 1979). The overall migration pattern seems to be closely related to that of its principal prey, herring (Gaskin & Smith 1979).

### 2.6.5.2 Cetaceans – Baleen Whales

#### **Fin whale *Balaenoptera physalus***

The Fin whale is listed by COSEWIC as a species of ‘special concern’ (Table 2.6.2, COSEWIC 2000). In the 1970’s, the western North Atlantic population was estimated at 3000 animals (Gaskin 1982), yet in 1998 a minimum of 1704 animals was estimated (NEFSC 1999). Although the most common of the larger whales in the Bay of Fundy in earlier years, currently perhaps 100 or fewer Fin whales appear offshore in June and July each year. They can also be sighted in the approaches to Head Harbour Passage (Fig. 2.6.2, Gaskin & Smith 1979, L. Murison, *pers. comm*). This species feeds on euphausiid shrimp and herring, and stays in the area until late fall (Ingersoll & Gorham 1978, Gaskin & Smith 1979).

#### **Minke whale *Balaenoptera acutorostrata***

The Minke whale forms a distinct Canadian East Coast population of about 2,145 animals and is a regular summer migrant to the approaches of the Bay of Fundy (Table 2.6.2, NEFSC 1999). This whale comes as far inshore as L’Etete and Western Passage, Blacks Harbour and even into Passamaquoddy Bay (Gaskin & Smith 1979). The principal prey is herring,; they also feed on alewife and capelin (Ingersoll & Gorham 1978, Gaskin 1983). While following their food, Minke whales occasionally become trapped in herring weirs. In most documented cases of weir entrapments during 1980 to 1990, they were released alive (Read 1994 in NEFSC 1999). The by-catch of Minke whales in other fishing gear is small (NEFSC 1999).

#### **North Atlantic (Northern) Right whale *Eubalaena glacialis***

The North Atlantic Right whale is the most endangered large whale in the world (Table 2.6.2, Knowlton et al. 1994, Brown & Kraus 1996, COSEWIC 2000). Slightly more than 300 animals are left, and the population is estimated to be increasing at only 2.5 percent per year (Knowlton et al. 1994). This is in contrast to other populations of Right whales in the eastern and western South Atlantic, which increase at 6.8 percent and 7.2 percent per year (Brown & Kraus 1996).

Brown et al. (1994) suggested that the absence of measurable recovery might be due to a combination of fewer actively reproducing females and lower reproductive rates of some females. The limited gene pool may also affect their recovery rate. However, after many years of very low birth rates (11.5 calves per year from 1980-1992, six calves per year from 1993-1995, Brown & Kraus 1996), in the 2000-2001 calving season, 30 calves were born (WWF 2001, L. Murison, *pers. comm.*). Three calves have already died, two by unknown reasons, one by a ship strike (L. Murison, *pers. comm.*).

Despite the small overall size, the population might be further divided into two sub-groups, defined by their use of the Bay of Fundy versus other nursery areas (Schaeff et al. 1993). Today, about 59 percent of the newborn calves are brought to the Bay of Fundy nursery area (Malik et al. 1999). In 1993-1995, Brown and Kraus (1996) documented a distributional shift of Right whales from the Browns-Baccaro area, Southern Scotian Shelf, into the Bay of Fundy, where numbers have doubled since 1980-1992.

#### **Humpback whale *Megaptera novaeangliae***

Humpback whales are listed as a species of ‘special concern’ (Table 2.6.2, COSEWIC 2000). The total population of Humpbacks in the western North Atlantic was estimated at around 1200 animals in the early 1970s (Mitchell 1973, Winn et al. 1975, both in Gaskin & Smith 1979), 1380-2300 in the late

1970s (Gaskin 1982), and at about 10,019 in 1998 (NEFSC 1999). In the Bay of Fundy, from 20-70 are sighted every year (L. Murison, pers. comm.).

### 2.6.5.3 Pinnipedia

#### **Atlantic Walrus** *Odobenus rosmarus*

The Atlantic walrus is now extinct in eastern Canada, but it presumably inhabited the area from the immediate post-glacial period to the early 19<sup>th</sup> century (Ingersoll & Gorham 1978). The disappearance or extirpation of the walrus from the area followed European settlement. Today, its distribution is circumpolar (Ingersoll & Gorham 1978). Squires (1946) noted that the walrus was formerly common at least along the Gulf of St. Lawrence coast, but was extirpated from the area nearly 200 years ago because of high exploitation for oil and ivory by early European settlers. The last recorded sighting of a walrus in the Bay of Fundy was in 1937, and in 1989 off Nova Scotia (L. Murison, pers. comm.).

#### **Harbour Seal** *Phoca vitulina*

The Harbour seal forms a western North Atlantic population with an estimated minimum population size of 30,990 in 1997 (NEFSC 1999). In the Bay of Fundy, Harbour seals occur year-round, and breeding groups have been reported in the Passamaquoddy Region (Kovacs et al. 1990). Most animals, however, are believed to move south during autumn and back north in spring and summer (Colbourne & Terhune 1991). No long-term studies have been conducted to determine abundance trends, and the overall abundance of Harbour seals in eastern Canada is not known (Stobo 1996).

Along the New England coast, the population has increased nearly five-fold since the Marine Mammals Protection Act was enacted in 1972 (NEFSC 1999, Jacobs & Terhune 2000). Summer surveys of seals in the Bay of Fundy in 1980s to 1990s also suggest an increase in Harbour seal abundance (Stobo & Fowler 1994, Jacobs & Terhune 2000). In 1987, Colbourne and Terhune (1991) counted up to 1000 Harbour seals in the Quoddy Region equally distributed among Passamaquoddy Bay, Deer and Campobello Islands and the mainland coast towards Point Lepreau. Despite fishery and aquaculture-related mortality, and deliberate shooting, the population is increasing at an estimated rate of 12 percent annually (NEFSC 1999).

#### **Grey seal** *Halichoerus grypus*

Grey seals occur in the Bay of Fundy in all seasons (Ingersoll & Gorham 1978). Although no local long-term population trends are available, overall Grey seal abundance has been increasing on the east coast of Canada and the Gulf of Maine since the 1960s, when the first reliable records were taken (Stobo 1996). The increase has been estimated at a rate of 6-12 percent annually (Stobo & Zwanenburg 1990, Zwanenburg & Bowen 1990, both in Stobo 1996), and overall abundance in the early 1990s was estimated to be approximately 140,000 (Stobo 1996). The largest pupping and breeding grounds have been located in the Southern Gulf of St. Lawrence and the eastern Scotian Shelf (Stobo 1996).

#### **Harp seal** *Phoca groenlandica*

Harp seals are rare visitors from the north (McAlpine et al. 1999b). Since 1846, 16 records of Harp seals have been made in the Bay of Fundy. Archaeological remains also suggest that this species visited the area occasionally (McAlpine et al. 1999b). Bone remains aged at 1000-4000 B.P. have been recovered from at least nine archaeological sites in New Brunswick, Maine and Massachusetts. One skeleton was found in Leda clay at Saint John, New Brunswick, which was radiocarbon dated at 12,650-12,800 B.P. (McAlpine & Walker 1990).

Since 1994 up to 45 harp seals have been recorded annually. This dramatic increase has been correlated with the collapse of fish stocks such as capelin on which they feed off Newfoundland in 1988

-1990 (McAlpine et al. 1999b). Today, Harp seals grow more slowly and pregnancy rate is lower than in 1980s. A food shortage caused by decline in capelin stocks may lead adult Harp seals to force immatures into poorer feeding areas such as the Bay of Fundy (McAlpine et al. 1999b)

**Hooded Seal *Cystophora cristata***

Hooded seals have been described as an occasional visitor from the north (Ingersoll & Gorham 1978). Since the mid 19<sup>th</sup> century, eight records of hooded seals have been documented in Bay of Fundy and Gulf of Maine. As with the Harp seal, a recent increase of this ice-breeding seal has been observed in the region with 31 additional records during 1994-1998 (McAlpine et al. 1999a).

**Table 2.6.2.** Status of marine mammals at risk occurring in the area as listed by the Committee on the Status of Endangered Wildlife in Canada in November 2000 (COSEWIC 2000, <http://www.cosewic.gc.ca>), and population estimates in the 1970s (Gaskin 1982) and in 1998 (NEFSC 1999).

Species	Status	YEAR	Population estimates	
	COSEWIC		Gaskin 1982	NEFSC 1999
Atlantic walrus Northwest Atlantic Population	Extirpated	1850		
Right whale Atlantic Population	Endangered	1980	high 10s to low 100s	295
Harbour porpoise Northwest Atlantic Pop. Bay of Fundy / Gulf of Maine Pop.	Threatened	1990 --	48,289	
Humpback whale Western North Atlantic Pop.	Special Concern	1985	1,380-2,300	10,019
Fin whale Atlantic Population	Special Concern	1987	3,000	1,704
Minke whale Canadian East Coast Pop.	not listed		some 1000	2,145
Harbour seal Western North Atlantic Pop.	not listed			30,990
Grey seal Northwest North Atlantic Pop.	not listed			2,010