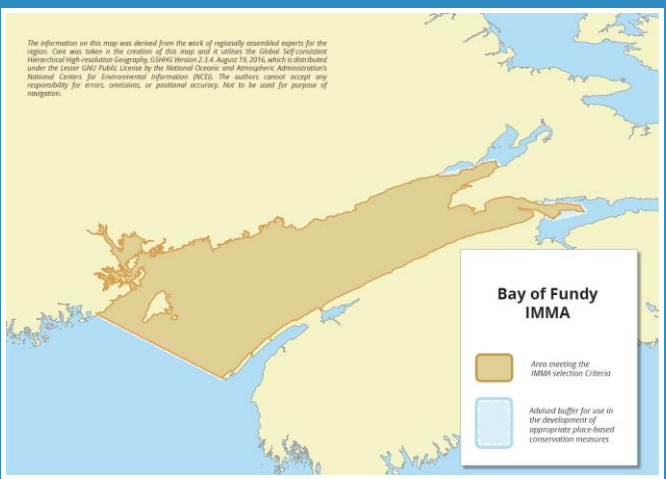
# Bay of Fundy IMMA




## Area Size

12,731 km$^2$

## Qualifying Species and Criteria

Common Minke Whale – *Balaenoptera acutorostrata*

Criterion C (2)

Sei Whale – *Balaenoptera borealis*

Criterion A

Fin Whale – *Balaenoptera physalus*

Criterion A; C (2)

North Atlantic Right Whale – *Eubalaena glacialis*

Criterion A; B (2); C (2)

Humpback Whale – *Megaptera novaeangliae*

Criterion C (2)

Harbor Porpoise – *Phocoena phocoena*

Criterion C (2)

Criterion D (2) Marine Mammal Diversity

*Balaenoptera acutorostrata, Balaenoptera borealis, Balaenoptera physalus, Eubalaena glacialis, Globicephala melas, Halichoerus grypus, Leucopleurus, Lagenorhynchus albirostris, Megaptera novaeangliae, Phoca vitulina, Phocoena phocoena*

## Other Marine Mammal Species Documented

*Balaenoptera musculus, Orcinus orca, Physeter macrocephalus*

## Summary

The Bay of Fundy IMMA is located off Nova Scotia, Canada extending between Nova Scotia and New Brunswick. This large ocean bay is a narrow, funnel-shaped body of water that is approximately 270 km long and 60 km wide at its widest point. The Bay of Fundy is a highly productive and biologically diverse ecosystem that is recognized for having the highest tidal ranges in the world (up to 16 m) which result in significant currents and mixing of the water column, support elevated productivity and concentrate prey, in turn attracting larger predators including marine mammals. North Atlantic right whales (*Eubalaena glacialis* – Critically Endangered), sei whales (*Balaenoptera borealis* - Endangered), and fin whales (*Balaenoptera physalus* – Vulnerable) regularly occur within this area. Several marine mammal species aggregate in the bay either throughout the year or seasonally to forage on the abundant food resources within the area. This area supports a high diversity of marine mammals, including at least 14 species of baleen whales, toothed whales, dolphins, porpoise and seals. This area wholly or partially includes 16 identified EBSAs, as well as designated North Atlantic right whale critical habitat.

## Description:

The Bay of Fundy is located off eastern Canada, between Nova Scotia and New Brunswick. This large ocean bay is a narrow, funnel-shaped body of water that is approximately 270 km long and 60 km wide at its widest point. The exceptional oceanographic conditions of the bay produce powerful tidal currents, resulting in nutrient-rich waters that accumulate prey resources. The inner bay and outer bay have somewhat different characteristics, with the inner bay having the most extreme tidal ranges and

Figure 1: Photos taken from Burntcoat Head in the inner Bay of Fundy area, demonstrating the vast tides of this highly productive and biologically diverse ecosystem. Photos obtained from National Resources Canada (NRC), used with permission from the Municipality of East Hants, Nova Scotia. Photo credits: Len Wagg.

extensive muddy substrate that becomes exposed at low tide, while the outer bay is subject to higher tidal mixing processes. The Bay of Fundy is a highly productive and biologically diverse ecosystem that is recognized for having the highest tides in the world (up to 16 m) which result in significant currents and mixing of the water column that support elevated productivity and concentrate prey. This in turn attracts larger predators, including a high diversity of marine mammals that are present in the bay either throughout the year or seasonally (Buzeta et al., 2014; Ward-Paige & Bundy, 2016). Several marine mammal research programs have focused survey and field study efforts in this region over the past few decades and whale-watching enterprises operate in the bay every summer.

Figure 2: A Critically Endangered North Atlantic right whale (*Eubalaena glacialis*) breaching. Photo credit: H. Moors-Murphy.

## Criterion A: Species or Population Vulnerability

There is a large number of Qualifying Species that regularly occur in this area including several vulnerable/at-risk species. The North Atlantic right whale *(Eubalaena glacialis*) is considered the most endangered of the large whales in the Northwest Atlantic and is listed as Critically Endangered (CR) according to the global IUCN Red List (Cooke, 2020). Additionally, the Canadian Species at Risk Act (SARA; Canadian legislation for conservation of at-risk species) lists the North Atlantic right whale as Endangered (DFO, 2014). Sei whales (*Balaenoptera borealis*) are listed as Endangered (EN) on the IUCN Red List (Cooke, 2018a), and while not currently listed under SARA, the Atlantic population has been assessed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC; an independent body that provides listing recommendations for consideration under SARA) (COSEWIC, 2019). Fin whales (*Balaenoptera physalus*) are listed as Vulnerable (VU) on the IUCN Red List (Cooke, 2018b) and the Atlantic population of fin whales is listed as Special Concern under SARA (DFO, 2017; approximately equivalent to IUCN "Near Threatened").

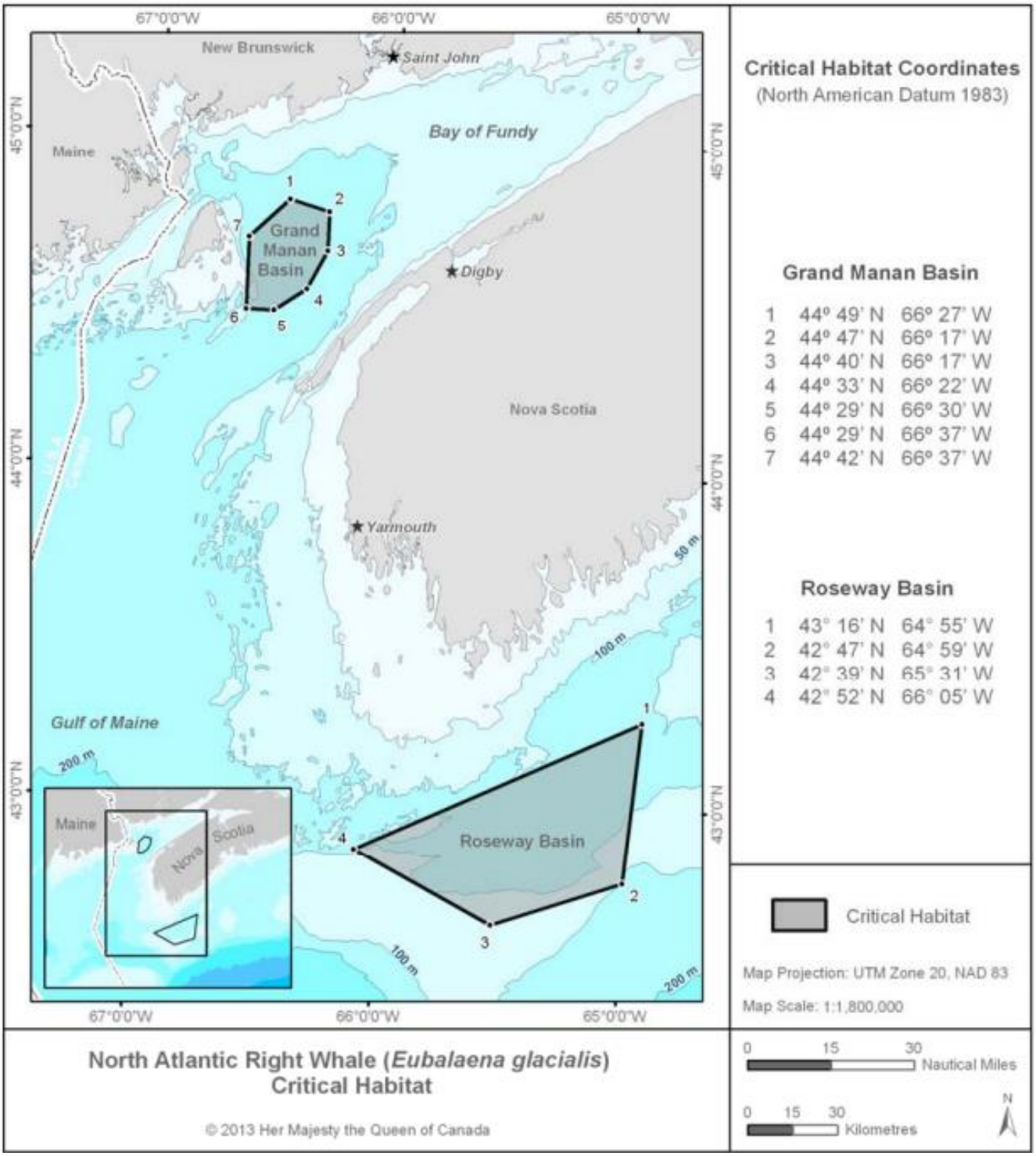



Figure 3: Boundaries of North Atlantic right whale Critical Habitat identified and protected under the Canadian Species at Risk Act within Grand Manan Basin and Roseway Basin. Grand Manan Basin is an important aggregation and foraging area for this Critically Endangered species located within Bay of Fundy IMMA. Excerpt from: DFO (2014).

## Criterion B: Distribution and Abundance Sub-criterion B2: Aggregations

Grand Manan Basin, located at the mouth of the Bay of Fundy, has been designated as Critical Habitat for North Atlantic right whales due to the high seasonal concentration of their primary prey, *Calanus* copepods, and the frequency of sightings there (DFO, 2014). Decades of focused research have demonstrated that Grand Manan Basin is an important aggregation area for socializing and feeding. Although right whale distribution has shifted since 2010, with increased occurrence in the Gulf of St. Lawrence and decreased sightings reported in the Bay of Fundy (Meyer-Gutbrod et al., 2022; Record et al., 2019), there has also been a shift in survey effort, with relatively limited coverage in the Bay of Fundy from 2017 onwards (DFO, 2019, 2020). Ongoing passive acoustic monitoring in Grand Manan Basin demonstrates that this area continues to be an important area for right whales, with relatively high acoustic presence observed in and around the basin particularly in spring, summer and fall (Davis et al., 2017; Durette-Morin et al., 2022; Moors-Murphy et al., 2024). Sightings data show that right whale distribution within the bay extends beyond this basin, particularly to the northwest (Davies et al., 2019; Moors-Murphy et al., 2024).

## Criterion C: Key Life Cycle Activities Sub-criterion C2: Feeding Areas

The Bay of Fundy has the largest tidal ranges in the world, resulting in significant currents and mixing of the water column that supports elevated productivity and concentrates prey, in turn attracting large predators including a variety of marine mammals (Buzeta et al., 2014; Ward-Paige & Bundy, 2016). Most of the marine mammal species that occur in the bay have been observed feeding and/or are presumed to be in the area to feed. It has been suggested that the summer-autumn cetacean populations that occur in the bay are highly reliant on the area's biological productivity which is driven by fine-scale tidal fronts and eddy systems created by strong tidal currents moving around islands, ledges, and variable benthic bathymetry. Several studies have shown spatial and temporal links between the distribution of marine predators in the region and the tide-induced upwellings and fronts that result in high abundances of prey species (e.g., Lechance et al., 2023).

Grand Manan Basin at the mouth of the Bay of Fundy has been recognized as an important feeding habitat for North Atlantic right whales and has been designated as Critical Habitat for the population (DFO, 2007, 2014). The edges of Grand Manan Basin lie at about 100 m depth, and the maximum depth of the central Basin is approximately 200 m. The area is exposed to strong tides and the topography and movement of water masses in Grand Manan Basin concentrate the primary prey of right whales, *Calanus* copepods (Murison & Gaskin, 1989; Mayo & Marx, 1990; Baumgartner et al., 2003; Michaud & Taggart, 2007; Plourde et al., 2024). This basin is the area where the majority of right whale sightings off Nova Scotia have occurred (DFO, 2007, 2014), and their preference for this area has been attributed to the basin having the highest concentrations of copepods in the Bay of Fundy (Murison & Gaskin, 1989; Woodley & Gaskin, 1996; Baumgartner & Mate, 2003).

The outer Bay of Fundy is a well-known feeding ground for humpback whales (*Megaptera novaeangliae*) (Baird, 2003). This species migrates into the area every summer, with the majority of sightings occurring in the July to September period (Lechance et al., 2023). Humpback whale sightings are usually associated with topographically induced oceanographic processes which aggregate their prey (e.g., euphausiids), such as tidal fronts and areas of upwelling associated with water depth and

bathymetric features (Lowe et al., 2018); consistent with where humpback whales have been observed in the outer Bay of Fundy (Lechance et al., 2023).

Ingram et al. (2007) reported that feeding behaviour (animals observed milling and in the act of lunging and surface swimming with their mouth open) was observed during 93% of minke (*Balaenoptera acutorostrata*) and 86% of fin whale encounters based on sightings data collected opportunistically from a whale-watching vessel during one season in the Bay of Fundy. Fin whales in the Bay of Fundy primarily feed on euphausiids (mainly *Meganyctiphanes norvegica*: Brodie et al., 1978), as well as on small schooling fish such as Atlantic herring (*Clupea harengus harengus*; Gaskin, 1983). Minke whales forage on a variety of fish and invertebrates throughout their range (Perrin & Brownell, 2002), and are probably feeding on a greater variety of prey and at higher trophic levels than fin whales (Gaskin, 1983; Ingram et al., 2007).

Lechance et al. (2023) demonstrated that minke, fin and humpback whales aggregated in the outer Bay of Fundy area in response to physical and biological features of the environment, such as depth, bottom topography, and fine-scale oceanographic features that aggregate prey and enable foraging.

Harbor porpoises (*Phocoena phocoena*) are distributed throughout the Bay of Fundy, with the highest densities observed in summer though at least some individuals overwinter in the area, and most births occur in the area in May (COSEWIC, 2022). Harbor porpoise feeding behaviour has been documented via visual sightings and passive acoustic detection of their foraging clicks from the mouth of the bay to the Minas Basin in the inner bay (Porskamp, 2015; Adams, 2018; COSEWIC, 2022; and references therein). This is a generalist species which exhibits a preference for small energy rich fish and squid (COSEWIC, 2022). In the Bay of Fundy, they feed mainly on juvenile Atlantic herring, supplemented by silver hake (*Merluccius bilinearis*) and Atlantic cod (*Gadus morhua*) and other species (Recchia & Read, 1989).

The large diversity of other species that commonly occur in the Bay of Fundy are also likely regularly foraging in the area, though it is not clear if this is a particularly important foraging area for these other species.

## Criterion D: Special Attributes
## Sub-criterion D2: Diversity

The dynamic and productive environment of the Bay of Fundy supports a large diversity of marine mammals. Several baleen whale species annually migrate into the area during summer to forage on the abundance of prey that occurs in the area, including North Atlantic right, humpback, fin, sei, and minke whales, as evidenced by sightings data (Gomez et al., 2020), predicted density maps that have been developed for baleen whales (Roberts et al., 2016), and passive acoustic monitoring studies that demonstrate patterns of seasonal occurrence of these species in the area (e.g., Davis et al., 2017, 2020). Harbor porpoises are known to occur in the area throughout the year, with the highest densities occurring in summer (COSEWIC, 2022). Long-finned pilot whales (*Globicephala melas*), Atlantic white-sided dolphins (*Leucopleurus acutus*), and white-beaked dolphins (*Lagenorhynchus albirostris*) have been commonly sighted in the area and occur throughout the year (Gomez et al., 2020), and the Bay of Fundy is highlighted in predicted mean density maps that have been developed for small delphinoids (Roberts et al., 2016). There are a large number of harbor seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) haul-out sites that occur in the Bay of Fundy, and the highest counts of harbor seals

off Nova Scotia are observed in this area (Lidgard et al., 2023). There are also occasional sightings of other species in the area such as blue (*Balaenoptera musculus*), sperm (*Physeter macrocephalus*) and killer whales (*Orcinus orca*) (Gomez et al., 2020).

## Supporting Information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