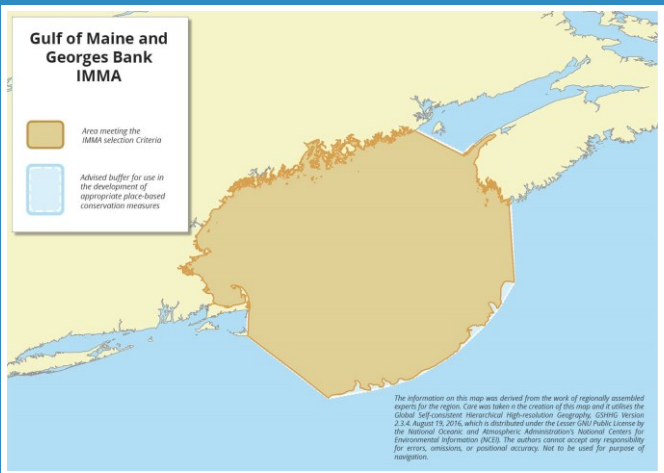

Area Size

148,729 km²

Qualifying Species and Criteria

North Atlantic Right Whale - *Eubalaena glacialis*

Criterion A; B (2); C (1, 2, 3b)

Fin Whale - *Balaenoptera physalus*

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

Sei Whale - *Balaenoptera borealis*

Criterion A

Sperm Whale - *Physeter macrocephalus*

Criterion A

Common minke whale – *Balaenoptera acutorostrata*

Criterion B (2)

Humpback Whale - *Megaptera novaeangliae*

Criterion B (2); C (2)

Harbor Seal - *Phocoena phocoena*

Criterion C (1, 2)

Atlantic White-sided Dolphin – *Leucopleurus acutus*

Criterion C (2)

Criterion D(2) - Marine Mammal Diversity

Balaenoptera acutorostrata, Balaenoptera borealis, Balaenoptera physalus, Delphinus delphis, Eubalaena glacialis, Globicephala melas, Grampus griseus, Halichoerus grypus, Leucopleurus acutus, Megaptera novaeangliae, Phoca vitulina, Phocoena phocoena, Physeter macrocephalus, Tursiops truncatus

Gulf of Maine and Georges Bank IMMA

Other Marine Mammal Species Documented

Balaenoptera musculus, Orcinus orca

Summary

The Gulf of Maine is a continental shelf sea off New England and southwestern Nova Scotia. It is isolated from the Mid-Atlantic Bight to the south by the Nantucket Shoals, from the Scotian Shelf to the north by Browns Bank, and from the wider Atlantic Ocean to the east by Georges Bank. Strong circulation over complex bathymetry aggregates fat-rich zooplankton, the preferred prey of North Atlantic right whales, and many forage fish preyed upon by other marine mammals in many areas in this IMMA. It encompasses some of the most important foraging habitats for marine mammals along the U.S. East Coast. Within this area there are four threatened species: North Atlantic right whales (*Eubalaena glacialis*), sei whales (*Balaenoptera borealis*), fin whales (*Balaenoptera physalus*) and sperm whales (*Physeter microcephalus*). This IMMA encompasses important foraging habitats, which leads to aggregations of North Atlantic right, humpback, fin and minke (*Balaenoptera acutorostrata*) whales. Reproductive behaviour of North Atlantic right whales has been witnessed in this IMMA and harbor seals (*Phoca vitulina*) breed in northwestern Gulf of Maine (GoM) waters. North Atlantic right whales perform consistent, seasonally-timed movements among specific Gulf of Maine areas. The area includes the Northeastern U.S. Foraging Area Critical Habitat for the North Atlantic right whale and the Stellwagen Bank National Marine Sanctuary.

Description:

The Gulf of Maine is a continental shelf sea off New England and southwestern Nova Scotia. It is isolated from the Mid-Atlantic Bight to the south by the Nantucket Shoals, from the Scotian Shelf to the north by Browns Bank, and from the wider Atlantic Ocean to the east by Georges Bank (Townsend, 1991). The regular flow of the cold, nutrient-rich Labrador Current from the Scotian Shelf, combined with intrusions of deep, warm, salty slope water through the Northeast Channel, and enhanced by strong tidal mixing drives high biological productivity over a series of shallow shoals and ledges, submerged offshore banks, and deep basins that encircle the interior of the IMMA. This strong circulation over complex bathymetry aggregates lipid-rich zooplankton, the preferred prey of North Atlantic right whales, and many forage fish preyed upon by other marine mammals, in areas such as Cape Cod Bay, the Great South Channel, and Jordan, Wilkinson, and Georges Basins (Record et al., 2019). The area includes the Northeastern U.S. Foraging Area Critical Habitat for the North Atlantic right whale and the Stellwagen Bank National Marine Sanctuary.

Criterion A: Species or Population Vulnerability

Four species occurring regularly with this IMMA are considered threatened with extinction according to the global IUCN Red List. The North Atlantic right (*Eubalaena glacialis*) whale is listed as Critically Endangered on the Red List (Cooke, 2020). Sei whales (*Balaenoptera borealis*) are listed as Endangered on the Red List (Cooke, 2018a). Fin (*Balaenoptera physalus*; Cooke, 2018b) and sperm (*Physeter microcephalus*; Taylor et al., 2019) whales are listed as Vulnerable on the IUCN Red List.

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

This IMMA encompasses some of the most important foraging habitats for cetaceans in U.S. waters (Kenney & Winn, 1986), which leads to aggregations of many species. It includes the highest density feeding area for North Atlantic right whales in U.S. waters: Cape Cod Bay. Modern photo-identification data of right whales in this area date back to 1959, and dedicated monitoring of right whales in this habitat has been conducted for over 20 years. Studies have demonstrated that this is an important habitat for multiple life history functions, including foraging, socialising, and as a post-calving 'nursery' area, where females return with their calves at the end of the breeding season (Mayo et al., 2018). In a study examining sightings data from 1998-2017, estimated right whale abundance increased over time, and abundance in peak months increased at 10%/year, much higher than the rate of increase for the overall population (Ganley et al., 2019). Over 40% of the entire population has been documented in this habitat on a single day via aerial surveys (i.e. 7 April 2019, Center for Coastal Studies).

The Gulf of Maine is the southwestern-most primary humpback whale (*Megaptera novaeangliae*) feeding ground in the North Atlantic Ocean (Katona & Beard, 1990; Stevick et al., 2006) and individuals aggregate there from March through December (Clapham et al., 1993; Robbins, 2007). Aggregations tend to occur in areas of high bathymetric relief, such as at banks, slopes and ledges from the waters off Massachusetts to Nova Scotia. While their specific distribution varies from year to year within the IMMA, the relative density of humpback whales tends to be highest in the southwest and northeast portion of the Gulf of Maine and Bay of Fundy (CETAP, 1982; Robbins, 2007).

Fin and minke (*Balaenoptera acutorostrata*) whales aggregate in many of the same areas used by humpback whales. Photo-identification research indicates that all three species exhibit extended occupancy in the region (Clapham & Mayo, 1987; Seipt, 1990; Murphy, 1996) and annual return (Clapham & Seipt, 1991). For both humpback and fin whales, there is also evidence that distribution and aggregation sites within the Gulf of Maine and Bay of Fundy are influenced by demographic class (Agler et al., 1993; Robbins, 2007).

Criterion C: Key Life Cycle Activities
Sub-criterion C1: Reproductive Areas

Reproductive behaviour of North Atlantic right whales has been witnessed in this IMMA in the form of "surface active groups" (Kraus & Hatch, 2001). Based on aerial survey data collected during a 7-year study, over 200 individual right whales were identified in the central Gulf of Maine, representing approximately half the population during that period. Significantly higher proportions of known

Figure 1: North Atlantic Right whales (*Eubalaena glacialis*) surface active group.
Photo credit: Center for Coastal Studies image under NMFS-ESA Permit#25740-02.

reproductive males and females were present in this region during winter months compared to other areas, suggesting that this region may comprise a mating ground (Cole et al., 2013). The Gulf of Maine also represents an important area for lactating North Atlantic right whale females, many of whom return to Cape Cod Bay and the greater Gulf of Maine with their calves at the end of the calving season (Mayo et al., 2018). Between 1997 and 2013, an average of 12.7% of calves of the year were observed in Cape Cod Bay (Mayo et al., 2018).

The harbor seal (*Phoca vitulina*) is the most widely distributed phocid in the northern hemisphere (Desportes et al., 2010). The North Atlantic subspecies (*Phoca vitulina vitulina*) haulout count (not adjusted for animals in the water) is 129,200 animals, of which 15% breed in northwestern Gulf of Maine (GoM) waters (Waring et al., 2015; NERC-SCOS, 2022, DFO, 2024). Harbor seals are distributed along the coast from the Canadian border to New Jersey. During the May to June breeding season there is a northward shift with the largest concentration of animals occurring in Maine (Gilbert et al., 2005; Waring et al., 2010). Harbor seals differ from other phocids in that they forage during lactation; the pups enter the water soon after birth and follow the female as she forages or moves between haulout sites (Boulva & McLaren, 1979; Lesage et al., 2004). Separation from the female during storms or in rough water can be an important source of pup mortality (Boness et al., 1992). Harbor seal breeding habitat in the GoM area is characterised by relatively isolated small islets, rocky ledges and reefs exposed at low tide, located in sheltered waters, but with access to relatively deep water for escape from predators (Gilbert et al., 2005).

Figure 2: Feeding fin whales (*Balaenoptera physalus*).
Photo credit: Center for Coastal Studies image under ESA-MMPA permit 19315-01.

Sub-criterion C2: Feeding Areas

Strong circulation over complex bathymetry in the Gulf of Maine aggregates lipid-rich zooplankton, the preferred prey of North Atlantic right whales, and many forage fish preyed upon by other marine mammals, in areas such as Cape Cod Bay, the Great South Channel, and Jordan, Wilkinson, and Georges Basins (Record et al., 2019). Consequently, the Gulf of Maine is feeding habitat for many species of cetaceans and both species of pinnipeds that occupy the area.

North Atlantic right whales aggregate in large numbers to feed in areas such as Cape Cod Bay (Mayo & Marx, 1990; Hudak et al., 2023), the Great South Channel (Beardsley et al., 1996; Kenney et al., 1995, 2001), and Jeffreys Ledge (Weinrich et al., 2000). Cape Cod Bay represents one of the most important historic and current feeding areas for the species within US waters. Right whale foraging behaviour has been extensively studied in this region via behavioural observation and biologging suction cup tags (e.g. Parks et al., 2012; Baumgartner et al., 2017; Hudack et al., 2023), often coupled with plankton sampling. Prey sampling and modelling efforts incorporating prey data have also been used to assess right whale foraging habitat throughout the region (e.g., Costa et al., 2006; Pershing et al., 2009; Sorochan et al., 2021; Meyer-Gutbrod et al., 2023).

Humpback whale feeding has also been well-studied in the southwest portion of this IMMA. Stellwagen Bank and the southern Gulf of Maine consistently attract a high density of humpback whales during spring, summer, and fall months. Humpback foraging behaviour in this area has been studied for more than four decades, and has been shown to involve a diversity of behaviours (Hain et al., 1982; Weinrich et al., 1992; Hain et al., 1995; Wiley et al., 2011; Allen et al., 2013; Ware et al., 2014). Surface observations, behavioural sequencing, biologging tags, active acoustic data collection, and oceanography have been utilised to examine humpback foraging strategies relative to demographics, conspecific behaviour, prey (type, behaviour, and densities), and oceanographic processes (e.g., Hazen et al., 2009; Wiley et al., 2011; Pineda et al., 2015). Biologging tags have also revealed acoustic behaviour associated with foraging activity (Stimpert et al., 2007).

Foraging behaviour of fin whales and Atlantic white-sided dolphins (*Leucopleurus acutus*) has also been documented. On 42 aerial surveys conducted by the New England Aquarium since January 2023, foraging behaviour (e.g., lunge feeding) and defecation have been observed 22 times for fin whales (New England Aquarium, unpublished data). Feeding was documented once and inferred in 9.5% (n=45) of opportunistically reported sightings of Atlantic white-sided dolphins on Stellwagen Bank and Jeffreys Ledge (Weinrich et al., 2001).

Pinnipeds forage at sea but require a solid platform for pupping, raising their young, molting, and resting. Harbor seals prefer isolated sandbars, small islets and rocky ledges and reefs exposed at low tide, all of which are distributed around the Gulf of Maine (Gilbert et al., 2005; Waring et al., 2015). They prefer foraging within 20 km of their haulout sites at depths of less than 100 m, but deeper depths and foraging further offshore have been reported (Lesage et al., 1999; Wynne-Simmonds et al., 2024). They rely on diverse prey consisting primarily of gadoids such as hake (*Urophycis* sp.), flatfish (*Pseudopleuronectes* sp., *Scophthalmus* sp.), sandlance (*Ammodytes* sp.), herring (*Clupea harengus*, shad (*Alosa* sp.), menhaden (*Brevoortia* sp., Payne & Selzer, 1989; Toth et al., 2018), all of which are plentiful in the Gulf of Maine.

Sub-criterion C3: Migration Routes
C3b – Migration / Movement Area

North Atlantic right whales perform consistent, seasonally-timed movements among specific Gulf of Maine areas (e.g., Kenney et al., 1995; Kenney et al., 2001). While calving takes place outside of this IMMA in winter, the majority of the rest of the population occupies Cape Cod Bay from winter to early spring. The population then shifts to the Great South Channel where they feed from spring to early summer. Right whales subsequently move out of this IMMA to feed in Canadian waters from summer into fall. When North Atlantic right whales return in large numbers to the IMMA, they aggregate in a possible mating ground in the central Gulf of Maine (Cole et al., 2013) as well as in a feeding area at Jeffreys Ledge (Weinrich et al., 2000) before returning to their winter Cape Cod Bay feeding ground. Although these seasonal movements involve the majority of the population, the exact routes taken within the IMMA are not clearly defined.

Criterion D: Special Attributes
Sub-criterion D2: Diversity

Species density modelling shows that 14 cetacean species have been recorded as present or seasonally present in the Gulf Maine and Georges Bank area, including gray seals (*Halichoerus grypus*), harbour seals, minke whales, fin whale, sei whale, humpback whale, right whale, long-finned pilot whale (*Globicephala melas*), Atlantic white-sided dolphins, common bottlenose dolphins (*Tursiops truncatus*), harbor porpoises (*Phocoena phocoena*), short-beaked common dolphins (*Delphinus delphis*), sperm whales, and Risso's dolphins (*Grampus griseus*) (Roberts et al., 2023). Two studies (Hodge et al., 2022; Roberts et al., 2023) have evaluated marine mammal species diversity along the entire United States East Coast. There is substantial overlap in the data sets used by both studies, but the studies used different methods to derive estimates of species diversity. Both studies found intermediate levels of species diversity in the Gulf Maine and Georges Bank area.

Figure 3: Harbor seals (*Phoca vitulina*) haul out.
Photo credit: Center for Coastal Studies image taken under NMFS-ESA permit 26939.

Supporting Information

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